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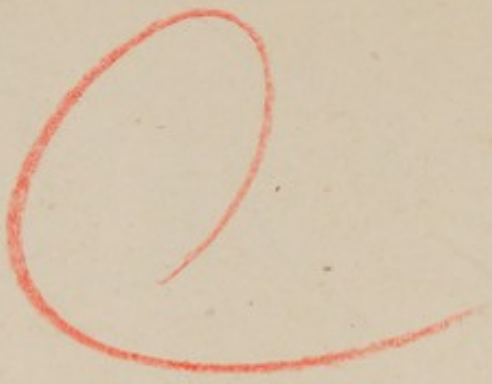

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PREFACE

IN 1915 a Geographical Section was formed in the Naval Intelligence Division of the Admiralty to write Geographical Handbooks on various parts of the world. The purpose of these handbooks was to supply, by scientific research and skilled arrangement, material for the discussion of naval, military, and political problems, as distinct from the examination of the problems themselves. Many distinguished collaborators assisted in their production, and by the end of 1918 upwards of fifty volumes had been produced in Handbook and Manual form, as well as numerous short-term geographical reports. The demand for these books increased rapidly with each new issue, and they acquired a high reputation for accuracy and impartiality. They are now to be found in Service Establishments and Embassies throughout the world, and in the early years after the last war were much used by the League of Nations.

The old Handbooks have been extensively used in the present war, and experience has disclosed both their value and their limitations. On the one hand they have proved, beyond all question, how greatly the work of the fighting services and of Government Departments is facilitated if countries of strategic or political importance are covered by handbooks which deal, in a convenient and easily digested form, with their geography, ethnology, administration, and resources. On the other hand, it has become apparent that something more is needed to meet present-day requirements. The old series does not cover many of the countries closely affected by the present war (e.g. Germany, France, Poland, Spain, Portugal, to name only a few) ; its books are somewhat uneven in quality, and they are inadequately equipped with maps, diagrams, and photographic illustrations.

The present series of Handbooks, while owing its inspiration largely to the former series, is in no sense an attempt to revise or re-edit that series. It is an entirely new set of books, produced in the Naval Intelligence Division by trained geographers drawn largely from the Universities, and working at sub-centres established at Oxford and Cambridge. The books follow, in general, a uniform scheme, though minor modifications will be found in particular cases ; and they are illustrated by numerous maps and photographs.

The purpose of the books is primarily naval. They are designed first to provide, for the use of Commanding Officers, information in a

comprehensive and convenient form about countries which they may be called upon to visit, not only in war but in peace-time ; secondly, to maintain the high standard of education in the Navy and, by supplying officers with material for lectures to naval personnel ashore and afloat, to ensure for all ranks that visits to a new country shall be both interesting and profitable.

Their contents are, however, by no means confined to matters of purely naval interest. For many purposes (e.g. history, administration, resources, communications, etc.) countries must necessarily be treated as a whole, and no attempt is made to limit their treatment exclusively to coastal zones. It is hoped therefore that the Army, the Royal Air Force and other Government Departments (many of whom have given great assistance in the production of the series) will find these Handbooks even more valuable than their predecessors proved to be both during and after the last war.

J. H. GODFREY
Director of Naval Intelligence
1942

The foregoing preface has appeared from the beginning of this series of Geographical Handbooks. It describes so effectively their origin and purpose that I have decided to retain it in its original form.

This volume has been prepared for the Naval Intelligence Division at the Cambridge sub-centre (General Editor, Dr H. C. Darby). It has been largely written by Mr S. T. Bindoff, Mr G. R. Crone and Mr F. W. Morgan, with contributions from Mr A. Constant, Dr H. C. Darby, Mr B. N. Darbyshire, Mr I. L. Foster, Mrs Margaret R. Mann, Professor A. A. Miller, Mr F. J. Monkhouse, Mr A. C. O'Dell, Admiral Sir Herbert Richmond, Dr Norman White, and Professor S. W. Wooldridge. The maps and diagrams have been drawn by Mr A. O. Cole, Miss S. H. C. Collins, Miss K. S. A. Froggatt, Miss M. Hart, and Miss J. D. I. Tyson. The volume has been edited by Mr F. W. Morgan.

E. G. N. RUSHBROOKE
Director of Naval Intelligence

October 1944

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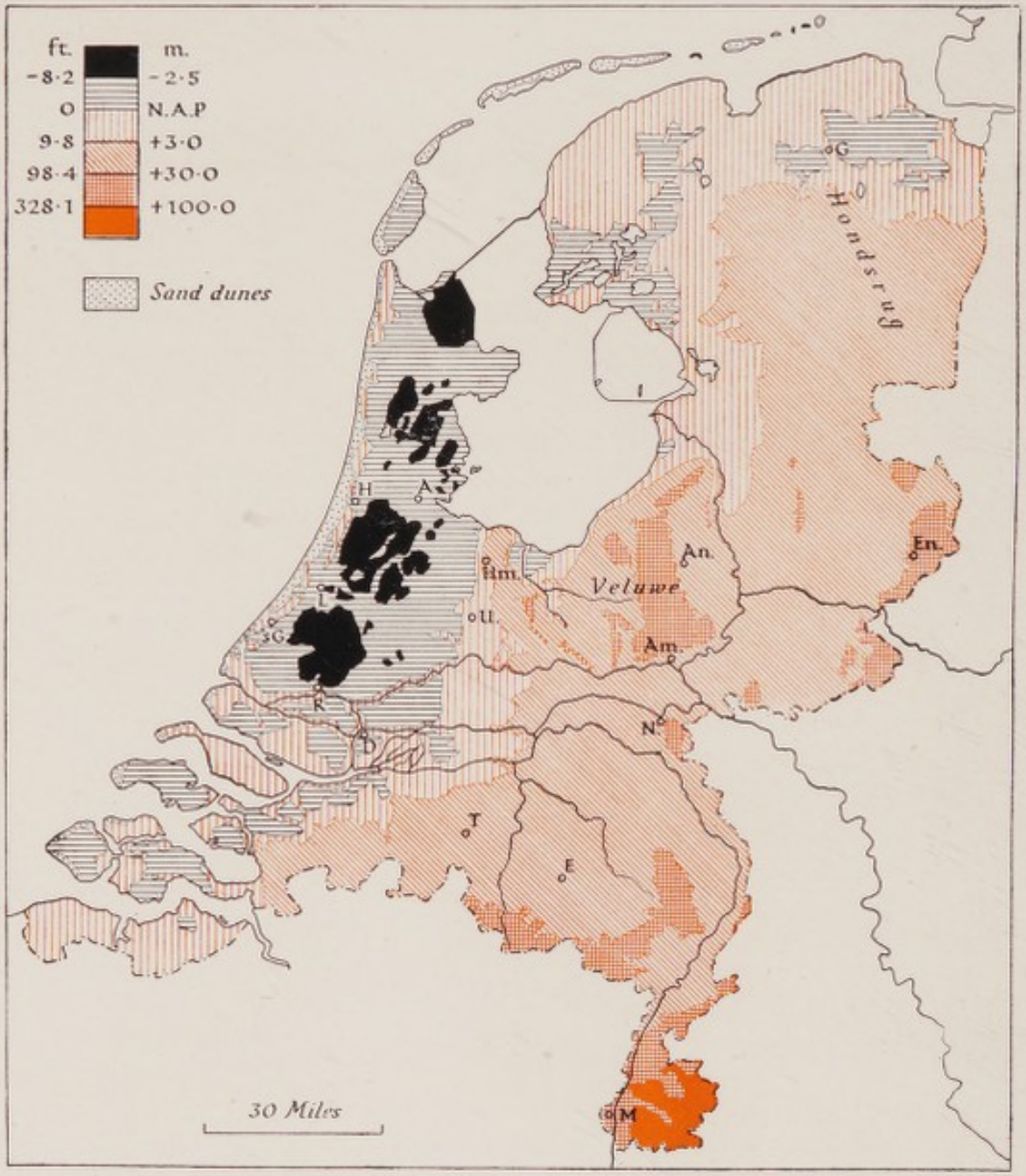


Fig. 1. Relief of the Netherlands

From: P. R. Bos—J. F. Niermeyer, *Schoolatlas der Gehele Aarde*, Plate 10 (Groningen, 1936).

A Amsterdam; Am Arnhem; An Apeldoorn; D Dordrecht; E Eindhoven; En Enschede; G Groningen; 's G The Hague; H Haarlem; Hm Hilversum; L Leiden; M Maastricht; N Nymegen; R Rotterdam; T Tilburg; U Utrecht.

CHAPTER I

GEOLOGY AND PHYSICAL FEATURES

Introduction : Geological History : Physical Features : Physical Regions : The Coastal Zone : The Alluvial Valleys : The Sand Country : The Plateau of South Limburg : Bibliographical Note

Introduction

The Netherlands, or Holland as it is often called, is one of the smallest countries in Europe, covering only 34,000 sq. km. or 13,120 sq. miles—less than half the area of Scotland. The most striking feature of the country is the large proportion of the surface —nearly two-fifths—which lies below sea level, and which is protected from inundation by massive sea and river dykes. Much of the remainder comprises sandy tracts, rising in places to a height of several hundred feet. Through the heart of the country flow the great rivers—the Maas and the branches of the Rhine.

Geological History

The landscape of the Netherlands is more completely artificial than that of any other tract of similar size in Europe. Moreover, its physical features are, with insignificant exceptions, the legacy of the latest and shortest of the periods recognized by geologists—the Pleistocene and the Holocene periods. Since the deposits of these recent phases cover most of its surface and extend to considerable depths beneath it, its earlier geological history is imperfectly known and might in any case seem irrelevant to its present geography. Nevertheless the later stages of fashioning can be regarded as a natural sequel of much that went before, and to see the Netherlands justly in their present physical setting requires a brief study of their earlier physical history.

Earlier Geological History

The Netherlands are a ' gift of the Rhine ' as Egypt is a ' gift of the Nile '. Yet in a broader sense it is the North Sea which forms the background and, in its past vicissitudes, provided the understructure of the country. The North Sea marks the area of an old-established geosyncline—that is, an area of persistent depression

and sedimentation. This role dates from Permian times at latest; the rocks of this and all succeeding systems thicken as they are traced from the bordering lands towards the North Sea coasts. The Netherlands area has lain at or near the southern limit of the great depression during the whole of post-Carboniferous time. In the

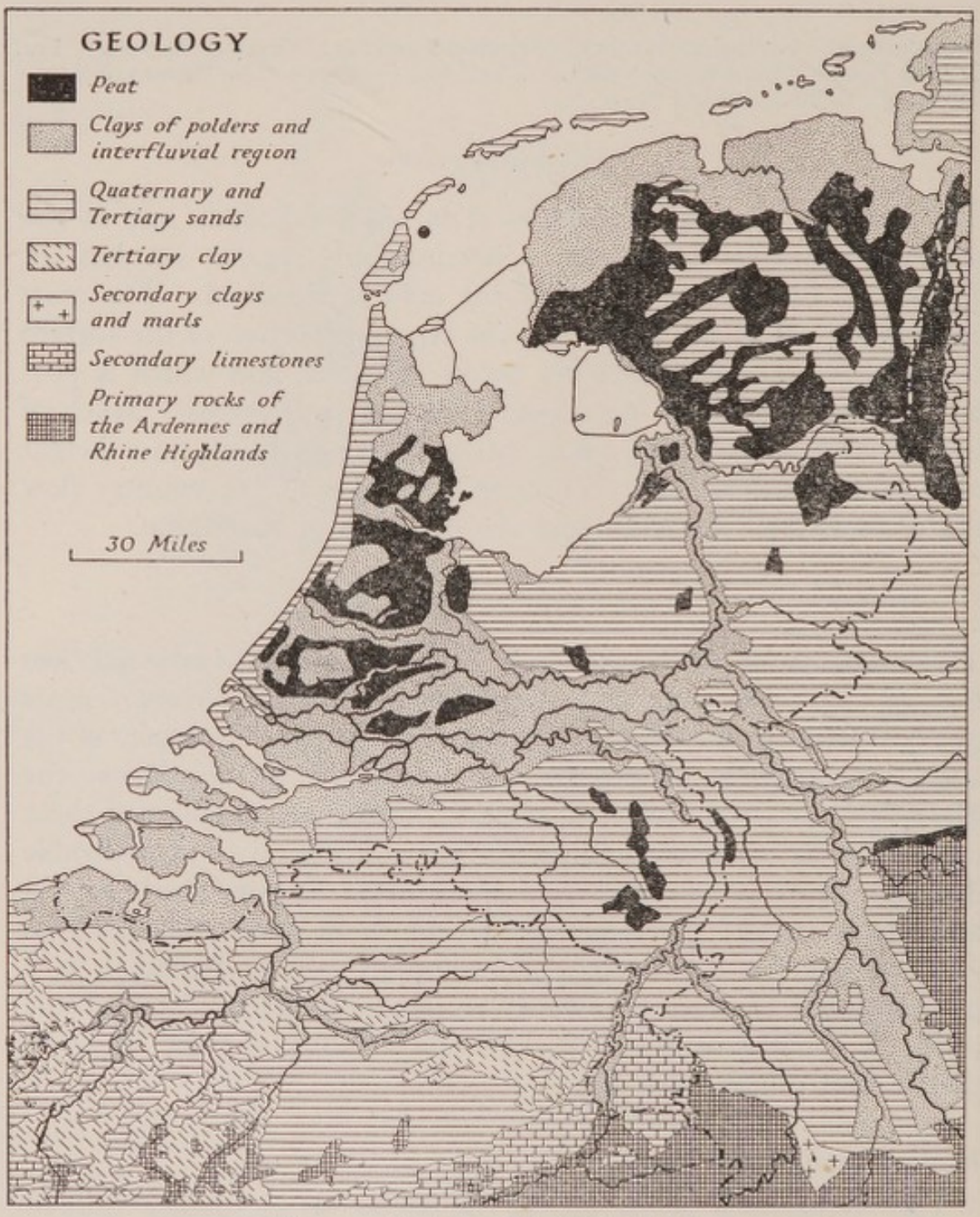


Fig. 2. Geology of the Netherlands

From: A. Demangeon, *Belgique, Pays-Bas, Luxembourg*, p. 24–5 (Paris, 1927). For the names of the rivers see Fig. 14.

The folding map at the end of this handbook shows the surface geology in considerable detail.

preceding phase the European region was crumpled to form the great Hercynian mountain system which stretches eastwards from Brittany and Spain across Central Europe to the Asiatic Altai and beyond. Long continued erosion then reduced the mountains to a peneplain, whose surface forms the essential floor of Europe; locally, as in the North Sea depression, buried deeply beneath later sediments, or elsewhere upheaved to give dissected upland blocks as in the Ardennes massif, distant only twenty miles from the southern extremity of Dutch Limburg (Fig. 2).

This ' Hercynian floor ', with its inlaid strips of coal-bearing rocks, has been proved by deep borings in southern Holland. Lower Carboniferous rocks equivalent to the British Carboniferous (or Mountain) Limestone are known in Dutch Limburg and in the area

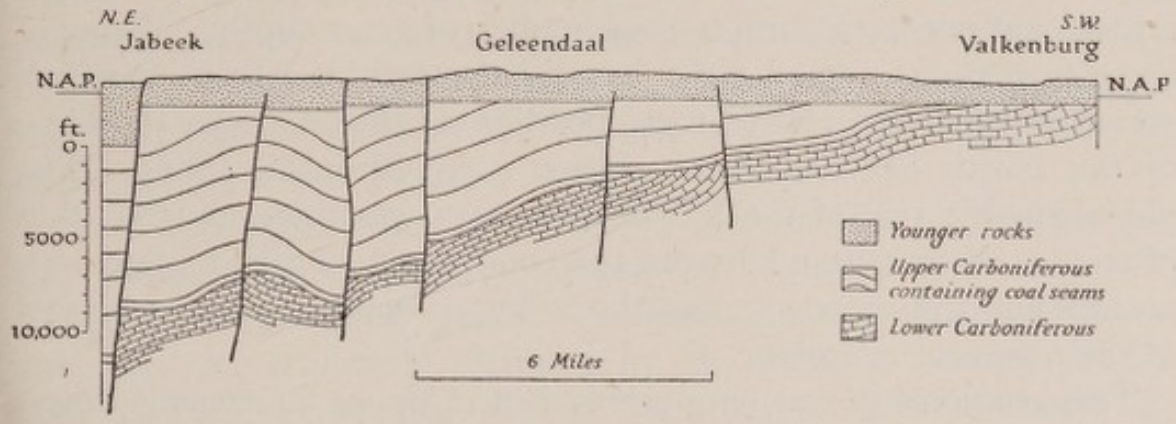


Fig. 3. The concealed coal measures of south Limburg

From *Le Pays Minier*, p. 37, Excursion B1, Congrès International de Géographie, 1938 (Amsterdam, 1938).
The black lines indicate faults.

north of Antwerp. Coal Measures occur more widely, notably in Limburg (Fig. 3), where they are worked on a large scale around Kerkrade and Heerlen. This coalfield is the evident continuation of that of the Belgian Campine and of the German mining area around Eschweiler. The productive seams are within 300 ft. of the surface and have been worked since the thirteenth century. Farther north, in the Peel region, coal has been encountered at depths of 2,000–3,000 ft. in the vicinity of Helenaveen, Kessel and Vlodrop. It is not at present worked, but may be regarded as accessible. Other subterranean outcrops are known in the German frontier region of Overyssel and Gelderland and these, too, are probably within reach of working. It is highly probable that there are other occurrences beneath the central and northern parts of the country but here the great thickness of the Mesozoic and Tertiary covering would place them beyond workable depth.

The Permian with the succeeding Triassic rocks form the first element in the filling in of the North Sea geosyncline—that is, in the 'cover' as distinct from the floor. Both formations contain thick beds of salt and the Triassic salt is worked at Boekelo. Comparatively little is known of the Jurassic rocks. The Lower and Middle (but not the Upper division) have been proved to be present. Cretaceous rocks, continuing those of the Münster Basin of Germany, are known in the frontier regions of Gelderland and Overyssel and they form the actual surface near Winterswijk. The topmost stages of the system occur also in Limburg.

It should be noted that all formations from the Permian to the Lower Carboniferous are known in borings only in southern and south-eastern frontier regions. They are presumed to underlie the central and northern parts of the kingdom at great depths. None of these formations extended far beyond the southern frontier which serves to mark the approximate position of the southern shoreline of the North Sea depression during early Mesozoic times. The physiographic role of the Netherlands area was then, as later, that of an area of transition between the continental land and a northern sea, though the successive coastlines lay, in general, south and east of their present successor.

This relationship was temporarily lost in upper Cretaceous times, when the Chalk sea, spreading far and wide in Western Europe, overstepped the bounds of the North Sea depression and similar localized subsidences. In early Tertiary (Eocene and Oligocene) times the marine bounds, though much contracted, still spread widely beyond the limits of the North Sea, in its southern part at least, for they embraced south-east England, most of Belgium, and northern France as far south as Paris. The Newer Tertiary phase (Miocene and Pliocene) ushered in by the building of the Alpine ranges saw the restoration of the basic age-long plan of the country. The geography of Miocene times plainly foreshadows the existing distribution of land and sea. Till towards the end of the Miocene times the sea barely transgressed the limits set by the limits of the present North Sea coasts. Then in late Miocene and early Pliocene times came the last of the major transgressions of the Tertiary sea of which there is witness. Relics of Lower Pliocene deposits extend far in Belgium, and are met with on the Artois Ridge of northern France as well as in many parts of south-east England. The latter part of Pliocene times witnessed the steady northward retreat of the sea from the lands invaded in this brief trespass. The prime cause

of this recession was a major regional tilting or movement *en bascule* whereby southern regions were uplifted and those to the north depressed. The pivotal line of the movement, significantly enough, lay near the southern frontier of the Netherlands, that is, the vicinity of the older coastlines. Thus it is that we find the Lower Pliocene deposits, which provide a ready index to the nature and amount of the tilting, poised high on the Artois downs in the south at elevations above 500 ft. while beneath Utrecht they are at 1,200 ft. below sea level.

The recession of the coastline also reflects the ' reclamation ' of the southern end of the old marine trough by the vast masses of sediments carried down by the Pliocene ancestors of the Rhine, Meuse, Scheldt, Thames, etc. By the end of Pliocene times the southern part of the North Sea was occupied by the seaward parts of a great confluent delta, across which an extended Rhine flowed northward to be joined by the Thames of that day and probably by the ancestors of our Fenland rivers.

Such in outline is the late Tertiary history of the regions of which the Netherlands form part. It can be comprehended only as a whole ; it is in no sense possible to detach for separate consideration the fragment artificially included by the political frontiers of the Netherlands. From this history the relevant facts of more immediate import can be simply deduced. The Netherlands are underlain by an appreciable thickness of Miocene and Pliocene deposits, dominantly sandy in character and marine in origin save for the topmost Pliocene deposits which are fluvio-marine or deltaic, representing a Pliocene Rhine delta more extensive than that of the present. These sandy late Tertiary deposits make little direct contribution to the soil of the Netherlands, since they were buried in turn by later accumulations. They provide, however, the proximate source of much of the later ' drift ' deposits, whether carried by the rivers or by invading ice.

The Glacial Period

The researches of the last half century have amply demonstrated that what is popularly known as the Great Ice Age was an episode of extreme complexity : on four successive occasions in Europe, over a span of about a million years, the ice-sheets spread from the centre of dispersal. These four glacial periods were separated by ' inter-glacial periods ' during which the climate was at least as warm as that of the present and the ice disappeared completely even

from its mountain fastnesses. Beyond the ice-limits the work of normal river and marine erosion continued throughout, and it was resumed periodically in the regions laid bare of ice during the inter-glacial intervals.

A further great complication resulted from the oscillations of sea level which accompanied the waxing and waning of the ice-sheets. The latter represented a great (and roughly calculable) mass of water temporarily withheld from the oceans and accordingly the periods of glacial maximum were periods of low sea level. Conversely, the melting of the ice-sheets returned water to the oceans and resulted in a high sea level during the inter-glacial phases. In harmony with these changes of sea level (or base level) rivers such as the Rhine developed steep gradients during the periods of low sea level, cutting down their bed or entrenching themselves. Their response to a rising sea level, on the other hand, was delta building.

So much at least of general explanation is a necessary preliminary to sketching the Quaternary evolution of the Netherlands. The inherent complexity of the record is increased by the inaccessibility of much of the evidence ; it is underground and only to be revealed by the happy chance of excavation or boring. Moreover, the region lies athwart the major ' ice boundary ' of Europe ; the northern and central areas were invaded by ice, those of the south were not. Thus arises the vexed problem of correlating the records of the glaciated and unglaciated areas. It must be clearly realized that many questions of detail are disputed, but these do not preclude a general picture of the latest vicissitudes of the region which prepared it for its first human tenancy.

Work of the Ice Sheets

There is no evidence that the ice of either the first or the second glaciation reached the Netherlands. In the third or Riss glaciation, generally considered to represent the maximum ice expansion in Europe, the ice spread as far south as the line Nymegen–Utrecht–Haarlem, and left the customary evidences of its presence. Thus the provinces of Drenthe, Friesland, and Groningen reveal considerable tracts of boulder clay or ground moraine containing large ' erratics '—far-travelled blocks of Scandinavian rocks which have served in more than one phase as a source of building stone. These boulder-clay areas are not closely comparable with British ' ground moraine ' areas, say in East Anglia, for most of the surface is covered with a sheet of sand, either outwash from the ice, or marking a later

marine trespass. This is locally built into dunes. The assemblage of soil and surface forms has something in common with the ' Breckland ' in East Anglia.



Fig. 4. The terminal moraines of the Netherlands

From : K. Oestreich, 'La genèse du paysage naturel,' *Tijdschr. Kon. Ned. Aardrs. Gen.* vol. 55, p. 562 (Leiden, 1938).

Along the southern margin of the ' ground moraine ' areas are the remnants of considerable ' terminal moraines ', forming true hill ramparts. Thus western Gelderland is almost enclosed by a broken morainic rampart running from Huizen via Amersfoort and Arnhem to Apeldoorn and beyond. This ' loop ' borders the Rhine flood

plain on the north from a point west of Rhenen to Arnhem and beyond, and thus marks the southern limit of the Veluwe region. The morainic crests rise to 150–250 ft. and since the flood-plain is here only about 20–25 ft. above sea level, the local relief is notable. A morainic ridge reaching similar elevations takes off from the south bank of the Waal at Nymegen and following a sigmoid course across the frontier is continued in Germany past Cleves almost to Krefeld, roughly along the water parting between the Rhine and the Maas (Meuse). Still other discontinuous morainic ' dumps ', trending on the whole from north to south, are seen in Overyssel.

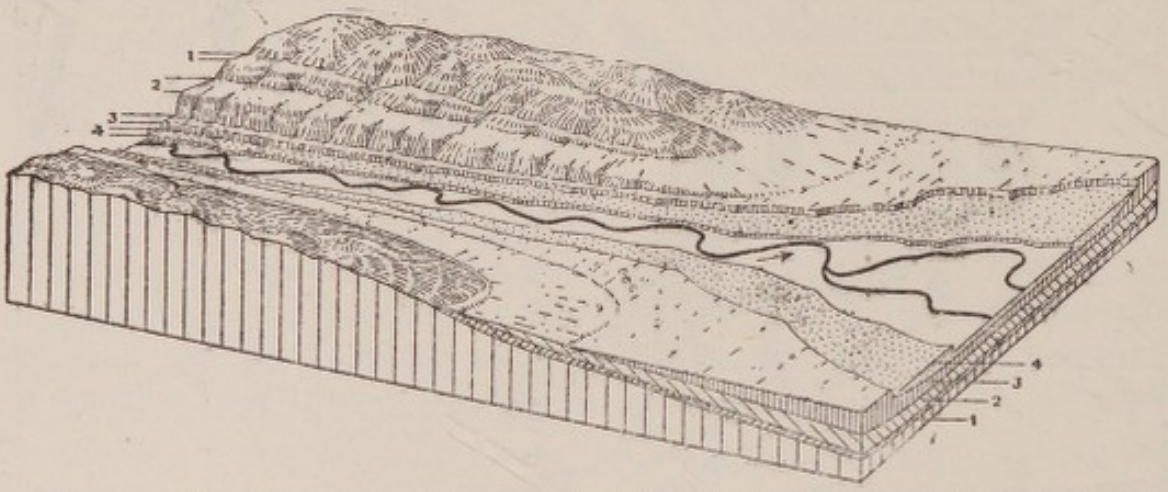


Fig. 5. Diagram showing the growth of the Netherlands and its hinterland

From : K. Oestreich, 'La genèse du paysage naturel', *Tijdschr. Kon. Ned. Aardrs. Gen.* vol. 55, p. 554 (Leiden, 1938).

The diagram indicates the evolution of the river terraces of the Rhine over an area stretching approximately from Bonn in Germany to the North Sea.

1..The highest of the Rhine terraces, Pliocene in age ; 2. High terrace ; 3. Middle terrace ; 4. Low terrace, together with post-glacial deposits.

The river flows across a sheet of recent alluvium.

These moraines bear little analogy to those marking the termination of a valley glacier. They are composed of sand and gravel, such as form the surrounding country rock, and have been interpreted by some as *moraines de poussée*—in effect ruckings up of the surface drift by ice pressure. Alternatively, it seems not unlikely that they are in the nature of ' kames ' representing the debris jettisoned at the ice front by sub-glacial streams. They are notable features in a country of so monotonously uniform a surface (Fig. 4).

South of the ice front normal river action proceeded unchecked, though not unaffected by the glacial conditions of the north. The German Rhine above the delta provides a rough chronology for a lengthy period in the form of gravel terraces at various levels above the stream. The highest of these terraces is regarded as marking the position and work of the late Pliocene Rhine. Better developed

are the so-called High and Middle Terraces which must mark one or more stages of the Pleistocene Ice Age—including the Riss glaciation. It is important to note that while the High Terrace like its Pliocene predecessor plunges steeply beneath the later deposits of the delta region so that its equivalents are to be looked for in depth, the Middle Terrace is a wide spreading gravel sheet in the Netherlands, capping the low interfluves between the Rhine distributaries (Figs. 5, 6).

The interglacial period following the Riss glaciation is marked (1) by the marine deposits to which the name Eemian has been given

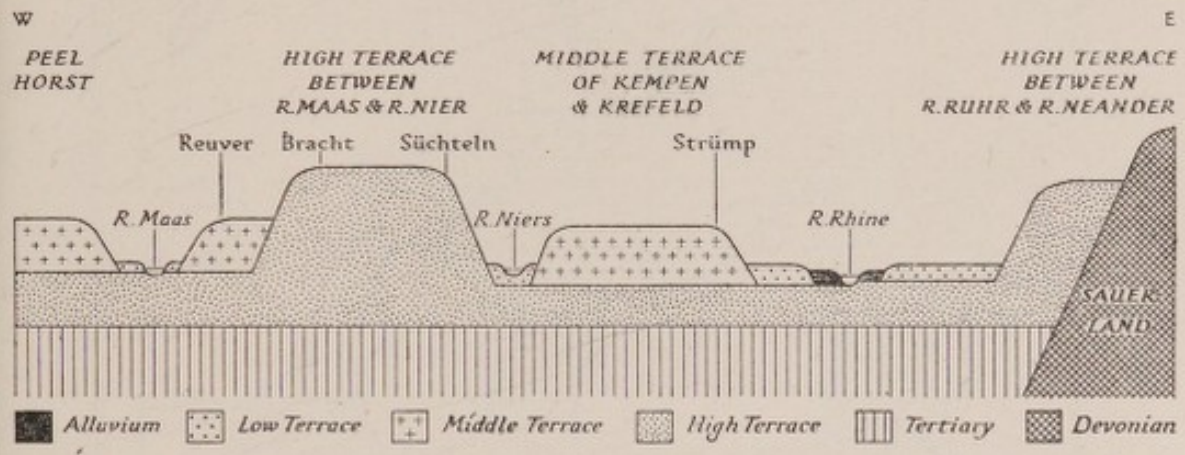


Fig. 6. Diagrammatic cross-section of the river terraces of the Maas and the Rhine
From R. Schuiling, *Nederland*, vol. 1, p. 687 (Zwolle, 1934).
The cross section, the vertical scale of which is greatly exaggerated, is taken along a line from the Peel through a point between Roermond and Venlo to the Rhine Highlands, over a distance of about 55 miles.

(from the little Eem valley which enters the Zuider Zee below Amersfoort), and (2) by equivalent fresh water deposits in the valleys farther inland. The Eemian deposits mark a rise of sea level due to melting ice (see p. 6). Their distribution is interesting and significant. They are not known in the coastal area south of Haarlem—that is, in South Holland and Zealand, but extend across North Holland and the region of the present Zuider Zee, sending thence an embayment south along the Eem valley into the great morainic loop noted above. They also extend northwards from the Zuider Zee along a narrow zone in western Friesland and thence into the islands of Terschelling and Ameland. From this distribution two suggestions emerge: first, the fundamental rather than accidental nature of the Zuider Zee submergence, for the transgression of the Eemian Sea points to a fundamental 'lowness' or tendency to depression. Further, the general distribution of the Eemian clays suggests that they mark out approximately the course

of the pre-glacial Rhine, some features of whose valley must have survived the glaciation unobliterated. This contention is enforced by noting the form of the Eemian transgression in the Ems valley (in western Germany) to the eastward. In the Rhine valley southward of the Eemian Sea this stage is probably represented, in part,

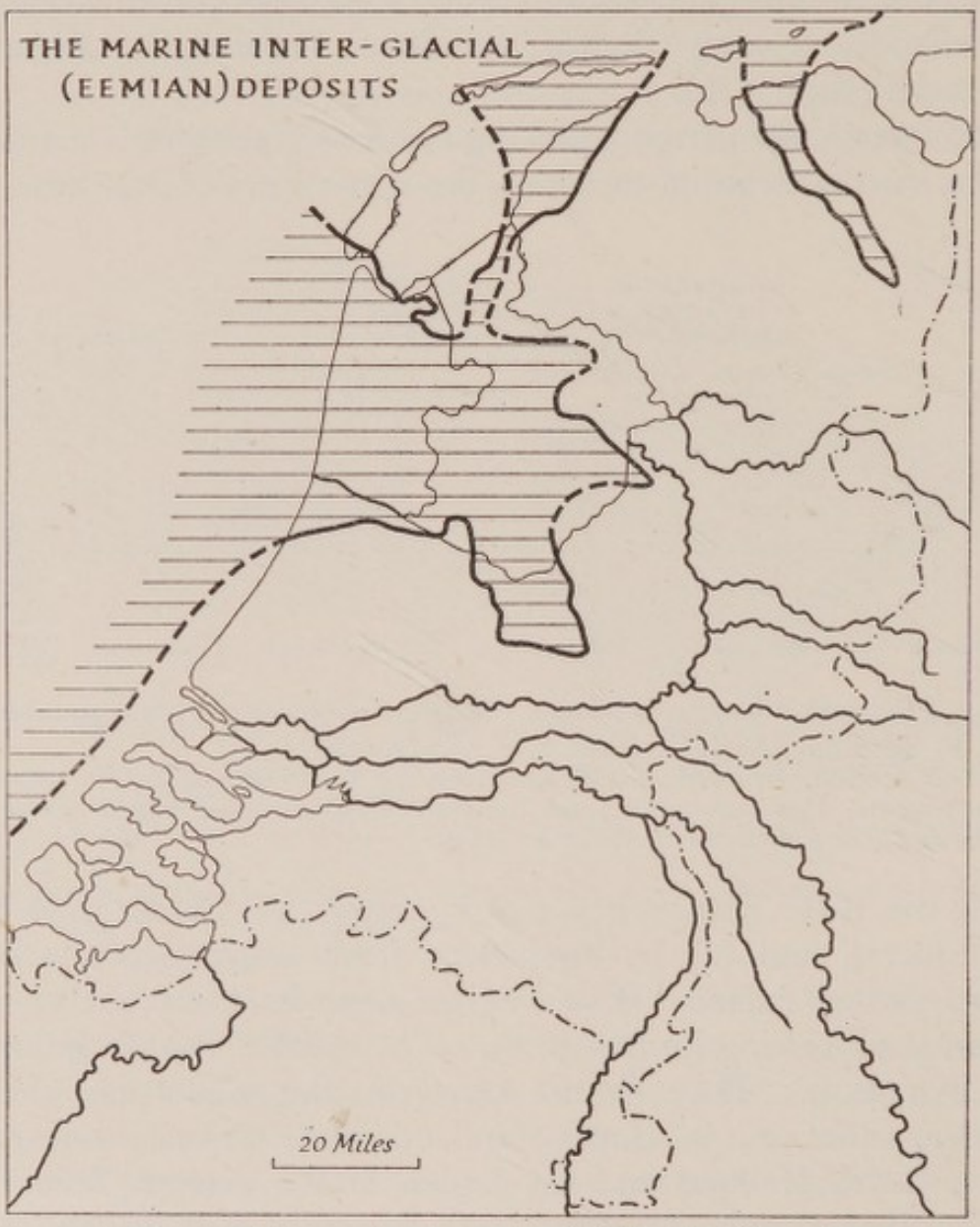


Fig. 7. The marine inter-glacial (Eemian) deposits
From: P. Tesch, 'L'origine du sous-sol des Pays-Bas', *Tijdschr. Kon. Ned. Aardrs. Gen.*, vol. 55, p. 551 (Leiden, 1938).

by the extensive Low Terrace, the last of the Rhine series. It is difficult to make an exact correlation of the glacial terraces with the glacial cycle. The formation of a terrace, however, implies two things: the laying down of the terrace deposits and the subsequent entrenchment of the river, which abandons them, as it were, in terrace form. It is this last episode which can most reasonably be

correlated with a glaciation (see p. 6). Nevertheless, some authorities correlate the terrace deposits with the succeeding fourth (Würm) glaciation on the grounds that they yield a cold flora and fauna. This glaciation was not marked by the presence of ice in the Nether-

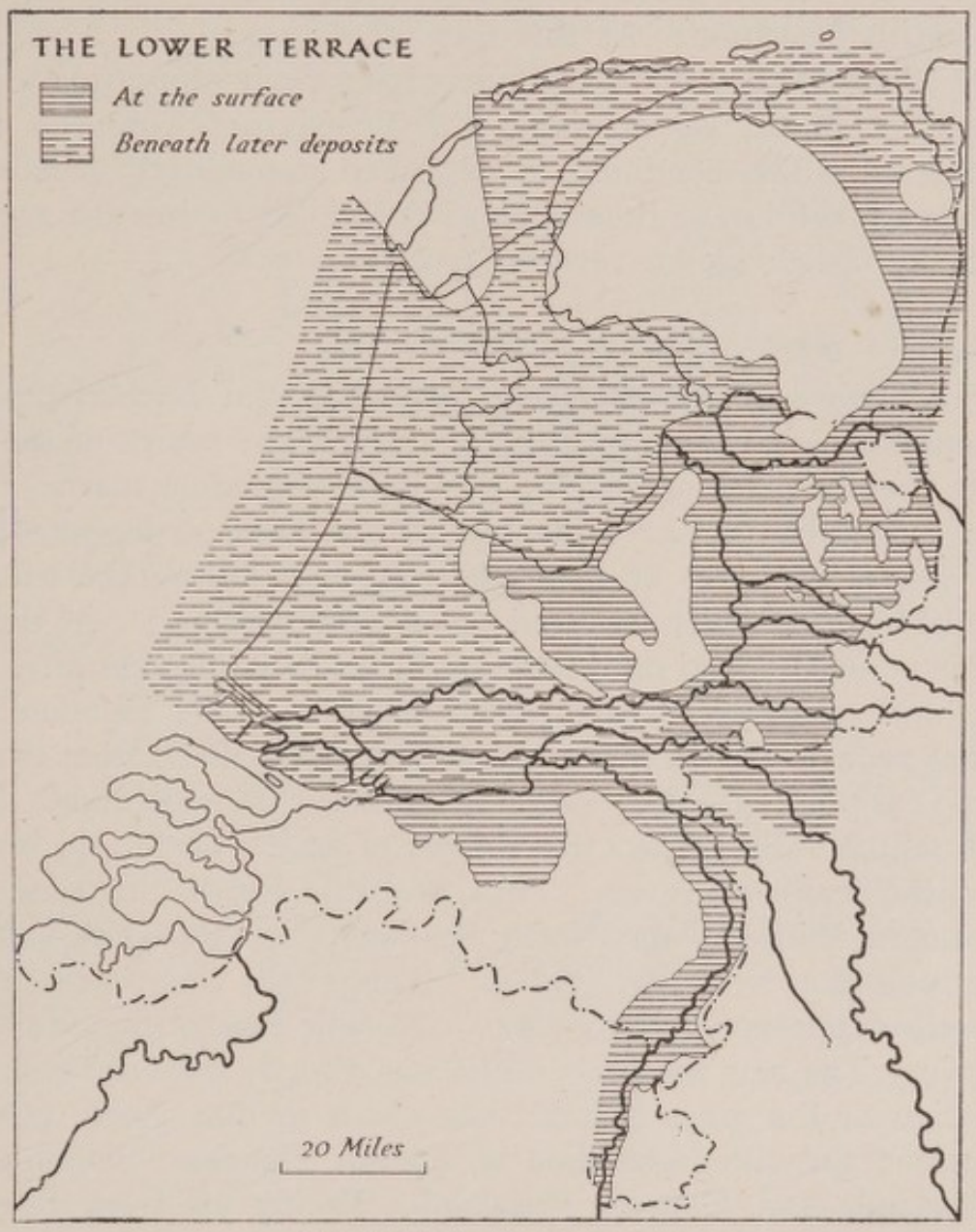


Fig. 8. The Lower terrace

From: P. Tesch, 'L'origine du sous-sol des Pays-Bas', *Tijdschr. Kon. Ned. Aardrs. Gen.*, vol. 55, p. 550 (Leiden, 1938).

lands; the ice sheet did not cross the lower Elbe. Thus the period of time represented by the glaciation must be regarded as filled either by the deposition of the Low Terrace deposits or by the succeeding period of river downcutting.

It is usual and convenient to regard all the deposits later than the fourth glaciation, that is, broadly speaking, than the Low Terrace,

as falling within the Holocene Period. This period, as defined in terms of the detailed chronology worked out in Scandinavia, began about 20,000 B.C. At this date, as we are well assured by evidence both in the Netherlands region and widely elsewhere, the sea level stood some 200 ft. below its present position as a consequence of the fourth glaciation. At this stage the floor of the North Sea, south of the Dogger Bank, was a low lying plain supporting a dense growth of forest, across which the British and European rivers meandered. The condition so described immediately recalls that at the end of Pliocene times (see p. 5) and emphasizes the age-long tendency of the region to revert to type (Figs. 7, 8).

Post-glacial period ; changes in the coastline

The history of the Holocene period in the Netherlands and surrounding areas is essentially the story of the return of sea level to its present place or near it, that is, of a gradual marine transgression similar to that evidenced by the Eemian deposits. The rise of sea level was at first relatively fast, during the so-called ' boreal ' period which followed the Würm glaciation. At the end of this period it stood only some 25 ft. below its present level. So great and relatively rapid a submergence naturally inundated the coastal zone of the Netherlands, and marking the marine trespass there is a thick group of Lower Holocene silts and muds. More important still was the fact that the rise of sea level led to the breaching of the Straits of Dover. Thus, probably, for the first time since the Lower Pliocene, the North Sea was put into south-westerly communication with the Atlantic. This vitally important episode is dated at approximately 5000 B.C. Notable consequences followed in train. The new southerly outlet was directly responsible for the initiation of the great offshore bar which in due course came to determine the outer shoreline of French Flanders, Belgium, the Netherlands and German Friesland. Taking off from Sangatte near Calais, this bar is virtually unbroken as far as the breaches of the Scheldt–Maas–Rhine estuaries. Resuming at the Hook of Holland, it sweeps in an unbroken curve to the Helder, beyond which it is represented in the familiar outlines of the Dutch and German Frisian Islands (Fig. 9).

Manifestly so large a structure must have taken time to build, even though there is good warrant for supposing that it grew as an offshore bar and not as a long shore spit. But its initiation was so vital and novel a feature that it serves to mark, for geologists and

archaeologists, the beginning of Upper Holocene time. Its value as a punctuation point is increased by the fact that its initiation coincided, approximately at least, with a major climatic change from

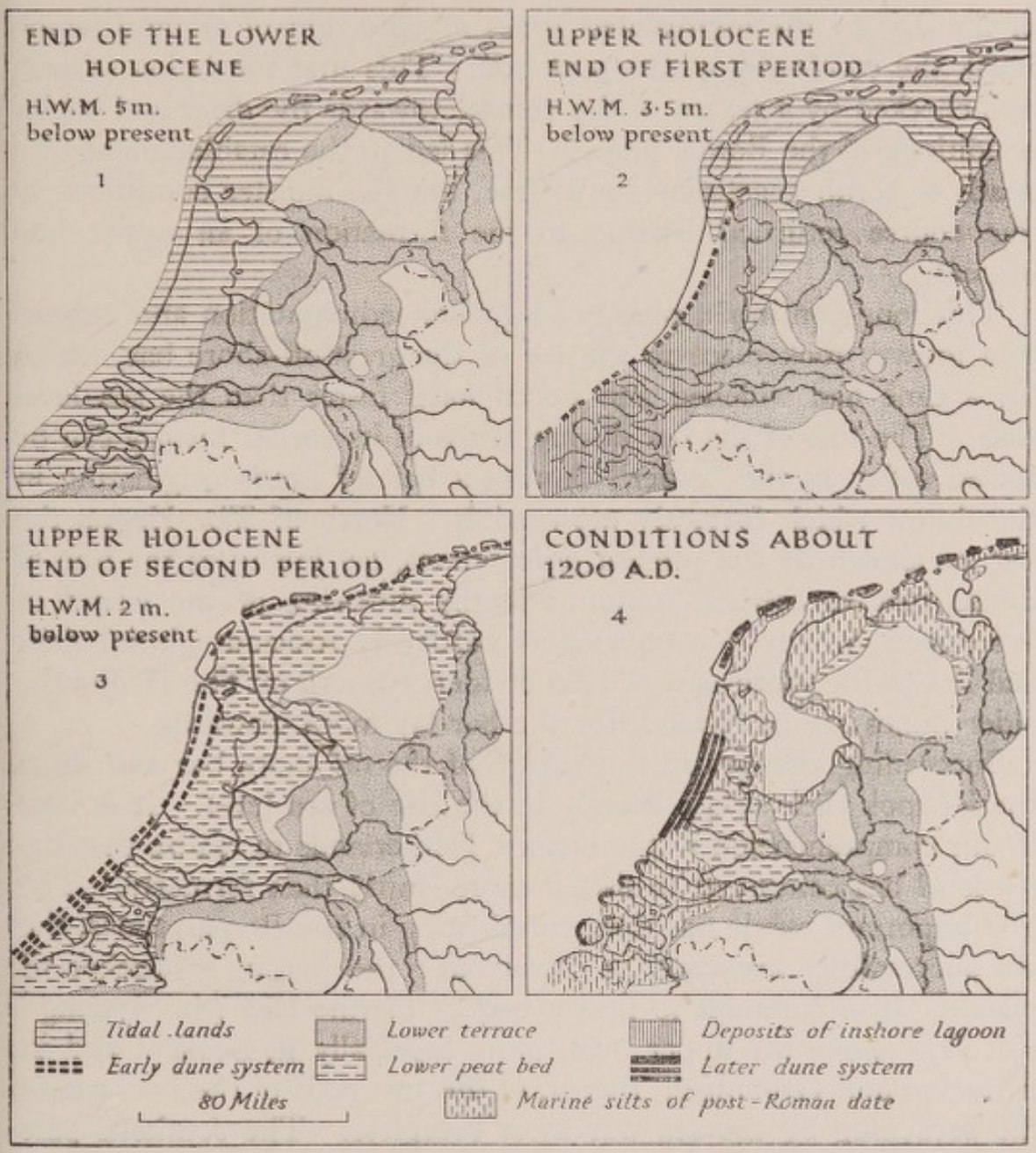


Fig. 9. The physiographic evolution of the Netherlands during Holocene times
From: W. C. De Leeuw, *The Netherlands as an Environment for Plant Life*, figs. 18–21 (Leiden, 1935)
H.W.M. High water mark.

the Boreal conditions to those of the milder and wetter Atlantic phase.

The first effect of the bar was to create a number of inshore lagoons, protected from the open sea, in which brackish water muds accumulated above the marine clays of the Lower Holocene. As the bar became broader it was crowned by sand dunes and the

composite rampart thus strengthened held the sea out almost completely for a while, permitting the accumulation of fresh-water peats. Here were conditions identical with those of our own Fenland and here as there we can trace the wandering river courses of the day by the intercalated zones of sand, gravel or mud which break the continuity of the peat bed. This first formation of peat was checked by a return of the climate towards the drier and colder conditions of the Boreal phase. This led to the establishment of a heath or scrub vegetation for a time, but the moister conditions in due course returned leading to the formation of an upper bed of peat.

This long-continued phase of lagoonal sedimentation and vegetation growth took place in the lee of the great off-shore bar, which for a time had widened and raised itself faster than the sea level rose. The line of the bar during much of its earlier history can be traced today in the ' older ' dunes—a belt of sands originating in the dunes which formerly crowned it. North of The Hague the bar, as shown by the present older dunes, lay inland of the line of dunes that succeeded, trending in the direction of the island of Wieringen, which is composed of relatively resistant glacial drift and lies to the south-east of Den Helder. South of The Hague the older dunes are not found, for the bar lay more seawards.

Succeeding changes in the nature of the off-shore bar and dune barrier took their origin mainly in the rise of sea level. It is vital to our comprehension of the historic Netherlands to realize that the sea level has continued to rise, if more slowly than formerly. The first important result was that, culminating in late Roman times, the sea successfully breached or ' overrode ' the bar in a number of places. It is common to find a bed of marine clay (the ' young ' sea clay) above the upper peat, more especially in Zealand and in Friesland and Groningen, that is, at the two ends of the bar, where the breaching by the sea was most complete. The southern part of the early dune system was largely destroyed after A.D. 300–500, and later on parts of the north were wiped out (Figs. 10, 11).

In the period A.D. 500–900 conditions in the North Sea changed : the off-shore bar took up a slightly different alignment in the course of forming a connection with the off-lying island of Texel, and the younger dune system came into existence along its crest, running in the direction of Texel, that is, along a line which was seawards of the line of the earlier position of the bar and the older dunes. Northwards of Texel, however, the bar kept more or less to its

original position, trending more and more eastwards towards the Ems, and shown today by the existing Dutch Frisian Islands, which

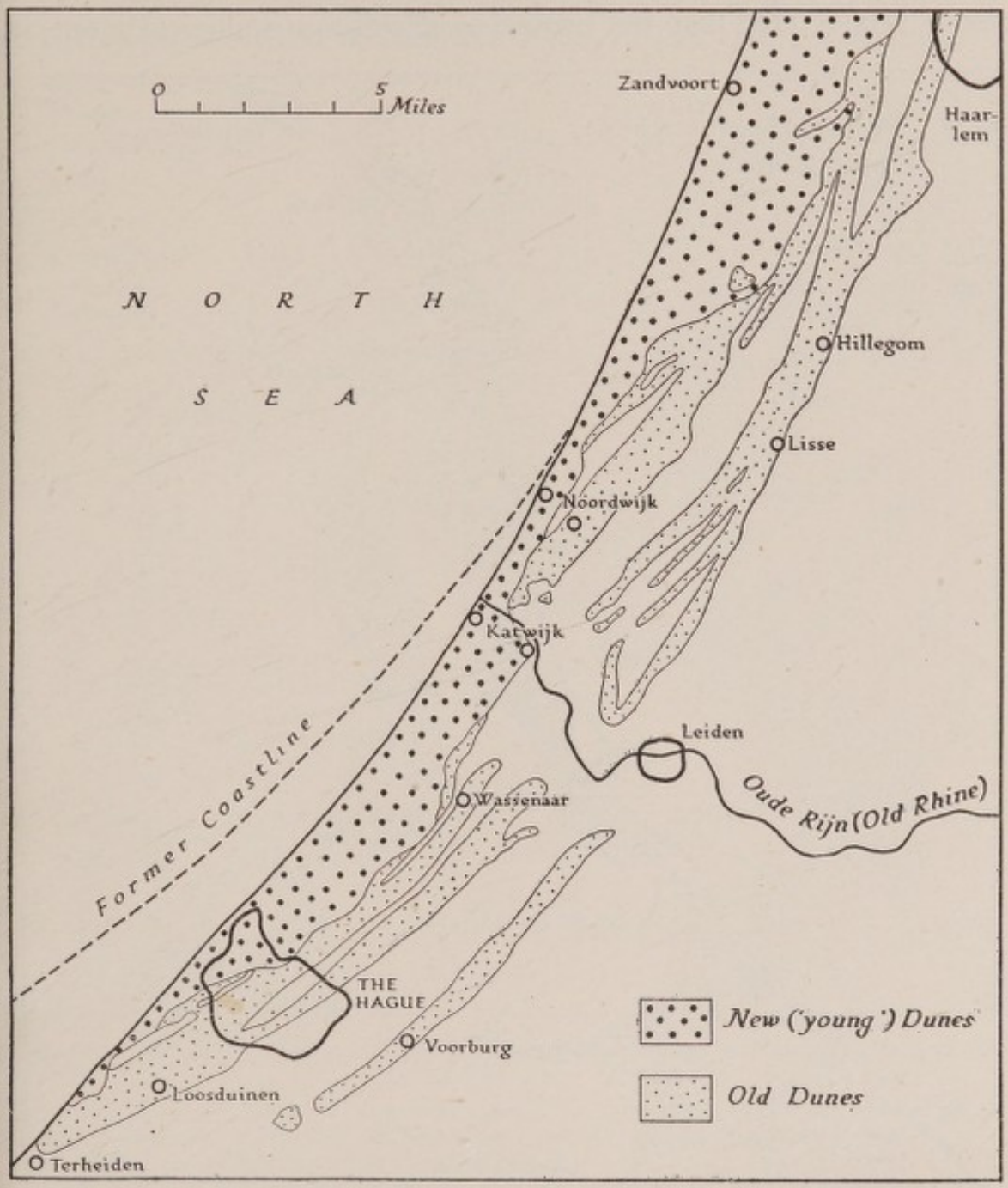


Fig. 10. The old and the new dune systems, south of Haarlem

From : W. C. De Leeuw, *The Netherlands as an Environment for Plant Life*, fig. 22 (Leiden, 1935).

The former coastline represents the earlier seaward limit of the older dunes. As a result of extensive and long continued manuring the sands of the older dunes now largely form productive horticultural land.

are, in effect, dune-crowned sections of offshore bar protecting small areas of polderland on their eastern shores. Roman and Merovingian remains have been found under the sands of the younger dunes.

Here, evidently, the story of geological evolution merges into the epic story of the human struggle against the encroaching waters (see p. 262). Had man not proved so effective a geological agent, it

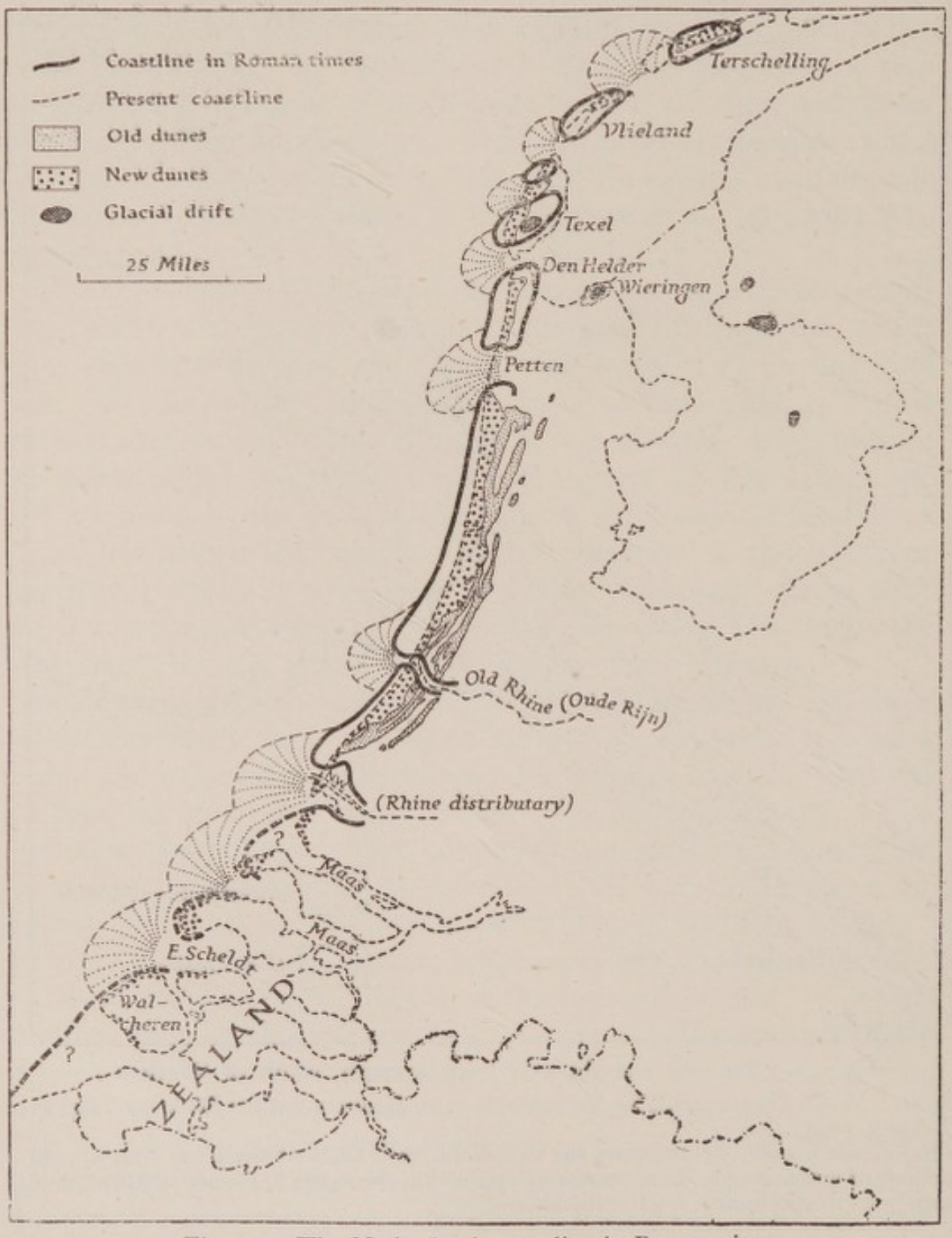


Fig. 11. The Netherlands coastline in Roman times

From: J. Van Veen, *Onderzoekingen in de Hoofden, in verband met de gestelheid der Nederlandsche kust*, p. 147 ('s Gravenhage, 1936).
N.W. New waterway.
The radiating dotted lines off the openings in the coast represent probable under-water banks; they are known as 'submarine deltas' (see p. 700).

is certain that the sea would have reclaimed in normal course all of Zealand, South Holland as far inland as Utrecht and Gorinchem and all North Holland in addition to the Zuider Zee. The historic

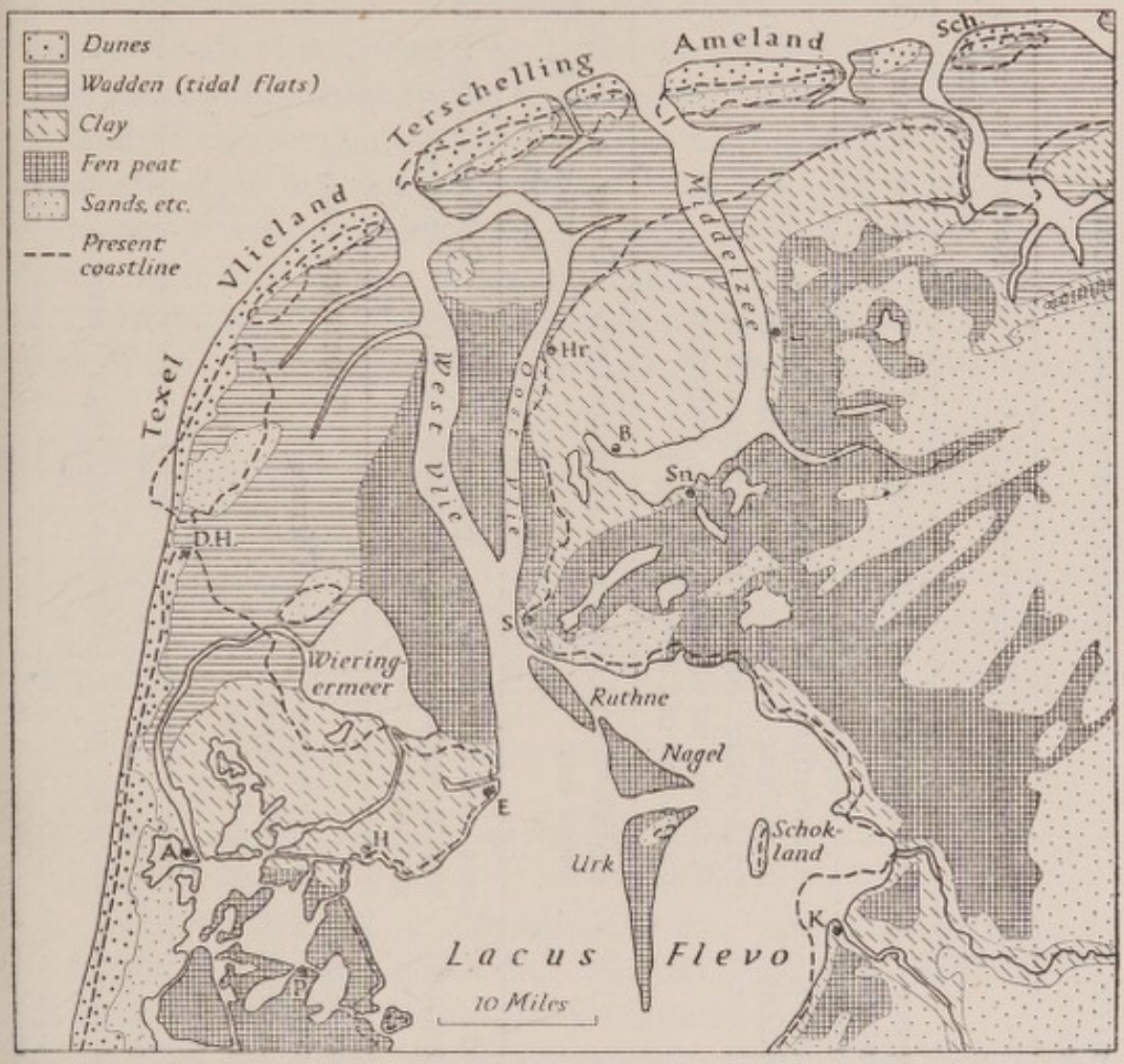


Fig. 12. The *Lacus Flevo* and the 'Friesche Middelzee' at the beginning of the Christian era

From : J. B. L. Hol and H. van Velthoven, 'La lutte contre les eaux et la mise en culture,' *Tijdschr. Kon. Ned. Aardrs. Gen.*, vol. 55, p. 603 (Leiden, 1938).
The sites of the following towns are indicated :

A Alkmaar ; B Bolsward ; D.H. Den Helder ; E Enkhuizen ; H Hoorn ; Hr Harlingen ; K Kampen ; L Leeuwarden ; P Purmerend ; S Stavoren ; Sn Sneek.

The extension of the Lacus Flevo and the widening of the West Vlie and Oost Vlie, its outlets to the North Sea, later in the Middle Ages formed the Zuider Zee (see p. 267). As a result, the low peat islands of Ruthne and Nagel disappeared and Urk and Schokland decreased in size. The Middelzee silted up, and the Lauwerszee, to the east, became silted in its inner reaches.

inundations which produced the latter and the Hollandsch Diep at the mouth of the Maas are events not only of the human story, but indications of the continuing action of the age-long geological processes which we have traced.

A summary of the geological history of the Netherlands from the Pleistocene period.

Historic Period	Resumption of submergence in early centuries of present era, and, sporadically, in later centuries, e.g., Zuider Zee		Breaching of dune barrier (older dunes); formation of new (younger) dunes	
Holocene Period c. 5,000 B.C. breaching of Straits of Dover	Upper Holocene	Submergence continuing more slowly and balanced by deposition in coastal zone	4. Formation of Upper Peat Bed	Return to milder and wetter climate.
			3. Cessation of peat formation	Cooler climate of sub-boreal phase
			2. Accumulation of brackish water muds in inshore lagoons, slowly passing to fresh water conditions with growth of dune barrier on offshore bar, leading to formation of Lower Peat Bed	
			1. Initiation and continued growth of off-shore bar	Onset of milder and wetter climate—Atlantic phase
c. 20,000 B.C.	Lower Holocene	Rapid Submergence	Great submergence in present coastal region, with resulting deposition of silts and muds	Cold dry climate (boreal phase)
Pleistocene Period	Northern Area		Southern Area	
	(iv) Fourth (Würm) glaciation not locally represented by deposits but coinciding with period of low sea level, with rivers extended across southern North Sea area		Low Terrace	
	(iii) Interglacial marine deposits (Eemian) (ii) Third (Riss) glaciation—boulder clay and terminal moraines		Middle and High Terraces	
	(i) (First and second glaciations not represented among superficial deposits).			

The Great Rivers

In the widest sense, the confluent delta of the Rhine–Maas–Scheldt extends beyond the boundaries of the Netherlands. The ' top-set ' beds of the delta (Fig. 13) extend up the Maas (Meuse) to Liége and up the Rhine to Bonn, while the ' bottom-set ' beds form the floor of the southern North Sea over a considerable area. The proximate cause of delta building has been the convergence of the three great rivers in the vicinity of a tidal ' node '—that is, an area of restricted tidal range, where the high waters of the North Sea tide, advancing from the north, are nearly neutralized by the low water of the Channel tide. The location of the delta is thus a direct

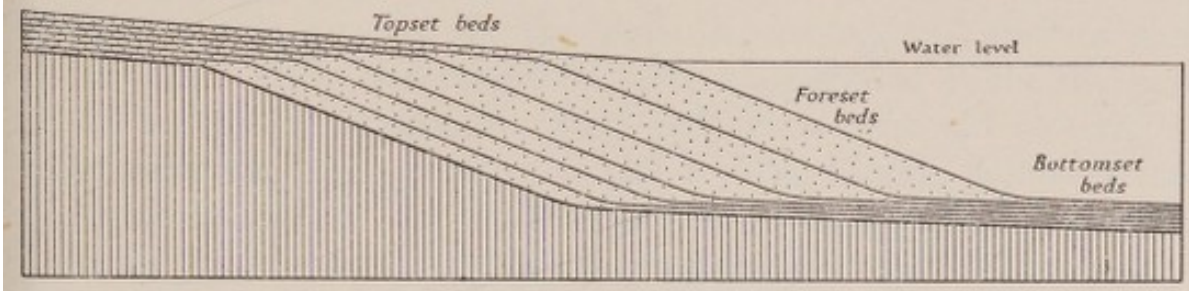


Fig. 13. Ideal section of a delta (after Longwell, Knopf and Flint)

consequence of the breaching of the Straits of Dover at the beginning of Upper Holocene times.

Interpreting the delta in the narrower and more popular sense as the low-lying land area about and between divergent distributaries, it is almost co-extensive with the Netherlands.

The main stream of the Rhine divides first within the Dutch frontier into a larger southern arm—the Waal, and a smaller northern arm, known initially as the Pannerdensch Canal. Seven miles below the first divergence, the latter branch receives a silted-up distributary draining from Germany (the ' Old Rhine ') and below this point the Pannerdensch Canal becomes the Neder-Rhine (Neder Rijn). Before reaching Arnhem, it throws off an easterly branch, the Yssel (IJssel, sometimes called the Geldersche IJssel), which enters the Zuider Zee on its eastern coast. The deep-water exits from the Zuider Zee, the Texel Zeegat and the Vliestroom are thus still functioning ' mouths ' of the Rhine and certainly mark the position of former river exits. Still farther east, the old channel of Middelzee, now cultivated land, which divides Friesland into Westergo and Oostergo, and the ' dead ' estuary of Lauwerszee,

mark similar ancient exits of Rhine water. Between these northern exits and that of the Waal, via the Hollandsch Diep and Haringvliet, lies the greater part of the Netherlands, excluding only Zealand, which includes the multiple mouths of the Scheldt. The main Rhine channels, the Neder-Rhine and Waal, undergo further bifurcation. The former divides into the Lek and the Kromme Rijn (Crooked Rhine) near Wijk-bij-Duurstede. The last-named

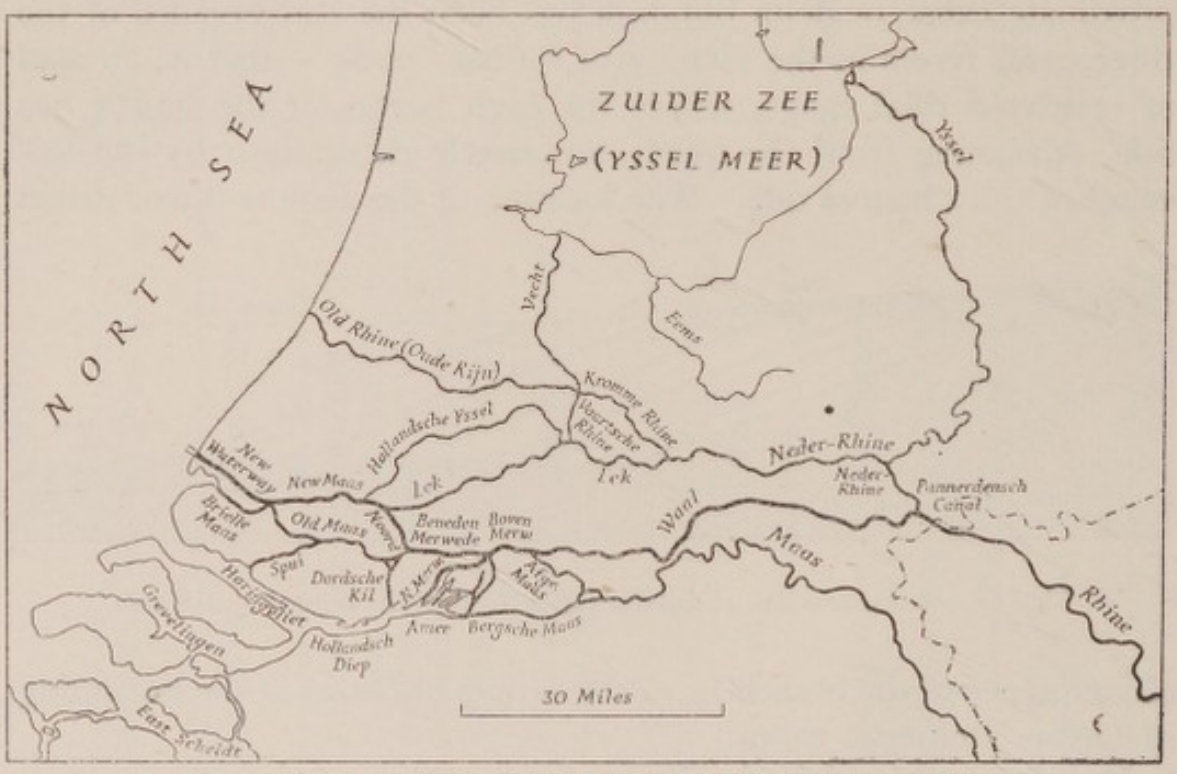


Fig. 14. The distributaries of the Rhine and Maas

From : P. R. Bos—J. F. Niermeyer, *Schoolatlas der Gehele Aarde*, Plates 13–16 (Groningen, 1936)

Afge. Maas : Afgedamde Maas, an outlet of the Maas closed by locks. At the point where the Maas and Waal approach most closely there is connection by a locked passage. The Brielle Maas is frequently known as the New Maas, of which it is the outlet.

stream flows to Utrecht and there divides into the Vecht, flowing to the Zuider Zee, and the ' Old Rhine ' (Oude Rijn) which passes Leiden to its North Sea outlet at Katwijk-aan-Zee. The Waal in its lower course flows close to the Maas which ' shapes for ' a confluence at a point about 20 miles west of Nymegen. Here there is, in fact, communication by lock-gates, but the Maas then diverges south-westwards round the island of Bommelerwaard and effects its real confluence with the Waal fifteen miles downstream near Gorinchem. The combined stream in its natural state flowed westwards to Dordrecht, whence it sent a northward channel—the Noord—to join the Lek, and to find its exit past Rotterdam as the

New Maas (Nieuwe Maas). A southern channel, the Old Maas (Oude Maas), rounds the island of Ysselmonde (IJsselmonde) and joins the New Maas at its western end to enter the sea as the Brielle Maas (New Maas). The New Merwede, which takes off below Gorinchem, is an artificial cut, made in the later nineteenth century, which conducts the bulk of the Maas-Waal water via the island-studded Biesbosch to the Hollandsch Diep and so to the sea (Fig. 14).

The geographical pattern of the various distributaries and the confusing but suggestive nomenclature of their exits indicates a radical and systematic series of diversions of the main Rhine outlet, for which there are available both historical evidence and a physical explanation.

It has been noted (see p. 10) that the pre-glacial course of the Rhine was northwards via the Eem depression and that of the Zuider Zee. From this course the river was expelled by the advance of the ice sheet, though the Yssel perpetuates the old pattern in some measure. The frontier of the Roman Empire followed the Kromme Rhine and the Oude Rijn (Old Rhine) past Utrecht and Leiden ; here is presumptive evidence that this stream was vastly more important then than at present. Today it is little more than a dead and abandoned branch, though of all the distributaries it alone preserves the name of Rhine. The main Rhine outflow has passed south to estuaries which still bear the name of the Maas. They have obviously been appropriated by the Rhine in the course of a regular southerly shift. The cause of this shift is not far to seek ; it lies in the increasing range of the tides southwards along the coast, from rather less than 5 ft. at the Texel to over 12 ft. at the mouth of the Scheldt. This has given a systematic advantage to leftward or southerly branches by affording a quicker fall and enhanced scour at time of low water. The higher level of high water in the south is impotent to check the tendency, for the ebb as usual is longer than the flood and it is during the ebb that the mass of river water finds chief opportunity for escape. The ebb-current, assisted by fresh-water flow, has thus consistently widened and deepened southerly exits at the expense of northerly exits. The process is reflected in the present discharge of the main branches ; thus the normal discharge of the Yssel, Lek and Waal are in the ratio of 1 : 2 : 6.

In summary then, the growth of the Rhine-Maas delta has been due to the blocking or displacement of the original northward outlet by ice, followed by a progressive southward shift of the chief mouth

over a distance of some sixty miles, in harmony with a tidal range increasing southwards away from the ' nodal ' area.

Physical Regions

Altitude as such contributes little to the differentiation of the surface. In the far south, near the common boundary of Belgium, Germany and the Netherlands the surface reaches 1,053 ft., but taking the country as a whole, very little exceeds 150 ft. N.A.P.* More than a third lies less than three feet above N.A.P., while the western coastal zone, protected by the dune barrier, and forming fully a quarter of the whole, is below this level. Above the vast featureless expanse of these low plains, the dunes and the morainic ridges build eminences which are locally almost spectacular. The former commonly reach an elevation of 30–40 ft., though the highest of the dunes, High Blinkert, near Haarlem, attains nearly 200 ft. In the country near Arnhem and Nymegen, where the morainic mounds rise sharply above the Rhine flood-plain, the highest of the mounds (Imbosch) north of Arnhem, reaches 361 ft.

The Netherlands may be divided into four main types of physical region : (1) the low coastal zone of clays and peat in the provinces of Zealand, North and South Holland and the seawards parts of Friesland and Groningen ; (2) the alluvial valleys of the great rivers ; (3) the sand country of North Brabant, north Limburg, Utrecht, Gelderland, Overyssel, Drenthe and south Groningen ; (4) the Cretaceous plateau of south Limburg. These regions may be subdivided further (Fig. 15) :

(1) The coastal zone
  - (a) Zealand and the islands of South Holland
  - (b) South and North Holland and western Utrecht
  - (c) The Frisian Islands and coastal zone of Friesland and Groningen.

(2) The alluvial valleys
  - (a) The lower Maas–Waal–Neder-Rhine valleys
  - (b) The Yssel valley
  - (c) The ' Geldersche vallei '.

* The datum for altitude measurements in the Netherlands is " Nieuw Amsterdamsche Peil (N.A.P.) ", the mean tide level at Amsterdam, in the days when its inlet communicated freely with the Zuider Zee. It is a revision of the earlier datum, A.P. The Netherlands Admiralty publish a number of local coast and port surveys, the datum for which is the local L.L.W.S. (low low-water springs).

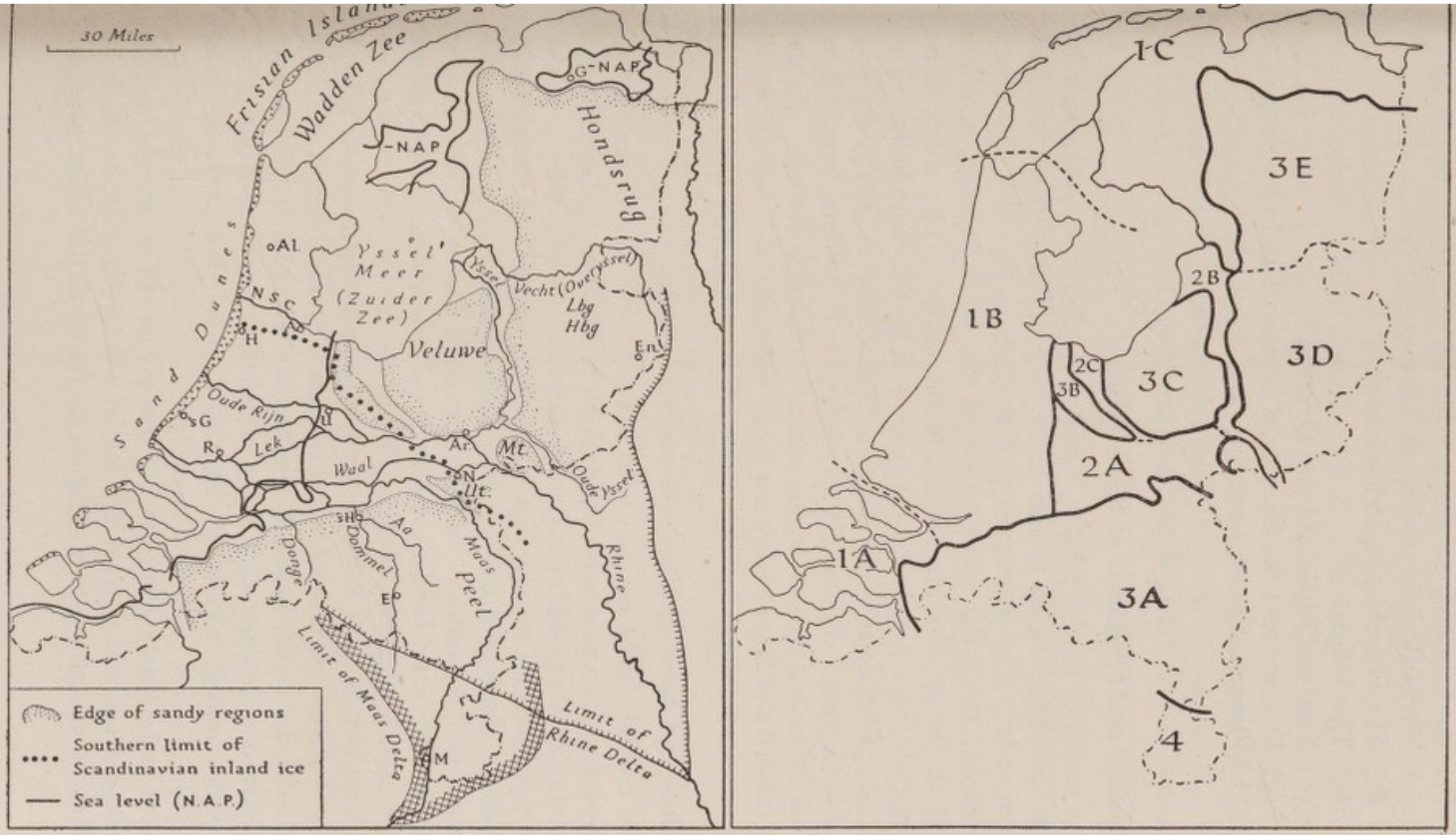


Fig. 15. The physical regions of the Netherlands

From : P. R. Bos—J. F. Niermeyer, *Schoolatlas der Gehele Aarde*, Plates 9, 10, 12–16 ; P. Tesch, 'Physiographic Regions of the Netherlands,' *The Geographical Review*, vol. 13, pp. 507–17 (New York, 1923). The map on the left shows some of the main components in the physical geography of the Netherlands. A Amsterdam ; Al Alkmaar ; Ar Arnhem ; E Eindhoven ; En Enschede ; G Groningen ; 's G The Hague ; H Haarlem ; 's H's Hertogenbosch ; N Nymegen ; R Rotterdam ; U Utrecht ; Hbg Holterberg ; Lbg Lemelerberg ; Mt Montferland ; Ut Uilenput. The map on the right shows the regions described on pp. 22–30.

(3) The sand country
  (a) North Brabant and north Limburg
  (b) The Utrecht-Gelderland ridge
  (c) The Veluwe
  (d) Eastern Gelderland and Overyssel
  (e) Drenthe and the interior of Friesland and Groningen.
(4) The Plateau of south Limburg.

1. The Coastal Zone

1*a* *Zealand and the islands of South Holland*

The estuaries of the Rhine, Maas and Scheldt are separated by islands at right angles to the coast, with dune barriers at their western ends. The islands, as well as Zealand Flanders (Zeeuwsch Vlaanderen) along the south shore of the West Scheldt, nowhere exceed 10 feet in altitude, except in the dunes. The entire coast is protected from inundation by dykes and by the dune belts. The soil is everywhere the fertile younger marine clay, largely given over to arable farming. Practically all the land is in polders, bounded by internal dykes and crossed by innumerable drainage ditches. As the great majority of the polders are some centuries old they are small and irregular in shape. Settlements are found mainly along dykes.

1*b* *South and North Holland and western Utrecht*

The coastal dunes extend, with a break near the Camperdowns (Kamperduin), from north of the Hook of Holland to Den Helder, and attain locally a width of as much as two and a half miles. In the lee of the dunes are marshy dune pans, which have been drained and cultivated. Springs break out at the dune foot and yield supplies of water which availed originally for such towns as The Hague ('s Gravenhage) and Leiden, and were carried considerable distances for the supply of Amsterdam. The lower part of the dunes also yield supplies of shell valuable as a calcareous fertiliser in a land largely destitute of limestone. Between The Hague and Alkmaar the coastal dunes are succeeded immediately inland by the narrow strip of sand (*geestgronden*), the remnants of the older dunes (see p. 14) and now largely converted into productive horticultural land (Fig. 16).

North and South Holland and Utrecht west of the city of Utrecht, include the greatest part of the land in the Netherlands which is below sea level, and within the region are found all the lowest polders.

The lowest polders of all are those lying between Rotterdam and Amsterdam, and the new North-West or Wieringermeer polder in the extreme north. A few miles north of Rotterdam the land surface stands 19⅓ ft. (5·9 m.) below N.A.P. The region is crossed from east to west by several great rivers, all embanked—in the south the Lek, Waal and Hollandsche Yssel and in the centre the Old Rhine (Oude Rijn). The north and south trending streams are all canalized, and have but little movement between their raised banks. In the south, the Vliet-Schie, Rotte, and western part of the Hollandsche

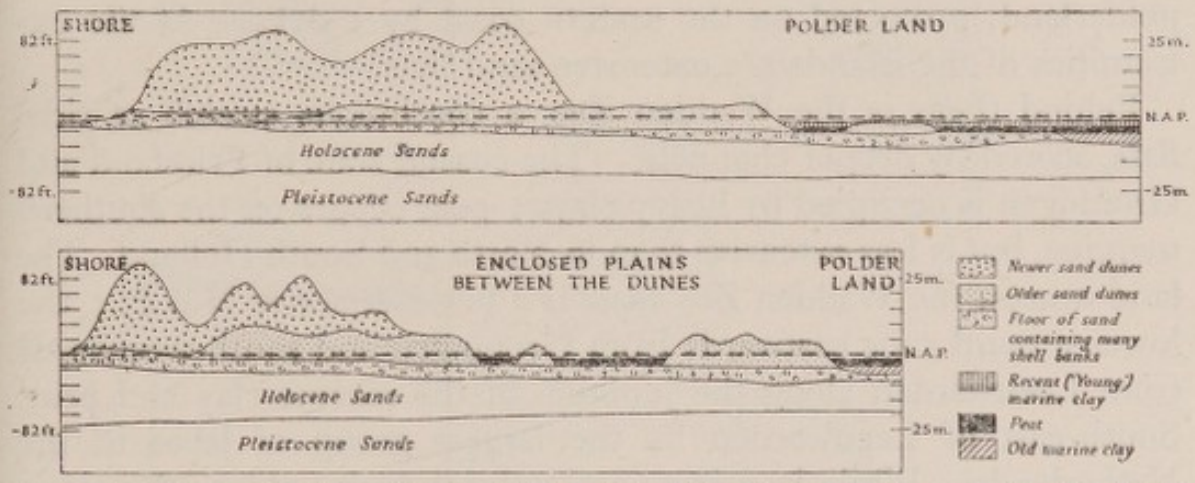


Fig. 16. Cross-sections, from west to east, of dune and polder country in North and South Holland

From : P. Tesch, 'Physiographic Regions of the Netherlands,' *The Geographical Review*, vol. 13, pp. 507–17 (New York, 1923).
The vertical scale is 25 times the horizontal scale. The upper section is taken to the north of Haarlem, the lower section between Haarlem and Leiden.

Yssel converge on Rotterdam, in the centre the Aar-Drecht and Vecht (a distributary of the Old Rhine) converge on Amsterdam.

Much of the surface of the region is peat. This was extensively dug for fuel in the past, leaving many lakes and pools. The larger lakes have been drained (see p. 286), but innumerable smaller lakes and pools remain. Drainage canals everywhere make up a complicated network. Dairy farming is now widespread, while market gardening is important near the cities.

This region is roughly bisected by the North Sea Canal, leading from Amsterdam to the sea at Ymuiden, and following the course of a former arm of the Zuider Zee, the Y (IJ), which is now drained to form the fertile Y-polders. In former centuries North Holland from the Y to Den Helder was much more restricted in area (see p. 287). The territory to the south of the Y, as far as the New Maas, forms the heart of the Netherlands. Politically and economically it has always been the centre of gravity, and on its perimeter stand the five

largest cities—Amsterdam, Rotterdam, The Hague, Utrecht and Haarlem.

1c *The Frisian Islands and coastal zone of Friesland and Groningen*

North of the Texel the dune belt is situated once more upon islands, here trending parallel with the coast—the Dutch Frisian Islands. Texel consists of a core of glacial drift, but otherwise resembles the others, in having a seaward front of dunes which curve round at each end towards the east, partly enclosing a coastal area of cultivated polderland, protected on the eastern coast by a dyke. At the extremities of the islands are extensive sand flats.

Behind them is the Wadden Zee, a continuous stretch of tidal flats, scored by deeper channels. The coastal zone of Friesland and Groningen is occupied by heavy clays ; peat occurs on the southern margins, but is less extensive than in North and South Holland. The land nearest the Wadden Zee coast is a few feet above N.A.P. ; the lower ground runs eastwards from Groningen and south-westwards from Leeuwarden along the junction of the marine clay and peat. South-east of Leeuwarden lie the largest group of lakes in the Netherlands. While in many parts natural drainage into the sea is possible at low tide, the entire coastal zone is poldered.

2. The Alluvial Valleys

2a *The Maas-Waal plain*

The largest alluvial flood plain is the broad valley of the Maas west of Grave and the roughly parallel Rhine distributaries (Neder-Rhine, Lek and Waal). This plain of river clay requires polders and artificial drainage, for the rivers flow, for the greater part of their length, in beds above the level of the plain between massive dykes. The Waal–Neder-Rhine–Maas plain separates the sandy region of North Brabant and north Limburg from the sands of the Utrecht-Gelderland ridge and the Veluwe, and the Yssel separates the Veluwe from the sandy territory of the north-east. Two minor tracts can be distinguished—the area between the Waal at Nymegen and the Maas at Mook, culminating in the Uilenput (315 ft.), and the Hettenheuvel-Montferland hills (305 ft.) lying east of the Rhine, but separated from the sandy regions of eastern Gelderland by the narrow valley of the Oude (Old) Yssel.

The relationship of sand country to alluvium is most clearly seen downstream of Arnhem and Nymegen, where the Rhine flood plain,

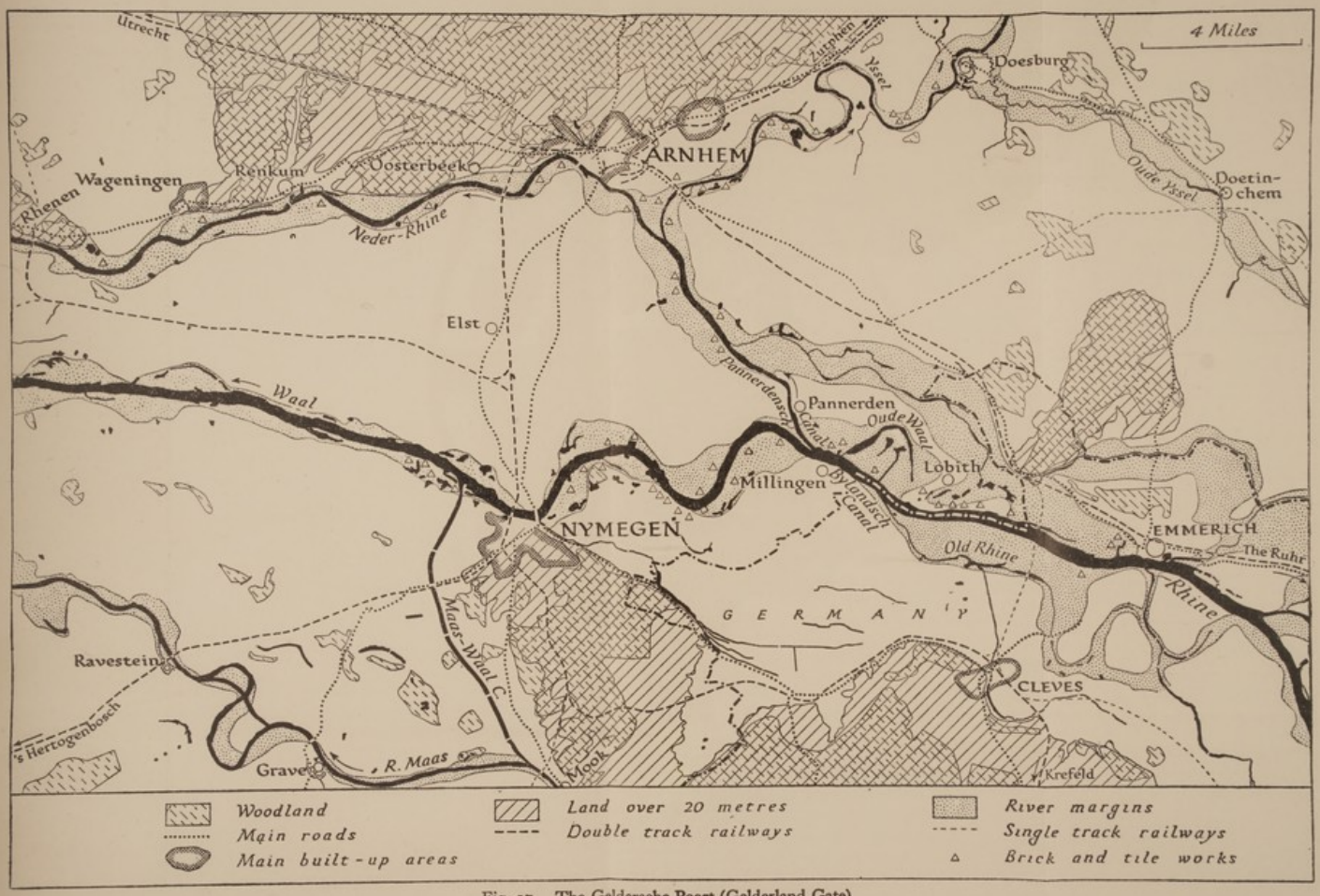
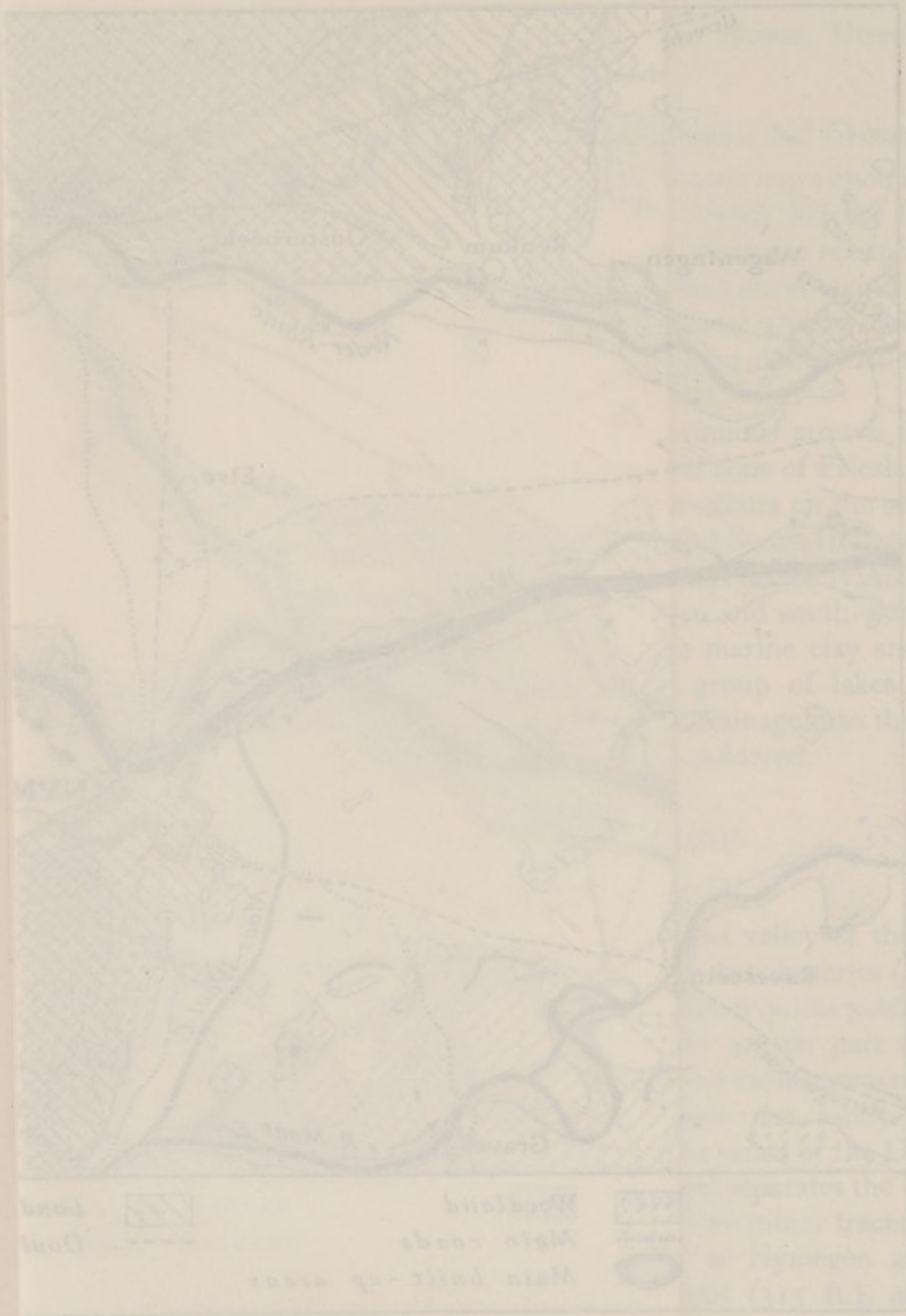


Fig. 17. The Geldersche Poort (Gelderland Gate)

From : (1) G.S.G.S. Series 4083, 1 : 50,000, Sheets 39, 40, 45, 46 (1940, reproduced from Dutch maps dated 1929, 1932–3, 1939, 1938–39) ; (2) G.S.G.S. Series 2451, 1 : 100,000, Sheet 5 (1943). The map illustrates how the hills of the Veluwe, approaching closely to the Neder-Rhine, and the hills of the Uilenput, approaching closely to the Waal, provide admirable sites for the gateway towns of Arnhem and Nymegen. To the north-east of Lobith lie the low hills of Montferland. The 'river margins' are mainly *uiterwaarden*, i.e. the land between the rivers and the main dykes, and generally represent the courses of the rivers during floods. These tracts are largely devoid of houses, roads and orchards, and are used as summer grazing land. The many brick and tile works along the rivers utilize the river clays for raw material and enjoy accessibility to the waterways. The map illustrates the complexity of the river courses, with the frequent backwaters and abandoned cut-offs. The course of the Rhine prior to the construction of the Pannerdensch Canal (see p. 279) can be traced in the belt of 'river margins' between Emmerich and a point below Pannerden.



some ten miles broad, forms the floor of a distinct trench, with the rivers penned to its sides by dykes. This is the distinctive region of the Betuwe. Northwards lies the Veluwe surrounded by its morainic loop ; west of Arnhem the low hills come so close to the north bank of the Neder-Rhine that there is no large river dyke downstream on this bank as far as Wageningen. On the south side of the Rhine flood plain Nymegen caps the sandy bluff, occupying a site exactly analogous to that of Arnhem on the north (Fig. 17 ; Plate 1).

2b The Yssel valley

The narrower plain of the Yssel is bounded on the west by the Veluwe hills and on the east by the lower sandy country of Overyssel. The river is dyked along most of its course, and enters the Yssel Meer by a delta. Towns like Zutphen, Deventer and Zwolle lie where patches of sands approach the flood plain.

2c The Geldersche Vallei

This small tract comprises the trough within the morainic hills of Utrecht and Gelderland. The greater part is drained by the northward flowing river Eems, which enters the Zuider Zee across a flood plain standing below sea level. The upper part of the trough rarely exceeds an altitude of 20 ft. ; it opens southwards into the flood plain of the Neder-Rhine between Rhenen and Wageningen. The bounding ridges of the Geldersche Vallei—the Utrecht-Gelderland ridge and hills of Gooiland to the west, and the Veluwe to the east—approach the Neder-Rhine very closely. The 3-mile wide gap opening into the Geldersche Vallei is closed by a large river dyke.

This small region is not an alluvial valley : while clays occur at the northern end, considerable tracts of peat are found higher up, and in several places the sands of the bordering regions form a continuous mantle across the valley. It is mainly its relief which relates it to the great alluvial valleys and distinguishes it from the ridges to the east and west. The low relief of the region is illustrated by the fact that until about ten years ago it was favoured as a route for the projected Amsterdam-Rhine Canal before the present route was adopted (see p. 580). In very early times the Geldersche Vallei was a glacial tongue basin.

Amersfoort is the only town of any size.

3. The Sand Country

3*a* *North Brabant and north Limburg*

This extensive terrain, an outwash plain in origin, is a continuation of the Belgian Campine. It differs from the similar regions of the north-east in the absence of boulder clay, erratics and glacial ridges, for it was not covered by the ice sheet of the third glaciation. In the west low bluffs up to 70 ft. in height reach the East Scheldt; northwards the region merges into the Waal-Maas flood plain, eastwards, across the narrower flood plain of the northward section of the Maas, a similar landscape is found along the German frontier. Altitudes are greatest along the Belgian frontier and reach 160 ft. Narrow strips of alluvium mark the course of northward flowing streams like the Donge, the Dommel and the Aa. In the east, the Maas swings in a flood plain up to 2 miles wide, bordered by low bluffs rising to 50 ft. Along the sides of the valley the three terraces cut during post glacial times can be traced. The right bank of the Maas is usually higher than the left.

The boundary between North Brabant and Limburg crosses the Peel, an extensive tract of peat bog, still largely unreclaimed. Many former bogs have been drained, but small patches occur elsewhere. These are ' high moor ' bogs (*hoogeveen*) (see p. 100). Considerable woodland remains. Mixed farming is widely carried on in comparatively isolated patches. A line of towns—Bergen-op-Zoom, Roosendaal, Oosterhout, the Langstraat, 's Hertogenbosch, Oss and Grave—marks the northern limit of the sandy territory towards the great plain of river clay, but urban development has been most active in recent decades more towards the centre, where manufactures have expanded, in Breda, Tilburg, Eindhoven and Helmond.

3*b* *The Utrecht-Gelderland ridge*

This narrow belt of morainic hills runs from the Zuider Zee near Huizen, where it is known as the Hills of Gooiland, to the valley of the Neder-Rhine at Rhenen. The Hills of Gooiland reach heights of 120 ft., but the main ridge exceeds 200 ft. in places. This comparatively high ground is nowhere more than 6 miles across. Woodland occurs frequently. On the ridge or along its western slopes is a line of towns—Zeist, Hilversum and Bussum—which have grown considerably in recent years as residential outliers of Utrecht and Amsterdam (Plate 4).



Plate 1. The Veluwe and the Rhine flood plain, west of Arnhem

To the left are the wooded slopes of the sandy hills of the Veluwe, fronting on the level plains of river clay threaded by the Neder-Rhine and small streams. The area shown in the photograph lies between Heelsum and Doorwerth.



Plate 2. The plateau of south Limburg, near Gulpen

Woodland, orchards and cultivation diversify the scenery of this undulating Chalk plateau, with its covering of fertile ' loess '.

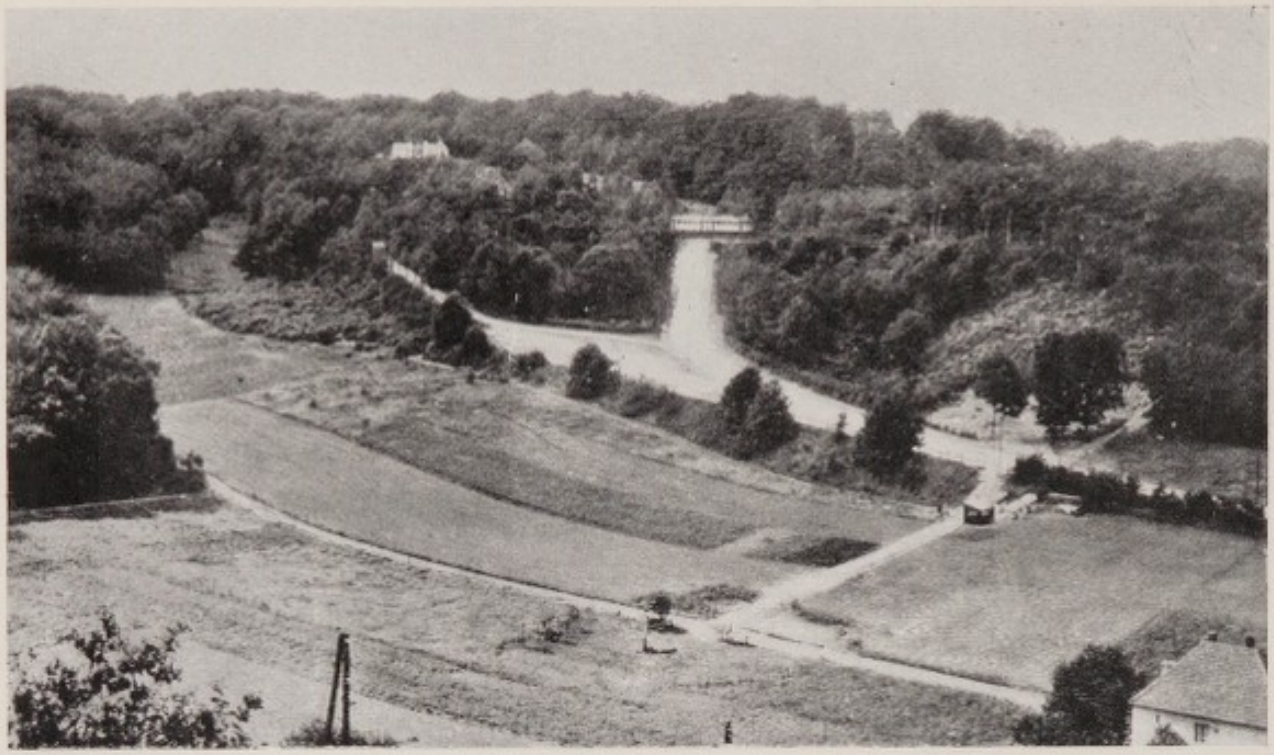


Plate 3. Wooded country at Beek near Nymegen
The view is taken at the German frontier.



Plate 4. Sandy heath near Bussum
The hills of Gooiland, south-east of Amsterdam, resemble the Veluwe in scenery, and provide recreation for the people of the capital.

3c *The Veluwe*

This extensive region of sands is bounded on its outer edges by the principal terminal moraines of the Netherlands, which drop sharply to the valleys of the Neder-Rhine to the south, and the Yssel to the east. Northwards, these hills approach closely to the shores of the Zuider Zee at Harderwijk. The Over Veluwe, for the greater part, exceeds 230 ft. in height, and in two areas exceeds 330 ft. Much of the region is thinly populated and given over to woodland and nature reserves. Apeldoorn is the largest town.

3d *Eastern Gelderland and Overyssel*

This region is separated from the Veluwe by the river clays of the Yssel, and may conveniently be regarded as ending northwards at the Overyssel Vecht, a river which flows westwards from German territory to enter the Yssel delta. Sands and gravels enter into the subsoil of the region, but both soil and drainage are complicated by the presence of boulder clay—remnants of the ground moraine (see p. 6). Relief is highest in the east along the German frontier, frequently reaching 150–200 ft.; most of the surface is between 30 and 60 ft. above sea level, while running through the centre and parallel to the Yssel is a glacial ridge, the Lemelerberg-Holterberg, attaining heights of 250 ft. The countryside is varied in appearance. Sandy heaths are cut across by narrow strips of alluvium along the frequent westward flowing streams; areas of bog are restricted save in the north; woodlands are extensive, while everywhere reclamation has created innumerable patches of meadow and arable. Towns are concentrated in the Twente industrial district near the German frontier.

3d *Drenthe and the interior of Friesland and Groningen*

The inner part of the north-eastern Netherlands lies mainly at an altitude of 10–40 ft., and culminates in the glacial ridges of the Hondsrug which runs south-eastwards from Groningen and attains in places an altitude of nearly 100 ft. To the west and north is a belt of fen peat or ' low fen '; fen peat also extends along the river valleys. In the centre, east and south-east are extensive areas of bog peat or *hoogeveen*, resulting originally from the imperfect drainage beneath the prevailing sandy subsoil (see p. 74). Most of this *hoogeveen* has been reclaimed for a productive agriculture (see p. 333), but wide areas remain east of Coevorden along the

German frontier. The largest of these areas of bog is the Boertanger Moor. A good deal of sandy heath remains, while much has been converted into woodland. In the centre population is thin and towns are few: the Groningen fen colony district, however, is the site of a variety of minor industries (see p. 370).

4. The Plateau of south Limburg

This is the smallest of the physical regions of the Netherlands. It includes almost the whole of the Limburg 'Appendix', which extends southwards between Belgium and Germany for more than 25 miles, reaches a maximum width from east to west of just over 20 miles, yet is attached to the main territory of the Netherlands by a corridor only 3 miles wide at its narrowest, near Susteren. The peculiar territorial position of this area is emphasized by the unusual position of Maastricht. For the greater part of its length the Belgian (western) frontier of south Limburg is formed by the Maas, yet Maastricht, the largest town in the province, stands on the west (left) bank of the river, with the Belgian frontier forming a semicircle $2\frac{3}{8}$ miles distant to the west.

Apart from the flood plains of the Maas, about 2 miles wide, south Limburg consists of a dissected plateau of Cretaceous rocks, rising above 300 ft. over considerable areas. The highest point is reached in the Vaalserberg in the extreme south-east—1,053 ft. The deep sinuous valleys with wooded slopes, and not infrequent rocky walls and swift-flowing streams, make the landscape quite different from that of the rest of the country. The surface of the plateau is covered with 'loess',* which gives rise, as usual, to soils admirably suited to wheat and sugar beet. Two right bank tributaries of the Maas, the Geul and the Geleen, divide the plateau into three main divisions (Plate 2).

The deeper geology of the region is also distinctive, for the concealed coalfield of the north-east is now in full exploitation. The resulting growth of industries, and the rise of mining towns like Heerlen and Kerkrade and of a number of colliery villages, gives a further unusual stamp to south Limburg (see p. 368).

* It has now been recognised that the deposit in south Limburg usually described as loess is not, in fact, true loess (i.e., wind-borne), and Dutch geologists now refer to it as *loessoïde*. This deposit is the product of the decomposition of the Upper (Senonian) Chalk, transported by surface streams, and mixed with other material. The term 'loess', therefore, when used in this handbook, and in the folding geological map at the end, is to be understood in this sense.

BIBLIOGRAPHICAL NOTE

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(2) Among standard Dutch works the following may be noted: J. van Baren, *De bodem van Nederland*, 2 vols. (Amsterdam, 1920–1927); F. J. Faber, *Geologie van Nederland* ('s Gravenhage, 1933); R. Schuiling, *Nederland, Handboek der Aardrijkskunde*, 2 vols. (Zwolle, 1934, 1936); W. A. J. M. van Waterschoot van der Gracht, 'The deeper geology of the Netherlands and adjacent regions', *Mededeelingen Rijksopsporing van Delftstoffen* No. 2 (Den Haag, 1909).

(3) Reports of the excursions of the International Geographical Congress, Amsterdam, 1938 provide detailed studies of certain areas—*Le Pays Minier, Rotterdam et ses environs, Polders et Dunes* (Amsterdam, 1938).

(4) For references relating to the evolution of the coast see p. 707.

(5) Useful material on the great rivers will be found in H. J. Mackinder *The Rhine* (London, 1908).

CHAPTER II

THE COAST

Introduction : The Belgian frontier to the Hook of Holland : The Hook of Holland to Den Helder : The Frisian Islands and Wadden Zee : Den Helder to the Dollart and the German frontier.

Introduction

The length of the Netherlands coastline is not easy to determine precisely. Measuring across the seaward ends of estuaries and of straits between islands the length from the Belgian frontier to the Ems estuary is 261 miles (422 km.). This is regarded as the length by the authorities responsible for coast protection (see p. 708). The mainland coast, together with all close-lying islands and islands around which navigation does not normally take place, i.e., including the Yssel Meer Dam but not the Yssel Meer (Zuider Zee) measures 470–520 miles ; to this figure the islands of Schouwen-Duiveland and Goeree-Overflakkee add a coastline of about 90 miles and the larger Frisian Islands about 100 miles, giving a total approaching 700 miles (1,126 km.). The length of all tide water coast and large tidal rivers would be greater still.

The central part, 75 miles long, is a remarkably straight coast, but the greater part is more complicated. To the south, in Zealand and South Holland, lie the estuaries of the Rhine–Maas–Scheldt and several large islands ; to the north lie the interior Wadden Zee and the long chain of the Frisian Islands. The Dutch coast is similar to the neighbouring coasts of Belgian Flanders and Germany in being low, but differs in that a much greater proportion is actually below sea level, and is protected from inundation by large sea dykes or by belts of sand dunes. Almost all the undyked coast is dune coast ; cliffs are virtually unknown. Offlying dangers to navigation consist of sand or mudbanks, with few reefs—off the Frisian Islands there is a large shingle bank called Vlieland Reef. In the south most of the coast fronts on to mud flats of varying width ; in the central section sandy beaches are prominent ; in the north the islands have sandy beaches running into extensive sandflats, while the mainland coast has a shore which is mainly muddy.

The following general description of the coast is arranged in four sections :

(1) from the Belgian frontier to the Hook of Holland, including the West Scheldt, East Scheldt and Maas estuaries, and the islands of Zealand and South Holland (Fig. 18).

(2) from the Hook of Holland to Den Helder (Fig. 20) ;

(3) the Frisian Islands and Wadden Zee (Figs. 21, 22) ;

(4) Den Helder to the Dollart and the German frontier (Figs. 21, 22).

The itinerary is that which could be followed by small sea-going ships ; islands separated from the mainland only by shallow creeks are described with the nearest mainland. Ports and smaller harbours are indicated on Figs. 18–22 ; the ports are described in Chapter XVI ; the brief particulars of the small harbours are given in the table on p. 524, and are not normally described in this account.

The Belgian Frontier to the Hook of Holland

General features

This coast, on both the mainland and the islands, is low lying, with the greater part protected by dykes. Settlement is mainly rural ; the only ports of any importance are Terneuzen and Flushing, though there are many small harbours (see p. 524). The coast may broadly be regarded as that of four great estuaries : (a) the West Scheldt, (b) the East Scheldt, (c) the Grevelingen Maas, (d) the Haringvliet Maas. These estuaries are separated from each other by three groups of islands and peninsulas : (i) the islands of Walcheren, North Beveland and the peninsula of South Beveland, (ii) the island of Schouwen-Duiveland and the peninsula of Tholen ; (iii) the island of Goeree-Overflakkee. To the north lie two much narrower waterways, the Brielle Maas estuary and the New Waterway (Nieuwe Waterweg). The southernmost estuary, the West Scheldt, is of enormous commercial importance, forming the approach to Ghent and Antwerp. The inner part of the East Scheldt estuary is navigationally speaking a dead end. It formerly opened into the West Scheldt, but a separation was brought about in 1866 when the dam carrying the Flushing railway was constructed. The East Scheldt estuary and the Grevelingen and Haringvliet Maas estuaries, however, are important for traffic from north to south, for the South Beveland canal permits a connection for large barges between the Rhine and Antwerp-Ghent, without the need of traversing the North Sea.

The South Shore of the West Scheldt

Tidal Information (in ft.)

	Spring rise*	Neap rise	Mean level		Spring rise*	Neap rise	Mean level
Wielingen Buoy	14·2	11·6	7·0	Bergen-op-Zoom	14·4	12·0	7·2
Terneuzen	16·4	13·8	8·5	Brouwershaven	9·7	8·2	5·0
Bat	17·9	14·9	8·9	Hellevoetsluis	7·6	6·5	3·8
Flushing	15·5	12·8	8·0	Dordrecht	6·5	5·5	3·2
Wemeldinge	13·4	11·2	6·9				

The Dutch coast of Zeeuwsch Vlaanderen (Zealand Flanders), the southernmost part of Zealand, begins at the Zwin estuary, a silted inlet important in medieval times as the entry to Bruges. The distant approach to the coast is made by the deep water Wielingen channel ; offshore anchorage can be found about 600 yards from the shore in depths of 32 ft.

From the Zwin the coast trends northwards for a mile before turning east-north-east to reach Kruishoofd lighthouse and Nieuwe Sluis, the most northerly point of the south shore of the West Scheldt. A substantial earthen dyke, in places reinforced with stone, protects the flat cultivated land from inundation ; it lies mostly a short distance back from the coast. Except where the dyke occurs the coastline is low and sandy with a narrow belt of low sand dunes between the beach and the dyke. There is soft sand at high water crossed by groynes. From the lighthouse the coast runs south-eastwards past the old fort of Frederik Hendrik, at first backed by sand dunes, then by an earthen dyke. Breskens is the terminus of a steam ferry to Flushing. From Breskens (3,300) the coast runs for about 25 miles south-eastwards to Terneuzen, in a straight course except for the broad creek known as Savojaards Plaat which dries out except for a narrow channel called the Braakman, employed in the Middle Ages as an entrance to a canal leading to Ghent. The whole of this coast is protected by a dyke. There are no sandy beaches, and all parts below high-water line are composed of marsh and drying mudflats. Offshore from Breskens to Savojaards Plaat lie extensive drying banks, but at Terneuzen the deepwater channel of the West Scheldt comes close to the south shore, where it is known as Pas van Terneuzen, and offers anchorage in depths of 20–60 ft.

Terneuzen, or Neuzen (see p. 441), is the chief town of Zealand Flanders, with a population of 11,300 ; its maritime lock is the

* Above the approximate datum of Mean low Low Water Springs.

entrance to the ship canal which gives Ghent a connection with the sea. From Terneuzen to the Dutch-Belgian frontier, the coast is about 23 miles long, first trending north-eastwards to the northward pointing peninsula ending in the Hoek van Ossenisse, then running south-eastwards to the Dutch-Belgian frontier at Oudendoel on the west bank of the Scheldt; this second stretch forms a wide bay largely taken up by the vast mudflats known as the Verdronken Land van Saaftinge. There are no sandy beaches along this coast, the drying parts below high water being marshes and mudflats. It is backed along the whole length by an earthen dyke. The deep channel of the Scheldt is generally far from this shore, for two reaches (Middelgat and Nauw van Bat) swing to the north, and only one (Zuidergat) comes near the south shore, where it offers anchorage in 58–96 ft.

Communications. The thinly populated region which backs the south coast of the West Scheldt is poorly served by east-west communications. Four main roads run southwards, those from Cadzand, Breskens and Terneuzen towards Ghent, and one from Walsoorden to Hulst and St. Nicolas in Belgium. A network of minor roads, mainly along dykes, reaches inland and touches the coast at many points. From Terneuzen a double track railway runs southwards along the canal to diverge at Sluiskil, one track running via Sas-van-Gent and Selzaete to Ghent, the other turning eastwards to Hulst. At Sluiskil there are a coke-oven plant and the synthetic nitrogen and ammonia works of *Cie Néerlandaise de l'Azote.*

North shore of West Scheldt from near Ossendrecht to Westkapelle

This length of coast comprises the south shore of the islands of South Beveland and Walcheren. Like the opposite shore it is bordered by dykes; the land behind, however, is lower and considerable areas lie below mean sea-level.

From the frontier on the Scheldt the coast runs for a short distance northwards to the narrow neck of land crossed by the Flushing railway and formerly a channel opening into the East Scheldt. Thence the general direction is westerly, but opposite the Hoek van Ossenisse there is a wide bay on which stands Hansweert, the entrance to the South Beveland Canal. At Hansweert three locks give admittance to the canal: they have sill depths of 11, 11½ and 6¼ ft.; vessels up to 20 ft. draught, 328 ft. length and 51½ ft. beam may be admitted to the canal. Westwards the coast extends to the south as far as Ellewoutsdijk. Beyond lies the Sloe, the shallow

channel leading to the East Scheldt and separating South Beveland from Walcheren. This channel mostly dries, but was important for shipping in earlier centuries. Up the channel lies the dyke carrying the Flushing railway which, apart from the shallowness of the Sloe, prevents through passage. The entire south shore of South Beveland and the south shore of Walcheren as far as Flushing are bounded by earthen dykes, and are composed of marsh and drying mudflats. From Flushing to Westkapelle, however, the shore is sandy, broken by stone dams and groynes over most of its length and backed by sand dunes, although a large stone dyke, 25–30 ft. high and in parts 320 ft. wide, provides protection against the sea (Plates 5, 6).

Flushing (see p. 444) is a packet station of some importance (population 21,700). The deep channel of the Scheldt comes close to the north shore in three reaches—the Nauw van Bat, the Middelgat, and the Honte,* as well as a secondary channel, Pas van Everingen. Off the south-west coast of Walcheren the narrow Oostgat, the second but less deep entry to the West Scheldt, lies close inshore.

Middelburg (18,000), the capital of Zealand, lies 4 miles north of Flushing along the Walcheren Canal. It was taken by the English Walcheren expedition of 1809, and held for a short time, during operations aimed originally at the seizure of Antwerp ; the effort was a failure, and thousands of troops died of fever in this marshy area.

Communications. Good means of communication are scanty. The sole railway is the Flushing line, which together with the only main road, follows a westerly course from Bergen-op-Zoom at the head of the East Scheldt, by way of Goes in the centre of South Beveland, to reach Middelburg and Flushing, via the embankment over the Sloe. The only important secondary road connects Goes with Hoedekenskerke on the south shore and with Katscheveer on the north shore. Goes (9,600) is an important market centre. The shallow Walcheren canal connects Flushing with Veere by way of Middelburg.

South Shore of East Scheldt

All the coast of Walcheren is protected by dykes, but the north-west coast is also skirted by sand dunes. From Westkapelle the belt, at first narrow, widens ; Domburg is built among the dunes, and not on the coast ; after Domburg the belt is much wider, reaching as much as three-quarters of a mile. The north-east coast

* On the history of the name ' Honte ', see footnote to p. 618.

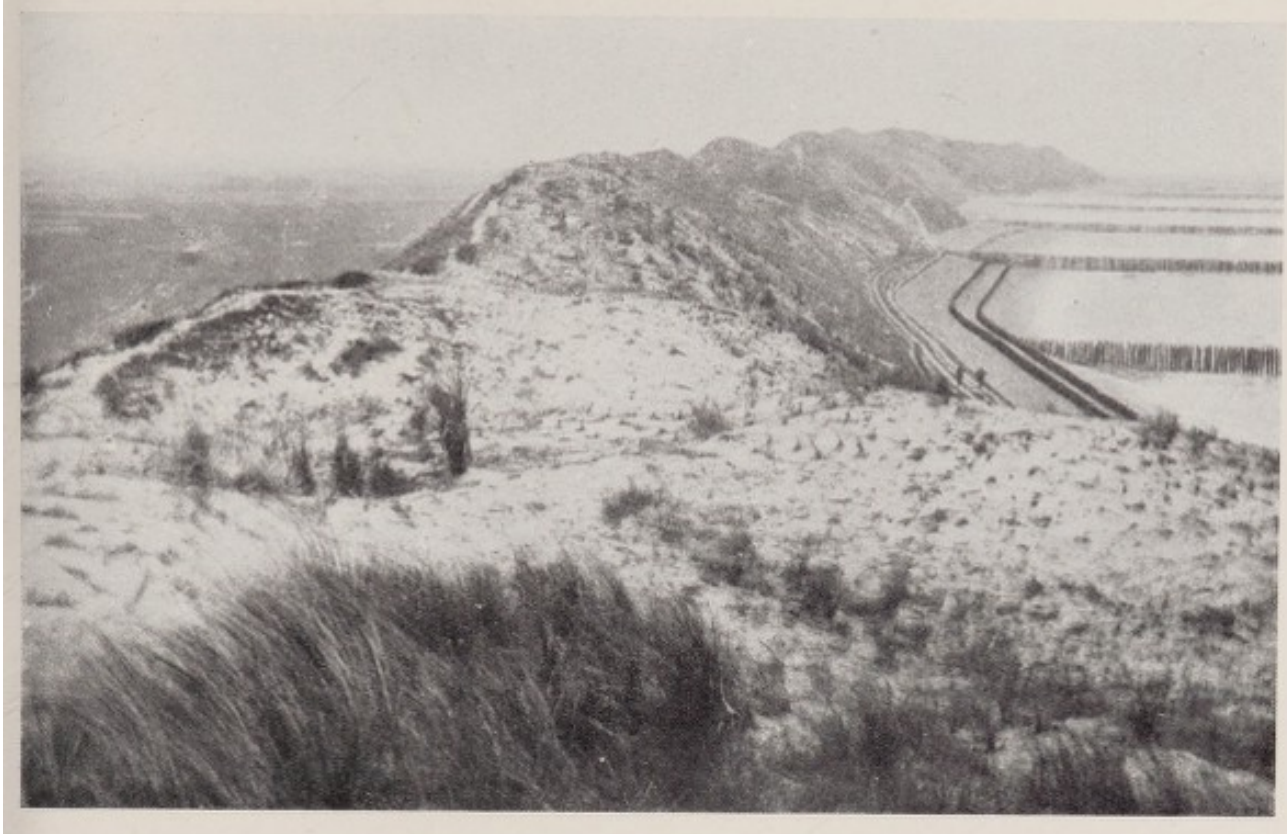

Plate 5. The dunes at Westkapelle, Walcheren

The sand of the dunes is planted with marram grass. To the right along the foreshore are protective works which counter the erosive effect of storm waves on the dunes ; on the left is the cultivated plain, lying below mean sea level. The dunes protect the north-west and south-west coasts of Walcheren ; the gap in the extreme west of the island is closed by the famous Westkapelle sea wall.



Plate 6. The western shore of South Beveland and the Sloe Dam

The view is taken looking west towards Walcheren, from the north-east corner of the dam which carries the Flushing railway across the Sloe channel.



Plate 7. The mouth of the Old Rhine (Oude Rijn)

The river enters the North Sea through lock gates, with Katwijk-aan-Zee on the right (south). The farther edge of the photograph is about 4 miles inland; Leiden lies just beyond.



Plate 8. Low water sand, Noordwijk-aan-Zee

The vessel, with 'scandalized' mainsail boom, is a hengst (see p. 353, fig. 82); it has a kedge set seawards.

has few dunes. The narrow and tortuous Veregat lies close to the shore, and leads to Veere, a small port, and southward into the Sloe channel between Walcheren and South Beveland. The south-west and north-west coasts of Walcheren have sandy beaches, in places reaching a width of 300 yards, and largely protected by groynes. Along the south-east and north-east coasts the shore is composed almost entirely of muddy banks, covered with coarse grass.

Separated from Walcheren by the Veregat and from South Beveland by the tortuous Zuidbuit and Zandkreek, lies the island of North Beveland. It is about 8½ miles long from west to east and has a coastline of about 20 miles. It is protected all round by dykes, with low sand-dunes on the extreme north-west corner.

Off the north coast of Walcheren and North Beveland the Roompot, one of the main entrance channels to the East Scheldt, lies fairly close to the shore; the north channel, Westgat, lies close to the south shore of the island of Duiveland. The least depths, which are liable to frequent change, that have to be passed over by a vessel going through the Roompot to Zierikzee (see p. 38) or into the East Scheldt proper are 12¼ ft.

The north coast of South Beveland from the Flushing railway embankment eastwards, together with the short stretch of mainland south of Bergen-op-Zoom, is about 26 miles long, protected along its entire length by a dyke except for two short stretches of narrow dunes south of Bergen-op-Zoom. East of North Beveland the shore fronts upon the East Scheldt, which is here very wide but mostly shallow. Along the entire length of shore lie drying mud-flats, extending in places as much as a mile offshore, although the deeper channel lies to the south-east along the shore of North Beveland. Halfway along the peninsula, where the channel comes close, stands the north outlet of the South Beveland Canal, near Wemeldinge. There are three locks, as at Hansweert; vessels can be passed through almost at any time. The small harbour of Bergen-op-Zoom is approached by tortuous channels from the East Scheldt. Bergen-op-Zoom was unsuccessfully assaulted by a British force in 1814.

Communications. The one main road and railway of South Beveland reach the mainland near Woensdrecht, where a secondary road runs south to Antwerp. At Bergen-op-Zoom (24,000), the railway runs eastwards to Breda, crossing the Rotterdam-Antwerp line at the important junction of Roosendaal. The main road continues east to Breda and sends a branch to the Moerdijk bridge

and Rotterdam, while a secondary road runs north to Steenbergen and Willemstad.

North Shore of East Scheldt

From the mainland to the north of Bergen-op-Zoom the peninsula of St. Philipsland and the low islands of Tholen and Schouwen-Duiveland extend north-westwards. They form, from the point of view of navigation, a peninsula which separates the East Scheldt from the Maas estuary, except for the linking channel of the Keeten-Mastgat-Zijpe and the Eendracht which opens into it. Tholen is separated from the mainland by the extremely narrow Eendracht and from Schouwen-Duiveland by the Mastgat. The Mastgat-Zijpe is the continuation of the Antwerp-Rhine canal route via the S. Beveland Canal, and is a deep channel. The island has a length of about 10 miles from north-west to south-east and a coastline of about 24 miles, along the entire length of which runs an earthen dyke. The whole of the shore is fronted by drying mudflats. Anchorage is depths of 78 ft. can be found off Zierikzee.

Communications. Roads on the islands are only of local importance ; there is a narrow gauge tramway running throughout its length.

The St. Philipsland peninsula leads northward to the Krammer and Volkerak, two channels which connect the Grevelingen Maas and the Haringvliet Maas. The peninsula comprises two former islands connected by a bridge and a silted area. Its coast is everywhere backed by an earthen dyke, and bordered by mudflats and banks. The secondary road running through the peninsula westwards from Steenbergen is of importance only as leading to the ferry across the Zijpe to Schouwen.

South Shore of the Grevelingen Maas

The island of Schouwen-Duiveland lies between the East Scheldt and Brouwershaven Gat. It is almost 15 miles long from west to east and has a coastline of about 40 miles. The north coast is followed by a dyke and fronted by occasional mudflats. The western coast is backed by sand dunes 70 to 90 ft. high. The dunes at North Schouwen are 300 yards wide, but farther west attain a width of nearly a mile. Here, for 9½ miles, there is a sandy beach averaging about 200 yards in width.

Communications. From the ferry at Zijpe, on the east coast, a secondary road runs westwards through the middle of Duiveland to



Fig. 18. The coast of Zealand and South Holland

From : G.S.G.S. Series (Air) 5010, 1 : 250,000 Sheet 15.
S.B.C. South Beveland Canal ; G Goedereede ; H Hansweert ; O Oosterhout ; W Wemeldinge ; Geert. Geertruidenburg ; Maassl. Maassluis ; Vlaar. Vlaardingen. The names of the ports which are described in Chapter XVI are shown in this map and in Figs. 20, 21, 22 by block capitals.

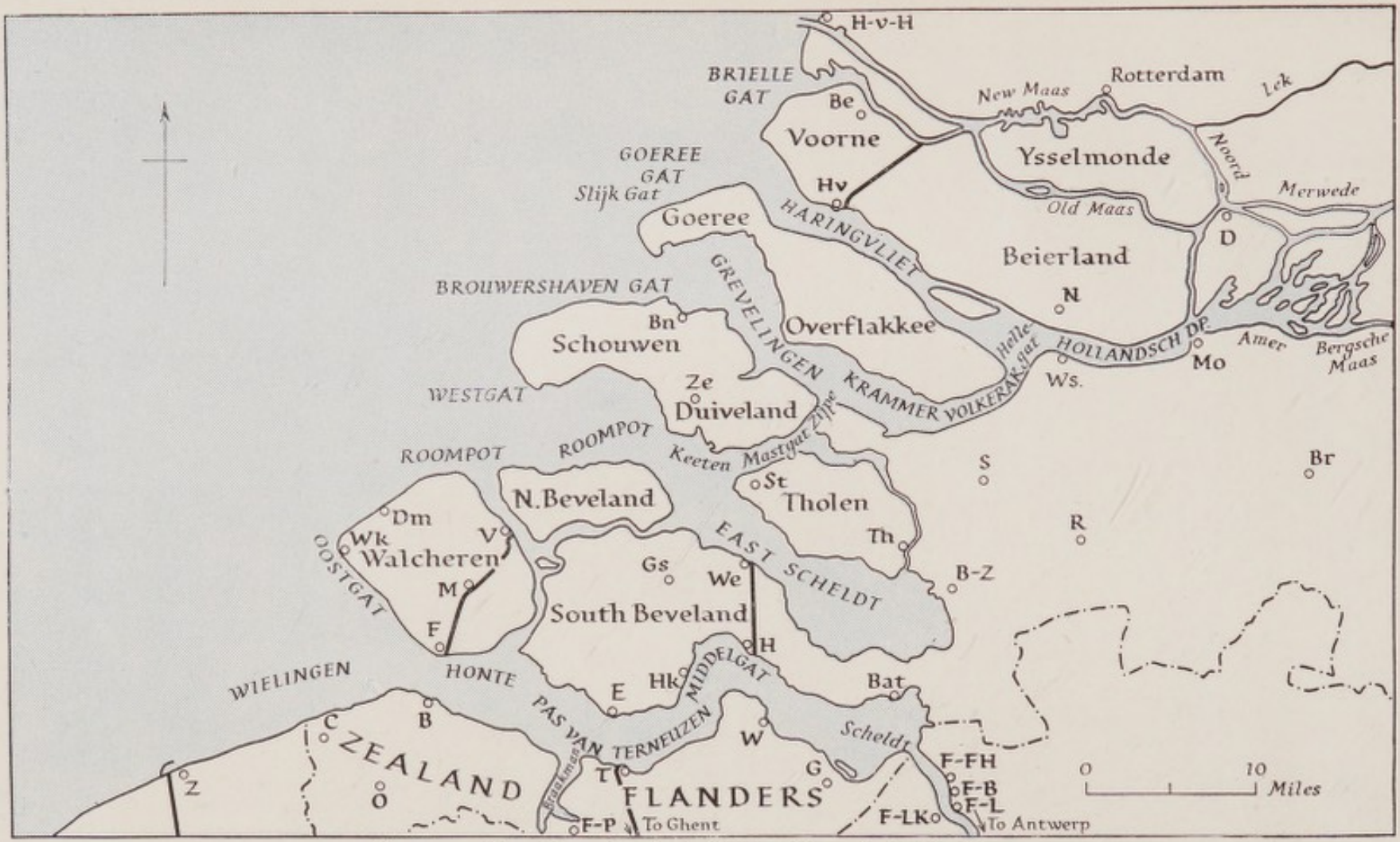

Fig. 19. The channels of the Rhine-Maas-Scheldt delta

From: G.S.G.S. Series (Air) 5010, 1 : 250,000 Sheet 15, Admiralty Charts, and Dutch charts—(1) De Schelde, van Vlissingen tot Antwerpen ; 1 : 50,000, *Ministerie van Marine, Afdeeling Hydrographie* ('s Gravenhage, 1938) ; (2) Nederlandsche Kust van West-Hinder tot Texel, 1 : 250,000, *Ministerie van Defensie, Afdeeling Hydrographie* ('s Gravenhage, 1931) ; B Breskens ; Be Brielle ; Bn Brouwerschaven ; Br Breda ; B–Z Bergen-op-Zoom ; C Cadzand ; D Dordrecht ; Dm Domburg ; E Ellewoutsdijk ; F Flushing ; G Grauw ; Gs Goes ; H Hansweert ; Hk Hoedekenskerke ; Hv Hellevoetsluis ; H-v-H Hook of Holland ; M Middelburg ; Mo Moerdijk ; N Numansdorp ; O Oostburg ; R Roosendaal ; S Steenbergen ; St Stavenisse ; T Terneuzen ; Th Tholen ; V Veere ; W Walsoorden ; We Wemeldinge ; Wk Westkapelle ; Ws Willemstad ; Z Zeebrugge ; Ze Zierikzee. The sites of forts referred to on p. 621, are indicated by F.F. F-B Blauwgaren ; F-FH Frederik Hendrik ; F-L Lilloo ; F-LK Liefkenshoek ; F-P Philippine.

Zierikzee (7,000) where it turns northwards to Brouwershaven, a narrower road continuing westwards from Zierikzee, eventually to reach Renesse.

The North Shore of the Grevelingen Maas

The island of Goeree (Goedereede)-Overflakkee is about 18 miles long from north-west to south-east and varies in width from 2 to 5 miles. The narrowest part represents the silted up strait of the Bornisse which was important in the Middle Ages as an entry to the East Scheldt.

The west coast of Goeree is bordered by sand dunes attaining on the south-west a width of 1,000 yards. The remaining coast is bordered by muddy shores backed by a dyke. Anchorage can be found in Springer Diep in 12–24 ft., close to the south shore of the island.

The Brouwershaven Gat is one of the two deepest channels leading into the Maas estuary, with a least depth of 10½ feet; it runs along the north shore of Schouwen, and forms the south branch of the Maas. By way of this channel and the Grevelingen, Krammer, Volkerak, Hellegat, Hollandsch Diep and Dordsche Kil vessels may reach Dordrecht on the Old Maas (Oude Maas) with similar least depths.

Communications. See p. 38.

The South Shore of the Haringvliet Maas

The northern branch of the Maas estuary is known as the Haringvliet. It extends inland at a fairly constant width of 2 miles, save for the island of Tien-Gemeten, partly mudflat and partly polder land, as far as Willemstad and Numansdorp, where it narrows to about 1¼ miles, thence being known as the Hollandsch Diep. The south shore of the Haringvliet Maas is formed by Goeree-Overflakkee. The north coast of Goeree is bordered by sand dunes up to several hundred yards in width. The remaining coast is bordered by muddy shores backed by a dyke. Anchorage can be found in 18–36 ft. at a distance of 3½–4 miles seawards.

Communications. A secondary road runs the length of the island, followed by a narrow gauge tramway. The Hollandsch Diep extends inland for 11 miles to the two bridges at Moerdijk carrying the main Rotterdam-Antwerp road and railway. Each shore is bounded by dykes, fronted by narrow flats between dyke and high water line. Beyond lie the confluence of the Maas and the Merwede

branch, which flow on either side of the marshy territory of the Biesbosch. The lower section of the Maas is here known as the Amer, and leads upstream to Geertruidenberg.

The North Shore of the Haringvliet Maas

From Fort Numansdorp on the south coast of Beierland, at the entrance to the Hollandsch Diep, the coast westwards to Hellevoetsluis is 12½ miles long and is low and muddy. From Fort Numansdorp to the Spui it is backed by two dykes, and from the Spui to Hel'evoetsluis (1,400) by a single dyke. The dyke lies mostly a little distance back from high water mark, but at three points—opposite the eastern and western ends of the island of Tien-Gemeten, and near Hoornsche Pier, it is steep-to, standing out close to the deeper channel. From Hellevoetsluis westwards there is about a mile further of dyke ; from this point the coast of Voorne is sandy, north-westwards to Bosduin, and north-eastwards into the Brielle Gat. This sandy stretch has a beach which is frequently 100 yards wide and at its widest reaches 600 yards ; it is backed by a narrow belt of sand dunes.

The Brielle Maas and New Waterway

From the most northerly point of Voorne an earthen dyke runs south-eastwards to Brielle (Brill), and thence continues up the shore of the New Maas. Brielle is now a very small town (population 3,500) and port, but is famous in Dutch naval history, for it was the birthplace of Admiral Maarten Harpertsz Tromp (1563), and its capture by William de la Marck in 1572 was the signal for the general rising of the people of Holland and Zealand. The low island of Rozenburg, bounded by dykes to the north and south, separates the Brielle Gat-New Maas from the New Waterway. The western end merges into a sandy spit, the Hoek van Holland, bounded to the north by the two dams on the south side of the New Waterway entrance which, together with the north dam, keep the entrance clear of longshore drift. The sand dunes of this western shore give way to mudflats.

The port of Hook of Holland (Hoek van Holland), is approached from the west, and good anchorage may be had outside the entrance to the New Waterway in depths of 25 ft. This great channel leads to the ports of Maassluis, Vlaardingen, Schiedam, Rotterdam and Dordrecht, and thence to the Rhine and other inland waterways (see p. 451).

Communications. South of the New Waterway means of communication are sparse. The only main road and railway lie in the extreme east—the Rotterdam-Dordrecht road and railway, which after crossing the Hollandsch Diep by the Moerdijk bridges, make connections with the principal roads and railways of the southern part of the Netherlands and with Antwerp and north Belgium. A good secondary road runs westwards from Rotterdam to Brielle, and thence southwards to Hellevoetsluis, where a ferry makes a connection with Middelharnis on Overflakkee. From Rotterdam a secondary road pursues a circuitous course to a point near Numansdorp, whence a ferry crosses the Hollandsch Diep to Willemstad. Five narrow gauge tramways converge towards Rotterdam.

Hook of Holland to Den Helder

Tidal Information (in ft.)

	Spring Rise	Neap Rise	Mean Level
Rotterdam	5·5	5·0	3·2
Hook of Holland	6·8	5·8	3·6
Scheveningen	6·8	5·8	3·6
Ymuiden (IJmuiden)	6·5	5·5	3·3
Den Helder	5·0	4·3	3·0

From the Hook of Holland dam to Den Helder, a distance of about 75 miles, the Dutch coast is in strong contrast to the coasts to the south or to the north. It is practically straight, with a very slight easterly curve, and it is almost entirely a dune coast. These dunes are of varying width but are mostly very broad. They are replaced by a dyke on only three sections—north of the Hook of Holland, around Petten, and at Den Helder. A number of seaside resorts lie along the coast but they are all, with the exception of Scheveningen, villages built among or behind the dunes. The sandy beaches of this coast do not show many variations. The width of sand below high water is about twice that of the sand above high water ; the low water sand is hard, the high water sand is difficult to walk through. The tide rises parallel to the coast, north-east and south-west, and the tidal current is felt close inshore. Groynes are necessary along many stretches.

Hook of Holland to Ymuiden

This stretch of coast is 34½ miles in length and trends at first north-east in a curve which gradually assumes a direction a little east of north. It is a low and sandy coast, followed by a beach

throughout, which mostly averages 100 yards in width, although it is 170 yards wide from Scheveningen to Katwijk-aan-Zee. The gradient of the beach is easy ; the low water sand is hard, and the high water sand is soft. The beach is protected by groynes from the Hook to a point just beyond Scheveningen.

The beach is backed almost throughout by dunes. As far as Scheveningen the belt of dunes is narrow, and the height varies from 20 to 60 ft. North of Scheveningen the belt attains a much greater width—up to 2 miles, although at Katwijk-aan-Zee they narrow considerably. North of Katwijk they rise in places to a height of 80 ft. and attain a maximum width near Zandvoort of 3 miles. Behind the dunes lie wooded country, bulbfields, orchards and polderland, including in the north the enormous Haarlemmermeer Polder.

There are small bathing resorts at Kijkduin, Terheiden, Katwijk-aan-Zee, Zandvoort (9,000) and Nordwijk-aan-Zee. At Katwijk the Oude Rijn, a mouth of the Rhine of much greater importance in earlier centuries, gains outlet to the sea by means of a lock. At Scheveningen there is a promenade and promenade pier 1,365 ft. long projecting seawards over the sand. Good anchorage may be had one mile off this resort in depths of 30 ft. It was off Scheveningen in June 1653 that an English fleet under Monk fought a considerable and successful action with a combination of Dutch fleets from the Texel and the Scheldt (Plates 7, 8).

Ymuiden to Den Helder

From Ymuiden (see p. 487) northwards the straight section of coast extends for 27½ miles to Huisduinen, near the tip of the peninsula of North Holland. The coast, like the coast southwards, is low and sandy and mostly bordered by sand dunes. About 10 to 15 miles north of Ymuiden stands Camperdown (Kamperduin), a high sandy ridge stretching northwards for 6 miles, with dunes as high as any in the Netherlands. The high dune, Kamperduin, has a very steep seaward face. From this point northwards to Petten, a distance of 3 miles, there is a break in the dunes, where the coast is bordered by a substantial dyke, the Hondsbossche sea-wall. North of Petten the dunes re-appear, and widen to include a stretch of water known as Zwanen Water. A considerable length of these dunes is planted with marram grass. From Callantsoog, immediately to the north, the dunes continue to Huisduinen, but the belt is much narrower and rarely exceeds 500 yards. The whole of

this stretch of coast has a sandy beach like the rest, though narrower at 70 yards and with a less easy, though not steep, gradient. From the north of Camperdown almost to Huisduinen runs a dyke or sea wall, which continues around the tip of the peninsula through Den Helder to the naval port of Willemsoord. This structure is about 3 miles long, and is very broad with a road running along the top ; on the inner side of the peninsula it forms a connection with the dykes which bound the shores of the Yssel Meer (Zuider Zee).

North of Ymuiden there are small resorts built among the dunes or behind the sea dyke at Wijk-aan-Zee, Egmond-aan-Zee, Bergen-aan-Zee, Petten, Callantsoog, and Huisduinen. All have anchorages over 30 ft. deep up to one mile off shore. Ymuiden stands at the entrance to the North Sea Canal (see p. 488) ; good anchorage may be had off the entrance of depths of 24–48 ft. ; Den Helder (see p. 513) adjoins the naval base of Willemsoord on the inner side of the peninsula. It may be approached through either of two channels of the Texel—the Molengat to the north-west or the Schulpengat to the south-west ; good anchorage may be had in depths of 48–60 ft. in the Marsdiep towards Texel. Den Helder controls the passage between the island of Texel and the mainland, which, together with the component channels, is known as Texelsche Zeegat (Texel Gat) or ' The Texel '. The channels lie through shoals, the chief of which, Haaks shoal, has a western edge rising very abruptly from deep water and is a considerable danger to navigation.

The waters around the Texel saw two important actions in the naval wars between England and the Netherlands. Off the Texel an English fleet under Monk defeated the Dutch under Tromp, who was killed in the action (July 1653). Off Camperdown in 1797 Admiral Duncan destroyed a Dutch fleet under De Winter.

Communications

Lying near the chief centres of population in the Netherlands, this 75 miles of coast is better supplied with means of communication than the coasts to the north and south. There is, however, no coast road properly speaking, but a main road (*Rijksweg*) runs inland parallel to the coast at a distance varying from $1\frac{1}{2}$ to $4\frac{1}{2}$ miles, along the junction between dunes and polders. This trunk road runs from Rotterdam to The Hague, which adjoins Scheveningen, by-passing Delft, to turn northwards. It passes near Leiden, and through Haarlem and Alkmaar, to meet the main road from Groningen via the Yssel Meer dam before reaching Den Helder.

Amsterdam is reached by two trunk roads from Haarlem and from a point near Leiden and by two secondary roads branching off north of Haarlem. From the coast short main or secondary roads run inland from the larger coast resorts and from Hook of Holland and Ymuiden.

A double track railway runs inland, following a similar course, from Rotterdam via The Hague, Leiden, Haarlem, Velsen and Alkmaar to Heer Hugowaard, whence it continues as a single line to Den Helder. Connections with the coast are made by double track lines from Hook of Holland, Scheveningen, Zandvoort, and Ymuiden, while most of the other resorts are served by light railway or tramway. Canals form a less direct but similar north-south route behind the coast—the Schie, Vliet, Ringvaart, Spaarne, Zaan, and North Holland canals, with a branch from Leiden to Katwijk-aan-Zee.

The Dutch Frisian Islands and the Wadden Zee

The Frisian Islands form a chain of low islands skirting the shore of the North Sea from Den Helder to the Elbe. The islands under Dutch sovereignty stretch from the Texel to the Ems estuary, at a distance from the mainland varying from 20 miles to 5 miles. The more easterly islands are sometimes called the *Wadden-eilanden*. Apart from flats and banks only occasionally above water at high tide, there are five large and four small islands. Texel, the most southerly, lies in a north-east-south-west direction, while Vlieland and Terschelling take up successively a more easterly direction; the fourth island, Ameland, lies due east and west, and the remainder curve again slightly to the north of east as far as the Ems approaches. The shores of the Frisian Islands are characterized by sandy beaches with firm low water sands and soft high water sand. All have considerable areas of sand dunes, and several are prolonged by extensive sand flats. On several of the islands there are large state nature reserves. Texel and Vlieland are the chief breeding ground of the *avocet*, a species of wader which is protected in the Netherlands.

The Wadden Zee

The stretch of tidal water lying between the Frisian Islands and the mainland is known as the Wadden Zee. Southwards it formerly opened into the Zuider Zee, the strait into which has now been closed by the Ysselmeer Dam (Afsluitdijk); eastwards, it is continued by similar stretches of water as far as the Jutland peninsula.

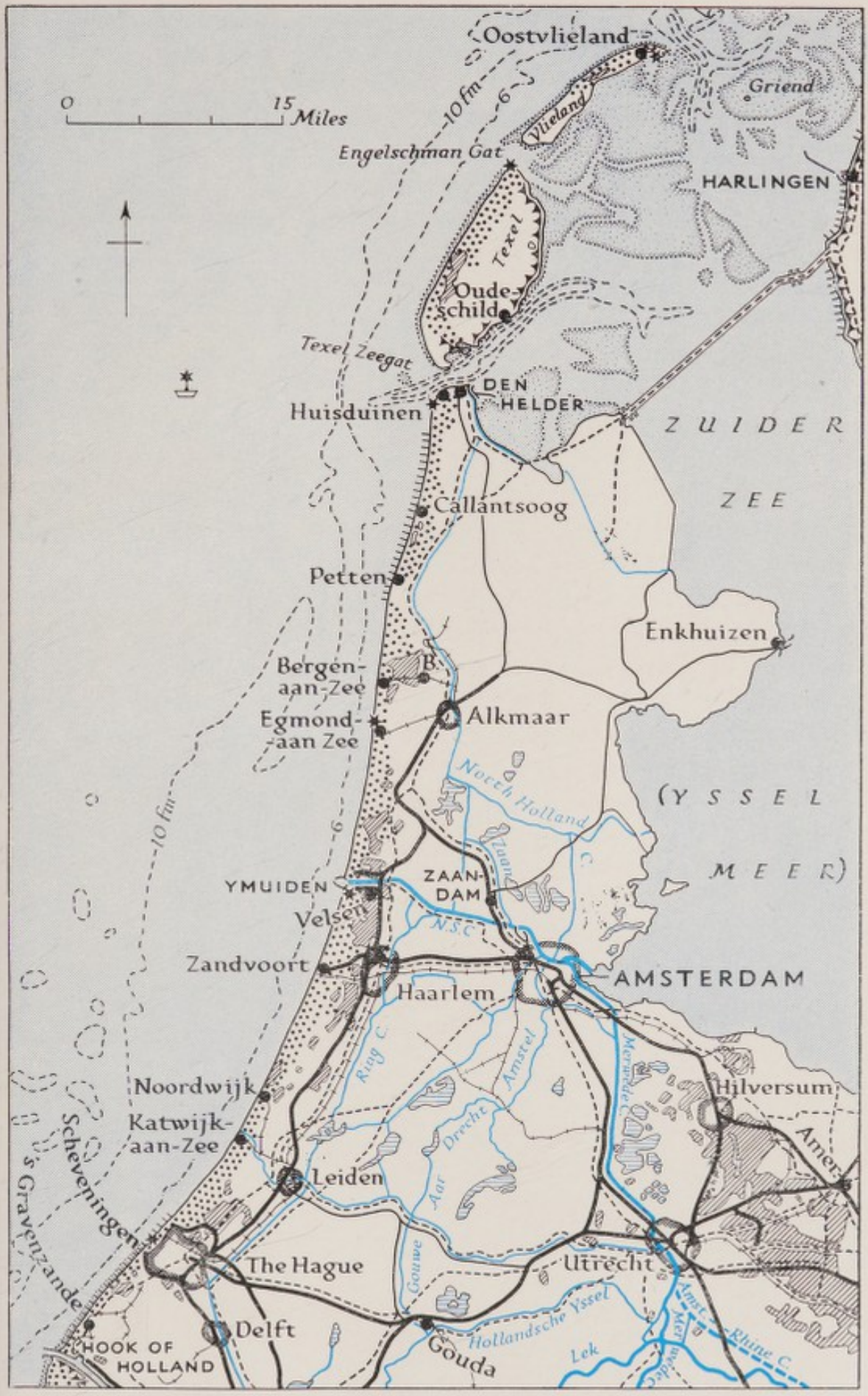

Fig. 20 : The coast of North and South Holland

From : G.S.G.S. Series (Air) 5010, 1 : 250,000 Sheets 16, 17
B Bergen ; N.S.C. North Sea Canal.



Fig. 21. The coast of Friesland

From : G.S.G.S. Series (Air) 5010, 1 : 250,000, Sheets 17, 18.

At its widest, between Vlieland and the mainland, it is 20 miles across ; at its narrowest, inside Schiermonnikoog, 5 miles. The whole stretch of water with the associated islands, as a physical feature, is without parallel in Europe.

Between the islands and the mainland the greatest area is taken up by water with a depth at M.L.W.S. of less than 6 fathoms, and most of the rest by drying sand and mudflats. Generally speaking, the proportion of the area taken up by these flats increases from south-west to north-east. East of Texel and Vlieland the flats are separated from the mainland by water up to 6 fathoms in depth ; from Terschelling eastwards, however, the flats extend right across. There is, therefore, no continuous longitudinal passage of water up to 6 fathoms throughout the Wadden Zee. Access to the North Sea is given by straits or *gaten* between the larger islands, except Texel and Vlieland. These straits are, from south to north-east, Texel Gat (' The Texel '), Engelschman Gat (Eierland Gat), Terschelling Zeegat, Ameland Zeegat, Friesche Zeegat, and West Ems. The first and last of these are the deepest ; the remainder decrease eastwards in depth and in the length of deeper channels. Eierland Gat, between Texel and Vlieland, is hardly usable.

Within these *gaten* are channels which for the greater part of their length are deep, sometimes exceeding 13 fathoms. Seawards these channels are cut off from deep sea, however, by shoals over which there are low-water depths of only a few fathoms, forming outward projecting banks. These are called submarine deltas, and result from the scouring of the tidal streams which, in keeping free the channels in the straits between the islands, carry seawards the silt, which accumulates where the speed of the tidal streams during the ebb is reduced in deeper water (see p. 700).

Tidal Information (in ft.)

	Spring Rise ft.	Neap Rise ft.	Mean Level ft.
Den Helder	5·0	4·3	3·0
Vlieland	6·2	5·2	3·2
W. Terschelling	7·1	6·1	3·9
Harlingen	7·1	6·1	3·9
Zoutkamp	9·9	8·5	5·6
Delfzijl	11·1	9·3	5·8

Texel

Texel is the largest of the Frisian Islands and is separated from Den Helder by the Texel Zeegat. The island is 13½ miles long and 5

miles broad. It is the most cultivated of the group, and possesses six villages besides smaller settlements. Two small bays, on the south-east coast and at the south end, afford shelter for small craft, while there is a small boat harbour on the east coast at Oudeschild. Sand dunes follow the entire north-west coast and curve round both the extremities. The dune coast is bordered by a sandy beach of fine sand. In rough weather the sea comes right to the foot of the dunes at high water. The beach is 80 yards wide at low water and has a moderate gradient. The east coast, for the greater part of its length, is backed by a dyke 10½ miles long. The north-east side of the island is bordered by mud and sand flats 9 miles wide.

Off the west coast anchorage may be found 1¾ miles offshore in depths of 30 ft. Off the east coast, for 7½ miles from the south end, lies the channel of Texelstroom, approached from the Texel Zeegat to the south-west by way of Helsdeur and Marsdiep, with depths up to 95 ft. Off the north-east tip of the island, the narrow channel of Engelschman Gat lies close to the shore ; this is the channel through Eierland Gat, the passage between Texel and Vlieland islands. This passage is of no importance as a passage to the inner waters for ordinary shipping.

The roads of the island mainly follow the edges of the polders lying to the east of the dunes. The principal road runs from Oudeschild inland to Den Burg and to De Koog ; others run northwards to De Cocksdorp. A ferry connects Oudeschild with Den Helder.

Vlieland

Beyond the Engelschman Gat lies the small island of Vlieland. Slightly curved in shape, it is about 10 miles long and one mile broad. The south-western and larger part is a wide expanse of flat sand, barely above sea level and subject to inundation in bad weather at high spring tides. The north-eastern part is mainly composed of sand dunes, with a sandy coast, and a beach about 160 yards wide at low water with a gentle gradient. In bad weather the sea comes up to the foot of the dunes. All the north-west shore is protected by groynes. The south-eastern shore is backed by a low sea dyke. There is one small village, Oost Vlieland, from which the main road of the island runs south-westwards to the post office where the wide sand flat commences. The road is continued by a light railway as far as Meeuwen Duin, at the western extremity of the dune section. There is a small tidal basin at Oost Vlieland. A ferry connects the



Plate 9. The sea dyke (*Ringmuir*) at Harlingen



Plate 10. Terschelling

The photograph shows the town of West-terschelling, looking north-east, the Brandaris lighthouse, and, in the background, the dunes on the North Sea coast of the island. To the south-west of Terschelling, in the outer grounds of the Vliestroom, lies the wreck of the *Lutine*.



Plate 11. The *terp* of Hoogbeintum, Friesland

Numerous *terpen* or refuge mounds can still be seen in Friesland. They usually carry one or two houses and sometimes a church.



Plate 12. A street in the village of Holwerd, Friesland

This scene is typical of innumerable streets in the Netherlands, in the suburbs of large towns such as Rotterdam as well as in villages. The houses are built in continuous rows, with little or no garden in front ; nearly all have roofs reaching down almost to the ground floor windows ; with their small size, red tiles and woodwork painted in vivid red, blue or orange they present something of a doll's house effect.

island with Harlingen. Sand and mud flats extend across the Wadden Zee almost to the IJsselmeer Dam.

It was between Vlieland and Terschelling in 1666 that a Dutch fleet was burned by an English force under Sir Robert Holmes.

Terschelling

Terschelling is separated from Vlieland to the south-west by Terschelling Zeegat, of which the principal channel, Vliestroom, gives access to the most used channels leading to Harlingen, the chief port of the Wadden Zee, and to the Kornwerderzand locks of the IJsselmeer Dam. It is separated from Ameland to the north-east by Ameland Zeegat, within which the main channel is Borndiep, an approach not suited for ordinary use. The island, which is 16 miles long and 2 miles broad, is a more extreme form of the Vlieland type, in that the central part is composed of dunes while there is a wide sand flat at each end. A sandy beach extends along the whole north coast, 200 yards wide at the north-east end but narrows to 100 yards farther west. In rough weather, especially from the north, the sea comes up to the foot of the dunes (Plate 10).

The south-east part of the island is protected by a stone-faced dyke, $7\frac{1}{4}$ miles long; at each end it meets the dunes which curve round from the north-east coast. Behind the dyke lies cultivated land. At the north-east end lies the small village of Oosterend; further along the cultivated stretch succeed Hoorn, Lies, Midsland and Kinnum, while at the extreme west end lies the small village of West Terschelling. West Terschelling is a small port protected by a breakwater, and has a quay. The approach to the port is by way of the Schuiten Gat. Off the west coast anchorage may be found in Boomkens Diep in depths of 30 ft. and 800 yards from the coast.

The main road of the island runs from West Terschelling to Oosterend, keeping to the centre and north side of the cultivated land. There is a dairy produce factory halfway along this road, and a gasworks at West Terschelling.

Ameland

Ameland is separated from Terschelling by the Ameland Zeegat and from Schiermonnikoog by the Friesche Zeegat. This latter passage is about 6 miles wide, and while of no importance to shipping in general, is much used by steam trawlers from Zoutkamp. The island is $12\frac{1}{4}$ miles long and $1\frac{3}{4}$ miles broad, and is composed mainly of sand dunes with small sand flats at the north-western and eastern

ends. It is connected with the mainland by the Ameland dam, which is covered at high water. The dam is broken by a number of passages to permit the movement of small craft.

The north, west and east coasts have sandy beaches similar to those of the other Frisian islands. The northern part is backed by dunes, the western section being a stretch of artificial dunes. The southern coast line is formed by a stone faced dyke about 8 ft. above high water level, and 8½ miles long. From the eastward end the sandy coastline is backed by cultivated land.

In the southern part of the island are several small villages, the largest of which is Hollum at the western end. These are connected by the principal road. Towards the eastern terminus of the road lies the village of Nes, about 500 yards inland from the south coast, from which a transverse road runs to a bathing place on the north coast and to a jetty on the south coast, which is the terminus for a ferry to Holwerd on the mainland, operated at or near high water.

Anchorage may be found to the north of the island 2 miles off in depths of 30 ft.

Schiermonnikoog

Eastwards beyond the Friesche Zeegat, lies the smaller island of Schiermonnikoog, the most easterly of the larger Frisian islands. It is 6¾ miles long and 1½ miles wide, and possesses one village. It consists of a crescent of dunes about 3 miles long, with a small sand flat to the west and a larger one, over 4 miles long, to the east and extending a narrow tongue westwards along the north coast. Only about a mile of the north coast has dunes coming close to the sea. Sandy beaches skirt the greater part of the island. To the south the dunes partly enclose one large polder which is protected seawards by a dyke, 1½ miles of which form the coast, with sections extending inland at each end. The village of Oosterburen (Schiermonnikoog) stands on the northward edge of the polder against the dunes ; a road runs through it from the northern beach to a small jetty on the south. Anchorage may be found 2¾ miles off the north coast in depths of 36 ft. To the south of the island drying sand and mud flats extend to the mainland.

Eastwards beyond Schiermonnikoog lie four small sandy islets, the rest of the Dutch Frisian islands. These consist of Simonszand, Boschplaat, Rottumerplaat and Rottumeroog, or Rottum, barely rising above the surrounding sand flats ; they are featureless and

uninhabited, and without fresh water. Rottumerplaat is slightly higher, for on the west side is a small area of sand dunes, on which stands the lighthouse. The nearest low water approach to the island is on the west side by the Schild channel. Eastwards is the deep channel of the Oude Wester Eems, leading to the Ems estuary and the Dollart ; 3 miles from Rottumeroog lies Borkum, the most westerly of the German Frisian islands.

Den Helder to the German Frontier

The remainder of the Dutch coast lies within the Wadden Zee, where, apart from the ports at each end, only Harlingen is frequented by the larger sea-going ships, although there is some traffic arising from small coasters and trawlers. Being considerably protected from wind and sea by the off-lying Frisian Islands, this coast is devoid of dunes and is entirely dyked.

Den Helder to Den Oever

Den Helder is connected to Willemsoord, the naval base, by movable bridges. From Den Helder the coast trends south-eastwards, for 6½ miles to the western corner of the bay known as Amstel Diep, the coastline consisting of a dyke followed by a road and a canal, with a large expanse of sand at the foot of the dyke. The dyke is constructed of basalt blocks and is from 10 to 15 ft. above high water mark. The small bay of Amstel Meer is cut off from the sea by a dam 1½ miles long, carrying a motor road. Thence to Den Oever the coast of Wieringen, trending north-east, 6 miles long, is low lying and firm bordering reclaimed land, and facing an area of drying sand. The main road, after leaving the Amstel Meer dam, continues directly to Den Oever a short distance inland from the coast ; it runs through the centre of what was the island of Wieringen before the reclamation of the Wieringermeer polder in 1930.

Den Oever is the south-western terminus of the Yssel Meer Dam, which runs for 18½ miles to a point on the mainland between Zurig and Kornwerder. The dam is an important component in the enormous Zuider Zee reclamation scheme (see p. 294). As a result of its completion the Zuider Zee to the south, now called the IJsselmeer (Yssel Meer), is cut off from direct connection with the sea and is thus non-tidal. The passage of small ships between the Yssel Meer and the Wadden Zee to the north is permitted by

locks at each end of the dam, one at Den Oever and two near Kornwerd.

Dimensions of Locks (in ft.)

	Length	Entrance width	Depth on sill
Den Oever	466	46	11
Kornwerderzand			
West Lock	454	46	10
East Lock	213	29½	10

To permit the outward passage of water from the Yssel Meer, there are three groups of five sluice outlets at Den Oever, and two groups of five sluice outlets at Kornwerderzand, each outlet being 4 ft. wide. The approach to the Kornwerderzand locks is first by the Vliestroom and then by the Inschot and Zuidoostrak channels, where the least depth is less than 16 ft. In the new approach to the locks it is only 7½ ft.

From Den Oever the dam pursues a straight course north-east for 14 miles, the remaining 4½ miles, within which lie the Kornwerderzand locks, consisting of a very slight V pointing south. The dam has a width of about 100 yards at the water line ; seawards it is flanked by a rampart of tipped blocks. A motor road and footway are laid along its inner side, while the construction of a railway track is intended (see p. 296).

Yssel Meer Dam to Zoutkamp

On the mainland of Friesland the coast outside or north of the Yssel Meer Dam trends northwards for 4¾ miles to the port of Harlingen (see p. 516). Here it turns to run in a general north-easterly direction for 38 miles to Moddergat, beyond which opens southwards the wide shallow bay known as Lauwerszee, on the south-east side of which stands Zoutkamp. All the way from the dam the coast is dyked, sometimes by a single dyke, while in other places there is an old sea-dyke or sleeping dyke (*slaperdijk*) one or two miles inland. The outer dyke is constructed of basalt blocks on an earthen foundation.

Along this stretch of coast the low water line skirts the dyke itself and there is little drying beach. Approach to this coast is by way of Terschelling Zeegat and Ameland Zeegat, which lead into tortuous channels around numerous sandbanks extending to the islands of Ameland and Terschelling. Anchorage is only found in the open sea, in depths of 54 ft. 3½ miles north of Terschelling and 10 miles

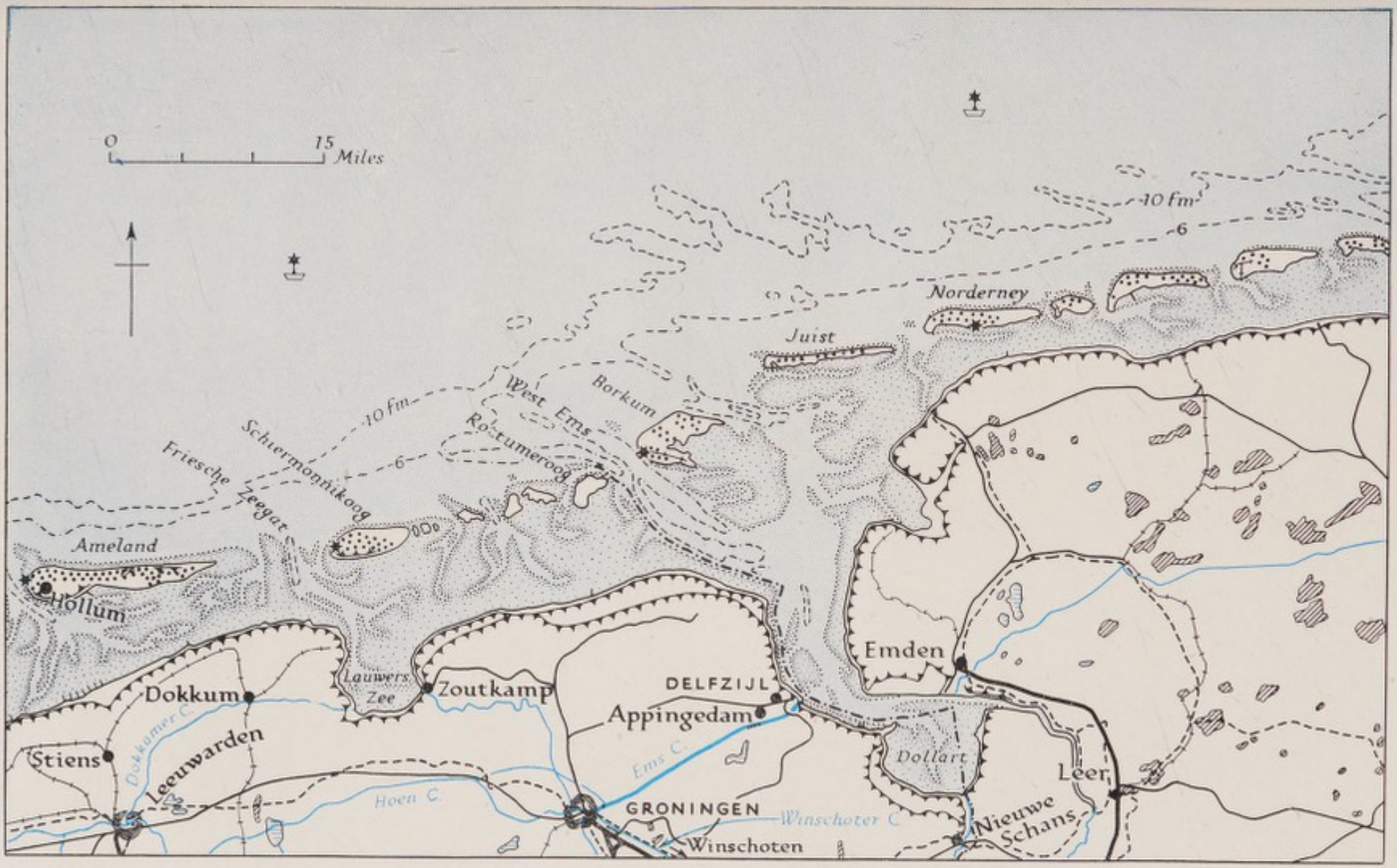

Fig. 22. The coast of Groningen

From : G.S.G.S. Series (Air) 5010, 1 : 250,000, Sheets 17, 18.

from the mainland. From De Zwarte Haan to a point 1¼ miles west of the Ameland Dam the dyke is inland from the coast, and is bordered by drying sandy flats. From the Ameland Dam to Oostmahorn, on the west shore of the Lauwerszee, extensive sand flats continue to the north. At Oostmahorn the dyke projects into the channel, but southwards to Dokkumernieuwezijlen in the south-west corner of the Lauwerszee it is fronted by sand flats leading to Dokkumer Diep, the channel which gives access to Dokkumernieuwezijlen and opens northwards into the Friesche Zeegat. Anchorage may be found in the open sea 10 miles north-west of Schiermonnikoog lighthouse, in depths of 42 ft. The coast from Dokkumernieuwezijlen to Zoutkamp at the head of the Lauwerszee, trends eastwards for 5½ miles. At each end of this section the dyke is near the shore, but in the centre it is fronted by reclaimed flats.

For considerable lengths along this coast of Friesland a slow but progressive conversion of salt marsh into polders is in progress. From Nieuwe-Bildtzijl to a point west of Holwerd, a distance of 7 miles, where there are salt marshes on the north side of the dyke, and for about 3 miles east of Moddergat, parallel wooden or wicker-work pales, 100–300 yards apart, can be seen standing out across the salt marshes at an angle from the shore. Three such maritime polders can be seen along this coast—north-east of the Bildtdijk, west of Holwerd, and east of Moddergat. Nieuwe Bildtzijl lies in an area reclaimed in this way at an earlier date, and to the south is an area reclaimed at a still earlier date—Oude Bildtzijl (see p. 705).

Zoutkamp to the German Frontier

From Zoutkamp to the German frontier the coast is fairly similar. From Zoutkamp it runs northwards a short distance before turning eastwards in a long curve for 34 miles to Oudeschip, on the Ems estuary. Here it turns south-eastwards to reach the frontier in two wide inward curves, the larger from Oudeschip to the spit at Termunten forming the western shore of the Ems estuary, the smaller from Termunten to the frontier at Nieuwe-Statenzijl forming the western shore of the Dollart.

This stretch of coast is 48 miles long and is backed by a dyke throughout its length, 15 ft. above the high water line. Most of it is fronted by off-lying Frisian Islands between 5 and 7½ miles distant. Much of this drying area is firm sand but there are many low water channels, and the action of the tides tends to produce

soft patches and occasional areas of mud. The gradient of the beach is imperceptible. At a point 5 miles north of Delfzijl the beach narrows from 800 yards width to a narrow strip as far as Delfzijl with a very steep gradient. Approach can only be made by the Ems or through the *gat* at either end of Schiermonnikoog Island ; anchorage may be found in the open sea in depths of 48 ft. anywhere to the north of the islands. The port of Delfzijl is approached by the Ems channel (see p. 518).

Along the greater part of this east-west coast the dyke lies inland, up to 1,000 yards distant, with reclamation of the shore flats taking place by means of parallel pales. For considerable distances the former sea-dyke (*slaperdijk*) is some way inland behind the present sea-dyke (sentry-dyke). Reclamation is most noticeable between Wierhuizen and Oudeschild (Fig. 146). Along the shore of the Ems estuary, however, the proximity of the deep channels renders reclamation impracticable and the dyke fronts the sea. Along the south shore of the shallow Dollart reclamation is in progress, and the dyke is here mostly 200 yards inland.

Communications

The land behind the coast from the Yssel Meer to the German frontier is only moderately provided with good means of communication. The main road from the dam runs along the coast to Harlingen and turns to follow an easterly course to Leeuwarden and Groningen. Secondary roads from Holwerd to the north join this trunk road at Leeuwarden and at a point 6 miles farther east, while from Leeuwarden a main road runs south-eastwards to Heerenveen and Meppel. At Groningen the main road bifurcates : one branch continues eastwards to Winschoten and the German frontier, and one turns southwards to Assen and Meppel ; a secondary road runs north-eastwards to Delfzijl.

The railway connections of this coastal region will be much improved by the eventual connection, through a line running across the Yssel Meer Dam, with North Holland. The only through line from east to west at present is a single track. From Harlingen a single-track line runs to Leeuwarden, from which a double-track line runs southwards to Heerenveen, Meppel and Zwolle ; it is the meeting point also of a single track line from Stavoren on the Yssel Meer coast and of a light railway system which serves the sea coast as far east as the Lauwerszee. The main single-track line continues east to Groningen, from which two double-track lines

proceed, one to Winschoten (continuing thence as a single track to the German frontier), and southwards to Assen and Meppel ; two single-track lines run from Groningen to Delfzijl, the more northerly of which sends off a branch which serves the sea coast between Zoutkamp and the Ems estuary.

A network of small canals serves this region, more especially the western part. Groningen is served by the more important Eems (Ems) and Winschoter canals which connect it with Delfzijl and the Dollart, and by the Drentsche canal which leads southwards to the main network of the country.

BIBLIOGRAPHICAL NOTE

(1) The *Admiralty Pilot* referring to the Netherlands coast is *North Sea Pilot*, Part IV, 9th ed. (London, 1934), with later Supplements.

(2) References on the history and physical evolution of the coast will be found on pp. 299—300, 707.

CHAPTER III

CLIMATE

Pressure and Winds : Temperature : Sunshine and Cloud : Fog and Visibility : Precipitation : Snow and Snow Cover : Weather : Bibliographical Note

The climate of the Netherlands is practically uniform throughout, for the greater part of the country consists of flat low-lying land and is small in size, no part being more than 100 miles from the sea, the influence of which is further extended by the wide estuaries of the Scheldt–Maas–Rhine and the broad expanse of the Zuider Zee. Furthermore, the Netherlands lie entirely within the zone of the prevailing westerly winds. The available data, which are plentiful, show only a gradual, and almost imperceptible north-eastward transition towards increasingly continental conditions, manifested in an increasing temperature range and an increasing preponderance of rainfall during the summer months.

Pressure and Winds

In general, the Netherlands lie within the stream of westerly or south-westerly winds flowing between the sub-tropical High and the Icelandic Low, but non-periodic pressure changes frequently modify, and sometimes reverse, this prevailing direction. The January isobars show low pressure to the north-west, towards the Icelandic low pressure centre, and high to the south-east, towards the continental high pressure ridge. The resultant winds are prevailingly from a south-westerly quarter. Inland at Maastricht, for example, winds from west, south-west and south make up 68% of all winds in December, but on the coast local effects reduce this figure somewhat, though the preponderance is still high (59% at Den Helder). During the summer months the barometric gradient is reduced, for the ' Icelandic Low ' has diminished and moved eastwards, while the continental high pressure ridge has been replaced by relatively low pressure. Winds are therefore less strong than in winter, and come from a westerly quarter, especially away from the coast.

Wind Velocity : Gales

The general flatness and low level of the countryside offer little resistance to air flow, and high winds form a notable feature of the climate, to which the numerous windmills and the wind-swept

form of the trees bear witness. The scarcity and poverty of trees, in turn, allow free play to the winds and do little to mitigate the windiness. Where trees are a characteristic feature of the landscape, as in the hillier districts of Limburg, and in parts of Utrecht, Gelderland and Overyssel, the wind velocity is noticeably diminished.

The strongest winds, as might be expected, are experienced along the coast, where obstruction is least, and which is, as a rule, nearest to the centres of depression. Winds of gale force* occur on an average thirty-four times per year at the coast, but only four times per year in the interior. The approximate percentage decrease in wind velocity away from the coast is as follows :

Distance from coast (in miles)	0	6·2	12·4	24·8	37·2
West winds (per cent.)	0	20	27	33	37
East winds (per cent.)	0	10	16	22	25

The reduction in force thus applies to all winds, even land winds, but much more strongly to winds from seaward. The most frequent strong winds and gales are from a south-westerly quarter, and are always associated with the passage of depressions. The direction and frequency of strong winds and gales for a coastal and an inland station are as follows :

Hourly direction of strong winds and gales (above force 6, Beaufort Scale) per annum at Den Helder and De Bilt

Den Helder	N	NE	E	SE	S	SW	W	NW	Total
Dec., Jan., Feb.	15	8	8	—	39	85	37	32	224
March, Apr., May	17	30	13	—	11	27	28	16	142
June, July, Aug.	6	—	—	—	13	28	31	23	101
Sept., Oct., Nov.	13	8	2	2	47	84	66	32	254
Year	51	46	23	2	110	224	162	103	721
De Bilt									
Dec., Jan., Feb.	0·5	—	—	2·0	9·0	15·0	3·0	3·0	32·5
March, Apr., May	2·5	1·0	—	—	2·0	2·5	4·5	6·0	18·5
June, July, Aug.	—	—	—	—	—	0·5	—	0·25	0·75
Sept., Oct., Nov.	2·0	—	—	1·0	7·0	6·0	1·0	0·5	17·5
Year	5·0	1·0	—	3·0	18·0	24·0	8·5	9·95	69·25

The figures are based on the hourly recordings or hourly means over the period 1923–26 and give the number of hourly occasions per annum on which winds above force 6 blow in each season. Calculated from data in C. Braak, 'The Climate of the Netherlands : D. Wind,' *Koninklijk Nederlandsch Meteorologisch Instituut, Mededeelingen en Verhandelingen No.* 32 ('s Gravenhage, 1929).

* 'As ordinarily understood a gale simply means a high wind. For technical purposes however it is necessary to have a more definite specification, and it is now the practice in the London Meteorological Office to limit the term gale to winds of force 8 or above on the BEAUFORT SCALE, although Admiral Beaufort himself described force 7 as a moderate gale'. (*The Meteorological Glossary*, 3rd ed. 1941, p. 92).

Apart from the conspicuous difference between coastal and inland stations, the striking feature is the prevalence of gales between south and north-west (about 85% at each station). The onshore direction of most of these winds makes them especially worthy of notice because of their ability to raise rough seas along the coast. They usually start from the south and veer to north-west before blowing themselves out. Autumn and winter are the stormiest seasons and gales are very rare in summer inland.

Daily variation in wind velocity

An examination of the averages, whereby the temporary effects of passing pressure systems are eliminated, shows that there is a well marked variation of wind velocity during the twenty-four hours. The minimum is reached about sunrise and sunset, the night being slightly windier than these times, but only slightly; the maximum, clearly defined, is reached during the afternoon, about 1 p.m. in winter and 3 p.m. in summer. The fluctuation is given in the following table; it is of the order of 1 knot in January and 3 knots in August when it is usually at a maximum :

Amplitude (knots)	Den Helder	Flushing	De Bilt	Groningen	Maastricht
January	0·9	1·0	1·2	2·0	1·0
August	2·5	2·8	3·1	4·0	3·7

The effect is mainly due to convection which causes a mixing of surface and upper air during the afternoon; some of the higher velocity of the upper air is thereby transmitted to the lower layers. Land and sea breezes are not very noticeable on the Dutch coast except in calm weather in summer. Under these conditions the wind may be expected to blow from the sea by day, reaching a maximum in the mid-afternoon and from the land by night reaching a maximum just before sunrise. The effect is seldom felt more than 30 miles inland and the breezes so produced are gentle.

Temperature

In mean monthly temperatures (see p. 58) there is very little difference over the country; mean temperatures are much the same as those of East Anglia. But the extreme range of temperature (Fig. 23) is greater and indicates continental influence. Thus the mean minimum for both January and February is below freezing, though only slightly, and extreme temperatures are as low as −4° (i.e. below zero, Fahrenheit). Only the three mid-summer months

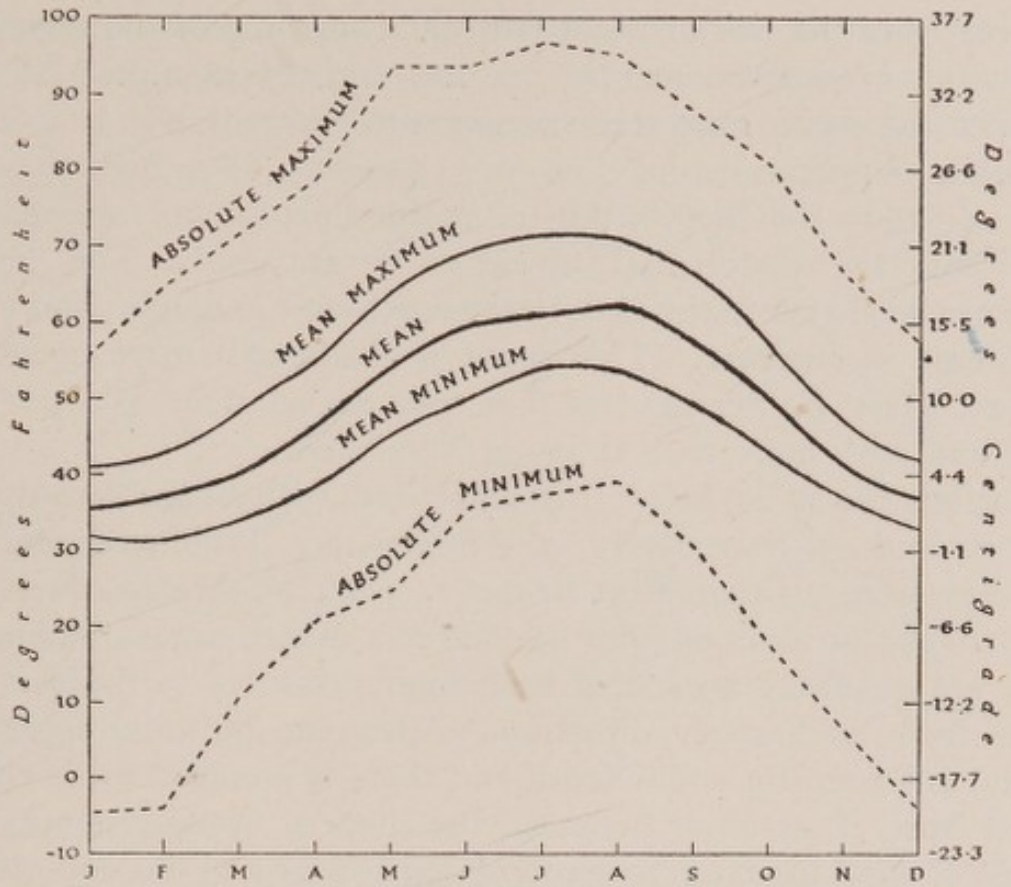

Fig. 23. Temperature graph for De Bilt (Utrecht), 1849–1936—mean, mean maximum and minimum, and absolute maximum and minimum

Data from E. van Everdingen, 'Le climat des Pays-Bas,' *Tijdschr. Kon. Ned. Aardrs. Gen.*, vol. 55, p. 576 (Leiden, 1938).

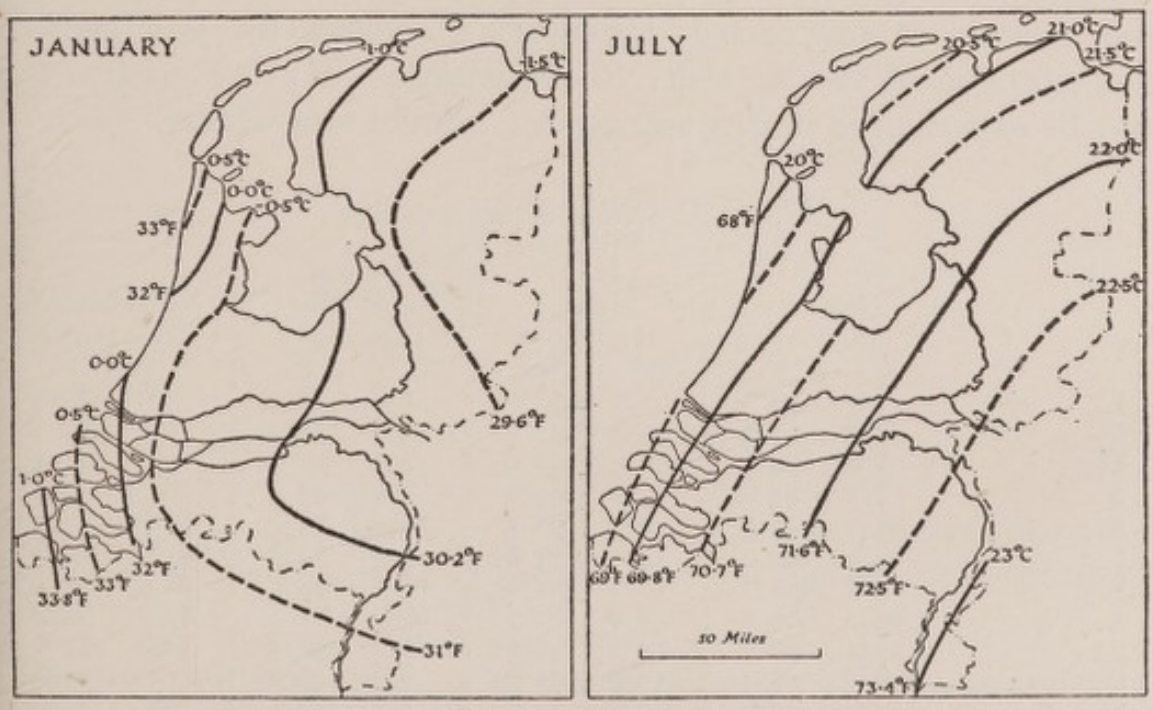

Fig. 24. Mean minimum temperatures (January) and mean maximum temperatures (July)

From : E. van Everdingen, 'Le climat des Pays-Bas,' *Tijdschr. Kon. Ned. Aardrs. Gen.*, vol. 55, p. 577 (Leiden, 1938).

are free from the risk of night frost, and in some of the regions of sandy soil even these months are not entirely exempt. At mid-summer the mean maximum temperature exceeds 68° F. and the afternoon temperatures may, on rare occasions, be as high as 95° F. Fig. 24 shows the distribution of mean maxima and minima and from this the continental influence is apparent. The greater extremes lie always to the east, to the north-east in winter, and to the south-east in summer. This point is made still more clearly in Fig. 25. Den Helder has less than four hot summer days per year compared with more than thirty at Maastricht.

Flushing has 32 days with frost and 7 days without thaw, compared with 79 and 11 respectively at Winterswijk. Prolonged spells of frost are more usual than in Britain : seven consecutive days with frost are not uncommon, and periods of a month are not unknown. They are generally associated with high pressures to the east and winds from an easterly direction. After one of these spells the ground is frozen for some depth and there is a considerable risk of glazed frost, if, as often happens, the thaw is brought about by a change of wind direction to south or south-west and the importation of warm moist oceanic air. The coating of ice so formed may be of considerable thickness. When the thaw has properly started the ground will be very boggy for some time, especially in heavy soil regions. This changeability of weather, which introduces sudden and sometimes unexpected difficulties in operations, is a marked characteristic of the weather. Temperatures of 55° F. (12·7° C.) may be experienced during any month, even in mid-winter.

Mean Monthly Temperatures

	Groningen 1894–1917		Den Helder 1894–1917		Utrecht (De Bilt) 1894–1917		Flushing 1894–1917	
	°C.	°F.	°C.	°F.	°C.	°F.	°C.	°F.
J.	1·2	34·2	2·7	37·0	1·9	35·4	2·9	37·2
F.	1·9	35·4	2·8	37·1	2·4	36·4	4·2	37·9
M.	4·0	39·2	4·4	40·0	4·8	40·7	5·3	41·5
A.	7·3	45·0	7·2	45·0	7·9	46·2	8·0	46·4
M.	11·7	53·0	10·7	51·2	12·1	54·0	11·8	53·3
J.	14·9	59·0	14·2	57·6	15·2	59·5	14·9	59·0
J.	16·3	61·3	16·1	61·0	16·6	62·0	16·9	62·5
A.	16·0	60·8	16·4	61·7	16·3	61·3	17·0	62·2
S.	13·5	56·5	14·5	58·2	13·6	56·5	14·9	58·8
O.	9·1	48·2	10·5	51·0	9·5	49·2	11·0	51·8
N.	5·0	41·0	6·9	44·4	5·7	42·4	7·0	44·6
D.	2·7	37·0	4·3	40·0	2·9	37·2	4·3	39·8

From : E. Alt, ' Klimakunde von Mittel- und Südeuropa ', *Handbuch der Klimatologie* B.3, Teil M, p. 156 (Berlin, 1932).

Weather systems have a profound influence in bringing about sudden and considerable changes of temperature. In winter at De Bilt easterly and north-easterly winds give temperatures 12° or

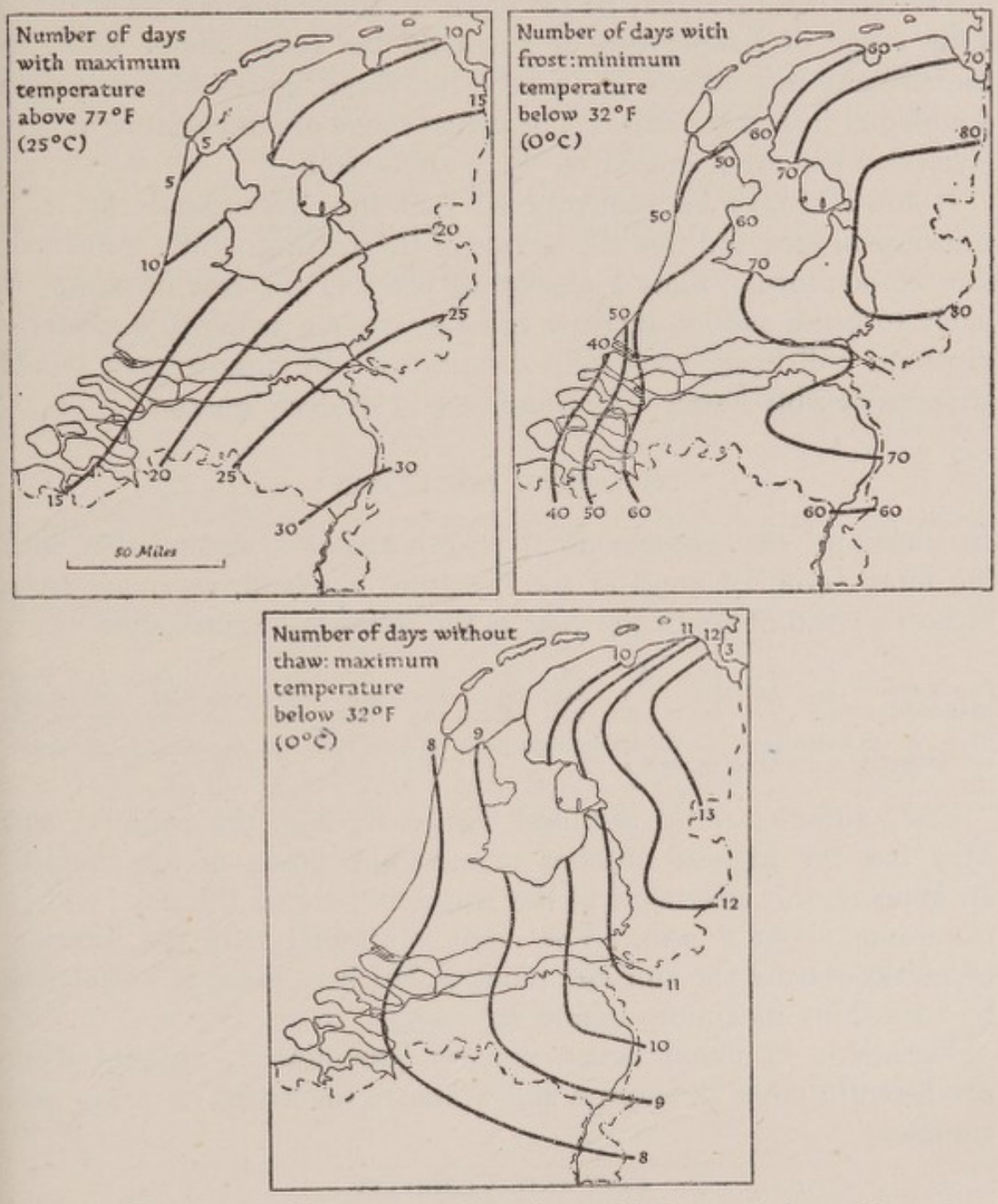

Fig. 25. Frequency of hot summer days, days with frost and days without thaw
From : E. van Everdingen, ' Le climat des Pays-Bas,' *Tijdschr. Kon. Ned. Aardrs. Gen.*, vol. 55, p. 578 (Leiden, 1938).

15° F. colder than westerly or south-westerly, while in summer the easterly (and especially south-easterly) winds are some 7·2° F. hotter than westerlies. Generally speaking the departures from the normal in winter are more numerous in a positive direction, but the negative

departures (cold snaps), though less frequent, are greater. In summer the opposite is the case, cool spells being frequent, but the temperatures are not seriously below normal. Hot spells are rarer, but the temperatures may be 18° or 22° F. above normal. The mean daily range of temperature is small on the coast, about 2° F. in January and just over 6° F. in July, but these figures are more than doubled at inland stations. The actual range of temperature on any given day will often exceed 18° F. at any season.

It must always be remembered that the Netherlands lie in a transitional area and that the source of the air profoundly influences the temperature. Thus a change of wind to the east in winter is likely to bring sudden increase of cold, while a swing to a westerly direction will bring back mild conditions. In summer east winds are considerably hotter than those from a westerly quarter.

Sunshine and Cloud

In sunshine the climate of the Netherlands is comparable with the more favoured areas of south-eastern England, receiving from 1,500 to 1,700 hours in the year as the following figures show :

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Year
Den Helder	44	79	132	169	241	230	220	205	157	100	52	36	1,666
Maastricht	49	73	120	138	217	201	194	186	153	99	57	36	1,521

From : E. van Everdingen, ' Le Climat des Pays-Bas ', *Tijdschr. Kon. Ned. Aardrs. Gen.*, 2nd series vol. 50, pp. 575, 576 (Leiden, 1938).

Early summer is the sunniest season through the country, and May has the highest number of sunshine hours of any month. In general, the afternoon is the sunniest part of the day, with a maximum about 2 p.m. The coast is sunnier than the interior, especially during the summer months, but here there is a tendency to a sunshine maximum before mid-day.

Variations in cloud cover are not pronounced, ranging from seven-tenths cover in autumn and winter to six-tenths in spring and summer.

Fog and Visibility

Winter is the season of most frequent fog, which is generally the result of nocturnal radiation under calm anticyclonic conditions. Such fogs occur mostly at night and may be dispersed by the warmth of the mid-day sun, but in winter they may persist throughout the day. When fog is recorded with wind it is generally with a light drift of air, from the south or south-west, which brings haze or bad visibility, especially at coastal stations. A light northerly

wind is often associated with fog at inland stations. Fog may be expected on about six days per month in winter, but decreases steadily as the daily warmth increases until summer is almost fog-free, except along the coast where occasional sea mists drift onshore, but do not penetrate far inland. Generally speaking, easterly winds give the best visibility, southerly the worst, but the presence of industrial regions in the line of air drift has a strong influence in increasing the frequency and severity of fog. Thus a light drift of air with low turbulence cloud from the east is generally fouled with industrial smoke from the Ruhr, and brings murk and fog to the eastern parts of the Netherlands.

Mean number of days with fog (visibility less than 1 km.)

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Year
Terschelling (1884–1908)	6·2	5·2	4·4	4·2	4·0	3·5	1·1	0·8	1·2	2·4	4·3	4·5	41·8
Flushing (1902–38)	5·6	4·3	3·6	1·6	1·8	1·2	1·0	0·8	2·1	2·8	4·5	6·0	35·3
De Bilt (1898–1938)	4·5	3·0	2·9	1·0	0·4	0·2	0·5	0·8	2·4	2·9	4·4	4·6	27·6
Winterswijk (1894–1923)	4·7	4·7	3·2	1·7	1·1	0·4	1·1	1·0	3·1	5·3	6·5	5·8	38·6
Maastricht (1932–38)	2·7	2·1	2·6	0·9	1·4	0·9	0·9	3·7	3·3	2·4	4·7	2·9	28·5

From: C. Braak, ' The Climate of the Netherlands, H. Fog ', *Koninklijk Nederlandsch Meteorologisch Instituut, Mededeelingen en Verhandelingen*, No. 42, p. 14 ('s Gravenhage, 1939).

Frequency of fog as a percentage of the number of observations, with various wind directions, 1932–8

	Den Helder			Groningen			De Bilt			Flushing			Maastricht		
	Dec.–Feb.	Sept.–Nov.	Year	Dec.–Feb.	Sept.–Nov.	Year	Dec.–Feb.	Sept.–Nov.	Year	Dec.–Feb.	Sept.–Nov.	Year	Dec.–Feb.	Sept.–Nov.	Year
N	2	1	1	12	3	2	10	9	3	5	0	1	2	16	4
NNE	2	3	1	2	5	2	6	8	3	4	0	1	9	10	5
NE	5	3	2	4	7	3	5	5	1	1	8	3	4	9	4
ENE	4	3	2	6	6	4	4	10	4	4	1	2	1	4	2
E	8	4	4	9	7	5	1	5	2	4	5	3	2	3	2
ESE	9	12	6	8	12	7	7	11	5	4	3	2	5	4	2
SE	7	9	5	4	4	3	4	6	3	6	8	4	3	8	3
SSE	10	7	6	5	8	5	8	10	6	9	6	6	4	5	3
S	13	5	7	10	2	5	11	7	8	7	5	5	2	8	5
SSW	8	2	3	11	5	6	8	6	5	7	3	4	2	1	2
SW	1	0	2	10	2	3	12	4	6	9	2	3	3	2	2
WSW	1	0	1	9	3	3	5	4	3	4	0	2	2	2	1
WWN	3	0	1	0	1	1	2	1	1	6	1	2	8	3	2
WNW	2	0	1	1	0	0	1	1	1	3	0	1	3	2	1
NW	2	0	1	2	0	1	1	4	2	5	3	2	10	2	3
NNW	2	0	1	0	0	0	7	6	2	3	1	2	5	4	4
Calm	12	0	5	0	14	17	40	44	24	17	11	7	10	10	8

From : C. Braak, ' The Climate of the Netherlands, H Fog ', *Koninklijk Nederlandsch Meterologisch Instituut, Mededeelingen en Verhandelingen*, No. 42, p. 34 ('s Gravenhage, 1939).

Precipitation

The distribution of rainfall over the Netherlands is very uniform (Fig. 26), the limits being about 22 and 32 ins. The wettest regions lie to the west and south-west of the Zuider Zee, and in the province of Limburg where there are low hills backed by the Venn and the

Eifel ; here the rainfall locally exceeds 31·5 ins., but not by very much.

Rainfall Regime

April is the driest month, except in the south and south-east where the February figures are much the same. The wettest month is August on the coast although towards the north-west coast the maximum is in October, and August, or perhaps July, inland.

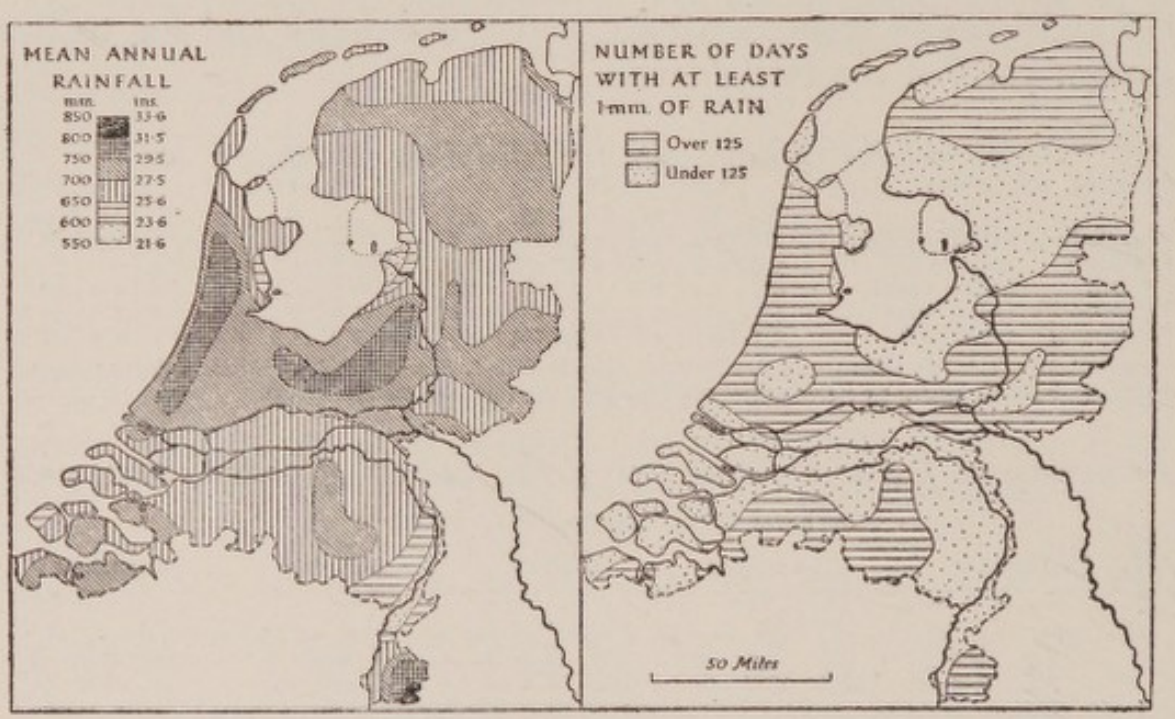

Fig. 26. Mean annual rainfall, and number of days with at least 1 mm. of rain
From : E. van Everdingen, ' Le climat des Pays-Bas,' *Tijdschr. Kon. Ned. Aardrs. Gen.* vol. 55, pp. 580, 581 (Leiden, 1938).

Average Rainfall (ins.) ; monthly values weighted to make a uniform month of 30 days

Station	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Year
Groningen	1·9	1·6	1·7	1·5	1·8	2·4	2·8	3·3	2·6	2·6	2·3	2·1	27·2
Den Helder	1·9	1·6	1·6	1·4	1·4	1·7	2·1	2·9	2·9	3·2	2·6	2·3	26·0
Utrecht (De Bilt)	2·1	1·8	1·8	1·7	1·9	2·3	2·8	3·2	2·6	2·8	2·4	2·6	28·7
Flushing	2·0	1·7	1·8	1·6	1·9	2·3	2·5	3·0	2·9	2·9	2·6	2·5	28·3
Winterswijk	1·9	1·7	1·9	1·7	2·2	2·4	3·2	2·9	2·4	2·7	2·2	2·4	27·8
Maastricht	1·8	1·6	1·8	1·6	1·9	2·4	3·1	2·6	2·3	2·4	1·9	2·1	25·9

From : (1) E. Alt, ' Klimakunde von Mittel- und Südeuropa ', *Handbuch der Klimatologie*, B. 3, Teil M, p. 238 (Berlin, 1932) ; (2) Maandelijksch overzicht der Weergesteldheid in Nederland, 1903–1939, *Koninklijk Nederlandsch Meteorologisch Instituut* (Utrecht, 1903–39).

Fig. 26 gives the number of days on which 0·04 in. (1 mm.) or more of rain falls. The differences over the country are not great. The following table gives the number of days per month on which 0·5 mm. or more precipitation occurs :

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Year
Groningen	17	16	16	14	14	14	15	17	16	18	19	19	200
Den Helder	16	15	15	13	12	11	13	15	15	17	18	17	181
De Bilt	18	17	17	15	15	14	15	17	17	18	19	19	206
Flushing	17	16	16	14	14	13	13	15	15	17	18	18	189

From : E. Alt, ' Klimakunde von Mittel- und Südeuropa ', *Handbuch der Klimatologie*, Band 3, Teil M, p. 156 (Berlin, 1932).

By this criterion rain falls on 180 to 200 days per year, i.e. on more than half the days of the year. It is clear that late autumn and early winter are the seasons at which wet days are most numerous and that late spring and early summer are the seasons with most rainless days.

Intensity of rain

Some idea of the intensity with which rain falls is conveyed by the following figures which show the average amount of rain that falls on each rain day :

Rain per rain day (mm.)

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.
Groningen	2·8	2·6	2·7	2·8	3·2	4·3	4·6	4·9	4·1	3·7	3·1	2·9
Den Helder	3·0	2·7	2·8	2·9	3·4	3·3	4·1	5·0	5·0	4·7	3·7	3·5
De Bilt	2·9	3·4	3·3	2·9	3·2	4·2	4·7	4·8	3·9	3·9	3·2	3·5
Flushing	3·0	2·7	2·8	3·0	3·6	4·5	4·9	5·2	5·0	4·4	3·8	3·5

Calculated from data in E. Alt, ' Klimakunde von Mittel- und Südeuropa ', *Handbuch der Klimatologie*, Band 3, Teil M, pp. 156 and 224 (Berlin, 1932).

In the winter and spring months the precipitation is rather light and often in the form of drizzle, but the summer rainfall tends to take the form of heavy showers. The duration of rain per rain day is also less in the summer, for winter rain is cyclonic and persistent, while the summer convectional showers are generally short-lived. It would be erroneous to suppose, however, that all summer rain is convectional in type ; a great deal is cyclonic, and, in fact, torrential rain is unusual. Heavy storms lasting half an hour are expectable once a year, but an hour of such rain occurs only once in two years, and very rarely lasts longer. The maximum expectable in 24 hours is only 3·5 ins. (90 mm.).

The subject of intensity of rainfall and of evaporation has received more attention in the Netherlands than in many other countries. Owing to the flatness of most of the country, run-off is very slow, and since much of the land surface lies below sea level, the disposal of water presents a problem calling for serious consideration. Where the soil is light and sandy, there is a rapid soak-away, but where it is heavy the water lies.

Thunderstorms

The great majority of thunderstorms occur in the summer, especially inland. Groningen has 9·1 in the three summer months out of a yearly total of 13·1 ; De Bilt 13·4 out of 23·7 ; most of these are convectional. Winter storms, which are cyclonic and usually associated with the passage of a cold front, are rare, but more frequent on the coast : Den Helder has 0·9 in the three winter months and Flushing 1·1 compared with 0·5 at Groningen and 0·6 at De Bilt, which are inland. The atmospheric instability that produces thunder may also produce hail. The months most liable to hail are March and April. Thunderstorms are not, however, a conspicuous feature of the climate.

Number of days with thunder

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Year
Groningen	0·1	0·1	0·2	0·6	2·3	2·9	2·9	2·3	1·5	0·4	0·3	0·3	13·9
Den Helder	0·3	0·2	0·5	0·8	2·3	3·0	3·0	3·2	2·8	1·8	1·2	0·4	19·5
De Bilt	0·1	0·2	0·8	1·4	3·7	4·5	4·2	4·7	2·0	1·2	0·6	0·3	23·7
Flushing	0·4	0·2	0·5	1·2	3·1	3·6	3·5	4·4	2·5	1·3	0·8	0·5	22·0

From : E. Alt, ' Klimakunde von Mittel- und Südeuropa ', *Handbuch der Klimatologie*, Band 3, Teil M, p. 238 (Berlin, 1932).

Variability of rainfall

The year-to-year fluctuations in rainfall at De Bilt are shown in Fig. 27. The mean annual departure from the mean rainfall is

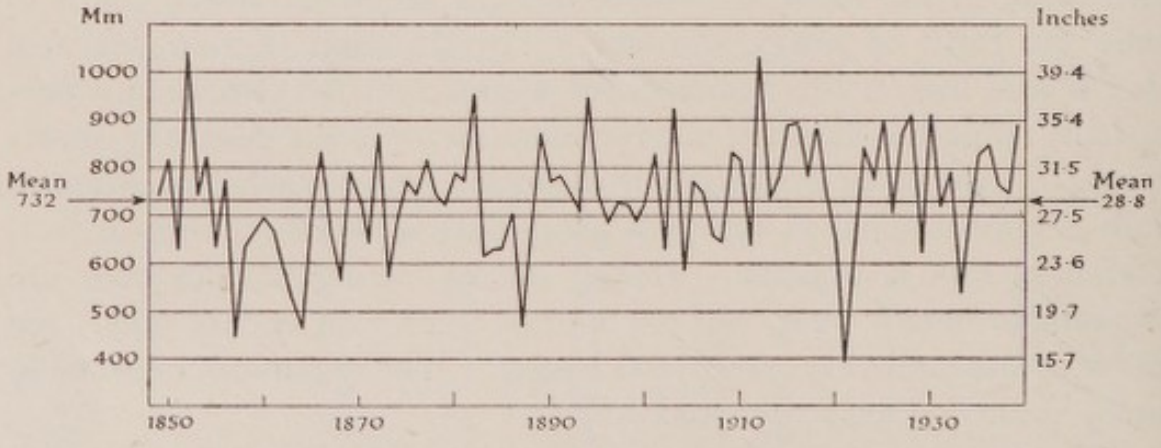

Fig. 27. Total annual rainfall at De Bilt (Utrecht), 1849–1939
From : *Maandelijksch overzicht der Weergesteldheid in Nederland*, etc.

13·2%. The graph shows that there have only been four years with rainfall less than 19·7 ins. (500 mm.) of which the most conspicuous is the drought year of 1921 in which the deficiency was 45%. There have been seven (or eight) years with rainfall exceeding

35·4 ins. (900 mm.) of which two exceeded 39·4 ins. (1,000 mm.). While the graph of annual fluctuation is irregular, there seems to be a suggestion of periodicity, however irregular, groups of predominantly wet years following groups of fine years. The tendency during the last seventeen years has been towards rainfall above the average, though this period has not been excessively wet. This constitutes the longest spell of predominantly wet years on record ; a relatively dry spell seems overdue.

Snow and Snow Cover

In the western part of the Netherlands in a normal year snow may be expected to fall with much the same frequency as in East Anglia. Inland towards the east the averages show a gradual increase, while in the extreme south-east on the rising ground of Dutch Limburg the frequency rises to over twenty-five days. The following table shows the number of days with snowfall (uniform month of thirty days). January, February, and March are the most liable, but two or three days may be expected in December.

Number of days with snowfall

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Year
Groningen	3·8	4·0	4·1	1·5	—	—	—	—	—	0·1	1·7	3·6	18·8
Den Helder	2·7	2·7	2·6	0·9	—	—	—	—	—	0·1	0·9	2·1	12·0
De Bilt	4·2	3·3	3·4	1·5	—	—	—	—	—	0·1	1·8	3·5	17·8
Flushing	4·1	3·3	3·3	1·2	—	—	—	—	—	—	1·1	2·3	15·3

From : E. Alt, ' Klimakunde von Mittel- und Südeuropa ', *Handbuch der Klimatologie*, B. 3, Teil M, p. 230 (Berlin, 1932).

The frequency and duration of snow-cover are very variable from year to year, especially nearer the coast where much depends on whether the low ground of the polders is already frozen. There is an increase in the average annual number of days with snow-cover, from less than ten on the coast to about twenty or twenty-two on the eastern border. The seasonal occurrence is much the same as in eastern England.

It should be remembered, however, that a very slight fall in the average winter temperature in the Netherlands means that the low ground is extensively frozen, with a correspondingly large increase in the persistence of snow cover.

Weather

The weather of the Netherlands, like that of all western Europe, is subject to sudden and considerable changes of a non-periodic

nature. There is, however, a tendency for certain types to dominate at certain seasons, and thus to merit separate consideration.

In winter, weather conditions are determined largely by the succession of depressions from over the ocean. December is the stormiest month, but March and April are nearly as bad. The most usual path of these depressions is to the west of the country. Winds, therefore, veer from south-east to south-west and then north-west; those from south to north-west may be very strong, raising rough seas along the coast. With southerly winds, visibility decreases, temperatures are high for the time of the year and there is much low cloud and drizzle. When the wind comes from the north-west there is a marked fall in the temperature, and clearer skies and occasional showers are experienced. In some years the weather is entirely of this type, but normally the procession of depressions is interrupted by the westward spread of the continental high pressure system. In the Netherlands, as in most maritime countries of western Europe, this is not of frequent occurrence, but once the anticyclone is well established it is apt to persist for several weeks, bringing a spell of bitterly cold weather. Conditions are rarely severe enough to freeze the shallow inshore waters of the Zuider Zee or even the mouths of the Rhine, but with long protracted cold this may occur. Calms are common and free radiation at night may cause winter fogs that may persist throughout the day. In general, however, there is a light easterly wind and skies are clear.

In summer, the weather may again be cyclonic, but the depressions are shallow and their passage eastwards across the country of short duration. Frequently they bring rain and a marked fall in temperature. Anticyclonic conditions are more frequent in this season and result in considerable spells of sub-tropical fine weather and often heat waves, especially in June. Less intense anticyclones are also common in September and October, bringing spells of fine weather equivalent to our 'St. Martin's Summer' or 'Indian Summer'.

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monthly means and normals for most of the climate elements ; (iv) from 1932 to 1937 the annual volumes of rainfall, previously appearing in the *Annuaire*, were published as *Regenwaarnemingen* 1932–37 ('s Gravenhage, 1936–38).

(2) Each of the climatic elements is described and discussed in the *Mededeelingen en Verhandelingen* of the Kon. Ned. Met. Inst. as follows :

A. Precipitation, by C. Braak. Pts. I–II. *No.* 34*a*, 34*b* ('s Gravenhage, 1933, 1934).
B. Température de l'air, by C.M.A. Hartmann, *No.* 24 (Utrecht, 1918).
B. (cont.) Air and earth temperature, by C. Braak, *No.* 33 ('s Gravenhage, 1930).
C. Air pressure } by C. Braak. *No.* 32 ('s Gravenhage, 1929).
D. Wind }
E. Evaporation, by C. Braak. *No.* 39 ('s Gravenhage, 1936).
F. Sunshine and Cloudiness, by C. Braak. *No.* 40 ('s Gravenhage, 1937).
G. Humidity, by C. Braak. *No.* 41 ('s Gravenhage, 1938).
H. Fog, by C. Braak. *No.* 42 ('s Gravenhage, 1939).

(3) A convenient summary account of the climate of the Netherlands is given in E. van Everdingen, ' Le climat des Pays-Bas ', *Tijdschr. Kon. Ned. Aardrs. Gen*, vol. 55, pp. 573–86 (Leiden, 1938). Less recent, but still valuable for a full discussion of observations at Utrecht, including diurnal variation, is M. Snellen, *The Climate of the Netherlands*, Washington Weather Bureau Bulletin No. 11, Rep. Int. Congr. Part 3, p. 627 (Chicago, 1893).

(4) Tables of climatic statistics for Groningen, Den Helder, De Bilt (Utrecht) and Vlissingen (Flushing) are given by E. Alt, ' Klimakunde von Mittel- und Südeuropa ' (Berlin, 1932) which is Band 3, Teil M, of the *Handbuch der Klimatologie* edited by W. Köppen and R. Geiger.

CHAPTER IV

SOIL AND VEGETATION

The Vegetation of Dune Sand : The Vegetation of Coastal and Estuarine Marshes : The Vegetation of the Peat Lands : The Vegetation of the River Silts : The Vegetation of the Inland Sands : The Vegetation of the Chalk and Muschelkalk : The Vegetation of the ' Loess ' : Floristic Elements in the Netherlands : Bibliographical Note

The vegetation of the Netherlands is of peculiar interest to the botanist. On the one hand there are few countries in which so large a proportion (68·7%) of the total area is devoted to agriculture, either arable or pastoral, and so little to forestry (7·8%—almost all recent plantings). On the other hand, despite the absence, save for a very small area in south Limburg, of any land more than 360 ft. above sea-level, no less than 15% of the country is unexploited, much of this bearing natural vegetation. This large unexploited area comprises heaths, sand-dunes, bogs, fens, salt-marshes and open water. Some of these areas are potentially exploitable, especially much of the bog and fen peat-land and the heaths, and large schemes of reclamation have been projected and begun. A complete extermination of the rich natural floras of these waste lands is fortunately guarded against by the setting aside of representative and especially interesting areas as Nature Reserves.

A second reason for the great botanical interest of the vegetation of the Netherlands, arises from the fact that, geologically speaking, the surface of the country is very new. Rocks of pre-glacial age occupy very limited areas in south Limburg and in one or two other localities. Elsewhere the country is covered with glacial, interglacial or postglacial deposits of ' loess ', sand, peat, sea-silt or alluvium. The age of most of these deposits is known fairly accurately, and so there is excellent material for studying problems of plant migration. Reclamation schemes, including the enormous project for the Zuider Zee, have exposed still newer deposits to colonization by wild plants, and provide for botanists an ecological experiment on an unprecedented scale. The distribution of soil parent materials (Fig. 28) provides a convenient basis for an account of the vegetation.

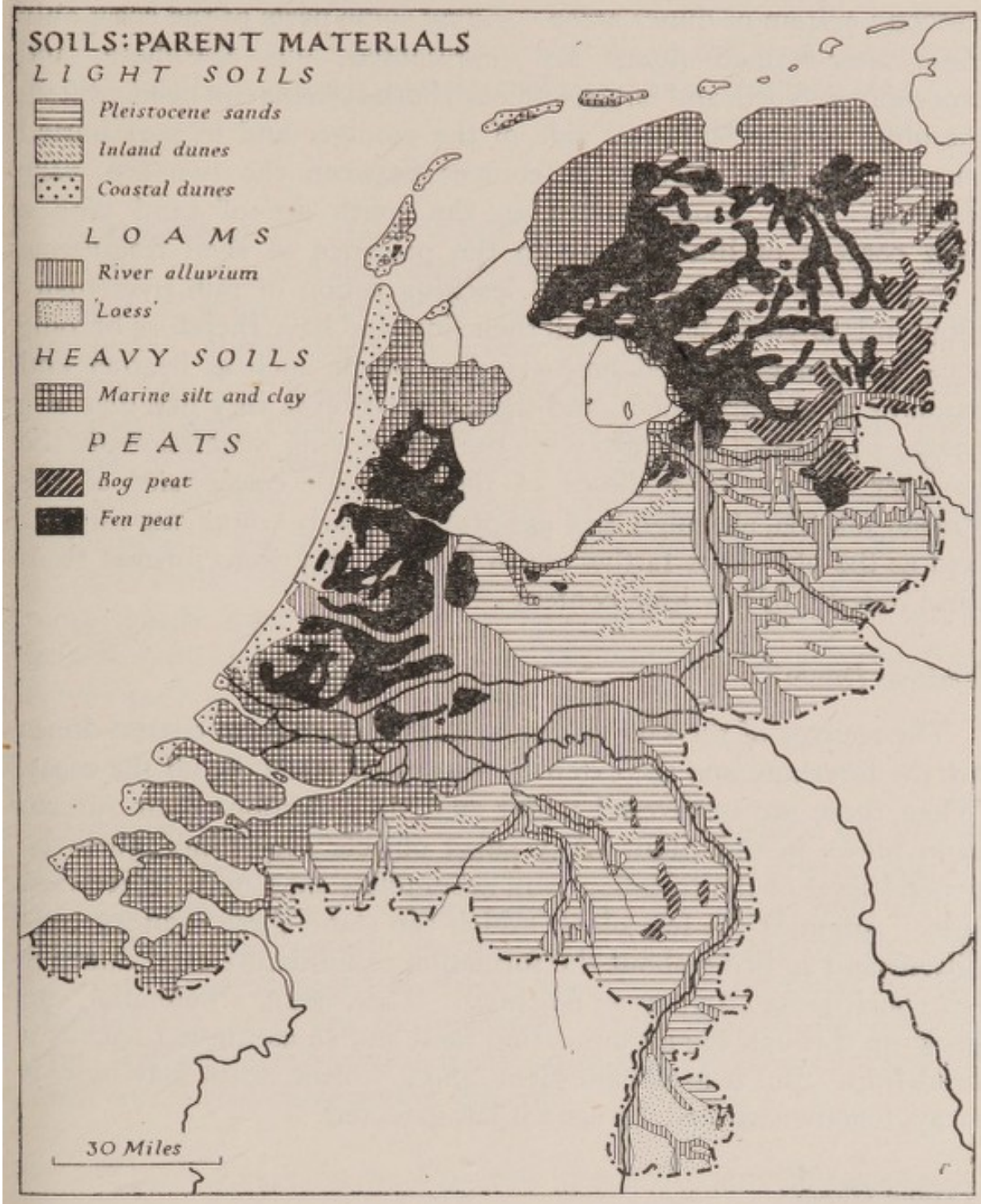

Fig. 28. Soils : parent materials (after J. van Baren)
From : W. C. De Leeuw, *The Netherlands as an Environment for Plant Life*, fig. 4 (Leiden, 1935).
On the nature of ' loess,' see p. 30.

The Vegetation of Dune Sand

There have been two main periods of dune-formation in Holland, one beginning about 5,000 B.C. and terminating with the destruction of much of the early dune-system during the first millennium A.D. After about A.D. 900 conditions in the North Sea changed again and

a second system of dunes arose. Along some parts of the coast only these later-formed dunes are represented, but elsewhere, and especially in North and South Holland, both systems can be identified, the older on the landward side of the younger and in part buried beneath it. The floristic differences between the two are very striking. The young dunes in the south are of sand with a high content of lime, owing to the presence of shell fragments. The old dunes, exposed to the leaching action of rain over many thousands of years, have lost all their lime and have therefore become acid. This has enabled lime-avoiding plants such as heather and sundews to colonize them, and their vegetation is very like that of a heath, in marked contrast with the lime-loving vegetation of the younger dunes. The dunes of the northern coasts and of the Frisian Islands, although they are probably fairly young, are often as acid as the old dunes farther south because they were formed from sand initially of low lime content.

Embryo Dunes

The sources of the sand which accumulates to form coastal dunes are the foreshore and the extensive sand-flats which lie off the coast. When these are uncovered under suitable conditions their surface sand blows in the wind. Any small objects projecting above the general level of the foreshore will accumulate sand on their leeward side. Amongst the few plants which can stand these rigorous conditions and so bring about the formation of miniature sand dunes is sea couch-grass (*Agropyron junceum*). This, being a perennial, can grow up through the accumulating sand and so continue to act as a sand-trap. But it is a small plant, and a violent storm may blow it away, together with all the sand it has gathered.

Yellow Dunes

Under favourable conditions ' embryo ' or ' primary ' dunes may become numerous and large enough to merge and provide an area sufficiently high for colonization by bigger species, less tolerant of flooding by sea water. By far the most important of these newcomers are the marram grass and the sea lyme grass, both tall robust grasses with far-creeping stems and abundant deep-running roots, and both having an extraordinary capacity for re-emerging after burial under blown sand. Their big tufts of leaves bring about a rapid accretion of sand to form large ' secondary ' dunes, often called

' yellow ' dunes because of the stretches of bare newly-blown sand. A few other species may be present, including the sand-sedge, sand fescue, sea holly and the pretty creeping sea convolvulus.

Grey Dunes

Meanwhile on the seaward side a new secondary dune will have been developing, and this catches the majority of the incoming sand, so that further growth of the first-formed dune is checked. Colonization of the more stable surface now proceeds apace. The pioneer grasses lose their vigour and gradually disappear, the yellow sand becomes hidden under a closed carpet of sand-sedge, various small grasses, herbs, mosses and lichens, and the dune is said to be in its ' tertiary ' or ' grey ' stage. If undisturbed by man, shrubby plants, and especially sea-buckthorn, invade the stabilized dunes and form a dense scrub into which birches and oaks may enter later. But more usually grazing prevents the formation of dune-woods, and as lime is more and more removed by leaching the vegetation changes from a poor grassy turf into a dune heath.

Dune Heaths

Heather-dominated dunes are specially characteristic of the ancient inner dune-system in South Holland and of the Frisian Islands. Their vegetation includes many heath and bog plants indicative of high acidity and poverty in plant nutrients. They are of great interest to the botanist but are not easily turned to useful account. Considerable areas are being planted with trees, chiefly Austrian Pine, but soil poverty, drought and exposure to wind and spray often make successful afforestation difficult.

The Vegetation of Coastal and Estuarine Marshes

The interior of a large sand dune contains a body of stored rain-water which floats on the denser sea water (Fig. 29). The vegetation of the dunes is therefore rooted in fresh water, in striking contrast with the vegetation of the extensive coastal and estuarine marshes which are, in varying degrees, saline. The other distinctive feature of these marshes is that they are tidal, quantities of silt being deposited by each tide. The mud-flats built up in this way are called *Wadden*. Vegetation is first developed when they have been raised sufficiently to be exposed for a short time during low water at spring

tides. The only species of higher plant which can tolerate this almost permanent immersion in salt water is the eel-grass (*Zostera*) and on suitably sheltered flats it forms dense 'sea-meadows'. The inhabitants of some of the small Dutch islands collect it in great quantities, dry it in the sun and sell it for stuffing cushions and mattresses, as heat and sound insulating material, and as packing material (*Zostera*). The eel-grass accelerates the deposition of silt and eventually the level becomes high enough for colonization by marsh samphire (*Salicornia*), whose dense communities cause still more rapid accumulation. Land reclamation by *Salicornia* is often

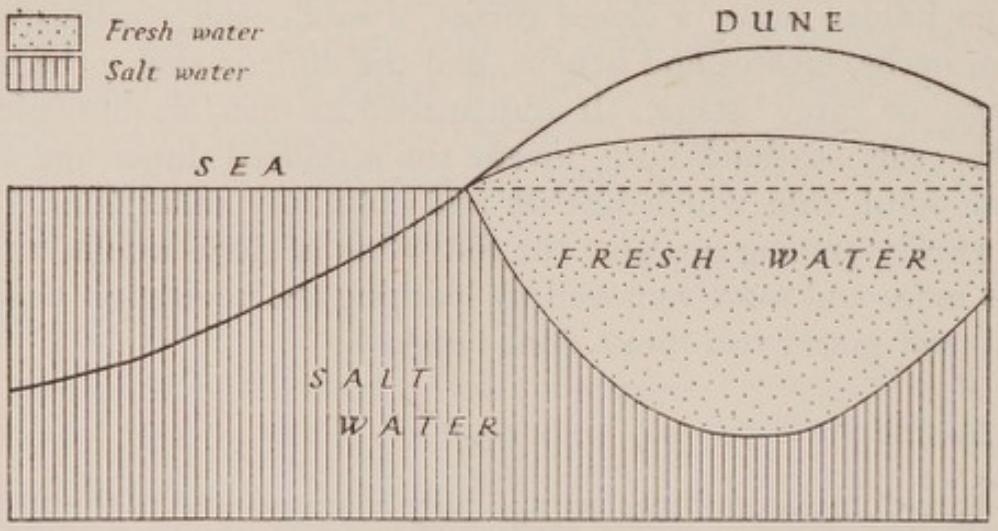

Fig. 29. Distribution of fresh water and sea water in a sand dune

From: W. C. De Leeuw, *The Netherlands as an Environment for Plant Life*, fig. 116 (Leiden, 1935)

The diagram represents the equilibrium condition between fresh and sea water.

aided artificially by building wicker-work fences which are nailed to piles driven into the silt. In the course of time the marsh surface is built above the level of ordinary high tides. Then other plants can colonize it, notably the mat-forming grass *Puccinellia maritima*, sea aster and sea lavenders.

As spring tides continue to add more silt the marsh surface becomes less and less affected by sea water and more subject to leaching by rain water. Species less tolerant of a high salt content appear, amongst them sea thrift, with rushes and grasses. Up to this point most of the plants have been succulent, with thick fleshy stems and leaves, but as flooding with sea water becomes infrequent the succulents disappear. By this time the marsh is useful for grazing and it is customary to build dykes which both protect the marshes from exceptionally high tides and prevent stock from straying too far seawards. At first summer dykes are built which do not prevent

inundation by high tides in winter. Then, after further raising of the level, higher dykes are built separating inner marshes from the outer polders. These reclaimed salt marshes soon acquire a rich and nutritious flora and make first-class pastures. Much of the older and drier silt land has been ploughed and grows excellent crops.

The gradual changes outlined above can be greatly accelerated by building large dykes and sluices and by deepening the channels of rivers. In this way numerous new polders have been created. Before they are of any agricultural value their salinity must be much reduced by the action of rain water, and during this waiting period they are colonized by a succession of plant communities each somewhat less tolerant of salinity than its predecessor. These successions have been carefully recorded by Dutch botanists and they are now able to estimate the residual salinity very accurately by inspection of the flora.

The Vegetation of the Peat Lands

Peat consists of plant remains which have not been broken down by microbial activity because of a permanently high water table. The effect of permanent water-logging is to impede or prevent the access of oxygen, and most of the organisms responsible for the decomposition of plant remains can only live when plentifully supplied with oxygen. Under such conditions, therefore, the plant remains accumulate as peat and may form beds up to forty feet in thickness. Examination of such beds generally shows that accumulation began in the open water of a lake or lagoon, and the succession of communities upwards from the base of the peat can often be matched today in the series of zones which surround the open water of a lake or pond. The Netherlands is especially rich both in peat deposits and in the various aquatic and sub-aquatic communities which are still forming peat today as they did in the past. Completely submerged pondweeds and minute free-floating plants are followed, as the water becomes shallower, by plants with floating leaves, such as water-lilies. Then come the tall, densely crowded sedges and reed-grasses of the reed swamp, and later still the willows and alders of the fen wood. Throughout this part of the succession the vegetation has been growing in water more or less rich in plant nutrients, water derived from the river system of the area. Peat formed under these conditions is itself rich in mineral salts and may contain much lime. It is called fen peat, and the plant communities of whose remains it

consists are called fen communities. Most of the surviving peat-forming vegetation of the Netherlands today is of this fen type (Fig. 74).

Under suitably cool and moist conditions another kind of vegetation may replace fen, giving rise to peat of a very different composition. The most important constituents of this bog vegetation are the bog mosses (*Sphagnum*), and the peat is called bog peat. The bog mosses are peculiar in being highly intolerant of base-rich water, and they can therefore establish themselves only after the peat has reached the water surface and only when there is enough rainfall to satisfy their high water requirements. There have evidently been periods since the last retreat of the ice which have been much more favourable for the growth of bog mosses in Holland than at present, and most of the bog peat can be traced to these periods. The mosses seem usually to have established themselves in the young fen-woods, whose regeneration they then prevented, and as the trees died their fallen trunks became buried in the rapidly deepening bog peat. Early stages in this transition from fen to bog can be found today, but it seems that summers are too dry now for the mosses to make successful headway against the fen wood. There is reason to believe that bogs already established might maintain themselves today, but the once extensive bogs of the north-east (Fig. 74) have all been drained and vast quantities of the peat removed for fuel, so that conclusive evidence is hard to find.

Bog peat is valuable as fuel because it is very poor in salts and therefore gives little ash on burning. For the same reason it is of little value for agriculture, even after draining. Fen peat, on the other hand, is rich in ash constituents and of little use as fuel, but is valuable for agricultural purposes after draining. Most of the extensive fen peatland which lies on the landward side of the silt-land has been drained and converted into good pasture, while some is now under the plough. Small areas have been left as Nature Reserves so that the various stages in the natural succession may still be studied.

The Vegetation of the River Silts

In the immediate neighbourhood of the large rivers the substratum for plant growth consists of silt deposited by the rivers in flood. When there has been no disturbance by man, plant communities can be found in a series of zones from the open water to the dry land, zones very like those seen round ponds and lakes. Submerged pond-

weeds, water-lilies with floating leaves, then reeds and finally willows and alders dominate the successive zones : there are, nevertheless, many striking differences from the communities of the fen succession. Many of the common fen plants are absent, and many others occur which do not grow in fens. There is no progressive accumulation of peat, presumably because the water-table is not maintained at a high level throughout the year, but may drop far below the surface during dry periods in the summer. Such communities are called marshes. With or without drainage they afford valuable pasture or hay during the spring and summer. If undisturbed, woody communities develop in which poplars, ash, elm and even oak play an important part besides the alders and willows of the fen woods. In parts of the Netherlands areas of river silt-land have been very successfully planted with poplars for match making, and with osier willows. Elsewhere, drainage has been followed by ploughing, but there is still much of the marsh land under grass.

Vegetation of the Inland Sands

Pleistocene sands cover large areas of Drenthe, Overyssel, Gelderland, North Brabant and Limburg. They vary a good deal in fertility, those of the south being on the whole more fertile than those of the north. There is good reason to believe that they were formerly under forest vegetation, almost certainly of oaks, birch and hornbeam, with perhaps some local beech forest on the better soils. Historical records and careful study of small relict areas of woody vegetation have enabled botanists to reconstruct a picture of these former forests. For instance, in the ' Geldersche Vallei ', east of Amersfoort, there are many woodland plants still surviving in hedgerows. These include wood anemone, wood sorrel, sweet woodruff and oxlip, all absent from similar soils to the north and south of the area. As late as the fourteenth century the Sylva Renham extended over the area. Then began the clearing of the forest, starting the process which ended in a ' flat moor covered with heather where only dispersed woodlets on the higher parts and on the lower ones meadows were to be found ' (Weevers). Another forest, ' het Beekbergwoud ' existed until 1870 between Apeldoorn and Zutphen. This was an alderwood with very rich ground flora. There is no doubt that this was the story over most of the region of inland sands.

Today all the better soils are either pasture or arable, while those too poor for profitable agriculture are covered with heather, or were so until quite recently. These heaths are a characteristic feature of

the inland landscape. They resemble the Surrey heaths or the Yorkshire moors, the heather being accompanied by other species tolerant of high acidity, a low content of plant nutrients, and summer drought. The most conspicuous of these are gorse, broom and juniper with smaller herbaceous plants such as heath grasses, tormentil, heath-rush and many mosses and lichens. Local damper areas have cross-leaved heath, bog-mosses, and marsh gentian. In the old days they were maintained as heaths by sheep grazing, burning and turf-cutting, but now that sheep farming is no longer profitable they are rapidly disappearing. Birches and pines are spontaneously colonizing some of them and large areas have been afforested, especially with Scots Pine. On the poorest sands it may be necessary to treat with artificial fertilizer before successful afforestation.

The Vegetation of the Chalk and the Muschelkalk

In south Limburg there is an appreciable area where chalk reaches the surface, and in the vicinity of Winterswijk in eastern Gelderland there are a few localities with outcrops of the older Triassic chalk or Muschelkalk. Here there are pastures with a flora closely resembling that of the English chalk downs, with their characteristic assemblage of short grasses (including sheep's fescue) and herbs, amongst which are many orchids such as the bee orchis.

The Vegetation of the Loess

The soil of much of south Limburg, however, is derived largely from the superficial deposits of ' loess '. This is the richest agricultural soil of the country and little natural vegetation remains today. It is clear, however, that it once supported forests of beech and hornbeam and here, as elsewhere in Holland, magnificent beeches up to 150 ft. in height are to be found in small plantations and in avenues.

Floristic elements in the Netherlands

The flora of Holland is of great interest to botanists as containing a mixture of Atlantic (West European), Boreal and Continental (East European) species in addition to its core of more widely distributed types. Many of these species are to be found on the coastal dunes. Damp ' slacks ' between neighbouring dune ridges support such atlantic species as *Centunculus minimus* and *Cicendia filiformis*, familiar to botanists in S.W. England, and the dune heaths have such

boreal species as the dwarf cornel (*Cornus suecica*), and *Linnaea borealis*, believed to have been carried by birds from Jutland. Continental species are less common, but the yellow-flowered everlasting (*Helichrysum arenarium*), a ' pontic ' species, has been recorded. The position of the Netherlands on the edge of the Central European land mass is doubtless responsible for this curious mingling of different floristic elements.

BIBLIOGRAPHICAL NOTE

The most useful sources of information about the vegetation of the Netherlands is the botanical periodical *Nederlandsch Kruidkundig Archief*, published at Amsterdam for the Nederlandsch Botanische Vereeniging. Numerous papers have appeared during recent years dealing both with floristic and ecological topics.

For descriptions of the vegetation of areas affected by the Zuider Zee reclamation scheme, the Mededeelingen of the Commissie voor het botanisch Onderzoek van de Zuiderzee should be consulted.

The leading Dutch journal dealing with the forests of the Netherlands is the *Nederlandsch Boschbouw-Tijdschrift*, which publishes papers dealing with heath, bog and dune afforestation as well as descriptions of existing forests and plantations. Longer accounts of forestry research appear in the *Mededeelingen van het Rijksbouwproefstation*.

Forest statistics can be found in *Forest Resources of the World* by R. Zon and W. N. Sparhawk (New York, 1923), and in the journal *Intersylva*.

CHAPTER V

THE PEOPLE

Physical Characteristics : Language : Religion : Education : Social Conditions : Some Aspects of Dutch Culture : Bibliographical Note

PHYSICAL CHARACTERISTICS

It is not easy to generalize about the physical characteristics of the people of the Netherlands, although a broad distinction may be made between the north and the south. The population of the provinces north of the Rhine, particularly Friesland and Groningen, is noticeable for the frequent occurrence of light-coloured hair, blue or grey eyes, fresh complexions, tall stature and a tendency towards long heads. In other words, it shows many of the physical characters of what has been called the ' Nordic ' type, and it is related to the representatives of this type found in Norway, Denmark, Sweden and parts of northern Germany. On the other hand, the population of the provinces south of the Rhine—Zealand, North Brabant and Limburg—shows a greater frequency of brown and dark brown hair, brown eyes, shorter stature and broad heads, although lighter colouring still predominates. These are characteristics of the ' Alpine ' types, which can be traced most clearly in the highland zone of central Europe.

These two main types have mixed considerably in the central areas. Consequently there is a gradual but noticeable gradation from north to south, with so-called ' Nordic ' traits becoming less pronounced southwards from Friesland, Groningen and Drenthe. Further, the Netherlands have been affected by the inroads of groups from the plains to the east. Considerable mixing is noticeable from the earliest times and even the local concentrations of associated traits which permit the use of such terms as ' Nordic ' and ' Alpine ' represent evolutions and segregations from the early mixed basis. Consequently, if the people of an area are described as being of a ' Nordic ' or ' Alpine ' type, the description implies no more than that the traits of those types are more concentrated in that area than they are in neighbouring areas.

Provinces north of the Rhine

In the lands north of the Rhine there is a considerable broad-headed element in addition to the tall fair longheads which form the majority of the population. Only in the province of South Holland,

where the frequency of light colouring is a little less than it is to the north, is this broad-headed element inconsiderable. Similarly, some evidence of mixture is seen in the fall of stature averages in Overyssel and Gelderland.

Careful study has been made of the Frisians. They are, in general, tall, with mean statures of 170 cm. (5 ft. 7 in.) or over, and broad shouldered. They are large-headed and have large faces with long, narrow noses. The frequent occurrence of light hair places the Frisians amongst the blondest people in the world. The large size of the head and face, particularly the very broad faces, are not typical 'Nordic' features. It is interesting to note how the 'Nordic' population has established itself on the bleak plains of marsh, sand and clay in the provinces of Friesland, Groningen and Drenthe, which form also a peninsula between the Zuider Zee and the North Sea.

Provinces south of the Rhine

In the provinces of Zealand, North Brabant and Limburg, stature is low, the average statures for the southern provinces being below 170 cm. (5 ft. 7 in.) while for the northern provinces they are consistently above this figure. Blonde colouring is also less frequent, although fair hair is still more frequent than dark hair, being observed in from 60% to 70% of the persons examined. Nevertheless it is less concentrated than it is in the northern provinces, where the corresponding percentage never falls below 70%, and in the extreme north is over 80%. Differences in eye colouring are still more marked. Light eyes occur in from 59% to 62% of the observed cases in the southern provinces. With the exception of South Holland, the percentage of the light types never falls below 70 in the northern provinces. In short, it may be said that the traits of the different stock—the 'Alpine' stock—here make up an important minority in the population. In Zealand, North Brabant and Limburg, people of short stature, stocky in build with broad shoulders, broad heads and medium to dark colouring of hair and eyes, would be more frequently noticed than they are in the north. Mixture would show itself clearly in short people with fair colouring, and possibly, in tall dark individuals.

LANGUAGE

Varieties of three main groups of dialects are spoken in the Netherlands, namely Frisian, Low Franconian and Low Saxon (Fig. 30).

They belong to the western branch of the Germanic or Teutonic division of the Indo-European languages.

Frisian Dialects

In the first century A.D., the Frisians occupied the territory between the Rhine and the Ems. In the eighth century the English saint, Boniface, established Christianity in Frisia. By the end of the twelfth century there had been Frisian migrations across the Lauwers and on to the Weser ; at the close of the thirteenth century Frisians had crossed the Elbe and had settled on the Schleswig coast, on the ' halligs ' and on the islands of Heligoland, Sylt, Amrum and Föhr. These came to be known as the East Frisians, to distinguish them from the West (Lauwers) Frisians who inhabited the North Sea coast from the Dollart to Haarlem, and the greater part of the Zuider Zee coast. The speech of the Frisians was closely related to English, which also belongs to the West Germanic group, and the recognition of this affinity has been preserved in the old tag that ' Bread, butter and green cheese, is good English and good Fries '.

West Frisian at one time extended as far west as North Holland, but now it is spoken only in the province of Friesland, north of the rivers Kuinre and Tjonger, and on the islands of Schiermonnikoog and Terschelling (except around Midsland). On the mainland, the chief varieties of *Landfries* are those of Hindeloopen, Zuidhoek, Noordklei and Wond. In the former Frisian towns, Hollands-' Dutch ' (see p. 82) has for several centuries been gaining considerable ground, and a ' Frisian-Dutch ' dialect, known as *Stadsfries* or *Steds*, has evolved in Leeuwarden, Sneek, Bolsward, Franeker, Harlingen, Stavoren and Dokkum. In other areas that were originally Frisian speaking, Low Franconian or Low Saxon dialects have prevailed, but Frisian has left deep traces on these dialects. In North Holland, where Frisian was widely spoken up to the end of the fifteenth century, the Hollands-Franconian dialect has become dominant, although the Frisian influence on it has remained strong and the term ' North Dutch ' is employed to describe the speech of this region (Fig. 30).

West Frisian has had a fully developed literary language from the time of Gysbert Japiks in the seventeenth century to the ' Young Frisian ' writers of the present century. Statistical information concerning the number of Frisian speakers in the Netherlands is not available, but in 1928 their number was estimated at 318,000.*

* A. Meillet and L. Tesnière, *Les langues dans l'Europe nouvelle*, p. 373 (Paris, 1928).

From time to time they have made strenuous efforts to secure the use of their language in education, in religion and in legal affairs.

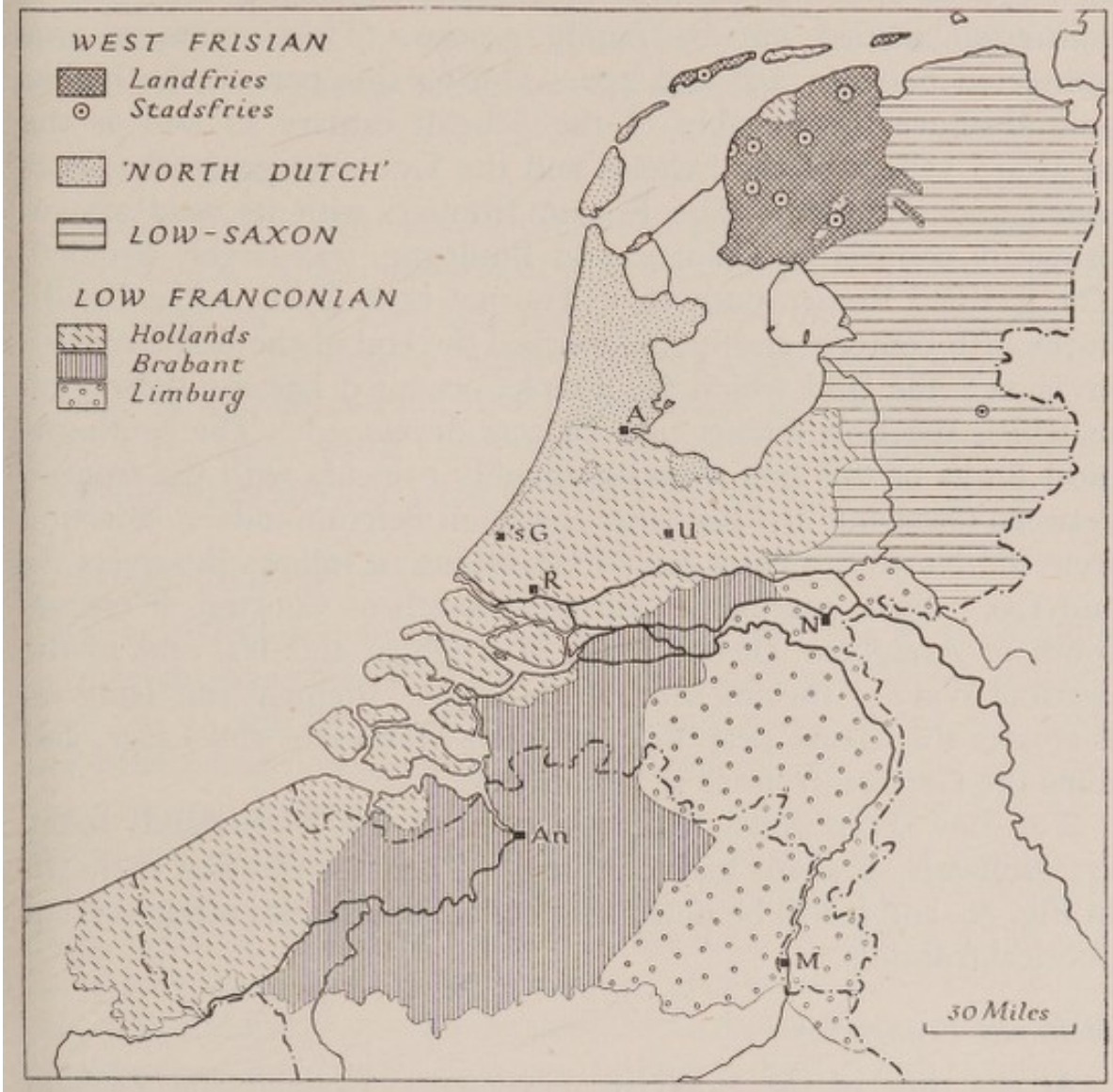

Fig. 30. The dialects of the Netherlands

From : J. van Ginneken, *Handboek der Nederlandsche Taal*, vol. I, p. 18 ('s Hertogenbosch, 1928).
A Amsterdam ; An Antwerp ; M Maastricht ; N Nymegen ; 's G Th Heague ; U Utrecht.

Low Franconian Dialects

The Low Franconian dialects of the Netherlands represent the Low Germanic speech of the Franks. By the third century A.D., the Salian Franks, who had come from the east through Drenthe and Salland, dominated the country between the Yssel and the lower Maas. Later they occupied the fertile land between the Lek and the Waal. Their attempts to establish themselves across the Waal were overcome by the emperor Julian who, in A.D. 358, permitted

them to settle in Toxandria, which roughly corresponded to the eastern part of modern North Brabant. The Franks slowly extended their sphere of settlement and their method was primarily one of infiltration carried out by family groups. This expansion was completed between 358 and 450. During this period, the higher ground above the marshes of the Scheldt estuary as well as the westward valleys of the Scheldt and the Lys were gradually penetrated and occupied. The Roman frontier, with its road system primarily connecting Cologne and Boulogne, was largely avoided. The fortified Roman outpost of Tournai capitulated to the Franks in the fifth century, and its fall marked the end of the first Frankish invasion ; the land which the Franks occupied became the region in which the Low Franconian dialects developed. The southernmost limits of this first invasion roughly coincide with the frontier between Germanic and Romance speech in Belgium today. Starting from the North Sea coast east of Gravelines, it follows the rivers Aa and Lys ; then, passing several miles south of Courtrai, it crosses south of Avelghem, thence south of Enghien and Hal and to the north of Wavre ; turning southwards below Tirlemont and Tongres, it crosses the Meuse near Visé, between Maastricht and Liége, and joins the German frontier at Hombourg.

The Low Franconian dialects spoken in the Netherlands today are Hollands, Brabant and Limburg. Their distribution is shown in Fig. 30, and it will be noted that dialect boundaries often overlap political frontiers.

Hollands-Franconian

At the time of the Frankish movements, Holland and Zealand were already settled, if only thinly, by Frisians and Saxons. The coastal regions, therefore, became ' franconized ' at a very early date—with the exception of the small northern part of Holland which long retained the name of West-Friesland. The speech of the original Frisian and Saxon inhabitants, however, left many traces on the Frankish dialect.

The main local variations of Hollands-Franconian are (i) West Hollands, spoken in Delfland, The Hague, Leiden and Haarlem ; (ii) South-east Hollands, spoken in Alblasserwaard, IJsselmonde, Voorne, Putten, Beierland and around Moerdijk ; (iii) the Utrecht dialect ; (iv) North-east Veluwe ; (v) Zealand ; and (vi) West Flemish, spoken between Cadzand and the Braakman.

An outlier of Hollands-Franconian is found at Het Bildt, a

part of the old Boornsee. This area was dyked in and settled under the leadership of Hollanders in the sixteenth century ; its speech today is the South-east Hollands variation. Up to 1786, Frisian alone was spoken on the island of Ameland, but the West Hollands variation is now spoken throughout the island.

Brabant-Franconian

Brabant-Franconian most closely represents the speech of the Salian Franks. It has many local variations both in the Netherlands and in Belgium. In the Netherlands, the West Brabant variation is spoken and it is found in Neder-Betuwe, Tielerwaard, Bommeler-Waard, Langstraat, around Breda, Rozendaal, Bergen-op-Zoom and Hulst—that is, in south Gelderland, in west North Brabant and in eastern Zeeuwsch Vlaanderen (Zealand Flanders).

Limburg-Franconian

Limburg-Franconian has close affinities with the West Middle German dialects of Aachen and Cologne, and it is probably derived from the speech of the Ripuarian Franks who, about A.D. 406, established themselves along the left bank of the Rhine between Cologne and Andernach, and in A.D. 455 spread to the Ardenne, reaching as far as Bingen on the Rhine by the end of the century.

The modern variants of Limburg-Franconian in the Netherlands are (i) Gelders, spoken in Lijmers, Over-Betuwe, Duffel, Land van Cuijk and Peel ; (ii) North Limburg, spoken in the Venlo area ; (iii) East Limburg, spoken between Sittard and Vaals a few miles inland from the Dutch–German frontier ; (iv) South Limburg, spoken from Roermond to Maastricht ; and (v) East Brabant, spoken in an area including Maas-en-Waal, 's Hertogenbosch, Tilburg and Eindhoven.

Low Saxon Dialects

In the sixth century A.D., Saxon tribes from north Germany conquered territory occupied by the Franks east of the Yssel, as far as Friesland and the *Ommelands* of Groningen. Their speech belonged to the Westfalian form of Low Saxon, which is also a Low German dialect. The ' purest ' Low Saxon is spoken in parts of Gelderland and Overyssel—in the former county of Zutphen, in Salland and in Twente, as far north as eastern Drenthe. In the province of Groningen, although Saxon communities have intermixed wth

Frisians, thus giving the Groningen speech a marked Frisian quality, the lowlands around the town of Groningen itself have been 'saxonized' since the fifteenth century. In the southern part of the province of Friesland, in western Drenthe and in northern Overyssel, Low Saxon prevails, but here again Frisian influence has been strong and there is an enclave of Frisian speakers around Donkerbroek and Oosterwolde. In the south-east Veluwe, on the other hand, between Arnhem and Zutphen, the tendency has been towards a fusion of 'Dutch' and Low Saxon. The following five varieties of Low Saxon speech can thus be recognized in the Netherlands; (i) Gelders-Overyssel; (ii) Drenthe; (iii) Groningen; (iv) Stellingwerf, extending from the Lauwers in the north to Elburg in the south; (v) South-east Veluwe. There has been a considerable amount of literary activity in the Low Saxon dialects.

Development of the Standard Language

The development of the standard language in the Netherlands has been the result of political, religious and cultural factors. Vernacular literature began to flourish in western Flanders in the thirteenth century and its greatest representative, Jacob van Maerlant, in his moralistic and scholarly works, composed a wider literary language which he called *Dietsch*. Each writer, however, tended to use his own dialect which, though written phonetically, could be understood throughout Flanders, Brabant, Zealand and Holland. During the fourteenth century, the political unity of Flanders and the commercial supremacy of Bruges helped both to bring about a unity in the language of that region and to give it an increasing importance as a medium of literary expression.

Towards the end of the fifteenth century, Brabant became more important, both politically and commercially. By the sixteenth century, Antwerp had become the heir to Bruges, there was a university at Louvain, the court had moved to Brussels and the Great Council of Justice met at Malines. There was, of course, considerable gallicization, but it was accompanied by a quickened consciousness of the significance of the vernacular, and attempts were made to 'raise up the mother language which now lies concealed in the earth like gold, so that we may prove how needless it is for us to beg for assistance of other languages'. Thus the dialect of Brabant gained unity and supremacy; foreign words, many of them brought in by the Humanists, were eliminated from its vocabulary and its orthography became more regulated; there was a

narrowing of the gap between its spoken and written forms and it began to replace Latin in official documents.

Meanwhile, in Gelderland and the north-east, a different literary language was being formed and it received its patterns from the east. The noblemen of Gelderland intermixed with those of Cleves and Juliers, while the people of Groningen became more and more concerned with the affairs of East Friesland ; Westfalian influence also became apparent in religious literature. A literary form of Low Saxon came to be used in the chancery of Gelderland and in the town hall of Groningen ; indeed, it was employed by historians, chroniclers and writers of religious works. Until High German penetrated into the domain of Low German, chiefly through the writings and translations of Luther, the literary unity of Gelderland and Groningen with the region adjoining on the east was unbroken. In Friesland, on the other hand, the language had not become a literary instrument, and it was losing ground both to Low Franconian and to Low Saxon.

Towards the middle of the sixteenth century, the language of Flanders, Brabant and Holland acquired a name of its own. Hitherto the term *Duitsch*, which is the same as the English *Dutch* and the German *Deutsch*, had been used to describe the written language. This term also embraced German—today it refers only to that language—although a distinction was beginning to be made between *Nederduitsch* (Dutch) and *Hoogduitsch* (German). From the seventeenth century onwards, *Nederlandsch* came into use instead of *Duitsch*, and this is the official name of the language today, though the people of the Netherlands often call their speech *Hollands* [*ch*] (a term which appeared about 1650) and in Belgium it is referred to as *Vlaams* [*ch*].

The close of the sixteenth century saw the centre of political and cultural influence moving to Holland. Here the dialect had been increasingly employed as a literary medium since the fourteenth century, and under the Renaissance efforts had been made to ' purify ' it of German loanwords. By the sixteenth century it had become a ' cultured ' speech, but it was being considerably affected by the southern dialects of Brabant and Flanders. For example, the diphthongized pronunciation of *huis* (house) and *muis* (mouse) spread to Holland from Brabant (probably from Antwerp), and it has become general in standard written Dutch and in educated speech. A standard had therefore been set up in the North and the language was ready for the demands that were to be made upon it.

It is true that the standard did not apply as strictly to non-literary purposes, for ' in town halls, States assemblies, merchants' offices, a much less pure language remained in use '.* Nevertheless, the prestige of the literary language in Holland stood high, and the Chambers of Rhetoric jealously guarded it.

The influence of the Holland dialect grew wider in the seventeenth century. The spoken language was not yet completely standardized, and ministers of religion, politicians and writers each spoke their own variety. But there was a strong tendency towards greater unification. A translation of the Bible (*Statenbijbel*) was published at Dordrecht between 1623 and 1635 ; scholars from the South had helped in the task of translation. The Reformed Church, therefore, was a powerful factor in the spread of a standard language, both through the translation of the Bible and through the pulpit. The standard spoken language was based on the dialect of Holland, but it drew both upon the written language and upon idioms from other parts of the country, from Frisian and from Saxon. It became the language of politics, of administration and of law ; it became the standard not only for the Union but also for East Friesland and Cleves.

It must be remembered, however, that the written language still showed considerable deviations from the spoken tongue. For one thing, the influence of the Southern dialects long persisted in words and phrases—especially in formal and official usage. This was not surprising when so many of the writers in the North were either of Flemish origin or closely connected with Flemish families. On the other hand, there was a vigorous campaign in the seventeenth century to eliminate loanwords from the language and the North enjoyed a ' golden age ' of literature. This literary awakening is associated with the names of P. C. Hooft (1581–1647), Gerbrand Breero (1585–1681), Joost van den Vondel (1587–1679), Constantin Huygens (1596–1687) and Jacob Cats (1557–1660). Individual predilections in vocabulary and syntax had not yet completely disappeared but a uniform literary language was being developed for the whole country and the translation of the Bible provided a pattern for style, word usage and grammar. Many handbooks of grammar were also produced, though it was not until the eighteenth century that the precepts of the grammarians were accepted as rules to be obeyed. And so, by the nineteenth century, a standard literary language had come into use throughout the Netherlands.

Orthography remained as the major cause of inconsistency, and

* P. Geyl, *The Revolt of the Netherlands*, p. 283 (London, 1932).

scholars proceeded to standardize it. For example, M. Siegenbeek in his *Verhandeling over de Nederduitsche Spelling* (Amsterdam, 1804) enunciated the principle of ' Write as you speak '. In 1849 the first of several annual congresses of writers from the Netherlands and Belgium was held to consider measures for consolidating the unity of the written language. These congresses had two outstanding results. The first was the beginning of work on the great Leiden Dictionary of the Dutch language, now slowly approaching completion. The second result was the publication of te Winkel's *Grondbeginselen der Nederlandsche Spelling* (Leiden, 1865) and of the *Woordenlijst der Nederlandsche Spelling* by te Winkel and M. de Vries (Amsterdam, 1866). The rules laid down in these two works, which differed from those of Siegenbeek, were officially accepted in 1873, although the Siegenbeek system tenaciously held its ground. Towards the end of the century an improvement on the te Winkel-de Vries method was published by Professor Kollewijn and it was widely adopted in schools and colleges. A compromise between the two systems was officially approved in 1918.

The standard spoken language which has evolved from the Holland dialect still differs in many respects from the written language of the Netherlands, but the dialects are now less important relatively to the standard language than in Belgium, where there is considerable literary activity in dialect. All educated people speak the standard language (i.e. modern Dutch) ; traces of the speaker's original dialect, however, still creep into their speech, and less importance is attached to complete uniformity of speech in the Netherlands than, for example, in France.

Afrikaans

Afrikaans is the form of Dutch spoken in the Union of South Africa. In 1652, Jan van Riebeek arrived at the Cape with a number of colonists who spoke different Dutch dialects, though the majority came from around Amsterdam. These colonists succeeded in absorbing the French Huguenots who arrived after the Revocation of the Edict of Nantes in 1685. The language shows an extreme simplification of grammar and much wearing down of the phonetic forms. In so far as Afrikaans is not the normal development of Dutch, it is Dutch modified by contact with non-Dutch speakers. There was, for example, sudden contact with ' Malayo-Portuguese ', a creolized language used by Europeans in dealing with slaves. On the other hand, contact with the standard Dutch of the Bible and

literature, and an increased awareness of the dignity of Dutch as an official language have combined to maintain the close affinity of Afrikaans with the language of the Netherlands, and a standardized literary language has emerged in Afrikaans.

RELIGION

General Features

Freedom of religion has been one of the constant factors in the history of the Netherlands since the end of the sixteenth century. The principle underlying this toleration was formulated as early as 1564 by William of Orange, when he declared before the Council of State, ' although attached to the Roman Catholic faith, I cannot possibly approve that princes should wish to rule the consciences of their subjects and deprive them of their liberty and worship of God '. The struggle for religious freedom in the sixteenth century had been so closely interwoven with the fight for the independence of the Netherlands that the Dutch republic in the seventeenth century became a sanctuary for all who fled from religious coercion in other countries. Flemings and Walloons came over from the Southern Provinces ; there were Nonconformist refugees from England, Jews from Spain and Portugal, and Protestants from France and Germany.

This principle of liberty of conscience has often been reaffirmed in the various constitutions of the Netherlands. Thus the constitution of 1798 regulated the status of Jews and Roman Catholics by permitting them to occupy public posts which had hitherto been open only to members of the Reformed Church. The constitution of 1814, too, while stipulating that the sovereign was to be a member of the Dutch Reformed Church, granted equal protection to all religious beliefs. Financial aid was promised to all churches to secure adequate salaries for the clergy, and a ministerial department for religion was established. It was the constitution of 1848, however, that brought complete freedom for all religious bodies, although it also led to the educational conflict concerning denominational schools (see p. 166). It was again declared in the constitution of 1938 that the freedom of all faiths is firmly established, and that all confessions are granted equal protection. All public appointments, privileges and honours are open to members of the various churches.

There has been a close relationship between politics and theology in the Netherlands since the sixteenth century. This interplay

between political theory and religious thought has produced a multiplicity of political parties and a variety of religious denominations. In the nineteenth century, for example, the seventeenth century antithesis between the ' strict ' or Precisionist Calvinists and the Liberal Calvinists had a parallel in the conflict between the Liberal and the Anti-Revolutionary parties (see p. 160). Early in the nineteenth century the *Réveil*, a movement which had its inspiration in Switzerland, and which found its first Dutch interpreters in W. Bilderdijk, Isaac da Costa and A. Capadose, exercised considerable influence both on political reactions and on spiritual development in the country. Later, the Anti-Revolutionaries, led first by Groen van Prinsterer and subsequently by Abraham Kuyper, stood for the reassertion of the doctrinal principles of Calvinism, especially of its theocratic ideas, and for the repudiation of the humanistic, rationalistic theories that had been both the cause and the effect of the French Revolution. The wider implications of the part played by religious factors in the formation of the various political parties are discussed in pp. 160–1, 166–8.

Religious Organizations

Religious toleration and the effects of theological controversies in the Netherlands have inevitably led to the appearance of many denominations within the country. The following table, based on the 1930 Census returns, shows the numerical strength of the most important among these denominations :

Confession	Membership
Dutch Reformed	2,732,333
Walloon Reformed	6,358
Remonstrant	29,719
Christian Reformed	50,230
Anabaptist	62,012
Evangelical Lutheran	78,330
Orthodox Lutheran	11,937
Reformed Churches	638,372
Roman Catholic	2,890,022
Dutch Israelite	106,723
Portuguese Israelite	5,194
Old Catholic	10,182
Others	169,575
Of no confession	1,144,393
Not declared	185
Total	7,935,565

From : *Jaarcijfers voor Nederland*, 1938, p. 12 ('s Gravenhage, 1939).

The variations in the numbers of members of the denominations during the past hundred years are indicated in Fig. 31, which also shows the striking increase in the number of persons of no confession.

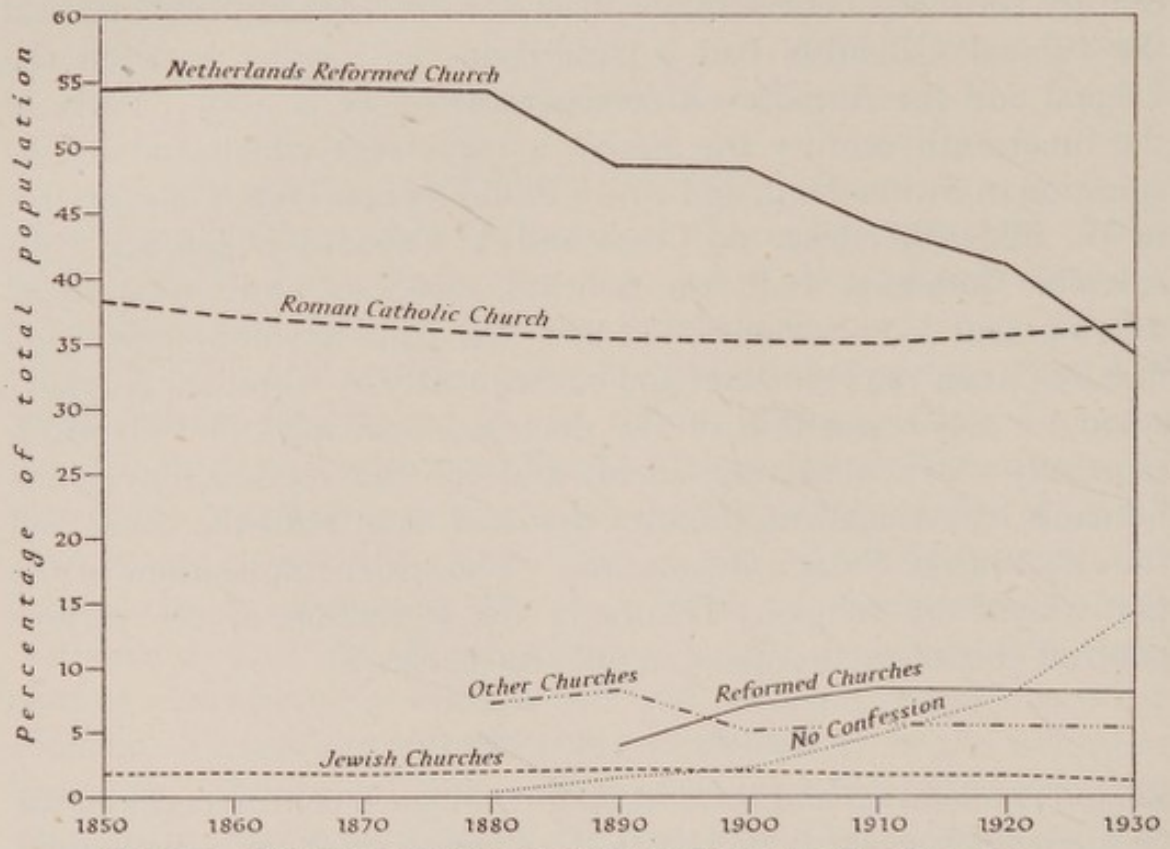

Fig. 31. Religious organizations in the Netherlands, 1850–1930

From : *Statistiek van Nederland, Volkstelling 31 December*, 1930, Deel V, p. 12 ('s Gravenhage, 1933).

The Dutch Reformed Church (Nederlandsch Hervormde Kerk)

The Dutch Reformed Church has for many centuries been closely related to the state. When the United Provinces secured their independence (see p. 128), the alliance between church and state was maintained in the new republic, and the Dutch Reformed Church became the single authorized confession, protected from the competition of other faiths. Until 1798, only Calvinists (i.e. members of the state church) could hold public appointments, and article thirty-six of the church's confession imposed on the government the duty of maintaining the ' true faith '. Since 1848, however, the Dutch Reformed Church has not been a ' state ' church, although the members of the Royal family belong to it. The state continues to subsidize the church, which also retains the right to appoint two professors of the faculty of theology at the state Universities of Utrecht, Leiden and Groningen.

The internal government of the Reformed Church was reorganized in 1816. Its congregations enjoy the right of self-administration and appoint their own ministers. Each church has its own council which nominates members to the General Synod. The system is therefore a modified form of Presbyterianism. In 1930, the members of the Reformed Church represented 34·43% of the total population, as compared with 54·6% in 1849. The church, which is divided into 1,433 congregations, embraces about 75% of the total Protestant population.

The following table shows the provincial distribution by percentage of the total population :

	Per cent.
North Brabant	7·43
Gelderland	47·25
South Holland	43·35
North Holland	25·70
Zealand	48·25
Utrecht	41·54
Friesland	41·92
Overyssel	45·05
Groningen	48·06
Drenthe	63·74
Limburg	2·91

From : *Statistiek van Nederland, Volkstelling, 31 December* 1930, Deel V, p. 11 ('s Gravenhage, 1933)

Closely associated with the Dutch Reformed Church are the Walloon Reformed Congregations (*Waalsche Kerk*), the descendants of Calvinist emigrants from the Southern Provinces and France in the sixteenth and seventeenth centuries, the Presbyterian congregation (*Presbyteriaansche Kerk*) at Amsterdam, and the Scottish Church (*Schotsche Kerk*) at Rotterdam.

The Remonstrants (*Remonstrantsche Broederschap*)

At the beginning of the seventeenth century the Calvinist Reformed Church in the Netherlands was involved in bitter theological controversy. Its confession of faith was embodied in the *Confessio Belgica*, drafted in 1561 by Guido de Bray, a zealous Calvinist minister from Tournai, and revised in 1566, and in the Heidelberg Catechism of 1563. These tenets were strictly Calvinist ; they affirmed the absolute sovereignty of God and the doctrines of original sin, the total depravity of man, predestination and election through divine grace, and determinism of the will. Their political implications involved not only the autonomy and

democratic organization of the Reformed Church free from state interference, but also the establishing of a state church, with the consequent supremacy of the church over the state. The theological crisis was precipitated in 1604 when Jacobus Arminius, a professor of Theology at Leiden, attacked the doctrines of predestination and of the corruption of man. In 1610, the supporters of Armininius published their *Remonstrance*, composed by Johannes Uytenbogaert and in which they rejected the two doctrines. The controversy was settled at the Synod of Dordrecht (1618–19) when the Remonstrants were repudiated and excluded from communion with the Reformed Church.

In modern times, the Remonstrants have stood for undogmatical Christianity and for practical philanthropy. Their congregations are autonomous and the ministry is open to women. In 1930 the Remonstrants, who had considerably increased in numbers since 1869, represented 0·4% of the Netherlands population and they were distributed among twenty-eight congregations. They maintain a seminary attached to the University of Leiden.

The Anabaptists or Mennonites (*Mennonieten Broederschap*)

Anabaptism came to the Netherlands from Germany early in the sixteenth century, and it rapidly gained many adherents in Holland. They accepted only the rule of the Bible and were guided solely by faith and love. Their beliefs thus made them rebels against the Roman Catholic Church and revolutionaries against the established order of the state. The Anabaptists were ruthlessly persecuted (see p. 122), and under Jan Mathijzen of Haarlem and Jan Beukelszoon of Leiden, many of them fled to Münster to establish 'a new Jerusalem'. With the fall of Münster in 1535, Menno Simonzoon, a former priest of Witmarsum in East Friesland, became the leader of the Anabaptists, who were subsequently also called Mennonites. They developed into 'a quiet, unworldly sect, averse from matters of state, all wrapt up in the endless quarrels and schisms which resulted from their markedly individualistic belief'.* The Anabaptists survived persecution and, in the tolerant conditions that prevailed from the seventeenth century, they were able to maintain their position. The Anabaptist denomination of today is of the congregational type and all of its 114 churches are autonomous. Its theology is undogmatic, it advocates the complete

* P. Geyl, *The Revolt of the Netherlands*, p. 58 (London, 1932).

separation of church and state, and rejects infant baptism. The pacifism of its founders has been discarded in recent years. Women are admitted to the ministry and a theological seminary is maintained. In 1930, Anabaptists represented 0·8% of the Netherlands population.

The Lutherans (*Luthersche Kerk*)

The Lutherans of the Netherlands are descendants of German and Scandinavian immigrants of the seventeenth century. The first Lutheran church was established in 1633. In the eighteenth century, the Lutherans became divided into liberal and conservative branches. A separatist movement of the liberal branch led in 1791 to the establishing of the Restored Evangelic Lutheran Church which became an authorized religious association in 1833 (the Orthodox Lutheran). Both Lutheran churches maintain seminaries attached to the University of Utrecht. In 1930, the fifty-one congregations of the Evangelical Lutherans (the parent body) represented about 1% of the Netherlands population, and about 0·2% were represented by the Orthodox Lutherans.

The Reformed Churches (*Gereformeerde Kerken in Nederland*)

In 1834 several congregations seceded from the Dutch Reformed Church over questions concerning church discipline and doctrine. In 1869 they organized themselves into the officially recognized Christian Reformed Church ; their members were mainly of the smaller middle and farmer classes. There was another secession from the Dutch Reformed Church in 1885 and 1886. This dissenting group led by Dr Abraham Kuyper (see p. 166), a minister of the parent church, assumed the name of *Doleerende Kerk* (Suffering Church). Its theology was essentially Calvinist and it aimed at the restoration of absolute church government as laid down by the Synod of Dordrecht. In 1892, the *Doleerende Kerk* united with many congregations of the Christian Reformed Church to form the Reformed Churches of the Netherlands (*Gereformeerde Kerken*). Under the leadership of Dr Kuyper, the new church became closely associated with the Anti-Revolutionary party (see p. 166).

Between 1892 and 1930 the Reformed Churches showed a considerable increase in membership, an increase not entirely disconnected with Dr Kuyper's political influence (see p. 166). In 1930 the members of the denomination represented slightly more than 8% of the total population of the Netherlands, and they were

strongest in the provinces of Friesland, Groningen, Zealand and Drenthe. The congregations numbered 742. The Free (Calvinist) University of Amsterdam, which was established by Dr Kuyper in 1885 and recognized by the state in 1905 (see p. 101), belongs to the Reformed Churches who also have a seminary at Kampen.

The Christian Reformed Church (*Christelijk Gereformeerde Kerken*)

When the Reformed Church denomination was created in 1892, several congregations of the Christian Reformed Church did not agree to the union and established the Christian Reformed Church (Restored). Their theological tenets are almost identical with those of the Reformed Churches except perhaps that a more rigid adherence to the articles of faith is required. The church maintains a seminary at Apeldoorn and in 1930 its 127 congregations represented about 0·6% of the country's population.

The Roman Catholic Church (*Roomsch Katholieke Kerk*)

Roman Catholicism survived the upheaval that accompanied the Reformation in the Netherlands. The overthrow of the church's domination had resulted in bewilderment and disorganization, but in 1583 Sasbout Vosmeer was appointed Vicar of Utrecht ; in 1592 he became Apostolic Vicar, and in 1602 Archbishop *in partibus infidelium*. Vosmeer set himself to the task of reorganizing the Roman Catholic Church in the country ; he was greatly helped by the spirit of aversion to persecution that prevailed in the Netherlands but he could not do much more than encourage the Roman Catholic community and prevent it from complete disintegration. Protestantization, however, proceeded apace ; there were quarrels between the secular and the regular clergy (especially the Jesuits) and Vosmeer had to escape to Cologne, where he continued to organize and inspire the remnants of his flock. The majority of the Roman Catholics lived in the Generality Lands (see p. 133). They were not persecuted but neither were they officially permitted to hold public religious services and to enjoy the full rights of citizenship. Politically, economically and culturally they were continually at a disadvantage.

The political emancipation of the Roman Catholics was attained in the constitution of 1798 (see p. 88). Thenceforth their influence grew gradually and steadily. The Constitution of 1848 brought them complete freedom of worship and organization. Shortly before, they had been granted a state subsidy ; their monasteries

had been emancipated ; they had been allowed to form associations and to hold public meetings. The further rights granted by the Constitution of 1848 helped to strengthen the demand for the restoration of the episcopal hierarchy to replace the apostolic-vicariates which had been responsible for the affairs of the church

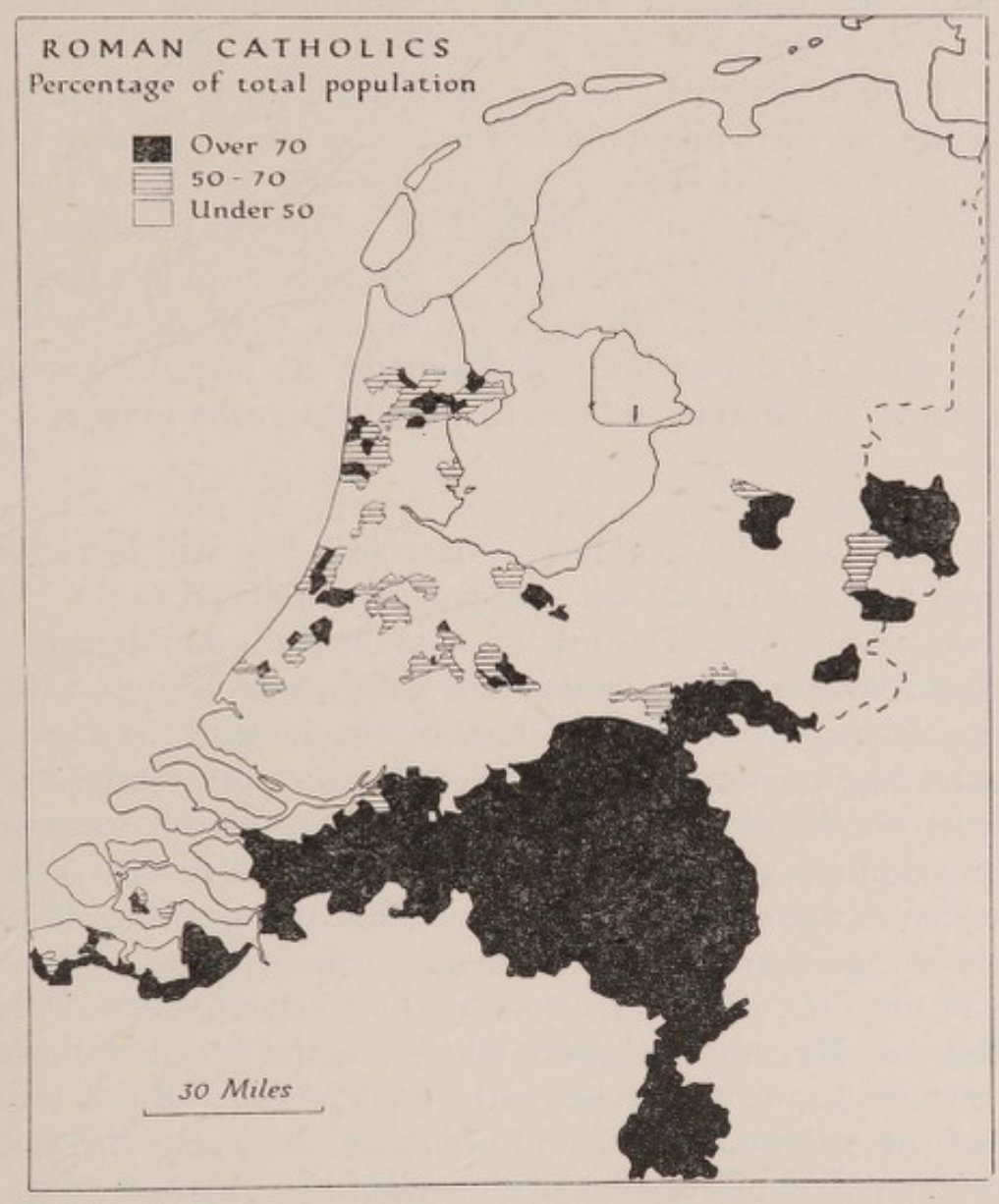

Fig. 32. The distribution of Roman Catholics, 1930

From : *Statistiek van Nederland, Volkstelling 31 December 1930*, Deel V ('s Gravenhage, 1932).

since the seventeenth century. The papal decree of March 1853 which re-established the hierarchy, produced an outburst of passionate indignation among the Anti-Revolutionaries and their followers. The Archbishopric of Utrecht, which had been created in 1559 (see p. 122) and had been in abeyance since 1602, was restored. Three other bishoprics created in 1559 were restored,

namely Haarlem, 's Hertogenbosch and Roermond, while the fifth—that of Breda—was a new creation. At the time of the restoration of the episcopacy, there were 1,203,923 Roman Catholics in the Netherlands and they were distributed among 918 parishes. Between 1853 and 1930 the Roman Catholic Church maintained its position ; in 1930 it was the largest religious community in the Netherlands, and its members represented 36·4% of the total population of the state. Their distribution in that year is shown in Fig. 32 which also brings out their predominance in the former Generality Lands. In the province of Limburg they constituted 93·5% of the total population and 88·6% in North Brabant. Only in Friesland (7%), Groningen (5·5%) and Drenthe (6%) did they form less than 23% of the total population. In 1930, the Roman Catholic Church was divided into 1,380 parishes ; it maintains its own University at Nymegen (see p. 102) in addition to more than 120 seminaries.

Jews

Portuguese and Spanish Jews—Marañ̃os—who had been forced to accept Christianity in their own country, migrated to the United Provinces after 1590. Towards the middle of the seventeenth century they were joined by German and Polish Jews, who united their congregations in 1673. The Jewish communities enjoyed the toleration shown towards other confessions and there was no restriction in the numbers that could be admitted to Amsterdam. At the same time, they were excluded from the guilds and could not hold office in the state or in the towns, but these were restrictions that were imposed on all non-Calvinist citizens. Permission was given to the Jews to hold their own Thora school, where Hebrew and Hebrew literature alone were taught ; it was here that Spinoza, ' the greatest Jew of the seventeenth century ' and a Dutch citizen, received his education. The Portuguese Jews especially went through a period of decline in the eighteenth century, but the German communities quickly regained their prosperity. The *Nederlandsch Israëlitisch Seminarium*, founded in Amsterdam in 1708 to train rabbis and teachers, became a state-recognized institution in 1834.

The combined Portuguese and German Jewish communities form the *Nederlandsche Joodsche Kerk* which is governed by a central commission. In 1930 its members were distributed among 140 congregations and they represented 1·5% of the total Netherlands population. At least half of them lived at Amsterdam ; the majority

were employed in the diamond trade and the tobacco industry. From 1933 onwards their numbers were increased by Jewish refugees from Germany.

Other religious bodies

The members of the other religious bodies in the Netherlands represent slightly more than 5% of the total population. They include (i) the *Old Catholics* (*Oud Roomsch Kerk*), who refuse to accept the doctrine of Papal Infallibility and permit divorce and married clergy ; in 1872 the Old Catholics and the Jansenists (the Church of Utrecht) united to form one religious body ; (ii) the Baptist Union of Holland (*Algemeene Doopsgezinde Societeit*), with 3,000 members, and (iii) the Free Catholics.

EDUCATION

Introduction

The educational system of the Netherlands exhibits certain peculiar, if not unique, features which are the result of the long-drawn-out conflict between opposing conceptions of the place of education in the national life. The chief stages in this conflict have been described in Chapter VI (especially pp. 160–1, 166–8) ; the main issue was the place of religion in education, and the contending parties those who wanted to secularize or ' neutralize ' education and those who wished to organize it on a denominational basis. When the State first intervened in the field of education, during the French occupation, it adopted the first of these conceptions. The Education Act of 1806 left practically no place for religion in State or ' public ' (*openbaar*) schools ; and indeed, if the ideal to be aimed at was a single comprehensive system of education, there was no alternative to this in a country so sharply divided in religion as the Netherlands. But the principle embodied in the Act of 1806 was one which neither the Protestant Churches nor the Catholic Church were prepared to accept. The agitation against it began before 1830, but it was only after 1848, when political power passed to the States-General, that the campaign on behalf of ' separate ' or denominational (*bijzonder*) schools was launched in earnest. This campaign gained its first major success in 1889, when ' separate ' schools secured

State financial support on a substantial scale, though not equal to that enjoyed by ' public ' schools. Thirty years later the denominational party achieved complete victory with the recognition of the principle of absolute equality between ' public ' and ' separate ' schools at the primary stage and virtual equality at the secondary stage. Embodied in the constitutional revision of 1917, this principle was given practical effect in the Education Act of 1920.

The Dutch educational system thus exhibits a dualism at almost every level and in almost every branch. On the one hand there are the State or public schools (infant, primary and secondary), and above them the State universities ; on the other, there are the infant, primary and secondary schools established and controlled by the religious communities, and by some non-religious agencies, as well as a ' separate ' (Roman Catholic) commercial college and two ' separate ' universities (one Calvinist and one Catholic). The only branch of education which has so far resisted this cleavage is technical and vocational education, although even here some institutions tend to acquire a certain religious character. Judged by the number of institutions and of scholars attending them, ' separate ' education flourished during the period 1920–40, especially at the primary level, and ' public ' education declined ; this discrepancy was less marked at the secondary level, and in the realm of higher education the State institutions easily held their own.

Primary and Secondary Education

Primary Education

Universal compulsory education was introduced into the Netherlands in 1901. Before the present war the age limits within which this operated were six and thirteen, and the education provided at this stage was known as Ordinary Primary Education (*Gewoon Lager Onderwijs*). Infant education between the ages of three and six, which was not compulsory, was provided by kindergarten schools (*Bewaarscholen*) ; and extended primary education, also non-compulsory, took the form either of a further two or three years (*Voortgezet* and *Uitgebreid Lager Onderwijs*). The following table gives the number of schools, teachers and pupils at these stages in 1930 and 1938, and illustrates the relative progress of the ' separate ' schools.

Primary Schools (*Public and ' Separate '*), 1930, 1938

	1930		1938	
	Public	Separate	Public	Separate
Nos. of Schools				
Ordinary	3,325	4,114	2,564	4,457
Extended	266	520	242	549
Nos. of Pupils				
Ordinary	446,397	736,131	357,752	785,429
Extended	27,127	34,057	39,483	60,114
Nos. of Staff				
Ordinary	14,515	21,541	9,892	20,292
Extended	1,321	1,823	1,464	2,270

From : *Jaarcijfers voor Nederland*, 1938, pp. 47–51 ('s Gravenhage, 1939).

The cost of infant and primary schools is met partly from central and partly from local public funds. The central government pays teachers' salaries, the communes pay for school buildings. In the case of ' separate ' schools the initiative has to be taken by parents. Any group of parents which can guarantee a certain number of pupils may establish a school ; it is required, however, to deposit a sum of money with the communal council, which remains its property (and earns interest) so long as the school conforms to the law, but which may otherwise be forfeited. ' Separate ' schools are visited by State inspectors in the same way as ' public ' schools.

There is at least one primary school in all but about 300 of the communes. The majority are co-educational, but Roman Catholic primary schools for the most part segregate the sexes. Ordinary primary education covers the following subjects : reading, writing and arithmetic, the Dutch language, history, geography, natural history, singing, drawing, gymnastics (including swimming) and handwork. Advanced primary education includes three of the following : French, German, English, mathematics and elementary business training. There are various special primary schools for children who are physically or mentally handicapped, and for the children of itinerant parents (for example, bargees) who cannot attend the ordinary schools.

Secondary Education

General secondary education (*middelbaar onderwijs*) is provided by three types of school : the *Gymnasium* or grammar school, the *Hooghere Burgerschool* (*H.B.S.*) or municipal secondary school, and

the *Lyceum*. The *Gymnasium* is the oldest and most traditional type ; its six-years' course lays emphasis on classical and literary studies, and was formerly regarded primarily as a preparation for the university. The present curriculum includes Greek and Latin, Dutch, French, German and English, geography, mathematics, physics, chemistry, natural history, drawing and gymnastics. In the last two years there are separate courses (A and B) designed to prepare for the university entrance examinations in the faculties of letters and science.

The institution of the *Hooghere Burgerschool* was part of the revolt against the ' classicism ' of the *Gymnasium*. Its five-year course is essentially modern, attaching special importance to modern languages and science, and aims at fitting the pupil for a variety of careers as well as preparing for the university. Instruction is given in French, German and English, mathematics, science (including biology), geography and economics, and a differentiation is made between studies with a literary and economic bias (branch A) and those with a scientific bias (branch B), each of which prepare for the corresponding university entrance examination.

A drawback formerly common to both the *Gymnasia* and the *Hooghere Burgerscholen* was that they compelled the pupil to choose between ' classical ' and ' modern ' courses at too early an age, a defect which each has attempted to remedy by some reform of the first stage of its curriculum. But from about 1910 there arose a new type of school, the *Lyceum*, which was designed not only to allow of the postponement of this choice, but also to avoid the alleged narrowing effect of a too exclusive concentration upon one or the other. In the *Lyceum* two years' preparatory work is followed by either a four-years' course on *gymnasium* lines, or three or four years' *H.B.S.* course. Schools of this type grew in popularity between 1920 and 1940 and at the end of that period they equalled the *Gymnasia* in number. All three types of secondary school are, with the exception of most Roman Catholic schools, co-educational, but there are separate Girls' Secondary Schools (*Middelbare Meisjesscholen*), although these, like secondary commercial schools (*Middelbare Handelsscholen*), sometimes take the form merely of separate classes at schools of other types. The following table shows the number of schools and pupils in 1920, 1930 and 1938 :

Secondary Schools, 1920–38

	1920	1930	1938
Nos. of Schools			
Gymnasia	48	56	52
Hooghere Burgerscholen	126	138	136
Lycea	16	40	56
Girls' Secondary	18	21	22
Day Commercial	55	45	21
Evening Commercial	132	124	133
Nos. of Pupils			
Gymnasia	5,178	7,833	9,287
Hooghere Burgerscholen	22,058	23,605	31,954
Lycea	1,396	8,481	15,301
Girls' Secondary	2,441	2,264	3,385
Day Commercial	3,971	3,007	2,383
Evening Commercial	14,787	13,902	20,374

From : *Jaarcijfers voor Nederland*, 1938, pp. 57–59 ('s Gravenhage, 1939)

Secondary education is financed in the same way as primary, except that the State does not bear the whole cost of salaries and equipment in ' separate ' schools, the balance (about 20%) being covered by the society responsible for the school.

Higher Education

The Universities

The first university to be established in the Northern Netherlands was Leiden, which was founded in 1575 to commemorate the heroic defence of the town against the Spaniards. The other provinces followed Holland, and universities were erected at Franeker (1585), Harderwijk (1600), Groningen (1614) and Utrecht (1636), while Amsterdam established a university of its own in 1632 ; but none of these won the same prestige as Leiden, which in the seventeenth and eighteenth centuries was one of the premier universities of Europe. In 1811, as part of the French reform of the Dutch educational system, the universities of Amsterdam, Franeker, Harderwijk and Utrecht were reduced to the status of high schools. Amsterdam and Utrecht were restored in 1814, but in 1818 the suppression of Franeker and Harderwijk was confirmed. Leiden, Groningen and Utrecht then became the three State universities and in 1876 the municipal university of Amsterdam was given practically equal status with them. In 1905 the Kuyper ministry carried an Act authorizing State recognition and support for ' free ' or denominational universities, one of which, the Free (Calvinist) University of Amsterdam, had been founded by Dr Kuyper himself

twenty years before. This Act encouraged the foundation of the youngest Dutch university, the Roman Catholic University of Nymegen, which has since diverted part of the flow of Dutch Catholic students to Louvain.

The State universities all include the six faculties of theology, law, medicine, science, philosophy and letters ; neither of the free universities has all of these, but they are under obligation to add the remaining faculties within a specified period. Admission to the university is by examination and by the payment of a matriculation fee of *f.* 300. The two university examinations (corresponding to English degree examinations) are the *Candidaats* and the *Doctoraal*, but only the latter, involving the presentation of a thesis and conferring the degree of Doctor, represents the completion of full academic training. The length of the full course varies from four to seven years according to the faculty. The Dutch universities are institutions solely devoted to the collection and dissemination of knowledge ; they are non-residential, and have little of the corporate character of the older English universities.

Numbers of Students at Universities, 1925–6, 1937–8

	1925–6	1937–8
Leiden	1,544	2,384
Utrecht	2,104	2,670
Groningen	955	921
Amsterdam	1,857	2,438
Free University (Calvinist)	348	611
Roman Catholic University	284	446
Total	7,092	9,470

From : *Jaarcijfers voor Nederland*, 1938, p. 70 ('s Gravenhage, 1939)

The Training of Teachers

The supply of teachers is maintained from two main sources, the universities and the normal schools (training colleges). The teaching staffs of the *Gymnasia* and *Lycea* are mainly university trained ; those of primary and *H.B.* schools come either from the normal schools (*kweekscholen*), of which there are about a hundred, or from special training courses, often part-time, which prepared for the two examinations qualifying respectively for the diplomas known as *Middelbaar Onderwijs Acte A* and *Acte B* ; the holder of *Acte A* can teach in all forms, the holder of *Acte B* only in the lower forms, of secondary schools. There is more movement between teachers of different grades than in England, this being particularly so in the case of university teachers, many of whom are

recruited from school-teachers who have distinguished themselves in research.

Technical and Vocational Education

Technical and vocational education, developed by private initiative from the close of the nineteenth century, has been brought increasingly within the purview of the Ministry of Education and financed out of public funds. It comprehends both full-time and part-time (usually evening) institutions, and covers a wide range of trades and professions, including all branches of seafaring and agriculture. It is graded in a similar fashion to the general educational system, and its high schools (Delft Technical High School, Wageningen Agricultural High School, and the Commercial High Schools at Rotterdam and Tilburg) correspond to the universities.

Numbers of pupils undergoing technical and vocational training, 1921 *and* 1937

Type of training	1921	1937
Day technical (boys)	13,721	32,531
Secondary technical	1,779	3,447
Art and applied arts	1,668	1,726
Evening technical (boys)	33,949	37,403
Navigation (maritime)	1,007	925
Navigation (inland)	1,392	1,294
Fishery	404	539
Ships' engineers	728	1,141
Vocational and domestic (girls) and agricultural	47,754*	61,600
Other	679	2,560
Total	84,777	143,066

* 1923

From : *Jaarcijfers voor Nederland*, 1938, p. 65 ('s Gravenhage, 1939)

The four high schools are attended by over 3,000 students, of which the technical high school at Delft accounts for more than half.

Number of students at vocational high schools, 1925–6 *and* 1937–8

	1925–6	1937–8
Technical High School, Delft	1,675	1,838
Agricultural High School, Wageningen	317	409
Commercial High School, Rotterdam	354	566
Commercial High School, Tilburg	91*	222

* In 1930–31 ; the school was opened in 1927

From : *Jaarcijfers voor Nederland*, 1938, p. 70 ('s Gravenhage, 1939)

Administration

Since the educational system is characterized by so high a degree of decentralization, and so much freedom is given to private initiative,

the work of the Ministry of Education is largely one of supervision and co-ordination. The Minister of Education, Fine Arts and Sciences, who is responsible for all branches of education other than agricultural (which is dealt with by the Minister of Agriculture and Fisheries) is assisted by an Advisory Council of not less than fifteen members, appointed by the Crown and serving for five years but eligible for re-appointment. The Council is organized in four sections, dealing with primary, secondary, higher and vocational education. The Ministry also has a Director-General (permanent under-secretary), departmental chiefs and subordinate officials. Inspection of schools is carried out by thirty inspectors and sixty-six supervisors, organized under four chief inspectors, each concerned with one branch of the service.

The Ministry is responsible for disbursing the public funds annually voted for education, and for supervising local expenditure. One result of the adoption of the principle of ' self-determination ' in 1920 was a great increase in the numbers of schools entitled to State support and a corresponding rise in the national expenditure on education. From *f.* 35 million in 1913 expenditure rose to *f.* 130 millions in 1928 and *f.* 166 millions in 1931 ; this last figure represented 22% of the national budget, the highest percentage of any European state. During the 1930's economies reduced the figure of expenditure, but in 1938, at *f.* 142 millions, it still accounted for one-fifth of the total budget.

General Features

During the present century almost every branch of the Dutch educational system has reached a high level of achievement. The success of primary education is reflected in the extremely low figure of illiteracy ; of conscripts for military service in 1937 only one in a thousand was illiterate. A less satisfactory feature was the relatively low proportion (in 1938 slightly above one-third) of children completing their ordinary primary education at thirteen or fourteen whose education was continued either in the advanced primary or the secondary schools, although this was to some extent offset by the increasing number attending vocational or technical schools. To the secondary schools belongs the chief credit for the high level of Dutch middle-class culture. The Dutch have long been noted for their command of foreign languages, and the compulsory French, German and English (although in recent years

English has tended to displace German as the second foreign language) of all secondary schools, together with the prevalence of travel abroad, have helped to give the average middle-class Dutchman a wider culture than his counterpart in neighbouring countries. It may, however, be argued that this has been achieved at the cost of some overwork and neglect of other interests. The general academic standard of the Dutch universities is as high as would be expected in a country which attaches such importance to learning, and every Dutch university has at least one faculty or department of international repute. It is also noteworthy that Dutch university teachers in general take a more active part in national affairs—in politics, for example—than is the case elsewhere.

Libraries, Museums and Learned Societies

The most important library in Holland is the Royal Library (*Koninklijke Bibliotheek*) at The Hague ; founded in 1878, it contains more than a million books, and is rich in pamphlets and manuscripts. There are numerous Dutch academies and learned societies, among them being the Royal Academy of Amsterdam (*Koninklijke Akademie van Wetenschappen*), which is general in scope, the Royal Netherlands Geographical Society, the Historical Society (Utrecht), the Colonial Institute (Amsterdam), and the Society of Dutch Literature (Leiden). An association founded in the eighteenth century, the Society of Public Benefit (*Maatschappij tot Nut van't Algemeen*), now organizes a travelling library service, and nearly 200 public libraries maintained with State assistance by the Society of Public Reading Rooms (*Vereeniging van Openbare Leeszalen*) serve the urban reader.

The Press

Before 1940 the Dutch newspaper press ranked deservedly high among the presses of Europe. Various factors entered into this result : the traditional importance of the Netherlands as a clearing-house of news and ideas, and of the newspaper as the chief medium of this process ; the religious colouring of many papers, which tended to keep up journalistic standards ; the prevalence of subscription as the means of purchasing a newspaper, which checked the development of ' popular appeal ' (the Amsterdam *Telegraaf* was the first important paper to revolutionize the traditional make-up) ; and finally, the serious discrimination with which most of them were read. Circulations were small by English standards, and the vitality of the local press checked the growth of the national

dailies. In 1940 there were about a hundred papers appearing daily or at less than weekly intervals, with a total average issue estimated at 1½ millions. Of the 79 dailies, about 32 were virtually neutral in politics and religion, 32 were Roman Catholic, 6 Liberal, 5 Calvinist and Conservative, and 2 Socialist. The four leading neutral dailies were *Het Nieuws van den Dag* (Amsterdam ; popular, with a circulation of about 250,000), *De Telegraaf* (Amsterdam ; about 120,000), *Algemeen Handelsblad* (Amsterdam ; about 50,000), and *Nieuwe Rotterdamsche Courant* (Rotterdam ; the traditional Dutch daily *par excellence* ; about 35,000). Among the leading dailies with political or religious affiliations were *De Maasbode* (Rotterdam ; Roman Catholic), *Het Volk* (Amsterdam) and *Voorwaarts* (Rotterdam) (both Socialist) and *De Standaard* (Amsterdam ; Anti-Revolutionary).

SOCIAL CONDITIONS

The Social Structure

Personal liberty, freedom of religion and education, and the right to own private property are recognized by the Constitution, but there are conditions laid down by law in which these liberties may be limited in the interests of public order and morality. The religious ceremony of marriage must be preceded by a civil ceremony. After marriage a woman may not conclude any contract without the written consent of her husband, and she cannot appear in a court of law without him except in cases of penal prosecution and actions for divorce. The law also indicates the duties of parents in respect of the care of their children and provides for the guardianship of orphans.

Nationals of other countries resident in the Netherlands are debarred from appointment to public offices and have no franchise, but otherwise they have practically full civil rights. Political refugees are given the right of asylum by the constitution. The fame of the Netherlands as a refuge for political and religious minorities dates almost from the foundation of the Republic.

Class Structure

The social structure of the Netherlands, while conforming to the general type characteristic of western Europe, exhibits certain

peculiarities which distinguish it, for example, from that of Great Britain. While it is democratic in the sense that there are no formal class privileges, social distinctions have in the past been rather more marked than in the neighbouring countries.

The nobility consists of the few families whose titles date back to the period before the Revolt (thus a Dutch Count is really a Count of the Holy Roman Empire), together with the small number ennobled since the establishment of the present monarchy. This nobility enjoys no political or constitutional privileges, and while it derives a certain social prestige both from its landed property, which in some cases is extensive, and from its relationship to the royal circle, as a class it is of relatively minor importance, although individual members of it have achieved leading positions in different fields.

The real ' aristocracy ' of the Netherlands is that upper middle class which since the time of the Revolt has dominated the commercial, social and cultural life of the country. The historic ' regent ' class which governed the Dutch Republic in the seventeenth and eighteenth centuries is represented today by the minor nobility bearing the title ' Jonkheer '. This has been conferred, since 1814, on all those who could prove that their ancestors for at least three generations belonged to the ' regent ' class ; the number of families bearing it is thus limited (although fresh claimants still come forward occasionally), but the fact that the title descends to all sons, and not merely to the eldest, has served to increase the number of individual holders.

Both in origin, and by reason of the present social position of the majority of its holders, the families bearing this title are to be regarded as belonging much more to the upper middle class than to the nobility proper. This middle class is essentially urban in character and outlook. In addition to the hereditary element, it is recruited from business and from the professions, and it is in these fields, and in government service, that this class chiefly finds employment. It is notable for its high level of culture (the proportion of university graduates is large) and for the width and tolerance of its outlook. At Amsterdam in particular the Jewish element was strong ; it would hardly be an exaggeration to say that such men as Texeira de Mattos formed the cultural élite of that city. Another characteristic element is formed by the colonial governing and administrative class, which gives parts of The Hague a rather Cheltenham-like quality.

During the last generation, as before, the upper middle class continued to provide the country with most of its leaders in all branches of national life. Below it in the social scale were the lower middle class and working class in the towns and the peasantry in the countryside. The prosperity which the Netherlands enjoyed during the half-century down to about 1930 created a generally high standard of living which tended to obscure the economic, as distinct from the social, inequalities between different strata of the population, so that the country exhibited an enviable social solidarity. With the decline of that prosperity, however, Dutch society was subjected, in common with its neighbours, to strains and stresses which were the more disturbing because the less familiar ; but of the essential soundness of the social structure the events of the four years following 1940 have furnished convincing testimony.

In general, the upper classes also fall into the higher income strata, although income does not necessarily determine social status.

Income and property distribution, 1938-9

Income	No. of persons	Value of property	No. of owners
*f.*801– 1,400	643,649	*f.*16,– 30,000	84,920
1,401– 2,000	369,295	30,– 50,000	42,924
2,001– 3,000	183,599	50,– 100,000	31,662
3,001– 5,000	100,474	100,– 200,000	14,262
5,001– 10,000	46,169	200,– 300,000	4,212
10,001– 20,000	14,641	300,– 500,000	2,875
20,001– 30,000	3,319	500,–1,000,000	1,755
30,001–100,000	2,921	over 1,000,000	816
over 100,000	341		
Total	1,364,408	Total	183,409

For some discussion of the economic and social conditions of industrial and agricultural workers, see pp. 109–13, 320–30.

Wealth and power have always been more concentrated in the Protestant north than in the Roman Catholic south, although considerable economic progress has been made in the south in recent decades.

Urban and Rural Population

In June 1939, 51% of the population lived either in towns of less than 20,000 inhabitants, or in rural communities. Not more than 22% of the working population was engaged in agricultural pursuits. Good transport facilities allow many people to work in the towns

and live in the country, while some work smallholdings too, so that the distinction between urban and rural life cannot be rigidly drawn, although it is probably more distinct than in Belgium.

Social Policy and Organization

The object of social policy in the Netherlands has been to ensure a high standard of living for all classes, and, under the auspices of a special Ministry for Social Affairs, continuous progress has been made towards this end, despite the brake imposed by the chronic unemployment of the ten years preceding 1940.

Social Services

Social Insurance. Prior to 1940 insurance against unemployment had never been compulsory. Voluntary facilities have existed since the beginning of the century, and they were augmented in 1916 by a law which instituted a system of state and municipal subsidies, which increased the benefits paid by the voluntary associations to their unemployed members. Such unemployment benefit was restricted to workers between the ages of fourteen and seventy, and at the beginning of 1938 there were some 546,000 persons so insured. In that year the Minister for Social Affairs projected two Bills, one to make unemployment insurance compulsory for all labourers, and the other to initiate a comprehensive scheme of family allowances.

Accident insurance was introduced in 1901 ; and in 1919 the Disability and Old Age Insurance Act covered all workmen over fourteen years of age and with an annual income below *f.* 2,000. In addition there was provision for voluntary old age pension insurance of persons below a certain income level irrespective of their occupations. Finally, a compulsory Sickness and Maternity Insurance Act in 1930 provided for extensive benefits in the case of prolonged illness, and a comprehensive system of services and payments in respect of maternity cases.

Poor Relief. In 1936, nearly *f.* 84 million was distributed in poor relief to about 300,000 applicants, representing approximately *f.* 10 per head of the population. This assistance was largely administered in the form of grants to needy families, but considerable sums were expended in the form of pensions, maintenance in homes and hospitals, and the upkeep of night refuges. The State was responsible for the bulk of this work, but religious and secular charitable organizations distributed over *f.* 11 million.

Housing. The building of new houses, for which there has been an annual demand of some 50,000, has been almost entirely controlled by building societies. Slums do not exist to the same extent as in Great Britain, but the communal councils have power to condemn houses which are adjudged unfit for habitation. All communes with more than 10,000 inhabitants or rapidly growing populations have been compelled to draw up planning schemes in recent years.

Rural housing constitutes one of the least progressive features in Dutch agriculture despite the invariably neat and pleasing appearance of the cottages. The normal small cottage could be rented at the equivalent of 4s. to 5s. per week (2s. before 1914). The local authorities, together with the State, jointly subsidize the erection of new cottages. A certain minimum standard is required for houses to qualify for the grant ; they should be detached, possess at least two bedrooms and have no cupboard beds. This practice of sleeping in cupboards with the doors closed is still prevalent in the more isolated districts and it is naturally conducive to the spread of tuberculosis and all infectious diseases.

Water supplies and sanitation are far from satisfactory in many rural districts, particularly in the west and north, where much of the land lies below sea level. Ground water is brackish, so that great dependence is placed on rain-water cisterns. Rather more than half of the communes in the Netherlands have a public water supply serving about two-thirds of the population. Electricity is by no means universal in the villages, and it is not cheap.

Co-operative Societies

The co-operative movement plays an important part in Dutch economic life, but would appear to be capable of considerable further development. In 1935 there were 397 retail societies, with a membership of 315,356. Almost three-quarters of these societies ran one or more retail shops, mainly dealing in groceries, drapery, household goods and bread. The remainder were largely concerned with fuel distribution and laundry.

Of the trading and industrial societies, numbering about 3,000, the majority are concerned with the agricultural community (see p. 324). Other concerns included 27 societies for supplying electricity, 14 ice factories, 9 strawboard mills and 13 farina mills. There were also 62 co-operative insurance companies.

Labour Organization

As in other western European countries, the pattern of labour legislation developed in the wake of late nineteenth century industrialization. The state has made many efforts to solve the growing problems of industrial labour, particularly by encouraging the establishment of labour exchanges through financial aid to the local authorities. Most communes established local exchanges ; if these were unable to satisfy an application for work, they would pass it on to one of the forty-one District Exchanges, which in turn might refer the application to the Central Labour Bureau at The Hague.

Trade Unions. Associations of workmen existed in the Netherlands from the middle of the nineteenth century. Since the legislation of 1872, which gave them a legal status, they have steadily developed in importance as collective bargaining agencies and also in numbers and strength of membership. In 1937 there were over 11,000 associations with a membership of about three-quarters of a million ; most of these assocations were affiliated to one of the six large central unions, according to their political, social or religious bias. On the whole the trade union organization has functioned well and the incidence of strikes in recent years has been markedly low. Frequently the unions negotiate collective contracts with employers, and recently these contracts have in some cases included terms which provided for family allowances, holidays with pay, and intermediate revision on the basis of changes in the cost of living.

Conditions of work. Factory legislation in the Netherlands commenced with the Van Houten Act of 1874, which prohibited the employment of children under twelve. In the next sixty years labour conditions for all classes of workers were gradually improved by successive laws. The employment age has been raised to fourteen, the maximum working day has been fixed at eight and a half hours and the working week at forty-eight hours for factory, workshop and office workers, and at ten hours and fifty-five hours for other workers. Night work is allowed only in special circumstances, and likewise work on Sundays or Saturday afternoons.

Protection for workers is afforded by a comprehensive series of safety regulations ; especially unhealthy or dangerous occupations are covered by special regulations, e.g. underground employment in mines of women and boys under the age of sixteen is prohibited. In short, the status and the standard of living of the Dutch labouring

classes has kept abreast, if not in advance, of the most progressive European countries.

The Standard of Living

Despite the rapid growth in population, industrialization brought such an increase in the national wealth during the last sixty years that the Netherlands has attained a general standard of living as high as that prevailing in Great Britain, and above that of all her continental neighbours.

Diet

The diet of the Netherlands people, though not quite as full and varied as that of the Swedes, is much akin to that of Belgium and on a higher level than both the French and German. The Dutch normally consume less meat and eggs than the British, but more milk, margarine and cheese.

Consumption of food per head, 1939, *in lbs.*

	Netherlands	Belgium	United Kingdom
Grain	277	379	285
Potatoes	257	370	185
Sugar	75	64	95
Meat	79	88	139
Milk (liquid)	246 (pts.)	137 (pts.)	165 (pts.)
Butter	12	18	24
Margarine	26	19·6	9·7
Other fats	11	5·7	10·1
Eggs	90 (No.)	163 (No.)	189 (No.)
Cheese	17	19·8	9
Fish	24	10·6	47
Calories per day	2,800	2,950	3,100

From official sources

Recreation

Since 1919, the Dutch week-end has become increasingly comparable with the British. Cycling is a favourite pastime and ranges from family outings to highly organized club competitions and six-day races. In summer-time swimming and sailing are very popular sports, while in the winter the freezing of lakes and canals in the north-eastern provinces makes ice sports possible. The Dutch have shown an increasing interest in association football, attaining a high standard of play in their competitions. Athletic standards are good, and besides acting as hosts for the 1928 Olympiad, the Dutch have figured prominently in subsequent contests.

In rural districts the great festive occasion of the year is signalized by the arrival of the annual fair. At such times picturesque costumes are worn (in many localities), particularly by the young women. Merrymaking may often be boisterous, but it is interesting to note that the consumption of intoxicants is very low. In recent years the per capita consumption of beer in the Netherlands has been even lower than in France or Switzerland, which are essentially wine-drinking countries, and only one-tenth of that in Belgium and one-quarter of that in Great Britain and Ireland. At the same time the consumption of all alcoholic beverages has declined by more than one-half since 1882, perhaps partially as a result of widespread temperance movements and partially because of increased State regulation and the restrictive licensing of public houses.

In different parts of the country the Sabbath is observed according to dominant church membership. On the whole it tends to be spent much as in England in the Protestant north, and on the French pattern in the Roman Catholic areas in the south.

SOME ASPECTS OF DUTCH CULTURE

Any sketch of the Netherlands' contribution to modern European culture must concentrate upon two periods, the seventeenth century and the last hundred years. The first period is identified with the ' golden age ' of the Dutch Republic, the second with the development of contemporary Dutch society. Between them lies a period of about 150 years during which Holland had little distinctive contribution to make to European civilization.

The Seventeenth Century

Painting and Architecture

It is natural to think of seventeenth-century Dutch culture first in terms of art, for its achievements in that field are unequalled in any other age or country. Never has so small a community (at most numbering two millions) boasted so many painters (their number approached one thousand); never did so many contemporary painters attain so high a standard. And yet all but a few of these painters are reduced to the stature of ' little masters ' by the three giants of the period. Frans Hals (1581–1666) came from Mechlin (the fact reminds us of the common source from which there flowed the two streams of Dutch and Flemish art), but it is in

his portraits, technically little short of miraculous, that the citizens of the Dutch Republic, from stately ' regent ' groups through jovial civic guards to captivating ragamuffins, will always live. Rembrandt van Rijn (1606–66) was the Beethoven of painting, first exploiting with superb ease and skill all the technical resources of his time and then pushing further and further into a realm of unearthly beauty where none could follow him. Jan Vermeer of Delft (1632–75), who, like Rembrandt, died in obscure poverty, left behind him relatively few paintings, but nearly every one is a masterpiece.

But the poverty-stricken artist was the exception in seventeenth-century Holland. There was an almost insatiable demand for paintings ; not only the wealthy ' regents ' and the town guilds, but farmers, innkeepers, indeed, everyone with money to spend and wall-space to cover, bought the best that was to be had. Fine pictures vied with sumptuous furniture, carpets and hangings, and with the shining brass familiar to us in contemporary interior-pieces. The market determined not merely the volume but the predominant character of the national art. The favourite subjects were landscapes, interiors and conversation-pieces, together with innumerable portraits, and the style was realistic, although the realism was far from being of the photographic kind. There were, of course, many painters who adopted, in greater or less degree, the baroque style fashionable throughout Western Europe ; their work was highly prized in its day, but it has not stood the test of time as has that of their more ' national ' contemporaries.

Seventeenth-century Dutch architecture reflects no less clearly than painting the predominantly bourgeois character of Dutch society. In the republic there was no royal court to commission palaces and government buildings such as those of Versailles or Greenwich. The Princes of Orange did a certain amount of building in the classical style (the Mauritshuis at The Hague is a good example), and the town of Amsterdam gave itself a magnificent town-hall (now the royal palace) on the Dam (Plate 68) ; both were built by Jacob van Campen, the leading apostle of the Italian Renaissance in the republic. Some churches of the period also reveal strong classical influence. But domestic architecture, which accounts for the greater part of the building then done as well as of what remains today, retains much more of the simplicity and intimacy of earlier Dutch Renaissance work. Brickwork predominated, and in its decorative treatment Dutch architects developed a technique which has been preserved to our own day.

Literature and Learning

Dutch literature is little known outside the Dutch-speaking countries ; the language is unfamiliar and there are few translations. In the seventeenth century the Netherlands produced one figure of Miltonic stature in Joost van den Vondel (1587–1679), a pure lyric poet of the first order in the cultured P. C. Hooft (1581–1647), and a ' poet of the people ' in Jacob Cats (1577–1660), whose work is still familiar among the peasants of his own province of Zealand. In the hands of these men the Dutch language, hitherto a somewhat ' barbarous ' amalgam of dialects with many imported elements, became a finished instrument and its finest manifestations part of the European heritage. Even so, Latin remained the language of the philosopher and scientist. All the writings of Grotius (1583–1645), classicist, philosopher, and the founder of international law, were in Latin, as were those of Christiaen Huygens (1629–95), mathematician and astronomer, and of Spinoza. Only Simon Stevin (1548–1620), an immigrant from the South, published his mathematical and other works in Dutch or French.

But Holland's direct contribution to European culture and ideas, important as it was, perhaps counted less than her indirect services. Foremost among these was the provision of asylum to the refugees from the political, religious and intellectual intolerance which held sway over most of Europe. It was to Holland that Descartes (1596–1650), ' the father of modern philosophy ', came to breathe the air of intellectual freedom. To Holland, too, had fled the Portuguese-Jewish grandparents of Benedict Spinoza (1632–77), from whose house at Rijnsburg, in the words of Renan, God was seen at closest range. Spinoza's daring speculations aroused the indignation of the orthodox, but he escaped the persecution which would have been his lot in any other country.

What the civic freedom of the Republic did for the persons of these émigrés, the Dutch press did for their ideas. If it was not completely free, the Dutch press was more free than that of any other country, save England during the Civil War period. In addition to their own prolific pamphlet literature, the Dutch printed many pamphlets for foreigners, who smuggled them into their censor-ridden countries. Dutch firms also carried out much book-production on foreign account. Some of these firms, such as Elsevier of Leiden and Amsterdam, occupy a leading place in the history of typography.

No one factor will explain the vitality of cultural and intellectual

life in the republic in the seventeenth century. Material prosperity counted for much ; so did the stimulus of distant trading and exploration and the presence of so many foreigners—it was said that you could hear every tongue in the world spoken in the streets of Amsterdam. Politically, too, the republic was well adapted to encourage free speculation and inquiry ; the diffusion of sovereignty which was the greatest obstacle to singleness of purpose and of policy was also the greatest safeguard against tyranny, and the class which ruled the republic, the regent oligarchy, was not unfitted either in temper or outlook to foster a culture at once national and cosmopolitan.

The Last Hundred Years

Architecture and Painting

If painting clearly holds pride of place in the artistic achievement of the ' golden age ', there is a strong case for regarding architecture as the most significant manifestation of the Dutch cultural renaissance of the late nineteenth and twentieth centuries. Three generations ago architecture in Holland, as elsewhere, was dominated by the Gothic revival ; its leading Dutch exponent was P. J. H. Cuypers (1827–1916), a pupil of Viollet-le-Duc, whose work is exemplified by the Rijksmuseum (1885) and the Central Station (1889) at Amsterdam. But although Cuypers looked back for inspiration to the Middle Ages, his work has an integrity of purpose of construction which links it with that of the far greater men who were to follow him.

By common consent H. P. Berlage (1856–1934) was not only the founder of modern Dutch architecture but one of the main formative influences on all subsequent architectural development. On the theoretical side Berlage stressed the social idealism which must animate the architect ; architecture, he maintained, was ' the aesthetic appearance of the social idea '. In practice his buildings displayed clean lines and plain surfaces which gave them a dignity verging on the austere. His Exchange Building (*Beurs*) at Amsterdam, commissioned in 1893 and opened in 1903, although in no wise alien to the true national tradition, inspired a movement which soon became world-wide. In Holland itself Berlage's chief lieutenants were K. P. C. de Bazel (1869–1923) and W. Kromhout (1864–1940), the latter remembered for his American Hotel at Amsterdam (1901).

Berlage was only indirectly responsible for the architecture of the great twentieth-century extension of Amsterdam. The ' Amsterdam

School ', inspired by an architect of genius, M. de Klerk (1884–1925), renounced Berlage's austerity and gave free play to the imagination, especially in the treatment of façades. In this ' expressionism ' their leader showed a sureness of touch which his followers sometimes lacked, and the results, from being a stirring contrast to the nineteenth-century town, tended to lapse into mannerism and artificiality. All the same, modern Amsterdam is architecturally the most significant town in Europe. In sharp contrast to the ' Amsterdam School ' stand the functionalists, who since the early 1920's have given the Netherlands a host of buildings inspired by the slogan ' fitness for purpose '. G. Rietveld's housing-blocks at Utrecht and J. J. P. Oud's at Rotterdam, together with large commercial and industrial buildings like the Volharding Co-operative Store at The Hague, are representative examples of this school. In the decade before the present war one or two leading architects appeared to be achieving a synthesis and equilibrium out of these opposing tendencies. Greatest among these contemporary Dutch architects is W. M. Dudok, whose town-hall at Hilversum (1931) is an acknowledged masterpiece ; he is closely followed by S. van Ravensteyn, a specialist in railway architecture, whose signal-boxes are as worthy of attention as his station-buildings (Plates 81, 94, 97, 98).

Among modern Dutch painters only one name ranks in fame with those of Berlage, De Klerk or Dudok. But Vincent van Gogh (1853–90) can hardly be said to belong to the Netherlands ; true, he served his painful apprenticeship as a draughtsman among the peasants of North Brabant, but it was only beneath the brilliant sunshine of Provence that he found and captured those welters of colour on which his fame rests. Ironically enough, it was Van Gogh's ambition to paint as well as the Maris brothers, who outside Holland are little remembered. These three brothers, Matthijs, Jacob and Willem, with Josef Israëls, Anton Mauve and Mesdag, together inaugurated the realist revival which goes under the name of the ' Hague School '. They were followed, in the second half of the century, by the mural painters, who, at first working somewhat after the manner of Puvis de Chavannes, became more linear and geometric until, like Toorop, they approached modern abstract composition. The early twentieth century saw the establishment of a school of Dutch impressionism in and about Amsterdam ; its leading names were those of Breitner and Isaac Israëls. Finally, we may distinguish the group of ' moderns ' such as Sluyters and

C. Toorop, who since the war of 1914–18 have constituted the most advanced element in Dutch art.

Literature and Music

The cultural and intellectual revival known as the ' movement of the 'eighties ', while of significance in almost every field of activity, exercised its most direct and profound effect upon literature. The movement had a precursor in E. Douwes Dekker (1820–87) or Multatuli, the novelist best remembered for his exposure of East Indian conditions in *Max Havelaar*. Its leaders were a group of distinguished writers all born shortly after the middle of the century ; its chief poets were W. Kloos (1859–1930) and H. Gorter (1864–1927), its leading prose-writer the novelist L. Couperus (1863–1933), some of whose books have been translated into English. A little later came Arthur van Schendel (1872–), author of twenty novels which make him the greatest living Dutch writer and an outstanding figure in the country's literary history, and Jo van Ammers-Kuller, a woman-novelist of great sensitiveness and charm, whose work is also accessible in translation.

In no sphere has there been a greater revival than in music. A century ago Holland was a land without music. J. J. H. Verhulst (1816–91) and R. Hol (1825–1904) did pioneer work in arousing musical consciousness, but it was not until the 1880's, at the time of the literary renaissance, that the musical revival began to gain real momentum. The first generation of Dutch composers included B. Zweers (1854–1924), J. Röntgen (1855–1932) and J. Wagenaar (1862–1941), as well as the gifted woman miniaturist, Catharina van Rennes (1858–1939). Among the leading figures of contemporary Dutch musical life perhaps the three best known outside Holland are W. Mengelberg (1871–), for many years conductor of the Amsterdam Concertgebouw orchestra, which he made one of the finest in Europe ; Pieter van Anrooy (1879–), who sprang to fame with his ' Piet Hein ' rhapsody but has since devoted himself to conducting ; and W. Pijper (1894–), ablest exponent of the revolutionary element in contemporary Dutch music.

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CHAPTER VI

HISTORICAL OUTLINE

The Revolt of the Netherlands, 1555–1609 : Political and Religious Discontent ; William of Orange ; The Separation, 1579–1609

The United Provinces, 1609–1795 : The Federal Constitution ; The War Renewed, 1621–48 ; The Constitutional Crisis, 1648–51 ; The English Wars, 1652–74 ; The Challenge of France, 1678–1714 ; The Eighteenth Century, Foreign Policy ; The Eighteenth Century, Internal Affairs.

The Period 1795–1830 : French Rule, 1795–1813 ; The Union of Holland and Belgium, 1813–30

Maritime and Economic Expansion, 1500–1815 : European Waters ; The Dutch East India Company ; The Dutch West India Company ; Industrial and Commercial Development ; The Decline of the Dutch Republic

The Kingdom of the Netherlands, 1830–1939 : The Break-up of the Union, 1830–39 ; The Period 1839–87 ; The Period 1887–1918 ; Between the Two Wars, 1918–39

Bibliographical Note

The Revolt of the Netherlands, 1555–1609

Political and religious discontent

During the first half of the sixteenth century there began a train of events that led ultimately to the emergence of a new state on the map of Europe.* At that time, the greater part of what later became the kingdoms of the Netherlands and Belgium formed part of the empire of Charles V (Fig. 33). He also ruled over Austria and Spain together with their dependencies ; but, in 1555, weary of the government of so many realms, he abdicated. The imperial title in Germany went to his brother Ferdinand ; while Spain and the Netherlands formed the inheritance of his son Philip, and, with the accession of Philip, the name ' Spanish Netherlands ' came into common use. The new king, in the presence of the deputies of the seventeen provinces of the Netherlands, swore to maintain the ancient rights and privileges of each separate province. But Philip, brought up in Spain, did not even understand the language of his subjects in the northern Netherlands, and from the first they regarded him with suspicion. He himself never felt at home among them, and in 1559 he left for Spain never to return again ; a regent was appointed to govern the provinces.

Even before his departure discontent had begun to accumulate ; it was partly political and partly religious. There were complaints

* For the earlier history of the Netherlands see the N.I.D. Handbook on *Belgium*, pp. 80–95.

that taxation was raised arbitrarily, that the offices of state were filled with foreigners, and that large numbers of Spanish soldiers were being maintained in the country. There was also discontent about the reorganization of the bishoprics in the Netherlands, and many believed its object was to effect more stringent measures for the stamping out of heresy. The doctrines of the Reformation had spread over the whole Netherlands before the accession of Philip in 1555. As early as 1518 Lutheranism had appeared at Antwerp, and an Inquisition had been set up on the Spanish model by Charles in 1522. The teachings of the Anabaptists had spread from Münster into Holland and Gelderland by 1530 ; more important than these, was the advent of Calvinism round about 1543, and Antwerp became a rallying point for Calvinist congregations. The Inquisition aroused indignation everywhere. Disorders broke out, and armed conflicts were feared. Calvinism soon became the dominant dissenting religion. In the summer of 1566 the Calvinists, swollen by the unemployed of the industrial districts, were roused to a pitch of excitement that culminated in an outburst of image breaking. The iconoclasts entered churches and religious houses, wrecking altars and destroying images and pictures. The unrest was felt over a wide area—in Antwerp, Ghent, Oudenarde, Tournai and Ypres, and it spread to the north, into Zealand, Holland and Friesland. As yet, there was nothing ' which would seem to announce in any way the sharp separation into a northern Protestant and a southern Catholic block which was to result from the fast approaching crisis '.*

To deal with this growing unrest, the Duke of Alva, one of the great Spanish generals, was sent in 1567 with a well-equipped army. Alva established a council (called by its enemies the ' Council of Blood ') to deal with all cases of treason against Spain. It kept its executioners ceaselessly at work and spread a reign of terror throughout the whole of the Netherlands ; large numbers of refugees fled to England. For a time all effective opposition seemed to have been crushed. But, in order to maintain his army, Alva was forced to resort to such heavy taxation that everywhere the result was uncompromising resistance.

William of Orange

One of the anti-Spanish leaders was William, Count of Nassau and Prince of Orange. William had been made stadtholder (or

* P. Geyl, *The Revolt of the Netherlands*, 1555–1609, p. 64 (London, 1932).

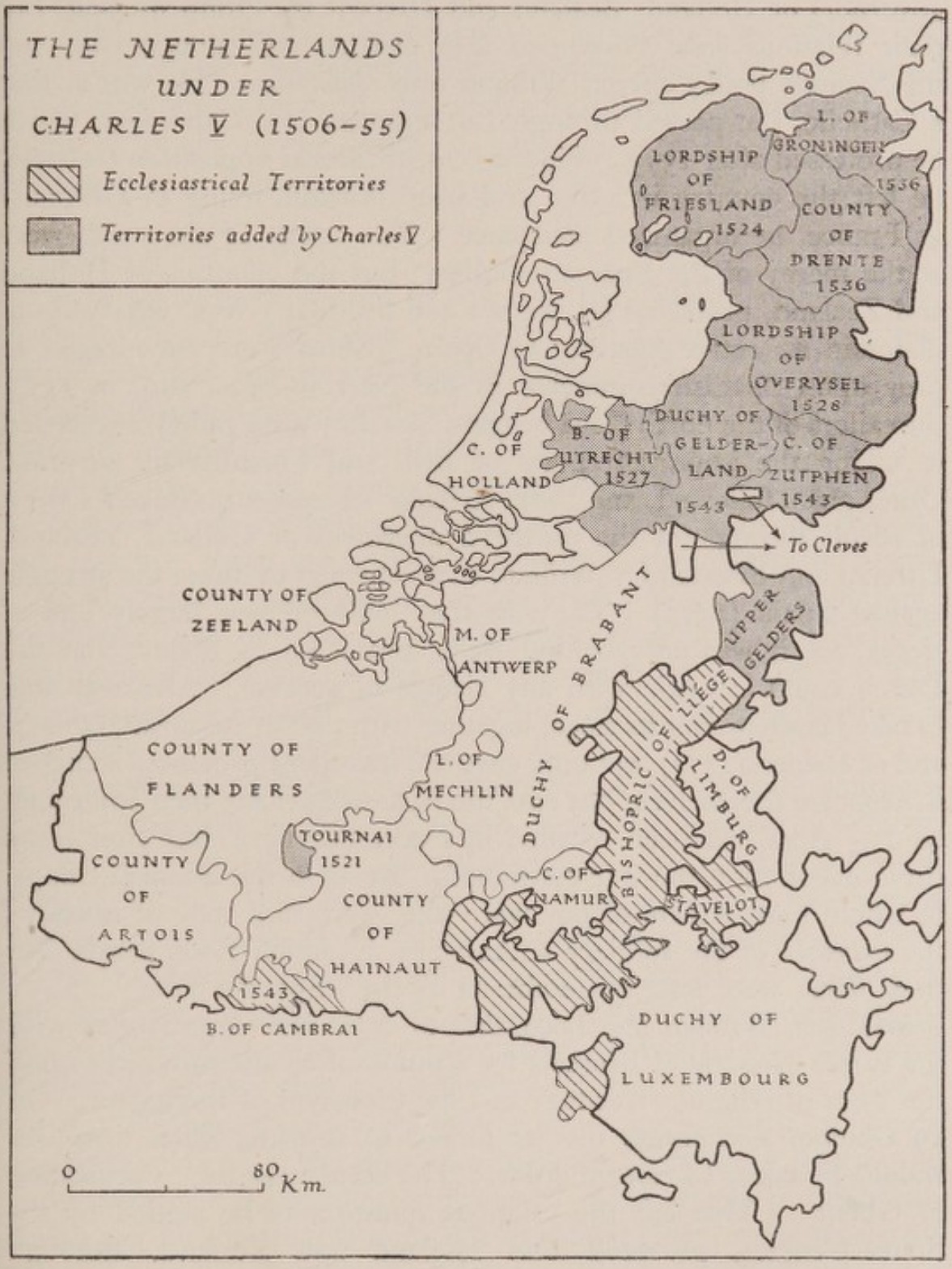


Fig. 33. The Netherlands under Charles V, 1506–55

From : (1) W. R. Shepherd, *Historical Atlas*, p. 117 (7th edn., London, 1930) ; (2) *Geschiedkundige Atlas van Nederland*, vol. I, plate 49 ('s Gravenhage, 1913–32). The map distinguishes between the original Burgundian inheritances of Charles and the territories added during his reign—see N.I.D. Handbook on *Belgium*, p. 93. It is difficult to be certain about many details of the boundaries partly because they were changing continually and partly because the status of some territories was ambiguous and can be given different interpretations. Hence it is not surprising that different authorities give different outlines of, say, the bishopric of Liége.

governor) of Holland, Zealand and Utrecht by Philip himself, but their relations soon developed into distrust and antagonism, and the Spanish policy stirred William into resistance. He was at first a Catholic, but passed through Lutheranism into Calvinism, which he professed after 1573. Finding constitutional opposition fruitless, he left the country in 1567, and from outside, living in Germany or France, he organized resistance. The towns of the south were at the mercy of the Spanish soldiery, but the counties of Holland and Zealand, protected by the sea and by their rivers, were able to maintain an active hostility to Spain. Ships were encouraged to prey upon Spanish commerce in the Narrow Seas, and, in 1572, the sailors of the north (' sea beggars ', as they were called) succeeded in taking the important ports of Brill and Flushing by surprise. Other gains followed, and these striking successes produced a wave of revolt throughout the northern provinces of Holland, Zealand, Utrecht and Friesland. William now returned to direct the struggle against Spain (1572). The war that followed was largely one of sieges, for it was only behind walls, protected by floods, that the Dutch could struggle with any chance of success. Alva was able to take Haarlem, but its siege, together with that of Alkmaar (1572–3) and of Leiden (1574), not only gave the insurgent provinces a chance to organize themselves, but cost the Spaniards many men and much effort. Alva had been recalled in December 1573, but after some futile negotiation the war continued. By 1576 the Spanish troops, to whom long arrears of pay were due, were in a state of mutiny ; the excesses of the soldiery at Antwerp, in which 7,000 people lost their lives, were long remembered as the ' Spanish Fury '. Even before this, William had been able to enter into negotiations with the States-General at Brussels for a union of all the provinces upon the basis of religious freedom and the exclusion of foreigners. On 19 October a congress met at Ghent to consider what measures should be taken to restore order. The result was the ' Pacification of Ghent '. This left the religious question to be settled by the States-General, provided that Holland and Zealand, although containing many Catholics, should remain Calvinist. It also stipulated that foreign soldiers should be expelled, but that the Spanish King should be recognized as sovereign.

The agreement was destined to be but short-lived. To Catholics the domination of the heretics was less tolerable than the evils of Spanish rule ; and the moderate thinkers on both sides were overwhelmed by the extremists. Many towns experienced a new

regime of persecution—this time at the hands of the Calvinists. Not even the diplomacy of William of Orange could smooth out these differences. Nor was the Spanish party slow to take advantage of the situation. In 1578, Alexander of Parma was appointed by Philip of Spain to the office of governor-general; and in him William was to find an adversary equal in ability to himself.

The Separation, 1579–1609

Parma set to work at once to win over the Catholic nobles of the south to the Spanish cause. In 1579 the League of Arras was formed by the representatives of Artois, Hainaut and Walloon Flanders, which aimed, amongst other things, at the defence of the Catholic religion. The northern provinces responded with the Union of Utrecht, which came to include Holland, Zealand, Utrecht, Gelderland (with Zutphen), Friesland, Groningen and Overyssel; and, in 1581, these provinces disowned the sovereignty of Spain. From this time onward, except for the brief interlude of Napoleon's domination and of 1815–30, the northern provinces constituted a unit distinct from that of the royal provinces to the south. The wider union, which at the Pacification of Ghent had seemed a possibility, was doomed to failure.

The provinces of Brabant and Flanders, outside both the southern and the northern leagues, were still under the control of William of Orange; and, through his influence, they accepted in 1582 the duke of Anjou as their sovereign—for a time he became the duke of Brabant and count of Flanders, but he soon withdrew. Even before the assassination of William in 1584, Parma, by diplomacy and by force, had done much towards restoring the authority of Spain throughout the two provinces. Antwerp was defended obstinately by its Calvinistic burgomaster, but, after a long siege it fell on 16 August 1585. By this time all the southern provinces had been restored to the Spanish allegiance. From this base in the south, and from the disaffected province of Groningen in the north, Parma and his lieutenants were able to extend their conquests almost up to the limits of the natural defences of the northern provinces (Fig. 34). Large numbers of the southern Protestants left the country to make their homes in the north or in England; others acquiesced and were converted back to Catholicism.

Upon William's death in 1584, his son Maurice, only seventeen years old, became stadtholder of Holland and Zealand and captain- and admiral-general of the Union. The supporters of the House

of Orange turned first to France and then to England for assistance. Queen Elizabeth sent a force under the Earl of Leicester, who was appointed governor-general with almost sovereign powers (1586). But his attempt to centralize the forces of the provinces was un-

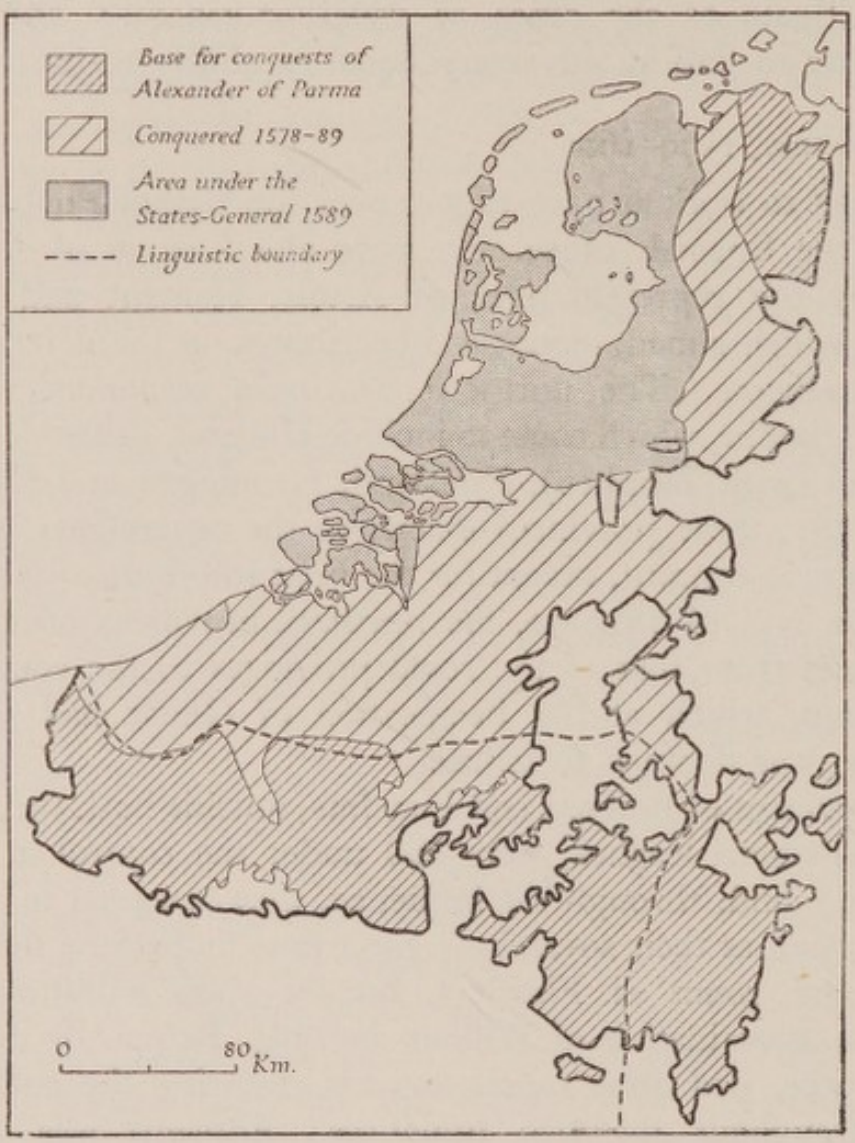


Fig. 34. The conquests of Alexander of Parma, 1574–89

From : (1) P. Geyl, *The Revolt of the Netherlands*, 1555–1600, p. 180 (London, 1932) ; (2) *The Cambridge Modern History Atlas*, map 22 (2nd edn. Cambridge, 1924).

The linguistic frontier is generalized. Note how the territory of the Dutch, apart from the islands, lay mainly to the north of the strategic frontier formed by the great rivers of the Maas (Meuse), the Waal and the Rhine. Cambrai, in the south, is left white because it was in French hands 1580–94.

successful, and his order prohibiting all trade with the enemy aroused the bitter hostility of the merchants of Holland and Zealand, who reaped rich revenue by such commerce. Within little over a year Leicester had returned to England. By 1588 the fortunes of the northern provinces were at a low ebb, but the concentration of Spain upon the great Armada gave them a respite. The military

ability of Maurice and the brilliant statesmanship of Oldenbarneveldt (the 'pensionary' of Holland*) maintained the struggle against Spain. Zutphen was captured in 1591, and the death of Parma in 1592 relieved the Dutch of a bitter foe. In 1594 Groningen was won, and by the end of 1597 a succession of sieges had established the military fame of Maurice.

But Philip still regarded the whole Netherlands as part of his realm, and, shortly before his death in 1598, he gave the area as a dowry to his daughter Isabel on her marriage to Archduke Albert of Austria. The representatives of all seventeen provinces were then summoned to Brussels to meet their new rulers, officially styled 'the archdukes'; but the northern provinces were still firmly resolved to maintain their independence. Being masters of the sea, they kept the coast closely blockaded and, under Maurice, they regained much of the territories in the north that had been conquered by Parma (Fig. 35). Moreover, they declined tentative proposals for peace, and demanded complete recognition as an independent power. After indecisive operations and long discussions that stretched over a number of years, Spain and the archdukes were compelled to agree to a truce for twelve years with the northern provinces 'in the capacity of free states over which Albert and Isabel made no pretensions' (9 April 1609). This truce left the northern parts of Brabant and Flanders in the possession of Holland; they were known as 'Generality Lands' (Generaliteitslanden), and were governed as common lands by the States-General. The truce, moreover, brought no opening of the Scheldt to any but Dutch shipping (see p. 620); Antwerp thus remained in decline to the great benefit of the Dutch ports.

The separate histories of Holland and Belgium may be said to have begun in 1609. The former was to attain a remarkable degree of prosperity; the latter, associated with the decadence of Spain, and then attached to Austria, was for long to continue in obscurity under its foreign governors, and to serve as a battleground for the armies of Europe, even after it attained independence in 1831.

Two points must be noted about this division of 1609. In the first place, there was no circumstance about the separation that suggests racial or linguistic cleavage. The Flemings made no attempt to separate from the Walloons, and the linguistic frontier never became a political frontier. On the contrary, many southern provinces presented a bilingual character—as they had always done.

* See footnote on p. 136.

Flanders, Brabant, Luxembourg and Liége—all included within their frontier both Flemish- and Walloon-speaking peoples.

In the second place, the separation corresponded to no clear-cut religious dividing line. There were Protestants in the southern provinces, and Catholics in the north. In many of the northern

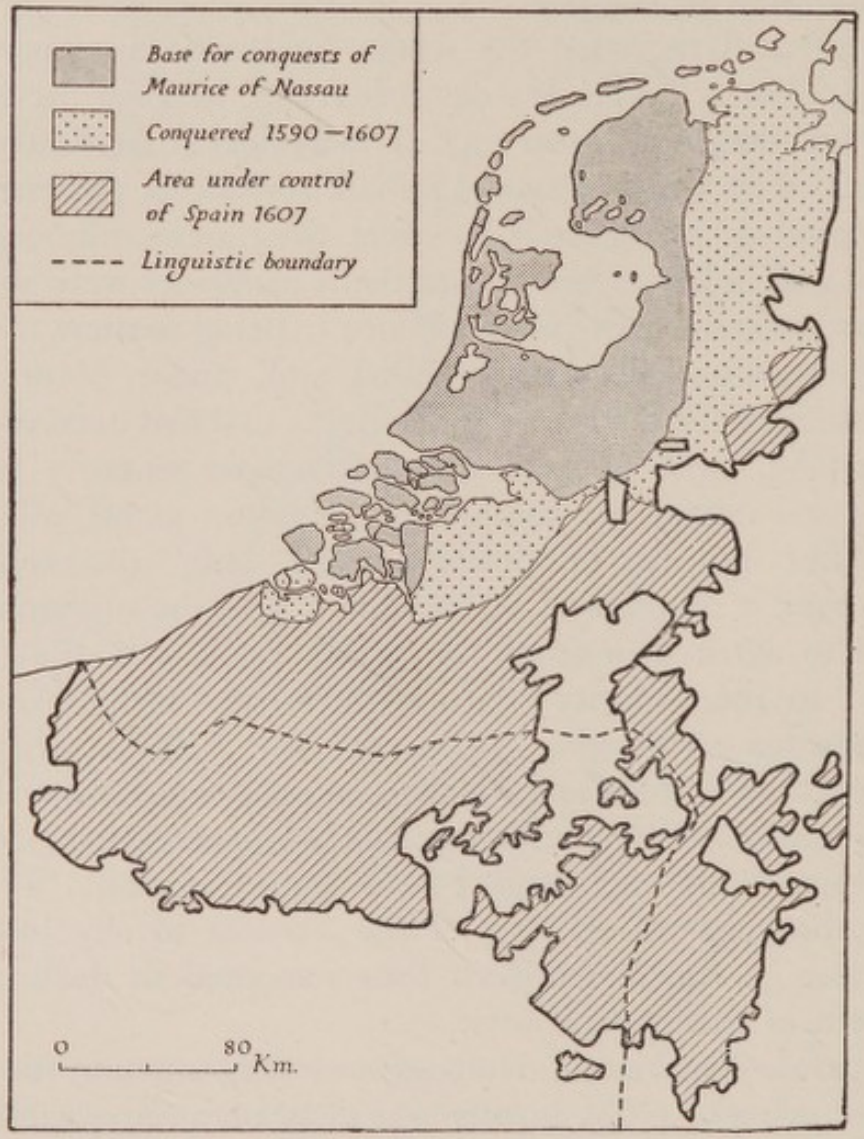


Fig. 35. The conquests of Maurice of Nassau, 1590–1607

From: (1) P. Geyl, *The Revolt of the Netherlands*, 1555–1660, p. 180 (London, 1932); (2) *The Cambridge Modern History Atlas*, map 22 (2nd edn., Cambridge, 1924). See underline to Fig. 34.

provinces there was a feeling of wavering and hesitation, especially in the east. The northern Catholics were afraid of Calvinist policy, and in 1580 the province of Groningen deserted to the Spanish cause (Fig. 34). Indeed, the division between north and south at this time corresponded not to the religious temper of the people but to the balance of military forces between Parma and William of Orange. The determining factor affecting this balance was

geographical and strategic, for the great strength of the northern rebels lay in their waters and rivers.

In the south, the regime of the archdukes was marked by a vigorous Catholic renaissance. The Church, with all the enthusiasm of the Counter-Reformation, exerted itself to strengthen its hold on the southern provinces ; and the work of the Jesuits was particularly important. Protestantism disappeared almost completely, and the Catholicism of the Belgian people became peculiarly profound and rooted. It has been said that the Jesuits made Belgium the most Catholic country in Europe. Professor Geyl has gone so far as to say that the divergence in religions between north and south was ' not the cause but the result ' of the political separation.* The northern provinces were cut off from the influence of the Counter-Reformation, and, there, the victorious Calvinists put great pressure upon the Catholic population. As the south became more Catholic, the north became more Protestant.

The United Provinces, 1609–1795

The Federal Constitution

Although victorious and independent, the United Provinces still faced many difficulties. The new political unit recognized in 1609 was not a unified state but a loose federation of semi-independent provinces with a complicated system of government, and with nothing that could properly be called a constitution. The franchise of each province was different from the rest, and the parliament or ' States ' of each province likewise differed in composition from those of its neighbours. Moreover, each province had its own laws, courts and taxes, and, to some extent, its own troops. It is true that in every province the chief official was known as the ' stadtholder ', but his powers were restricted, and they, too, varied from province to province. His office was somewhat of an anomaly in a republic, but it was a relic of the days when each province contained a lieutenant of the king whose power had now been thrown off. ' Such a medley of diverse and conflicting authorities within a state of so small an area has no counterpart in history. It seemed impossible that government could be carried on, or that there could be any concerted action or national policy in a republic which was rather a many-headed confederation than a federal State '.†

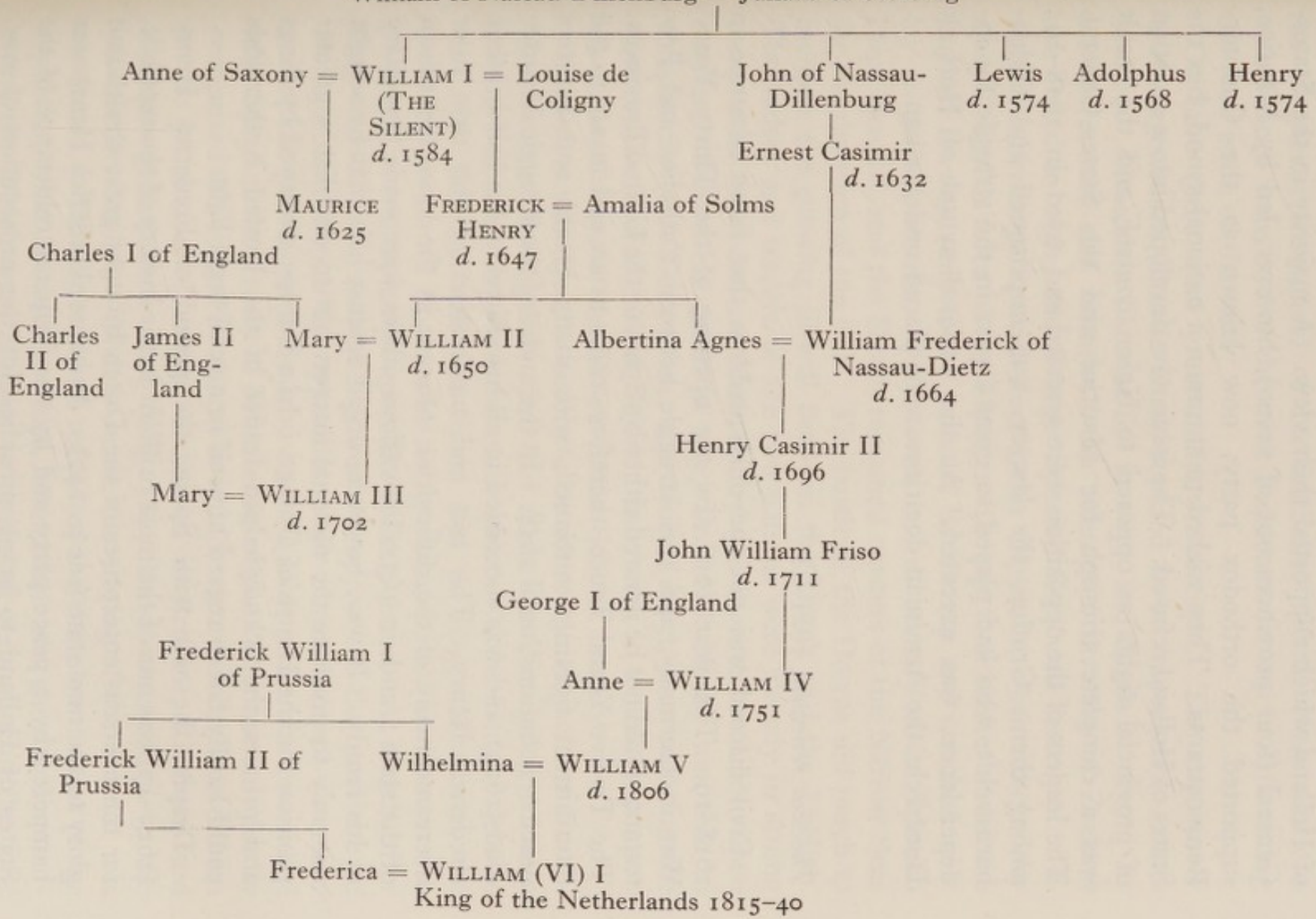
* P. Geyl, *The Netherlands Divided*, 1609–48, p. 17 (London, 1936).
† G. Edmundson, *History of Holland*, pp. 114–115 (Cambridge, 1922).

Counterbalancing these separatist tendencies was the central government or States-General, composed of representatives from each of the seven provinces. This body appointed the captain-general and the admiral-general of the Union, and these offices were filled by a member of the House of Orange. That the princes of Orange exercised an important unifying influence was due to the prestige which the leadership of William the Silent and the military ability of his son, Maurice, conferred upon their House. Maurice held the office of stadtholder in five provinces ; so did Frederick Henry (1625–47), William II (1647–50), and William III (1672–1702). Friesland and Groningen, however, remained faithful to the Nassau-Dietz branch of the family, and it was this collateral line that ultimately provided a stadtholder common to all seven provinces in 1747 (see table on p. 131).

The province of Holland outweighed the other six in importance ; and Holland, in turn, was dominated by the great trading cities, especially by Amsterdam. There were nineteen votes in the States of the province of Holland ; eighteen leading towns had one vote each, while the remaining vote had to suffice for the rest of the province. The burgher oligarchy in the province of Holland stood for separatism in a loose federation ; the House of Orange, on the other hand, stood for the authority of the States-General and for a centralization of authority under one head. The result was continual disagreement between the States of Holland and the States-General, and all kinds of difficulties were put in the way of concerted action. It is the tragedy of Dutch history in the seventeenth century that these two influences could so seldom be harmonized. The recurring clash of interests resulted in the revolutions of 1618, 1650 and 1672 (and also in those of 1747 and 1787). During two periods, between 1650–72 and 1702–47, the republic had no captain-general and was without a stadtholder, except in the two provinces of Friesland and Groningen, and in Gelderland after 1722.

The truce of 1609 had hardly been concluded when fresh difficulties emerged, for the seven provinces became torn by theological strife which was bound up with political issues. This theological strife has become associated with the names of two professors of theology at Leiden, who differed with each other about obscure points connected with the doctrine of predestination. One of them, Francis Gomarus, maintained the orthodox Calvinist point of view ; the other, Jacob Arminius, attacked it, and in 1610 his followers

The House of Orange to 1840



(known as Remonstrants) appealed to the States of the province of Holland which supported their view. A majority in the States-General (four provinces out of seven), however, led by Maurice, supported the orthodox party, now known as the Counter-Remonstrants. They wished to summon a national synod, but the States of Holland refused. The issue now developed into a question of provincial rights as opposed to Union control, and the result was a complete triumph for Maurice and the States-General. The leaders of the opposition were arrested and tried in 1618–19; among them, Grotius, the lawyer, was imprisoned and Oldenbarneveldt, who had played so great a part in the struggle for independence, was executed. At the national synod of Dort or Dordrecht the Arminian doctrines were placed under a ban.

The war renewed, 1621–48

Civil discord was not the only problem that faced Maurice in 1618–19. The year 1618 saw the opening of the Thirty Years' War in Germany, and this struggle between Catholics and Protestants could not be ignored either by Spain or the United Provinces. The Twelve Years' Truce, therefore, came to an end in 1621, and intermittent fighting continued, with many breaks and abortive peace negotiations, until 1648. In the midst of the struggle Maurice died (1625), and was succeeded in all his offices by his half-brother Frederick Henry. The tact and moderation of the new ruler overcame many of the difficulties inherent in the loose federalism of the state; and, in 1631, his various offices were made hereditary in his family. It was, however, urged against him that he sought not only to promote the national interest but to establish a greater position for the House of Orange. In a Europe governed by kings and princes the acknowledged leader of the United Netherlands could hardly fail to regard himself in a semi-regal light.

Despite the war with Spain, the period of Frederick Henry (1625–47) was one of the most brilliant in the history of the republic, for the overseas enterprises of the Dutch brought great wealth and glory to the new state (see p. 147). At home, Frederick Henry was hampered by a peace party and by the frequent reluctance of the States of Holland to grant subsidies for the prosecution of war. But, on the other hand, in 1628–9, he was successful in concluding an alliance with France against Spain, despite the fact that one of

the French demands was the assistance of the Dutch fleet against the Huguenot stronghold of La Rochelle. These close relations with France were one of the most important factors in influencing the final issue of the war.

On land there were great military successes. The capture of 's Hertogenbosch (Bois-le-Duc), reputed to be impregnable, came in 1629. Maastricht likewise fell in 1632, and Breda in 1637. At sea there were also victories. An attempted invasion of Zealand was foiled in 1631, and a large Spanish fleet was destroyed. In 1639 another large Spanish fleet under Oquendo, when attacked by a small Dutch force under Maarten Tromp, took shelter under the English Downs, only to be pursued by Tromp and attacked as it lay in neutral waters. Only seven out of seventy-seven Spanish ships escaped, and the Dutch remained masters of the Narrow Seas for the duration of the war. The battle of the Downs did much to increase the growing ill-will between the Dutch and the English. The sailors and traders of the two nations were already in strong competition overseas, and their rivalry was soon to break into open warfare. Before his death in 1647 Frederick Henry was able to conquer Sas van Gent (1644) and Hulst (1645), thus securing the southern bank of the West Scheldt and, with it, a firm grip upon all the waterways of the Rhine–Maas–Scheldt estuary.

But Spain was already ceasing to be the real enemy of the Dutch. The revolt of Portugal in 1640 had taken the Portuguese colonies from the Spanish flag, and the main quarrel of the Dutch overseas was with Portugal and not Spain (see p. 149). Moreover, the declining power of Spain and the growing power of France was putting a new complexion upon European politics. At length, after long negotiations, with the powerful support of the province of Holland, and despite the opposition of Frederick Henry's successor and of the provinces of Zealand and Utrecht, peace was concluded with Spain at the Treaty of Münster in 1648. This not only finally recognized the United Provinces as independent but confirmed them in the possession of various territories in Brabant, Limburg and Flanders gained since 1609 (Fig. 36); these were added to the 'Generality lands'. What is more, the closing of the Scheldt was confirmed. This latter clause registered the complete success of the republic; what Antwerp had lost, Amsterdam now gained. Furthermore, the Dutch were allowed to retain all conquests in the East Indies and Brazil made at the expense of the Portuguese; they were also given freedom of trade in both East and West Indies. Thus

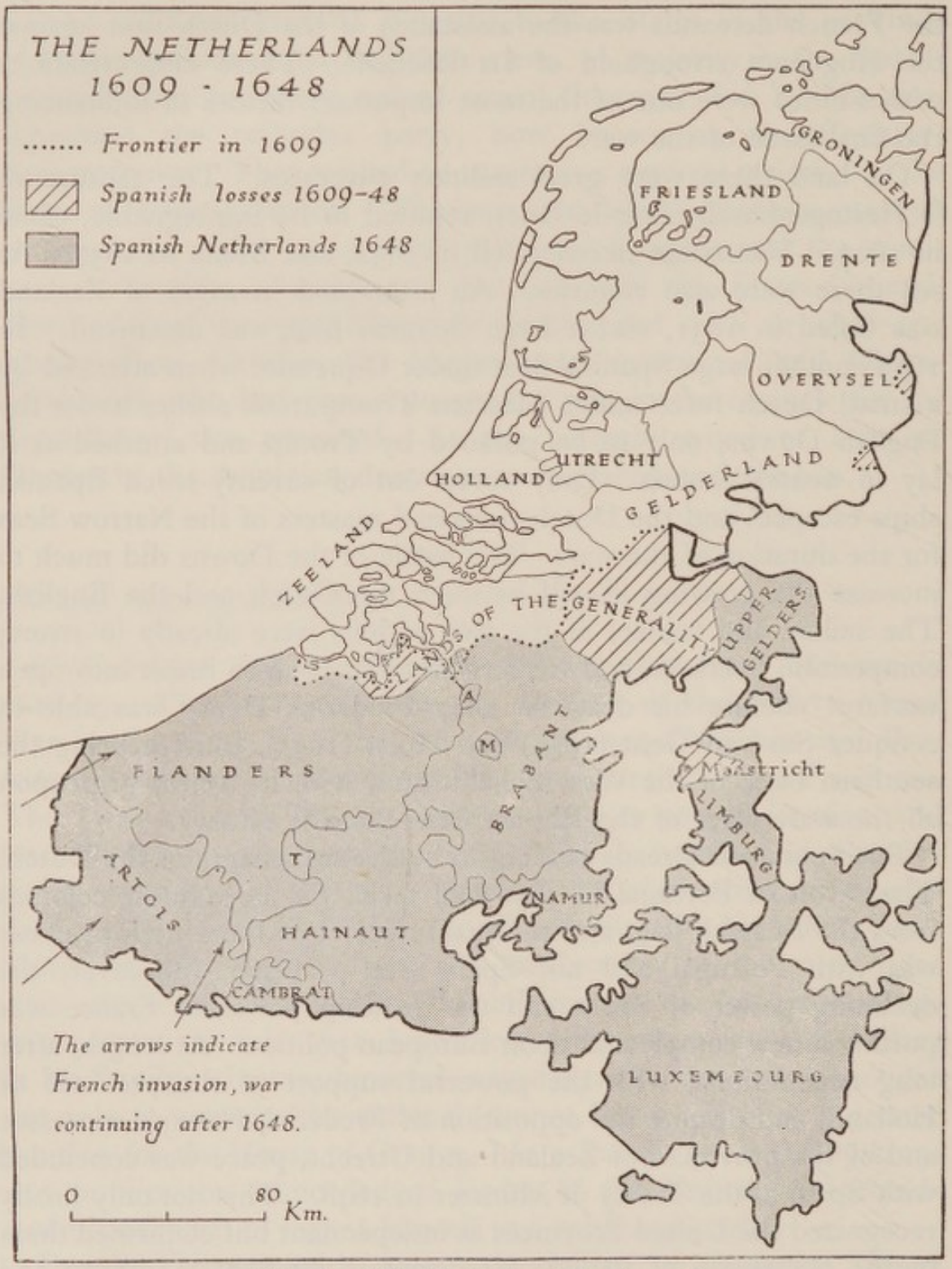


Fig. 36. The Netherlands in 1609–48

From : (1) P. Geyl, *The Netherlands Divided*, 1609–1648, p. 154 (London, 1936); (2) *The Cambridge Modern History Atlas*, map 22, (2nd edn., Cambridge, 1924).

The province of Drenthe, although it took part in the Revolt, was not admitted into the union as a separate province because of its poverty and sparse population. Though unrepresented in the States-General, it retained some measure of local independence. Its claim to admission in 1651 was not allowed, and it was not until 1796, under the French occupation, that it obtained the privilege of being reckoned as an eighth province with representation in the States-General of the Batavian Republic.

A Antwerp ; M Malines ; T Tournai

the struggle that had lasted nearly eighty years came to an end, and the middle of the seventeenth century marked, perhaps, the highest point of Dutch greatness.

The constitutional crisis, 1648–51

With the conclusion of the war, the constitutional difficulties inherent in the federal structure of the republic once again became prominent. A dispute arose between the province of Holland and the States-General over the question of reducing the armed forces of the state. The States-General and William II, who had been against making peace with Spain, wished to maintain a skeleton army in case of a renewal of war. The rich traders of the province of Holland, wishing to make sure of peace, objected to this and gave orders for disbanding the troops in the pay of the province, though these troops formed part of the federal force. William then imprisoned six of the leading members of the States of Holland, and attempted to occupy Amsterdam. For a few days civil war threatened, but a settlement was patched up by which William gained his way. But in this very year of triumph (1650) William, aged only twenty-four years, died of smallpox. A week after his death his son was born.

The death of William II soon enabled the anti-Orange, anti-centralist party to triumph. At the suggestion of the States of Holland a 'Great Assembly' of representatives from all seven provinces met at The Hague on 11 January 1651 to consider the situation. It decided, in effect, that each province possessed sovereign powers, with control over its own armed forces. There was to be no captain-general nor admiral-general; a field marshal was put at the head of the army. What was more, five of the provinces, at the instigation of Holland, agreed not to fill the office of stadtholder; his powers were transferred to the provincial States. The two provinces of Friesland and Groningen alone remained with a stadtholder—William Frederick of Nassau-Dietz, cousin of the late William II.

The result of these arrangements was the complete domination of the province of Holland in the affairs of the Union. In the province of Holland the office of 'pensionary' had receded somewhat in importance since the death of Oldenbarneveldt, but it was now occupied by John de Witt, the twenty-eight-year-old son of one of

the six men imprisoned in 1650.* The young John de Witt now raised the office to new heights of importance, and became, from 1653 to his death in 1672, not only the most powerful figure in the whole of the United Provinces, but also one of the most important statesmen in Europe.

The English Wars, 1652–74

Dutch commercial supremacy had not reached its outstanding position by the middle of the seventeenth century without considerable friction between Dutch and English traders in many parts of the world (see p. 150). The civil war in England (1642–8) had prevented an open challenge from England ; but the reorganization and revival of the English navy under the Commonwealth and Protectorate could only lead to one result—war with the Dutch republic. Their common feeling in religion and republicanism was not strong enough to withstand the growing antagonism of English and Dutch sailors. As well as the demand that Dutch ships should salute the English flag in ' the narrow seas ', the whole issue of colonial trade was at stake.

In October 1651 the English Parliament passed the famous ' Navigation Act ', which forbade the importation of goods into England except in English ships or in those of the country which had produced the goods. The economic effects of this blow against the Dutch carrying trade have been discussed many times, and opinion has been divided about its importance. It is true its provisions were often disregarded, but at any rate it remained in force until the stronger Act of 1660, and this in turn was reinforced by a number of subsequent measures. But whatever its immediate economic effects, the Navigation Act of 1651 was a political measure of the first importance. It was a prelude to the struggle for commercial supremacy which continued throughout three Anglo-Dutch wars and which was to end in the triumph of England upon the seas.†

* The States of each province and the corporations of all the leading towns had a legal adviser whose office was known as that of advocate (*advocaat*) or pensionary (*pensionaris*). The office of advocate of the States of Holland was raised by Johan van Oldenbarneveldt, who held it from 1586 to 1618, virtually to that of chief minister of the Republic. Under John de Witt, who held the same office from 1653, it was again raised to the highest level of importance ; and from this time, its holder was known as the 'grand pensionary ' (*raadpensionaris* or ' council pensionary ').

† For a more detailed account of Dutch naval history during 1572–1797, see Appendix III, pp. 632–50.

THE FIRST ANGLO-DUTCH WAR, 1652–4. Hostilities broke out as a result of an armed collision off Dover over the question of saluting the English flag, and a naval war followed. On the one hand were the Dutchmen De Ruyter and Tromp ; the latter was killed in action in August 1652. On the other hand were the Englishmen Blake and Monk. Both sides had successes to their credit, but the Dutch stood to lose most because of their vast carrying trade. The Dutch fleet was accordingly used to protect the convoys of merchant vessels that came through ' the narrow seas ', particularly those from the East Indies. Soon the trade of the republic was at a standstill and Amsterdam was ruined. The Dutch were anxious for peace, and there was also a peace party in England. At the Treaty of Westminster (April 1654) the Dutch agreed to salute the English flag in ' the narrow seas ', and they also undertook to pay compensation for English claims overseas. In return, England recognized the freedom of the North Sea fisheries. Cromwell had tried to insert a clause barring the young prince of Orange from becoming stadtholder and captain-general ; but the States-General refused to allow this interference with its internal affairs, although the States of Holland, led by De Witt, accepted this clause in a secret treaty. The conclusion of the First War was thus far from being decisive, but the republic had, at any rate, been made to feel the full force of the English challenge upon the seas.

THE SECOND ANGLO-DUTCH WAR, 1664–7. The peace of 1654 had not removed the fundamental causes of hostility between England and Holland. Nor was the English attitude changed by the Restoration of 1660, for the sympathy of Charles II was in favour of his nephew the Prince of Orange, and against De Witt. The second English Navigation Act of 1660, accordingly, showed no leniency, and by 1664 the seamen of the two nations were at war in fact if not in name. There were disputes in the East and in West Africa, while, in North America, New Amsterdam was seized by the English in 1664 and renamed New York. At last, war was formally declared in March 1665. A series of great sea battles culminated in June 1667 when the Dutch fleet under De Ruyter entered the Thames estuary, sailed up the Medway, attacked the English fleet as it lay at anchor, and bombarded Chatham ; Dutch guns were heard in London, already ravaged by the Plague and the Great Fire in the previous year. Negotiations for peace were already afoot, and, in the following month, the Treaty of Breda was concluded by which New Amsterdam was retained by England in exchange

for Surinam ; the practice of saluting the English flag remained unchanged.

THE THIRD ANGLO-DUTCH WAR, 1672–4. In the years that followed the second Anglo-Dutch war, it was becoming clear that the Dutch republic was ceasing to be the real enemy and competitor of England. The rising power of France under Louis XIV, and the French threat to the balance of power in Europe, soon produced a reaction in favour of England's former enemies. In the summer of 1667, Louis invaded the Spanish Netherlands, but was forced to conclude a peace by the Triple Alliance between England, Sweden and the United Provinces. It was true that Louis gained some territory on his north-east frontier by the Treaty of Aix-la-Chapelle in May 1668, but a halt, at any rate, had been set to the growing ambition of France.

From 1668 onward, Louis prepared to attack the Dutch on a larger scale. Charles II of England, in return for a subsidy and for a promise to restore the Roman Catholic faith in England, allied with France in the Secret Treaty of Dover ; and in due course the English fleet put to sea against the Dutch (March 1672). On land, the French invaders made rapid advance, and Amsterdam itself was saved only by the opening of the dykes. Once again, as in the struggle against Spain, a great flood stretched from Muiden on the Zuider Zee to Gorinchem on the Maas. In this crisis, when all seemed lost, the province of Holland rallied to the House of Orange ; and William III (not yet twenty-one) was elected stadtholder of Holland, then of Zealand, then of all the provinces except Friesland and Groningen ; and he was also appointed captain-general of the Union (June 1672). Moreover, in all five provinces the office of stadtholder was declared hereditary in his family. In the meantime, De Witt and his party had fallen from power, and he himself and his brother were literally torn to pieces by a mob in the streets of The Hague.

It was William III who saved the Dutch from Louis XIV. In England, public opinion was roused to such a pitch that Charles II was compelled to make peace in 1674, and the Treaty of Westminster provided for a mutual restoration of conquests. The war between Holland and France dragged on until 1678, when, at the Treaty of Nymegen, the French gave up their conquests, and acknowledged once more the independence of the Dutch. The third war with England had been but the preliminary to a great struggle with France that shook all Europe.

The challenge of France, 1678–1713

In the years following 1678, the growing aggression of Louis XIV became so marked that the commercial disputes between the English and the Dutch were overshadowed by the wider question of the balance of power in Europe. The great enemy of the Dutch had become France not Spain ; and, likewise, the enemy of England had become not the United Provinces but France also. The leader of resistance in Europe was William III of Orange, and in 1686 he was able to form a league consisting of the United Provinces, Spain, Sweden, Austria and Brandenburg together with several other German states. After the Revolution of 1688 by which William ascended the throne of England as the consort of Queen Mary, England joined the coalition against France, and a Grand Alliance was formed in 1689. Among the Dutch, a natural criticism was that William subordinated their interests to those of the English ; but, despite much opposition, William remained supreme in the States-General until his death in 1702. He was fortunate in securing the confidence of Heinsius, the pensionary of the province of Holland ; and Heinsius continued William's foreign policy after 1702 until his own death in 1720. During this period, the United Provinces, in alliance with England, were twice at war with France—between 1689–97 and between 1702–13 respectively.

When hostilities opened in 1689, the allies were at first unsuccessful both at sea and on land. At sea, the combined Anglo-Dutch fleet was defeated by the French admiral Tourville off Beachy Head (10 July 1690), and it did not recover mastery of ' the narrow seas ' until its victory off Cape la Hogue in 29 May 1692. On land, victory likewise followed upon initial defeat ; and, at length, in 1697, the Treaty of Ryswick was concluded. By this, the rights of France in Alsace were recognized ; the Dutch were allowed to garrison certain fortresses in the south of the Spanish Netherlands (the ' barrier fortresses ') ; William himself was acknowledged as king of England ; and, finally, there were commercial clauses favourable to the Dutch.

The years 1697–1702 were but a breathing space for the fresh assembly of French energies ; and, when William III died in 1702, the Dutch were already on the verge of war with France over the question of the Spanish Succession. William's second Grand Alliance of 1701 had included England, the United Provinces and Austria, and to these were soon added nearly all the states of central and western Europe. Now, in 1702, although the death of William

did not affect the foreign policy of the States-General, there were internal difficulties. The office of stadtholder had been declared hereditary in five provinces in 1672, but William died childless, and the burgher party was strong enough to prevent John William Friso, the stadtholder of Friesland and Groningen, from being elected to the office of stadtholder in the other five provinces (see table on p. 131). Moreover, as in 1650, the office of captain-general was allowed to lapse and the government of the United Provinces entered a period of extreme decentralization.

But despite these internal problems, the foreign policy of Heinsius remained firmly directed against Louis XIV. During the war of the Spanish Succession, Dutch troops shared in the victories of Blenheim (1704), Ramillies (1706), Oudenarde (1708), and Malplaquet (1709), until peace came in 1713. The Peace of Utrecht (1713–15) re-affirmed the closure of the Scheldt ; the Southern Netherlands themselves were handed over for safe keeping to Austria on condition that the Dutch were allowed to retain garrisons in seven of the barrier fortresses. But although the United Provinces had thus managed to save themselves from their enemies, they could not save themselves from their friends. It has been said that the Peace of Utrecht laid the foundation of England's colonial empire ; and, in the commercial race between England and Holland, the greater size and superior advantages of England had begun to count. The Dutch still retained their great possessions overseas, but had fallen behind, relatively speaking, and the great colonial struggle of the eighteenth century was left to be fought out between England and France.

The Eighteenth Century, Foreign Policy

The United Provinces remained at peace for some thirty years after the Peace of Utrecht. The country, without a captain-general since 1702, was now largely under the influence of the province of Holland which, in turn, was dominated by Amsterdam and its rich merchants. With the Scheldt closed, and the trade of Antwerp much reduced, the burghers of Amsterdam reaped a full reward. It is true that a threat to their monopoly came in 1723 with the establishment of the Ostend Company for eastern trade ; but in 1731, the Dutch, supported by the English, were able to secure the suppression of the company in return for their consent to the Pragmatic Sanction of Charles VI of Austria. It was through this commitment that the United Provinces became involved in the War

of the Austrian Succession. Their alliance with England and Austria did not save them from invasion by France. In 1745–6 the French under Marshal Saxe overran the Austrian Netherlands ; and in the following year the French were in occupation of Dutch (Zealand) Flanders. Only the arrival of an English fleet in the Scheldt saved Zealand from invasion. The United Provinces, torn by internal dissension, could take no really effective action ; both army and navy were in poor condition. In 1748 came the Treaty of Aix-la-Chapelle by which the French conquests were given up, and Dutch garrisons were again allowed to enter the ' barrier towns '. But by this time the finances of the country were crippled, and the Dutch were fortunate enough to be able to maintain their neutrality throughout the Seven Years' War (1756–63).

During the War of American Independence (1775–83) opinion was divided in Holland. The stadtholder* himself was in favour of the English, but the great mass of opinion was in sympathy with the colonies. The attitude of the English government to neutral shipping, and the attacks of English privateers upon Dutch shipping led the United Provinces (by a majority of only four to three) to join the Armed Neutrality of the North—a league of Russia, Denmark, Sweden and others for the protection of commerce. The war that followed (1780–3) left both Dutch shipping and the Dutch colonies completely open to attack from England ; and, at the Treaty of Paris, the United Provinces were compelled to yield some of their East Indian rights and possessions to England.

In the meantime, the Austrian emperor, Joseph II, as ruler of the Belgian provinces, took advantage of internal difficulties following the war with England to demand the opening of the Scheldt, and he was induced to withdraw his demand only on the payment of a substantial indemnity (1785). He was able, however, to compel the withdrawal of the Dutch garrisons from the barrier towns. Before the decade was out, however, the relations between the Austrian Netherlands and the United Provinces were overshadowed by the opening of the French Revolution which was soon to involve all Europe in war.

The Eighteenth Century, Internal Affairs

From the death of William III in 1702 until 1747, the forces of centralization in the United Provinces remained at a very low ebb.

* For the return of the Orange dynasty in 1747, see p. 142.

It is true that the stadtholder of Friesland and Groningen became (though with limited powers) stadtholder of Gelderland in 1722. But the other provinces, under the influence of Holland, had agreed neither to appoint stadtholders nor a captain-general of the Union. The country remained a confederation of sovereign and semi-sovereign principalities without any recognized head of state ; and this situation continued throughout the first half of the eighteenth century.

When, in 1747, the French occupied Dutch Flanders and threatened Zealand, popular feeling rose against the burgher oligarchy, and turned once more, as in 1672, to the Orange dynasty. Zealand elected, as its stadtholder, William IV, who was descended from William the Silent in the female line, and whose family had for long been stadtholders in Friesland and Groningen (see table on p. 131). The other provinces soon followed this example, and the Orange family was acclaimed in Utrecht, Overyssel and even in Holland itself. William IV was thus the first member of his family to be stadtholder in all the seven provinces ; and, to crown this achievement, the States-General elected him captain-general and admiral-general of the Union, and declared these offices hereditary in the Orange family.

But the elements opposed to centralization were not completely outwitted, and William IV's efforts to restore prosperity after the peace of 1748 were greatly hampered by anti-Orange opposition, and particularly by the attitude of the rich merchants of Amsterdam. Unfortunately, he died in 1751, leaving a three-year-old son. His wife, who now became regent, died in 1759 ; and, while their small son grew up, the regency was in the hands of the States-General itself. The United Provinces, once more, were without an effective head of state.

William V came of age in 1766, but he was not a strong character, and was unable to withstand the opposition of the so-called ' patriot ' party which drew support from various anti-Orange factions. Moreover, the spirit of revolution was in the air—in the United Provinces as in the American colonies and in France. William was only saved by his wife's uncle, the King of Prussia, from being driven out of the country in 1784. The internal situation grew so difficult that in 1787, the Prussian army had to enter the country in support of William. The result was complete victory for the House of Orange, and the ' patriot ' leaders were made ineligible for any public office.

But these measures were themselves an indication of something

radically wrong either with the constitution of the country or with the chief officers of state. Like many other anachronisms in Europe, the United Provinces were soon to be swept away in the wars of the French Revolution.

The Period 1795–1830

French Rule, 1795–1813

In 1792, the armies of Revolutionary France attacked Austria at her weakest point by an invasion of Belgium and of the ecclesiastical

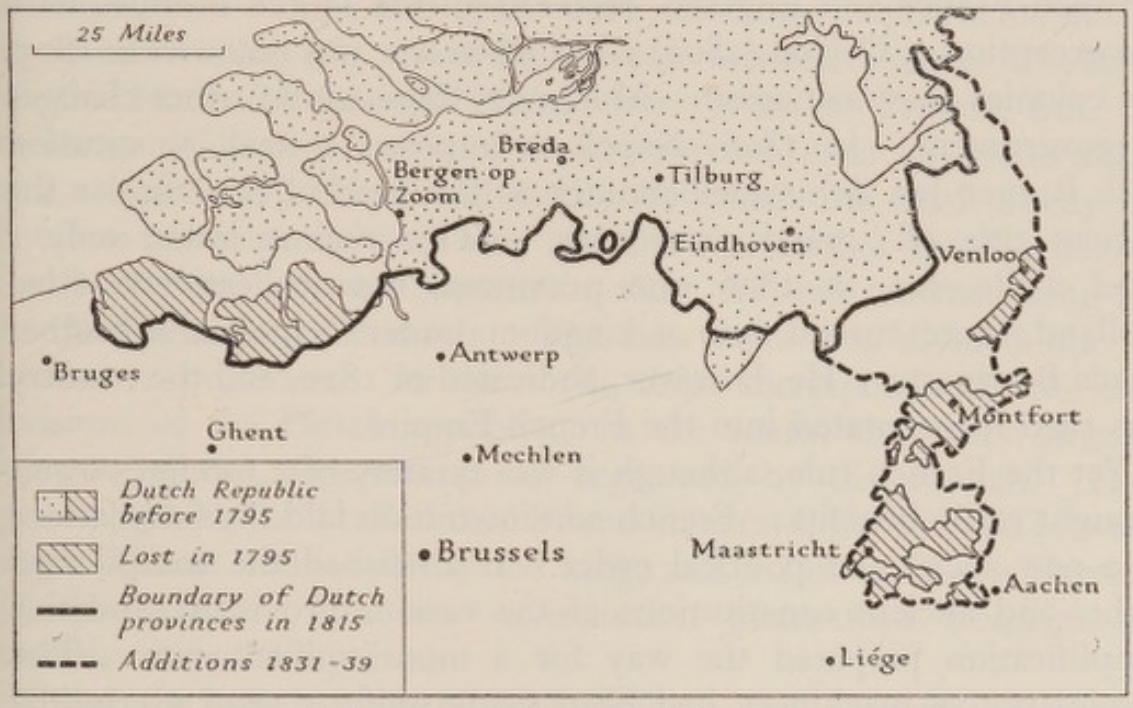


Fig. 37. The southern frontier of Holland, 1795–1839

From : (1) *Geschiedkundige Atlas van Nederland*, vol. I, plate 13, ('s Gravenhage, 1913–32) ; (2) L. Van der Essen, *Atlas de Géographie historique de la Belgique*, maps xi and xiii (Bruxelles et Paris, 1929). Between 1648 and 1795 there had been minor changes along the eastern frontier. Thus Upper Gelderland went from the Spanish Netherlands to Prussia in 1713 ; while the Dutch Republic gained Venloo and some outlying districts to the south in 1715. The limits of the Dutch strip along the southern bank of the West Scheldt had also fluctuated in detail.

province of Liége. By the middle of 1794, the French were masters of the Austrian Netherlands, and they threw open the Scheldt to navigation. The Dutch republic, despite attempts to remain neutral, was inevitably drawn into the war. Indeed, the ' patriot ' party was in sympathy with the revolutionaries ; and, in 1794–5, the French armies marched into the country. It was a hard winter, and the French troops were able to pass over the frozen rivers and marshes. Amsterdam was occupied without opposition, and the Dutch fleet was taken as it lay ice-bound at the Texel. What remained of the Dutch forces retreated into Germany, and the

Orange family fled to England. The offices of stadtholder and of captain-general were abolished, and the United Netherlands became the ' Batavian Republic ', closely allied to France ; some frontier readjustments were also made (Fig. 37).

The French connexion soon brought difficulties. At home, the connexion involved French control, and there were successive changes in the form of government. Abroad, the connexion meant war with England ; Dutch commerce was crippled, and the Dutch colonies were seized by the English. The Treaty of Amiens, between France and England, restored all the Dutch colonies with the exception of Ceylon (1802) ; but when war was renewed in 1805, the colonies were lost again. Moreover, there were further changes in government. In 1806, Napoleon imposed a new constitution with Rutger Jan Schimmelpenninck as the head of state under the ancient title of ' grand pensionary '. This regime lasted only a brief while, for, in 1806, the provinces, now collectively styled Holland, were turned into a kingdom under Napoleon's brother Louis Bonaparte. He, however, abdicated in 1810, and the country was then incorporated into the French Empire.

Yet the French rule, although it was tyranny of a foreign power, brought many benefits. French administration laid the foundations of a new social and political order. It abolished the complicated rights and ancient constitutions of the various provinces, and this simplification prepared the way for a more unified state. The administrative machinery had been made uniform, and a criminal and civil code, modelled upon the ' Code Napoléon ', had been introduced.

The union of Holland and Belgium, 1813–30

The news of the defeat of Napoleon at the battle of Leipzig on 19 October 1813, led to a general uprising of the Dutch, and the formation of a provisional government in Holland. Prince William of Orange accepted the offer of sovereignty and landed in December. William had the support of the British Government who now, as in 1715 (see p. 140), wished to see a state at the mouth of the Rhine strong enough to be a barrier against French aggression. This need for a strong barrier was a predominant factor in the events that followed. In the meantime, the Belgians had asked that the southern provinces should be made an independent state under the rule of an Austrian archduke, but the allies were in agreement about the need

for a strong state. The Protocol to the Treaty of London (21 June 1814), united the Dutch and Belgian provinces into one state.

The completion of these arrangements was interrupted by the news of Napoleon's return from Elba, and soon the Dutch and Belgian soldiers alike were defending the existence of the new state of the Netherlands on the field of Quatre Bras (16 June 1815). After the Hundred Days' campaign was over, the Congress of Vienna confirmed the agreements made by the preliminary treaties. The new kingdom of the Netherlands was to include the ecclesiastical principality of Liége, and there were also some adjustments along the frontiers (Fig. 38) ; thus the German territories of the new king (of the House of Orange-Nassau) were given to Prussia, but, in exchange, William was to become, in a personal capacity, grand duke of Luxembourg ; this grand duchy (to which the small duchy of Bouillon was now added) was to be a member of the Germanic Confederation. On 27 September 1815, he was crowned king of the Netherlands at Brussels. The new state was divided into a number of provinces. In the north, these corresponded to the old divisions of the Dutch republic ; in the south, they very largely reproduced the departments as organized by the French. The governing body, still called the ' States-General ', was divided into an Upper House nominated by the king, and a Lower House elected by the people. The new constitution guaranteed freedom of worship and of the press.

From the outset, the union of Holland and Belgium presented great difficulties despite the affinities of the Flemish and the Dutch. North and south were divided by two centuries and a half of widely separate national life ; the closing of the Scheldt and the Dutch control of the ' barrier towns ' had left bitter memories in the south. Holland was a commercial country desiring free trade, while Belgium was agricultural and industrial and wished for protection. The situation, too, was complicated by financial difficulties. Holland's debt was some 2,000 million florins, that of Belgium was only 30 million, yet she was forced to bear one-half of the total liabilities. Above all, they were separated by quite different religious beliefs. The Belgians, Flemings and Walloons alike, had become intensely Catholic (see p. 129), and hostile to a king who was a Dutchman by birth and training and a Calvinist by religion. Moreover, despite the good intentions of the king, the idea was current in the south that Holland was the predominant partner. Though the population of Belgium was nearly three and a half millions and that of

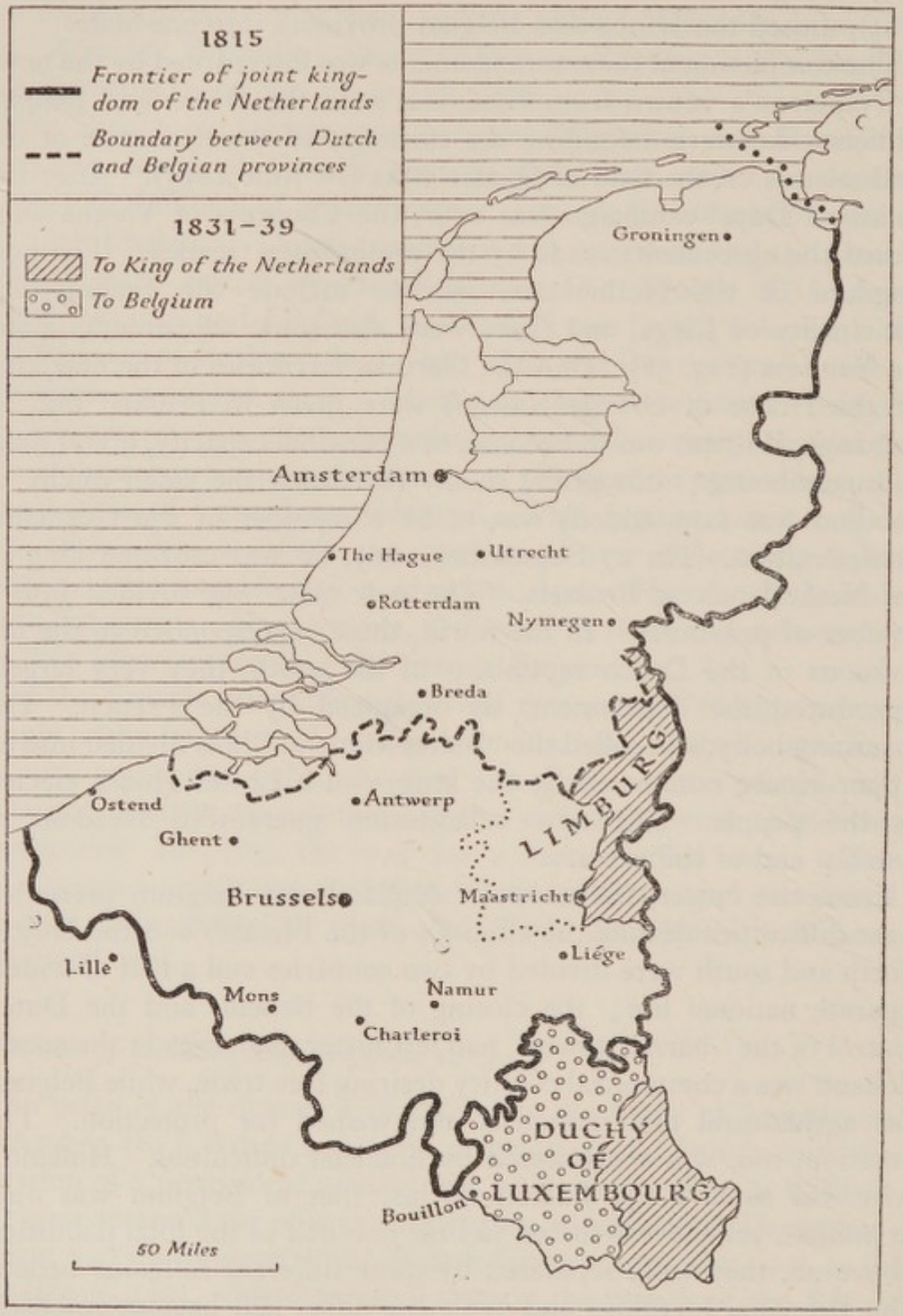


Fig. 38. Holland and Belgium in 1831–39

From: *The Cambridge Modern History Atlas*, map 109 (2nd edn., Cambridge, 1924).

For the changes along the eastern frontier of the Belgian provinces between 1795 and 1815, see Figs. 42 and 43 of the N.I.D. Handbook on *Belgium*.

Holland only a little over two millions, the two countries had equal representation in the States-General. The seat of the government was established in Holland, despite an early agreement that the States-General should meet alternately in a Dutch and Belgian city. The public offices were filled by northerners. In 1830, of the seven members of the government, only one was a Belgian ; in the army, only 288 Belgians were officers out of 1,967. Moreover, in 1822, Dutch had been made the official language in the Flemish districts. This was particularly offensive to the Walloons and also was unpopular with very many Flemings themselves who had only an incomplete knowledge of the popular language and who were replaced by Dutchmen. Thus this measure alienated the Flemish *bourgeoisie* without conciliating the working classes.

At length in 1828, the two extreme parties in Belgium, the Catholic ultramontanes and the revolutionary Liberals, united in their hatred of the Dutch regime, formed an alliance for the overthrow of the government. Petitions were submitted setting out the Belgian grievances, and demanding a separate administration. During 1830, popular riots grew into a Belgian national revolt (see p. 155).

Maritime and Economic Expansion, 1500–1815

European waters

The first step in the rise of Dutch commerce was the great development of Dutch fishing in the North Sea during the fifteenth century. For some mysterious reason the heavy shoals of herring, that appeared each year in the Baltic, took to spawning in the North Sea instead. The loss of the Hanse fish trade meant the gain of the English and Dutch. In their large boats (called busses), first used in 1410, and manned by ten or more men, the Dutch were able to seek out the large and rich spawning grounds of the North Sea banks. They also devised a new method of gutting and salting the fish, and Charles V erected a statue in Amsterdam to Beukelszoon, the inventor of the new method. By 1620, it has been estimated that some 2,000 vessels were engaged in the North Sea fishery, and it used to be said that Amsterdam was ' built on herringbones '. The Dutch fisheries, according to one view, were more valuable than the combined manufactures of England and Holland.

The distribution and marketing of the herring catch gave opportunities for return cargoes ; and, in the words of a Dutch contemporary, ' the herring keeps Dutch trade going, and Dutch trade sets the world afloat '. The geographical position of Holland gave

it many advantages for trade. Set midway between the northern and southern seas of Europe, and lying at the mouth of the greatest system of arterial waterways on the continent, it was well placed for developing large-scale entrepôt trade.

Soon, the Dutch seaman were trading in Scandinavian and Baltic waters. In 1524, Bergen was opened to Dutch trade, and the Dutch demand for timber and for that miscellany known as ' naval stores ' led to an increasing interest in the trade of Baltic lands. Thus it has been estimated that, between 1559–94, the Dutch share in the import trade of Finland rose from 3% to 34%. In the year 1640, some 1,600 ships out of a total of 3,450 passing through the Sound into the Baltic were of Dutch origin ; and, about this time, a Dutch contemporary asserted that, if it were not for the Baltic trade, grass would grow in the streets of Amsterdam. A good deal of the interplay of Dutch and English politics centered around this question of the control of the Sound. In one of his last speeches, Cromwell warned the English Parliament against Dutch supremacy in northern waters : ' If they can shut us out of the Baltic Sea and make themselves masters of that, where is your trade ? Where are the materials to preserve your shipping ? ' For, indeed, the ' naval stores ' of Baltic lands were as important to sea-power in the seventeenth and eighteenth centuries, as heavy industry was to be in more modern times.

There is, then, a danger of over-estimating the part played by the distant trade of the Eastern seas in the commercial economy of the Dutch. The northern waters, in which Dutch seamen made their first experiments, always continued to be an important item in Dutch prosperity. In the seventeenth century, it has been computed that more than one-half of the ships that left Dutch ports sailed into the North Sea and the Baltic. Some of the others turned south into French and even into Spanish ports (after 1648), and into the Mediterranean. What Venetian galleys had at one time brought, the Dutch seamen now went to fetch. Wheat from Sicily, wine, fruit and the produce of the Far East *via* the Levant, came in exchange for fish and manufactured goods. The amazing efflorescence of Dutch prosperity was built as much upon their trading connections in Europe as upon more distant commerce.

*The Dutch East India Company**

When, in the sixteenth century, the northern nations began to

* See also vol. 11 of the N.I.D. Handbook on the *Netherlands East Indies*.

challenge the supremacy of Spain and Portugal in the trade of the world, the Dutch had even more reason than the English and the French for injuring the power of Spain. To commercial rivalry was added the bitterness of their struggle against Spain at home, and Dutch seamen played a full part in the attempts to discover north-eastern and north-western passages to the riches of the East. The union of the crowns of Spain and Portugal in 1580 gave them their chance of attacking their arch-enemy, and the scattered Portuguese possessions in south-eastern Asia and elsewhere were more vulnerable to attack than the land empire of Spain in the New World. Thus it was that although the quarrel of the Dutch was with Spain, it was the Portuguese empire that suffered most from the Dutch attack.

Before 1580, Lisbon had been one of the centres of the Dutch carrying trade, and many Dutchmen had sought employment in Portuguese vessels and service. One of these men, Linschoten by name, had spent six years at Goa, and in 1595–6 he published a book (*Navigatio ac itinerarium*) revealing how slender was the Portuguese grip upon the eastern seas. Between 1596–1601, fifteen Dutch expeditions were despatched to the East ; and, in 1602, the various groups interested in these ventures were amalgamated by the States-General into the Dutch East India Company, which now became a powerful weapon against Spain.

The chief goal of the European powers in the East was not India but the wealthy spice islands of the Malay Archipelago. Here, the Portuguese possessions fell one by one before the attack of the Dutch. In 1617, Jan Pieterszoon Coen, a native of Hoorn, and scarcely thirty years of age, was appointed governor-general of the Company's affairs. He returned home in 1622, but was persuaded to take office again in 1627, and then remained in the East until his death in 1629. He had established his headquarters in 1619 at Batavia on the north coast of Java, and by the time of his death, Dutch prosperity had been firmly founded in the eastern seas. Beyond the Malay Archipelago, Dutch connections extended as far as Cambodia and Japan. In 1636 the Dutch entered Ceylon, which was conquered by 1658. In the meantime, trading posts were established on the mainland of India, and a calling station was set up at the Cape of Good Hope (1652). They also carried on trade with Persia and Arabia. The Company was at the peak of its prosperity in 1670, when it possessed some 150 trading ships and some 140 ships of war ; it was able to pay a dividend of 40%.

This outstanding position was not reached without a struggle with another power also intent on trading with the East. The English East India Company had been founded in 1601, and, as long as Portuguese power was undefeated, English and Dutch did not come into violent clash. But, especially after the truce with Spain in 1609, the Dutch attitude to the English traders grew more bold. 'Were they masters', Coen wrote home, 'the Dutch would quickly be out of the Indies, but praise be to the Lord, who has provided otherwise. They are an unendurable nation'. The English Company was an incidental product of English development; the Dutch company had behind it the whole backing of the state. The hostility of the two culminated in the 'massacre' of some Englishmen by the Dutch at Amboina in 1623. There was loud indignation in England; but by this time the English had virtually disappeared from the south-eastern seas of Asia, although English merchants managed to retain a share in the less important trade of the Indian peninsula itself. Nor did the Dutch permanently lose their rich eastern possessions despite all the vicissitudes of the eighteenth and nineteenth centuries. The Napoleonic Wars saw these colonies in English hands, but all were restored in 1815 except for the Cape of Good Hope, Ceylon, and a few points on the Malabar coast.

Not all the voyages of the Dutch seamen resulted in such rich gains as those offered by the spice islands, but they have left names important in the history of geographical discovery in both the Pacific and Australia. Janszoon (1606), Brouwer (1611), Hartog (1616), Schouten and Le Maire (1615–16), Hartogszoon (1616), Houtman (1619), Nuyts (1627), Tasman (1642–4), Van Delft (1707), Roggeveen (1721), and others too—all bear witness to the enterprise of the Dutch in the southern seas.

The Dutch West India Company

In 1621, another Dutch company was founded through the efforts of Usselincx, a merchant of Antwerp who had been forced by the Spaniards to take refuge in the northern provinces. It was granted the monopoly of trade on 'the barbarous coasts' of Africa and America. Settlements were planted on the North American coasts from 1625 onwards. Greater prizes lay to the south, however, and the renewal of war with Spain in 1621 (see p. 132), gave the new company ample opportunity for action. Some of the West Indian islands were taken from Spain, and settlements were also planted in the Spanish territory of Guiana and in the Portuguese territory of

north-eastern Brazil (1624). The Dutch were active, too, on the opposite coast of the Atlantic, and their settlements in West Africa, made at the expense of the Portuguese, gave them a good grip on the slave trade of the North Atlantic. The character of the Company can be seen from the way it opposed a suggestion for peace with Spain in 1633 on the grounds of the profit gained from the ' acts of hostility against the ships and property of the King of Spain and his subjects '.

These western possessions were not as lasting as those in the eastern seas. The Dutch were ejected from Brazil by the Portuguese during the years 1640–54 ; they exchanged New Amsterdam (or New York) for Surinam at the peace of 1667 (confirmed in 1674). During the Napoleonic Wars, their colonies were in English hands, but all were restored except for a part of Guiana. Not all remained in Dutch hands, however, and by the twentieth century only Dutch Guiana and a few West Indian Islands testified to the former place of the United Provinces among the trading empires of the North Atlantic.

Industrial and Commercial Development

The overseas expansion of Dutch commerce was reflected in industrial and commercial development at home. The republic had but few native raw materials and Dutch industries were therefore built up largely on the products of its empire. The processing of cocoa, the weaving and dyeing of cotton and silk, the refining of sugar, the blending of spices, the preparation of coffee—these and many other finishing or ' trafieken ' industries formed the basis of prosperity at home. Diamond-cutting, which had moved from Venice to Antwerp, now became important in Amsterdam, and remained there throughout the centuries. The construction of mathematical and nautical instruments and charts also flourished greatly, as might be expected in so maritime a nation. The Dutch, too, had the largest printing industry in Europe, and in the printing of maps and charts they particularly excelled. The work of Ortelius (1527–98) and Mercator (1512–94) was followed in the seventeenth century by the productions of the three great cartographic houses of Hondius, Blaeu and Janszoon. Their enormous atlases ran to many editions, accompanied by text in all the important European languages.

In this general industrial expansion, the republic was helped by its immigrants. From England came Protestants during Mary's

reign, Catholics during Elizabeth's reign, and Puritans during the Stuart period. From the Spanish Netherlands came Protestants during the war of independence ; while Jews came from Spain and Portugal. Protestants also came from France both before the Edict of Nantes (1598) and after its revocation (1685). From Germany, also, many immigrants came during the Thirty Years' War.

These industrial activities were paralleled by agricultural improvements. Much land was reclaimed, and many flood prevention schemes were undertaken (see p. 286). The introduction of roots and artificial grasses, and the extensive use of manure, gave bigger yields of food and fodder crops. By the eighteenth century, many countries in Europe had much to learn from Dutch husbandry. Market-gardening developed on the outskirts of towns, and the growing of tulips became a national industry. But, great as it was, this agricultural improvement could not outpace the technical development of the time. Much land still remained to be drained ; there was also a good deal of heath yet to be reclaimed. Some land was intentionally left without improvement. Thus the Boertanger Moor, in the north-east, was left untouched as a natural protection for the eastern frontier ; not until 1824 was agriculture and cattle-raising allowed there, and the work of settlement in the area did not really begin until 1868.

This general advancement was connected, in turn, with financial progress. Dutch business developments of the seventeenth and eighteenth centuries anticipated many of the features of later times—bills of exchange, trusts, joint-stock companies, speculative manias, commercial crises. The Amsterdam bourse replaced that of Antwerp as the chief money and stock market of Europe. Not only commercial companies, but princes, and even kings, came here to seek long or short term loans. Here, too, was the Bank of Amsterdam founded in 1609 on the model of the Rialto Bank established in Venice in 1587 ; it was the first institution of its kind in northern Europe.

This mundane prosperity of a Protestant community was reflected in the art of the time. Dutch painting sought its subjects not in madonnas and churches, but mainly in streets, windmills, kitchens, docks, ships, and in the shrewd countenances of bankers and merchants and of their wives. Hals (1584–1666), Rembrandt (1606–69), Vermeer (1632–75), De Hooch (1629–78), Ruysdael (1625–81) are only a few of the great galaxy. The origin of this flowering of Dutch art has been much discussed, but one thing is clear : ' From the time

of the political separation of the northern and southern Netherlands, but not before, in style as in the choice of subjects a definite North Netherlands school, not itself seriously divided by local differences, can be sharply distinguished '.*

The decline of the Dutch Republic

The Dutch republic did not maintain its commercial leadership for long. In the hundred years between about 1650 and 1750, England emerged from her struggle, first with the republic itself and then with France, as the foremost commercial and colonial power in Europe. During the War of the Spanish Succession (1702–13), and at the ensuing Treaty of Utrecht, it was already clear that the role of the United Provinces in the councils of the European states had become a secondary one.

The causes of this decline in relative importance are to be sought mainly in two facts. In the first place, it was not so much decline as lack of growth that was responsible for this secondary role. It has been estimated that Dutch commerce increased until about 1730, and that afterwards it remained fairly stationary. In the meantime, France and particularly England were advancing from strength to strength. Their larger size and their richer resources at home were beginning to be felt. The population of France in 1700 has been estimated at about nineteen millions, that of England at about five and a half, while that of the United Netherlands numbered only two and a half.† The figures can only be very approximate, but they are indicative. The second cause of the decline of the republic lay in political conditions at home, and may be summed up briefly by saying that the weakness of the central government made decisive action increasingly difficult (see p. 129).

Despite this relative decline, Amsterdam remained the most important money market in Europe. There was a time in the eighteenth century when one-third of the shares of the Bank of England, one-third of those of the English East India Company, and one-half of the English National Debt bonds were in Dutch hands. It is clear from this that the decline of Holland was far from being castastrophic. The process of decline has been summed up by saying :

* G. N. Clark, *The Seventeenth Century*, p. 350 (Oxford, 1929) ; see also pp. 113–20.

† Ibid. p. 9.

' First, Holland lost her intermediary position in world trade as other European countries developed their own shipping and port facilities, and direct trading routes were established between nations which had previously used Dutch shipping and trading agents '. Secondly, this decline in stapling organization was not counterbalanced by any fresh industrial developments to replace the *trafieken* industries which were suffering from foreign competition. ' Thirdly there was a gradual shift of interest from trade to finance—to insurance and credit banking, and, because of the low rate of interest in Holland, to foreign loan business and speculation. This did not necessarily indicate economic decline, but the recurrent crises due to an overdevelopment of speculation sapped confidence in Amsterdam, and indirectly strengthened the position of London '.*

Before the end of the eighteenth century, England and Holland were at war—in 1780–3 during the American Revolution (see p. 141), and again during the Napoleonic Wars (see p. 144). Now, most of her trade, and almost all her ships fell into English hands, as did her overseas possessions. It was at about this time that the great collapse of the Dutch East India Company came. It ceased to pay dividends in 1782, and it was dissolved in 1798; its assets were equal to only one-eighth of its obligations which were taken over by the government. With it fell the Bank of Amsterdam from which it had borrowed heavily.

When the United Provinces emerged from the Napoleonic Wars, all the Dutch possessions were restored by England except for the Cape, a portion of Guiana, Ceylon, and a few points on the Malabar coast. Her rich islands in the East Indies remained to her, together with some few islands and points elsewhere. But with the industrial revolution of the nineteenth century, the new kingdom of the Netherlands was to fall even more behind the great powers of Europe. Yet although she lacked the raw materials of heavy industry she entered the modern world not without certain advantages. Her skill in agriculture, her tradition of sea-faring and commerce, and the valuable remains of her colonial empire—all these were ingredients which enabled her to make an important contribution to the economy of Europe in the coming century.

* This paragraph is partly quoted from and partly based on C. H. Wilson, ' The Economic Decline of the Netherlands ', *The Economic History Review*, vol. 9, p. 113 (London, 1939).

The Kingdom of the Netherlands, 1830–1939

The Break-Up of the Union, 1830–9

THE BELGIAN REVOLUTION. The outbreak and swift development of the Belgian Revolution in the late summer of 1830* were viewed with mixed feelings by the Dutch nation. Of the three possible solutions of the problem thus created—the transformation of the kingdom into a unitary constitutional monarchy, the administrative separation of Holland and Belgium, and the complete severance of the two—Dutch opinion was solidly against the first as involving the shifting of the political centre of gravity from north to south. So long as administrative separation remained practical politics, this was the solution favoured in Holland, and it was in this sense that the States-General advised the king in September.

The failure of the royal forces to retake Brussels (23–26 September), followed by the rejection of the Dutch overtures for administrative separation, virtually ruled out a settlement on these lines; and when, in November, the Belgian National Congress declared almost unanimously in favour of an independent monarchy, the end of the Union was in sight. The only hope of saving it lay in the possibility that the Conference which had assembled in London in response to William I's appeal for the support of the Powers would regard the break-up of the Kingdom as inconsistent with European security. But of the five Powers represented, France was determined to oppose any attempt to restore the kingdom; Britain would not support any settlement which involved a breach with France or conflicted with the national aspirations of the Belgians; while Austria, Prussia and Russia, preoccupied with problems in Germany, Italy and Poland, were in no position to insist on restoration. The decision of the Conference (December 1830) to accept the principle of Belgian independence was therefore the logical outcome both of affairs in Belgium and of the general European situation; but in applying that principle the Conference adopted a strictly historical and legal standpoint. Holland was to retain all the territory of the old republic; Luxembourg was to be excluded from the settlement on the ground of the peculiar status it had acquired in 1815; while the division of the national debt, of which slightly more than half was to be borne by Belgium,

* See the N.I.D. Handbook on *Belgium*, p. 113.

reflected the fact that this debt had been partly accumulated from wars fought in defence of the southern Netherlands.

THE ESTABLISHMENT OF THE BELGIAN KINGDOM, 1831. These terms secured the king's assent; had they been accepted by Belgium the Dutch people would have considered themselves well out of a union which they had never liked, and which in many respects had seemed to operate to their disfavour. But in Belgian opinion the historico-legal justification of these terms counted for little beside what it considered their fundamental injustice; and after the rejection of the candidature of the Duc de Nemours to the Belgian throne, the Conference's own candidate, Prince Leopold of Saxe-Coburg, exacted a revision of these terms as the price of his acceptance. Despite its former description of the terms as 'final and irrevocable', the Conference made considerable changes in favour of Belgium, and upon the acceptance of the modified terms (the XVIII Articles) by the Belgian Congress, Leopold ascended his new throne (July 1831).

In Holland what appeared to be the surrender of the Conference to Belgian intransigence rallied opinion in support of the king, and William seized this favourable opportunity of sending his army into Belgium and routing the raw Belgian forces in the Ten Days' Campaign (August 1831). Only the entry of a French army, hastily authorized to act in the name of the Conference, saved Brussels from reoccupation.

The Ten Days' Campaign was the result of a shrewd analysis of the situation and fully achieved its object of exposing the weakness of the state which the Conference was erecting on the north-east frontier of France—a lesson which the pressure needed to secure the withdrawal of the French army from Belgium could not fail to drive home. The Conference's third set of proposals (the XXIV Articles) therefore modified both the territorial and the financial terms in favour of Holland. It needed a threat of abdication from Leopold to secure the assent of the Belgian Chambers to these articles, but on 15 November 1831 the treaty was signed by which the powers recognized the independence and neutrality of Belgium. The grand duchy of Luxembourg was to be divided, and the king of Holland was to receive a portion of the province of Limburg in exchange for that part of Luxembourg assigned to Belgium (Fig. 38). The Scheldt was to be opened to navigation, but Holland was to have the right to impose a toll at the mouth of the river. The national debt was divided.

NEGOTIATIONS, 1831–9. That nearly seven years passed before this treaty (not without further changes) could be incorporated in a final settlement between Holland and Belgium was due largely to the obstinate optimism of William I. The success with which he had flouted the Conference in August 1831 only strengthened his conviction that if he could but avoid committing himself long enough the situation must eventually turn in his favour. At first he had the additional motive of wanting to retain the strategic advantage which the possession of the citadel of Antwerp gave him, and which more than offset the complete freedom on the Scheldt now enjoyed by Belgium. After fruitless negotiations during 1832, Britain and France (the other Powers declining to co-operate) resorted to coercion. In November 1832 a French army besieged the citadel and an Anglo-French fleet blockaded the Dutch ports. After a gallant defence the citadel surrendered on 22 December, and the French army withdrew; but the embargo and blockade continued in force until the Convention of 21 May 1833 secured Belgium against any further dangers from the Dutch king.

Dutch public opinion had warmly supported the king's policy of resisting the sanctions of the Conference, and on the strength of this support William succeeded in blocking the further negotiations of 1833. But the Convention had deprived the king of his advantageous position, and the situation was now wholly in favour of Belgium, for not only were Luxembourg and Limburg, including much territory which the XXIV Articles awarded to Holland, treated as part of Belgium, but the Belgian government was released from its financial obligations under the Treaty, pending a final settlement. In these circumstances William I rapidly lost the support of the Dutch people for his 'wait and see' policy. The prosperity of Belgium, and especially of Antwerp, made an ever sharper contrast with the depression into which Holland sank under the burden of public expenditure and indebtedness. It was not, however, until March 1838, after nearly five years of this ruinous situation, that the king bowed to the inevitable and accepted the XXIV Articles.

It was now the turn of the Belgians to be troublesome, but, save for modifications in detail, the Conference stood by the XXIV Articles. Accepted first by Holland and then with great reluctance by Belgium, these articles were embodied in the three treaties of London of 19 April 1839, which brought the long-drawn-out negotiations to a close. Belgium gave up eastern Luxembourg and

eastern Limburg to the king of Holland in a personal capacity; and Limburg, like what remained of Luxembourg, now became part of the Germanic Confederation.* Belgium's liability for the national debt was reduced by more than one-third. The navigation of the Scheldt was opened, subject to a toll, and it was not until 1863, and only then after long negotiation, that Belgium was able to buy out this right.

The Period 1839–87

CONSTITUTIONAL PROBLEMS, 1839–48. For Holland, hardly less than for Belgium, the settlement of 1839 marked the opening of a new era. For the first time since 1795 the Dutch nation was free to work out its political destiny unhampered by external ties. The final separation from Belgium could not fail to be followed by domestic reconstruction; indeed, the realization of this fact was partly responsible for William I's obstinate refusal to accept what had been inevitable since 1833. For what had been at stake since 1830 was not only the Union; it was the whole autocratic system—a relic of the 'enlightened despotism' of the last century—identified with the king. In a Europe divided into two camps, a liberal West and an autocratic East, Holland, with her great tradition of liberty, clearly belonged to the liberal camp; only the system of royal absolutism and the impact of the Belgian revolution had so long attached her to the other.

The abdication of William I in October 1840 removed the greatest obstacle to the political re-orientiation of the country. His son and successor, William II, had the qualities proper to a constitutional monarch, and these contributed not a little to the relative ease with which Holland passed through the crisis of 1848. Even before William I's abdication the liberals had won a small measure of constitutional reform, including the principles of ministerial responsibility and parliamentary control of finance (1840). But the campaign for fundamental reconstruction, inspired and led by the greatest of Dutch liberals, J. R. Thorbecke (1798–1872), gathered strength during the 1840's and was reinforced by popular discontent, especially after the failure of the potato crop in 1845–6. The revolutionary year 1848 therefore found Holland in a state of political

* Limburg was not fully incorporated into the kingdom until 1867; while on the death of William III in 1890, when the throne passed to his daughter Wilhelmina, the grand duchy of Luxembourg went under the Salic Law to a kinsman, Adolph, Duke of Nassau; see p. 162–3.

and social tension, and but for the king's timely initiative in the matter of constitutional revision the country might have undergone a violent upheaval.

THE CONSTITUTION OF 1848. The revised constitution, based on the work of a commission which included Thorbecke and other prominent liberals, came into force in November 1848. It established the 'four freedoms' cherished by contemporary Liberalism—freedom of worship, of speech, of the press, and of public meeting. The form of government was converted into a constitutional monarchy of the orthodox type. The king retained the executive power; to him were entrusted the command of the armed forces, the conduct of foreign relations, the right of declaring war and concluding peace, the administration of the colonies, and the power of dissolving the States-General; but in these and all other matters he was to act on the advice of Ministers, who were responsible to the Chambers for all executive acts. A Council of State (like the name of the legislative body, this title recalled an organ of the old Republic), of fourteen members, and under the presidency of the king, had to consider all proposals made to or by the States-General. Legislative power was exercised jointly by the king and the two Chambers of the States-General. The First (or Upper) Chamber of thirty-nine members was elected by the Provincial States from those paying the highest amount in direct taxes; its members served for nine years, but one-third of the Chamber was elected every three years. The Second (or Lower) Chamber of sixty-eight members* was elected by direct vote of all adult males paying not less than 20 guilders in direct taxes, the electorate being grouped in equal districts; members served for four years, but half the Chamber was elected every two years. Provincial and communal administration was reorganized on similar lines.

PARTIES AND PROGRAMMES, 1848–87. Three main parties contended for the support of the limited electorate (about 100,000 in a population of 3 millions) enfranchised in 1848–50: the Liberal, Anti-Revolutionary and Catholic parties. To the Liberals the new constitution was a means to an end, the transformation of Holland through free political activity into a society in which the individual found the greatest scope for self-development. The Liberals were fortunate in their leadership: in Thorbecke they had not only the ablest of Dutch parliamentarians, but a

* One member for every 45,000 population.

statesman of European reputation. The Anti-Revolutionary party was the party of the Dutch Reformed Church ; it saw in Calvinism the true foundation of Dutch social and cultural life, and strove to protect religion from the attacks of the more secular-minded Liberals. Its leader, Groen van Prinsterer, was an eminent historian who reinterpreted Dutch history in the light of these politico-religious principles. The Catholics resembled the Anti-Revolutionaries in being essentially a religious party. The historic enmity between the two creeds remained standing for a time in the way of their co-operation—how high religious passion could still run was shown by the outburst against the establishment of a Catholic hierarchy in Holland in 1853.

Since the Liberals alone commanded enough support in the country to give them an absolute majority in the Second Chamber, the parliamentary history of this period is the history of Liberal majorities and governments alternating with uneasy coalition governments recruited from Anti-Revolutionaries and Catholics, together with the handful of pre-1848 Conservatives. Such coalitions were invariably weak and timid ; the Liberal governments tended to be stronger, but they too had their difficulties, notably that personal antipathy between William III, who had succeeded his father in 1849, and Thorbecke, which was one of the motives for occasional royal interventions of doubtful propriety in the political arena. The resulting weakness of ministries *vis à vis* the Chamber was from the outset a defect in the Dutch parliamentary system, and one moreover which was to grow more serious as time went on.

THE PRINCIPAL REFORMS. Of the reforms undertaken during this period none was more important or aroused greater controversy than the development of State education. As in England at the same period, the chief issue was the place of religion in primary education. The Liberals wished to encourage undenominational or ' mixed ' schools, in which religious instruction should be limited to the common ground of all creeds. This principle was opposed by both Anti-Revolutionaries and Catholics, who wanted State support for denominational or ' separate ' schools, although each was jealous of any favour being shown to the other. After the failure of a bill (1854) affirming the general principle of ' mixed ' education but containing provision for ' separate ' schools, an act was passed (1857) embodying this principle, but with some practical concessions which split the religious opposition. The concessions were, how-

ever, resented by Liberal opinion, especially that of the younger generation which came to the fore in the 1870's. On the strength of the Liberal victory at the elections of 1877, therefore, the progressive Liberal Prime Minister, Kappeyne, carried a new Education Act which put ' separate ' schools at a disadvantage compared with the State schools. It was their common opposition to this measure which knit the two religious parties together in the ' Christian ' coalition which was soon to wrest their ascendancy from the Liberals, and a reassertion of the claims of denominational education became the main plank in their programme at the time of the constitutional revision of 1887.

Liberalism also inspired the notable reforms in financial and commercial policy which marked this period. The liquidation of the immense financial burden resulting from the Belgian Revolution was the principal achievement of F. A. van Hall, who in the 1840's cleared off the mounting arrears and reduced the annual debt charge to manageable proportions. Thorbecke, in the course of his first Ministry (1849–53), abolished or reduced many fiscal hindrances to free internal and external trade, and began that shifting of the burden from indirect to direct taxation which was a feature of the century. But the *laisser faire* of Dutch Liberalism did not preclude considerable State intervention in the economic field. The middle years of the century saw a renewal of the large-scale reclamation of inundated land begun in the seventeenth century : the Haarlemmermeer was drained and poldered, and has since become the centre of intensive cultivation. Thorbecke's second Ministry (1862–6), besides taking the country a further long stage towards complete free trade, also promoted important public works, including the construction of the North Sea Canal between Amsterdam and Ymuiden and improvements in the Maas between Rotterdam and the sea. The province of Holland had long been famous for its towns, but it was only now that these towns began that rapid growth which has produced the heavy urban concentration of present-day North and South Holland. In general, it may be said that Thorbecke and his contemporaries put their country into a most favourable position to seize the opportunity that the last quarter of the century was to bring.

There is unfortunately a darker side to this picture of a country emerging from the political and economic stagnation of the later years of William I—in the colonial sphere. The rehabilitation of the national finances, and to a less extent the revival of the national

economy as a whole, would not have been possible but for the harsh exploitation of the Dutch colonies, especially those in the Far East, through the institutions of slavery and of the ' cultivation-system ' (*cultuur-stelsel*). Those institutions the States-General inherited in 1848 from the previous royal administration of the colonies, and Dutchmen can hardly reflect without shame on the lapse of time before their suppression. Slavery was abolished in the East Indies in 1860 and in the West Indies in 1863, and the cultivation-system in the East Indies would have disappeared at the same time but for the opposition of Thorbecke and some of his colleagues ; eventually the system was abolished in 1871.

FOREIGN RELATIONS, 1839–87. After the separation from Belgium, Holland found herself playing a smaller role in European affairs than at any time since the achievement of her independence. (The outburst of historical study, especially of the ' heroic ' period of Dutch history, was in some measure a compensation for her decline in Europe.) Thus Dutch foreign relations after 1839, although of interest in the national history, are of small significance in the history of Europe. The most important episode in which Holland was directly involved was the question of Luxembourg in 1867.

In 1815 Luxembourg had been erected into a grand duchy and its sovereignty vested in the male line of the House of Orange, with reversion to the elder branch of the Nassau family. By the settlement of 1839 William I ceded a portion of Luxembourg to Belgium and received in exchange a strip of Limburg linking Maastricht, formerly an *enclave*, with the rest of Dutch territory. Both were made member-states of the German Confederation ; the status of Limburg became still more complicated when it was brought within the scope of the constitution of 1840 and thus became virtually a Dutch province. The anomalies of the position of Luxembourg and Limburg occasioned some friction during the next quarter-century, especially in 1848, but it was not until Prussia's victory of 1866 over Austria and her allies of the Confederation that they became a subject of European concern. Early in 1867 negotiations were undertaken for the sale of Luxembourg by William II to the Emperor Napoleon III, who wanted this territory both for reasons of prestige and of defence. The transaction was on the point of conclusion when Prussia announced that the French acquisition of Luxembourg would constitute a *casus belli*. The solution of the difficult problem created by this unexpected threat was left to an international con-

ference meeting in London. The conference ruled that Luxembourg should remain independent under Orange sovereignty, but should become a neutral state like Belgium, and that Dutch Limburg should be incorporated into the Netherlands. Three years later, when France and Prussia went to war, both respected the neutrality of Luxembourg as well as of Belgium.

In Holland the crisis caused much excitement and ill-feeling, which culminated in the overthrow of the coalition then in power for its alleged mismanagement of the affair, but as the London settlement did nothing to strengthen the slender tie connecting the grand duchy with Holland, this was left to be severed in 1890 by the operation of the succession law.

THE 'SEVENTIES AND 'EIGHTIES. In the late 'seventies and early 'eighties it became clear that there were new forces at work in Dutch society which could find no adequate political expression within the framework of the existing constitution. The expansion of trade and industry, the growth of towns, and the spread of education, were rapidly developing a politically-conscious and articulate lower-middle and working class, whose aspirations the old political parties could neither share nor formulate. On the one hand, the Liberal party, even after the death of Thorbecke (1872), remained essentially the party of the professional and commercial middle class, although a progressive or radical element was beginning to make itself felt. On the other, the two religious parties, although they also, especially the Anti-Revolutionaries after the death of Groen (1876), to some extent refashioned themselves on more democratic lines, represented the vertical divisions of society into creeds, a division which was to be increasingly obscured and confused by the horizontal lines of social cleavage. Moreover, as the existing parties felt the impact of the new forces, they lost some of that cohesion which is essential to the successful working of a party system, and the old party alignments gave place to a confusion of groups and factions. It was the impossibility of constructing Ministries on party lines which led to the formation, in 1878, of the non-party Ministry of Van Lynden, which was followed in 1883 by a fresh coalition under the veteran Heemskerk, who relied on tactical skill and opportunism to take the place of a coherent programme founded on principle.

The growing recognition of the bankruptcy of the existing system lent force to the demand, first formally expressed in the Chamber in 1882, for a revision of the constitution and in particular for a

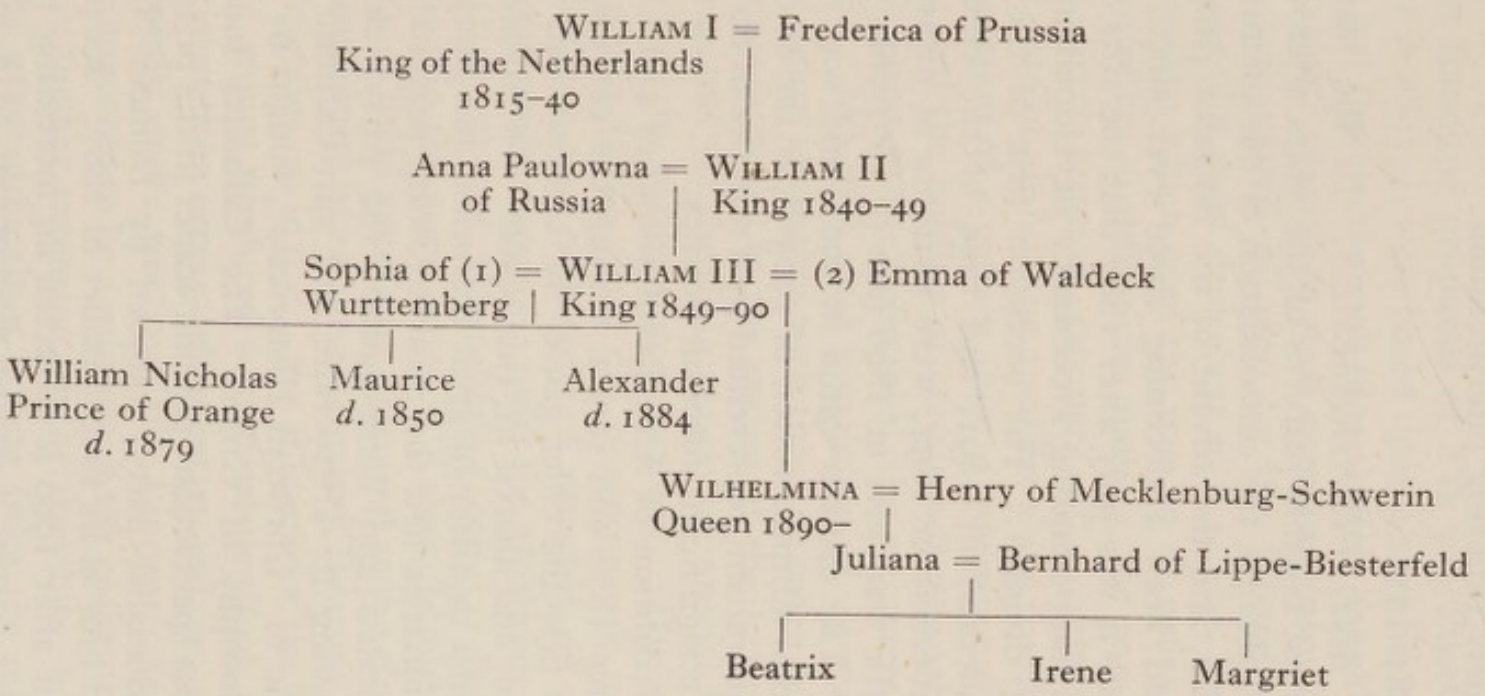
bold extension of the franchise. Revision was already becoming a necessity on other grounds. The birth in August 1880 of a princess, now Queen Wilhelmina, to the ageing William III, dispelled the fear of the extinction of the royal house to which a catastrophic series of deaths had given rise, but the death of the last male heir in 1884 made it certain that this princess would succeed as a minor, a contingency which necessitated a change in the constitution. The reorganization of the army, rendered urgently necessary since the Franco-Prussian war had exposed the weakness of the national defences, was also impossible without an amendment of the constitution.

The government's proposals for revision were submitted to the Second Chamber in March 1885. They were withdrawn in April 1886 after an alliance of Anti-Revolutionaries and Catholics had demanded concessions in education as the price of their acceptance. The elections which followed strengthened the elements in favour of an extended franchise, to which the king gave his assent, provided it did not extend to full manhood suffrage. New bills were now introduced, and having been accepted by two successive States-Generals, as required by the existing constitution, they received the royal assent and came into force on 30 November 1887.

THE CONSTITUTION OF 1887. The principal changes introduced concerned the succession to the throne, the franchise, the composition of the Chambers, the administration of justice, and the organization of the army. The membership of the First Chamber was raised from 39 to 50, and that of the Second from 86 to 100. The method of election, by indirect vote through the Provincial States to the First Chamber, and by direct vote in equal electoral districts to the Second Chamber, remained unchanged. As before, members of the First Chamber were to sit for nine and those of the Second for four years, but whereas the First Chamber was still to be renewed by one-third every three years, the Second was now to be elected *en bloc*.

With the two major issues of the franchise and of education, the revised constitution dealt only in general terms. Thus article 80 laid down that members of the Second Chamber were to be elected ' by the male inhabitants . . . who fulfil the requirements of the election law as to aptitude and social condition and have attained . . . not less than 23 years '. The election law in force was still Thorbecke's law of 1850, which made the payment of a minimum of 20 guilders in direct taxes the principal qualification ; how far

The House of Orange from 1815



this could be revised according to the terms of article 80 had yet to be determined. Similarly, the new article 192 relating to public instruction stipulated that this should be an object of care to the government, which was to organize public instruction, and itself provide primary education, throughout the country, ' the religious opinions of everybody being respected '. This article, too, was capable of widely differing interpretation.

The Period 1887–1918

PARTIES AND PROGRAMMES. In the history of party politics, the most notable features of the years after 1887 were the eclipse of the Liberals, the consolidation of the alliance between the religious parties, and the advent of the Socialist party. Orthodox Liberalism had been a declining force ever since the death of Thorbecke, but it was only after 1887 that the rifts which already threatened its long-standing ascendancy developed into permanent and crippling division. The secession first of the radical wing (Liberal-Democrats) in 1891, and then of the conservative (Independent Liberals) in 1894, were portents of disaster which the extension of the franchise in 1896 (see p. 167) only postponed for a few years. The disaster came in 1901, and was repeated, after the brief Liberal administration of 1905–7, at the elections of 1909. Thereafter Liberalism, represented by a number of dissident groups, ceased to be a significant force in politics.

It was the coalition of Anti-Revolutionaries and Catholics, foreshadowed since 1878 and forged during the campaign of 1885–7, which was at first the chief gainer by the revision. Both parties contributed to, and shared in, this result. In Abraham Kuyper, a former Calvinist minister of great oratorical and literary power, the Anti-Revolutionaries had the most arresting personality in politics, who reinvigorated and democratized the party, although at the cost of alienating its aristocratic and anti-Catholic wing, which, under the title of ' Christian Historicals ', sought to keep alive the political philosophy of Groen. The Catholics found a scarcely less able, if less spectacular, popular leader in the priest, Dr Schaepman. The Socialist party, founded by Domela Nieuwenhuis in 1881, secured him as its first member in 1887. Its progress was at first slow, but after 1900 it attracted an increasing following away from the other parties. At the elections of 1913, sixteen Socialist members were returned, and the party held the balance of power in the Chamber.

THE PRINCIPAL REFORMS. The two great issues left partly open in 1887, education and electoral reform, dominated political activity during the closing years of the century. The Coalition Ministry led by Mackay (1887–91) gave as much State support to denominational schools as the terms of article 192 would allow (1889), but this still fell far short of the coalition's ultimate goal of equality of treatment for ' mixed ' and ' separate ' schools. The franchise proposals of Tak van Poortvliet, Minister of the Interior in 1893–4, were based upon a very liberal construction of article 80, but the elections of 1894, largely fought on this issue, returned a majority adverse to such sweeping enfranchisement, and the electoral law carried in 1896 by the Liberal government of Van Röell stopped a good deal short of it. This law introduced a complicated system which gave the vote to all males of twenty-five possessing one of six qualifications, namely, the annual payment of 1 guilder in direct taxation, payment of a certain annual rent, ownership or hire of all but the smallest ships, receipt of a certain salary or possession of a certain sum in government bonds or at a savings bank, and the holding of certain educational qualifications. The new law approximately doubled the electorate, raising it to nearly 750,000 ; but in a total population of 4½ millions this remained a low figure compared with those of other democracies.

Disappointing as it was to the parties of the Left, this extension of the franchise was yet the main reason why social legislation now came to the fore in parliamentary activity. The government of Goeman Borgesius (1897–1901) did pioneer work in the fields of industrial insurance and housing and rounded off the system of compulsory universal education ; and the Coalition Ministries led by Kuyper (1901–5) and Heemskerk (1909–13) both included a vigorous worker in the same cause in Talma, Minister of Labour. A great project of State insurance, promised at the elections of 1909, was still in preparation when the Heemskerk ministry fell in 1913.

As in the 'eighties, so in 1913, the splitting of the Left into more or less hostile groups produced a political deadlock which made it necessary to resort to an extra-parliamentary and non-party, although ' leftist ', Ministry under Cort van der Linden. At the outset its principal task appeared to be a solution of the parliamentary problem by means of a further extension of the franchise, but it was soon faced with the grave difficulties arising from the outbreak of war in 1914. If, however, the critical situation put many fresh obstacles in the way of constitutional revision, it also made revision more

necessary than ever. The national solidarity fostered by the country's isolation led, after a lengthy campaign in the States-General, to agreement upon a series of constitutional amendments, which came into force on 12 December 1917.

THE CONSTITUTION OF 1917. The essential changes concerned the two longstanding questions of the franchise and of education. The new electoral laws passed between 1917 and 1922 in conformity with articles 81–83 of the constitution extended the franchise to all men and women of twenty-five years, and introduced a system of proportional representation in national, as well as provincial and local, elections. These sweeping changes, so long demanded by the Left, secured the necessary support from the Right in exchange for the constitutional recognition of the principle, for which the religious parties had striven even longer, of equality of treatment for 'mixed' and 'private' schools. Thus the constitutional revision of 1917, based upon agreement of all the main political groups, appeared to offer a final settlement of the two questions which had for half a century or more dominated, and in a sense obstructed, Dutch parliamentary development.

THE WAR OF 1914–18. Although by the close of the nineteenth century Holland had already taken that neutral stand in European politics which she was to maintain until May 1940, her geographical position could not fail to make Dutch policy, especially in the matter of national defence, a subject of great interest, and on occasion of sharp controversy, among her neighbours. The army, reorganized on the basis of compulsory service some time after the constitutional revision of 1887, became an effective deterrent to the adoption elsewhere of military plans involving violation of Dutch territory. Conceived in the same spirit, but misunderstood and severely criticized by Entente opinion, was the proposal of 1910 to fortify the mouth of the Scheldt. But Holland gave no European government any reason to doubt the sincerity of her determination to remain neutral, and to defend her neutrality by force in the event of war.

No neutral felt more severely the effects of war when it eventually came in 1914. Surrounded by belligerent states, and with operations taking place only just beyond her borders, Holland had difficulty in asserting her neutral rights against the powerful combatants. That she so far succeeded was due, first, to the praiseworthy impartiality with which she conducted herself towards them, and secondly, to her clear determination, backed by the full mobilization of her army and navy throughout the war, to resist any serious

infringement of her neutrality. The difficulties with which she had to contend were of two kinds, those arising from conflicting interpretations of international law, and those caused by the impact of the war on Dutch economic life ; but both were due ultimately to the fact that Holland controlled one of the best developed trade routes between Germany and the outer world. Germany naturally wished to take advantage of this route, both as a gap in the Allies' blockade, and as a supply line to her forces. But from the start of the war Great Britain's command of the sea enabled her to dictate the amount and character of Dutch imports from abroad, and as the war went on these were cut down to the bare minimum adjudged necessary for Holland's own consumption, and left no margin with which to pay for equally indispensable goods, such as coal, which she drew from Germany.* This stringent control applied no less to imports from the Dutch colonies than to those from foreign countries. The very restricted trade thus allowed was, moreover, subject to increasing risks from mines and submarines, and when in 1917 Germany embarked upon unrestricted U-boat warfare it practically stopped altogether. The combined effect of the blockade and counter-blockade was therefore to produce in Holland towards the close of the war a food problem hardly less serious than in Germany.

To a country like Holland, which had prospered through the free international exchange of goods, the slow strangulation of trade, and with it of the industries which relied upon imported raw materials, meant not only the threat of starvation, but a creeping paralysis affecting every branch of economic life. The maintenance of more than 500,000 men under arms (about one in twelve of the population) served to conceal the real extent of unemployment ; but the financial burden of keeping the country on a war footing amounting to nearly *f.* 2,500 million, or about ten times the pre-war budget, was itself a serious aggravation of the problem.

Between the Two Wars, 1918–39

THE POLITICS OF THE 1920's. The main interest of Dutch politics in the period ' between the wars ' lies in the working-out of the constitutional reforms of 1917. Of the two major changes then made—the settlement of the education question and electoral

* The war-time shortage of coal led to increased exploitation of the Limburg mines, the only ones in Dutch territory.

reform—the first might have been expected to loosen, if not to dissolve, the coalition, whose principal *raison d'être* the education conflict had thus far furnished; and indeed, after a period of coalition government (1918–25) under Ruys de Beerenbrouck, Holland's first Catholic Prime Minister, and afterwards under the Anti-Revolutionary leader Colijn, the split between the two parties over diplomatic representation at the Vatican, and the consequent fall of the Colijn government (November 1925), appeared to herald a new party alignment. The soundest basis for such a regrouping would have been an alliance between the Catholics, the largest party after the 1925 elections, and the Socialists, whom the extended franchise had helped to make the second largest party, with twenty-four members. But the attempt to forge this alliance in 1925 failed, and the resulting deadlock led, as in 1913, to the formation of an extra-parliamentary cabinet, under De Geer. This was a disappointing anti-climax, following so quickly upon the electoral changes by which it was hoped to overcome the difficulty of recurrent stalemates. Critics of proportional representation point to the adoption of that principle as an important contributory cause of the difficulty. Although modified soon after its introduction to mitigate this particular evil, the system certainly accentuated the tendency, so long apparent, of Dutch parties to break into small fragments and thus increased the difficulty of forming stable and resolute governments. Moreover, by enlarging the rôle of party organizations, it probably also contributed to that strengthening of the 'professional' political element in the Chambers which was a feature of this period.

ECONOMIC PROBLEMS. After the temporary stimulus afforded by the return of peace-time conditions was removed, it became clear that the twin pillars of the Dutch economic system before 1914—agriculture and trade—were both seriously weakened. Although Dutch agriculture was highly efficient and well-organized, it had difficulty in holding its own in the face of overseas competition. In these circumstances it was a bold act of the government to undertake and press on vigorously with the long-projected reclamation of the Zuider Zee, which when completed will add 7% to the land area of Holland. Dutch trade was particularly hard hit, for not only had world trade shrunk in volume, but the Dutch share of it was especially vulnerable in post-1918 conditions, dependent as it was so heavily upon the Central European hinterland.

With agriculture and trade both threatened, it is not surprising

that this period should have seen a considerable expansion of Dutch industry. The Limburg coalmines quadrupled production in the twenty years following 1918. Lack of other mineral resources restricted Dutch enterprise largely to light industries, but firms like Fokker's (aircraft) and Philips' (electrical apparatus) established international reputations.

The economic problems of the decade following 1918, serious as they appeared at the time, were eclipsed by those arising from the world depression of 1929–33. To protect themselves from the full fury of this economic blizzard the Dutch were driven to institute a set of controls without precedent (save during the later war years) in their history. At first improvised to meet the most urgent needs, these controls had by the late 1930's hardened into a regular system, with a managed currency (Holland went off gold in 1936), import quotas, and State subsidies as its leading features. Thus within a few years the country was forced to abandon the free-trade system on which its prosperity had been built up during the previous seventy-five years (see p. 406).

THE POLITICS OF THE 1930's. It was the impact of the depression which led to the formation in 1933 of a 'national' government headed by Dr. Colijn, the strongest political personality in the country, and supported by all the conservative groups. This government pursued an orthodox deflationary policy which, while it involved much individual hardship and provoked vigorous Socialist opposition, brought the country safely through the worst of the crisis. It also tackled the increasingly urgent problem of national defence, both at home and in the colonies; but, as the event was to prove, nothing could have been accomplished, with the limited means and within the brief time available, which could have saved either the motherland or the Eastern empire from disaster. The Colijn ministry was succeeded in 1939 by another coalition in which the Socialists took part and in which Socialist ministers for the first time held office. It was this government which followed Queen Wilhelmina into exile in May 1940.

The years of depression saw the birth of the Dutch Nazi movement (*Nationaal Socialistische Beweging*, abbreviated to N.S.B.), led by A. A. Mussert, an engineer in government service who later forfeited his post under the law forbidding membership of the N.S.B. to State servants. The Dutch movement closely followed the German in its doctrines, tactics and organization. At first it had some success among Dutch youth and among the worst sufferers from

the depression, but after its gains in the 1935 provincial elections (when it secured 8% of all votes cast) its fortunes declined, and long before 1940 the vast majority of the people regarded its members as actual or potential traitors, a view which their rôle during and since the German invasion has proved substantially correct.

FOREIGN RELATIONS, 1918–39. In the years immediately following 1918 Holland suffered from a wave of unpopularity in Allied countries which was the more regrettable because it was largely, if not wholly, undeserved. The government's refusal to surrender the ex-Kaiser, although based upon the same strictly legal attitude which Holland had consistently upheld during the war, could hardly fail to arouse Allied resentment. Anti-Dutch feeling was strongest in Belgium, where the government was tempted to foster, rather than to discourage, it because of the claims which that government now brought forward involving Dutch sovereignty.

The principal demand put forward officially by Belgium was for a new regime on the Scheldt and neighbouring waterways (see p. 627). But there was also an unofficial, or semi-official, programme which claimed the cession by Holland of two territories represented as being essential to Belgian security—Zealand Flanders and Dutch Limburg. Despite the violent agitation behind these demands, the Allied Powers could not countenance claims which were wholly lacking in historical or legal justification, and the campaign achieved nothing save to hinder Belgo-Dutch collaboration for some years.

In one respect the international position of Holland underwent an important change after 1918. By accepting membership of the League of Nations, the Dutch government modified the country's neutral rôle, since Holland was thereby committed to join in the enforcement of collective security. So long as the League appeared capable of organizing such security, this was a justifiable departure from tradition ; but when it became clear that collective security was a myth, and that the states of Europe must look to their own salvation, Holland had reason to revise her view as to the propriety and utility of her League commitments. Belgium pointed the way in 1935 by voluntarily resuming neutral status, although no longer under international guarantee. Holland soon followed Belgium's lead, as did several other minor states. Their common interests and outlook drew these states together into a group (the ' Oslo ' group), with periodic meetings to discuss political and economic problems. It was this group which on 23 August 1939 appealed to the Powers to spare humanity a second world war ; their appeal

was repeated a few days later by the Queen of Holland and the King of the Belgians. But by then the situation was irreparable.

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CHAPTER VII

GOVERNMENT, ADMINISTRATION AND LAW

Central Government : Political Parties : Provincial and Local Government : *Waterstaat* : Legal System : Police System : Bibliographical Note

The Netherlands constitution as it existed on the eve of the German invasion of 1940 was the product of a century and a quarter's development. The first constitution or fundamental law (*Grondwet*) was promulgated in 1814 on the re-establishment of the Netherlands as an independent state ; this constitution placed little check upon the royal authority, but by means of a series of revisions, notably those of 1848, 1887 and 1917, it has gradually been converted into a democratic parliamentary constitution. The constitution itself lays down the procedure for revision. Any amendment must be passed by both Chambers of the States-General, receive the royal assent and be promulgated like any other law ; the two Chambers have then to be dissolved and new ones elected, by which the amendment must be passed again, this time by a two-thirds majority and within thirty days of the election.

The text of the constitution is long and unusually detailed. It is divided into eleven chapters, and the principal subjects treated are : the Crown and its advisers ; the States-General ; the Provincial States and communal administration ; justice ; religion ; defence ; public works (*Waterstaat*) ; and education and public assistance.

Central Government

The Crown

The sovereignty of the Netherlands is vested in the House of Orange-Nassau. The succession lies in the male line, but failing a male heir passes to the female line. In default of a legal heir the sovereign and a specially augmented States-General have power to designate a successor, and if there is neither sovereign nor legal heir the States-General alone exercises this power. The sovereign and heir both attain majority at the age of eighteen, and the constitution makes provision for a regency during the minority of a sovereign. The sovereign may not wear any other crown, nor may the seat of

government be transferred outside the country (but this last provision has been suspended during the German occupation).

The present sovereign, Queen Wilhelmina, was born in 1880 and succeeded her father, William III, in 1890. Until she reached her majority in 1898, her mother, Queen Emma, acted as regent. Queen Wilhelmina married in 1901 Prince Henry of Mecklenburg-Schwerin, who died in 1934. Their only child, Princess Juliana, was born in 1909, and married in 1937 Prince Bernhard of Lippe-Biesterfeld. There are three daughters of this marriage : the Princesses Beatrix (born in 1938), Irene (born in 1939), and Margriet (born in 1943 in Canada, where Princess Juliana went with her children in August 1940). There has been no male representative of the House of Orange since the death in 1890 of King William III (see table on p. 165).

By the constitution the sovereign alone wields the executive power in the state. This includes the command of the armed forces, the conduct of foreign relations (although since 1922 the sovereign has not been able to make war or peace, or ratify treaties, without the assent of the States-General), the appointment of ministers, and the right to dissolve the Chambers either separately or together ; but in all matters the Crown has to act on the advice of its ministers, who are both legally and politically responsible for its acts. In practice, therefore, the role of the sovereign in the Netherlands approximates closely to that of the King in this country. The analogy also applies to the general position of the Dutch royal family in the national life ; indeed, as her reign lengthens, and especially since the death of her consort, Queen Wilhelmina is coming to enjoy a position comparable with that of Queen Victoria. The Dutch royal house is wealthy (in addition to the civil list and revenues from royal domains it has a large private fortune), but the simplicity of its way of life, symbolized perhaps by its regular use of that democratic vehicle, the bicycle, is one important factor in its popularity. The Queen and Princess Juliana are also acknowledged leaders in the promotion of schemes of social welfare.

The Council of State and the Ministers

In wielding the executive power the Crown is assisted by two groups of advisers. The first group composes the Council of State (*Raad van Staat*) of fourteen members appointed and presided over by the sovereign. The Council is a permanent advisory body, with

the right of being consulted on a variety of topics on which the Crown has to give a decision, and notably on administrative conflicts, as well as of suggesting subjects of legislation. It is organized in ten sections, each handling a particular branch of government and assisted by an expert supernumerary councillor. The other group is the Council of Ministers (*Minister-Raad*), corresponding to the British Cabinet, although only styled a Cabinet Council (*Cabinets-Raad*) when presided over by the sovereign. In the last pre-war Dutch government there were eleven ministries : General Affairs, Home Affairs, Foreign Affairs, Defence, Finance, Colonies, Education and Fine Arts, Economic Affairs, Social Affairs, Justice, and Public Works or *Waterstaat*. As a rule, a minister is the head of a department, but the appointment of Ministers of State, or ministers without portfolio, is not uncommon. Ministers are appointed by the sovereign, but are responsible to the Chambers. As in England, although the existence of a prime minister is unknown to the constitution, the premiership is well-established, being conferred by the sovereign's command to submit a list of proposed ministers. Ministers are paid a salary of *f.* 16,000 a year ; the Foreign Minister receives an additional sum of *f.* 10,000 for representation.

In general, governmental procedure is similar to that in Great Britain. The chief difference lies in the relationship of ministers to the Chambers. With some exceptions, ministers do not, as in England, retain their membership on appointment ; the constitution provides seats for them in both Chambers, but they appear there in their ministerial capacity, with a consultative vote only, and not as members. (A constitutional amendment proposed in 1936, which would have made ministerial office legally incompatible with membership of either Chamber, was not adopted.) This tendency to separate the executive authority from the legislature makes for a rather different working of the parliamentary system from that obtaining in Britain ; in particular, it has encouraged the formation of extra-parliamentary ministries, that is, ministries which do not depend directly upon a majority in the Chambers, and which generally include some ministers without definite party-attachments, when, owing to a parliamentary deadlock, the construction of a normal coalition-ministry is impossible.

The States-General

Although the Dutch Parliament bears the name of the sovereign body of the old Republic, in its modern form it dates only from

1840, following the break-up of the Kingdom of the Netherlands, in which the States-General had represented both the northern and southern provinces. The States-General consists of two Chambers, the First and the Second, of which the Second is, rather confusingly for Englishmen, the Lower. The States-General meets at The Hague; the formal opening of each session takes place in the thirteenth-century Knight's Hall (*Ridderzaal*) in the Palace (*Binnenhof*) of the medieval Counts of Holland, and the ordinary sittings are held in two other chambers of the same group of buildings.

The First Chamber, of fifty members, is chosen by indirect election, its members being elected by the Provincial States, which are themselves elected by universal suffrage (see p. 181). For this purpose the eleven Provincial States are arranged in four groups, with roughly equal populations, each group being allotted approximately one-quarter of the total membership of the Chamber.

Group	Provinces	Population (1939)	Number of Representatives
1	North Brabant, Zealand, Utrecht, Limburg	2,415,800	13
2	Gelderland, Overyssel, Groningen, Drenthe	2,201,000	13
3	North Holland, Friesland	2,129,000	12
4	South Holland	2,173,000	12

Since, however, the members of the different Provincial States represent widely varying numbers of voters, it is necessary to 'weight' their votes in order to bring the composition of the First Chamber into line with the wishes of the electorate (see p. 181). Members of the Chamber are elected for six years, but half of them retire every third year; each election is therefore for half the Chamber, and the Provincial States of Groups 1 and 3 and those of Groups 2 and 4 accordingly vote at alternate elections.

The Second Chamber, of 100 members, has been elected, since the reforms of 1917–22, by universal suffrage. All Dutch men and women, of twenty-five years and over and not disfranchised by any of the specified natural or civil disabilities (mental deficiency, imprisonment, etc.), are not only entitled, but are obliged by law,

to exercise the vote. In 1939 there were 4,639,503 voters, or 98·5% of all citizens of twenty-five and over. The electoral system used is a complicated variety of proportional representation. The Second Chamber is elected as a whole, and sits for four years unless previously dissolved.

The constitution provides for annual sessions of the States-General of not less than twenty days' duration, and for an interval not exceeding two months between the dissolution of either or both Chambers and their reassembly. In practice, the States-General sits, with intervals, throughout the year. Members of the First Chamber resident outside The Hague receive a daily allowance for expenses, those of the Second a salary fixed by constitutional amendment of 1938 at *f.* 4,500 a year, and a pension based on length of service up to a maximum of *f.* 2,800.

The States-General shares the legislative function with the sovereign, but the two Chambers differ in the extent of their legislative competence. Both the sovereign (acting in conjunction with the Council of State and on the advice of the minister concerned) and the Second Chamber enjoy the exercise of the initiative in legislation, but the First Chamber can only put forward proposals not taking the form of bills. Moreover, it has no power to amend bills accepted by both the Sovereign in Council and the Second Chamber ; it can only accept or reject them.

Political Parties

The most striking feature about Dutch political parties in recent years has been their multiplicity ; great and small, they numbered more than fifty in the immediate pre-war period. The adoption of proportional representation was not the cause of this phenomenon, which was apparent before 1914 (see p. 163), but it has undoubtedly increased the number of small parties or groups seeking representation. Considerably more than three-quarters of these small parties are uniformly unsuccessful. In the last States-General before 1940 only ten parties were represented in the Second Chamber, and only seven in the First, and in the Second Chamber the three leading parties between them held 71 of the 100 seats. What the new electoral system has done is to stabilize the representation of these three parties in successive chambers, as the following table showing the composition of the Second Chamber between 1918 and 1940 makes clear.

Parties	Elections					
	1918	1922	1925	1929	1933	1937
Catholic (*Roomsch Katholiek Staatspartij*)	30	32	30	30	28	31
Labour (*Sociaal-Democratische Arbeiders Partij*)	22	20	24	24	22	23
Anti-Revolutionary (*Anti-Revolutionnaire Partij*)	13	16	13	12	14	17
Christian-Historical (*Christelijk-Historische Unie*)	7	11	11	11	10	8
Liberal State Party (*Liberale Staatspartij* or *Vrijheidsbond*)	10	10	9	8	7	4
Liberal Democratic League (*Vrijzinning Democratische Bond*)	5	5	7	7	6	6
Communist (*Communistische Partij van Nederland*)	2	2	1	2	4	3
National-Socialist (*Nationaal Socialistische Beweging*)	—	—	—	—	—	4
Other parties	6	3	1	2	7	4

The balance of parties throughout this period made it inevitable that any government resting upon a parliamentary majority must be a coalition drawn from two at least of the three leading parties, the only alternative being an extra-parliamentary ministry of the type mentioned above (p. 177).

The evolution of these three parties has been sketched elsewhere (see p. 166). The Catholic party has been for many years the strongest party in the Second Chamber. It neither needs nor has developed much party organization. Since the settlement of the historic educational controversy, and its leading partnership in successive governments, the party has had to define more clearly its attitude towards economic and social problems; while favourable to social reform and not averse from an increase in State intervention, it rejects socialism as destructive of the foundations of Christian society. The Socialist party, after its swift progress down to 1925, barely succeeded, under proportional representation, in maintaining its representation at the three following elections. Its reluctance to share in office (which it finally did in 1939) or to shed its earlier republicanism was symptomatic of a rather doctrinaire attitude which partly explains this check to its progress. In sharpest contrast to the Socialist programme stood that of the Anti-Revolutionary party, which championed strong government at home and in the colonies, strict economy in State expenditure (save for the re-armament which it considered essential), and the defence of the religious element in the national life.

No other party could secure two-figure representation in 1937, but both in the Chambers, and in the country as a whole, some of these small groups, with long traditions and able leaders, enjoyed an

importance not to be measured by their numerical strength. Liberalism remained split into radical and conservative groups, but the principles common to both were still a force in political life. Communism made little headway in the Second Chamber, even during the worst crisis years; and National Socialism, after its success in the provincial elections of 1935, could secure only four seats at the national elections two years later, a result which marked a decline in the appeal which the movement made to the Dutch elector.

Provincial and Local Government

The Province

The Dutch Republic down to 1795 consisted of seven provinces and the Generality lands (see p. 127). After being repeatedly reorganized and renamed between 1795 and 1813, the provinces were revived with practically their old frontiers (the most important change being the transference of Zealand Flanders, formerly a Generality territory, to the province of Zealand) and under their historic names in 1813–14. At the same time two new ones were created: North Brabant, formerly Generality land, and Drenthe, which had not enjoyed provincial status under the Republic. Since that time the number has grown to eleven: the settlement of 1839 led to the creation of the province of Limburg, and in 1840 the province of Holland was divided into two, North Holland and South Holland (Fig. 39).

The Provinces of the Netherlands

Province	Capital	Population (to nearest hundred)	
		1930	1939
South Holland	The Hague	1,957,600	2,173,900
North Holland	Haarlem	1,509,600	1,701,200
North Brabant	's Hertogenbosch	808,400	1,051,900
Gelderland	Arnhem	829,300	938,200
Limburg	Maastricht	550,800	619,800
Overyssel	Zwolle	520,800	585,100
Utrecht	Utrecht	406,900	489,600
Friesland	Leeuwarden	399,700	427,800
Groningen	Groningen	392,400	427,300
Zealand	Middelburg	247,600	254,500
Drenthe	Assen	222,400	250,400

Each province has its own legislative and administrative assembly, which bears the historic name of Provincial States (*Provinciale Staten*). Members of the Provincial States are elected by universal

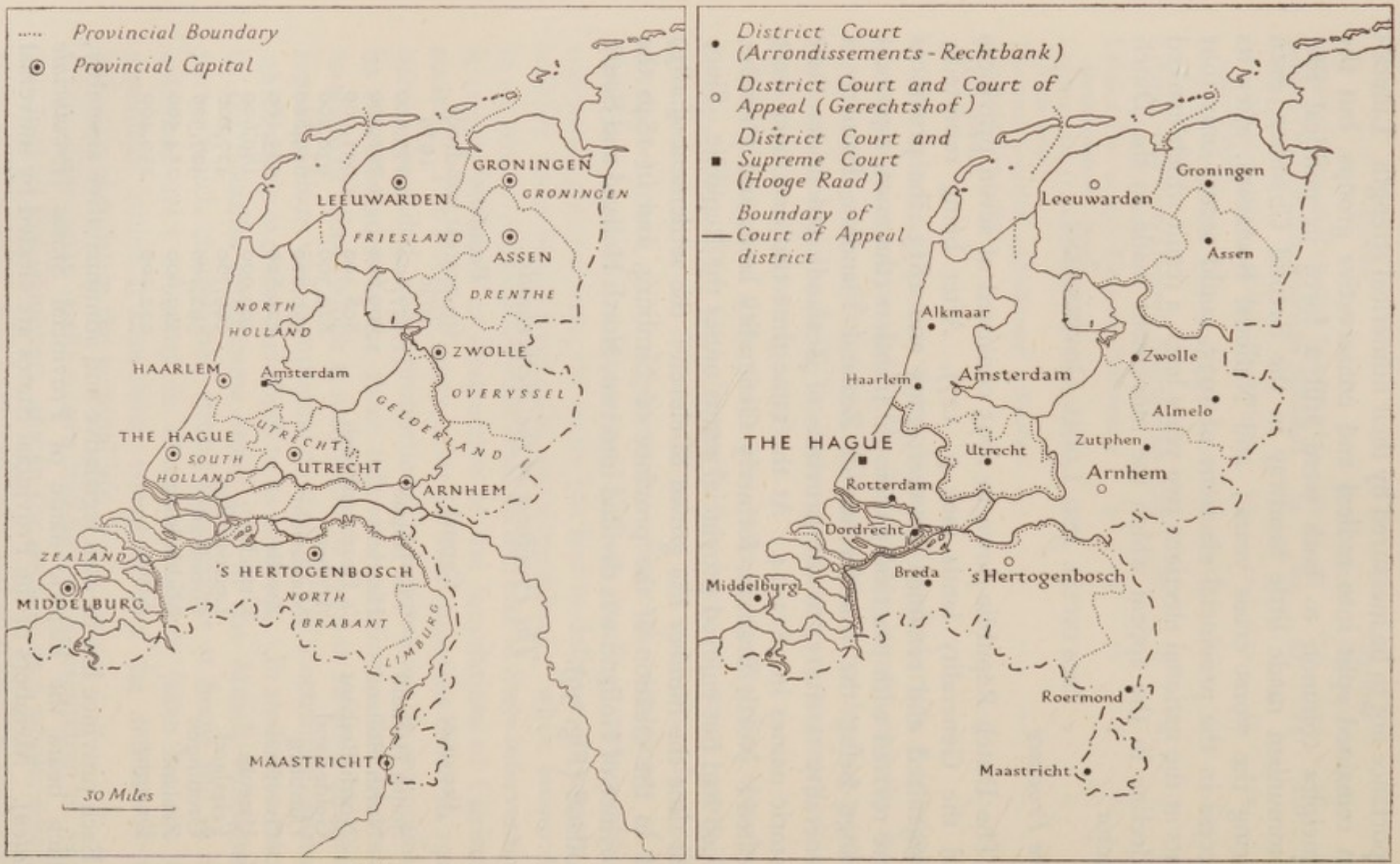

Fig. 39. Administrative and judicial divisions of the Netherlands
From official sources.

suffrage according to the same system as for the States General ; they sit for four years, and all retire together. The size of the Provincial States varies with the size of the population : the largest is that of South Holland, with eighty-two members, the smallest that of Drenthe, with thirty-five. This still means, however, that whereas South Holland has one member for every 24,000 inhabitants, Drenthe has one for every 6,000, a discrepancy which necessitates the ' weighting ' of the Provincial States' votes for elections to the First Chamber. Thus, since 1938 every vote cast in these elections by members of the South Holland States has counted as 239, while Drenthe votes count only as 64. The following table shows the voting value of all the provinces :

Province	Size of Provincial States	Population per Member to nearest hundred	Voting Value
South Holland	82	23,900	239
North Holland	77	19,600	196
North Brabant	64	14,000	140
Gelderland	62	13,400	134
Limburg	45	12,000	122
Overyssel	47	11,000	111
Utrecht	41	9,900	99
Friesland	50	8,000	80
Groningen	45	9,400	67
Drenthe	35	6,300	64
Zealand	42	5,900	59

The Provincial States are responsible for the entire administration of the province, with the exception of the public works and services administered by the *Departement van Waterstaat*, but their decisions in certain matters (such as provincial taxation) are subject to government control. The executive power in the province, as well as the day-to-day transaction of business, are confided to a permanent committee of six members (in Drenthe four), known as the Deputed States (*Gedeputeerde Staten*) ; this committee also exercises supervision over communal authorities. Both the Provincial States and the Deputed States sit under the presidency of a Commissioner appointed by the Crown (*Commissaris der Koningin*).

The Commune

The commune (*gemeente*) is the basis of Dutch local government (Fig. 40). In 1940 there were 1,054 communes (the number has been gradually reduced in recent years through amalgamation), ranging



Fig. 40. The communes of the Netherlands, 1930

The boundaries are taken from the maps issued in *Aandeel van elk der Voornamste Kerkelijke gezindten* . . . which is a supplement to Deel V of *Volkstelling* 31 *December* 1930, *Statistiek van Nederland* ('s Gravenhage, 1933).

Broadly speaking, the communes are larger in the sandy districts of the east and south.

from rural districts with a few hundred inhabitants to the great towns with their hundreds of thousands; but large and small, urban and rural, they are administered on a uniform plan. Government is by two bodies, the communal council (*gemeenteraad*) and the aldermen (*wethouders*), together with a chief executive officer, the burgomaster (*burgemeester*). The council, which varies in size from seven in the smallest communes to forty-five in the largest, is elected by universal suffrage. The aldermen are chosen by the council from among its own members; the smallest communes have two, the largest six aldermen. The burgomaster is not elected, but is appointed by the Crown; he holds office for six years, and need not be a resident in the commune. The council also has its own officers, a secretary and a tax-collector, but in the smaller communes these offices are often filled by the burgomaster. Moreover, neighbouring communes up to a certain size may share any or all of these officials, a practice which may end in formal amalgamation.

In his capacity as a Crown official the burgomaster is personally responsible for the maintenance of public order and morals, but as the head of the commune he shares executive authority with the aldermen, forming with them the *College* or committee of *Burgemeester en Wethouders*, known as *B. en W.* The council itself performs both legislative, administrative, and taxative functions; it has power to attach to its bye-laws penalties not exceeding two months' imprisonment or a fine of *f.* 300, but in this, as in other matters, its decisions are subject to the approval of the Deputed States of the province. Communal revenues are derived from a variety of local taxes, the most important being the tax levied as a percentage of State taxes (*opcenten*).

Waterstaat

In the organization known as *Waterstaat*, a term which may roughly be translated as Public Works, the Netherlands possesses an authority without parallel in any other country. Its existence is due to the overriding importance of drainage and dyke-maintenance in a country nearly half of which lies below sea and river-level; but besides all the operations connected with the regulation of the water-level, this organization has come to control almost all public works and all forms of transport.

The *Waterstaat* authority has central, provincial and local institutions. The central institution is the *Departement van Waterstaat*,

headed by a Minister. To this ministry is entrusted the management of State roads, railways and waterways, and the supervision of all forms of private transport, its jurisdiction in these matters being known as *Rijkswaterstaat ;* it also controls the work of the provincial and local *waterstaat* authorities. The provincial authorities exercise similar control over waterways and roads within their area ; they are immediately responsible to the *Deputed States*. The local *waterstaat* authority is the *waterschap*. Since the *waterschap* originated as an association of the inhabitants of a polder or similar unit for joint drainage and defence against flooding its boundaries are determined by physical considerations and do not coincide with those of the communes. The *waterschap* is now a kind of commune for special purposes, and its organization approximates roughly to the communal model. Itself elected by local landowners according to a special franchise, it entrusts day-to-day business to a permanent committee corresponding roughly to the *wethouders* of the commune, while at its head stands a *Dijkgraaf*, whose position is comparable to that of the burgomaster. There are also a number of joint *waterschap* authorities under various names. The *Veenschap* is a special type of *waterschap* mainly concerned with peat-cutting and with the polders (*veenpolderen*) which result. Outside the low-lying areas the *waterschappen* perform rather different functions, some of them being exclusively concerned with roads. All *waterschappen* are empowered to issue regulations and to enforce the performance of necessary maintenance works ; except in the case of financially-weak localities, which are supported out of State or provincial funds, the expenses of the *waterschappen* are defrayed from special taxes on the owners of the lands concerned (see p. 299).

Legal System

The basis of the Dutch legal system is the constitution, which, as its name (*Grondwet*) implies, is the fundamental law of the country. The principles of modern Dutch law are those of the Napoleonic Code, which superseded the historic Roman-Dutch law during the French occupation ; there is thus a strong family likeness between the laws of Holland and of France, the parent-country, as well as those of Belgium. (Roman-Dutch law itself lives on in two former Dutch colonies now part of the British Commonwealth, namely, South Africa and Ceylon.) The constitution guarantees the fundamental rights of the individual : freedom of speech, of religion, of education, of the press, and of association. The laws governing

the exercise of these liberties, and the rights of person and property, are collected into five codes, the civil, criminal, and commercial codes, and the codes governing procedure in civil and criminal cases. The oldest of these codes date from 1838, but they have since been extensively revised ; the former Code of Criminal Procedure was superseded by an entirely new one in 1926. The question of a complete revision of all the codes has long been discussed but so far has not been undertaken.

The Courts of Law

The organization of Dutch law courts was last revised in 1934. The courts of general jurisdiction are arranged in four grades. The lowest grade consists of the 62 *Kanton Gerechten*, roughly equivalent to English police-courts ; in these a single magistrate deals with minor civil and criminal cases, in all but the smallest of which appeal lies to the court next above. This court is the *Arrondissements Rechtbank* or district court. The country is divided into 19 districts and the *Rechtbanken* is located in the chief town of each district. There are normally three judges on the bench (one for juvenile cases, unless of a serious nature) and the court is competent to determine all civil and criminal suits of a certain gravity. It also hears appeals from the *Kanton Gerechten* within its district. Attached to each *Rechtbank* is a certain number of notaries public (on a scale of one to every 4,000 inhabitants), appointed by the Crown and authorized to take oaths and depositions. At five of the 19 district-centres ('s Hertogenbosch, Arnhem, The Hague, Amsterdam, and Leeuwarden) there are also *Gerechtshoven*, each with a bench of three judges whose principal function is to hear appeals from the *Rechtbanken* (Fig. 39).

The Supreme Court (*Hooge Raad van Nederland*) sits at The Hague. Its president, vice-president, and five members are all appointed for life by the Crown, and vacancies are filled from among names submitted by the Second Chamber after receiving the Court's own suggestions. The work of the Supreme Court falls into three main divisions : it hears all cases arising from offences committed by leading servants of the Crown (ministers, colonial governors, commissioners, etc.) ; it administers certain special branches of law, for example, prize law ; and it is the final court of appeal from the lower courts, in which capacity it has a right of cassation.

In addition to this system of courts, there are a number of courts with special jurisdictions. Such are the Arbitration Courts (*Scheids-*

gerechten), and their Courts of Appeal (*Raden van Beroep*), which deal with disputes arising out of social and economic legislation; the Civil Service Courts (*Ambtenarengerechten*) dealing with cases affecting civil servants in their official capacity; and the courts (*Raden van Beroep voor Directe Belasting*) handling cases relating to taxation. Appeal from all these courts lies to a Central Court of Appeal (*Centrale Raad van Beroep*) at Utrecht, except from the taxation courts, appeals from which go to the Supreme Court.

The Ministry of Justice

The principal functions of the Ministry of Justice, named, after the French fashion, Public Ministry (*Openbaar Ministerie*), are: to supervise the administration of the law by the courts, to prosecute in criminal cases, and to control the State police force. The Ministry is represented in the Supreme Court and the *Gerechtshoven* by a *Procureur-Generaal*, assisted by an *Advocaat-Generaal;* in the *Arrondissements Rechtbanken* by an *Officier van Justicie* and his deputy; and in the *Kanton Gerechten* by a subordinate official (*Ambtenaar*). Of these officers, only those attached to the Supreme Court hold their appointment for life; the remainder are appointed by the government of the day.

Police System

The National Police

The police force of the Netherlands falls into two categories: national and local. The national police force consists, not of a single body, but of three corps, separately organized and with different powers and duties. They are, in the order of their establishment, the *Marechaussée* or gendarmerie, the *Rijksveldwacht* or civil constabulary, and the *Politie-troop* or military police.

The *Marechaussée* (the name comes from seventeenth-century France) was established in 1818 and has since been steadily increased both in strength and in the scope of its activities. In 1940 it consisted of twenty-four officers and about 1,150 N.C.O.'s and men, of whom about 500 were mounted. It is organized in divisions, districts and brigades, the last varying in strength from three to twenty-five men. Although in peace-time its work was of a civilian character, the *Marechaussée* is a semi-military force, subject to military law and responsible for its military duties to the Ministry of Defence. During the pre-war years it was mainly concentrated on the eastern frontier, where it co-operated with regular troops.

The *Rijksveldwacht* is, by contrast, a purely civil force dating from the middle of the last century. Subject to the Ministry of Justice, it has had its own Inspector since 1937, and on the eve of the war numbered about 1,370 officers and men. Its main work is in the field of criminal investigation, but it also performs ordinary police duties. Last to be established was the *Politie-troop* or military police corps, which was formed towards the close of the last war. Originally controlled by the Inspector of *Marechaussée*, it has since been given independent command. Both in peace and war the *Politie-troop* carried out military duties. Its strength before the war was twenty-three officers and about 1,800 other ranks.

The (Local) Communal Police

By far the greater part of the policing of the country is done by the communal police, which numbered about 11,000 before the war. The burgomaster is the chief of police in each commune, but he is assisted by a commissioner (in large communes a chief-commissioner) appointed by the Crown but paid by the commune at a salary agreed upon with the Crown. Small communes can share a communal police-force, but in a large commune such as Rotterdam the communal police is a strong force, with a criminal department, a mounted brigade, and a separate river-police.

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(2) A brief general account of the government and politics of Belgium and Holland, by R. K. Gooch, is included in *Governments of Continental Europe*, ed. J. T. Shotwell (New York, 1942), and two chapters on the same subject appear in *The Netherlands*, ed. B. Landheer (Berkeley and Los Angeles, 1943).

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CHAPTER VIII

PUBLIC HEALTH

Public Health Organization : Medical Personnel : The Cross Societies : Vital Statistics : Causes of Death : Some Important Diseases : Notifiable Infectious Diseases : Bibliographical Note

A study of the public health of the Netherlands is of special interest. The general mortality rate and the infant mortality rate have been reduced to lower levels than in any other country, New Zealand and Australia excepted. Though the Netherlands has participated in the general decline of the birth rate it has done so to a less degree than any other country of north-west Europe, with the exception of Iceland. Declining morbidity and mortality rates appear to have resulted from well sustained public health effort reinforced by improved economic and social conditions. Public health innovations and reforms that have achieved such important results have almost invariably owed their inception to private enterprise, the State stepping in to co-ordinate, assist and supervise only when local schemes have been well under way. The population, responding to persistent health propaganda, appears to have attained a higher degree of hygienic enlightenment than have the population of most other countries. Lastly there is the fact that the Netherlands remains the last stronghold of malaria in north-west Europe.

Public Health Organization

In 1918 a Ministry of Labour, Commerce and Industry was created and to it were confided all the Central Government's responsibilities for the public health which previously had been discharged by the Ministry of the Interior. A Director-General of Public Health is in charge of the public health work of the Ministry, and is also the President of the Central Public Health Council. This Council has a membership of about seventy, in addition to the President and Secretary, both of whom are whole time Government officials. The membership includes the Chief Inspectors of Health, but the majority of the members are unofficial, selected for their special competence in one or other of the many subjects dealt with by the Council. The unofficial members are unpaid. The Council sits at The Hague. Numerous sub-committees or commissions deal

with current business and with the different subjects assigned to the Chief Inspectors of Health. Other commissions are appointed *ad hoc* to consider any special problems. It is the duty of the Council to keep itself informed of all matters affecting the public health and to keep the Minister informed of any matters calling for his attention. This is done by the Chief Inspectors of Health, each with regard to the subjects for which he is responsible. The services directed by the Chief Inspectors of Health deal with :

(1) Infectious disease control. The application of laws regulating the practice of medicine and ancillary professions, and the medical care of the poor ; (2) Application of pharmacy laws, and laws concerning foodstuffs, and environmental hygiene ; (3) Child welfare and the campaign against tuberculosis ; (4) Housing ; (5) Meat inspection.

The Chief Inspectors of Health direct the work of regional inspectors.

Labour Health administration is in the hands of a special department of the Ministry of Labour, Commerce and Industry. The Director-General of Labour is at the head of the factory inspection service. For the purposes of factory inspection the country is divided up into about a dozen subdivisions, each under a Chief Inspector. A museum in Amsterdam illustrating the hazards of industry and means of preventing occupational diseases and accidents deserves mention.

All communes with populations in excess of 18,000 are obliged to create Health Commissions. Several small adjacent communes may unite to form a commission. The members of these local commissions are nominated by the Governor of the Province, on the recommendations of the college of aldermen, and are recruited for the most part from doctors, engineers and others likely to be specially interested in health problems. The secretary, who is not a member of the commission, is a salaried official, half of his pay being contributed by the State. All resolutions of communal and municipal councils dealing with health matters must be referred to their health commissions whose advice, however, they are not bound to take.

Public Health Laboratories

In 1910 a Central Public Health Laboratory was established in Utrecht. Any doctor may obtain its assistance in the diagnosis of infectious and other diseases free of charge. In the case of

communicable diseases positive findings are reported to the Health Inspector concerned, as well as to the doctor concerned. At the request of Inspectors of Health the Laboratory undertakes more extensive investigations, such as the search for carriers of infection of certain diseases, or the bacteriological examination of water supplies. The Chemical Section of the Laboratory undertakes, among other things, the chemical examination of water supplies. In 1921 a Veterinary Section was added to the Laboratory. The State Serological Institute is also in Utrecht. It undertakes the manufacture of sera and vaccines of all kinds, and is in charge also of anti-rabies treatment.

Water supplies

Among the many factors that have contributed to the striking improvement of the public health of the Netherlands during the present century, the constantly increasing provision of pure water supplies has been one of the highest importance. The decreased prevalence of waterborne infections following the introduction of a pure water supply will be referred to when typhoid fever is under discussion. But the importance of adequate supplies of safe water is not limited to considerations of human pathology ; they are of very great importance to dairy farmers, milk production and the butter and cheese industries.

In the western part of the country, lying at or below sea level, with its superabundant collections of surface water, the provision of pure drinking water has presented problems of the greatest difficulty. Shallow wells in this low lying country are easily contaminated and consequently dangerous. To encourage the provision of pure water supplies, especially for the smaller communes, there was created in 1913 a State Bureau for Water Supplies, *Rijksbureau voor Drinkwatervoorziening*, as a Department of the Ministry responsible for public health. It is the function of the bureau to advise Government on all matters concerning water supplies, state subventions in aid of approved schemes and the elaboration of laws and regulations dealing with the subject. The bureau also advises provinces, communes and private water undertakings, and publishes information relating to geological, hydrological and other matters of interest to water supplies in general.

The communes are responsible for the provision of water for their populations but satisfactory schemes are beyond the unaided resources of the smaller communes. In 1924 two-thirds of the total

population were adequately provided for ; considerable progress has been made since. In 1924 there were 108 water supply services. Of these, 78 were communal services ; 29 were private water undertakings, and one, the largest, was the provincial water supply service in North Holland which supplies more than a hundred communes. In Amsterdam, The Hague and Rotterdam the water supply services are communal. In Arnhem and Utrecht water companies operate the service. There has been a welcome tendency for the large towns to extend their water supplies to adjacent villages and small towns, from which their agricultural produce is drawn, action prompted mainly by anxiety to safeguard the health of their own communities from the introduction of infection with such produce. Two further examples of regional distribution schemes are those of the island of South Beveland and the island of Tholen, which were completed in 1913 and 1923 respectively. In both cases the water is brought from North Brabant.

The Rotterdam water supply, which provides also for Delft, Schiedam and Vlaardingen, is drawn from the New Maas. Purification is by slow sand filtration after sedimentation. A special laboratory controls the efficacy of the purification plant. In Amsterdam and The Hague the water supplies are drawn from the subsoil of the dunes. In both cases aeration, to get rid of the iron, precedes slow sand filtration. The purification of water by chlorine or other chemical agent appears to be rarely if ever used in the Netherlands.

Medical Personnel

Medical profession

Medical education is provided by the State Universities of Leiden, Utrecht and Groningen and by the Municipal University of Amsterdam. The medical course extends over six to seven years and the standard of education is high. When qualified the doctor must have his diploma visé'd by the medical inspector of the place wherein he intends to practise his profession. Foreign medical practitioners were allowed to practise after passing an examination ordained by the Senate of one of the State Universities. In the communes bordering Belgium and Germany Belgian and German practitioners were allowed, by reciprocal agreements, to practise in Dutch territory.

Doctors are under an obligation to notify the cause of death of their patients to the local representative of the *état civil*. They must also notify cases of infectious disease to the communal authority,

and give certificates to persons whom they vaccinate against small-pox.

At the end of 1937 there were 6,284 medical practitioners in the Netherlands (one for 1,380 inhabitants), 1,198 dentists and 1,069 midwives.

Medical assistance

The provision of medical assistance for the poor is largely in the hands of voluntary organizations. Some religious communities provide free medical care for their indigent members. In cases in which such voluntary help is not forthcoming the commune assumes the responsibility. In the largest communes the communal medical service provides treatment. If resources do not permit of the formation of such a service the commune may grant a subvention to a doctor or a midwife, or both, to care for the needy. Without such subvention it might not be profitable for either to settle in the district.

But the characteristic feature of Dutch medical practice is the widespread development of Sick Clubs, or Sick Funds, which depend upon small weekly subscriptions, and which provide free medical attendance, including medicines. Benefits do not usually include hospital or other institutional treatment, but this may be secured by an additional insurance. Some sickness insurance schemes are administered by large enterprises, railway companies and the like, for each employer must insure against sickness all employees with salaries less than *f.* 1,200 a year ; some are sick clubs organized and administered largely by doctors themselves ; others are general societies with local branches, the local committees being formed of doctors, druggists and representatives of the insured. There are also funds administered by members who are themselves interested in the financial prosperity of the organization, interests which may well run counter to the provision of adequate medical care of the members as a whole. This form of sick club was disapproved by the medical profession and was in consequence losing ground.

Midwives

Midwives in the Netherlands receive excellent training and the standing of the calling is high. Their training is largely concentrated in two State Schools of Midwifery, one in Amsterdam, the other in Rotterdam, and in a private school, a Catholic foundation, sub-

ventioned by the state, in Heerlen. The course of training lasts three years. The training is free to selected candidates in Amsterdam and Rotterdam, and in the third year of training students receive some small financial remuneration. The thorough training given to midwives, and the attention given in that training to mothercraft and the care of the infant, may have contributed much to the remarkable fall in the infant mortality rate (see p. 200). Success in a final theoretical and practical examination is a necessary prelude to obtaining a diploma without which the midwife is not authorized to practise. That practice is confined to attendance on normal labour. If there be complications a doctor must be called in.

There is in the country as a whole about one midwife for 8,000 inhabitants. The proportion of births attended by doctor or midwife varies much in the different provinces. In Limburg only some 17 % of births are attended by doctors : in the province of Utrecht the proportion is about 65 %. More than half the total births of the country are attended by midwives only.

Hospital Nurses

In many of the larger hospitals the standard of training of nurses has been high for many years, but it was as recently as 1924 that the state intervened and by the introduction of a State Diploma secured greater uniformity and an improved status for the nursing profession. Hospitals of not less than 40 beds may provide a recognized course of nurse's training. The course lasts three years at least, and is both practical and theoretical. There are two forms of State Diploma, one for general nursing, the other for the nursing of mental cases.

The Cross Societies

Very great contributions have been made to public health progress by the ' Cross Societies ', the number of which is somewhat bewildering. The first in the public health field was the *White Cross Society*, founded in 1875 in the North Holland province. Doctors of the Amsterdam hospitals were prominent among its founders and there was close co-operation between the Society and these hospitals. The primary purpose of the White Cross Society was educative, the inculcation of ideas of hygiene among the people, with special reference to the prevention of communicable diseases. It paid special attention to the care of the sick in their own homes. Its members could obtain skilled nursing on very reasonable terms.

In 1900 a group of philanthropic enthusiasts created an exactly comparable organization for the remaining ten provinces of the Netherlands, which was called the *Green Cross Society*. This prospered in its turn and is now the predominant Cross Society. In 1917 the two Societies were federated but preserved their original designations ; they work on precisely similar lines. In 1924 the ten provincial associations of the Green Cross Society had 759 local branches with a membership of about 400,000. The White Cross Society had 109 local associations with a membership of about 60,000.

The societies provide sick room equipment, a service of health visitors and visiting nurses, domestic help for sick mothers, health education, while disinfecting stations have been built, and in some towns and villages public baths have been installed. Last, but not least, the Green Cross Society has been active in the campaigns against tuberculosis and venereal diseases. The headquarters of the Green Cross Society is at Utrecht where there is a school for social workers and visiting nurses.

In parts of the Netherlands in which the population is predominantly Catholic the local associations have remained outside the Federation and work under the name of the *White and Yellow Cross*. *The Orange Cross Society* is a league designed to render assistance in the event of any national catastrophe, by the care, treatment or transport of the wounded or the sick.

In spite of all the friendly rivalry of the Crosses of varied colours the Netherlands *Red Cross Society* flourished. It has a large hospital which is also a nurses' training school, and organized first-aid training classes.

Vital Statistics

The registration of births, deaths and marriages in the Netherlands is very complete. Each commune has an office of the *état-civil* and a census bureau. The former receives notifications of births, within three days of birth, and issues burial permits when all necessary information has been received relating to the fact and the cause of death. Every month, each office of the *état-civil* sends individual cards of all births, still-births and deaths to the Central Statistical Bureau. The census offices keep records of all arrivals in and departures from the communes and are thus always in possession of immediately available information concerning the populations of the communes.

A very interesting comparatively recent innovation has been the introduction of individual cards. For each live birth a card is made out, on which full information is inscribed regarding parentage. This card follows the individual concerned throughout life, from commune to commune, accumulating information as to nature of employment, marriage, parentage of the partner, the birth and death of children, and many other particulars. The last item inscribed on this condensed life history is the cause of death. Then the completed card is sent to the Central Statistical Bureau. In course of time that Bureau will be in possession of demographic material of unique value for statistical, genealogical, biological and other studies.

Birth rates

Birth rates, death rates and infant mortality rates in the Netherlands, 1850–1940

Year	Number of live births per 1,000 inhabitants per annum	Total number of deaths per 1,000 inhabitants per annum	Number of deaths under 1 year per 1,000 live births
1850–1859	33·8	25·5	195
1860–1869	35·2	24·8	197
1870–1879	36·2	24·5	202
1880–1889	34·7	21·3	183
1890–1899	32·8	18·7	159
1900–1909	31·0	15·6	130
1910–1919	26·8	13·4	95
1920–1923	26·9	11·1	68
1924	25·1	9·8	61
1925	24·2	9·8	58
1926	23·8	9·8	61
1927	23·1	10·2	59
1928	23·3	9·6	52
1929	22·8	10·7	59
1930	23·1	9·1	51
1931	22·2	9·6	50
1932	22·0	9·0	46
1933	20·8	8·8	44
1934	20·7	8·4	43
1935	20·2	8·7	40
1936	20·2	8·7	39
1937	19·8	8·8	38
1938	20·5	8·5	37
1939*	20·6	8·6	34
1940*	20·9	9·9†	39

From official sources

* Preliminary figures.

† 9·4 excluding war losses.

The Netherlands has participated in the decline of the birth rate that has been so marked a feature of the vital statistics of western European countries during the present century, but to a much less degree than most. Annual birth rates in the Netherlands, though but two-thirds of the rates recorded at the opening of the century, are still above 20 per thousand. This is true of no other country of

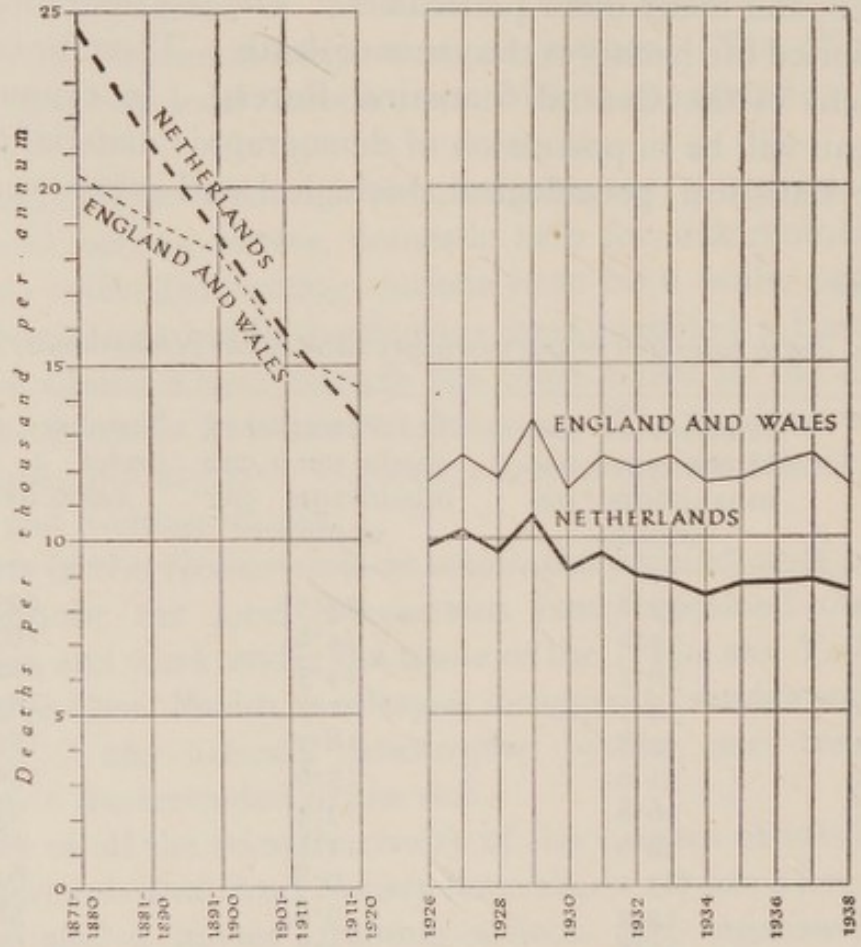

Fig. 41. Death rates in the Netherlands and in England and Wales, 1871–1920, 1926–38.
From official sources.

north-west Europe except Iceland and occasionally Northern Ireland (see pp. 237–9).

Mortality rates ; expectation of life

The decline in the general mortality rates of the Netherlands has been phenomenal. Since the war of 1914–18 these rates have been consistently lower than those of any other country in Europe. Up to 1910 the general mortality rates of England and Wales were lower than those of the Netherlands : during the last two decades, however, the Dutch rates have been from 1·8 to 3·6 per thousand lower (Fig. 41).

While unstandardized death rates of different countries are not strictly comparable, it is possible to compare the average expectation of life, or the mean after-life time, prevailing in the Netherlands and in England and Wales.

Expectations of life, or Mean after-life Time

Age	0	1	10	20	30	40	50	60	70
				Netherlands 1931–5					
Male	65·1	67·5	60·1	50·9	41·9	32·8	24·1	16·3	9·8
Female	66·4	68·1	60·5	51·1	42·1	32·2	24·6	16·7	10·2
				England and Wales 1933–5					
Male	59·6	62·9	56·2	47·2	38·5	29·9	21·8	14·6	8·8
Female	63·6	66·1	59·3	50·3	41·6	32·8	24·4	16·7	10·2

The most noteworthy feature of this table is the narrow margin by which the female expectation of life exceeds the male in the Netherlands. Indeed at age 40 the male expectation of life exceeds that of the female. It would seem that the great saving of life, which the remarkable fall in the mortality rate since the beginning of the century denotes, has benefited the male sex to a greater extent than the female. At age 40 English women have a longer expectation of life than Dutch women, but the mean after-life of men at that age is nearly three years longer in the Netherlands than in England and Wales. The relative disadvantage of Dutch women will be referred to again when tuberculosis is being discussed. Male death rates in 1935, 1936 and 1937 in the Netherlands were 8·8, 8·7, and 8·9 as compared with female rates of 8·6, 8·6, and 8·7 per thousand of each sex.

The rate of increase of population in the Netherlands is more than double that of most other countries of north-west Europe. The annual increase of population per cent. between 1920 and 1935 in certain of these countries, according to census or estimated populations in those two years, was : Netherlands 1·43, England and Wales 0·50, Norway 0·56, Sweden 0·38, France 0·48, Germany 0·58, Switzerland 0·46.

The highest provincial birth rates are those of North Brabant, Limburg and Drenthe ; the lowest, North Holland, Zealand and South Holland (Fig. 46). The birth rates of small rural communes are in general some 25 % or more higher than those of the large towns. The death rates of the large towns are consistently lower

than those of small communes and than those of the country as a whole. In England and Wales the death rates of large towns are higher than those of the country as a whole though the difference is generally but small.

Infant mortality

Perhaps the greatest achievement of public health activity in the Netherlands is the reduction of the infant mortality rate to a lower



Fig. 42. Infant mortality rates, 1925–39
From official sources.

level than that of any other European country, lower than the rates of Sweden and Norway, and almost down to the level of the New Zealand rate. The decline in the infant mortality rate has been almost uninterrupted since 1875. Up to that time rates of 200 or more infant deaths per 1,000 live births were a common occurrence ; they were consistently some 50 per 1,000 higher than the English rates. By the end of last century the rates of both countries were very similar, about 150 per 1,000 live births. Since 1900 a steady and rapid decline has characterized the infant mortality curves of both countries, but the improvement in the Netherlands has gone

much further (Fig. 42). During the last ten years the rates in the two countries have been as follows :

Deaths of Infants under 1 *year of age per* 1,000 *live Births*

	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
Netherlands	50	46	44	43	40	39	38	37	34	39
England & Wales	66	65	64	59	57	59	58	52	50	55

From : *Annual Epidemiological Report* of the Health Organization of the League of Nations (Geneva, 1941).

It is noteworthy that the infant mortality rates in the Netherlands vary inversely with the size of the communes, while in England and Wales the rate is higher in the large towns than in smaller centres of population. Public health work in the Netherlands has succeeded not only in removing the perils to infant life that were formerly inherent in urban conditions of life but in making the cities less dangerous to infants than the countryside. Infant mortality rates in the largest cities were :

Deaths under 1 *year per* 1,000 *live births*

	1936	1937	1938
Amsterdam	29	28	29
Rotterdam	31	30	30
The Hague	28	26	29
Utrecht	37	28	32
Haarlem	31	26	29
Groningen	31	26	26
The Netherlands	39	38	37

From official sources.

In this remarkable saving of infant life in the Netherlands, improved economic standards, better housing, safer water supplies, and the efficient control of epidemic disease have obviously contributed much. But great credit is due to direct efforts to promote infant welfare. The training of midwives, visiting nurses and other social workers engaged in child welfare work is very thorough. Puericulture is welded into the whole national scheme of hospital teaching, work and family practice. In 1937 there were 934 infant welfare centres in the provinces of the Netherlands : there were 22 in Amsterdam, 11 in Rotterdam, and 10 in The Hague. During

that year just over half the total number of infants were brought to these centres. Health nurses assist the doctor in the consultations in the centres and act as the link between the centre and the home. Ante-natal clinics are also well attended. By such efforts the standard of mothercraft has been raised to a very high level in the Netherlands.

Causes of Death

The number of deaths attributed to each of the 43 causes of death of the international abridged nomenclature, for the years 1936, 1937 and 1938, will be found in the table on p. 203. The most frequently certified causes of death are similar to those in England and Wales. In both countries twelve causes are usually responsible for about three-quarters of the total deaths.

Principal Causes of Death, 1937

Cause of Death	Netherlands		England and Wales	
	Death rate per 100,000 inhabitants	Per cent. of total deaths	Death rate per 100,000 inhabitants	Per cent. of total deaths
Diseases of the heart	136·5	15·5	313·7	25·2
Cancer and other malignant tumours	131·1	14·9	163·3	13·1
Cerebral haemorrhage, cerebral embolism and thrombosis	65·0	7·4	66·5	5·3
Pneumonias	62·5	7·1	72·0	5·8
Senility	54·0	6·1	41·4	3·3
Congenital debility and malformations, premature birth and other diseases of early infancy	41·9	4·8	47·2	3·8
Tuberculosis of respiratory system	33·6	3·8	58·8	4·7
Other forms of tuberculosis	14·4	1·6	11·1	0·8
Nephritis	29·8	3·4	36·7	2·9
Violent and accidental deaths (suicide and homicide excepted)	27·3	3·1	42·5	3·4
Diseases of circulatory system, other than diseases of the heart	26·0	2·9	69·5	5·6
Diabetes	19·0	2·1	17·8	1·4
All other causes		27·3		24·7
		100·0		100·0

From : League of Nations, Health Organization, *Annual Epidemiological Report* (Geneva, 1941)

Diseases of the heart and circulatory system and cancer are responsible for much higher death rates in England and Wales than in the Netherlands.

Cause of death	Deaths			Rates per 100,000		
	1936	1937	1938	1936	1937	1938
Typhoid and paratyphoid fever	44	49	34	0·5	0·6	0·4
Typhus fever	0	1	0	0·–	0·–	0·–
Smallpox	0	0	0	0·–	0·–	0·–
Measles	232	111	302	2·7	1·3	3·5
Scarlet fever	69	46	56	0·8	0·5	0·6
Whooping cough	406	334	322	4·8	3·9	3·7
Diphtheria	103	47	81	1·2	0·5	0·9
Influenza	1,564	3,156	1,100	18·4	36·7	12·7
Plague	0	0	0	0·–	0·–	0·–
Tuberculosis of respiratory system	3,067	2,887	2,754	36·0	33·6	31·7
Other forms of tuberculosis	1,190	1,235	1,192	14·0	14·4	13·7
Syphilis	263	261	237	3·1	3·0	2·7
Malaria	4	4				
Other infectious or parasitic diseases	621	535	662	7·3	6·2	7·6
of which acute poliomyelitis	17	8		0·2	0·1	
,, ,, cerebro-spinal meningitis	57	54		0·7	0·6	
Cancer and other malignant tumours	11,140	11,272	11,803	130·8	131·1	135·0
Tumours, non-malignant, or of which nature not specified	637	650	619	7·5	7·6	7·1
Chronic rheumatism and gout	161	199	194	1·9	2·3	2·2
Diabetes mellitus	1,731	1,637	1,256	20·3	19·0	14·5
Alcoholism (acute or chronic)	30	26	25	0·4	0·3	0·3
Other general diseases and chronic poisonings	1,084	1,114	1,253	12·7	13·0	14·4
Progressive locomotor ataxia and general paralysis of insane	218	200	222	2·6	2·3	2·6
Cerebral haemorrhage, cerebral embolism and thrombosis	5,679	5,593	5,303	66·7	65·0	61·1
Other diseases of the nervous system and of organs of special sense	1,836	1,679	1,780	21·6	19·5	20·5
Diseases of the heart	11,658	11,738	12,322	136·9	136·5	141·9
Other diseases of circulatory system	2,062	2,236	2,307	24·2	26·0	26·6
Bronchitis	1,187	1,295	1,174	13·9	15·1	13·4
Pneumonias	5,315	5,371	5,068	62·4	62·5	58·4
Other diseases of respiratory system (tuberculosis excepted)	1,051	1,077	886	12·3	12·5	10·2
Diarrhoea and enteritis	682	617	713	8·0	7·2	8·2
of which under 2 years*	395	332		2·3	2·0	
Appendicitis	452	362	386	5·3	4·2	4·4
Diseases of liver and biliary passages	767	746	717	9·0	8·7	8·3
Other diseases of digestive system	1,642	1,723	1,622	19·3	20·0	18·7
Nephritis	2,515	2,564	2,691	29·5	29·8	31·0

Cause of death	Deaths			Rates per 100,000		
	1936	1937	1938	1936	1937	1938
Other diseases of genito-urinary system	1,459	1,600	1,607	17·1	18·6	18·5
Puerperal septicaemia*	169	140	128	1·0	0·8	1·5
Other diseases of pregnancy, childbirth and puerperal state	349	297	348	2·0	1·7	4·0
Diseases of the skin and cellular tissue and of the bones and organs of locomotion	486	450	409	5·7	5·2	4·7
Congenital debility and malformations, premature birth and other diseases of early infancy*	3,710	3,641	3,828	21·6	21·4	44·8
Senility	4,650	4,644	4,511	54·6	54·0	52·3
Suicide	694	685	737	8·1	8·0	8·5
Homicide	32	31	47	0·4	0·4	0·5
Violent and accidental deaths (suicide and homicide excepted)	2,364	2,346	2,455	27·8	27·3	28·3
Cause of death not specified or ill-defined	2,600	2,917	2,846	30·5	33·9	32·8
Total	73,923	75,516	74,044	868·1	878·3	852·7

* Rates per 1,000 living births

From : League of Nations, Health Organization, *Annual Epidemiological Report* (Geneva, 1941)

Some Important Diseases

Tuberculosis

As in nearly all countries tuberculosis is still an important cause of invalidity and premature death. In recent years it was gradually loosening its grip of the populations of countries with improving social, economic and housing standards, and in large measure as the result of direct attack on the disease. The Netherlands was an outstanding example of such countries. But the threat of tuberculosis remains. Social and economic upheavals such as are at present afflicting so many countries will inevitably result in a marked increase of tuberculosis prevalence.

Tuberculosis of the respiratory system was responsible for 11% of the total mortality of the Netherlands in 1911 ; the percentage fell to 8·5 in 1921, to 4·1 in 1936, and to 3·7 in 1938. The rapid decline in incidence is shown in the following table :

Netherlands : Death rates from tuberculosis per 100,000 *of the average population according to sex*

Year	Respiratory Tuberculosis		All Forms of Tuberculosis		
	Male	Female	Male	Female	Persons
1901–1905	137·7	133·1	195·7	185·2	190·4
1906–1910	123·5	128·5	166·8	169·2	168·0
1911–1915	106·7	114·3	141·9	148·7	145·3
1916–1920	123·9	141·8	165·7	183·0	174·4
1921–1925	74·1	88·4	103·3	116·8	110·0
1926–1930	58·7	69·7	81·2	92·4	86·8
1935	35·6	39·4			
1936	35·1	36·9			50·0
1937	34·2	33·0			48·0

From official sources.

Exactly comparable figures for England and Wales are not available, but the following table shows the incidence of the disease on the two sexes over the same period in that country :

England and Wales : Standarized death rates from tuberculosis per 100,000

Year	Respiratory Tuberculosis		All Forms of Tuberculosis		
	Male	Female	Male	Female	Persons
1901–1910	135·8	95·1	189·1	142·4	164·6
1911–1920	115·8	87·3	155·0	121·8	137·5
1921–1930	86·8	67·7	110·0	88·8	99·3
1935	62·7	48·6	77·4	61·0	68·7
1936	60·1	45·7	74·4	57·8	65·7
1937	59·5	45·9	73·9	58·4	65·7
1938	55·0	41·0	68·5	52·8	60·2

From : *Annual Report of the Chief Medical Officer of the Ministry of Health for the year* 1938 (London, 1939).

It will be noted that the course of the declining tuberculosis mortality in the two countries has been strikingly different. In England and Wales, the male tuberculosis death rates have been consistently higher than the female rates. In the Netherlands, female death rates have fairly consistently exceeded the male rates. The excess female tuberculosis mortality is more marked in rural areas than in towns. This is shown in the following table :

Netherlands : Tuberculosis mortality per 100,000 *by sexes and by size of communes*

Year	Males Population of Communes			Females Population of Communes		
	100,000 and over	5,001 to 100,000	5,000 or under	100,000 and over	5,001 to 100,000	5,000 or under
			Pulmonary	Tuberculosis		
1921	96	86	80	101	100	108
1925	72	61	65	75	74	81
1930	50	52	49	50	52	66
			All forms of	Tuberculosis		
1921	126	120	111	131	131	145
1922	100	89	107	103	102	114
1930	66	70	70	69	75	89

From : 'Tuberculosis in Rural Areas'—*Bulletin of the Health Organization League of Nations*, vol. 8, Nos. 4–5 (Geneva, 1939)

Many factors probably contribute to the relatively excessive female tuberculosis mortality in rural areas—heavy domestic work in farms and cottages in which hygienic standards are below those of towns, rooted customs and prejudices, and lower standards of health education and of public health activity generally. The open-air work of the males protects them to some degree from faulty environmental conditions in their homes.

Milk-borne infection is of considerable importance in the Netherlands. From recent work of Ruys and others it would appear that some 10% of pulmonary tuberculosis cases in children are caused by bovine strains of the tubercle bacillus in town and country alike. Bovine strains are responsible for a like proportion of adult pulmonary cases in the country, but for only some 1·4% of such cases in the towns. Rather more than a fifth of all other forms of tuberculosis are caused by bovine strains of the bacillus.

The direct attack against tuberculosis began at the close of the last century and in characteristic Dutch fashion was launched by private enterprise. In 1897 a Dutch Sanatorium was opened in Davos by a Society for the Care of Dutch Tuberculosis Patients. In the same year another Society was formed for the creation and management of popular sanatoria in the Netherlands : many sanatoria were built. It was soon realized however that one could not combat tuberculosis solely by treating the sick and 1907 saw the creation of the Netherlands Central Association for the Campaign against Tuberculosis, (*Nederlandsche Centrale Vereeniging tot bestrijding der tuberculose*) to

co-ordinate the work of all the various organizations engaged in the task. Local and provincial societies organize the work, while the central society is in charge of propaganda, the training of nurses, and the encouragement of scientific research. In addition to the central association and eleven provincial societies, there are between eight and nine hundred local societies.

In 1920 an Inspectorate of the Ministry assumed the general supervision of the campaign. In the large towns there are special communal anti-tuberculosis organizations, but in most parts of the country the Green, White and Yellow and White Cross Societies also undertake anti-tuberculosis work. Health visitors and visiting nurses arrange for isolation of the patient at home, disinfection, instruction as to how risks of infection can be lessened, and the general care of the patient. Sometimes the local society provides financial aid. If the case be suitable for institutional treatment efforts are made to obtain its admission into a hospital or sanatorium.

In towns of importance a tuberculosis dispensary serves as the headquarters of doctors and visiting staff. Provincial societies reinforce local efforts and organize dispensaries to serve the needs of groups of communes outside large centres of population. Medical specialists give free consultations to all in these dispensaries.

It is not possible to assess the contribution which these measures have made to the remarkable decline in the tuberculosis prevalence. There has been a very marked improvement in the standard of living of the working classes since the beginning of the century. Between the passing of the Housing Law in 1901 and 1935, communes and building associations built more than 200,000 new dwellings, while many slums have been cleared.

Venereal Diseases

There is no compulsory notification of venereal diseases in the Netherlands, no state regulation of prostitution, and no state organized treatment of venereal diseases, except for the treatment provided in the ports for merchant seamen in accordance with the provisions of the International Agreement of Brussels 1924. Thanks, however, to voluntary effort venereal diseases are adequately dealt with, and there are plentiful facilities for treatment in all the large towns.

Pioneer work in handling the venereal disease problem in the Netherlands was done in a seamen's policlinic set up in Rotterdam by the Society of Tropical Medicine. There it was shown that

social workers could render most valuable service, persuading patients to continue treatment till they are cured, and by tracing contacts. The Netherlands Society for Combating Venereal Diseases was formed in 1914. There are constituent societies in nine of the eleven provinces. In each of the provinces there is a committee to organize the campaign under the general supervision of Inspectors of the Central Government. The system of social service that was so successful in Rotterdam was everywhere taken as a model. In most places nurses and social workers of the Cross Societies are employed in the work.

Malaria

The Netherlands is the only country in north-western Europe in which malaria remains an endemic disease of any importance. For that reason, if for no other, the disease calls for more than passing mention in a chapter dealing with the health problems of that country. The disease figures but rarely as the cause of death on a death certificate, and not being a notifiable disease, there are no official figures published giving the case incidence of the disease in different parts of the country year by year. Thanks, however, to the painstaking and stimulating research work carried out in recent years by Swellengrebel and his colleagues we are in possession of more complete information about malaria in the Netherlands than we have of the malaria problems of any other country.*

At the present time malaria is very largely confined to the province of North Holland. The adjoining lowlands of South Holland, Utrecht and Gelderland, the physical features of which are in outward appearance so strikingly similar, are almost completely free from malaria. Geologically, however, the two regions are very different. South Holland, Utrecht and Guelderland were formed largely by silt deposited by the Rhine and the Maas, and contain abundant stores of fresh water. North Holland, which has been for the most part reclaimed from the sea, has surface water with a much higher saline content.

The mosquito that transmits malaria in the Netherlands is *Anopheles maculipennis*. Mosquitoes of this species are found in all parts of the country but malaria is largely restricted to North Holland. The anomaly was the subject of much speculation until

* ' Malaria in the Netherlands ' by N. H. Swellengrebel and A. de Buck (Scheltema & Holkema Ltd., Amsterdam), published in English, pp. 267, deals very fully with the subject.

research showed that *A. maculipennis* is not a homogeneous species. Two quite distinct ' races ' occur in the Netherlands, a long-winged variety, *A. maculipennis* var. *messeae*, and a short-winged variety, *A. maculipennis* var. *atroparvus*. The eggs of these two races have characteristic markings which render identification easy in most cases. The two races have different habits and do not interbreed. The *atroparvus* variety lay their eggs and breed in brackish water ; the long-winged variety has a marked preference for fresh water in which to breed. In collections of water with a sodium chloride content of 0·25% or over practically all mosquito larvae found are of the short-winged *A. maculipennis*.

It is the short-winged *atroparvus* race which is the vector of malaria in the Netherlands. Thus is explained the geographical distribution of malaria in the Netherlands at the present time.

The curve of human malaria cases reaches its height in the Netherlands in May, June and July, most commonly in June. There is sometimes a secondary smaller rise in the autumn. It is a curious fact that during the months of maximum incidence, May to July, it is almost impossible to find infected anophelines in the Netherlands, whereas in August, September and October the proportion of infective short-winged *A. maculipennis* in houses in malaria infected villages may be astonishingly high. It is during these three months that the vast majority of malaria infections in the Netherlands are acquired. The strain of *Plasmodium vivax* that is responsible for practically all the malaria of the Netherlands is remarkable in that the incubation period of the disease it causes is very prolonged. Often a period of eight to nine months elapses between the infecting mosquito bite and the onset of the febrile attack ; during this period the malaria parasites remain dormant in the body. Thus the malaria cases in May to July are manifestations of infections acquired during the previous autumn. This prolonged incubation period is not quite a constant phenomenon ; a certain number of autumn cases result from recent infections.

It is certain that large numbers of Anopheles are infected during the summer months. This is, however, the period of sexual activity of the mosquito during which the females undertake long flights for oviposition. The mortality among such mosquitoes is high. Moreover a large proportion of the short-winged *A. maculipennis* after egg-laying resort to stables in preference to human habitations. Both the races are zoophile. In any case it is almost impossible to find infective anophelines at this season. How comes it then that the

short-winged *A. maculipennis* becomes so effective a transmitter of malaria in the autumn ?

The period of sexual activity of *A. maculipennis* in the Netherlands comes to an end in August. When this occurs mosquitoes of the long-winged race develop fat and take up their quarters for the winter ; during their hibernation they do not feed. The short-winged *A. maculipennis* behave differently ; when they cease to reproduce they do not cease to feed. The female ' short-wings ', freed from any obligation to undertake long egg-laying flights, remain in the shelter of a house, preying at will on its inhabitants, and possibly taking very short occasional flights to neighbouring premises. Should the household contain a malaria ' carrier ' ideal conditions exist for the infection of the remaining members.

Such in bald outline are the facts that explain most of the vagaries of malaria in the Netherlands at the present time and the persistence of the disease.

Malaria is not evenly distributed throughout North Holland, the province that suffers so much more severely than the remainder. Even in individual towns and villages the centres of malaria infection often consist of groups of houses separated from other centres of infection by whole streets in which the disease seldom if ever occurs. Not all houses offer the same favourable conditions for sheltering the semi-hibernating short-wing *A. maculipennis*.

There is evidence that malaria is much less prevalent than it was a generation or so ago. In the second half of the last century Amsterdam doctors kept records of cases of malaria fevers ; these include an assortment of febrile conditions, but their simple intermittent fevers were almost certainly malarial. The number of such cases ranged from a minimum of 1,963 in 1861 to a maximum of 23,872 in 1857. Between 1920 and 1936 malaria cases seen by doctors in Amsterdam ranged from 15 in 1932 to 2,391 in 1922, the average annual number of cases being 418. The 1857 and 1922 figures are equivalent to 155‰ and 3‰ of the populations of Amsterdam in these two years. It is noteworthy that the 1857 outbreak was mainly of the autumnal type, unlike the present day summer type that has been described above. It would seem that the strain of *Plasmodium vivax* responsible for the malaria of last century had not the same tendency to produce the delayed infections that characterizes the present Dutch strain.

Among the factors that have caused the reduction of malaria are the much greater facilities for medical treatment now available to all

sections of the population, and the consequent more prompt treatment of fevers, improved methods of diagnosis, and the extended use of quinine. The type of the disease is mild and the economic standard of the population is high. Whether the privations to which the population of the Netherlands is now being submitted will result in a marked exacerbation of the disease remains to be seen. It is a not improbable contingency.

Notifiable Infectious Diseases

Cases of infectious disease are notified by doctors to the burgomaster of the commune and to the medical inspector. Each week a return of all such cases is sent from each commune to the Chief Inspector, in whose office the information is published in the form of weekly, monthly and annual reports. The Law on Infectious Disease takes cognizance of cholera, typhoid fever, typhus fever, smallpox, scarlet fever, diphtheria, dysentery and plague, but a royal decree may extend the list and make notification of additional diseases obligatory for a year at a time. The following table gives the number of cases of infectious disease that were notified in the Netherlands each year from 1930 to 1938, together with the number of deaths for which each disease has been responsible.

Cases and Deaths of Notifiable Diseases, 1930-1938

Diseases		1930	1931	1932	1933	1934	1935	1936	1937	1938
Typhoid Fever	C.	639	460	490	471	398	359	290	237	204
	D.	83	53	61	65	49	74	33	37	26
Paratyphoid Fever	C.	216	156	189	204	94	84	120	118	68
	D.	3	2	4	3	2	1	0	2	3
Gastro-enteritic Paratyphoid	C.	17	62	69	250	164	88	183	405	138
	D.	2	5	10	4	5	6	11	10	5
Undulant Fever	C.	18	23	21	27	34	25	27	27	24
	D.	0	0	0	0	0	0	0	0	0
Bacillary Dysentery	C.	72	162	753	415	328	382	386	408	1,000
	D.	3	10	22	9	7	11	11	7	10
Amoebic Dysentery	C.	38	15	9	7	7	8	8	17	19
	D.	2	2	0	0	3	2	1	4	1
Scarlet Fever	C.	13,183	8,229	9,788	10,571	11,994	9,198	11,004	10,109	11,555
	D.	84	55	62	49	54	58	69	46	56
Diphtheria	C.	7,450	5,693	5,353	4,251	2,990	1,762	1,544	1,068	1,272
	D.	439	312	272	143	187	143	109	103	81
Cerebrospinal Meningitis	C.	140	178	164	136	113	89	89	100	132
	D.	85	102	72	68	57	44	57	54	60
Poliomyelitis	C.	599	136	242	146	197	52	101	60	686
	D.	56	17	26	21	20	7	17	8	57
Encephalitis lethargica	C.	89	68	60	47	43	63	50	29	32
	D.	35	52	35	22	24	32	26	28	22
Weil's Disease	C.	26	30	207	150	114	96	67	96	85
	D.		3	16	11	16	3	7	13	11

From official sources.

The history of cholera in the Netherlands relates to the middle of last century and need not concern us here. Typhus fever has been all but unknown during recent years ; one case was reported in 1937.

Smallpox has been a very rare disease during the last decade. The last case was reported in 1931. Vaccination is not compulsory except for children entering school and for their teachers, and also for recruits in the armed forces. There is no compulsory revaccination. Judging from vaccination returns the population of the Netherlands is not adequately protected against smallpox. The numbers of vaccinations and revaccinations performed in four recent years were :

1934,	21,940,	2·63 per thousand
1935,	17,682,	2·09
1936,	21,061,	2·49
1937,	25,458,	2·95

In 1929 when there was the last serious threat of smallpox, vaccinations and revaccinations numbered 1,469,914, nearly a fifth of the total population.

Each commune is obliged to organize free vaccination facilities for its population once every three months.

Typhoid and Paratyphoid Fevers

The remarkable decrease in the incidence of typhoid and paratyphoid fevers in the Netherlands has been very similar to the decrease experienced in England and Wales. Sporadic cases and limited outbreaks occur in both countries from time to time, and with a comparable degree of frequency, but large scale epidemics have been very rare in recent times. The mortality rates attributed to typhoid and paratyphoid fevers in the large towns of the Netherlands are generally lower than those of the kingdom as a whole :

Typhoid and Paratyphoid Fevers : Deaths per 100,000

	1935	1936	1937	1938
Amsterdam	1·2	1·0	0·8	0·3
Rotterdam	0·3	0·0	0·0	0·2
The Hague	1·9	0·4	0·2	0·2
Utrecht	0·6	0·0	0·6	0·0
The Netherlands	0·9	0·5	0·6	0·4
England and Wales	0·4	0·6	0·5	0·4

That typhoid fever in the past was pre-eminently a water-borne disease in the Netherlands is shown by the remarkable decrease in the incidence of the disease that followed the installation of protected water supplies. The water supply of Amsterdam was installed in 1853 when the typhoid fever death rate was 214 per 100,000. By 1885 the rate had fallen to 10, and remained below 20 per 100,000.

Recent rates have been less than 1 per 100,000. The experience of other towns has been similar. A very marked decrease in typhoid incidence followed the installation of piped water supplies in the polder communes between 1908 and 1913.

Small outbreaks of food-poisoning are not infrequent. The cases of the gastro-enteritic form of paratyphoid contained in the list of notifiable diseases were of this nature. Duck eggs have been responsible each year for a certain number of cases. Ducks are not infrequently infected with organisms closely allied to the paratyphoid bacilli, and the eggs of such ducks may be infected. All duck eggs offered for sale must be marked as such, and consumers are recommended to cook them for at least ten minutes. Special instructions are given to industries, such as pastry cooks, using duck eggs in the preparation of human food, regarding the precautions to be taken to avoid any possible risk of such infections. The foods incriminated as the sources of infection in 80 cases of the gastro-enteritic form of paratyphoid fever in Amsterdam in 1937 were : duck soup, 24 cases ; duck eggs 24 ; pigeon eggs 2 ; eels 3 ; steamed mackerel 22 ; minced mackerel 3.

Zymotic Diseases of Childhood

All the common zymotic diseases of childhood are less fatal than they are even in England, where the prevalence of most of them is low and where they are mild in type. Death rates per 100,000 in recent years have been :

Death rates per 100,000 *inhabitants*

	Netherlands			England and Wales		
	1936	1937	1938	1936	1937	1938
Measles	2·7	1·3	3·5	6·7	2·6	3·9
Scarlet Fever	0·8	0·5	0·6	1·2	0·8	0·8
Diphtheria	1·2	0·5	0·9	7·5	7·2	7·1
Whooping Cough	4·8	3·9	3·7	5·1	4·3	2·7

The relative position of the Netherlands is even more favourable than these figures indicate, for with her higher birth rates she has proportionally more individuals of susceptible age. Measles and whooping cough are not notifiable diseases so it is not possible to compare the case incidence or the case mortality rates in the two countries. The case mortality rates of scarlet fever are 0·5% in the Netherlands, 0·8% in England and Wales, both figures indicative

of a very mild form of the disease. The case mortality rate of diphtheria in the Netherlands, 6·0%, is higher than the English rate, 4·8%. The difference may be due to a more frequent adoption in England of a bacteriological, rather than a clinical, criterion for diagnosis. Recently some attempts have been made in the Netherlands to combine immunization of children against diphtheria with vaccination against scarlet fever : the proceeding afforded much less protection against scarlet fever than it did against diphtheria.

Acute poliomyelitis, or infantile paralysis, was abnormally prevalent in the Netherlands in 1938, when 686 cases were recorded, 57 of which terminated fatally. Cases were more numerous in country districts and small towns than in the large centres of population. A larger proportion of mild cases appears to be notified in the Netherlands than in England and Wales. The case mortality rates during the three years 1936–38 in the two countries were 9·6 and 16·7% respectively.

Weil's Disease

Weil's Disease, or leptospirosis icterohaemorrhagica, began to be reported in the Netherlands in 1929 and was made a compulsorily notifiable disease in 1932. It is probably an old disease, sporadic cases having been unrecognized until medical research focused the attention of the profession on the likelihood of its occurrence and the variability of its symptomatology. The Institute of Tropical Hygiene of Amsterdam has carried out interesting and valuable research on the leptospiroses.

The specific cause of Weil's Disease was discovered by Inada and Ido in Japan in 1914 ; they called it *Spirochaeta icterohaemorrhagiae*. Rats are the carriers of infection. The leptospirae leave the rat's body in the urine ; if the infected urine be passed into water the leptospirae remain alive and virulent for a long period of time. In 1924 it was shown that the sewer rats of the Netherlands were heavily infected. Human beings are infected by falling into infected water, by bathing, or by close association with rats. The leptospirae enter the human body through the abraded or even the unbroken skin ; most commonly in the Netherlands, through the nasal mucous-membrane. Of 337 cases in the Netherlands, 60 (18%) infections were contracted by accidental immersion in water ; 197 (60%) by swimming, and 68 (22%) were occupational infections, fishermen, divers, seamen, reed-cutters, and workers in places overrun with rats (slaughterhouses, sewers, butter factories, barns and

stables). It must not be inferred that swimming is an exceptionally dangerous recreation in the Netherlands. In 1932, the year of maximum prevalence of Weil's Disease, there were 71 cases recorded in Rotterdam; bathers in the Rotterdam public baths that year exceeded 1,600,000.

The majority of cases of Weil's Disease in the Netherlands occur in a few large towns. Rotterdam, Amsterdam and Dordrecht have recorded most. Dordrecht had three swimming pools; in two the water was repeatedly changed but in the third the water was stagnant and fouled by numerous rats. Among bathers in the latter there were 34 cases of Weil's Disease, one for 4,229 bathes. The closing of this bathing pool was followed by a marked decrease in the incidence of the disease.

BIBLIOGRAPHICAL NOTE

Very complete statistical information is published annually in the reports of the Central Statistical Bureau. The Annual Epidemiological Report of the Health Organization of the League of Nations was a convenient source of information concerning death rates, birth rates, infant mortality rates, and the incidence of communicable diseases, in all countries for which such information is available. The last issue of this Report concerned 1938 and was published in Geneva, 1941.

An authoritative and full account of the public health organization and administration of the Netherlands is contained in a series of lectures given to foreign health officials who visited the country in 1924. These were published in French by the League of Nations, Geneva, 1924: *Vingt-neuf conferences données à l'occasion du voyage d'études organisé par l'organisation d'hygiène de la Société des Nations, Avril-Mai* 1924.

Malaria in the Netherlands by N. H. Swellengrebel and A. de Buck (Scheltema and Holkema Ltd., Amsterdam, 1938), is a comprehensive study of the epidemiology of malaria in that country.

'Leptospiroses' by B. Walch-Sorgdrager, *Bulletin of the Health Organisation, League of Nations*, 1939, v. 8, Nos. 1–2, pp. 143–386, is a comprehensive study with a very complete bibliography. It treats of the epidemiology of Weil's Disease with particular reference to the Netherlands.

CHAPTER IX

GROWTH AND DISTRIBUTION OF POPULATION

General Features : Distribution of Population : The Growth of Population : Regional Variations in the Growth of Population : Cities and Towns : Rural Settlement : Bibliographical Note

General Features

The population of the Netherlands at the end of 1938 was officially estimated at 8,728,569, so that the average density over the whole country was 686·5 per sq. mile or 265 per sq. km. The following table shows how this compares with neighbouring countries :

Estimates of Population on 31 December 1938

	Population	Area in sq. km.	Density per sq. km.	Density per sq. mile
Germany*	67,600,000	470,000	144	373
United Kingdom	47,600,000	244,000	195	505
France	41,980,000	551,000	76	197
Netherlands	8,729,000	33,000	265	687
Belgium (1 July 1938)	8,387,000	30,000	275	712
Denmark	3,777,000	43,000	88	228

* 1937 frontiers (i.e. including the Saar territory) ; the date of the estimate is June 1938.

From : *Statistical Year Book of the League of Nations*, 1938–9, p. 18 (Geneva, 1939).

This high density of population, the second highest in Europe, is surprising for a country which is not generally regarded as highly industrialized, and which contains large areas of infertile soil. According to the census of 1930, the effective working population was 3,185,816, of which about two-fifths were engaged in mining and industry and one-fifth in agriculture. The distribution of the working population by occupation group was as follows :

Category	Totals	Percentages
Agriculture, etc.	639,026	20·1
Fishing and hunting	16,164	0·5
Mining and industry	1,235,912	38·8
Commerce and transport (includ-cluding banking and insurance)	743,979	23·4
Liberal professions and similar occupations	188,936	8·6
Domestic service	243,555	7·6
Others	32,845	1·0
Total	3,185,816	100·0

From : *Petit Manuel Statistique*, p. 21 (La Haye, 1938).

It will be seen from these figures that the Netherlands is more highly industrialized than is usually believed, and that the fisheries, in spite of their historic role in the development of the country, employ very few people. The proportion of workers engaged in commerce and transport is exceptionally high, exceeding that of any other country except England and Wales. The proportion of workers engaged in industry, commerce and transport has been increasing for some time, while that of workers in agriculture and fisheries has been decreasing, as the following table shows :

Occupation groups 1899-1930 (*in percentages*)

	1899	1909	1920	1930
Mining and Industry	33·8	35·2	37·9	38·8
Agriculture	29·6	27·3	23·0	20·1
Fishing and Hunting	1·2	1·1	0·8	0·5
Commerce and transport (not including banking)	16·8	18·4	19·8	21·8
Others	18·6	18·0	18·5	18·8
	100·0	100·0	100·0	100·0

From : G. J. de Vries ' Les principaux moyens d'existence et de communication aux Pays-Bas ', *Tijdschr. Kon. Ned. Aardrs. Gen.*, vol. 55, p. 657 (Leiden, 1938).

Both the above tables tend to obscure the importance of the agricultural workers, whose absolute numbers actually increased by 2·7% between 1920 and 1930. Moreover, many of the Netherlands' industries depend on agricultural products—dairying, distilling and brewing, starch and cardboard manufactures, boots and shoes, for example—while agricultural produce and derived manufactures enter largely into the Netherlands' foreign commerce.

Distribution of Population

The high average density of 686·5 per sq. mile is attained mainly through an intense concentration of population in two out of the eleven provinces.

Few parts of the world are so densely populated as North and South Holland ; even in Belgium there is no province which shows such a high figure. The western part of the province of Utrecht is also very densely populated, even though the barren eastern part reduces the density for the province as a whole. These three provinces comprise only a fifth of the total area of the kingdom, but account for half the population. Limburg also shows a density

Population of the Netherlands by provinces, 31 Dec. 1938

Province	Area in sq. miles	Total population, 1938	Per sq. mile
South Holland	1,130	2,138,819	1892·2
North Holland	1,059	1,666,368	1459·9
Utrecht	526	472,709	898·1
Limburg	846	602,983	712·5
North Brabant	1,921	1,019,123	530·7
Gelderland	1,941	914,207	471·2
Groningen	886	421,605	471·2
Overyssel	1,301	569,920	437·8
Zealand	690	254,565	369·2
Friesland	1,251	422,333	327·2
Drenthe	1,029	245,321	238·4
Netherlands	12,579	8,728,569	686·5

From : *The Statesman's Year Book*, 1941, p. 1138 (London, 1941).

above the average, but the remaining seven provinces are below the average.

The great concentration of population in North and South Holland and western Utrecht is due to the fact that suitable sites for commerce coincide with the most intensively cultivated lands. This coincidence is not accidental but was brought about by great effort on the part of the trading cities themselves, whose burghers devoted the profits from their lucrative transit trade to the reclamation of lakes and marshes.

Apart from the great urban development in North and South Holland and western Utrecht, which is based essentially on position, population density depends partly on the fertility of the soil and partly on the degree of industrialization. Broadly speaking, the fertile clay lands of the dyked coastal areas, together with similar alluvium in the interfluvial region between the Neder-Rhine and the Maas, are well populated, while the infertile sandy lands of the eastern and southern parts of the country are scantily populated, except in the extreme south, where the ' loess '-covered lands of south Limburg support a high density. Within recent years, however, the development of industry in parts of the sandy regions, e.g., in Overyssel, North Brabant, and in eastern Gelderland, has resulted in the rise of high local densities amid regions of otherwise exceptionally low density.

Within the main regions the patchy distribution of soils results

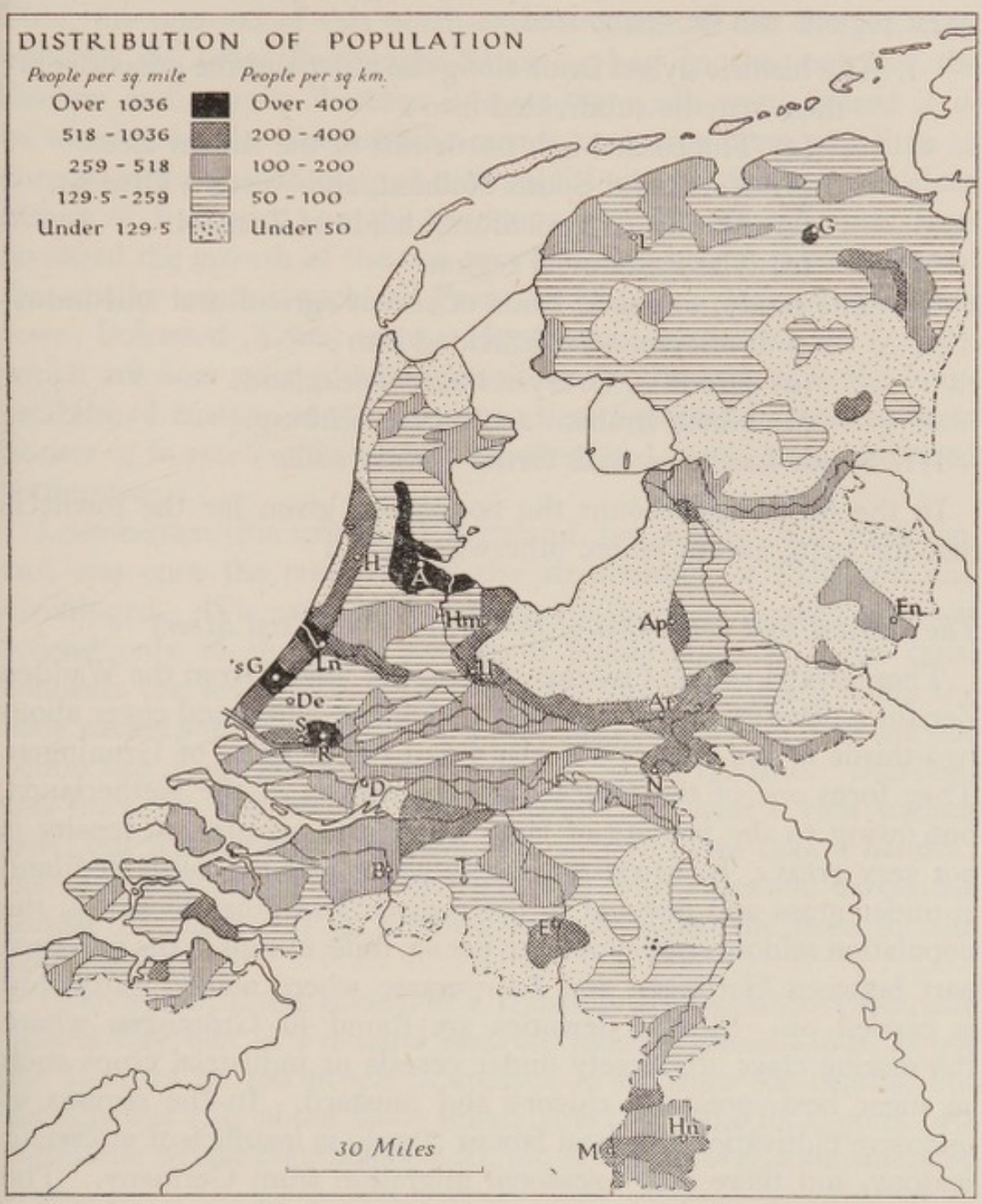

Fig. 43. The distribution of population in the Netherlands

From : A. Demangeon, *Belgique, Pays-Bas, Luxembourg*, p. 235 (Paris, 1927).

The map refers to the distribution at a date prior to the last census (1930), but the distribution has not greatly changed since. The towns shown are those which, in 1939, had a population over 50,000 : A Amsterdam ; Ap Apeldoorn ; Ar Arnhem ; B Breda ; D Dordrecht ; De Delft ; E Eindhoven ; En Enschede ; G Groningen ; 's G The Hague ; H Haarlem ; Hm Hilversum ; Hn Heerlen ; L Leeuwarden ; Ln Leiden ; M Maastricht ; N Nymegen ; R Rotterdam ; S Schiedam ; T Tilburg ; U Utrecht.

in a very uneven distribution of population (Fig. 43). The following seven regions can be recognized :

I. The historic dyked lands along the coast and the great rivers ; these may be subdivided into :—
   (*a*) The coastal belt north-east of the Zuider Zee.
   (*b*) North and South Holland, and western Utrecht.
   (*c*) The dyked agricultural lands of Zealand.
   (*d*) The interfluvial region.

II. The sandy, morainic lands of recent agricultural and industrial development, subdivided into :—
   (*a*) Drenthe, Overyssel and Gelderland.
   (*b*) North Brabant and north Limburg.

III. South Limburg, with fertile ' loess ' soils.

In the following account the population given for the towns is that for 1936, except where otherwise stated.

The Coastal Belt north-east of the Zuider Zee (Yssel Meer)

These dyked lands of marine clay extend inland from the Wadden Zee for a distance of some twelve to eighteen miles, and cover about two-thirds of the area of Friesland and rather more of Groningen. They form one of the richest farming regions of the Netherlands, but owing to the paucity of large towns the population density is not very great. In Friesland, where about half the cultivated land is under grass and devoted to dairy cattle and other livestock, the population seldom rises above 250 per sq. mile, except in the northern part between Harlingen and Lauwerszee where market gardening is carried on. Similar densities are found in Groningen where the marine clays are largely under cereals or industrial crops such as sugar beet, potatoes, chicory and mustard. In the regions of intensive cultivation the local labour supply is insufficient at certain seasons, and there was a seasonal migration from Germany. The lowest densities (below 130 per sq. mile) of this coastal belt are found round the ' meres ' of south-west Friesland. As these overlie patches of infertile sand they are not worth the expense of drainage. Sneek (16,000), which has a butter and cheese market, is also a tourist centre.

In spite of the prosperity of the coastal strip in Friesland and Groningen there is remarkably little urban development. With the exceptions of Groningen (121,600 in 1939) and Leeuwarden (55,000 in 1939) there are no towns in the coastal belt with over 16,000

inhabitants. This paucity of towns is due to a variety of reasons. First, the position of this north-eastern corner of the Netherlands, between the great Boertanger Moor or bog on the east and the shallow and stormy Wadden Zee on the north-west, caused it to be avoided by the direct traffic routes, and thus there was little to encourage the growth of great commercial cities. Secondly, modern means of transport and the tendency towards centralization have favoured the growth of the two provincial capitals at the expense of the smaller centres such as Franeker (8,500) a former university town, Bolsward (6,800) once a Hanse town, and Dokkum (5,100), which are now mere picturesque villages. Thirdly, it is the long-established custom of the people to live dispersed in isolated farm houses or in small and scattered hamlets, and not in large nucleated settlements.

Leeuwarden, the capital of Friesland, has a long civic tradition, and was once the residence of the stadtholders of Friesland and Groningen. It is now chiefly famous for its cattle market, which is second only to the great market of Rotterdam. A barge canal connects the town with the port of Harlingen (11,000), while the little packet station of Stavoren is the rail-head for the ferry-service connecting Friesland with Enkhuizen in North Holland. Stavoren was once the seat of the Frisian princes and later a rich trading port, but became silted up, and is now little more than a hamlet; the new road connecting North Holland with Friesland across the Zuider Zee dam will no doubt greatly diminish the need for the ferry-service.

Heerenveen, a fen colony in a transitional position between the coastal clay belt of Friesland and the interior glacial sands, is not the town of 21,700 people it appears to be from the census, but actually has only about 6,000 inhabitants; it is the focal point of a commune whose population of 21,700 is spread over a considerable area.

Groningen, the sixth city of the Netherlands in size, acts as a regional capital for all the north-eastern part of the Netherlands. It not only possesses a University and a 'Cathedral', but has long been an important commercial city, and is now linked to the port of Delfzil (9,750) by the Ems Canal, taking ships of over 1,500 tons. Lying at the meeting place of the marine clays, the sandy Hondsrug and the great peat bogs of south-east Groningen, it was not only in a good position to effect exchanges of the products of each region, but about the year 1600 the burghers actually undertook the first

great systematic reclamation of 'high' peat bogs ever attempted (see p. 333). Eventually all the land between Groningen and Winschoten (14,000) was drained, and after many conflicts with the neighbouring province the system was extended southwards to include all the great bog which lay on the Groningen-Drenthe border. As the reclaimed lands lent themselves to intensive agriculture they soon became densely populated, and thus they greatly increased the importance of the centre within whose sphere of influence they lay. This belt of the 'fen colonies', stretching south-eastwards from Groningen for a distance of 20 miles, is one of the most densely populated rural regions of the Netherlands, with over 500 inhabitants per sq. mile. Its small towns, such as Veendam (14,000), Hoogezand (11,700), Wildervank (10,300), and Sappemeer (6,700), carry on manufactures, using straw from the clay belt for their cardboard carton industry, much of which was exported, and potatoes from the fens as a basic material for the production of many subsidiary products. By virtue of their attachment to Groningen and their dense population, these fen colonies belong to the coastal belt of well populated agricultural lands, but by virtue of their soil and subsoil they belong to the sand-and-peat region.

The Frisian Islands. Though divided between North Holland, Friesland and Groningen provinces, these islands are alike in being the remains of the great offshore bar (see p. 14) and in being inhabited by people of Frisian origin. They consist mainly of infertile sand-dunes, though the eastern part of Texel has some polder lands. Population is everywhere scanty, even Texel having only 110 per square mile, and there are no settlements of over 5,000 inhabitants. As the former important fishing industry is moribund and holiday resorts are only small, the population must largely rely on the resources of the land such as sheep in Texel and goats in Vlieland, while whortleberries are collected on Terschelling and birds' eggs on Rottum. There is a flying-boat harbour, De Mok, at the southern end of Texel.

North and South Holland and western Utrecht

The astonishingly high densities of 1,892 per square mile in South Holland and 1,460 per square mile in North Holland are mainly a reflection of the great development of city life. Outside the big towns, population density varies markedly with the productivity of the land and type of agriculture. Thus along the belt of new sand-

dunes which border the sea from Den Helder in the north to the Hook of Holland in the south, there are stretches, especially in North Holland, which are almost deserted except for small bathing resorts, e.g. Wijk-aan-Zee (9,400), Katwijk (17,500), Bergen-aan-Zee (6,400) ; yet on the older sand-dunes on the sheltered landward side of the coastal strip, where the soil has been improved from early times by the addition of peat, silt, manure, etc., there is a narrow belt of very dense population, averaging over 500 to the square mile and mainly dependent upon intensive horticulture on very small holdings. Indeed, rural densities of 2,000 to 2,500 per square mile are sometimes attained. Similar high densities depending on horticulture are found around Rotterdam, and in North Holland within a triangle formed by Hoorn, Enkhuizen and Medemblik. Elsewhere, the population densities based upon agriculture are not so remarkable, as neither the dairy industry of the older and wetter polders, nor the arable land of the newer and better-drained polders, demands so much labour ; the density varies from about 130 to 500 per square mile. The increasing tendency for many people who work in the towns to live in the country serves to increase the density of the rural population. The countryside, indeed, is dominated by the towns in this region, in spite of the high value of the agricultural and horticultural products and of their importance in the Netherlands export trade. The towns were mainly responsible for the draining of the land and now provide a market for the agricultural produce or handle its export.

All the towns of the two Hollands and Utrecht, with the exception of The Hague and one or two minor centres, owe their existence primarily to trade. As this commercial life became important early in the Middle Ages when goods in bulk could be moved only by water, it follows that all the trading cities grew up on waterways. Even those such as Leiden, Utrecht, Gouda, etc., now well inland on what appear to be artificial canals, were originally on actively flowing rivers. Those towns still flourish whose waterways were capable of being deepened to keep pace with the ever increasing draught of seagoing ships, such as Amsterdam and Rotterdam. The others have either become moribund or now rely on other factors for their prosperity. Best known of the moribund group are the so-called ' dead cities ' of the Zuider Zee, e.g. Medemblik (6,000), Hoorn (12,500), Edam (8,700) and Enkhuizen (9,600). Among the towns which have turned to other activities are such centres as Utrecht (165,000 in 1939) and Leiden (78,000 in 1939),

with their universities, Gouda (33,000 in 1939) with its cheese and pork market and manufactures of glycerine and candles, Delft (55,000 in 1939), with its cable, pottery and vegetable-oil industries, and Alkmaar (33,000 in 1939), with its cheese market.

It is difficult to say whether the trading towns of the Zuider Zee or those along the distributaries of the Rhine and Maas were the more important in the seventeenth century heyday of Dutch prosperity, but it is clear at the present day that only Amsterdam (800,000 in 1939) of the Zuider Zee towns has survived as a great port and has done so only by turning its back on the shallow inland sea. Amsterdam's first attempt to reach deep water on the North Sea by cutting the North Holland Canal in 1815 was not a lasting success, though it led to the transformation of Den Helder, at its seaward end, from a simple fishing village into a considerable port (37,000 in 1939), now a naval station (see p. 513). A deeper canal was constructed (1865–1876) to reach the North Sea at Ymuiden (see p. 487), one of the two chief fishing ports of the Netherlands. Ymuiden, together with Velsen, forms an urban centre of 44,500 people and possesses the only blast furnaces in the kingdom. Nearby is Beverwijk (21,000), with jam and cigar factories. Largely in consequence of this deep-water route Amsterdam is now more important than ever, though its large size is due to some extent to the great extension of its boundaries which took place in 1921. Even outside this new boundary (see p. 501), the conurbation extends along the dykes of the river Zaan to Zaandam (38,000 in 1939) and beyond, along the so-called Zaanstreek, noted for the preparation of foodstuffs, such as flour, chocolate, vegetable oils, etc. Many people who work in Amsterdam live in the country, not only near Amsterdam but also in the dune belt at such places as Zandvoort (9,000), a growing seaside resort, at Bloemendaal (15,900) in the wooded inner dunes, and especially among the woods and heather of the Gooiland. This hilly region lies in the south-eastern part of North Holland at the northern end of the morainic hills which continue into eastern Utrecht. Here, Hilversum (74,000 in 1939) and Bussum (29,000 in 1939) are garden cities, the former being also noted for its broadcasting station and manufactures of wireless equipment. Baarn (13,100) in the province of Utrecht, is an inland resort mainly frequented by holiday-makers from Amsterdam. Apart from Amsterdam and the towns already mentioned there are only two other urban centres of any size in North Holland. Haarlem (140,000 in 1939), capital of North Holland, is devoted to horti-

cultural interests, especially of bulbs and choice vegetables, but also has machine shops, boat building yards and famous laundries.

In South Holland there is no single city with the dominating position which Amsterdam holds in North Holland, for Rotterdam (620,000 in 1939) and The Hague (504,000 in 1939) are only 13 miles apart, only about 8 miles lying between the built-up areas of the two cities. The Hague monopolizes the functions of administration, and the extension of its boundaries in 1915 to include Loosduinen and the seaside resort and fishing port of Scheveningen merely served to emphasize its residential and non-commercial character. Voorburg (28,000 in 1939) and Rijswijk are virtually suburbs of The Hague. Curiously enough, though The Hague is the residential seat of the sovereign and the centre of the national administration, it is not the capital of the Netherlands, an honour which belongs to Amsterdam. Rotterdam, though it has no important administrative functions and cannot boast a university, far surpasses Amsterdam as a port, its tonnage being the greatest on the continent ; and if it is less renowned than Amsterdam for banking or finance it is equally important for industry, and is the centre of the shipbuilding industry (see pp. 384, 456).

Forming part of the Rotterdam conurbation are a number of satellite towns which bring up the total population to not less than 730,000. Practically continuous with Rotterdam on the downstream side of the New Maas lies Schiedam (62,624 in 1939), Rotterdam's ancient rival. This town is now noted for its gin distilleries, which use imported grain, but it also possesses shipyards, glass and other factories. Vlaardingen (31,000 in 1939), 2 miles farther west, is one of the two chief fishing ports of the Netherlands, chiefly concerned with the herring industry. The packet station and bathing resort of the Hook of Holland at the mouth of the New Waterway, which lies 14 miles from Rotterdam, is included within the commune of Rotterdam, though Hillegersberg (23,000 in 1939), now practically a suburb of Rotterdam, is a separate commune. Upstream from Rotterdam as far as Dordrecht extend numerous shipyards and engineering shops which form a manufacturing strip comparable in activity with Clydeside, though there are no big towns, Ridderkerk (15,500) and Zwijndrecht (12,300) being the largest.

Dordrecht (63,000 in 1939), often called Dort, lies at the junction of no less than four waterways, Merwede, Old Maas, Dordsche Kil and Noord. It was the leading port of Holland in the Middle Ages, but on the loss of its ' staple ' rights in 1795 a period of eclipse set in.

The shallowness of its waterways hinders its revival as a sea port, but it has gained rapidly in recent years with the introduction of industries similar to those of Rotterdam, while maintaining its long-established sawmills which originally used timber floated down the Rhine.

Although smaller than the three great cities of North and South Holland, Utrecht (165,000 in 1939), the fourth city of the Netherlands, has also a number of satellite towns and villages. These are pleasantly situated on the western edge of a line of wooded morainic hills, which stretch from north-west to south-east and form the westward boundary of the glacial soils of the north-eastern part of the Netherlands. This residential belt begins at De Bilt (13,700) in the north, well-known for its Royal Meteorological Institute, and continues along the tramway *via* Zeist (34,000 in 1939), a garden city surrounded by woods, orchards and market gardens, Driebergen (8,900), Doorn (4,500), Amerongen, and others to Rhenen (8,200) on the Lek.

The sandy hills themselves are naturally scantily peopled, although the density rises slightly on their eastern side where the low-lying Geldersche Vallei, an old glacial tongue-basin, has between 250 to 520 per square mile on sandy and peaty soils. It contains the railway junction and market town of Amersfoort (49,000 in 1939), with textile factories and engineering works.

The Dyked Agricultural Lands of Zealand

At the southern end of the coastal zone is a region which in density of population (369 per square mile) and type of population distribution very closely resembles the coastal strip of Friesland and Groningen. On similar marine clays, there is a similar agricultural population concerned with arable and mixed farming. There is an even greater paucity of urban life. In the whole of Zealand there is only one town with over 20,000 inhabitants, namely Flushing (23,000 in 1939), which, since the building of the railway connecting Walcheren and South Beveland with the mainland in 1873, has flourished as a packet station and port, principally for passengers and trade from England. It also has a shipbuilding industry. The earlier ports of Zealand, such as Middelburg (18,300) and Veere on Walcheren, Zierikzee (6,900) on Schouwen, and Sluis (2,800) on the Zwin in Zealand Flanders have decayed, either through the silting of their harbours or owing to the increased size of ships.

Middelburg, the capital of Zealand, in spite of the attempt to revive its life by the construction of the Walcheren canal, remains little more than a picturesque memorial of a more active commercial past.

The position of the Zealand islands at the mouth of the Rhine, Scheldt and Maas has not favoured the development of any great modern port. In the section of Zealand Flanders the small port of Terneuzen (11,500) lies at the seaward end of the Ghent canal, but the nearness of the international frontier and the competition of Antwerp and Ghent restrict its growth.

The island of Goeree-Overflakkee in South Holland belongs to this region and so also does that part of the mainland of South Holland south of the Old Maas. Population densities and occupations are very similar to those of Zealand, and the old historic ports such as Brielle (3,500) and Hellevoetsluis have similarly silted up.

The Interfluvial Region

These productive dyked lands have occupations and population densities very similar to those of the coastal belt in Friesland and in Zealand. They have a similar paucity of large towns in spite of being threaded by three great rivers, the Waal-Merwede, Lek and Maas. Their moist meadows are more suited to pasture than to the plough, and about a third of the cultivated area is devoted to the production of animal feedstuffs, though the Betuwe, with lighter and better drained soil, is noted for its orchards and soft fruit industry. Population varies, therefore, with the intensity of cultivation, from about 130 to 520 per square mile, though the watery Biesbosch is almost uninhabited.

Urban life is concentrated at the present day in the two large towns of Arnhem (90,000 in 1939) and Nymegen (95,000 in 1939), situated at the eastern end of the region on the Neder-Rhine and Waal respectively, where glacial ridges coming down close to the rivers offer firm and defensive sites. A number of small ancient towns have shown some signs of revival recently. Such are Tiel (12,700), on the Waal, a centre of the fruit and jam industry; Gorinchem (14,200), pronounced and often spelt Gorkum, situated where the little river Linge joins the Merwede, and possessing a cattle market and factories for sugar, glucose and mustard; Wageningen (14,000), on the Neder-Rhine. It may here be noted that the lower course of the Maas has never had any towns of importance owing to difficulties of navigation and liability to floods,

and thus the few settlements which occur along its valley are placed mainly at some distance from the stream at the junction of the firm land and the flood plain, e.g. at Heusden (2,800), Geertruidenberg (2,800), and 's Hertogenbosch (49,000 in 1939).

Drenthe, Overyssel and Gelderland

In the greater part of this area the population is under 130 per square mile, but in certain belts and patches it reaches over 520 per square mile. With a few conspicuous exceptions urban development is of recent date. Owing to the widespread occurrence of infertile sands and gravels and the presence of some unreclaimed peat-bogs, 30% of Drenthe, 18% of Overyssel and 12% of Gelderland is still uncultivated. The afforestation of the most sterile regions, the reclamation of the bogs and the improvement of the soil in other parts is rapidly reducing the areas with very low population densities.

In Drenthe, and on its borders in southern Friesland and Groningen and in northern Overyssel, the most productive and densely populated areas are the reclaimed bogs, where an intensive agriculture is carried on similar to that of the English fens. Population densities are between 130 to 260 per square mile. Areas of boulder clay are too patchy to have much effect on population densities. The sandy soils, though much improved and now usually growing rye and forage crops supporting poultry, dairy and bacon industries, have a rather lower population range. Urban centres are few and small. Emmen in Drenthe attains its total of 48,127 inhabitants only by including numerous fen-colonies in the neighbourhood. Hoogeveen, an older fen-colony, has 16,700 inhabitants. Assen, though the capital of Drenthe, has only 20,235 inhabitants (1939), while other centres are very small: Meppel (13,300), a railway junction and a butter and a cattle market; Odoorn, 12,800; Borger, 10,200.

In Overyssel and Gelderland the population density is considerably greater, owing partly to the presence of river valleys giving better opportunities for agriculture and commerce, and partly to the development of large-scale industry. The Yssel and Vecht valleys are both densely populated, and the former, with its useful waterway, has several historic trading towns, such as Zutphen (21,490), Deventer (41,000 in 1939), Kampen (20,612), while Zwolle (42,500 in 1939), the capital of Overyssel, lies between the two rivers near their mouths, which are only nine miles apart. All these old towns

are market centres, while Zutphen has timber and alimentary industries, Deventer heavy chemicals, cotton and flour mills, and Kampen a tobacco industry.

Another line of settlements lies along the western edge of the Yssel valley at its junction with the sandy hills of the Veluwe. Many of these towns had old paper manufacturing industries, formerly using water power from the Veluwe streams ; of these, Apeldoorn (72,600 in 1939), with its modernized paper industry, is the most important. Renkum (21,000), Epe (14,400) and Heerde (9,300) are the biggest of the minor centres.

The Veluwe, or ' bad land ', is the largest area of scanty population now remaining in the Netherlands, as neither the new plantations of conifers nor the old woodlands and heather can support many people. Its solitudes are scarcely disturbed by the royal summer residence at Het Loo, an observatory, and a radio station (near Kootwijk). On the lower western side of the Veluwe there are a few scattered settlements such as Barneveld (15,300), Ermelo (16,400), a centre for tobacco growing, Nijkerk (10,650) and Ede (36,400 in 1939), the latter possessing one of the three chief rayon factories of the Netherlands.

Although the textile industry is found in a few towns west of the Yssel, it is especially noteworthy in the Twente district of eastern Overyssel and the adjoining region of Gelderland. Here the cotton industry established in the nineteenth century (see p. 362) led to the growth of large new towns such as Enschede (91,500 in 1939), Hengelo (41,500 in 1939), Almelo (36,200 in 1939), and many smaller places such as Oldenzaal (10,300), Borne (10,000), Haaksbergen (9,300), Rijssen (10,200), in Overyssel, and Winterswijk (19,100) and Aalten (11,800) in Gelderland. Some of these towns have added other industries ; for instance, Hengelo is important for Diesel engines, pumping and electrical apparatus ; while the discovery of salt at depths near Enschede has given rise to the manufacture of caustic soda at Boekelo. The region may see a considerable increase in population if the development of the deep coal seams near Winterswijk should become possible.

The remaining centres of Overyssel and Gelderland are mainly small market towns, often with co-operative dairies, such as Doetinchem (16,300), which also possesses a bicycle-tyre factory, and Voorst (14,800) in Gelderland, and Raalte (10,500), Hellendoorn (14,700) in Overyssel.

Overyssel is the most highly industrialized province of the Nether-

lands, with 48·5% of the employed population engaged in manufactures in 1936. It is followed closely by North Brabant and Limburg, both with 44·6%.

North Brabant and north Limburg

In type of population distribution, in economic life and in the recent rapid increase of population, this area closely resembles the region of Overyssel, Gelderland and Drenthe. There are similar sandy plains with similar small farms, interspersed with patches of heath, woods and plantations, and a sprinkling of bogs and meres, while the great bog of De Peel forms a desolate and only partly reclaimed area along the frontier between North Brabant and north Limburg; old settlements lie along the fertile silts of the valley route ways, and old cottage industries have been transformed or supplemented by recent industrial development.

Thanks to modern industry and to a favourable position for commerce, North Brabant and north Limburg have a rather denser population than is found in the three sandy north-eastern provinces. The region with less than 130 per square mile is limited to a strip along the Belgian frontier bordering the Campine, and thence stretching north-eastwards to include the Peel bog. Elsewhere the densities of the country districts are between 130 to 260 per square mile, except on the marine and fluvial clays of the north and north-west, where the densities are higher. It is the presence of numerous towns and industrial villages which raises the population to such high densities round Eindhoven, Tilburg, and 's Hertogenbosch.

The towns are arranged in two lines, a less important one along the Maas valley, and a much more important line along the railway which traverses the centre of the sandy lands from Bergen-op-Zoom in the west to Venlo in the east. The old fortress of Roermond (17,000) on the Maas at its junction with the Roer, remains small in spite of its railway junction and its caustic soda and other industries, possibly owing to its unfavourable frontier position, and the same drawback has hindered the growth of Venlo (27,900 in 1939), an old fortified trading city manufacturing military and naval instruments, which remains chiefly a market town in spite of its important railway junction. For the rest of its course the Maas has no town of even moderate size actually on its banks, but the old town of 's Hertogenbosch (or Bois-le-Duc), often called ' Den Bosch ' (49,000), is just out of reach of its winter floods at the junction of the rivers Dommel and Aa, the latter now replaced as a waterway by the Zuid-Willems canal. 's Hertogenbosch is not only the capital of North Brabant

and an important market town, but possesses diversified industries, such as the manufacture of cigars, margarine, refrigerating machinery, and boots and shoes. Westward of the town stretches for 24 miles a series of villages known collectively as the Langstraat, or long street, which concentrates most of the boot and shoe industry of the Netherlands. The chief centre is Waalwijk (10,800), while the numerous other villages nearby which make footwear include Loon-op-Zand (10,900) and Dongen (9,500). The whole Langstraat numbers about 78,000 people.

Along the railway from Bergen-op-Zoom to Venlo are some of the newest as well as the oldest towns of North Brabant. Bergen-op-Zoom (25,300 in 1939), where the steep bluffs (' bergen ') of the sandy region overlook the East Scheldt, has lost its old maritime importance and its ancient textile industry, but carries on engineering (*Stork* works), and chemical manufactures. Roosendaal (26,100 in 1939), a frontier station at the junction of the Antwerp-Rotterdam and Flushing-Venlo railways, is a modern town, but Breda (51,800 in 1939) is an old fortress and trading town revivified by new industries, including one of the three chief rayon factories of Holland, machine shops, and cigar and match factories. Industrial life reaches its highest intensity in and around Tilburg (97,200 in 1939) and Eindhoven (113,000), the former being the centre of the Netherlands woollen industry while Eindhoven is famous for electric lamps and radio apparatus (see p. 389). Small places in the neighbourhood of these towns specialize in such industries as linen at Boxtel (11,000), woollen manufacturing at Geldrop (9,500), cigars at Valkenswaard (10,300). Oss (16,000) has the largest insulin factory in the world and is a centre of the margarine industry. Helmond (28,820 in 1939), seven miles east of Eindhoven, with an old castle, carries on engineering (*Stork* works), textile and cocoa industries.

Farther east, in north Limburg, there has been little industrial development, and population drops to under 130 per square mile ; but the future exploitation of the Peel coalfield may well bring changes.

South Limburg

The fertile ' loess ' plateaux (see p. 30), the verdant valleys and the modern coal exploitation of south Limburg support so many people that the province as a whole ranks fourth in population density, in spite of very moderate densities in north Limburg. Maastricht (67,900 in 1939), the capital of the province, was already important

in Roman times for its crossing (' *trajectum* ') across the Maas, from which it takes its name. Its numerous industries include china and glass factories, paper making, brewing, sulphuric acid and the larger of the two cement works in the Netherlands. Heerlen (50,552 in 1939) and Kerkrade (37,600 in 1939), are the chief centres of the coal mining industry. Their industries (see p. 376) include the manufacture of coke and briquettes, while a great electric central is located here. Brunssum (15,500) and Hoensbroek (13,700) are also mining centres. Lutterade, close to the state-owned Maurits mine, manufactures nitrogen products, sulphuric acid and explosives. Other towns are mainly market towns, such as Sittard (15,600), Geleen (14,400), Echt (10,400), Maasbree (15,000), Venraij (13,800) and Valkenburg (2,100).

The Growth of Population

The population of the Netherlands has grown from 2,613,000 in 1830 to 8,923,000 in 1940. The greater part of this increase has occurred during the present century : from 1830 to 1899 the increase was 72%, while from 1899 to 1940 it was nearly 98%. In the former period the average annual increase was 28,000 : in the latter period nearly 108,000. The greatest increase over a short period occurred during 1909–20, when it amounted to 17·2%. In fact, the rate of increase was rising until as late as 1921, since when it has declined, reaching 15·6% in 1920–30 and 12·5% in 1930–40. The year 1921, therefore, marks a turning point in the history of the population of the Netherlands.

The growth has been greater in the Netherlands than in Belgium. In 1830 Belgium had greater numbers but by about 1935 the Netherlands had overtaken it.

	1830	1931	1938
Netherlands	2,613	8,061	8,728
Belgium	3,500	8,159	8,387

The rate of increase, in fact, has been attained by no other country in western Europe. During the period 1846–1935, for example, making allowance for territorial changes, population increased in the Netherlands by 174%, in England and Wales by 136%, in Belgium by 91%, in Germany by 90%, and in France by 18%. It should be remembered that Belgium suffered through the war of 1914–18, but the addition of new territory in 1919 more than compensated for the loss.

As in most European countries, there is an excess of females over males ; in 1937, for every 10,000 inhabitants, there were 4,985 men and 5,015 women, and the population was made up of 4,307,107 males and 4,332,488 females.

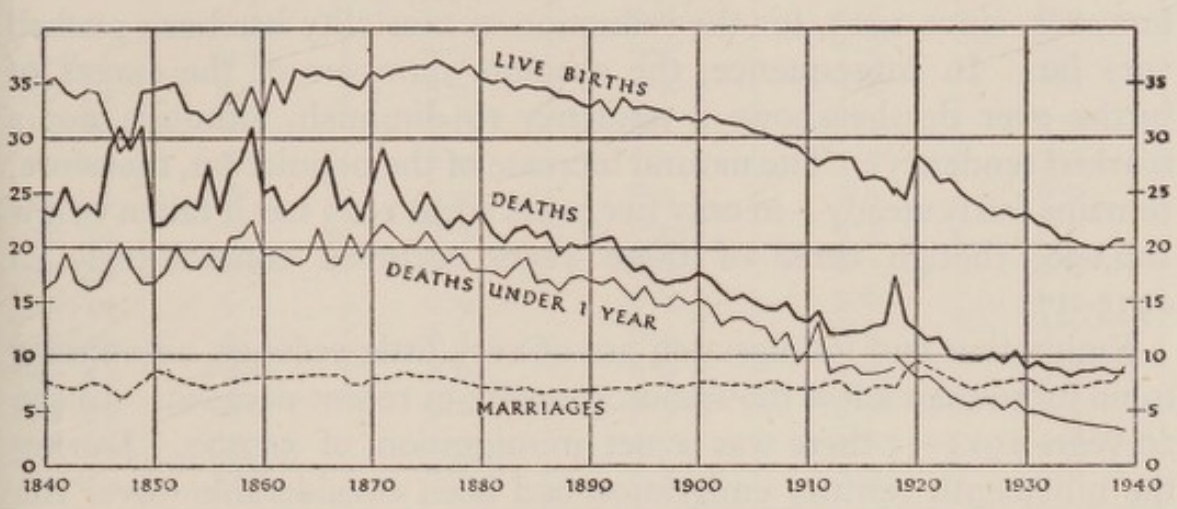

Fig. 44. Birth, death, marriage and infant mortality rates in the Netherlands, 1840–1939

From : Afl. No. 2, 1940, *Maandschrift*, Central Statistical Bureau ('s Gravenhage, 1940).
Live births, deaths and marriages are given per 1,000 inhabitants ; deaths of infants under one year are given per 100 live births. Before 1918 the figures of deaths did not include those of infants dying before the attestation of birth.

General Movement of Population

The changes in the population and the factors which contributed to them in recent years may be summarized as follows :

The Population of the Netherlands, 1923-38

Year	Total Numbers				Per 1,000 inhabitants		
	Population	Births	Deaths	Excess of Births	Births	Deaths	Marriages
1923	7,149,847	187,512	72,809	114,703	26·2	10·2	8·0
1924	7,263,893	182,430	71,167	111,262	25·1	9·8	7·8
1925	7,365,732	178,545	72,121	106,424	24·2	9·8	7·4
1926	7,471,512	177,493	73,357	104,436	23·8	9·8	7·4
1927	7,576,272	175,098	77,614	197,484	23·1	10·2	7·5
1928	7,678,187	179,028	73,816	105,212	23·3	9·6	7·7
1929	7,781,376	177,216	83,224	93,992	22·8	10·7	7·9
1930	7,883,870	182,310	71,682	110,628	23·1	9·1	8·0
1931	7,998,568	177,387	77,048	100,339	22·2	9·6	7·4
1932	8,122,482	178,525	83,059	105,466	22·0	9·0	6·9
1933	8,236,891	171,289	72,096	99,193	20·8	8·8	7·2
1934	8,341,208	172,214	70,164	102,050	20·7	8·4	7·3
1935	8,433,266	170,245	73,660	96,765	20·2	8·7	7·2
1936	8,515,713	171,675	73,923	97,752	20·2	8·7	7·5
1937	8,598,258	170,220	75,516	94,704	19·8	8·8	7·7
1938	8,683,438	178,413	74,044	104,369	20·5	8·5	7·7

From : *Jaarcijfers voor Nederland*, 1938, p. 13 ('s Gravenhage, 1939).

The Balance of Births and Deaths

Although the population in recent years has continued to increase, the number of births has shown a slight downward trend. The number of deaths has not shown any general downward trend, however, since 1923, for the reduction of mortality has been pushed very far. In consequence, the absolute numbers of the excess of births over deaths shows a tendency to diminish, although not a marked tendency. The natural increase of the population, therefore, remains fairly steady—in only five years since 1923 has it fallen below 100,000, though three of these years occurred consecutively in 1935–37.

Emigration and immigration are of very little account, amounting to no more than a few thousands annually in recent decades. In the 20 years 1915–35 there was a net immigration of 59,000. During the nineteenth century emigration had been considerable—over the whole period 1840–1930 the net emigration was 402,000.

With the steady growth of population through a fairly constant annual natural increase in *numbers*, however, the *rate* of increase is declining. This is not due to any decline in marriage rates, which have remained remarkably constant. In 1840 the marriage rate was 7·4 per 1,000 inhabitants, in 1938 7·7, while since 1923 the variation was between 8·0 and 6·9. Clearly a number of other factors affect the rate of increase of the Netherlands population.

Age Groups

The age composition of a population is a product of its past and has a vital bearing upon its future. Compared with its neighbours the Netherlands has a larger proportion of its population in the younger age groups and a smaller proportion in the older groups.

Thus in the Netherlands, compared with any neighbouring country, there is a greater proportion of the population included within all the age groups below 24 years, and a smaller proportion included within all the age groups above 30 years. In western Europe it has a population which has aged least.

Nevertheless the proportions are changing in the direction of increasing age, as in other countries. The second table on p. 235 shows the changing age proportions for females from 1879 to 1930 : the proportions for males show no significant divergence.

Population by Quinquennial Age Groups, as a percentage of *Total* Population. Based on estimates.

Age Group	Nether-lands	Germany	England and Wales	Belgium	France
	1937	1937	1937	1938	1936
0–4	9·5	8·1	6·8	6·8	8·2
5–9	9·6	7·2	7·2	7·5	8·4
10–14	9·5	8·0	7·8	7·8	8·6
15–19	9·2	7·8	8·1	8·3	5·6
20–24	8·5	6·9	7·9	5·5	7·3
25–29	8·3	9·1	8·4	7·9	8·0
30–34	7·7	8·9	8·2	8·2	8·0
35–39	6·9	8·3	7·6	8·3	7·5
40–44	6·2	6·9	6·8	7·6	6·4
45–49	5·3	6·1	6·4	6·5	6·1
50–54	4·8	5·6	6·0	6·0	5·8
55–59	4·2	5·0	5·5	5·5	5·5
60–64	3·6	4·5	4·7	4·9	4·8
65+	6·7	7·6	8·5	9·3	9·8
	100·0	100·0	100·0	100·0	100·0

From : *Statistical Yearbook of the League of Nations*, 1939-40, pp. 26-30 (Geneva, 1940).

Percentage of all females in the age groups from 1 *to* 59 *years*, 1879–1930

Age	1879	1889	1899	1909	1920	1930
Under 1	3·15	2·87	2·80	2·66	2·59	2·12
1	2·73	2·62	2·56	2·50	2·12	2·06
2	2·61	2·53	2·53	2·44	2·07	2·06
3	2·55	2·46	2·47	2·38	2·12	2·00
4	2·40	2·40	2·36	2·35	2·14	2·01
5–9	11·09	11·15	11·10	11·18	10·62	10·33
10–14	10·05	10·60	10·34	10·33	10·26	9·32
15–19	8·99	9·33	9·39	9·35	9·66	9·27
20–29	15·09	15·70	16·41	16·12	16·57	17·28
30–39	12·65	12·13	12·74	13·35	13·38	13·97
40–49	10·78	10·07	9·70	10·30	11·04	11·04
50–59	8·70	8·38	7·85	7·62	8·25	8·79

From : *Jaarcijfers voor Nederland* 1938, p. 9 ('s Gravenhage, 1939).

Thus the proportion of females under 14 has diminished, and the proportion in the 15–59 group has increased. For males the position is the same. In ages over 59 the proportion has risen in all age groups for males, and for females except the group 60–64, in which the figure for 1930 is the same as that for 1879.

Two consequences result from an ageing population : (a) an

increase in the death rate—because the higher death rate of the older people will play an increasingly important part in influencing the total death rate ; further, it should be remembered that the rate by which the span of life can be lengthened is diminishing ; (b) a decrease in the number of births—because the older generations, which will become more numerous, are likely to produce fewer children.

The factors of death-rate and birth-rate must now be analysed separately.

The Death-rate

With improvements in medical science, in hygiene (see p. 198) and the standard of living, the death-rate in the Netherlands has declined steadily (Fig. 44), at a rate approached by few other countries in the world.

Death-rates 1911-38 (*per* 1,000 *inhabitants*)

	1911–13	1921–5	1926–30	1931–5	1936	1937	1938
Netherlands	13·1	10·4	9·9	8·9	8·7	8·8	8·5
Germany*	14·8†	13·3	11·8	11·2	11·8	11·7	11·7
United Kingdom	14·2	12·4	12·3	12·2	12·3	12·6	11·8
Belgium	15·3	13·4	13·7	12·9	12·8	13·1	13·0
France	19·0	17·2	16·8	15·7	15·3	15·0	15·4

From : *Statistical Yearbook of the League of Nations* 1939–40, p. 38 (Geneva, 1939–40). For a discussion of the causes of death, see p. 202.

* 1937 frontiers (i.e. including the Saar territory).

† For 1913 only.

The contrast with Belgium and France is striking. The expectation of life in the Netherlands is, as would be expected, greater than in neighbouring countries.

Mean Expectation of Life at Birth

	Male	Female
Netherlands (1931–5)	65·1	66·0
England and Wales (1930–32)	58·7	62·9
Germany (1932–4)	59·9	62·8
Belgium (1928–32)	56·0	59·8
France (1928–33)	54·3	59·0

From : *Statistical Yearbook of the League of Nations*, 1939–40, pp. 66–68 (Geneva, 1940).

An analysis of mortality by age and sex amplifies the figures of the crude death-rates : the contrast with Belgium is all the more striking when the rates for various age groups are examined.

*Mortality by age and sex; specific rates of 10,000 inhabitants of each age group**

Age Groups	Netherlands 1936–7		England and Wales 1937		Belgium 1936–7		France 1936	
	M	F	M	F	M	F	M	F
0–1	118	93	647	502	848	675	185	149
1–4			54	48	63	54		
5–9	12	10	20	17	21	16	18	17
10–14	9	9	12	11	15	14	13	13
15–19	15	13	21	18	22	20	29	29
20–24	20	16	28	26	38	31	40	35
25–29	19	19	29	27	37	32	47	39
30–34	23	23	32	29	41	35	60	41
35–39	27	30	42	35	50	40	80	48
40–44	37	38	59	44	65	49	103	60
45–49	54	52	87	62	93	67	125	76
50–54	84	80	136	91	135	94	172	105
55–59	130	125	197	129	188	135	229	139
60–64	211	199	309	212	272	208	353	223
65–70	352	318	460	335	421	331	486	320
70–75	569	550	749	564	656	543	1,229	1,006
Over 75	1,310	1,277	1,530	1,299	1,381	1,222		
Total	88		124		129		156	

From: *Statistical Yearbook of the League of Nations*, 1939–40, pp. 61–63 (Geneva, 1940).

The Birth-rate, Fertility and Reproduction Rates

While much may yet be done to lengthen the span of life, the excellence of the existing health services in the Netherlands implies that there is less room for improvement than in many countries, and clearly the process cannot be continued indefinitely. It is the number and rate of births which are the more important factors in deciding the future trend of population. Just as the present numbers of a population and its age composition are determined not by the birth and death-rates now prevailing, but by the rates which have prevailed during the lifetime of all the generations now living, so will present numbers and age composition act as the main determinant of the population of future generations.

The Birth-rate. The birth-rate in the Netherlands has declined, as in many other countries (Fig. 44). The rate of decline, however, has been less than in Belgium and in the United Kingdom.

* The rates for infants under one year are calculated per 10,000 living births.

Birth-rates, 1911-38 (*per* 1,000 *inhabitants*)

	1911–13	1921–5	1926–30	1931–5	1936	1937	1938
Netherlands	28·1	25·7	23·2	21·2	20·2	19·8	20·6
Germany*	27·0†	22·1	18·4	16·6	19·0	18·8	19·7
Belgium	22·7	20·4	18·6	16·8	15·2	15·3	15·6
United Kingdom	24·3	20·4	17·2	15·5	15·3	15·3	15·5
France	18·1	19·3	18·2	16·5	15·0	14·7	14·6

From : *Statistical Yearbook of the League of Nations*, 1939–40, p. 37 (Geneva, 1940).

* 1937 frontiers (i.e. including the Saar territory).
† For 1913 only.

Fertility and Gross Reproduction Rate. The crude birth-rate merely expresses the number of births per thousand of the total population irrespective of age and sex. Neither this rate nor the balance between it and the death-rate is a true measure of the capacity of a population for further increase. A population may be preparing for decline while it is actually increasing in numbers, for the capacity for further increase depends upon fertility and mortality in different age groups of women below 50. The fertility of a population clearly depends upon the number of women between 15 and 50—the reproductive period. But since the younger women have a higher fertility than older women, the composition of the population by age, especially the age of its women, is an important factor. The figures for *total fertility* show how many children would be born on an average to 1,000 women passing through the child-bearing age (i.e., between the ages of 15 and 50), assuming that current rates of fertility at all ages remain unchanged and that none of the women die during that period. The figures are obtained by adding together the numbers of children born to every thousand women during each year of age.

Total Fertility

Netherlands	(1936)	2,591	Germany	(1934)	2,032
	(1937)	2,543		(1936)	2,212
	(1938)	2,633	France	(1935)	2,045
	(1939)	2,641		(1936)	2,045
Belgium	(1939)	2,097	England and Wales	(1931)	1,920

From : *Statistical Yearbook of the League of Nations*, 1940–41, pp. 46–7 (Geneva, 1941).

The figure for the Netherlands means that, according to fertility rates in 1938, a thousand women would give birth to 2,633 children,

assuming that none of the women die before they reach 50. But since the number includes both boys and girls, it is not a measure of the extent to which the population is equipping itself for reproduction. This is expressed by the number of girls born to every woman during the child-bearing years, since these will be the potential mothers of the future. In the Netherlands this figure, which is called the ' gross reproduction rate ', was 1·277 for 1938. That is to say, at the current rate of reproduction 1,277 girls would be born to 1,000 women during the child-bearing years.

Net Reproduction Rate. But some of the girls will die before they reach the child-bearing age and some will not live through the reproductive period. The rate of effective reproduction is thus represented by a figure which allows for losses by death among females between birth and the age of 50 years. This figure is known as the ' net reproduction rate ', and is obviously lower than the gross rate. The net reproduction rate is usually expressed in terms of unity : for the Netherlands in 1938 it was 1·158. Thus according to the fertility and mortality rates of 1938 a thousand women were being replaced not by 1,277 girls but by 1,158. The net reproduction rate is an indication of the probable ratio between female births in two successive generations, according to current rates of fertility and mortality. It shows, therefore, the extent to which a population is likely to reproduce itself, and indicates whether the population is likely to increase or decrease. A net reproduction rate of 1·0, if maintained, means that a population is likely to remain constant provided that fertility and mortality do not change.

In the Netherlands, therefore, the replacement of the population is ensured, at present, by an appreciable margin. In this it differs from all other countries of north-west Europe except Eire.

Net Reproduction Rates

Netherlands	(1936)	1·140	Belgium	(1936)	0·831
	(1937)	1·119		(1939)	0·859
	(1938)	1·158	England and Wales	(1936)	0·773
Germany	(1935)	0·906		(1937)	0·782
	(1936)	0·934	Sweden	(1935)	0·729
France	(1936)	0·880		(1936)	0·756
	(1937)	0·870			

From : *Statistical Yearbook of the League of Nations*, 1940–41, pp. 48–9 (Geneva, 1941) ; and *ibid.*, 1939–40, pp. 48–9.

Eire, Poland and Italy also have rates above unity.

Future Trends

While the birth-rate in the Netherlands is declining, the population is still likely to increase, therefore, for some years to come. The country is not dissimilar from others in north-west Europe in the general trend of its birth and reproduction rates, but the slowing up of the rate of increase has occurred later. As long as current mortality and fertility rates continue an increase will continue. If, as seems not unlikely, in the light of the experience of other countries, fertility diminishes an eventual decline of population will not make itself apparent for some time.

The comparatively rapid increase of population, unaccompanied by any considerable emigration in recent decades, has given rise to the question as to whether the Netherlands is over-populated, or in danger of becoming over-populated. With an annual natural increase of over 100,000, 40,000 new wage earners enter the labour market each year. The severe unemployment during the crisis years of 1930–35 seemed to many to give some point to this question. The effects of economic depression however must not be confused with the possible pressure of population. Statisticians agree that so far the Netherlands is not over-populated, for the standard of living has not been prevented from rising. In any conditions of good or fair activity in world trade it seems likely that the Netherlands will continue to provide a modest living for its people, through the application of capital, skill, and technical proficiency.

Regional Variations in the Growth of Population

The provinces which showed the greatest increases in population in the years between 1830 and 1938 were those with the highest proportion of urban population. South Holland, for instance, increased its population nearly fivefold, North Holland rather more than fourfold and Utrecht rather less than fourfold. At the other end of the scale the provinces of Friesland and Zealand showed relatively small increases, Zealand not even doubling, and Friesland only just doubling, its population. The other provinces showed a threefold population increase (Figs. 45, 46).

The most rapid rate of increase occurred after about 1869 in the case of North and South Holland, but the steepening of the curve of growth did not begin until about 1889 in Overyssel and North Brabant, about 1899 in Gelderland and about 1909 in Limburg. This acceleration in the rate of increase came first in North and

South Holland, following the development of industry and the expansion of trade and transit traffic which took place in the later nineteenth century (see p. 363); in the other provinces it was associated with the introduction or intensification of industry, and to some extent with improvements in methods of farming.

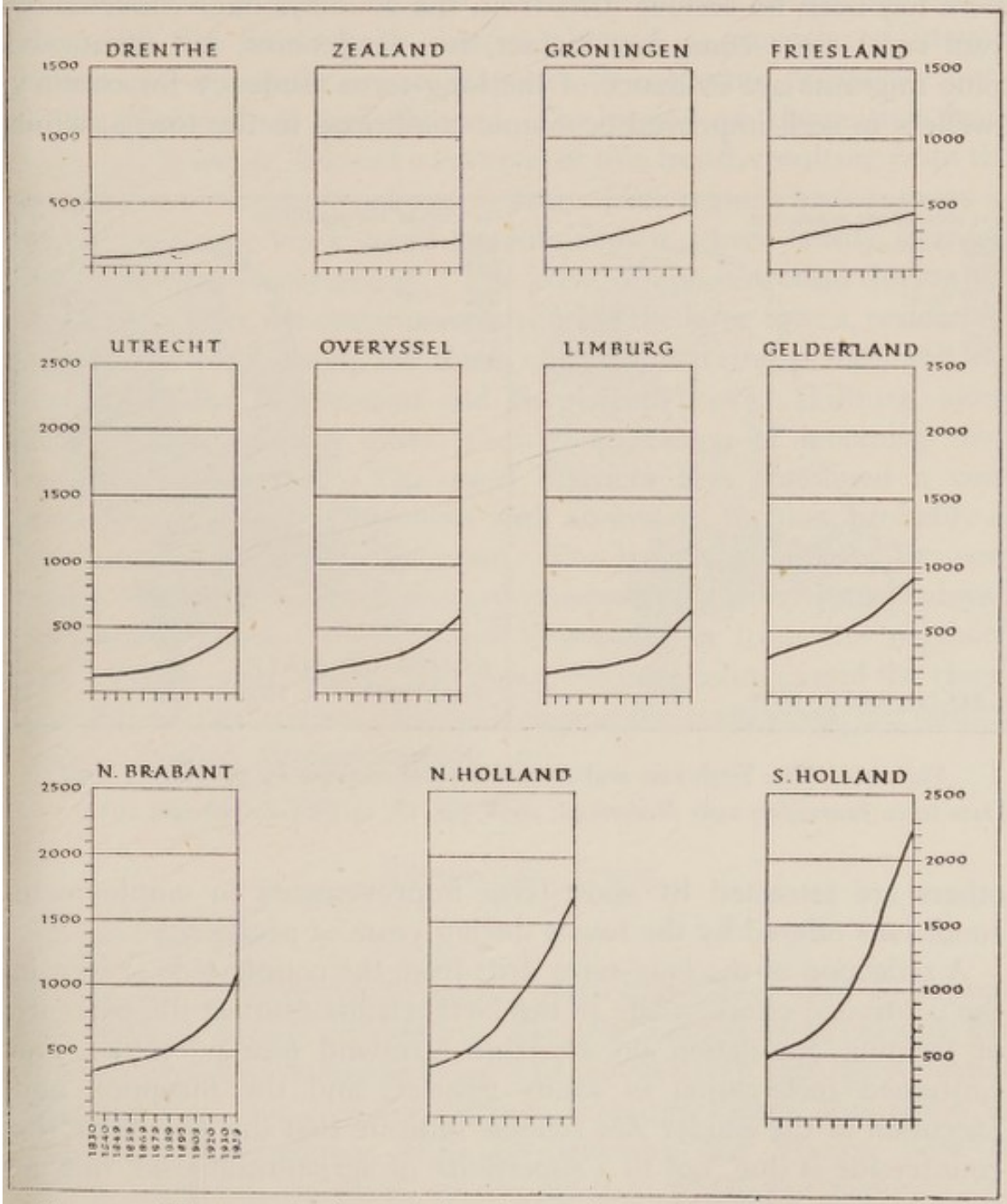

Fig. 45. The growth of population, by provinces, 1830–1939 (in thousands)

Data from *Jaarcijfers voor Nederland*, 1938, p. 3; 1939, p. 3 ('s Gravenhage, 1939, 1942).

The graphs clearly show the effects of the comparatively feeble industrial development in Drenthe, Zealand, and Friesland. The marked industrialization and urban growth experienced in Overyssel, Limburg, N. Brabant, and N. and S. Holland are reflected by the steepening of the graphs.

There is little depopulation of the rural districts in the Netherlands, though population has grown at a slower rate than in the urbanized areas. The northern and south-western marine clay areas, the peat colonies and the river-clay (interfluvial) area suffer emigration from many of their rural communes, but in general there has been no serious drift from the countryside. Movements from rural areas comprise, in fact, two tendencies, not identical: some migrants are evidence of the long-term tendency for country dwellers to seek improved economic conditions in the towns, while

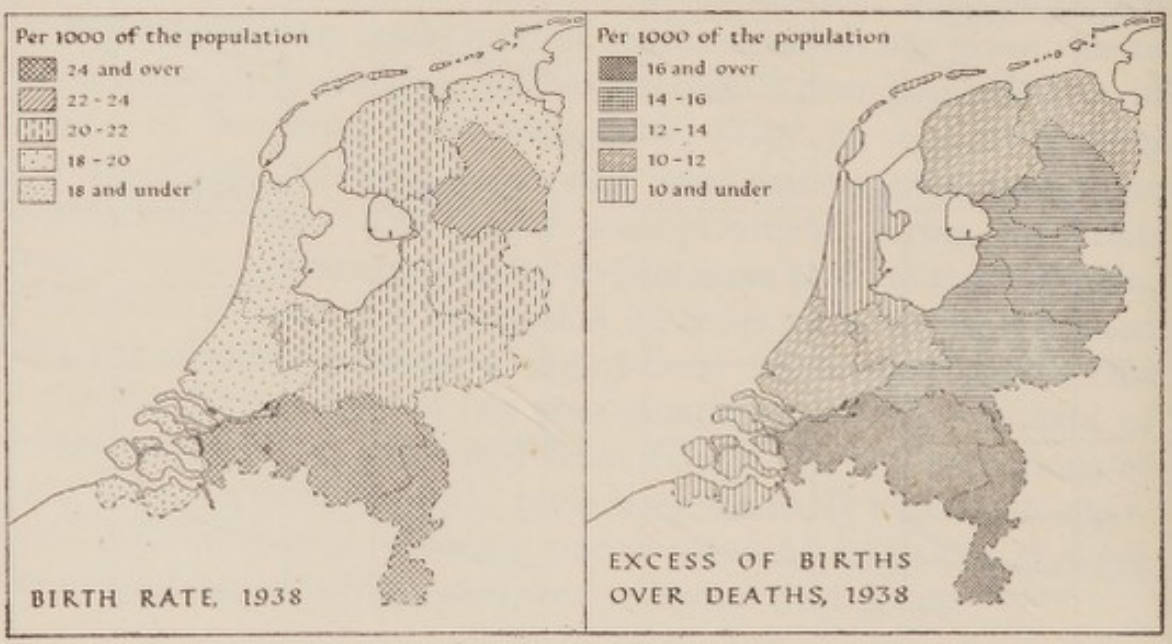

Fig. 46. The birth rate and rate of natural increase by provinces, 1938
Data from *Jaarcijfers voor Nederland*, 1938, pp. 18, 20 ('s Gravenhage, 1939).

others are attracted by short-term improvements in employment conditions offered by the towns during years of prosperity.

A reflection of the long-term drift from the countryside is seen in the continued efforts made in the Netherlands to meet the pressure of farming population on available farmland (see p. 327). The continued reclamation of sandy districts and the inception and execution of the Zuider Zee scheme indicate that the drift from the countryside is due, not to a superfluity of agricultural land, but, in large part, to a shortage.

Short-Term Population Movements

An interesting result of detailed statistical surveys of population movements has been to show that well-marked short-term migration

takes place within the country in response to variations in agricultural and industrial prosperity. Such movements may pass through a complete cycle within five years and thus are largely unrevealed by the decennial census. During the period 1925–30, for example, the large cities, industrial regions like south Limburg and Twente, and specialized agricultural regions like the Westland market gardening area and the flower-bulb district showed a pronounced inward movement of population, in response to economic prosperity both in the Netherlands and abroad. The period of depression from 1931–35, however, showed a reversal of this trend, resulting from the movement of unemployed people from these regions back to areas in which part-time work could be obtained or where family financial assistance was forthcoming. The areas of concentration during the crisis years were the communes bordering the large towns, residential districts in rural areas, the dune villages, watering places, and the district around Roosendaal and Bergen-op-Zoom. Tilburg, alone of the manufacturing cities, showed an excess of incoming over outgoing population. The sand districts also contained a considerable number of communes with an inward surplus, probably as a result of continued reclamation. The large commune of Emmen, which lost many people in years of prosperity, saw many unemployed emigrants return. The exodus of population from the northern and south-western marine clay areas, the peat colonies and the river-clay (interfluvial) region continued during the crisis years, but underwent a marked diminution (Fig. 47).

Towns and Cities

Urban Population

The official Dutch statistics of urban population omit all centres of less than 20,000 inhabitants. By this method of calculation the urban population amounts to 49% of the total, but this figure cannot be used as a basis of comparison with the urban population of neighbouring countries, such as Germany and France, both of which classify as urban all communities in which the agglomerated or grouped population reaches the low figure of 2,000.

It is clear that many centres of population in the Netherlands with numbers below 20,000 perform an urban function as market or manufacturing centres. A number of these smaller centres owe their existence to both types of activity. Among the numerous

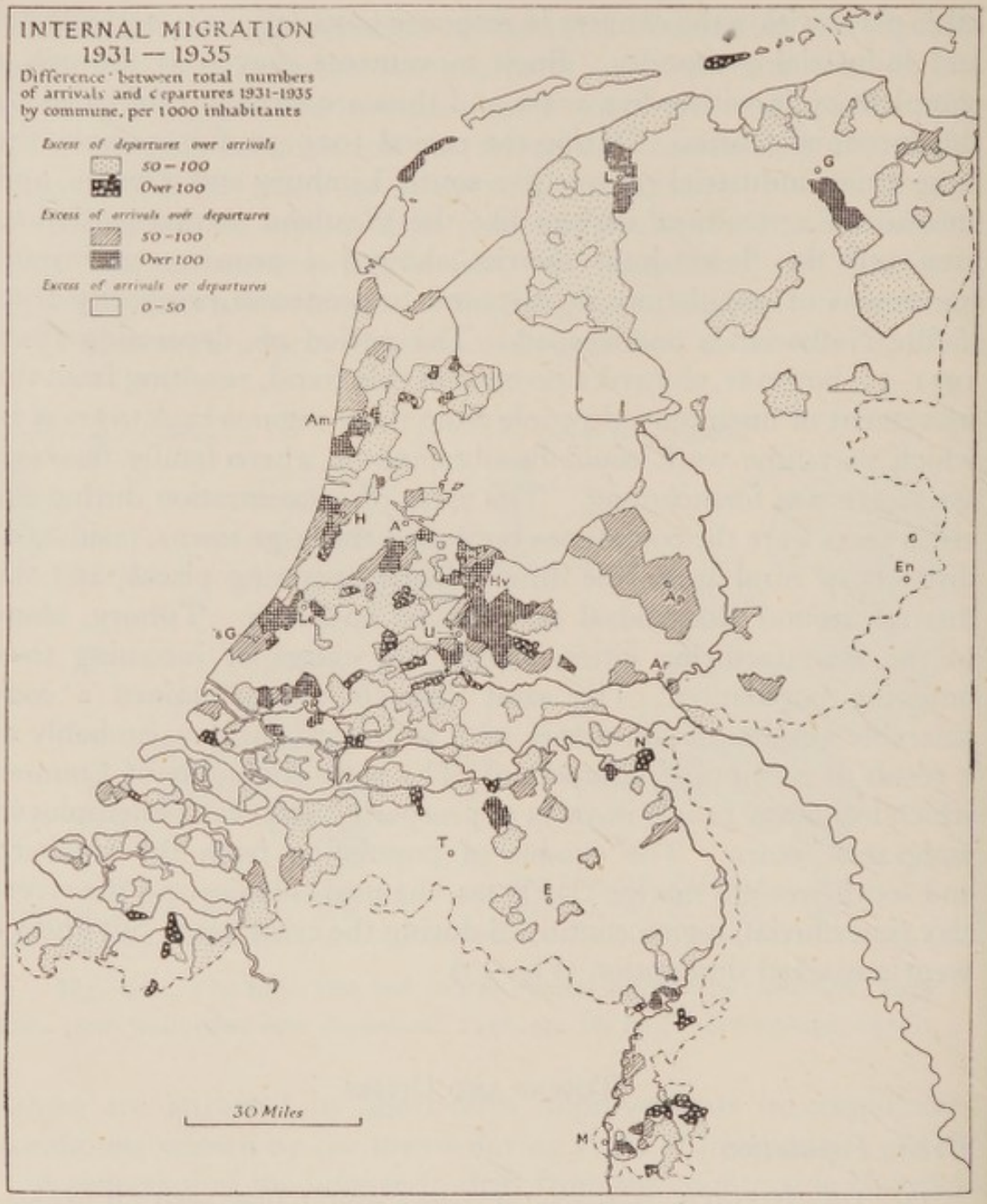

Fig. 47. Internal migration, 1931–1935

Based on a map by M. J. Boerendonk, ' Verschil Tusschen Vestiging en Vertrek, 1931 T/M 1935 ', in Departement van Economische Zaken *Verslagen en Mededeelingen van de Directie van den Landbouw*, 1939, *No.* 1. *De Economische Toestand van den Landbouw in* 1937/1938 *en andere Ontwerpen* ('s Gravenhage, 1939).

A Amsterdam ; Am Alkmaar ; Ap Apeldoorn ; Ar Arnhem ; E Eindhoven ; En Enschede ; G Groningen ; 's G The Hague ; H Haarlem ; Hv Hilversum ; L Leeuwarden ; Le Leiden ; M Maastricht ; N Nymegen ; R Rotterdam ; T Tilburg ; U Utrecht.

The map shows mainly the effects of short-term movements of population in the period which saw the maximum development of the economic depression. Many people were forced to leave the centres of commerce and industry. Thus the large urban communes of Amsterdam, Rotterdam, Eindhoven, Tilburg, Arnhem, Nymegen, Enschede, Maastricht, and Groningen showed no great change in population, although over the ten-year intercensal period they showed considerable increases.

examples of small market towns below the 20,000 figure may be cited Middelburg, the capital of Zealand (18,400), Tiel (12,700), which possesses a famous fruit and vegetable market, Ommen in Overyssel (8,600), and many others. Among the smaller manufacturing centres, communes such as Oss (16,000), Oldenzaal (10,300), Borculo (5,600), and many others, seem out of place in the rural category to which they are officially assigned.

On the other hand, numerous agricultural workers live within the confines of urban communes such as Haarlem (140,000), Alkmaar (33,000), and even within the boundaries of Amsterdam as reconstituted in 1921. In many communes also, especially in the fen-colonies, agricultural and industrial work are closely bound up with each other, and rural and industrial workers live side by side, as at Veendam (13,600), Wildervank (10,300), and similar ' street ' settlements.

A further difficulty arises in an attempt to draw a distinction between urban and rural population. The census does not distinguish between nucleated and dispersed population, so that communes such as Emmen (48,000), and Heerenveen (22,000) appear on the list of urban centres, whereas, in fact, the central nucleus is small and the greater part of the population is scattered over the commune. In the Haarlemmermeer (33,000) there can hardly be said to be any central nucleus.

It will be seen, therefore, that it is difficult to draw a hard and fast line between urban and rural population. This is due not only to statistical difficulties, but also to a variety of more fundamental causes—the penetration of the countryside by small secondary industries, especially in North Brabant, Overyssel, Gelderland and Limburg, and the presence of highly intensive agriculture and horticulture alongside large centres of population, particularly in North and South Holland. Whatever figure is adopted as the dividing line between urban and rural population it is clear that the Netherlands as a whole is among the more highly urbanized countries of Europe. A calculation which includes all communes with a nucleated population of 10,000 and upwards gives an urban figure of about 60%, and even this is probably an understatement. Urbanization is, however, very unequally distributed throughout the country, as the following table shows :

Percentage of population living in towns of 20,000 *inhabitants or over,* 1 *January* 1939, *by provinces*

Province	Percentage	Province	Percentage
North Holland	72	Limburg	30
South Holland	67	Groningen	28
Utrecht	52	Friesland	18
Overyssel	47	Zealand	9
Gelderland	41	Drenthe	8
North Brabant	38		

Even the addition of centres down to 10,000 inhabitants fails to raise the urban figures of the last three provinces to anything but mediocre levels, the figures being increased only to 24% for Friesland, 20% for Zealand and 29% for Drenthe.

Number and Distribution of Cities

The Netherlands have a high proportion of large urban centres. There are seven cities* with over 100,000 inhabitants, as compared with four in Belgium and one in Denmark. Three cities, Amsterdam, Rotterdam and The Hague have over half a million inhabitants as against one city in Belgium. This substantial number of large cities is the result not merely of local commerce and industry, but more especially of long-established and far-flung trading and colonial connections.

The large cities, in common with urban population generally, are markedly more developed in North and South Holland than in the other provinces. Four of the seven cities of over 100,000 inhabitants are in these two provinces, two being in North Holland and two in South Holland. Of the remaining three, one each is claimed by Utrecht, Groningen and North Brabant. All three of the largest cities with over 500,000 inhabitants are in North and South Holland (Fig. 48).

The Growth of the Cities

Earlier Development. The growth of civic life in the Netherlands began remarkably early, in fact, together with the southern part of the ' Low Countries ' (now Belgium) the region possessed during the Middle Ages a larger number of flourishing cities than could be found in any area of a similar size north of the Alps.

On the whole the development in the northern, or Dutch, Netherlands came rather later than in the southern provinces, though a few

* Here, and elsewhere in this handbook, the term ' city ' is employed to denote a large town, although the word does not occur in Dutch usage.

cities, such as Utrecht and probably Leiden, date back to Roman times. The early trading cities, such as Dordrecht, Utrecht and Amsterdam entered upon their first period of prosperity about the thirteenth century, though many were founded before that time. In the fifteenth century the remarkable growth of the herring trade led to the great development and prosperity of the coastal cities,

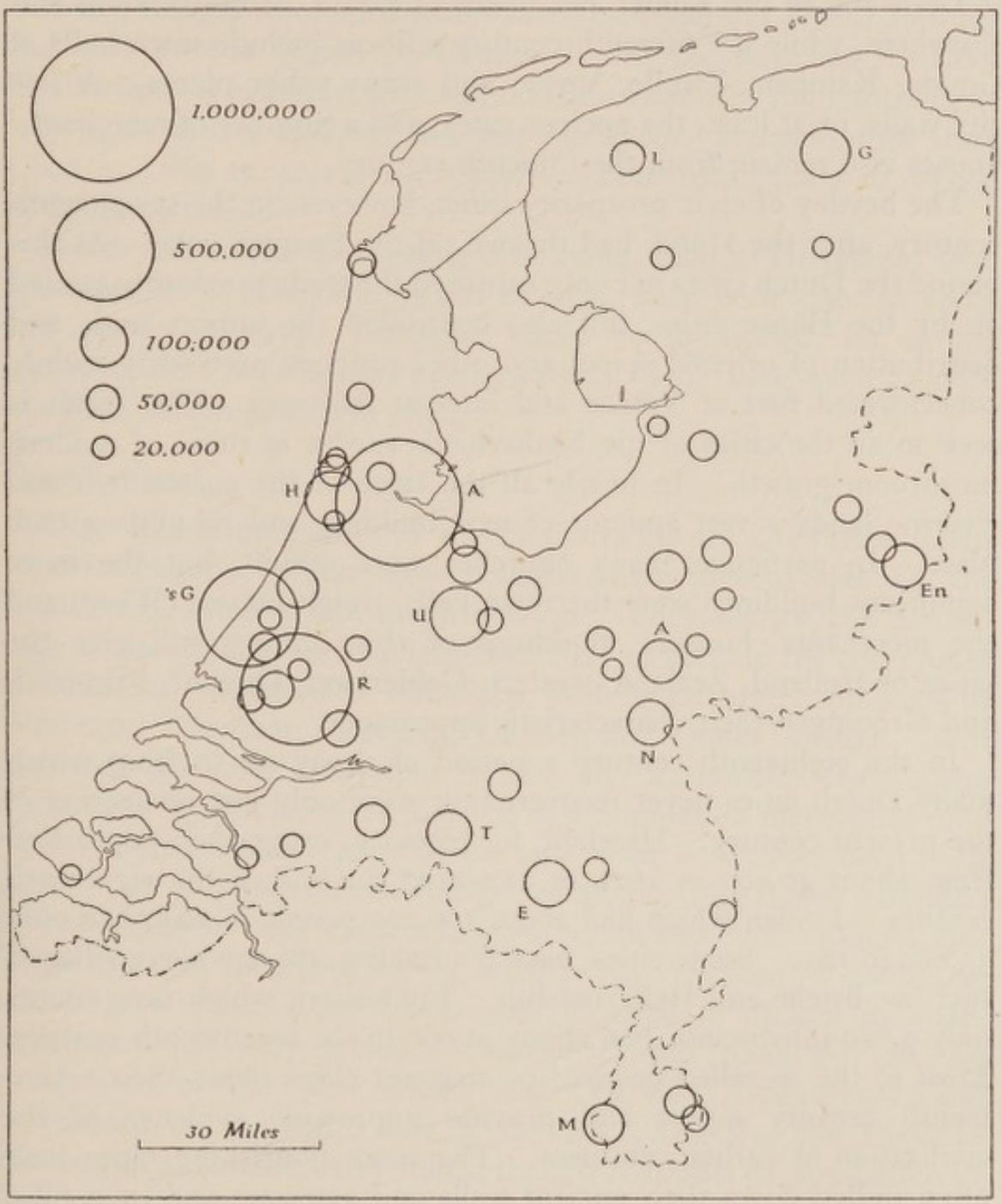

Fig. 48. The distribution of towns with populations exceeding 20,000 (31 December, 1939)

Data from *Jaarcijfers voor Nederland*, 1939, p. 4 ('s Gravenhage, 1942).
A Amsterdam ; A Arnhem ; E Eindhoven ; En Enschede ; G Groningen ; 's G The Hague ; H Haarlem ; L Leeuwarden ; M Maastricht ; N Nymegen; R Rotterdam ; T Tilburg ; U Utrecht.

such as those in Zealand and along the shores of the Zuider Zee, and many cities which flourished at that time are distinguished by churches, town halls, and other monuments of the fifteenth and earlier centuries. Among the oldest memorials of a flourishing past are the Dom at Utrecht and the Oude Kerk at Amsterdam (both thirteenth century in part), and fourteenth-century Gothic churches at Delft and in the Zuider Zee towns of Edam, Monnikendam and elsewhere, while the fifteenth-century edifices include town halls at Gouda, Kampen, Zwolle, Veere, and many other places. A few city walls, or at least, the ancient gates, and a number of merchants' houses also remain from the fifteenth century.

The heyday of civic prosperity came, however, in the seventeenth century, after the Dutch had thrown off the Spanish yoke. At this period the Dutch cities not only captured the trade previously carried on by the Hanse cities, but also controlled the import trade and distribution of oriental spices and other produce previously mainly concentrated first at Venice and later at Antwerp. The result is seen in all the cities of the Netherlands except in those of modern mushroom growth. In nearly all the cities of the coastal belt and riverine lands a vast amount of new building and rebuilding took place. In particular many churches were rebuilt, but the more significant buildings were the town halls, weigh-houses (*Waag*) and the merchants' houses. Buildings of this century still give the cities of Holland, Zealand, western Gelderland, Utrecht, Friesland, and Groningen their characteristic appearance.

In the eighteenth century a period of decay set in from which many Dutch cities never recovered, or were only just recovering in the present century. Haarlem, for instance, dropped in population from about 40,000 in 1622 to 21,000 at the end of the eighteenth century ; Leiden which had about 100,000 people in 1640 had only 35,000 in 1830. Some cities, once flourishing, are now mere villages, such as Brielle and Hellevoetsluis. Enkhuizen, which now counts only 9,600 inhabitants, had about 40,000 in the seventeenth century. Most of the so-called decayed or stagnant cities retain their seventeenth century aspect and provide impressive evidence of the civilization of earlier centuries. The more flourishing cities have often pulled down their ancient walls and gateways and even filled in their canals, though in most cases the *singel* or defensive moat remains, and is a very marked feature of the plan of every town in the polder and riverine lands.

Modern development. Towards the end of the nineteenth century

and during the present century, the introduction and expansion of many industries was reflected in great increases in the urban population, and in the growth of new towns. The three big cities, Amsterdam, Rotterdam and The Hague all showed spectacular increases between 1869 and 1939. Amsterdam increased its population by 200 %, Rotterdam by 430 % and The Hague by 460 %.

Many villages developed into towns, especially in North Brabant and the Twente region of Overyssel and the adjacent districts. Eindhoven, for example, with 113,000 inhabitants in 1939, numbered only 5,700 as late as 1909, and 3,200 in 1869. Hengelo grew from 5,600 in 1869 to 42,000 in 1939, Kerkrade from 5,000 to 38,000 in the same period.

Residential towns also sprang into being, such as Hilversum with 6,600 people in 1869, and 74,000 in 1939, Zeist with 5,400 in 1869, and 34,000 in 1939. Examples could be multiplied, for of the 56 towns with over 20,000 inhabitants in 1939, there were 24 with less than 10,000 people in 1869.

Conurbations

The three largest cities of the Netherlands are composite towns or conurbations, which have reached their present size by the inclusion of suburbs and satellite towns. For instance, the boundaries of Amsterdam were enlarged in 1921 to include the communes of Buiksloot, Nieuwarden, Ransdorp, Watergraafsmeer, and parts of Westzaan, Zaandam, Oostzaan, Diemen and Ouder Amstel. This increased the area controlled by the city authorities from 4,630 hectares to 17,455 hectares, but led to a population increase of only 36,000. Considerable parts of the new areas have since been built upon or are scheduled for building. Similarly, The Hague extended its boundaries in 1925 to include Loosduinen and Scheveningen, but it has not yet incorporated its satellite of Voorburg, a commune which grew from 4,900 inhabitants in 1909 to 29,900 in 1940. Rotterdam not only includes Delfshaven and Kralingen on the north side of the New Maas, and Charlois, Katendrecht, and Feijenoord on the south side of the river, but also the Hook of Holland at a distance of 17 miles, though it attains its population of 612,000 without the addition of its adjacent satellite Hillegersberg (23,000), or of the old towns of Schiedam (63,000) and Vlaardingen (31,000), which are almost contiguous and virtually form part of the Rotterdam conurbation.

Similar absorption of neighbouring communes has taken place in

the case of smaller centres. For instance, Eindhoven (113,000) annexed the communes of Gestal, Stratum, Strijp, Tongelre and Woensel in 1920; in the same year Maastricht (68,000) annexed Oud Vroenhoven and St. Pieter. Haarlem (140,000) annexed Shoten in 1927, and Enschede (91,000) annexed Lonneker in 1934. Two satellites of Breda (52,000), Prinsenhage and Ginneken, raise its population to 80,000. Several small conurbations are developing in Twente.

An interesting example of a conurbation without a central civic organization is afforded by the Langstraat, which is composed of at least ten 'street' villages, merging one into another, for a distance of about ten miles, together with a few outlying villages which are also engaged in the boot and shoe industry.

Rural Settlement

For the Netherlands the conventional classification of rural settlements into nucleated and dispersed is hardly applicable owing to the number and variety of the types which are found in such a restricted area. It is convenient to divide them into (A) types of settlement largely peculiar to the Netherlands, and (B) types having close affinities with those found in the neighbouring parts of western Europe. These may be further subdivided into a total of eleven sub-types (Fig. 49). Such a division cannot be exact, but it serves to distinguish the principal variations in settlement pattern which have arisen in the Netherlands as a reflection of varying historical and geographical factors. These types of settlement are not often found in their pure forms. A constant tendency to dispersion has operated for some centuries and has been accelerated in recent decades by the introduction of motor transport. As a rule, the polderlands have retained their early settlement forms more than the sandy regions, owing to the restriction of sites dry enough for building.

(1) *Settlements associated with 'terpen', 'wierden', 'vliedbergen' and similar refuge mounds*

In the regions of old marine clays in Friesland and Groningen the early settlements were built on artificial refuge mounds for protection against inundation. It seems probable that the land stood relatively higher than at present, and that in late Roman times the country was only subject to floods when exceptionally high tides

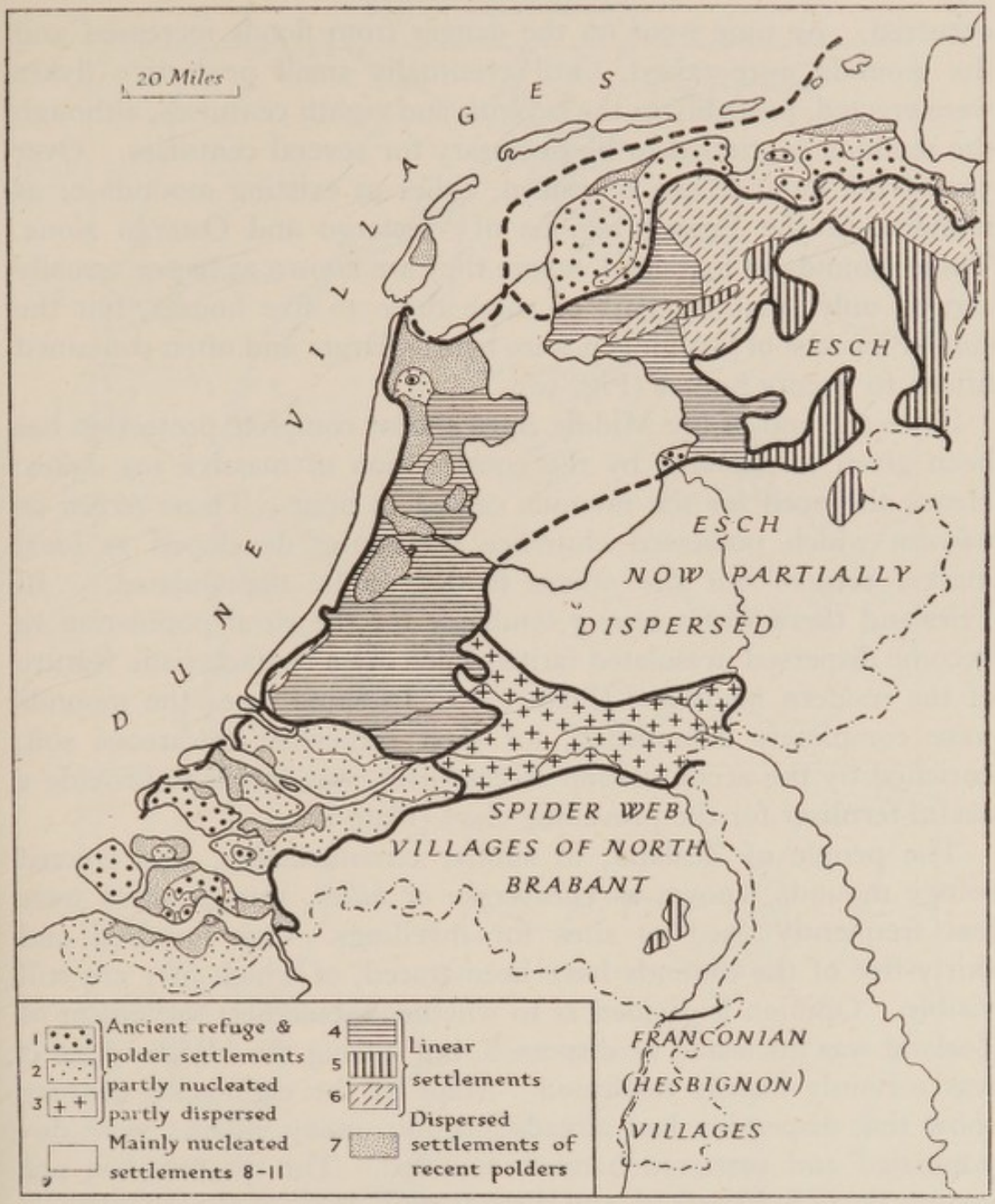

Fig. 49. Rural settlement in the Netherlands

From : H. J. Keuning, ' L'Habitat rural aux Pays-Bas ', *Tijdshr. Kon. Ned. Aardrs. Gen.*, vol. 55, p. 654 (Leiden, 1938).

A. Types of settlement mainly peculiar to the Netherlands.

Ancient refuge and polder settlements, partly nucleated, partly dispersed. (1) Settlements associated with *terpen*, *vliedbergen*, *wierden* and similar refuge mounds ; (2) remnants of dyke villages of the early polders ; (3) villages of the interfluvial (river-clay) region.

Linear settlements : (4) linear settlements (street villages) of the low fens ; (5) linear settlements (canal villages) of the high fens ; (6) linear settlements on unilateral slopes.

(7) Dispersed settlements of recent polders

B. Types of settlement having affinities with types elsewhere in western Europe —mainly nucleated settlements. (8) *Esch* villages of Drenthe, Overyssel, and Gelderland ; (9) ' spider web ' villages of North Brabant ; (10) ' Franconian ' (*Hesbignon*) villages of south Limburg ; (11) villages on the landward side of the coastal dunes.

occurred. As time went on the danger from floods increased and the mounds were raised, until eventually small protective dykes were erected, probably in the seventh and eighth centuries, although the mounds continued to be necessary for several centuries. Over 500 of the mounds can be traced, either as existing mounds or as remains, in the Frisian regions of Westergo and Ostergo alone. These mounds in Friesland, where they are known as *terpen*, usually carried only small hamlets of some three to five houses, but the similar *wierden* of Groningen were usually larger and often contained fifteen to twenty houses (Fig. 50).

Since the end of the Middle Ages almost complete protection has been given to the area by the construction of massive sea dykes. Hence the need for the mounds ceased to exist. Those *terpen* or *wierden* which possessed churches sometimes developed as local market centres but the others tended to be depopulated. In Friesland there was a strong tendency for the rural population to become dispersed in isolated farms which are a characteristic feature of the modern landscape (Plate 14). In some cases the mounds were completely demolished, for their somewhat calcareous soil, enriched by the accumulation of centuries, was found to provide a useful fertiliser for the prevailing clays (Plate 11).

The people of Zealand, in similar circumstances, also erected refuge mounds, known as *vliedbergen* or *hillen*, though these were less frequently used as sites for dwellings. One hundred and thirty-five of the mounds have been traced, of which fifty are still visible. Opinion is divided as to whether the earliest settlement of Zealand was nucleated or dispersed, but during the Middle Ages it was certainly mainly nucleated. Maps of the eighteenth century show that dispersion had already begun ; many villages were depopulated and scattered hamlets founded. This process has not gone as far as in Friesland, and there are still many nucleated villages.

(2) *Remnants of Dyke Villages of the Early Polders*

In certain coastal areas polders were early reclaimed from shallow estuaries and tidal flats—along the Lauwerszee of Groningen, the Middelzee of Friesland, the estuary shores of South Holland, in parts of the Zealand islands, and along the original coastal lands of Zealand Flanders. In these areas settlements represented a later stage than the settlements associated with refuge mounds. They lay at first along the primitive dykes, but with the passage of the centuries the settlement often spread away from the dykes as drainage

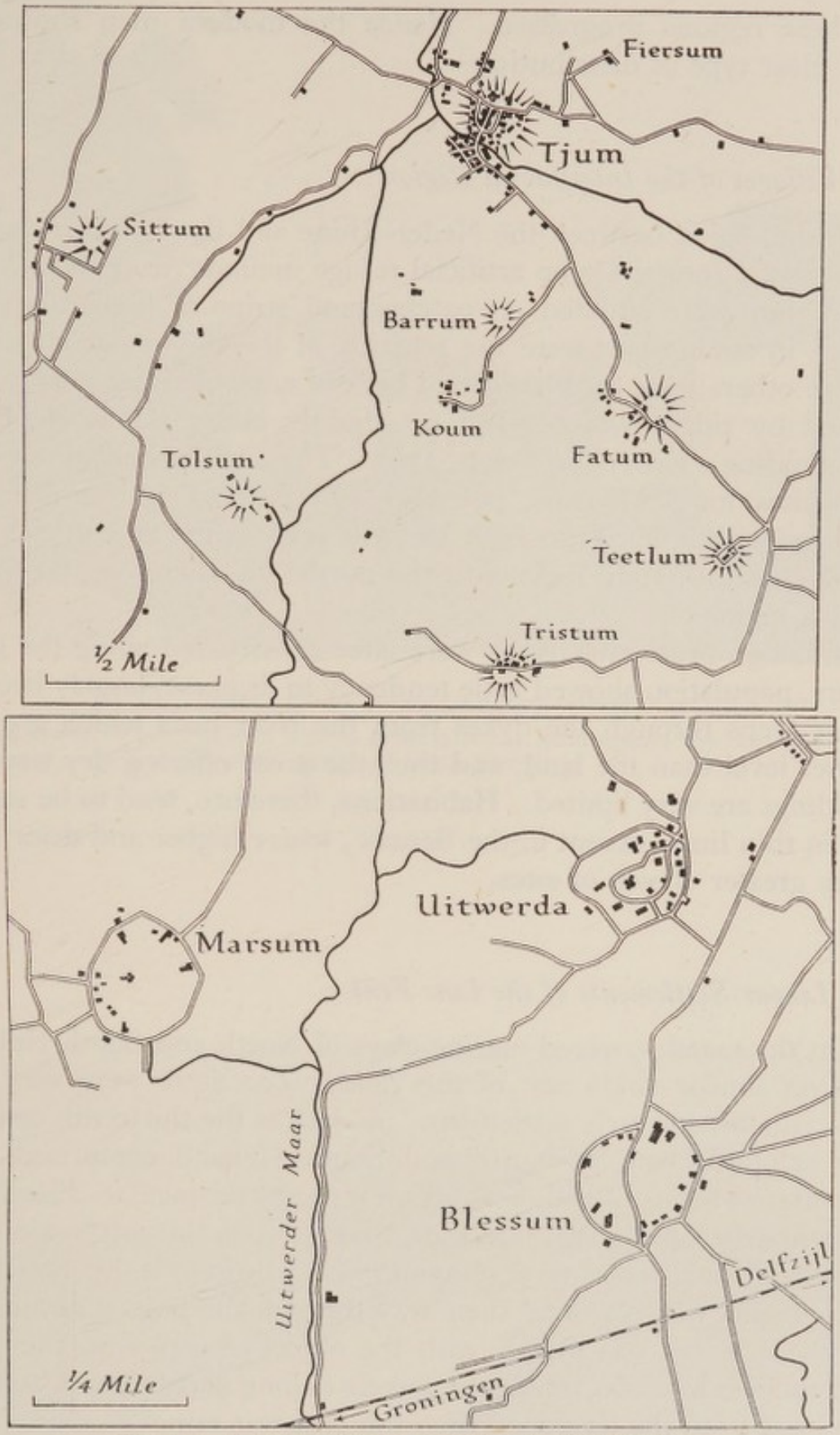

Fig. 50. Terp villages in Friesland and Groningen

Fom : H. J. Keuning, ' L'Habitat rural aux Pays-Bas ', *Tijdschr. Kon. Ned. Aardrs. Gen.*, vol. 55, pp. 644–645 (Leiden, 1938).

The upper map shows the small terp settlements of north Friesland ; the lower map shows the larger terp settlements of north-east Groningen, along the shore of the Ems estuary. The settlements, with the progressive drainage of the surrounding country, have moved downhill away from the original mound, giving a ' ring ' character to the villages of Groningen and a landscape of scattered farms in Friesland. In both areas the land is at approximately mean sea level.

of these regions progressed. Hence the modern map shows no very clear type of distribution.

(3) *Villages of the Interfluvial Region*

In the region between the Neder-Rhine and the Lek early settlements were sometimes on artificial refuge mounds (*woerden*). More often they were situated on patches and strips of higher ground, which in some cases were the remains of the fluvio-glacial plains, and in others were the abandoned beds of ancient rivers now represented by ridges which stand up slightly above the level of the surrounding countryside (see p. 279). The latter provided not only firm sites for settlement, but also well drained and fertile soil. Villages with affinities to both the *terp* settlements and to the *esch* villages of the sandy regions to the north can, therefore, be found in this region.

Although protective dykes were later constructed along the great rivers, population showed little tendency to disperse, largely because water seeps through the dykes from the river beds which are at a higher level than the land, and thus the areas offering dry sites for buildings are very limited. Habitations, therefore, tend to be strung out in thin lines, except in the Betuwe, where higher and drier land gives greater choice of sites.

(4) *Linear Settlements of the Low Fens*

On the marsh-covered marine clays of North and South Holland and on similar lands east of the Zuider Zee there were very few sites suitable for early settlement. As late as the thirteenth century the habitable land of North and South Holland comprised only the interior zone of the dunes and a few clayey peninsulas. Elsewhere were marshes, peat-bogs and lakes, among which the only reasonably firm land consisted of river alluvium in the form of levees bordering the streams which wound their way through the bogs. Settlement on these levees was mainly with the object of exploiting the peat, and the region was divided into parcels of long narrow strips stretching back from the levees. When the peat was removed the cavities filled with water, so that settlement was more than ever confined to the levees. In later times, these devastated areas were dyked, and the water pumped out, but they remained damp, and settlement



Plate 13. A south Limburg village

Massively built farm houses with a great gateway leading into the centrally placed farmyard are a feature of the village of south Limburg.



Plate 14. A farm near Leeuwarden, Friesland

The typical Friesland farm, with its enormous barn, and surrounded by a clump of trees, forms an isolated and conspicuous feature of the landscape. The barn serves mainly as a hay store and as a cattle byre. The house (seen on the right of the barn, partly concealed by trees) is usually built out on one side of the barn.

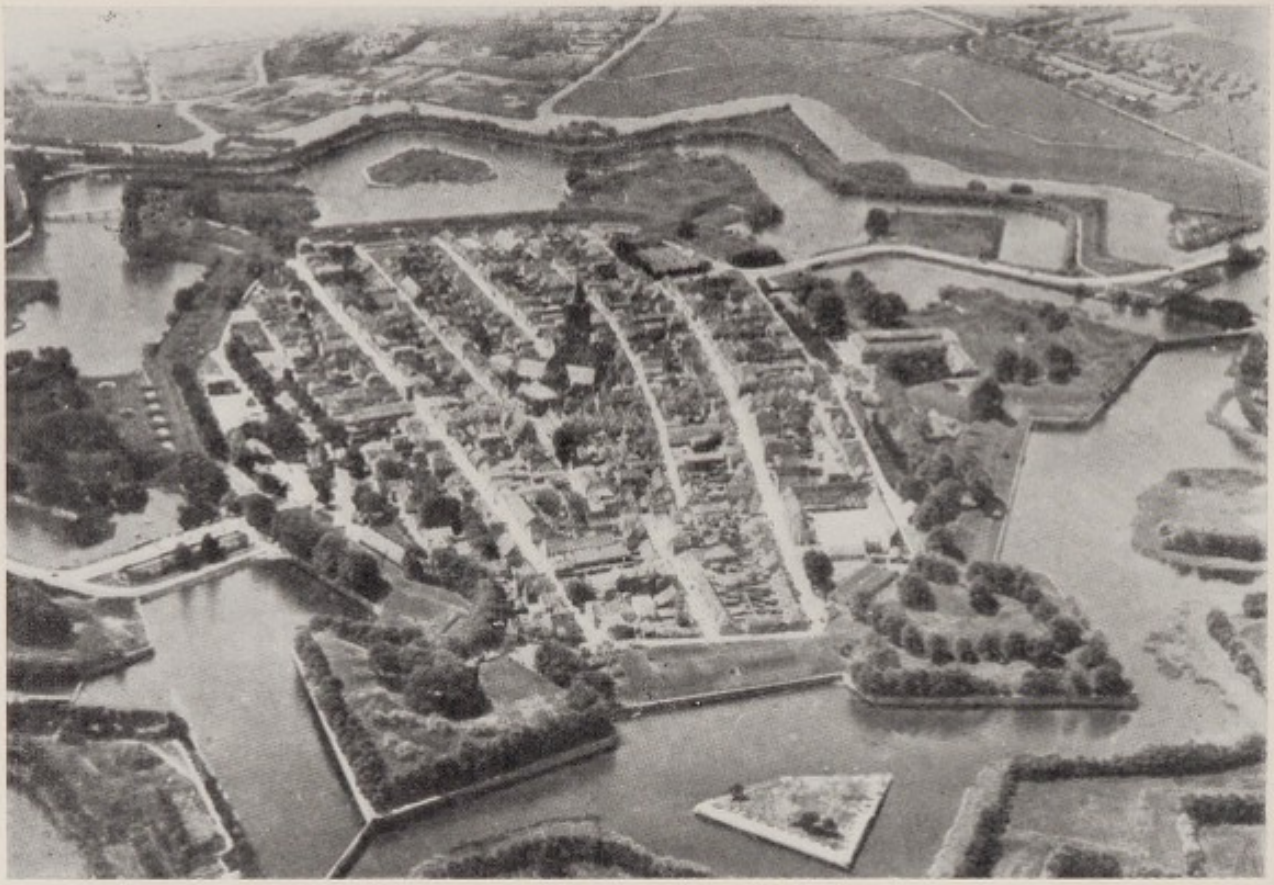

Plate 15. Naarden, North Holland

Naarden, with 7,200 inhabitants, is typical of many small stagnant towns in the Netherlands which have preserved much of their seventeenth century appearance. The elaborate moat (*singel*), has been retained, though the defensive walls have given place to ornamental grounds.



Plate 16. Gouda, South Holland

The fifteenth century town hall stands in the middle of the market place, as the central point of the town's life. The old houses seen on the left have their gable ends characteristically facing the street. Though built as residences for substantial burghers many now have shops on the ground floor.

clung to the dykes. Villages necessarily assumed linear form both on levees and dykes (Fig. 51).

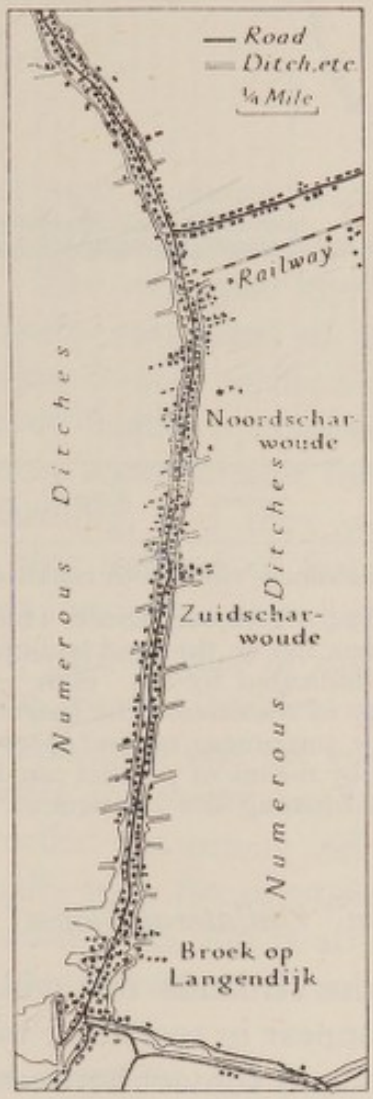

Fig. 51. Dyke villages in North Holland

From : G.S.G.S. Series 4096 ; 1 : 25,000 sheet 245.
With the early progress of peat-cutting the formation of pools confined the settlements to the ridge remaining. Later the land on either side was largely drained, and is now crossed by a maze of ditches and canals.

(5) *Linear Settlements of the High Fens*

The High Fens (Bogs—*hoogveen*) were mainly brought under cultivation in the seventeenth and eighteenth centuries by reclamation societies according to plans laid down in advance (see p. 333). The land was divided into long narrow strips running back from the larger canals, which formed the principal means of communication, and all the villages are therefore of linear type. Variety occurs only

where a village is built upon two parallel canals which are close together (Fig. 52).

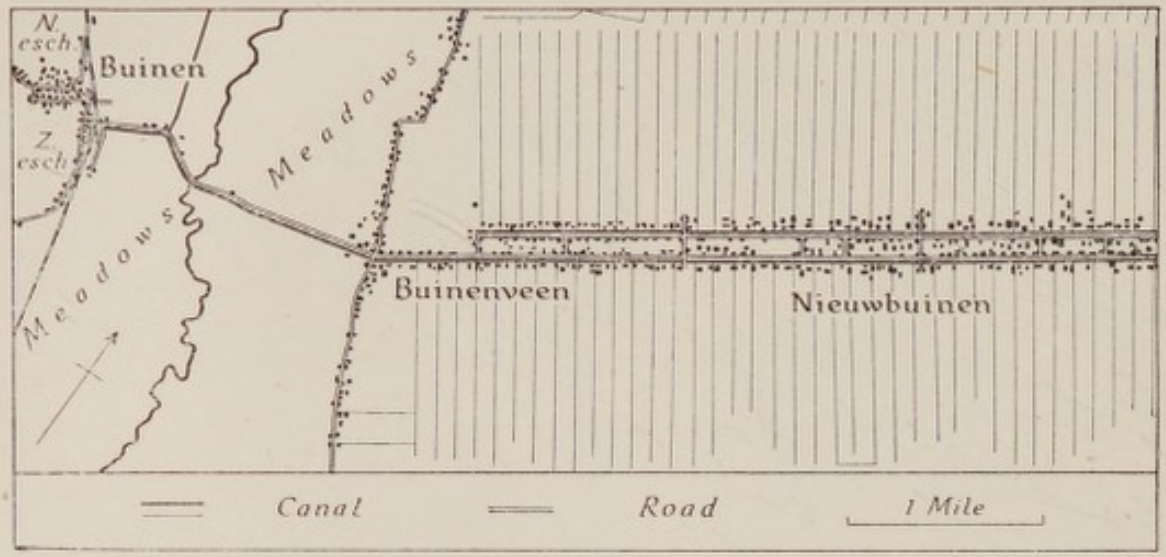

Fig. 52. Fen colony villages in north-east Drenthe

From : G.S.G.S. Series 4083 ; 1 : 50,000, sheets 12,17
The earliest settlement, Buinen, lies on the sand and gravel ridge of the Hondsrug ; patches of boulder clay are indicated by the ' esch '—areas of former open-field cultivation. Along the valley of the stream the *laagveen* (fen) provided meadow-land. To the north-east, the settlement of the *hoogveen* (bog) came much later, with the drainage of the bog by means of parallel canals, along the larger of which all the houses were located forming the contiguous settlements of Buinenveen and Nieuwbuinen.

(6) *Linear Settlements on ' Unilateral Slopes '*

It was not only in the fenlands that villages assumed a linear form, for such villages appear in two other types of country. They often occur along the zone of contact between a sandy and a marshy region, as on the eastern side of the dune-belt and in parts of North Brabant, e.g., the villages of the Langstraat. They are also frequent in the interior of Friesland and Groningen, where low ridges alternate with marshy valleys. The open-field system appears to have been abandoned very early here, and each farmer owned a strip of land stretching from the top of the ridge, where his arable land was situated, to the water-meadows in the valley. Farm houses lay along the trackway which followed the ridge, and therefore a linear village developed.

(7) *Dispersed Settlements of the Recent Polders*

In the polders of the last hundred years or so, although they lie at a lower level than the old polders, more efficient pumping has enabled settlement to disperse. In these recently drained areas

population is scattered in small hamlets, as in the Haarlemmermeer, or in isolated farms, as in the polders near Amstelveen and Nieuwekop, and in the Wieringermeer (the north-west polder of the Zuider Zee).

(8) '*Esch*' *Settlements*

The *esch* type of settlement is characteristic of the north-eastern morainic regions of the Netherlands, especially in Drenthe, Overyssel, and Gelderland. The *esch* (also known as *enk* or *eng*) is a patch of fertile soil, usually composed of boulder clay and often situated at a slightly higher level than the surrounding land, which consisted of infertile sandy heaths interspersed with moist valleys. These *eschen* were the only areas suitable for arable land under the methods of medieval farming, and they were cultivated on the open-field system. As this method of farming necessitated close collaboration, the farmers lived close together in a nucleated village, the size of which varied with the size of the *esch*. This word was often used as a synonym for the arable 'openfield' or 'infield'. Rough grazing on the heathlands was the common property of the village, and so at first were the water meadows along the streams, but these were soon parcelled out among individuals. This type of village, associated originally with the open-field system of farming, is not peculiar to the Netherlands, but is also very characteristic of south-eastern England, north-eastern France and large parts of central Europe (Fig. 53).

Even from early times, however, the population was not entirely collected into nucleated villages. Some *eschen* were so small that they could only support one or two farms (*eschen-zwermdorpen*) while the large *eschen* tended to be encircled by small hamlets (*krans-eschdorpen*), though the largest of these, especially if it possessed a church, often became a small market centre. Occasionally, too, there were permanent isolated dwellings on the heaths, especially in the Veluwe, as the grazing grounds were too remote from the village to permit of the sheep being driven home every night.

When the reclamation of the sandy heaths was begun, the heaths in Overyssel and Gelderland ceased to be the common property of the village and passed under private ownership. They did not, as in England, pass into the hands of the lord of the manor but into the hands of small peasants, who settled in small hamlets and isolated cottages. In Drenthe the heathlands remained the common

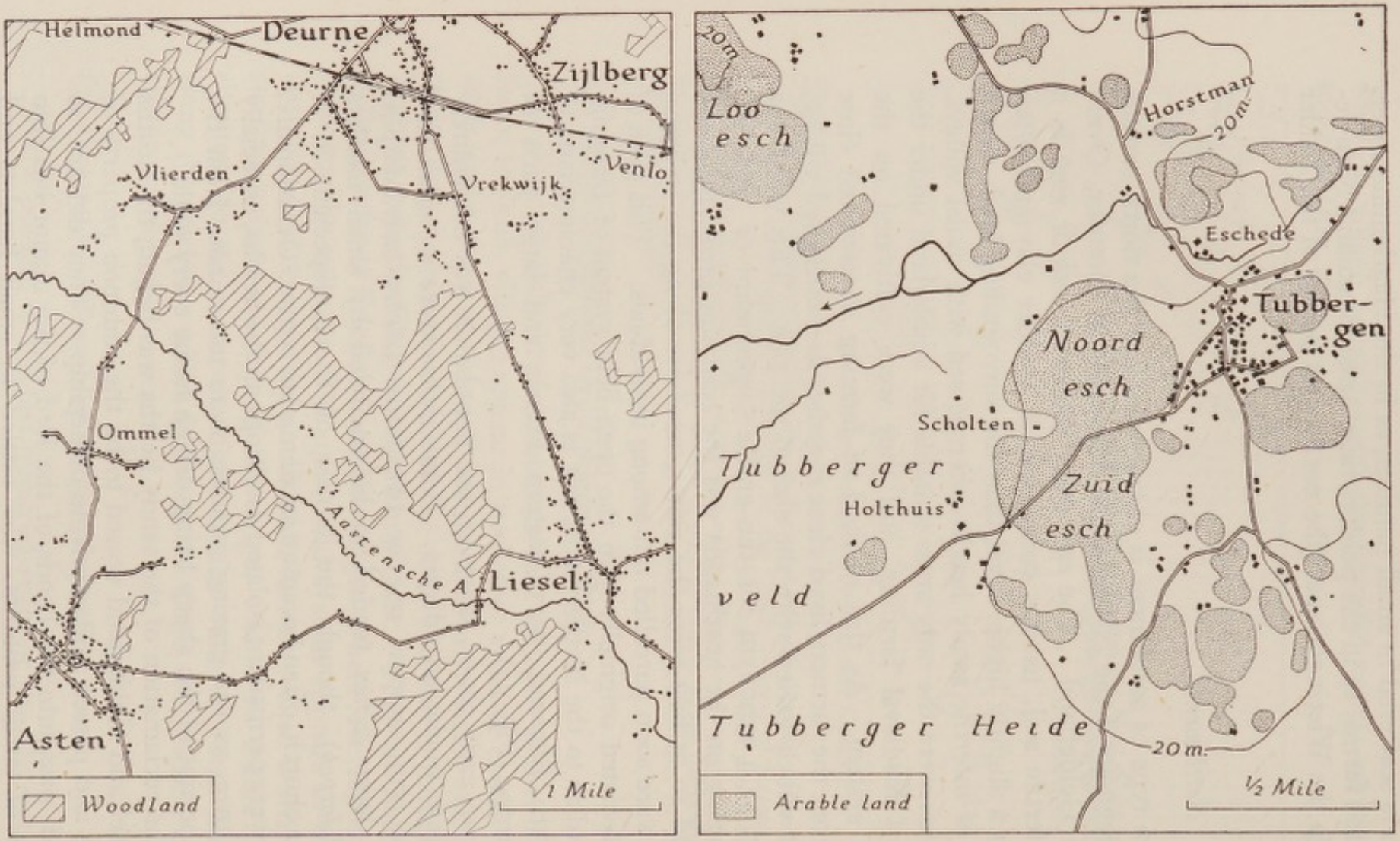

Fig. 53. Spider-web villages of North Brabant and esch villages of Overyssel

From : (left-hand map) G.S.G.S. Series 4427, 1 : 25,000 Sheet 27 N.W. and (right-hand map) H. J. Keuning, ' L'Habitat rural aux Pays-Bas ', *Tijdschr. Kon. Ned. Aardrs. Gen.*, vol. 55, p. 635 (Leiden, 1938), and 1 : 50,000 Sheet 28, Almelo O, *Ministerie van Defensie, Topographische Dienst* (1938).

The left-hand map shows the spider-web villages which have developed in North Brabant through expansion along the roads. The right-hand map shows the esch village of Tubbergen and the subsidiary settlements of Eschede, Scholten, Holthuis and Horstman. These grew up on the edges of the arable land, which, consisting mainly of patches of boulder

property of the village, but in order to cultivate them daughter-villages and hamlets were founded.

At the present day, therefore, settlement is partially nucleated, and partially dispersed. Nucleated settlements are most frequent in Drenthe where the *eschen* were larger and the reclamation of the heathland was usually undertaken by the village. In the heathlands of Overyssel, Gelderland and the Geldersche Vallei (in the province of Utrecht), rural population was never highly nucleated and is now almost entirely dispersed.

(9) *Spider-web Villages of North Brabant and north Limburg*

Nucleated villages, similar to the *eschdorp*, were originally the rule in this region. They were, and still are, mainly strung out along the river valleys just above the water meadows. The gently sloping sides of the valley were originally cultivated in the open-field system, while the heathlands covering the low plateaus between the valleys provided common grazing. The evolution of rural settlement was not dissimilar to that which took place in Drenthe. When the reclamation of the heathlands began, satellite hamlets were founded at some distance from the parent village, which thus became a road centre. Along these roads, houses were built, giving a characteristic ' spider-web ' appearance to the ground-plan (Fig. 53).

(10) *Compact ' Franconian ' (Hesbignon) Settlement of south Limburg*

Nucleated settlement is the rule in this region. It is associated with the open-field system of cultivation, but the appearance of the villages differs from that of the other nucleated villages of the Netherlands owing to the massive and defensive appearance of the farmsteads. Each farmstead is built round three sides of a square, the fourth side being formed by a high wall which fronts the street. These farms are sometimes built contiguously, so that the streets are bordered by great solid walls, pierced only by massive wooden gateways. This type of village is known as Franconian and is very characteristic of the adjacent districts of Hesbaye in Belgium and the Rhineland in Germany (Plate 13).

(11) *Dune Villages*

In the coastal dune-belt the fishing villages were, and still are, nucleated settlements. The development of horticulture along the

inner or old dunes has completely destroyed the original settlement pattern ; in its place a ' suburbanized ' landscape has developed, the nursery gardens being peppered with houses and greenhouses. In other parts of the dune belt modern settlements are mainly health resorts or residential towns or villages.

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A small but useful work is *Bevolking en Oppervlakte der Gemeenten van Nederland op* 1 *Januari* 1936, ed. H. W. Methorst ('s Gravenhage, 1936), which gives the population of each commune for 1936. Convenient summary tables relating to all aspects of population statistics appear in *Jaarcijfers voor Nederland* ('s Gravenhage, annually), and in *Petit Manuel Statistique*, published also as *Statistisch Zakboek* ('s Gravenhage, 1938).

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3. Material relating to the distribution of population will be found in A. Demangeon, *Belgique, Pays Bas, Luxembourg* (Paris, 1927), which forms vol. 2 of the *Géographie Universelle*, edited by P. Vidal de la Blache and L. Gallois ; F. Cornelissen, *Les Industries des Pays-Bas* (Paris, 1932) ; W. E. Boerman ' Die Niederländische Kulturlandschaften ', *Comptes Rendus du Congrès International de Géographie*, Tome Premier, pp. 38–44 (Leiden, 1938) ; J. B. L. Hol and H. van Velthoven, ' La lutte contre les eaux et la mise en culture ', *Tijdschr. Kon. Ned. Aardrs. Gen.*, vol. 55, pp. 602–28 (Leiden, 1938), and G. J. de Vries, ' Les principaux moyens d'existence et de communication aux Pays-Bas ', *ibid.*, pp. 656–96 ; a good account of the distribution of population is given in F. Leyden, ' Die Volksdichte in Belgien, Luxembourg und den Niederlanden ', *Petermanns Mitteilungen, Ergänzungsheft No.* 204, p. 54 (Gotha, 1929).

4. For material on towns and cities, see p. 695.

5. The two principal studies of rural settlement in the Netherlands are H. J. Keuning, ' L'Habitat rural aux Pays-Bas ', *Tijdschr. Kon. Ned.*

Aardrs. Gen., vol. 55, pp. 629–55 (Leiden, 1938), and H. Blink, 'Studien über nederzettingen in Nederland', *Tijdschr. Kon. Ned. Aardrs. Gen.*, vol. 18, pp. 731–67; *ibid.*, vol. 20, pp. 59–107, 481–514, 936–58 (Leiden, 1901, 1902, 1904). A detailed account of the fen colonies is given in H. J. Keuning, *De Groninger Veenkolonien* (Amsterdam, 1933).

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CHAPTER X

DRAINAGE AND RECLAMATION

Introduction : Historical Changes in the Coast Line : The Rivers : The Drainage of the Lakes : Polders, Boezems, Boezemgebieden and Boezemland : The Reclamation of the Zuider Zee : Drainage Administration : Bibliographical Note

Introduction

A considerable area of the Netherlands is below sea level and therefore owes its existence to the protection afforded by the sea dykes. A less extensive area would also be periodically flooded and reduced to swamp but for the river dykes. These areas together amount to about two-fifths of the total surface of the country. The struggle to protect and to add to these lands menaced by sea and river has lasted for a thousand years. Until the sixteenth century, losses were considerable and the gains small. In recent centuries, however, the losses have decreased in scale, and damage has been suffered mainly through dyke breaks and the temporary flooding of large tracts. Thus extensive floods occurred in 1825, when large parts of Groningen, Friesland and North Holland were inundated. In 1906, large areas in eastern Zealand were flooded, and in 1916 much damage was also done in North Holland (Plate 17). Among recent notable river floods were those of the Maas and Waal in 1926.

The regions of the Netherlands protected from sea and river and which are artificially drained include the historical core of the country, with the capital city, much of the best agricultural land and principal industrial areas (Fig. 54). Only within recent decades have agriculture and industry on a large scale spread eastwards on to the sand country. The development of reclamation and drainage is therefore an integral part of the history of the Netherlands, and has left its impress on many aspects of national life.

The Sea Polders

There are, broadly speaking, two types of land protected from flooding—the sea polders and the river polders. The level of 1 metre + N.A.P. (Fig. 55) marks the limit of the land which would be submerged daily were the sea dykes to be removed. It is also a convenient boundary, as in general it separates the alluvial deposits from the glacial drift and outwash sands. Areas of higher land are

also enclosed by dykes, especially in the south-western estuaries where tides are higher ; drainage is also facilitated by dyking. Thus the entire coast of the Netherlands, with the exception of the western dune belt and a few scattered portions formed by low cliffs of boulder clay or by the margin of the glacial sands, is protected by dykes.



Fig. 54. The Netherlands without dykes

From : W. C. Leeuw, *The Netherlands as an Environment for Plant Life*, fig. 2 (Leiden, 1935).

The areas protected by dykes from flooding by the sea are shown in black, and the areas protected by dykes from flooding by the rivers are stippled. Most of the area in black is less than 1 m. above mean sea level, but portions, e.g., Zealand Flanders, where the tides are higher, are 2–3 m. above mean sea level

The area behind the sea dykes is of two main types : first, the low peat formed at or close to sea level, together with the older marine clays ; and secondly, the land which has been gained from the sea by reclamation and drainage, consisting mainly of recent marine clays. The low peat area in North and South Holland is in general 1 to 2 m. below sea level, but in Friesland it is somewhat higher. Where lake bottoms have been reclaimed, their surface

descends to 5 m. (16½ ft.) below mean sea level. The surface of land won from tidal flats may be up to 2 m. (6½ ft.) above sea level ; where it has been gained from the sea bottom, as has, for example, the

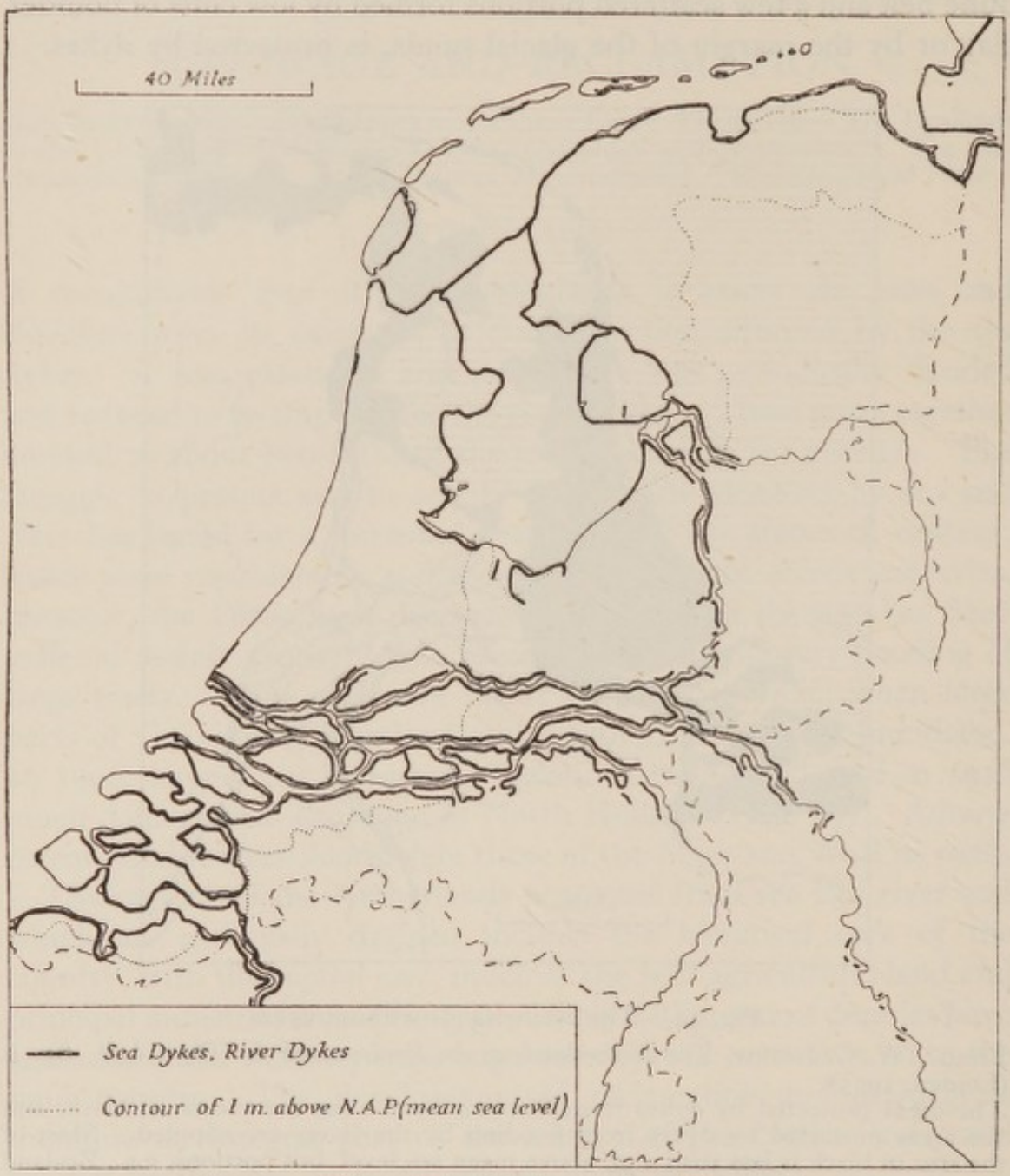

Fig. 55. The principal dykes of the Netherlands

From : P. R. Bos–J. F. Niermeyer, *Schoolatlas der Gehele Aarde*, plate 10 (Groningen, 1936).

The map does not show the interior dykes. Undyked sections of the North Sea coast are protected by sand dunes, which are well above N.A.P. (mean sea level).

Wieringermeer, the surface may be 5 m. (16½ ft.) below sea level.

The principal area which owes its existence to the sea dykes comprises most of the provinces of North and South Holland, between the coastal dune belt and the Zuider Zee or the level of

1 m. + N.A.P. on the east (Fig. 55). This contour runs to the west of Utrecht and reaches the Yssel Meer west of Naarden. The region north of the Y (IJ), except for reclaimed lakes, 3–4 m. — N.A.P., and the Wieringermeer polder, 5·20 m. (17 ft.), does not lie much below sea level. The Y (IJ) itself was reclaimed when the North Sea Canal was built (1865–76); as a former arm of the sea, the level of its floor is lower than the neighbouring polders, being 2·5 to 5 m. (8–16½ ft.) below sea level. South of the Y (IJ) the low peat, formed close to sea level, has sunk through drainage and consolidation to a general level of 2 m. (6½ ft.) — N.A.P. Much, however, of the peat has been dug away, uncovering the marine clays, so that lower levels, down to 5 m. (16½ ft.) — N.A.P. are frequent. The largest of the reclaimed lakes is the great Haarlemmermeer, with a level of 4·20 m. (13½ ft.) — N.A.P. Along the southern margin is a strip of recent marine alluvium, reclaimed in the Middle Ages from the estuary of the Maas, and now lying about sea level.

The South Holland and Zealand islands have been formed by the dyking of banks and flats, and the central portions, owing to consolidation, are usually lower than the margins. In Zealand Flanders the greater part is above mean sea-level, rising to 3 m. (9¾ ft.) + N.A.P.

The River Polders

The area protected from flooding by the river dykes lies mostly between the Neder-Rhine–Lek and the higher land south of the Maas, with the addition of the flood plain of the Yssel and the Geldersche Vallei. In the west, where the river levels are above that of the surrounding land, the dykes prevent the land from being permanently inundated; in the east, where the land is higher but still below the flood level of the rivers, they protect it from winter flooding. From the separation of the Neder-Rhine and the Waal to the Alblasserwaard the levels of the river polders descend from approximately 11·5 m. (37½ ft.) to 1 m. (3¼ ft.) + N.A.P.

It is convenient to consider the drainage of the Netherlands under six headings :—(1) historical changes in the coast line, (2) the rivers, (3) the drainage of the lakes, (4) polders, *boezems*, *boezemgebieden* and *boezemland*, (5) the reclamation of the Zuider Zee, (6) drainage administration. (See also Chapter I, Geology and Physical Features; Appendix VIII, Shore-line Processes; Appendix IX, Coast Protection.)

Historical Changes in the Coast Line

Introduction

In Roman times the portion of the Netherlands now below approximately 1 m. + N.A.P. was a plain lying generally above sea level, but liable in parts to flooding by high tides. The surface was for the most part a great expanse of peat, up to 16 ft. thick, resting upon old marine clay in the west and on sands in the east.

The coast of this low-lying plain to the south-west was bordered by numerous islands which were constantly changing their size and shape owing to tidal scour in the estuaries. A similar process occurred in the mouths of a former branch of the Rhine which reached the North Sea by traversing the portion of the coastal dunes now represented by the islands of Texel, Vlieland and Terschelling. As a result of the increasing tidal range southwards (see p. 21), there has been a lowering of the base level of the rivers entering the southern estuaries. Hence the southerly exits of the rivers have become more active than the northerly exits, with a consequent shift of the main discharge of Rhine water to the south. A further complication to the defenders of the land was the continuing rise of sea level in relation to the land (see p. 12). Broadley speaking, until A.D. 1300 the sea gained upon the land ; after 1300 the work of reclamation succeeded first in arresting the advance of the sea and then in reclaiming parts of the coast. For many centuries, however, the gains were not continuous and valuable tracts of land continued to be lost to the sea. It should be remembered that by no means all of the land reclaimed, from the earliest times, has been maintained ; much of the reclaimed area was submerged in later centuries, some to be recovered eventually, some to remain permanently lost.

Advances of the sea before 1300

The southern part of South Holland, the north-west of North Brabant and all Zealand as far as Flanders, including what is now Zealand Flanders (Zeeuwsch Vlaanderen), had become by 1300 an archipelago of over sixty islands, separated by tidal channels, mostly shallow. Broadly speaking, the islands of Zealand (Walcheren, North and South Beveland and Schouwen) were not dissimilar from their present outlines ; the islands of South Holland, however, were very different from their present shape, for Voorne was much

smaller and Goeree-Overflakkee hardly existed then as dry land (Fig. 56).

In the middle of the coastline of the country, from 's Gravenzande northwards to Petten, the shore remained comparatively unchanged and in the course of centuries retreated only slightly. North Holland, especially to the north of Amsterdam, was broken up into



Fig. 56. Zealand in 1300

From : *Geschiedkundige Atlas van Nederland*, vol. 1, Holland, Zeeland en West-Friesland in 1300, plate 6 ('s Gravenhage, 1913–32).
The stippled areas show unprotected islands and low banks. The remaining territory was protected by sea dykes or, on the North Sea coast, by sand dunes. Both Reijmerswaal and Saeftinghe, with the surrounding land, were lost to the sea by inundations after 1300 and have never since been reclaimed. The Zwin was the channel which led to Bruges by way of Damme. The navigable channel of the Scheldt at this time lay off Bergen-op-Zoom and continued to the north of North and South Beveland (see also pp. 269–70, 618).

an archipelago by incursions from the Zuider Zee. The North Sea coast between Den Helder and Petten was cut across by four channels connecting the two seas.

The southern part of what was to become the Zuider Zee, the *Lacus Flevo* of the Romans, communicated with the Wadden Zee by one or more delta branches of the Rhine. It remained so until the twelfth century, when it drained into the Wadden Zee by a navigable channel, the Vecht or Flie, and other waterways. The

sea progressively penetrated and widened these valleys, and the submersion of the lands around the *Lacus Flevo* proceeded slowly. There are records of extensions of the sea in 839, 1134 (when Harlingen was engulfed), 1170, 1237, 1250 and 1285, while at the end of the fourteenth century came submersions which further widened the channels leading to the sea. The Zuider Zee thus took its origin in the fusion of two quite different stretches of water —the *Lacus Flevo* and the widened seaward connections. By about 1300 it had become a real bay, known as *Almare* (Fig. 12).

In the early Middle Ages the centre of Friesland was occupied by a long arm of the sea known as the Friesche Middelzee, which extended inland past Leeuwarden as far as Bolsward and Sneek (Fig. 12). Farther east lay the Lauwerszee, much larger than its present extent, while a flood of 1277 formed the wide and shallow inlet on the south shore of the Ems which is known as the Dollart.

Reclamation before 1300

The inhabitants of the coastal territories made early attempts to restrain the advance of the sea. The earliest polders in Goeree date from before 1065 and in the island of Voorne from 1105. The first step was the building of dykes around the higher lying islands flooded only by exceptionally high tides (*schorren*), forming *opwassen*. Then followed the throwing of dams across the watercourses separating these islets, e.g. the Schenge in South Beveland and several creeks in Zealand Flanders, and their consolidation into larger units. When these nuclei were formed, the reclamation of the surrounding *aanwassen* (mud flats) was undertaken. In Zealand it was customary to level the earlier dyke (*slaperdijk*) as newer dykes were constructed seawards. This practice had disastrous results when a rupture of the new sea dyke occurred, and the destruction of the old slaperdijk was finally forbidden. Walcheren, South Beveland and Schouwen appear as islands with a central undyked core, surrounded by a series of high dykes.

To the north of Amsterdam, in West Friesland,* sea dykes were known before 1288 and probably date from around 1000. Inland from the sea coast dykes had been constructed to prevent the spreading of the *Lacus Flevo* as early as the seventh and eighth centuries. In Friesland and Groningen, dykes enclosed the fertile sea clay areas. These early dykes were small and weak constructions, at

* West Friesland is the northern portion of the territory west of the Zuider Zee, and is now part of the province of North Holland.

first built some distance from high water line to escape the full force of the sea. They also ran up the river banks to points where the level of the water was no longer threatening. Outside the dykes, along the coast or estuaries, extended expanses of sand or mud flats, dry at low water, upon which high spring tides deposited their silt, thus gradually building them up to higher levels. Silting occurred around the Zealand islands, but was most prominent in Friesland and Groningen, where the alluvial flats of the river Fivel and the wide Middelzee were completely silted up and reclaimed by successive series of dykes. About one-third of the original area of the Lauwerszee was also reclaimed in this way, and much of the Dollart, where, however, the original gains were not held.

The shoreline in 1300

The year 1300 is usually taken for maps which show the probable coastline of medieval times, because it is the earliest date for which the location of dykes can be determined with some accuracy. Such maps are partly conjectural, but they depend mainly upon a basis of documentary evidence, such as records relating to grants of land and to the construction of polders ; for most polders the date of construction is known. In later centuries the work of the Dutch cartographers adds further useful evidence. Much of the history of land and water in the Netherlands can be traced in large-scale topographical and cadastral maps—for example, plots of land in long cultivated areas are usually smaller and more irregular in shape than those in areas reclaimed later, and quite often straits and bays of the medieval period can be distinguished on the present map by differences in field patterns and boundaries.

Advance of the sea since 1300

The floods which occurred many times after 1300 take on a serious appearance, for records about them are more abundant, and the extent of their depredations can be known with greater accuracy. These inundations carry on the tale of the floods of the earlier Middle Ages. In South Holland and Zealand floods occurred in 1374, 1376, 1377, 1379, 1393 and 1396, and there were great inundations in 1405, 1421 and 1530–2.

The rivers steadily shifted their exits southwards through the greater range of the tides in the southern North Sea (see p. 21). Thus the mouth of the Scheldt, which at one time may have joined

that of the Maas, for a considerable period discharged principally into what is now the East Scheldt, the present West Scheldt being then a relatively insignificant estuary. By about 1400 the continuation of this process had converted the once-shallow strait between Flushing and Cadzand into a deep water entry and given the estuary of the West Scheldt its present form.* The enlargement of this channel was one of the chief causes of the loss of land in Zealand. Walcheren, unlike the other islands of Zealand, had to face the continual action of wave erosion on its west coast, and strong sea dykes were necessary very early.

The polders in the north-west of North Brabant have also been formed by the reclamation of tidal deposits since the thirteenth century. Here in the fifteenth century there was a great advance of the sea, when a large portion of the Groote Hollandsche Waard between Geertruidenberg and Dordrecht was inundated ; a new arm of the sea, the Hollandsch Diep, was formed, and the flooded area of the Biesbosch (bies = reed) came into being. The catastrophe, which had been threatening for some time, occurred during a westerly storm in November 1421, accompanied by a high flood level on the Merwede ; it is known as ' St. Elisabethsvloed '. The Biesbosch remained for centuries an expanse of sands and river clays, covered with reeds and willows, and, in fact, has never been fully reclaimed (Fig. 57).

Between the Hook of Holland and Scheveningen a period of slow retreat of the shore continued until modern protective works were devised in the nineteenth century to counteract this loss. The retreat in the seventeenth and eighteenth centuries amounted to 700 yards in front of Mosselput between 1611 and 1800, while even from 1843 to 1890 the foot of the dunes was driven back 16 yards. Northwards to a point beyond Ymuiden the retreat of the coast was of less magnitude, but in the extreme north the story was different. Along the narrow peninsula of North Holland in medieval times the four channels between the islands composing the strip were blocked and remained as gaps in the dunes. The waves here, however, are as strong as anywhere on the coast, and the land created out of the shallow straits was for a long time liable to flooding (Fig. 60).

The Frisian islands have undergone considerable changes in the course of centuries, gains and losses on the whole being equal. Texel, composed partly of glacial drift, has kept the most constant

* See footnote on p. 618.

shape ; the others, comprising dunes, sand flats and poldered fields, have undergone frequent changes. Vlieland, for example, in recent centuries has suffered a considerable retreat of its northern shore (Fig. 144).

In Friesland and Groningen the sea advanced but little after 1300. Much of the early reclamation of the Dollart was not maintained, for in 1413, owing to the destruction of the wooden sluices at Reide,

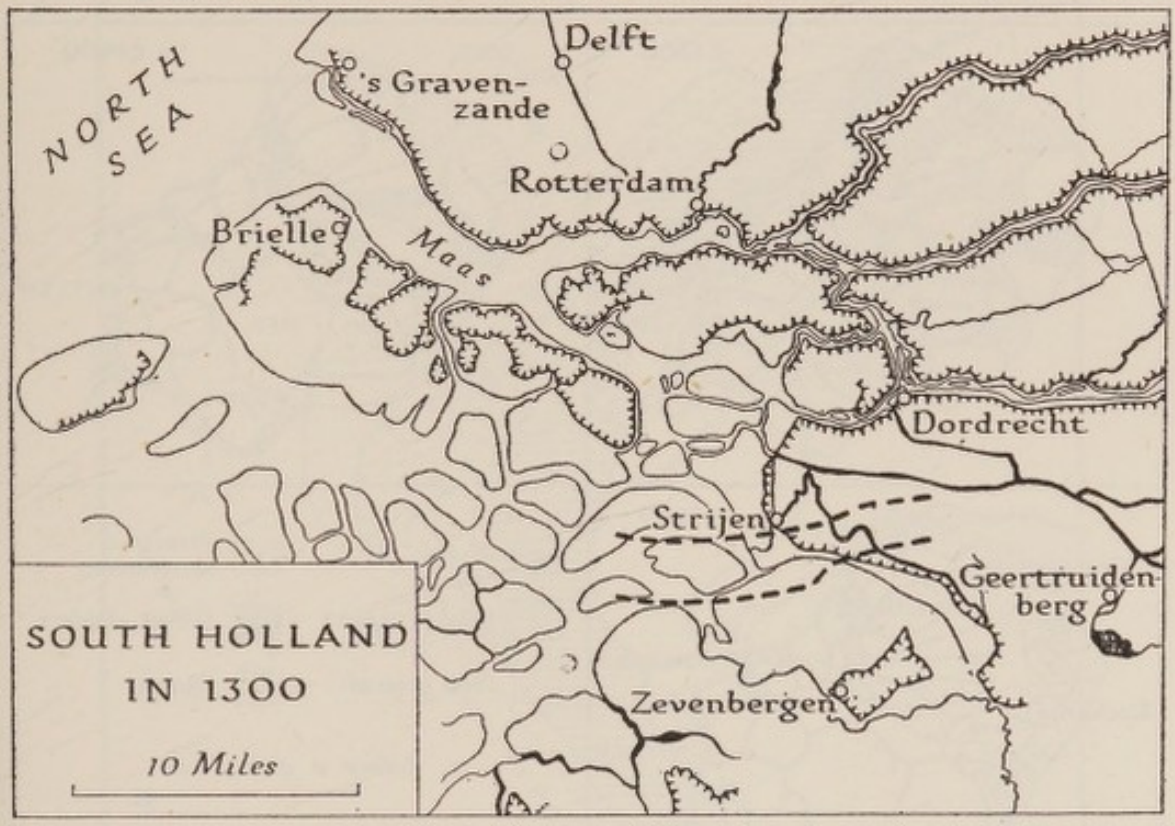

Fig. 57. South Holland in 1300

Mainly from : *Geschiedkundige Atlas van Nederland*, vol. 1, Holland, Zeeland en West-Friesland in 1300, plate 4 ('s Gravenhage, 1913–32).
The barbed lines indicate sea and ' great river ' dykes. The dyked rivers between Rotterdam and Dordrecht (Hollandsche Yssel, Lek and Waal) were open to the sea ; most of the others were separated from the sea by dams. The Maas mouth at this time was much wider than it is now. The broken lines indicate approximately the shores of the Hollandsch Diep, formed by the great inundations of 1421 and 1425.

a great area was flooded and some thirty villages were lost. Storms have always been liable to cause ruptures of the dykes, with resulting inundation. Such floods occurred in the sixteenth century, and as late as 1825 an enormous part of Friesland was inundated.

Reclamation since 1300

In Zealand, South Holland, and the western part of North Brabant, reclamation was mainly from coastal mud flats, assisted in places by natural silting, hindered in others by the enlargement of channels and gullies by tidal scour and storms.

In Zealand Flanders (Zeeuwsch Vlaanderen) the coastline underwent changes as great as those anywhere. The region was originally a stretch of sand and mud flats fringing the mainland, and these were intersected by numerous tidal estuaries (e.g. the Zwin and the Braakman) connected by small creeks. As the estuaries silted up, portions were closed. Drainage of newly reclaimed ground was relatively easy, for the sea deposits build up sufficiently high above

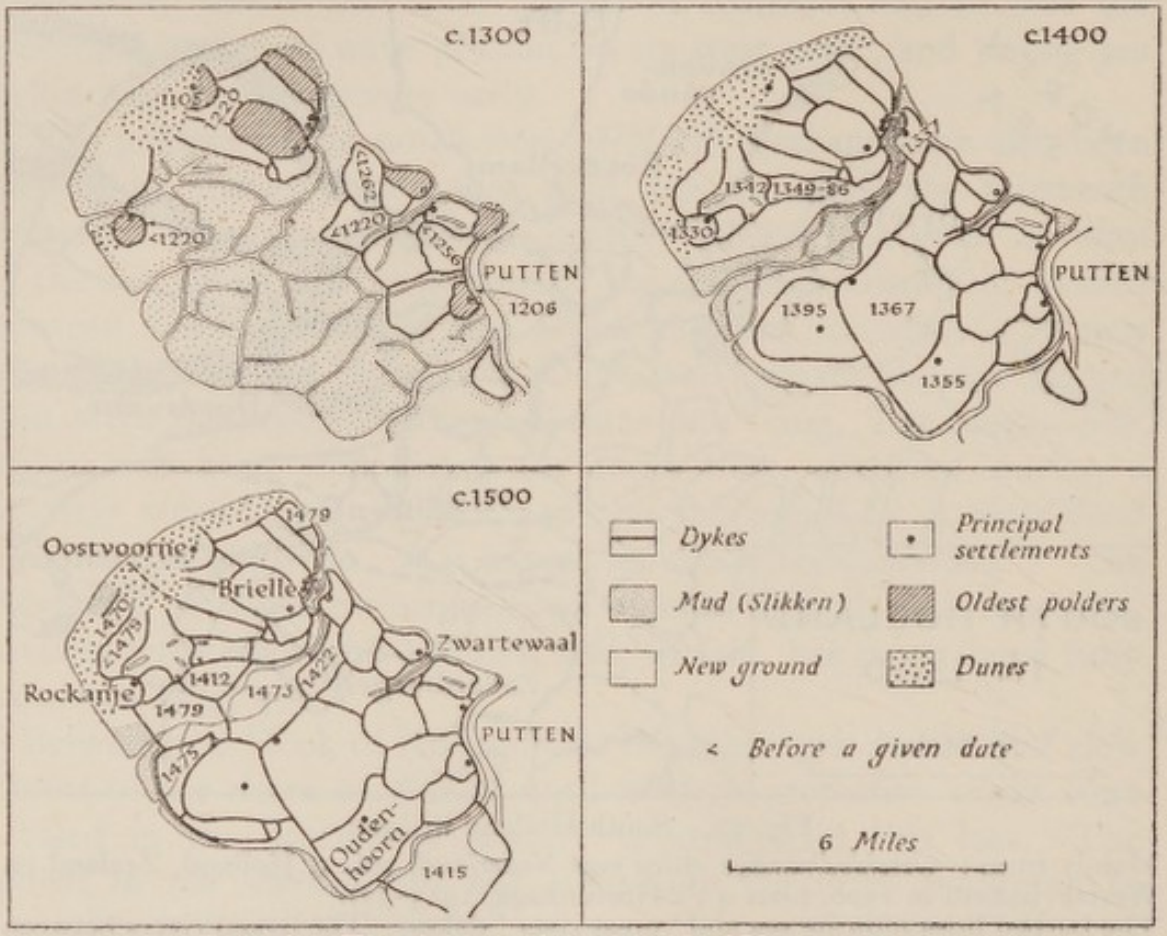

Fig. 58. The dyking of the island of Voorne, to 1500

From : W. C. Leeuw, *The Netherlands as an Environment for Plant Life*, figs. 27, 28 (Leiden, 1935) ; R. Schuiling, *Nederland*, vol. 2, opp. p. 504 (Zwolle, 1936). The figures indicate the date of the enclosure of a dyked area. Progressive extension of dykes from early in the thirteenth century has given the island its present shape.

low water for the water to be drained off naturally through sluices. Zeeuwsch Vlaanderen is thus a land of polders mostly reclaimed from tidal estuaries and interconnecting waterways, detached portions of which are now utilized as drainage channels. The only considerable arm of the sea now remaining is the Braakman.

It is due to the greater extent of the dunes in Walcheren that it is the only Zealand island to have preserved its outline more or less unaltered over several centuries. The history of the island revolves around the struggle to maintain the western defences, particularly

at Westkapelle, where the Westkapelle sea dyke dates from the fifteenth century. In the course of three and a half centuries the shore has retreated no more than 185 yards owing to the determined and untiring efforts of the community.

Gains from the sea have been marked in the west of South

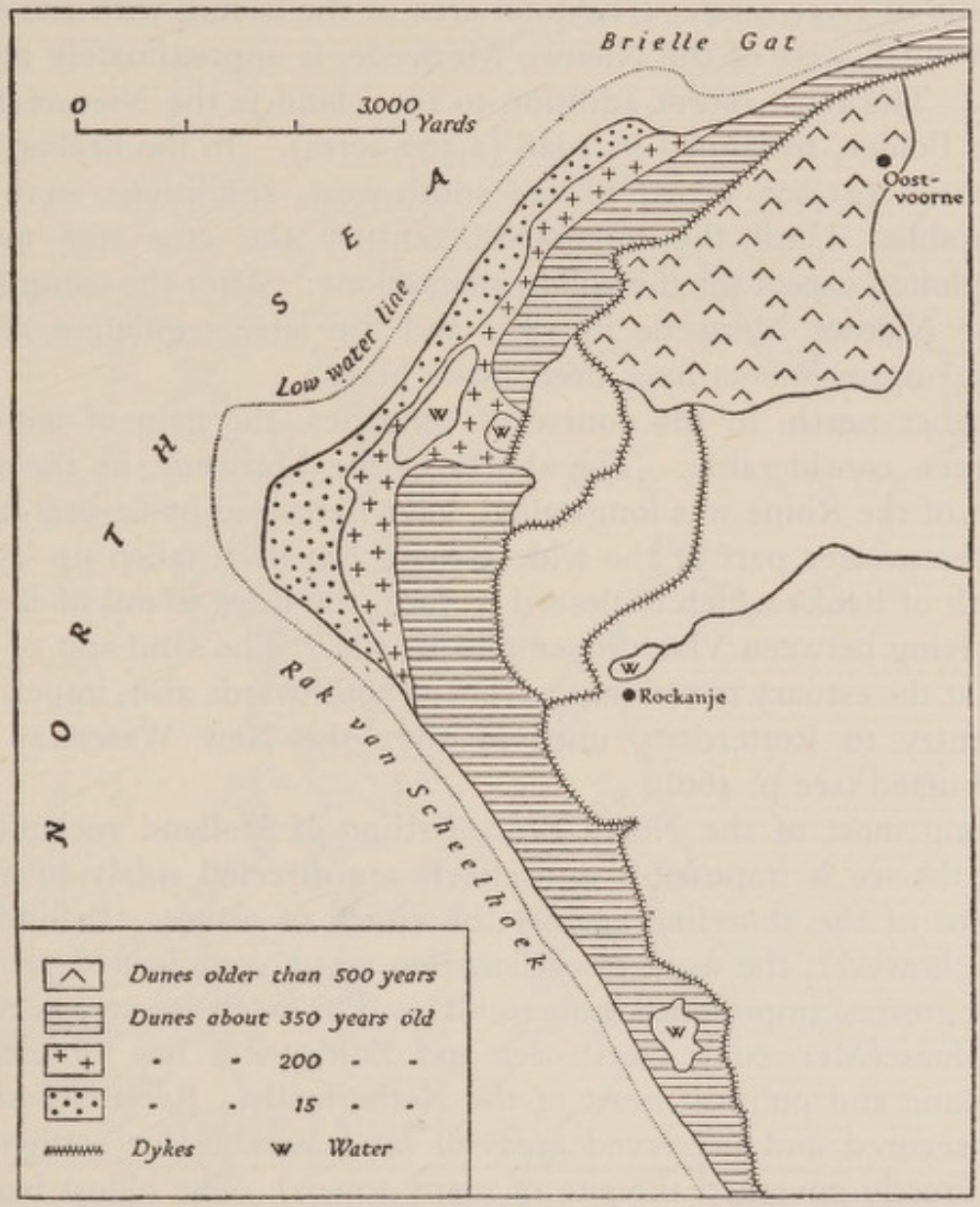

Fig. 59. Dunes on the west coast of Voorne
From : R. Schuiling, *Nederland*, vol. 2, p. 504 (Zwolle, 1936).

Beveland, through the reclamation of the Sloe. Since the building of the railway dykes across the Sloe and the former channel of the East Scheldt in the last century, and the consequent gradual silting up of these channels, South Beveland and Walcheren have virtually become a peninsula springing from North Brabant. In Goeree-Overflakkee and Voorne, polders were added progressively throughout the Middle Ages (Figs. 58, 59).

Upstream from the head of the Hollandsch Diep some recovery has been made to compensate for the losses of 1421 (see p. 270). Around Dordrecht, for example, conditions were favourable for reclamation ; during the sixteenth and seventeenth centuries, the Eiland van Dordrecht was gradually extended by the dyking of the deposits of river mud. The total area of the island, with the Biesbosch north-west of the Nieuwe Merwede, is approximately 20,000 acres. The most recent addition to the island is the Nieuwe Biesbosch Polder, reclaimed in 1926 (2,500 acres). In the Brabantsche Biesbosch (25,000 acres) to the south-west, conditions were less favourable. Until the nineteenth century the area was mostly unexploited except for the willow plantations. After the completion of the Nieuwe Merwede in 1884 and the later regulation of the Maas, improvements have been made here.

Farther north, in the course of centuries, the gain of territory has been considerable. The shores of the Merwede, as the main outlet of the Rhine was long called, have narrowed by several miles, and the greater part of the wide estuary has been taken up by the growth of banks which coalesced to form the large island of Rozenburg lying between Vlaardingen and Brielle. The sand spit of Den Beer at the estuary mouth has advanced southwards also, imperilling the entry to Rotterdam, until in 1872 the New Waterway was constructed (see p. 460).

Along most of the North Sea coastline of Holland reclamation from the sea is impossible and efforts are directed solely to maintenance of the shoreline against the attack of waves. Behind the coast, however, the work of reclamation was a complicated process, of the greatest importance in its results. The extensive area between the Maas (Merwede), North Sea and Zuider Zee has formed the economic and political heart of the Netherlands. Reclamation not only secured and preserved areas of land suitable for settlement, but directly governed the site of many towns. The oldest land in this region, existing before the draining of the lakes (see p. 286), is known as the ' Oude Land '.

The area between the Maas and the Y was protected in the south by a system of dykes, springing from the dunes and *geestgronden* behind the North Sea coast, and running in a general south-east and easterly direction to effect a junction with the river dykes of the Lek. This line was originally some distance inland, traversing the rivers Schie and Rotte, above Schiedam and Rotterdam. Owing to the strength of the flood waters of the Lek and the currents of

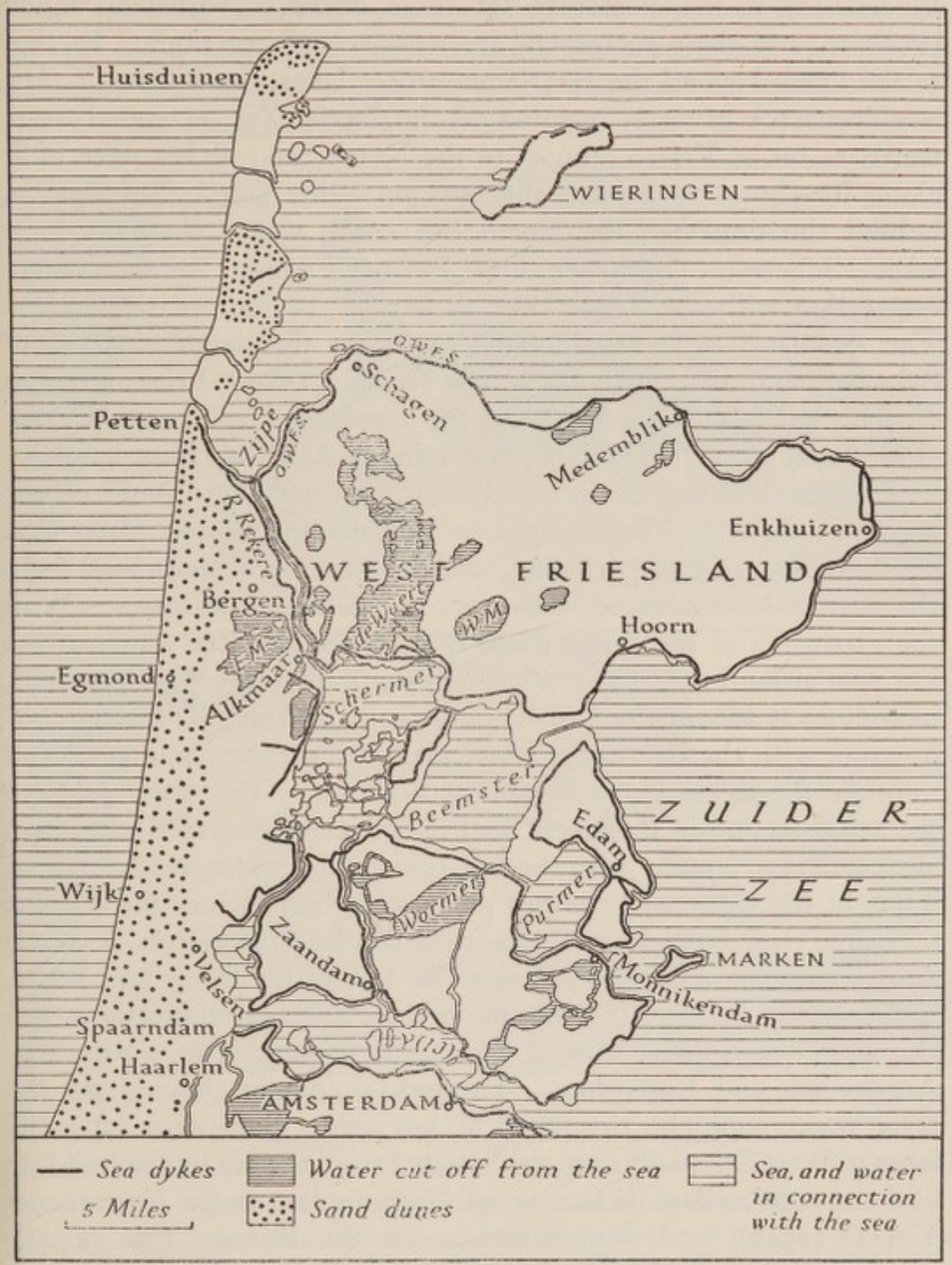

Fig. 60. North Holland in 1300

From : *Geschiedkundige Atlas van Nederland*, vol. 1, Holland, Zeeland en West-Friesland in 1300, plate 1 ('s Gravenhage, 1913–32).
E. M. Egmonder Meer ; O.W.F.S. Oude West Friesche Zeedijk ; W. M. Wogmeer. After the construction of the sea dykes, the next stage in reclamation was the isolation of the water in open connection with the sea by means of dams. The lakes were then enclosed by dykes and drained. Later large areas were reclaimed from the sea on the north coast.

the estuary it was necessary for these dykes to withstand much pressure, and their successors are massive constructions. Farther to the north beyond the Haarlemmermeer lakes, the Binnen Y (IJ), a wide stretch of water opening off the Zuider Zee, extended westwards as far as Velsen, almost to the North Sea ; dykes were built along its shores to protect the land on either side. Northwards, behind the dunes of the North Sea coast, was a chain of large lakes—Schermer, Beemster and Purmer, which were in open connection with the Zuider Zee as late as the fourteenth century. The mainland of North Holland ended in the neighbourhood of Schagen, and the north of North Holland (West Friesland) was virtually an island, protected on the north-west and north by the Oude West Friesche sea dyke, now lying well inland (Figs. 60, 61).

After the building of the sea dykes to the north and south of this region in the early Middle Ages, two developments took place—the strengthening of these defences, and the winning of more land from the sea, counterbalanced, however, by considerable losses. With the expansion of the *Lacus Flevo* into the Zuider Zee much of the low peat around the southern basin of the Zuider Zee was destroyed, including, it is said, four towns and many villages. This, in conjunction with the rise in sea level, made it necessary to extend and improve the dykes along its southern shores. The water level in the sea arms and in the rivers, and in the lakes connected with them also, rose in sympathy with the sea, threatening widespread flooding. Thus in the thirteenth century dams were built across the mouths of many rivers to isolate them from the external waters, e.g. the Amstel and the Zaan flowing into the Y, and the Schie and Rotte. Later, partly because of their importance for communications and shipping, these dams formed the nuclei of important towns, e.g. Amsterdam and Rotterdam. Through sluices in these dams the river water could be evacuated at low tide. Somewhat later the lakes of West Friesland were also isolated from the sea by the building of dams at Schardam (before 1319), Nieuwendam on the Krommenei Y (IJ) (1357), and Monnikendam on the Purmer Eije (1400). Similarly a dam on the Spaarne isolated the waters of the lakes south of the Y (IJ) (Fig. 60). By these operations the ' oude land ' was protected from the inroads of the sea, though this protection was by no means complete.

In the north of North Holland the gains from the sea at first were small. At this time the mainland ended near Petten ; to the north extended low flats with scattered dunes, the higher portions

forming the islands of t'Oghe (now Kallantsoog) and Huisduinen. After the great storm of 1421 measures were begun to close the gap in the dunes north of Petten. During the seventeenth century the northern islands were connected to the mainland by banks of sand. In 1609 the extensive Wieringerwaard was reclaimed. But extensive

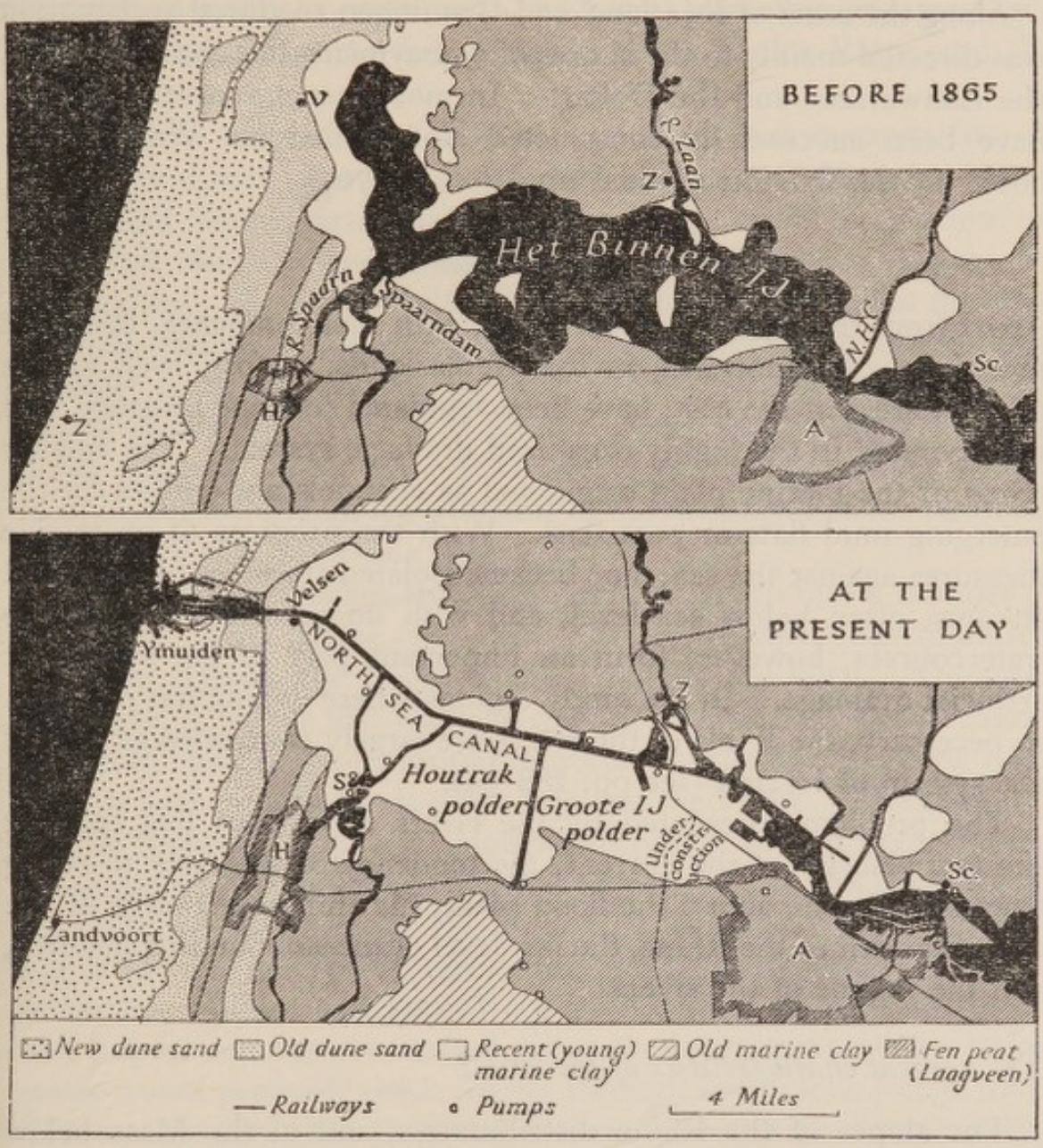

Fig. 61. The Y (IJ) polders and the North Sea Canal

From : W. Tuckermann, *Länderkunde der Niederlande und Belgiens*, pp. 38, 39 (Leipzig und Wien, 1931) ; G.S.G.S. Series 4323 (Geological), 1 : 50,000, Sheets 24 (Kwartblad 1, 2), 25 (Kwartblad 1, 3) ; G.S.G.S. Series 2541, 1 : 100,000 Sheet 1 (1944).

A Amsterdam ; H Haarlem ; S Spaarndam ; Sc Schellingwoude ; Z Zaandam ; N.H.C. North Holland Canal.

Before the construction of the North Sea Canal, which was completed in 1865, the Y (IJ) was in open connection with the Zuider Zee and extended westwards almost to the North Sea. The peat area exposed after its waters were drained was removed and the clay converted into the fertile Y polders.

reclamation in this area was the work of the nineteenth century. In connection with the building of the North Holland Canal in 1824, the Koegras polder was formed between the canal dyke and the dunes, and in 1847 the great Anna Paulowna polder was reclaimed.

Along the coast of Friesland and Groningen medieval reclamation was directed mainly to the shores of embayments like the Middelzee, the Lauwerszee and the Dollart. In more recent centuries polders have been successfully constructed along the main Wadden Zee coast by the fixation of tidal mud (see p. 704).

The Rivers

Apart from the Rhine and the Maas, with their branches, there are few rivers of importance in the Netherlands. Most, even in the diluvial areas of the east, have been regulated in some measure, and incorporated in the highly organized drainage system. The smaller rivers of the marine plain originated as channels and gullies on the emerging mud flats or peat fens. With the progress of protective measures against the sea, they became isolated stretches of canalized streams, often below sea level, and with no natural flow. These watercourses, however, form an important part of the system of artificial drainage. In the sandy regions where dyking has not been so necessary, the levels of the rivers are largely controlled as part of the system of *boezems* (see pp. 288–94).

The problems presented by the rivers arise from five factors: the low velocity of the current, the tendency of the river to swing from side to side across the flood plain, the shift southwards of the dominant exit of the Rhine, the low level of the surrounding country, and the regime of the rivers.

The natural characteristics of the rivers

The slopes of the Rhine distributaries, and of the Maas below Grave, are very gentle and the rivers wind across the plain (Fig. 14). At Lobith, near the German frontier, the summer level of the Rhine is only some 10 m. (32·8 ft.) above N.A.P., and at Gorinchem, it is at zero. At Heumen the summer level of the Maas is also about 10 m. N.A.P.

Owing to this decreasing gradient, the stream velocity falls and the rivers deposit great quantities of silt. Formerly, in times of flood, they easily overflowed their low banks and deposited part of their

burden along the margins, forming natural levées. The effect of this over long periods was to raise the beds of the rivers above the level of the surrounding country. This difference of level has been increased by the tendency of the land, through improved drainage, to consolidate and sink. The general cross-section of the inter-fluvial land is thus concave, with the lowest part often occupied by a smaller stream (e.g. the Linge, between the Neder–Rhine and the Waal).

Meanders, or traces of former meanders, are conspicuous all along the lower courses of the Neder-Rhine, Geldersche Yssel, Waal, and Maas, particularly near the Rhine–Waal bifurcation, on the Waal above Nymegen and on the Maas between Grave and St. Andries. In times of flood, the rivers often cut across the base of these meander loops, leaving the old course as a curved lake (oxbow) or as a short side arm. An example of a natural cut-off occurs on the Neder-Rhine at Rhenen, and probably dates from the ninth century. The cumulative result of the movement of the meanders down stream is a widening of the river flood plain. Artificial cut-offs are also numerous (Fig. 64).

In their lower reaches the main rivers break up into a number of branches. The Rhine has now three principal distributaries, the Yssel (IJssel), the Neder-Rhine–Lek, and the Waal. The most southerly of these, the Waal, is now dominant, and this accounts in part for the decay of a former important outlet, the Kromme Rijn, with its branches the Oude (Old) Rijn and the Vecht. The tendency for the Rhine outlet to shift southwards (see p. 21) has been utilized by engineers to solve problems of river control and drainage, e.g. in the cutting of the Nieuwe Merwede. Through the natural deepening of the more southerly exit an increasing proportion of the water of the main Rhine is drawn off by its southern branch, the Waal, and but for river works carried out at the bifurcation, all the Rhine water would probably reach the sea through this branch (see p. 280). The invasion by the sea of the Groote Hollandsche Waard in the early fifteenth century (see p. 270) probably marked a definite stage in the ascendency of the Waal.

The Rhine–Waal bifurcation and Pannerdensch Canal

The history of the bifurcation of the Rhine and Waal illustrates some problems of river control (Fig. 62). During the Middle Ages the Waal branched off from the Rhine just above Schenkenschans, which it passed to the south ; the Rhine flowed in a great meander

past Schenkenschans to Lobith on the north. From the fifteenth century, the Waal drew off an increasing share of the upper Rhine water, so that by the seventeenth century there was a lack of water in the Neder-Rhine and Yssel, and the Rhine bed below Schenkenschans was silting up. To remedy this situation, it was decided to cut a new channel from the Waal to the Neder-Rhine; the

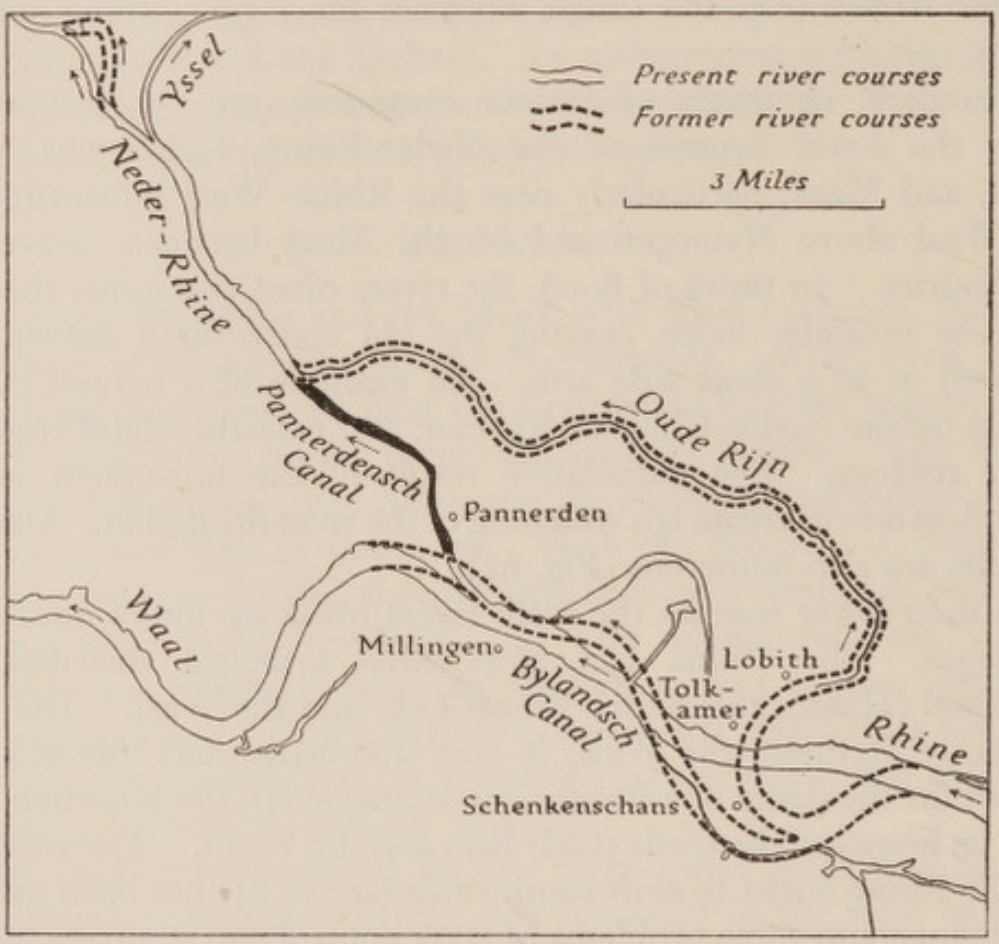

Fig. 62. The Pannerdensch Canal

From: R. Schuiling, *Nederland*, vol. 1, opp p. 243 (Zwolle, 1934).
The map shows some of the changes in the courses of the Rhine and Waal at their bifurcation. The Pannerdensch Canal was cut in 1707–10, the Bylandsch Canal in 1774. The large ox-bow to the north of the latter is the relic of an earlier course of the Rhine.

Pannerdensch Canal was accordingly begun in 1707, and probably completed in 1710. The 'Upper' Rhine in this section became more active, and eroded the right bank opposite Schenkenschans, in the process of cutting off the meander: at the same time the Waal in its turn began to silt up. Finally the Rhine broke into the Waal north of Schenkenschans and, eroding its northern bank, threatened Herwen. It was then decided to dig a new channel across the loop, and the Bylandsch Canal was completed in 1774. At first the river would not follow the new course. In 1776, however, advantage

was taken of a severe frost ; the ice on the Bylandsch Canal was broken, while the former course remained frozen. When the flow began again, the old course remaining blocked, the water followed the new course, widening and deepening it. The portion of the Rhine rendered superfluous by the Pannerdensch Canal was afterwards used as an escape channel during periods of flood. By international agreement it was arranged that two-thirds of the volume of the undivided Rhine should pass down the Waal ; of the remaining third flowing down the Rhine, one-third passes down the Yssel. Thus of the undivided Rhine water, two-ninths only reach the Neder-Rhine and Lek.

The River Dykes

The stretches of river clay were inhabited at an early period ; their level being then probably higher in relation to the rivers than at present, they were above all but the highest floods, when the inhabitants took refuge on artificial mounds (*woerden*). From the eighth century, small dykes were built along the banks, and these were raised and strengthened as the rivers built up their beds and the land sank through consolidation. The system of high dykes, (*bandijken*) had been completed by the thirteenth century, and their maintenance organized on the initiative of the Counts or Dukes.

The Rhine and its distributaries are now dyked practically from the German frontier : the principal exception is the stretch below Arnhem at the foot of the glacial hills. From Arnhem to Amerongen there are no dykes, apart from those which close the southern end of the Geldersche Vallei above Wageningen. Along the Waal the dykes are continuous. On the Maas they are continuous on the right bank from Mook and on the left bank from Grave. Gaps or lower portions were left in them to allow the floods to escape (*overlaten*). To the west of a line roughly from Wijk-bij-Duurstede to Tiel the adjoining land is below the mean level of the rivers (M.R. = Middelbare Rivierstand, the average of the six summer months), generally by 6 to 10 ft. The land is in polders, and owing to the low level, pumping is necessary to remove the surplus water. To the east, where the land is above M.R., the dykes give protection against temporary inundation. Floods occur generally in winter and early spring, and the rise is often considerable : high river level at Wijk in the years 1901 to 1910 was 9·4 ft. above summer level, and the comparable figure for Bommel was 12·9 ft.

The river dykes are built where possible at some distance from

the summer bed, to decrease the danger of their foundations being eroded and to accommodate the extra water in time of flood. Between them and the summer bed lie stretches of river deposits, known as *buitendijksche landen*. The outer margins of these are bare or covered with willows : the inner portions, protected against small rises of river level by low banks (*kaden*) are the *uiterwaarden* (Fig. 63).

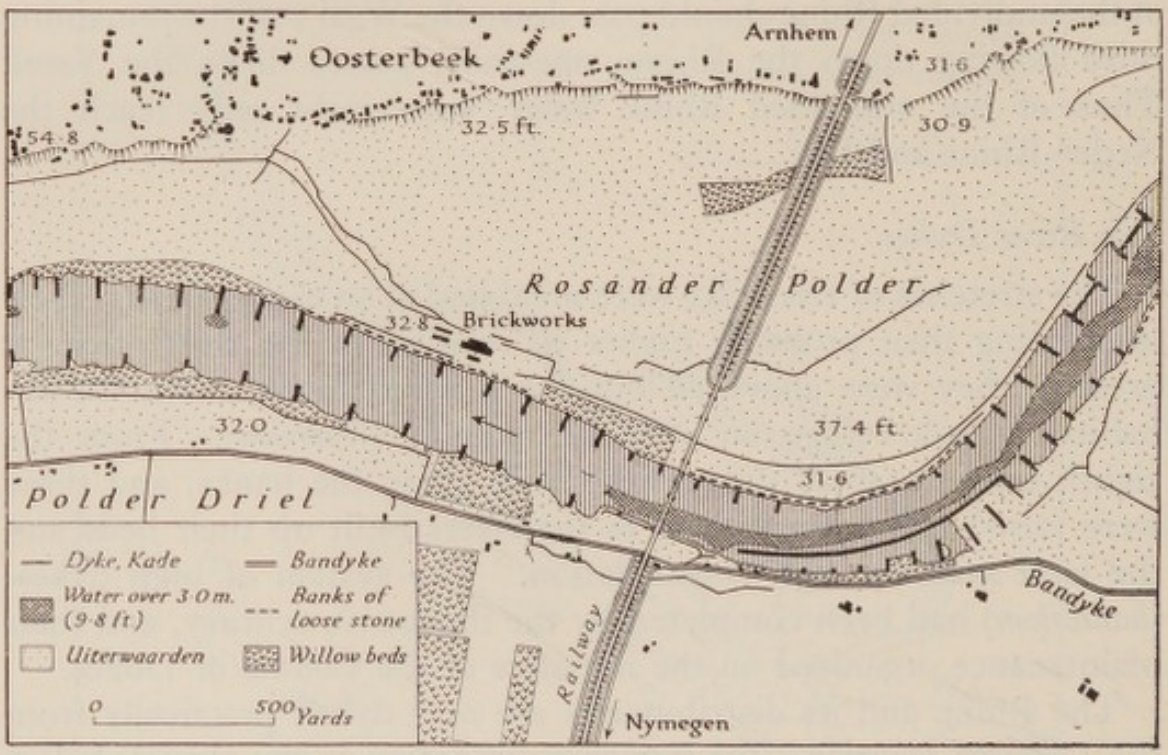

Fig. 63. The Neder-Rhine at Oosterbeek

From : P. R. Bos, J. F. Niermeyer, *Schoolatlas der Gehele Aarde*, plate 15 (Groningen, 1936).
The depths are at ordinary low river level. The figures indicate the height of the land surface above N.A.P. (mean sea level). The *uiterwaarden* comprise the land between the river bank and the main dyke (*bandijk*, bandyke) and are frequently flooded. To the north are low sandy hills.
The map also shows how the nature of the river flood-plain necessitates the construction of elaborate approaches to the great railway bridges.

Where these are covered with grass they afford summer pasture for cattle. During winter floods the *uiterwaarden* are submerged, and the river then extends from dyke to dyke.

Infiltrating river water, if unchecked, may undermine the banks or dykes. This phenomenon is particularly troublesome along the Lek. In any event, the infiltrating water (*kwel*), adds to the drainage problems of the polders ; with a high river level the *kwel* may reach the surface. This infiltration is checked by making *kwelkaden*, that is, bands of clay inserted in the ground close to the inner sides

of the dykes. The Land van Maas en Waal suffers much from *kwel* water : the effects are, however, mitigated to some extent by the existence of the Linge, which, owing to its low level, carries off much of this water (Fig. 64).

Flood control and river improvement

Until the nineteenth century little was done to improve the courses of the rivers, beyond building groynes to protect the banks from erosion, and cutting off some of the meanders. The main problem was to cope with the recurring and disastrous breaks in the dykes. Along the rivers, many sheets of water (*wielen*), around which the dykes make a detour, are relics of these. The general method employed was to divert the flood water through sections of the river dykes into nearby lowlying areas, which served as temporary reservoirs and relieved the pressure on the dykes downstream. The water was then carried away ultimately by the existing drainage system, or made its way down, more or less parallel to the river, to another similar section in the dykes where it could rejoin the river. A section of the dykes kept for this purpose either at a low level, or built less strongly, is known as an *overlaat*. These problems were most serious along the Maas and Waal.

The Maas and Waal floods

Where the Maas approaches the Waal near Heerewaarden the rivers are separated by a narrow territory only a few hundred yards wide. For several centuries they were connected by three branches. In this area the level of the Waal is usually higher than that of the Maas : thus when the Waal was in flood masses of water flowed through these channels and the Heerewaarden *overlaten* into the Maas (Fig. 64). If, as frequently happened, the Maas was also in flood, the Waal water held up these floods, causing extensive inundations high up the Maas valley. The disposal of the Maas flood water plus the overflow from the Waal was further complicated by the fact that the two rivers came together again farther downstream. At a date before the fifteenth century the lower Maas had abandoned its earlier course to the sea, probably during extensive flooding, and taken a new course from Heusden to the Waal at Woudrichem. At this point again the Maas water was held back by the Waal. The relief afforded to the Waal by this diversion was thus only temporary.

Efforts to solve the increasing danger of floods were made through

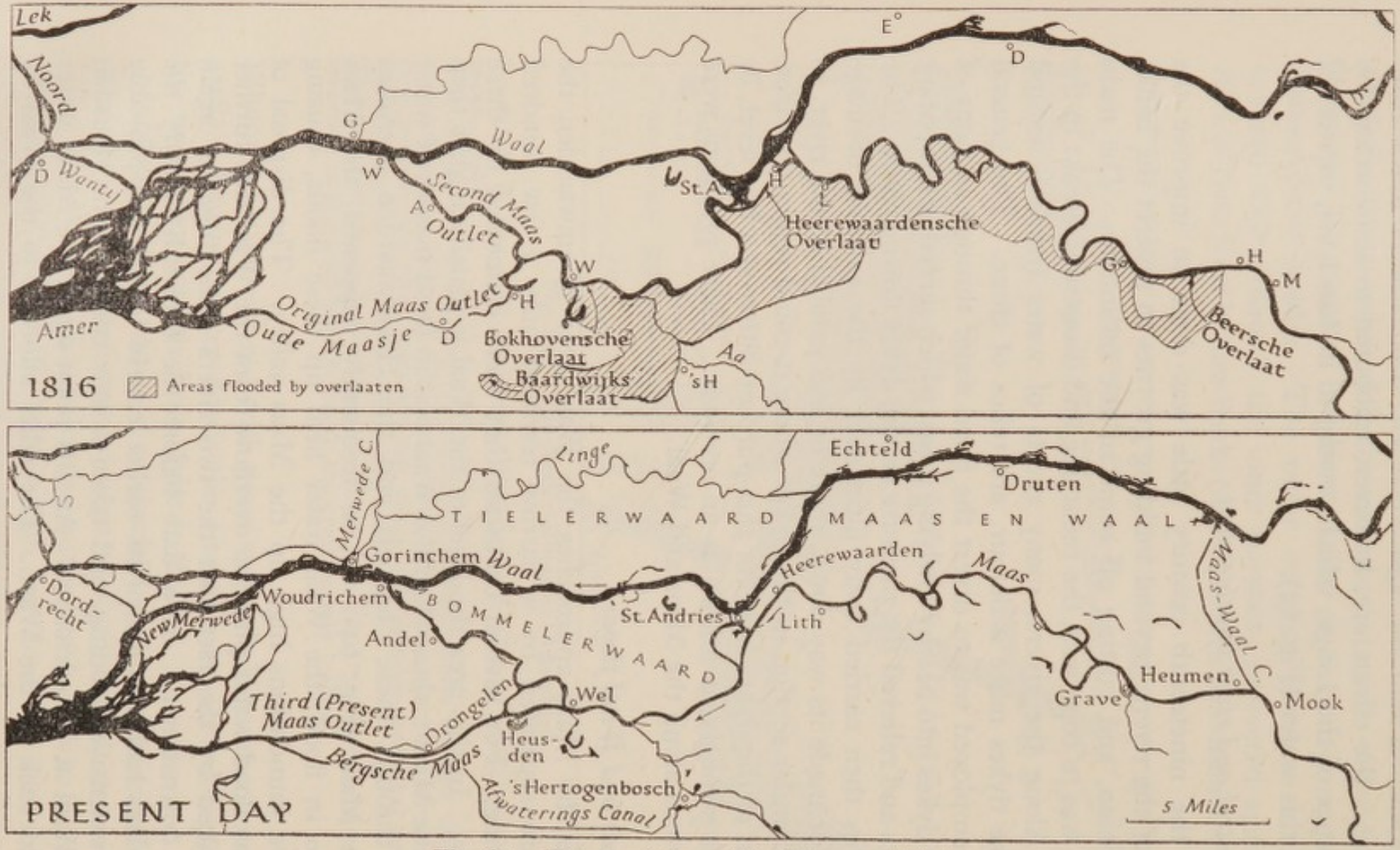

Fig. 64. The regulation of the Maas and Waal

From : A. Arrowsmith's map of the Netherlands, 1816 ; G.S.G.S. Series 2541, 1 : 100,000 Sheet 5 (1943).
The upper map shows the approximate areas flooded by *overlaten*, i.e., low sections in the river dykes to permit the temporary dissipation of excessive flood water. The lower map shows the separation of the Maas and Waal, now complete except for locks at St. Andries and Andel ; the new course of the Maas to the sea via the Bergsche Maas ; and the straightening of its course below Grave.

the provision of additional *overlaten*—on the Maas near Beers and near Baardwijk. This system was by no means ideal. The Beersche Maas, which worked during twenty-seven winters in the forty years 1875 to 1914 and in thirteen of these more than once, reduced some 50,000 acres of land to poor and precarious grazings, harmed by the acid water originating in the Peel, and isolated many villages for long periods. The construction of the Nieuwe Merwede along the line of one of the principal channels traversing the Biesbosch greatly relieved the congestion of flood water in the lower Waal ; about two-thirds of the water now reaches the sea by this branch. In 1883 comprehensive works were begun to eliminate this scourge.

The Maas improvement scheme

The basis of this scheme was the complete separation of the Waal and Maas. Already two of the connections at Heerewaarden had been closed and the third, the Canal at St. Andries was provided with a lock. All connection was now severed in this area, except at St. Andries, by the building of a great dyke between the rivers. But the main solution for this problem of the disposal of flood water was found in cutting a new bed, the Bergsche Maas, from the Maas at Wel to the Amer, thus virtually reviving the older course of the lower river. The former course from Heusden to the Waal was closed by locks at Wel and Andel, though navigation between the two is still possible. The Baardwijksche overlaat was also raised, and so virtually suppressed. The Bergsche Maas, by shortening the river course, increased the stream velocity and lowered the level. The Beersche traverse could not, however, be completely suppressed, for the extremely sinuous course of the river below Grave still impeded the rapid disposal of the floods. After the disastrous floods of the winter of 1926–27, when the river dykes burst at seven points above Grave and the Land van Maas en Waal was inundated, further works were undertaken, including the dredging of the channels of the Amer and Bergsche Maas to lower the river level as far upstream as Grave where a barrage with locks had been built in connection with the Maas canalization ; the widening and deepening of the summer bed and the lowering and levelling of the winter bed ; the control of the summer water level by a barrage with locks at Lith (the locks, as in the case of the reconstructed canal at St. Andries, being built to admit 2,000 ton vessels) ; and the cutting through of the great meanders below St. Andries and between Lith and Grave. This great scheme was practically completed by 1939, with bene-

ficial results to the agricultural and social conditions of the riverine districts of North Brabant, and to the Maas navigation (see p. 574).

The Drainage of the Lakes

Before the full exploitation of the area within the sea and river dykes could be successful, two problems had to be solved—the disposal of the surface water and the drainage of the existing permanent bodies of water—the lakes and meres. Since the general level of the land was below that of the sea, and the natural watercourses were isolated from the surrounding land by the dykes, there was no natural drainage flow, and a complex, artificial system of polders and *boezems* had to be built up gradually (see p. 288). The drainage of the lakes was made possible by the introduction of windmills for raising water.

Development of windmills

During the fourteenth century small tracts of land were enclosed by banks and ditches. These ditches partially dried out the enclosed land, but the water in the ditches remained to be disposed of. It was not until the introduction of windmills, that the water from the ditches could be raised efficiently to a higher channel, and the size of the polders could be increased. Windmills for raising water were introduced into South Holland early in the fifteenth century : before 1600 they were in common use south of the Oude Rijn and spread thence throughout the country. To raise the water more than 6½ ft. two or more series of mills were erected at ascending levels until the required height was reached (*molengang*). This technique then made possible the drainage of the deeper lakes.

Drainage of lakes north of the Y (IJ)

Some of the smaller lakes in the north, including the Egmondermeer and Bergermeer, were drained in 1564 (Fig. 60). An advance was marked by the draining of the Wogmeer, 7½ ft. deep, in 1608. Encouraged by these successes, the more enterprising engineers turned their attention to a larger lake—the Beemster. The necessary capital was then available in the wealth accumulating from the trade with the Indies. In the reclamation of the Beemster, the initiative was taken by a syndicate of Amsterdam merchants headed by Dirk van Os, the technical advice being provided by Jan Adriaanzoon, the ' engineer and builder of mills ' known by the name of Leegh-

water. The lake was enclosed by a *ringdijk* and a *ringvaart* (canal); it was drained by twenty-six watermills in two series in approximately a year. In January 1610, however, winter storms breached the North Holland sea dykes in several places and the floods refilled the lake. It was finally drained in 1612, and later the Schermer, Purmer and other lakes were similarly reclaimed. The early ventures proved most profitable, as the lake bottoms were very fertile, but later ventures were less so, owing to the high costs of constructing dykes (Plate 25).

Drainage of lakes south of the Y (IJ)

In the region between the Y and the Maas estuary, the country was mainly a great expanse of peat and marsh, with a few large lakes or meres. Settlement had spread north-eastwards from the *geestgronden* and clay areas north of the Maas, attracted by the profits to be gained from the cutting of the peat, an important source of fuel. The areas from which peat had been cut were at first abandoned as derelict wastes of swamp and pool. With the gradual establishment of the authority of the *Graaf van Holland* the movement became more regularized, and leaseholders were required to make some attempt to rehabilitate these areas. When windmills became common, impoldering and draining became more effective. With improvements in technique, it was possible to dig out the peat to a greater depth; the fertile old sea clays below the *veen* (peat) were exposed, and their value as arable prompted more ambitious schemes. During the seventeenth and eighteenth centuries several large areas were thus reclaimed.

In Schieland peat-digging had by the middle of the seventeenth century reduced the countryside to an expanse of morass broken only by narrow strips carrying the roads and villages. It was not until the nineteenth century that drainage (*droogmakerij*) on a large scale was carried out. The great Zuidplas polder, lying nearly 20 ft. below sea-level, was drained between 1828 and 1839 by means of a series of windmills. Steam pumps were first used in 1843. The Prins Alexander polder, completed in 1874, has one of the lowest levels of all, being almost 21 ft. below sea level (Fig. 66).

The Haarlemmermeer

The greatest achievement in drainage south of the Y, however, was the Haarlemmermeer. Lying to the east of Haarlem and Leiden, in the early seventeenth century this lake had an area of about

40,000 acres and a depth up to 11½ ft. Owing to the magnitude of the undertaking and to the opposition of vested interests, such as the burghers of Haarlem, its reclamation was not undertaken until the nineteenth century. The final incentive was provided by the effects of two great storms in the winter of 1836, when the floods reached Leiden and Amsterdam. Work was begun in 1840; three main pumps were erected, at Heemstede on the Spaarne, on the ringvaart near Halfweg, discharging into the Y, and in the south-west corner, discharging into the Katwijk canal. Pumping began in 1849, and by 1852 the water had been removed. The sale of the reclaimed land met all charges excluding interest.

In Friesland few lakes have been drained: most of them have sandy, instead of clay, bottoms, and would not therefore repay the cost of reclamation.

Polders, Boezems, Boezemgebieden and Boezemland

Polders

The basic unit of the drainage system evolved in the Netherlands is the polder. A polder is as an area of land within which the circulation of the water is isolated, generally by dykes, from that of the external waters, of the sea or the land, and within which the level of the subsurface water is artificially controlled. A polder does not necessarily lie below sea-level, and may or may not evacuate its superfluous water mechanically: in Zealand many polders lie above mean sea-level and the drainage water is evacuated at low tide, and in Friesland dyking is exceptional and the levels are controlled by sluices in the ditches.

Polders vary considerably in area and in outline, from the small irregular polders reclaimed piecemeal from the fen, or the long polders formed by the progressive reclamation of tidal flats, to the extensive and more rectangular polders of large scale reclamation works, e.g. in the Wieringermeer and the Haarlemmermeer.

Except where they comprise the great sea or river dykes, the dykes enclosing the polder (*polderkaden*) are not high or massive constructions, being generally a few feet in height only. In North and South Holland and Utrecht all polders are surrounded by *kaden*, but elsewhere, especially in Friesland, if the polder level is above that of the *boezem* (see below), these banks are unnecessary. In each polder the drainage water is collected and gravitated through a system of ditches and canals, to a convenient point of discharge from where the water can be evacuated either by gravitation or by

pumping. The surface of the polder is cut up by a number of drainage ditches (*slooten*), not generally deeper than 6 ft. and in open connexion with the main ditch or *molentocht*, at the head of which, in the case of low-lying polders, stands the pumping engine. This raises the water to the level of the waterway into which the drainage is provisionally evacuated (*boezem*), or—conditions permitting—evacuates the water direct into adjoining open water (Figs. 65, 66).

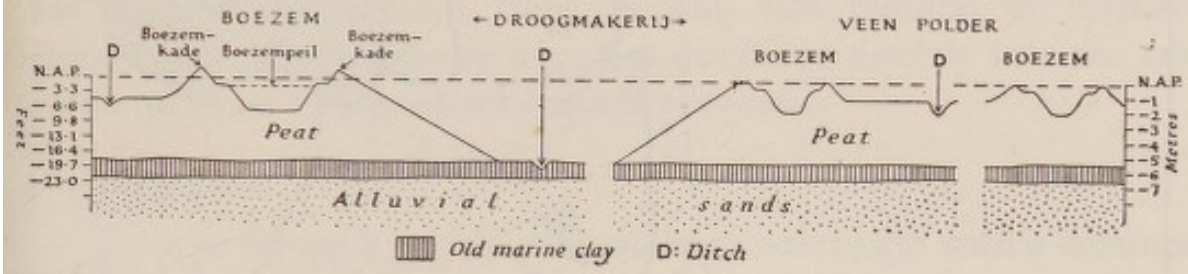

Fig. 65. Diagrammatic cross-section to illutrate relative levels in the polders

From : P. Tesch, ' Physiographic Regions of the Netherlands ', *The Geographical Review*, vol. 13, p. 510 (New York, 1923) ; J. B. L. Hol and H. van Velthoven, ' La lutte contre les eaux et la mise en culture ', *Tijdschr. Kon. Ned. Aardrs. Gen.*, vol. 55, pp. 606–7 (Leiden, 1938).
The diagram shows two of the main types of polder : the *droogmakerij* or drained lake (usually very low lying) and the *veen* polder. For explanation see pp. 288–289.

In the *droogmakerijen* (i.e. deep polders, usually formed by the draining of lakes), where the surface level is exceptionally low, the component polders are enclosed by a *ringdijk*, 6–13 ft. wide at the crown, and higher and stronger than the usual *polderkaden*. These ring dykes have usually a waterway, *ringvaart*, on their outer side which forms part of the *boezem*. In this type of polder (*droogmakerij*), the outer portions are higher than the centre : consequently low dykes and sluices in the ditches are necessary to prevent the flow of water to the centre.

Boezem

Whenever possible, the polder evacuates its surplus water directly into adjoining open water. Where this is not possible, an intermediate stage is necessary.

A *boezem*, the first stage in the evacuation of such surplus water, is essentially a means of temporary storage. It may be formed of portions of canalized rivers, artificial waterways or canals, or in some cases lakes or marshes. Throughout a *boezem* the surface of the water is maintained at a predetermined level. The waters of all

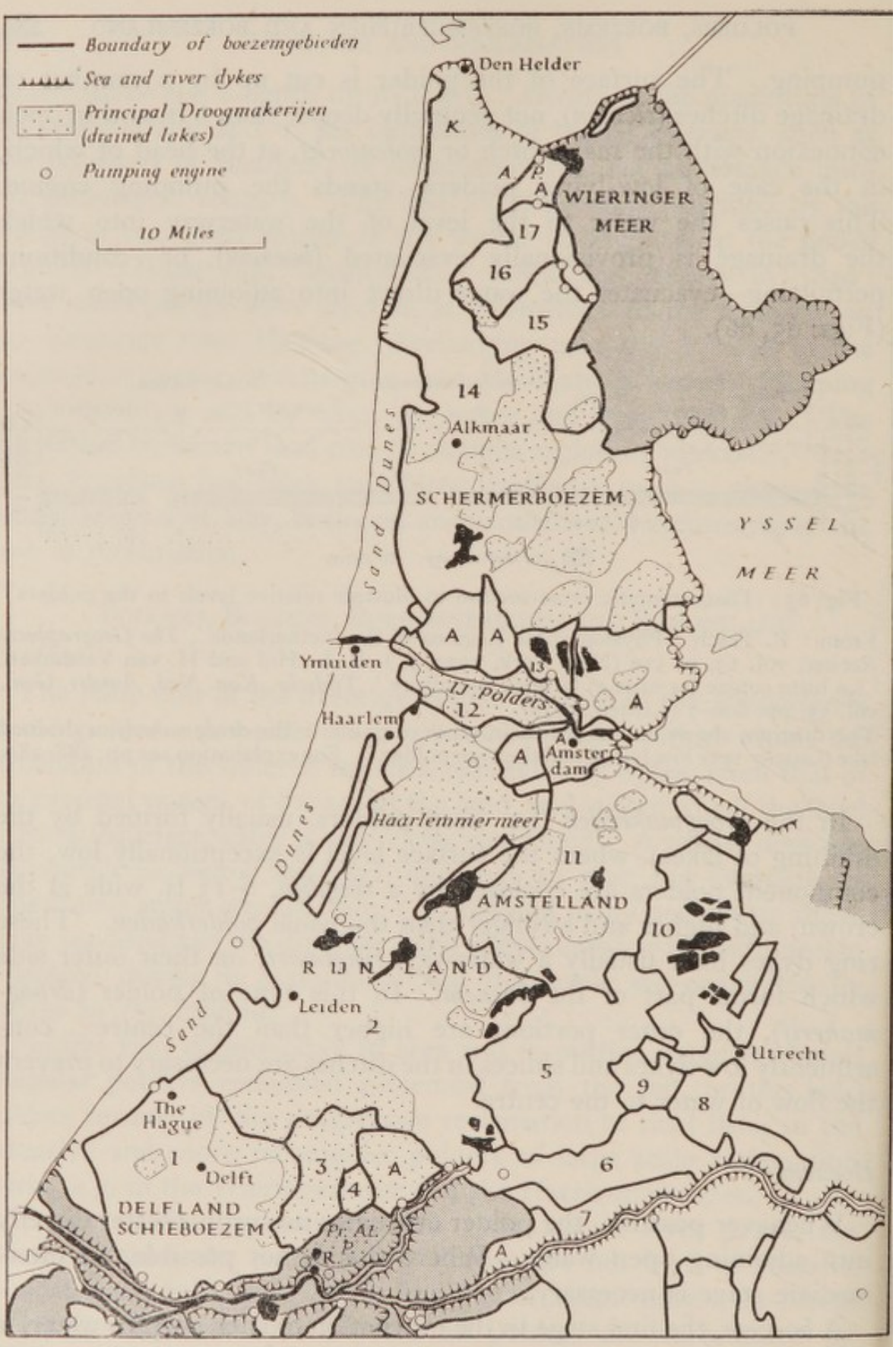

Fig. 66. The drainage system of North and South Holland, showing *boezemgebieden* From : P. R. Bos—J. F. Niermeyer, *Schoolatlas der Geheele Aarde*, plate 11c (Groningen, 1936).
(i) The heavy stipple indicates *boezemgebieden* (see p. 291) which discharge directly into rivers or the sea or Yssel Meer. (ii) The areas within heavy black lines and numbered 1–17 are the boezemgebieden draining most of North and South Holland. (iii) Areas marked ' A ' discharge through more than one boezem or through a boezem and directly to external waters as well.
The many internal dykes and polder kaden are omitted. The black areas show existing lakes. K Koegraspolder ; A. P. Anna Paulownapolder ; Pr.Al.P. Prins Alexander Polder ; R Rotterdam.

polders, except those which can dispose of their water directly into the sea or a large river, pass through the appropriate *boezem*. If the latter has direct access to sea or river its water is either discharged through sluices or pumped out, if its level is too low. Even if natural evacuation is possible for long periods, pumping is often preferred, for sluices in the great protecting dykes may be an element of weakness : in addition, exceptionally high levels in the external waters, resulting from storms on the coast or river floods, may last for considerable periods, thus making this method of disposal impossible. If the *boezem* does not discharge directly into the sea, its water must be passed into another *boezem*.

Boezemgebied

The area served by one such system of waterways with a common level, and from which the superflous water has a common exit or exits, is known as *boezemgebied* (the term boezem is sometimes also used in this wider sense, but it is simpler to preserve the two terms). The polder land of the Netherlands is divided into a large number of these regions, e.g. the Rijnlandsboezem(gebied), Delflandsboezem (gebied), and Frieslandsboezem(gebied), which have evolved in harmony with the natural topographical and hydrological conditions of the respective areas. An area in or adjoining a boezemgebied which drains naturally into the boezem, and which is susceptible to flooding during high water stages in the boezem, is known as *boezemland*, e.g. portions of the geestgronden and dunes of North and South Holland ; the most notable, however, occurs in Friesland. A small area with natural drainage lying along the boezem outside the boezem dykes is known as a *vlietland*.

The proportion which the area of the boezem bears to that of the boezemgebied, that is, the proportion of water to land surface, has a bearing on the effectiveness of the drainage system. Where the land area is large in relation to the boezem (i.e. water) surface, there will be more difficulty in disposing of the results of heavy or prolonged rainfall than in those regions where the water surface is proportionally higher. The area of the boezem will vary according to the season, but the following figures show average conditions in several boezemgebieden : in Rijnlandsboezem(gebied) the relation of water to land surface is 1 : 32 and in Delflandsboezem(gebied) it is even lower, 1 : 95. On the other hand for Friesland the proportion is much more favourable, namely 1 : 12, so that sudden increases in run-off can be more easily handled.

Sub-surface water level of polders

A definite subsoil water level is maintained in each polder, governed by its situation and the use to which the land is put. This level is maintained by varying the amount of water evacuated from drainage ditches into the boezem. Large scale maps give the summer level (*Zomerpeil*) of the water in every polder referred to the Amsterdam datum (Z.P.±A.P.). In older polders, reclaimed when the technique was less advanced, or where the subsoil, as in the *veen-polders*, is peat, the subsoil water level is relatively high, and they are mostly in pasture. Where the land, mostly on the clays, is in arable, a lower subsoil water level is necessary, owing to the depth to which the roots descend, and during the winter the aim is to keep it if possible 1·5 m. below the surface. In the summer this level is generally higher. The amount of pumping necessary to maintain the fixed level will vary according to the nature of the subsoil and the season of the year. Where the subsoil is permeable, polders lying at a lower level than those surrounding them are troubled by water infiltrating into them below their dykes, and much pumping will be necessary, for they are dealing also with the surplus water of contiguous polders. Polders along the great rivers suffer similarly from *kwel*, or seepage, and those lying by the sea in these conditions have the added damage wrought by the salt content of the water. In extreme cases pumping may be practically continuous.

Water level of boezems

The level of a particular boezem must obviously not be so high as to endanger the adjacent dykes, nor, if it is used as a commercial waterway, too low to impede navigation. The aim is to select a level which can be maintained with slight fluctuations only. When the danger level (*maalpeil*) is reached, all pumping from the polders into it ceases until the level is restored. Boezems which have a maalpeil are known as *besloten*, or closed, boezems. If the boezem can at all times evacuate its water naturally or the installations can dispose of any likely volume of water it has no danger level, and is known as a *vrije*, or free boezem. Delflandsboezem(gebied), for example, which is a *besloten boezem*, has a *boezempeil* of 0·402 m. (1·3 ft.)—A.P., and a *maalpeil* of 0·252 m. (0·8 ft.)—A.P., that is, after a rise in level of 0·15 m. (0·5 ft.) pumping ceases temporarily. The Rijnlandsboezem(gebied) is a free boezem. In order to deal with exceptionally heavy discharges, some polders within a besloten

boezem often have a portion of their area dyked off to form a reservoir in which water may be temporarily held while the boezem itself is closed.

Care must be taken when fixing the boezem level to see that it is not too low to affect adversely the subsurface water level of the boezemland. This is particularly the case in the bulb growing areas of the geestgronden, where a relatively high subsurface water level is necessary. When there is a lack of water in the polders, as a result of summer drought or of subsoil drainage into lower lying polders, water can be passed into the polder from the boezem through the mill sluices, or from one polder to another through syphons under the dykes.

Rijnlandsboezem (*gebied*).—This boezemgebied is one of the largest, and is responsible for the drainage of approximately 251,000 acres. Of this about 185,000 acres are in polders, and the area of the boezem, that is the surface of the drainage canals and lakes used for water storage, etc. is 8,900 acres. The balance is made up of the eastern slopes of the dunes (26,000 acres) and the boezemland (30,900 acres), mostly in the geestgronden. Woerdensboezem partially drains through it by sluices at Bodegraven, and Amstellandsboezem is also connected with it. The boezem comprises several elements ; portions of rivers, now dyked and closed by dams, e.g. the Oude Rijn and Spaarne ; lakes used as reservoirs ; and artificial waterways, e.g. the Haarlemmermeer ringvaart, the Nieuwe canal to Katwijk, and the Oude Wetering. The boezem discharges its water at four points ; at Spaarndam and Halfweg into the Noordzeekanaalboezem, at Gouda into the Hollandsche Yssel, and at Katwijk into the North Sea. It is also connected for navigation with neighbouring boezems. As the pumping stations at Spaarndam and Gouda can deal with all the superflous water, this is a free boezem. The boezem level in the centre of the area has varied since 1900 between 1·1 and 2·4 ft. — N.A.P. The fluctuations on the circumference are greater, as south-west winds tend to pile up the water in the north-east portions.

Control of water levels in Boezemland

In those portions of a *boezemgebied* which drain naturally into the *boezem* (i.e. boezemlands) where the level of the land is higher than that of the boezem, the water level is not necessarily controlled. In some cases, however, the water level is controlled—to facilitate the

disposal of winter floods, to hold up the surface water temporarily after heavy rainfall so that the boezem can first deal with the drainage of other areas, and during periods of drought to pass water into the boezem to maintain its level, e.g. for navigation. In the boezemland therefore the level is controlled by sluices in the drainage ditches. With a few exceptions, e.g. in north-east Groningen and to the south-west of Sneek, Groningen and Friesland are boezemland. In the lower lying central region, however, the water is pumped out of the ditches, as the subsurface water level would otherwise be too high for agriculture. The area of Frieslandsboezem is approximately 766,000 acres ; with a summer level of 2·2 ft. below N.A.P., the area of the boezem is about 59,000 acres or one-twelfth of the boezem-gebeid. The boezem is formed by canalized rivers and canals, but principally by the numerous lakes. The boezem water reaches the sea through twelve sluices (called *zijlen* in Friesland). As the tidal range is sufficient for natural evacuation in the north-east only, the two most important are the Dokkumer Nieuwe Zijlen and the Friesche Zijlen, near Zoutkamp, both discharging into the Lauwerszee. The others only work effectively when a north-east wind is blowing, as that reduces the sea level outside the sluices. Before the building of the great enclosing dam, the level of the Zuider Zee was often too high for the sluices to work effectively.

Much has been done in recent years to make the southern portion of Frieslandsboezem independent of the northern, e.g. by the building of a large pumping station at Lemmer.

The Reclamation of the Zuider Zee

The partial reclamation of the Zuider Zee is the most ambitious scheme undertaken in the Netherlands. The inception of the present work may be dated from 1886. The main motive for the adoption of the scheme by the State in 1918 was the desire to increase agricultural production, and to provide an outlet for rural workers. Other considerations were the protection the work would afford to the lands around the Zuider Zee (the floods of 1916 in North Holland having brought this into prominence), the improvement in farming conditions, particularly in Friesland, through the creation of a fresh water lake, and the beneficial effect of the expenditure on labour and materials. Against these had to be weighed the cost of necessary

supplementary works around the Wadden Zee, and the effect upon the inhabitants of the ports and fishing villages around the Zuider Zee (see p. 350).

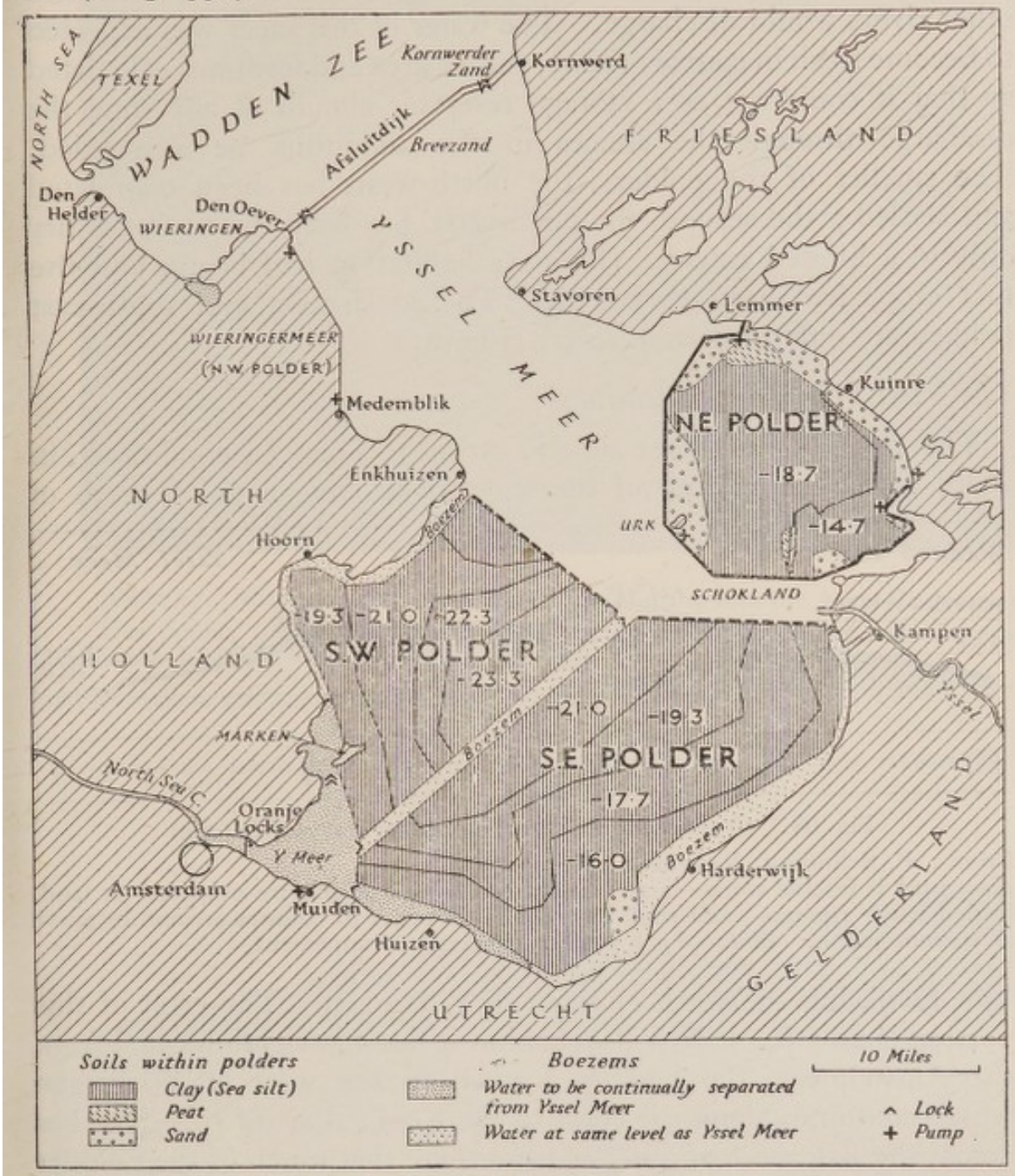

Fig. 67. The Zuider Zee scheme

From : P. R. Bos—J. F. Niermeyer, *Schoolatlas der Gehele Aarde*, plate 14 (Groningen, 1936).
The N.W. polder is complete ; the N.E. polder is separated from the waters of the Yssel Meer and is partly under crops. The S.W. and S.E. polders are planned. The figures indicate depths in ft. below N.A.P. (mean sea level).

The basis of the scheme was the exclusion of tidal water from the basin by a great *afsluitdijk* extending from North Holland via the island of Wieringen to the Friesland coast, and the reclama-

tion of four large polders, sited with regard to the depth and character of the bottom. In the centre would remain a body of water to be known as the Yssel Meer (IJsselmeer), into which the Yssel and other rivers would discharge. The water of this meer was expected to become fresh in course of time, and its area and level was calculated so that it could act as a storage reservoir should at any time the discharge through the sluices in the afsluitdijk be suspended. The smaller of the polders, the north-west, has been completed and settled ; the second, the north-east, has been dyked but is dry only to a limited extent. (By 1944 habitation had begun and the first crops had been harvested.) The south-west and south-east polders are only projected, so far (Fig. 67).

The Yssel Meer Dam (*Afsluitdijk*)

The work began rather slowly, owing to financial conditions, in 1920, with the building of the short dyke from a point north of

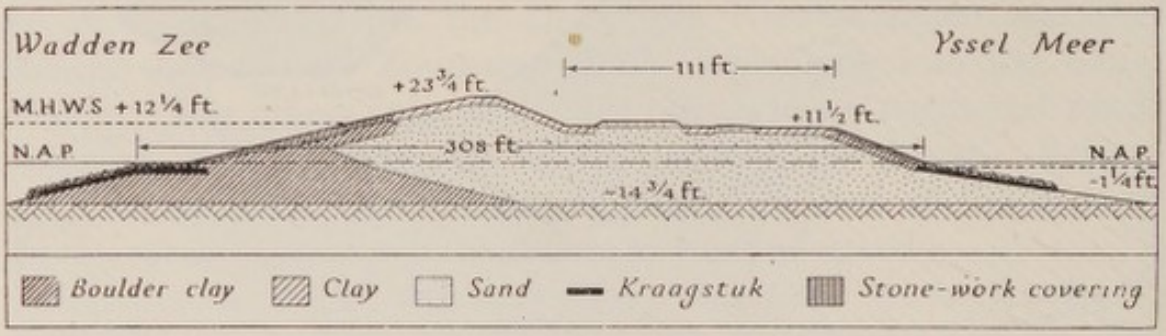

Fig. 68. Cross-section of the Yssel Meer dam (*afsluitdijk*)

From : R. Schuiling, *Nederland*, vol. 2, p. 552.
Kraagstuk is fascine work—large mats of brushwood which are prepared on land, loaded with ' rip-rap ', and sunk in position, in order to counter erosion by wave or current action. *Zinkstuk* is a similar protective arrangement.

Van Ewijksluis in North Holland to Wieringen. The crest of this portion is 20·3 ft. + N.A.P. ; behind it lies a navigation canal from the Amstelmeer, the boezem formed to the west of Wieringen which continues along the coast to De Kooi. Part of this dyke lies across the Balgzand, and it was from there that much of the boulder clay used for the whole work was dredged. The main dam runs from Den Oever on Wieringen to the Friesland coast between Zurig and Kornwerd. The length of the main dyke is 18 miles. The crest is 23–24½ ft. + N.A.P. ; it is built of boulder clay backed by sand. The foot of the outward face is protected by sunken masses of brushwood and rubble, and at wave level by blocks of basalt. On the inner side is a berm, 98 ft. wide, which carries the roadway, and has space for a proposed double railway track (Fig. 68).



Plate 17. Rupture of a dyke (1916); sea pouring into the Anna Paulownapolder
This polder, one of the largest in the Netherlands, lies in the extreme north of North Holland. It was drained in 1847.



Plate 18. Fascine work
These mats of brushwood (*kraagstuk* or *zinkstuk*) are used for underwater protection against tidal scour; they are floated to the required position, weighted with stones, and sunk. The fascines shown were used in the sill dam in the De Vlieter channel, eastward of Wieringen, in connection with the Zuider Zee reclamation.

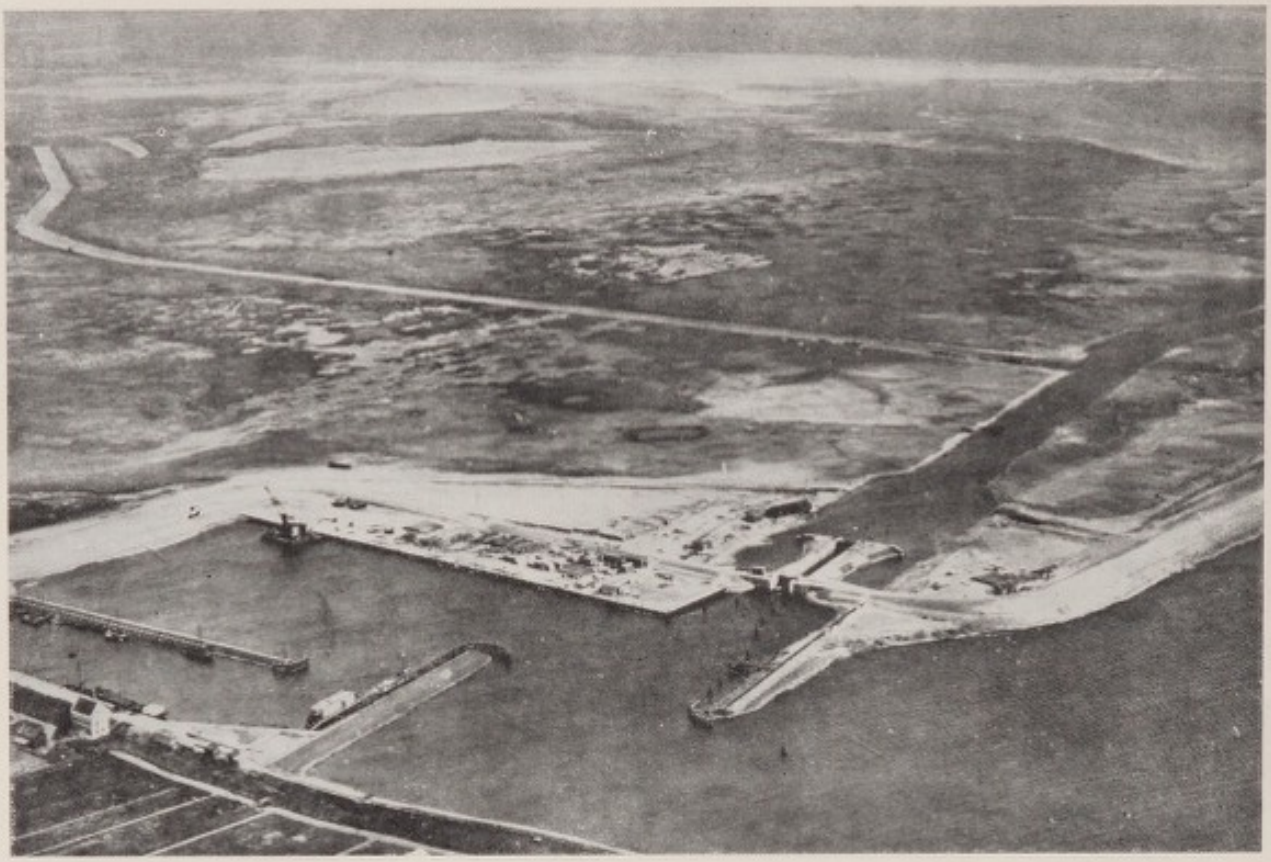

Plate 19. The Wieringermeer polder ; drying sea floor

The photograph shows a great part of the Wieringermeer or north-west polder drying out after its separation from the Zuider Zee (1930–1). The small harbour is De Houkes (looking south-east).

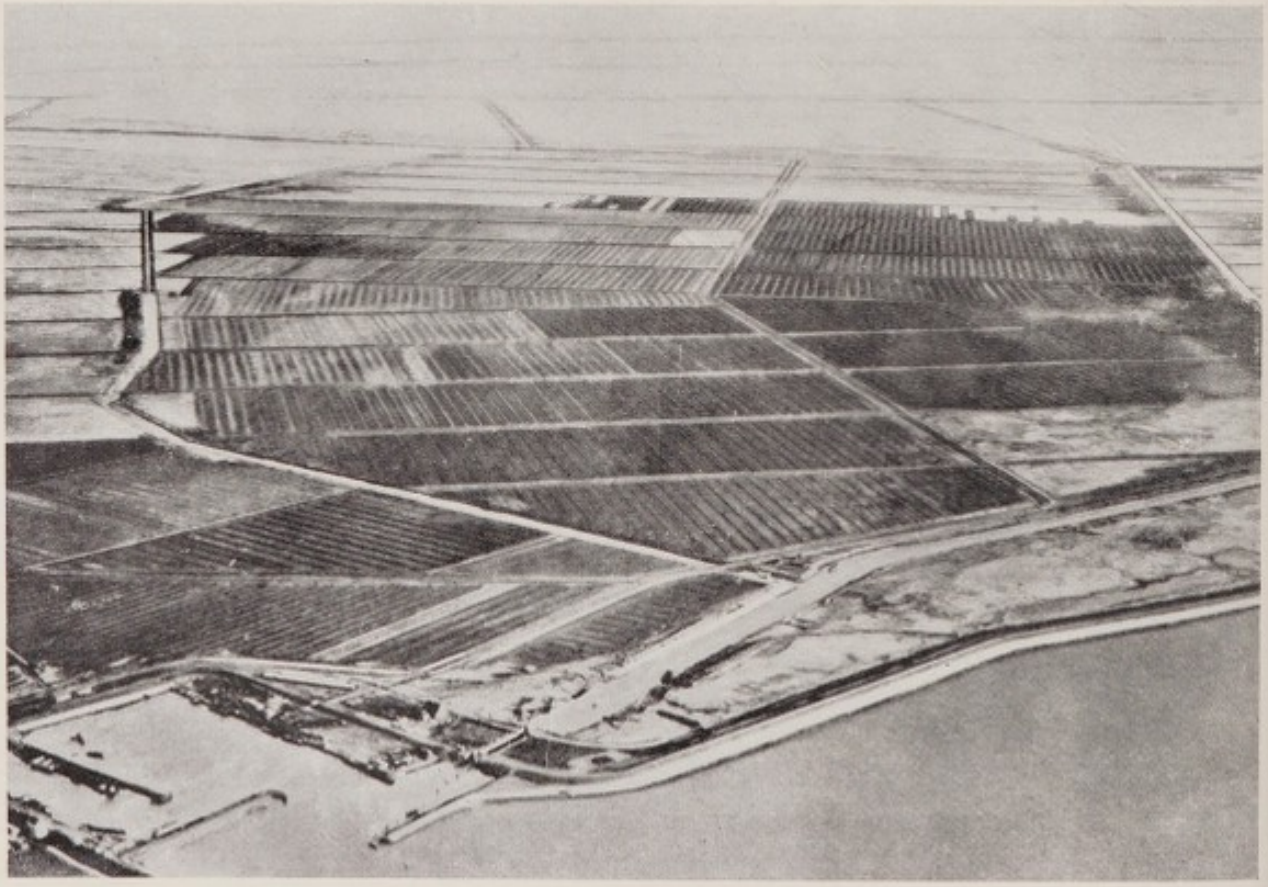

Plate 20. The Wieringermeer polder under cultivation

A later photograph of the same area, which now presents the normal aspect of cultivated polderland, with the drainage ditches forming a rectangular network.

The construction of the dam involved the creation of an artificial island, known as Breezand. Two groups of sluices were also built, one at Den Oever, the other at the Kornwerderzand, to control the level of the Yssel Meer. These were built in the open sea, the sites being enclosed in temporary dykes and pumped dry. There are fifteen discharging sluices at Den Oever, automatically closed by the rise of the tide, and a lock to accommodate 2,000-ton Rhine barges ; at Kornwerderzand there are ten sluices and a lock for vessels up to 600 tons. The dyke was completed by the closing of the De Vlieter channel on 28 May 1932 (Plates 21, 22).

The North-West Polder

While the main dyke was under construction, the enclosing dyke for the north-west polder, the Wieringermeer, was being built under water, and pumping began in February 1930. The crest of the dyke is 13·9–14·3 ft. + N.A.P. The polder is drained by two pumping stations, the ' Leemans ' at Den Oever, with three centrifugal electric pumps, and the ' Lely ' at Medemblik, with two diesel centrifugal pumps. The reclaimed land comprises about 49,000 acres. The polder is divided into four sections, according to the level of the surface, by main canals which are also used for navigation, and are connected with the West Friesland Trekvaart by a lock at Kolkorn and with the Amstelmeer by a lock at Haukes.

In the north and north-east of this polder occur patches of post-glacial sands ; much of the remainder consists of marine clays with varying proportions of sand, the heavier clays being in the south-west and extreme south, and east of Slootdorp. The clays are in arable and the lighter soils in dairy farms. The canals and main drainage ditches divide the polder into numerous generally rectangular strips with access to roads and drainage ditches accessible to small barges. The dairy farms range from 50 to 100 acres, the arable from 100 to 150 acres. Three villages have been founded in the polder : Slootdorp, Middenmeer and Wieringerwerf. The latter, provided with a *terp* (see p. 252) in case of flooding, is to be the administrative centre (Plates 19, 20, 26).

Much thought was given to the development and organization of the polder before it was opened to settlers, in order to avoid difficulties such as had attended the early exploitation of the Haarlemmermeer. The most suitable crops were determined by trials on a small polder reclaimed in 1927. The holdings, for which there was a keen demand when the first results were known, were leased only

to farmers with experience and technical knowledge, who possessed some capital resources. The majority of these came from the neighbouring provinces. In 1937, 255 holdings were being worked, and the population of the polder was 3,521.

The North-East (uncompleted) Polder

The plans for the north-east polder were sanctioned in 1931, but little was done in the crisis years. In 1936, however, the enclosing dyke was begun. Since 1939, owing to the demand for agricultural produce, the work has been continued, and part is now reclaimed. The floor of the Yssel Meer in this quarter is comparatively level, at 13–14½ ft. below N.A.P., and the building of the dyke presented little difficulty. Its actual course was laid down to include little sand, to avoid the deeper channels, and to avoid interference with the approach to the harbour of Lemmer and with the discharge of the Zwarte Water. The dyke touches the island of Urk and passes south of the island of Schokland before turning east. It is not known how far the sea floor has dried out. The polder is drained by three pumping stations—Lemmer and De Voorst (electrical) and Urk (diesel).

The area enclosed amounts to 117,000 acres. Owing to the slope of the surface from east to west, it is divided into two sections, the western with a sub-surface water level of 18·7 ft. — N.A.P., the eastern 14·6 ft. The layout of the drainage system and of proposed communications is controlled by the positions of the three pumping stations, where there are locks at the terminations of the main canals. These intersect approximately in the centre of the polder. Of the area of the polder 60% is clay or heavy sandy clay suitable for arable cultivation. In planning the subdivision by ditches into lots, the aim has been to avoid too uniform and rigidly rectilinear a pattern. Each block is within about three miles of a navigable canal. It is stated that in the spring of 1943, 21,000 acres were being cultivated, and it was hoped that by the following spring this would have increased to 61,000 acres. An eventual population of 50,000 is anticipated, including a town of some 10,000 persons.

It has been calculated that the cost of draining the North-East Polder will amount to *f.* 2,260 per hectare, compared with *f.* 4,150 for the North-West Polder.

Drainage Administration

During the thirteenth century special administrative bodies came into existence, first in Zealand and spreading thence along the great rivers and then through Holland and Utrecht, to maintain the dykes, control the water, and collect the dues. The most usual name for such a body was *waterschap* ; upon it the authority of the Count was represented by the *dijkgraaf* and the local interests by popular representatives. For larger areas, with wider problems to deal with, other bodies on similar lines also evolved, known as *Hoogheemraadschappen*. The imposition of a common policy through these agencies was achieved only in the face of much opposition from an individualistic people. One of the best known and most important of the Hoogheemraadschappen was that of the Rijnland, which was in being in the middle of the thirteenth century. As they dealt with matters vital to the very existence of the country, they grew into powerful autonomous organizations with judicial rights, asserting their authority against the cities and states.

The Waterschap

With the establishment and growing influence of the national state, which could override local jealousies and rivalries, their powers have been much curtailed in the last century. The *waterschap* remains the basic administrative unit—a semi-autonomous union of one or more polders, controlled by local representatives, and with administrative responsibilities. The election of members of a *waterschap* is open only to owners of land within the boundaries, and the larger owners have more than one vote. The *waterschap*, imposes taxation, according to the extent of land held by each owner and maintains the necessary works. The provincial states and the central government now exercise general control, and contribute part of the necessary finances, especially for large-scale works, such as the prevention of *vallen* in the Calamiteuse Polders (see p. 706). The special department—the *Waterstaat*—is responsible for the main dykes, waterways, and other installations (see p. 185).

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2. Many references will be found in R. Schuiling, *Nederland*, 6th ed. (Zwolle, 1934–5).

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CHAPTER XI

AGRICULTURE

Soil Regions : Land Utilization : Main Crops : Animal Husbandry : Horticulture : Land Tenure : Agricultural Population : Co-operative and Credit Societies : Social and Economic Problems of Agriculture : Note on Reclamation of Heath and Moor : Bibliographical Note

The area of farm and horticultural land in the Netherlands in 1938 was 5,820,000 acres, or over 70% of the total area. This proportion of farmed land is high for western Europe, and results from the successful efforts made to extend the area of cultivation.

Percentage of total area, 1938

Farm and horticultural land	71·56
Marsh and alluvial land (including land in process of reclamation)	3·75
Uncultivated land	8·18
Woodland	7·84

About two-fifths of the farmed area is arable and nearly three-fifths is permanent pasture. The maintenance of grass meadows for cattle rearing is a characteristic feature of Netherlands farming : of the arable land little more than one-tenth is in rotation meadows and fodder crops. In Belgium, where stock raising is also developed, the proportions of arable and pasture are approximately reversed, and about one-fifth of the arable is in rotation meadow and fodder.

The Netherlands is one of the most intensively farmed countries in western Europe, crop yields and animal densities being among the highest.

	Number of livestock per 247 acres (100 hectares) of cultivated area, permanent meadow and pasture		Average yield of cereals in 1933–7, quintals per hectare	
	Cattle	Pigs	Wheat	Rye
Netherlands	109	71	29·6	23·3
Denmark	93	111	31·3	17·3
Belgium	88	52	26·5	23·9
Eire	84	20	24·6	18·6
Germany	71	83	22·2	17·1
France	45	20	15·3	11·6
Great Britain	43*	21*	22·8†	16·1†

* Excluding Northern Ireland ; † together with Northern Ireland.
From : *Population and Agriculture*, pp. 15, 16, League of Nations, European Conference on Rural Life, 1939 (Geneva, 1939).

These results are a reflection partly of the high density of population in the Netherlands and partly of the intensive application to agriculture of labour and capital.

Soil Regions

The agricultural productivity of the Netherlands owes at least as much to the work of Dutch farmers and engineers as to the natural fertility of the soil. Throughout most of the country the farmland has been reclaimed from the sea or protected from river floods by dyking, or won from the heaths and wastes of the east and south-east. In the dyked areas control of the sub-soil water level is necessary to maintain the agricultural value of the land. In the east and south-east, drainage has improved the sands and the river flats, and fertilizers, natural and artificial, are everywhere heavily used. In some parts the cultivators have virtually created new soils : much of the peat cover has been removed from the high moors to render them productive, and for centuries along the *geestgronden* behind the dune belt the old marine sands have been mixed with peat from neighbouring morasses and with enormous quantities of manure to sustain a remarkable horticulture. The work of the Dutch in their struggle against the sea is widely recognized ; equally important, if less well known, is their success in bringing great areas of the inland wastes under cultivation.

Four broad divisions of soils are recognizable (Fig. 69) : (1) the polderland ; (2) the river clays ; (3) the sands and gravels of the south and east ; and (4) south Limburg.

(1) *The Polderland*

West of the 1 metre N.A.P. contour lies the region of the polders, accounting for 55% of the total area of the country, and comprising the coastal zone from Groningen to Zealand. The northern and southern portions of this belt are formed of recent marine clays, reclaimed in the last few centuries from the sea, and lying close to sea level. In North and South Holland there is a layer of low peat covering the old sea clays, with areas of clays exposed by the drainage of lakes or the removal of the peat. On the west this portion is protected from the sea by the littoral dunes, backed by the belt of older sand dunes which form the *geestgronden* : elsewhere it is protected by sea and river dykes. The land is divided by dykes and drainage channels into polders.

Where the sub-surface water level in these polders is relatively high, or low peat soils predominate, the land is generally in pasture, though in some areas it is used for horticulture. The rich grass polders of North Holland, South Holland and western Utrecht, which require little artificial manuring, were for long the centre of the Dutch dairy and cattle industry, but are now surpassed in output by Friesland, where clays, sands, and peat alike are given up to pasture, and by North Brabant. Where the water level can be kept lower, and clays prevail, arable is general. For cultivation, the aim is to keep the sub-soil water level at a depth of 4 ft. in winter. In the polders of North and South Holland arable farming is concentrated on the old sea clay bottoms of the drained lakes, e.g., the Beemster, Schermer and Haarlemmermeer ; in Schieland ; and on the very fertile recent clays of the Y polders and the Weiringermeer.

The polders of the south-west, including the islands of South Holland and Zealand, Zealand Flanders and the coastal strip of north-west North Brabant, are composed entirely of the recent marine clays with their heavy soils. After reclamation, the salt is removed by drainage and cultivation, and within about four years a fertile soil is obtained, giving high yields of grain and root crops. This, with Groningen, is the predominant arable area of the Netherlands, though mixed farming and market gardening are found locally. Owing to the geological formation, difficulty is experienced in obtaining adequate supplies of fresh water in Zealand, but supplies are now piped from the mainland. (For a general account of the polder lands see Chapter X).

(2) *The River Clays*

The belt of river clays, with patches of gravels, occupies the courses of the Waal, Maas, Lek–Neder-Rhine, Oude Rijn (Rhine) and Yssel. Although lying above sea level, this territory requires to be dyked against river floods, and thus conforms more to the western polder districts, into which it in part extends. The river clay areas are not in general as good farming land as the marine clays. The surface is more broken, the sub-soil more variable, the clays being interspersed with sands and gravel, and the drainage poor locally. They suffer much from the infiltration of river water through the dykes, and are also liable to inundation. Thus large areas, e.g., above 's Hertogenbosch, are almost uninhabited grazing grounds, though recent control works have encouraged the growing of grain. Where, however, the hydrological conditions are better, mixed

farming and some horticulture is practised; but, above all, this area, particularly the Betuwe, is one of the great orchard districts of the Netherlands.

(3) *The Sands of the East and South*

East and south of the 1 metre N.A.P. contour, the soils are much poorer. The surface cover, with the exception of the river clays, is formed mainly from outwash sands and gravels; in the north-east, owing to recent glacial action, moraines and bands of boulder clay occur, and as a result of the ill-developed drainage, there are extensive tracts of wet, acid, peat moors (see p. 74). Much of the 'high' peat area has been reclaimed (see p. 330), and the *Veenkoloniën* are now areas of intensive cultivation, mainly of rye for straw, potatoes for the potato flour factories, and some wheat and spring barley. There is little animal husbandry, and horticulture has only developed recently.

Over the rest of the sand area the soils give good results if moderate amounts of fertilizers are applied: with the use of these, side by side with the steady clearing and drainage, and irrigation of drier areas, cultivation has extended remarkably in the last fifty years.

(4) *South Limburg*

The southern part of the province of Limburg forms an agricultural region which is very distinct from the sands of north Limburg and North Brabant. Its fertile loams are roughly half arable and half pasture, dairy farming having been stimulated by the development of the mining centres, while meadow orchards are also important. Sugar beet is an important crop.

Land Utilization

As a result of the expansion of the farmed area in recent decades and the improvement of soils, types of farming associated with these soil regions have in many places spread beyond their boundaries. Thus grassland has increased on the sands of the east and south-east, and horticulture has expanded (Fig. 73).

The area of farmland continues to increase: between 1920 and 1938 it expanded by 6·4%. This is due to progressive reclamation from the sea, the most spectacular addition in recent years being the Weiringermeerpolder, and the gradual reduction of the uncultivated

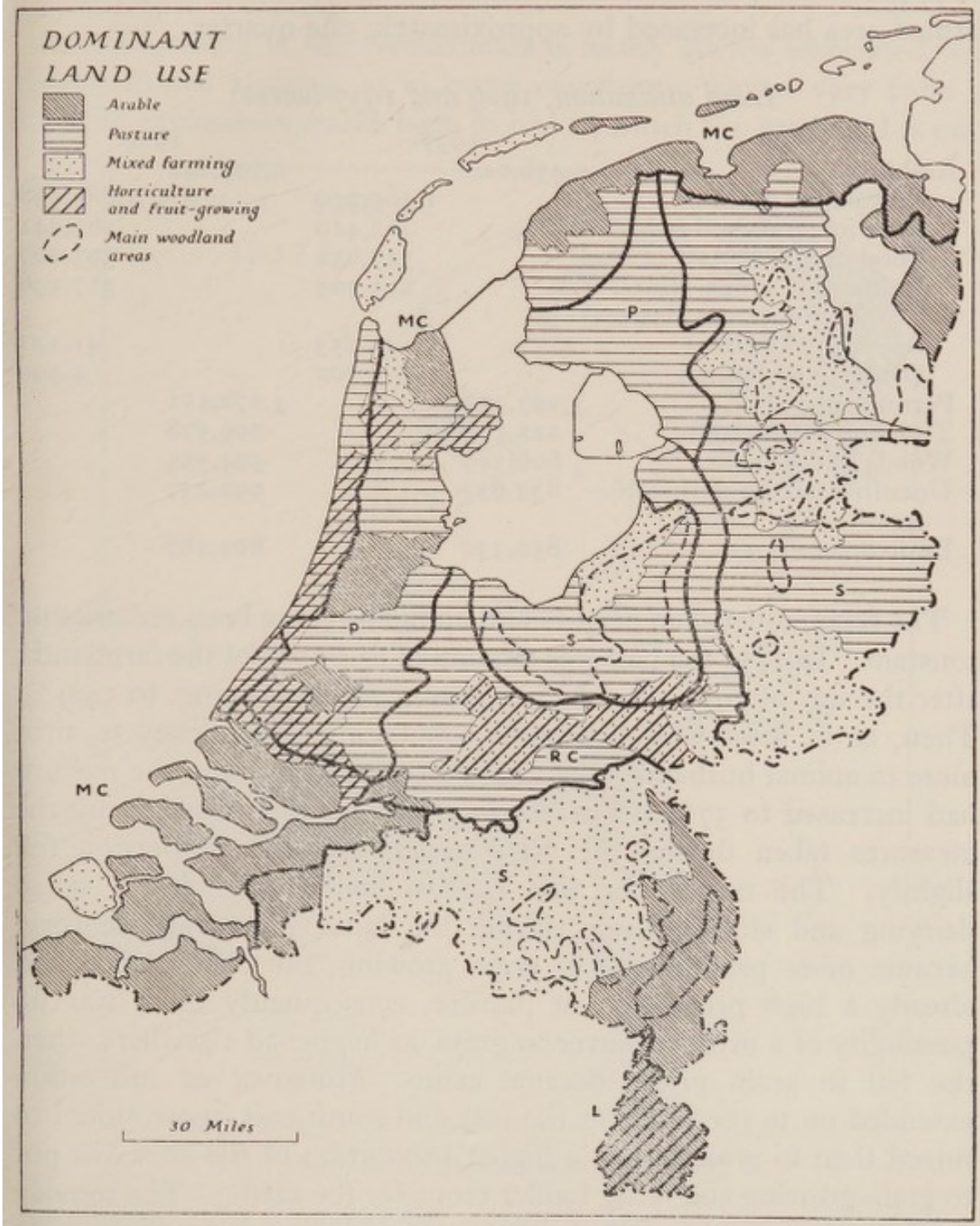

Fig. 69. Dominant land use in the Netherlands

From official sources.

The distributions show the mode of agriculture which, of the total area devoted to agriculture in the different regions, is dominant. In the arable areas, for example, mixed farming may be important locally. The black lines indicate the approximate boundaries of the parent materials of the main soil types ; L ' Loess ' ; S Sands ; MC Marine Clay ; P Peat ; RC River Clay (the three latter forming the polderlands).

The white area in the north-east indicates the fen colony area.

land, particularly in the sand areas. In the last hundred years the farmed area has increased by approximately one quarter.

Land utilization, 1929 *and* 1937 (acres)

	1937		1929	
Arable	2,436,020		2,304,842	
Cereals for grain		1,365,210		1,085,538
Rotation grass and fodder		262,410		262,341
Food crops		517,652		593,707
Industrial crops (incl. factory potatoes, flowers)		243,305		317,536
Seeds (incl. bulbs)		42,753		41,121
Other (incl. fallow)		4,700		4,599
Permanent grass	3,197,370		3,172,171	
Tree and bush crops	222,563		209,578	
Woods and Forests	606,349		594,555	
Uncultivated land (heath, moor, etc.)	833,933		992,237	
Built-up areas, etc.	850,330		801,187	

The relation between pasture and arable has long been remarkably constant. In 1833 the pastures amounted to 57·6% of the farmland : after the war of 1914–18, which favoured arable farming, to 54·9%. Then, as in most west European countries, the tendency to turn more to animal husbandry became marked, and by 1930 the pasture had increased to 57%. Further increase was then checked by the measures taken during the crisis years, and the proportion fell slightly. The reason for this relative stability is clear : when dairying and stock raising, during the latter nineteenth century, became more profitable than grain growing, the Netherlands had already a high proportion of pasture, consequently there was no possibility of a great turnover to grass, as happened elsewhere when the fall in grain prices became acute. Moreover as cultivation extended on to the sands of the east and south-east, more suited to mixed than to grass farms, a higher proportion of the area was put to grain growing and other fodder crops for the cattle. The remedy for falling prices, therefore, was not a rapid laying down of arable to pasture, but, particularly in the dairying districts, a concentrated effort to increase the output and quality of the products.

A feature of the arable is the large area under cereals—about three-fifths. Their increasing predominance is the result of the attempt to make the country more self sufficing in foodstuffs which marked legislation during the economic depression : in 1928, 47·2% only of the arable was given up to cereals, in contrast to 60·4% in 1938.

Arable farming in the Netherlands is nearly always associated with some animal farming, as in many countries. Farms vary from an almost exclusively arable farm to one in which the grassland is quite

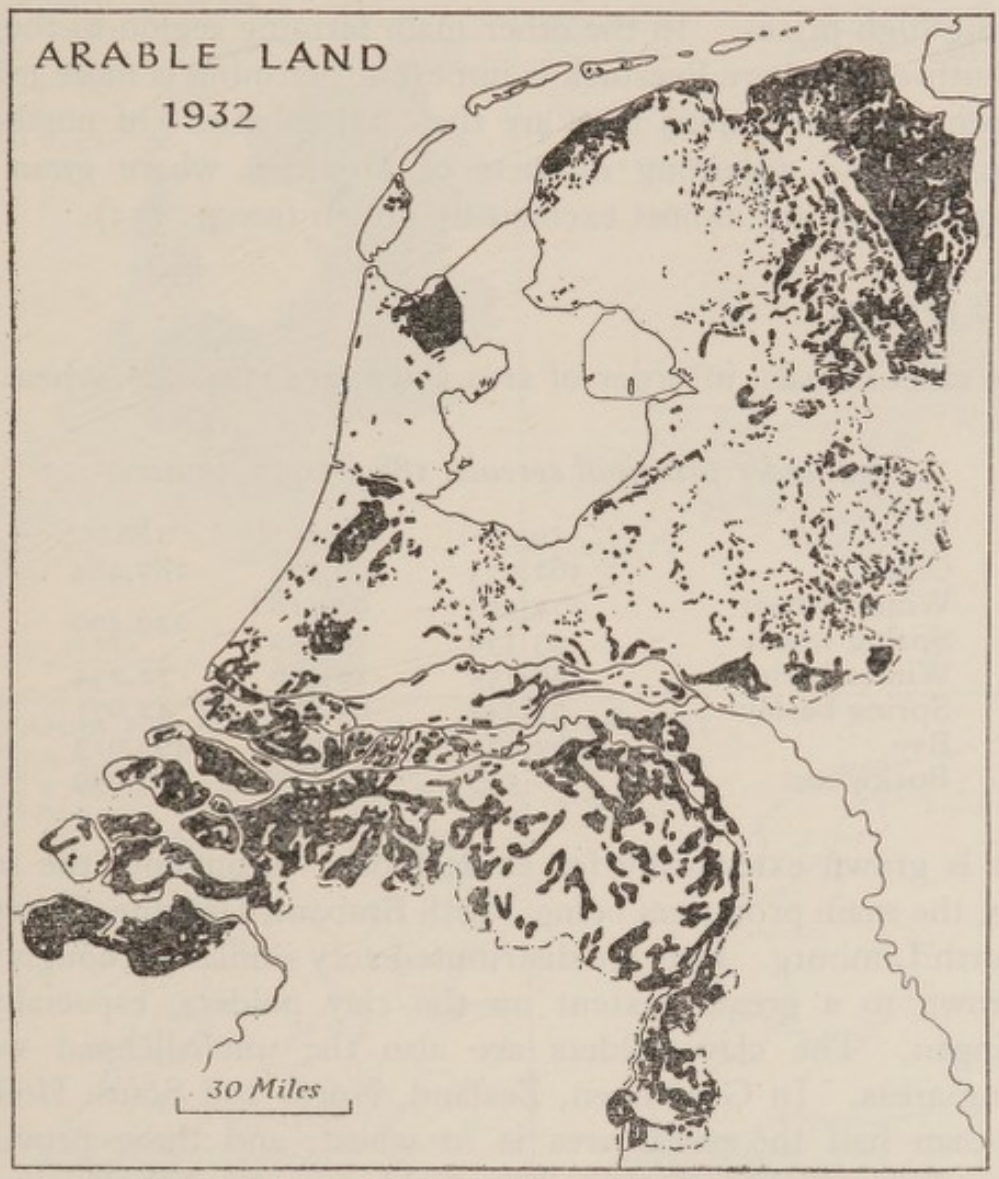

Fig. 70. Distribution of arable land

From official sources.
This includes land in rotation grass as well as grain and other crops. Note the concentration on the reclaimed moors of the north-east, the clay polders of Groningen and Friesland, and the polders of the South Holland islands and of Zealand. In the interior the distribution reflects local conditions of soils, drainage and rainfall.

important and the grain is fed to the stock—a ' mixed farm '. The dominant regions of arable farming are the northern and southern extremities of the polderland (Fig. 70), and much of the province of Limburg. To these must be added old sea clay areas of the drained lakes of North and South Holland (Meerlanden, Rijnland, Delfland,

Schieland), and the Noordoost and Weiringermeerpolders. Here are grown much of the wheat, flax, potatoes and sugar beet. In North and South Holland, near the horticultural areas of the *geest-gronden*, there is a pronounced tendency for the market gardens to spread on to the heavier clays whenever their products are commanding high prices. In the other main farming region to the east and south-east, where livestock is important, farming is more mixed. The principal exceptions here are the ' fen colonies ' of north-east Groningen and adjoining districts of Drenthe, where grain and industrial crops are almost exclusively grown (see p. 335).

Cereals (*Fig.* 71)

The chief cereals, in order of area sown, are rye, oats, wheat and barley.

Area under principal cereals, 1882–1937, *in acres*

	1937	1929	1882
Oats	362,973	396,173	287,484
Winter wheat	274,313	94,118	229,490
Spring wheat	43,336	18,152	
Winter barley	48,755	12,486	72,234
Spring barley	72,447	65,281	42,071
Rye	562,834	487,642	499,913
Buckwheat	558	1,784	117,639

Rye is grown extensively for cattle fodder throughout the sands region, the main producers being North Brabant, Drenthe, Overyssel and north Limburg. Oats are distributed very similarly, though they are grown to a greater extent on the clay polders, especially in Groningen. The clay polders are also the unchallenged wheat growing areas. In Groningen, Zealand, North and South Holland more than half the cereal area is in wheat, and these provinces produce 70% of the output. The yield over the whole country is high, 27·5 cwt. per acre, and reaches 30·9 cwt. in Zealand. Barley is relatively of little importance, and it is again the clays of Groningen and Zealand that produce more than half the total.

As in other west European countries, grain growers were heavily hit by overseas competition in the closing years of the nineteenth century, particularly in Zealand, a traditional grain growing district, and farmers turned to more profitable industrial crops. In the decades before 1890 the area sown to wheat stood on an average around 212,500 acres : in the following years it declined steadily, with some recovery in the years 1914–18, to an average of 142,000

acres in the period 1921–30, when it again had to compete with low prices of imported grain. On the other hand, owing to the expansion of animal husbandry on the sands, the area under rye was fairly steady (1881–90, 506,000 acres, 1921–30, 492,000 acres), and that

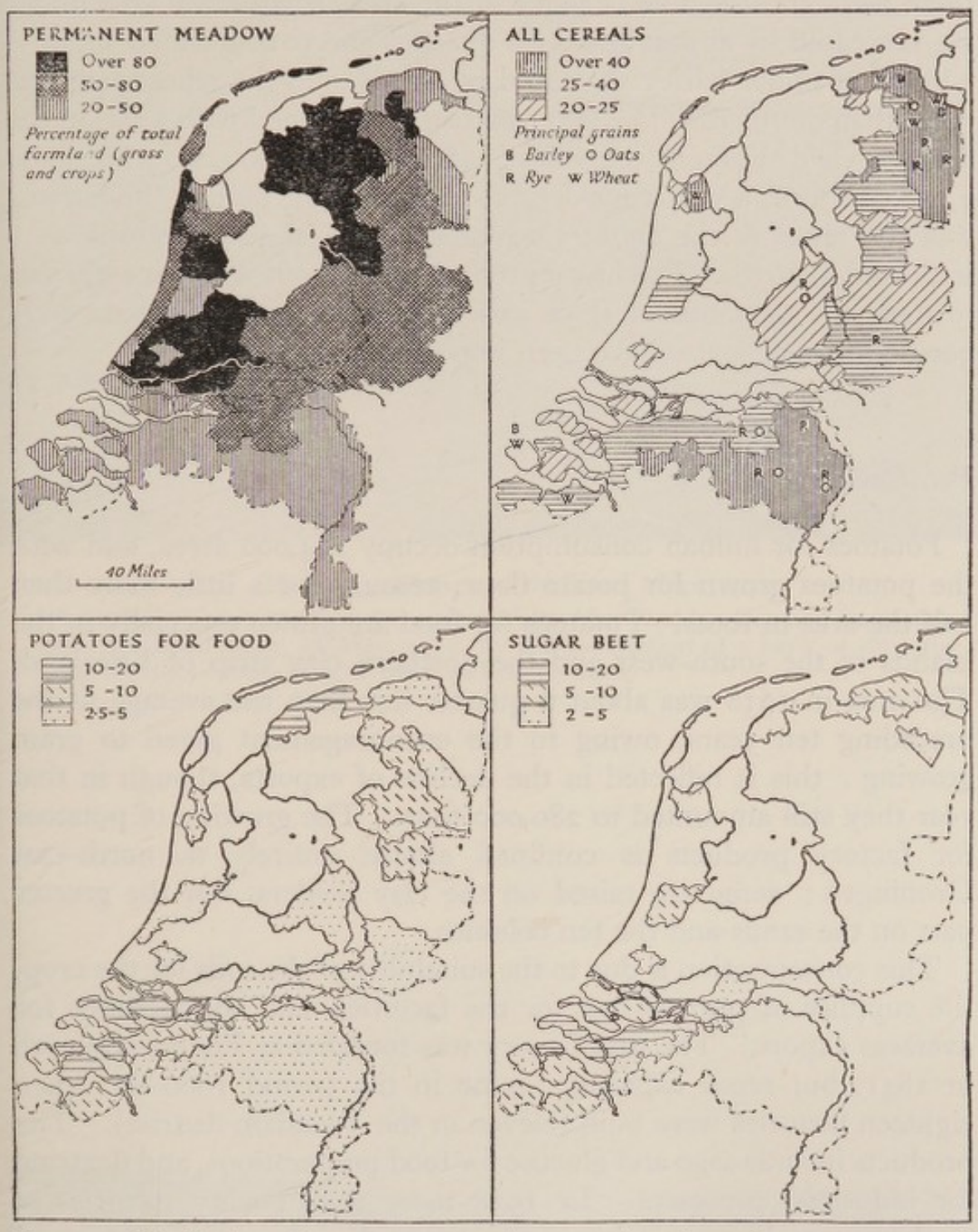

Fig. 71. Distribution of permanent meadow, cereals and certain root crops, 1938

From official sources.

Wheat and barley are mainly grown in the polderland, oats and rye for fodder in the sand districts. In the fen colonies of the north-east grain, largely for straw, and factory potatoes are important. Sugar beet is confined almost entirely to the clays of the south-west.

under oats increased considerably (287,000 to 378,000 acres). The emergency measures radically altered these tendencies. Between 1928 and 1938 the area under these four crops increased by 30%, and though their relative positions remained the same, there were considerable changes in the areas sown : the area under rye increased by approximately a quarter, and oats declined slightly, while that under barley increased by a half, and the wheat area was more than doubled. The latter increase, combined with a rise in the average yield, brought the wheat harvest from 1,996,000 tons up to 4,338,000 tons, a very considerable achievement, though the harvest was still short of the country's requirements, as 644,100 tons were imported in 1938. The home production of grain is also insufficient to meet the demands of stock raisers, so that in recent years 800–900,000 tons of maize have been imported.

Potatoes (*Fig.* 71)

Potatoes for human consumption occupy 224,000 acres, and with the potatoes grown for potato flour, account for a little more than half the area in roots. Potatoes for food are grown especially in the islands of the south-west and the northern clay strip of Friesland. The area in 1938 was about a quarter less than the average of the preceding ten years, owing to the encouragement given to grain growing : this is reflected in the decline of exports, though in that year they still amounted to 280,000 tons. The growing of potatoes for factory products is confined almost entirely to north-east Groningen ; some are raised on the clay polders, but the greater part on the sands and the fen colonies.

This concentration is due to the suitability of the soils for the crop, the supplies of peat as fuel for the factories, and the facilities for overseas export. The first factory was founded at Foxholsterbosch in 1841, but rapid expansion came in the period 1860–80, when eighteen factories were built (eleven in the Veendam district). The products include sago and glucose for food preparations, and dextrine for industrial processes. In 1938 there were twenty factories at work, sixteen being run by co-operatives, handling 808,000 tons of potatoes, the co-operatives taking 85%. These products are an important item in the export trade, 86,400 tons of potato meal (*f.* 16·5 mill.) and 20,700 tons of dextrine (*f.* 2·6 mill.) being exported in 1938, approximately half of the meal going to Great Britain.



Plate 21. Closure of the Yssel Meer, 1932

The photograph was taken the moment after the Wadden Zee had been separated from the Zuider Zee, 28 May, 1932, by the completion of a bank of clay, the first stage in the construction of the Yssel Meer Dam.

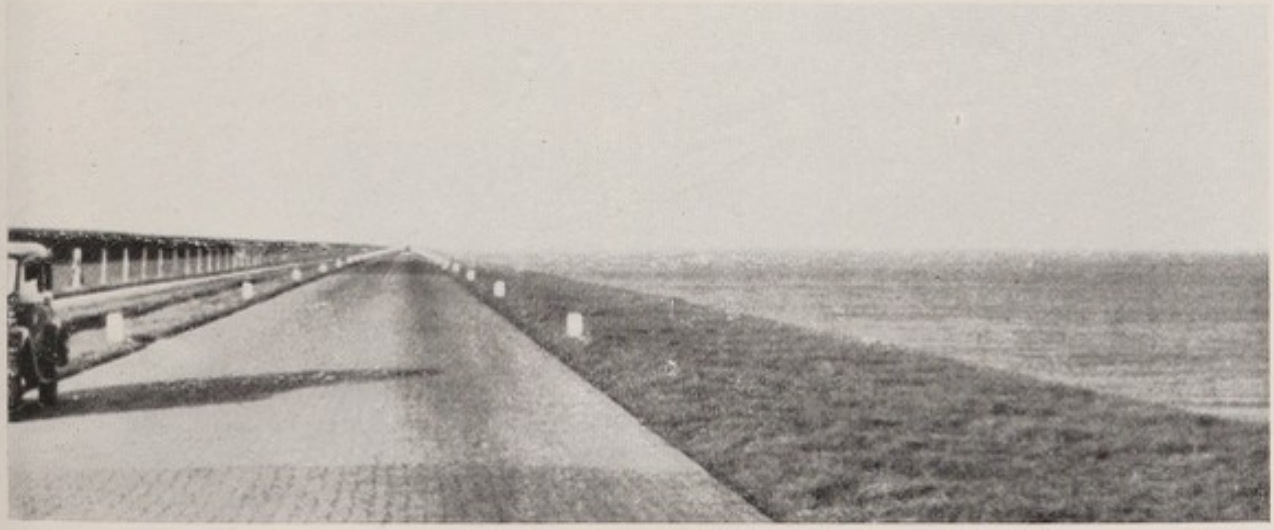

Plate 22. The Yssel Meer Dam, looking north-east

The Wadden Zee, outside the dam, lies to the left.



Plate 23. Glass-houses in Westland

Westland is the chief centre of glass-house cultivation in the Netherlands. The photograph was taken looking west towards Monster, with the North Sea in the distance, and shows the main road from The Hague to Hook of Holland.



Plate 24. Flower-growing near Lisse

Lisse lies in the belt of *geestgronden*, or old sand dunes, between Haarlem and Leiden.

Sugar and fodder beet

Sugar beet (107,000 acres) and fodder beet (119,000 acres) are grown especially in the south-west, where the better drained clays are more suited to these crops than the clays of the Groningen polders. Owing to the movements of the international sugar market, the area under sugar beet has declined very considerably in recent decades, partly balanced by a much increased yield. In the years 1921 to 1930 the average area was 159,000 acres. Although some raw beet sugar is exported, there is a net import of sugar: the quantity in 1938 was 92,000 tons only, mostly cane sugar. Of the twelve sugar beet factories, six are co-operatively managed.

Other crops

With fluctuations in demand and in financial returns, several different minor crops have been grown from time to time, especially in the south-west arable region. Madder, rape seed, and hemp are no longer of importance: their place has partly been taken by caraway, colza, poppy and chicory. Until the turn of the nineteenth century, flax was an important crop, and supported a thriving industry, largely domestic. By 1931, however, the area had dwindled to 16,000 acres. During the economic crisis when other crops were restricted and its cultivation encouraged, the area rapidly expanded to 51,000 acres in 1938, mostly in Zealand, but small areas also in South Holland islands and North Brabant. Apart from potatoes, the most widely grown food crops now are beans and peas, accounting for 126,000 acres.

Animal Husbandry

Cattle (*Fig.* 72)

The animal husbandry of the Netherlands is primarily concerned with the production of milk, either for liquid consumption in the great cities, or for the making of butter, cheese, and other milk products such as condensed and dried milk, chocolate, or casein. There is also breeding and export of the dairy strains for which the country is famous, while beef cattle are fattened in the districts around the large towns. In the neighbourhood of Schiedam the residues from the distilleries are used for this purpose.

Cattle Raising in North and South Holland. The traditional centre of the dairy industry is the pasture polders on the low peat of North and South Holland and western Utrecht where older polders with clay soils are also under grass. Cattle raising developed here before

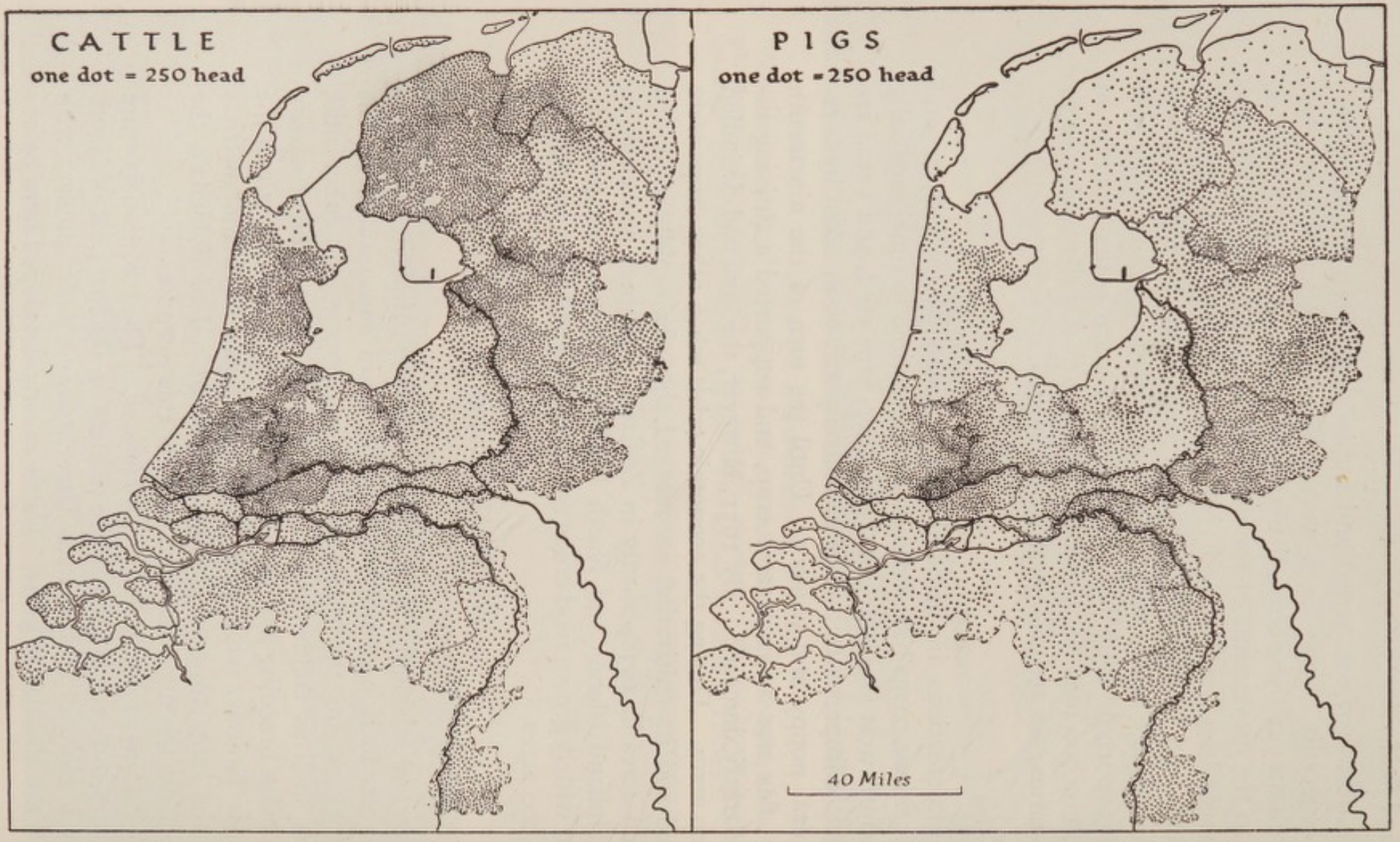

Fig. 72. Distribution of cattle and pigs

From : *L'Agriculture aux Pays-Bas*, Direction de l'Agriculture, pp. 84, 95 (La Haye, 1937).
The main cattle areas correspond closely with the distribution of permanent meadow (Fig. 71). The mixed farming regions, e.g., North Brabant, have medium densities. Low densities occur in the fen colonies, the arable polders, e.g., Wieringermeer, and the poor areas of Gelderland. The correlation of pig-raising and dairying was formerly closer, but is still apparent, except in the more recent dairying districts of Friesland. There are few pigs in the arable polders or the fen colonies.

reclamation had been completed and it was not practicable to raise crops on a large scale. The natural conditions favoured the continuance of this specialization, for the soils and the sub-surface water level over much of the area when reclaimed are not suited to arable farming, while they encourage the growth of rich pasture. The position of the region in the west of the country, and between the North Sea and the Zuider Zee, gives a mild, moist, climate which again favours the growth of rich pasture with a longer period of growth than elsewhere. The cattle can also spend a great part of the year in the open, provided protection is given against strong winds. Over most of this area more than 80% of the farmland is in permanent grass: rotation grasses or fodder crops are not important in farm economy, and in some cases the entire holding is meadow land.

In the neighbourhood of Amsterdam, Rotterdam and Utrecht, all the work of the farms is directed to maintaining as large and as steady a supply of milk for the liquid market as possible. Calving is arranged to extend throughout the winter period passed in the stables, where the animals are fed on meadow hay grown on the farm itself, and a small allowance of imported oil cake or concentrates. As soon as the milk yield begins to decline, the animals, perhaps after being fattened, are sold, usually for slaughter, and others bought to replace them, for little breeding is undertaken. The north and east of South Holland and western Utrecht specialize almost entirely on the production of farm cheese, known by the name of Gouda, but the proportion of the national milk output consumed in this way is very small. Much of the Edam cheese is also farm made. Over this pasture region as a whole where the farmers are less conservative than those of Gouda, most of the milk is sent to the industrial dairies manufacturing cheese or butter.

Cattle Raising in Friesland. The leading province for factory products, however, is now Friesland where the pastures are concentrated on the less-well drained sea clays and the low peat, but are extending also over the sands. With the absence of large towns there has not been the same incentive to concentrate on the supply of milk for liquid consumption, while co-operative undertakings are well developed. The Friesland farmers are also specialists in cattle breeding, on which they have concentrated for centuries, with the result that their well-known black and white breed, remarkable for milk yield, has commanded good prices elsewhere in the Netherlands, and throughout the world. Along with

this goes the raising of cattle for beef. Successful breeders are not, however, confined to Friesland, and good animals are bred, for example, in North Holland and southern Drenthe.

The introduction of artificial fertilizers and the possibility of importing concentrated cattle food have led to a great expansion in stock raising over the sand areas. The recent increasing output of dairy produce is mainly due to this development, much of the butter from industrial dairies originating in this region. The supply of milk, eggs, pigs, poultry, and vegetables to the growing industrial centres is also important.

The number of cattle in the Netherlands has increased continuously, and in 1938 was 2,763,453. As the prime interest is dairying, the proportion of milch cows and cows in calf is high—53·6%. The numbers remained practically stationary in the war years 1914–18, but they grew by as much as 20% between 1920 and 1930, and continued to increase at about the same rate down to 1938. Nearly one-quarter of the total were then in the three provinces of Friesland, South Holland, and Overyssel. The greatest density per 100 ha. of farmland, however, is in Utrecht (184), but the above three provinces follow closely with 165, 157 and 142 respectively. In the arable provinces of Groningen and Zealand, the density falls to 74 and 58. By the better use of pasture, and improvement of the stock, to give greater yields, and higher fat content, the output per animal has been raised. While the number of cows increased by a fifth between 1920 and 1930, the output of butter rose by nearly one-third and of cheese by one-fifth; the pasture increased by 7·4% only, so that the rise is due to more intensive use of the existing pasture, better stock, and expansion in the mixed farming areas.

Milk

The annual output of milk is about 5,000 million kilograms: of this 24% goes to the liquid market, and 4% is fed to stock: butter accounts for 48%, cheese for 20% and other milk products for 4%. Industrial dairies number 875, of which 513 are co-operative; these deal with about two-thirds of the milk destined for dairy products, producing nine-tenths of the butter and three-quarters of the cheese. The co-operative societies are numerous both in the pasture areas of Friesland and North Holland and in the mixed farming areas of North Brabant and Drenthe, while of the private concerns one-third are situated in South Holland. Farm butter is made

on about 10,000 small mixed holdings in Zealand and Limburg, and elsewhere in conjunction with cheese making.

About two-thirds of the total milk produced is consumed by the home market in one form or another, or fed to stock. The balance provides the exports of butter, cheese, condensed milk, and milk powder, valued at *f.* 118·7 million in 1938 and *f.* 121·9 million in 1937. In the course of this century the butter export has more than doubled, and the cheese export has risen by 25%. The last decade, however, has seen a change in the relative positions of butter and cheese. The very rapid early increase of cheese exports was not maintained, the 1938 figures being well below the 1928–32 average, while the export of butter, perhaps owing to the greater demand for it on the British market, and through the government measures to combat the crisis, was in 1938 one-third higher, though lower than the peak year 1936. Over two-thirds of the exported butter, nearly one-fifth of the cheese, and more than one-third of the condensed milk went to Great Britain.

No butter or cheese can be exported without the official guarantee affixed by one of the government control stations, and the quantity of uncontrolled produce now manufactured is negligible.

Production of butter and cheese (*thousand tons*)

	1926	1936	1938
Butter (under State control)	75·4	94·1	94·8
Butter (uncontrolled)	7·9	7·2	6·2
	83·3	101·3	101·0
Cheese (controlled)	115·7	118·1	123·5
,, (uncontrolled)	6·8	3·2	1·4
	122·5	121·3	124·9

The export of butter rose from 47,000 tons in 1929 to 51,000 in 1938, but the export of cheese fell from 96,000 tons to 58,000 tons, and of condensed milk from 171,000 tons to 152,000.

Meat

The production of beef and veal (123,127 tons in 1938) meets practically all the home demand. The principal markets for cattle are Rotterdam (1938 : 121,900 cattle, 84,400 calves), 's Hertogenbosch (80,500 ; 12,400), Leeuwarden (65,400 ; 61,200), Zwolle (48,700 ; 45,800), and Groningen (35,800 ; 45,500). The export

of pedigree cattle, mainly from Friesland and North Holland, has been adversely affected by world economic conditions. The number in 1938 was 361 animals only, which included 82 bulls and 57 milch cows, to the value of *f.* 105,000. The previous year the number had been 2,095, including 325 bulls and 764 milch cows.

Pigs (*Fig.* 72)

In the past pigs have been an important subsidiary to dairy farming, but in recent years they have depended less upon milk by-products, and more on imported and locally raised feedstuffs. While overseas markets were open for bacon exports, their numbers grew rapidly, exceeding two million in 1930. Later various methods were taken to reduce the numbers, which declined to 1,537,783 by 1938. About half of these were in the three provinces of Gelderland, North Brabant (mixed farming areas) and South Holland (cheese and distillery areas) and there were relatively few in the arable provinces of Groningen and Zealand. After the home demand had been met, there was an export of 28,500 tons of ham and bacon and 2,000 tons of pork, valued at *f.* 24·5 million. These quantities were a marked decline on the average for the years 1928–32—61,850 tons of ham and bacon, and 25,250 tons of pork. In fact, the sole remaining market of importance in 1938 was Great Britain, which took all the bacon.

Sheep

The importance of sheep in Netherlands farming has declined very much in the last half century, as in Belgium, and for the same reasons—diminution of the heathlands, fall in the price of wool, and popular prejudice against mutton. A great effort has been made in the Netherlands, however, to breed an animal suitable for both mutton and for wool. The old indigenous breeds of wool and heath sheep were first replaced by imported strains from Britain—Lincolns and Wensleydales, and latterly by crosses, of which the most successful is the improved Texel sheep, a cross of indigenous and Lincoln strains. In 1938 the number of sheep was 654,251, of which half were lambs, in contrast to 976,436 in 1866. A few thousand tons of fresh and chilled mutton are exported annually ; the wool is mainly used in home industries.

Poultry

Like pig raising, poultry farming as a subsidiary source of income has developed on the sand districts very considerably in this century,

especially after 1921. The number in 1938 was nearly thirty million, contrasted with five million in 1904 and twenty-five million in 1930. One-third are in Gelderland, where much of the poorer land is given up to poultry farms, and one-sixth in North Brabant. The output of eggs was 2,160 million, and approximately a quarter of these were sold in the four markets of Roermond, Venlo, Arnhem and Enschede. Exports were 88,288 tons, a figure ten per cent. above that of the pre-crisis year 1929 ; of these, one half went to the United Kingdom, and a quarter to Germany. The total value of poultry exports was nearly *f.* 40 million. In that year also 1·7 million live birds were exported, the majority to Germany ; and 3,000 tons of dead birds, principally to Great Britain. Duck breeding, mostly for the eggs, has been long established in the Netherlands, and in 1938 ducks numbered 875,000. The traditional centre is Waterland (Landsmeer-Volendam), but it has recently become important in the north Veluwe.

Horticulture

A variety of horticultural products has long been a characteristic of Netherlands agriculture, but it is only within this century that they have figured prominently in the export trade. This development has been due to the growth of dense industrial populations in western Europe and to the improvement in communications which has allowed the Netherlands, by exploiting their favourable geographical position, to enter these markets. Furthermore, the fall in general agricultural prices and the pressure on the available land, have obliged the smaller cultivators to concentrate upon products of relatively high value.

The area under horticulture in 1938 was 139,000 acres. Of this total 109,000 acres were occupied by market gardeners and fruit growers, but bulbs (19,000 acres), nurseries (6,400 acres), and flowers (3,400) were also important (Fig. 73). In addition to these fruit gardens there were approximately 94,000 acres of pasture orchards. The horticultural area increased by about 28% between 1910 and 1921, and by 26% between 1921 and 1930. The peak was reached about 1932, since when, owing to the economic situation, the area has been restricted to approximately the 1930 figure.

Market Gardening

The development has been greatest along the belt of *geestgronden* in South and North Holland, particularly the southern portion,

which enjoys a mild climate, is sheltered by the sand dunes, and has a well drained soil, improved by large additions of peat and manures; it is, furthermore, well placed in relation to the great

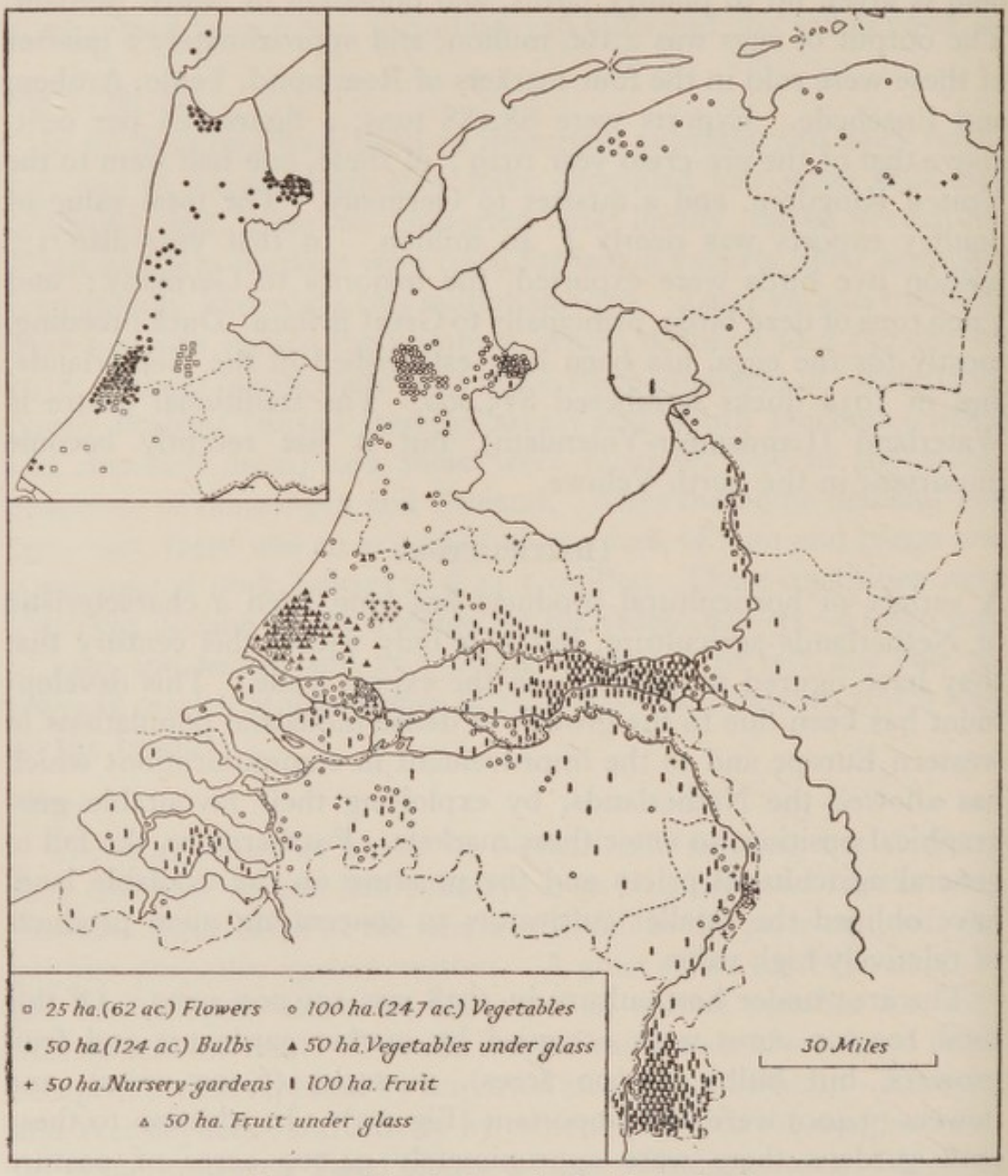

Fig. 73. Horticulture in the Netherlands

From: *L'Agriculture aux Pays-Bas*, Direction de l'agriculture, p. 58 (La Haye, 1937).

Glass-house cultivation is concentrated in South Holland, fruit in the Betuwe and south Limburg, and bulb-growing (see inset) and vegetables in North Holland.

urban centres and to foreign markets, particularly London. The centre of this area, the district of Westland between the New Waterway and The Hague, has largely concentrated upon cultivation under glass. South Holland in 1930 had 69% of the hot-houses of the

whole country, and 83% of the unheated glass houses; approximately four-fifths of these were in Westland and the adjoining districts of Delfland and Schieland. The only other province with an important proportion of glass houses was North Holland. The varied produce of this intensive cultivation includes grapes, cucumbers, tomatoes, peaches, lettuces, cauliflowers, and other vegetables. Farther to the north, in the Langendijk north of Alkmaar, vegetables are grown in the open, and in the Streek between Hoorn and Enkhuizen. Here the scale and uniformity of the cultivation approach arable farming rather than horticulture. More varied market gardening is followed around Rotterdam, e.g., at Pijnacker to the north, and Ysselmonde to the south, and in the neighbourhood of Amsterdam and Utrecht. Market gardening, however, is spreading throughout the country wherever valuable and varied crops are sought after and the local conditions are favourable. Venlo is an important centre, partly developed to meet the German market, and horticulture is spreading in western North Brabant, Walcheren and around Hoogeveen-Sappemeer in Groningen (Plate 23).

Bulb and Flower Growing

Bulb growing (tulips, hyacinths, narcissi, and irises), carried on almost entirely for export, is largely concentrated on the *geestgronden*, though the profits derived from it have caused cultivation to spread on to the clays. The chief centres are Sassenheim, Lisse, Hillegom, and Leiden, and, on the clays, the Streek and the north of North Holland. Market flowers are also extensively grown in the Leiden-Lisse area, and around Utrecht, but the chief area lies to the east of Aalsmeer. Nurseries, raising ornamental plants and trees, are largely concentrated around Boskoop (Plate 24).

Fruit Growing

In addition to the fruit grown under glass in Westland, the commercial production of fruit has recently been considerably developed throughout the country. Formerly the bulk was obtained from the old type of pasture or arable orchard which is still dominant in south Limburg and the river clay districts of Gelderland, the two provinces with the greatest areas of orchard, but the introduction of low growing varieties of trees and the interplanting of the orchards with bush fruits is transforming the distribution. These changes

have to some extent been introduced in the older orchard districts, but are more marked in the newer districts of western North Brabant, the neighbourhood of Goes in South Beveland, and South Holland. The main tree crops are apples, pears, and plums, and the small fruit includes strawberries, grown particularly in western North Brabant and Kennemerland, gooseberries and currants. With the increase of production, preserving industries have grown up, notably at Breda, Tiel and Elst.

Trade in Horticultural Products

The annual value of horticultural production in the pre-crisis years of 1928 and 1929 was estimated at about *f.* 250 million, of which *f.* 145 million were exports. The collapse of foreign markets, absorbing well over half the output, had a disastrous effect on the growers, only partially balanced by protection of the home market. The government has, therefore, been obliged to reduce production drastically, and to subsidize exports. The worst year was 1935, when the value of exports declined to *f.* 57 million : these had recovered to *f.* 84 million by 1938, but even in that year state subsidies amounted to *f.* 12 million. Vegetables and fruit account for 46% of the value of the exports, and bulbs for 40·5%. The feature of the development since 1929 has been the increase in the share of bulbs, for it was then 30·2%, compared with 57·1% for vegetables and fruit. Of the latter the most important commodities by value were tomatoes (*f.* 7·15 million), onions and shallots (*f.* 6·22 million), salads (*f.* 4·41 million), fruit pulp (*f.* 3·96 million), and grapes (*f.* 3·55 million). The United Kingdom took the largest proportion of the onions, fruit pulp, salads and preserved vegetables, while most of the tomatoes, grapes, and cucumbers went to Germany.

Land Tenure

Holdings

The total number of agricultural holdings in 1930 was 372,081, comprising about 5·56 million acres. Many of these, however, were holdings of less than 1 ha. (2·47 acres) occupied by those not primarily engaged in agriculture ; others were held by farm labourers, etc. The number of holdings over 1 ha. in 1930 worked by farmers and market gardeners was 192,144—175,025 by farmers, and 17,119 by market gardeners.

Holdings over 1 ha. (2·47 acres), not including Market Gardens

The 175,000 farmers worked an area of 4,753,000 acres, giving an average of 27 acres per holding. Those working from 2·47–12·3 acres (1 to 5 ha.) of land numbered 58,295. As it is estimated that in general about 12 acres (5 ha.) represents the minimum area, with the exception of market gardens, that can be effectively cultivated and give full-time employment to one worker, it is clear that many in this class must be economically unsound. In many cases, especially in the east, members of the family, by temporary or permanent employment in the industrial centres, contribute to the upkeep of their home. The general prestige attaching to the occupation of land probably also encouraged the working of uneconomic units. This desire for land, and the growth of the rural population, also tends to diminish the size of the holdings and to raise the value of land, so that it becomes more difficult for smaller holders to obtain an economic return for the capital and labour outlay. The average size of a holding has declined from 28·8 acres (11·66 ha.) in 1910 and the following table shows the considerable relative gain made by the 5–10 ha. and 10–20 ha. classes, which in 1930 comprised half the total.

Agricultural holdings (exclusive of horticulture) by sizes

Size		1910	1921	1930
ha.	acres			
1–5	2·47 – 12·3	55,366	60,610	58,295
5–10	12·3 – 24·7	37,331	44,468	50,832
10–20	24·7 – 49·4	29,411	33,076	39,814
20–50	49·4 –123·5	23,331	22,182	23,572
50–100	123·5 –247·1	3,214	2,529	2,356
100 and over	247·1 and over	191	210	156
		148,844	163,075	175,025

Size of Holdings, by Regions, excluding Market Gardens

The average size of the holdings naturally varies throughout the country according to the type of farming and the principal crops. In general those on the reclaimed clays are larger ; many have been planned as units, and at least about 50 acres are required for efficient working. In the pasture districts proper, the average is slightly smaller and for the mixed farms of the sand regions still smaller. In the latter, farms were originally made by piecemeal reclamation of heath and waste by family labour, and their area was limited by the amount of animal manure available. When the great expansion

over the sand regions took place towards the end of the last century, the colonists were mainly small men thrown out of employment elsewhere through the agricultural depression, who engaged in subsistence farming for want of sufficient capital. There are also quite considerable differences within each agricultural region, due to contrasts in general economic development.

Average size of holdings in acres

	1910	1921	1930	Increase (+) or decline (—) per cent.
Sea clays, with arable and mixed farming	55	47·7	45·2	—17·7
River clays with mixed farming	23·4	21·8	22·0	— 5·7
Pasture areas	39·5	36·1	35·3	—10·1
Sand regions	18·8	18·7	20·1	+ 6·3
Fen colonies	33·1	34·4	37·2	+ 8·5
Horticultural districts	34·1	29·6	27·7	—15·7

On the arable marine clay areas there is a range from an average of 104 acres for Nieuw-Oldambt to 26 acres on Walcheren : on the sand regions it runs from 32 acres in Westerwolde to 14 acres in the eastern Veluwe, where poultry farming alone brings in an economic return. Low averages are also found in Bommelerwaard (river clay), 16 acres, and in the Frisian islands (pasture region) 24 acres. Since 1910, partly through the elimination of uneconomic holdings and partly through planned reclamation, the average has risen in the fen colonies and on the sand regions.

Horticultural Holdings

To the figures given in the table on p. 321 should be added a number of market gardens. In 1930 there were 24,565 horticultural holdings, comprising 140,000 acres : of these 7,446 were less than 2·47 acres (1 ha.). For the whole group the average was 5·7 acres, one-third being between 2·47 and 4·9 acres. Since 1910 the numbers have risen by very nearly 60% ; in the earlier years the area increased at a proportionately higher rate than the number, but after 1921 this tendency was reversed, and technique became more intensive as market gardening offered more attractions. Thus the average size in 1910 was 5·6 acres and in 1921, 5·9 acres.

Of the holdings worked by agricultural labourers, many are little more than allotments, and their number has declined very strikingly in recent years. The total in 1930 was 57,078—of which 13,560 were over 2·47 acres, in contrast to 86,099 and 24,705 in 1910. As

the number of holdings above 2·47 acres has declined more rapidly than that below, the decrease is perhaps due to a tendency for those working larger plots to become their own masters.

Fragmentation of Holdings

Some check upon the excessive subdivision of land has probably been exercised by the fact that nearly half (43·8%) of all holders are tenants, working 49·03% of the land. In the Netherlands also it is not the general custom for land to be divided up among heirs. The proportion of tenant farmers has not greatly changed in recent years, though in the period between 1910 and 1921 when prices were comparatively good, farmers were buying their farms, and the proportion of tenants declined from 49·17% to 43%. Owner-cultivators are more frequent among the small farmers of the sand districts, particularly in Overyssel (71·71%), North Brabant (63·13%) and Gelderland (62·70%). On the other hand, pastoral Friesland and arable Zealand have fewer owners (39·39% and 40·81%).

In addition to decreasing size, a further obstacle to efficient farming arises from the subdivision of farms into numerous scattered parcels of land. This is particularly marked in the sand region where formerly the open-field system was usual, and ownership is more common. In 1924 it was estimated that 1,730,000 acres required consolidation, including 20% of the total area of North Brabant, and at least 35% of Drenthe, Overyssel and Limburg. Little progress, however, has been made, less than 22,000 acres having been dealt with.

The Agricultural Population

From the tendency for holdings to increase in number and decline in size despite the expansion of the cultivated land, it is clear that the pressure of the rural population is severe. This is, in fact, the basic problem of Dutch agriculture, and it has not been eased by progress in industrial development or the opening-up of overseas markets. In 1930 the agricultural population was returned at 639,026 persons, of whom 529,708 were men and 109,318 were women, forming together one-fifth (20·1%) of all those gainfully employed. The census figure for 1920 was 622,514; the absolute increase was due, however, to the rise in the number of women workers, the number of males having declined by 3,134. Between 1909 and 1920, when farming prospects were on the whole good, male workers increased by 27,117, while women declined by 23,269.

Although the Netherlands is one of the few west European countries where the agricultural population is not decreasing, it has ceased to absorb its share of the natural growth. In 1920 it had accounted for 22·9% of those gainfully employed. In the period 1920–30, though the actual numbers had increased by 2·7% the position relative to the total gainfully employed had deteriorated sharply, the latter having increased by 15·6%, while those in industry increased by 20·2%. The relation of the number of workers to the total area of farmland changed very little between 1909 and 1930; there was one worker per 8·6 acres in 1909 and one per 8·9 acres in 1930. As grassland increased more rapidly than arable, it seems probable that labour on the latter was more intensive.

Status of the Agricultural Population

The farming population in 1930 comprised about 175,000 farmers, 25,000 market gardeners and horticulturists, and 440,000 family assistants and hired workers. It is estimated that the latter numbered approximately 300,000; about one-sixth only of these possessed holdings, so that Dutch farm workers, like the British, are essentially a landless class. There is a certain amount of seasonal migration, especially for the harvest in Groningen; many workers also prefer to be able to move in search of better wages. The economic crisis hit the farm workers severely, though perhaps not so hard as the industrial. In the winter of 1930–1, unemployed numbered 108,000, or more than one-third of the total. Some of these would not normally be working in winter, but by 1935–6 the number had reached 128,000. Permanent relief of this unemployment, and of the pressure on the land in general, is impossible, owing to the absence of opportunities for emigration or absorption in industry. The sole prospect seems to lie in a revival of international commerce in farm products; even the effect of this would be diminished by the probable increase in the output per head.

Co-operative and Credit Societies, etc.

Co-operative societies

The co-operative movement has contributed much to improving the position of agriculture in national life, but its development has not been equally pronounced in all branches. Factors contributing to its growth have been the opportunity it offers to small farmers, comprising the bulk of land holders, to obtain more favourable terms



Plate 25. A farm in the Beemster

The Beemster is a large polder area, south east of Alkmaar, formed by the drainage of the Beemster lake in 1612.



Plate 26. The Wieringermeer polder : ploughing the sea floor

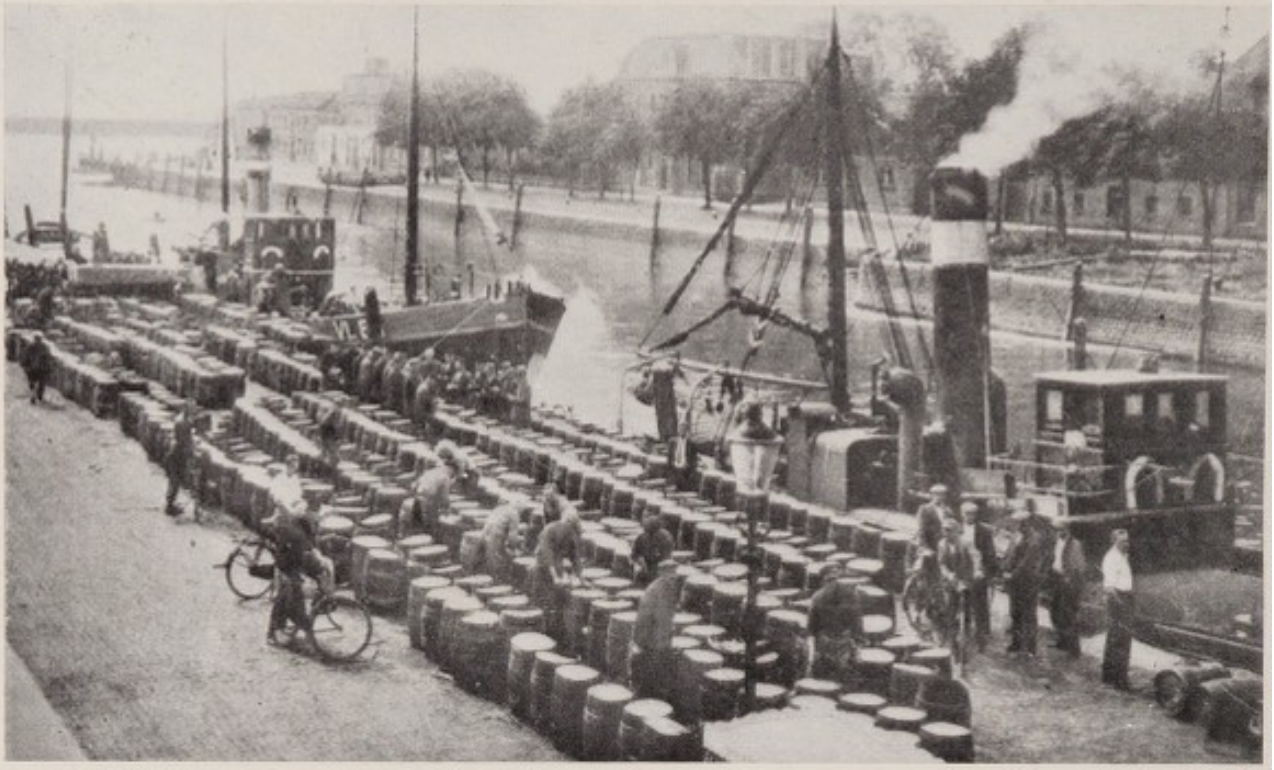

Plate 27. Steam drifters at Vlaardingen

The drifters are berthed in the Koningin Wilhelminahaven. The quayside is lined with *kantjes*, in which herring are packed and salted at sea.



Plate 28. Scheveningen

The photograph shows the outer part of the fishing harbour, looking south. The long dark building is the fish market. The Hague lies in the background.

for the purchase of their requirements, for securing part of their necessary capital needs at lower rates of interest, and for securing a share in foreign markets by maintaining adequate standards for exports. Some factors, on the other hand, are less favourable to its growth—the tradition of individual independence, strongest in the west ; the fact that the home market takes a considerable share of the produce, and is therefore difficult to organize in the face of numerous and competitive small units ; and the possibility of obtaining considerable amounts of capital from other financial sources. The movement on the whole is less developed among the arable farmers of the west and the cheese farmers of South Holland ; the Frisian farmers on the contrary, looking largely to the export trade, are well organized co-operatively, while consumer societies are particularly strong among the mixed farming peasants of the east and south-east.

The chief consumer organization is the *Cooperatieve Aankoopvereeniging* with headquarters at Rotterdam and about 520 affiliated local societies. Its main function is the bulk purchase or preparation and distribution of artificial fertilizers and concentrated feeding stuffs. In 1937, co-operatives supplied 61·3% of the concentrates used (estimated at 1·65 million tons) and 64·5% of the artificial fertilizers (total 1·28 million tons) and most of these were bought through this organization. It also stores, cleans and sells the cereals of its members. The heaviest purchasers in relation to farmed area were the peasants of Drenthe, followed by those of Gelderland and North Brabant. Similar purchasing societies exist among the dairy farmers and market gardeners.

Producer societies function in connection with dairying, straw board, and potato flour industries. Selling co-operatives are also important, particularly the *Centraal Bureau van de Veilingen* which organizes the auctions of vegetables and flowers. In 1938 the value of the fruit and vegetables thus sold amounted to *f.* 70 million and of flowers to *f.* 8·5 million. One-third of the eggs sold are dealt with by similar societies.

Agricultural Credit societies

The credit societies, the first of which was founded by the *Nederlandsche Boerenbond* in 1897, have done much to raise the status of the peasant and to encourage improvements. Those granting short term credit are organized upon the Raiffeisen system in two main groups, the *Cooperatieve Centraele Raiffeisen-Bank* at Utrecht, with 729 affiliated societies, and the Roman Catholic *C.C. Boerenleenbank*

at Eindhoven, with 568 societies. In 1938 the total advances stood at *f.* 208·9 million : as their deposits were then *f.* 460·6 million, it has been suggested that they were acting rather as ordinary deposit banks for the peasants than as land banks. It is estimated that these land banks have resulted in a saving for the peasants of about *f.* 6 million a year. Specialized branches of farming often have their own credit societies, for example, the *Cooperatieve Zuivelbank* of Friesland, affiliated to the Utrecht group ; long term credit for land purchase is provided by the *Cooperatieve Grond Kapitalbank* at Utrecht. While it seems probable that much of the capital in Dutch farming is obtained from sources other than the credit societies, the latter occupy an important place in the national economy.

Total volume of credit, 1938, *f.* million

	Bills of exchange, advances, etc.	Deposits, credits, etc.
Four commercial banks	322	684
Agricultural co-operative banks, central and local	326	507

Farmers' Central Organizations

Most of the co-operative societies are associated with one or other of the three principal farmers' central organizations. These are, as in Belgium, divided largely on religious lines ; together they comprise three-quarters of the two hundred thousand farmers. The ' neutral ' organization, the *K. Nederlandsch Landbouwcomite*, one of whose main functions is the tending of advice to the government, was founded in 1884 and has about 52,000 provincial members ; the *Cooperatieve Aankoopvereeniging* mentioned above is an offshoot. The Roman Catholic organization was founded in 1896 as the *Nederlandsche Boerenbond* : it was not at first sectarian but in 1924 the Catholic societies came together as the *Katholieke Nederl. Boeren- en Tuindersbond*. With 75,000 members distributed in more than 800 local societies, this is the strongest of these bodies. The credit societies under its auspices are members of the Boerenbank at Eindhoven. The third central association is the Protestant *Christelijke Boeren- en Tuindersbond* formed in 1918, with about 18,000 members.

A fourth organization, the *Nationale Bond ' Landbouw en Maatschappij '*, with a National Socialist flavour, was founded a few years ago to advance agricultural interests within the social framework, and to obtain higher prices for farm products. Its membership had

reached 24,000 by 1938. The market gardening and horticultural interest is represented by the *Nederlandsche Tuindersbond* with 3,907 members, mostly in North and South Holland, and the *Algemeene Vereeniging voor Bloembollencultuur*.

About one-fifth of the farm-workers are organized in unions. The neutral union, *Nederlandsche Bond*, had 30,000 members in 1937, the Protestant union, *Nederlandsche Christelijke Landarbeidersbond*, had 25,000; the Catholic union, since labourers are relatively less numerous among the peasants of the south-east, has the lowest membership, 18,000.

Social and Economic Problems of Farming

Pressure on the Land

Though small holdings do not necessarily mean inefficient cultivation—in certain conditions they produce higher yields and more valuable crops—for ordinary farming they require proportionately more labour per unit of produce, resulting in a lower return for the worker, as they do not permit an extensive use of machinery. Where a holding is also composed of a number of small plots, the return per labour unit will be further diminished. Thus the smaller farmers are further handicapped compared with the larger, who are increasingly employing mechanical aids. The rise in output per worker has therefore not been an unmixed blessing: many of the difficulties of the market gardeners arise in fact from increased output resulting from technical advances. Since the main problem is the surplus rural population, the incentive to the Government to encourage labour-saving devices or to increase the minimum size of holdings has not been strong.

The pressure on the land is equally serious in its inflationary effects on values. High prices and rents tend to increase indebtedness, for land represents the greater part of the capital employed. The purchase price of medium farms in Groningen in 1938 was equivalent to £90–110 per acre, and in North Brabant to £45–60, while in the latter province the price of smaller holdings might be as much as £80 per acre. As a result, agricultural indebtedness is heavy; an official estimate put the borrowed capital of cultivators at 57% of the total employed, including their private capital. In the horticultural districts, where glasshouses and expensive apparatus are necessary, the proportion is even higher. The returns for cultivators on the smaller holdings, therefore, after allowing for

interest on their own capital, are often lower than the wages of hired workers, and in the years of economic depression their position has been extremely precarious, necessitating direct subsidies from the government. This heavy capitalization has also proved a handicap to the selling of produce at competitive prices in foreign markets.

Such considerations as these have had to be weighed by the State in determining its attitude towards agriculture. Until the onset of the economic slump in the 'thirties, the state policy was that of liberal free trade, as it was recognized that Dutch prosperity depended upon unrestricted commercial exchange. The foundation of agricultural policy was the free admission of necessary products of low relative value, and their working-up into products of high value which would command good prices in the world market. Owing to the high density of population this included the free admission of grain for human food and for cattle. Thus government energies were directed to encouraging, by means of technical education and advice, a high standard of dairy and horticultural products, and the careful supervision of exports. The closer this adjustment of output to the world market, the greater were the difficulties which the depression brought in its train, and from a position of free competition the State was forced practically to assume the organization of agriculture, to control imports, to lay down what should or should not be produced, to regulate home prices, and to subsidize exports.

Crisis Legislation, 1930–38

A measure of the problem to be tackled is afforded by the figures of the exports of farm products, which fell from *f.* 877 million in 1929 to *f.* 250 million in 1935, though quantities had fallen by less than half. Under the export law of 1929 and the crisis laws of 1933 (extended in 1938) the State aimed at modifying the balance of trade in its favour by regulating imports by quotas, supporting the farmers, and maintaining export markets by international agreements, subsidies and improved selling methods. This policy required the regulation of the areas sown to particular crops and of the numbers of live stock, price control, direct subsidies to small farmers and the enforcement of export standards.

To remove in part the dependence upon imports and to improve the trade balance, the area under wheat and grains was increased, at the expense of other crops, the export market for which had declined. In 1931 a Wheat Commission was established which guaranteed a price to the farmers (1930–32, *f.* 12·5 per quintal : 1938–39,

f. 10), then sold the grain at a higher price to the millers, who were obliged to use 35% of home grown grain, and disposed of the balance for other uses at controlled prices.

Where the loss of foreign markets was severely felt, e.g., by the potato growers, restriction of area was enforced and compensating subsidies or guaranteed prices granted. The area under food potatoes was also curtailed. For sugar beet, a minimum price was guaranteed for a certain percentage of the 1928–30 averages, varying with the price of sugar. This quota was reduced in 1936, except for farms specializing in beet growing. The horticulturalists were harder hit than others. Cultivated areas were drastically reduced, and a minimum price for exports was maintained by subsidies, and by the government's purchase of the unsold produce, which was either distributed to the unemployed or destroyed.

In the dairy industry the price of milk was maintained by a tax on butter, ultimately borne by the home consumers, as it was returned for all butter exports, controlled by a monopoly from 1936. To prevent increased consumption, margarine was also taxed, and the addition of a percentage of butter was required. For liquid milk, minimum prices were fixed for the cities, and the number of distributors limited. The government, having already raised the price of butter to home consumers, was unwilling to increase that of milk also. By advice to the producers it encouraged the lowering of production costs, with the inevitable result that yields increased, the total output of milk remained as high as ever, and the price to producers was barely remunerative. The level of butter exports was well maintained, those of cheese and condensed milk falling to about two-thirds and three-fifths respectively.

Other measures included a reduction in the numbers of cattle ; 250,000 head were bought and slaughtered by the government between 1933 and 1936, and the meat sold at cheap rates to the unemployed. The breeding of calves was restricted, and a slight decline in numbers was effected down to 1936. Restriction of numbers was more effective in the case of pigs, and between 1934 and 1937 there was a decline of about one-third in total numbers ; the following year, with improved conditions, the numbers had increased again.

All these schemes required (1) constant adjustment to meet changing conditions and experience of their working, (2) unprecedented State control, and (3) heavy charges on the public, either by direct State subsidy or by a rise in prices. Total expenditure under the

crisis regulations for agriculture, amounted to *f.* 115·3 million in 1933 ; it had increased to approximately *f.* 200 million in 1936 and 1937, but the situation was then eased by the devaluation of the guilder in 1936 and the improvement of the export trade.

These measures tended to benefit the larger farmers most. To direct assistance for the small holders a Bureau for Small Farms was set up in 1934. Farm workers became entitled to unemployment pay, or were put to relief work. Those who worked for others irregularly, and could not support themselves on their own holdings, received a weekly cash payment according to size of farm and family. Necessitous full-time holders received fertilizers, fodder, and machinery at reduced prices, or free.

Other steps to improve the farmers' position were simplification or consolidation of scattered holdings, and legislation on tenancies. Under a law of 1938, the application of one-fifth of the owners involved, instead of one-quarter, secured the preparation of a consolidation scheme, and the assent of a majority, or of the owners of more than half the area, was sufficient for its adoption.

Note on Reclamation of Heath and Moor

The poorer soils to the east, south-east and south of the Netherlands contrast sharply with the low-lying west, and the differences are reflected in the agriculture, which reached its present development much later. Apart from the clay belts among the great rivers, and south Limburg, the soils are mainly developed on the diluvial sands and gravels, interspersed, as in Drenthe, with tracts of boulder clay. In certain districts, e.g., the Veluwe, the sand forms dunes and moving drifts, now mostly fixed by afforestation. These soils in their natural condition are loose, poor, and arid, lacking in lime, nitrates, and humus. Owing to the recent geological history of the area, the drainage is also in places ill developed. In the north-east particularly there are extensive areas of high acid peat moors, now largely reclaimed. The Boertanger Moor, along the German frontier, is still largely devoid of settlement. In contrast to the sands are the strips of alluvial flats, low peat, and marsh along the streams ; these, with the heavy clays and other low ill-drained areas, formerly largely wooded, are now the chief permanent pastures. (Fig. 74.)

Until the nineteenth century this land of heath, moor and woodland was sparsely peopled, except for some settlement along the streams and on the high peat moors. Most of the remaining uncultivated land in the Netherlands is still found here. In 1833 there were

2,249,00 acres of waste in the whole country ; a century later this had been reduced to 854,000 acres, all chiefly in the east and south-east. In Drenthe, waste land still amounts to 30% (1914 : 44%) of the total area of the province, in Overyssel to 18% (1914 : 26%) and in North Brabant to 13% (1914 : 21%). In Groningen, which includes other types of land, and where the reclamation of the moors has proceeded farthest, the proportion of waste is 3% (7%) only. It should be noted that the above total area of waste does not include the low peat fens of the west, which in some cases through poor drainage and soil, are of little value. The progress made in reclaiming waste land in the sandy country is shown in the following table.

	1914 thousand acres	1935 thousand acres
Unreclaimed high peat	83·1	56·5
Dalgronden	56·8	42·0
Heaths	984·5	631·7
Moving sand dunes	37·5	24·2
Fixed dunes	92·9	99·6
Total	1,254·8	854·0

' Dalgronden ' are areas from which (high) peat has been removed, but which have not yet been fully reclaimed and cultivated.

The establishment of the *veenkoloniën*, agricultural settlements on the high peat moors, preceded by two centuries any comparable movement towards the reclamation of the sands.

The sandy heath districts

Down to the eighteenth century, settlements were largely confined to higher elevations along the streams where the boulder clay was not covered by sand and the subsoil drainage was better. Each of these communities formed practically a self sufficient unit, composed of three distinct sections, the pasture along the stream, the restricted arable area immediately adjoining the village, and a wide stretch of grazing on the neighbouring heath. The arable strips were owned by individual peasants, but the grazing on the waste was held in common, forming units known as *marken* in the north and as *gemeynten* in the south. The area of arable was closely related to the numbers of cattle, sheep and pigs that could be maintained, for its fertility depended upon the manure they provided ; the river flats furnished pasture for the cattle and hay for the winter, the heaths supported the sheep and provided litter for the stalls, which went

ultimately to fertilize the fields, while the pigs found their food in the woodlands. Under this system crops of rye and buckwheat could be raised almost continuously on the arable. From time to time it was possible to take further small plots into cultivation, and even to found new settlements, but progress was limited by the numbers of animals that could be maintained. The increase of the arable did not keep pace with the growth of population and there was a steady migration to the west and the cities.

The great strides in agriculture in these areas, mainly since the middle of the last century, resulted from a number of interrelated causes. The obstacle which communal ownership presented to the reclamation of the waste was finally removed in the north by the Markenwet of 1886. In the south the *gemeynten* had, during the French occupation, been declared to be the property of the communes. Many at once had proceeded to sell off the better land, with the result that large tracts of poor land remained derelict. Later, however, the communes, with state encouragement and assistance, came to recognize their obligation to develop this residue. The main causes of the expansion were the revolution in farming technique following upon the introduction of artificial fertilizers and later of fodder grain and concentrated cattle feedstuffs from overseas, the expansion of the market for agricultural, especially dairy, produce in industrialized western Europe, and more recently the establishment of industries in the region itself. The first of these changes removed the dependence of the arable area upon the number of animals, and enabled wide stretches to be cultivated where clays, silt or finer sands predominate over the coarser sands and gravels, or the sub-soil is more compact, or the rainfall heavier. The crops, instead of being raised mainly for human consumption on the farms, were supplemented by imported fodder, and fed to livestock ; the farmers now depended upon the sale of milk, eggs, and pigs for their income. The tendency to mutual help, fostered earlier by the isolation and self-sufficiency of the small communities, and by association in the use of the common land, created a favourable atmosphere for the rapid spread of co-operative organizations for credit, purchases and dairy production. These have done much to increase the quantity and improve the quality of the output, especially in dairy farming ; the Netherlands butter exports come from the industrial dairies in these sand districts.

The establishment of industries, attracted thither by cheap land and the surplus of labour already accustomed to domestic industries,

has eased the pressure on the land, and provided opportunities for market gardening and fruit growing in their neighbourhood. The state has also fostered this movement of internal colonization. In 1904 it began to advance loans free of interest to communes for the reclamation of waste land, and provided technical advice. Since 1919, to relieve over-population and unemployment, this assistance has been greatly extended, e.g. through free loans for the building of farms, by advancing from 60 to 90% of the costs of reclamation, and by educational and information services. (For special assistance given in the crisis years, see p. 329.) An important share in this work has also been taken by a private organization, the *Nederlandsche Heidemaatschappij*, founded in 1888. This is a non-trading and non-profiting association, which now works in close co-operation with the government. It carries out reclamation schemes, makes the results of its experience and research widely known, supervises the use of government grants, and encourages afforestation and fruit growing, the development of freshwater fisheries, and the improvement of roads and rural housing. The state has also taken an increasing part in the afforestation of waste land. At the end of the last century, it began to buy and plant suitable areas, especially in the Veluwe, and later placed all state-owned heath, dunes and woods under its forestry service.

The ' high ' peat moors

Outstanding examples of the reclamation of waste are the *veen-koloniën* or moorland agricultural settlements on the ' high ' peat moors of the north-east, particularly in the region from the south of Groningen through eastern Drenthe to north-eastern Overyssel. Similar but less extensive areas lie along the Drenthe-Friesland border, and in the Peel of North Brabant. The initiative in this settlement came from the city of Groningen in the seventeenth century. Previously the moors had in part formed the common grazing land of the neighbouring villages, and with the growth of population some small scale reclamation had been carried out. When much of the moorland area lying near Groningen came into the possession of the city at the end of the sixteenth century, the whole pace of the movement quickened. The great demand for turf as fuel, especially in the provinces of North and South Holland, provided the first impetus ; during the seventeenth and eighteenth centuries the removal of the peat in this area was completed. The first stage was the cutting of a canal, the Winschoterdiep, which

drained the adjacent moors, and on which the turf was carried away, and the founding of small settlements, Hoogezand, Sappemeer, Oude-Pekela, and others. The movement then spread southwards with the establishment by Wildevank in 1647 of Veendam and

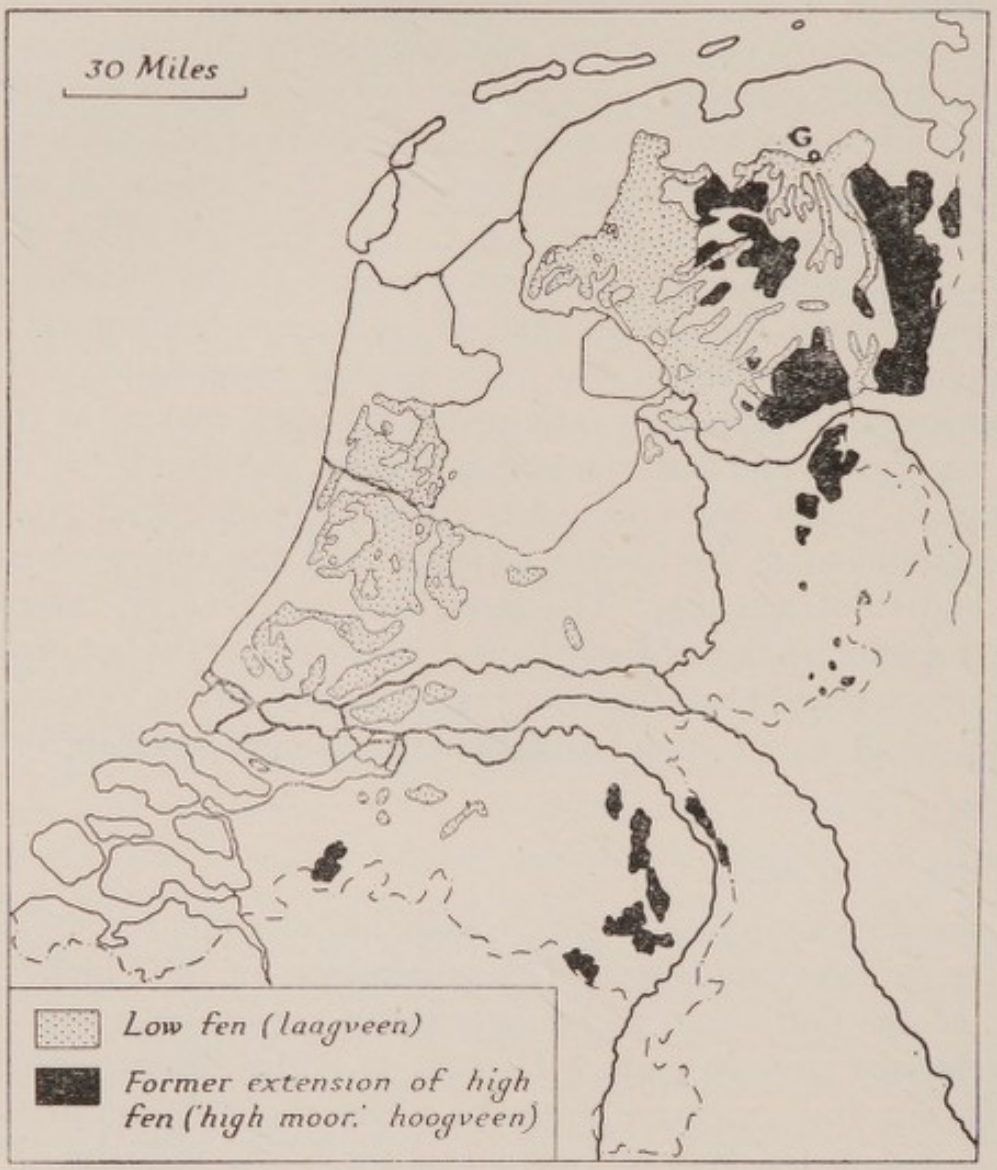

Fig. 74. High fen and low fen in the Netherlands

From : W. C. Leeuw, *The Netherlands as an Environment for Plant Life*, Fig. 8 (Leiden, 1935).
G Groningen.
Most of the high fen, and some of the low fen, have been removed in the course of reclamation.

Wildevank. The central portion was opened up early in the nineteenth century, when the city cut the Stadtkanaal south-eastwards through the Oostermoer. By the end of the century contact was made with the similar reclamation in south-east Drenthe where companies had begun to remove the peat about 1850, and where some of the area is still in this preliminary stage.

Following the removal of the peat came the transformation of the cut-over districts into arable. From the first the city, when granting concessions, had insisted that the land must ultimately be brought into cultivation. The strips between the canals were leased to individual settlers on such terms that in the course of time they came in practice to own their holdings. As the peat was removed, the interest of the city authorities shifted to the canals as a source of revenue.

The cultivators preserve the top, lighter, layer of peat, and dig away the remainder; the top layer is then mixed with sand from the drainage channels to form the arable bed. It is important that the sandy subsoil should be covered by at least 0·75 metre of this litter. This bed possesses excellent physical properties, being level, well drained, and easily workable, but is acid and poor in lime and nitrates. To compensate for this lack, it was formerly necessary to put a considerable portion of each holding down to pasture, so that manure could be supplied by the herds and flocks. This source proved insufficient by itself, and here again the city contributed by supplying all kinds of refuse and garbage which were carried by barge to the colonies. The demand for manure, however, was so great that its price rose to almost prohibitive levels, particularly with the introduction of potato growing in the early nineteenth century. Later, however, came the introduction of artificial fertilizers, which allowed the substitution of a purely arable system for the complicated mixed farming one, facilitated the production of specialized varieties of crops, rid the soil of pests, and greatly reduced labour and overhead charges. From this time the farmers concentrated almost entirely upon potatoes for industrial purposes, rye, and oats, with small areas in sugar beet, fodder and seed. Since the crisis of 1929–34, however, the area in potatoes has had to be reduced, and wheat has been introduced.

Production, unlike that of the sand districts, is not for consumption, but almost entirely for industrial purposes. Most of the potatoes go to the potato flour factories, providing the basis for the manufacture of starch, glucose and dextrine. To obtain better prices for the growers, these factories are now run co-operatively, and are scattered widely throughout the area to reduce transport charges. The older private factories, centred in Veendam and Hoogezand, concentrate on specialized products. Similarly the rye and oats are grown for their straw which goes to the strawboard factories, the grain being sold outside the area. Without this market,

in districts with a low cattle density the straw would otherwise be useless. This development of industries closely allied to agriculture was also stimulated by the demand for barges and coastal craft for the transport of peat, and by the rise of spirit distilling to use the surplus grain and potatoes. Later a number of secondary industries, drawing upon the reservoir of semi-skilled labour, also grew up, such as the manufacture of packings in conjunction with the strawboard industry, and of the special machinery, which now has an international reputation, required in the potato flour factories.

In the more recently reclaimed districts in the south, these outlets for surplus rural labour are as yet largely lacking, and the industrial population is small. In Drenthe, about two-fifths is engaged in agriculture, and another quarter is still engaged in reclaiming the moors. As this work must soon come to an end, the problem of finding alternative employment becomes acute.

The area of unreclaimed peat moor is dwindling rapidly, and amounted to 56,500 acres in 1934 (1914: 83,000 acres). As a source of fuel peat is now insignificant; there is, however, still a small industry concerned in preparing peat litter for horticultural use.

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CHAPTER XII

FISHERIES

Introduction : Sea Fisheries : Coastal and Inland Fisheries ; Fishery Administration and Research : Imports and Exports : Some English Fishery and Nautical Terms derived from Dutch : Bibliographical Note

Introduction

Historical background

Several factors induced the Dutch to engage in fishery from early times. Much of the low-lying coast offered shelter to small craft, especially the estuaries of the south, the Frisian islands and the Zuider Zee, while the shallow sandy bottom, rich in fish, soon attracted a people whose soil in early days provided only a meagre livelihood. In the Middle Ages when herring formed an important staple food, the Dutch fishery was already unsurpassed and gradually developed a monopoly, while the herring fishery was known as ' the Great Fishery ', or ' principale goudmijne ' of the land.

The sea fishery was one of the chief factors which favoured the development of Holland as the most powerful maritime nation in the seventeenth century, and the English watched with understandable jealousy, especially when large fleets of *buizes* were to be seen off the coast of East Anglia. However, through the growing activity of English and Scottish fishermen, and the Anglo-Dutch wars, Holland experienced a set-back, the number of Dutch fishing vessels decreasing from 1,500 to 200 during the first half of the eighteenth century, although an attempt had been made to keep this failing trade alive by means of premiums.

During the Napoleonic Wars the decline continued and revival was not evident until the second half of the nineteenth century. During the war of 1914–18 the fishery suffered many vicissitudes, but in 1920–30, though recovery was slow, the industry was not unprofitable. In this period, however, the Dutch failed to renew their ageing fleet, and as a consequence interests in recent years have concentrated increasingly in the North Sea, for it became more difficult for the deep sea fleet to complete with the up-to-date vessels of other European countries.

General features

The Netherlands administration recognizes three distinct sections in the fishing industry: (i) Sea Fishery, (ii) Coastal Fishery, (iii) Inland Fishery. In 1937, 14,399 persons were engaged in sea and coastal fishery, in 1930 the number was 16,164. Of these, 40%

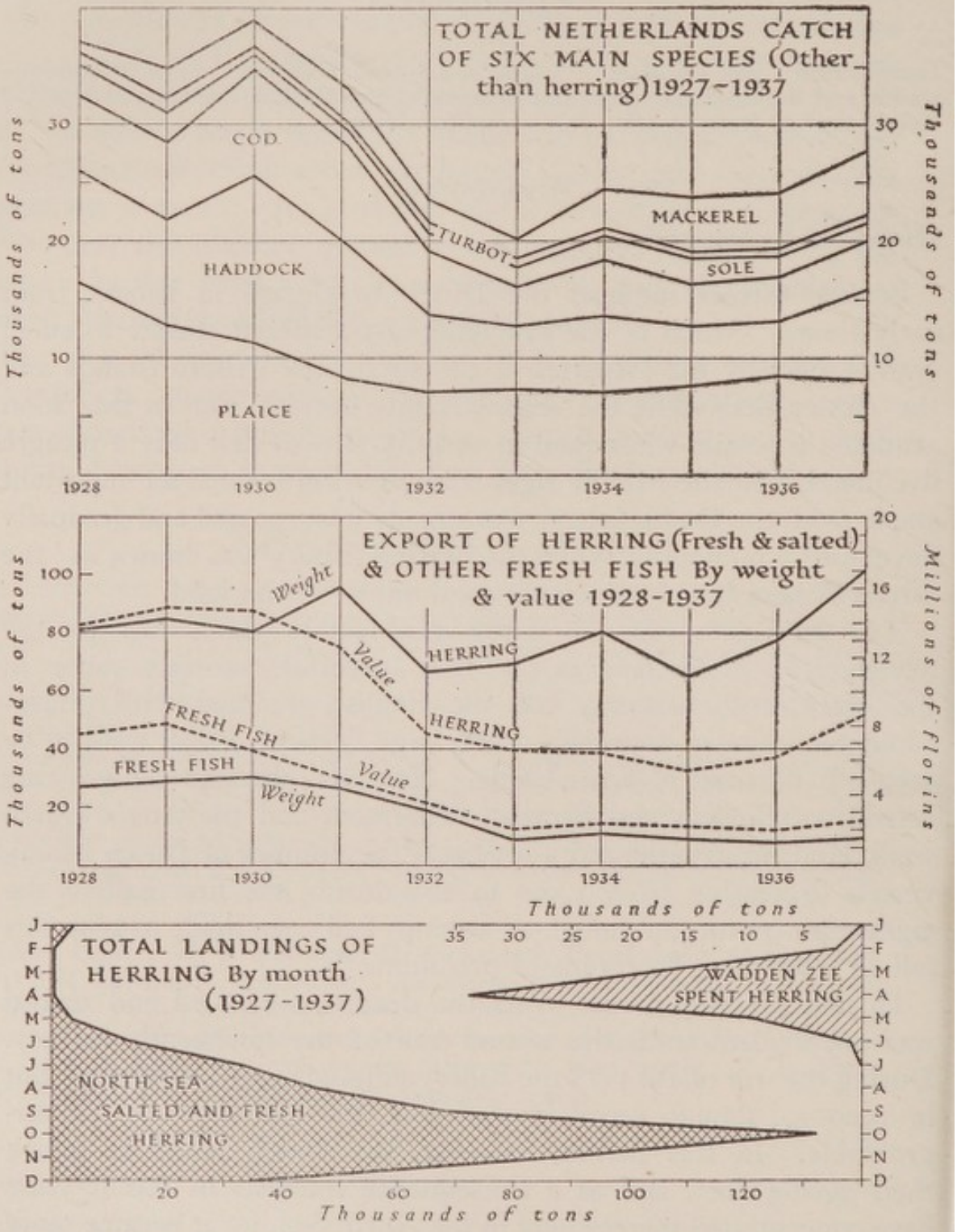

Fig. 75. Sea fishery landings and exports, 1928–37; landings of herring by season

From: *Bulletin Statistique des Pêches Maritimes des Pays du Nord et de l'Ouest de l'Europe*, vols. 17–27 (Copenhague, 1929–39).

worked in steam, and 60% in motor vessels and other craft. It is difficult to ascertain the size of the inland fishery, a part-time occupation of local importance, but in 1937, 50,000 inland fishery permits were issued. In 1930 the total number engaged in fishery accounted for 0·5% of the occupied population.

The total value of the fisheries in 1937 amounted to *f.* 21 million, the catch weighing 262,900 tons. Of the total value 79% was derived from the sea fishery and 21% from the coast and inland fishery. Of the total weight of catch, however, 154,500 tons were landed from seaward, and 108,000 tons from the estuaries, 70% of the sea fishery being from drift nets (mainly herring), 29% from trawling, and 0·9% from seine netting.

Total catch, by species, of sea and coast fisheries, 1937, *in thousands of tons and millions of florins* (Fig. 75)

Sea Fishery				Coast Fishery			
Species	Weight	Value	Per-centage	Species	Weight	Value	Per-centage
Herring	116·2	9·2	53·3	Mussels	66·4	1·1	21·2
Plaice	8·4	1·4	8·6	Whitebait	24·0	0·4	7·7
Haddock	7·9	1·0	6·2	Herring	7·4	0·5	9·6
Mackerel	5·6	0·4	2·7	Eel	4·0	1·4	27·0
Whiting	4·9	0·4	2·7	Shrimp	2·7	0·4	7·7
Cod	4·0	0·8	5·2	Oyster	0·9	0·8	15·4
Sole	1·9	1·6	9·8	Smelt	0·7	0·08	1·5
Dab	1·8	0·2	1·5	Anchovy	0·3	0·1	0·2
Turbot	1·1	0·5	3·3	Lobster	0·02	0·02	—
Other species	2·7	0·7	6·7	Other species	1·6	0·4	9·7
TOTAL	154·5	16·2	100·0	TOTAL	106·4	5·2	100·0

From: *Jaarcijfers voor Nederland*, 1938, p. 246 ('s Gravenhage, 1939); *Bulletin Statistique des Pêches maritimes des Pays du Nord et de l'Ouest de l'Europe*, vol. 27, 1937 (Copenhague, 1939)

In the Inland Fishery 2·3 tons of salmon valued at *f.*35,000 and 657 tons of *fint*, valued at *f.*19,000 formed the main catch.

THE SEA FISHERY

This is the most important section of the industry. In 1937, with a catch valued at *f.* 16·2 million, the Netherlands landed 4·4% of the total fish catch from all waters by countries of north-west Europe (Fig. 76). Since 1928 the Netherlands have ranked fifth by weight of the total fish landings from all waters, their average share being 3·7%.

Landings by the countries of north-west Europe, 1937, from (1) all waters (2) the North Sea, in percentages, including landings in foreign ports but excluding shellfish

Country	From all waters	From the North Sea	
	Total	Total	Herring*
England and Scotland	27·5	33·0	27·3
Norway	25·5	22·8	28·2
Germany	10·5	22·6	27·7
France	7·5	2·7	2·3
Netherlands	4·4	14·1	12·9
Denmark	2·0	2·0	0·1
Belgium	0·8	1·4	0·6

* Salted, fresh, and spent herring.

From : *Bulletin Statistique des Pêches maritimes des Pays du Nord et de l'Ouest de l'Europe*, vol. 27, 1937 (Copenhague, 1939).

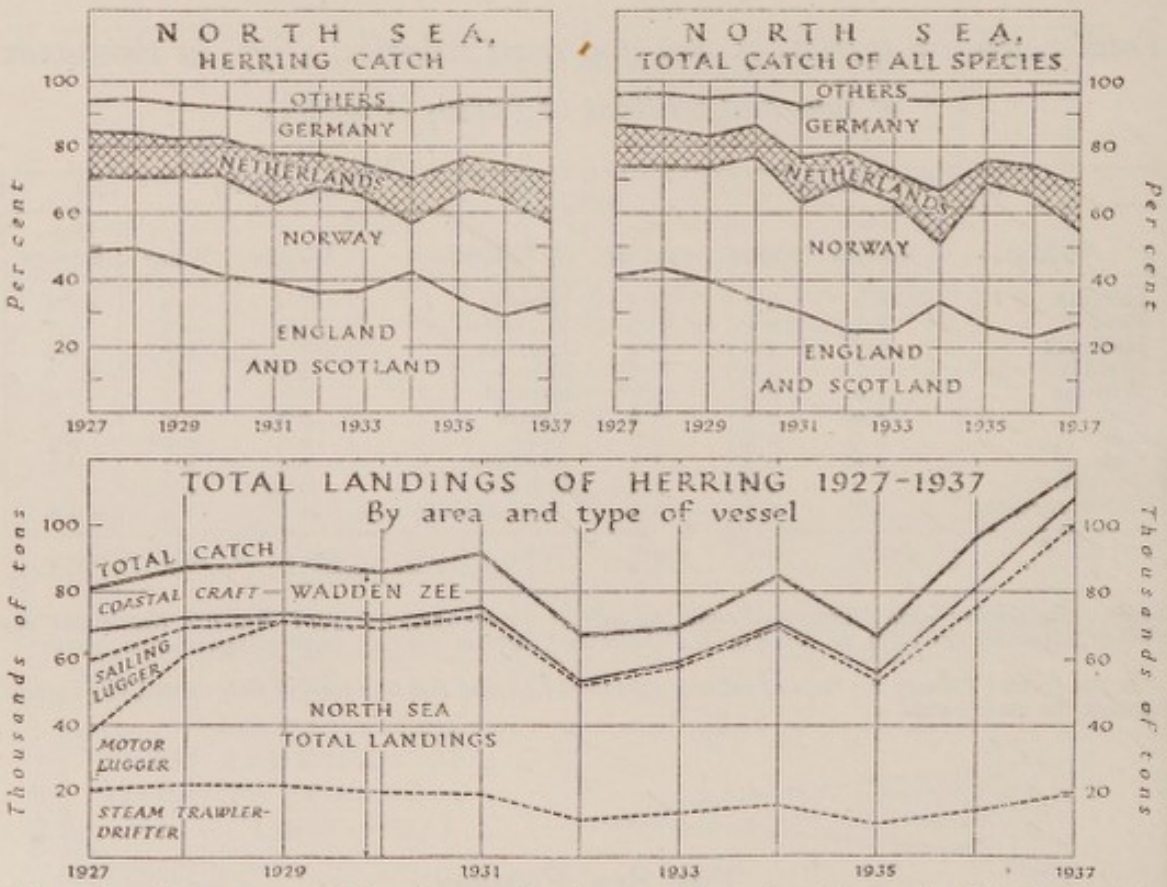

Fig. 76. Percentage of herring and other species taken from the North Sea by various countries of north-west Europe, 1927–37 ; Dutch landings of herring by sea and type of vessel, 1927–37

From : *Bulletin Statistique des Pêches Maritimes des Pays du Nord et de l'Ouest de l'Europe*, vols. 17–27 (Copenhague, 1929–39).

From 1927–31 the Netherlands ranked third in total landings from the North Sea but in 1932 dropped to fourth place, the catch falling from 14·6 to 10·1% (Fig. 76).

Principal fishing grounds

In contrast to her great neighbours, Holland has confined her sea fishery interests in recent years almost entirely to the North Sea, most of her trawlers being no longer suitable for voyages of three to four weeks. Furthermore, the Netherlands do not provide a large market for the deeper-water species, whereas neighbouring countries such as Great Britain and Germany which possess such markets are sufficiently supplied by their own vessels.

During the period 1932–7, 99·3% of the total Dutch catch was taken from the North Sea. In 1932, when the trawlers fished more widely abroad than usual, 98·7% came from the North Sea, and the remainder from Iceland, the English Channel, the Færöes, and Irish Sea grounds. Although the Norwegian Sea was visited in 1936, and the Barents Sea and Bear Island in 1937, the thorough exploitation of the North Sea continues, and the vessels now largely concentrate from the German Bight to the Viking Bank. Trawling is carried on throughout the year by the steam trawlers and motor luggers, but during the herring season, from July to November, many of the steam trawlers engage in herring trawling while the motor luggers and smaller steam trawlers engage in the herring drift-net industry. The smaller steam trawlers should more accurately be classed as ' drifter-trawlers ', for their function changes according to the season. The main North Sea grounds are generally dominated by particular types of vessel. The outer grounds such as Viking Bank and the Patch are fished over almost entirely by the steam trawlers. The central North Sea from the eastern edge of Dogger Bank to the Great Fisher Bank and the Jutland coast are worked mainly by the smaller steam drifter-trawlers, together with a few of the larger steam trawlers and motor luggers, while the inner grounds from Brown Ridge to Borkum and Sylt are worked almost entirely by the motor lugger (Fig. 77).

The herring industry (Fig. 75)

The herring is predominant in the sea fishery, the 1937 catch of 116,000 tons representing 12·9% of the total North Sea herring catch and 75% of the total Netherlands sea fishery landings by weight and 56·8% by value. This is a marked recovery from 1932, when only 66,000 tons were landed.

Although the bulk of the catch was by drift netting, herring trawling has become increasingly popular especially since the years

of the depression. It is carried on mainly by the larger steam trawlers with a capacity of at least 1,500–2,000 cases of 1 cwt. each, for, to make a profit, it is necessary to bring back the greatest possible

Principal Areas of the North Sea frequented by Dutch vessels ; grounds, seasons and species (Fig. 77)

Area	Grounds	Season	Species	Approx. Line of Centre of Fishery			
				From		To	
				Lat. (N)	Long.	Lat. (N)	Long.
A	Brown Ridge, Zwarte Bank	Jan.–Feb.	C.P.D.	52° 40′	3° 20′ E	53° 10′	3° 20′ E
B	Norderney, Ameland and Terschelling Banks	Apr.–Jun. Dec.–Feb.	P.D.W.	53° 30′ 53° 30′	6° 05′ E 3° 30′ E	53° 30′ 53° 30′	7° 00′ E 6° 05′ E
C	Sylt and Heligoland (seining area)	Jan.–Dec.	P.S.T.	54° 10′	7° 30′ E	55° 20′	7° 30′ E
D	Black Bank, Borkum Deep, Glay Deep, Dogger Swatch (seining area)	Jan.–Dec.	H.P.C. S.T.M.	54° 30′	3° 20′ E	54° 30′	7° 00′ E
E	East Dogger Bank ; Middle Rough (E 1) ; North-west Rough (E 2)	Oct.–Nov.	H.M.	55° 30′ 55° 35′ 55° 10′	4° 20′ E 2° 50′ E 1° 10′ E	55° 30′ 55° 45′ 55° 10′	5° 30′ E 2° 50′ E 1° 30′ E
F	Great Fisher Bank	Apr.–Jun.	C.	56° 40′	4° 20′ E	56° 40′	5° 30′ E
G	Ling Bank	Oct.–Mar.	H.M.	57° 10′	3° 00′ E	58° 30′	3° 00′ E
H	The Patch, Bergen and Viking Banks	Jan.–Dec.	C.	59° 00′	1° 30′ E	61° 00′	3° 00′ E
I	Moray Firth, Smith Bank	Jan.–Mar.	C.	58° 00′	3° 10′ W	58° 10′	3° 20′ W
Trawl Herring Fladen, Long Forties, The Gut		July Aug.	Hr. Hr.	58° 00′ 56° 50′	0° 30′ W 1° 00′ E	56° 00′ 55° 40′	2° 00′ E 1° 30′ E
Drift Net Herring Bressay to Long Forties North-west Dogger to Dowsing Smith's Knoll to Thames Estuary		May–Aug. Sept.–Oct. Nov.–Dec.	Hr. Hr. Hr.	60° 00′ 56° 00′ 53° 00′	0° 30′ W 1° 00′ E 1° 30′ E	57° 00′ 55° 00′ 52° 00′	0° 0=00′ 1° 0=00′E 1° 30′ E

From official sources

C. Cod ; D. Dabs ; H. Haddock ; Hr. Herring ; M. Mackerel ; P. Plaice ; S. Sole ; T. Turbot.

The Areas A–I, and those covered by trawl herring and drift net herring, are shown in Fig. 77.

Area A was formerly good but is deteriorating. In B, the centre of fishery moves in March from eastward to westward of Borkum L. V. In D, Mackerel fishery is concentrated in the Glay Deep ; this ground is especially good between 4° and 5° E. In E. the species caught feed mainly on Herring spawn ; on the Middle Rough (E 1) N.–S. trawling is common. In H, Mackerel are found on the east side of the Patch in October at 70–90 fathoms. N.–S. trawling is always found in this area. In the Gut, trawl herring is especially good in 15–30 fathoms.

Although many skippers have an individual preference, often inherited, for a particular ground during a certain wind or state of tide, vessels mainly move with the fish, exchanging information freely.

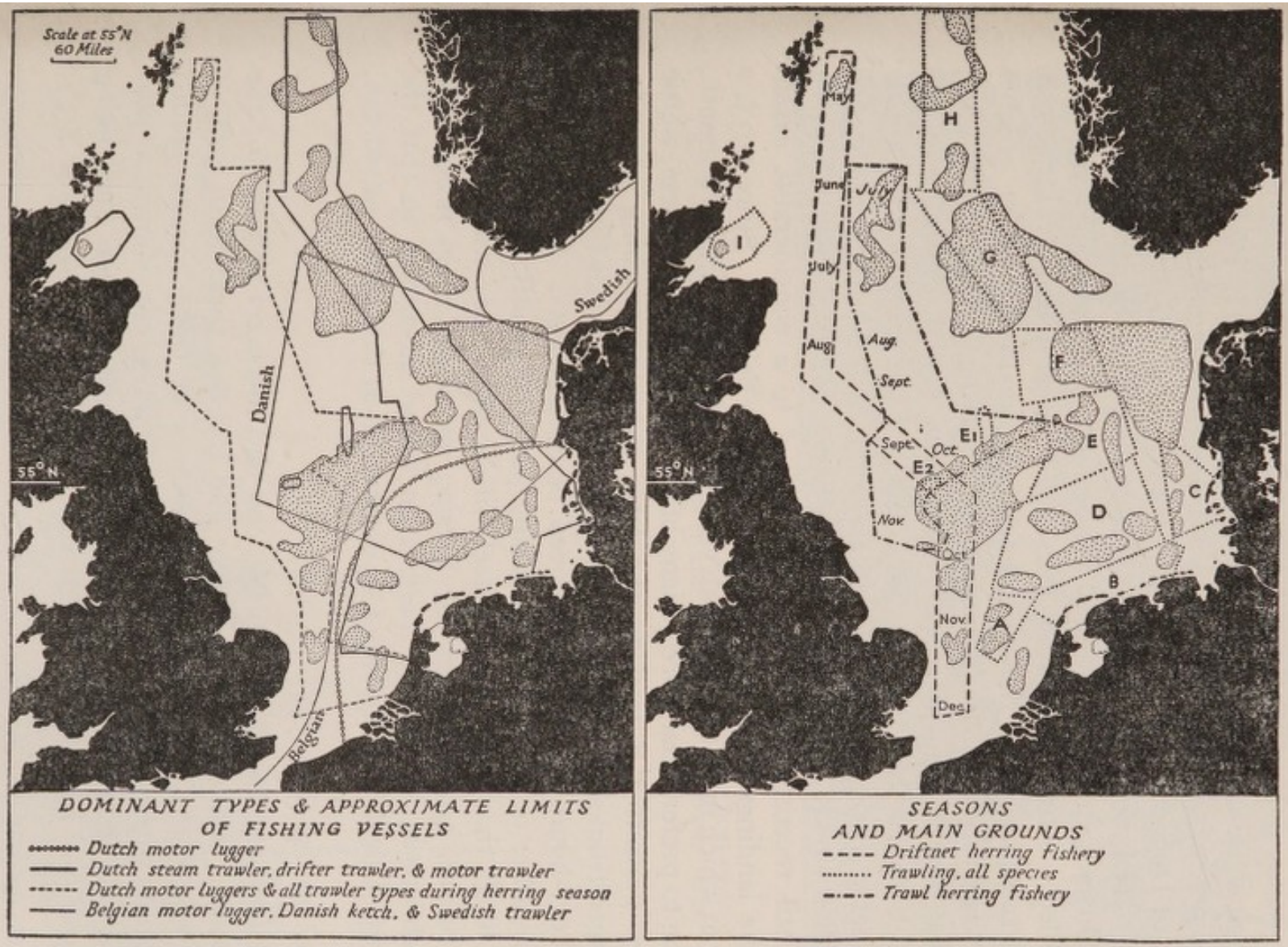

Fig. 77. Main North Sea areas visited by Dutch fishing vessels according to season and type of craft

From official sources.

The grounds, species and seasons fished in areas A–I are tabulated on p. 342. It should be noted that the older steam trawlers and drifter/trawlers are generally found to the south of 55° N. when engaged in white fish trawling.

quantity of fish. The first landings of salted herring occur in May. These catches, mainly of the Norse and Shetland variety, are obtained from the northern North Sea from Fair Isle to Bressay, the greater part of the early landings being made by steam drifter, though some of the larger motor luggers take part. By September, the centre of the fishery is over the spawning grounds on the western edge of Dogger Bank ; in the following month (Fig. 77), when dense shoals are breeding nearest the Dutch coast from Smith's Knoll and the Dowsing to the shallows of Sandettie, the landings are frequently doubled. After November the motor luggers usually remain in port refitting while the steam drifters remain at sea for another six weeks. By early January the season is usually finished but further shoals appear on the numerous banks off the Flanders coast between the Galloper, Sandettie and the shore, for the winter and early spring spawn. From these banks the ' maizy ' weakened fish drift slowly, much influenced by winds and tidal steams.*

Until recently the Netherlands relied to a considerable extent on the landings of fresh herring by British drifters. Since 1933, a year in which most of the British vessels marketed at Great Yarmouth, owing to preferential prices, many of the Dutch motor luggers, whose range permitted a visit to the later autumn spawning grounds, changed from salted to fresh herring fishery, which has the advantage of short hours at sea and reduced operating costs. Consequently the number of motor luggers taking part has greatly increased and it is likely that this type of vessel will be even more widely used in the future, provided that the herring are taken when nearest the Dutch coast. Moreover there is an added advantage in that the export of fresh herring is not so obstructed as that of the salted fish.

Other sea fish (Fig. 75)

Plaice, sole, haddock, whiting, cod and mackerel account for the remaining landings of importance and together these form 32% of the total catch, by value. The amounts of these species landed between 1930–5 dropped severely and have not shown a proportionate recovery, the plaice landing for 1937, 8,400 tons, being 50% of the 1928 figure. The value of plaice in 1937 was 1·3%

* It is unlikely that any considerable migration takes place whereby the Flanders herring moves along the length of the Dutch coast. Species which are found off the Zealand estuaries in February, and in the Wadden Zee in April, more likely come directly from seaward to spawn in the shallows. The fact that spawning occurs at different times may be attributed to the fact that the fish belong to different races, for several varieties are known to exist off this coast.



Plate 29. Fishing craft at Hoorn

Hoorn, to the north of Amsterdam, is a Zuider Zee fishing port of long standing. The smaller craft in the centre and to the left are aaks ; the two larger vessels on the right are aalboots.



Plate 30. Aaks and kwaks at Volendam

Volendam, another Zuider Zee fishing port, lies between Hoorn and Amsterdam. The low midship freeboard of these craft should be noted ; some carry the *kwakuil*.



Plate 31. The Maurits state mine, Lutterade, south Limburg

The construction of this mine, the largest and best equipped in Europe, was begun in 1915 ; production started in 1924 ; in 1939 an output of 2,650,000 tons of coal was attained and 6,700 workers were employed. The coal makes high quality coke, and the coke-ovens adjoining the mine produced 1,600,000 tons in 1938 ; there is a large synthetic nitrogen plant nearby.

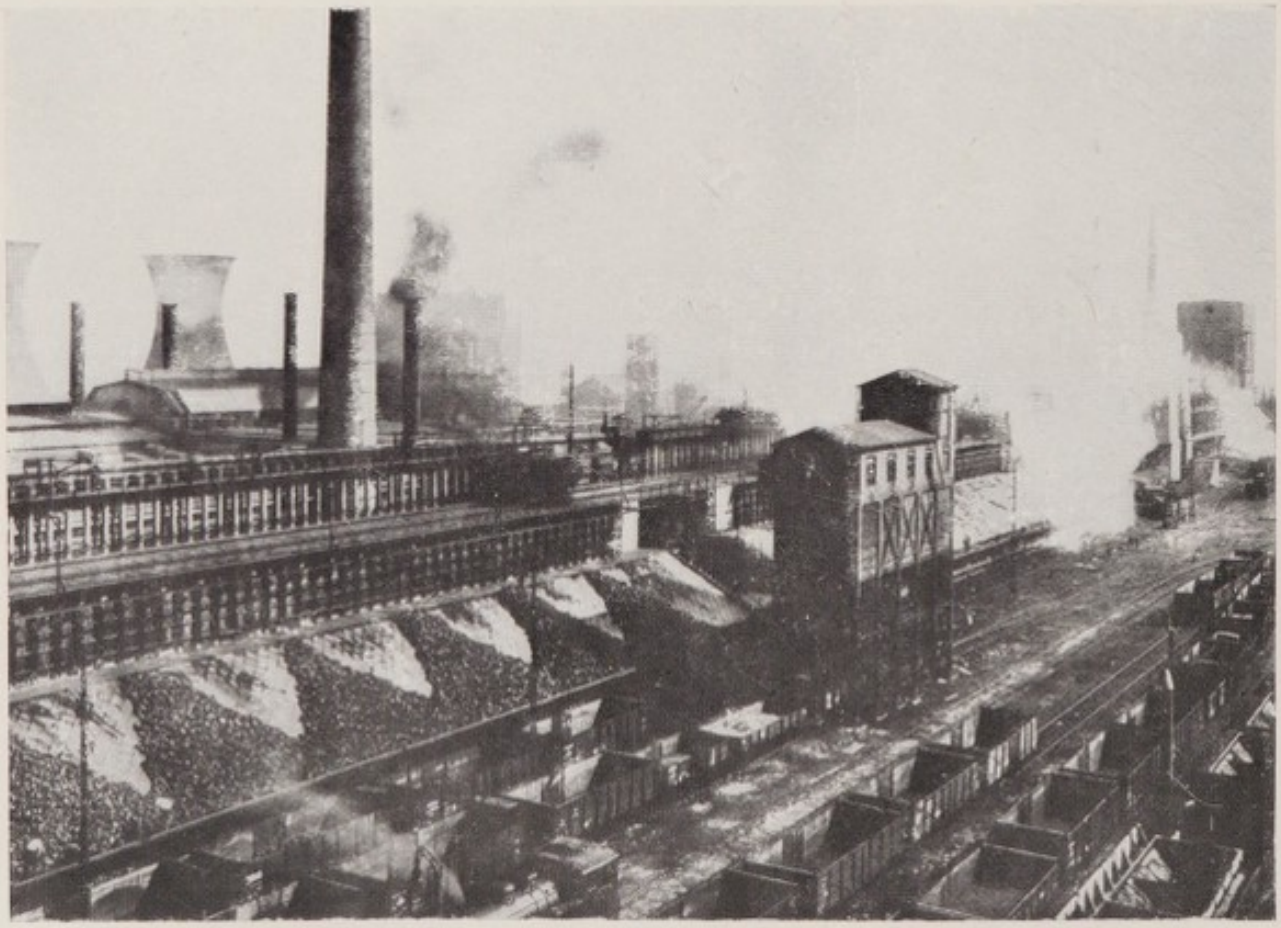

Plate 32. Coke-ovens, Emma State mine, Amstenrade, south Limburg

This coke-oven plant produced 800,000 tons of coke in 1938.

less than that of sole, whose catch only amounted to 1,900 tons. Haddock formed 6·2% of the total value, while the mackerel fishery which has developed considerably during the last few years landed 5,600 tons, five times as much as in 1928.

Economic position of the herring trawl and drift net fishery

From 1931–5 the industry experienced some of the worst years in its history. The economic depression led to a contraction of the home market, while at the same time the great foreign market in Germany, upon which the industry prospered, was closed. There were the added difficulties of four bad harvest years during which the North Sea yields were at their lowest for many years. Various measures were taken to counteract these difficulties—the number of nets per vessel and net lengths were regulated and so were the number of vessels at sea, the length of the season and the rest in port between voyages. Wireless was used to regulate landings, for which also licences and quotas were put into force, and the government opened a credit to buy up all landings which threatened to fall below a minimum fixed price. Such restrictions proved very beneficial to the industry, for supply was regulated and fish could be brought to market over a longer period, thus reducing the possibility of a serious price fall.

Economic position of the white fish trawling industry

The white fish fishery has shown itself to be more adaptable to changing conditions. Even before the depression this industry was facing difficulties caused by high costs of production. At the same time the North Sea appeared to be failing in supply and it seemed also that Dutch vessels were no longer able to supply the kind of fish most in demand in Germany, France and Belgium. After 1930, foreign markets declined, and 1932 was the most unfavourable year in the history of the industry. In 1933, a stoppage occurred in 75% of the fleet, lasting for seven months, many vessels passing into the hands of the banks. An expansion of the home market was fostered but efforts in this sphere met with little success, for the prices of other foods fell more quickly than those of fish, and there was an increased demand for the cheaper Scandinavian varieties, large quantities of which were landed by Norwegian, German and Danish vessels until import quotas were imposed in December 1933.

Salaries and wages formed 35% of the total working costs of the Ymuiden trawling industry, and these conditions necessitated a reduction of wages resulting in great dissatisfaction between seamen and owners.

The continued landing of unprofitable ' small fish ' through over-trawling, especially by the smaller steam trawlers, resulted in the effects of the depression being especially severe among this class of vessel. The motor luggers have not fared so badly, for their maintenance and operating costs are lower, while many are skipper-owned. As a result, the trawling industry is turning more towards the development of the motor lugger for use over grounds adjacent to the Dutch coast. The cheapness of diesel oil favours this development, and many conversions from sail to motor lugger have been made in recent years, while a modest number of new motor luggers have been built.

Since 1934 the industry has shown a slight recovery, due partly to a revival in the export trade and partly to increased home consumption, but even so, the value of the export in 1937 was only 25% of the 1929 figure.

Principal sea fishery ports

A remarkable characteristic of the Netherlands sea fishery is the concentration of enterprise in a small number of ports, together with a further distinction according to the type of vessel (see p.349).

Ymuiden (*IJM*) was developed between 1890–6 and has always been the base for the steam trawlers, 100% of the steam trawler landings being made here from 1930–7. Its fish market is one of the finest in the world.

Scheveningen (*SCH*) was built in 1900 entirely for motor luggers, and extensive improvements to the harbour were completed in 1930. Cold storage rooms are provided to accommodate 3,000 barrels of herring, facilities especially needed during the period of the early summer catch (Plate 28).

Vlaardingen (*VL*) is the chief port for the steam drifter trade, the centre of fishing activity having moved upstream from Brielle, the chief fishing port on the Maas in earlier centuries (Plate 27).

Other ports occasionally used by sea fishery vessels are *Den Helder* (*HD*), *Maassluis* (*MA*), and *Zoutkamp* (*ZK*), but these are of little importance (Fig. 79).

The sea fishing fleet (*Figs.* 78, 80, Plate 27)

Most of the vessels in the sea fishery fleet have been out of date for some years, while many are now unsuited even for the North Sea

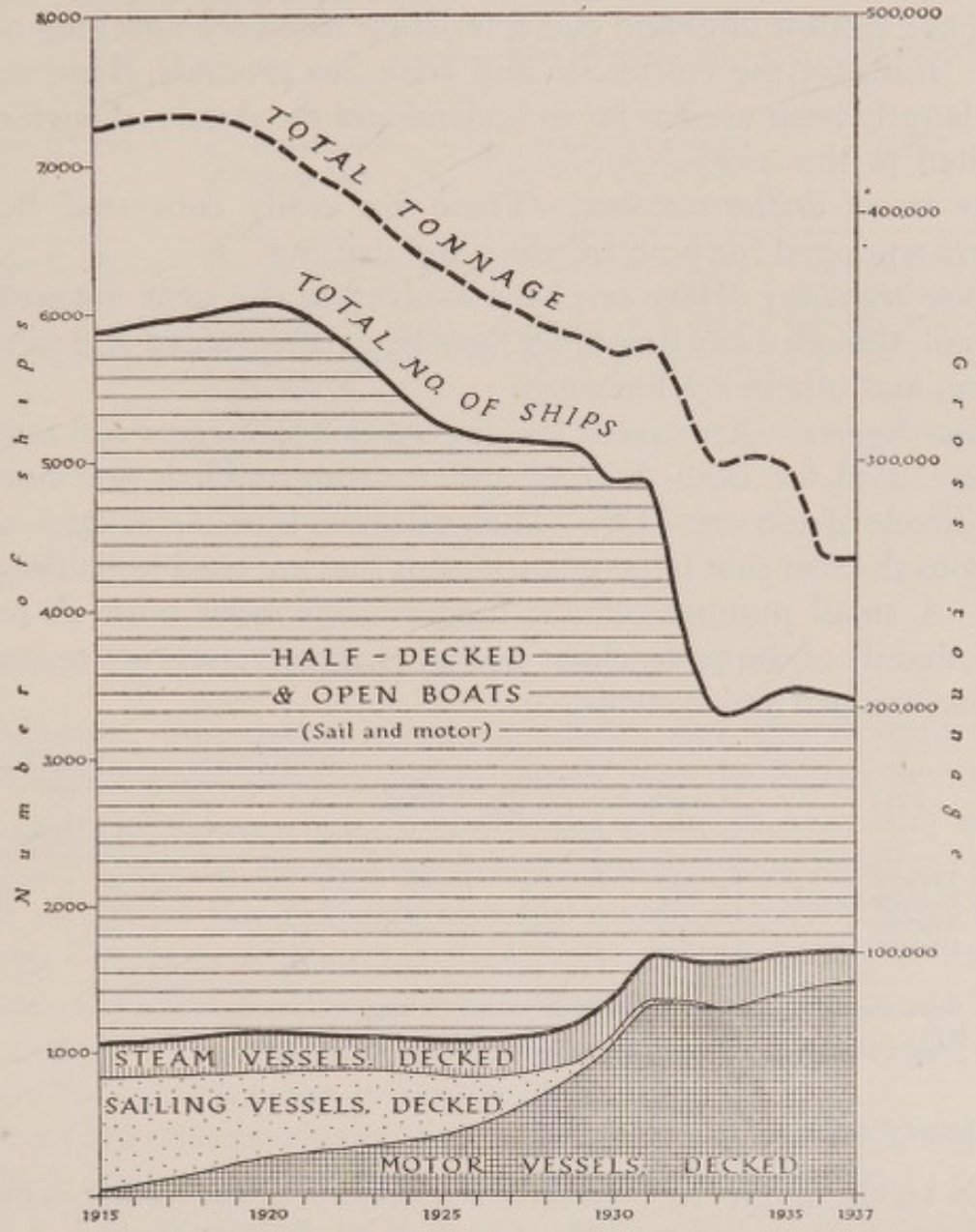

Fig. 78. Changes in the composition and total tonnage of the Dutch fishing fleets, 1915–37

From : *Bulletin Statistique des Pêches Maritimes des Pays du Nord et le l'Ouest de l'Europe*, vols.10 –27 (Copenhague, 1922–39).

It should be noted that a large proportion of the decked motor vessels in each year are converted sailing vessels, though the exact number of conversions is uncertain.

passage and were never designed for ocean work. The Netherlands have not developed their fleet in the same way as Great Britain, Germany or Belgium, and consequently the Dutch have been largely

unable to compete in outer waters, and since 1928, with the development of the close fishery, an increasing number of motor luggers has been in use.

The steam trawlers. Most of these have changed hands several times and exhibit lines and characteristics which are now long out of date. Built for the North Sea and Irish Sea grounds, these vessels have latterly been used as far as Iceland and the Arctic, though quite unsuited to this work.

The steam drifter-trawlers. These are really converted Scotch drifters equipped for both trawling and drifting.

Motor trawlers. Have not been evolved to the same extent as in Belgium, though a small number have been constructed and put into service, and others are building.

Motor luggers. Are mostly lengthened sailing luggers and ketches, and are used for both drifting and trawling. They are motored with diesels of 100–200 H.P. Their effective trawling range is small owing to the fact that large quantities of fuel are used in hauling the nets. A small number of new luggers have been built in recent years, mainly of the 70-ft. class. Most of these vessels are registered at Scheveningen and Katwijk.

Type	Length, ft.	Gross Tonnage	Total	British built		Dutch built	
				No.	Av. Age	No.	Av. Age
Steam Trawler	125	185	66	33	26	25	22
Steam Trawler-Drifter	85	75	73	32	39	41	30
Motor Trawler	130	200	2	—	—	2	6
Motor Lugger (*a*)	90	100	97	—	—	97	18–20
(*b*)	75	80					

Eight steam trawlers were built in German yards ; in 1939 five motor trawlers were building in Dutch yards.
From : *Lloyd's Register of Shipping*, 1939, *Trawler Section* (London, 1940)

Sea fishery tackle

The tackle of the Netherlands sea fishery is much the same as that used by other nations in the North Sea. The drift net and other ground drag nets are used, though the beam trawl is not so extensively used owing to the damage which results to herring spawn. Unlike the drift-net fishery, trawling is concerned with seven main species—herring, whiting, plaice, haddock, cod, sole and dab ; since 1939 the trawl fishery has increased by 78% especially on inshore grounds. The use of the seine net is restricted by the narrow channels and strong tidal set which is found off much of the Dutch coast, both factors being unfavourable for this type of fishery. Deep line fishing is relatively unimportant.

Sea fishery ; craft, grounds, tackle and ports

Craft	Ports	Areas (see Fig. 77)	Tackle
Steam Trawler	Ymuiden exclusively	Trawling in areas G, H, I and in trawl herring area	Mainly otter trawl, herring trawl and ground drag nets. Lining
Motor Trawler	Vlaardingen, Rotterdam	Trawling in areas E, E1, E2, F and trawl herring area	Ditto
Steam Drifter/ Trawler	Vlaardingen, also Ymuiden	Trawling in areas A–F ; Drift-netting for herring May–Dec. ; Seining in areas C, D	Ground drag nets and seining tackle ; herring drift nets
Motor Lugger	Scheveningen, Ymuiden, Vlaardingen : smaller vessels at Den Helder, Maassluis, etc.		

From official sources

The Coastal and Inland Fishery

Historically, this fishery of the shallows was the forerunner of more vigorous pursuits in deeper waters over the North Sea banks. It is especially important in the larger river estuaries and in the Wadden Zee. In contrast to the sea fishery, it is mainly a retail trade except for the oyster culture and mussel fishery. The ' spent herring ' industry is mainly carried on from January to April in the estuaries of the Scheldt and in the Wadden Zee (Figs. 75, 76), and the mussel and oyster fishing is also seasonal. There is no particular season for other species in the coastal fishery.

The Netherlands mussel landings since 1928 have amounted to 82–84% of the total for all countries, and oyster landings in 1937 were 77%. The eel catch is also most important.* There are five important coastal fishery areas :

(1) The estuaries of Zealand, (2) the Wadden Zee, (3) the rivers of South Holland, (4) the Yssel Meer, (5) the Lauwerszee and Dollart.

* Eel fishery has for many centuries been closely connected with Great Britain, for since Elizabethan times live eels have been carried in so-called ' eel-boats ' from Friesland to the Thames. By virtue of a concession granted by Elizabeth they are exempt from all taxes and dues and are allowed to anchor between Billingsgate and the Tower. This concession was acknowledged by Charles I in recognition of ' their straightforward dealings with us '. Formerly 15–20,000 lbs. of eels were brought across on every journey. In recent years it has been the practice to land the eels from larger vessels at Harwich for reshipment to the Thames.

Coastal fishery, 1937, main species landed (in millions of guilders and thousands of tons)

Area	All Species		Fish		Cru stacea	
	Value	Weight	Species	Weight	Species	Weight
Zealand	2·27	51·8	Whitebait	6·9	Mussel	42·6
			Anchovy	0·07	Shrimp	1·5
					Oyster	0·8
					Lobster	0·01
Yssel Meer	1·21	3·7	Eel	3·6	—	
			Smelt	0·1	—	
Wadden Zee	0·88	35·0	Herring	7·4	Mussel	23·7
			Whitebait	3·3	Shrimp	0·2
			Eel	0·2		
			Anchovy	0·2		
South Holland	0·22	3·2	Whitebait	1·9	Shrimp	0·8
			Smelt	0·4		
			Eel	0·1		
Lauwerszee and Dollart	0·16	11·7	Whitebait	11·7		

From : *Jaarcijfers voor Nederland*, 1938, p. 248 ('s Gravenhage, 1939)

In Zealand there is also ' nest ' fishery for spent and young herring, and a large cockle fishery for oyster breeding, while in South Holland young herring is caught for pearl essence, which is extracted from their scales and used in the production of artificial pearls.

(1) *The estuaries of Zealand* have supported an important fishery since the Middle Ages. The big return from these estuaries arises from the culture of mussels and oysters—' the Zealand luxury '. In recent years the oyster beds have suffered damage from slipper limpets and the Chinese woolhand crab. Bergen-op-Zoom is noted for its anchovies.

(2) *The Wadden Zee* offers marked contrasts with Zealand. The ' spent ' herring industry, which is found in the shallows inside the Frisian islands, employs a large number of small craft of all types during March and April. In the southern portions of the area, sea crabs (in the *zostera* area), ' nest ' herring, sprats and prawns are caught.

(3) *The estuaries of South Holland.* Smelts are the most important species and are usually caught in winter. The salmon fishery, which was formerly important, has decreased considerably in recent years. Stellendam is the most important centre in this area.

(4) *The Yssel Meer.* In 1937, the landings from this area comprised mainly eels and smelts. The landings have greatly increased since 1933. Before the closing of the Zuider Zee the ' spent ' herring industry was notable on the Isle of Marken as well as in many other small havens.

(5) *The Lauwerszee and Dollart* together rank least in value, the small industry in these waters being centered entirely on whitebait.

Effects of the damming of the Zuider Zee (Yssel Meer)

The fishery in the Zuider Zee has declined since the construction of the dam (Afsluitdijk). From 1921 various forms of relief were

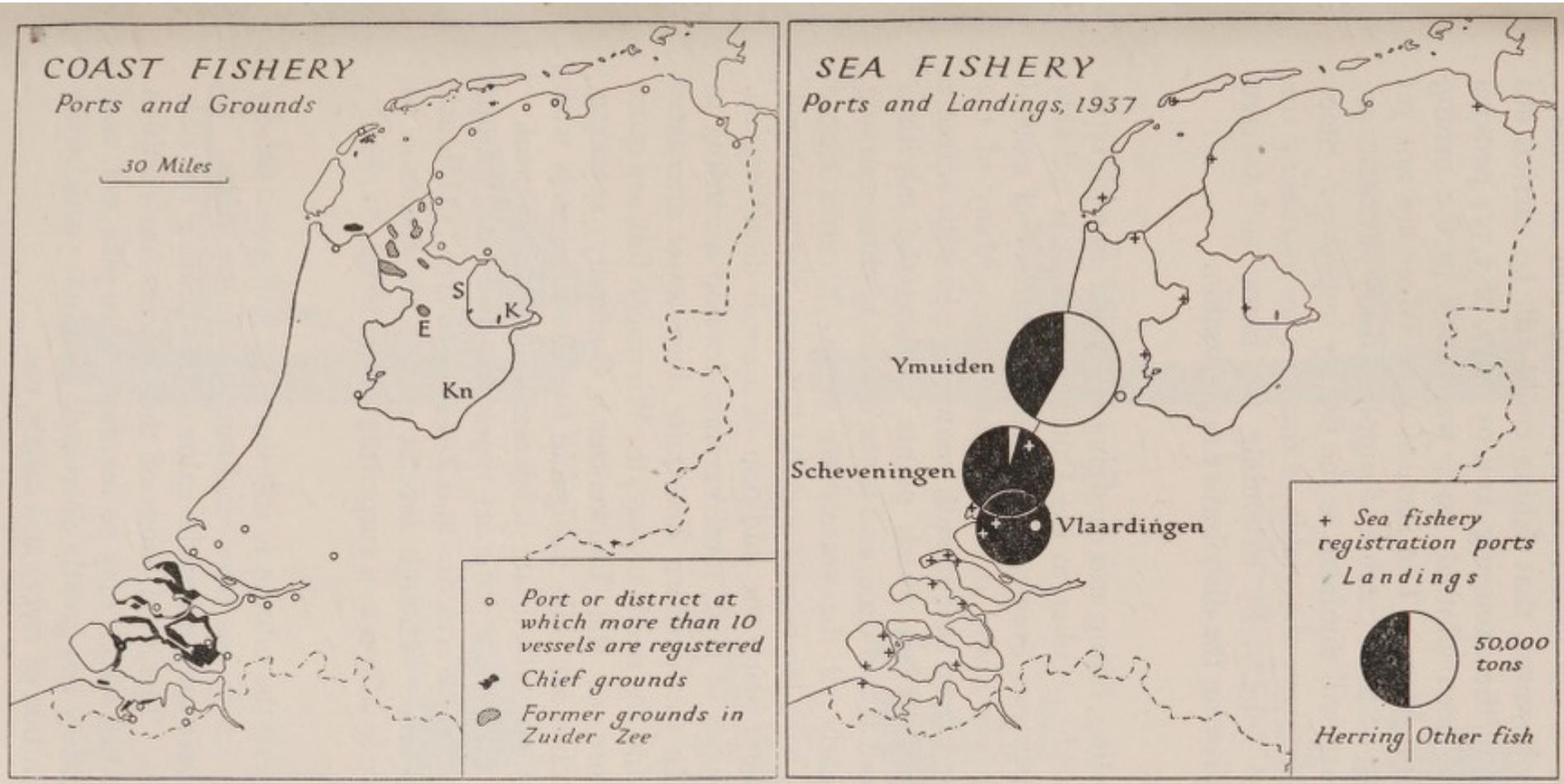

Fig. 79. Coast fishery (ports and grounds), sea fishery (ports and landings), 1937

From official sources.

Four fishing areas are shown in the Zuider Zee. The whole of Kamperzand (K) and most of the Spaanderbank (S) were enclosed within the N.E. polder. Enkhuizerzand (E) and the Knar (Kn) ground are still worked over. The circles indicate ports and districts at which over ten coast fishery vessels were registered: (from north to south) Finsterwolde, Termunten, Usquert, Oostdongeradeel, Westdongeradeel, Het Bilt, Barradeel, Wonseradeel, Vlieland, Hemelumer Oldephaert, Lemsterland, Anna Paulowna, Ransdorp, Hardinxveld, Schiedam, Heenvliet, Hellevoetsluis, Zwaluwe, Klundert, Willemstad, Zierikzee, Tholen, Bergen-op-Zoom, Yerseke, Terneuzen, Graauw, Philippine, Clinge.

Sea Fishery registration ports were: Terschelling (55 vessels registered), Delfzijl (20), Zoutkamp (98), Harlingen (96), Texel (105), Den Helder (244), Wieringen (324), Enkhuizen (24), Urk (210), Edam (18), Ymuiden (173), Katwijk (133), Scheveningen (155), Hook of Holland (18), Maassluis (42), Rotterdam (52), Vlaardingen (90), Brielle (44), Goedereede (24), Ouddorp (23), Stellendam 57), Brouwershaven (10), Bruinisse (75), Veere (16), Arnemuiden (41), Kruiningen (16), Flushing (32), Breskens (43).

put at the disposal of the fishermen deprived of their livelihood. It has been found, however, that fishing could still be carried out successfully even after the damming, and by 1937, of 3,354 persons to whom work had been allotted, 49% were back in the fishing industry of the Yssel Meer. The men of Yssel Meer are not yet able to make a living on their catch and supplementary payments are given annually, which will diminish as the fishery improves. Steps are being taken to improve the yields of the area by increasing the productivity of the fishery, by extending the home and foreign market, and by improving the distributive organization.

Coastal fishing fleet

The inshore trawling, lining and dredging is carried on with types of craft, rig and tackle peculiar to the Dutch coast. It is unlikely that any other nation has ever produced such a variety of coastal craft and tackle as are found in the Netherlands. Many of the vessels are developed from seventeenth century types with scarcely any alteration of rig, a fact which points both to the maritime supremacy of Holland at that time, and to the dislike of change among the fisherfolk. Nearly all the vessels are sloop or cutter rigged 30–60 ft. in length, with lee boards and flat bottoms, the only break with their forerunners being the addition of a small diesel engine. Among the many types of boat, local variants develop according to local conditions. In the Wadden Zee quite deep water alternates with drying banks, and the needs of, say, the Wieringen folk are quite different from those of the Lauwerszee. Generally speaking, narrow water stretches are only navigable by shorter vessels with narrow forestaysails which facilitate quick and secure ship control.

It is possible to divide the different types into two main groups according to origin. (1) North Sea and Zuider Zee area ; (2) South Coast and Zealand area. Though several vessels are common to both areas, types are localized to a surprising extent (Figs. 81, 82).

The inland fishery

In the inland fishery the salmon is still the most important fish by value, although the catch has been declining for many years. In 1937, 656,726 fint were caught but the value of this landing was only 55% of the salmon. The total catch of this species has doubled since 1928. Other fish which may be mentioned are pike, eel, carp and tench. The fishery has greatly decreased in recent years owing to the increased pollution of rivers and canals, etc.

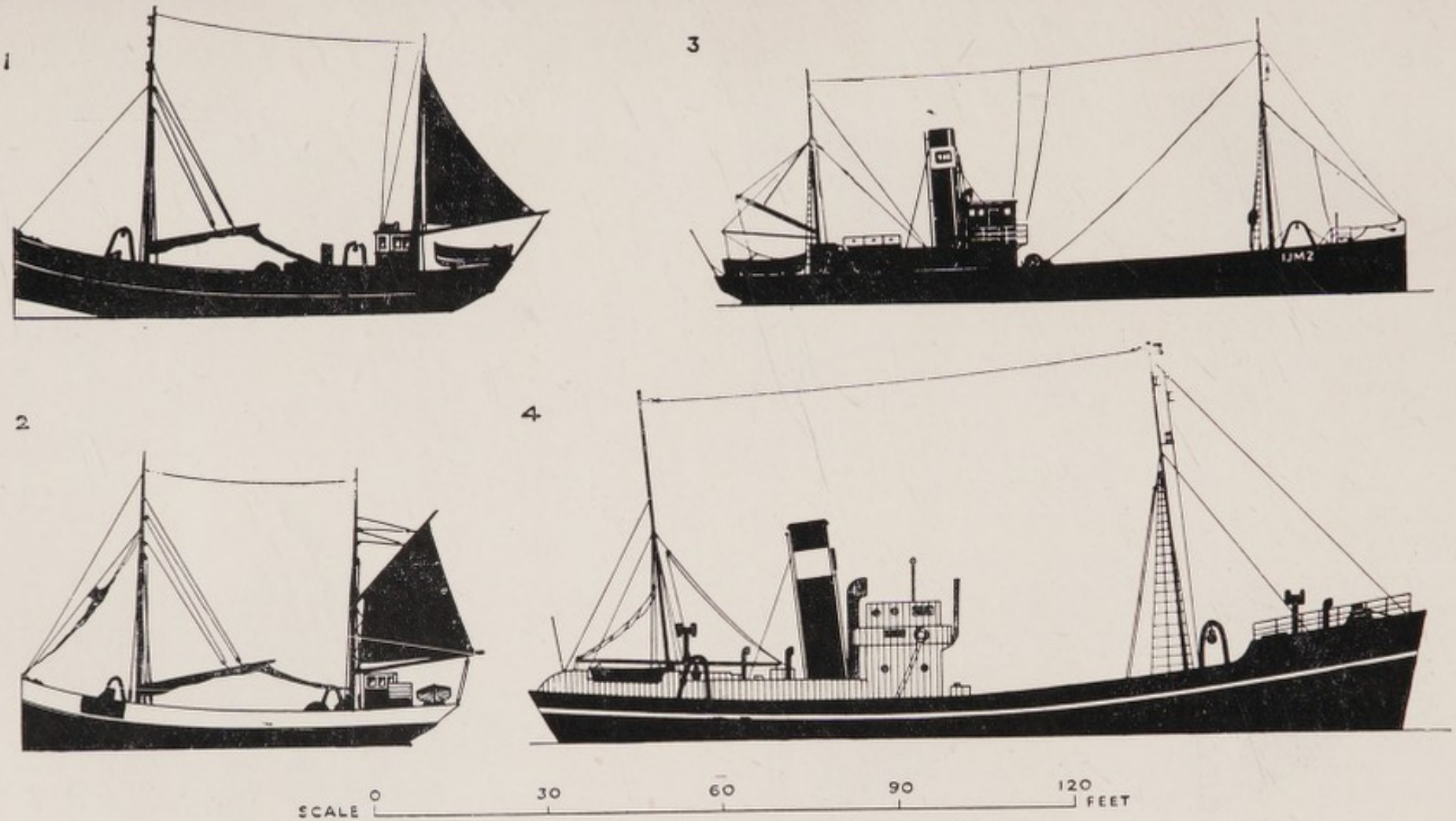

Fig. 80. Netherlands deep sea fishing craft

From official sources.
(1) Motor lugger, 90 ft. class ; (2) motor lugger, 75 ft. class (both of these types are developed from sailing ketches) ; (3) steam trawler, 125 ft. class, built about 1920—the main trawling fleet is composed of this type of vessel ; (4) steam trawler, 150 ft. class—modern vessels built 1935–39 and purchased in Great Britain.

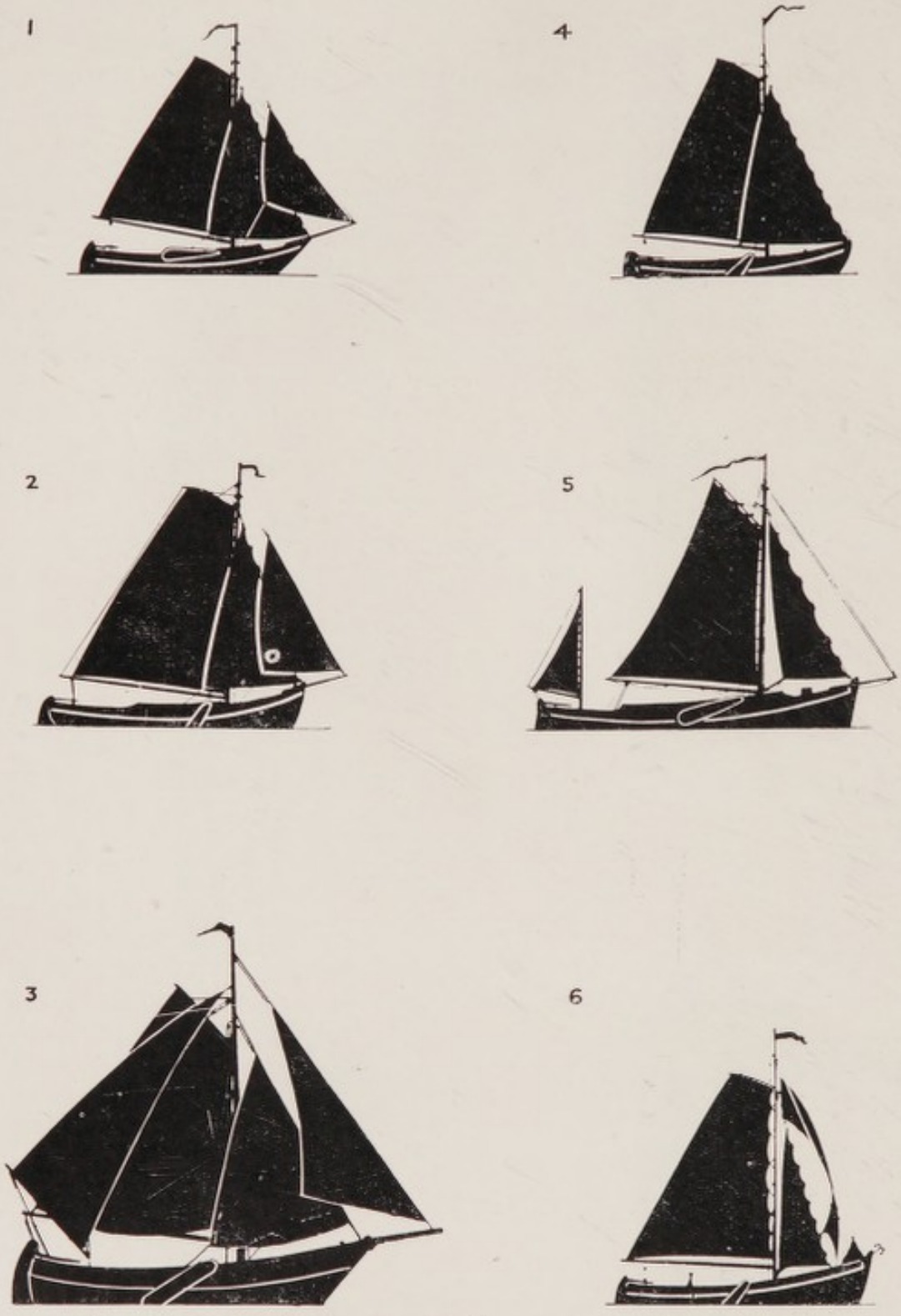

Fig. 81. Netherlands coastal fishing craft—north coast types

From official sources and *Handbuch der Seefischerei Nordeuropas*, Bd. VII, Heft 2, ' Die nederländische Seefischerei ' (Stuttgart, 1932).
(1) Pluut (Harderwijk), (2) Aalboot (Frisian Islands), (3) Schokker (coastwise, all coasts), (4) Aak (Lemster and Wieringen, (5) Schnigge (Peazans, Dollart, Lauwerszee), (6) Kwak (Valendam).
These vessels are drawn on the same scale as those in Fig. 80.

Coast fishery : Craft, grounds and tackle (*Figs.* 81 82)

Area	Typical Craft	Grounds	Tackle	
			Drag nets	Standing nets
North Coast Yssel Meer	*Ewer*—a derivative of many types. *Botter*—spread to the coast from Urk and Marken. *Pluut*—Harderwijk. *Kwak*—Volendam. *Aak*—Lemster, Wieringen. *Jol*—Stavenisse (the only keel ship).	The Knar, Spaanderbank, Enkhuizen Sand and Kampersand. Other areas between Wieringen and Stavoren.	*Kuil* attached to cross legs on the kwak. *Dwarskuil*, with two vessels ' in span ' before the wind. *Wonderskuil* used on the beam.	*Butt nets* and other standing bag nets.
Wadden Zee Islands	*Aalboot*—Frisian. *Vlet*—Den Helder. *Kubboot*—Texel, Wieringen. *Schnigge*—Peazans, Dollart, Lauwerszee.	East of Vlieland. South of Terschelling. South of Ameland.	*Reep nets*—herring. *Gigo* nets—for eel and herring. Frisian Is.	*Kubb* (eel) baskets and *fuken* baskets.
South Coast Zealand and South Holland	*Hooghars*—Flushing, Arnemuiden. *Hengst*—Clinge, Graauw Phillipine. *Jacht*—Bruinisse. *Aak*—especially in the Grevelingen. *Botter*—widespread.	Tholen—South Beveland. North and South Beveland—Walcheren. Other areas in the West Scheldt. Overflakkee—Schouwen, etc.	*Stroopnet*, *Schrobnet*, *Kurre shellfish dredge* and various other prawning nets, etc.	*Ankerkuylen*, *Steerthamen*, *Buhnen*, *Weeren*, *Zalmsteek*, *Pile draw nets*, etc.

The *Schokker* is used off the whole coastline for coastwise traffic. The *Kof* is a small open general-purpose boat used throughout in all branches of the fishery. See also Plates 29, 30.

From : *Handbuch der Seefischerei Nordeuropas*, Bd. VII, Heft 2, ' Die nederländische Seefischerei ' (Stuttgart, 1932)

Imports

In 1937, the Netherlands imported 13,900 tons of fish, the heaviest import being salted herring—3,600 tons. By both weight and value the imports of sea fish into the country have shown a gradual diminution since 1928, except for the years 1932–3 when large quantities were imported from Scandinavian countries. By value, 30% of all fish came from Norway (salted herring and fresh fish), 12% from France (oysters), and 10% from Great Britain (salted cod and haddock).

Exports (Fig. 75)

With no great industrial population to feed and a relatively low fish consumption per head of population (24 lbs. annually) the prosperity of the Dutch fishery has always been greatly dependent upon the export trade, which in recent years has contracted severely. In 1937, the exports were nearly twice as large as the imports. Of an export of 167,000 tons valued at *f.* 15·8 million, 70% was sea fishery produce. The principal species by weight and value was salted herring (103,000 tons valued at *f.* 8·2 million); 43,000 tons of mussels were also exported but their value was exceeded by that of fresh fish which in weight was only one-fifth of the mussel export. Others species included anchovies, shrimps and oysters.

Export of the sea fishery showed a marked decline from 1931 owing to quota restrictions in foreign markets. Exports of fresh fish fell from 76,000 tons in 1931 to 55,000 tons in 1933, but more striking was the fall in the exports to Germany and France, the largest markets. The recovery in 1937 was due largely to the greatly increased export of herring, the fresh fish industry remaining in difficulties, with many crews ashore. From 1935–5 the decrease in herring export to Germany was partly balanced by an export to the U.S.S.R. but the results on the whole continued to be unfavourable for the sea fishery. The coastal fishery maintained itself throughout the depression both in weight and value. In 1937, Belgium took 23% by value (mussels, oysters, salted herring, and fresh water fish); Germany took 19% (anchovies, shrimps, salted herring), France 18% (fresh water fish, mussels, fresh fish), Great Britain 6·7% (oysters, shrimps and fresh fish).

With the rise of competition from the heavily subsidized German fleet, and from the more modern Belgian vessels, the Dutch will be forced to increase their foreign markets where possible. A beginning has been made in the U.S.S.R., South Africa and the

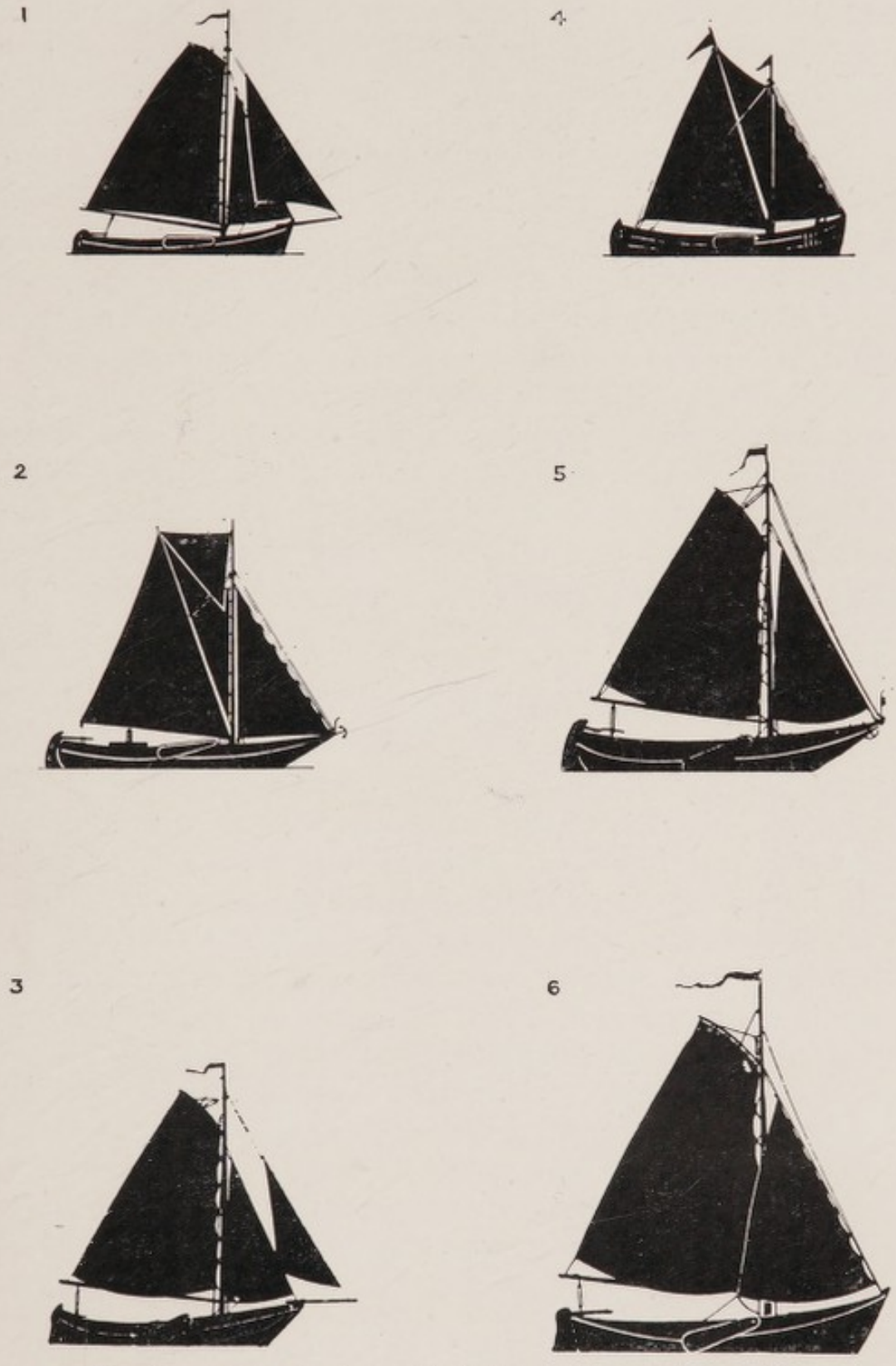

Fig. 82. Netherlands coastal fishing craft—south coast types

From official sources and *Handbuch der Seefischerei Nordeuropas*, Bd. VII, Heft 2, ' Die nederländische Seefischerie ' (Stuttgart, 1932).
(1) Jacht (Bruinisse), (2) Hooghars (Arnemuiden), (3) Hengst (Clinge, Graauw, Philipine), (4) Kof (general purpose—all coasts), (5) Hooghars (Flushing), (6) Botter (widespread).
These vessels are drawn on the same scale as those in Fig. 80.

U.S.A., but only on a small scale so far. Further, it may be possible to develop the preserved fish industry, which up to now has received but little attention.

Fishery Administration and Research

Fishery inspection came into existence in 1911, and the country was divided into seven areas for this purpose; in 1932 the whole inspection was placed under the *Ministerie van Economische Zaken en Arbeid*. Fishery inspectors supervise registration of vessels, tackles, etc. Police control in the North Sea is carried out by two vessels, one of which, the *Nautilus*, can be used for scientific research investigation. Research is conducted by the *Rijksinstituut voor biologischen en hydrografisch Visscherij*, at Den Helder. The *Collegie voor de Visscherij*, created in 1857, is a development of the medieval *Collegie voor de Zeevisscherij*, and publishes various fishery statistics. The *Raad voor de Visscherij* is a body of fishery experts, which among other activities gave support to the Zuider Zee fishermen affected by the drainage works.

Besides the *Nederlandsche Haringcontrole* which regulates the export of herring, two semi-official bodies exist for the marketing of fishery produce. Fishery schools under the *Ministerie van Onderwijs Kunsten en Wetenschappen* give training and instruction in fishery, navigation and seamanship. They are situated at Ymuiden, Scheveningen, Katwijk, Vlaardingen, Enkhuizen, Bunschoten, Urk and Wierum. After two winter terms certificates of qualification can be obtained for seaman, helmsman or engineer.

The shipowners have two principal organizations; *Reedersvereeniging voor de Nederlandsche Haringsvisscherij*, at Vlaardingen, and *Vereeniging van Reeders van visscherijvaartingen*, at Ymuiden. The fishermen are organized in various committees according to their political creed. Capitalist enterprises are found only to a small extent in the coastal fishery, and accordingly such committees in this branch of the industry tend to aim at mutual help, joint-selling and insurance.

Some English Fishery and Nautical Terms Derived from the Dutch

From the early Middle Ages, the great sailors and merchants in northern seas came from the towns of the Hanseatic League in North Germany and from the Netherlands, and English sailors began to borrow nautical terms from these Dutch and Low German

seamen, who were highly skilled navigators. As Dutch and Low German are nearly related and possess many words in common it is not always easy to determine the exact source of these early borrowings.

In the fifteenth century when English shipping became of more importance our sailors borrowed from their superior Dutch rivals a large number of nautical terms. This continued until very recent times and was especially frequent with the naval wars and maritime rivalry of the seventeenth century, while several terms are believed to have been introduced by William III.

The fact that so many words and the greater part of our names for various kinds of vessel have come to us from the Netherlands is a proof of that great proficiency in shipbuilding and navigation which has been enjoyed for so long by the Dutch.

English nautical terms derived from Dutch or Low German :

Ahoy, Anker, Avast, Balk, Ballast, Belay, Beer, Brood spat, Boom, Bow, Bowsprit, Bulwark, Bunting, Buoy, Bumkin, Buss, Buff strops, Braiding, Caboose, Cooper, Corver, Crank, Cruise, Cruiser, Cuddy, Commodore, Companion, Dandy, Dandy span, Dandy wink, Deck, Derrick, Dock, Dobber, Dogger, Dredge, Drumbler, Duffel, Elger, Flemish coil, Flyboat, Fother, Freighter, Garboard, Garnel, Gallowses, Ground tackle, Gybe, Hoy, Halibut, Handspike, Harpoon, Helm, Herring, Hoist, Hull, Jagger, Keel, Keelson, Keg, Lask, Lash, Luff, Leak, Laveer, Lighter, Lubber, Lugger, Maelstrom, Mate, Marline, Mesh, Moor, Maund, Orlop, Outligger, Pump, Pinky, Pram, Reef, Reeve, Roarer, Rope sick, Salvage, Selvagee, Scallop, Scout, Scow, Shallop, Sheer, Shoal, Silt, Skegg, Skipper, Slab, Slab-line, Sloop, Sluice, Smack, Splice, Strand, Swab, Strop, Tackle, Taffrail, Thole pin, Trinket, Wreck, Yacht, Yawl.

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1. The most comprehensive account of the history and development of the Netherlands fishery up to 1931 is given by J. J. Tesch and J. de Veen in ' Die Nederlandische Seefischerei ', which composes the *Handbuch der Seefischerei Nordeuropas*, Bd. VII, Heft. 2, ed. H. Lubbert and E. Ehrenbaum (Stuttgart, 1933) ; there is also A. Beaujon, *History of the Dutch Sea Fisheries*, International Fisheries Exhibition (London, 1884). An exhaustive account of the history of the North Sea fishery, from the point of view of fishery rights and maritime law, is given in T. W. Fulton, *The Sovereignty of the Sea* (Edinburgh and London, 1911).

2. Among descriptive accounts are : P. G. van Tienhoven, *The Fisheries of the Netherlands* (The Hague, 1915), which is still useful, though out of date ; G. V. de Vries, ' Les principaux moyens d'existence et de communication aux Pays-Bas ', pp. 74–6, *Tijdschr. Kon. Ned. Aardrs. Gen.*, vol. 50 (Leiden, 1938) ; D. J. van Dyk gives a good account of recent trends in the trawling industry in *Tijdschr. v. Economische Geographie*, 25 ste Jaar, pp. 99–102 ('s Gravenhage, 1934). Valuable information on recent developments is provided by the *Reports on Economic and Commercial*

Conditions in the Netherlands, published by the Department of Overseas Trade, London, the latest of these being dated 1938. The *Rapports et Procés-Verbaux des Réunions* of the ' Conseil permanent international pour l'exploration de la Mer ', published at Copenhagen, contain from time to time articles by J. J. Tesch and others, as well as shorter references, which throw light on various aspects of the Netherlands fishery and research organization.

3. Accounts of the problem of fishermen deprived of a livelihood by the damming of the Zuider Zee are to be found in J. G. Schilthuis, ' Les travaux du Zuiderzee et plus spécialement du Polder nord-est en voie d'aménagement ', and G. F. N. Houben, ' Les pêcheurs du Zuiderzee avant et apres le barrage de cette mer intérieure ', *Congrés international de Géographie, Excursion B.*5 (Amsterdam, 1938).

4. Valuable statistical surveys are to be found in the ' *Bulletin statistique des Pêches maritimes des pays du Nord et de l'Ouest de l'Europe* ' of the ' Conseil permanent international pour l'exploration de la Mer ', vols. 17–27 (Copenhague, 1929–1939). Summary and detailed tables appear in *Jaarcijfers voor Nederland*, 1938 ('s Gravenhage, 1939), and useful comparative statistics can be found in the *Statistical Yearbook of the League of Nations*, 1938–9 (Geneva, 1939).

5. The following general works on fisheries contain relevant material : J. F. Jenkins, *The Herring and the Herring Industries* (London, 1927) ; W. C. Hodgson, *The Natural History of the Herring of the Southern North Sea* (London, 1934) ; G. C. L. Howell, *Ocean Research and the Great Fisheries* (Oxford, 1921) ; A. M. Samuel, *The Herring* (London, 1918) ; J. T. Travis, *The Herring and the Herring Fisheries* (London, 1927).

CHAPTER XIII

MINING AND INDUSTRY

General Features : Historical Background : Location of Industry : Minerals other than Coal : Coal Mining and Power Supplies : The Chemical Industry : The Metal Industries : The Textile and other Industries : Capital Combinations in Dutch Industry : Bibliographical Note

General Features

The Netherlands now ranks as an industrial country, for 39% of the occupied population in 1930 were engaged in mining and industry, and since then the proportion has steadily risen. The numbers employed increased by 20% between 1920 and 1930, while the population as a whole increased by 15·6%.

Occupational groups, as percentages of the total occupied population

	1899	1909	1920	1930
Industry	33·8	35·2	37·8	38·8
Agriculture	29·6	27·3	22·9	20·1
Commerce and Transport	16·8	18·4	19·6	21·8
Other occupations	19·8	19·1	18·8	19·3

From : G. J. de Vries, ' Les principaux moyens d'existence et de communication aux Pays-Bas ', *Tijdschr. Kon. Ned. Aardrs. Gen.*, vol. 55 p. 657 (Leiden, 1938).

The importance of the industries of the Netherlands appears clearly enough in the export trade. In 1938, for example, among the eighteen leading export items valued altogether at *f.* 678 million, industrial and mineral products accounted for *f.* 386 million. Agricultural exports like cheese, butter and milk products, it should be remembered, also involve a good deal of factory processing.

With a modest production of coal—12–15 million tons annually—heavy industries like the production of steel and chemicals are not important, although some branches of heavy engineering are well developed. Industries dependent upon Dutch agricultural products and upon colonial imports are considerable, though their importance is often overestimated. Some of the most successful industries produce highly fabricated articles like ships, dredgers, or marine engines—unsuited to the methods of mass production. Many

products are covered by patent rights. Other industries depend upon the application of research to the production of new commodities like the margarine-vegetable oil group, electrical and wireless equipment, rayon, or pharmaceutical products like insulin.

A commercial country like the Netherlands is saturated with capital, while applied science is highly developed. Thus the large scientifically-based type of industry is well represented, and is often considered to offer the main chance for the further development of Dutch industry ; it has been observed that the Netherlands can export ' only capital and intellect '. Many industries are related to powerful concentrations of capital. Nevertheless, the mobility of technological knowledge provides a perpetual danger, and foreign commercial policy can easily bring about a shifting of a part of an enterprise to the country of consumption.

The development of the heavily-capitalized type of industry has been further reinforced by the relatively high cost of labour in the Netherlands, originating partly in the long established and prosperous commercial activities of the coast and river ports. Many manufacturers have been forced to concentrate upon activities in which direct labour costs can be offset by the application of extensive research and care in design. Within the country, too, the earlier operation of this tendency for the commercial activities of North and South Holland to force up wages encouraged some industries to migrate inland. By the end of the nineteenth century the textile industry had transferred itself to Twente and North Brabant ; in recent decades the shoe and cigar industries have increasingly shifted from the ports to North Brabant, Utrecht and Overyssel. Here labour was cheaper, an important attraction for industries like these in which wages costs account for a relatively high proportion of the cost of the product.

Numbers Employed in Industry

A precise analysis of the numbers employed in each industry is difficult, for official statistics give a division both by numbers employed in various classes of trades and by numbers employed in establishments in each industry. The former exceed the latter by about 200,000 or 20%.

Personnel of Industry, 1930

Industry	By Establishments		By Trades
Earthenware, glass, lime, stone		39,715	40,084
Diamonds and other precious stones		1,750	6,919
Printing, etc.		36,764	30,867
Building and contracting		155,484	257,466
Chemical industries		23,833	25,956
Wood, furniture, straw		49,453	57,748
Clothing		105,043	135,167
Leather, rubber, footwear		40,142	42,766
Mining of coal, peat, etc.		53,794	51,447
Coal	39,266		
Metallurgy, engineering, electrical apparatus, shipbuilding, etc.		211,606	237,421
Shipyards	33,201		
Electric lamps and radio valves	20,314		
Paper		18,505	21,271
Textiles		82,143	88,295
Wool	11,792		
Cotton	39,702		
Artificial silk	8,722		
Gas and electricity		19,288	20,296
Foodstuffs and tobacco		192,588	218,824
Tobacco, etc.	30,073		
Industry, total		1,030,097	1,235,912

From : *Jaarcijfers voor Nederland*, 1938, pp. 88–9, 94–7 ('s Gravenhage, 1939).

Whether regarded by establishment or by trade, the distribution of employed workers in the Netherlands is not remarkable in any way. No great numbers are accounted for under staple industries like mining, smelting, chemicals and textiles. The numbers employed in the chemical industry are small, while those employed in all classes of metal industries are relatively large. The industries which mainly serve the home market, like the building trades, clothing, food and tobacco, bulk very large, although in food-packing industries a large part of the product is exported.

Size of Industrial Undertakings

Industry is organized predominantly on a small or medium scale. In 1920 concerns employing from 200 to 999 workers numbered only 558, and in 1936 only 594. Of concerns employing 1,000 workers or more there were 71 in 1920 and 85 in 1936.

Percentage of Insured Workers employed, by size of Industrial Concerns, 1920–1936

	Fewer than 5 workers	5–199 workers	200–999 workers	1,000 workers and over	Total
1936	15·7	46·4	19·5	18·4	100·0
1934	15·3	46·9	18·8	19·0	100·0
1932	14·6	47·7	18·7	19·0	100·0
1930	14·9	46·3	18·5	20·3	100·0
1920	10·2	45·7	22·3	21·8	100·0

From : *Rotterdamsche Bankvereeniging*, Quarterly Review, No. 2, Year 1939, p. 41.

Historical Background

Early History—Before 1815

In the Middle Ages, the northern Netherlands did not experience any development of manufactures comparable to that which took place in Flanders. Shipbuilding was active, but the manufacture of woollen cloth was more important, especially at Haarlem, Leiden, Dordrecht, and Rotterdam. It was in the seventeenth century that industries peculiar to the country became prosperous and renowned. Sir Walter Raleigh wrote that the Dutch possessed as many vessels as all the other Christian kingdoms together ; these were all home-built, and it was to the shipyards of Zaandam that Peter the Great came to master the art of shipbuilding.

Other industrial activities were largely confined to the working up of imports for re-export. The saw mills of Zaandam were the most important in Europe ; linen was imported from neighbouring countries for bleaching ; the paper industry had a big internal and foreign market, and the first paper mill was established at Zaandam, the chief centre of the industry, in 1606. The production of chocolate from cocoa beans expanded from the end of the seventeenth century, and the industry, which was centred chiefly at Middelburg, had a widespread export trade. The manufacture of vegetable oils from home-grown colza and linseed early became important. The preparation of tobacco grew into a considerable industry in the seventeenth century. The cutting and polishing of diamonds began at Amsterdam, following the fall of Antwerp in 1585, and received a great stimulus with the opening up of the Brazilian mines in 1727. The famous pottery industry of Delft reached its zenith about 1700, but thereafter slowly declined owing to competition from English Wedgwood ware, and from French products.

Some industries—notably shipbuilding—declined very considerably during the eighteenth century, and industry as a whole was unable to keep pace with development abroad, especially in England.

This failure may be ascribed to the failure of Dutch merchants during the eighteenth century to invest their capital in home industry ; to the reluctance of the mercantile interests to allow tariffs adequate to protect Dutch manufacturers ; and to the absence of iron ores.

Windmills provided the chief motive power for industry, which was therefore comparatively free in its location. It should be remembered that the country possessed virtually no coal supplies, for Limburg did not become Dutch territory until the nineteenth century (see p. 158).

An exception to this story of decline was furnished by the textile industry, which benefited from the immigration of skilled textile workers from Flanders, from the end of the sixteenth century, and from France after 1685. During most of the seventeenth century the industry was not surpassed technically by the English mills. The Twente industry was at first devoted to linen, but in 1728, a beginning was made with fabrics which were half linen and half cotton, and in 1795 cotton took the lead. The older centres of the important towns were gradually deserted for the rural districts of Twente and North Brabant, where labour was cheaper and taxation less onerous.

Early Nineteenth Century

Until about 1870, the Netherlands did not share to any great extent in the industrialization of Europe. After the French occupation came the union with Belgium, 1815–30, with the result that Belgian industries gained considerably from the Dutch market at home and in the colonies. Following the separation of the two countries, a number of Belgian textile manufacturers set up mills in the Netherlands.

Great efforts to encourage industry, not without success, were made by William I (1813–40). He assisted the formation of the *Nederlandsche Handelsmaatschappij* (Netherlands Trading Company), to facilitate trade with the Dutch East Indies. This company encouraged the establishment of further cotton mills in Twente, in co-operation with an Englishman, Thomas Ainsworth. The company maintained the initiative until 1850, when private manufacturers become more active, and the industry began a steady growth. The first steam spinning mill had been set up in 1829, but steam was not applied to weaving until 1852.

The king achieved some success in fostering the metal industries. The shipbuilding industry had reached its lowest point of activity

about 1815, but in 1837, the first iron sea-going steamers for the government were built in the Netherlands. For long, nevertheless, Dutch shipowners replaced their wooden ships mostly with English built iron ships. The first marine engineering works to be established in the country were those of the *Feijenoord Shipbuilding and Engineering Company* at Rotterdam. Several others were fostered by William I.

In this period of slow growth of industry, private initiative was not altogether absent. The large-scale manufacture of cocoa became possible in 1825, when C. J. van Houten succeeded in producing cocoa free from cocoa fat. In 1834, the first machine paper mill was established at Zaandijk. In 1836, a large importer of Belgian pottery opened a pottery works at Maastricht which was to become world famous ; a second factory was established there in 1885. The opening of a potato starch factory at Muntendam in 1840, marked the beginning of another important Dutch industry.

Revival of Industry after 1875

As the nineteenth century progressed, the development of Dutch industry accelerated, especially after about 1875. Broadly speaking, the development of heavy industry followed, instead of preceding, the expansion of light industry. The country was well placed for the import of cheap steel from Belgium or Germany, and it was situated at a point where English and German coal competed, thus lowering the price. The improvement of waterways, both in the Netherlands and in neighbouring countries, reduced the cost of imports of coal and steel. The growth of European trade encouraged the expansion of the Dutch ports, and the continued development of the Netherlands East Indies encouraged Dutch shipbuilding and the rise of new industries.

The textile industries successfully adopted improved machine methods. In 1874, differential import duties favouring Dutch imports in the Netherlands East Indies were abolished ; the resulting loss of preference drove manufacturers at home to adopt successfully the latest technical improvements in the cotton industry, and they were able to compete in foreign markets. After 1860, the Tilburg woollen industry similarly improved its technical equipment, and likewise the footwear industry of North Brabant.

After about 1875, the shipbuilding industry succeeded in producing iron and steel ships at competitive prices, and since then progress

has been continuous. The yards of Friesland and Groningen became suitable only for small vessels, and the construction of large vessels become concentrated in North and South Holland provinces. Naval architecture attained a high development, and later on the Dutch were among the first to grasp the possibilities of the diesel engine for ship propulsion. The marine engineering industry enjoyed an attendant expansion. The improvement of the waterways in the latter half of the century called into being a further variety of specialized engineering activities.

Native capital turned increasingly to investment at home. The reorganized pastoral industries became the basis of milk-processing and allied activities. In 1871, Dutch interests purchased the secret of margarine manufacture from the French discoverer and the first margarine factory was established at Oss, North Brabant. The strawboard industry was started in 1874. The match industry began at Eindhoven in 1870, using local poplar wood, and ten years later, most of the Dutch factories were amalgamated. The Delft pottery industry underwent a revival through the application of new methods and improved designs. At the end of the century a zinc concentrating plant was opened at Budel.

The twentieth century saw the rise of industries requiring little raw material, but depending upon the application of capital and scientific research in a high degree. The *Philips* electric lamp works at Eindhoven were established in 1895, and eventually became responsible for one-fifth of the world's output. Other new industries were the production of wireless apparatus, aircraft, and artificial silk. At the same time, came the beginnings of heavy basic industries ; the coalfield of south Limburg came into active production in 1909, and the development of coke ovens followed. Shortage of materials resulting from the war of 1914–18 encouraged this expansion. The working of the salt deposits of Gelderland began in 1919, and the blast furnaces of Ymuiden commenced operations in 1924.

The world economic depression severely affected wide sections of Netherlands industry severely, and unemployment as a whole reached a proportion higher than that in many countries (see p. 417). The production of coal and coke was not greatly affected and never fell below the 1929 figure, and the output of electricity showed an uninterrupted expansion. Shipbuilding, however, declined until in 1932 activity amounted to only 13% of the 1929 figure ; by 1936 it had recovered to reach 49%, although in 1938 a figure of 122% was

attained. Among the textile industry, cotton mills suffered more than the woollen industry.

Netherlands Industrial Production Indices (1929=100)

	Coal	Coke-ovens	Power stations	Ship-building	Cotton Mills	Woollen Industry
1929	100	100	100	100	100	100
1930	105	116	111	76	98	101
1931	111	120	119	61	87	95
1932	110	115	119	13	65	92
1933	109	118	122	18	76	106
1934	107	127	127	22	77	106
1935	103	132	130	28	80	104
1936	111	140	136	49	91	118
1937	124	154	151	91	111	129
1938	117	147	164	122	104	127

From : *Rotterdamsche Bankvereeniging*, Quarterly Review, No. 2. Year 1939, p. 43.

Location of Industry

The most industrialized provinces are not those of North and South Holland, but Overyssel, Limburg and North Brabant, with 48·5%, 44·6% and 44·6% of their occupied population respectively engaged in industry. North and South Holland have larger absolute numbers employed, but the percentage is reduced owing to the greater intensity of agriculture in these provinces and to the concentration of commercial and transport activities in the larger cities and sea ports. Overyssel, Limburg and North Brabant, on the other hand, are regions of less intensive agriculture in which industry has made considerable progress in recent decades.

In general, the industries of the Netherlands are fairly widely distributed. There is a great concentration in the large cities of such establishments as bakeries, laundries and printing works, which are found in all urban centres in numbers proportionate to the size of the local population, and of such occupations as the manufacture of clothing. The majority of industries, however, are more irregularly distributed. In seven areas, industries are sufficiently numerous to allow of their being called industrial regions for convenience : (1) South Holland province, especially above and below Rotterdam ; (2) North Holland province from the North Sea to Amsterdam, with outlying centres to the east towards Hilversum ; (3) North Brabant ; (4) south Limburg ; (5) Overyssel and Gelderland from Nymegen to Zwolle ; (6) the Twente district of eastern Overyssel ; (7) Groningen.

The industries of the ports are described in detail in Chapter XVI, and of the inland towns in Appendix VII.

South Holland

The region is dominated by the shipbuilding and repairing industry (see p. 384). Yards and engineering works extend all the way from Schiedam and along the Noord to Dordrecht, larger vessels being built below the Lek-Yssel confluence. Marine engineering is less well represented. The only towns outside Rotterdam of any industrial importance are those lying near the waterside. In Rotterdam itself a miscellany of refining industries are carried on, as in most big ports —fertilizers, vegetable oils, sugar, tobacco, distilling, etc. The only petroleum refinery in the Netherlands, owned by the *Bataafsche Petroleum Mij.*, is situated at Pernis. Factories are increasing along the waterway below Rotterdam, securing the advantages of cheaper land and shipping berths alongside the factory; such are the *Hollandia* sugar refinery near Hook of Holland and *Anglo-Dutch* condensed milk works near Vlaardingen (Figs. 86, 108).

Dordrecht is not as important for shipbuilding as the towns lower down the Noord, but carries on engineering, chemical, timber and refining industries. Shipyards lie above Dordrecht on the Merwede at Sliedrecht and Hardinxveld.

A region of scattered industry may be distinguished stretching from Utrecht to The Hague. Utrecht has important engineering and chemical industries, which are found also at Zuilen and Maarssen to the north-west. Manufactures include milk products and cheese at Gouda, barge building at Alphen a/d Rijn, the long renowned woollen and printing industries of Leiden, and pottery and margarine at Delft. The Hague, though the least industrial of all Dutch cities, carries on light metal working and manufactures paper and chocolate, while its eastern satellite of Voorburg has a considerable margarine manufacture.

North Holland

Across the centre of the province from the North Sea to the Zuider Zee lies the second large manufacturing zone of the Netherlands. Dominated by Amsterdam, it resembles the Rotterdam area in being greatly dependent on a good seaward approach; it differs in having more varied industries.

The capital has its refining industries of chocolate, rubber, vegetable oils; shipbuilding yards, including one of the largest single

yards in the Netherlands ; the greater part of the marine engine capacity ; and miscellaneous engineering works, as well as the various food, clothing, printing and other light industries characteristic of a large city (see p. 511). An interesting feature is the comparative absence of industry in the immediate neighbourhood of the city, in the *buitengemeenten*, more especially to the north and south, an absence ascribed partly to the lack of good sites for large buildings owing to the nature of the soil, and partly to the fact that labour, in the intensively cultivated market gardening areas, is no cheaper than in the city.

Westwards the first important concentration of industry is found in the *Zaanstreek*, along the river Zaan from Zaandam on the North Sea Canal northwards as far as Krommenie and Wormerveer. This is the chief centre, in the Netherlands, for the timber trade and for rice milling ; other industries include the building of small ships and barges, the refining of vegetable oils and paper making. At the seaward end of the canal lies a growing industrial centre—Ymuiden and Velsen on the south bank of the canal, and Beverwijk on the north. The chief industry centres upon the related group of blast furnaces, coke ovens, heavy chemical works and cement plant ; others are fish-canning at Ymuiden, paper at Velsen, and cigar-making at Beverwijk. Four miles to the south of Velsen lies Haarlem, a centre of engineering and wagon-building industries and ship-building. To the east of Amsterdam cheap land and lower labour costs encouraged the establishment of cocoa factories at Weesp and Bussum, and of textile mills, cigar and radio equipment works at Hilversum.

North Brabant

The industries of North Brabant include both old and new manufactures, and are situated mainly in the line of towns extending eastwards from Bergen-op-Zoom. Bergen engages in sugar refining, distilling and hardware manufacture, while Roosendaal refines sugar and makes brushes. Breda is a larger manufacturing centre in the district known as the *Baronie*, and besides engineering and match factories, has an important artificial silk works. Tilburg and its neighbour Goirle are the chief centres of the North Brabant textile industry, which is found also in small centres of the nearby area, the *Meierij*, and farther east in Eindhoven, Geldrop, Helmond, and Bokstel. Tilburg is concerned mainly with woollen manufactures and clothing, while eastwards cotton and mixed fabrics

become more important. The North Brabant industry is distinguished from the Twente textile industry in being much more decentralized.

Eindhoven carries on the manufacture of cigars and matches, but is now much better known for the Philips lamp and valve works (see p. 684). Helmond has linen mills using Irish and Belgian flax, in addition to its other textile industries. One of the most interesting examples of the early factors involved in the location of industry may be seen in the *Langstraat*, a string of small towns and villages lying between 's Hertogenbosch and Geertruidenberg—Vlijmen, Nieuwekuik, Drunen, Baardwijk, Waalwijk, Sprang, Besoijen, Capele, Waspik, Ramsdonk, of which the largest is Waalwijk (*c.* 10,000 inhabitants). These villages lie between one and three miles from the Maas, where the river clay meets the sands of North Brabant. Oakwoods on the sands, the lime-free streams which issued from them, and the rich meadows of the river clays, provided the material for a tanning industry which has long been famous in the Netherlands, and which gave rise to the manufacture of footwear. The industry is carried on in many small factories, but it is aided by a central research and testing station. There are also several milk product factories.

South Limburg

In the extreme west lies Maastricht, the largest centre of population in the region, with important glass, pottery, earthenware and cement works, related in part to the proximity of calciferous rocks of the southern frontier region and the coal to the east. The chief centres of population in the coalfield are 12 or 15 miles distant—Heerlen (50,000) and Kerkrade (38,000). Heerlen is the administrative headquarters of the State mining organization. Population is not so densely clustered as in some coalfields, for the by-product works and coke ovens adjoin the mines, as at the Maurits and Emma mines. The more scientific development of the coalfield has resulted in the establishment of several large mines instead of many small ones, while the largest of all, the Maurits mine, lies some distance to the north-west of the remainder.

Gelderland and Overyssel from Nymegen to Zwolle

In this region of the great rivers, brick and tile works are found along the belt of river clay. Nymegen is a centre of engineering and

barge building, and has small artificial silk and electrical industries. Arnhem is the headquarters of the Dutch artificial silk industry and carries on engineering and shipbuilding; it is also the site of an important tin smelter. Westwards from Arnhem lie paper mills, while Ede, nearby, manufactures artificial silk. Northwards along the Yssel lie brickyards, while small foundries and engineering shops are situated at Doesburg, Dieren, Deventer and Apeldoorn. Apeldoorn and Deventer also have small textile industries.

The Twente Region

Beginning as a region of domestic industries which supplemented the meagre returns of the agriculture of this sandy countryside, the Twente region gained from the arrival of French, German and southern Netherlands refugees in the sixteenth and eighteenth centuries, who found the area well placed for export to Germany, then an important market for textiles. Of all the industrial regions of the Netherlands the Twente is most given over to one dominant industry.

While more centralized than the textile industries of North Brabant, the cotton manufacture is found alike in large towns and in villages. The chief centres are Enschede-Lonneker, Almelo, Hengelo and Borne; there are also two groups of minor centres, to the west and north-west of Enschede and to the south-west.

Cotton industry in Twente, 1929

	Factories	Total number of Employees	Spindles	Looms
Enschede-Lonneker	28	14,397	602,328	19,394
Hengelo (O.) and Borne	7	4,399		4,772
Almelo	5	4,260	470,098	7,585
Delden, Goor, Haaksbergen, Hellendoorn, Losser, Oldenzaal, Ootmarsum, and Vreizenveen	15	6,561		11,815
Borculo, Groenlo, Neede Lichtenvoorde, Winterswijk, Aalten and Breedevoort	16	1,991	—	3,177
Total	71	31,608	1,072,426	46,743

From: F. Cornelissen, *Les Industries des Pays-Bas*, p. 146 (Paris, 1932).

The centres at Borculo, Groenlo, etc., in Gelderland are of recent origin. The different stages of the industry in the whole region are not markedly localized. Enschede-Lonneker contain two-thirds of

the combined spinning and weaving mills; Almelo is mainly a weaving centre, like Borne; Hengelo is the administrative centre for the industry. The finishing trades are well represented at Almelo, Nijverdal, Goor, Boekelo and Eibergen. Linen mills are found at Almelo and Vriezenveen, and jute mills at Rijssen and Oldenzaal. Several towns produce mixed fabrics and made-up goods.

Other industries of the region are mainly engineering and metal-working. At Hengelo, in fact, more than half of the working population is employed at the *Stork* marine diesel-engine works.

Groningen

The small industrial region of north-west Groningen is almost unique. The fen colonies early developed small industries, using peat for fuel, and are now the site of over 30 factories for the manufacture of potato starch and potato flour, while sugar factories and milk-processing plants are also found. The majority of all these factories lie to the south-east of the city of Groningen, within a triangle formed by Hoogezand, Winschoten and Ter Apel. A second group of factories are the strawboard works in the same area, using the products of local agriculture to serve a wide export market.

For centuries the Groningen district was an important shipbuilding centre, but with the increase in the size of ships the industry declined. In recent decades, however, it has revived to achieve a remarkable dominance in the construction of motor coasters of several hundred tons gross, known as *Groninger*. Half a dozen yards lie on the Winschoter canal at Waterhuizen, Foxhol, Maartenshoëk and Hoogezand, while others lie at Groningen and Delfzijl. Appingedam constructs marine diesel-engines.

Minerals other than Coal

The mineral products of the Netherlands are almost entirely non-metallic. The greater part of the country is composed of very young rocks, and the carboniferous rocks which approach the surface in south Limburg, while rich in coal, are virtually devoid of iron ore. A small quantity of limonite, an iron oxide, is obtained in the Peel district of North Brabant and the Overyssel. In the extreme south of Limburg search has been made for zinc and lead ores, thought to be a continuation of the Moresnet deposits in Belgium. So far

indications of the presence of these ores have been found, but no positive result has been achieved.

Clay and Limestone

Tertiary clays are dug for brick making at Tegelen, Reuver, Zevalmen and Brunsum in Limburg, in the Twente district of Overyssel, and near Winterswijk in Gelderland; a pre-glacial lacustrine clay (*potklei*) and glacial clays are dug in the north of the country. The greatest use for bricks and tiles, however, is made of alluvial clay, marine or fluviatile in origin; the river clays of Gelderland are the basis of a considerable brick and tile industry in the valley of the Yssel and in the neighbourhood of Arnhem and Nymegen. Bricks are also made from the 'loess' of Limburg. Here, in the south, calcareous rocks provide building stone and material for the manufacture of cement.

Salt

In 1919 borings proved the existence of workable beds of salt at Boekelo near Enschede in Overyssel, about 6 miles from the German frontier. The salt lies in Triassic rocks at a depth of 1,320 ft. Other borings have reached important salt beds at depths over 3,280 ft. to the north-east near Winterswijk, in Gelderland, below which lie the coal beds discovered in 1904; other beds have been located near Hengelo. The salt mines of Boekelo employ 330 workers; output increased steadily to 76,000 tons in 1936 and jumped to 132,000 tons in the next year. The industry is operated by a company in which State and private interests participate.

Cement Manufacture

Owing to the extensive road improvements undertaken in recent years the demand for cement had increased considerably. In the four years 1936–39, while production increased from 400,000 to 540,000 tons, imports rose from 350,000 to 600,000 tons. There were only two cement manufacturing companies in the Netherlands. One, with works at Maastricht, had an annual capacity of 400,000 tons; the other, a subsidiary of the *Kon. Ned. Hoogovens en Staalfabriek*, had works at Ymuiden, producing Portland blast furnace cement from furnace slag, with an annual capacity of 200,000 tons.

Power Supplies

Coal Mining : Organization

Coal is one of the few industrial raw materials found on a large scale in the Netherlands. Production now reaches 14 million tons annually and exceeds the requirements of the country. The coal-fields form an extension of the German and Belgian coal deposits and are situated around Heerlen in the south of Limburg.

The good quality of the coal had long been known, and open cast mining was carried out at the abbey of Kloosterrade (Rolduc) as early as 1113, in the valley of the Wurm, along what is now the German frontier. For centuries, however, little use was made of the coal. In 1845 small mines were started by the company operating the Aachen-Maastricht railway. In 1898 came competing offers for concessions from German, French and Belgian interests. At the beginning of the century there were four private mining companies in the Netherlands, all owned by foreigners. It was considered undesirable that only alien companies should have a preponderant interest in the working of Dutch coal ; in 1901 the State reserved to itself almost all the territory not already leased and in 1912 the State domain was extended to all Limburg. The mining organization was established in 1902, and the four mines were opened in 1909, 1914, 1918, and 1926. The geological survey mines department, *Rijkopsporing van Delfstoffen*, proved in 1904 the existence of further beds in the Peel district of Limburg and in Gelderland.

The war of 1914–18 encouraged further exploitation, although the State was actuated from the beginning by reasons of promoting the general improvement of the national economy. Private enterprise developed, too, until by 1939 there were three companies operating six mines, as well as the Domaniale Mine which had originally belonged to the State but which was temporarily ceded to a private company.

The operators of the private mines obtain their coal mining property as a concession from the State, the State mines being given the same rights. Surface and underground rights are separate. Only the Domaniale Mine is now conceded to a private company by a contract specifying a royalty for the Dutch government. The State mines are managed exactly like a private concern, operating under the laws regarding surface rights and following the regulations of the inspectorate of mines in the same way as the private companies. Their capital, however—*f.* 43 million of shares and *f.* 35 million of

bonds—are owned by the State. By 1935 construction costs on the mining works had amounted to *f.* 195 million : the difference is paid for by sums set aside for depreciation.

The Coalfield (*Fig.* 83)

The reserves of the south Limburg coalfield have been estimated

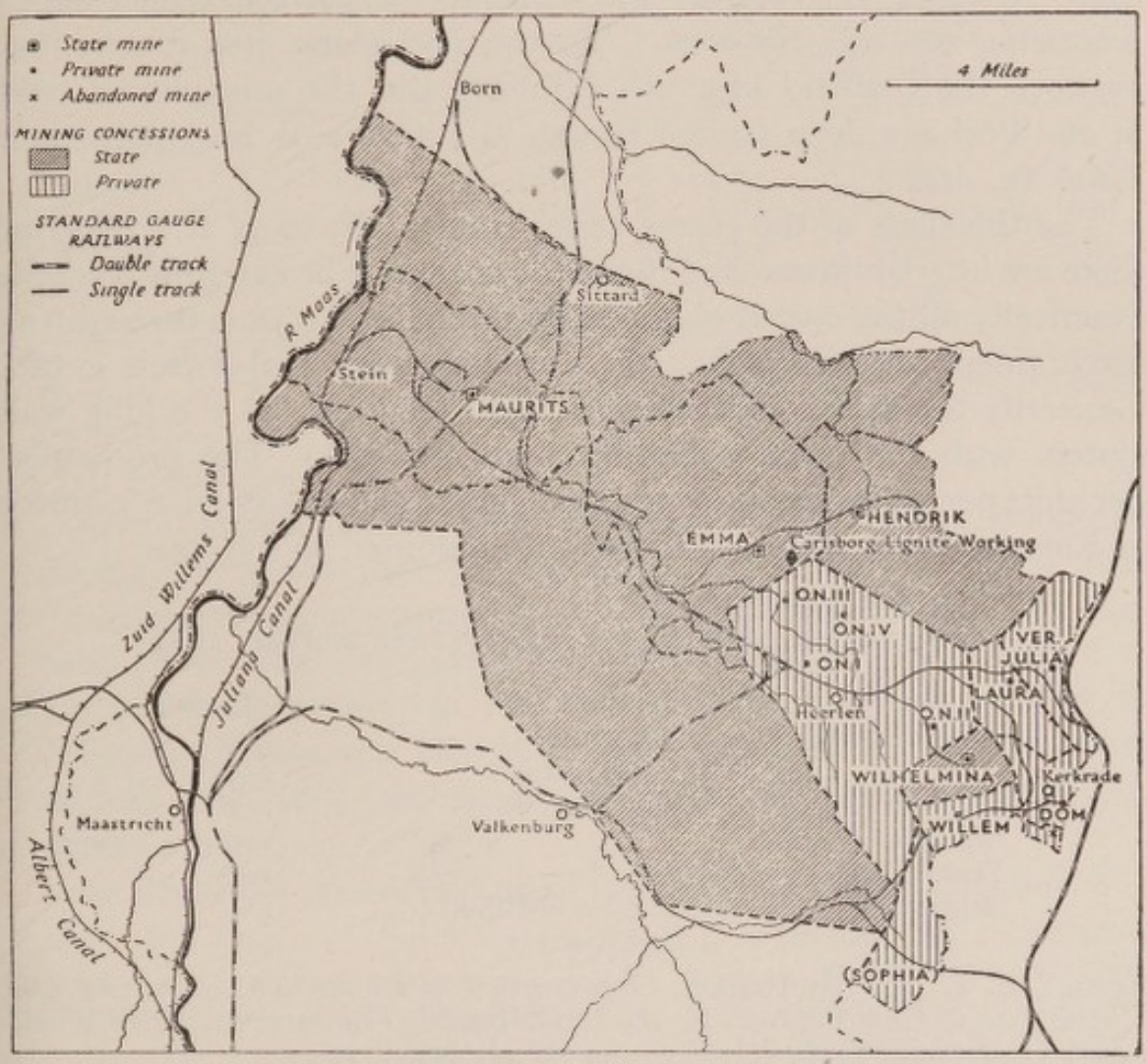

Fig. 83. Mining concessions and mines in the south Limburg coalfield

From : P. R. Bos—J. P. Niermeyer, *Schoolatlas der Gehele Aarde*, plate 11B (Groningen, 1936) ; G.S.G.S. Series 4040 ; 1 : 50,000, sheets 48, 58, 59 (1943). Dom Domaniale Mine ; O.N. Oranje Nassau mines ; Ver Vereeniging
The Sophia mine is not in production. Stein and Born are coal ports on the Juliana Canal (see also Figs. 133, 136).

at 3,000 million tons, and of the two undeveloped areas—the Peel district in central Limburg and south-east North Brabant, and the Winterswijk district in eastern Gelderland—at 2,000 million tons, not deeper than 4,000 ft. The State reserve comprise 59,000 acres. The reserves of coal in the existing concessions amount to 900 million tons. The upper carboniferous beds within which lie the

coal seams attain a thickness of about 10,000 ft. These beds are composed mainly of schists and sandstones ; the lowest beds are practically devoid of coal seams. In the beds in which workable coal lies thick masses of intervening sediments divide the seams into three main groups. The whole series is inclined to the north-west, folded considerably and faulted. At Kerkrade the seams lie near the surface, at Heerlen 350 ft. below the surface, with a depth increasing towards the west. To the north, the area intervening between the coalfield of south Limburg and the unexploited field of the Peel is a deep faulted trough in which coal lies more than 8,200 ft. deep.

The thickness of the seams varies from $2\frac{1}{4}$ ft. to $7\frac{3}{4}$ ft. Most of them are interlaminated and hence the coal must be carefully washed. Practically all the coal is obtained by mechanical means through the use of pneumatic coal picks ; there are only a few coal-cutters in use. Generally the coal is extracted in large quantities by the long wall system with conveyors operating along the face. The production per shift per underground worker is higher than in any other country of Europe except Poland ; in 1935 it amounted to 2·6 tons.

Production per shift per underground worker, 1934

Country	District	Quantity, tons
Netherlands	State mines	2·3
	Private mines	2·4
Germany	Ruhr coalfield	2·1
England		1·5
France		1·2
Belgium	Campine coalfield	1·4
	Liége district	0·8

From : F. K. T. van Iterson, *Organization of Production, Processing and Distribution of Coal Products (in the Netherlands), Transactions, Third World Power Conference*, 1936, vol. 3, p. 563 (Washington, 1938).

In the Dutch mines great care is taken to prevent accidents, and the accident rate (total accidents) is lower than in any other important coal mining country, in proportion to the amount of coal raised. In proportion to the number of underground workers the rate is again the lowest ; if surface workers be included, however, the accident rate is slightly higher than in the United States.

Fatal accidents in coal mining, 1934

Country	Total number		Number		
			Per 1,000 workmen		Per 100,000 metric tons
	Underground	Underground and Surface	Underground	Underground and Surface	
Netherlands	13	16	0·60	0·50	0·13
Prussia	414	459	2·04	1·61	0·38
Belgium	157	177	1·82	1·41	0·67
France	148	176	0·94	0·77	0·36
Great Britain	999	1,073	1·60	1·35	0·47
United States	1,100	1,155	2·09	0·31	0·31

From: F. K. T. van Iterson, . . . *Coal Products* (*in the Netherlands*), *Transactions, Third World Power Conference*, 1936, vol. 3, p. 563 (Washington, 1938).

Coal Production

About 40,000 people were occupied in coal mining, production during the years 1936–39 averaging 13½ million tons, of which 8 million tons were accounted for by the four State mines. Maximum total production was 14½ million tons in 1937. All classes of coal are produced; 50% of the output is high quality coking coal (Maurits, Emma and Hendrik mines), 37% industrial coal (private mines), and 10% anthracite (Wilhelmina State mine and small private mines).

In detail the production of all the mines in 1939 was as follows:

Mine	Location	Production in 1939 000 metric tons	Content of volatile matter per cent.
State mines			
Maurits (1926)	Lutterade	2,650	20–26
Emma (1914)	Hoensbroek	2,270	20–26
Hendrik (1918)	Rompen	1,550	20–26 +15–17
Wilhelmina (1909)	Terwinselen	1,374	9–10
Private mines			
Oranje-Nassau	Heerlen, Schaesberg, Heerlerheide	2,339	10–20
Laura and Vereeniging	Eygelshoven, Julia	1,410	10–18
Willem-Sophia	Spekholzerheide	471	5–15
Domaniale Mine	Kerkrade	786	5–15

In 1938 the estimated productive life of the mines was as follows (in years) :

Domaniale Mine	20	Hendrik State Mine	50
Oranje-Nassau Mines	30	Willem-Sophia Mine	55
Wilhelmina State Mine	35	Emma State Mine	65
Laura and Vereeniging Mines	40	Maurits State Mine	70

The Limburg mines are well served by means of transport ; apart from the main line system, narrow gauge lines transport coal and coke to the ports of Stein and Born on the Juliana Canal (see p. 558).

Coke-Ovens

More than half the coking coal produced was utilized in Dutch coke-ovens, the rest being exported. During 1936–38 coke production averaged 3·2 million tons, of which 2·4 million tons were contributed by the State mines, while a further 700,000 tons of gas-coke were produced from gas works. The principal ovens were those at the Maurits and Emma mines, which produced, in 1938, 1,600,000 tons and 800,000 tons of coke respectively. At the Maurits mine the plant comprises a battery of 489 ovens ; the coal gas is stored in a waterless gasholder, the second largest in Europe. At Sluiskil, Zealand, there is a 125-oven plant of the *Association Co-operative Zélandaise de Carbonisation*, which produced about 500,000 tons of coke, largely for supply to the French metallurgical industry. At Ymuiden the plant of the *Kon. Ned. Hoogovens en Staalfabriek* produces about 300,000 tons (Plates 31, 32, 55).

Disposal of Coal and Coke

Internal consumption amounted to about 10,500,000 tons of coal and 1,300,000 tons of coke.

Consumption of coal, coke and briquettes, 1938, *in terms of coal equivalent* (*omitting coal for coke ovens—about 4 million tons*)

	Million tons
Railways and steam trams	0·8
Household consumption	3·2*
Gas works	1·3
Power stations	1·2
Consumption at mines	0·5
Bunkering	1·0
Industrial and other uses	4·2
* Plus 6–700,000 tons gas coke	12·2

The production of industrial coal in the Netherlands is not sufficient to meet all needs, and hence 4·5 million tons were imported in 1938—three-quarters from Germany and most of the rest from Great Britain. Exports amounted to 6·7 million tons of coking coal and coke—principally to Belgium and France, with Germany as a secondary customer. The Netherlands is a relatively low price country for imported coal. Seaborne imports from England have only a short sea passage and can be moved inland by waterway; many Dutch consumers secure English coal as cheaply as consumers in London. German coal enters by the Rhine waterway.

Gasworks. Of the population of the Netherlands, 71% enjoys the use of gas daily, which is supplied by 166 gas works and thirty-three distribution stations. The gas works are nearly all municipally owned. The only important gas grid system is that connected with coke ovens at the Maurits and Emma mines; served by seventeen distribution stations, this system supplies the whole of south Limburg as well as the towns of Eindhoven and 's Hertogenbosch.

Lignite

Lignite is worked in Limburg at Carisborg near Heerlen. Production amounted to 200,000 tons in 1927, but ten years later was 143,000 tons. There is only one pit. Most of the product is exported.

Petroleum Products

The refining of petroleum is not an important industry in the Netherlands: of a total oil import of 1,687,000 tons in 1938 only 433,000 tons were crude oil. The largest refinery is the comprehensive installation at Pernis, west of Rotterdam, belonging to a R.D.S. subsidiary; this plant has a through-put capacity of 660,000 tons a year. There is also a small refinery at Maassluis, with a capacity of 2,000 tons specializing in lubricants, and another at Flushing which handles black oils and produces road surfacing materials.

Storage capacity in the country amounted to 1½ million tons—over 1 million at Pernis and Vlaardingen, 400,000 tons at Amsterdam and the rest at Flushing, Den Helder, Arnhem and Wormerveer.

The distribution inland of petroleum products was carried out mainly by tank barge. The *N.V. Bataafsche Import Maatschappij* supplied its fifty distribution depots throughout the country by tank barge from Rotterdam, Amsterdam or Groningen.

Consumption of petroleum products in 1938 *: (in* 000 *tons)*

	Diesel Oil	Motor Spirit	Fuel Oil	Kerosene	Lub. Oil and grease	Total incl. unnamed types
Motor Vehicles	22	401			12·3	435·3
Bunkering	200		235			435
Domestic	51·5		1·5	185		238
Industrial	106·5		45·5	7·5	26·2	191·1
Waterway transport and fishing	101			42	12	155
Agriculture	4			20		24
Railways	6			1·5	2·5	10
Gasworks	10					10
Others	—				1	9·35
Totals	501	401	282	256	54	1,507·75

Electric Power

At first the Netherlands lagged behind other countries in the production of electricity, but in recent decades progress, largely under official control, has been rapid. The government supervised the industry throughout, and has granted concessions to allow the more remote areas to be supplied. Development, as in other countries, has been in the direction of a number of large power stations.

In 1939 there were 52 generating stations—3 State controlled (at the Limburg mines), 7 provincial, 17 municipal, 2 provincial and municipal, 10 co-operative, and 13 attached to private industrial undertakings. The aggregate installed capacity was 1,600,000 kw., output in 1937 was 2,550 million kwh., in 1939 2,900 million kwh. Development has been greatest in the chief centres of population and industry. Stations with a capacity over 100,000 kw. are situated at Amsterdam (Noord I), Velsen, Geertruidenberg, Nymegen, and Lutterade. The first four of these receive coal cheaply by waterway, while the Lutterade station is near the Maurits mine. Practically all the smaller stations were coal fired, except a few diesel-operated plants in isolated districts like the Frisian Islands.

There was no extensive system of inter-connection between the principal stations, and transmission systems rarely covered more than one or two provinces. The principal systems were Groningen–Friesland–Drenthe (supplied by the stations at Leeuwarden and Groningen), Utrecht–Gelderland, North Brabant, and North Holland. The Limburg coalfield was linked to the Belgian system

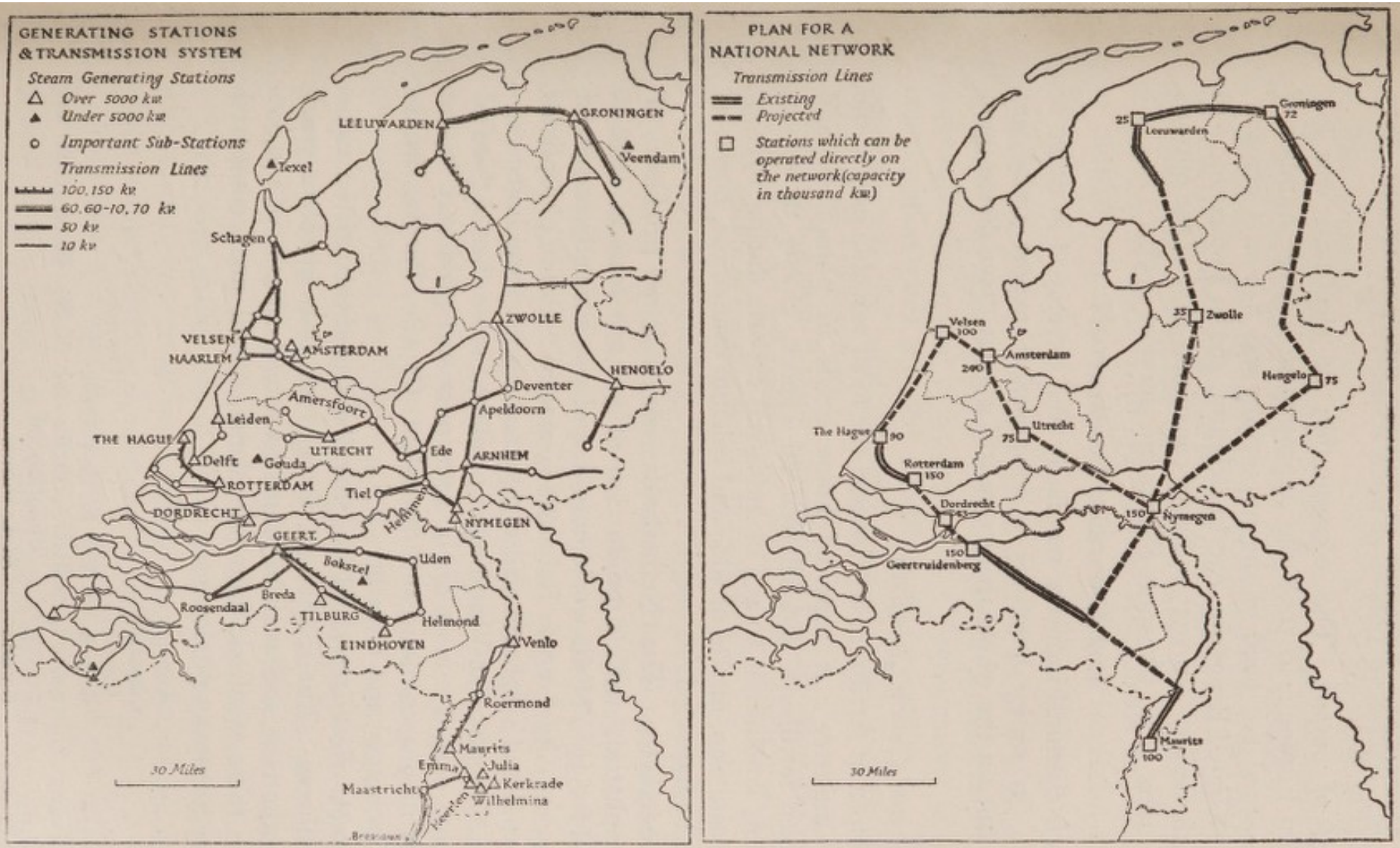

Fig. 84. Electricity distribution in the Netherlands

From (1) Official sources—left-hand map ; (2) Association of Managing Directors of Electricity Supply Undertakings in the Netherlands, 'Regional Integration of Electricity Utility Facilities', *Transactions Third World Power Conference*, vol. 7, p. 649 (Washington, 1938)—right-hand map.
Geert. Geertruidenberg.
The left-hand map illustrates the comparative lack of co-ordination in the existing electricity distribution ; the right-hand map indicates a proposal made by a number of engineers for the connection of the principal existing power stations by means of a grid covering the whole country.

through Maastricht. Schemes of further inter-connection were projected (Fig. 84).

Disposal of output. The consumption of electricity was low for western Europe: in 1938 the approximate average number of kwh. consumed per head of the population was 810 in Germany, 650 in the United Kingdom, 630 in Belgium, 460 in France and 320 in the Netherlands. In 1937 industry consumed 46% of the output, domestic users 32%, transport 8%, public services 2·5%.

The Chemical Industry

The Dutch chemical industry was fairly well developed in range of products; in some directions a considerable export trade was possible, but on the whole there was still a great dependence upon imports.

Fertilizers and Heavy Chemicals

The output of fertilizers represented the most valuable part of the chemical industry: it supplied home needs in phosphatic and nitrogenous fertilizers and allowed an export, chiefly of superphosphates, amounting to 4% of industrial exports during 1937–9. Potash, basic slag, nitrate of soda and calcium cyanamide, however, all had to be imported.

Superphosphates. The Netherlands was a large producer of superphosphates; with a production of 550,000 tons in 1938 it accounted for 3½% of the world output, and was normally surpassed in Europe only by France, Italy and Germany. Crude phosphates are imported and sulphuric acid is obtained mainly from home production. One plant at Vlaardingen produced more than a third of the national output; most of the remainder was produced by the six plants of one combine at Amsterdam, Capelle, Pernis, Zwijndrecht, Groningen and Utrecht.

Nitrogenous Fertilizers. These provided two-thirds of the value of all fertilizers. The fixation of nitrogen has only in recent years become important, and, with an estimated annual capacity of 140,000 tons from three synthetic ammonia plants, is still small compared with other European producers.

Location	Annual Capacity (tons)	Owners
Sluiskil (1926)	60,000	Cie N. de l'Azote
Ymuiden (1927)	20,000	R.D. Shell and K.N. Hoogovens en Staalfabriek
Lutterade (1930)	60,000	State mines

All three plants adjoin coke-ovens and use coke-oven gas as a source of hydrogen. The Sluiskil plant is owned by Dutch, Belgian and Italian interests.

By-product nitrogen was produced at the coke-plants of the Emma and Maurits mines (9,200 tons) and at the Ymuiden coke ovens (3,500 tons). The industry employed altogether 6,000 people. The bulk of the output was used for the production of artificial fertilizers : 295,000 tons of sulphate of ammonia were produced in 1938, and 5,300 tons of calcium nitrate. Nitric acid plants had been set up at Sluiskil, Ymuiden and Lutterade ; imports were still necessary, however.

Sulphuric Acid. Dutch requirements of sulphuric acid in 1938 amounted to 590,000 tons, derived from a production of 525,000 tons and a net import of 65,000 tons. Three-quarters of this large consumption went into the manufacture of fertilizers. The chief producer was the sulphuric acid plant at Sluiskil, with an annual capacity of 170,000 tons.

While no calcium carbide was produced, a carbide works was under construction at Amsterdam in 1940. The production of hydrochloric acid was insufficient for requirements.

Other chemical products. About 10,000 tons of caustic soda were produced by the electrolytic process ; the largest factory was at Boekelo in Gelderland, near the salt which provides the principal raw material ; others were at Roermond and at Wormerveer (North Holland). Imports of *soda ash* for the soap, textile and chemical industries amounted to about 55,000 tons annually.

From imports of cinchona bark from the Netherlands East Indies and of semi-refined quinine from Germany there was a production of quinine salts at two factories in Amsterdam and Maarssen (Utrecht) which accounted for the greater part of the European output. The *Organon* factory at Oss (North Brabant) is the largest in Europe for the manufacture of insulin ; it also prepared other glandular products. In pharmaceutical products as a whole, however, the country produced only about half its requirements.

Three soap works, two of which are owned by Unilever, together with seventy-two small undertakings, produce about 94,000 tons, which is approximately equal to home consumption.

Production of explosives is very small. Toluol was produced at the three large coke-oven plants at Sluiskil, Lutterade, and Ymuiden as well as in a factory at Krimpen a/d Yssel (S.H.) ; about nine-

tenths of the output, or 2,500 tons, were exported. Demands for other explosives were met mostly by imports.

The Metal Industries

For a country practically devoid of metallic ores the Netherlands possesses a considerable industry in the refining of metals, though it was small in comparison with the industry in neighbouring countries.

Iron and Steel

The consumption of iron and steel is considerable, specially in the shipbuilding industry, but the proximity of the cheaply produced steel of Belgium, Luxembourg and Germany prevented any early development of iron-smelting. Steel making plants have been even later in appearing, and there is an export of scrap and of pig iron, 490,000 tons and 240,000 tons respectively in 1937. The iron smelting industry was begun in 1924 with the establishment of a blast furnace works at Ymuiden by the *K.N. Hoogovens en Staalfabriek N.V.*, where there are now three furnaces, the only ones in the country. Two-thirds of the company's capital was provided by the State and the municipality of Amsterdam, and the remainder by the Royal Dutch Shell group ; there is a community of interests with German cartels. Coal is coked at the adjoining coke-ovens (see p. 491) ; ore is imported from Spain and Sweden, at an average of 474,000 tons yearly from 1932 to 1937. The capacity of the furnaces is 300,000 tons of pig-iron a year, and output amounted to 299,000 tons in 1937.

Before 1939 there was only one steel furnace plant, that at Utrecht, with an annual capacity of 60,000 tons. In 1939, one of two new steel furnaces had been completed at the Ymuiden blast furnace works, with a total crude steel capacity of 100,000 tons annually. Shortly before the occupation a steel rolling mill was started at Velsen, near the Ymuiden furnaces, to ensure a minimum of home-produced rolled steel.

Non-ferrous metals

Zinc. A Belgian company owned a plant at Budel, south of Eindhoven, near the Belgian frontier, for the smelting and refining of zinc concentrates, with an annual capacity of 28,000 tons of metal. Zinc rolling mills were installed in 1925. Another firm operated a rolling mill at Utrecht.

Tin. In 1939 the greater part of the world's tin was derived from four smelters—one each at Penang and Singapore, a third at Liverpool, and a fourth at Arnhem. The Netherlands was responsible, through this smelter, for treating one-fifth of the world output of ore and for producing 35% of the total metal production in

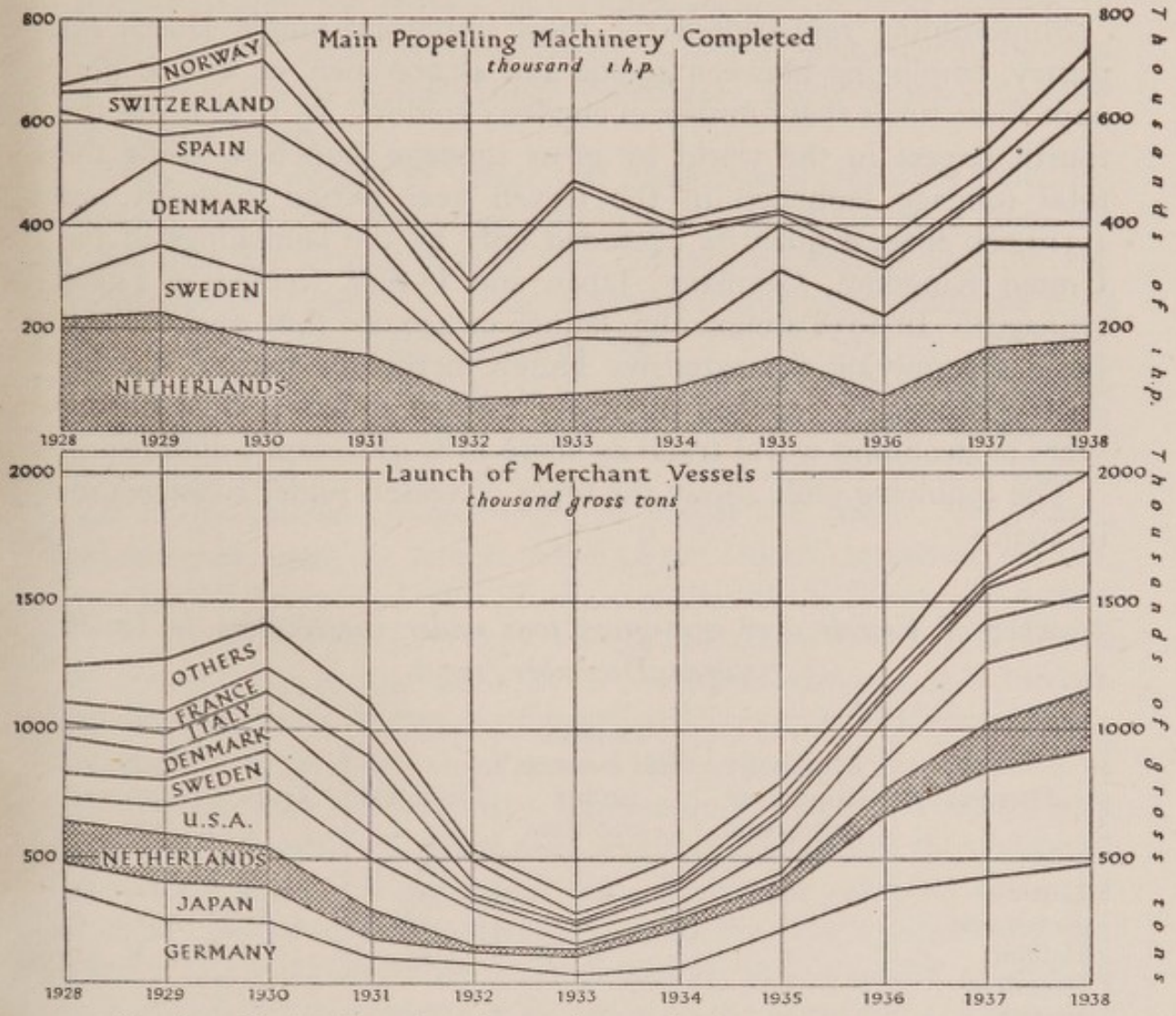

Fig. 85. Production of marine engines and of merchant vessels, 1928–38

Data from : *The Glasgow Herald Trade Review*, 1928–38.

The upper graph illustrates the output of the minor producers of propelling machinery, i.e., excluding Great Britain, U.S.A., France, Germany, Italy and Japan. The lower graph indicates the output of all the builders of merchant vessels, except Great Britain. See also Fig. 95.

Europe. Opened in 1929, the Arnhem smelter had an annual capacity of 30,000 tons of metal, and produced in 1938 26,000 tons. It was fitted to treat both pure tinstones from the Netherlands East Indies and the more complex Bolivian tin concentrates. The greater part of the production was exported.

Aluminium. Imports of a few hundred tons of ingot aluminium

were worked up into sheet form at Rotterdam and Dieren. Shortly before the outbreak of war, a new rolling mill and pressworks was erected at Utrecht.

Shipbuilding and Ship-repairing (*Figs.* 85, 86)

Shipbuilding represented the most important single Dutch industry, employing between 40,000 and 45,000 men, as well as perhaps three times that number in ancillary trades. In 1938 it was the fourth largest in the world by gross tonnage launched, while the total tonnage launched in the eleven year period 1928–38 was 1,310,000 tons, a quantity exceeded only by the launchings of the United Kingdom, Germany, Japan and U.S.A. (including Lakes tonnage). In 1938 a maximum launch of 240,000 tons was reached. Besides supplying the extensive Dutch mercantile marine, the industry is usually engaged on many foreign orders ; thus during years of declining world trade its share in world output diminishes.

The following table shows the types of vessels under construction in 1938 :

Number of Vessels over 100 *gross tons under construction in Dutch yards, December*, 1938

Owners	Merchant ships over 1,000 tons	Tankers and coasters under 1,000 tons	Dredgers	Tugs	Barges, Hoppers, etc.
Dutch	29	60	1	4	11
Argentine		1	1		1
Belgian	1	1	1		3
Brazilian	1	1			
British	3	32			
Egyptian					1
French	1	1		1	
German		1			
Norwegian		2			
Portuguese				1	1
Russian			7	3	
Swedish					1
Swiss		1			

Miscellaneous craft comprised an auxiliary schooner, a minelayer, a pontoon rock-breaker, a tin dredger and two trawlers (Dutch) ; a crane pontoon (British) ; a floating crane (French) ; a motor schooner (Portuguese) ; and the two submarines *Sep* and *Orzel* (Polish Government).

From : *The Glasgow Herald Trade Review*, 29 December 1938.

The largest vessel for Dutch owners was the passenger liner *Oranje*, 20,000 tons gross, designed to be one of the fastest motor vessels in the world ; the largest vessels for British owners was the *Denbighshire*, 9,100 tons gross. A prominent feature of the tonnage under construction was the great number of motor coasters—nearly ninety—mainly for British and Dutch owners, a type of vessel in which Dutch yards have specialized. Another characteristic of the industry is shown by the variety of dredgers, tugs, cranes, etc., built on foreign order.

Over thirty vessels of under 100 gross tons were being built, including yachts, coasters, tugs and barges. It will be seen from the table that the Dutch output was not appreciably swollen by the construction of barges ; in recent years relatively few additions have been made to the inland waterway fleet.

The greatest concentration of shipyards is along the rivers between Schiedam and Dordrecht, where there are twenty-two important yards and nearly twenty small yards. The largest yard is that of the *Rotterdamsche Droogdokmij.*, in which the *Nieuw Amsterdam*, 36,000 gross tons, the largest vessel in the Dutch mercantile marine, was built. Associated with this yard is that of the *Nieuwe Waterweg Scheepsbouw Mij.* at Schiedam, which built cargo vessels. A second important yard is that of the *N. V. Wilton-Feijenoord* at Schiedam which undertakes all classes of work. Other yards with considerable outputs of fairly large ships were *P. Smit Jr.* (*and Burgherhout*) of Rotterdam, *Van der Giessen* at Krimpen a/d Yssel, and *Werf Gusto v.h. A. F. Smulders* at Schiedam, which specialized in the construction of dredgers, floating cranes, etc. Five other yards lay along the Lek and Noord below Dordrecht ; two on the Waal at Sliedrecht and Neder Hardinxveld ; three yards building vessels under 1,000 tons are situated farther inland, at Heusden on the Maas and at Deest and Millingen near Nymegen (Plate 33).

Amsterdam. A number of yards at Amsterdam make it the second most important centre, and the *Nederlandsche Scheepsbouw Mij.* there, building vessels up to 20,000 tons gross, has the largest output of any single yard in the Netherlands. The yards of *Nederlandsche Dok Mij.* and *Verschure* also build ships of several thousand tons. There are two smaller yards at Haarlem.

There are two other important centres of the industry. The *Kon. Mij. de Schelde* at Flushing builds merchant vessels up to 15,000 gross tons, as well as warships. In the extreme north-east around Groningen there are fourteen yards engaged solely in the

construction of motor coasters, about 350 tons deadweight, and barges. Several yards lie at Delfzijl and Groningen, but the majority lie some miles east of Groningen on the Winschoter Canal.

In recent years no constructional work has been undertaken at the government dockyard at Den Helder.

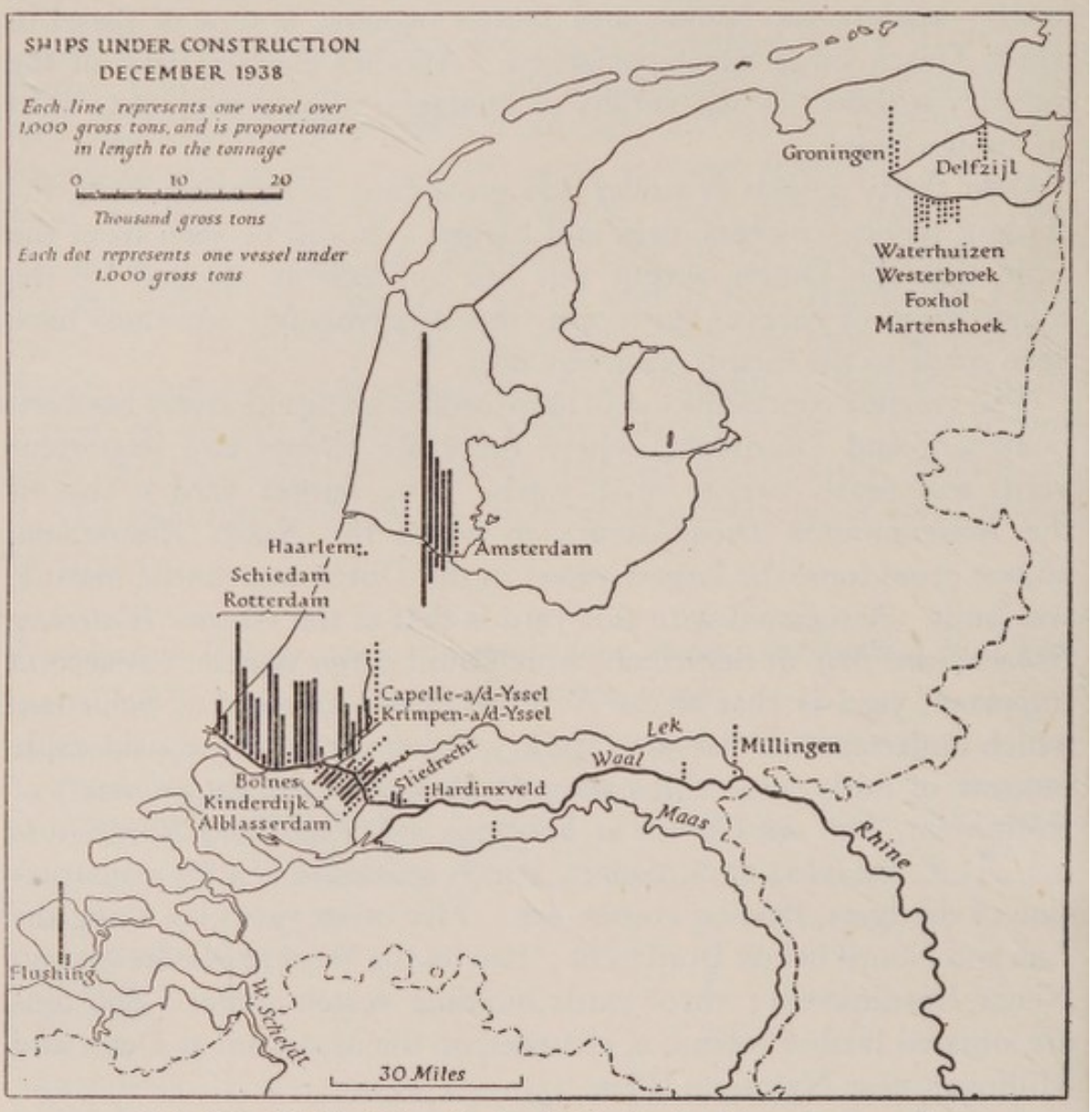

Fig. 86. Shipbuilding in the Netherlands, December, 1938

Data from : *The Glasgow Herald Trade Review*, 1938.
At this date the largest vessel under construction was the 20,000 gross ton motor liner *Oranje*—at Amsterdam. See also Fig. 95.

Ship-repairing. The repairing industry has attained a considerable importance in the Netherlands, and depends mainly upon patent slips and floating docks. Patent slips number seventeen, and were used mostly for the repair of barges and small ships, although on the largest slips vessels of 4,000 tons could be hauled up. There are twenty-five floating docks in the Rotterdam and Amsterdam

areas, the largest, which was operated by the *Wilton Feijenoord* company at Schiedam, had a lifting capacity of 46,000 tons. There are only five drydocks of any size, three at Amsterdam and two at Flushing, apart from two at the Den Helder naval base. The total capacity of floating docks, drydocks and patent slips at any one time is estimated at 350,000 tons of shipping, from 200 to 46,000 tons. In recent years 2½ to 3 million tons of shipping annually have undergone repair in the Netherlands.

For details of shipyards and engine works, see Chapter XVI.

Marine Engineering

The development of marine engineering was a natural corollary of the progress of the shipbuilding industry. In power of completed engines the industry is, of course, behind countries like the United Kingdom, U.S.A., Japan, Italy, Germany and France, which maintain powerful navies and operate many fast liners. A considerable number of foreign orders are executed, and the Dutch marine engineers normally build more engines for abroad than are constructed abroad for Dutch-built ships.

The Netherlands is, in fact, the most important of the smaller European producers of marine engines; its output of complete engines amounted to over 1,500,000 i.h.p. during the eleven year period 1928–38, and exceeded that of Sweden, Denmark, Norway, Belgium, Switzerland or Spain. All types of engine are produced—reciprocating, turbine and diesel—although diesel-engine production is most widespread and most widely known (Plate 34).

The output between 1928 and 1938 was equally divided between the engine shops of shipbuilding yards and marine engineers not building ships. Over two-thirds of the total output was accounted for by five firms.

1928–38, *i.h.p. of completed engines, in thousands*

	Total	Total as % of national output	Largest output in one year
Marine Engineers			
Nederlandsche Werkspoor, Amsterdam	339	22	92
Kromhout Motorenfabriek, Amsterdam	193	13	28
Stork Bros., Hengelo	147	9	38
Shipbuilders			
Wilton Feijenoord, Schiedam	194	13	84
Kon. Mij. de Schelde, Flushing	173	11	53

From: *The Glasgow Herald Trade Review*, 1928. . . . 1938.

Other important engine builders are the *Bolnes* works, at Bolnes near Rotterdam, the *Deutz* works at Rotterdam, the *Brons* works at Appingedam near Groningen, and the shipyard *P. Smit*. Generally speaking the shipyard works build all types of propelling machinery, the *K. M. de Schelde* works specializing in turbines, while the marine engineering companies build diesel-engines, although the *Werkspoor* plant also constructs turbines and boilers.

Machinery

The Netherlands specialized in the construction of machinery for her own industries and for those of her colonies, e.g. sugar mill equipment, oil well machinery, tin dredges, margarine and refrigerating machinery. Other specialized products were closely connected with the public works contracting industry which depends mainly upon the maintenance and improvement of the waterways and ports of the country. Specialized construction equipment such as dredgers, pontoons, pumps, caissons and cranes are necessary for the undertaking of such works, and the works themselves such as locks, bridges, and reinforced concrete construction call for special designs for each case. Dutch engineering skill is aided by the scientific work of such institutions as the Technical High School, Delft. The leading firms engaged in hydraulic engineering have their headquarters at Rotterdam, Schiedam, Sliedrecht, Amsterdam, Beverwijk and Haarlem. Contracts for port undertakings and river regulation works have been carried out in Latin America, Japan, China and Siam, as well as in the Dutch colonies.

Other engineering and metal industries

For a great part of her consumption of metal goods, machine tools, and engineering products the Netherlands relied mainly upon imports. Heavy electrical equipment and railway locomotives were produced only on a small scale, for example, and there was no manufacture of aero- or motor car engines. Nevertheless some branches of the metal industries were well advanced. The industry as a whole, excluding blast furnaces, foundries, refineries and shipyards, but including marine engineering, employed over 150,000 people.

Electrical and Wireless Equipment. In 1939 the Netherlands was the fourth largest exporter of these manufactures in the world. The

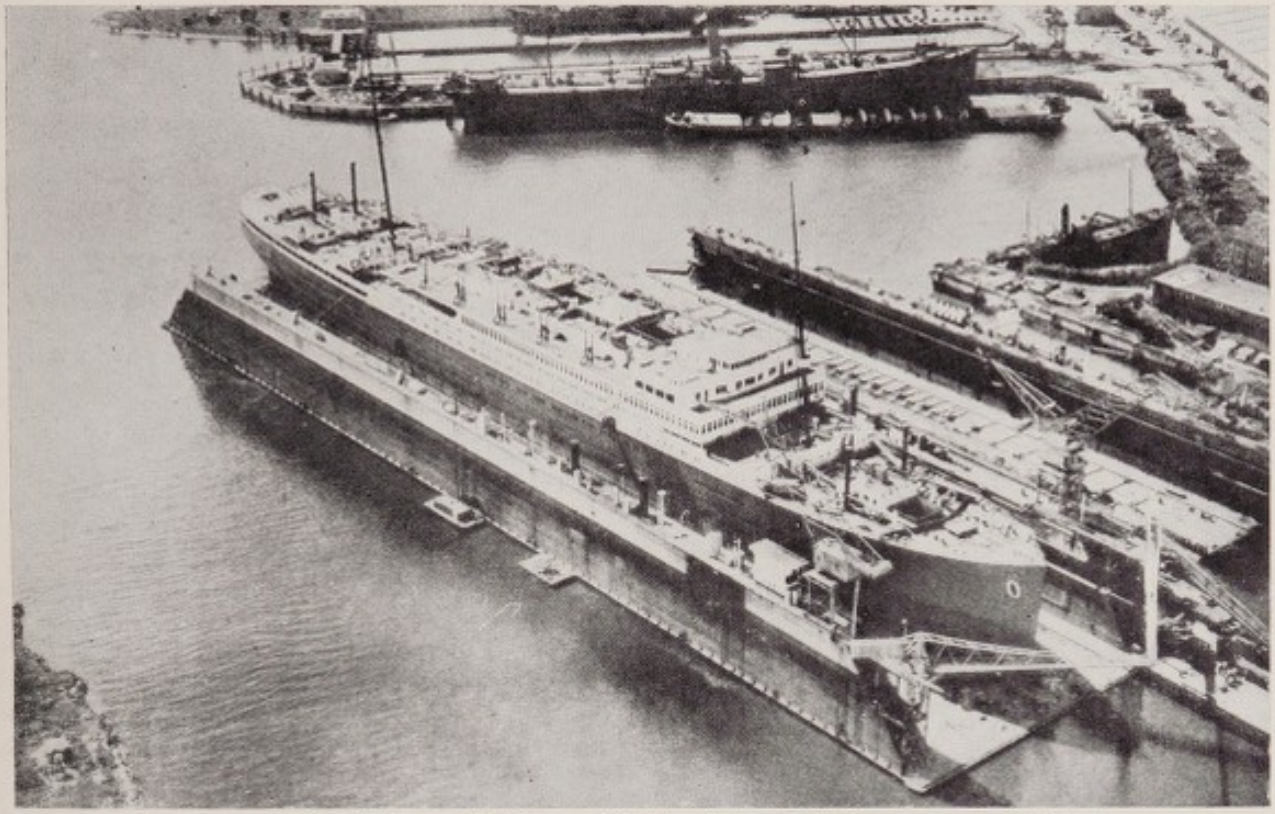

Plate 33. The Wilton-Feijenoord West Yard, Wiltonhaven, Schiedam

The liner in the floating dock is the *Statendam*, 28,000 tons gross (*Nederlandsch-Amerikaansche Stoomvaart Mij.*). Launched and engined by Harland and Wolff, the vessel was completed by Wiltons in 1929.

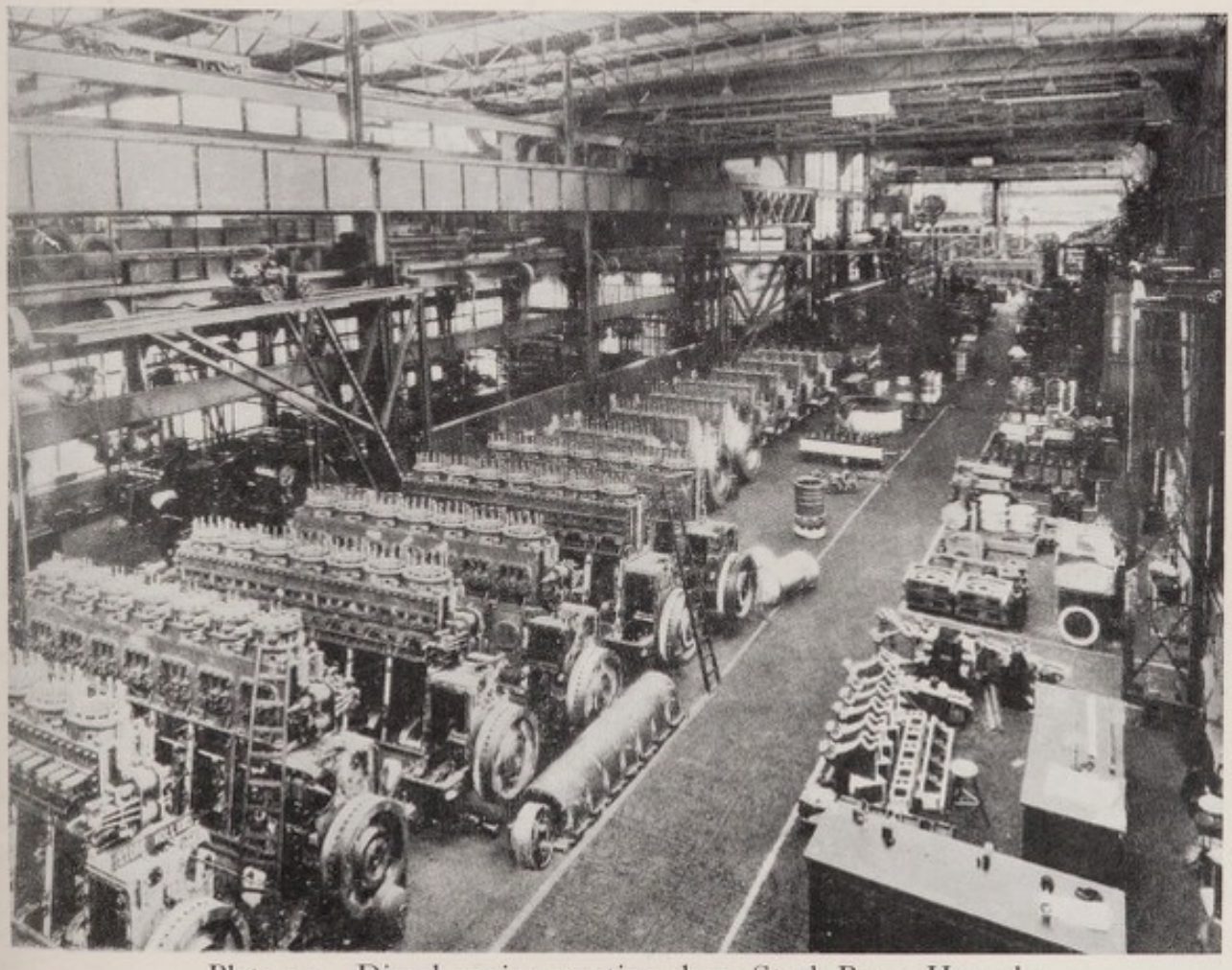

Plate 34. Diesel-engine erecting shop, Stork Bros., Hengelo

This company specializes in marine and locomotive diesel-engine construction, for which it has a world-wide reputation. Branches at Helmond and Bergen-op-Zoom manufacture steam turbines and pumps.

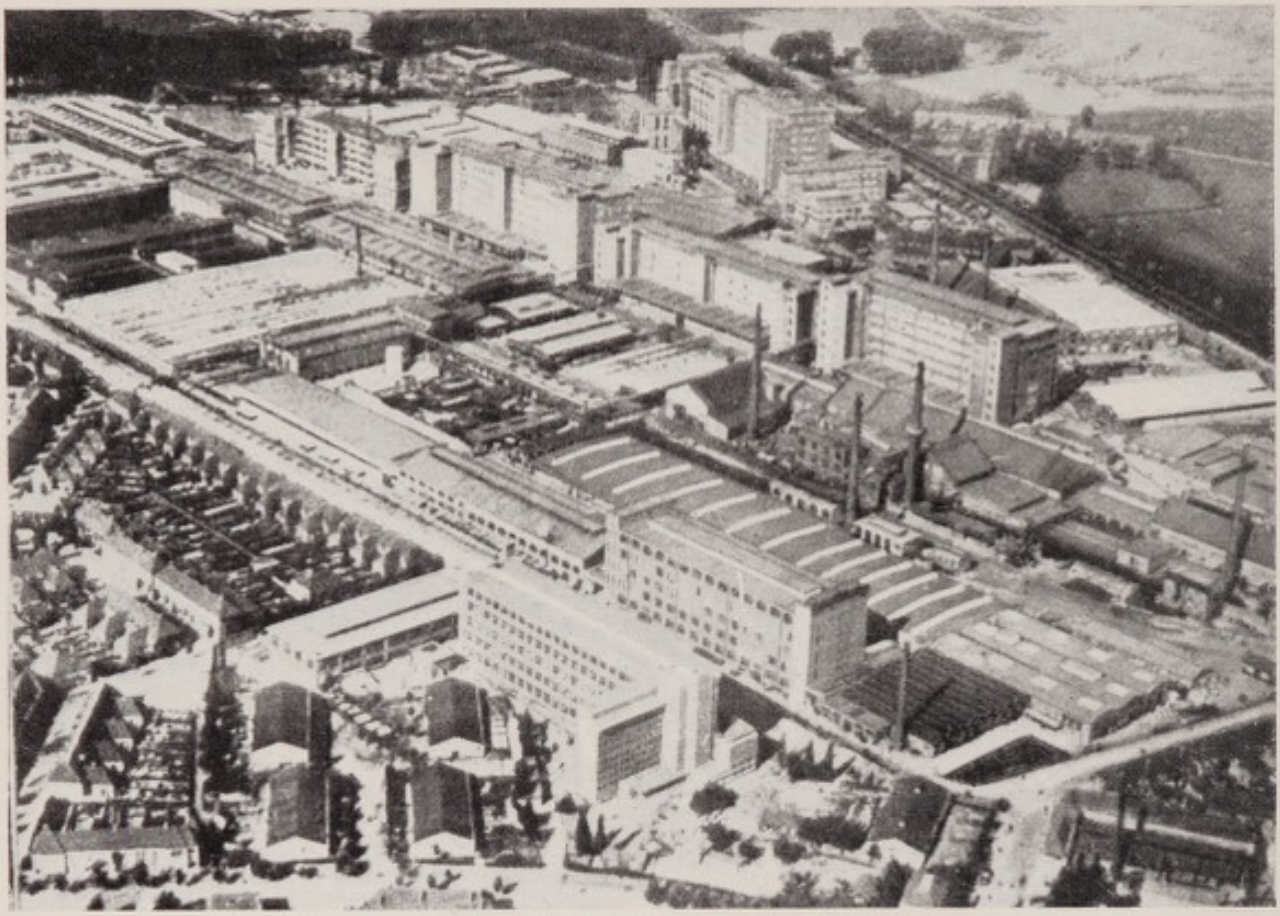

Plate 35. Part of the Philips works, Eindhoven

This is one of the largest factories in the world for the production of lamps, valves and specialized electrical and radio equipment.



Plate 36. Van Gelder's paper mills, Ymuiden

This plant, opened in 1895, is now the largest in the Netherlands, and produces newsprint as well as sulphite and mechanical pulp and cellulose. A 400 ft. length of quay has a depth of 31 ft. alongside and is equipped with 4 electric travelling cranes.

Philips Gloeilampenfabrieken at Eindhoven was outstanding in Europe ; employing up to 20,000 people, these works had an output of lamp bulbs and radio valves which was among the largest in the world, and produced X-ray and wireless apparatus as well. An important factory at Nymegen produced 10% of the European output of tungsten wire. Factories for the manufacture of cables were situated at Delft, Alblasserdam, Amsterdam and Haaksbergen. A number of factories, of which the largest was at Nymegen, produced generators, motors, transformers, switchgear and railway equipment, but the total production of electrical equipment was sufficient for only part of the national requirements (Plate 35).

Railway Rolling Stock. The *N. V. Nederlandsche Werkspoor*, with a probable capacity of about fifty a year, was the only firm building steam locomotives. Wagons and coaches were produced, however, on a scale sufficient to provide an export to the colonies ; the two leading firms were *Werkspoor*, at Amsterdam and Zuilen (Utrecht), and *Beijnes* at Haarlem.

Motor Vehicles and Bicycles. The *Kromhout Motorenfabriek* of Amsterdam, constructors of marine engines, produced a small number of commercial vehicles. A Ford plant at Hembrug on the North Sea Canal assembled vehicles from components imported mainly from the Ford works at Antwerp. Most of the cars and lorries in use were imported. Although there were thirty firms making bicycles, there was also a considerable import.

Aircraft. Since 1930 the aircraft industry has expanded, engines and many components being imported. The *Fokker* works at Amsterdam were by far the largest, and produced large commercial aircraft and military sea-planes. *Aviolanda* at Papendrecht made Dornier flying boats from imported German components, while *Koolhoven*, near Rotterdam, produced aircraft of various types.

Armaments. The Dutch armament industry was insignificant. The State arsenal at Hembrug employed 600 people in the production of smaller calibre guns. A few of the larger engineering works, such as *Wilton Feijenoord* and *Werkspoor*, sometimes produced artillery.

The Textile and other Industries

The textile industry employed 82,000 people in 1939—40,000 in cotton and linen manufacture, 12,000 in woollen manufacture, 18,000 in the manufacture of lace, artificial silk and carpets ; others were employed in the jute, coir, hemp and rope industries. Output

met most home requirements and allowed a 25% margin for export, chiefly of cotton goods to the N.E.I.

Cotton

The most important textile industry was the cotton manufacture. There were 21 spinning mills and 78 weaving mills, with 1,266,000 spindles and 50,700 looms ; many of these mills had their own bleaching and dyeing sections. A considerable quantity of yarn was imported. The industry is concentrated in the Twente district of Overyssel, where there are 17 large mills of which 7 are spinning mills, 5 are weaving and 5 are ' mixed '. In general, the Dutch cotton industry, more than in some countries, is organized on a basis of combined mills. A secondary cotton manufacturing centre lies in North Brabant, where there are 4 large mills.

Wool

The woollen industry is established mainly in North Brabant, Helmond being the chief centre, with Tilburg second in importance. High quality products are manufactured at Leiden, and other factories are found in the Twente district. In 1937 there were 96 woollen mills with 5,758 looms and 250,000 spindles.

Linen

From a home production of flax fibre factories in North Brabant at Tilburg, Steenbergen, Zevenbergen, Hooge and Lage Zwaluwe, and Goirle manufacture linen fabrics.

Other Textiles and Clothing

Rayon and Staple Fibre. The rayon industry was active ; it had an annual capacity of 14,000 tons and an output of about 10,000 tons, which permitted a net export of 5–6,000 tons. There were three important factories—at Arnhem, Ede, and Breda—and a fourth at Nymegen.

The staple fibre industry was little developed.

Lace, Carpets and Clothing. In 1937 the manufacture of lace occupied 8,000 workers, and was scattered among many small factories ; the carpet industry employed 2,500 workers. The ready-made clothing industry employed over 15,000 workers ; the large towns were the main centres. The Netherlands was handicapped

in some of the more expensive grades, for it is not a centre of origin of fashions. There was a considerable import of clothing.

Miscellaneous industries

Leather and Footwear. The home production of leather amounted to about 16,500 tons, from over 100 tanneries scattered all over the country, but lying chiefly in North Brabant. Most leather was consumed by footwear factories, of which, in 1935, there were over 200 with an annual capacity exceeding 5,000 pairs each, while the entire output amounted to 15 million pairs. In recent years the home manufacture has succeeded in supplying almost the entire home market. The numbers of workers was 13,000 in 1935. Production was centred in North Brabant at Waalwijk, Loon-op-Zand, Dongen, Tilburg, Oisterwijk and Eindhoven, while there was a Bata factory at Best. The chief centre outside this province was Nymegen.

Timber, Paper, Pulp. The timber trade was concentrated at Amsterdam, Zaandam, Dordrecht, Rotterdam, The Hague, Haarlem, and Utrecht. The home production of pulp amounted to 43,000 tons (chemical) and 65,000 tons (mechanical); it was supplemented by imports of 86,000 tons and 20,000 tons respectively. The principal pulp and paper mills are situated at Velsen, Apeldoorn, Renkum and Wormerveer (North Holland). A mill at Maastricht specialized in thin and opaque printing paper. There were twenty-eight smaller mills, mainly situated near the eastern frontier within thirty or forty miles of Nymegen. An important export industry was the manufacture of strawboard in Groningen and Drenthe from cereal straw, with peat as a fuel. There were nine co-operative and ten private strawboard mills.

With a production averaging 234,000 tons of paper during 1934–7 and 250,000 tons of board (including strawboard), the Netherlands was the seventh largest producer of paper and board in Europe.

Rubber. The rubber industry is not greatly developed, and employed about 2,000 people. The three largest factories are near Arnhem, at Doetinchem (Gelderland) and at Loosduinen near The Hague; they produce mainly cycle tyres.

Tobacco. The tobacco industry employed 30,000 workers in 2,250 factories. The principal feature of the industry was cigar manufacture, which produced an export surplus; there was some import of cigarettes. Factories are widely scattered; cigar manufacture is carried on especially in the 'Meierij' of North Brabant,

i.e. near Eindhoven and 's Hertogenbosch, and in North and South Holland provinces. Cigarette factories are found chiefly in Amsterdam and Rotterdam.

The Diamond Industry. The long established diamond cutting and polishing industry was already losing ground to the Belgian industry early in this century. During the war of 1914–18 almost all the Antwerp workers moved to Amsterdam, and for a short time the Dutch industry was very prosperous. In 1919 there were 11,000 people employed, but in 1923 only 5,000, and over the years 1932–9 the average number was 3,000, compared with 15,000 in Antwerp. The industry suffered greatly during the depression of 1930–4, while a rival industry established in South Africa competed more with Amsterdam than with Antwerp.

Food Industries

Large numbers of the occupied population are engaged in the preparation of foodstuffs in the towns, as in other countries, mostly in small establishments, although in the cities there are large bakeries, confectionery factories, packing plants, etc. Other food industries, however, are more restricted in their location.

Sugar manufacture and refining. This industry employed more than 11,000 people in 1939. Twelve factories produced sugar from sugar beet, taking the whole of the Dutch crop. Six of these were run by co-operatives, and all twelve produced 233,000 tons of raw sugar annually, meeting three-quarters of the home demand. These factories were situated mainly in Drenthe and Overyssel.

Milk products. This industry, including the manufacture of butter, employed 14,000 people. Condensed and dried milk factories were situated chiefly in Friesland, and produced largely for export. Butter production averaged 100,000 tons annually, and was made mostly by machine in modern dairy plants; the cheese output, amounting to 125,000 tons, was still made on farms to a substantial extent.

Vegetable Oils. Oilseeds and crude vegetable oils were imported for refining and export; fifty-three refineries employed 5,000 people. The margarine industry employed 3,000 people in fifteen factories. Margarine was formerly largely exported but in recent years has supplied mainly the home market. The industry was widespread, but the most important factories were the *Unilever* works in the Rotterdam district.

Other food industries. Cocoa and chocolate factories employed

7,000 people in Amsterdam and Rotterdam. Rice polishing mills were concentrated around Zaandam. Flour mills employed 7,000 people; potato-flour (farina) was manufactured in twenty-four factories, mostly in Groningen and Drenthe, the bulk of the output of 140,000 tons being exported. The brewing and distilling industry employed 7,000 people and export slaughter houses 4,500.

Capital Combinations in Dutch Industry

A remarkable feature of the industrial development of the Netherlands in the past few decades has been the emergence of powerful groups with considerable capital resources. These 'combines' have, furthermore, acquired considerable interests in related industries abroad, and have participated in a number of international cartels. These and other industries have also developed the machinery of joint sales organizations, control of raw material supplies, and interlocking financial interests which have everywhere become a common feature of twentieth century industrial methods.

The match, glue, tube and linoleum industries are well organized and are related to foreign interests, but the most interesting examples of this tendency are the sugar, electrical, aircraft, margarine, artificial silk and petroleum industries.

Centrale Suiker-Mij. This organization controls almost the entire output of sugar in the Netherlands and operates the refineries which handle the Dutch production of sugar beet. A few years ago it acquired considerable capital holdings in the English beet sugar industry.

Gloeilampenfabrieken Philips. The factories of this consortium or trust employ 20,000 people in the Netherlands and 15,000 in foreign countries. In order to surmount tariff walls factories have been established in Poland, Belgium, Sweden, Spain and England. In the past considerable rivalry existed between the group and German-American electrical interests, but the Dutch interests had the benefit of sound banking support and eventually agreements relating to markets, etc., were achieved. A cartel was arranged between the Philips, Osram (Siemens-A.E.G.) and General Electric companies, together with lamp manufacturers in France, Hungary, Austria, and Switzerland.

Aircraft. The *Fokker* aircraft works, long famous for its technical achievements, has interests in the United States. In 1929 capital subscriptions were opened for the *Fokker Aircraft Company*, backed

by *General Motors*, founded by the Dutch company for the construction of aircraft within the U.S.A.

Margarine, etc. In 1927 occurred the amalgamation of the two leading producers of margarine and allied products—*A. Jurgens V. Fab.*, which held the entire capital of *Jurgens Co., Ltd.*, of London, and *Van den Berghs Fab.*, with interests in the Netherlands and continental countries. The resulting combination, *Margarine-Unie*, was joined in 1929 by the Swedish Paensson group, which operated the chief oil and soap factories in the Balkans, and then united with *Lever Bros.* and the American company of *Proctor Gamble & Co.* to form *Unilever*, an organization holding almost a monopoly of margarine manufacture and possessing world wide ramifications.

Artificial silk. A Dutch company producing artificial silk with a principal factory at Arnhem, and operating others in Belgium, amalgamated first with a manufacturer owning a factory at Breda, and later with German producers. The resulting combination, *Algemeene Kunstzijde Unie* (A.K.U.) possessed other factories in continental countries and in England, U.S.A. and Japan. In 1939 it entered into cartel agreements with other producers in Germany, Italy and Switzerland.

Royal Dutch-Shell Group. The Royal Dutch Company was formed in 1890 to exploit petroleum in the N.E.I. Some years before, the Samuels in England had started a trading business in the Far East, dealing especially in Russian kerosene, which in 1897 led to the formation of the *Shell Transport and Trading Co., Ltd.* Both businesses developed rapidly, especially in oil transportation and storage, and in 1902 formed a joint marketing organization, the *Asiatic Petroleum Co., Ltd.* In 1907, with the formation of the *Anglo-Saxon Petroleum Co.* and the *Bataafsche Petroleum Mij.*, came the complete amalgamation of the interests of the two groups, ownership being 60% Royal Dutch and 40% Shell. Production was taken up in most important fields throughout the world, while large interests were acquired in the Mexican Eagle group. In 1924 the group, equally with the *Anglo-Persian Oil Company*, the *Standard group* and the *Compagnie Française des Pétroles*, acquired 23¾% of the share capital of the Iraq Petroleum Company in order to work the fields of northern Iraq.

The group now engages in the production and marketing of practically all petroleum products and operates about thirty refineries. In 1938 it owned or chartered 280 tankers, aggregating 2¼ million deadweight tons, together with over 1,000 small vessels. In 1937

production of crude amounted to 31½ million tons, derived mainly from Venezuela, U.S.A., N.E.I., Mexico and Romania. The head offices of the group are situated in London and at The Hague, the former being concerned generally with shipping and transportation, and the latter with technical matters.

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CHAPTER XIV

COMMERCE AND FINANCE

Transit Trade : Foreign Trade : Commercial Policy : Finance : General Economic Situation : Bibliographical Note

The Netherlands plays an active, and in some ways unique, part in European trade. The value of trade per head of population is the fourth highest in any country in Europe.

Per capita value of Imports and Exports Together (1937) (*in old U.S.A. gold dollars*)

Belgium-Luxembourg	122	Netherlands	102	Finland	66
Denmark	112	Sweden	99	Germany	40
Norway	106	United Kingdom	91	France	37

From : *Statistical Yearbook of the League of Nations*, 1938–9, p. 219 (Geneva, 1939).

In the same year, only the United Kingdom, Germany, France and Belgium had a greater value of combined imports and exports. Such figures, however, conceal the fact that a great part of the Netherlands commercial activity is devoted to the transit trade (*doorvoer*), which in quantity exceeds the foreign trade (*invoer* and *uitvoer*).

Transit Trade

Although most European countries are used, to some extent, by their neighbours as channels for the passage of goods, none can claim parity with the Netherlands in the remarkable importance of its transit trade. The most significant factor determining the growth of this trade is the strategic geographical position which the country holds astride the mouths of the Rhine, Maas and Scheldt. Two-fifths of the tonnage of the boats using the Dutch rivers and canals in 1937 were engaged with transit goods. Almost three-quarters of the trade is done by transhipment in Dutch ports from ship to barge or rail wagon and vice versa, but a significant proportion passes through the waterways without such transhipment.

Transit Trade, 1938

(in thousands of metric tons)

	With transhipment		Without transhipment	
	Incoming	Outgoing	Incoming	Outgoing
By sea	20,849·7	17,050·5	665·0	782·3
By river and canal				
Belgian frontier :				
Eastern route	12·3	19·1	462·0	898·6
Western route	96·6	337·1	4,768·0	5,878·2
German frontier	15,627·5	19,215·6	7,493·2	5,829·0
By rail				
Belgian frontier	56·8	137·4	2·8	3·9
German frontier	155·7	28·1	3·4	2·4
By road				
Belgian frontier	1·1	8·6	5·4	0·9
German frontier	1·7	5·2	1·0	5·5
By air				
German frontier	0·2	(0·02)	—	—
Totals	36,801·6	36,801·6	13,400·8	13,400·8

Adapted from *In,- Uit-, En Doorvoer*, pp. 412–418 ('s Gravenhage, 1939), and *Jaarcijfers voor Nederland*, p. 302 ('s Gravenhage, 1939)

The total volume of the transit trade amounted to 50,202,400 tons, while in the same year the total volume of direct imports and exports together, i.e. the foreign trade, amounted to 37,208,300 tons (Figs. 87, 88).

Quite two-thirds of the transit trade is waterborne between the German frontier and the Dutch ports of Rotterdam and the other ports of the New Waterway, together with Amsterdam. A substantial movement takes place without transhipment by way of the western (Scheldt) route between Germany and Belgium. This western route to Belgium is much more important than the eastern route via the Juliana, Maastricht-Liége and Zuid-Willems Canals. In comparison with waterborne traffic, movements by rail, road and air are unimportant.

Incoming commodities comprise raw materials and foodstuffs destined for the industrial areas of the Rhineland, Switzerland and to a lesser extent, Czechoslovakia, Italy and S.E. Europe. Cereals, ores, timber, oilseeds and nuts, tobacco, and—coming particularly from Dutch overseas possessions—tin, rubber, copra, petroleum and petroleum products and coffee, were all supplied to the continent in this way. From the inland countries, largely by way of the Rhine, came manufactures of all kinds along with coal, coke and fertilizers, to be sent through the Dutch ports to all parts of the world. Coal

is of particular importance in the Rhine traffic, some 12 million tons being despatched by way of Rotterdam in 1937, in addition to the fact that it is the dominant commodity in the trade between Belgium and Germany.

The transit trade represented an income to the Netherlands of

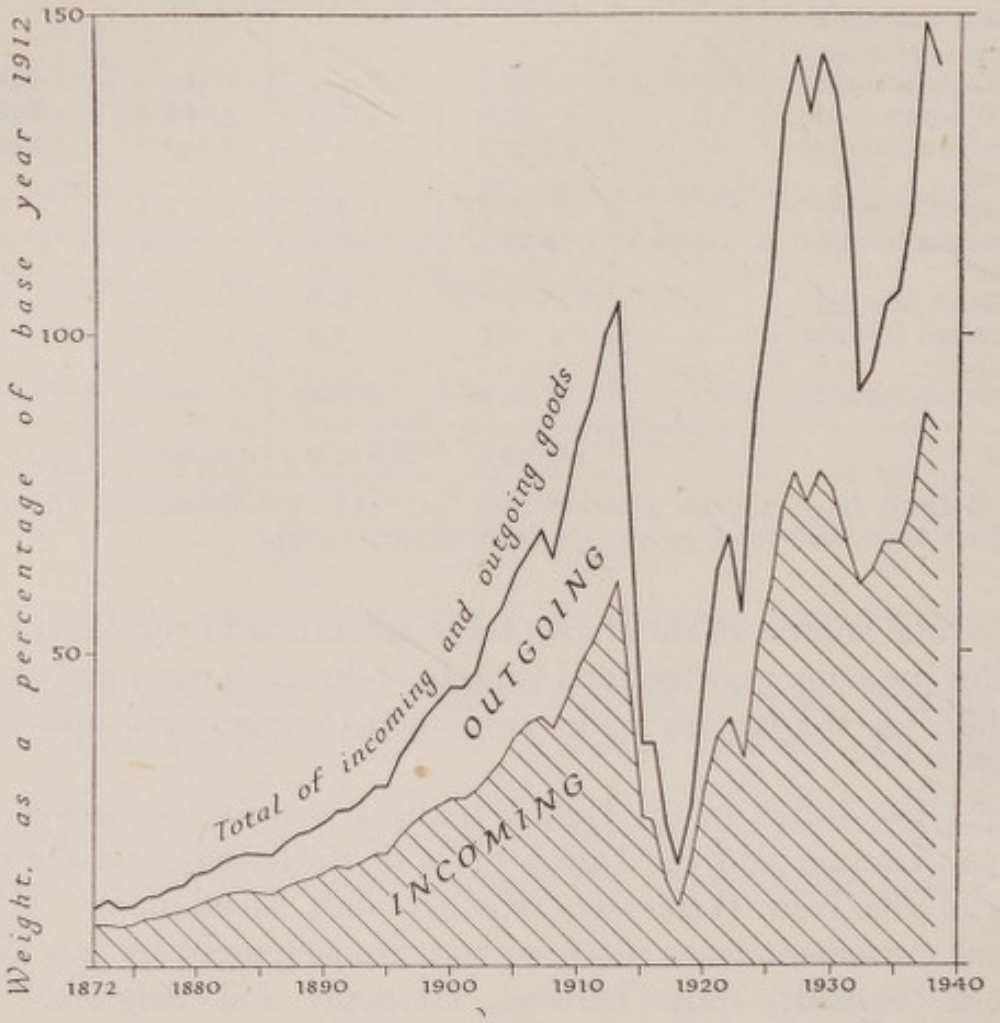


Fig. 87. Movement of goods across the Netherlands frontiers, 1872–1938, as a percentage of the movement of goods in 1912

Data from : *In-, Uit-, en Doorvoer*, 1938, p. xxxi ('s Gravenhage, 1939).

The figures include transit trade as well as Dutch foreign trade. The effects of the war of 1914–18 and of the world economic depression of 1929–36 are clear enugoh. Incoming goods are greater in amount than outgoing goods : while the transit trade is equal in each direction, the foreign trade of the Netherlands is characterized by a considerable inward excess.

between 4 and 5% of the credits in her balance of payments, but it was very dependent on the commercial policies of the participating countries. French and German desires to develop their own ports resulted in differential rail tariffs, which, when coupled with the keen rivalry of Belgium, tended to create difficulties and instability.

Foreign Trade

The foreign trade of the Netherlands, like that of the United Kingdom, was nourished by maritime traditions and firmly consolidated by colonial development. The later nineteenth century brought two fresh trends ; first came agricultural specialization, and later came the establishment of modern industries partly based on imported coal but with a progressive development of domestic resources.

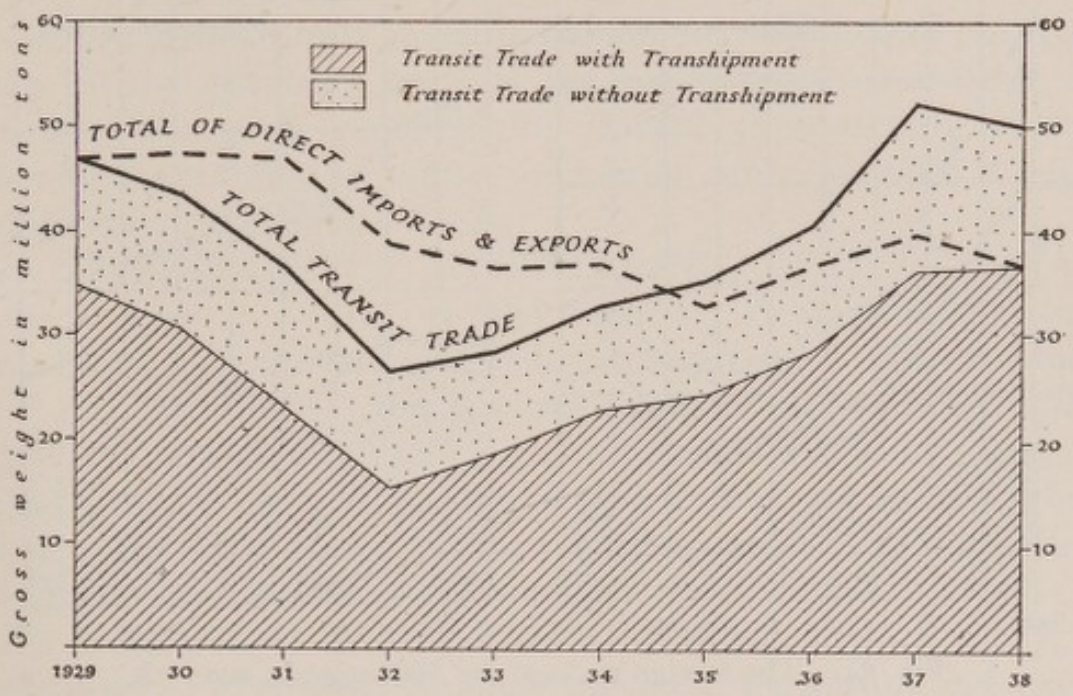


Fig. 88. Transit trade through the Netherlands, 1929–38

From : *Market Letter No.* 83, Continentale Handelsbank (Amsterdam, 15 February, 1939).

Transit trade declined from 1929 to 1932 as part of the shrinkage of world trade, and then increased steadily until 1937, when it reached a higher level than it had attained in 1929, largely as a result of an intensive German trade drive. Since 1935 the volume of transit trade has exceeded the volume of Dutch imports and exports together. The graph shows that the volume of transit without transhipment, e.g., cargoes between Belgium and Germany moving by barge over the Dutch waterways, has remained fairly constant ; fluctuation occurs to a much greater extent in the transit with transhipment, i.e., break of bulk.

Consequently foreign trade became of vital importance to the economic health of the nation—the need of overseas markets for the agricultural surplus and the manufactured goods was offset by demands for raw materials and the specialized manufactures of other countries. In 1935, 5·5% of European imports from, and 5% of exports to, the rest of the world were the portion of the Netherlands.

Balance of Trade and Balance of Payments

There is a consistent import surplus (Fig. 89) indicating a ' visible ' adverse balance of trade. This is typical of countries like

the Netherlands and the United Kingdom, where maritime activity and foreign and colonial investment play such an important part in economic life. Indeed, it is by means of the revenue derived from shipping and kindred services and by the returns on capital invested abroad, which together constitute the ' invisible ' exports, that the balance of payments is approximately achieved.

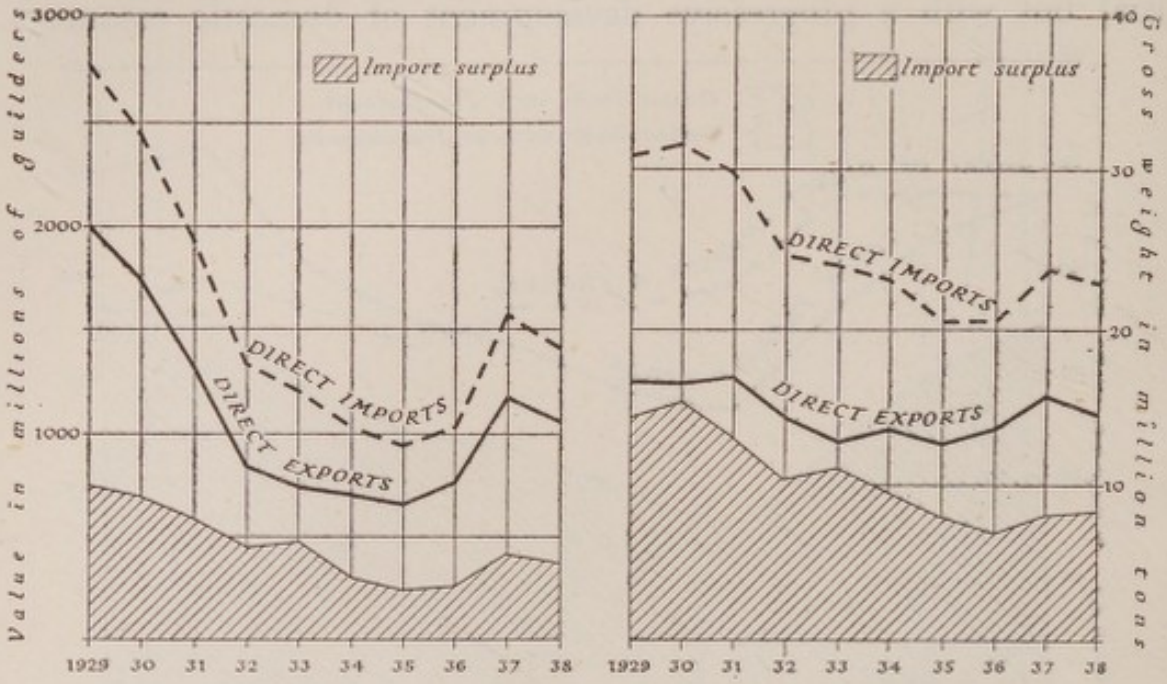


Fig. 89. The foreign trade of the Netherlands, 1929–38

From : *Market Letter No.* 83, Continentale Handelsbank (Amsterdam, 15 February, 1939).

During the depression years, 1929–36, the value of the foreign trade declined more than the weight. The subsequent recovery in both value and weight was only partial. The excess or surplus of imports over export is characteristic of Netherlands foreign trade.

The balance of payments for 1936–8 was as follows (in millions of guilders) :

	1936			1937			1938		
	Credit	Debit	Balance	Credit	Debit	Balance	Credit	Debit	Balance
Trade	796	1,072	−276	1,205	1,607	−402	711	979	−268
Interest	259	82	+177	309	127	+182	199	56	+143
Services	218	74	+144	319	84	+235	184	69	+115
Total	1,273	1,228	+ 45	1,833	1,818	+ 15	1,094	1,104	− 10
Gold	456	516	− 60	928	1,671	−743	748	504	+244
Capital	878	843	+ 35	1,621	1,392	+229	445	587	−142
			+ 20			−499			+ 92

From : *Jaarcijfers voor Nederland*, 1938, pp. 348–9 ('s Gravenhage, 1939)

Direct Imports

The needs of industry are met by the import of tropical raw materials and mineral ores. The Netherlands trade returns are

grouped according to the industry by which any specific commodity is produced. The six groups which are of major importance are detailed with their 1938 values in millions of guilders :

I. AGRICULTURE, FISHERY, STOCK BREEDING, ETC. Value *f.* 416m.; 28·76% of total imports. Principal commodities are : Seeds (*f.* 65m.), maize (*f.* 48m.), wheat (*f.* 41m.), hides and skins (*f.* 22m.), raw tobacco (*f.* 21m.), fruit (*f.* 19m.), cocoa beans (*f.* 18m.), coffee (*f.* 16m.), wool (*f.* 14m.). It should be noted that linseed and ground nuts amounted to about two-thirds of the seeds. Maize is the necessary basis of the pig, poultry, and starch industries. Wheat is required for human consumption in considerable quantities as home production only supplies a small proportion of the national needs.

II. METALLURGY, ENGINEERING, SHIPBUILDING. Value *f.* 371m. ; 26·29% of total imports. Principal commodities are : Iron, steel, and manufactures (*f.* 119m.), tools and machinery (*f.* 114m.), vehicles (*f.* 39m.), copper and manufactures (*f.* 19m.), instruments and apparatus (*f.* 14m.), ships and aeroplanes (*f.* 14m.). Germany is by far the greatest supplier of goods in this group. Much of the metal is essential for the production of the Netherlands own specialized industrial exports.

III. CHEMICAL INDUSTRIES. Value *f.* 137m. ; 9·68% of total imports. Principal commodities are : Petroleum and petroleum products (*f.* 40m.), fertilizers (*f.* 35m.), chemical products (*f.* 32m.). The bulk of the petroleum supplies come from Venezuela by way of the Netherlands West Indies, and from the U.S.A. Potash salts and basic slag from Germany comprise the chief fertilizers ; together with phosphates from French North Africa, they are processed in the Netherlands, and about one-half of the concentrated fertilizers are exported.

IV. MINING. Value *f.* 137m. ; 9·68% of total imports. Principal commodities are : Coal and briquettes (*f.* 52m.), ores, (excluding iron and manganese) (*f.* 51 m.). The production of the Netherlands coal mines would be sufficient to meet the needs of the home market, but since special types of coal are preferred for certain purposes, large quantities are imported from the neighbouring German coal districts, while Netherlands coal and coke are exported to Belgium and France. Tin ore (*f.* 43m.) was procured mainly from the Netherlands East Indies islands, Banka and Billiton, and from Bolivia. The Netherlands tin smelting industry has come into being since 1929, and in 1938 it dealt with approximately one-sixth

of the world production. Other ores include iron, chiefly from Sweden and North Africa ; manganese from the N.E.I., U.S.S.R. and South Africa ; unwashed pyrites from Spain ; and zinc largely from Belgium and Mexico.

V. TEXTILES. Value *f.* 87 m. ; 6·14% of total imports. Principal commodities are : Woollen fabrics (*f.* 25 m.), cotton yarns (*f.* 21m.), woollen yarns (*f.* 19m.), cotton fabrics (*f.* 16m.). In 1937, 68% of the Netherlands demand for cotton and linen yarns was covered by the home industries working in imported raw material.

VI. TIMBER. Value *f.* 70m. ; 4·94% of total imports. The bulk of this trade was in constructional timber, but about 10% consisted of pulp and 5% of plywood. Timber is the only large item among the Netherlands imports from the U.S.S.R. Finland is the most important source of supply.

Other imports in 1938 amounted to *f.* 197m.—14.51% of the total. Clothing (*f.* 28m.) and paper (*f.* 20m.) were the two most important constituents. Cement (*f.* 5·2m.), porcelain (*f.* 3·5m), glass (*f.* 7·1m), rubber (*f.* 8·6m), and leather (*f.* 5·2m), also deserve mention.

Direct Exports

The products of agriculture together with food manufactures represent the most important section of the exports, but specialized industrial manufactures and general goods for the colonies create other notable groups.

Four main groups accounted for about 80% of all exports ; they are detailed below with their principal components.

I. AGRICULTURE, FOOD MANUFACTURES, ETC. Value *f.* 491m., 49% of total exports. The chief commodities are : Milk and products (*f.* 45m.), vegetable oils (*f.* 45m.), butter (*f.* 44m.), eggs and egg products (*f.* 40m.), bulbs, flowers, etc. (*f.* 38m.), cheese (*f.* 29m.), fresh vegetables (*f.* 28m.), and bacon (*f.* 23m.). Milk, condensed or evaporated, was shipped all over the world, the chief customer being the United Kingdom. Cocoa-butter and linseed oil each accounted for about one-third of the vegetable oil exports, and ground nut oil for one-sixth. Sales of butter, bacon, and eggs increased steadily from 1936 to 1939, in each case the United Kingdom being the chief recipient.

II. METALLURGY, ETC. Value *f.* 225m., 22·5% of total exports. The principal commodities are : Radio apparatus (*f.* 45m.), ships, dredgers and aeroplanes (*f.* 43m.), tin in pigs (*f.* 42m.),

tools and machinery (*f.* 38m.), and iron and steel and manufactures (*f.* 34m.). The Netherlands specializes in the production of dredgers, a proportion of which formed the chief item of export to the U.S.S.R. Others are despatched to the N.E.I. to participate in the tin dredging enterprises. Exports of pig tin fell very considerably in 1939 as a result of Singapore tin smelters starting operations, which cut out the work previously done in Amsterdam.

III. CHEMICALS. Value *f.* 105m., 10·5% of total exports. Only two classes were of considerable significance, coke (*f.* 24·9m.) and fertilizers (*f.* 23·4m.). Of the latter, ammonium sulphate (*f.* 11·3m.) and superphosphate (*f.* 9·4m) account for the bulk of the trade. Among medicines, (*f.* 10·3m.) quinine salts have a place of special importance because their raw material, cinchona bark, is monopolized by the Dutch.

IV. TEXTILES. Value *f.* 77·8m., 7·8% of total exports. Cotton piece goods (*f.* 38·4m.) and rayon yarns (*f.* 13·3m) are the items of chief importance, the former being largely exported to the N.E.I.

Coal exports (*f.* 40m.) almost equalled the value of imported coal, whilst other exports include diamonds (*f.* 15·6m.), herrings (*f.* 7·6m.), electric light bulbs (*f.* 7·6m.)—products of three noted industries.

Unlike the neighbouring industrial countries of Germany, Belgium and the United Kingdom, the Netherlands is faced with the problem of marketing a large agricultural surplus. Heavy industry products and ores are a necessary part of her imports, and while her manufactures cover a very wide range of goods it is interesting to note that those which figure prominently in the export list tend to be of a specialized type, often protected by international patents.

Foreign Trade by Countries

The geographical distribution of the Netherlands foreign trade in 1938 was as follows :

Origin of chief Imports into the Netherlands, 1938
(values in millions of guilders)

Country	Total value	Principal commodities
Germany	300·9	Tools and machinery, 53 ; Iron, steel and manufactures, 51 ; Coal, coke and briquettes, 36 ; Fertilizers, 18 ; Chemical products, 13 ; Textile fabrics, 12 ; Paper and manufactures, 12 ; Clothing, 11 ; Instruments and apparatus, 9 ; Copper and manufactures, 8 ; Fruit, 2 ; Ships and aeroplanes, 2.

Country	Total value	Principal commodities
Belgium and Luxembourg	162·2	Iron, steel and manufactures, 32 ; Textile yarns, 16 ; Vehicles, 13 ; Tools and machinery, 8 ; Coal, coke and briquettes, 6 ; Textile fabrics, 6 ; Chemical products, 5 ; Cotton, 4 ; Hides and skins, 4 ; Copper and manufactures, 3 ; Raw wool, 3.
U.S.A.	153·3	Maize, 20 ; Wheat, 19 ; Petroleum, 13 ; Tools and machinery, 12 ; Cotton, 10 ; Fruit, 9 ; Vehicles, 9 ; Iron, steel and manufactures, 9 ; Tobacco, 5 ; Instruments and apparatus, 3 ; Copper and manufactures, 2.
U.K.	115·1	Tools and machinery, 20 ; Textile fabrics, 11 ; Textile yarns, 10 ; Iron, steel and manufactures, 7 ; Raw wool, 5 ; Ships, aeroplanes, 3 ; Clothing, 3 ; Instruments and apparatus, 2.
N.E.I.	101·7	Tin ore, 32 ; Tobacco, 11 ; Seeds (mainly oleaginous), 6 ; Hides and skins, 3 ; Chemical products, 2.
France	64·9	Textile yarns, 9 ; Hides and skins, 4 ; Chemical products, 2 ; Fertilizers (from North Africa), 6.
U.S.S.R.	31·7	Timber and manufactures, 18 ; Wheat, 7.
Sweden	29·9	Timber and manufactures, 7 ; Iron, steel and manufactures, 4 ; Paper, 2.
Argentina	64·0	Seeds, 29 ; Maize, 15 ; Wheat, 5 ; Hides and skins, 2.
British West Africa	18·0	Cocoa beans and waste, 14.
Canada	23·0	Maize, 7 ; Wheat, 7.

Other notable suppliers and the values of the chief products which they export to the Netherlands are : Bolivia (ores, *f.* 9m.), Brazil (cotton, *f.* 3m. ; tobacco, *f.* 2m. ; fruit, *f.* 2m.), Denmark (ships and aeroplanes, *f.* 2m.), Finland (timber and manufactures, *f.* 11m. ; paper, *f.* 1m.), N.W.I. (petroleum and products, *f.* 22m.), Norway (ships and aeroplanes, *f.* 2m.), India (seeds, *f.* 12m. ; cotton, *f.* 3m.), Italy (fruit, *f.* 2m.), Manchukuo (seeds, *f.* 7m.), Poland (timber, *f.* 8m.) and Uruguay (wool, *f.* 2m.).

The total of these imports represents 71% of all imports.

Destination of chief Exports from the Netherlands, 1938
(values in millions of guilders)

Country	Total value	Principal commodities
U.K.	233·9	Butter, 29 ; Eggs and their products, 23 ; Bacon, 22 ; Bulbs and flowers, 19 ; Milk and products, 13 ; Fresh vegetables, 12 ; Paper and strawboard, 12 ; Vegetable oils, 9 ; Ships and aeroplanes, 6 ; Textile manufactures, 4 ; Cheese, 4 ; Tools and machinery, 4 ; Tin and manufactures, 3.

Country	Total value	Principal commodities
Germany	153·8	Eggs and their products, 15 ; Coal, coke and briquettes, 14 ; Butter, 12 ; Tin and manufactures, 11 ; Cheese, 10 ; Fresh vegetables, 7 ; Vegetable oils, 6 ; Bulbs and flowers, 2 ; Yarns and cordages, 1.
Belgium and Luxembourg	105·7	Coal, coke and briquettes, 16 ; Cheese, 9 ; Vegetable oils, 5 ; Paper manufactures, 2 ; Yarns and cordages, 2.
N.E.I.	97·0	Textile manufactures, 33 ; Ships and aeroplanes, 15 ; Tools, machinery, 7 ; Iron, steel and manufactures, 4 ; Paper and manufactures, 4 ; Milk and products, 3 ; Butter, 1.
France	60·2	Coal, coke and briquettes, 18 ; Cheese, 2 ; Yarns and cordages, 1.
U.S.A.	37·1	Bulbs and flowers, 4 ; Tin and manufactures, 3 ; Vegetable oils, 2 ; Yarns and cordages, 2 ; Leather, 2.
Sweden	35·8	Coal, coke and briquettes, 6 ; Vegetable oils, 3 ; Tin and manufactures, 3 ; Bulbs and flowers, 3.
U.S.S.R.	23·5	Tin and manufactures, 11 ; Ships and aeroplanes, 7.

Other notable customers and the values of the chief products that they receive from the Netherlands are : Brazil (ships and aeroplanes, *f.* 4m.), Canada (yarns and cordages, *f.* 1m.), Curaçao (iron, steel and manufactures, *f.* 3m), Malaya (milk and products, *f.* 3m.), Norway (ships and aeroplanes, *f.* 2m.), Philippines (milk and products, *f.* 4m.), Switzerland (coal, coke and briquettes, *f.* 4m. ; vegetable oils, *f.* 2m.), and Spain (milk and products, *f.* 3m).

The total of these exports accounted for over 65% of all exports.

Principal Suppliers and Customers

Germany. Generally speaking, imports are the product of German heavy industry, while exports are either of agricultural origin or specialized industrial manufactures. Of recent years trade has been inhibited by German financial restrictions. The 'guns before butter' policy reacted adversely against Netherlands exports of agricultural goods.

Belgium and Luxembourg. Most of the vehicles imported from Belgium are of German or American make and are assembled in Belgium. Products of the Belgian textile industries bulk large in the list of imports. The exports consist of a large number of commodities none of which are of special importance.

United Kingdom. Competition on the British market has been particularly keen since the Ottawa agreement. Preferential tariffs

for British Empire produce have sometimes made it difficult for the Netherlands to market at competitive prices. The maintenance of the agricultural export trade to the United Kingdom will nevertheless remain of vital importance to the Netherlands' economy.

U.S.A. The imports of grains are important, but during recent years they have tended to fluctuate violently according to the harvests. Raw cotton supplies from the U.S.A. have steadily declined in favour of imports from Belgium, Brazil and Egypt. The import of iron, steel and manufactures was negligible until it began to increase rapidly in 1937.

Netherlands East Indies. Imports are for the most part tropical raw materials, with the important addition of tin ore. The bulk of exports take the form of manufactured goods, capital installations and some food products.

France. About two-thirds of the chemical products imported consist of soda for which France enjoys a monopoly as the Netherlands supplier. Most of the fertilizers imported are potash compounds. The exports of coal and coke amount to one-third of all exports to France, compared with which any other single item is of minor significance.

U.S.S.R. Netherlands trade with Russia comprised only a few items, grain and timber imports being balanced against exports of pig tin and floating dredgers.

Commercial Policy

The Era of Free Trade, 1850–1930

In the late eighteenth century Dutch commercial activity declined in comparison with that of neighbouring countries and was further impaired by the Napoleonic occupation. The suspension of commerce and navigation seemed to induce an economic apathy which only dispersed after many decades. The prolonged dispute over the independence of Belgium (see Chapter VI) tended to inhibit recovery, and it was not until after a final settlement had been reached in 1839 that the Dutch were able to turn to the initiation of the policy of freer trade which had been opposed by the protectionist desires of Belgian industrialists. Legislation of 1850 abolished differential duties, thus anticipating the foreign trade policy of the western European states which was based, from the Anglo-French Trade Agreement of 1860 until 1914, on the principle of equality

among the nations as legally embodied in the 'Most-Favoured-Nation' clause. The rising tide of Dutch liberalism brought a further all-round reduction of tariffs in 1862. Agriculture—assisted by the new facilities for prompt export provided by railway and steamship—was the first branch of the national economy to flourish. The neglected ports had to be modernized, and the opening of the New Waterway in 1872 and the North Sea Canal in 1876 gave convenient access to Rotterdam and Amsterdam, and at the same time furnished an impetus to Dutch maritime activity. It was a time of expansion in world trade, and the reviving national energy found increasing possibilities in commerce and industry. Netherlands agriculture did not escape the European depression which lasted from 1877 to 1895, but her industrial strength and her commercial importance grew apace, and by 1914 she had achieved a status and significance out of all proportion to her population. At that time her import duties were of a purely fiscal character and varied between $2\frac{1}{2}\%$ and 5%. Trading conditions were not so easy in the post-1919 world, but the tariff of 1924, providing for a duty of 8% ad valorem on finished articles, could hardly be considered a protective measure.

The Growth of Trade Controls, 1931–40

In 1930, Netherlands exports began to decline while imports continued to increase. Through the introduction of high protective tariffs in several countries and of quota regulations in France, the Netherlands was in danger of being flooded with foreign goods. This danger was augumented by the monetary devaluation in Great Britain and Scandinavia where the price level consequently sank far below that of the Netherlands.

Great Britain's agricultural protection, instituted by the Ottawa Agreement of 1932, had the effect of diminishing Dutch exports as a result both of quota restrictions and of tariffs which discriminated in favour of Dominion produce. Germany too, tended to decrease imports from the Netherlands by increasing agricultural tariffs from the 30% ad valorem duties established in 1927 to a rate of $50–54\%$ in 1931.

These circumstances forced the government in 1931 to raise the duties on finished articles to 10% and to limit, quantitatively, the import of a number of articles. The dangers of introducing an extensive quota scheme—decline in initiative in protected enter-

prises, and a general diminution of the total volume of trade—were fully realized and the policy was only adopted with reluctance.

The Netherlands had already made two attempts to revive her foreign trade by regional agreements. The Oslo Treaty, concluded in 1930 between Belgium, the Netherlands and the Scandinavian countries, provided that no participating country should raise its customs duties without first informing the other members and giving them an opportunity of voicing any objections they might have against the intended measures and of making counter-suggestions. If the countries concerned could not come to an agreement, the measure in question should be executed after one month's notice, during which time the country which considered itself at a disadvantage was at liberty to resign from the treaty. The devaluation in the Scandinavian countries, which were bound more closely to England economically as a result of the formation of the sterling block, and the absence of all regulations regarding quotas, left the Oslo Treaty of little practical effectiveness.

The Treaty of Ouchy, 1932, which was to provide a gradual reduction of the Belgian and Netherlands mutual customs duties to half their existing tariffs, was not signed on account of the resistance offered by Great Britain, who considered the treaty to be a violation of the 'Most-Favoured-Nation' policy. In both these treaties there was provision for the possibility of other countries joining.

As the depression took on ever greater proportions and foreign competition became more menacing for the Netherlands economy, the 'Crisis Law' of 1933 gave the government a free hand to fix prices and customs duties. Upon this authorization, the duties on finished articles were raised to 12% and on half-finished articles to 3–6% of their value. Further, the Netherlands began to use trade restrictions in negotiations with other states as a means of obtaining more favourable conditions for Dutch exports.

After the monetary devaluation in September 1936, these restrictions came to play a more important part, and by 1939 a policy which had been initiated by a series of improvisations had settled down into a definite system of temporary trade agreements. Bilateral agreements, reviewable from year to year, were made with many countries, each allotting the other a proportion of specific imports operated by means of quotas. To ensure a balance of payments, clearing accounts were set up in some instances—notably with Italy, Germany Chile and Turkey—outstanding items from one year being balanced by a reduced quota in the next.

The Oslo States met from time to time, and a second agreement, concluded at The Hague in May 1937, freed certain specified classes of goods from import restriction, but in a world subject to controlled trade it was difficult for small states to give a lead towards a return to free trade without placing their economies at the mercy of foreign dumping.

FINANCE

Currency

The unit of currency in the Netherlands is the guilder or florin of 100 cents, equivalent to 1s. 8d. at the gold parity of *f.* 12·107 to the £. The following coins are in circulation :

Bronze	Silver
½ cent	10 cents (*dubbeltje*)
1 cent	25 cents (*kwartje*)
2½ cents	50 cents
	1 guilder
	2½ guilders

The 5- and 10-guilder gold coins ceased to circulate on the abandonment of the gold standard in September 1936. The currency unit is always referred to as the guilder, but with figures and statistics it is expressed as the florin—*f.* 1·00, *f.* 1,000 or sometimes *fl.* 1·00, *fl.* 1,000. The Netherlands Bank issues notes to the value 10, 20, 25, 50, 100, 200, 300 and 1,000 guilders. Old issues of 40 and 60 guilders are gradually being withdrawn from circulation.

The following table shows variations of the guilder in relation to sterling since 1930 :

Guilders per £ at 1 January in each year

1930	12·09 1/16	1935	7·29
1931	12·05 7/8	1936	7·25
1932	8·44½ (*a*)	1937	8·96 7/8 (*b*)
1933	8·31¼	1938	8·98
1934	8·09½	1939	8·52½
		1940	7·53 (*c*)

(*a*) Effect of Great Britain's departure from the gold standard.
(*b*) Effect of Netherlands' departure from the gold standard.
(*c*) Official Bank of England rate.

State Finance : The Budget

The following table gives the budgetary position (in thousands of guilders) in the Netherlands :

Year	Population	Revenue	Expenditure	Surplus
1910	5,899,000	198,781	197,091	1,690
1920	6,821,000	613,695	613,031	664
1930	7,844,000	636,330	608,387	27,943
1931	7,999,000	557,557	603,157	—45,600
1933	8,237,000	516,959	572,830	—55,871
1935	8,433,000	614,372	687,280	—72,908
1937	8,598,000	689,950	703,590	—13,640

From : *Jaarcijfers voor Nederland*, 1938, p. 374 ('s Gravenhage, 1939)

The budget estimates for 1938 were as follows (the percentage of total revenue is shown within brackets) :

Revenue

A. *Ordinary Service*		
Direct Taxation (16%) (Ground, Income, Capital, Defence and Property in Mortmain Taxes)	*f.*	116,400,000
Indirect Taxation (60%) (Customs, Excise, Stamp, Registration and Succession Duties, Dividend, Tantieme, Turnover, Coupon, Gold and Silverware Taxes)		428,475,000
Other Ordinary Revenue (21%) (Departmental receipts, e.g. Operation of State Mines, Posts and Telegraphs, Unemployment Insurance)		145,075,275
		689,950,275
B. *Revenue from Capital Service*		24,239,950

Income-tax (yielding 11% of the total revenue) would not appear to bear so heavily as it does in Great Britain where in 1940 it produced 40% of the total. Indirect taxation assumes much greater prominence in the Netherlands, providing 60% as opposed to 45% in Great Britain. The greater importance of indirect taxation in the Netherlands is typical of fiscal policy in continental countries.

Expenditure

A. Ordinary Service		B. Capital Service	
Civil List	*f.* 1,760,000	Home Affairs	*f.* 15,072,567
Parliamentary and Executive	1,940,195	National Debt	11,000,000
General Affairs	83,544	Finance	98,462,686
Foreign Affairs	3,710,573	Defence	41,620,200
Justice	26,360,786	Waterways and Public Works	11,918,000
Home Affairs	33,529,868	Economic Affairs	174,000
Education	142,361,033	Social Affairs	1,825,000
National Debt	150,567,958		180,072,453
Finance	63,263,280	*Less* Revenue	24,239,950
Defence	110,359,238	Deficit on Capital Service	155,832,503
Waterways and Public Works	50,255,348		
Economic Affairs	13,948,113		
Social Affairs	97,040,622		
Colonies	8,379,557		
Contingencies	30,000		
	703,590,115		
Less Revenue	689,950,275		
Deficit on Ordinary Service	13,639,840		

From : *Jaarcijfers voor Nederland*, 1938, pp. 374–89 ('s Gravenhage, 1939)

The division of the Netherlands budget under two headings is required by the Civil Accounts Code of 1927. Ordinary expenditure is to be met by Ordinary revenue, but Capital expenditure can be provided for by the raising of loans. The Minister of Finance has power to determine which expenditures may be carried to the Capital service in any year. Items which would appear as an increase to the Ordinary service deficit may thus be passed over to the Capital service, and in consequence the true position of the state's finances is often obscured.

The distribution of the National Debt per inhabitant was *f.* 392 in 1938 (Fig. 90).

Provincial Finance

The eleven provinces have the power to levy a surtax on the capital amounts of the property, income and ground taxes paid to the state. The maximum percentage which may be levied is fixed by law. Further income is derived from tolls on certain canals, roads and bridges. The yield of provincial properties and an annual grant from the state contribute the remainder of their revenue. In their expenditure, the provinces disburse large sums for the upkeep of waterways, roads and protective works against flooding. Their activities also include the maintenance of museums, libraries and

historic buildings, grants to educational institutions and agricultural societies, and extensive subsidies to various branches of the health services.

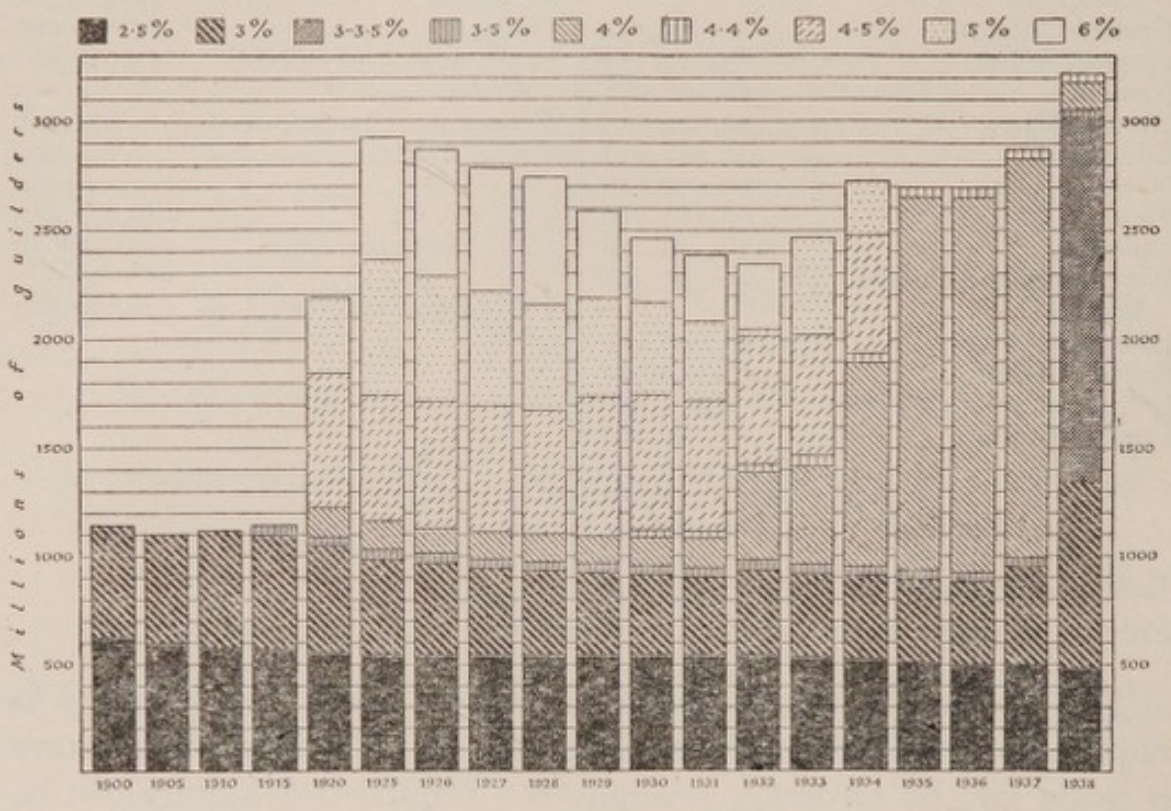


Fig. 90. Growth and composition of the consolidated national debt, 1900–38
From : *Petit Manuel Statistique*, 1937, p. 174 (La Haye, 1938), and official sources.
The somewhat inflationary financial conditions and difficult economic situation after 1918 caused a considerable rise in the national debt, and new issues bore high rates of interest. In the more stable conditions prevailing later, debt redemption, particularly of the high yielding stock, proceeded steadily until 1932. Then, with the growth of expenditure on social services and public works, e.g., schemes for the relief of unemployment, the total of debt again commenced to rise. New issues were made, yielding 4% per annum, but in 1938 a very large conversion took place, a new stock, bearing 3% for ten years and 3½%, subsequently being created to replace nearly all the 4% stock.

Communal Finance

The 1,054 communes fulfil a more important function in the fiscal structure than do the provinces. They have a dual task imposed on them by the constitution—the care of local economy and the execution of certain Acts of Parliament, general Government measures and provincial ordinances. Revenue is derived from surcharges on the state taxes, and from local taxes on dogs, lodgers, entertainments, multiple residences, fire insurance, and other small duties. Additionally, some communes operate profit-making public

utilities, and all receive direct grants for the state out of the State Communal Fund. The total revenue of all the communes varies between *f.* 770 and *f.* 790 millions, of which 10% is received directly from the state. Expenditure is very widely dispersed. It covers items of education, poor law administration, public works, housing, national health, police, industry, arts and sciences, and the social services. Capital developments are usually financed by borrowing.

It should be noted that the word ' municipality ' is often used in English works to indicate the local administrative unit of the commune (see p. 183).

Banking and Credit

The Netherlands Bank. The central bank, founded in 1814, is a private company, established by a special bank act last renewed for five years in 1937. The head office is at Amsterdam. The Bank is the Government's banker, and the Government shares in the profits as a return for the grant of the monopoly of issuing banknotes. The business of the Bank, in addition to this latter function, consists mainly in discounting bills of exchange and advancing money on national and foreign stock and on goods. For this business it has branches in most of the large towns ; its establishments in Amsterdam, Rotterdam and The Hague act as clearing houses for the accounts of other banks. The total of notes in circulation at the beginning of 1938 was *f.* 906,834,000.

The General Banks. As opposed to the Netherlands Bank which must publish weekly accounts, the Joint Stock banks are remarkably free from legal limitations. In consequence they tend to conduct banking business in the widest sense. Of the combined capital of *f.* 400 million of some 200 of these banks, *f.* 245 million is accounted for by the ' Big Five '—*Amsterdamsche Bank*, *Incasso Bank*, *Rotterdamsche Bankvereeniging*, *Twentsche Bank*, and *Nederlandsche Handel-Maatschappij*. The latter is distinguished by its extensive colonial business.

The financial position of these banks improved as a result of the general expansion of business activity consequent to the devaulation of the currency. The general banks are closely connected with the financing of industrial enterprises, but, whilst this tendency is more marked than in Great Britain, it is by no means so complete as it is in Germany.

The Private Banks. These banks have of late tended to decline in

numbers as a result of absorption by the joint-stock banks. They conduct general banking business but often specialize in buying and selling securities for clients.

The Colonial Banks. In this category come the banks which operate in the colonial possessions and also maintain branches in the Netherlands. They are, for the most part, financed with Dutch capital and operated by Dutch management.

Of the institutions working in the Netherlands East Indies the *Nederlandsch-Indische Handelsbank* (capital *f.* 55 million), and the *Nederlandsch-Indische Escompto Mij.* (capital *f.* 47 million) are particularly important. The Bank of Java controls note issue and acts as the central bank for the Netherlands East Indies.

The Mortgage Banks. The business of these banks has tended to decline in recent years. There are some fifty concerns specializing in property mortgages, twenty-seven in colonial and foreign mortgages, and twelve in shipping negotiations.

Amsterdam Cashier Institutions. There are three institutions, *Associatie-Cassa*, *Ontvang-en Betaalkas*, and *Kasvereeniging*, which operate in Amsterdam as collecting agents for banks and stockbrokers.

Agricultural Credit Banks. There are some 1,300 local societies performing the simple function of receiving deposits in return for interest payments, and making loans to agriculturalists out of such deposits. Most of them are members of one of the two Central Agricultural Loan Banks which exist at Utrecht and Eindhoven. These latter are able to borrow capital at cheap rates for the use of the local societies, and they also act as supervisors by reason of the annual inspection of the accounts of member societies which they conduct.

Savings Banks. Of the 500 private savings banks the majority are of a philanthropic character, their directors being unsalaried and their organization non-profit making. The number of accounts at the end of 1937 stood at 1,145,000 and the aggregate of deposits at *f.* 479 million.

The Post Office Savings Bank. Founded in 1880, the Bank has now some 1,500 depositories. The following statistics show an increase not only of passbooks issued, but also of the total and average amounts of deposits :

Post Office Savings Bank, 1933–8

Year	Deposits Without interest (*f.*1,000)	Repayments Including interest (*f.*1,000)	Savers' Balances (*f.*1,000)	Pass Books in use (in thousands)	Average Credit Balance per book *f.*
1933	184,053	180,164	528,697	2,268	233
1934	179,832	182,571	539,518	2,264	238
1935	173,452	186,829	540,019	2,266	238
1936	168,429	176,548	545,743	2,267	241
1937	217,988	175,715	602,568	2,306	261
1938	262,584	202,536	662,616	2,380	278

The fact that of a population of eight and a half million, more than one-quarter have savings accounts in this Bank alone, affords an indication of the thrifty habits of the Dutch working class.

The Postal Cheque and Transfer Service

The postal cheque system has been steadily growing in importance; at the end of 1939 total accounts were *f.* 328 million, the investment of which in government securities enabled the service to be operated without charge to the client. As in other European countries, accounts are kept by the Post Office quite separately from the Post Office Savings Bank. The service is of great convenience to small traders who would not normally operate commercial bank accounts.

The Amsterdam Stock Exchange

By the end of the fifteenth century Amsterdam was already a trading centre of international importance and merchants assembled daily at fixed hours to do business. As their numbers grew, the Town Council of Amsterdam decided to build the famous 'Old Exchange' which was opened at the beginning of the seventeenth century. With the foundation, in 1602, of the 'Dutch East Indian Company', stock exchange business began. The business done in the shares of this company and similar ventures soon became very brisk, especially when, in course of time, government bonds and loans of Amsterdam and other towns came on to the market.

By 1720 Dutch traders were meeting obstacles and rivalries which reduced profits and encouraged them to emphasize the financial elements of their business. The Anglo-Dutch community in London represented a well-tried channel for intercourse and investment, and increasing numbers of Dutch merchants took to

investment in Bank of England, East India and South Sea stocks. Much of the antipathy to the National Debt demonstrated by eighteenth-century Englishmen was aroused by the fact that a large proportion of it was taken up by Dutch investors. The close connexions with England tended to fail as a result of the Napoleonic wars, and when Dutch finance began to recover, its energies were directed more towards American investment.

In recent years, the securities traded in Amsterdam have been very varied. Nearly 3,000 are officially quoted, more than half of which are loans and bonds—domestic, colonial and foreign. Among the shares traded, those of colonial plantations play an important part. A large number of United States shares are quoted, and they have considerable popular support.

Insurance

In 1936 the Insurance Chamber reported control over 185 Dutch companies, but this number was largely made up of small concerns which during the later 1930's showed some tendency to decline.

In life insurance the six largest Dutch companies accounted for more than half of the business, a little over 5% being in foreign hands. Of the foreign companies, British and German, numbering eighty-five and thirty-one respectively, were much the most important. Their principal sphere was commodity insurance, in the fire section of which British concerns dealt with the bulk of Dutch business.

General Economic Situation

Effects of the War of 1914–18

The war years brought many difficulties and hardships despite the successful though often uneasy maintenance of neutrality. By 1916 the rise in prices had initiated an increasing amount of racketeering and resultant hardship. This was inflamed by the big profits made by certain sections of the community in their trade with the belligerents, a profit which was not accompanied by any increase in the amount of goods and services becoming available for Dutch consumption. In 1919 the cost of living had increased, for all classes of the population, to something over twice the 1914 level.

Post-War Recovery, 1919–29

Nevertheless, post-war recovery was by no means so difficult for the Netherlands as it was for her neighbours, who had been ravaged

by war and saddled with unprecedented increases in their national debts. In comparison with the turbulent currency conditions of Germany, the Netherlands seemed to offer a safe haven for investment and much foreign money came into the country during the early 1920's. Bank policy wisely tended to discourage speculative investment by rationing credit in these immediate post-war years.

On 28 April 1925 the gold standard, which had been abandoned in 1914, was resumed without much of the strain which so many other countries underwent in order to attain it. Later in the same year gold coins were issued for circulation, although paper money continued to be used in the bulk of transactions.

The war years had necessitated a higher degree of dependence on home industry, which now continued to develop in the subsequent period. In particular, the coal industry was to quadruple its annual output in the twenty years between 1917 and 1937. Both industry and agriculture enjoyed a real measure of prosperity from 1925 until the first impact of the world depression early in 1930

Depression and Partial Recovery, 1929–40

The depression did not at first affect the Netherlands as suddenly or as severely as it did many of her continental neighbours. Her coal production actually increased between 1929 and 1931, and the thrifty habits of the people enabled them to draw on their savings when the difficult times came. The causes of the depression were not of national origin but came through the widespread dislocation of world trade which inevitably damaged the Netherlands economic and financial structure. Unemployment began first of all in the luxury industries, nearly 90% of diamond workers being displaced during 1931 largely owing to the falling away of the American demand. It gradually permeated all industries as the foreign and transit trades declined and the volume of production contracted. By March of 1932, 277,000 people were unemployed and the returns for January in subsequent years have been as follows (in thousands) :

1933	1934	1935	1936	1937	1938	1939	1940
398	387	432	475	466	439	406	356

When related to the total population these figures indicate that the proportion of unemployment was even greater and more persistent than it was in Great Britain during the same years.

The combined value of imports and exports declined by 66%

from 1929 to 1935. The pit of the depression was not passed until 1936, and recovery was by no means complete in 1939.

Government Policy

At first the government concentrated on endeavouring to balance the budget. Beginning in 1931, stringent retrenchments were undertaken in all the spending departments, whilst taxation, both direct and indirect, was increased. At the same time industry was rationalized as much as possible, and wage cuts were introduced so that prices might be competitive in the foreign markets.

In 1933, in view of the gravity of the situation, a National Government was formed under the leadership of Dr Colijn. It persevered with the policy of strict economy, and, whilst strenuously resisting suggestions that the currency should be devalued, endeavoured to increase exports through subsidising producers out of the proceeds of levies raised by charging the home consumer a higher price. Between 1934 and 1936, $33\frac{1}{3}\%$ of the state's gross receipts were paid to farmers in this way by the Government. This, unfortunately, tended to make the cost of living rise at a time when wages were falling and unemployment was very severe.

The latter problem was met by extensive relief and the initiation of public work schemes—such as extra employment on the draining of the Zuider Zee—which gave occupation in January of these years to the following numbers of those previously cited as unemployed :

1936	1937	1938	1939
54,600	20,200	51,500	66,000

(It should be noted that the weather was particularly bad in the January of 1937.)

Two other suggestions for reducing unemployment were mooted but not legislated. They concerned the establishment of a juvenile labour service and the restriction of employment of married women.

Monetary Policy, 1931–6

On the monetary side the government moved cautiously. When Great Britain left the gold standard in 1931, the Netherlands joined the ' gold bloc ' formed by France, Italy, Switzerland, Poland and Belgium, and steadfastly defended the position of the guilder. Lively controversy went on during subsequent years as to the wisdom of currency devaluation. When Belgium devalued in March 1935 the position of the remaining gold-bloc currencies—those of France,

Switzerland and the Netherlands—became particularly difficult. During the following year the Netherlands Bank made fifteen changes in the bank rate in order to prevent an undue drain of gold from the country, and it eventually succeeded in restoring stability.

However, in September 1936 France devalued and her example was immediately followed by Switzerland. This left the guilder

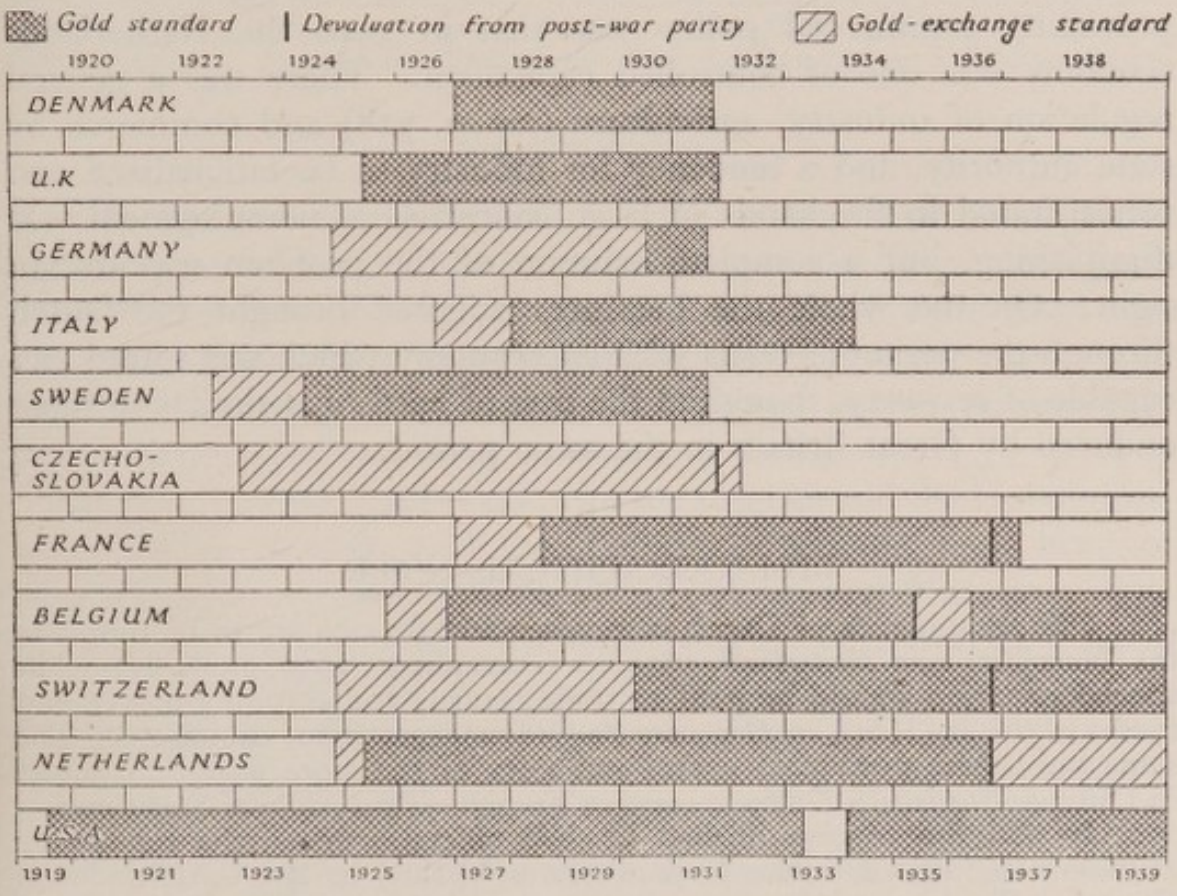


Fig. 91. Tenure of the gold or gold exchange standard, 1919–39
From : *The United States in World Economy*, p. 131 (Washington, 1943).

entirely isolated. The Netherlands government and the Netherlands Bank feared that foreign speculation would attack the currency and drain away the gold reserves. In consequence the gold standard was reluctantly abandoned on 29 September 1936. Export of gold was prohibited, and the government was authorized to found an Exchange Equalization Fund to be operated by the Netherlands Bank (Fig. 91).

After Devaluation, 1936–40

The effect of devaluation was beneficial to the home and colonial export trades, especially as it coincided with a rising world market.

Trade increased owing to better chances to compete, and the government eased the domestic price level by reducing subsidies and a number of quotas and duties. In 1937 the industrial position appeared to be much improved, shipping freight rates (see p. 430) rose and the transit trade increased—in all, the country appeared to be on the way to economic recovery.

The result of these measures taken in conjunction with the prevailing commercial policy was that in 1940 the Netherlands economy was one of controlled capitalism. There was a general regulation of industry, agriculture (see p. 328) and commerce by state authority, and a tendency for industry to be rationalized and concentrated in the hands of large concerns. Unemployment was diminishing, but a complete solution of the problem was not in sight. On the whole the measures adopted brought the Dutch through the period of crisis with an economy which was sound and capable of recovery, though at the cost of hardships similar to those endured by Great Britain in the same period.

BIBLIOGRAPHICAL NOTE

1. Official statistics of Dutch commerce and finance are to be found in the *Jaarcijfers voor Nederland*, 1938 ('s Gravenhage, 1939, annually), while special attention should be paid to trade returns and shipping movements found in the *In-, Uit-, en Doorvoer* ('s Gravenhage, 1939, annually). The same publishers produce a useful summary of the more important tables in Dutch—*Statistisch Zakboek*—and in French—*Petit Manuel Statistique*.

2. In addition to unpublished English official sources, the reports on economic conditions in the Netherlands published by the Department of Overseas Trade provide a good commercial guide. The most recent reports are for the years 1932, 1933, 1936 and 1938.

3. There is a League of Nations Economic Intelligence Survey publication, *Europe's Trade* (Geneva, 1941), which gives the international setting of the Netherlands' commercial activity.

4. The leading Dutch banks issue reports in English which often afford a valuable insight into current economic affairs: (i) The *Continentale Handelsbank* (Amsterdam) has circulated a market letter once or twice each month since 1935; (ii) The *Amsterdamsche Bank N.V.* issues a Quarterly Review; (iii) The *Rotterdamsche Bankvereeniging* also publishes a Quarterly Review. The articles and summaries in these publications are particularly helpful to an understanding of economic developments in recent years.

5. The following books have sections bearing on various aspects of Dutch commerce and finance:—C. Wilson, *Anglo-Dutch Commerce and Finance in the Eighteenth Century* (Cambridge, 1941); H. V. Hodson, *Slump and Recovery*, 1929–1937 (Oxford, 1938); H. Parker Willis and B. M. Beckhart (ed.), *Foreign Banking Systems*, pp. 723–64 (London, 1929); H. Liepmann, *Tariff Levels and the Economic Unity of Europe*, ch. 5, pp. 296–304 (London, 1938); B. Landheer (ed.), *The Netherlands* (Berkeley and Los Angeles, 1943).

CHAPTER XV

THE MERCANTILE MARINE

Introduction : The Merchant Fleet : Traffic, Services and Companies : Financial Aspects, 1930–9 : Personnel and Administration : Ocean Salvage : Towage of Floating Docks : Note on the Netherlands Tonnage Regulations : Bibliographical Note

Introduction

The Netherlands merchant fleet in 1939 was the seventh largest in the world, comprising 1,630 steam and motor vessels over 100 gross tons, with a total tonnage of 3,507,000. The revenue from the mercantile marine is of great importance as an invisible export ; in 1937 this revenue amounted to *f.* 150 millions, and was second only to the revenue derived from investments abroad.

The Dutch traditionally rank with the English and the Norwegians as sea-faring peoples, and the tonnage of shipping per head of population is exceeded only in Great Britain and Norway. The present importance of the mercantile marine is, however, a fairly recent phenomenon, for in the early nineteenth century, after the losses sustained during the Napoleonic wars, the Dutch flag had almost disappeared from the seas. The revival of the Netherlands as a sea-faring nation came mainly after 1870 ; it was associated with the expansion of heavy industry, and was aided by the work of Prince Henry, brother of King William III. This period saw the foundation of several leading shipping companies : although the *Koninklijke Ned. Stoomb. Mij.* had owned ships since 1856, the *Nederland N.V. Stoomv Mij.* was founded in 1870, the *Nederlandsch-Amerikaansche Stoomv. Mij.* in 1871, and the *N.V. Rotterdamsche Lloyd* (Ruys and Zonen) in 1875. The economic expansion of the N.E.I. encouraged the shipping industry ; in 1891 the *Koninklijke Paketvaart Mij.*, a few years after its foundation, undertook the operation of extensive inter-island services in the archipelago, and in 1903 the Java-China-Japan line was founded to carry on fast services between countries of the Far East.

In 1905 the fleet was the ninth largest in the world. The Netherlands, like other neutrals, suffered from the war of 1914–18, but her losses—343 ships of 296,000 gross tons—were much smaller than those sustained by other important neutral fleets. Shipping

companies, however, flourished on soaring freights. After the war came a boom period, to be succeeded by a severe decline of traffic during 1930–6. Tonnage reached a maximum of 3,118,000 tons in 1931, but fell to 2,511,000 tons in 1936 (Fig. 92).

The Merchant Fleet

Classification by Size

In 1939 the fleet comprised the following tonnage groups :

Vessels over 100 *gross tons ; tonnage in thousands*

Size	Steamers		Motorships		Total	
	No.	Gross Tonnage	No.	Gross Tonnage	No.	Gross Tonnage
Under 1,000 tons	250	67·7	719	173·4	969	241·2
1,000–1,999 tons	110	163·7	12	17·0	122	180·7
2,000–3,999 tons	133	371·1	20	57·8	153	428·9
4,000–7,999 tons	116	666·9	71	458·6	187	1,126·6
8,000–9,999 tons	17	147·4	40	344·2	57	491·6
10,000–14,999 tons	6	66·2	17	190·2	23	256·4
15,000 tons and over	6	136·1	6	108·9	12	245·0
	638	1,619·2	885	1,350·3	1,523	2,969·6
Tankers	45	137·2	62	400·3	107	537·5
Total	683	1,756·4	947	1,750·6	1,630	3,506·1

From : *Lloyds Register of Shipping*, 1939–40, *Vol. III, Appendix, Statistical Tables*, 1939, pp. 8–9 (London, 1939).

The figure given for tankers differs from an official figure given in the table on p. 424 ; the discrepancy arises from differences in classification and in date of survey.

Over 300 of these vessels, however, were fishing vessels. Of the 650 merchant vessels proper of less than 1,000 gross tons, the motorships exceed the number of steamships. Of the 554 vessels over 1,000 gross tons, however, 388 were steamships and 166 motorships. The proportion of motorships is much greater than in the British merchant fleet, but smaller than in the Norwegian. Of the steamers, 50 were turbine driven : these are mainly fast liners. Of all steamers, 169 were oil burning.

The largest vessel in the fleet was the *Nieuw Amsterdam*, 36,000 gross, 20½ knots ; others were the *Statendam* (28,000 tons, 19 knots), *Rotterdam* (24,000 tons, 17 knots), and the *Oranje* (19,800 tons, 21 knots), a motor liner which completed her trials in 1939.

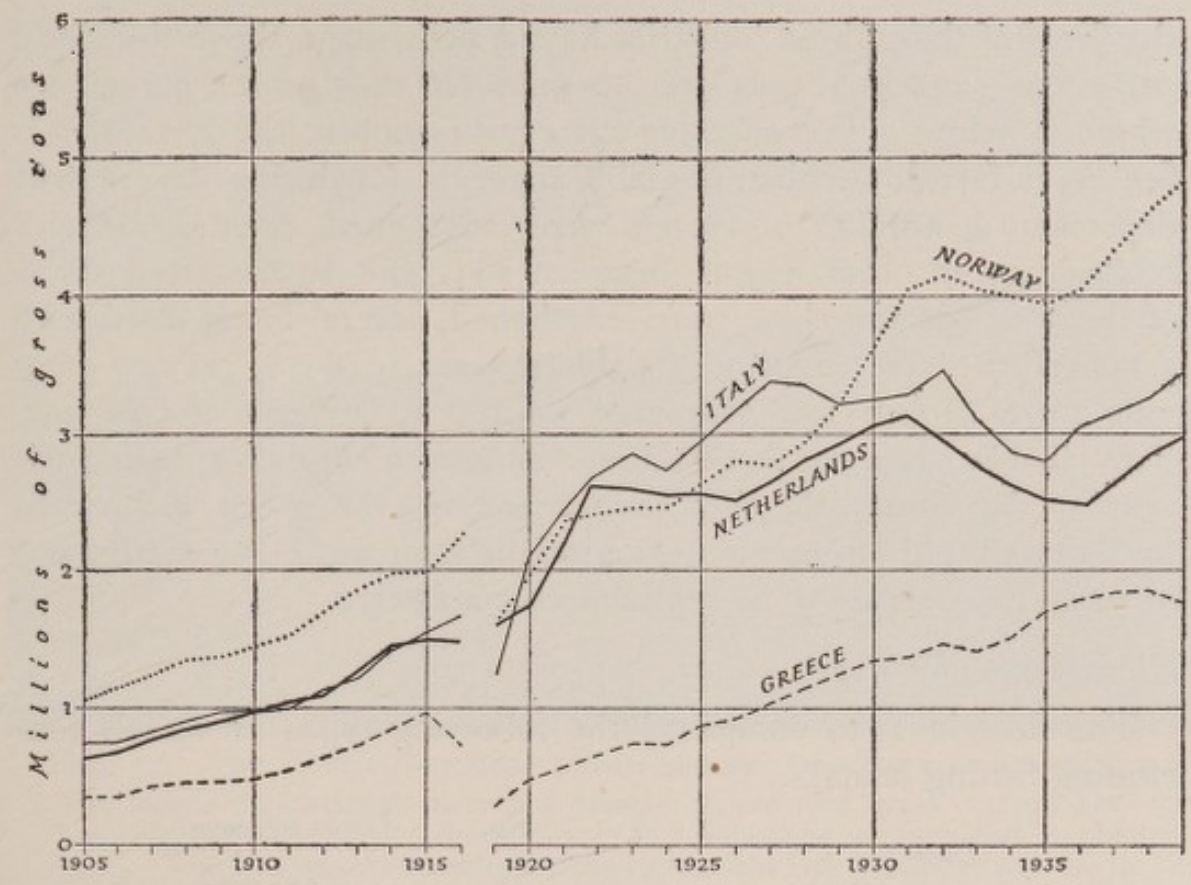


Fig. 92. The growth of the Netherlands merchant fleet

From : *Lloyds Register of Shipping*, 1939–40, *Vol. III, Appendix, Statistical Tables*, 1939, pp. 17–9 (London, 1939).
The graphs refer to steam and motor tonnage only. Of the four countries shown, the Netherlands fleet suffered most severely from the economic depression.

Classification by Age

Though the position concerning replacements is not entirely satisfactory, the fleet compares well with most others in age of its ships :

Percentage of total shipping owned, over 100 *gross tons, by age group*

	Under 5 years	5 and under 10	10 and under 15	15 and under 20	20 and under 25	Over 25 years
World	15·5	9·8	15·7	22·0	16·2	20·5
Netherlands	22·4	15·0	19·0	25·0	9·4	8·8
Great Britain	21·1	10·5	24·2	21·0	12·3	10·7
Norway	24·7	20·9	18·3	15·7	9·6	10·9

Data from *Lloyds Register of Shipping*, 1939–40, *Vol. III, Appendix, Statistical Tables*, 1939, pp. 9–11 (London, 1939)

In age composition, the Netherlands fleet is not dissimilar from those of Great Britain and Norway. In vessels up to 15 years old

the fleets of these three countries have a percentage above the world percentage, and in vessels over 20 years old they have a percentage which is below. The effective age composition in the Netherlands fleet is, in fact, lower than the table suggests, for during the years of depression a number of vessels were lengthened, re-engined* and modernized in other ways. Between 1931 and 1936 sixteen ships, of the 7–11,000 ton class, were lengthened, several being fitted with a Maierform bow. During the eleven years 1928–38, 521,000 gross tons were broken up, compared with only 200,000 in Norway. Nevertheless, as a result of the curtailment of building during the years of depression, the fleet has reached an average age which calls for a more rapid replacement programme than was being carried out in 1939 if vessels are to be replaced satisfactorily.

Classification by Type

The fleet in 1939 composed the following types of vessels (excluding fishing boats).

	No.	Gross tonnage
Deep Sea :		
Liners	264	1,661,000
Tramps	93	378,000
Tankers	117	552,000
Short Sea :		
Liners	158	163,000
Tramps	15	24,000
Coasters	495	122,000
Tugs (over 100 tons)	49	13,000
Total	1,191	2,912,000

From official sources

Tankers. As an owner of tankers the Netherlands is surpassed only by Great Britain, U.S.A. and Norway. The bulk of the fleet is operated by three subsidiaries of the Anglo-Saxon Petroleum Co. —two of the companies have their offices at The Hague and one is established at Curaçao. The Anglo-Saxon Petroleum Co. is a subsidiary of the Royal-Dutch Shell group. A few ships are operated by subsidiaries of the Standard group. The growth of the tanker fleet is illustrated in Fig. 93.

Tramps. The tramp fleet of the Netherlands is comparatively small, and engages largely in the carriage of bulk cargoes such as coal in the Netherlands import trade. Comparatively few engage in the international tramp trade.

Liners. Liners form the backbone of the Netherlands fleet. Although one company operates a super liner (the *Nieuw Amsterdam*)

*Usually diesel engines replaced steam.

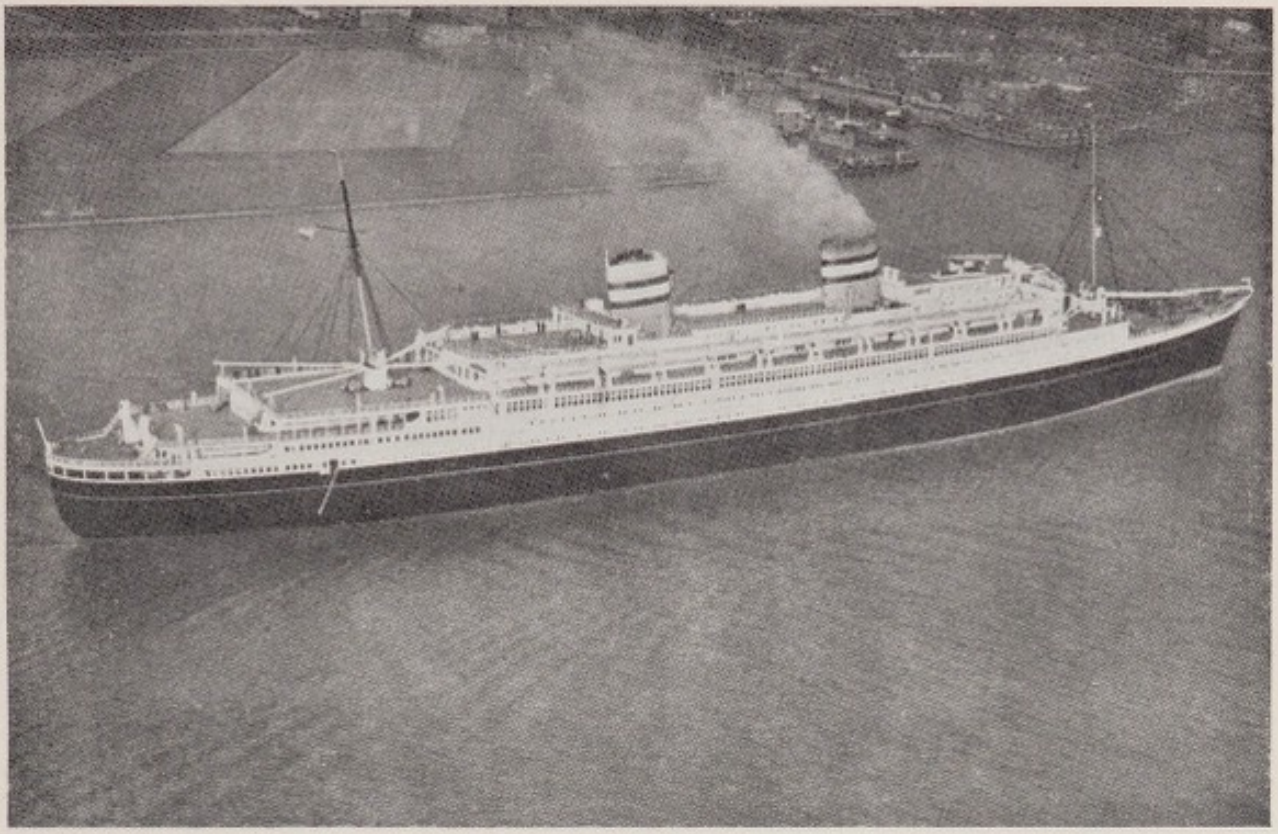


Plate 37. The *Nieuwe Amsterdam* (*Nederlandsche-Amerikaansche Stoomvaart Mij.*)
The largest Netherlands merchant vessel—36,300 tons gross, 21,500 net, speed 21½ knots, length 700 ft., draught 31.7 ft.; launched in 1937 and completed in 1938. The hull was constructed by the Rotterdam Dry Dock Co. and the turbines by *Kon. Mij. de Schelde,* Flushing.

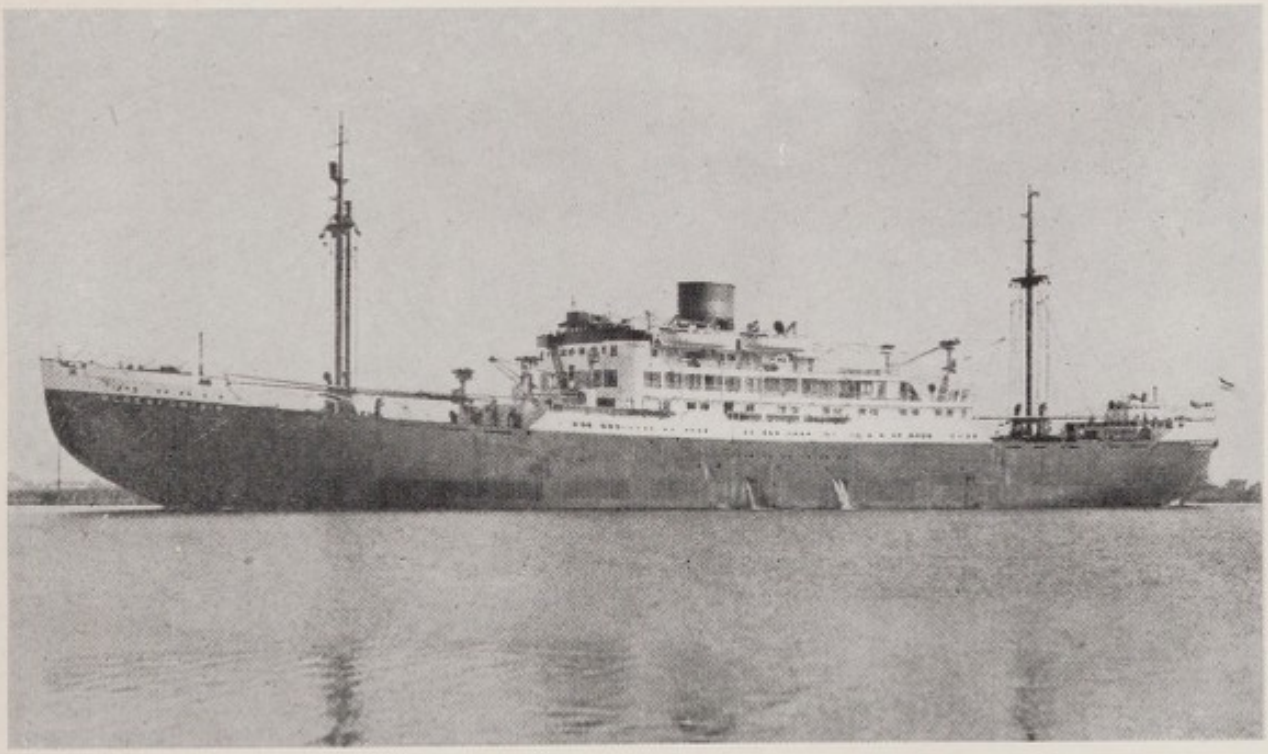


Plate 38. The *Bloemfontein* (*Holland-Afrika Line—Vereenigde Nederlandsche Scheepvaart Mij.*)
A good example of a Dutch passenger and cargo liner, with accommodation for 115 passengers and with refrigerated chambers; 10,100 tons gross, 6,200 net, 10,600 deadweight, speed 17 knots, draught 30.1 ft. The *Bloemfontein*, as well as the *Jagersfontein*, was built in 1934 by *Nederland Scheepswerf Mij.*, Amsterdam; the diesel-engines were supplied by Stork Bros., Hengelo.

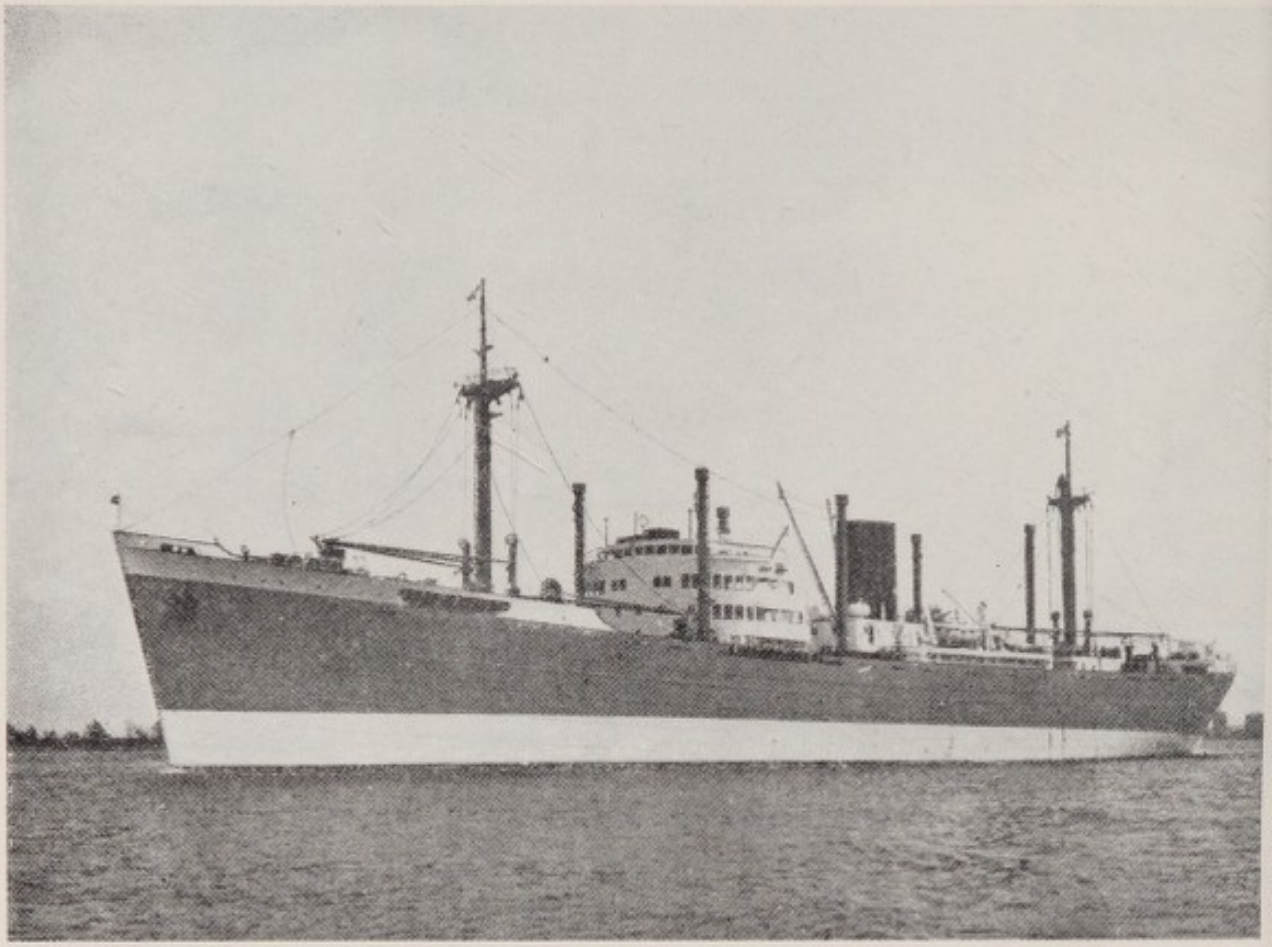


Plate 39. The *Brastagi*/*Weltevreden*/*Japara*/*Bantam* ; *Ruys and Zonen* (*Rotterdamsche Lloyd*
Motor vessels, of 7,200 tons gross, 4,100 net, 11,700 deadweight, and operating services to the N.E.I., the *Brastagi* and *Bantam* were built and engined by *Kon. Mij. de Schelde*, Flushing ; the *Japara* and *Weltevreden* were built by *P. Smit*, Rotterdam, and engined by *de Schelde* and *Krupp Germaniawerft*, Kiel, respectively.

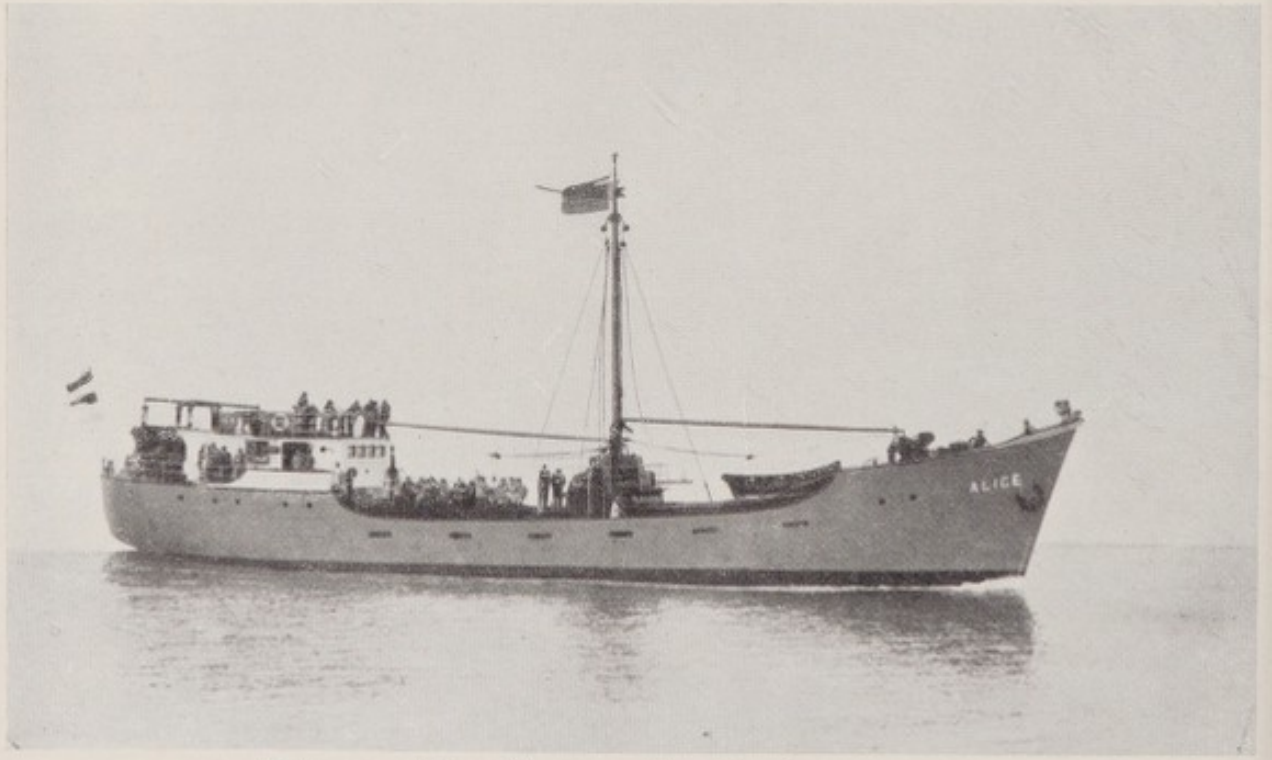


Plate 40. The *Alice*, a modern Dutch motor coaster
This vessel, with a length of 127 ft. and a beam of 23¼ ft., has a gross tonnage of 291, and a net tonnage of 320. She was built in 1939 by *Van der Werff Scheeps.* at Westerbroek near Groningen, and was engined by *Appingedammer Brons Motorenfabriek*, Appingedam.

on the North Atlantic route, services have grown up mainly around two routes—to the Dutch possessions in the East and West Indies. From these routes branches have developed, and in 1940 a considerable fleet of fast liners, mainly cargo carriers, served the Far East, Australia and Indian Ocean on the one hand, and the West

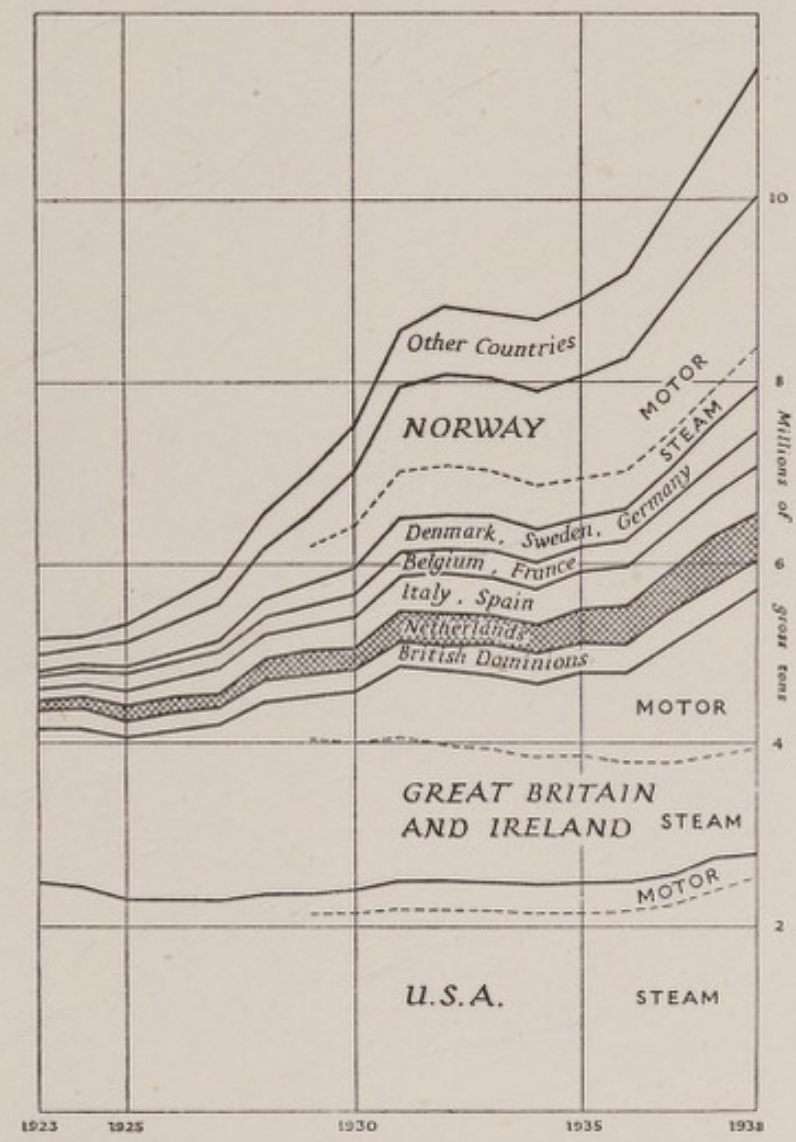


Fig. 93. Growth of the world tanker fleets, 1923–38

From : T. Koopmans, *Tanker Freight Rates and Tankship Building*, p. 3 (Haarlem and London, 1939).

Indies, North, South and central America on the other. Specialized vessels, such as banana carriers, have also been developed, and the majority of vessels in the cargo fleet operating services to the N.E.I. are fitted for the carriage of vegetable oils in deep or peak tanks. Some have their foot peak tanks fitted for the carriage of latex in bulk. Ships fitted with refrigerated chambers number about 25.

The liner type of ship has been well developed in the short sea

trade, largely to serve Dutch exports of dairy produce and vegetables. These vessels average 1,000 tons gross.

Coasters. The coasters form the largest group by type in the Netherlands fleet, numbering 495 ; their individual tonnage varies from about 150 to 475 tons gross as a rule, but the extreme limits are 78 and 953 tons gross. The great majority are tramps, run by the owner-skipper and his family. In 1926 there were only 115 vessels of this type ; the rapid expansion of the fleet has depended largely on the successful development of the economical *Groninger* type (see p. 386). In recent years the coasting tramp was successfully penetrating the coasting trade of Great Britain (Plate 40).

Traffic, Services and Companies

Shipping Traffic

Of all shipping which entered the Netherlands ports in 1938 nearly one-quarter was under the national flag, while the German and British flags were close behind. These three accounted for nearly two-thirds of the total.

Entries of shipping, 1938, *in thousands of tons gross*

Flag	With cargo	In ballast	For repair	For bunkering	In direct transit	Total
Dutch	12,666	1,055	570	287	241	14,819
German	10,447	1,185	52	402	684	12,770
British	9,129	874	473	637	594	11,707
Norwegian	3,351	408	673	471	247	5,150
Italian	923	1,575	19	477	93	3,087
Swedish	2,117	321	55	138	192	2,823
Greek	851	487	272	734	103	2,447
French	1,214	482	105	243	220	2,264
Danish	916	166	90	128	120	1,420
Total, including all other flags	46,011	6,979	2,493	4,276	2,998	62,747

From : *Statistiek van de Scheepvaart op het Buitenland over* 1938, p. 8 ('s Gravenhage, 1939)

Vessels in direct transit were those which called en route to a final destination, without loading or discharging cargo, and not for repair or bunkering. A large number of vessels called to effect repairs ; Dutch yards are well equipped and offer competitive prices (see pp. 386–7).

Services

The Netherlands ports are connected by lines to most countries. In Europe the principal exceptions are Norway and Russia, connec-

tions with which are maintained by foreign companies. Outside Europe it is principally in Canada, the Congo, the Persian Gulf and Burma that the Netherlands flag does not show itself regularly. Dutch exports to these regions are comparatively small, and imports, such as wheat from Canada or rice from Burma, are handled by tramps. The Levant and Black Sea also do not figure prominently in Dutch liner services, although in 1939 the *Nederland Stoomvaart*

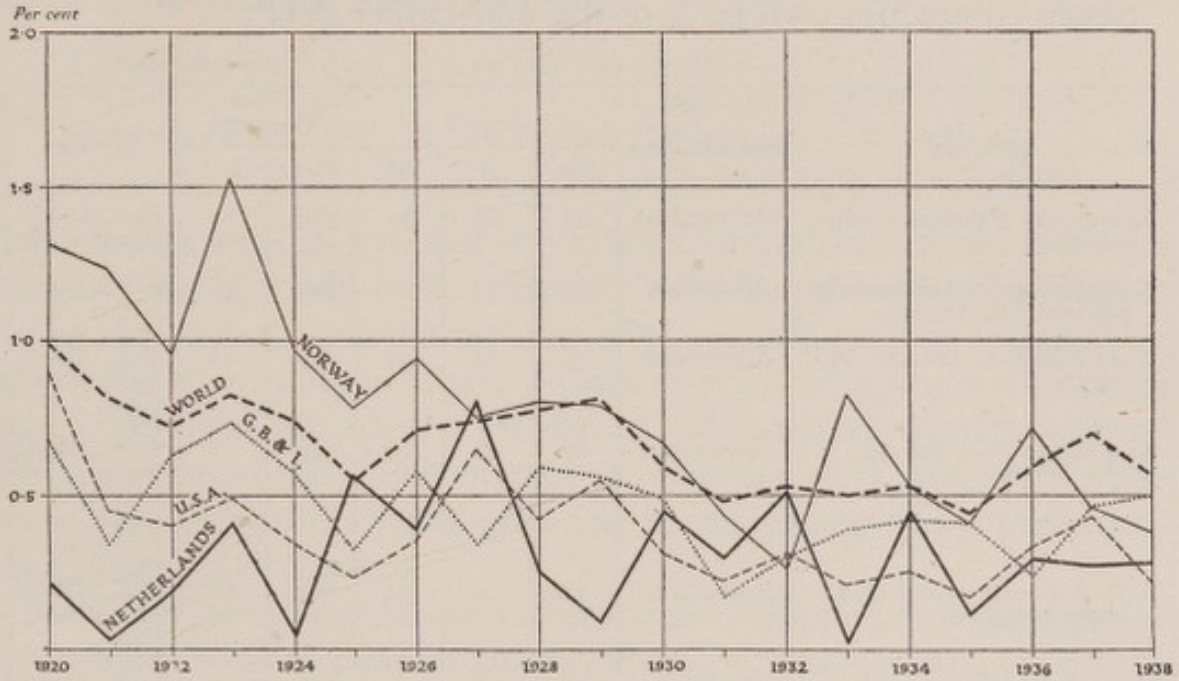


Fig. 94. Shipping losses, 1920–38

Data from : *Lloyds Register of Shipping*, 1939–40, vol. 3, Appendix, Statistical Tables, 1939, pp. 24–7 (London, 1939).
The graphs show the percentage of the tonnage owned by the various countries lost in each year.
It must be remembered that losses suffered by a fleet are affected by a variety of factors—age of vessels, type of route served, proportion of fleet engaged in coastwise traffic, etc.

Mij. and *Rotterdamsche Lloyd* established a direct connection between the Netherlands and the Levant. The Netherlands flag was represented in the Pacific by two services, operated jointly by the British-Dutch *Silver-Java-Pacific Line :* Pacific Coast–Gulf of Mexico–S. Africa—East (round the world), and Pacific Coast–East–India.

An interesting new venture in 1939 was the establishment of a regular service by a Netherlands company between Great Britain and Great Lakes ports.

Shipping Companies

In contrast to some countries, such as Greece and Norway, where shipping companies operating one ship or a few ships are the rule,

in the Netherlands the typical organization is the large company operating many ships. Only in the coastwise vessels is the owner-captain still met with. Nevertheless, the management of the leading companies has not been overweighted in the direction of financial rather than professional interests. The Netherlands shipping companies include several very large undertakings, the equal of any foreign companies.

Seven companies own 60% of the non-tanker fleet :

Company	Headquarters	Vessels			Gross Tonnage		Services
		No.	S	M	Fleet	LV	
Koninklijke Paketvaart Mij. (1891)	Amsterdam	137	86	51	330	14	East, Aust., Cape, E.A.
Nederlandsch-Amerikaansche Stoomv. Mij. (1871)	Rotterdam	27	17	10	322	36	U.K., Cont., U.S.A., C., W.I., Pac.
Nederland N.V. Stoomv. Mij. (1870)	Amsterdam	34	10	24	317	20	U.K., Cont., Med., East, Cape, C., Pac.
Koninklijke Ned. Stoomb. Mij. (1856)	Amsterdam	87	68	19	297	11	Cont., Med., Baltic, U.S.A., W.I., S. Amer., Pacific
N.V. Rotterdamsche Lloyd (Ruys & Zonen)	Rotterdam	31	9	22	253	17	U.K., Cont., Med., East, Cape, U.S.A., C.
Vereenigde Nederlandsch Scheepv. Mij. (1920)	The Hague	27	16	11	180	10	U.K., Cont., Baltic, Med., East, Aust., W.A., Cape, E.A.
Java–China–Japan Line (1903)	Amsterdam	11	8	3	92	11	East, Aust., W.A., Cape, E.A.

S : Steam ; M : Motor ; LV : Largest Vessel ; E.A. : East Africa ; W.A. : W. Africa ; W.I. : West Indies ; C. : Canada.

The pressure of competition has encouraged the companies to co-operate under schemes for joint working and capital combination. The share capital of the *Vereenigde Nederlandsche Scheepvaart Mij.* (*United Netherlands Navigation Company*) is owned by eight constituent companies. *The Koninklijke Paketvaart Mij.* operates the local services in the N.E.I. under contract with the government, and runs sixty-eight inter-island lines, as well as lines to ports in neighbouring countries. In 1939 the *Nederlandsche-Amerikaansche Stoomv. Mij.* took over the Red Star line from the German Bernstein concern.

Financial Aspects, 1930–9

Shipping in the Depression, 1930–6

The Netherlands suffered as severely as any maritime country during the depression of 1930–6. In six years, the fleet, which had doubled since 1914, suffered a tonnage reduction of 17%, while twenty-three companies lost *f.* 200 million in capital reserves. The fall in gross receipts was as follows :

Gross receipts 1930 : *f.* 329 million (freight—*f.* 251 million passengers—*f.* 77·6 million)
Gross receipts 1936 : *f.* 166 million (freight—*f.* 129·5 million passengers—*f.* 36·3 million)

In common with all national fleets, the Dutch fleet suffered from the constriction of world trade ; like the British and Norwegian fleets it suffered, further, from the increase of subsidized sailings operated by countries attempting to secure a share of world shipping traffic larger than their previous share. Finally, the Netherlands owners suffered peculiarly from the disadvantages of operating on a gold basis when so many competitors were operating in currencies which had abandoned the gold standard.

In these conditions the capital structure of the industry came under scrutiny. Shipping has more and more become an enterprise with an uncertain income, and to increase the fixed charges with fixed obligations to banks and bond-holders seemed unwise. In fact, during the years of depression the greatest difficulties were experienced almost exclusively by those companies which were partly operating on borrowed money.

Government assistance, 1933–6

Ship-owners were, by tradition, reluctant to urge government subsidies, but at length, in 1933, they appealed for support. A company known as BENAS was established in which the government participated, to provide credit for renewing out-of-date tonnage. It also advanced to more than twenty owners sums to offset the difference between wages in Netherlands currency and wages in the currency of other countries, as an interest-bearing credit. This company also assisted in the reorganization of the *Nederlandsch-Amerikaansche Stoomv. Mij.* and the Holland Steamship Company with resultant writing off of capital. The *Vereenigde Nederlandsch Scheepvaart Mij.*, which had been created during the boom period, lost 75% of its capital of *f.* 100 millions.

BENAS also advanced working capital where the maintenance of a line was considered to be of national importance, as in the South American trade. It was only in the North Atlantic trade that a building advance was made for the construction of a super liner (the *Nieuw Amsterdam*). A scheme was operated during 1935 and 1936 for the advancement of working capital, up to a limited maximum.

Government assistance, 1936–9

With the recovery from depression freights rose, and at first building increased. The rise in building costs, however, was greater

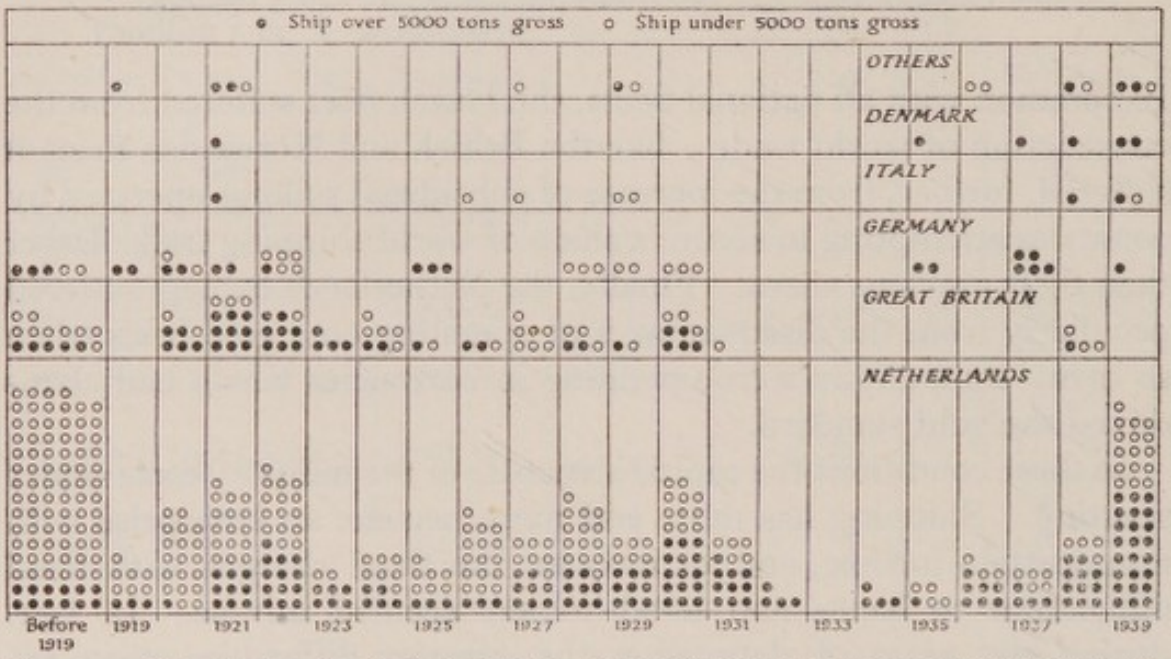


Fig. 95. The Netherlands fleet (steam and motor vessels over 1,000 tons gross), 1939, by country and date of building

Data from : *Lloyd's Confidential Index, Foreign*, December, 1939 (London, n.d.). The diagram illustrates the decline of Great Britain as a builder for Dutch ships. Output in the Netherlands reflects the post–1918 reconstruction, the expansion up to 1930, and the rapid revival in 1938–9 following the severe shipping depression of 1932–5. The most recent construction included a high proportion of larger vessels.

than the rise in freights, and building soon fell off, for the construction of a new ship appeared highly speculative. Early in 1939 the government considered a form of subsidy for the construction of new tonnage, and offered to grant loans to established companies for the construction of new vessels up to 50% of the cost, at $2\frac{1}{2}$%, subject to two conditions (1) that there should exist a reasonable proportion between the existing capital resources of the company and the amount of loan to be secured by a mortgage ; (2) the ship must be constructed by a Netherlands shipyard, and material and fittings must as far as possible be of Netherlands manufacture. In this way,

the company would not contract loan obligations out of proportion to its ability to pay interest in bad years, and employment would be spread within the country. Apart from inspection of the balance sheet by BENAS, there was to be no further interference by the government in the affairs of the company. The extensive building programme of 1939 indicated that recovery had been considerable (Fig. 95).

Personnel and Administration

Recruitment of Officers

Examinations for certificates are conducted by the Examination Committee which is appointed by the Government. The certificates awarded in 1937 were as follows :

	No. of entrants	No. of certificates granted
Deep Sea		
1st Officer	79	40
2nd Officer	84	50
3rd Officer	215	102
Engineer	427	216

From : *Jaarcijfers voor Nederland*, 1938, p. 68 ('s Gravenhage, 1939)

The number of entries for 1937 was little more than half the number for 1931, when they were at their maximum.

For the training of masters, mates and engineers, there are the mercantile marine training colleges at Rotterdam, Amsterdam (two), Den Helder, Flushing, Delfzijl, Harlingen, Groningen, and Terschelling. A college at Scheveningen trains second and third class officers.

Administration

Legislation provides for the supervision of all matters concerning the shipping register ; provision for safety ; the issue of certificates of nationality ; the application of the maritime law in the Commercial Code and of separate shipping laws ; the supervision of boilers ; the maintenance of discipline ; and the insurance of passengers and crews. Supervision of loading gear is exercised by the Port Labour Inspectors (*Inspectie van den Havenarbeid*). Navigation Inspectors (*Inspecteur voor de Scheepvaart*) examine the seaworthiness of ships. The Navigation Court (*Raad voor de Scheepvaart*) investigates maritime disasters and takes disciplinary measures.

The Nautical Institute and Technical Museum at Rotterdam exhibits the newest inventions in connection with the operation of ships and the maintenance of the Dutch ports.

Ocean Salvage

Dutch seamanship finds its highest expression in ocean salvage and towage. Port and river towage is, of course, necessary on an extensive scale in the many harbours and waterways, and river tugs operate on European rivers outside the country, but it is in long-distance ocean salvage and towage that the Dutch enjoy a well-deserved reputation.

The principal undertaking in this field is the world famous Rotterdam towage company of L. Smit & Co. (*N.V. Internationale Sleepdienst Mij.* and *N. V. Smit & Co.'s Sleepdienst*), which operated twenty tugs in 1939. Most of these were designed for ocean towage, in which the company specialized. The magnitude of the company's operations may be judged from the fact that during the period 1892–1934 it carried out 6,415 towages (564 steamers, 481 obsoletes, 1,436 dredgers, 2,259 Thames barges, 1,118 lighters, 165 floating cranes, 57 floating docks, and 292 other craft). Of this total, only 48 tows were lost, or 0·74%.

The tugs of this company have operated all over the world, and have gained for the Netherlands a reputation for unequalled prowess in the difficult work of ocean salvage. The successful strategy of these operations calls for an extremely well-planned but flexible organization, and the company maintains a private wireless station and intelligence service. From their nature, tow contracts and casualties are haphazard in their occurrence : the aim of a salvage company must be to keep its vessels at sea for as short a time without a tow as possible.

The Smit tugs operate from home bases at Rotterdam, Maassluis and Hook of Holland, and from permanent or occasional bases abroad at Falmouth, Yarmouth, Harwich, Brest, Corunna, Fayal, St. John's and other ports. It is not unusual for several different tugs from one or more of these bases to take part in one comparatively straightforward operation, though no more than one may be used at any given moment. Tugs may be changed several times in the course of a long tow, according to the position of waiting reliefs, the passing of another ' contract ' tow, the casualty situation in any particular area, and the needs of bunkering and re-victualling (Fig. 96).

Of the twenty vessels which composed the fleet in 1939, five were motor tugs and fifteen were steam-propelled. The company has always been in the forefront of design for ocean-going tugs. The *Zwarte Zee*, for example, is the largest vessel in the fleet and the most

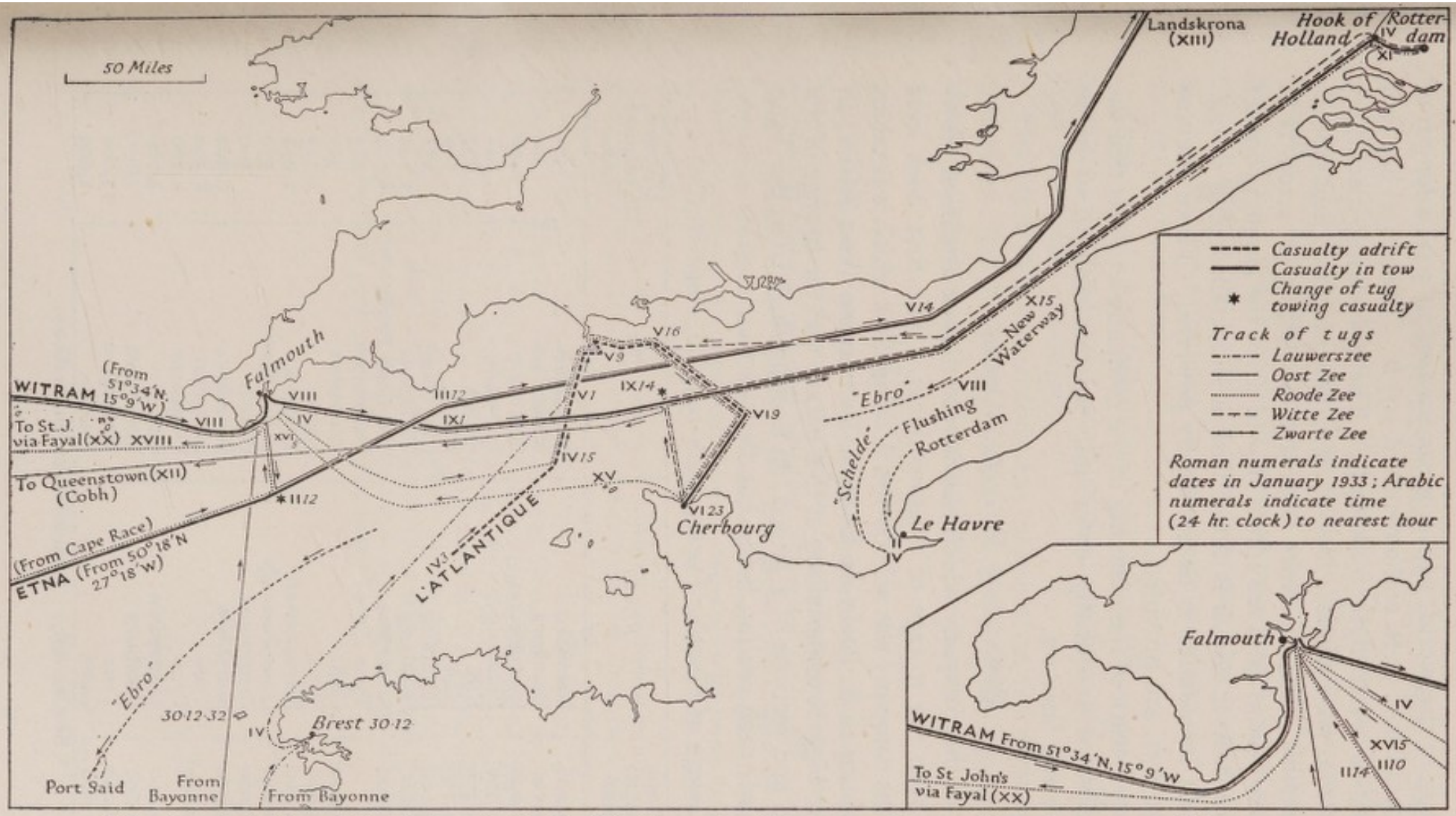


Fig. 96. Activities of Dutch tugs in the English Channel and its approaches, 30 December, 1932—18 January, 1933

From official sources

In the heavy Atlantic gales preceding and during the early part of this period the *Witram* and the *Etna* both sustained damage to rudder posts. On January 3 the French liner *L'Atlantique* caught fire while on passage from La Pallice to Cherbourg and was abandoned on the following day. Tugs accompanied the drifting vessel from a point north-west of the Casquets, past Portland, to a point south-east of the Needles, where the Dutch tugs took her in tow. The map shows the movements of these three casualties and of the five tugs which, at various times, were concerned with them. Intersecting routes are shown chronologically.

At the same time other tugs of the Smit company, 'Ebro' and 'Schelde' were on passage through these waters in connection with chartered tows.

powerful tug in the world, with a gross tonnage of 793, a length of 196 ft., a breadth of 32 ft. and a depth of 19½ ft. The vessel has four decks and five water tight bulkheads. The propelling machinery consists of two six-cylinder, four-cycle, solid-injection, high-speed, direct-reversible Diesel motors with a total output of 4,200 H.P. coupled to a Vulcan fluid reduction gear to drive the single propeller shaft. The hawser winch is fitted with a shock-absorbing device. The wireless installation is exceptionally powerful. Three anchors of about 20 cwt. are provided.

A curious feature of the manning of the company's tugs is that the sons of captains frequently enter into apprenticeship, so as to command a tug later on.

Towage of Floating Docks

The work of the company which has attracted most attention, however, has been the towage of floating docks. The first dock ever towed by this company was a 2,000-ton floating dock which was taken from Hamburg to S. Paolo de Loanda (Portuguese West Africa) in 1896. The biggest undertaking of this nature was the towage of the middle and end sections of a 50,000 ton floating dock from the Tyne to Singapore, each section being handled by four tugs.

Towage of Floating Docks, 1920–1933 (*L. Smit & Co.*)

Year	Lifting capacity, tons	From	To	Distance in nautical miles
1920	4,200	Hamburg	Rotterdam	324
	4,200	Hamburg	Rotterdam	324
	10,000	Invergordon	Schiedam	490
	46,000	Hamburg	Schiedam	324
	4,200	Kiel	Rouen	567
	4,200	Kiel	Havre	500
1921	3,600	Hamburg	Cherbourg	531
1922	1,600	Hamburg	Tarragona	2,100
1923	8,000	Rotterdam	Tandjong Priok	8,700
1924		Tyne	Dartmouth	485
	1,800	Cadiz	Cartagena	300
	3,000	Tyne	Lagos	4,332
	4,200	Bremerhaven	Valencia	1,954
1926	40,000*	Queenborough	Scapa Flow	530
	40,000	Portsmouth	Rosyth	500
1928	3,000	Rotterdam	Sourabaya	9,000
	50,000†	Tyne	Singapore	8,500
		Tyne	Singapore	8,500
1929	4,000	Amsterdam	Curaçao	4,700
	11,000	Hamburg	Rotterdam	(lost)
1932	17,000	Tyne	Wellington	13,000
1933	1,600	Cadiz	Passajes	1,000

* Section only. † Middle and end sections.

E. W. Blocksidge, *Hints on the Register Tonnage of Merchant Ships*, p. 71–2 (Liverpool, 1942) describes the Netherlands regulations as follows: 'The British regulations were adopted in 1899 for sea-going ships. The method of treating open spaces is also the same; but the British method of limiting the propelling power allowance to 55% of the gross tonnage in accordance with the Act of 1907, has not yet been adopted.

River vessels for Holland and the River Rhine are measured for carrying capacity, and a scale marked on their sides between the light and loaded conditions.

The registered dimensions are measured in the same manner as directed in the British regulations, except that the rake of the stem above the upper deck is not included in the length'.

BIBLIOGRAPHICAL NOTE

1. Fragmentary information on the Netherlands mercantile marine is to be found in a number of scattered sources. Summary tables of the fleet are given in *Lloyd's Register of Shipping, Statistical Tables*, pp. 4–27 (London, 1940); details of the vessels over 1,000 gross tons owned by the various companies are given in *Lloyd's Confidential Index, Foreign* (London, 1939); short descriptions of vessels and services, together with notes on the history of the leading companies, may be found in E. C. Talbot-Booth, *Merchant Ships* 1940 (London, n.d.).

2. Information on the economic position of the mercantile marine is given in the *Reports on Economic and Commercial Conditions in the Netherlands*, for 1932, 1933, 1936, 1938, compiled by the Department of Overseas Trade (London, 1933, 1934, 1936, 1938); E. Heldring, 'Nederlandsche Lijnvaart', *Tijdschr. Kon. Ned. Aardrs. Gen.*, vol. 53, pp. 3–14 (Leiden, 1936); C. J. P. Zaalberg, 'The Netherlands Merchant Navy', *Amsterdamsche Bank N.V. Quarterly Review No.* 63, *April* 1040 (Amsterdam); and the quarterly reviews of the *Rotterdamsche Bankvereeniging*.

3. A general survey of tanker operation is provided by T. Koopmans, *Tanker Freight Rates and Tankship Building* (Haarlem and London, 1939).

4. Some information is to be found in the *Jaarverslag der Inspectie van den Havenarbeid over* 1938 ('s Gravenhage, 1939).

CHAPTER XVI

THE PORTS

Introduction : Terneuzen : Flushing : Hook of Holland : Maassluis : Rotterdam (including Vlaardingen and Schiedam) : Dordrecht (including Zwijndrecht) : Ymuiden (IJmuiden) : the North Sea Canal : Zaandam : Amsterdam : Den Helder : Harlingen : Delfzijl : Groningen : Minor ports : Conditions since the Occupation : Bibliographical Note

Introduction

Navigation off the Dutch coast is not altogether free from difficulty. The shores are low and seldom visible for more than about 12 miles, even in clear weather, while the strong tidal streams and the prevalence of fog and mist at certain seasons complicate navigation. Nevertheless, the adverse factors are less serious than off the Belgian coast ; off-lying shoals are fewer, and the traffic of commercial and fishing vessels, while considerable, is less marked than farther south.

The entrance to the West Scheldt is complicated by the Raan and other banks, although the deep channel of the Wielingen provides a least depth of 5 fathoms M.L.W.S. Off the Zealand estuaries shallow water is also found some distance offshore, while farther out are banks like Schouwen and Steen, with least depths respectively of 3 and 2½ fathoms ; these are the most northerly of the extensive series of shoals which are found in the southern North Sea and converge towards Dover Strait. Along the greater part of the gently curving coast northwards of the Hook of Holland, however, the 6-fathom line comes gradually to within about a mile of the shore, hence entry to Hook of Holland and the New Waterway (Nieuwe Waterweg) is short and direct. Off this coast the bottom slopes much more gently seawards to the 10-fathom line.

From the Texel the long chain of the Frisian islands runs northwards and north-eastwards, interrupted by *gaten* or straits ; seawards there are two gravel and shingle banks, Vlieland Reef and Borkum Reef. The 6-fathom line lies at a varying distance : off the greater part of each island it is about three miles distant, but outside each *gat* between the islands the submarine contours regularly bend seawards. The shoals which they indicate, known as submarine deltas (see p. 700) are a peculiar feature of this coast. They are penetrated by channels or *dieps*, in which the water is often fairly

deep. Within the fringe of islands lies the Wadden Zee, an expanse of drying flats threaded by channels, now cut off from Yssel Meer (Zuider Zee) by the Wierigen Dam (Afsluitdijk). The Yssel Meer can now be entered only through locks, by vessels drawing no more than 10 ft. at M.L.W.S.

Tides

Off Flushing the spring rise above chart datum is 15½ ft., decreasing northwards to 6½ ft. in the Maas and 6 ft. in the Texel. Farther northwards it increases gradually, being 7 ft. in Terschelling Gat, 8 ft. in Ameland Gat, 9¼ ft. in Friesche Gat, and 9–11½ ft.. in the Ems. The stand of high and low water varies along the coast. North-eastward of the West Scheldt the low water stand gradually increases in duration, until at Hook of Holland it lasts for about three hours, giving a long or double low water stand ; northwards of Hook of Holland the duration of the low water stand gradually diminishes. Northwards of Ymuiden the high water stand increases, and at the Texel the greater part of the tidal rise occurs during the first two hours of the flood tide. North-eastward of the Texel this long stand diminishes until at the Ems estuary the tidal wave is again normal.

On these coasts the water level may be affected very considerably by strong and long-continued winds, to the extent of several feet. Westerly winds raise the sea level and easterly winds lower it.

In hard winters the harbours to the north and the inner reaches of the estuaries to the south may be impeded by ice. During the exceptional conditions of 1929, for example, navigation for steamers was impeded for 13 days at Bat on the West Scheldt, for 1 day at Wemeldinge on the East Scheldt, 12–18 days in the Brouwershaven Gat and Hollandsch Diep, 15 days at Kijkduin in the approaches to the Texel, and 16 days at Delfzijl.

The Ports

Fifteen ports are separately distinguished in Dutch statistics of trade and navigation, and are given detailed returns of foreign trade by sea and of cargo movements by inland waterway. They are also grouped according to their position on the two great sea entries of the North Sea Canal and the New Waterway.

Inward movement of shipping in foreign trade, 1938

Ships with cargo and in ballast entering for discharge or loading, repair or bunkering, and in direct transit) in thousands of gross tons

Port	No.	Tonnage
North Sea Canal Ports	*3,850*	*8,889*
Amsterdam	3,233	7,445
Ymuiden	416	1,180
Zaandam	201	264
New Waterway Ports	*16,676*	*46,998*
Rotterdam	14,378	40,120
Vlaardingen	737	2,752
Hook of Holland	520	2,247
Schiedam	340	1,397
Dordrecht } Zwijndrecht }	570	376
Maassluis	131	106
Remaining Ports	*6,472*	*7,658*
Flushing	1,545	4,248
Terneuzen	1,728	2,753
Delfzijl	660	371
Harlingen	347	215
Groningen	352	71
Other Ports	*1,840*	*445*

From : *Statistiek van de Scheepvaart op het Buitenland*, p. 14–15 ('s Gravenhage, 1938)

Ships in 'direct transit' are those which call at a port, but not for the purpose of loading or discharging cargo, and not for repair or bunkering.

Of these fifteen ports Dordrecht and Zwijndrecht may be taken as one, for they lie on opposite banks of the Old Maas. Vlaardingen and Schiedam share largely in the conditions which favour Rotterdam, although they are administered separately and compete with Rotterdam. Groningen, the smallest of the ports, has only in recent years been entered separately in the trade returns.

Not all of this shipping traffic enters the ports to which it is assigned in the statistics. The greater part of the tonnage entering Terneuzen is in direct transit and is accounted for by ships passing through the lock *en route* for the Belgian port of Ghent, and a small tonnage passes Rotterdam *en route* for the Rhine, *i.e.* the Rhine—sea traffic to Duisburg and even to Basle. Further details will be found under the heading 'trade' in the account of each port.

Movement of cargo in foreign trade, 1938 (thousands of tons)

Port	Imports, direct		Exports, direct		Unloadings in transit		Loadings in transit		Total Port Movement		Total
	Sea	Water-way	Sea	Water-way	Sea	Water-way	Sea	Water-way	Sea	Water-way	
North Sea Canal Ports	*3,510*	*1,403*	*1,342*	*331*	*1,057*	*586*	*987*	*541*	*6,896*	*2,863*	*9,759*
Amsterdam	2,431	880	1,194	219	1,054	581	976	539	5,655	2,219	7,874
Ymuiden	826	469	132	103	—	3	3	—	962	574	1,537
Zaandam	253	55	16	10	2	3	8	2	279	69	348
New Waterway Ports	*7,852*	*1,297*	*3,561*	*1,544*	*19,651*	*14,803*	*15,700*	*18,959*	*46,765*	*36,603*	*83,369*
Rotterdam	7,004	846	3,018	1,150	17,500	13,839	14,849	16,827	42,371	32,662	75,033
Vlaardingen	657	81	386	265	1,945	752	609	1,934	3,597	3,031	6,628
Hook of Holland	39	3	21	—	20	—	7	3	88	7	95
Schiedam	40	96	44	19	32	90	126	27	242	233	475
Dordrecht-Zwijndrecht	109	255	90	107	103	116	102	118	405	596	1,000
Maassluis	4	15	2	2	50	6	6	50	62	73	135
Remaining Ports											
Flushing	213	34	160	53	2	323	332	1	707	411	1,117
Terneuzen	202	401	158	106	134	4	22	58	517	569	1,085
Delfzijl	141	8	219	16	—	3	3	—	363	27	390
Harlingen	68	65	91	15	4	—	5	—	168	81	250
Groningen	46	99	57	13	—	—	—	—	103	112	215
Minor Ports	*179*	*6,057*	*214*	*5,374*	*1*	*17*	*2*	*12*	*395*	*11,460*	*11,855*
Total	12,212	9,366	5,802	7,453	20,850	15,736	17,050	19,571	55,914	52,127	108,041

From : *Jaarstatistiek van den In-, Uit-, en Doorvoer over* 1938, pp. 32-33 ('s Gravenhage, 1939)

It should be noted that in the last three columns the transit figures are counted twice. Thus the 17,500,000 tons unloaded by sea in transit at Rotterdam is later loaded there in transit (16,827,000 tons by waterway and the rest by rail and road). The last three columns, therefore, indicate not the quantity of cargo moving through the port, but the quantity which is handled. Direct imports and exports, on the other hand, are recorded only as unloaded (imports) or loaded (exports).

In the movement of cargo the dominance of Rotterdam is very marked, for it handles four-fifths of the seaborne cargo, a quantity which is nearly eight times as large as the weight of cargo accounted for by Amsterdam. In the trade of all the ports transit imports are nearly twice the direct imports, and transit exports are nearly three times the direct exports.* Rotterdam accounts for most of the transit ; of the smaller ports which handle this traffic Vlaardingen is first owing to extensive ore imports ; the smaller transit traffic at Amsterdam is better balanced, however.

Technically, the port works are of no great interest, except for those of the North Sea Canal, leading to Amsterdam, an impressive engineering achievement in a difficult terrain. Of the natural entries for shipping, Rotterdam stands on one which required the great undertaking of a new direct cut in the last century, the New Waterway. It is the river connections by way of the Waal-Rhine which make the site of Rotterdam so advantageous. The best natural entry in Dutch territory—the West Scheldt—is used only by the secondary Dutch ports of Flushing (Vlissingen) and Terneuzen ; it is more important as the gateway to Antwerp, the chief Belgian port and rival of Rotterdam.

The wet dock is little used in the Netherlands ports, for the low rise of tide permits tidal basins to be used for cargo handling. The ports are mostly owned and supervised by the municipal authorities within whose jurisdiction they lie. At Rotterdam and Amsterdam quays are normally leased for long periods to shipping and other companies.

In the following account the fourteen ports named above (Dordrecht and Zwijndrecht being counted as one) will be described, together with Den Helder, the principal Dutch naval base. The ' other ports ' are very small, and comprise mostly drying harbours. The majority are found in South Holland and Zealand. Altogether seventy-eight minor ports are described in the *Zeemansgids voor de Nederlandsche Kust*, fifty-two on the coast and twenty-six within the Yssel Meer (Zuider Zee). The more important of these are listed on p. 524.

* The foreign trade of the Netherlands, i.e., imports for consumption within the country or exports of Dutch produce (as distinct from transit trade) is often referred to as ' direct ' imports and ' direct ' exports or as ' special ' imports and ' special ' exports.

Terneuzen

(Figs. 97,117 ; Plate 41)

Terneuzen, or Neuzen (11,000), is the only port of any size in Zealand Flanders. It derives little trade from the Dutch territory on either side of it, and is important mainly as a point of entry to the Ghent-Terneuzen ship canal, although it carries on a considerable trade in transhipment for the nearest parts of Belgian Flanders.

Lying on the south bank of the West Scheldt about 11 miles upstream from Flushing by the deep channel, it is approached by the Honte and by the Pas van Terneuzen. Least depths are about 25 ft. Sheltered anchorage for deep-draught vessels may be found on the north side of Terneuzen road in depths of 60 ft. The tidal rise is 16·4 ft. (M.H.W.S.). The largest ship known to have loaded at the port had a gross tonnage of 10,300.

Detailed Description

The port comprises two outer harbours giving access by three locks to the Ghent-Terneuzen Canal, along which lie two well-equipped basins. In Terneuzen itself there is little accommodation save for fishing boats and barges.

The western outer harbour (Westelijke Buitenhaven), with depths of 23½ ft., leads between two breakwaters, continued by sloping dykes, to the West Lock. Continued by the West Canal Arm, this gives the most direct entry to the canal. About 1,000 yards north of Westelijke Buitenhaven, enclosed by two breakwaters, channels with depths of 11½ ft. and 9½ ft. lead to the Middle and East Locks which lie on either side of the town and lead by converging arms to the canal.

Dimensions of locks, in ft.

	Length	Width	Depth
West Lock	459	59	26
Middle Lock	295	36	19
East Lock	377	26	14

Southwards, along the canal, there are 3,000 ft. of quayage, including a deep-water berth of 650 ft., and the two basins opening off the east bank. Noorder Kanaalhaven is about 200 ft. wide, with a mean length of nearly 600 ft. ; Zuider Kanaalhaven is 300 ft. wide and 780 ft. long. Both have depths of 26 ft. ; they are equipped for the rapid handling of bulk cargoes.

Port Facilities

Owing to its position at the entrance to the canal, Terneuzen maintained a large number of tugs, eighteen normally being available. Lifting equipment comprised seven cranes up to a capacity of 5 tons on the canal quay and eight up to 5 tons in the canal basins. There were no repair facilities beyond a small shipyard which constructed barges and maintained a floating dock stated to be capable of lifting ships up to 600 tons.

The Town

For centuries Terneuzen had little but local importance. The opening of the Ghent–Terneuzen ship canal in 1827 made little difference to the town. With the construction in 1870 of the railways to Ghent and Terneuzen, and the building of wharves and quays by the railway company, trade expanded, and the transhipment traffic has continued, although the waterways are now much more important than the railway.

The town is small and compact, with narrow streets, lying between the Middle and East Locks. Newer buildings have spread south-eastwards along the road to Axel. Electricity is supplied from a small power station at Driekwart on the west bank of the canal, and gas from the gasworks at Axel. A piped water supply has only recently been laid on.

The town is the seat of a police court (*Kantongerecht*).

Trade

In 1938 the shipping movement at the port was as follows (with cargo and in ballast) :

	Entries		Sailings	
	No.	Gross Tonnage	No.	Gross Tonnage
For discharge or loading	174	355,000	228	360,190
In direct transit	1,554	2,398,000	1,434	2,276,000

From : *Statistiek van de Scheepvaart op het Buitenland over* 1938, pp. 14–15 ('s Gravenhage, 1939)

The cargo trade returns are swollen by the inclusion of goods which pass Terneuzen and are handled at Sluiskil, the port to the south near the Belgian frontier, and the site of two important industrial undertakings—a coke-oven plant and a synthetic ammonia plant. The shipping passing through the port as ' direct transit ' is in passage to Ghent.

Cargo trade, 1938 (*including Sluiskil*) *in thousands of tons*

Commodity	Special Trade				Transit Trade			
	Imports		Exports		Imports		Exports	
	Sea	Water-way	Sea	Water-way	Sea	Water-way	Sea	Water-way
Ores	116·5			50·6				
Coal	51·1	299·2			61·7		7·8	
Coke and Briquettes		3·6	101·4	13·7				
Fertilizers	25·1	7·6	54·2	19·7				
Stone	4·8	12·8			3·3		2·0	
Iron and Steel					14·3		8·0	3·6
Minerals and products thereof		62·2			5·2	3·3	1·7	42·1
Chemical products				6·9	1·6		1·1	
Pulpwood					36·9			
Total, including unnamed goods	202·5	400·8	158·1	105·9	134·4	4·2	21·6	57·9

From : *Jaarstatistiek van den In-, Uit-, en Doorvoer over* 1938, vol. 1, p. 399 ('s Gravenhage, 1939)

At Terneuzen itself there is little cargo movement originating in Dutch Flanders except for some export of fruit. Transit with transhipment is much more important : raw materials for the industries along the banks of the Ghent-Terneuzen Ship Canal are unloaded at Terneuzen and transferred to barges. In this traffic the port is complementary to Flushing, for barges which discharge Westphalian coal there proceed to Terneuzen and secure a cargo for Belgian destinations. The export trade in this transhipment is very small, for most of the products of the industries are marketed in Belgium. In the special trade the import of coal and the export of coke and fertilizers shown in the table above are mainly on account of the coke ovens and synthetic ammonia plant at Sluiskil. The total quantity of seaborne cargo handled at the two ports amounted to 516,600 tons ; waterway cargo amounted to 568,800 tons.

Communications

The older part of the port around the locks is not served by railway, but the east bank of the canal has good rail connections. A double-track line runs southwards ; at a point 3 miles south of the town station the line divides, one single track continuing southwards through Sas-van-Gent across the Belgian frontier to Selzaete and Ghent, and another single track turning eastwards to Axel and Hulst, eventually crossing the frontier to continue to St. Nicholas and Malines.

Terneuzen is well placed for waterway transport by large barges, for the Ghent-Terneuzen Canal leads southwards to western Belgium

and provides connections to northern France, while the West Scheldt gives access both to Antwerp and to the South Beveland Canal, leading to the Netherlands and the Rhine.

For roads see Fig. 117.

Flushing (Vlissingen)

(Figs. 98,117 ; Plates 42, 43)

Flushing (22,000) is the third largest port of the Netherlands. Its hinterland, as the term is usually understood, is very restricted, and the port derives the greater part of its traffic from the Harwich packet service and from its place as a leading bunkering port.

Approach and Access

Of all the Dutch ports only the Hook of Holland has a shorter and more direct approach from the North Sea. Standing at the south end of Walcheren island, on the north shore of the West Scheldt, at its western entrance, Flushing can be approached by three channels—by the wide Wielingen from the south-west, with a least depth of 28 ft., by the narrow Oostgat from the north, with a least depth of 23 ft., and by the Deurloo channel from the west across the Raan Bank, with 17¾ ft. Off the port is the Honte,* the first reach of the deep channel up the West Scheldt. Anchorage in the roadstead is not safe during bad weather from the west ; in such circumstances vessels anchor farther up the Scheldt in Terneuzen road. The tidal rise is 15½ ft. (M.H.W.S.).

Detailed Description

The port comprises two main sections—an outer tidal harbour (Buitenhaven) and an inner series of three basins separated by a lock from the harbour entrance. The Buitenhaven is about 1,000 yards long and 300 yards wide. The northern end is shallow and much of the perimeter is not quayed, but it contains the berth for the Harwich boats and the bunkering facilities. The wet dock system consists of two basins (Eerste and Tweede Binnenhaven) opening northwards from the Verbreed Canal, which in turn leads northwards, by way of the Verbindings Canal, to the Walcheren Canal. The Verbreed Canal is continued westwards by the narrow arm of Het Dok, in which the shipyards are situated.

* See footnote on p. 618.

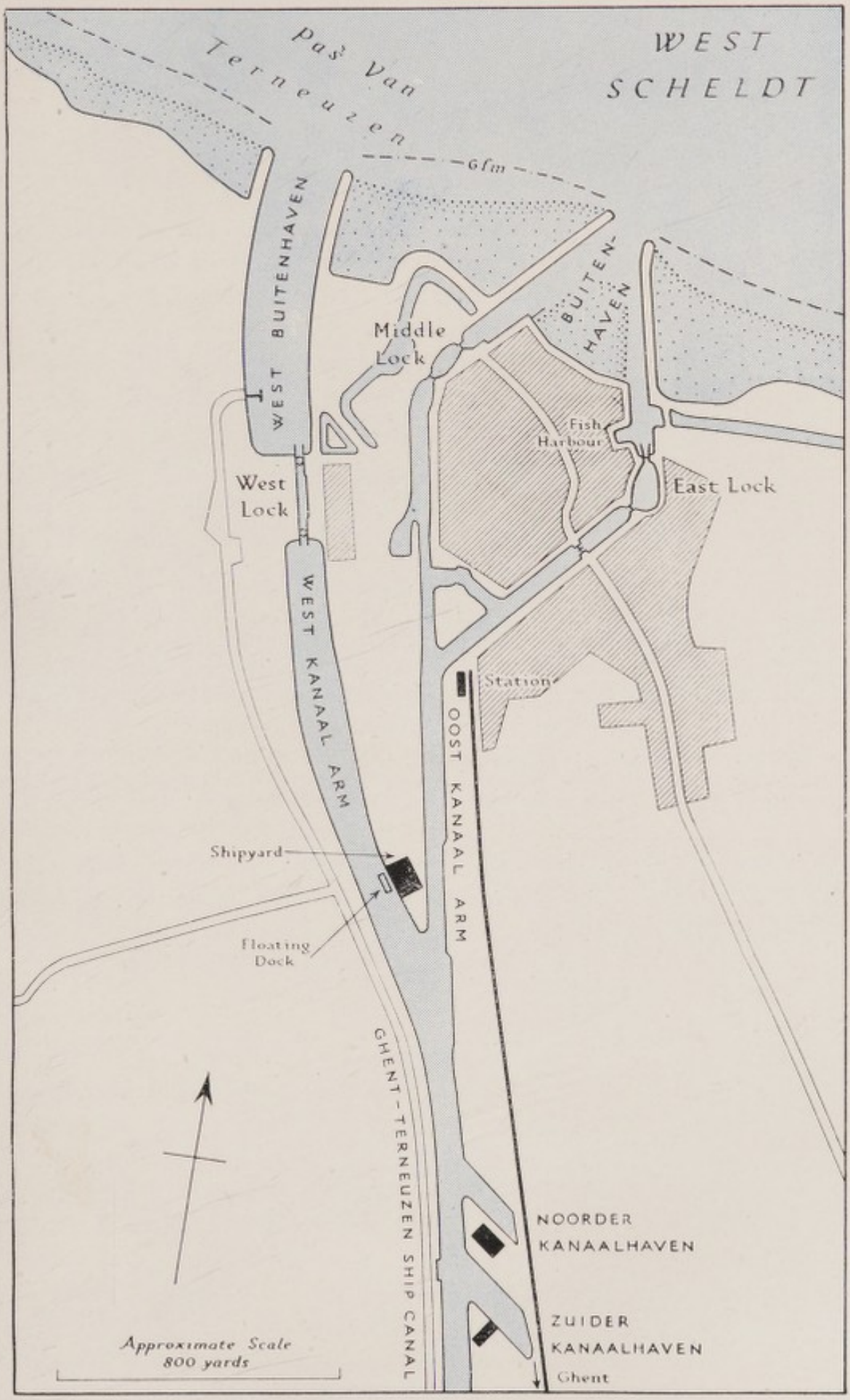


Fig. 97. The port of Terneuzen

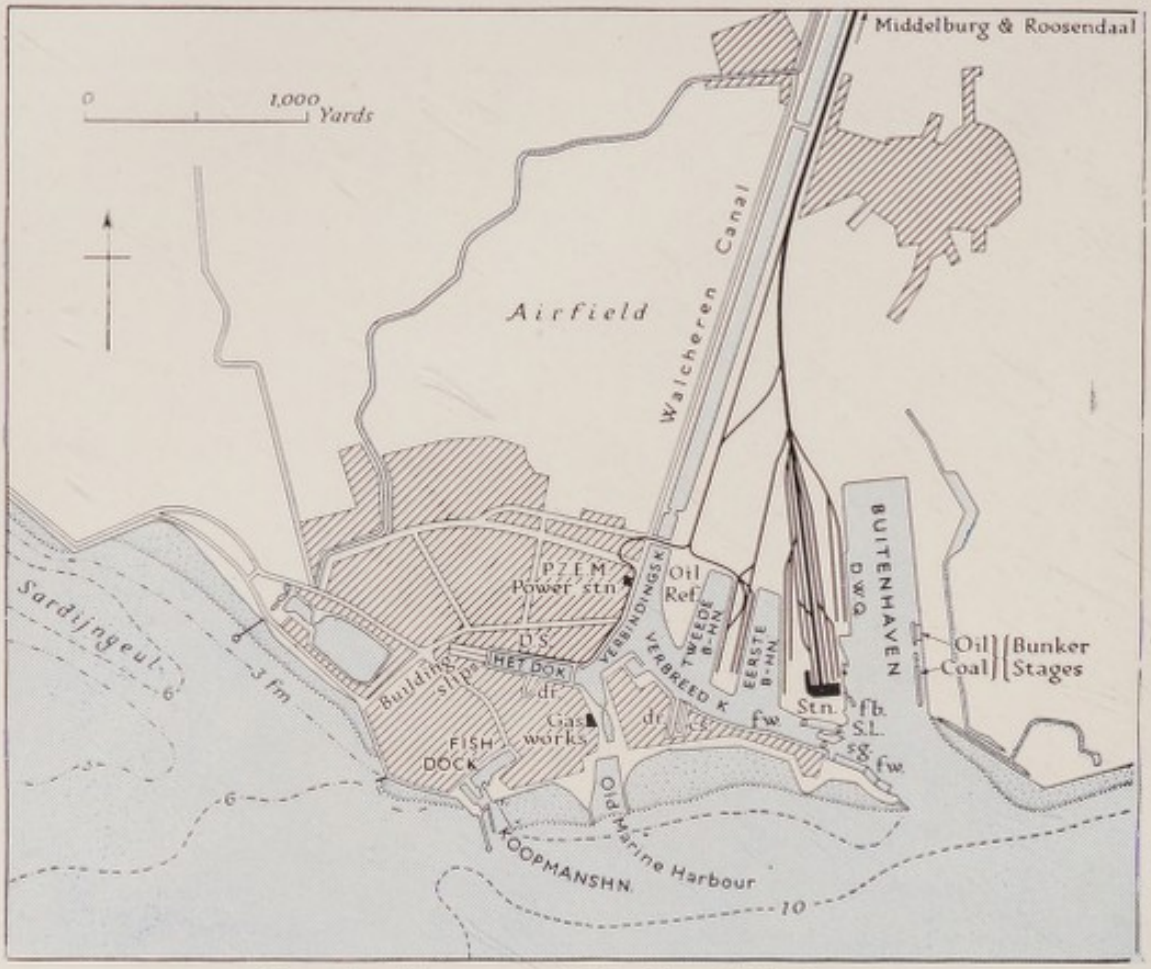


Fig. 98. The port of Flushing (Vlissingen)

cs covered building slip ; dr dry dock ; D.S. De Schelde shipyard ; D.W.Q. Deep water quay ; fb ferry berth ; fw fendered wharf ; S.L. sea-lock ; sg pontoon lock gate ; the small lock is between the sea lock and the gate.

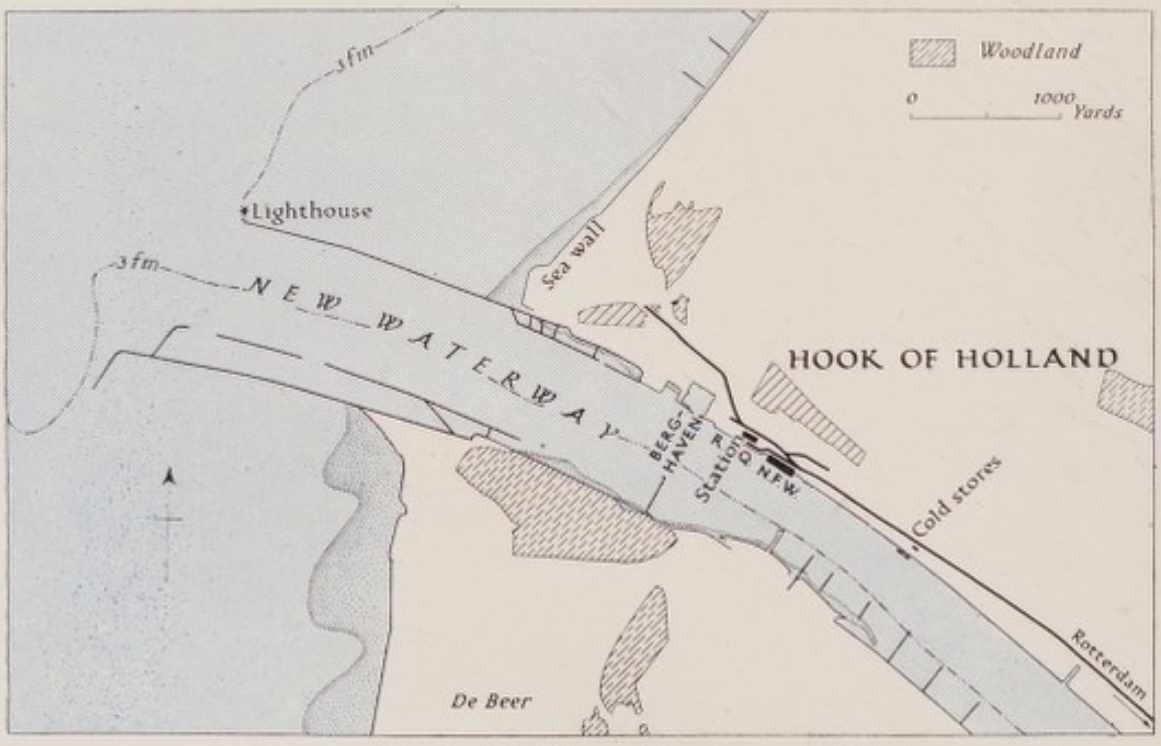


Fig. 99. Hook of Holland (Hoek van Holland)

NFW New Fruit Wharf ; RQ Railway quay.

Dimensions of Locks, in ft.

	Length	Width	Depth on sill, M.L.W.S.
Large lock	481	65	12½
Small lock	211	26	12½
Pontoon lock gate		115	12½

Binnenhaven. The Eerste and Tweede Binnenhaven are each about 150 yards wide and over 400 yards long. The former is used chiefly by naval and government vessels. The latter has a quay on the east side and jetties on the west side serving the oil refinery. On the south side of the Verbreed Canal are the *De Schelde* company's two covered building slips and the new dry dock. West of the old entrance is the fitting out basin of the shipyard known as Het Dok, which is normally closed by means of a pontoon bridge. The general depth in the inner harbour is 24 ft. although there is less water along the sloping walls which take up most of the water front.

Details of Quayage

Name	Approx. depth L.W., ft.	Length ft.	Name	Approx. depth L.W.	Length ft.
Buitenhaven :			*Binnenhaven :*		
Coaling pontoon	28	540	*Eerste B.*		
Oiling pontoon	28	430	East side	24	1,450
Deep water quay	34–21	1,080	North side	24	300
North floating stage	28	240	West side	24	1,400
Centre floating stage	28	255	*Tweede B*		
South floating stage	28	126	East side	24	1,400
Fendered wharf	28	850	West side (3 jetties)	24	1,000

In the Verbreed and Verbindings Canals the only berths of much use are the fendered wharf along the south side of the former, which is 1,500 ft. long and has depths of 24 ft. maintained, although it is normally used only by small vessels.

Port Facilities

Warehouses are few. In the commercial port there are six cranes, one of which is on the deep water quay ; one of the four on the west side of the Eerste Binnenhaven has a capacity of fifty tons. The fitting out basin has two cranes up to ten tons and one 150-ton hammerhead. Repairing facilities include two dry docks. The new dock in the Verbreed Canal has a length of 448 ft. and a sill depth of 20½ ft. at M.H.W.S. The shipyard has two building slips, the largest being 590 ft. long. This well-equipped yard is capable of most repair work. It builds ships up to 21,000 tons displacement, including cruisers ; four vessels can be built simultaneously. The engine works construct both turbines and diesel engines.

The Town

The old town is a compact area overlooking the Scheldt, and centred around St. James's church (Groote Kerk). Newer buildings lie to the north-west along the sea promenade and northwards beyond Het Dok. Electricity is supplied by the P.Z.E.M. power station which lies on the west side of the Verbindings Canal ; the gasworks lie on the south side. Water is supplied by a network serving a considerable territory.

History

The name Flushing (Vlissingen) first occurs in the thirteenth century. The village then lay farther inland and to the north-west ; it was connected with the sea by an inlet which formed the earliest harbour on this coast. Shortly before 1308 a new harbour was constructed east of this old harbour, and it quickly attracted the seafaring folk of the former settlement, which then became a purely agricultural hamlet. The town which grew up around the new harbour was at first called ' New Flushing ', but soon became known simply as ' Flushing ', while the original village was called ' Old Flushing '. Count William III of Holland granted Flushing town privileges in 1315. The church of St. James (Groote Kerk) was built during the next forty years ; it was completely destroyed by fire in 1911, and was replaced by the present one. With the development of the Honte as a highway of trade from about 1375, Flushing grew in importance, despite the opposition of Middelburg, and in the fifteenth century secured full municpal status and was made defensible by the construction of town-walls. The strategic importance of Flushing was clearly grasped by the Emperor Charles V, who called it " the key of the Netherlands ".

The most memorable event in the town's history took place on 6 April 1572, when the population, stirred by the news of the rebels' capture of Brill five days before, rose in revolt and held off a Spanish force until reinforcements could come by sea. Flushing was then converted into a base for the privateering exploits of the rebels, and a prize-court sat there to dispose of the booty. With the rise of the United Provinces as an independent state, Flushing became of vital importance through its command of the West Scheldt estuary, and the fact that in 1585 it was one of the towns handed over to England as security for the repayment of the cost of the English forces sent to support the Revolt, shows how desperate the rebels' position must



Plate 41. Terneuzen ; Westelijke Buitenhaven, looking north from south bank
The pontoon berth and entrance to the west lock (the main entrance lock to the Ghent-Terneuzen Ship Canal) are on the right.

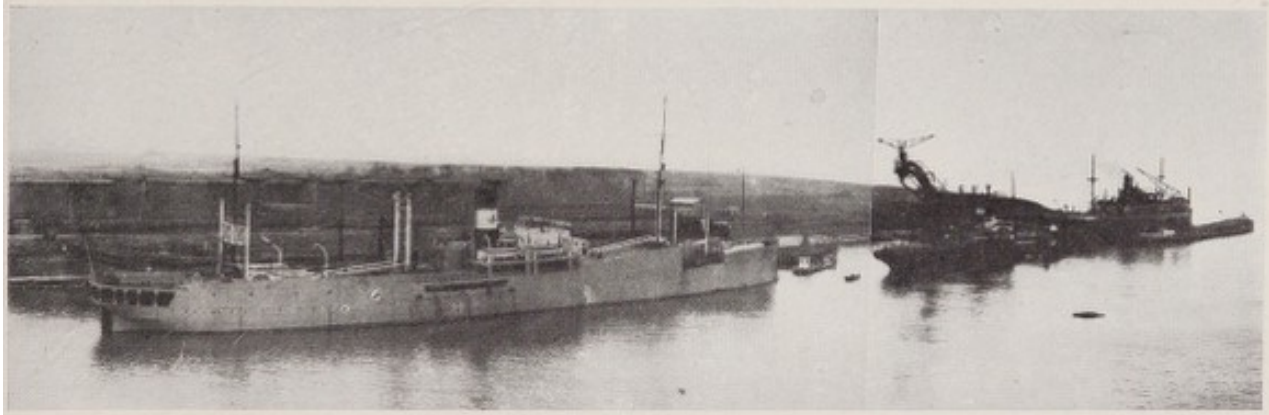




Plate 42. Flushing (Vlissingen) ; Buitenhaven, looking south
The upper picture shows the oiling berth and coaling pontoon on the east side of the Buitenhaven ; the lower picture shows the west side with the end of the deep water quay, the floating stages, the Breskens ferry and Harwich packet berths. The lock entrances are hidden from view, but beyond them the eastward projecting breakwater can be seen.

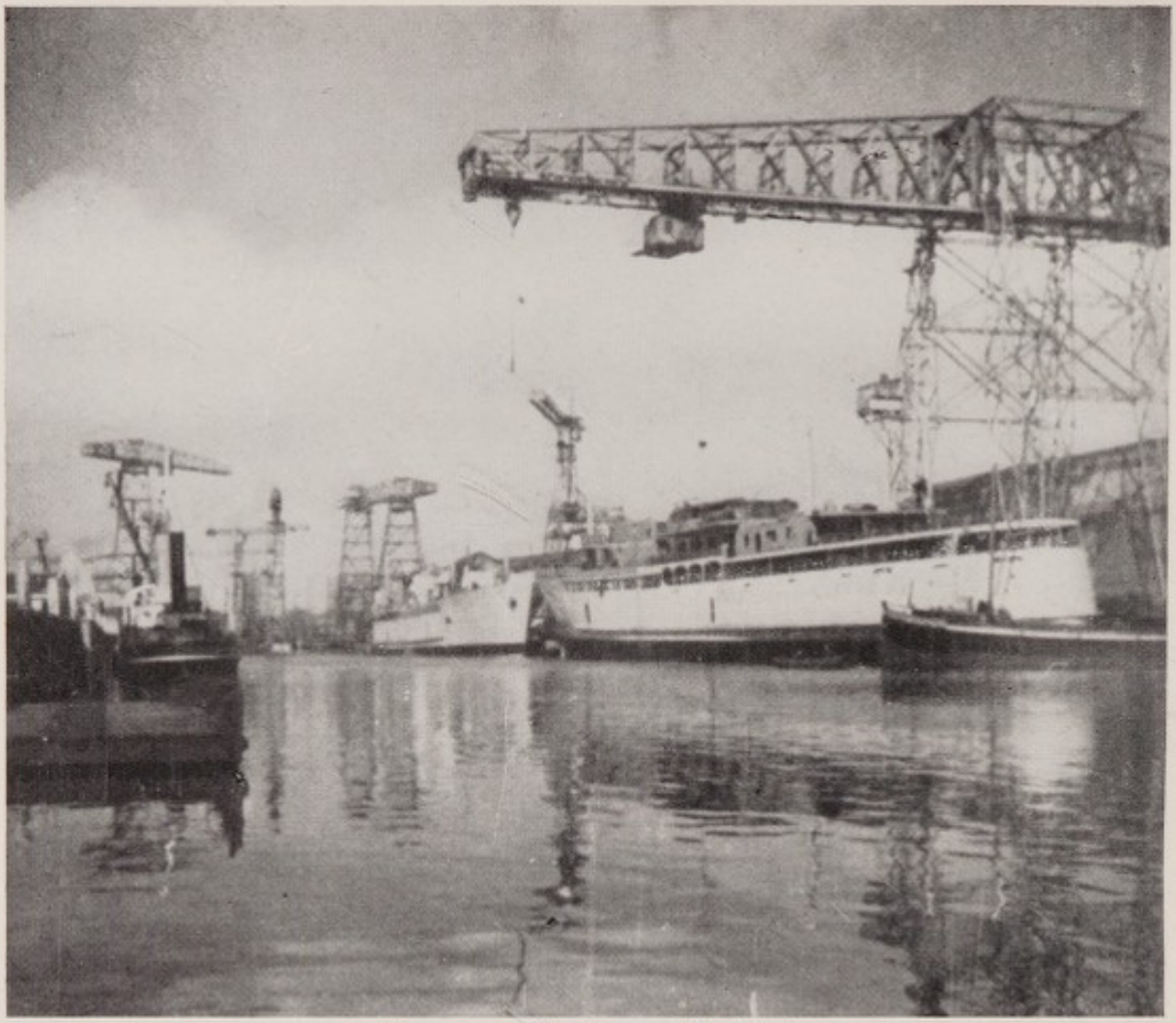


Plate 43. Flushing : Het Dok
Here are situated the building slips, fitting-out wharves and engine works of *Kon. Mij. de Schelde*.

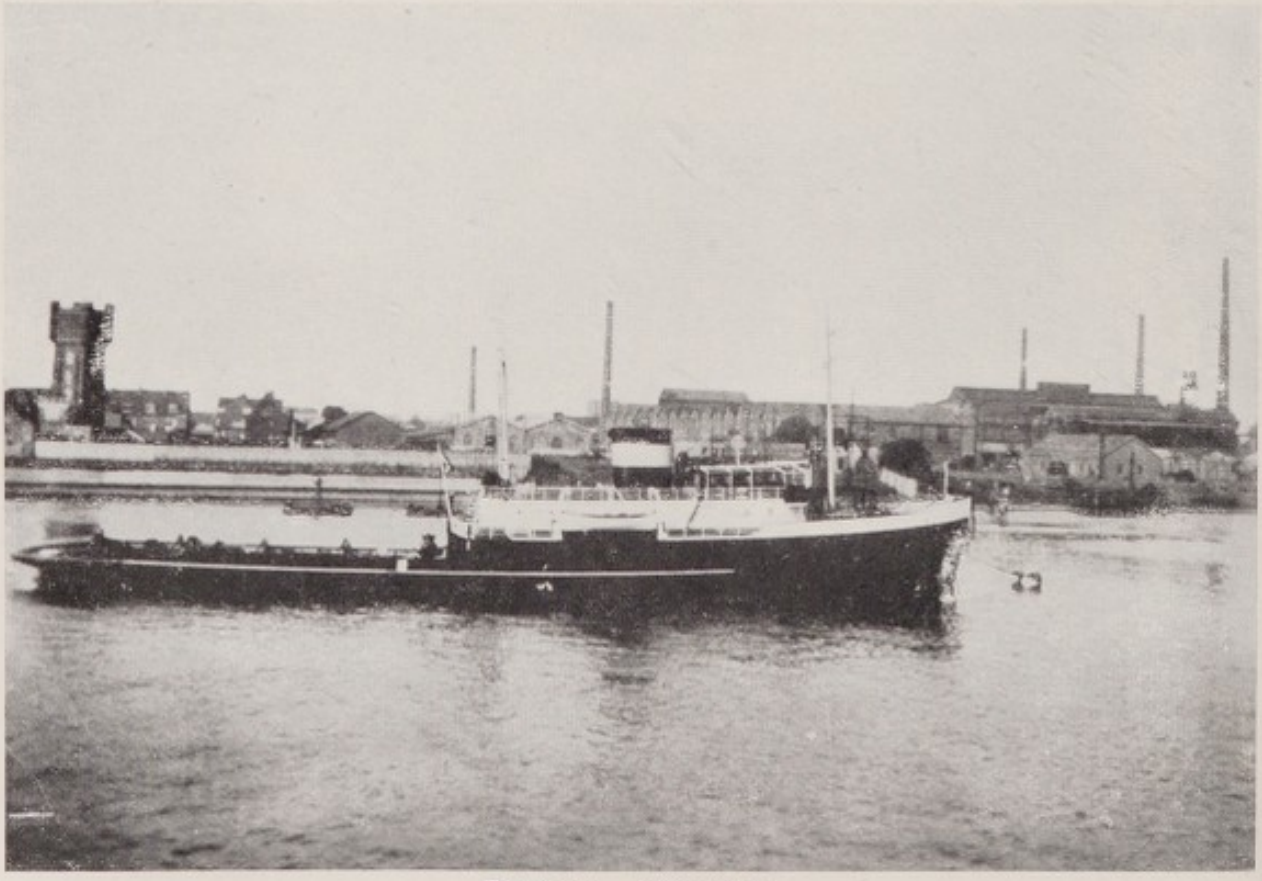


Plate 44. Maassluis
Maassluis is the home port of the *Smit Internationale Sleepdienst*. The vessel in the photograph is the *Zwarte Zee*, the largest in the company's fleet and the most powerful tug in the world.

then have appeared. It was thirty-one years before the United Provinces, by repaying the English debt, redeemed Flushing and so freed themselves from their dependence upon England. It was during the English occupation that there was born in Flushing the greatest of Dutch admirals, De Ruyter (1607–76).

Although Flushing remained important as a base for Dutch fleets lying in the estuary, its trade suffered from the decay of Antwerp and the Brabant hinterland. It was not Zealand, but Holland, which reaped the reward of the closure of the Scheldt. Thus during the eighteenth century the town fell into decline. When the French overran the Republic in 1793–4 they secured the right to garrison Flushing and did so until 1813. In 1809 there took place the ill-fated Walcheren expedition, intended by England as a prelude to the seizure of the French naval base at Antwerp. A landing was made on the island on 31 July; after both Veere and Middelburg had fallen, and Flushing had been heavily bombarded the French commander surrendered, with a garrison of 6,000 men, on 16 August. Flushing remained in English hands for nearly two months, after which, owing to the heavy toll which disease took of the troops and the impossibility of further progress, the whole force was withdrawn. The expedition had achieved little save to cause Napoleon to strengthen the defences of Zealand, which was done in 1810.

In the earlier part of the nineteenth century the activity of the port was at a low ebb, but the construction of the South Beveland railway in 1866 enabled it to reap the benefit of its position as the most westerly port in the Netherlands. It became an important ferry terminus for the English traffic; the service to Harwich was opened in 1875. A revival of interest in its strategic location occurred in 1910, when the Dutch government proposed to modernize the fortifications. The new outer harbour, Buitenhaven, was completed in 1931.

In the future Flushing as a port can hardly look forward to any great expansion. The hinterland is limited and adequately served by other ports, although Flushing will continue to benefit from its function as a packet station and starting point for express through trains. The *De Schelde* works should continue to provide a good deal of employment. The strategic position of the port, controlling the entrance to the West Scheldt, will remain.

Trade

The movement of shipping at Flushing in 1938 was as follows (with cargo and in ballast) :

	Entries			Sailings	
	No.	Gross tonnage (in thousands)		No.	Gross tonnage (in thousands)
For discharge	469	1,341	After loading	460	1,435
To undergo repair	13	22	After repair	12	15
For bunkering	940	2,857	After bunkering	1,253	3,220
In direct transit	123	28	In direct transit	109	102

From : *Statistiek van de Scheepvaart op het Buitenland over* 1938, p. 14–15 ('s Gravenhage, 1939)

The tonnage of vessels which call exclusively for bunkering, therefore, is about double the tonnage of vessels in the passenger and cargo trade.

Cargo Trade, 1939, *in thousand tons*

Commodity	Special Trade				Transit Trade			
	Imports		Exports		Imports		Exports	
	Sea	Water way	Sea	Water way	Sea	Water way	Sea	Water way
Coal	0·5	9·2	25·3			322·2	324·7	
Iron and Steel	1·9	9·9						
Fuel Oil	92·2		73·2	18·2		0·5	0·5	
Benzine	11·7		0·8	2·2				
Gas Oil	55·2		41·7	25·3		0·2	0·8	
Crude petroleum	32·4							
Timber	6·7			4·2				
Total, including unnamed goods	212·9	34·4	159·8	52·8	1·6	332·0	332·2	0·6

From : *Jaarstatistiek van den In-, Uit-, en Doorvoer over* 1938, vol. 1, p. 398 ('s Gravenhage, 1939).

About 80% of the goods handled at Flushing arise from the bunkering trade. Of all ships which call at Dutch ports exclusively for bunkering the greatest number are accounted for by Flushing. The trade is of very recent development, and has shown a continued expansion. In 1927 the *Steenkolen-Handels-Vereeniging* opened a coal bunkering station, to which was added in 1934 an oil bunkering station. The coal is almost all supplied from Westphalia in Rhine-barges. The bunker oil is derived from direct imports.

The general trade of the port is very restricted. Imports comprise petroleum for the *Vlismar* refinery, timber from British Guiana for the timber trade at Middelburg, and metals for the shipyard. The

timber import occurred for the first time in 1931. Exports comprise mainly fruit and vegetables from the neighbouring countryside, especially onions and red currants ; they are carried to England by the ships of the *Zealand Steamship Company* in the Harwich packet service.

Industries

The principal employer of labour is the *Kon. Mij. De Schelde*, one of the biggest shipyards in the Netherlands. Besides undertaking both hull and engine construction, this company also operates a small but well equipped aircraft factory. At times it engages in constructional engineering, and supplied the bascules for the new bridge over the South Beveland Canal at Vlake. The *Vlismar* oil refinery specializes in the treatment of black oils and in the preparation of road surface materials.

Communications

The deep-water quay and adjacent areas are served by adequate rail sidings, which are equipped with cranes. A double track line connects Flushing with Roosendaal and thence with all parts of the Netherlands and with Germany. The Walcheren Canal, which will admit vessels with a draught of 20 ft., carries only a restricted traffic. By way of the West Scheldt and the South Beveland Canal large barges can reach the Rhine.

For roads see Fig. 117.

Flushing is the terminus of the ferry to Breskens, on the south shore of the Scheldt, for passengers and road vehicles. Many people who work in Flushing and live on the south shore cross daily by the ferry. Traffic is heaviest on Thursdays, when the market is held in Middelburg, the capital of Zealand.

Hook of Holland (Hoek Van Holland)

(Figs. 99, 117 ; Plate 45)

The Hook of Holland is one of the two leading ferry ports of the Netherlands and owed its importance mainly to the L.N.E.R. traffic from Harwich. It lies at the entrance to the New Waterway (Nieuwe Waterweg) on the north bank, and is entered between the two breakwaters, about 800 yards apart, in depths of 37–49 ft. The tidal rise is 6·8 ft. (M.H.W.S.).

There are several small jetties and ferry piers, while the Berg-

haven with depths of 15 ft. is used by tugs and fishing boats. The Railway Quay is the principal berth, being the terminus of the Harwich service. It is about 1,600 ft. long with a depth alongside of 40 ft. Eastwards lies the New Fruit Wharf, 600 ft. long and with similar depths. Both of these quays have good railway facilities, and the Railway Quay is equipped with three light cranes. There are no repair facilities.

Hook of Holland is little more than a village, with a population estimated at 3,500 ; it is part of the commune of Rotterdam. It came into being about 1890, nearly twenty years after the opening of the New Waterway, and has since depended almost entirely on its ferry port function. The electricity supply is derived from the Rotterdam system, and gas from The Hague, while the water supply is provided by water boats from Rotterdam. Hook of Holland is connected with Rotterdam by a double track electrified railway.

Primarily a passenger port, Hook of Holland handles little cargo. In 1938, in the special trade, imports amounted to 39,000 tons (chiefly oranges and apples) and exports to 22,000 tons (chiefly express merchandise, but including 10,000 tons of vegetables from Westland destined for Great Britain). Transit traffic by sea amounted to 20,000 tons inwards (again chiefly oranges and apples) and 7,000 tons outwards. Waterway traffic did not exceed a few thousand tons.

Ships entered numbered 520, of 2,247,000 gross tons, and ships departed 539, of 2,115,000 gross tons. Of this number, 413 ships entered from Great Britain ; most of the rest came from Belgium, France, Germany and U.S.A.

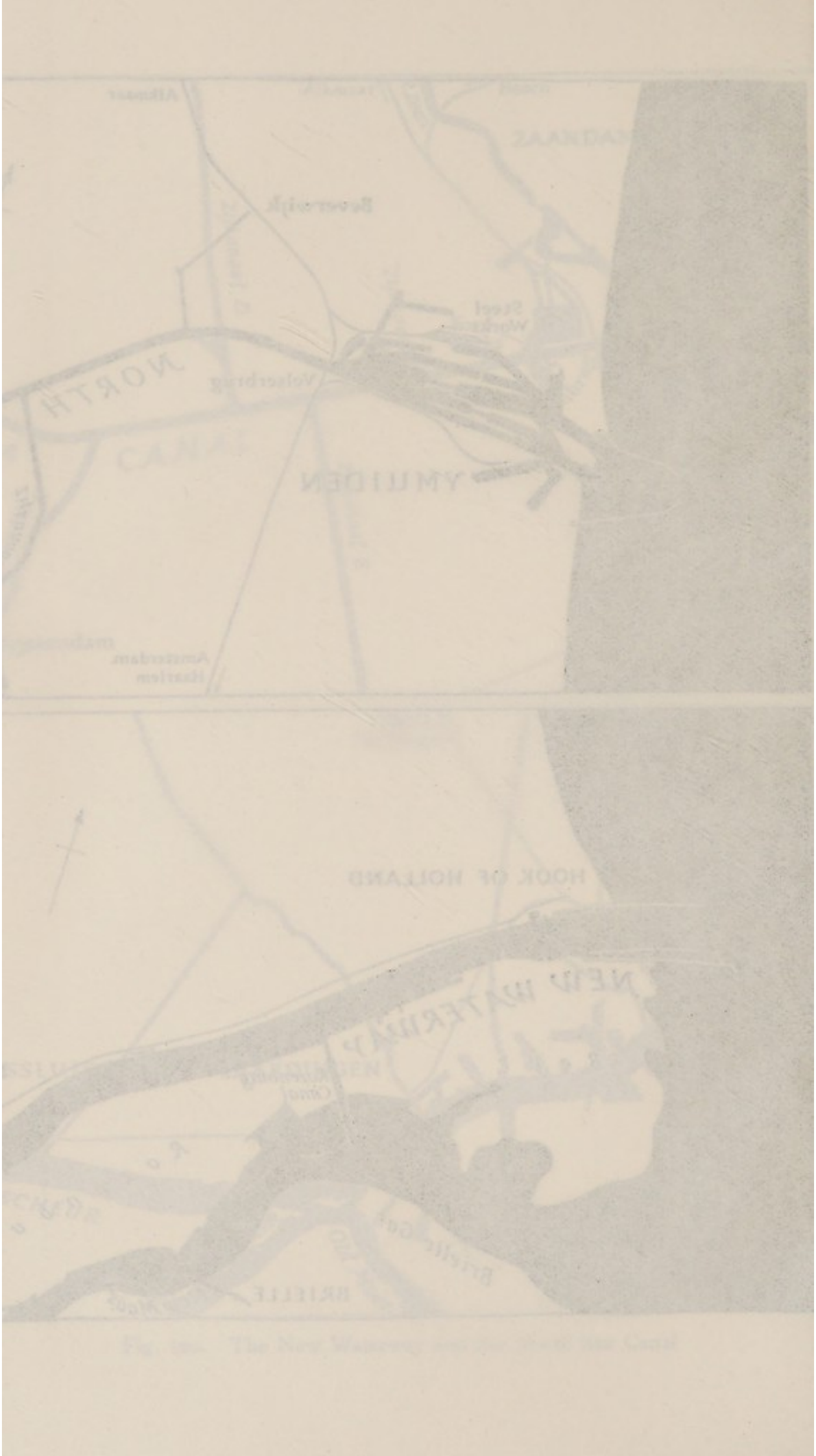
Maassluis

Maassluis (9,000) lies on the north bank of the New Waterway about six miles upstream from Hook of Holland. Depths in the channel exceed 30 ft. The harbour comprises a tidal basin 140 ft. wide and 1,000 ft. long, with depths of 15 ft. At the end of the harbour locks give access to a canal leading to Delft, while several shallow basins are used by barges and fishing boats. Maassluis is a minor fishing port, but is chiefly important now as the headquarters of the ocean-going tugs of *L. Smit's Internationale Sleepdienst.*

Electricity is supplied by the Rotterdam-Westland system, and gas by a local gasworks. The waterworks is thought to take its supply from the river, preparatory to filtering.



Fig. 100. The New Waterway and the North Sea Canal



The main support of the population is industry—a large mechanical glass factory, several foundries and small engineering works, rope works and the *N. V. Witol* oil refinery. This refinery, which has a capacity of 20,000 tons annually, produces white oils, marine oils, transformer oils, etc. There is also a small ship-repairing yard.

In 1938 131 ships of 106,000 gross tons entered the port and 129 of 68,000 tons departed. Seaborne imports (direct) amounted to nearly 4,000 tons, most of which was coal ; direct exports to 2,000 tons. By waterway 15,000 tons were unloaded and 2,000 tons loaded. There was a relatively considerable transit trade, comprising an import of 50,000 tons of ores, which were despatched by waterway, and an export of nearly 6,000 tons of coal.

Rotterdam, Including Vlaardingen and Schiedam

(Figs. 100–10, 117 ; Plates 47–52)

Rotterdam is the largest port in continental Europe, the second city of the Netherlands, and an important manufacturing centre.

Approach and Access

The port lies about 18 miles from the sea on the New Maas (Nieuwe Maas) ; much of the seaward connection is provided by the New Waterway (Nieuwe Waterweg). The approach from the sea offers no great difficulties in the way of shoals, and leads through the moles at Hook of Holland (see p. 449), The entrance is about 800 yards wide, and the fairway in the New Waterway about 300 yards wide. A depth of 36 ft. can be carried through ; the journey to Rotterdam takes 1½ to 2 hours. The port is normally accessible to ships drawing 33 ft., and the largest vessel using it as a home port was the *Nieuw Amsterdam*, 36,000 gross tons, 700 ft. long, 88 ft. beam, and 31½ ft. draught. The tidal rise is 5½ ft. (M.H.W.N.) ; high water occurs 1 hour 58 minutes after high water at Hook of Holland, and low water 2 hours 44 minutes after.

Depths are fairly well maintained by tidal scour and have been improved by extensive training works. Dredging is necessary, however, especially around the confluence of the Old Maas and in the entrance at Hook of Holland. The material dredged from the New Waterway in 1938 amounted to 2,447,500 cu. yards, and from the fairway outside the entrance 528,400 cu. yards were removed.

In 1937 about the same quantity of material was dredged ; in 1936 only about two-thirds, but in 1934 and 1935 half as much again.

Upstream, beyond Maassluis (see p. 450), the channel is known as the Scheur. At a point where the channel turns to an easterly direction, the Westgeul opens southwards into the Old Maas, known below the Westgeul as the Botlek, and leading into the Brielle estuary. The Botlek leads to the Voorne Canal, which functioned as an approach to Rotterdam before the cutting of the New Waterway. Above the Old Maas confluence the port of Rotterdam begins at Vondelingplaat on the south bank ; on the north bank, however, the ports of Vlaardingen and Schiedam (see p. 453) are passed before the jurisdiction of Rotterdam is reached.

Detailed Description

Owing to the small rise of tide, wet docks are unnecessary at Rotterdam, and all handling of cargo is conducted from quays along the riverside or within the many large and small basins which open off the river on both banks. A good deal of cargo is handled from ships moored to buoys in the midst of a basin, but this practice is decreasing. The basins are all called *havens*.

In 1938 the port provided 33½ miles of mooring space for sea-going ships along quays, buoys and stone banks. The river itself covers an area of 1,554 acres, while basins with depths exceeding 19½ ft. at low water covered 1,155 acres. Basins for river vessels occupied 284 acres, not including basins within the barge locks. The number of berths available is as follows :

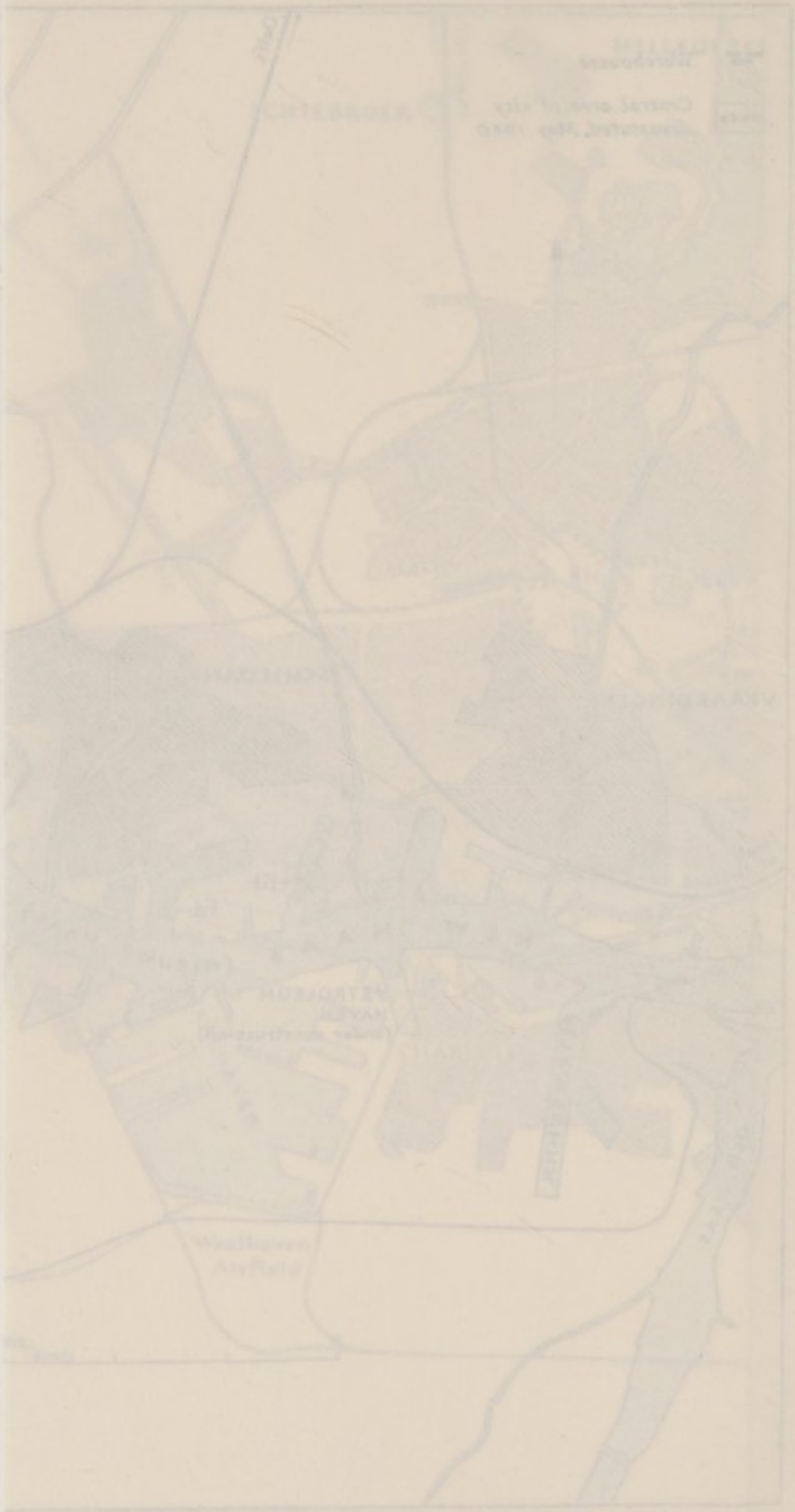
Depth ft.	Alongside	Dolphins or buoys	Buoys in river
30	5	5	4
26	89	45	7
20	29	54	—
16	60	15	2
12	6	5	2

The principal quays and havens for sea-going ships may be described briefly, working downstream from the bridges in the city, under the headings of (1) basins (*havens*) on the right bank, (2) quays on both banks, (3) basins (*havens*) on the left bank.



Fig. 101. Rotterdam

fd floating docks ; Hp Hofplein station ; K.G. Keilehaven gasworks. For details of basins and quays see Fig. 102.



Principal right (north) bank basins (havens)

Name	Date of completion	Length ft.	Width ft.	L.W. Depth ft.	
Parkhaven	1900	1,575	400	21–26	Small short-sea traders.
St. Jobshaven	1909	1,150	328	21–26	General cargo and grain.
Schiehaven	1909	2,000	393	20–26	General cargo and liners.
Yselhaven	1915	1,720	393	33	Cargo and passenger liners of leading lines.
Lekhaven	1916	2,575	393	33	Cargo liners, general cargo.
Keilehaven	1914	2,950	230	13	Coasters, river craft.
Benzinehaven		920	130	10	
Merwehaven entrance	1932		400	39	Short-sea traders.
No. 1 branch		2,000	500	39	
No. 2 branch		1,400	450	33	
No. 3 branch		600	400	26	
Wilhelminahaven (Schiedam)					No quays : 10 berths at buoys; bulk cargo and coaling.
entrance		1,312	656	32	
basin		2,625	787	32	
Wiltonhaven					Shipyard, *Wilton-Feijenoord*.
Vulcaanhaven (Vlaardingen)		2,400	720	33	3 berths at buoys ; ore and coal.
Koningin Wilhelminahaven		2,000	300	13	Used by herring fleet.

The first of these basins, Parkhaven, leads by the Parksluis into the Coolhaven and thence to the Delfhavensche Schie waterway leading to Delft. Below the Schiehaven a lock leads into a further series of small barge basins. Below the Merwehaven the Voorhaven leads into the Schiedam wet docks for barges.

The principal quays on both banks are as follows :

Quay (right bank)	Length ft.	L.W. depth, ft.	Quay (left bank)	Length ft.	L.W. depth, ft.
Maas Railway Station	1,640	19½	Nassaukade	2,010	19½
Parkkade	1,730	19	Wilhelminakade	2,790	33
St. Jobskade	540	28	Katendrechtsche-kade	1,180	23
Lloydkade	1,740	30	St. Janskade	2,790	20–23
Pelgrimskade	400	19	Kortenoordschekade	2,790	24
Yselkade	345	29–33			
Lekkade	430	29–33			

Lloydkade is used by the Rotterdam-Lloyd liners and Wilhelminakade by the Holland-America liners, the largest vessels calling regularly at the port.

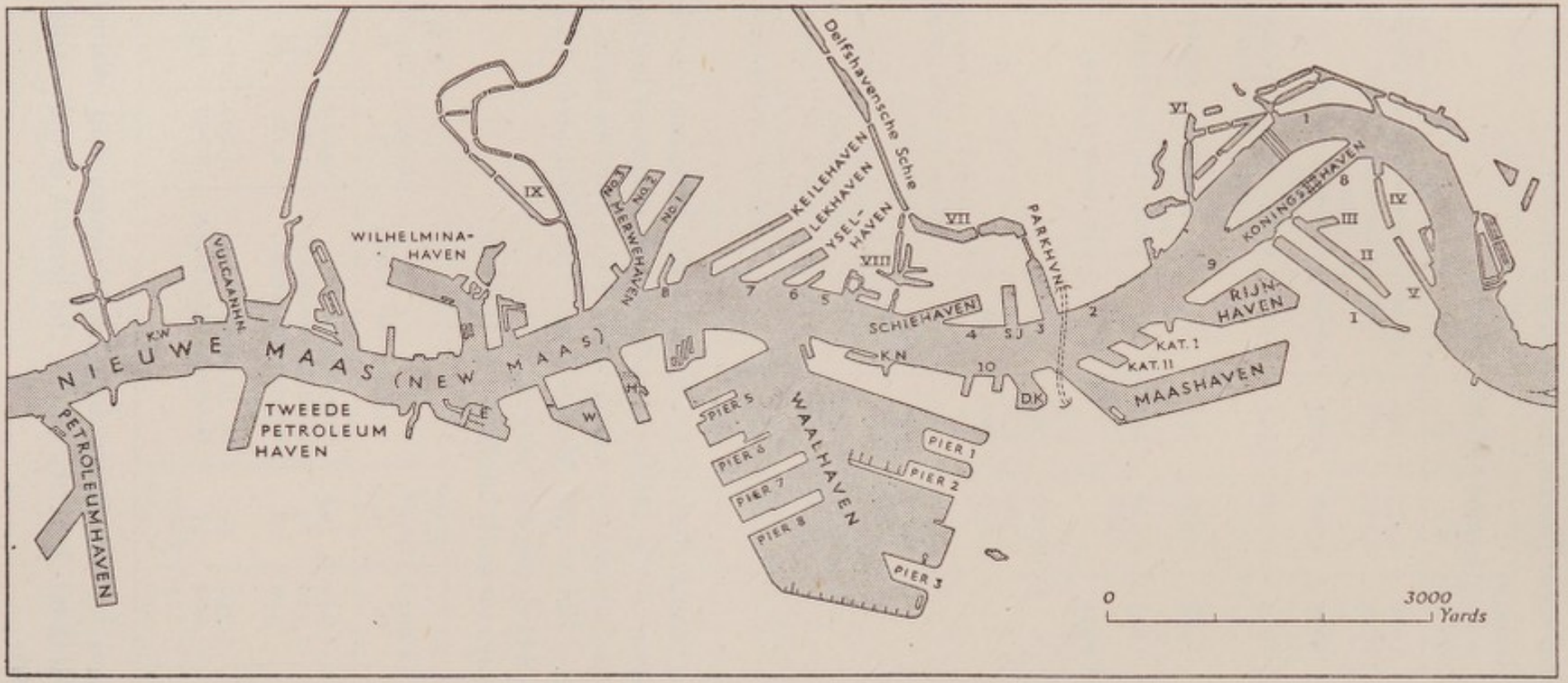


Fig. 102. Rotterdam : basins and quays

Basins : B Benzinehaven ; DK Dokhaven ; E Eemshaven ; H Heyschehaven ; KAT I Eerste Katendrecht Haven ; KAT II Tweede Katendrecht Haven ; KN Kortenoordschehaven ; KW Koningin Wilhelmina Haven ; SJ St. Jobshaven ; W Werkhaven.
Barge basins : I Spoorwegbassin ; II Binnen Haven ; III Entrepothaven ; IV Nassau Haven ; V Persoons Haven ; VI City barge docks ; VII Coolhaven ; VIII Middenkous basins, etc. ; IX Schiehaven.
Quays : 1 Maas Station ; 2 Parkkade ; 3 St. Jobs Kade ; 4 Lloydkade ; 5 Pelgrimskade ; 6 Yselkade ; 7 Lekkade ; 8 Nassau Kade ; 9 Wilhelmina Kade ; 10 St. Jans Kade.

Principal left (south) bank basins (havens)

Name	Date of completion	Length ft.	Width ft.	L.W. Depth ft.	
Rijnhaven	1895	2,000	1,250	23–28	Quay berths as well as 12 berths at dolphins; direct transhipment of timber, general cargo.
Katendrechthaven I	1888	590	345	21–23	General cargo and short-sea trade.
Katendrechthaven II	1896	755	394	24½	
Maashaven	1905	4,500	1,050	33	Partially quayed; 17 berths at dolphins.
Petroleum haven (Old basin)		540	198	27	Heavy bulk cargo and grain.
Waalhaven (see below)					
Petroleum haven		4,400	700	33	Oiling piers in outer part and branch.
branch		2,500	500	33	
Kortenoordsche-haven		1,100	228	23–26	

Waalhaven, constructed in stages during the period 1908–30, is the largest basin in the port and is used mainly for direct transhipment of coal, ore and timber. Besides quay berths there are 82 berths at dolphins and buoys. The entrance is 920 ft. wide, with a depth of 33 ft. Most of the basin has depths of 26–33 ft., and the remainder in the southern part has depths of 13–20 ft. Further quayage is provided by seven piers, four extending from the western side of the basin and three from the eastern side; all are in various stages of construction. Along the south side of the basin, in depths of 13 ft., there are ten jetties for barges, and nine similar jetties along the north side of Pier No. 2.

Quays and basins for river and canal craft. Besides the Delfhavensche and Schiedam barge basins, there are two further important groups. Above and below the Maasbrug, extending into the oldest part of the city, there are nine basins with depths of 8–11½ ft. On the south bank, west of the bridge lie three further basins, the large Binnenhaven and Spoorweghaven and the smaller Entrepothaven. These have depths of 21–23 ft. and are used by Rhine barges, coasters of 1,500 tons, and occasionally short-sea traders up up to 3,000 tons.

Port Facilities

Besides grain silos, cold stores and bonded warehouses, there are about 80 transit sheds. Warehouse accommodation, though consider-

able, is not large for a port of the size of Rotterdam, since much of the cargo handled moves directly to or from barges. The lifting equipment in 1938 comprised 493 appliances of one kind or another. The nature of the trade of Rotterdam is reflected in the fact that at Antwerp, where a smaller tonnage of cargo is handled, there were 636 lifting appliances. Most of the cranes, etc., in Rotterdam are owned by private firms, and some are rented to the users by the municipality. All are electrically operated.

	Cranes under 10 tons	Cranes over 10 tons	Bridge cranes	Coal tips	Grain elevators	Bunkering appliances	Sheer-legs
For sea-going ships							
On quays right bank	136	3			3		21 under 75 tons
On quays, left bank	104	1	27	3	4		4 of 100–200 tons.
Floating	78	6			25	6	
For waterway traffic							
On quays	56	1	6		5		
Floating	2				2		
	374	7	33	3	39	6	25

From: *Rotterdam: Statistiek van Handel, Nijverheid en Verkeer* 1938 *I-IV*, p. 107, Kammer van Koophandel en Fabrieken (Rotterdam, n.d.)

Repair Facilities. Besides four transverse patent slips for vessels up to 4,000 tons, there were sixteen floating docks and one construction dry dock. Of the floating docks, nine had a lifting capacity of under 10,000 tons each, six a capacity of 10–20,000 tons, and one a capacity of 46,000 tons. Apart from a number of smaller ship-repairing firms, the shipyards offered important facilities for repair and refitting, and own twelve of the floating docks, the other four being municipally owned.

N. V. Wilton Feijenoord, owning five floating docks, has repair yards at Delfshaven, and a shipyard at Schiehaven with four building slips and a construction dry dock. The slips are 500 ft., 350 ft. and 255 ft. (two) in length respectively. The construction dock comprises a dry dock with a building space on either side at a higher level; the whole is enclosed, and the water level inside can be raised to allow a completed hull on either building space to be floated and warped across into the dry dock. When the water level is lowered the hull can be moved outside the dock. This dock was the prototype of the construction dry dock of the *A. C. Chantiers de la Loire*, St. Nazaire. The Wilton company completed the *Statendam*, 28,000

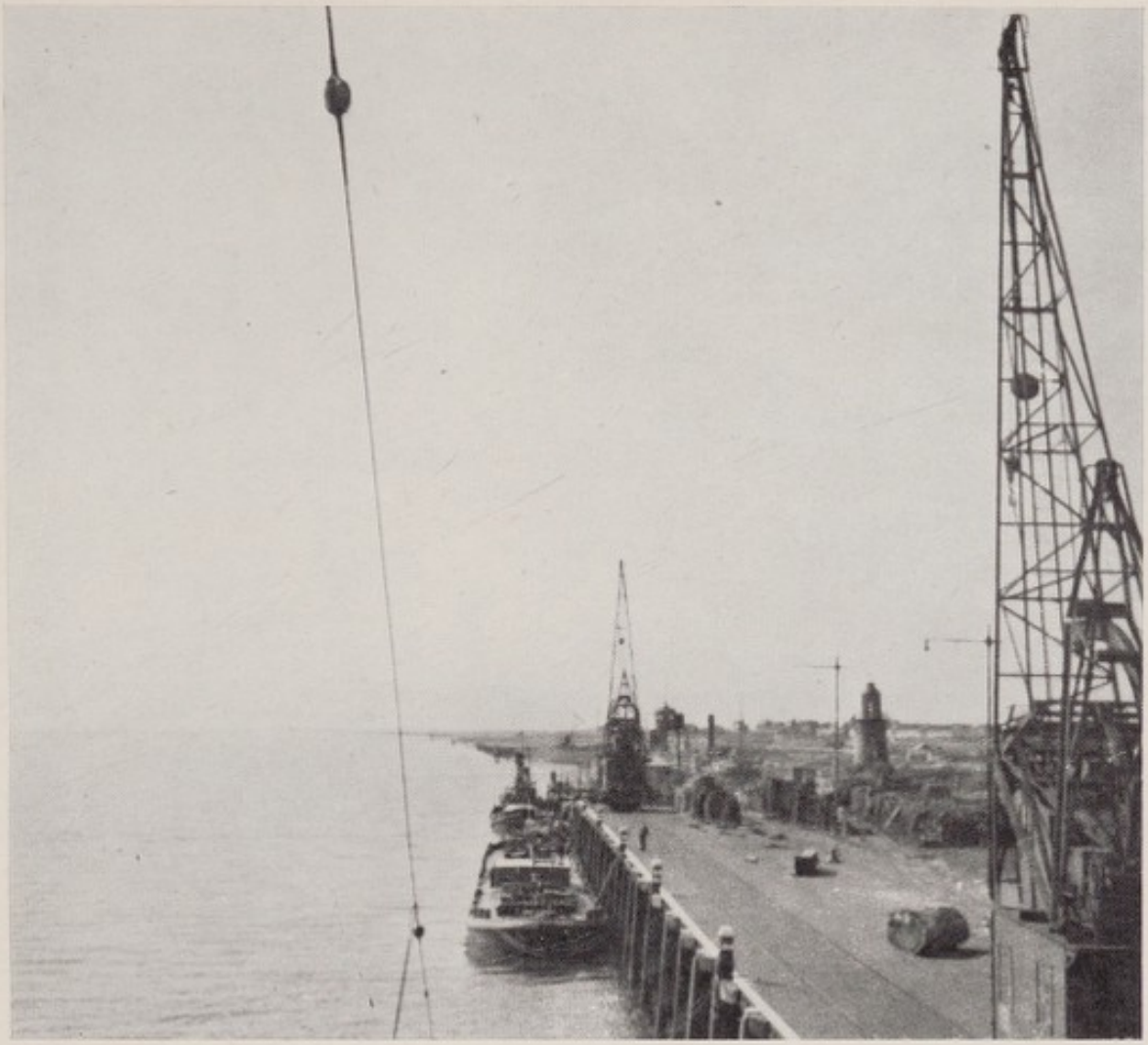


Plate 45. Hook of Holland (Hoek van Holland)
The railway quay, looking west towards the entrance to the New Waterway.



Plate 46. Vlaardingen : Vulcaanhaven, looking north
This basin is used for discharging ores.



Plate 47. Rotterdam : general view, looking north-west

In the foreground is Feijenoord ; the bascule road bridge (*Koningbrug*) and the vertical-lift railway bridge connect it with Noorder Eiland, while the fixed road and railway bridges (*Willemsbrug* and *Spoorbrug*) lead to the centre of the city. Much of this built-up area on the north bank was destroyed in May 1940. The white area in the left background comprises mainly open spaces near the Parkhaven.

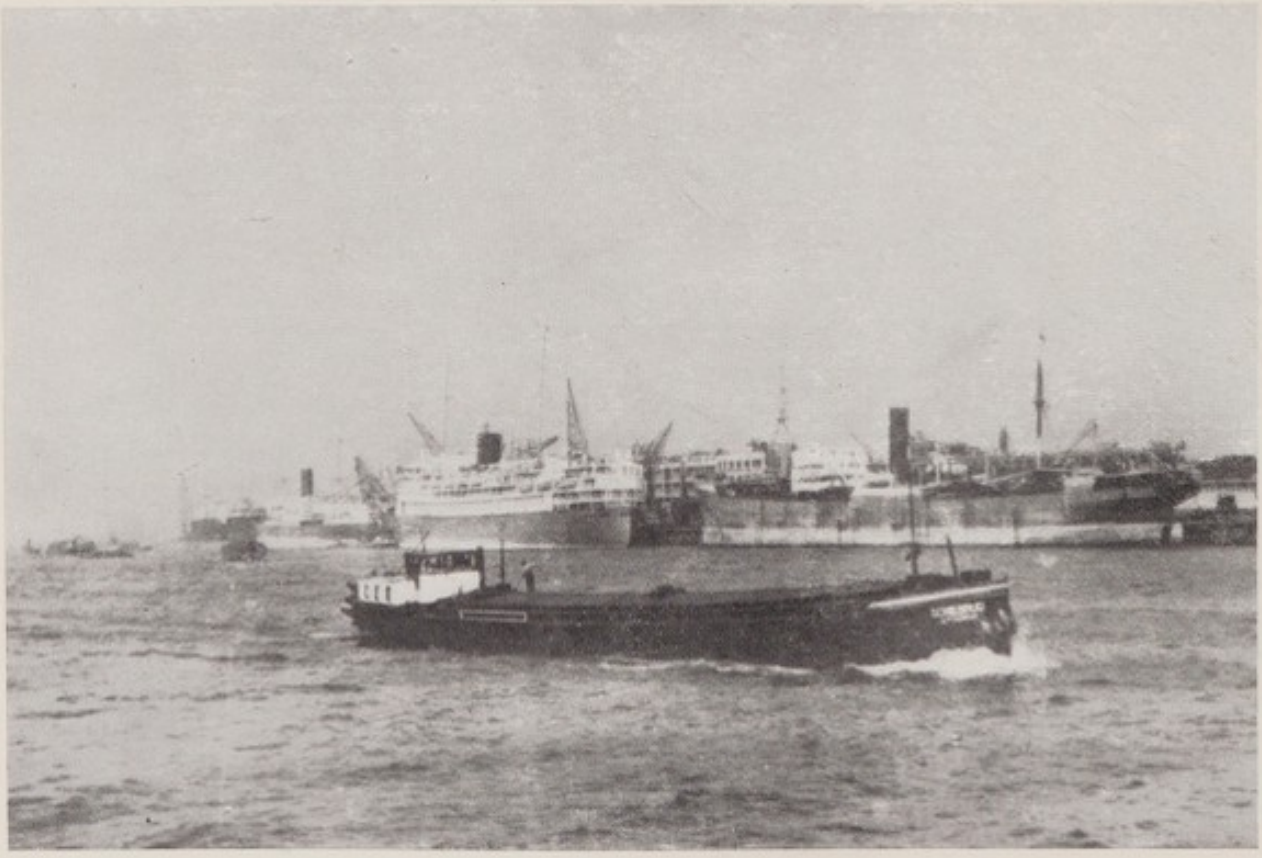


Plate 48. Rotterdam : The New Maas

The photograph shows some of the liner berths along the north bank.

tons gross : it can undertake most classes of hull and engine repairs, and constructs M.A.N. diesel engines under licence.

The *N. V. Rotterdamsche Droogdok Mij.*, including the *N. V. Scheepsbouw Mij. Nieuwe Waterweg*, owns seven floating docks, and has three building slips in use—650 ft., 550 ft. and 450 ft. long ; it constructed the *Nieuw Amsterdam*, 36,000 tons gross, in 1938. The *N.V. Machinefabriek en Scheepswerf van J. Smit Jr.* has four building slips up to 400 ft. in length and four up to 250 ft. in length, and normally builds ships up to 10,000 tons ; it constructs *Burmeister and Wain* diesel engines under licence. The *N.V. Werf Gusto* with four building slips up to 320 ft., specializes in the construction of dredgers, large sheer-legs and floating cranes. All these firms are well equipped with cranes, machine shops and gear. Many smaller building and repairing yards lie upstream above Rotterdam (see p. 385).

Harbour craft. The port is normally served by 134 ship tugs and about 300 tugs for moving barges, while the twenty ocean-going salvage tugs of the *L. Smit Internationale Sleepdienst Mij.* are stationed at Maassluis. There is also a very complete equipment of salvage lighters, pumps, diving gear, etc.

The Town

Of the entire population of 620,000 in 1939, 30% lived on the south bank, which has seen the greatest urban expansion in recent decades, for here lies most of the land suitable for dock, factory and housing development. Extensions of the city boundaries began in 1869 ; in 1914 Hook of Holland was annexed ; as a result of the latest extension in 1934 the land area of the commune amounted to 47½ sq. miles, and of the urban agglomeration of Rotterdam to 34 sq. miles. Satellite towns—Schiedam, Overschie, Hillegersberg, Kapelle a/d Yssel and Ysselmonde—had a population in 1936 of 110,000. It is estimated that by 1970 the entire concentration will have increased its present population of about 750,000 to 1,000,000.

The oldest part of the city lies on the north bank of the New Maas, at the confluence of the river Rotte, within the triangle formed by the Hofplein to the north, the Goudsche Singel to the east and the Coolsingel and Schiedamsche Singel to the west. The northern part comprises the territory on which the earliest medieval settlement expanded, and until 1940 consisted mainly of closely packed buildings. The southern part of the triangular area, between the Hoogstraat and the Maas, comprises seven canals, branches and barge

docks, and represents the results of reclamation of the river shallows after about 1500. The whole triangle covers an area of about half a square mile, and within lay many of the principal buildings of the city—the Raadhuis (Town Hall), old town hall, Library, Stock Exchange, dominated by the church of St. Laurence (*Groote Kerk*), a brick gothic church, dating from 1412. This area, the *Binnenstad*, was devastated by the German bombing raid of May 1940; few buildings were left standing save the *Groote Kerk*, the town hall, the post office and a few others. Part of the built-up area east of the *binnenstad* was also destroyed.

Bridges and the Maas Tunnel. The city is connected to the south bank by four bridges on either side of Noorder Eiland. The river between the city and Noorder Eiland is spanned by two fixed bridges side by side: the Willemsbrug downstream, a road bridge 1,070 ft. long, and a railway bridge upstream, both having a clearance of 23 ft. above high water. The *Koningshaven*, between Noorder Eiland and the south bank, is spanned by two bridges, side by side; downstream is the *Koninginnebrug*, a road bridge with a double-leaf bascule opening, while upstream is the railway bridge with a central portion which can be raised vertically, 145 ft. above high water.

A number of ferry services for passengers and vehicles provide additional crossings, but to meet the growing development of the south bank a tunnel became necessary. Work on the Maas tunnel, commenced in 1938, was due to be finished in 1941. Nine box-shaped reinforced concrete tunnel sections, each about 200 ft. long, 82 ft. wide and 27½ ft. high, were floated into position, sunk into a previously dredged channel, and joined up. The tunnel provides separate passenger ways for traffic in each direction. At each end there are four escalators for pedestrians and cyclists.

Public Utilities. The electricity, gas and water supply systems are municipally owned. There are four power stations, with a total installed capacity of about 160,000 kW. The *Galileistraat* station opened in 1935, is the principal source of supply, with a capacity of about 80,000 kW, and probably carries most of the load. The smaller station at Schiehaven is used as a reserve; there are two small stations near the Maashaven and in the Keilehaven gasworks. These stations supply neighbouring communes and twenty communes to the south, as well as contributing to the supply for the electrified railways of South Holland. The largest gasworks is near the Keilehaven: it consumes 375,000 tons of coal annually. Smaller gasworks are situated at Feijenoord, Pernis, Schiedam and Vlaar-

dingen. The main waterworks lies on the north side of the river about three miles above the centre of the city. The supply is drawn entirely from the river, and after filtering and chlorination, is adequate both in quantity and purity.

The city is the seat of a district court (*arrondissement-rechtbank*). There is a large commercial high school, one of the two in the Netherlands.

History

Rotterdam takes its name from the small river, the Rotte, which here joins the Maas and which down to the seventeenth century formed part of the natural water defences of the town. Rotterdam yields place in antiquity to most of its neighbours, for the charter of 1270 formerly accepted as evidence of its origin is now generally believed to be spurious, and Count William IV's charter of 1340 thus marks the beginning of its municipal career. Like Dordrecht, Rotterdam lay within one of the main theatres of feudal warfare in the Netherlands and suffered much from contending armies, notably on its capture, after a four months' siege, by the Emperor Maximilian in 1489. The development of the town was also hampered by the competition of older and more powerful neighbours, especially Dordrecht, which sought by means of its staple-privilege (see p. 484) to monopolize the traffic of the Maas and Rhine. It was, therefore, not until the seventeenth century that Rotterdam became a leading port ; in 1600 it still counted only about 15,000 inhabitants but by 1700 it had nearly four times as many.

Rotterdam was one of the earliest Dutch towns to suffer from the excesses of Spanish troops at the time of the Revolt ; a Spanish force retiring from the island of Voorne in May 1572 occupied and pillaged the town. The ' massacre of Rotterdam ' intensified the fear and hatred of Spanish rule. As soon as the Spaniards had withdrawn, Rotterdam joined the Revolt and, protected by its waterways, was never again threatened.

Of the eminent men born in Rotterdam, Erasmus (1467–1536) and Piet Hein (1570–1629) are the most famous (see p. 635). Another famous Dutchman who, although not born in Rotterdam, had a long association with it, was John van Oldenbarneveld. Oldenbarneveld was pensionary, or chief magistrate, of Rotterdam from 1577 to 1586. In 1586 he became Advocate, or Pensionary, of the province of Holland, and in this capacity he ranks, after William the Silent, as the chief architect of Dutch independence.

In the seventeenth century the herring fishery and the Greenland trade remained important, but were overshadowed by trade with the Indies and with England, Scotland and France. In the succeeding hundred years, trade continued to develop and industry expanded, while the ports downstream like Schiedam, Pernis, Vlaardingen and Maassluis shared in the prosperity. The French revolutionary armies occupied the city in 1795, and for the next twenty years its trade was at a low ebb.

Opening of the New Waterway. With the increase in the size of ships came the great problem of the Maas waterway. Already by

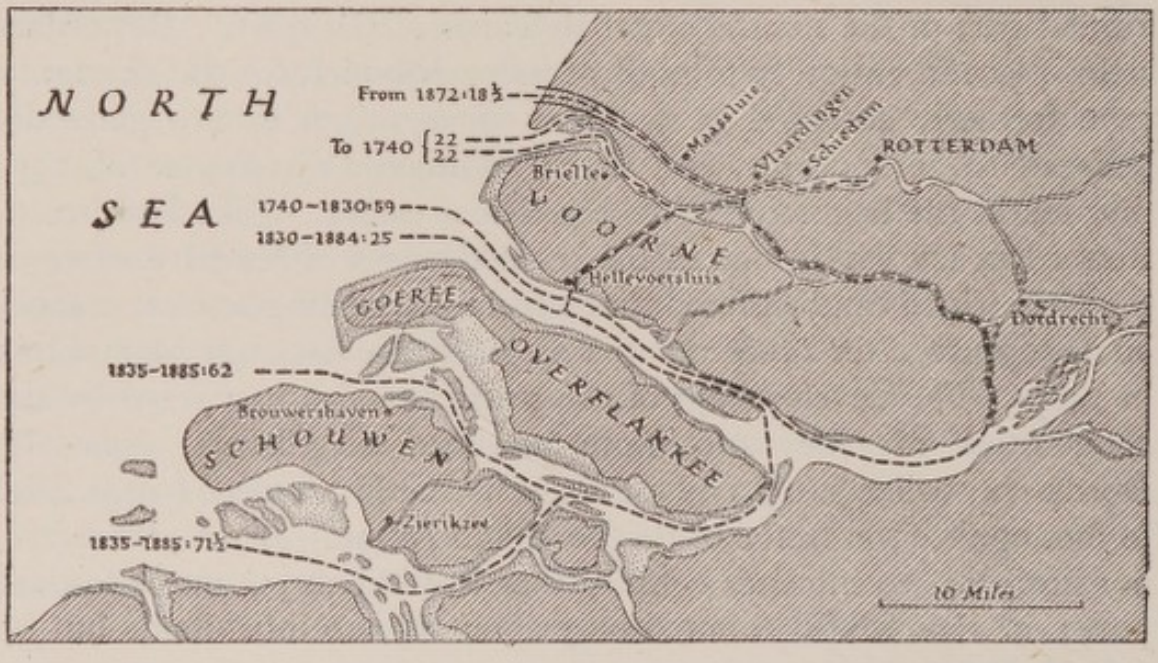


Fig. 103. Former approaches to Rotterdam showing distances in km.
From : W. E. Boerman (ed.), *Rotterdam et ses environs*, p. 89 (Amsterdam 1938)

the eighteenth century sand and mud banks in the estuary had coalesced to form the island of Rozenburg, dividing the Maas into two channels, the Scheur to the north and the Old (Oude) Maas to the south. The Merwe off Rotterdam now came to be known as the New (Nieuwe) Maas. Owing to silting the Brielsche Maas was given up for the Goeree Gat, which in turn, early in the nineteenth century, silted rapidly (Fig. 103).

The first attempt to achieve a more direct entry came with the opening in 1830 of the Voorne Canal from Hellevoetsluis to Heenvliet, but the silting of the Goeree Gat continued. Eventually Caland, the Waterstaat engineer, proposed a direct entry through Hoek van Holland sandspit on the lines of a solution suggested much earlier by Cruquis. After Caland had studied the tidal movements



Plate 49. Rotterdam : Waalhaven
The photograph shows a small part of this immense basin, looking north-east from the south bank. In the background can be seen Pier 4, with the small ship-yard of *Scheepswerf Waalhaven*.

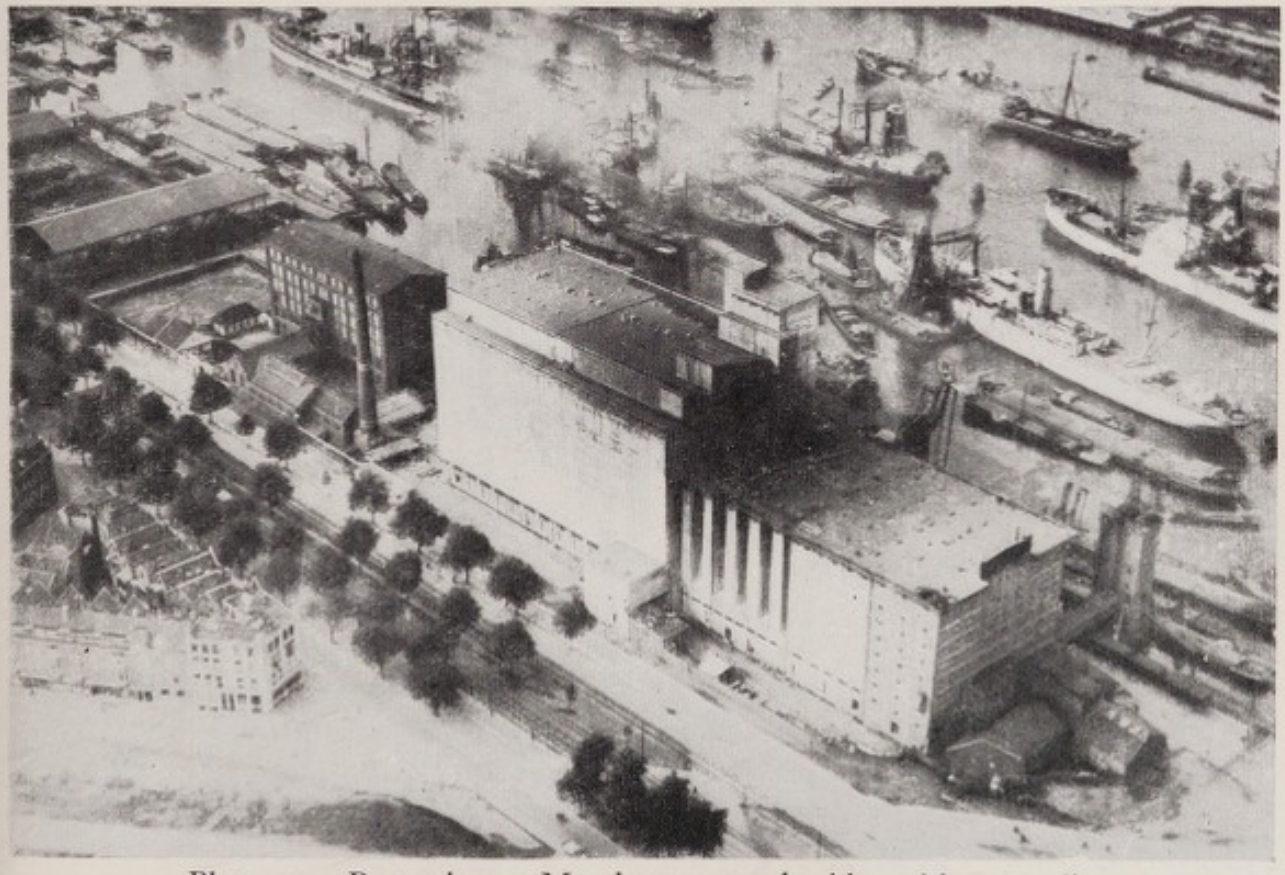


Plate 50. Rotterdam : Maashaven, south side, with new silo
The photograph shows the arrangement frequently used for discharging in the Rijn-, Maas-, and Waalhavens—the mooring of ships in mid-basin, and the use of barges and floating gear.

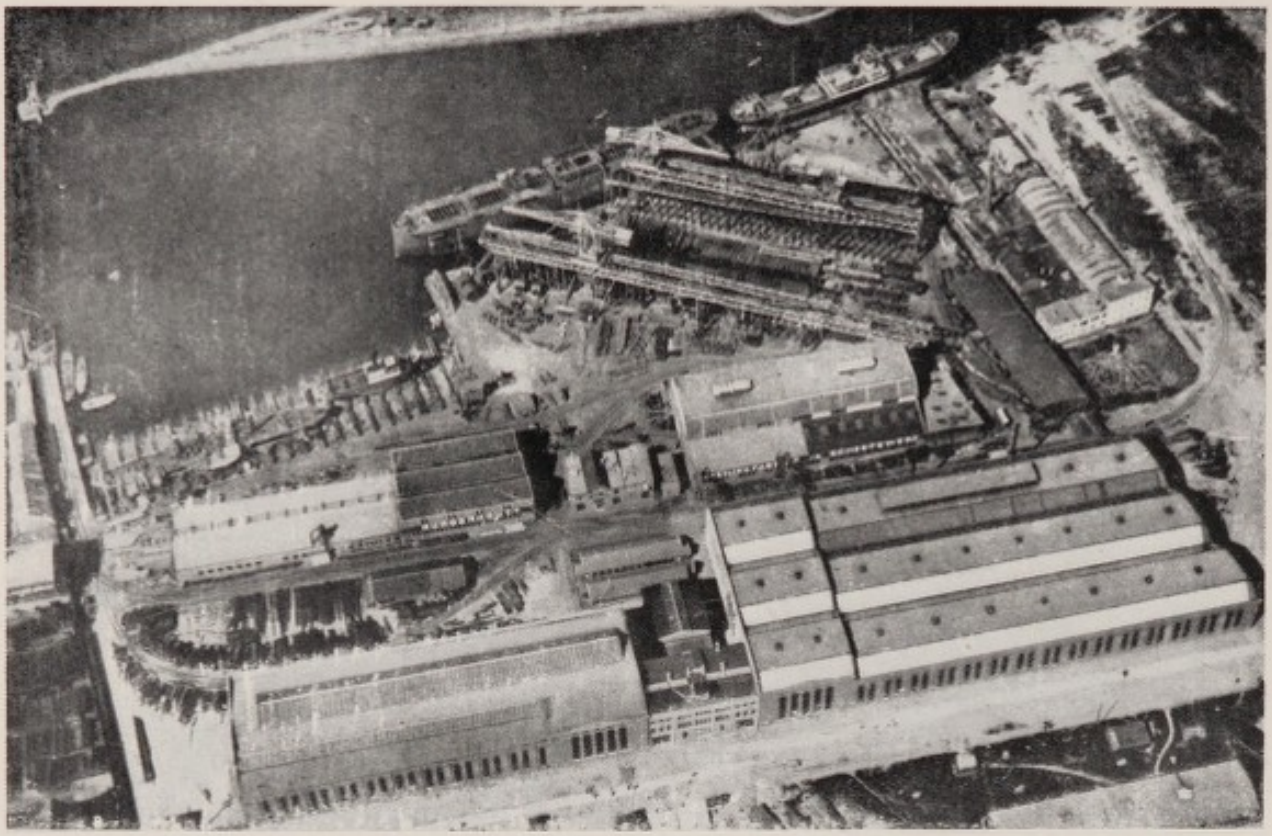


Plate 51. Rotterdam : *P. Smit Jnr.* shipyard, formerly *Burgerhout* yard

This yard lies on the south bank of the Maas (Fig. 108). The four building slips, equipped with a gantry, are 200–250 ft. long : a broadside launching slip can also be seen. To the left of the photograph lie four slips up to 450 ft. in length. Ships up to 10,000 tons are built here, and diesel-engines constructed under licence of Burmeister and Wain.



Plate 52. Rotterdam : Van Nelle's coffee and tea warehouse

of the Clyde and Gironde estuaries his scheme was adopted in 1863 (at the same time as Amsterdam decided on the construction of the North Sea Canal); the work was started in 1866 and completed in 1872. The New Waterway (Nieuwe Waterweg) was at first only partially successful, but it allowed a passage to the sea in a few hours. The original depth of 10 ft. has since been progressively increased by dredging to 33 ft. at low tide.

The early nineteenth century had been a period of comparatively little progress, although a steamer service on the Rhine was opened in 1823. The completion of the Antwerp-Cologne railway in 1843 aroused considerable concern in Rotterdam, but it was not until 1857 that the Rotterdam–Emmerich railway was completed with a terminus at the Maas station; the Spoorweghaven was opened in 1874, and the Binnenhaven and Entrepothaven followed. After about 1870 bulk traffic with the hinterland began to expand and in 1874 a beginning was made with mooring berths at buoys for this trade. The opening of Rijnhaven followed in 1894 and the much larger Maashaven was completed in 1905, involving the demolition of the village of Katendrecht. The general cargo trade demanded improved facilities, and in 1912 the Lekhaven and Yselhaven were started. The steady growth of the transit trade continued, and to avoid barge congestion the Waalhaven was commenced in 1913.

The war of 1914–18 resulted in the loss of most of the trade of the port, which recovered its pre-war volume only in about 1923. Thereafter expansion was rapid, however, and in 1925 the tonnage of entries equalled those at Antwerp. Tonnage handled at Rotterdam in 1938 exceeded the figure for 1913 by 70%.

The completion of the Waalhaven was achieved in 1930, and in 1932 the Merwehaven was opened. The economic depression affected Rotterdam more than Antwerp and even more than Hamburg for a short time, but it recovered and by 1934 was handling more shipping tonnage than either. Projected works include two groups of basins on the south bank above Pernis; work on the more westerly has been started. A further project is for a canal, the Koedood, connecting the Waalhaven with the Old Maas in the direction of Barendrecht, and thus reducing the barge traffic beneath the bridges.

Trade

Shipping. Rotterdam handles normally between 55 and 65% of the net tonnage which arrives at Netherlands ports, while Antwerp

handles 80% of the shipping which arrives at Belgian ports. In 1850 Rotterdam closely rivalled Amsterdam, when it accounted for 36% of the net tonnage of arrivals ; in 1870 the figure reached 50%, below which it has never since fallen.

By tonnage of shipping engaged in the foreign trade, Rotterdam

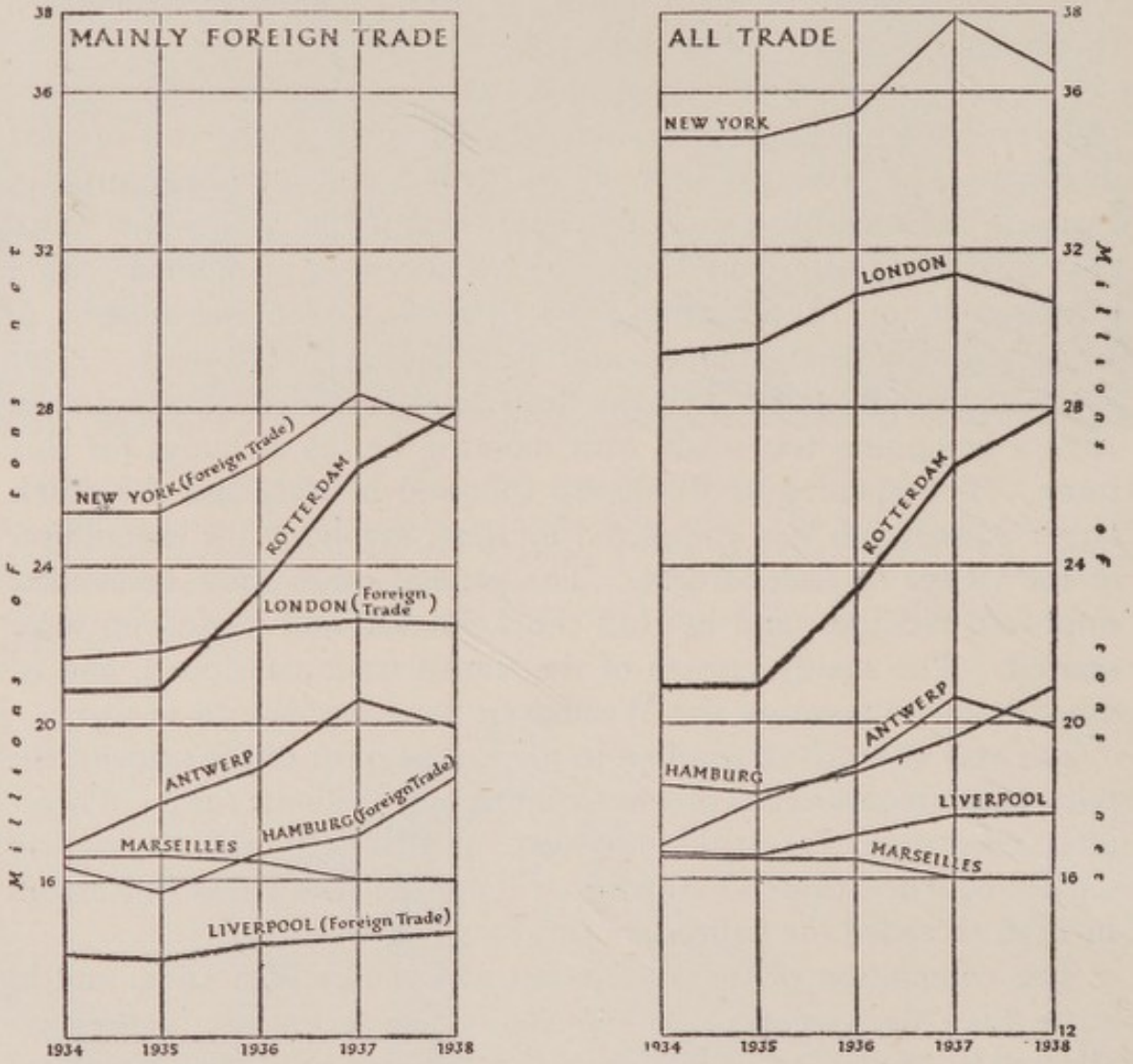


Fig. 104. Shipping tonnage at Rotterdam, etc. 1934–8.
Data *from Rotterdam : Statistiek, etc.* 1938, pp. 18–9 (Rotterdam, n.d.).

(including other ports on the New Waterway) closely follows London and New York in most years, while in 1938 its foreign traffic was the largest of any port in the world. Normally it takes third place, however, but surpasses Antwerp and Hamburg, and is thus the largest port in continental Europe. Coastwise traffic, as at Antwerp, is comparatively small ; for both foreign and coastwise shipping Rotterdam still leads among continental ports, but falls considerably below New York and London (Fig. 104). The average size of

ships entering Rotterdam is greater than the average for Hamburg, but about the same as the average for Antwerp.

Percentage of total traffic of Antwerp, Hamburg and Rotterdam accounted for by each port, 1938

	Percentage of total : number of ships	net tonnage
Antwerp	24·7	28·92
Hamburg	39·04	30·44
Rotterdam	32·26	36·16
New Waterway	36·26	40·64

From : *Rotterdam : Statistiek, etc.*, p. 17

Rotterdam is not the only seaport on the New Waterway and Rhine-Maas delta ; the ports of Hook of Holland, Poortershaven, Maassluis, Vlaardingen, Schiedam and Dordrecht–Zwijndrecht handle an aggregate tonnage which is about one-sixth of the tonnage handled by Rotterdam.

Net tonnage of sea-going ships entering the ports of the Rhine–Maas delta, 1938, *in thousands*

	From ports outside the Rhine-Maas delta	Including the mutual traffic between ports of the Rhine-Maas delta
Hook of Holland	1,144	1,153
Poortershaven	22	22
Maassluis	60	90
Vlaardingen	1,429	1,961
Schiedam	1,160	2,485
Rotterdam	23,837	24,744
Dordrecht-Zwijndrecht	157	169
	27,809	30,624

From : *Rotterdam: Statistiek, etc.*, p. 3.

As in most big commercial ports of Europe, the great majority of ships entering are of moderate size. Of vessels navigating the New Waterway in 1938, 7,709 drew up to 21 ft., 5,105 between 21 and 27½ ft., 474 between 27½ and 32½ ft., and 4 drew more than 33 ft.

By flag, the largest tonnage is accounted for by German vessels, with the Netherlands flag coming second, and the British flag third. The three together account for five-eighths of the traffic ; they are responsible for a similar proportion at Antwerp. The large German

tonnage at Rotterdam, as at Antwerp, arises main from the fact that outward bound liners from Hamburg and Bremen frequently call in order to complete a cargo, often with consignments originating in Germany (Fig. 105). The Norwegian, Italian, Swedish, Greek and French flags are also well represented.

Sea-going ships entered at Rotterdam, according to flags
(*thousands of net tons*)

Flag	1937	1938	Flag	1937	1938
German	5,789	6,356	Greek	1,033	880
Dutch	4,556	5,020	French	1,113	836
British	4,108	4,076	U.S.A.	660	597
Norwegian	1,802	1,951	Danish	497	556
Italian	1,174	1,448	Jugoslav	364	429
Swedish	983	1,056	Total, including all others	23,750	24,744

From : *Rotterdam : Statistiek, etc.*, p. 10–11

Liner sailings. As with most ports of north-west Europe, the majority of regular sailings are made to neighbouring countries, although the ships engaged are mostly small short-sea traders. The Hook of Holland—Harwich packets account for a large number of sailings. Of over 5,000 regular sailings from Rotterdam and adjacent ports, including Hook of Holland, in 1938, nearly 2,000 were to the British Isles, 1,700 to North Sea and Baltic ports and 500 to ports in France, Spain, the Mediterranean, Black Sea and Levant. The Atlantic coasts of North and South America accounted for 356 departures, China and Japan for 153, ports in Africa for 141 and the N.E.I. for 58.

Types of Cargo. Rotterdam is chiefly known as a port for handling heavy shipments of bulky goods, such as ore and cereals inwards and coal outwards ; in 1938, for example, over 2,000 ships arrived with ore and over 2,000 sailed with coal. This trade arises mainly from the proximity of the Ruhr coalfield and from the cheap water transport afforded by the Rhine. Nevertheless, the general cargo trade accounts for a great part of the prosperity of the port. Half of the inward cargoes in 1938 were bulk cargoes, one-third were general, and one-sixth were general together with cereals, timber, etc. Of outward cargoes over half were general.

Sea-going ships entering and departing from Rotterdam, grouped according to cargoes, 1938

Entered		Departed	
Cargo	Number	Cargo	Number
General cargo	3,179	General cargo	4,953
,, ,, and cereals	648		
,, ,, and wood	536		
,, ,, and coal	301		
,, ,, and other cargoes	465		
Whole cargoes		*Whole cargoes*	
Ore	2,036	Coal	2,041
Cereals	837	Cereals	336
Timber	547	Coke and patent fuel	298
Petroleum and petroleum products	459	Petroleum and petroleum products	224
Coal	305	Sand	146
Iron	177	Phosphate	135
Bananas	104	Broken stone	134
Phosphate	82	Bananas	132
Sugar	77	Nitrate of soda and other fertilizers	104
Ground nuts	43	Iron	67
Cereals and timber	31	Asphalt	29
Fruit (excluding bananas)	26	Bricks and tiles	13
Soya beans	21	Ore	11
Totals, including other cargoes	10,224		9,030

From : *Rotterdam : Statistiek, etc.*, p. 13–14

The general cargo trade is less well developed than at Antwerp, Hamburg or London. For example, in the period 27 June to 6 August 1938, advertised sailings of ships taking cargo to all destinations excluding the North Sea, Baltic and British Isles, numbered 84 from Rotterdam compared with 131 from Hamburg and 187 from Antwerp. Rotterdam does not enjoy the widespread imperial connections of London, or the many subsidies made to German lines, or the enormous steel export at Antwerp which provides many consignments for completing cargoes. Nevertheless, the port authorities are making efforts to attract the general cargo or packed goods (*stukgoederen*) trade, and by 1936 had succeeded in gaining 250,000 tons of this trade from Antwerp.

Important as bulk cargoes are at Rotterdam, they have not secured for the port any great advantages in freight rates. Among inward cargoes Antwerp enjoyed a preference in coal freights for several years until 1939, although in the import of ores Rotterdam secured

better rates, and with bulk cargoes from distant sources, like grain, seeds, rice and sugar, the rate usually quoted applied equally to Antwerp and to Rotterdam.

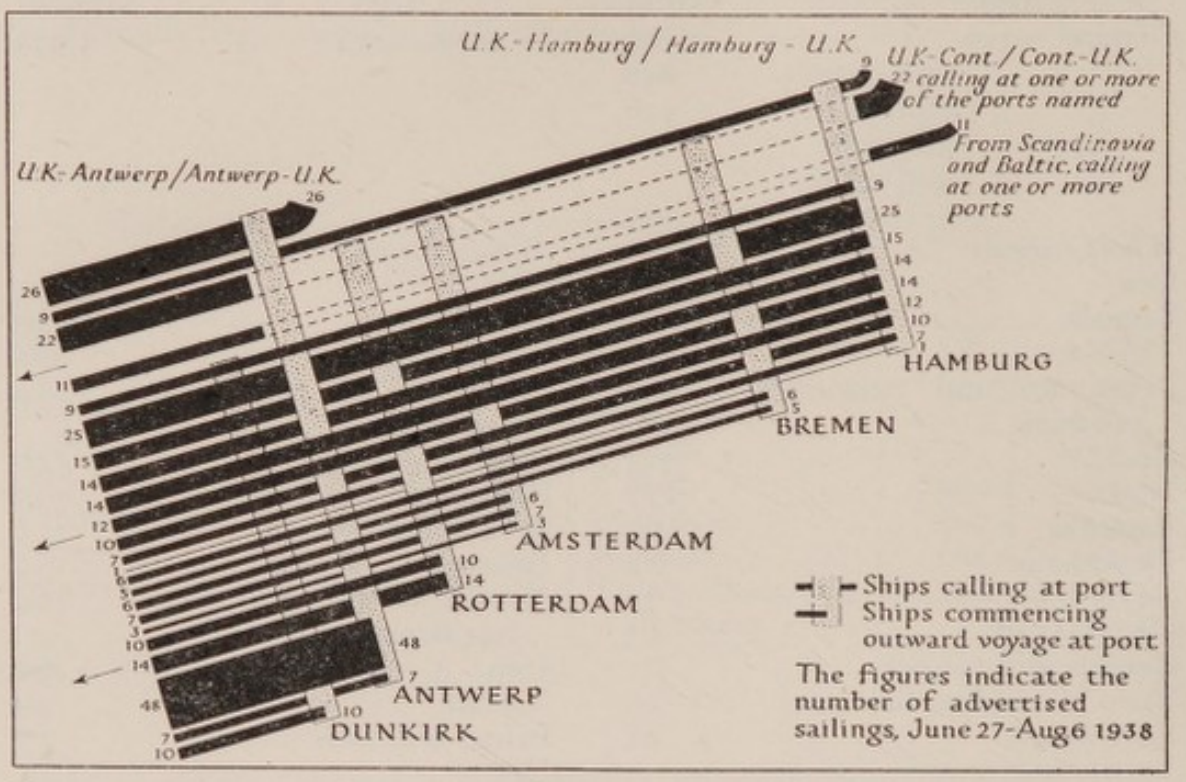


Fig. 05. Advertised liner sailings from continental North Sea ports, 27 June–6 August, 1938

Data from *Lloyd's Loading Lists*, June, July 1938.

The lines indicate the number of advertised sailings to all destinations west of Dunkirk excluding the British Isles, North Sea and Baltic, according to the various ports from which they were to begin or to call. There were 33 sailings involving U.K. ports and 11 involving Scandinavian and Baltic ports. Of the sailings which concerned continental North Sea ports only, 107 commenced at Hamburg, 55 at Antwerp, 24 at Rotterdam, 16 at Amsterdam, and 11 at Bremen ; in addition, 76 called at Antwerp, 29 at Rotterdam, 50 at Bremen and 12 at Amsterdam. There were thus available, for shipment from north-west continental Europe, 131 sailings from Antwerp, 107 from Hamburg, 63 from Rotterdam, 61 from Bremen and 28 from Amsterdam. In the liner trades therefore, Rotterdam holds a comparatively modest place.

Average freight rates, pence per ton

	1936	1937	1938	1939
Coal				
Tyne/Blyth/Dunston to :				
Antwerp	46¼	55½	—	164¼
Rotterdam	55½	60	51	75
Elbe ports	49¼	71	49¼	59
Swansea to :				
Antwerp	55¼	63½	47½	66¼
Rotterdam	65	77¼	61¼	54¾

Minerals	1936	1937	1938	1939
Bona to :				
Antwerp	62¼	104½	80	119¾
Rotterdam	65¾	99¾	78	74½

From : *Daily Freight Register, Annual Review for* 1939, pp. 4–5 (London, 3 January 1940)

Cargo. In the volume of sea-borne freight handled, Rotterdam surpassed London in 1937 and 1938, and in the foreign trade was far ahead of New York. Among continental European ports it is easily superior to Antwerp and Hamburg, and handles nearly as much as all the leading French ports together (Fig. 106).

Sea-borne cargo, thousands of tons, 1938

	Imports	Exports	Total
Rotterdam	27,504	19,261	46,765
London	34,538	7,540	42,078
Hamburg	18,241	7,501	25,742
Antwerp	11,873	11,706	23,579
Newcastle	2,224	13,069	15,293
Liverpool*	8,821	2,765	11,586
Marseilles	6,712	3,243	9,955
Amsterdam	3,485	2,170	5,655

From : *Rotterdam : Statistiek, etc.*, pp. 56–7.

* Excluding coastwise traffic. Rotterdam, like Antwerp, carries on little coastwise trade ; a considerable part of the total for London includes coastwise trade. In 1938 the foreign trade of New York amounted to 13·6 million tons (long tons) of imports and 7·9 of exports, and the coastwise trade to 34·8 million tons inwards and 7·2 outwards. The figures for Rotterdam include the smaller ports of the New Waterway.

The cargo traffic of Rotterdam, more than in most ports, consists of goods handled on account of foreign countries nearby. In the following account imports for consumption in the Netherlands and exports of Netherlands produce will be referred to as *special* trade and trade on foreign account as *transit*.

Goods traffic by sea via Rotterdam (including other ports of the New Waterway) 1938, *thousands of tons*

	Imports	Per cent.	Exports	Per cent.	Total	Per cent.
Special	7,859	28·5	3,561	18·5	11,420	24·4
Transit	19,644	71·5	15,700	81·5	35,344	75·6
	27,503	100·0	19,261	100·0	46,754	100·0

The transit trade applies more to exports than to imports. Of the total trade only 25% is on home account, compared with 60% at Antwerp. It is clear that Rotterdam functions mainly as a port for foreign countries ; of these Germany is of the greatest importance.

The cargo handled at Rotterdam shows a great disproportion in another direction, viz., the mode of conveyance between the port and inland centres. The waterway is dominant, and in few other ports are railways of so little significance for the movement of freight.

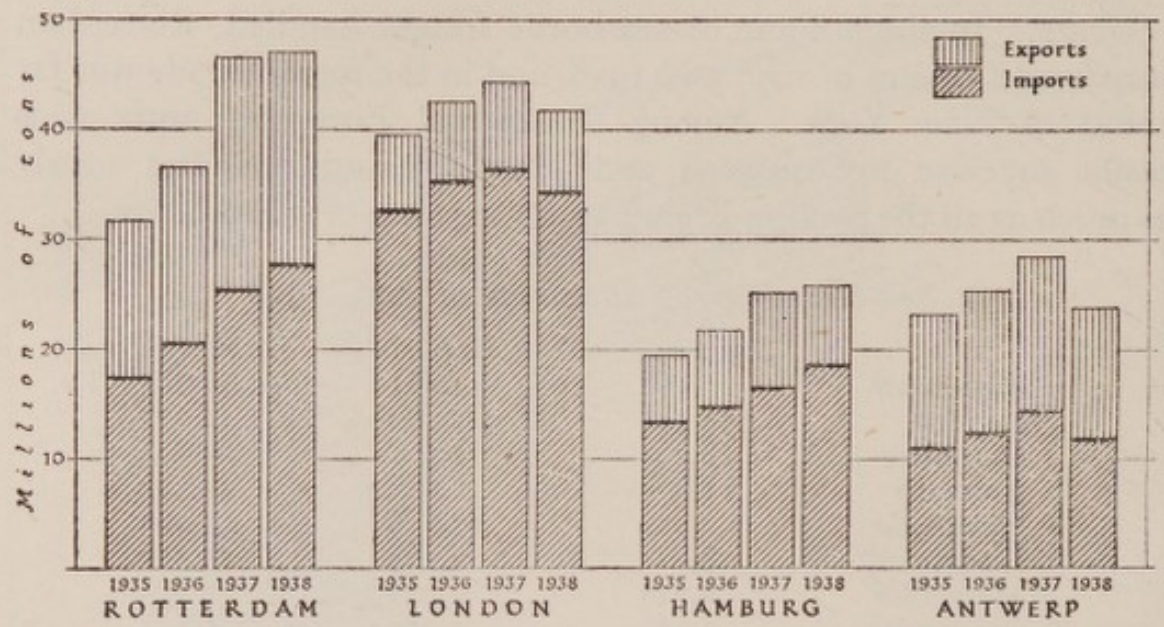


Fig. 106. Cargo trade of Rotterdam, London, Hamburg, Antwerp, 1935–8
Data from *Rotterdam : Statistiek, etc.* 1938, pp. 56–7 (Rotterdam, n.d.).

International Waterway and Rail Movements of Goods at Rotterdam (not including other ports of the New Waterway), 1938, *in thousands of tons*

	Import	Transit	Total	Export	Transit	Total
Waterway	846	13,839	14,685	1,150	16,827	17,977
Rail	99	138	237	53	32	85
Total	945	13,977	14,922	1,203	16,859	18,062

From : *Rotterdam : Statistiek, etc.*, pp. 65, 95.

Figures are not available to show the proportion of goods carried by waterway and by rail in the internal trade of the country, but the railway plays a similarly minor part.

The combined movements of cargo in the port may be summarized as follows :

	Special	Transit		Special	Transit
Sea-borne imports	7,003	17,500	Sea-borne exports	3,018	14,849
International traffi by waterway and rail, from Rotterdam	1,203	16,859	International traffic by waterway and rail to Rotterdam	945	13,977

(in thousands of tons).

From : *Rotterdam : Statistiek, etc.*, pp. 43, 65, 95.

The differences between the figures of sea-borne trade and international traffic in the special trade give a measure of the goods which pass through Rotterdam in connection with the internal trade of the Netherlands. The difference is complicated by movements into and out of bond, and into and out of stock. The relatively small discrepancies between the figures of sea-borne imports and international traffic in the transit trade are less easily explained; they arise partly through the inevitable delays attending transhipment between barge and ship and *vice versa*.

It should be noted that the waterways are not engaged solely in the carriage of bulk cargoes. They handle a considerable quantity of general merchandise, and while road transport in recent years has secured much of the merchandise traffic in the Netherlands domestic trade, the waterways remain successful for the carriage of general merchandise in the international traffic.

Cargo movements; special trade. The imports, comprising foodstuffs and raw materials, are more than double the exports, comprising products of high value and certain special bulky goods. The largest single item of imports for Dutch consumption is mineral oils and refined products (2,260,000 tons) a great proportion of which is bunker fuel. The second largest group import consists of cereals and maize (1,807,000 tons). Next come two raw materials—oil-bearing seeds and nuts for the extensive oil-processing industry of the Netherlands (440,000 tons) and timber of all kinds (435,000 tons). Seaborne coal imports amount to 290,000 tons, while crude phosphates, fruits and vegetables, ores, woodpulp, and raw cotton, wool and other textile raw materials make up considerable tonnages. Manufactures amount to nearly 300,000 tons, iron and steel forming the principal item.

Imports by waterway amount to 846,000 tons—a relatively small figure, because the greater part of such imports can be distributed in the Netherlands before reaching Rotterdam. Coal, iron and steel, and fertilizers make up half of the total.

Of the exports of Dutch produce by sea, coal, with 986,000 tons, makes up one-third of the total; this comprises bunker coal and exports to France and Belgium. Mineral oils, largely bunker fuel, come next, followed by fertilizers, manufactures, and fruit and vegetables.

Exports in the special trade by waterway exceed imports, and are dominated by mineral oils—partly bunker fuel and partly exports of refined products.

Trade of Rotterdam 1938 (*thousands of tons*)*

Commodity	Special Trade						Transit Trade						Total Seaborne Trade	
	Unloadings			Loadings			Unloadings			Loadings			In-wards	Out-wards
	Sea	Water-way	Rail	Sea	Water-way	Rail	Sea	Water-way	Rail	Sea	Water-way	Rail		
Foodstuffs :														
Cereals, maize (excl. flour)	1,807	32	—	47	8	—	1,948	26	—	238	1,735	—	3,755	285
Fruit and vegetables	125	2	7	177	2	11	102	2	1	58	26	24	227	235
Coffee, tea, cacao	59	1	—	25	4	—	55	1	—	37	23	1	114	62
Sugar	128	1	—	16	6	—	181	4	—	8	177	—	309	24
Raw Materials and Semi-Manufactures :														
Oilbearing seeds and nuts	440	4	—	19	3	3	759	16	—	95	735	—	1,199	114
Timber	435	7	11	3	1	—	647	5	—	14	638	—	1,082	17
Wood pulp, etc.	67	—	—	—	—	—	143	14	—	15	142	—	210	15
Textile raw materials	66	11	—	5	1	—	57	5	—	29	34	—	123	34
Fertilizers	49	72	—	285	27	—	27	533	—	538	25	—	76	823
Iron and manganese ores	3	—	—	12	40	—	9,376	—	—	25	9,351	—	9,379	37
Other ores	98	5	—	—	—	—	1,535	5	—	12	1,528	—	1,633	12
Iron and steel scrap	—	4	—	32	23	—	295	—	—	6	290	—	295	38
Iron and iron and steel semi-man.	15	1	—	19	—	—	149	8	—	8	149	—	164	27
Other metals	28	11	1	19	7	—	42	11	—	18	25	—	70	37
Mineral oils and oil products	2,260	32	2	441	792	14	525	58	—	79	503	—	2,785	520
Coal and patent fuel	298	210	22	986	50	—	486	10,875	111	11,128	489	—	784	12,114
Raw phosphates	165	—	—	—	—	—	268	—	—	6	262	—	433	6
Minerals and man. thereof†	17	37	2	62	5	—	69	921	—	927	68	—	86	989
Metals, alloys and man. thereof†	43	23	10	31	9	—	42	154	3	168	32	—	85	199
Manufactures :														
Chemical products	35	92	3	30	4	—	34	201	—	208	26	—	69	238
Iron and steel	135	128	3	7	—	—	6	273	1	275	3	—	141	282
Machinery, tools, wire, cables	19	5	10	19	1	1	5	20	8	32	2	—	24	51
Vessels and aircraft	30	—	1	42	—	—	—	—	—	1	—	—	30	43
Yarns, ropes, piece goods, clothing	24	8	2	46	6	1	10	3	2	10	5	—	34	56
Paper	30	10	1	71	7	—	20	30	—	35	15	—	50	106
Total, inc. unspecified commodities :	7,004	846	99	3,018	1,150	53	17,500	13,839	138	14,849	16,827	32	24,504	17,167

* to the nearest thousand tons and not including quantities below 1,000 tons ; †not separately specified.
From : *Rotterdam : Statistiek, etc.*, pp. 36–43, 58–65, 88–95.

Cargo movements : transit trade (*transit with transhipment*). The excess of inward shipments is relatively small, for the transit trade is dominated by German imports of ores and exports of coal. Ores amount to 10,911,000 tons and coal to 11,128,000 tons ; the greater part moves by way of the Rhine. Nevertheless, foodstuffs and other raw materials in transit bring about an inward excess of about 2,500,000 tons. They are products on the way to Germany, Switzerland, and Strasbourg, and include cereals and maize (1,948,000 tons), mineral oils (486,000 tons), timber (647,000 tons), oil-bearing seeds and nuts (759,000 tons), coal (406,000 tons), and crude phosphates (268,000 tons). Exports in transit, apart from coal, are represented by much smaller tonnages—mineral and metal products not separately specified in the trade returns (1,095,000 tons), fertilizers (538,000 tons), iron and steel (275,000 tons), and chemical products (208,000 tons).

Ore traffic. In few ports is a single commodity so dominant as the import of iron, manganese and other ores at Rotterdam. A heavy commodity like iron ore is particularly sensitive to slight differences in freight cost, hence the Rotterdam–Rhine route, being the shortest and most convenient approach for bulk transport to the Ruhr furnaces, retains a dominant share in the import trade.

Ore arrivals by sea in certain continental North Sea ports, 1937 *and* 1938, *in thousands of tons*

	1937	1938		1937	1938
Rotterdam (and other ports on the new waterway)	11,020	13,073	Ghent	720	
			Hamburg	639	698
			Bremen	555	592
Emden	3,736	3,590	Amsterdam	222	267
Antwerp	2,965	2,518			

From *Rotterdam : Statistiek, etc.*, p. 141

The traffic is particularly suspectible to trade depression, and in recent years it grew partly in relation to the development of the German re-armament programme. The arrivals of all ores at Rotterdam and Vlaardingen in each of the four years 1935–8 were 6·4, 9·4, 11·6 and 12·8 million tons.

Ore arrivals, Rotterdam and Vlaardingen, 1935 and 1938, in thousands of tons

	1935	1938		1935	1938
Iron ore			*Pyrite, copper pyrite, copper ore, residues (pyrite ashes)*		
Sweden	1,668	3,070	Spain	505	832
Norway	1,445	2,734	Cyprus	73	111
Fr. N. Africa	590	1,608	Sweden	33	104
Canada	79	874	Portugal	—	92
Spain	544	725	Norway	82	87
Other parts of Africa	184	647	France	151	58
France	249	501	All sources	1,036	1,419
All sources	4,920	10,449	*Bauxite*		
Manganese ore			Adriatic coast	193	302
Africa	21	229	France	81	84
U.S.S.R.	85	56	All sources	274	494
Brazil	—	39			
All sources	115	326			

From : *Rotterdam : Statistiek, etc.*, p. 136–40.

Trade by countries. As with many great European ports, the greater part of the shipping traffic is carried on with European countries—approximately 60%.

Origin of traffic entered at Rotterdam (excluding Schiedam and other ports of the New Waterway), including arrivals from ports in the Rhine–Maas delta, 1938, in thousands of net tons

Europe :	*14,365*	*Asia :*	*3,012*	*America :*	*5,531*
Germany	3,261	Japan	1,053	U.S.A.	2,494
G.B. and I.	2,105	British terr.	757	N.W.I.	807
Norway	1,579	N.E.I.	557	Canada	646
Netherlands	1,258	China	316	Argentina	634
Sweden	1,165			Other British terr.	430
France	919	*Africa :*	*1,774*		
Italy	897	French terr.	749	Mexico	146
Belgium	699	British terr.	496		
Spain	604				

From : *Rotterdam : Statistiek, etc.*, pp. 6–9.

This table shows the origin of all shipping traffic, and the figures, therefore, are enlarged by the tonnage engaged in passenger services. Trade with other parts of the Netherlands is in reality very small, for of the 1,258,000 tons entering Rotterdam, 900,000 tons originated in other ports of the New Waterway. A feature of the table is the modest figure of tonnage from Dutch overseas possessions—1,364,000 tons, less than the traffic from Norway. In 1935 the N.E.I. had a slight lead over the N.W.I., but by 1938 the N.W.I. had increased its tonnage at a much greater rate, a reflection of the

expansion of the petroleum exports passing through Aruba and Curaçao. Of the three principal countries from which originated arrivals at Rotterdam, the primacy of Germany arises largely from the large number of outward-bound German cargo liners which call at Rotterdam and Antwerp to complete their cargo ; arrivals from U.S.A. include frequent passenger sailings as well as cargo traffic ; arrivals from Great Britain comprise mainly general traders, but include packets and colliers, and a few outward-bound cargo liners calling at Rotterdam to complete a cargo (Fig. 105).

Waterway traffic. It is clear that the great rivers which lead from Rotterdam towards the interior of Europe play a dominant part in the existence of the port. In the port itself conditions are favourable for the handling of enormous numbers of large waterway craft, for the New Maas is wide, the construction of extensive basins or *havens* has been feasible, and the low range of the tide obviates the need of wet docks, and thus barges can moor alongside ocean-going ships at the quay or at buoys, and transhipment can be carried out quickly and cheaply. The riverward connections of Rotterdam have been of as much value to the development of the port as the seaward connections.

The Maas carries a not insignificant traffic in connection with Rotterdam, but compared with the Rhine traffic it is comparatively small.

Cargo movement on the Rhine and Maas, 1938, *in thousands of tons*

	From Rotterdam	To Rotterdam	Both ways
Rhine	17,760	14,150	31,910
Maas	73	1,326	1,399

From : *Rotterdam : Statistiek, etc.*, p. 62

A curious feature of the Maas traffic is the preponderance of the downstream cargoes. These consist primarily of coal from the Limburg mines, but include some quantity of exports in transit from the Liége district as well as Belgian exports to the Netherlands, by way of the Liége–Maastricht Canal and the Juliana Canal.

Destination and origin of goods traffic on the Rhine at the Netherlands–German frontier, near Lobith, 1938, in thousands of tons. (Fig. 107)

	Upstream, i.e. from the port	Downstream, i.e. to the port	Both ways	Percentage of total
Netherlands total	*21,739*	*20,810*	*42,549*	
Rotterdam	17,760	14,150	31,910	57·2
Amsterdam	568	1,164	1,732	3·1
Schiedam	27	33	60	
Vlaardingen	1,861	750	2,612	
Dordrecht	49	219	268	
Other Dutch ports	1,474	4,493	5,967	
Belgian total	*5,152*	*6,382*	*11,534*	
Antwerp	3,571	3,337	6,907	12·4
Ghent	786	844	1,630	
Brussels	101	360	461	
Other Belgian ports	694	1,841	2,535	
French total	*29*	*260*	*289*	
German oversea ports	*550*	*708*	*1,258*	
Other oversea ports	*81*	*75*	*157*	
Total	27,553	28,235	55,788	

From : *Rotterdam : Statistiek, etc.*, p. 66–9, 83.

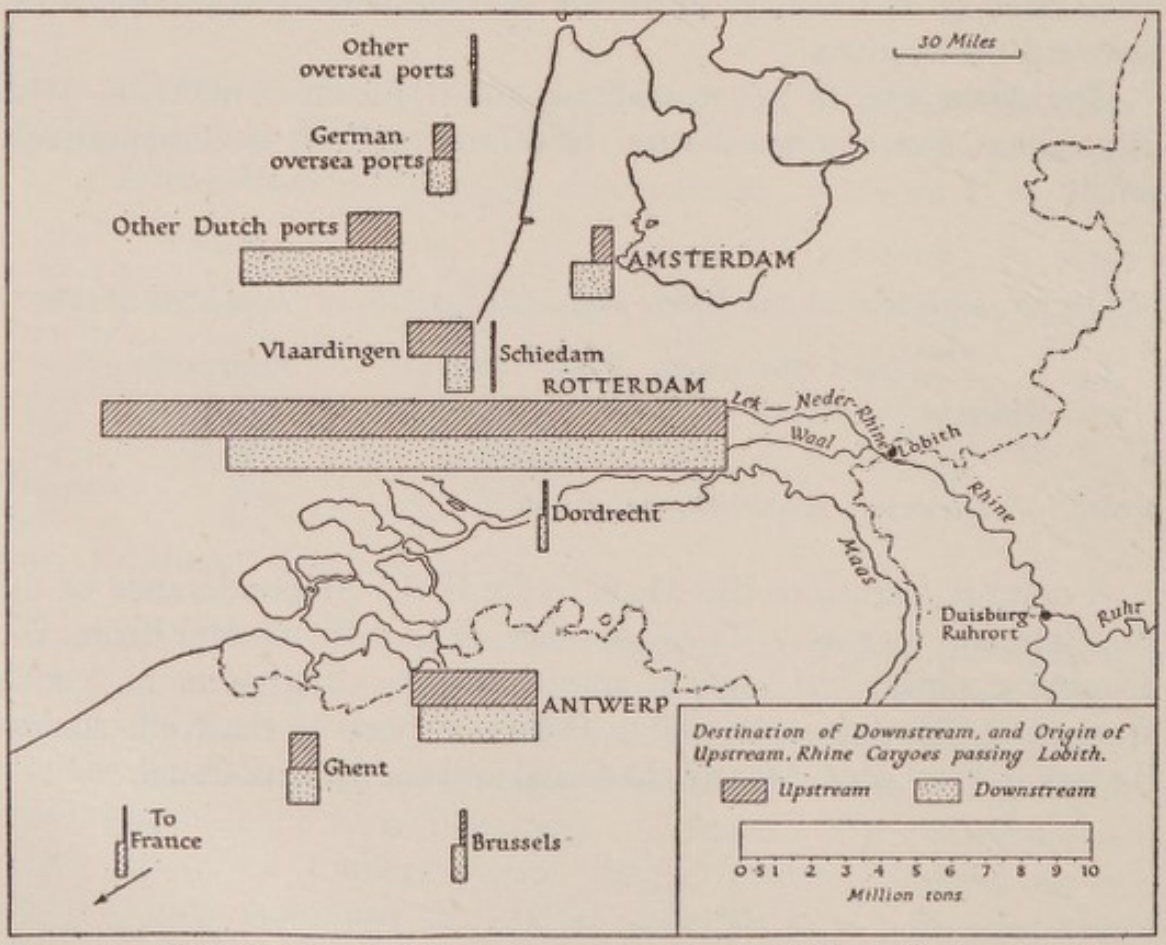


Fig. 107. Distribution of Rhine cargoes passing Lobith, 1938, by capacity of loaded barges

Data from *Rotterdam : Statistiek, etc.* 1938, pp. 24–31 (Rotterdam, n.d.).

The traffic shown in the above table comprises various categories —special trade imports and exports for the Netherlands, and special trade for Belgium in passage through the Dutch waterways, but the bulk is composed of transit trade (with transhipment) between Germany and the Dutch and Belgian seaports. The commodities carried in the entire Rhine traffic do not differ greatly in nature from those moving to and from Rotterdam alone, except that the ore movements upstream from non-Dutch ports are relatively less important.

Originating on the Rhine there is a further traffic which passes through Rotterdam without stopping at the port—the Rhine–sea traffic (transit without transhipment via the Dutch ports) between German Rhine ports and various overseas ports. This traffic normally operates mainly to German ports, with British ports taking second place :

Cargo movement in the Rhine–sea traffic (transit without transhipment) via Dutch ports, 1938, *in thousands of tons*

Upstream		*Downstream*	
Country of Origin		Country of Destination	
Germany	565	Germany	697
Great Britain	70	Great Britain	27
Poland and Danzig	4	Poland and Danzig	17
Denmark	1	Denmark	28
Total including other countries	645	Total including other countries	779

From : *Rotterdam : Statistiek, etc.*, p. 84

Cargoes in this traffic are extremely varied.

The Hinterland : Netherlands. Rotterdam is not so far ahead of Amsterdam for Netherlands special trade as for special and transit trade together :

	Imports		Exports	
	Special trade	Transit	Special trade	Transit
Rotterdam	7·0	17·5	3·0	14·8
Amsterdam	2·4	1·0	1·2	1·0

(in millions of tons)

From : *Verslagen der Bedrijven Diensten en Commissien van Amsterdam over* 1938, No. 28, *Handelsinrichtingen*, p. 11 (Amsterdam, 1939) ; *Rotterdam : Statistiek, etc.*, pp. 36–43

It handles, in fact, about three times as much as Amsterdam in the special trade in both trade imports and exports. The figures for Rotterdam, however, are inflated by the bunkering trade, which

is much greater than at Amsterdam. The competition between the two ports does not apply equally to all commodities, for Rotterdam has a greater advantage for bulk cargoes. The capital remains important for the merchandise trade, and for the trade with the N.E.I. Rotterdam benefits from its better connection with the Rhine, although the completion of the Amsterdam-Rhine canal should reduce this advantage. It has also gained in recent years through the improvement of the Maas navigation making a connection with the south Limburg coalfield (see p. 574).

The Hinterland : Germany. The greater part of the prosperity of Rotterdam depends upon the transit traffic with Germany and is therefore subject to any measure adopted in that country to deflect trade towards German seaports. It shares with Antwerp this susceptibility to factors outside its control but is not affected in the same way. In the past two decades Antwerp has suffered a decline of German rail transit traffic through the increasing application of *Seehafenausnahmetarife*—special rates designed to deflect railborne goods to Hamburg and Bremen, regardless of the cost. The railway traffic of Rotterdam in this direction is of little importance, a position not altogether a drawback, for it is railway tariffs which are most easily manipulated by means of special rates.

The waterway hinterland of Rotterdam in Germany includes first of all the Ruhr coalfield, which is the origin and destination of most traffic, and secondly the Rhine above Duisburg, the Main and the Neckar basins. Its position in relation to this hinterland is affected by two main sets of factors—German aims and Belgian aims. German policy in recent decades expressed itself in the construction first of the Dortmund-Ems canal, which enabled Emden to function as an ore-importing port for the Ruhr, and second, of the Mittelland Canal, which, while of interest mainly for internal German traffic, would improve connections with the Elbe and therefore with Hamburg. The third step is the planning of the Hansa Canal, which, by providing a direct waterway from the Ruhr to Bremen and Hamburg, should be the most effective of all. The success of the German plans will depend upon the degree to which waterway rates can be manipulated like railway rates in order to benefit the favoured ports. Without specially low rates these waterways would not greatly favour Hamburg, for the Rotterdam–Rhine route is the most economic, and the extension of the German waterways could, in conditions of unrestricted trade, extend the hinterland of Rotterdam eastwards.

The Hinterland : France and Switzerland. The Rhine leads also to Strasbourg and Basle. Through its waterway port at Strasbourg eastern France is provided virtually with an outlet to the sea, and the city has become, in terms of goods handled, one of the leading ports of France. Owing to the lack of good waterways leading westwards from Alsace to the Seine and thence to Rouen or Le Havre, eastern France has a permanent interest in the Rhine, especially in connection with the export of Alsatian potash and with the import of timber, coal, cereals and petroleum products.

Competition with Antwerp. The shorter distance and easier passage from the Ruhr to Rotterdam compared with the longer and more difficult journey to Antwerp by way of the Rhine, East Scheldt, South Beveland Canal and West Scheldt gives Rotterdam an advantage in waterway freight over Antwerp-Ghent of 25% from the Rhine-Herne Canal and 30% from Rhein-and Ruhr-Hafen. Belgian interests have attempted to reduce this advantage, and periodic efforts have been made to secure the Netherlands, agreement to the construction of a canal between Antwerp and the Rhine, either to Moerdijk or to Ruhrort (see p. 598). Following the breakdown of the negotiations for the Moerdijk Canal part of the funds which had been accumulated for its construction have been used to subsidize all departures for the Rhine from Antwerp and Terneuzen as well as some arrivals, so as to reduce the freight differences. In recent years ores bound for the Rhine have benefited by 3 fr. per ton and metallurgical products from the Rhine by 2 fr. per ton. Over the period 1929–36 the share of Antwerp in the Rhine traffic at Lobith rose from 10% to 14% and the share of Rotterdam fell from 60% to 55%, although a decline in the Antwerp traffic followed, for Rotterdam replied by reducing quay and pilotage tolls. It should be remembered that Ghent also has a considerable interest in transit traffic with Germany by way of the Rhine.

The Belgian subsidies on barge freights are resented in Rotterdam, and the Netherlands attitude on the Moerdijk Canal project is resented in Belgium. The Rhine waterway traffic is the lifeblood of Rotterdam, but only an important adjunct to the trade of Antwerp. The rivalry between the ports is bound up with the problem of the regime governing the Scheldt estuary and the Dutch claim to sovereignty over the Wielingen Channel (see p. 618).

The French government is involved to no small extent. Broadly speaking, in order to lessen the competition of Antwerp with Dunkirk for the trade of northern France it secured a diversion of traffic from

the Belgian port by granting in return reductions of the *surtaxes d'origine* and *surtaxes d'entrepôt* levied on goods moving between Strasbourg and Antwerp by way of the Dutch waterways. Thus the gain to the French ports at the expense of Antwerp necessitated compensation by a diversion to Antwerp of some French traffic which would normally pass through Rotterdam.

In a treaty of 1937 the French applied a system of rationing of goods entering France by way of Belgium, amounting to a loss to Antwerp and Ghent of 500,000 tons annually. Two concessions were granted in return : (1) France undertook for a term of five years not to impede the export of French goods via the Belgian ports and exempted from surtaxes goods imported into Alsace-Lorraine via the Belgian ports for the same period, at the time promising not to levy surtaxes on fresh articles ; (2) some hundreds of thousands of tons of bulk cargoes, such as Norman iron ore moving to the Ruhr and imports of coal for the French railways, which would normally have passed through Rotterdam, were turned to Antwerp.

The Franco-Belgo-Dutch Agreement on Port Traffic, 1939

In 1939 the entire problem of competition between Dutch and Belgian ports for the Rhine traffic entered upon a new phase, with the conclusion, between Belgium, France and the Netherlands, of an ' Agreement regarding certain Questions connected with the Regime applicable to Navigation on the Rhine '. The initiative in this matter had been taken by France, but the discussions promised results of considerable importance to Belgo-Dutch relations. There were three principal provisions :

Article 1 gave the Netherlands equality of treatment with Belgium over goods entering or leaving Strasbourg by the Rhine, by the abrogation of the *surtaxes d'origine et d'entrepôt*.

Articles 3 and 4 limited competitive attempts by Belgium to increase its share of Rhine traffic ; Belgium undertook not to increase the existing premiums or bounties, and the Netherlands not to levy such premiums. The share in the Rhine traffic crossing the Netherlands-German frontier to be apportioned to the Belgian seaports was fixed at not less than 18% and not more than 24%.

Article 5 provided for the setting up by the Belgian and Netherlands governments of a mixed commission for the purpose of considering the possibility of fixing by common agreement the taxes

and dues chargeable in the ports of Antwerp, Ghent, Rotterdam and Amsterdam.

Industries (*Fig.* 108)

The industrial establishments of Rotterdam were classified in 1938 as follows :

Industry	Number of establishments		Number of employees	
Metal Industries	*1,219*		*15,156*	
Shipbuilding yards with annexed engineering works		9		6,261
Other construction of steam engines, implements, instruments		827		6,645
Metal working		380		2,250
Foodstuffs and luxuries	*1,638*		*12,330*	
Bakeries		411		3,131
Grain and flour mills		13		139
Dairy processing factories		47		871
Tobacco and cigar factories		45		738
Others		1,122		7,251
Clothing and dry cleaning	*939*		*8,641*	
Building trades	*898*		*6,198*	
Wood, cork and straw	*568*		*3,096*	
Chemicals	*115*		*2,638*	
Printing	*229*		*2,457*	
Paper	*115*		*1,337*	
Textiles	*65*		*1,253*	
Total, including others	*6,610*		*55,973*	

From : *Rotterdam* : *Statistiek, etc.*, p. 149

The nine big shipyards in and near Rotterdam together with the forty smaller yards lying between Schiedam and Dordrecht make the New Maas-Noord one of the most important shipbuilding rivers in the world (see pp. 385, 456). The majority of the engineering industries are concerned with products ancillary to ship construction, but there are several other considerable plants. The *N.V. Electrotechnische Industrie* constructs electrical machinery of all kinds ; *De Nederlandsche Staalindustrie* is the largest engineering works in the city itself, and makes steel frames and cranes ; *Van Berkel's Patent Mij. N.V.* manufactures weighing and slicing machinery ; the Koolhaven aircraft works are situated at the Waalhaven airport. A number of other firms manufacture electrical equipment, hoisting gear, pumps, tanks and metal containers.

Among the food industries are some which work for export, such as the two large *Unie-Lever* margarine and oil factories and others

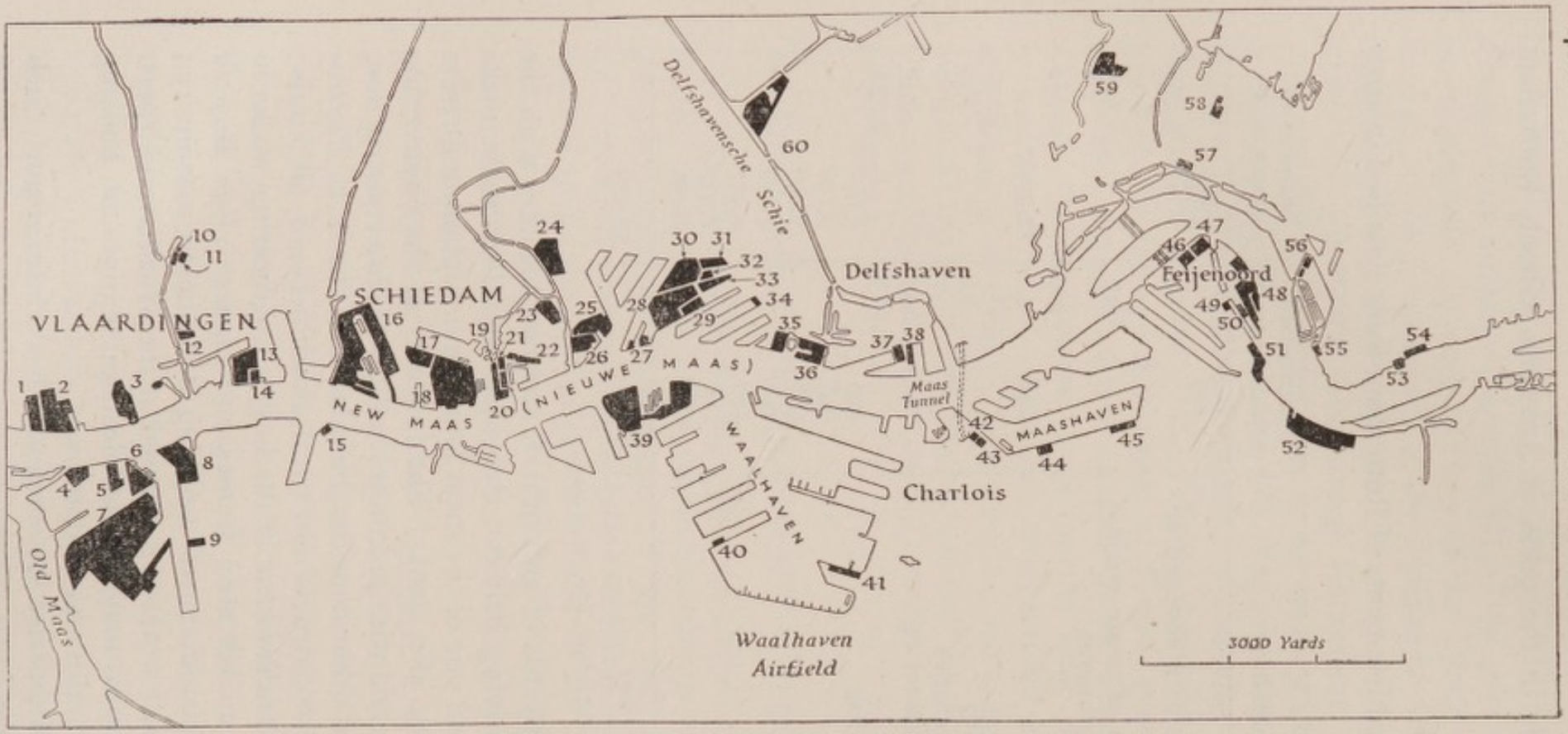


Fig. 108. The industries of Rotterdam

From : G.S.G.S. 4458 sheets 2 and 3, and other official sources.
1 Fertilizers ; 2 B.P.M. oil storage ; 3 Unilever soap works ; 4 superphophate works ; 5 chemical works ; 6, 8, 9, 15, 27, oil storage ; 7 B.P.M. refinery, storage ; 10, 14, 40, 41 shipyard ; 11, 23, 51 gasworks ; 12, 49, 50, 57 dairy products ; 13 edible oil storage ; 16 Wilton-Feijenoord S ; 17 Swarttouw E.W. ; 18 Nieuwe Waterweg S ; 19 Unilever oil storage ; 20 oxygen plant ; 21 Swarttouw E.W. ; 22 glass works, distillery ; 24 Vereenigde glass works ; 24 Werf Gusto S ; 26 candle factory ; 28 Keilehaven gasworks ; 29 Ned. Staal Industrie ; 30 Galileistraat power station ; 31 Ford Depot ; 32 E.W. ; 33 Van Berckel works ; 24, 44 flour mill ; 35 assembly shops ; 36 Wilton-Feijenoord S ; 37 Schiehaven power station ; 38, 45 silo ; 39 R. Dry Docks Co.'s S ; 42, 43 E.W. ; 46, 59 brewery ; 47 Unilever margarine factory ; 48 dismantled Wilton-Feijenoord S ; 52 P. Smit S ; 63 Deutz E. W. ; 54 metal works ; 55 Rotterdam S ; 56 waterworks ; 58 gas holders ; 60 sawmill.
(E.W. engineering works ; S shipyard.)

of this industry, and the *Galak* and *Hollandia* milk-processing plants. Most of the textile and clothing factories are of the small type so often found in a large city, but there is a large rayon spinning mill belonging to the Dutch Rayon trust (*AKU*).

In the chemical industry two important superphosphate works are situated at Pernis and Vlaardingen, the latter having an annual output of over 200,000 tons. At Krimpen-a/d-Yssel is the largest tar distillation plant in the Netherlands, handling most of the coal tar produced in gasworks. At Schiedam there are two important glass works. Near the Petroleumhaven is situated the *Bataafsche Petroleum Mij.* oil refinery, the largest in the country, a complete installation with a capacity of 12,500 barrels per day, while at Maassluis there is the smaller *N.V. Witol* refinery.

Communications

Railways. The basins and quays for the most part have adequate railway connections (Fig. 109). Standard gauge lines and their relation to passenger stations may be summarized as follows :

Route	Passenger Stations
Rotterdam–Hague (electrified throughout)	Hofplein, Delftsche Poort (Centraal)
Hook of Holland–Rotterdam–Utrecht–Germany	Maas Station
Hook of Holland–Rotterdam–Nymegen–Germany	Delftsche Poort (Centraal), Ysselmonde
Antwerp–Roosendaal–Rotterdam-Amsterdam	Delftsche Poort (Centraal), Ysselmonde

All these routes are electrified over the stretches passing through Rotterdam. Only the last named route crosses the river in Rotterdam. As a whole the railway lines do not run straight through the city but enter it by branches from outside loops. The marshalling yards and sidings are as follows :

		Main tracks
Ysselmonde	M.Y. (Hump)	30
Feijencord	M.Y. (Hump)	22
Binnenhaven	Siding	14
Maashaven, Waalhaven, Petroleumhaven	Siding	
Maas Station	Siding	12
Schiehaven (Rechtermaasoever)	Siding	10
Hudson Straat (Vierhaven)	Siding	16
Mathenesser Dyk	Siding	8
Schiedam Station	Siding	9

The Ysselmonde yard has a maximum daily capacity of 1,000 trucks and a storage capacity of 2,800; at Feijenoord storage capacity is 800.

Waterways. Rotterdam may be regarded as the principal 'hub' of inland waterways in Europe. The Lek and Noord-Waal lead to the Rhine and principal German waterways; barges of 1,200 tons capacity can reach Basle, barges of 2,500 tons can reach Strasbourg, those of 3,000 tons Mannheim, and those of 4,300 tons Duisburg-Ruhrort. The Waal and Maas-Waal Canal leads to the Maas, and the Juliana Canal for barges of 2,000 tons, and 450-ton barges can pass to Liège. The Noord–Hollandsch Diep–Scheldt route to Antwerp has a least depth of 10 ft. and leads to the Albert Canal, the Scheldt and the canals of northern France. Three routes to Amsterdam have least depths of 10, 9 and 9 ft.

Roads. See Fig. 117.

Dordrecht, including Zwijndrecht

(Figs. 103, 106, 110, 111, 117; Plates 53, 54)

Dordrecht (60,000) is one of the oldest of Dutch ports, a precursor of Rotterdam. Owing to the deeper and more direct approach enjoyed by Rotterdam, Dordrecht has fallen far behind, although in recent years its trade has expanded. It stands 26 miles from the North Sea by the shortest route, at the junction of the Old Maas, Merwede, Noord and Dordsche Kil. It can be reached by four different approaches:

(1) East Scheldt, Mastgat, Volkerak, 58 miles, least depth 11 ft.; (2) Brouwershaven Gat, Krammer, Volkerak, 53 miles, least depth 11 ft.; (3) Goeree Gat, Haringvliet, 40 miles, least depth 13 ft. (all three of these approaches continue through the Hollandsch Diep and Dordsche Kil); (4) New Waterway and Old Maas, 26 miles, least depth 15 ft. The tidal rise is $7\frac{1}{2}$ ft. (M.H.W.S.).

The town lies on the south shore of the Old Maas, and is fronted by quays and basins along the Mallegat, Old Maas, Merwede and Wantij. The port can accommodate at quays twenty-two vessels of 16 ft. draught or less, five of 20 ft., and one of 26 ft. There are many smaller quays for river craft.

Accommodation in the port may be summarized as follows:

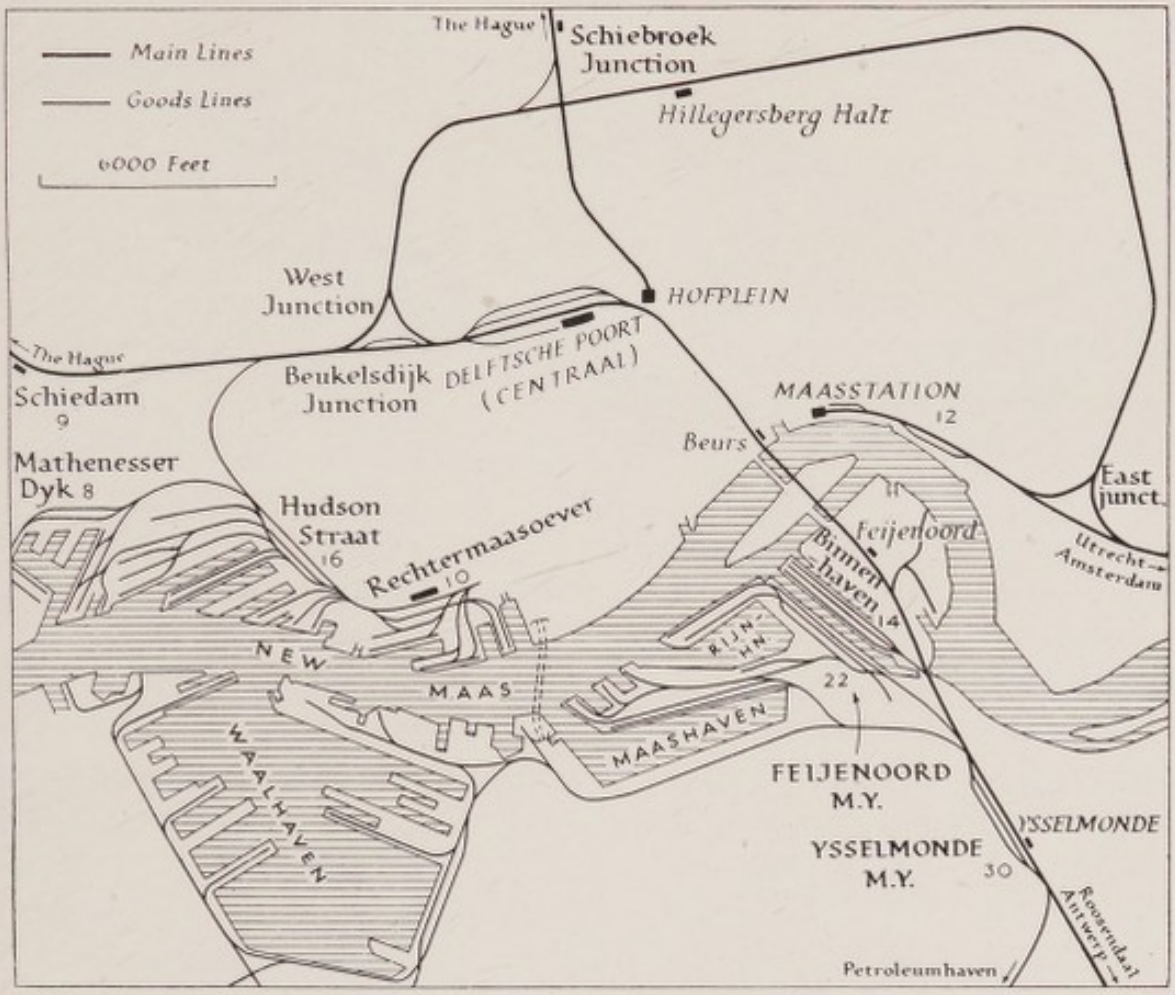


Fig. 109. Rotterdam : railway communications

From official sources.

M.Y. Marshalling yard. The figures indicate the number of main tracks in each yard and siding. The Maas road tunnel is shown by broken lines. North-south rail traffic between the two waterfronts can cross the Maas only by one bridge.

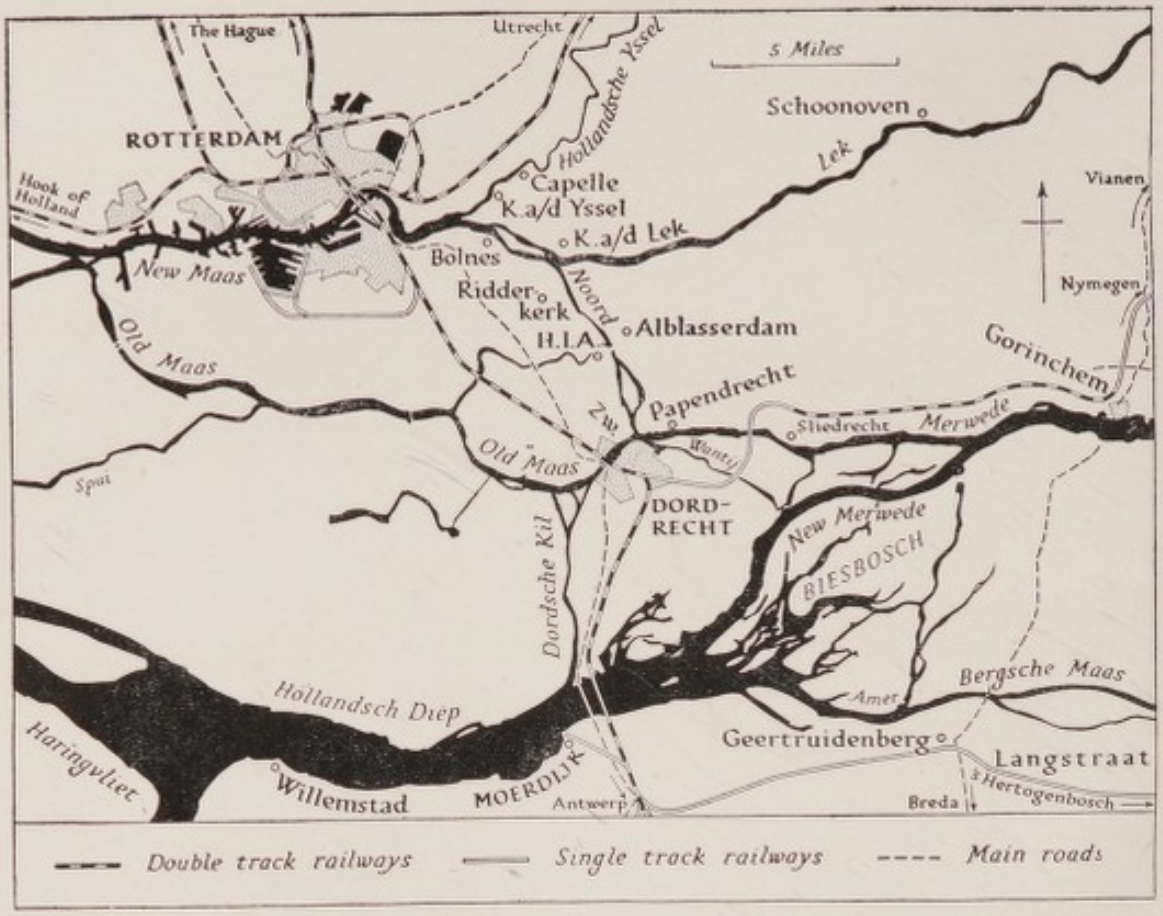


Fig. 110. The river crossings at Rotterdam, Dordrecht, and Moerdijk

From G.S.G.S. Series 2541 1 : 100,000 sheets 3, 4 (1943).
H.I.A. Hendrik Ido Ambacht ; K Krimpen ; Zw Zwijndrecht.
These main north-south crossings connect the centre of population in the Netherlands with Belgium and France.

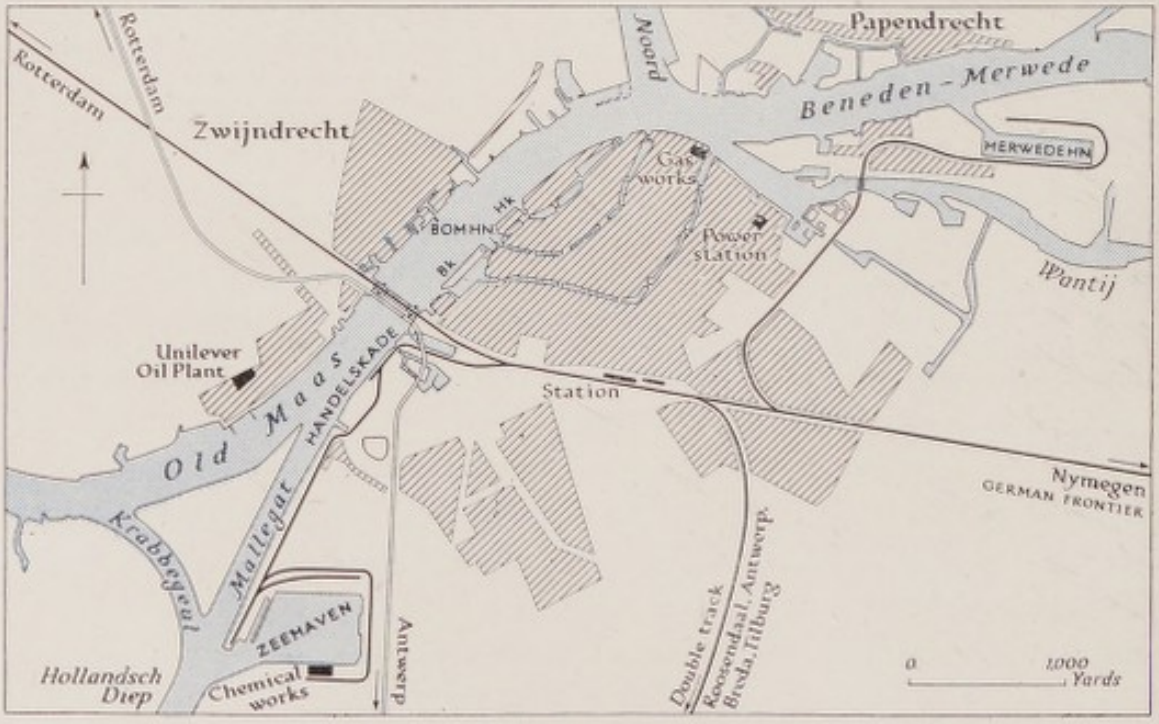


Fig. 111. The port of Dordrecht

Bk Buitenkalkshavenrade ; Hk Hooikade.
In the south-west corner of the map the Dordsche Kil leads to the Hollandsch Diep. Spoorweghaven is south-east of the bridges.

	L.W. depth, ft.	Quayage, ft.	
Basins:			
Zeehaven	26	1,210	
Spoorweghaven	?	2,090	
Kalkhaven	19½	2,300	Coasters; general cargo
Bomhaven	12		Tugs
Nieuwehaven	9–11		
Wolwevershaven	10–13	N.W. 770, S.E. 839	
Riedijkshaven	11		
Merwedehaven	13		Rhine barges
Quays:			
Handelskade	17	880	
Buiten Kalkhaven Kade	15	1,100	
Hooi Kade	11	590	
Merwede Kade	—	—	

Zeehaven is the principal basin in the port; it is equipped with four transporters, and carries on much of the timber trade.

At Zwijndrecht on the north shore of the Old Maas quays extend along the river.

Port Facilities

There are a number of warehouses, although their number is not known. Quay cranes number five—two 5–10-ton, two 2–5-ton and one 25-ton. There are no dry docks, but considerable repairing facilities are provided by the six shipyards engaged in the building and repair of barges and ships. The *Penn en Bauduin* yard builds small vessels and is well equipped to construct engines, boilers and propellers. *De Biesbosch* yard has three slips on which ships up to 13,000 tons deadweight can be built; it constructs boilers, and steam engines up to 1,000 h.p. There are many tug owners in the port, as well as a salvage company and three dredging outfits. There are also normally maintained four floating derricks, of 20-, 30-, 70- and 80-tons capacity, as well as two 8–10-ton floating steam grabs.

The Town

Dordrecht (commonly known as Dort) lies along the north shore of the island, about 7 miles long and 5 miles wide, which is formed by the rivers Merwede and Old Maas to the north, the Dordsche Kil to the west, and the New Merwede to the south and east. The old town is bounded to the south and east by the line

of waterways from Kalkhaven to Riedijkshaven ; this area is further divided into three islands by two parallel inner canals. The town has a population of 60,000, while on the opposite banks lie Zwijndrecht (12,000) and Papendrecht (5,000).

Electricity for Dordrecht and the surrounding area is supplied by the power station, of 43,000 kW capacity, near the Wantij river. There is a local gasworks. Water is taken from the Wantij and filtered.

The town is the seat of a district court (*arrondissementrechtbank*).

History

Dordrecht has a strong claim to be regarded as the oldest Dutch town. The name first appears, as ' Thuredrech ', in 1049, and the place was described as an *oppidum* in 1200, so that its municipal status must date at least from the twelfth century. It was also the first Dutch town to have its own ' jurats ' or councillors, who appeared there in 1220. Dordrecht played a leading part in the incessant rivalries and wars between the neighbouring feudal magnates, especially the Counts of Holland, the Dukes of Brabant, and the Bishops of Utrecht, throughout the later Middle Ages, and it was at one time the residence of the Counts of Holland. Although these wars caused much damage from time to time—Dordrecht was more than once taken and sacked—they also gave the town opportunities to secure valuable economic privileges from rulers anxious for its support. Of these privileges by far the most important was the ' right of staple ', that is, of the compulsory unloading of all goods at its wharves, which Dordrecht secured over the traffic of the Maas and Rhine. The town received its earliest staple-privileges in 1276–7, and in 1299 they were extended to all goods passing along the Lek and Merwede. Such privileges could not have been either secured or retained had not Dordrecht been exceptionally well situated in respect of trade, but from the beginning they were attacked by rival towns such as Rotterdam and Gorinchem. They were twice withdrawn (in 1326 and 1393), but early in the fifteenth century John of Bavaria, Count of Holland and Zealand, restored and extended them.

In June 1572, two months after the rebels' capture of Brill and Flushing, Dordrecht threw in its lot with the Revolt, and at the beginning of July the town summoned a meeting of the States of Holland to its own guildhall and thus helped to lay the foundations of the country's independence. Two years later the first general

synod of the Dutch Reformed Church also met there. Dordrecht continued to take a leading part in the affairs both of the province of Holland and of the Union, but it was not until the seventeenth century that it became even more celebrated, first as the meeting place of the National Synod called in 1618 to settle the bitter religious controversy associated with the names of Arminius and Gomarus (see p. 130), and then as the birthplace and training ground of one of the Republic's two greatest statesmen. John de Witt came of a famous Dordrecht ruling family ; both his grandfather and father had held high office in the town, and the latter, Jacob de Witt, was one of the six regents imprisoned by Prince William II in 1650 (see p. 135). John de Witt himself became pensionary, or chief magistrate, of Dordrecht, and in 1653 he became pensionary of Holland, or Grand Pensionary, an office he held until 1672. During these twenty years he was one of the most powerful men in Europe. He was—with scant justice—held responsible for the crisis of 1672, when France and England jointly attacked the Republic : together with his brother Cornelius, he was brutally done to death by the infuriated mob at The Hague on 20 August 1672.

Dordrecht was also the birthplace of the seventeenth-century painter, Albert Cuyp, as well as of other seventeenth-century masters, notably Ferdinand Bol, Nicolaas Maes and Abraham Bloemaert. The town's fame as a nursery of painters has lasted down to the present time, with Ary Scheffer (1795–1858) as its greatest nineteenth-century figure.

Modest prosperity in the eighteenth century was followed by the French occupation. The next century saw a relative decline of the port ; like Rotterdam, it suffered from the silting of seaward approaches and the increase in the size of ships. The opening of the New Waterway placed Dordrecht at a relative disadvantage, for it was now farther from the sea by the most direct route. This drawback has remained. Nevertheless, the deepening of the Old Maas was virtually completed in 1932, and together with the construction of the Zeehaven, will enable Dordrecht to enjoy prosperity of a modest order. It is hoped that some of the German transhipment traffic with smaller vessels at Rotterdam may be attracted.

Trade

In 1938, 442 ships of a gross tonnage of 320,000 tons entered Dordrecht and Zwijndrecht with cargo and in ballast, as well as

128 of 56,000 tons in direct transit; 392 vessels sailed, of 278,000 tons, as well as 107 of 51,000 tons in direct transit. Most of these ships traded with Great Britain and, to a lesser extent, with Germany.

Cargo Trade, 1938, *in thousand tons*

Commodity	Special Trade				Transit Trade			
	Imports		Exports		Inward		Outward	
	Sea	Water-way	Sea	Water-way	Sea	Water-way	Sea	Water-way
Iron, manganese and other ores					46·7	4·0		50·5
Coal, etc.	3·9	58·9	5·5	56·5	33·6	16·4	6·8	44·5
Lime, cement, etc.		25·1						
Fertilizers	2·5	5·4						
Stone		22·7				28·8	28·8	
Iron and steel scrap			18·0	7·6	2·5			2·4
Iron and steel		23·4			1·9			1·9
Minerals and products thereof		8·3	2·6		5·3	54·5	54·5	5·3
Timber	67·5	9·7						
Pit props	32·0							
Total, including goods not named	109·0	163·8	40·9	75·4	101·8	116·0	102·3	115·7
Ditto (1935)	75·6	153·6	102·3	31·0	21·9	38·6	31·3	27·9

From: *Jaarstatistiek van den In-, Uit-, en Doorvoer over* 1938, vol. 1, pp. 393–4 ('s Gravenhage, 1939)

In 1938 the seaborne movement of goods in both directions was slightly less than the waterway tonnage. While special imports greatly exceeded exports in the seaborne trade, the transit traffic was equally balanced. Most trade is carried on with the neighbouring countries of Europe. Small quantities of a great variety of goods are handled, more than in most minor ports, but the great part is concerned with heavy goods, either raw or semi-finished materials.

Industries

The industries of Dordrecht are varied and resemble those of Rotterdam. Shipbuilding and repairing is important, though mainly concerned with river craft (see p. 385). The *Aviolanda* seaplane assembly plant at Papendrecht is one of the largest in the Netherlands. Armaments were also manufactured. Besides wire drawing and general smith and foundry work (there were twenty-seven lead foundries), the metal industries are well represented. An important electrical engineering works, the *Dordt* or *E.M.F.*, constructs electric motors up to 250 h.p., especially for dock machinery. Several firms manufacture hardware and machinery; one of these, *N.V. Lips*, is one of the largest European manufacturers of safes and locks, and has a European reputation. Seven firms in



Plate 53. Dordrecht : general view, looking north-east

On the left is the Old Maas ; in the background are the Beneden Merwede (to the right) and the Noord (to the left). The small basin in the foreground is the Nieuwe Haven.

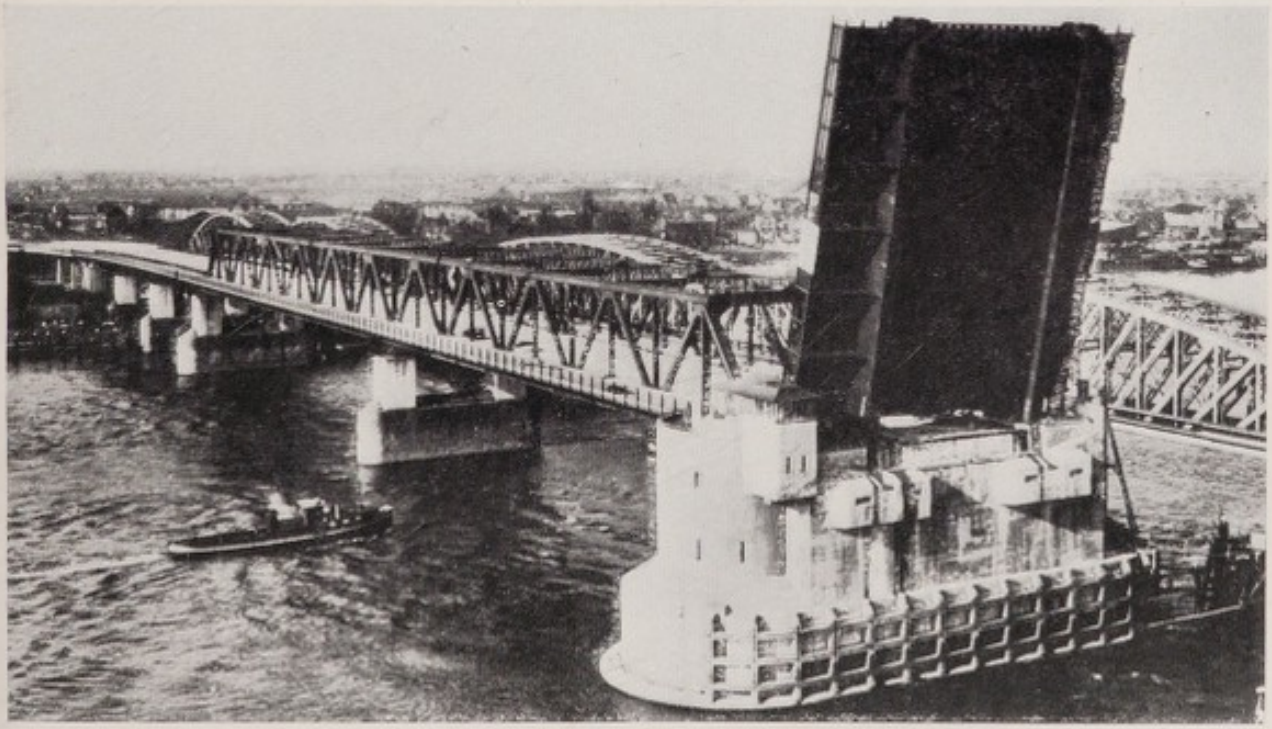


Plate 54. Dordrecht : new road bridge, looking north across the Old Maas

This bridge has a double leaf drawbridge section ; behind lies a railway bridge, with a swing bridge section. These bridges carry the main Rotterdam–Antwerp traffic.



Plate 55. Ymuiden : Hoogovenhaven and steel works, looking north-east
This is one of the largest steel works in Europe, operating three blast furnaces, coke ovens, chemical works, cement works and steel mills.

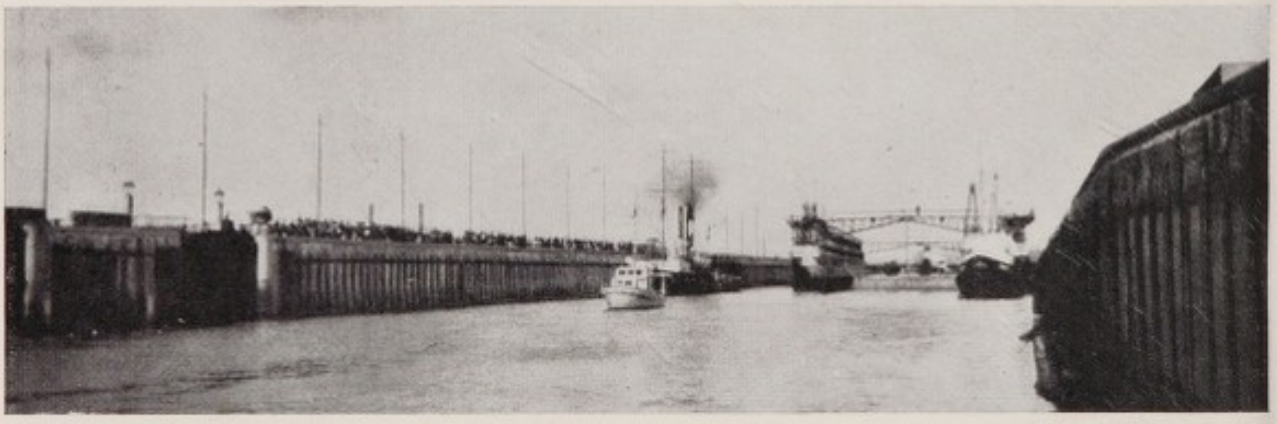


Plate 56. Ymuiden : North Lock
This lock, leading to the North Sea Canal, is the largest in the world. The photograph shows the passage of a floating dock bound for Germany, 1938.



Plate 57. Ymuiden : North Sea Canal and Velsen railway bridge, looking east

Dordrecht manufacture glass. Chemical industries include half a dozen manufacturers of heavy chemicals, which produce superphosphates, ammonia and ammonia derivatives, acetylene, soda; the largest chemical plant, *N.V. Stikstofbindungsindustrie Nederland*, produces cyanides and prussiates. Oil mills include a *Unilever* subsidiary; the plant, which is in Zwijndrecht, is one of the largest in the Netherlands and has a capacity of 150,000 tons of seed annually.

Communications

Railway. The central quays and basins are not served by railway tracks, but the Merwedehaven, Spoorweghaven and Zeehaven have adequate rail connections. The double-track electrified line from Rotterdam passes through Zwijndrecht and crosses the Old Maas by a bridge with two moving sections. Beyond Dordrecht the line forks; the main line to Antwerp continues as a double track (steam operated), while the line to the German frontier via Nymegen is a single track (steam operated), as far eastwards as Sliedrecht. Normally all trains between Amsterdam and Belgium, as well as all trains between Rotterdam and the German frontier via Nymegen, stop at Dordrecht.

Waterways. The waterway connections of Dordrecht are as good as those of Rotterdam, and give access for large barges to all the chief waterways of Belgium, Germany and the Netherlands. It lies on the Antwerp-Rhine route, and is the point at which the estuary tugs and the river tugs interchange.

Roads. Dordrecht lies on the main Rotterdam–Antwerp road. Before the construction of the new road bridge west of the railway bridge the only exit northwards to Rotterdam was by ferry to Zwijndrecht. The new bridge carries north- and south-bound traffic clear of the towns (Figs. 110, 117).

YMUIDEN (IJMUIDEN)

(Figs. 100, 112, 117; Plates 55–7)

Ymuiden, at the seaward entrance to the North Sea Canal, is one of the largest fishing ports in Europe. The newest of all the Dutch ports, it is now one of the chief centres of heavy industry in the Netherlands. After the opening of the canal the small village behind the dunes underwent a rapid transformation. The commune of Velsen, in which Ymuiden is situated, has a population of 45,000.

Approach and Access

The seaward approach is made without difficulty and the harbour is entered first between the ends, 600 ft. apart, of the two converging breakwaters which form the Buitenhaven or outer harbour. The breakwaters are almost 1,500 yards long, and besides providing an area of sheltered water for the entrance to the port, prevent the accumulation inside of drifting shore material. Each breakwater has an apron of masonry blocks which extend some distance and prevent any vessel from lying alongside. Anchorage may be found in parts of this outer harbour in depths of 30 ft. Anchoring in normal times is forbidden, unless special permission is obtained from the port authorities. The tidal rise is $6\frac{1}{2}$ ft. (M.H.W.S.). The deep water channel through the port carries 34 ft. at low water. The largest vessel regularly passing through the locks was the *Oranje*, 20,000 tons gross, 29 ft. draught.

Detailed Description

From the Buitenhaven two channels lead into the port on either side of an island ; the Noorderbuitenkanaal, which leads to the North Lock of the canal entrance, has a depth of $36\frac{3}{4}$ ft. ; the Zuiderbuitenkanaal has a depth of $34\frac{1}{2}$ ft. Eastwards of the island these channels are connected by the Verbindings Kanaal, with $34\frac{1}{2}$ ft.

The port has been considerably extended in recent years, and several works were approaching completion in 1940. It may be regarded as comprising three main sections—the locks, the outer basins and the inner basins.

The Locks. The four locks giving admission to the North Sea Canal lie roughly east and west. The principal, the North Lock (Noordersluis) is the largest in the world, its dimensions exceeding those of the Panama Canal locks.

Dimensions of Ymuiden Locks, in feet

	Length	Width	Depth	Depth of outer approach	Depth of inner approach
North Lock (Noordersluis)	1,300	164	49	41	41
Middle Lock (Middensluis)	740	82	33	$34\frac{1}{2}$	$33\frac{3}{4}$
South Lock (Zuidersluis)	390	59	26	$27\frac{3}{4}$	27
Small Lock	226	59	$17\frac{1}{4}$		

Depths are given below Mean Sea Level

The outer basins of the port are seaward of the locks and therefore tidal ; they comprise the two basins of the fishing harbour (Haringhaven and Visschershaven), the steel works basin (Hoogovenhaven) and the uncompleted Berghaven. Haringhaven has no quayage, Visschershaven being the centre for the fishing activities of the port, with 2,100 ft. of quayage on its eastern side and two large fish market buildings. Hoogovenhaven has 31 ft. of water and 900 ft. of quayage specially equipped for handling ore and coal.

The inner basins lie inside the locks and are therefore of the nature of wet docks. They are all of recent construction. Staalhaven and Westelijke Rijksbinnenhaven are used only by barges, while Oostelijke Rijksbinnenhaven and the Paper Mill Quay have a good depth of water.

Name	Length	Width	Depth	Length of quayage
Outer (tidal) basins :				
Haringhaven		350	16	
Visschershaven	2,700			4,600
Hoogovenhaven			31	900
Berghaven				
Inner basins :				
Westelijke Rijks-binnenhaven	2,460	90	15	—
Staalhaven	2,200		10	
Oostelijke Rijks-binnenhaven			22	
Paper Mill Quay			31	400

Dimensions in ft.

The Westelijke Rijksbinnenhaven serves the cement works ; Staalhaven serves the steelworks which lie to the north of the blast furnaces ; Oostelijke Rijksbinnenhaven serves the foundry works and the P.E.N. power station ; the Paper Mill (Van Gelder) is served by the quay alongside the works.

There is a quay 630 ft. long east of the south lock, on the southern side.

Port Facilities

Lifting equipment is confined to special gear for the different works ; the Hoogoven quay has three transporters and the power station quay one transporter, while three medium cranes are situated on the foundry quay of the Oostelijke Rijksbinnenhaven. There are no warehouses beyond the two fish markets. There are no

dry docks or slipways, and trawlers were accustomed to proceed to Amsterdam for any extensive repairs.

The Town

Ymuiden is a closely built-up town in the south side of the port, and part of the commune of Velsen, a settlement lying farther east. The whole has a population of 45,000. Across the canal, a few miles to the north-east lies Beverwijk (10,000).

The P.E.N. power station, on the north side of the canal, with a capacity of about 100,000 kW, is part of the North Holland 50kV grid and supplies current for the whole of North Holland outside Haarlem and Amsterdam. The paper mill and iron and steel works have large private power stations. Gas is supplied by the coke oven plant north of the harbour ; the water-supply is derived from the dunes.

Trade

The movement of shipping in the port during 1938, not counting the passage of ships through the locks to and from Amsterdam and Zaandam, was as follows :

	Inwards		Outwards	
	No.	Gross tonnage thousands	No.	Gross tonnage thousands
Loaded	334	1,115	206	594
In ballast	76	61	175	436
For repair and bunkering	6	4	6	4
	416	1,180	387	1,034

From : *Statistiek van de Scheepvaart op het Buitenland over* 1938, pp. 14–15

The cargo traffic arises from the heavy industries in the neighbourhood ; there is little connection with a more distant hinterland, while the transit traffic is no more than a few thousand tons annually. Imports by sea in 1938 included iron and manganese ores (492,000 tons), pulpwood (219,000 tons), cellulose (22,000 tons), and coal (76,000 tons) ; imports by waterway included coal (263,000 tons), stone (130,000 tons) and raw iron and steel (13,000 tons). Exports comprised mainly raw iron and steel—102,000 tons by sea and 87,000 tons by waterway. The total movement of cargo was as follows (in thousands of tons) :

	Imports		Exports	
	Sea	Waterway	Sea	Waterway
1938	826	469	132	103
1937	921	557	122	112
1936	757	405	127	102
1935	703	397	117	87

From : *Jaarstatistiek van der In-, Uit-, en Doorvoer over* 1938, vol. 1, pp. 388–9 ('s Gravenhage, 1939)

The ores are imported from Sweden, Spain and North Africa. The waterways are responsible for most of the arrivals of coal and for all the limestone, although the export of pig iron and semi-manufactured iron and steel is carried about equally by sea and by canal.

Industries

The fishing activities of the port were responsible for a number of small fish canning and fish-meal factories as well as extensive refrigerating plants, and two soap works. The K.N.H.S. (*Koninklijke Nederlandsche Hoogovens en Staalfabriek*) plant is now one of the largest steel works in Europe. The Netherlands government and the city of Amsterdam hold 40% of the shares, and other important holders are the Royal Dutch Shell group and the German steel company, *Gutehoffnungshütte* of Oberhausen. Production began in 1923 ; there are now three blast furnaces, a coke oven plant, an open hearth steel works, two rolling mills, a chemical plant for treating coke oven gas, a slag processing plant and a cement works, using limestone from Belgium, ore from Spain, Sweden, Norway, etc., and coal from Limburg, Germany and Great Britain, which arrived mainly by sea or waterway. Consumption of ore and limestone averages 400,000 tons annually, and of coal 250,000 tons ; the output in 1938–9 from the two furnaces in operation was 276,000 tons of pig iron, of which 223,000 tons were exported.

The open hearth steel works had a capacity in 1939 of 100,000 tons from three furnaces. The coke oven plant, besides supplying coke to the furnaces, supplies gas to the surrounding district as far as Zaandam and Haarlem. The chemical works, founded in 1929, for the treatment of gas, operate a synthetic ammonia plant (see p. 380) ; the slag processing plant produces road materials ; the cement works, which began operating in 1931, have an annual capacity of 200,000 tons.

The paper mill on the north bank of the canal is the largest in the Netherlands ; it was opened in 1895.

Communications

Ymuiden is connected with Haarlem by an electrified double track line ; there is a station near the Visschershaven as well as a town passenger station. The North Sea Canal provides northward and southwards connections to the waterway system of the Netherlands, and eastwards via Amsterdam and the Merwede Canal large barges may pass to the Rhine. For roads see Fig. 117.

The North Sea Canal

(Figs. 100, 112 ; Plates 56–61)

The North Sea Canal, 15 miles in length, connects Amsterdam directly with the North Sea. In 1940 the ruling depth was at least 34 ft. ; the largest of the entrance locks at Ymuiden would permit the largest vessel to enter with ease. It is said to be capable of accommodating vessels of 100,000 gross tons. The existing dimensions of the canal are :

Width at bottom, straight sections	164 ft.
Width at bottom, bends	196 ft.
Width at water level	393 ft.

Work was in progress, however, to enlarge the canal along its entire length to a bottom width of 328 ft. and to a depth of 49 ft. In 1940 much of the work had been completed.

The canal is navigable day and night, lights on lamp posts being placed at intervals of 500–800 ft. and about 16 ft. above the water level along each bank. All ocean-going vessels can reach Amsterdam without the assistance of tugs. It is crossed by two railway swing bridges, the Velserbrug near Velsen, and the Hembrug near Zaandam ; each has a navigable width of 180 ft. The Velserbrug has a clearance of 21 ft. above normal canal level, and the Hembrug a clearance of $36\frac{3}{4}$ ft. Branch canals lead off to the north and the south, as well as the river Zaan leading to Zaandam.

At the eastern end the canal passes through the Afgesloten Y by the Oranje locks into the Buiten Y and thence to the Yssel Meer (Zuider Zee). With locks at each end, therefore, it forms, with the basins of Amsterdam, an enormous wet dock. The level of the canal surface is 5m. ($16\frac{1}{2}$ ft.) below N.A.P. (mean sea level). The greater part of the canal runs through polders below sea level, and the destruction of the sea locks would result in the flooding of a great part of Amsterdam. The water supply of the canal is provided by drainage water evacuated from neighbouring polders.

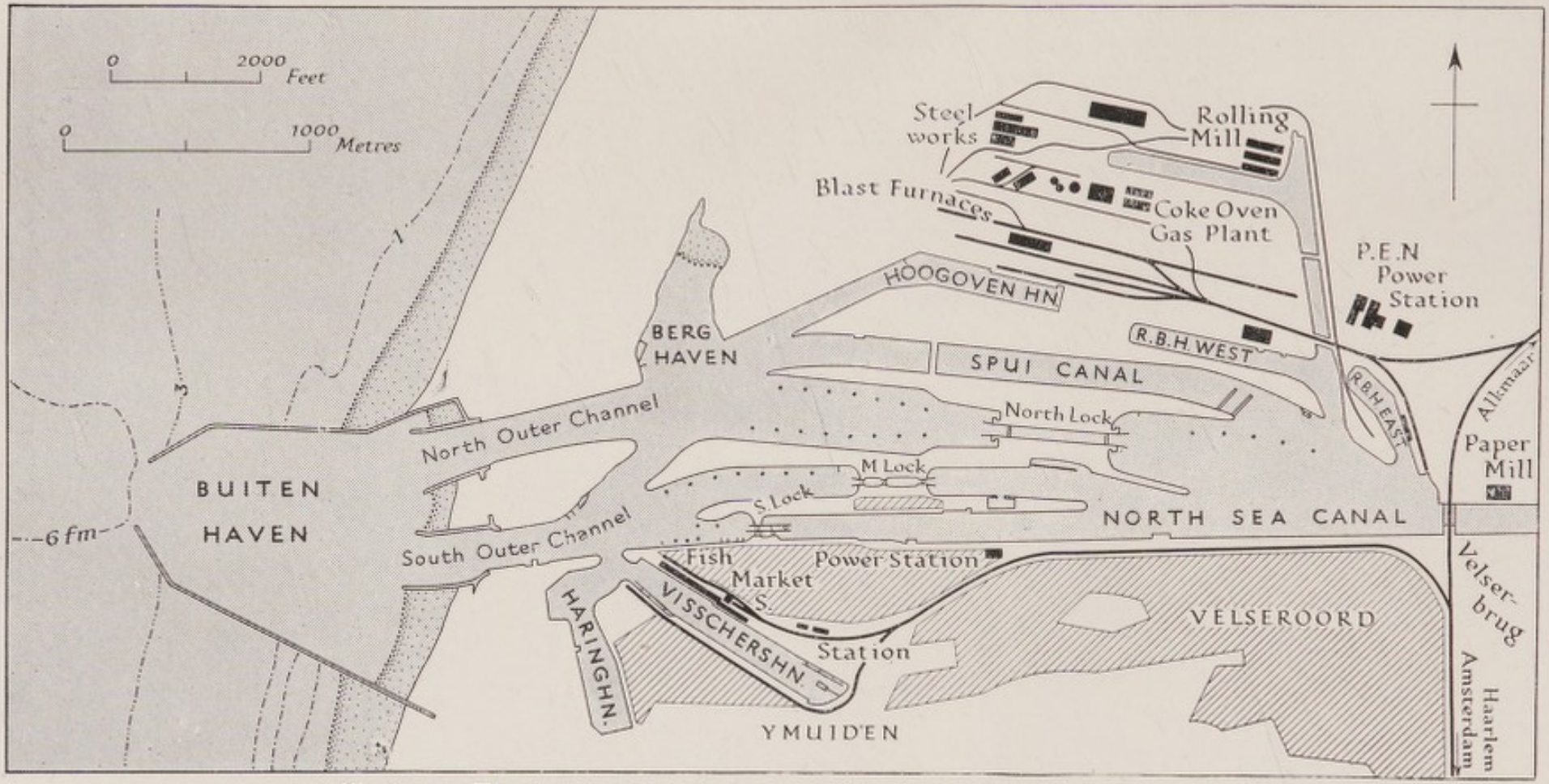


Fig. 112. The port of Ymuiden ; entrance to the North Sea Canal

S Fish Market Station ; R.B.H. Rijksbinnenhaven.
The North Lock is the main entrance and the Middle and South locks are secondary entrances.



Fig. 113. The port of Amsterdam (see also Figs. 100, 114, 115)

1 Surinamekade ; 2 Sumatrakade ; 3 Javakade ; 4 Handelskade ; 5 ditto (E. portion) ; 6 Panamakade ; 7 Levantskade ; 8 Ertskade ; 9 N.G.H. Entrepotkade ; 10 Zeeburgerkade ; 11 Borneokade ; 12 K. Ned. Arsenal ; 13 Ford works ; 14 Superphosphate works ; 15 W. gasworks ; 16 waterworks ; 17 E. gasholders ; 18 Werkspoor engine works ; 19 Old Royal Dockyard ; 20 Neth. Dock Co. ; 21 Neth. Shipb. Co. ; 22 Noord power station ; 23 Fokker aircraft works ; 24 R-D Shell ; 25 Du Croo and Brauns eng. works ; 26 Amsterdam Dry Dock Co. ; 27 Kromhout engine works ; 28 Holl. Dr. en Kabel works ; 29 gasholders ; 30 Vershure shipyard ; 31 sulphuric acid factory.

The North Sea Canal was opened in 1876 to replace the first artificial entry to Amsterdam, the North Holland Canal (1824), which soon became inadequate. It resulted in the drainage of much of the neighbouring fen, and necessitated the cutting through of the coastal dunes which reach a height of 100 ft., and the construction of a massive outer harbour at Ymuiden on a coast where winter storms are severe. At the same time the Oranje locks were constructed, cutting off the Y from the Zuider Zee. The development of traffic led to repeated widening and deepening of the canal. In 1896 a larger lock was opened, the first in the world to be entirely electrically operated. The North lock was opened in 1930.

Inland vessels up to 2,000 tons deadweight can pass through the Oranje lock at the eastern end of the canal into the Yssel Meer.

Zaandam

Zaandam (35,000) stands on a northward branch of the North Sea Canal, a few miles west of Amsterdam. The port comprises two basins, Nieuwe Zeehaven and Oude Zeehaven. Nieuwe Zeehaven, lying to the west of the Hembrug, is entered directly off the North Sea Canal. Opened in 1911, it is about 2,000 ft. long, 500 ft. wide, with depths of 32 ft. It is primarily a timber discharging basin, and has extensive timber ponds on the eastern side. Three buoys provide one berth 650 ft. long and one berth 500 ft. long.

To the north of the railway embankment, and entered by a cutting, is Oude Zeehaven and Voor Zaan which can be approached from the east side of the Hembrug by way of Zijkanaal G, in which there are depths of 28 ft. This is the old part of the harbour. Oude Zeehaven is the only part suitable for sea-going ships, having accommodation for eight berths of 20 ft. depth and about 300 ft. length. To the north, on the west side of the Zaan, lies Houthaven, the old timber harbour, while to the east as well as to the north there are considerable facilities for barges.

The town of Zaandam lies to the north, on both banks of the Zaan. It is one of the oldest ports in the Netherlands, and was formerly of much greater relative importance. In the seventeenth and eighteenth centuries, Zaandam was the centre of the sawmilling and shipbuilding industries of the country, and it was here that the Czar Peter the Great came in 1696 to master the art of shipbuilding. The colonial trade survives in the extensive rice import. Zaandam has in the last century or so, however, been quite overshadowed by Amsterdam,

although the opening of the North Sea Canal in 1876 enabled it to share in the advantages of a more direct and deep water approach.

The trade of the port is largely bound up with its refining industries, hence a considerable number of ships sail in ballast :

Shipping Movement, 1938, *in thousand gross tons*

	Inward		Outward	
	No.	Tonnage	No.	Tonnage
Loaded	167	253	50	18
In ballast	34	11	93	176
	201	264	143	194

From : *Statistiek van de Scheepvaart op het Buitenland over* 1938, pp. 14–15 ('s Gravenhage, 1939)

The cargo movement is almost entirely inwards, and in 1938 amounted to 253,000 tons inwards (timber 195,000 tons, rice 49,000) by sea and 55,000 tons (coal and mineral products 26,000 tons) by waterway. Exports amounted to 16,000 tons by sea and 10,000 tons by waterways ; they comprise vegetable oils, cocoa products and wood pulp. Transit traffic was insignificant.

The industries are typical port industries—saw-milling and woodworking, oil seed crushing and vegetable oil refining, cocoa manufacture, and some engineering.

Amsterdam

(Figs. 100, 106, 107, 113–5, 117 ; Plates 58–69)

Amsterdam (800,000 in 1939), the capital and largest city of the Netherlands, is one of the most important ports on the North Sea after the giant ports of Rotterdam, Antwerp and Hamburg. It is approached by the 15 mile long North Sea Canal (see pp. 492–3), which has a depth of 34 ft., now being deepened to 49 ft. The largest vessel using the port was the *Oranje*, 20,000 gross tons, 613 ft. long, 29 ft. draught.

Detailed Description

The port lies almost entirely on the south side of the Afgesloten Y, taking up the water frontage of the city ; the Afgesloten Y varies in width from 575 to 2,300 ft. The port consists of a number of basins opening without locks from the North Sea Canal and the Y. Entrance to the barge canals leading northwards or southwards from the North Sea Canal or the port of Amsterdam is controlled by locks.

The centre of the city water front is the De Ruyterkade, a terminus for passenger boats which run to many towns in the Netherlands. One group of basins lies east of this quay, towards the Oranje locks, while a second group of newer basins lies west of the quay and extends nearly as far as Zaandam. Of the existing quayage with a depth of over 30 ft., 10,000 ft. lie to the east of De Ruyterkade and 9,000 ft. to the west. The eastern quays receive all the lines using the port, including the largest vessels which call. Nevertheless, the layout of the city makes expansion possible only on the west, i.e. seawards. Here are the newest basins, Coenhaven and Westhaven, in part not yet fully equipped with shore installations.

Among the basins with deep water and behind the main waterfront lie a number of barge quays and basins.

Principals basins and quays for sea-going ships (dimensions in ft.)

	Basins			Quays		
Eastern Part	Length	Width	Depth	Length	Depth	
Y Eiland						
Surinamekade				2,600	33	Used by largest
Sumatrakade				3,200	33	vessels visiting the
				1,150	33	port.
Y-Haven	5,250	700	34*			
Javakade				3,600	33	
Handelskade				4,100	27	Regular lines.
Oostelijke Handelskade				1,900	33	
W. head Westerdok				265	27	
Spoorwegbassin	2,500	330	24–31			
South side				2,625	24	Rhine barges and
Panamakade				2,200	26–31	Limburg coal.
Ertshaven	2,350	490	29*			
Levantkade				2,300	24	6,000-ton ships.
Ertskade				1,020	29	Ore and coal.
West portion				600	26	Barges.
Entrepothaven	3,600	3,800	29–33			
Handels Entrepotkade				2,080	29	Stockade off waterfront.
Zeeburgerkade				1,150	32	
Borneokade				2,650	32	Ships up to 10,000 tons.
Outer Binnenhaven				820	24	Holland line.
De Ruyterkade, 2 piers				470	22	Coasters.
Western Part						
Steenenhoofd	1,090		18	coasters		
Silokade				400	29	Grain.
Oude Houthaven			23–26			No quays; used
Nieuwe Houthaven						by vessels of 4–5,000 tons;
Minervahaven						timber ponds.
Superfosfaatfabriek and Katoenloodsen				750	21–26	
Coenhaven	2,200	1,950	33	9,360	33	Coal and general barge transhipment; 6,000 ft. undeveloped waterfront.
Petroleumhaven		100			30	5 berths.
Westhaven	2,500	840		690	32	Ford Motor Works.
North Side						
R. Dutch-Shell					33	600 ft. on buoys.

* Depth in fairway

The Handelskade is most frequently used by ships, followed by Sumatrakade and the quays of Spoorwegbassin. The port provides

sixteen berths with a minimum depth of 30 ft.; sixty-six with a depth of 20–30 ft., and thirty-three with a depth of 12–20 ft. (including berths at undeveloped quays, but excluding berths in the timber basins; the latter number eleven with 20 ft. depth and seventeen with 16–20 ft.). There are also ninety-one berths on mooring buoys—twenty-two with 30 ft. and over sixty-eight with 20–30 ft., and one with 12–20 ft.

Port Facilities

The port is well equipped with warehouses, which number fifty-six; open stacking space on the quays is restricted, however. Quay cranes with a capacity under 10 tons number about 180 on the deep water quays and twelve on the remaining quays. There are also eighteen transporters: these are used mostly for handling coal in Coenhaven, Spoorwegbassin and on Ertskade, but several are also fitted on Sumatrakade; there are also a coal tip and a floating coal elevator. The normal equipment of the port includes one 100-ton and one 80-ton floating crane, sixteen smaller floating cranes, and a 50-ton floating sheerlegs, as well as seven floating grain elevators, each of which has an hourly capacity of 250 tons.

Repair Facilities. There are three dry docks on the north side of the port, the largest having a length of 640 ft. As in other Dutch ports, there is a good equipment of floating docks; there are four with a lifting capacity under 2,000 tons, three with a capacity of 3–7,500 tons, and one 25,000 ton dock. The considerable ship-building industry of Amsterdam provides further repairing facilities. The *Nederlandsche Dok Mij.*, which owns the three dry docks, operates three building slips up to 500 ft. in length. It normally builds vessels up to 10,000 tons gross, and constructs steam propelling machinery. The *Nederlandsche Scheepsbouw Mij.* builds hulls but not machinery; it constructed the *Oranje*, 20,000 tons, during 1938. The yards include five building slips, up to 800 ft. in length. The *Amsterdam Droogdok Mij.*, the principal owner of floating docks in the port, engages mainly in repair work, but also constructs boilers and machinery. The *Verschure* yard has three slips up to 325 ft. in length; it specializes in the building of dredgers, floating cranes, etc., and constructs engines and boilers. All these yards have a good equipment of cranes, fitting-out berths and gear of all kinds. A number of smaller yards build tugs, barges, etc.

The City

Amsterdam first became the capital city of the Netherlands during the period of the Batavian Republic and the French occupation, and though the political seat of government is now at The Hague, the city's claim to this distinction is generally recognized. It owes this not only to its commercial and financial supremacy among Dutch cities, but also to its importance as a cultural centre and to its close relations with the overseas empire. Though surpassed by Rotterdam in the volume of shipping using the port, its entrepôt trade, as distinct from the transit traffic, gives it a considerable commercial importance. Industries, though frequently on a small scale, are significant in the aggregate. As a centre of communications it is also notable : it is the terminus of numerous passenger routes to the Far East and to South America, and with its airport at Schiphol, of long distance air routes. Though it no longer maintains its former supremacy in finance, it still ranks among the leading money markets of Europe. Finally, for a large part of the country it is the principal centre for the distribution of goods and for professional services.

Its close relations with the overseas territories are exemplified by the Colonial Institute, where colonial administrators are trained and research into the cultures of the native peoples and their problems is carried on. In science and the arts it also plays an important role. Many scientific organizations have their seats in the city, the principal being the Royal Academy of Sciences, and there are two universities, the State University, dating from 1632, but reconstituted in its present form in 1887, and the Free University. Numerous museums house examples of Dutch achievements in many fields, the Rijksmuseum containing the finest existing collection of Dutch and Flemish paintings. An important source of influence are its newspapers and publishing houses.

The Site of Amsterdam

The position of Amsterdam in relation to the Y (IJ) and the Zuider Zee has been decisive for its development. By the thirteenth century the Y had become a broad tidal arm of the sea, leading into the interior of North Holland (see p. 296). Immediately before entering the Zuider Zee, the Y narrowed, and this constriction, together with the current and the direction of the prevailing wind, kept open a channel deeper than any found elsewhere on the southern

shores of the basin. On the south side of these narrows, the Amstel entered a small bay which formed a sheltered roadstead. When a dam was built on the Amstel a short distance above its mouth, an even more sheltered harbour was provided. This site about the mouth of the Amstel was therefore conveniently placed for transhipment from sea-going vessels to smaller craft suited to navigation in the interior waterways reached via the Y. Throughout its history Amsterdam has flourished as an entrepôt, for which the necessary conditions were implicit in its site from the first. Rivals among the older towns of the Zuider Zee were handicapped by the silting up of their approaches, e.g., Muiden, otherwise favourably placed at the mouth of the Vecht, or lay too far from the waterways of the south to be easily reached by small craft, e.g., Medemblik and Stavoren.

Apart from its all important position, the site of the city has few conspicuous features. On either side of the river mouth stretched a level, waterlogged expanse of peat, with patches of sand, fringed with tidal flats and banks which could be easily reclaimed for harbour works. Until the dyking of the shores of the Y, the area was sparsely inhabited, and threatened with destruction by the encroaching Zuider Zee. This terrain had both advantages and disadvantages. When larger brick buildings replaced the earlier wooden structures, great numbers of oak piles had to be driven into the morass to provide the foundations. The low flat surface, with a high sub-soil water level, also made the disposal of sewage and the supply of drinking water difficult. The system of canals partially solved the drainage problem, but these difficulties were always present, and became particularly acute with the city's expansion in the nineteenth century. On the other hand there were no serious hindrances to the expansion of the port along the Y waterfront or of the city inland, and in early days the marshy nature of its environs, combined with the ability to inundate the approaches, as was done twice in the seventeenth century, was a defensive factor of some importance. Expansion, however, was costly, as canals and drainage had to be provided, and, later, the adjacent polders suppressed. This required co-operative effort, so that the city did not grow continuously, but in a series of well-defined stages.

Relation to routes. Trading relations which developed with the eastern parts of the country and later with foreign countries tended to centre in Amsterdam. The closing of waterways by dams (see p. 276) in the course of reclamation, thus restricting access to the



Plate 58. Amsterdam : North Sea Canal and Hembrug, looking west

The photograph shows an incoming North German Lloyd ship. The Hembrug is the largest swing bridge in Europe ; it carries the railway from Amsterdam to Zaandam, Alkmaar and Den Helder. Road traffic, as at the Velsen bridge, is carried by a ferry.



Plate 59. Amsterdam : Westhaven, looking north

On the east side of the Westhaven stands the Ford factory ; immediately behind, and crossing the picture, is the canal ; opposite the entrance to the Westhaven is the Nieuwe Zeehaven, a broad cut leading to the timber ponds and newer basins of Zaandam, which can be seen in the distance. The Hembrug and *Kon. Nederland Arsenal* are just off the photograph, to the right.

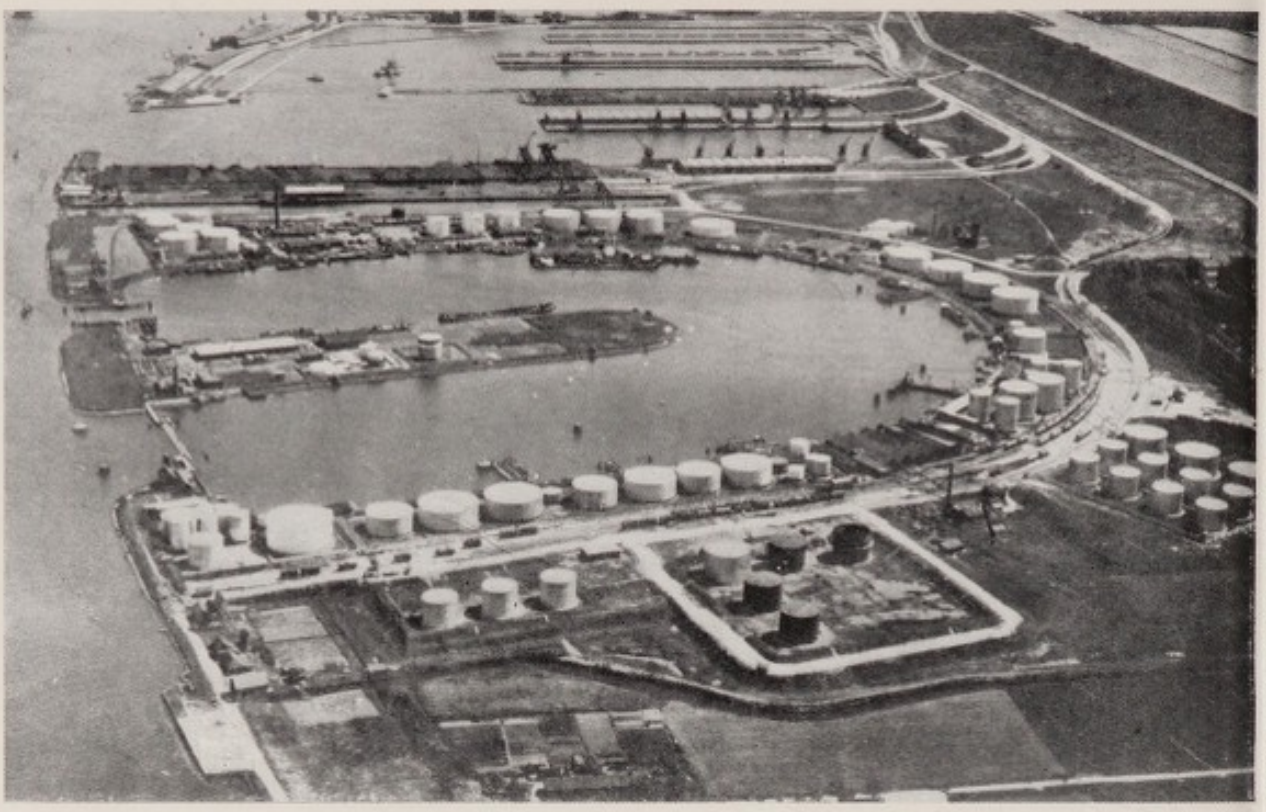


Plate 60. Amsterdam : Petroleumhaven, looking east
Beyond lies Coenhaven



Plate 61. Amsterdam : North Sea Canal and power stations, looking west
In the foreground is the Fokker factory, and alongside is the J. v. Hasselt Kanaal (West) ; beyond the power stations is the yard of *Ned. Sch. Mij.* Across the canal are the timber basins and in the distance can be seen the Coenhaven and Petroleumhaven.

interior, contributed to this as Amsterdam remained in open communication with the Zuider Zee.

More important eventually than this local connection was Holland's position in relation to the trade routes of western Europe. Between Flanders and regions farther south a flow of trade had developed with northern Europe, in which the Hansa cities of Hamburg and Lübeck played a leading part, exchanging corn, timber, fish and beer for the cloth, manufactured goods, wines, salt, and other products of the south. Upon this route, Holland occupied a favourable intermediary position, at a point on the Rhine delta where the open sea voyage ended and inland navigation to the Rhine, to Zealand, and to Flanders began. It is probable that before the rise of Amsterdam part of this traffic found its way through the waterways of North Holland via Alkmaar, Haarlem, and Gouda to the Lek, with a secondary route via the Y, the Vecht, and Utrecht. It is thought that difficulties in the use of the route, caused by the progress of reclamation, led to its diversion through Amsterdam, providing the first impetus to its growth. It seems more probable that expansion was due to the growing recognition of Amsterdam's advantages as a transhipment point.

After its rise the chief connection between Amsterdam and Zealand and Flanders lay through Haarlem, Gouda and Geervliet. For communication with the Rhine, Amsterdam was on the whole unfavourably placed, but this was outweighed by the other advantages the town enjoyed. In the early stages there was some traffic up the Geldersche Yssel but control of this was contested by several towns, and in any case by the seventeenth century navigation on the Yssel had deteriorated. The route via the Vecht and Utrecht was also difficult ; the route via Gouda and Dordrecht provided a convenient alternative. The northern portion of the Hansa route lay through the Wadden Zee and the Zuider Zee. It is indeed difficult to separate the rise of Amsterdam from its relation to this great trade route. The route had several advantages : it offered a more sheltered passage than that along the lee shore of the North Sea coasts, and was less exposed to hostile attack, a circumstance of particular importance in the sixteenth century, when the Spaniards held the southern Netherlands and threatened the approaches to the Rhine.

In the seventeenth century, at the time of Holland's overseas expansion, this route was still important. In course of time, however, as the draught of vessels increased and the channels silted up, particularly the Pampus bank off the entrance to the Y, its value

declined, and Amsterdam's position as a seaport was threatened. The attempt to provide an alternative approach by the construction of the North Holland Canal failed, owing to its insufficient dimensions, but with the opening of the North Sea Canal in 1876, the port was finally given a close and assured connection with the sea. The Y, as represented by this canal, has again become the dominant factor in the city's prosperity; the Zuider Zee, destined to be largely reclaimed, has become of minor significance.

History

Foundation and early years. The early history of Amsterdam is somewhat obscure. The first mention of the town dates from 1275, and its foundation in all probability cannot antedate this by many years. It can scarcely have preceded the dyking of the banks of the Y and the erection of the dam at the mouth of the Amstel, and the completion of these is generally assigned to the early years of the century. By 1275, when Floris V granted it freedom from tolls throughout Holland and Zealand, it must have already become a trading centre. The following years were evidently marked by progress, for about 1300 it received a charter. It was, however, still a small community, numbering about one thousand inhabitants.

The town grew up around the dam on the Amstel built in the sea dyke a short distance above the river mouth, the present Vijgendam. The first settlement was on the right bank, known from the site of the first church as the Oudekerkzijde. Here the Warmoesstraat below the dam and the Nes above it ran along the line of the dyke. The town soon spread to the left bank, the Nieuwekerkzijde, where the Nieuwendijk and Kalverstraat also lay along the dyke. By 1342 the first defensive ditches had been dug, the Oudezijds Voorburgwal and the Nieuwezijds Voorburgwal, which joined the Amstel upstream by the Grimburgwal and the Spui. Amsterdam began therefore as a typical 'double dyke' settlement. The town was still small, extending for about a thousand yards along the river, and with an area of rather less than 100 acres.

In the following century its growth was remarkably rapid, partly owing to the interest shown in it by the Counts of Holland, to whose territory it had been annexed in 1317. With the extension of the Counts' authority over the entrances to the Zuider Zee the prosperity of the town correspondingly increased. The first definite step to supremacy in the north is generally seen in its establishment as the staple for the import of beer from Hamburg in 1323. This brought



Plate 62. The *Oranje* at Amsterdam, looking north-west
This photograph shows the centre of the port ; in the foreground are the jetties of De Ruyterkade, and in the distance the power stations. The *Oranje* (*Ned. Stoom. Mij.*), 20,000 tons gross, 11,600 net, speed 21 knots, draught 30 ft., was completed by the *Ned. Sch. Mij.* in 1939, with Sulzer engines. Some distance above the water line the sides curve inward, and she was special bilge keels in the form of a series of blades.



Plate 63. Amsterdam : the eastern harbours, looking east-north-east
From left to right are the Afgesloten Y, the Ertshaven, the Spoorwegbassin and the Entrepothaven ; the large ship is lying in the eastern end of the Y-haven. In the central background are the Oranje locks opening into the Yssel Meer ; in the foreground are the Reitlanden marshalling yard and engine shed.

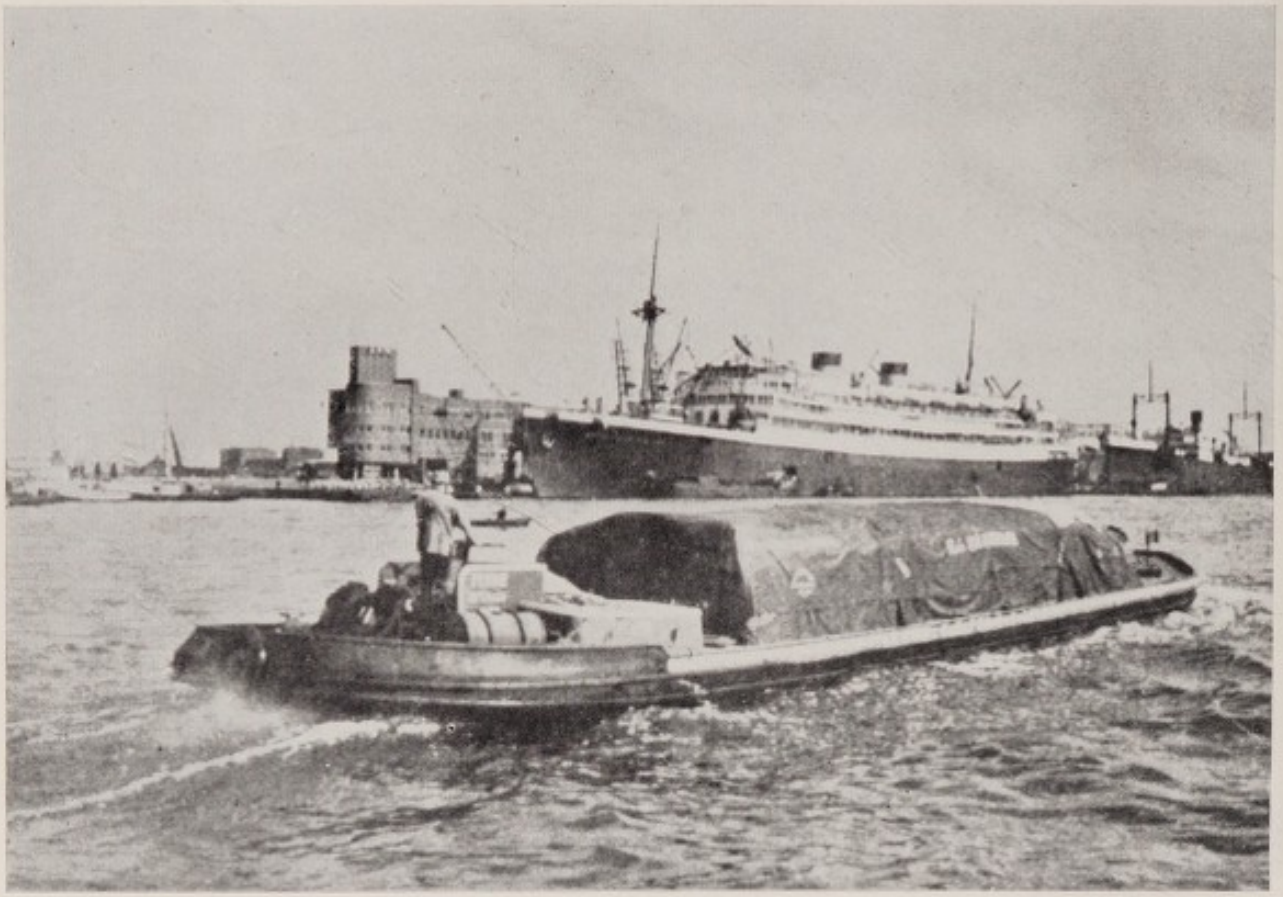


Plate 64. Amsterdam : Y-haven (IJ-haven), and Javakade, looking north-east The building is the offices of the *Ned. Stoom. Mij.* ; berthed at the quay is the *Johan van Oldenbarnevelt*, one of the largest vessels of the company's fleet—19,000 tons gross, 11,300 net, 17/19½ knots speed, draught 29 ft. This ship, and the *Marnix de St. Aldegonde*, were completed in 1930 by the *Ned. Sch. Mij.* ; both are propelled by Sulzer diesel-engines.

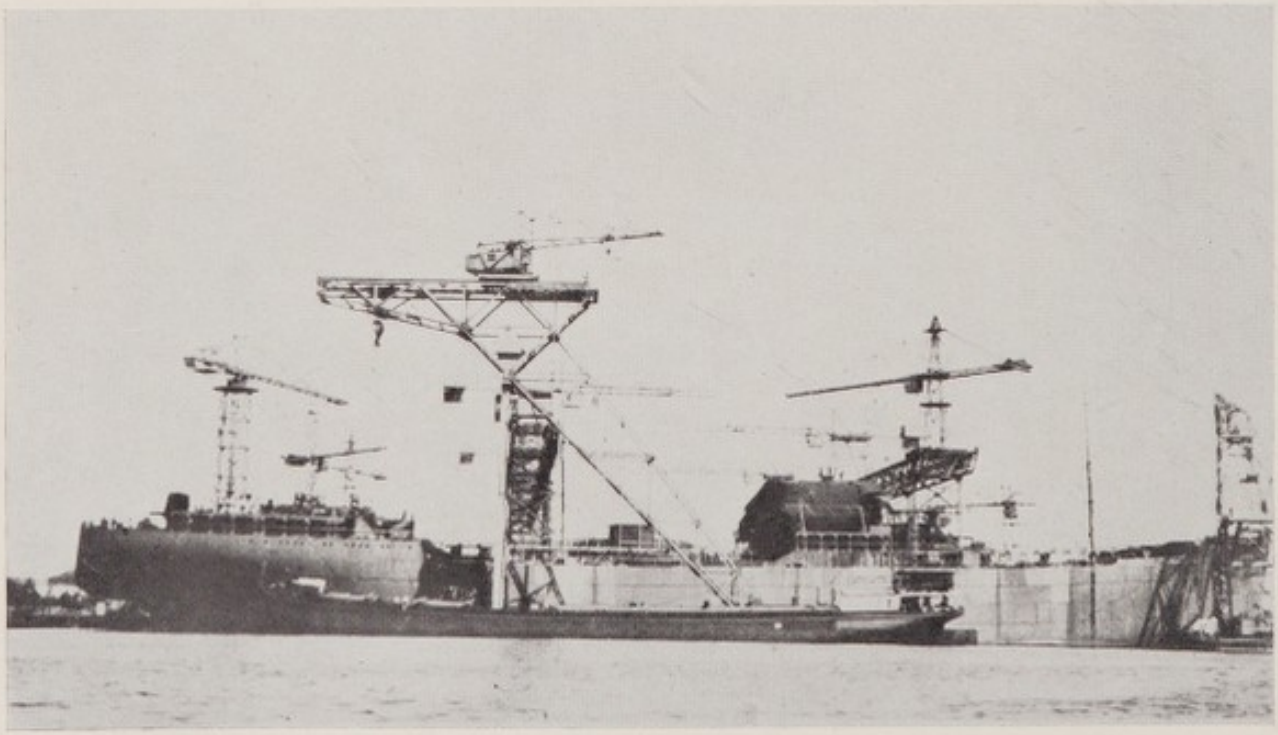


Plate 65. Amsterdam : fitting out wharves, *Ned. Sch. Mij.*
Alongside the tanker hull is a 150-ton floating crane.

many Hansa merchants to the town and created a demand for ships. Local shippers developed into traders on their own account, rivalling and ultimately displacing the foreigners. In course of time their activities took them into all parts of the Baltic, to Flanders, and to England for wool. The space required by these commercial enterprises and by the shipyards caused repeated expansion of the town.

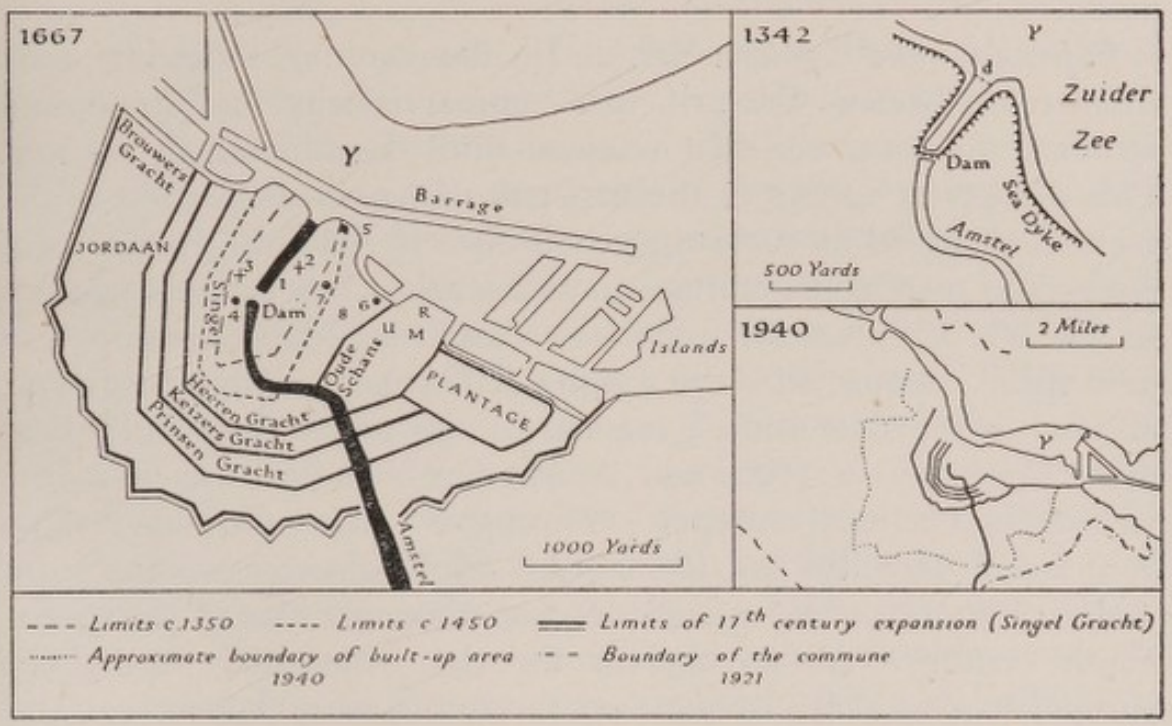


Fig. 114. The growth of Amsterdam

From : J. F. Hazewinkel, ' *Le développement d'Amsterdam*,' *Annales de Géographie*, vol. 35, pp. 322–9 (Paris, 1932) ; R. Schuiling ; *Nederland*, vol. 2, p. 218 (Zwolle, 1936) ; G.S.G.S. Series 2541, 1 : 100,000 sheet 1.
1 Warmoesstraat ; 2 Oude Kerk ; 3 Nieuwe Kerk ; 4 Stadthuis ; 4 Schirerstoren ; 6 Montelbaantoren ; 7 Waag ; 8 Lastage ; MRU sites of ' islands '. of Marken, Rapenburg, Uilenburg.
Early city limits : Oudezijds Voorburgwal and Nieuwzijds Voorburgwal (*c.* 1350) ; Geldersche Kade, Kloveniersburgwal and Binnen Singel (*c.* 1450) ; Singel Gracht (17th century expansion).
The maps summarize the expansion of Amsterdam from a small port on the Amstel to the commercial metropolis and capital of the Netherlands.

The first notable expansion occurred in 1382 when outer ditches—the Oudezijds and Nieuwezijds Achterwallen—were built 260 ft. beyond the old ditches, and likewise converging to the south. In 1442 the boundaries were formed by the Geldersche Kade, the Kloveniersburgwal and the inner Singel ; large towers protected the approaches—St. Antonispoort on the eastern boundary, the Schreierstoren on the Y guarding the eastern entrance to the harbour, and the Munttoren. Already the centre of activity was tending to move from the Amstel to the Y, for a maritime town was growing up in

the east outside the sea dyke. When, a few years later, the town again expanded and received stone walls, this shipbuilding and commercial quarter was moved eastwards; known as the Lastage, it was protected by the Oude Schans moat and the stone-built Montalbaantoren. By the middle of the sixteenth century, the population had risen to 40,000 and was again pressing on the city limits.

Expansion and 'golden age'. In the century following 1585 Amsterdam became the principal commercial city in Europe, and assumed the form which it retained until the nineteenth century. This prosperity sprang in the first place from its succession to the position occupied by Antwerp, when that city fell into the power of Spain, and merchants, craftsmen, and scholars fled to the sanctuary on the Y. Commercial intercourse with the Mediterranean also grew apace. Later, with the waning of Portuguese power, came an advance in the East Indies, marked by the foundation of the East India Company in 1602, and Amsterdam was established as the predominant colonial entrepôt. Through its secure position, remote from assault from the sea, and capable of defence by flooding from landward attack, it was spared the fate of many cities in the seventeenth century. As an asylum for the persecuted throughout Europe, it soon came to stand in the forefront of intellectual and scientific advance. The civic authorities, who in 1578 had been reconstituted on more progressive lines in keeping with the spirit of the age, were alive to the opportunities the occasion offered, and in command of the requisite capital. The territorial expansion of the city was therefore deliberately planned in a manner unique in contemporary Europe.

The first stage followed on the fall of Antwerp. In the years 1585 to 1593, the 'Lastage' was incorporated within the city, and a new 'sea town' was established on three islands, Uilenburg, Rapenburg, and Marken. Rapenburg became the Jewish quarter, to which immigrated Portuguese Jews after 1600 and German and Polish Jews during the Thirty Years' War. The new city boundaries were the Heerengracht on the west and the Rapenburgerstraat on the east. At the instance of Prince Maurice the city was enclosed by a wall with twelve bastions and an outer moat. The shipping lying off the quays along the Y front was protected by a double barrage of piles; within this the merchant vessels were laid up during the winter. In 1605, the population is estimated to have been 105,000, occupying scarcely three-quarters of a square mile.

The great plan, which followed, increasing the area fourfold, was drawn up in 1610 ; the first portion of the work was begun two years later, under the direction of Frans Hendricksz Oetgens, a former mayor, assisted by Staets and Sinck. The city having now forsaken the Amstel for the Y, the basic idea of the plan was a semi-circle of concentric canals resting on the Y. The fortifications of 1595 were levelled, and three canals constructed on the west, the Heerengracht, Keizersgracht, and Prinsengracht, equally distant from each other and issuing from the Brouwersgracht. These ended at first at the Leidschegracht, but on the conclusion of the Thirty Years' War, another landmark in the city's prosperity, they were continued to the Amstel and around the eastern quarters, as the Nieuweheerengracht, etc. From the centre roads were built radiating outwards, crossing the canals by numerous bridges. Along the quays the merchants built tall houses of the characteristic small Dutch bricks with narrow frontages and courtyards in the rear, which served collectively as offices, warehouses, and dwellings, the numerous canals placing them in easy communication with the docks. Many imposing public buildings were also erected, including the new Town Hall, now the royal palace, on the Damplein, designed by Jacob van Kampen in 1652. On the east the maritime town was again moved, this time to the semi-artificial islands of Kaltenburg, Wittenburg and Oostenburg, and a similar quarter sprang up in the west on Prinseneiland and other islands. The area in the east, as yet unoccupied, was laid out as an open space, known as the 'Plantage' ; it was partly built over in the eighteenth century. In the new district on the west beyond Prinsengracht a workers' quarter, the Jordaan, grew up. Around the whole was built a massive rampart with twenty-six bastions, with a moat and a tree-lined walk beyond.

By the middle of the eighteenth century, before the check administered to its growth by war and revolution, the population had reached 200,000—a figure not materially surpassed for a century.

Stagnation and revival. By the close of the eighteenth century, changes in international commerce and politics were adversely affecting the position of the Netherlands. Great Britain was securing the carrying trade and diverting commerce to other centres, and Dutch intervention in the War of Independence resulted in severe shipping losses. The occupation of the country by the French and the Napoleonic continental system interrupted the flow of commerce and severed communications with her eastern possessions.

All these events were particularly disastrous for Amsterdam whose life blood was the profits of wide commercial and financial operations. In addition, access to the port was becoming increasingly difficult, and it was in danger of silting up.

The nineteenth century therefore opened unpromisingly. On the liberation of the country in 1814 there were two vital problems to be solved ; the restoration of the city as a commercial centre, and the improvement of access from the sea. The House of Orange and the citizens proved equal to the challenge. The foundation of the Netherlands Bank in 1814 and of the Netherlands Trading Company in 1824 served eventually to re-establish the city as an entrepôt for the East Indian trade. The East Docks and the West Docks date also from this period. To solve the navigational difficulties the North Holland Canal from the Y to the Nieuwediep at Den Helder was cut between 1819 and 1824, giving a depth of 16½ ft. as opposed to 12½ ft. in the Zuider Zee approach. The canal was not adequate, however, to deal with modern shipping, and the city continued to languish. The site of the bastions of 1612 and a narrow strip beyond sufficed for new buildings until 1875.

The decisive factor in the revival was the construction of the North Sea Canal, opened in 1876. This provided a deep waterway, with a constant level, the only drawback being the possibility of its freezing over thickly. At once the city responded to the new stimulus ; docking and storage facilities were extended in the east, where the city possessed vacant lands, and where later the Merwede Canal, accessible to large Rhine barges, debouched. In recent years port facilities and industries have extended westwards along the canal (see p. 495).

Later nineteenth century. Renewed activity followed the building of the North Sea Canal. Old buildings were demolished and parts of canals filled in, such as the Rozengracht and the Nieuwezijds Burgwallen (1867–82), and replaced by characterless groups of buildings. (In some cases, later on, this filling in of canals was to improve traffic conditions, e.g., the Rokin, part of the inner Amstel.) The city again began to overflow its limits and a small extension of boundaries was made in 1877, mainly in the south-west. This expansion was uncontrolled by the authorities and monotonous unplanned quarters sprang up, with little regard to social requirements, hygiene, or through traffic facilities. Within the Singel the walls and most of the gates were demolished, and were not replaced, as in other Dutch cities, by continuous boulevards or open spaces, though

portions were used for new streets and squares such as the Sarphatistraat, Marnixstraat (1872) and the Frederiksplein. Beyond the Singel the first extensions were mainly to the south and south-west; one of the earliest was the Schildersbuurt (Painters' quarter), between the Amstel and the Boerenwetering. Like the Dichtersbuurt (Poets' quarter) to the south-west between the Vondelpark and the Overtoom, this was a particular example of the contemporary failure to order urban expansion. Some beginnings of planning and provision of amenities, however, were made. The large public garden, the Vondelpark, dates from 1865, and a plan to carry a wide roadway round the city was begun in 1881 with the construction of the Ceintuurbaan. This started westwards from the Amstel, but its further progress was permanently blocked by the Vondelpark. Another plan, the possibilities of which were not fully realized, was the creation of a museum quarter between the Vondelpark and the Schildersbuurt, where the Rijksmuseum (1885), the Stedlijk Museum, and the Concertgebouw now stand. Later developments spread in most directions, one of the principal being the Oosterpark district begun in 1887. This period of growth was marked by the extension of the city boundaries in 1896 to include the commune of Nieuwer Amstel, by then virtually part of the city, and portions of the communes of Diemen and Sloten.

The situation of the railway stations later raised difficulties to planning. The first railway, from Haarlem, opened in 1839, ended at first near the Haarlemmer Poort, but was afterwards carried, partly on a viaduct, to the Droogbak. In 1875, when the eastern railway to Amersfoort was built, the terminus was erected on the Oosterdok dyke. To provide a central station these two lines were linked up, and a central station built on an artificial island off the Damrak. This brought the terminus close to the business centre and the docks, but entirely destroyed the prospect of the city front from the Y. The Rhine railway (1843) ended at the Weesperstation outside the Singel. This was later joined to the other lines, but the south and south-west remained without adequate railway facilities. A loop-line is now under construction (see p. 513).

For the first half of the nineteenth century living conditions in many parts of the city were bad, the inhabitants being crowded together in large old houses in unhygienic surroundings. The laying out of new quarters, and, since the beginning of this century, the establishment of state-assisted co-operative housing societies, has relieved this congestion, and sanitation has been improved.

Formerly garbage and sewage polluted the canals, but the water in these is now periodically renewed, and a separate sewage system prevents their contamination. Owing to the absence of deep wells, drinking water was first obtained from rain water cisterns or carried by barge from the Vecht and hawked through the city, and was for long a source of disease. Since 1850, however, drinking water has been obtained from the dunes near Zandvoort, but the failing supply and growing demand make it imperative to find alternative sources, and various schemes to utilize water from the Lek have been considered.

Twentieth century. In the early years of the present century growth continued not only in areas immediately contiguous to the city but around smaller communities at some distance. To the east, in proximity to the docks, the Dapper, Indische, and Transvaal quarters came into existence, and these are now among the most densely populated parts. The outward spread included the area north of the Y, whither industry was migrating in search of deep-water frontages. In 1921 the city boundaries were again enlarged considerably to absorb these dormitory suburbs, taking in portions of the communes of Westzaan, Oostzaan, Diemen and Oude Amstel, and the communes of Buiksloot, Nieuwendam, Ransdorp, Watergraafsmeer, and Sloten. This added 11,374 acres to the city's area, making a total of 43,133 acres. Recent expansion of the city proper have been chiefly in the south, the Olympia quarter, and in the west.

The development of South Amsterdam (Amsterdam–Zuid) represents one of the most remarkable achievements in town-planning in the present century ; architecturally, the new quarters are of the highest order.

Population. In 1897 the population approached half a million, more than twice the figure for 1849. It has continued to grow, but recently at a slower rate, the figures for 1930 and 1939 being 757,000 and 800,000 respectively, partly owing to a falling off in flow of immigrants. The plans for the future envisage a maximum population of one million.

As in most modern cities, there has been a decline in the population of the centre. In 1859 96% of the total population were living in the ' old city ', including the Jordaan and the Jewish quarter ; thirty years later the proportion had fallen to 76%, and by 1930 to 24%. The absolute decline between 1859 and 1930 amounted to 51,000. In contrast, the ' new city ', mostly beyond the Singel with part of the area north of the Y, housed 23% in 1889, and 60% of the total in

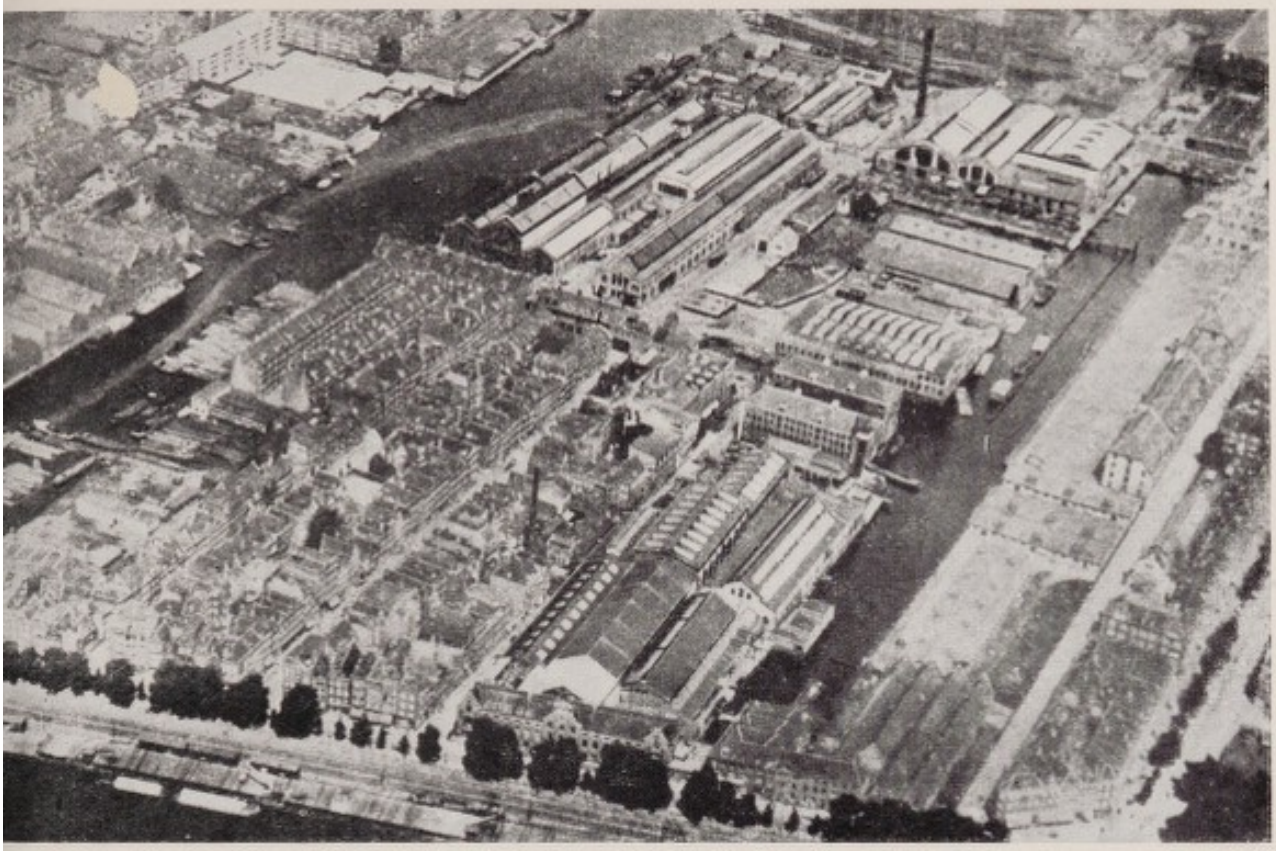


Plate 66. Amsterdam : *Nederlandsche Werkspoor* engine works, from the south-west
This company is a leading manufacturer of all types of marine engine, and has specialized in diesels.

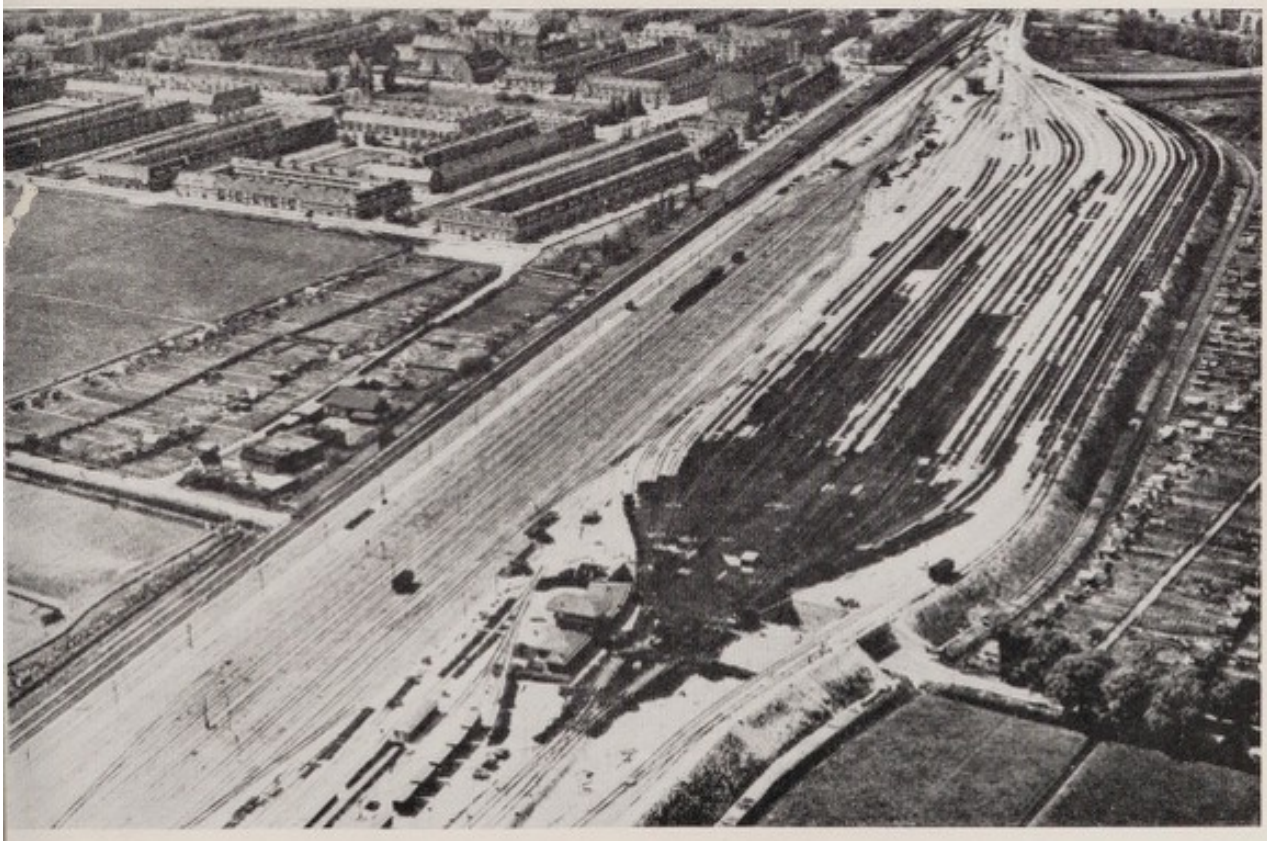


Plate 67. Amsterdam : Watergraafsmeer marshalling yard, looking west



Plate 68. Amsterdam : Royal Palace and Damplein, looking west
The Dam is virtually the centre of the city, and has been so since the first establishment of the settlement. The Nieuwe Kerk stands on the right.



Plate 69. Amsterdam Zuid : Daniel Willink Plein
The view is taken from the square south-west along Zuider Amstel Laan. This neighbourhood is an example of the well-planned southern suburbs of the city.

1930. In the latter year 15% of the population was living in the outer suburbs. This change has been due to the demand for business accommodation in the centre, to the reconstruction of the older quarters. and the building of housing estates by the city authorities in the suburbs. Many of the inhabitants of the formerly densely peopled areas, e.g. the Jordaan, have removed to the municipal estates north of the Y.

With development in communications, the influence of the city has now spread beyond the boundaries of 1921, and towns such as Hilversum, Bloemendaal, and Zandvoort are virtually parts of ' greater Amsterdam '.

Future development. The city authorities now rigorously control the development of all land within their boundaries, and their approval must be obtained for the design and siting of new buildings, and for the demolition of the old. To safeguard the future of the city and to provide for modern requirements, a detailed development plan was adopted in 1935, incorporating partial schemes already in execution. Apart from providing for further dock and industrial development, mainly westwards along the North Sea Canal, the aim is to segregate residential and industrial quarters, the former in the west and south, the latter in the Ouder Amstel and southern Sloten areas, and to improve communications. Areas are also reserved for market gardens. An ambitious ' green belt ' is envisaged, including parks within the Ringbaan loop (the railway to the western docks) and the planting of the ' Boschpark ' between the Nieuwe Meer and the Amstelveensche Poel.

Trade

The trade of Amsterdam has a certain metropolitan character, and in its variety and colonial interests resembles that of London. It has specialized in several directions and differs from that of many ports.

The shipping movement in 1938 was as follows (thousands of gross tons) :

	Inward		Outward	
	No.	Tonnage	No.	Tonnage
Loaded	2,774	6,291	2,446	5,411
In ballast	315	584	555	1,425
For repair, bunkering, in transit	144	570	134	558
Total	3,233	7,445	3,135	7,394

From : *Statistiek van de Scheepvaart op het Buitenland over* 1938, pp. 14–15 ('s Gravenhage, 1939)

By flag more than half of this shipping was Dutch. The British flag was next, with less than one-third of the Dutch total, and the Norwegian, German and Swedish followed some way behind. Among the rest the Greek flag was well represented. Amsterdam is the principal home port of many Dutch lines, especially to the N.E.I. and N.W.I.

The cargoes by class indicate the nature of the trade of Amsterdam, for by far the greater number are of *stukgoederen*, i.e. general merchandise, carried in both passenger and cargo liners. There are nearly as many inward cargoes of general merchandise as outward cargoes. The export trade of Amsterdam includes bulk cargoes, although these are not very frequent.

Number of Cargoes, 1938

	Inward		Outward
Merchandise	1,746	*Merchandise*	1,930
Bulk cargoes		*Bulk cargoes*	
Coal and coke	274	Coal and coke	94
Timber	188	Phosphates	55
Petroleum and refined products	139	Petroleum and refined products	24
Grain, etc.	50	Sulphuric acid	22
Phosphates	23	Grain	17
Pyrites	22	Others	271
Cacao	21	Various and mixed	117
Others	13		
Various and mixed	387		

From : *Verslagen der Bedrijven Diensten en Commissien van Amsterdam over* 1938 *Handelsinrichtingen*, pp. 4–5 (Amsterdam, 1939)

The cargo trade of Amsterdam includes (1) a great part of the foreign trade of the Netherlands (i.e. direct imports and exports), (2) a transit trade, of no small amount, in goods on German account moving along the Rhine, (3) a more distant trade in the transhipment of colonial and South American goods. Large quantities of goods consigned from South America to Mediterranean ports and colonial produce consigned to Britain and the Baltic ports were regularly handled. Warehouses and equipment are specially designed to facilitate this trade.

Some of these features appear in the detailed statement of trade. In the transit trade, for example, 180,000 tons were reshipped by sea, including 93,000 tons of oil-bearing seeds and nuts, 9,000 tons of cocoa, 26,000 tons of coffee, 4,000 tons of tropical fruit and 18,000 tons of rubber, while over 50,000 tons of such produce were reshipped by barge.

*Principal items in the Foreign Trade, Special and Transit, of Amsterdam, 1938**

Commodity	Special Trade						Transit Trade						Total Seaborne Trade	
	Unloadings			Loadings			Unloadings			Loadings				
	Sea	Water-way	Rail	Sea	Water-way	Rail	Sea	Water-way	Rail	Sea	Water-way	Rail	In-wards	Out-wards
Butter, cheese, animal products	5	1	—	104	3	2	8	1	—	4	3	—	13	108
Maize	86	—	—	—	—	—	23	—	—	18	3	—	109	18
Linseed	211	—	—	—	—	—	8	—	—	—	6	—	219	—
Oilbearing seeds and nuts	33	—	—	—	—	—	148	—	—	93	13	—	181	93
Cacao	68	—	—	5	1	—	23	—	—	9	11	—	91	14
Cocoa waste	11	—	—	—	8	—	—	—	—	—	—	—	11	—
Tropical and sub-tropical fruit	19	—	—	—	—	—	12	—	—	4	5	3	31	4
Fodder	31	—	—	2	—	—	29	—	—	19	9	—	60	21
Rubber, etc.	3	—	—	—	—	—	31	—	—	18	5	—	34	18
Ores	127	1	—	7	48	—	139	—	—	4	135	—	266	11
Coal, including briquettes and bunker coal	472	326	62	47	8	—	70	223	—	259	3	—	542	306
Coke	1	33	—	161	5	—	—	2	—	2	—	—	1	163
Fertilizers	2	1	—	146	2	—	2	9	—	10	—	—	4	156
Iron and steel, crude	14	23	11	51	5	1	11	70	2	78	5	—	25	129
Copper	1	—	—	—	—	—	24	3	—	5	21	—	25	5
Steel, semi-manufactured	16	80	2	4	—	—	2	52	—	56	1	—	18	60
Minerals and products thereof	37	194	1	8	2	—	64	9	—	12	56	—	101	20
Raw phosphates	94	—	—	—	—	—	—	—	—	—	—	—	94	—
Chemical products	24	54	2	40	3	—	20	48	—	53	16	—	44	93
Refined petroleum, kerosine	163	—	—	7	—	—	—	—	—	—	—	—	163	7
Oil fuel	55	—	—	50	—	—	1	—	—	2	—	—	56	52
Benzine	158	3	—	7	2	—	2	—	—	—	2	—	160	7
Gas oil	174	3	—	37	8	—	5	—	—	2	4	—	179	39
Distillates and residues	13	13	—	7	—	—	3	—	—	—	3	—	16	7
Timber	187	8	11	1	—	—	18	2	—	4	15	—	205	5
Coffee	32	—	—	3	1	—	39	—	—	26	9	1	71	29
Unmanufactured tobacco	38	1	—	7	9	5	4	—	—	1	2	—	42	8
Wine	1	—	—	—	—	—	14	1	—	4	10	—	15	4
Sugar	25	—	—	48	9	—	54	—	—	2	51	—	79	50
Paper and printed matter	29	10	2	43	3	—	14	18	—	26	6	—	43	69
Total, including unnamed goods : 1938	2,431	880	141	1,193	219	22	1,054	581	12	976	539	11	3,485	2,169
1937	2,457	808	134	1,215	272	24	1,064	739	13	1,123	548	11	3,521	2,338
1936	2,347	844	114	1,062	226	19	778	533	9	814	395	12	3,125	1,876
1935	2,485	956	108	990	270	23	600	505	6	760	320	11	3,184	1,750

* In thousands of tons, to the nearest thousand tons

From : *Jaarstatistiek van den In-, Uit-, en Doorvoer*, vol. 1, pp. 380–3 ('s Gravenhage, 1939)

Besides this long distance transit trade Amsterdam engages in the handling of commodities like those which form the bulk of the transit trade of Rotterdam, but on a much smaller scale. The movement of coal, ores, metal, chemicals and timber may be discovered in the table on page 509.

In the Netherlands foreign trade the largest group of imports were provided by the liquid fuels, in refined form ; much of this import was re-exported as bunkers. The coal import was considerable (472,000 tons), the greater part being despatched farther inland by canal and rail. There was an appreciable export of coal, while coke (161,000 tons), formed the largest single export by weight ; fertilizers followed closely (146,000 tons), and butter, cheese and other animal products (104,000 tons). Other important exports by weight were paper and sugar, though there was a considerable import of each of these. There was a great variety of manufactures moving in both directions.

In the balance of cargo Amsterdam showed an inward excess ; this derived mainly from the Netherlands foreign trade, for in 1935–7 there was an outward surplus in the transit trade.

		1935	1936	1937	1938
Inward :	Special	2,485	2,347	2,457	2,431
	Transit	699	778	1,064	1,054
	Total	3,184	3,125	3,521	3,485
Outward :	Special	990	1,062	1,215	1,193
	Transit	760	814	1,123	976
	Total	1,750	1,876	2,338	2,169
Inward Excess		1,434	1,249	1,183	1,316

Waterway Traffic. Amsterdam disputes with Ghent for the title of the port handling the third largest quantity of Rhine traffic after Rotterdam and Antwerp. Most of this traffic is on German account, but by no means all. It is important to remember that, as at Rotterdam, the Rhine traffic is not only in heavy bulk cargoes, although these usually occupy the largest barges. The loading of barges in 1938 was as follows :

Incoming Rhine Barges		Outgoing Rhine Barges	
Nature of loading	No.	Nature of loading	No.
Merchandise	824	*To Germany*	
Coal	599	Merchandise	823
Coke	5	Coal	—
Gravel	231	Coke	5
Iron	29	Timber	2
Creosote	61	Tar	9
Cement	35	Residues and other petroleum products	37
Sulphuric acid	16	Ore and pyrites	114
Motor vehicles	5	Bauxite	2
Others	25	Iron and steel scrap	21
In ballast	16	Others	32
Total	1,846	In ballast	128
		To other countries	
		With cargo	18
		In ballast	735
		Total	1,926

From : *Verslagen der Bedrijven Diensten en Commissien van Amsterdam over* 1938 : *Handelsinrichtingen*, pp. 7–8 (Amsterdam, 1939)

Industries

In 1938 about 72,000 people in Amsterdam were engaged in industry—22,000 in the metal industry, 18,000 in the manufacture of clothing, and 15,000 in the preparation of foodstuffs. The majority of the heavy industries lie on the north bank of the Y.

The *N.V. Werkspoor* is the largest engineering firm in the Netherlands. The present company was established in its present form in 1891, but was a development of a whole series of engineering undertakings working uninterruptedly on the same site since the seventeenth century. It undertakes a variety of engineering work but specializes in all types of marine engines (see p. 387) ; several foreign constructors build *Werkspoor* engines under licence. The company has a plant at Zuilen which produces rolling stock and iron constructional work. The *N.V. Kromhout Motorenfabriek* is a second large producer of marine engines, specializing in diesels. Besides small firms, there are eight other plants of some importance engaged in many branches of engineering.

The *Fokker* works represented about 95% of Dutch aircraft output, having a monthly output of about fifty machines ; most of the raw materials and components were imported. The *Ford* works near the Hembrug assembles chassis and engines, using components imported from the Ford factories at Antwerp and

Poissy (near Paris). The *Minerva* works is a smaller plant producing motors. Several factories produce electrical equipment; the *Draka* works for the manufacture of wire and insulated cables normally employed about 1,000. The largest plant of any kind is the *Royal Netherlands Arsenal*, near the Hembrug, employing normally 5,000 and making all kinds of ordnance.

Besides two fairly small factories which manufacture explosives in co-operation with the arsenal, there are an important sulphuric acid plant and a superphosphate works, as well as a plant which in 1940 had started the production of calcium carbide. Two factories produce pharmaceutical goods, one of these being among the three principal producers of quinine in the Netherlands. There is a large linseed oil mill, with a normal input of 40,000 tons of seed annually.

Flour mills, breweries and other food processing plants are of the size and number which would be expected in a capital city; there are also several chocolate, cocoa and tobacco factories. The cigarette factory of the *British-American Tobacco Company* normally employed 2,000 workers. Clothing and made-up goods, printing and building, accounted for a great proportion of the employed population. The famous diamond industry, long in decline, had reached a very low ebb (see p. 392).

Communications

Railways. Most quays have adequate railway connections, the eastern part of the port being equipped to handle a large number of wagons in connection with the extensive liner traffic. The main sorting yard is the Rietlanden, between Ertshaven and Spoorwegbassin. With a capacity of 1,500 wagons this yard is operated on the ' hump ' system, using steam locomotives. The western quays are served by branches from a line passing the Central Station; the two main streams of traffic converge at Muiderport junction, south of which is the Watergraafsmeer marshalling yard (Fig. 115). The north side of the Afgesloten Y has no railway connections.

The railway network is peculiar in that all lines pass through the bottleneck of the Central Station. Two double-track lines approach the city from the south-east, giving direct connections with the German frontier and most parts of the Netherlands, including Rotterdam, and join at the Muiderpoort junction to pass by way of the eastern basins to the Central Station. Two double-track lines approach from the west, giving connections to the coast towns from

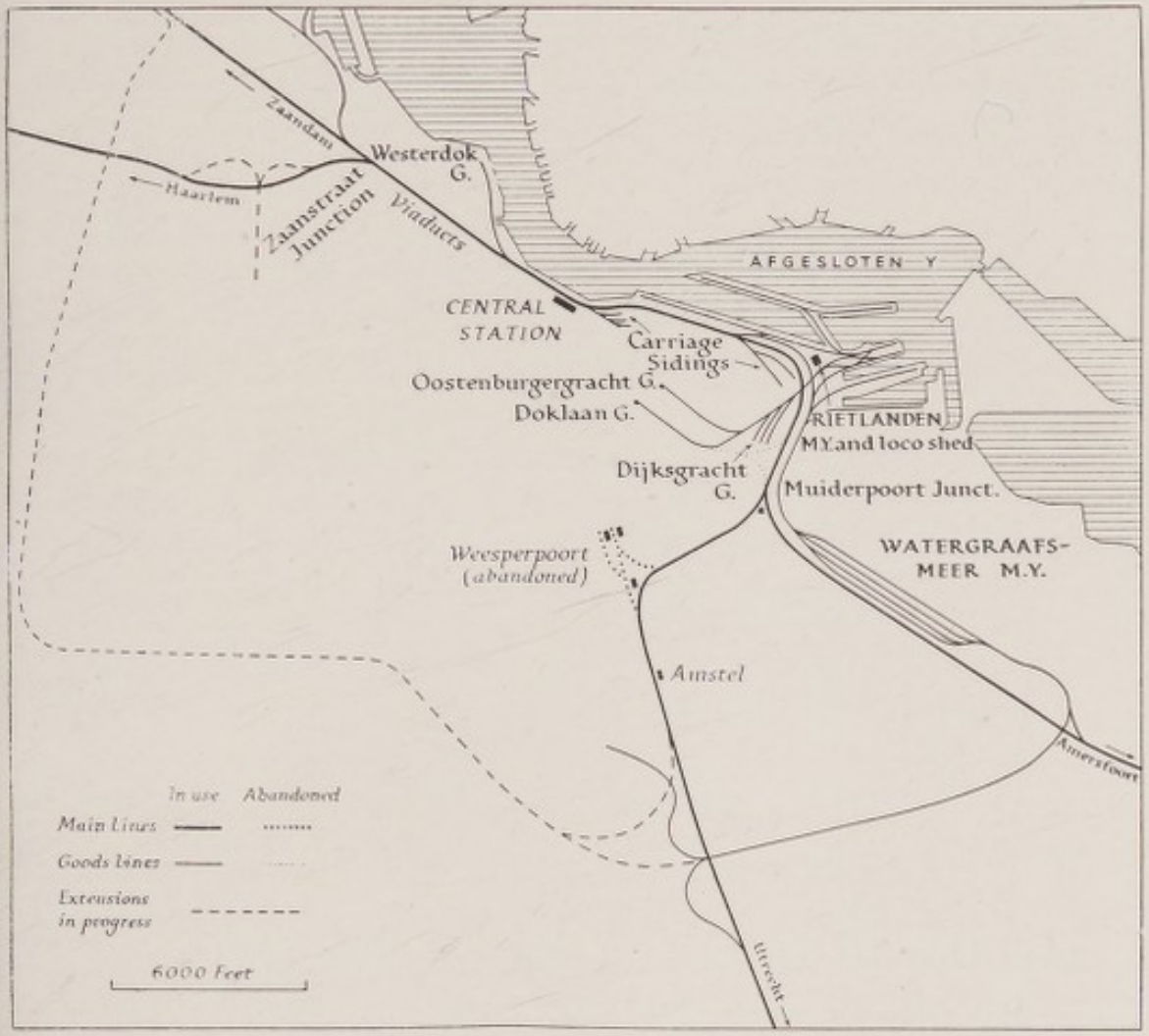


Fig. 115. Amsterdam : railway communications

From official and other sources. G goods station ; MY marshalling yard. The extension will relieve the bottleneck by which all traffic through Amsterdam must pass through the Central station tracks. This congestion was reduced earlier by improvements at the Central station which necessitated the filling up of the old canal basins. The Weesperpoort station and approach lines were closed in 1938 and the lines and station have since been dismantled.

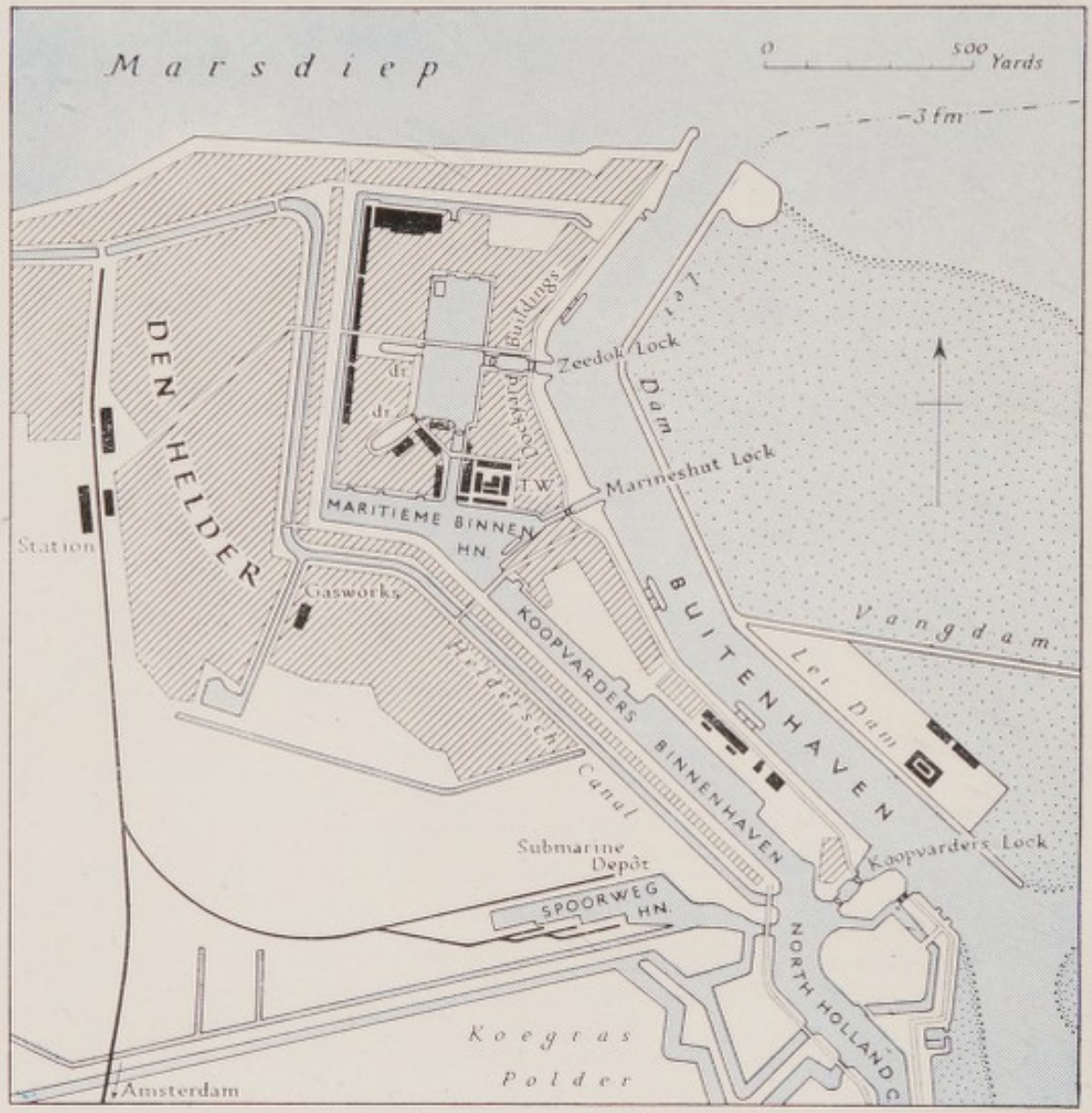


Fig. 116. The port of Den Helder

dr dry docks ; T.W. torpedo workshops.

Den Helder to Rotterdam ; these join at the Zaanstraat junction to enter the Central Station by way of a series of viaducts. Both of these western lines give access to Ymuiden. The bottleneck will be obviated by a loop line now under construction.

Waterways. Apart from the North Sea Canal, four waterways converge on Amsterdam. Eastwards the Yssel Meer (Zuider Zee) is reached by way of the three Oranje locks, the largest of which has a sill depth of 14 ft. 8 in. Northwards the two Willem locks admit to the North Holland Canal leading to Den Helder ; the least depth is normally 16½ ft. Southwards the River Amstel, approached through the four Amstel locks, leads to Gouda and Rotterdam ; it is suitable for craft drawing 7 ft. By far the most important waterway is the Merwede Canal, approached through the Zeeburg locks and leading to the Lek and thence to the Rhine. It admits vessels up to 328 ft. in length, 33½ ft. beam and 9 ft. draught. The canal is in process of reconstruction between Amsterdam and Utrecht ; together with the new canal from Utrecht to Tiel on the Waal, it will form the Amsterdam-Rhine Canal (see p. 580).

Roads. See Fig. 117.

Den Helder

(Figs. 116, 117 ; Plate 71).

Den Helder (35,000) is the principal Dutch naval station in the home territory ; as a commercial port it is of no significance. It has a commanding position, sheltered from the North Sea, but controlling the Texel Gat, the opening between the mainland of North Holland and the island of Texel which gives access to the Wadden Zee.

Approach and Access

From the North Sea approaching vessels pass through the extensive banks of Noorder Haaks and Zuider Haaks, which form an immense submarine delta (see p. 700), by three channels. Molengat to the north has a least depth which may vary from 9 to 22 ft. over a year or so ; West Gat in the centre has a least depth of 12 ft. ; Schulpengat, to the south, which comes close inshore to the coast of North Holland, has a least depth of 22–25 ft. in the centre of the fairway. These converge towards the Helsdeur, a channel leading through the Texel Gat, and continuing eastwards by Marsdiep into the Wadden Zee. Both these channels have deep water. The

Gat is about 2,500 yards wide at its narrowest. Within the Wadden Zee the deepest water of the Texel Stroom runs north-eastwards off the island of Texel. The tidal rise is $4\frac{3}{4}$ ft. (M.H.W.S.).

Detailed Description

The harbour area of Den Helder is known as Nieuwediep, and the dockyard itself is more properly known as Willemsoord. Lying on the eastern or protected side of the Helder peninsula, the port comprises a breakwater (Lei Dam) behind which lies the long narrow outer harbour or Buitenhaven. This harbour is about 6,600 ft. long ; the entrance is about 300 ft. wide ; farther on, behind the Outer Quay, the width varies from 375 ft. to 420 ft. The entrance has a depth of 35 ft. There are about 1,600 ft. of quayage with 27 ft. of water, and 4,400 ft. with 24 ft. of water. In the north the Zeedok Lock, 61 ft. wide and 24 ft. deep, gives access to the Marinewerf or naval dockyard, a basin which can accommodate vessels of 420 ft. in length, with depths of 23 ft.

Behind the island of Willemsoord, on which is situated the greater part of the dockyard, and the long narrow stretch of land which backs Buitenhaven, lies a second and narrower strip of water, the Maritieme Buitenhaven to the north with about 20 ft. of water, and the Koopvaarders Binnenhaven, or commercial harbour to the south, with 18 ft. of water, both being little more than a continuation of the North Holland Canal. The former is entered from the Buitenhaven by the Marineschut Lock, 30 ft. wide, 122–105 ft. long, and 9 ft. deep, the latter by the Koopvarderschut Lock, 54 ft. wide, 223 ft. long, and 17 ft. deep. To the south lies the Spoorweghaven, normally used by submarines, with depths of 18 ft.

The port can accommodate alongside forty ships drawing 12 ft., nine drawing 20 ft. and four drawing 26 ft. For ships berthed in the Buitenhaven catamarans must be used.

Port Facilities

There are no cranes for commercial use, and of the basins only the Spoorweghaven has any railway connections. In the naval dockyard there are two dry docks, the larger of which has a length of 370 ft. and a depth of $19\frac{1}{2}$ ft. Extensive repairs can be carried out, and there are small slipways used for building minelayers and minesweepers.

The Dockyard. In 1939 the arsenal and dockyard employed about 2,500 workers. It formed the main Dutch naval base : nearly

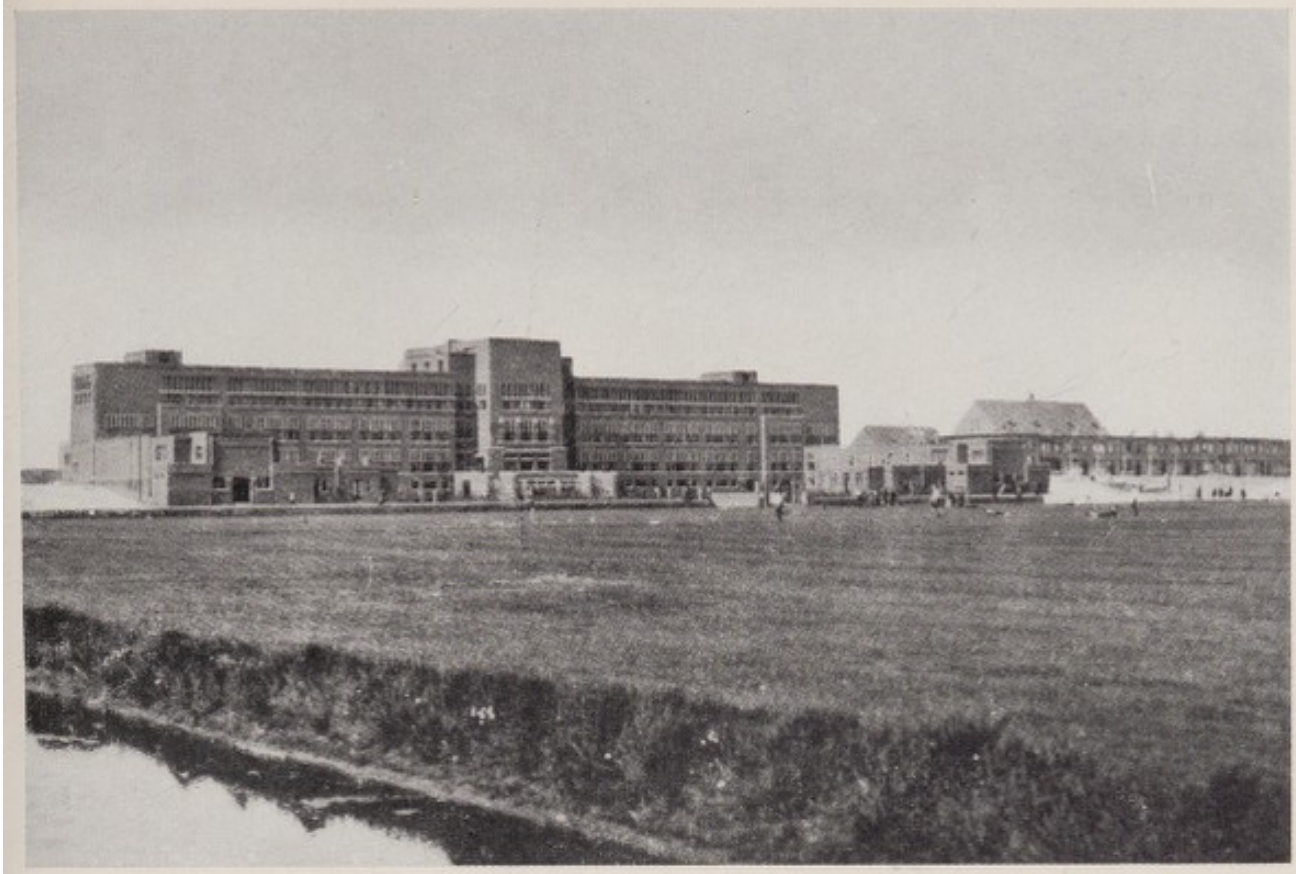


Plate 70. The Hague : Municipal Lyceum, Stokroosplein



Plate 71. Den Helder : Spoorweg Haven, looking east

This basin was used as a submarine depot. The stretch of water in the background is the Buitenhaven.

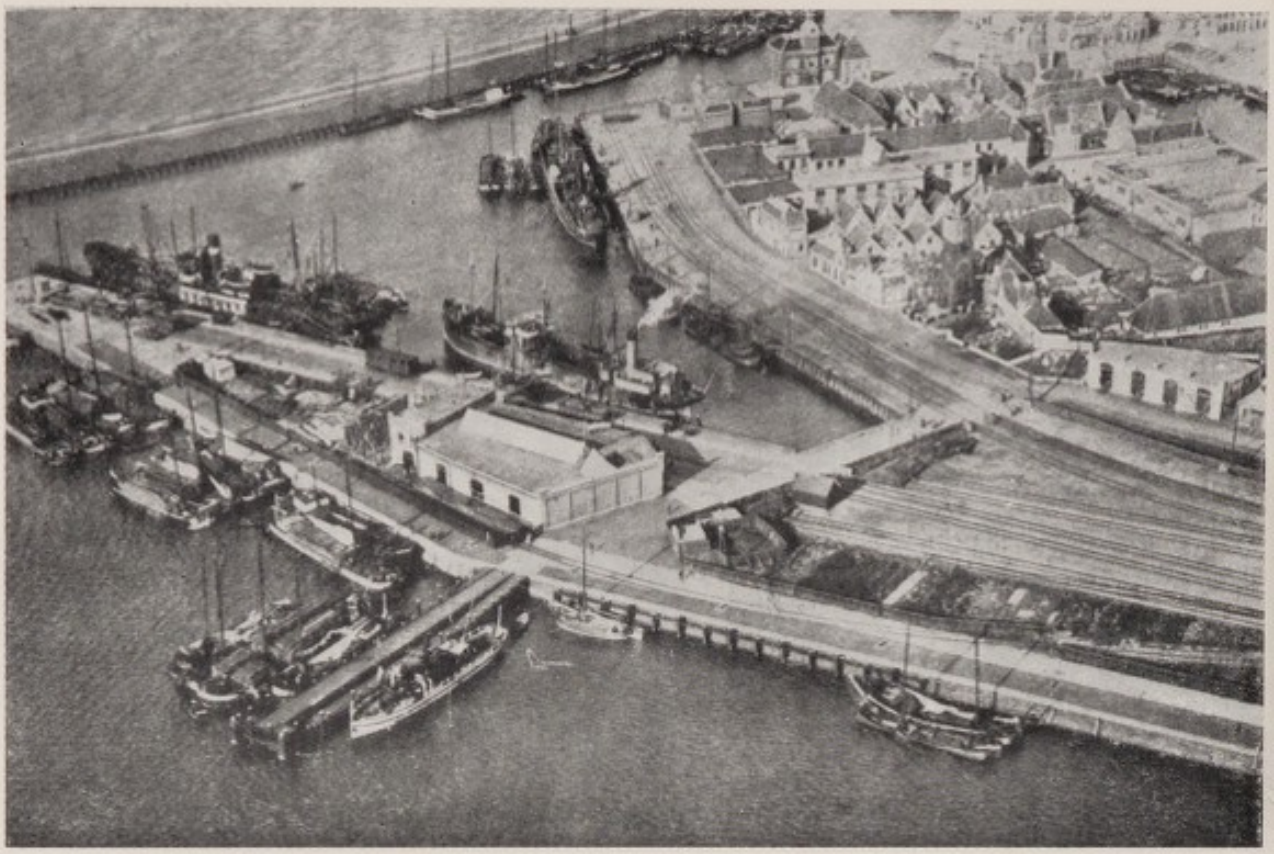


Plate 72. Harlingen, looking north

In the foreground is Nieuwe Willemshaven ; behind it lies Willems Haven, while to the right, part of the Zuider Haven is visible.



Plate 73. Delfzijl, looking north along the main quay

The cardboard being loaded from the lighter is the leading export from Delfzijl.

the whole of the submarine fleet and the bulk of the surface fleet were stationed there in 1940. No large vessels can be constructed at Den Helder, or accommodated in the dry docks, but the dockyard was equipped for extensive repairing, servicing and training for naval purposes.

The Town

The town of Den Helder is bounded on the south by a series of fortifications dating from the French occupation during the Napoleonic period. These comprise three forts connected by fortified dykes and canals ; on the North Sea coast is the Erfprins fort, to the south is Dirks Admiral fort, and to the south-east is the Oever fort, divided into Oost-Oever and West-Oever by the construction of the North Holland Canal. The town consists of three parts—the Nieuwediep district of the Willemsoord dockyard and the commercial port, the old part of Den Helder lying to the east of Fort Erfprins, and the newer residential zone to the south and west.

Electricity is supplied from the main North Holland grid by way of a substation at Schagen ; the dockyard has its own diesel-driven power plant. The gasworks lies near the Maritieme Binnenhaven. A good supply of water is derived from the dunes to the south-west.

The town is the seat of a police court (*kantongerecht*).

History

For centuries Den Helder was little more than a fishing village, renowned for the hardihood of its sailors. The earliest settlement lay farther to the west, but had to be abandoned owing to encroachment by the sea ; the position of the old village of Den Helder is now deep beneath the Schulpengat (Fig. 149). With the rise of the northern provinces as an independent state in the seventeenth century Den Helder became an important strategic position, for it controlled the shortest sea passage to Amsterdam, i.e. by way of the Zuider Zee (and continued to do so until the opening of the North Sea Canal in 1876). A great part of the naval operations in the Anglo-Dutch wars centred upon the Texel as a principal base of the Dutch fleet (see Appendix III).

The strategic position of Den Helder made it the object of attack during the Revolutionary and Napoleonic Wars. In January 1794 a detachment of French cavalry captured the Dutch fleet as it lay held fast in the ice in the Texel. In 1799 a force of 13,000 Russian and 10,000 English troops under the Duke of York attempted an

invasion here, but were defeated soon after by the Franco-Dutch forces stationed at Bergen and at Castricum to the south.

In the nineteenth century Den Helder saw an early period of expansion, for with the opening of the North Holland Canal in 1825 as an entry to Amsterdam, the town was transformed into a port of some magnitude. The opening of the North Sea Canal in 1876, however, put an end to this prosperity, and Den Helder has since depended almost entirely upon the dockyard.

Trade and Industry

The commercial port is of little significance save for the import of coal for the gasworks and domestic consumption. Industry outside the dockyard is of small importance ; there are several small engineering workshops and two shipbuilding and repair yards which handle fishing boats.

Communications

Railway connections consist only of a single-track line southwards to Heerhugowaard, whence a double-track line runs to Amsterdam. Waterway connections are good, by way of the North Holland Canal, which will admit vessels drawing 13 ft. There is a ferry service to Texel.

For roads see Fig. 117.

Harlingen

(Figs. 117, 118 ; Plate 72)

Harlingen (11,000) is a small port on the Friesland coast of the Wadden Zee, 4½ miles north of the eastern end of the Zuider Zee dam. It is approached from the North Sea by the Vliestroom channel in the Eierland Gat between the islands of Terschelling and Vlieland. The channel through the Wadden Zee is narrow and tortuous, and in the close approach low water depths are only 9–12 ft. The tidal rise is 7 ft. (M.H.W.S.). During severe winters the port may be icebound for some weeks.

In the outer port there are four tidal basins—Voorhaven, Nieuwe Willemshaven, Willemshaven and Buitenhaven. Buitenhaven gives access by sluice gates to Noorderhaven and Zuiderhaven, which lead to the canals of Friesland. The tidal port can accommodate, alongside quays suitable for discharging cargo, four ships drawing 16 ft. There are no quayside cranes, although two floating cranes

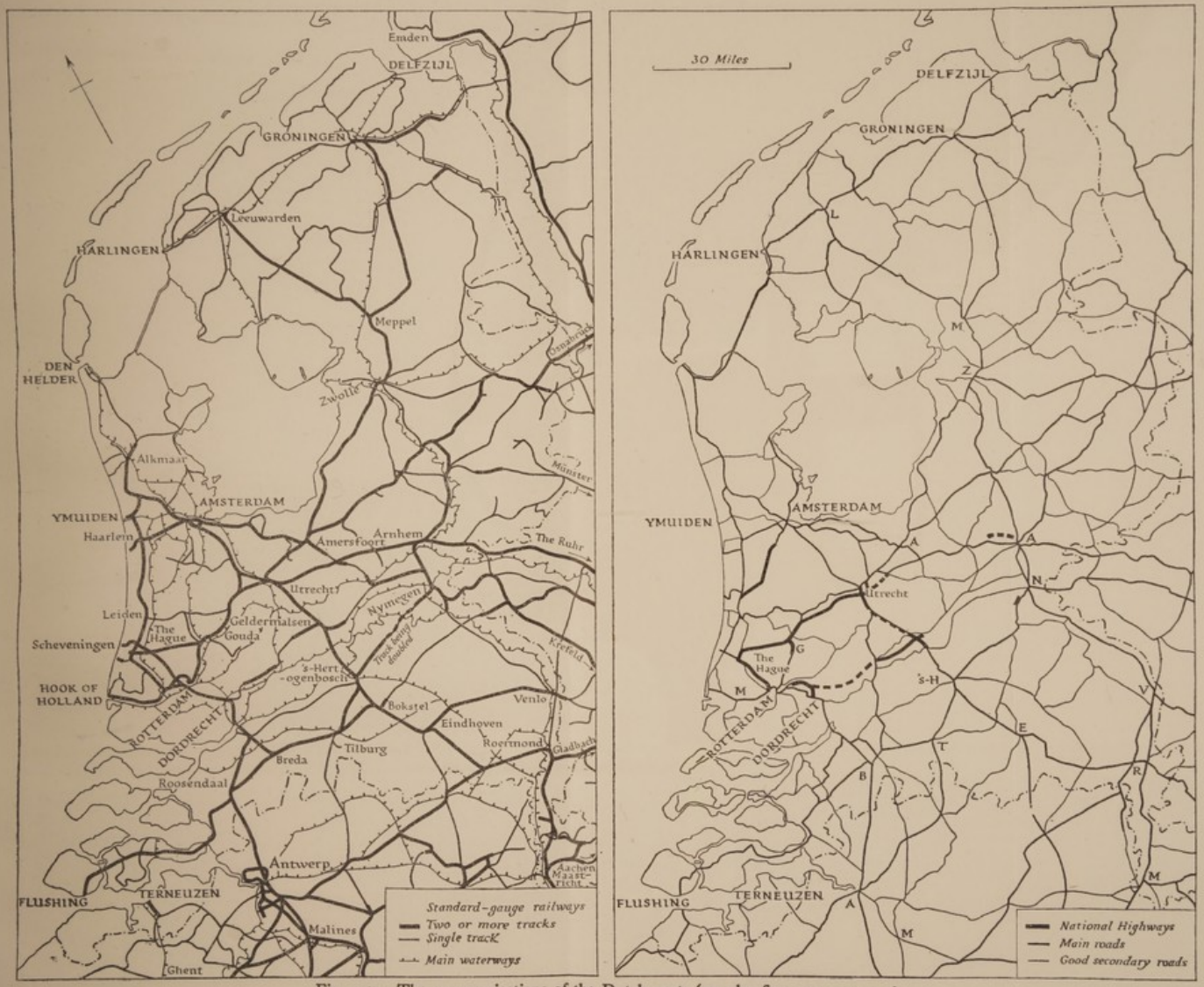


Fig. 117. The communications of the Dutch ports (see also figs. 122, 125, 134)

From G.S.G.S. 4183, 1 : 300,000 (1942); G.S.G.S. Series 4416, 1 : 100,000, Sheet M1 (1943); Series 2541, 1 : 100,000, Sheets 1, 1A, 2A, 4, 5 (1943, 1944).
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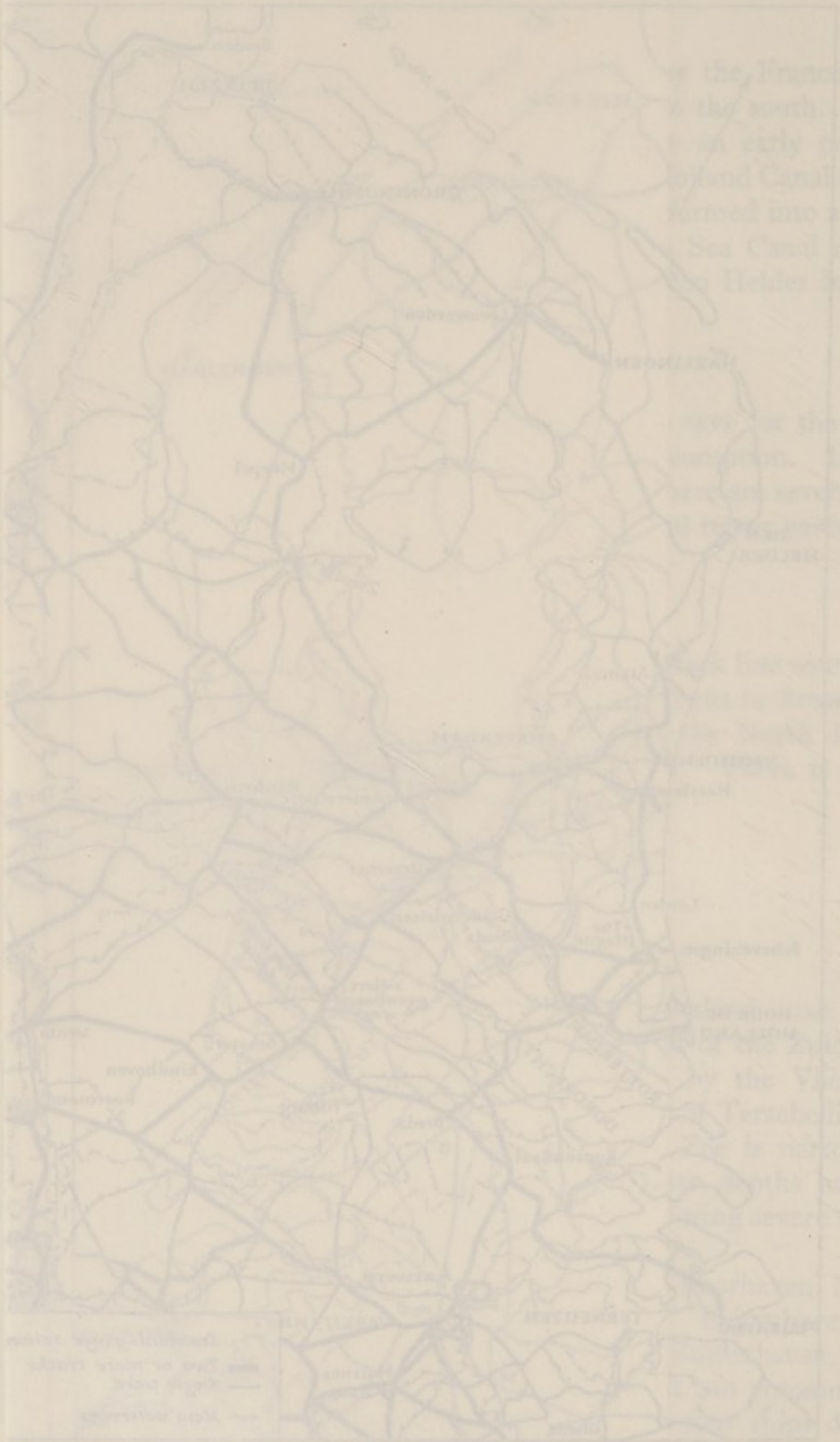

were normally operated. Warehouse capacity is about 1,000 tons. There are no dry docks.

The town is mainly confined within the old fortifications to the east. Water and electricity are supplied from Leeuwarden ; there is a local gasworks, using coal delivered by inland waterway. Industries include sawmilling, tanning, fish preserving and the manufacture of cigars, while a well-equipped yard in the south quay of the Zuiderhaven built coasters and barges.

In 1938, 347 vessels of 215,000 gross tons entered the port and 330 of 206,000 gross tons cleared. Harlingen is primarily a port for the coasting and short-sea trades. Regular services connect it with London and Hull. Its hinterland includes the agricultural province of Friesland—exports comprise vegetables, dairy products and strawboard ; imports are coal, timber and raw materials for the minor industries of the district. Coal is imported from Great Britain, and basalt is imported for road metal and building. Ground nuts are handled for the oil mills at Aengwerden, Kollummerland, Leeuwarderadeel, and Uitingeradeel ; Baltic timber is imported for the sawmills at Harlingen and woods for the cabinet factories of Hindelopen, Schoterland, Haskerland, Lemsterland, etc. Transit trade amounts only to a few thousand tons annually. The economic position of the port has deteriorated since about 1930, for with the shrinkage of foreign markets for Dutch agricultural produce, the principal export of Harlingen has declined. Imports in 1938 included 40,000 tons of coal, 10,000 tons of stone and 13,000 tons of timber by sea, and 30,000 tons of stone and 27,000 tons of mineral products by waterway ; exports included 18,000 tons of butter, 7,000 tons of cheese, 31,000 tons of other animal products and 21,000 tons of potatoes by sea, and 14,000 tons of potatoes by waterway.

	Imports		Exports	
	Sea	Waterway	Sea	Waterway
1938	68	66	91	15
1937	93	64	96	20
1936	111	59	96	13
1935	120	65	84	8

in thousands of tons

From : *Jaarstatistiek van den In-, Uit-, en Doorvoer*, vol. 1, p. 397 ('s Gravenhage, 1939)

While the port is served by the main railway system, most cargo is moved by the waterways. The principal canal leads westwards to Franeker and Leeuwarden and thence to Groningen, giving also

connections southwards to Bolsward and Sneek. A single-track railway runs to Leeuwarden and Groningen. For roads see Fig. 117.

Delfzijl

(Figs. 117, 119 ; Plate 73)

Delfzijl (10,000) is one of the largest of the secondary ports of the Netherlands, serving the productive agricultural and industrial region of Groningen. Its trade has expanded steadily in recent years.

It lies on the west bank of the Ems estuary about 19½ miles from its mouth. The channels in the estuary have a low water depth of 36 ft. ; close approach is made by Doekegat and Bocht van Watum, a channel only 120 yards across at its narrowest point, but having low water depths of 20 ft. The tidal rise is 11 ft. (M.H.W.S.).

Detailed Description

The part of the harbour which is frequented by most seagoing ships is tidal, and could accommodate ships up to 26 ft. in draught. Quayage is restricted ; berths alongside number six—one with depths of 12 ft., one with depths of 16 ft., and four with depths of 26 ft. The principal quays—partly stone and partly wooden staging—lie on the west side not far from the entrance, with probable depths of 27 ft. at the outer end and 15 ft. at the south end. In the east of the harbour is Balken Haven, a large basin with low water depths of 27 ft. ; berths are provided at about thirty-five dolphins and eight mooring buoys, and are used by ships discharging timber into barges.

In the centre of the port are two canal entrances. The Damsterdiep, a barge canal leading to Appingedam, is entered by two side-by-side pairs of gates, giving a width of 20 ft. and a depth of 6 ft. These gates are crossed by a fixed concrete bridge in two sections, with a height clearance of 13 ft. A short distance inside the gates a bridged entrance admits to Houthaven, a small barge basin on the west of the town. Close south of the Damsterdiep gates is the lock opening into the Eems Canal, a waterway leading to Groningen, with depths of 13 ft. and admitting coasters up to 800 tons. The lock is 196 ft. long, 34 ft. wide and has a sill depth of 17½ ft. ; it is spanned at the south end by a steel lifting bridge. A short distance southwards along the canal is a barge basin, Het Dok, with about 1,000 ft. of quayage and depths alongside of 16 ft. Farther to the

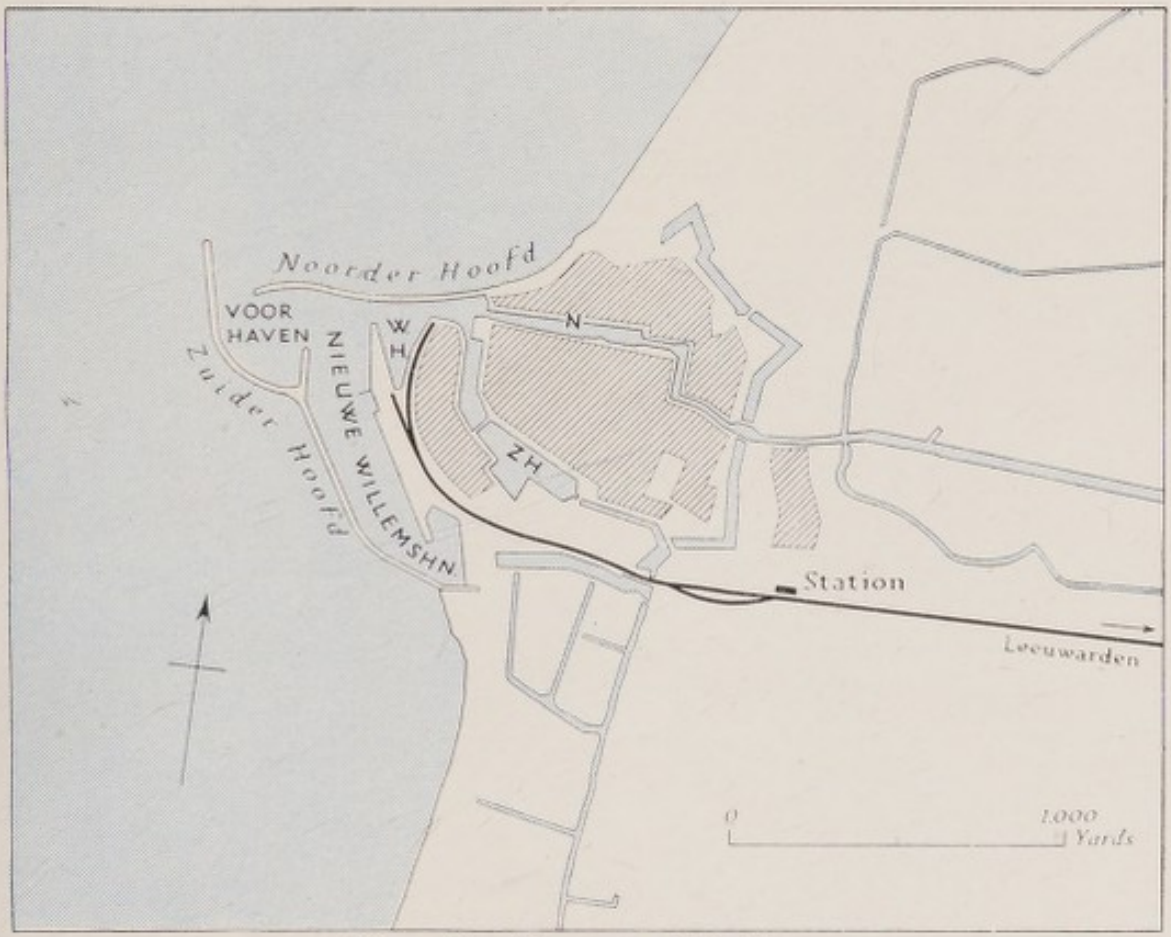

Fig. 118. The port of Harlingen
N Noorderhaven ; WH Willemshaven ; ZH Zuiderhaven.



Fig. 119. The port of Delfzijl

N Niestern shipyard ; S Sanders shipyard.

east of the Eems Canal entrance are a pair of gates controlling the outlet of the Duurswold drainage canal. This entrance can be used by inland waterway craft when the tide permits ; a short distance along the canal lies the small *Sanders* shipyard.

Port Facilities

Four warehouses lie on the main quays capable of storing, among other commodities, 28,000 tons of nitrates, which Delfzijl imports on a considerable scale. These quays are equipped with six 3-ton electric cranes and one 8-ton transporter. There are no dry docks. The *Niestern* shipyard in the Eems Canal has two side slips capable of handling ships up to 600 tons, and the *Sanders* yard has one slip of a similar capacity. Both yards can carry out extensive repairs.

The Town : Industry

The old part of the town is cut off from the port by a sea dyke pierced by two gates and is backed by the railway and the Houthaven. Buildings are close together and the streets narrow. To the south-east, extending across the canals to the suburb of Farmsum, are newer quarters. Electricity is supplied from the large station at Helpman, south of Groningen.

Besides the two shipyards there are several engineering workshops employed mainly in connection with the engines of barges and coasters ; one of these can repair boilers. There are two sawmills and three brickworks along the Damster Diep. At Appingedam (6,600) a few miles to the west, is situated the *Bronsmotorenfabriek*, a plant with a considerable output of diesel engines, normally supplied for the coasters built in the yards at Delfzijl, at Groningen and along the Winschoter Canal.

Trade

In 1938 the movement of seagoing ships in the port was as follows (thousand gross tons) :

	Inwards			Outwards	
	No.	Tonnage		No.	Tonnage
In ballast	304	163	In ballast	89	69
Loaded	150	175	Loaded	364	245
For repair	21	5	After repair	21	5
For bunkering	4	2	After bunkering	4	2
	479	345		478	321
In direct transit	191	26	In direct transit	269	37

From : *Statistiek van de Scheepvaart op het Buitenland over* 1938, pp. 14–15 ('s Gravenhage, 1939)

The figures under transit do not include seagoing ships entering the Eems Canal for Groningen.

The chief import is coal, largely English, followed by Baltic timber, sand and gravel, artificial fertilizers, Chilean nitrates, potash and cellulose. Exports by sea comprise mainly strawboard, making up half the weight, ferruginous earth, coal-dust ovoids, potato flour and dextrine, coal and coke. It should be noted that there is a considerable outward excess of cargo. Much of the trade rises from the strawboard and potato flour industries of north-east Groningen, but there is also a considerable traffic by barge to the Ems. In 1938, 2,904 barges of 404,000 tons capacity departed from Delfzijl for the Ems, and 3,010 of 415,000 tons capacity arrived. The inward traffic is largely coal and coke, some of which is re-exported ; the outward traffic is sand and gravel dredged from the Dutch Rhine and carried by sea to Delfzijl for transhipment to the Ems.

Commodity	Imports		Exports	
	Sea	Waterway	Sea	Waterway
Coal	57		4	2
Coke			1	4
Briquettes			5	9
Fertilizers	37	3		
Minerals and manufactures thereof		2	57	
Timber	45	2		
Paper, etc.			122	
Total, including unnamed goods :				
1938	141	8	219	16
1937	152	4	228	34
1936	167	8	188	30
1935	178	8	159	20

in thousands of tons

From : *Jaarstatistiek van den In-, Uit-, en Doorvoer over* 1938, vol. 1, pp. 396–7 ('s Gravenhage, 1939)

Communications

Two single-track lines connect the port with Groningen ; only the main quay is served by railway lines. Waterway connections are good, for the Eems canal, leading to Groningen, admits vessels of 13 ft. draught and 33 ft. beam, and connects with the entire waterway system of Groningen and Friesland. For roads see Fig 117.

Groningen

(Fig. 117 ; Plates 74, 75)

The Port

Groningen (115,000), the metropolis of the north-eastern Netherlands, is a minor seaport by virtue of the connection with Delfzijl and the Ems estuary provided by the Eems Canal (15 miles in length). The lock at Delfzijl is 196 ft. long, 34 ft. wide and 17½ ft. deep on the sill ; the canal has a depth of 13 ft., a width of 80 ft., and a clearance width of 32 ft. under the fifteen bridges which cross it. At the quays in the city the depth of water is 9½ ft. Loading and discharging is done by means of elevators.

In 1938, 352 vessels of 71,000 gross tons entered the port, and 332 of 68,000 gross tons departed. Most of the inward traffic came from Germany, Great Britain and Sweden ; most of the outward-bound vessels were destined for Germany, Great Britain and Denmark. Cargo movements are small, and there is no transit trade.

Total trade, 1935–8 (*thousands of tons*)

	Imports		Exports	
	Sea	Waterway	Sea	Waterway
1935	47	127	51	5
1936	53	116	89	17
1937	39	111	76	22
1938	46	99	57	13

From : *Jaarstatistiek van den In-, Uit-, en Doorvoer, over* 1938, vol. 1, pp. 395–6 ('s Gravenhage, 1939)

Imports by sea in 1938 included 6,000 tons of lime and cement and 26,000 tons of timber ; exports included 8,000 tons of rye and 31,000 tons of flour. Imports by waterway included 47,000 tons of coal and coke and 28,000 tons of fertilizers ; outward movements by waterway are inconsiderable.

The Town

Groningen is the capital of the province of Groningen. It is situated on a dry site at the northern extremity of the Hondsrug ridge, overlooking the polders to the north. It lies at the confluence of two canalized rivers, the Drentsche Aa and the Hunze, which continue to the Lauwerszee as the Reit Diep. The growth and development of Groningen have always been closely related to its water communications. As far back as the thirteenth century it

established communication with the Hanse towns by way of the Reit Diep.

The older part of the city is still surrounded by the former moat, and in the centre lies a group of open spaces. The church of St Martin dates from 1477. The University of Groningen was founded in 1614, but the present buildings are modern.

History

The town belonged originally to the *pagus* or *gouw* of Triantha (Drente), the countship of which was bestowed by the Emperor Henry II on the Bishop and Chapter of Utrecht in 1024. In 1040, Henry III gave the church of Utrecht the royal domain of Groningen, and in the deed of gift the ' villa Groninga ' is mentioned. The city was walled in 1255 and before 1284 it had become a member of the Hanseatic League. By the end of the fourteenth century it was practically a powerful independent republic which exercised an effective control over the Frisian Ommelanden between the Ems and the Lauwerszee. Later incidents in the city's history record the wars fought on the soil of the Netherlands. In 1536 it passed into the hands of Charles V. In 1579 it adhered to the Union of Utrecht, but fell to the Spaniards in the next year. They withstood a siege by the Dutch in 1591, but in 1594 they gave up the city to Prince Maurice. In 1672 it was besieged by the Bishop of Münster, but was successfully defended, and in 1698 its fortifications were improved by Coehoorn, the Vauban of the Netherlands.

The seventeenth century was a period of great activity in Groningen. Trade was prosperous and the shipbuilding industry was very active. Much capital was invested in the new reclamation works in the fens to the south-east (see pp. 333–5). It is said that the university was attended by 6,000 students, of whom 2,500 were foreigners. The eighteenth and early nineteenth centuries saw a comparative decline in the importance of the city—in 1869, for example, the population was only 38,000. After the opening of the Eems Canal in 1876, and the development of industries in the neighbouring district, its importance recovered, and the population has since continued to grow steadily.

Industries

Groningen is an important market centre for cattle, horses and cereals, produced in the surrounding region, and carries on various industries connected with agriculture, such as the processing of



Plate 74. Groningen : The Ems (Eems) Canal, looking west
In the background the buildings of the city can be seen.



Plate 75. Groningen : Museum of Navigation



Plate 76. A brick-surfaced road (Holten-Rijssen-Almelo)

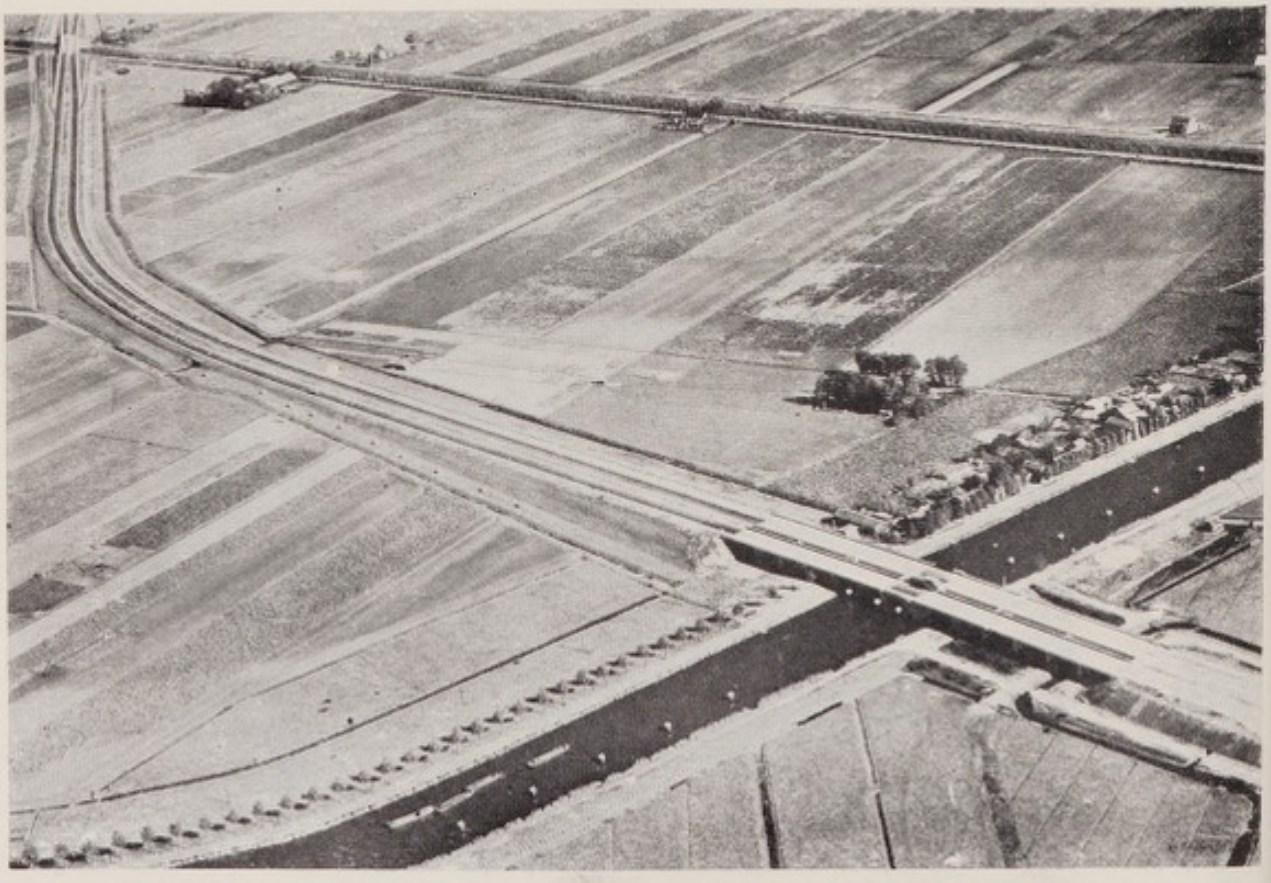

Plate 77. A double track National Highway (The Hague-Utrecht)
Driving straight across the polderland, the road is a good example of the modern Dutch arterial road.

dairy produce and the manufacture of glucose and dextrine. It manufactures superphosphates and other heavy chemicals as well as pharmaceutical products. In and near the city there are fourteen shipyards which construct mainly the small coasters which are known as ' Groninger ' (see p. 385). There is also a variety of agricultural and general engineering activities carried on.

Communications

The rail journey from Amsterdam takes about five hours either by the Enkhuizen–Stavoren ferry and the single-track line from Leeuwarden in the west, or from the south by way of the double-track line which passes through Utrecht and Zwolle. A double-track runs eastwards to Winschoten, and from there a single-track line crosses the German frontier at Nieuwe Schans for Emden. Two single-track lines run to Delfzijl on the Ems estuary, one to the north and the other to the south of the Eems Canal. A branch line serves the rural district to the north.

The inland waterways which radiate from Groningen serve to connect it with the extensive network of canals in the north and east of the Netherlands, for barges of up to 200 tons capacity. An important new development is the improvement of the waterways leading westwards and south-westwards to Lemmer on the Yssel Meer ; the Starkenborgh Canal, as it is called, can accommodate vessels up to 1,000 tons capacity.

For roads see Fig. 117.

Minor Ports

The great majority of the minor ports of the Netherlands are small drying harbours. The following minor ports are the more important.

Port	*Long.* N.	*Lat.* E.	*Normal minimum depth ft.*	
Anna Jacobapolder	51° 38′	4° 5′	10	Tramway ferry port.
Breskens (3,300)	51° 24′	3° 34′		Two tidal basins, several thousand ft. of quayage (berths grounding at L.W.); 320 ft. concrete quay 16 ft. L.W. used by 2,000 ton cargo vessels. 12-ton steam crane. Port for Flushing ferry.
Hellevoetsluis	51° 49′	4° 7′	11	(a) Commercial harbour 15 ft. (b) Tramway ferry port. Two small dry docks.
Hansweert	4° 0′	51° 26′		See p. 35
Middelharnis (4,700)	4° 10′	51° 45′	11	Tramway ferry port, 15-ton crane.
Moerdijk	4° 38′	51° 42′	8½	Ferry pontoon pier.
Numansdorp (4,300)	4° 26′	51° 43′	10½	Tramway ferry port.
Scheveningen	4° 16′	52° 7′	8	One of the principal fishing ports; accommodation for 32 craft up to 200 ft. in length, grounding at L.W.
Stellendam (1,800)	4° 2′	51° 50′	7	Ferry pier.
West Terschelling (3,300)	5° 13′	53° 22′	9–11	Tidal harbour; vessels can lie alongside in western part.
Wemeldinge (2,300)	4° 0′	51° 32′		See p. 37.
Zijpe (5,400)	4° 4′	51° 38′	10	Tramway ferry port.
Zoutkamp	6° 20′	53° 20′		A lock with 12 ft.-sill depth admits to the Reitdiep, leading to Groningen. Fishing port.

Conditions since the Occupation

Damage resulting from warfare has not, in general, been excessive. At Rotterdam the city suffered more than the port, in which there were few elaborate works to be damaged. The centre of the city was almost completely destroyed by bombing in May 1940, only the Town Hall, police headquarters, main port and telegraph office and a few other buildings being left. The site has now been cleared.

Among port equipment tugs have been moved to different centres and it is probable that a number of cranes have been dismantled and taken to German and other ports. The entrance to Ymuiden was blocked in May 1940 by the sinking of the *Jan Pieterszoon Coen* (11,000 tons gross). In several shipyards, notably at Rotterdam and Flushing, uncompleted hulls remain, some damaged.

Trade has fallen to a very low ebb. Amsterdam is little used and the tonnage handled at Rotterdam is in the neighbourhood of one-fifth of the peace-time figure. After the occupation the port for a time carried on a considerable exchange of Ruhr coal and coke for Swedish ore, but this traffic has declined. Delfzijl, as the 'safest' Dutch port, has increased its traffic—the tendency was observable in the last quarter of 1939. Traffic in small ships between the ports and inland centres has developed to some extent.

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2. Two official statistical works are devoted to the trade of the ports. *Statistiek van de Scheepvaart op het Buitenland* deals with the shipping traffic at 15 ports both separately and together, as well as with the inland waterway navigation for the whole country; the latest issue is for 1938 ('s Gravenhage, 1939). *Jaarstatistiek van den In-, Uit-, en Doorvoer*, *vol.* 1, pp. xxxii–iii, 380–401 ('s Gravenhage, 1939), deals with the merchandise and bunkering traffic of the ports by sea, rail and waterway. A short study of port trade is given by H. C. Kuiler in 'De Nederlandsche zeehavens,' *Tijdschr. voor Economische Geographie*, 29th year, pp. 274–82 ('s Gravenhage, 1938). A. Demangeon and L. Febvre, *Le Rhin* (Paris, 1935), survey the relations of the Dutch ports to the Rhine hinterland.

3. Among works which deal with the port of Rotterdam are: *The Port of Rotterdam*, published by the municipality (1926), and *G. Dirkzwager M. Zoon's Guide to the New Waterway* (Annually, Rotterdam, latest issue 1939). The trade and industry of the port are admirably described in *Rotterdam*, *Statistiek van Handel, Nijverheid en Verkeer*, 1938 *I–IV*, published annually by the Kamer van Koophandel en Fabrieken (Chamber of Commerce). The same authority publishes annually a very useful short report in English, abridged from the full report in Dutch.

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CHAPTER XVII

ROADS

Road Construction : Road Transport : Road Classification : Road Development : The Road Network : Bibliographical Note

The small country of the Netherlands, exceptionally well supplied with waterways, has until recent years been able to cater for its road traffic with the defective pattern of past centuries. In 1939 there were about 4,200 miles of roads which could serve as ' main ' roads ; minor roads totalled 3,500 miles, and local roads, many of which were little more than tracks, totalled 7,200 miles. The ratio of road length to area is lower than in Belgium, France and Great Britain.

The many waterways necessitate frequent bridges or ferries, while the general flatness of most parts of the country results in many level crossings over railway tracks. The maximum safety load for bridges in the central parts of the country and over all new bridges is, with few exceptions, 14 tons. Elsewhere it is fair to assume that the maximum is $3\frac{1}{2}$ tons. A standard minimum of 8 tons for the whole country is aimed at, consequent upon the extensive improvements now being undertaken.

Attempts are being made, as opportunity presents itself, to transfer tramways from the roadway to special tramway tracks.

Road Construction

The older roads were built on the polder dykes, hence their angular pattern and narrowness. Unfortunately the areas of densest population are near the polders and so the most important old roads are those which are most confined to the pattern of the dykes. The more modern roads break away from the polder dykes and run straight across the country. This results in even greater problems with the foundations, and many of these roads have been built, like the railways, on fascine work on which sand has been poured. This method of building roads is slow and expensive, hence the use of

wooden piles has been tried. Trials were made of this technique in 1937 near Hazerwoude in South Holland province, on Road No. 21. The areas in which the subsoil comprises peat lying on sand with deeper layers of peat beneath prove the most difficult for road building, as the foundations do not easily consolidate. Such areas are found in Friesland, Groningen, North and South Holland and in the western part of Utrecht province.

With practically no home-produced road metal it has proved necessary to use substitutes. Bricks have proved the most popular on account of the colour, non-slipperiness and absorptive qualities of the bricks made in the Netherlands. The bricks are placed immediately on a thin layer of sand for low-grade roads, but for the better roads they are placed on a good sand foundation, or on asphalt, or even on concrete, e.g. the Zuider Zee dam. Asphalt is being increasingly used in the Netherlands, particularly in the western half of the country, as the surface ' gives ' with subsidence of the subsoil and does not break. Local sources of road metal include the use of quartz gravel from the Maas in Limburg, and stones from harbour works discarded with the reclamation of the Zuider Zee. A certain amount of slag is used, while rubber paving has been experimentally tried at Scheveningen and at Rotterdam. Concrete has been generally reserved for the new National Highways of the ' autostrade ' type. Imported road metals include porphyry from Belgium and basalt from Germany.

Road Transport

The increase in the number of motor vehicles has affected road development. In August 1937 there were 143,336 motor vehicles, of which 49,156 were lorries and 3,841 buses. While there are fewer vehicles than in many European countries the high percentage of lorries has led to transport problems. A further problem, almost peculiar to the Netherlands, arises from the great number of cyclists : bicycles number 3,600,000, or two bicycles for every five of the population. The widespread use of the bicycle necessitates the building of cycle tracks, but unfortunately this solution is most difficult in built-up areas where the problem is most acute. The following figures from the 1937 traffic census on a road artery at The Hague reveal the nature of the cyclist problem (see also Fig. 120).

Traffic on The Hague–Rotterdam Road. 8.00 *a.m. to* 8.00 *p.m.*

Observation Point	*Location*	*Cycles*	*Motor vehicles*
Ypenburg	2 km. outside built-up area	4,437	7,604
Wenkebachstraat	1½ km. inside ,, ,,	14,402	7,585
Rijswijkscheweg Viaduct*	2½ km. ,, ,, ,,	39,016	12,408
Spui	Centre of town	23,977	8,045

* This viaduct is like a funnel, compressing traffic from an important residential quarter before it reaches the centre of the town.

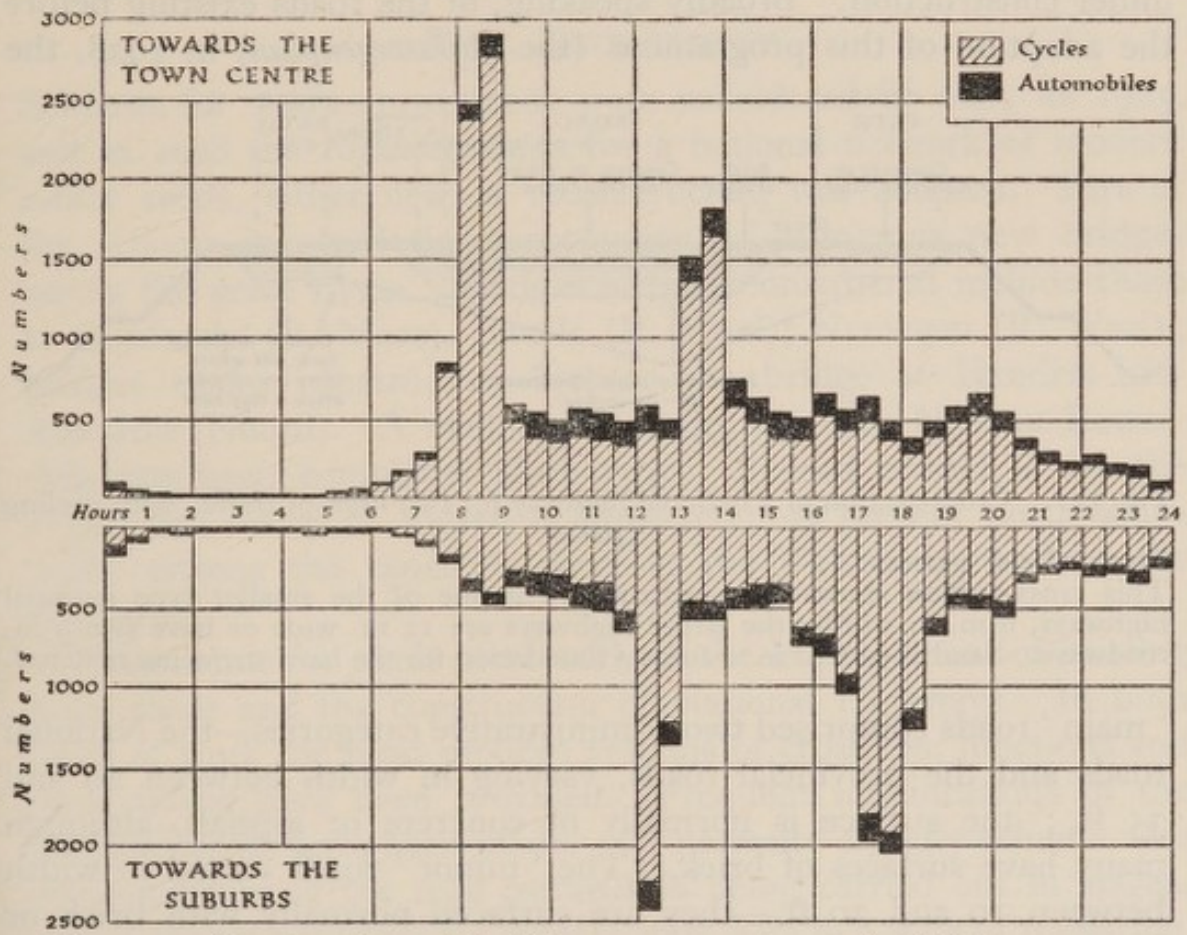


Fig. 120. Road traffic at The Hague over 24 hours, by half hours, 1937

From Permanent International Association of Road Congresses, 8th Congress, The Hague. 1938, *Report No.* 63, pp. 7, 10.

The dominant feature of the traffic is the large number of people cycling to and from their homes in the suburbs and place of work in the city.

The greater part of road traffic circulates within the central part of the Netherlands lying between the North Sea coast, the Yssel Meer and the Neder-Rhine and Lek. The roads carrying the greater volume form three sides of a rectangle with its base close to the North Sea coast: Dordrecht–Rotterdam–The Hague–Haarlem and Velsen–Amsterdam–Utrecht and Amersfoort, while an important secondary stream moves between Leiden and Utrecht. Over the

rest of the country traffic thins out ; the more important centres of minor traffic webs are Breda-Tilburg–'s Hertogenbosch, Roermond–Maastricht, Arnhem–Utrecht and Amersfoort, and Almelo–Enschede.

The Road Classification

The classification of roads in the Netherlands is complicated by the fact that the extensive programme of National Highways was in mid-course in 1939, and while some had been completed, more were under construction. Broadly speaking, of the roads existing before the adoption of this programme (the *Rijkswegenplan*) in 1928, the

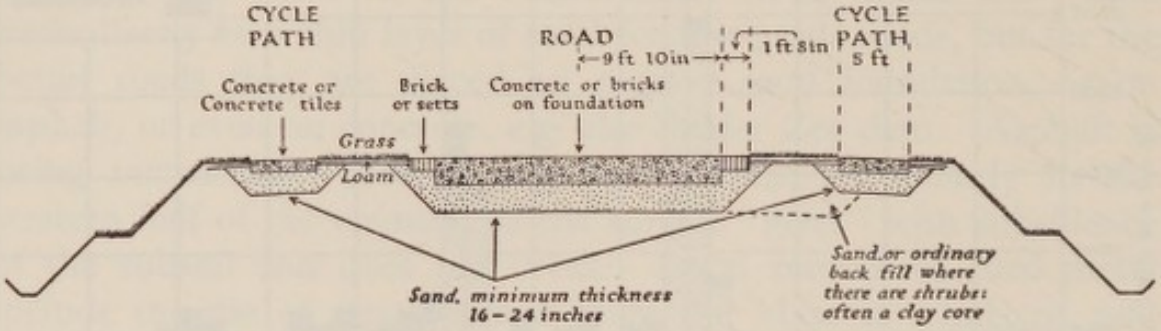


Fig. 121. Cross-section of a national highway for two lines of traffic, with cycling paths

From official sources.
This cross-section shows the construction of one of the smaller type national highways, 6 m. in width ; the larger highways are 12 m. wide or have two 6 m. roadways. Sand is packed in to form a foundation for the hard surfacing material.

' main ' roads comprised two administrative categories—the National roads and the provincial roads, varying in width between 20 and 35 ft. ; the surface is normally of concrete or asphalt, although many have surfaces of brick. The ' minor ' roads varied in width between 10 and 20 ft.—they are surfaced normally with brick or cobbles, though many are in a bad state of repair. ' Local ' roads, connecting villages and farms, are narrow and are often little more than tracks.

Road classification, 1939

Type	Length miles	Equivalent English category	Administration
National roads National Highways	1,800	First class	State (Dept. van Waterstaat)
Provincial	2,400	Second class	Provinces
Minor	3,600	Third	Local authorities, communes and even individuals
Local	7,200		
	15,000		

The National Highways include newly constructed roads and radically reconstructed national and provincial roads. Many sections of these National Highways comprise two carriageways each over 20 ft. (6 m.) wide, while other sections consist of one carriageway over 20 ft. wide (Fig. 121 ; Plate 75).

The National Highways and the much greater number of National roads (improved and reconstructed in varying degrees) comprise the *Rijkswegen*, which are numbered 1 to 81, e.g. Rijksweg 3, Rijksweg 12, etc. (see pp. 691–98).

Road Development

Schemes for road improvement were considered as early as 1925, and in 1928 the *Rijkswegenplan* for a national network of modern motor roads, either new or reconstructed, was adopted. Part of the scheme involved the construction of numerous new bridges across the great rivers. Bridges already constructed include those at Dordrecht (R. Maas), Zwolle (R. Yssel), Nymegen (R. Waal) ; bridges under construction include the bridge at Hendrik-Ido-Ambacht (Noord). A road tunnel under the New Maas at Rotterdam has been completed since 1940. A road tunnel under the North Sea Canal at Velsen is projected ; at present north-south traffic crosses the canal by ferry at the Velserbrug and at the Hembrug.

The scheme for roads involved both the improvement of existing main roads and the construction of National Highways. In both types of work the most modern systems of crossings, junctions and cycle tracks have been provided. Frequent modifications of the *Rijkswegenplan* have been made. Of necessity a costly scheme, this reconstruction of the road network is being carried out in stages, and in 1939 the roads of the Netherlands were in a state of transition (Figs. 122, 123). Coexisting with the old dyke roads, but carrying relatively little traffic, are roads of the most modern type.

The Road Network

The pattern of the road network shows a number of major routes running from north to south or from east to west. In addition there are secondary networks around the larger groups of population, e.g. around Maastricht, Venlo, 's Hertogenbosch, Breda, Rotterdam, Utrecht, Nymegen-Arnhem, Deventer-Zwolle and Amsterdam. These secondary centres are caused in part by large rivers dividing the country into ' compartments '.

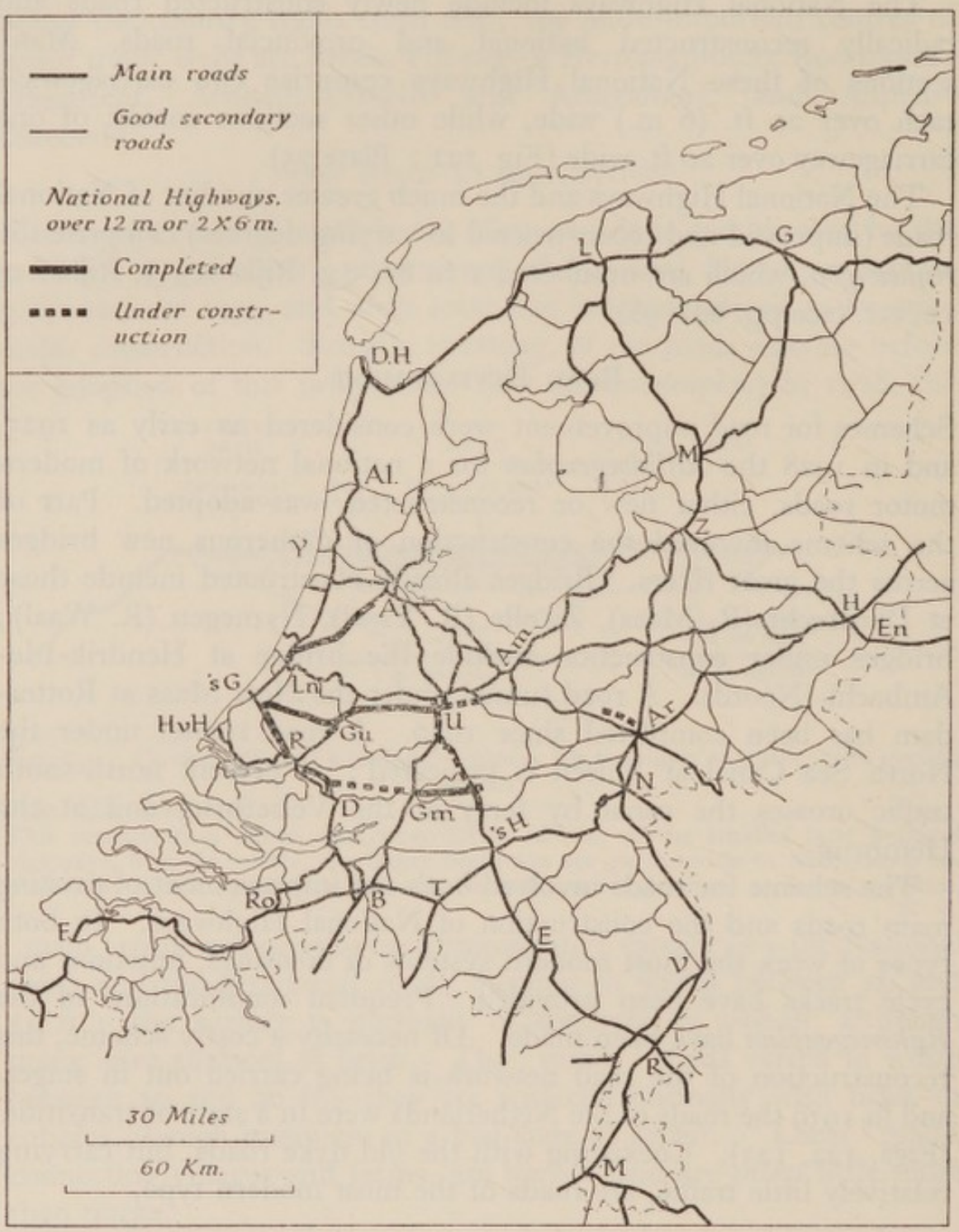


Fig. 122. The road network

Based on G.S.G.S. Series 4238, 1 : 200,000, Sheets 1, 'North', 'Centre'; G.S.G.S. Series 2451, 1 : 100,000, Sheets 1, 1A, 2A, 4, 5.

It is difficult to map the roads of the Netherlands according to a classification which is both simple and rigid; the main roads shown above are mainly over 5 m. wide and metalled.

A Amsterdam; Al Alkmaar; Am Amersfoort; Ar Arnhem; B Breda; D Dordrecht; DH Den Helder; E Eindhoven; En Enschede; F Flushing; Gr Groningen; Gm Geldermalsen; Gu Gouda; 's G The Hague; H Hengelo; HvH Hook of Holland; 's H 's Hertogenbosch; L Leeuwarden; Ln Leiden; M Maastricht, Meppel; N Nymegen; R Rotterdam, Roermond; Ro Roosendaal; T Tilburg; U Utrecht; V Venlo; Y Ymuiden; Z Zwolle.

Roads south of the Great Rivers

South of the great river belt of the Netherlands the road pattern is dominated by the international routes into Belgium and Germany. The main roads running from Belgium are: Antwerp–Breda, Turnhout–Tilburg, Hechtel–Eindhoven, Hechtel–Roermond, Hasselt–Maastricht, and Liège–Maastricht. These main roads are supplemented by good secondary roads: Antwerp–Bergen-op-Zoom, Oostmalle–Breda, Turnhout–Breda, Turnhout–Eindhoven, Hechtel–Weert.

Six main roads lead into Germany: Maastricht–Aachen, Roermond–Aachen, Roermond–Gladbach, Venlo–Geldern, Gennep–Geldern, Nymegen–Cleve, while between Maastricht and Roermond runs a main road parallel to the frontier. The good secondary roads, all south of Venlo, run from near Roermond south-eastwards to Wassenberg and north-eastwards to Bruggen, and from Venlo to Bruggen.

To the north the road pattern is controlled by the three crossings of the Maas and of the Waal. The lowest crossing is by the recently constructed Moerdijk road bridge over the Hollandsch Diep and this carries the main route via Breda from Antwerp to Rotterdam. The middle crossing is by a bridge near Geertruidenberg, and the upper crossing is near 's Hertogenbosch, carrying the main road from Eindhoven to Utrecht. Upstream from the middle bridge the Maas ceases to be a formidable barrier, but the Waal continues to offer a wide barrier, so that the eastern roads converge at Nymegen (Figs. 122, 126).

South of the river belt there is only one main road from west to east: Flushing–Bergen-op-Zoom–Breda–Tilburg–'s Hertogenbosch–Nymegen. In the west, along the island of South Beveland, this road has many bends, but on the mainland there are many straight stretches, and villages cause few interruptions. Secondary cross-roads help to complete the pattern. The most important of these roads is from the island of Schouwen to the mainland and thence, partly using a stretch of main road, to Geertruidenberg and 's Hertogenbosch. Good secondary roads are most sparse in the eastern sector of the heathlands, to the west of Venlo and between Grave and Roermond.

The belt of the Great Rivers (*Fig.* 126)

Apart from the bridges over the Maas the crossings of the branches of the Rhine are important. The most westerly road runs from the

Moerdijk bridge to Rotterdam crossing the Oude Maas at Dordrecht by a new bridge and the New Maas at Rotterdam by bridge and tunnel. The road northwards from Geertruidenberg requires a ferry to cross the Waal at Gorinchem and immediately south of the Lek joins the road from 's Hertogenbosch to Utrecht. This latter

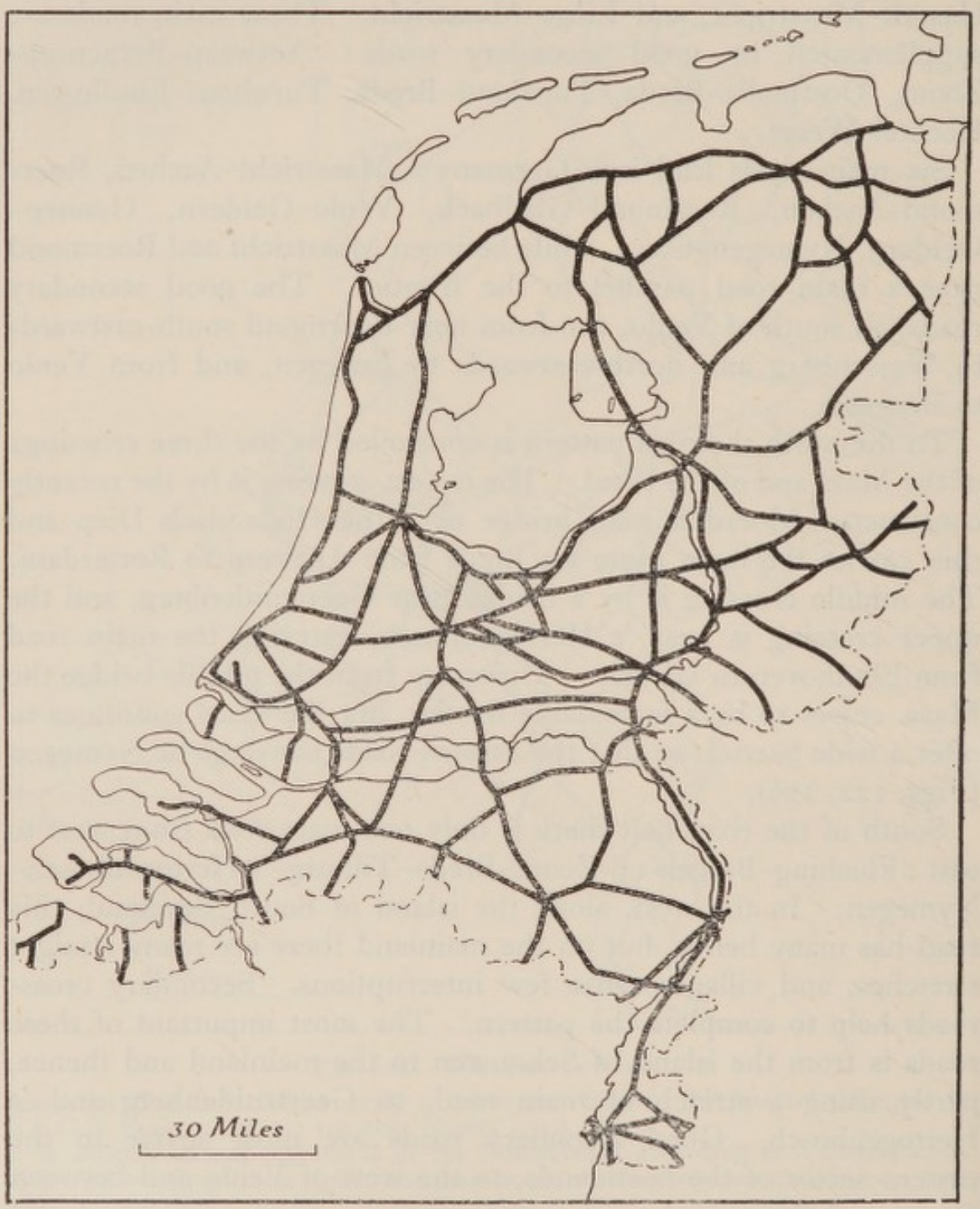


Fig. 123. The *Rijkswegenplan*

From : P. R. Bos–J. F. Niermeyer, *Schoolatlas der Gehele Aarde*, plate 12 (Groningen, 1936).
The map shows the plan for a complete network of national highways, either the super roads like those shown in Fig. 122, or the narrower highways, which are often improved existing roads (Fig. 121).

road, after crossing the Maas, crosses the Waal at Zaltbommel and the Lek at Vianen. The road from Nymegen crosses the Neder–Rhine at Arnhem. Many of the minor roads make the crossing of the rivers by ferries.

Within the river belt there are secondary roads on the dykes, parallel to the streams, and these roads are of necessity full of bends. Secondary roads run on the north dyke of the Waal and on the south dyke of the Lek. Many stretches are of poor quality, although most of the roads are metalled.

The Central Belt

North of the Lek the road network is denser than in most of the Netherlands, and is dominated by the large centres of population, by the river crossings to the south, and by the narrowing of the country by the Yssel Meer. It is within this region that the modern National Highways have been planned and partly built, e.g. from The Hague to Rotterdam and to Utrecht. The linking up of the four principal cities in the kingdom (The Hague, Amsterdam, Rotterdam and Utrecht) by these modern roads is approaching completion ; as they are extended eastwards Utrecht will enjoy a central position in the road network similar to its position in the railway network.

South–north routes include the road from The Hague to Den Helder, which runs some five miles in from the coast, and those from 's Hertogenbosch to Utrecht and Amsterdam and from Arnhem to Zwolle east of the Yssel. A secondary route is that from Doetinchem, near the German frontier, through Zutphen and Deventer to Zwolle, to the west of the Yssel.

The four principal east–west routes are from The Hague and Rotterdam to Utrecht–Arnhem–Hengelo and Enschede, Haarlem–Amsterdam – Hilversum – Amersfoort – Apeldoorn – Deventer – Hengelo, Amsterdam – Bussum – Amersfoort – Zwolle – Almelo – Hengelo, and from Den Helder across the Zuider Zee dam to Harlingen. Except for the country to the north of Amsterdam and to the east of Apeldoorn there are few good secondary roads.

The only main roads into Germany in this sector are from Arnhem to Emmerich, from Hengelo via Enschede to Osnabrück, and from Hengelo via Oldenzaal to Bremen. Good secondary roads run across the frontier south and south-east from Doetinchem, east from Winterswijk and east from Oldenzaal.

The northern Netherlands

North of Zwolle the main road pattern is extremely simple: it consists of an inverted triangle joining Meppel, Leeuwarden and Groningen with prolongations at each of the angles—southwards to Zwolle, westwards to Harlingen and the Zuider Zee dam, and eastwards to the frontier village of Nieuwe Schans. South of the Harlingen–Nieuwe Schans road are a number of cross-roads, but north of it only two good secondary roads are found and both of these lead to Holwerd, the ferry terminus for the island of Ameland. On the whole, this extensive part of the country is not well provided with secondary roads.

For a considerable distance south of the Dollart only one main road, that from Nieuwe Schans to Oldenburg, crosses the frontier, and only four reasonably good secondary roads. From Hardenberg, east of Zwolle, a narrow secondary road connects with a wide secondary German road. South-east from Coevorden and south-east and north-east from Emmen narrow secondary roads run across the frontier.

BIBLIOGRAPHICAL NOTE

1. Some account of the problems of road construction in the Netherlands will be found in *Report of the Proceedings*, 8th International Road Congress, The Hague, 1938, Reports 16, 37, 63, 90 (Rennes-Paris, 1939). Miscellaneous information on the layout and construction of certain important roads will be found in the reports of the excursions of the same congress; a very comprehensive study of most aspects of the road system is given in R. Loman, 'De Wegen voor Gewoon Verkeer en het Gebruik Daarvan', *Tijdschr. Kon. Ned. Aardrs. Gen.*, vol. 50, pp. 478–545 (Leiden, 1933).

2. Articles dealing with special aspects of road construction and transport will be found in various technical journals, especially *Transport* (London), *Modern Transport* (London), *Roads and Road Construction* (London) *Annales des Ponts et Chaussées* (Paris) and *Strassenbau* (Halle).

3. A general survey of Dutch roads, with references to their history and to road traffic, will be found in R. Schuiling, *Nederland*, vol. 2, pp. 705–12 (Zwolle, 1936); J. J. Stieltjes, 'De exploitatie van het Railloos Verkeer', *Tijdschr. Kon. Ned. Aardrs. Gen.*, vol. 50, pp. 545–65 (Leiden, 1933).

4. Maps of particular value are: G.S.G.S. Series 4438, 1 : 800,000, sheet 'Holland, Belgium and Central Germany', and G.S.G.S. Series 4427, 1 : 25,000, various sheets.

CHAPTER XVIII

RAILWAYS

Introduction : Historical Background : The Railway Network : Railway Traffic : Permanent Way and Signalling : Fuel and Traction : Locomotive Rolling Stock : Other Rolling Stock : Train Operation : South Limburg Coal Mines Railway System : Light Railways and Tramways : Conditions since the Occupations : Bibliographical Note

Introduction

The railway network of the Netherlands has a density which is only about half of that in Belgium. In 1940 the total length of the railway system was 3,667 km. (2,278 miles) with, in addition, 2,717 km. (1,688 miles) of tramway. This represents one km. of line for every 9·9 sq. km. of area (in Belgium the figure was 5·9, in Great Britain 7·4, in Germany 9·5 and in France 12·9 per sq. km.). The comparative density of the railway network in the Netherlands and in neighbouring countries may also be expressed as follows :

Kilometres of line (1934)	Nether-lands	Belgium	Great Britain	Germany	France
Per 100 sq. km.	10·6	33·6	13·6	14·6	11·7
Per 10,000 persons	4·4	12·4	7·1	10·3	15·4

The Netherlands railways are managed under a company charter, with the state holding all the shares. The total railway staff numbers 30,000. Operation is centralized to an exceptional extent, and immediately prior to the German invasion in May 1940 all the operating districts had been abolished and the superintendents and their staffs were being concentrated in the head offices at Utrecht.

The railways are essentially a passenger traffic system, for goods traffic is dominated by the inland waterways. Before the introduction of motor road transport, 60% of all freight inside Dutch territory was carried by water and 20% by rail. In recent years, since the development of motor road transport, 54% has been carried by water, 33½% by road, and only 12½% by rail. Relatively little bulk freight is carried by rail ; coal is mostly transported by water, and agricultural produce by road and water (see p. 589). Until the development of the Limburg coalfield there was little mineral traffic originating in the Netherlands which could travel by rail, and the early railways were hard pressed to get sufficient revenue.

The construction of an extensive system of new trunk roads and the improvement of existing roads have diverted passenger traffic from rail to road, especially on the shorter runs. Further, many of the intermediate stations are distant from the settlements served by them, for the track was laid in a straight line between the large towns ; a result of this is that over 10% of the stations have double names, showing that they are not close to any one large settlement. To stem the declining passenger traffic, expensive main line electrification has been developed. Some halts and stations which had been closed while the lines were operated by steam were re-opened after electrification, but the tendency has been to close intermediate stations. In essence, the railways abandoned light local traffic to the roads and concentrated on fast long-distance traffic.

Historical Background

The Hollandsche IJzeren Spoorweg Maatschappij—H.IJ.S.M. (Holland Iron Railway Company) was founded by Amsterdam business men in 1837. Opened from Amsterdam to Haarlem two years later, and extended to The Hague and Rotterdam in 1847, this is still considered the main line of the Netherlands system. The *Netherlands Rhine Railway Company* (*N.R.S.*), formed under the personal guarantee of King William I, after the States-General had refused support, depended on English capital and equipment. The main route, opened completely by 1856, was Amsterdam–Utrecht–Arnhem–Emmerich (German frontier), and it was subsequently joined by The Hague and Rotterdam–Utrecht section. These early lines were built as broad gauge (1,940mm.) but altered to standard-gauge (1,435mm.) in the fifties.

In 1860 the state commenced to promote, finance and build railways in many parts of the country. A private company known as the *Company for the Operation of State Railways* or *Staats Spoorwegen* (*S.S.*) was formed to operate the state lines which were opened as widely scattered lines, e.g. between Breda and Tilburg, Harlingen and Leeuwarden, Roosendaal and Bergen-op-Zoom. The *Netherland Central Railway* (*N.C.S.*), a private company, opened the line Utrecht-Zwolle–Kampen in 1864, and the *North Brabant German Railway Company* (*N.B.D.S.*) was opened in 1878 from Bokstel via Venlo to Wesel on the Rhine. The Flushing-German mail route did not use the latter line until 1881.

The year 1890 was important for further developments, the chief of which was the redistribution of the state railways and N.R.S. between H.IJ.S.M. and S.S., the former acquiring several of the state lines which until then had been operated by S.S., whilst the S.S. system acquired the whole of the N.R.S. The principle

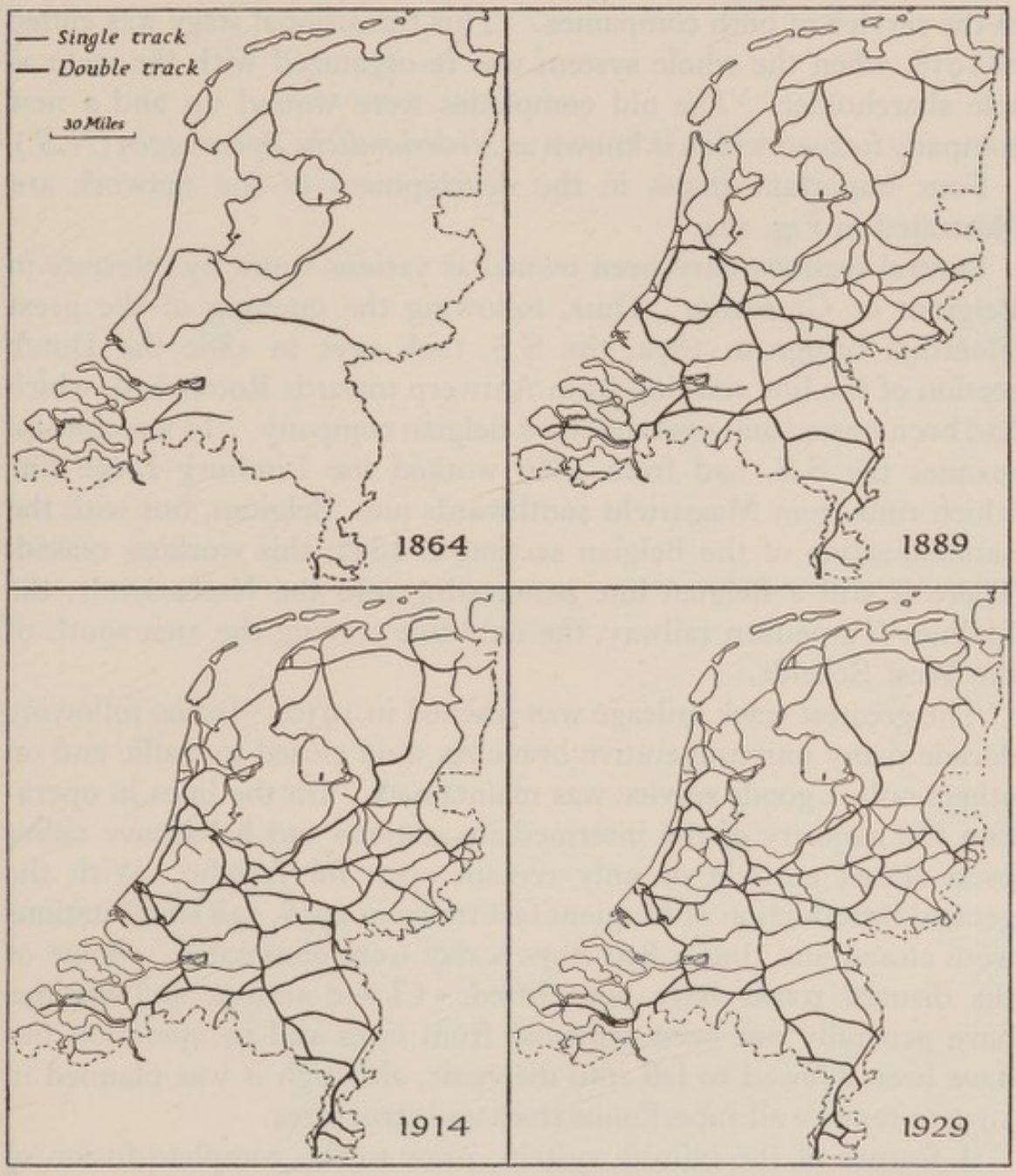


Fig. 124. Growth of the Netherlands railway network

From : 100 *Jaar Spoorwegen in Nederland* (Utrecht, 1930).

From 1830 until 1864 progress was slow, but the following twenty-five years saw the virtual completion of the main network. The peak of railway mileage was reached in 1929. Many of the tracks were originally single, and were only doubled as traffic warranted. Since 1929 considerable stretches of track have been lifted, both before and after May 1940 ; the 1938 network is shown in Fig. 125. The line south of the West Scheldt is the Belgian-owned Malines–Terneuzen railway.

behind this change was to provide competition on the main routes to Germany and Belgium and to give approximately equal strength to the two companies. The N.C.S. and N.B.D.S. were not effected until 1917 when the S.S. took them over. In 1917 the two main companies, H.IJ.M.S. and S.S., pooled resources, revenue and expenditure and operated under one management, with the staff in the service of both companies. This transitional stage was ended in 1938, when the whole system was re-organized with the state as sole shareholder. The old companies were wound up and a new company formed which is known as *Nederlandsche Spoorwegen* (*N.S.*).

Four important stages in the development of the network are illustrated in Fig. 124.

Several sections have been owned at various times by interests in Belgium or Germany. Thus, following the opening of the great Moerdijk bridge in 1872, the S.S. took over in 1880 the Dutch section of the line running from Antwerp towards Rotterdam, which had been owned and operated by a Belgian company. In a reciprocal manner the S.S. had from 1866 worked the Limburg–Liége line which runs from Maastricht southwards into Belgium, but with the nationalization of the Belgian section in 1897, this working ceased. There is still a Belgian line penetrating into the Netherlands, the Malines–Terneuzen railway, the only line serving the area south of the West Scheldt.

The greatest track mileage was reached in 1930. In the following decade many unremunerative branches were closed to traffic and on others only a goods service was maintained. On the lines in operation the majority of the intermediate stations and halts have either been closed entirely or only remain open for freight. With the general introduction of frequent fast trains in 1938, 148 small stations were closed and thus 1,800 stops a day were eliminated. Some of the disused tracks have been lifted. Closed sidings and stations have generally not been removed from lines still in operation but have been allowed to fall into disrepair, although it was planned in 1939 to remove all superfluous track and structures.

A feature of the railway system, prior to the complete fusion of interests in 1938, was the divided ownership of the lines. Although the greater part of the system was worked by the two leading companies (H.IJ.S.M. and N.S.), on 31 December 1937, 2,213·2 km. of the lines were owned by the state; only 827·4 km. were built and owned by the two companies. They also worked 301·5 km. of privately-owned line, all of which was of merely local interest.

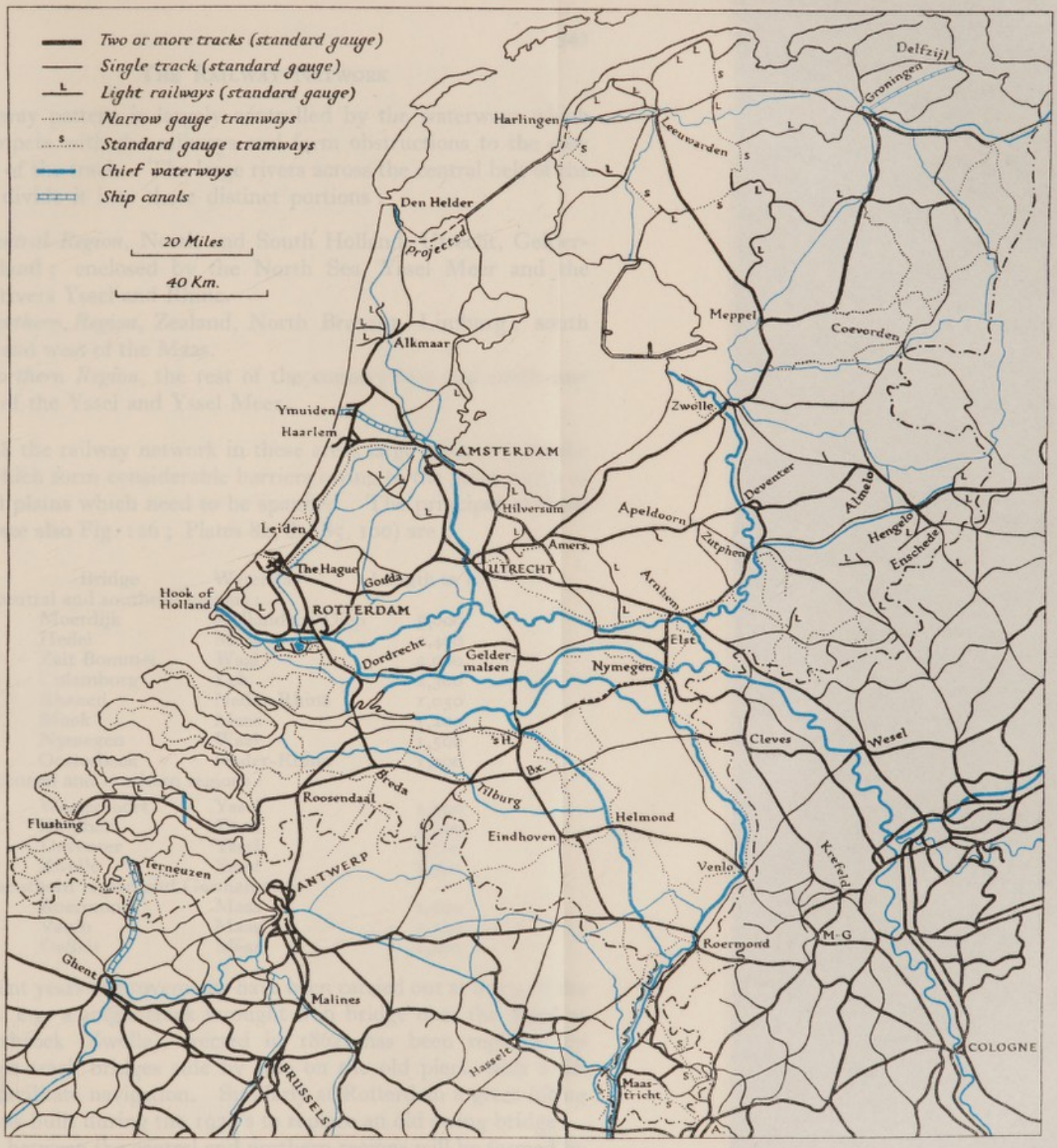
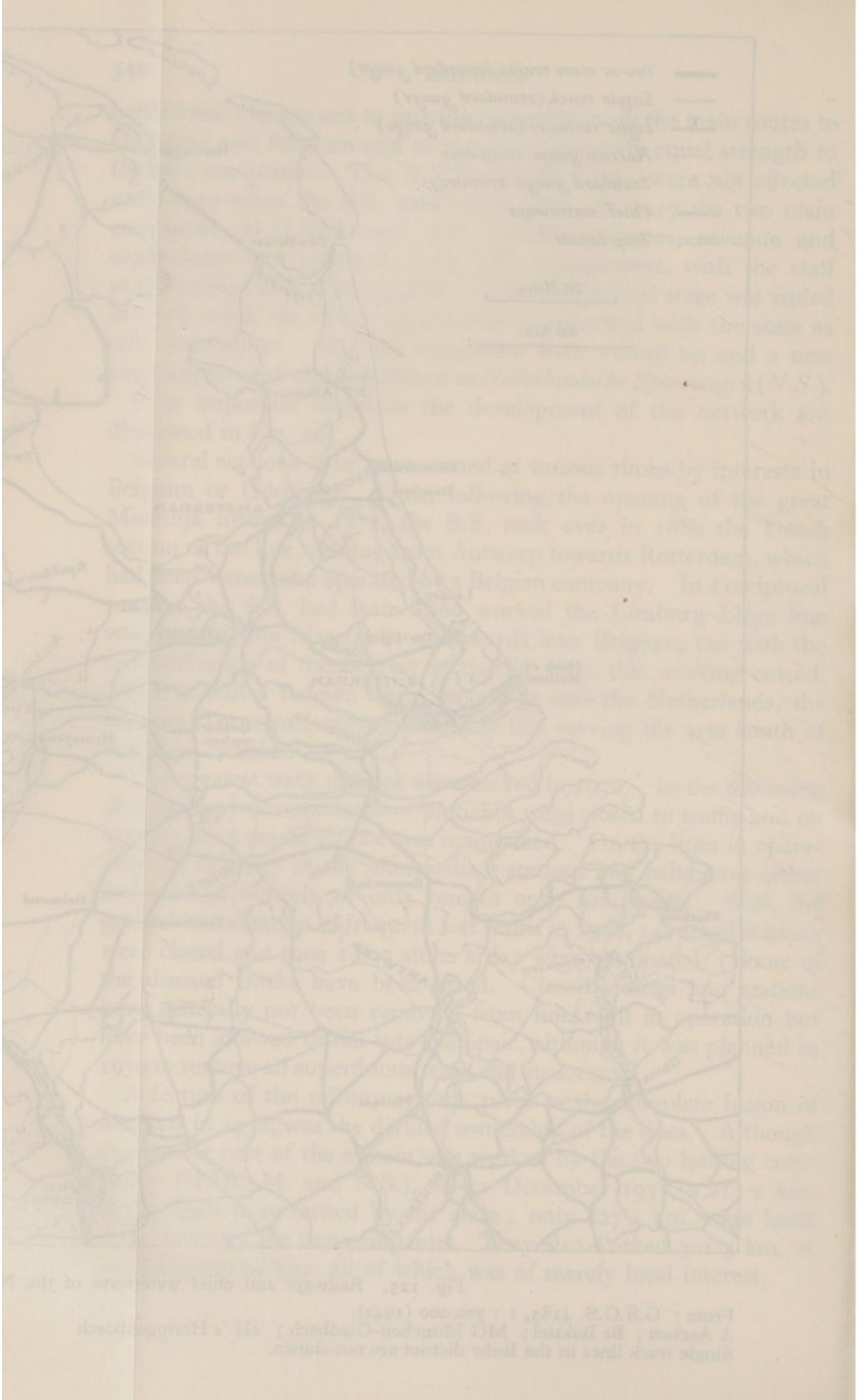


Fig. 125. Railways and chief waterways of the Netherlands

From : G.S.G.S. 4183, 1 : 300,000 (1942).
A Aachen ; Br Bokstel ; MG München-Gladbach ; 'sH 's Hertogenbosch
Single track lines in the Ruhr district are not shown.



The Railway Network

The railway pattern is largely controlled by the waterways which both compete with the railways and form obstructions to the easy building of the track. The large rivers across the central belt of the country divide it into three distinct portions :

(*a*) *Central Region*, North and South Holland, Utrecht, Gelderland ; enclosed by the North Sea, Yssel Meer and the rivers Yssel and Rhine.
(*b*) *Southern Region*, Zealand, North Brabant, Limburg ; south and west of the Maas.
(*c*) *Northern Region*, the rest of the country east and north-east of the Yssel and Yssel Meer.

To link the railway network in these areas large bridges cross the rivers, which form considerable barriers owing to the great width of the flood plains which need to be spanned. The principal of these bridges (see also Fig. 126 ; Plates 82, 84, 85, 100) are :

Bridge	Waterway	Length in ft.
Between central and southern regions :		
Moerdijk	Hollandsch Diep	5,000
Hedel	Maas	2,400
Zalt Bommel	Waal	2,900
Culemborg	Lek	2,300
Rhenen	Neder-Rhine	1,050
Mook	Maas	1,200
Nymegen	Waal	1,500
Oosterbeek	Neder-Rhine	1,200
Between central and northern regions :		
Westervoort	Yssel	1,500
Zutphen	Yssel	1,200
Deventer	Yssel	1,700
Zwolle	Yssel	1,500
Between southern region and Germany :		
Roermond	Maas	1,200
Venlo	Maas	1,200
Oeffelt	Maas	1,200

In recent years improvements have been carried out at many of the bridges : e.g. a single-track wrought iron bridge over the Yssel at Hattemerbroek (Zwolle), erected in 1864, has been replaced by two single-track bridges side by side on the old piers, with a lift span to facilitate navigation. Similarly at Rotterdam a great lifting bridge was built during the 1920's to replace an old swing bridge.

A link between the central and northern regions will be formed by

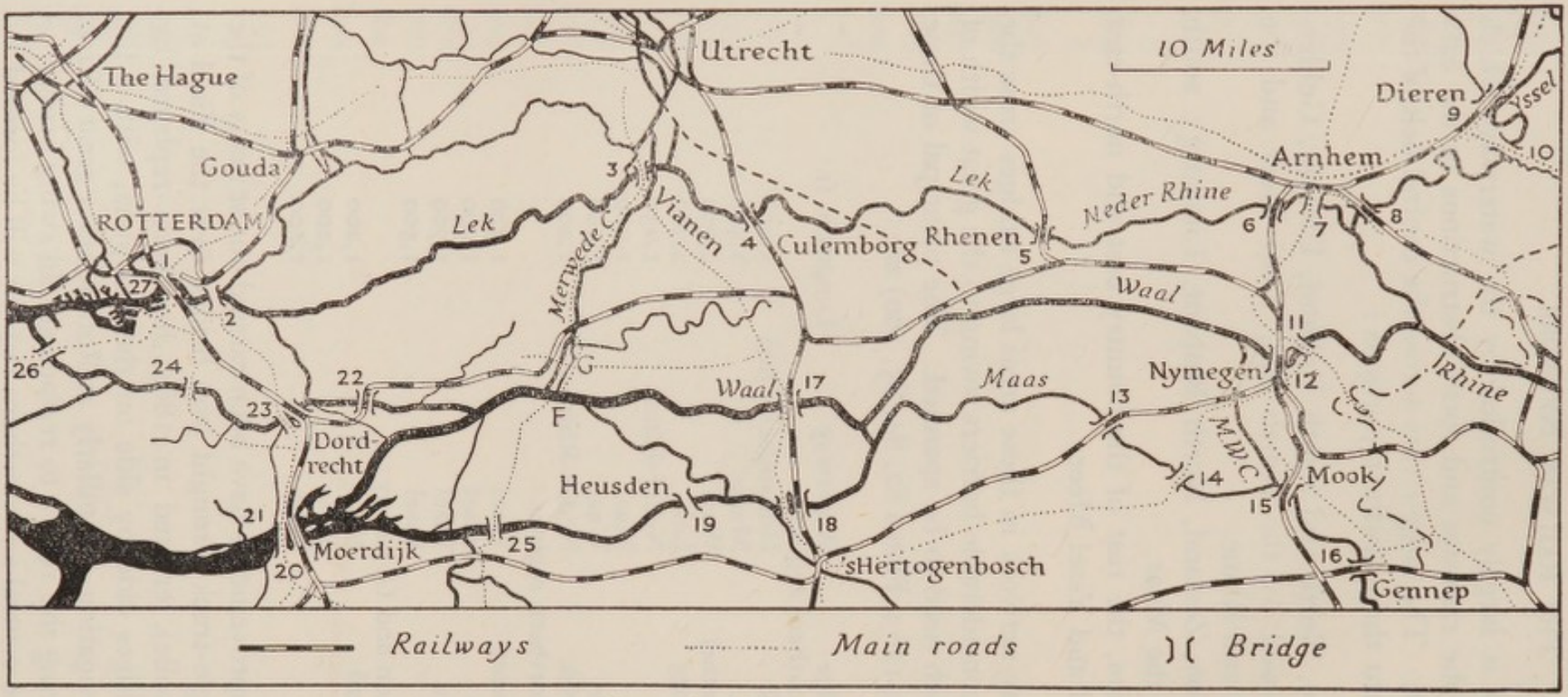


Fig. 126. The great bridges

From : G.S.G.S. 2451, 1 : 100,000, Sheets 4, 5 (1943) and official sources.
Key to bridges (H, road ; R, railway) ; 1 Maasbrug, H Spoorbrug, R (New Maas) ; 2 Ysselmonde (under construction), H (New Maas) ; 3 Vianen H (Lek) ; 4 Culemborg, R (Lek) ; 5 Rhenen R (Lek) ; 6 Oosterbeek R (Neder Rhine) ; 7 Arnhem H (Neder Rhine) ; 8 Westervoort HR (Yssel) ; 9 Dieren HR (Apeldoorn C) ; 10 Doesburg H (Yssel) ; 11 Nymegen H (Waal) ; 12 Nymegen R (Waal) ; 13 Ravestein R (Maas) ; 14 Grave H (Maas) ; 15 Mook R (Maas) ; 16 Gennep R and H (minor) (Maas) ; 17 Zaltbommel H and R (Waal) ; 18 Hedel R and H (Maas) ; 19 Heusden H for secondary roads (Maas) ; 20 Moerdijk H (Hollandsch Diep) ; 21 Moerdijk R (Hollandsch Diep) ; 22 Papendrecht R (Merwede) ; 23 Dordrecht H and R (Old Maas) ; 24 Barendrecht H (Old Maas) ; 25 Keisersveer H (Bergsche Maas) ; 26 Spikenisse R (Old Maas) ; 27 Maas tunnel H (New Maas).
G Gorinchem ; F Ferry. Some of the road bridges shown are pontoons. The broken line represents the Amsterdam–Rhine C., under construction.

the projected railway along the Zuider Zee dam connecting North Holland province with north Germany via Groningen. This work, not completed by March 1942, would form an important alternative to the route passing to the south of the Yssel Meer. Passengers have for long been carried across the Zuider Zee by railway steamers between Enkhuizen and Stavoren and these services have, since the completion of the Zuider Zee dam, been supplemented by a limited bus service across the dam.

The Railway Network in the Centre and South (*Fig.* 125)

The central part of the Netherlands network is largely double-tracked. While there are many cross lines the pattern is dominated by the routes of the so-called *midden net* (midland system) from Amsterdam to Eindhoven and from The Hague and Rotterdam to Arnhem, with the Amsterdam–Bentheim and Enschede route as a second important trunk line. The midland routes cross at Utrecht and so make this place suitable for the railway headquarters. There is no direct straight line from Amsterdam to Rotterdam ; the two routes pass through Haarlem and through Gouda. The former has direct passenger trains serving large towns en route—Haarlem, Leiden, The Hague, Delft—and traverses the eastern border of the horticultural area. Various short spurs run out from this line to the coastal bathing resorts. The latter runs through an area of pastures. The more densely populated area, which includes Amsterdam and Rotterdam, has railway connection with the rest of the country by only three double-track routes, viz., those via Hilversum, Utrecht and Dordrecht.

Railways are sparse south-west of Rotterdam. Except for the double-track line to Flushing from Roosendaal no standard gauge railway, connected with the network of the Netherlands, has been built to the seaboard of the islands. Between Flushing and Rotterdam the railway has to curve inland to the Moerdijk bridge 15 miles east of the direct line. Dutch (Zealand) Flanders is completely isolated from the Dutch railway system except by a circuitous route well south of Antwerp. In the extreme south, in the Maastricht Appendix, the main lines are double-track but the mineral lines are single-track. The double-track line from Roermond to Eindhoven provides the main link between Limburg and the rest of the Netherlands.

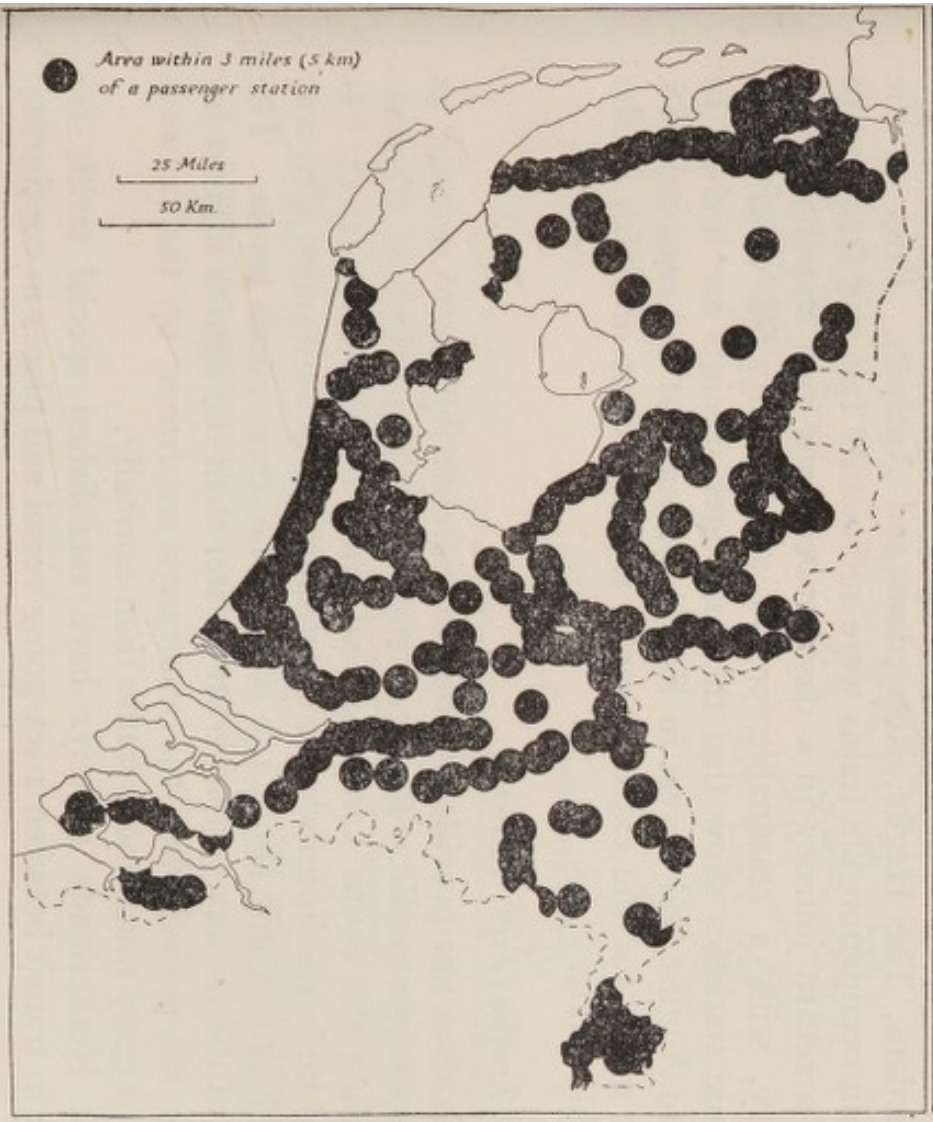
The Railway Network in the North (*Fig.* 125)

The pattern of the railways in the northern half of the country is less closely knit than in the centre and south. In the northern regions, north of the line Amersfoort–Hengelo, the only double-track route is that running from Zwolle to Meppel, where it bifurcates, with one double track going north to the provincial centre of Leeuwarden and the other to Groningen and Winschoten (near the German frontier). While this is a double track line it traverses, over much of its route, areas of sand and peat and as a result the stations are far apart (Fig. 127), for the paucity of settlement does not justify the upkeep of stations. All the other northern lines are single track. South of Almelo along the German frontier are areas of sands, and here are found single-track lines, except the Deventer–Bentheim and Enschede routes of international value, crossing into Germany. A large part of the strategic line parallel to the frontier is single tracked as little traffic originates along it.

Railways across the frontiers

Between the West Scheldt to the south-west and the Ems estuary to the north-east over twenty routes run into the neighbouring countries. Most of the routes are not of great international importance, for the Netherlands lie off most of the direct lines between north-western and central or southern Europe. Two passenger routes for Hook of Holland and Flushing are run from the seaboard. The main routes are those into Belgium and into Germany, the latter having through connections with the North German plain, the Rhine valley and the Ruhr.

Of the eight double-track routes from the Netherlands five (from Oldenzaal, Arnhem, Nymegen, Venlo and Roermond) run into Germany and three (from Roosendaal, Weert and Maastricht) into Belgium. The principal routes into Germany are from Amsterdam via Oldenzaal to Osnabrück–Hamburg–Berlin ; from Arnhem via Emmerich to Cologne ; and from Nymegen via Cleves to Cologne. Of these routes those from Oldenzaal and Arnhem carry the greatest weight of traffic. The single-track lines do not transport much traffic except that from Winterswal to the Ruhr and from the Limburg coalfield to the Aachen coalfield. The only two lines of importance from the Netherlands into Belgium are those from Roosendaal to Antwerp and Brussels and thence to Paris, and from Maastricht to Liége and thence to Luxembourg or to Paris.



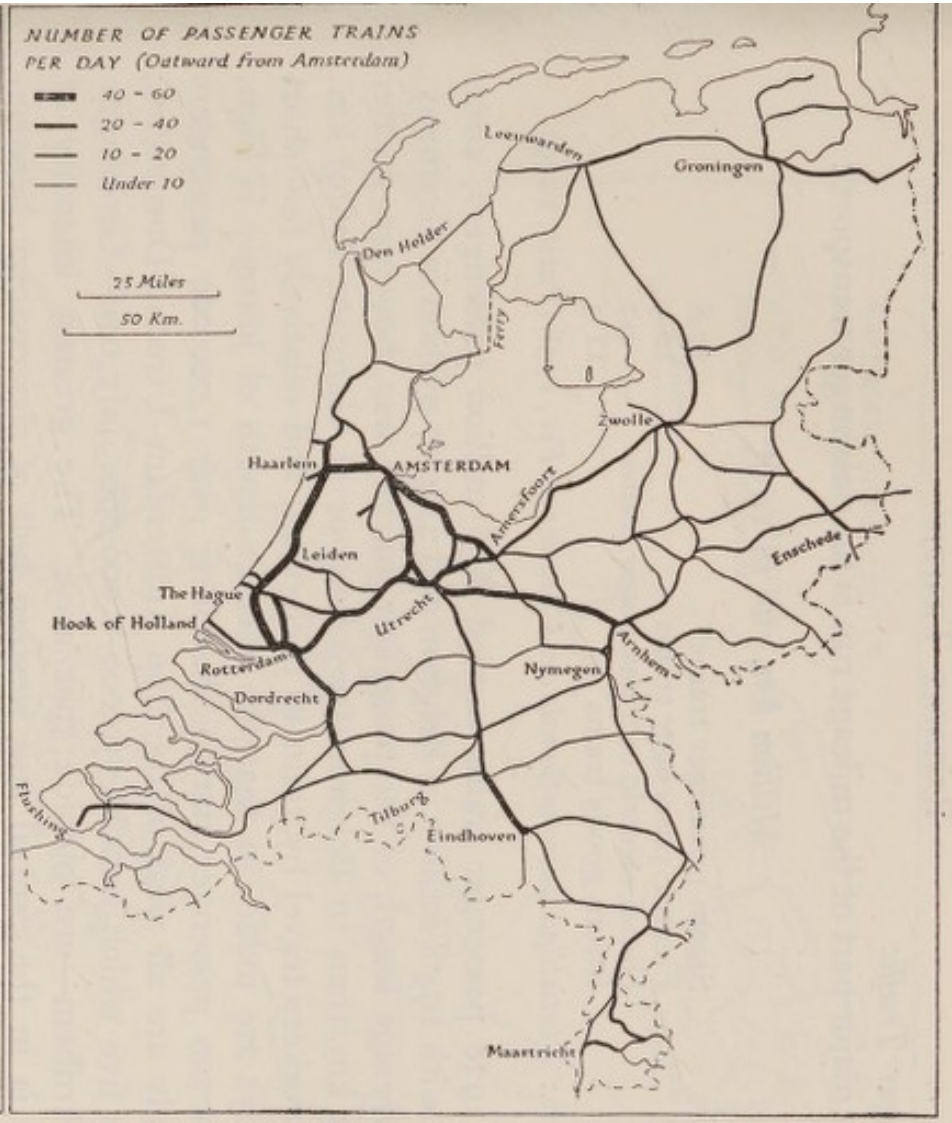


Fig. 127. Passenger stations open and passenger train frequency, October 1939

[35] Data from *Officiele Reisgids der Nederlandsche Spoorwegen*, 15 October 1939, and *ibid.*, timetable A.
In much of the north and south-east there are fewer railways, and the straight-running lines often avoid settlements. The map of train frequency largely reflects the distribution of population; it is not a complete index of the availability of trains, for junction connections were well timed, and thus increased the value of the services provided.

Railway Traffic

Passenger Traffic

The major part of the mileage run is for passenger transport :

Million km. run in 1938

Steam passenger trains	27.8
Electric passenger trains	10.9
Diesel-electric etc. passenger trains	4.7
Steam goods trains	11.3

From : *Statistique Internationale des Chemins de Fer*, 1938 (Paris, 1939)

In 1938 passenger trains carried 80·8 million passengers, compared with 194·8 million in Belgium and 2,041·7 million in Germany. The average length of the passenger journey was, however, greater at 38·5 km. than in Belgium (30·6 km.) or in Germany (28·9) km. Few workers travel by train to their work and relatively few short journeys are made, so that the average length of journey is high. The seven passenger stations handling over 1,000,000 passengers annually are all west of the line Amsterdam–Utrecht–Dordrecht ; of the five which handle 750,000–1,000,000, only two—Groningen and Arnhem—are outside that area. The greatest intensity of traffic is in the central and western belt of the country between Amsterdam, The Hague, Rotterdam and Arnhem. Prior to the German occupation the trains were sufficiently fast and frequent to allow a return journey in a day between any two stations in the country, with a reasonable period at the outward destination. Revenue statistics show that the passenger receipts are highest in June to August and lowest in February, but that the seasonal flow is not great, for the extreme range is only about one-fifth of the monthly totals.

Goods Traffic (*Figs.* 128–30)

This does not provide so important a contribution to revenue as the passenger traffic. Fig. 129 shows the main flow of wagons, excluding the south Limburg coal lines, in November 1935. It should be borne in mind that the average daily movement each way on each line is only about 150 wagons, i.e. three goods trains. The value of the railway system is far greater than the figures suggest for during the period when the waterways are frozen up the railways have to carry much more traffic than normally.

The Netherlands railways have established special tariffs for goods in transit between a sea-going vessel and places in continental

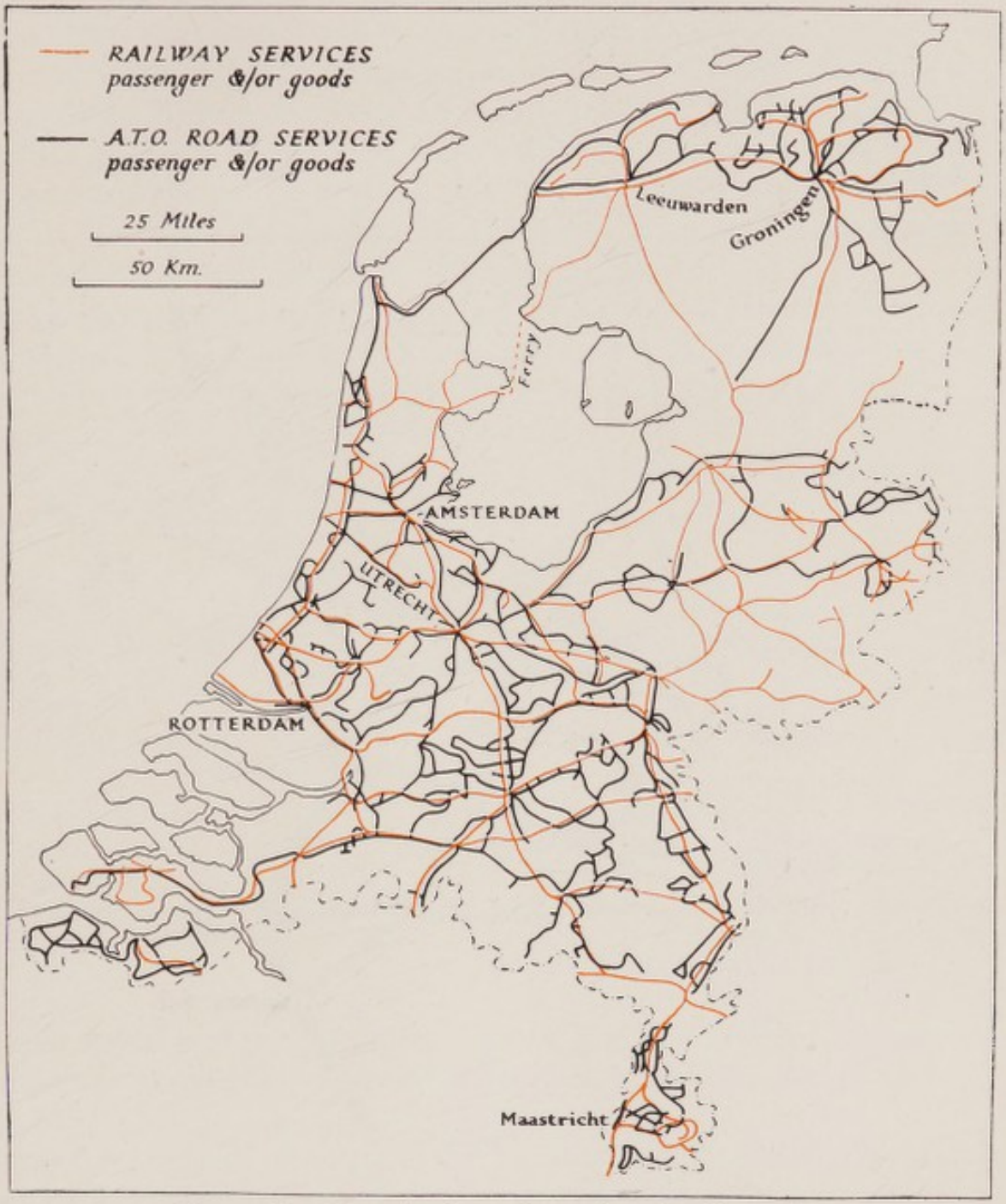


Fig. 128. Co-ordination of road and rail services

From : J. Ente, ' Nieuwe stoppen in den outwikkelingsgan van het goederen-vervoer der Nederlandsche Spoorwegen ', *De Ingenieur*, vol. 52, no. 46, p. 44 ('s Gravenhage, 1937).

The state railway has charge of forwarding goods, which are sent via transit stations ; the road services are integrated with key railway stations. A road-rail container system has been developed which allows transhipment between rail wagon and motor truck without crane facilities.

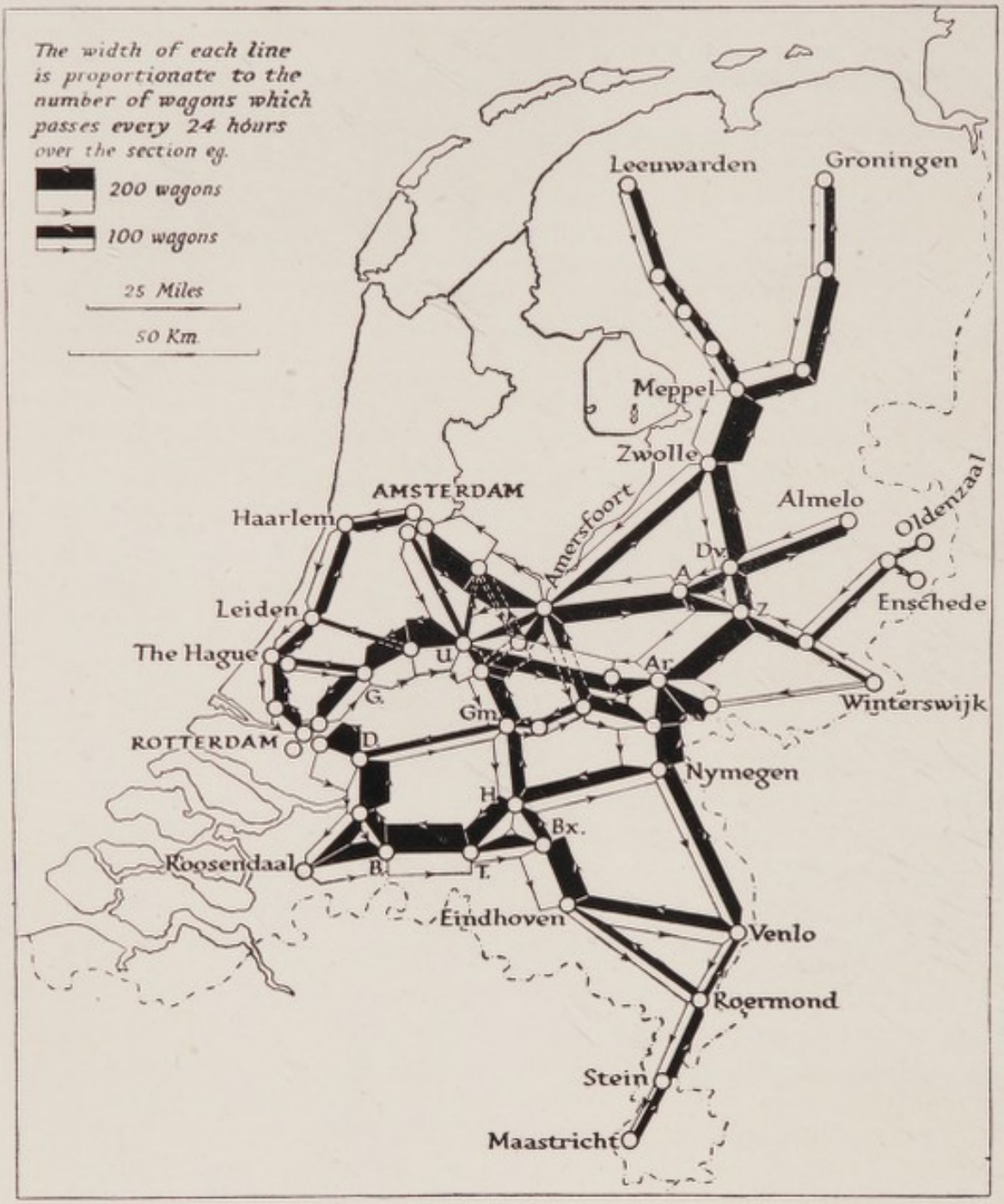


Fig. 129. Goods wagon flow, 1928

From : J. Ente, ' Nieuwe stoppen . . .' *De Ingenieur*, vol. 52, No. 46, p. 45 ('s Gravenhage, 1937).

A Apeldoorn ; Ar Arnhem ; B Breda ; Bx Bokstel ; D Dordrecht ; Dv Deventer ; G Gouda ; Gm Geldermalsen ; H 's Hertogenbosch ; T Tilburg ; U Utrecht ; Z Zutphen.

This diagram shows the flow of wagons, both loaded and empty, on the main lines. It is mainly a reflection of methods of railway working and indicates the routes which bear least waterway competition.

Europe. Even though large reductions are given for consignments of over 1,000 tons, little traffic is moved from the Rhine, for the railway rates cannot approach the river charges. In addition, the German State Railway does not furnish the Dutch with any assistance in competing with the Rhine waterway. The movement of goods between the Netherlands and the two neighbouring countries across the land frontiers is considerably less than the exchanges with these countries by waterway (see p. 594).

The greater part of the traffic carried over the land frontier is by river or canal for both Belgium and Germany. Nevertheless, the railways every year carry considerably more than the roads, while air transport is, as yet, on a very small scale.

The principal items carried by rail in 1938 into (or from) and across the Netherlands were :

From Belgium		*Into Belgium*	
Stone	164,554 tons	Coal	804,403 tons
Cement and lime	50,072 ,,	Coke	610,262 ,,
Coal	44,286 ,,	Briquettes	227,062 ,,
Pitprops	35,793 ,,	Potatoes	63,343 ,,
Chemical products	24,767 ,,	Sugarbeet	51,449 ,,

From Germany		*Into Germany*	
Timber	70,902 tons	Coal	236,407 tons
Machinery	47,371 ,,	Vegetables	101,158 ,,
Animal products	26,636 ,,	Briquettes	59,576 ,,
		Coke	58,466 ,,
		Raw phosphates	42,378 ,,

These statistics include traffic originating in the Netherlands as well as transit trade between countries lying on either side of the Netherlands.

There is comparatively little seasonal variation in the traffic of the total rail-borne freight.

The railways do not feed the ports of Amsterdam and Rotterdam to anything like the same extent as in the case of Antwerp. Only about 2% of the total trade of Amsterdam is handled by rail and only about ½% for Rotterdam as compared with 22% for Antwerp. The traffic at the two ports in 1938 was, in thousand tons :

	By sea	By river and canal	By rail and light railway
Amsterdam	5,655	2,219	186
Rotterdam	42,374	32,662	322

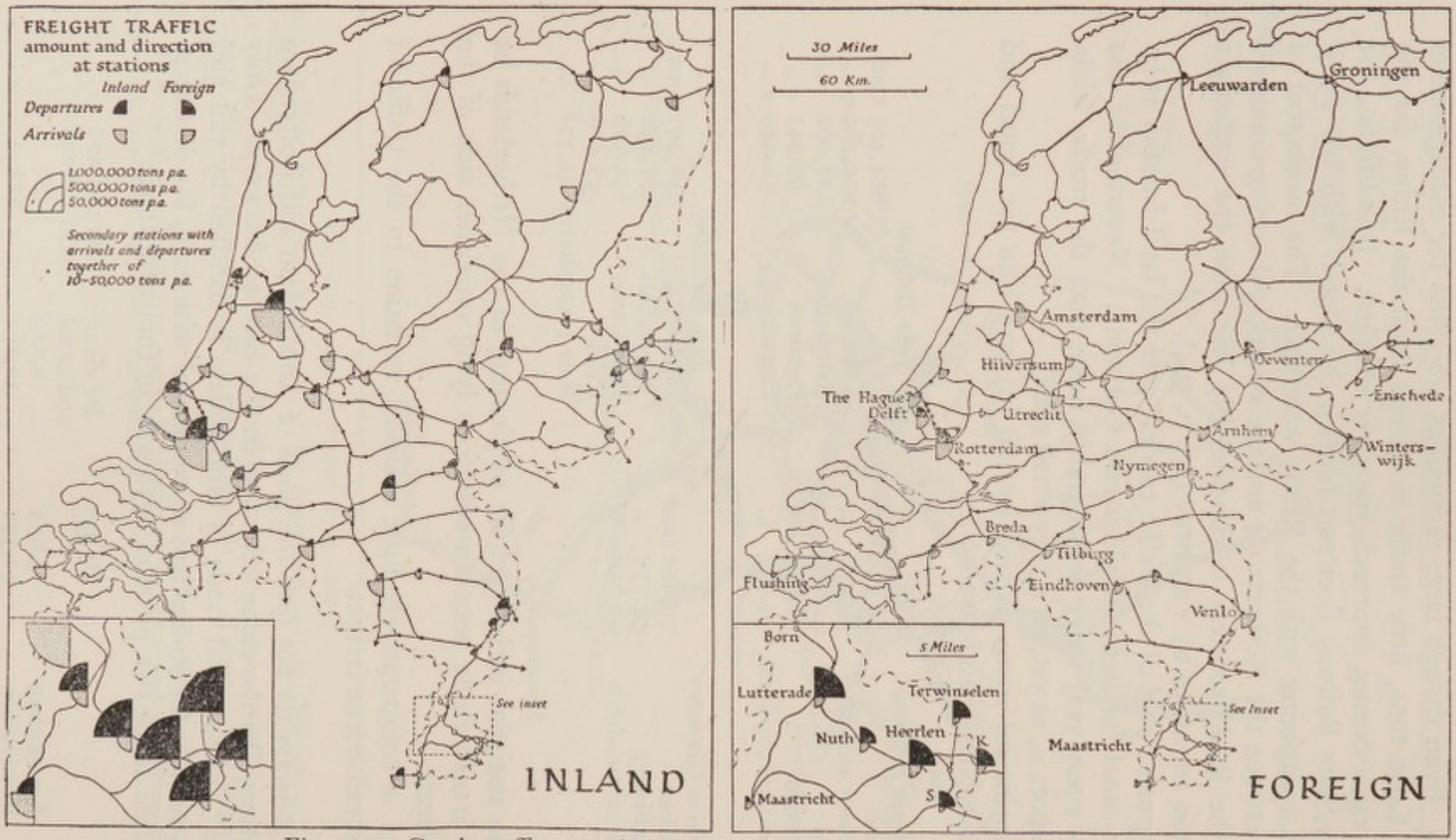


Fig. 130. Goods traffic at stations which handle more than 10,000 tons annually

Data from Table No. 18, *N.V. Nederlandsche Spoorwegen, Verslag over het jaar* 1937 (Utrecht, 1938).

At the two principal centres for general traffic—Rotterdam and Amsterdam—arrivals greatly exceed departures in the inland trade but are about equal in the foreign and transit trade. At nearly all other stations there is a pronounced excess of arrivals in the foreign and transit trade. In Limburg there is an enormous preponderance of outward movement (inland) : coal is despatched by the branch lines to Stein and Born on the Juliana Canal ; there is a considerable preponderance of outward traffic in the foreign trade, arising from the export of Dutch coal to Belgium and Germany.

Tonnage of rail-borne freight per month, 1937, in thousands of tons

Month	Internal own lines	Internal exchange with tram lines		Traffic to and via				Transit	Total
				Belgium		Germany			
		To	from	To	from	To	from		
Jan.	778	24	10	195	29	50	181	1	1,267
Feb.	820	32	11	156	36	56	186	1	1,299
Mar.	862	34	13	159	33	57	218	2	1,377
April	860	26	13	158	38	60	242	2	1,398
May	828	24	11	164	34	30	181	1	1,274
June	884	21	11	165	43	53	191	1	1,368
July	905	23	13	162	43	48	173	1	1,369
Aug.	851	28	14	193	36	45	192	2	1,361
Sept.	860	31	15	180	38	53	204	2	1,381
Oct.	912	27	20	181	37	62	197	2	1,437
Nov.	841	25	18	183	35	62	180	2	1,345
Dec.	762	23	13	167	35	61	196	2	1,259
Total	10,163	318	160	2,062	437	635	2,341	18	16,134
of which total coal	7,157	181	—	1,783	31	289	1,724	—	11,165

From N. V. Nederlandsche Spoorwegen te Utrecht, etc. *Verslag over het Jaar* 1937 (Annual Report), Table 17 (Utrecht, 1938)

Permanent Way and Signalling

The track, constructed to the standard 4 ft. 8½ in. (1,435mm.) gauge, is of flat-bottomed rail weighing 92 lb. per yard for main lines and 76 lb. for branch lines. While the track is well maintained, considerable difficulty arises from the poor quality of the ballast, which consists principally of river gravel or sand from pits in the 'high' central region of the Netherlands. A feature of the track formation is the great number of small bridges and culverts demanded by the many streams, canals, drains and flood-outlets. Most of the curves are of large radius. There are no steep gradients and no tunnels in the country. In 1940 there were 3,667 km. (2,278 miles) route distance—7,149 km. (4,442 miles) of track—of standard gauge track in operation, of which 527 km. (327 miles) were electrified.

	Double Track	*Single Track*
All traffic	1,686 km.	1,629 km.
Goods only	14	338

The axle-load permissible on all the main state lines is 16 tons. This is also true for all the branch lines except those from Alkmaar to Warmenhuizen, Kwadijk to Volendam, and Gouda to Schoonhoven, which can only take 13 tons.

On the Dutch railways the signalling system is akin to the British ; the permanent way construction follows continental practice, with flat bottom rails, but with special Dutch-type sole plates. Semaphore signals are generally standard, with the upper quadrant used on home and starting signals for all-clear and the lower quadrant on distant signals for caution. Bracket signals are used for junction and station route signals as in England. The arms point to the right of the post with the signals on the right-hand side of the track. In order to pick up bearings in the foggy weather so frequently experienced in the Netherlands two approach boards, about 40 yards apart, are placed 150 yards in front of each distant signal. These boards are sloping and painted in broad black and white slanting stripes to draw attention to the distant and home signals. There are as yet only two short sections with colour-light signals : viz., outside The Hague (Holland station) and between Gouda and Oudewater. Colour-light signals are used on bridges, e.g. on that at Rotterdam over the Maas.

Block working, by which the line is divided into sections each controlled from a signal box, is universal on the double-track and is used on some single-track lines.

Fuel and Traction

One of the greatest problems of the Dutch railways is the supply of motive power, and various types of propulsion are employed. Whichever type of engine or motor is used the fuel supply forms a large item in the cost of maintaining the services ; it amounts to nearly one-quarter for steam trains, one-third for electric trains and over two-thirds for diesel-electric trains.

Fuel consumption and cost

Type of motive power	1928		1937		
	Quantity of fuel or power consumed	Cost, million guilders	Quantity of fuel or power consumed	Cost, million guilders	Cost in guilders per 100 train-km. in 1937
Steam	760·0*	7·1	625·0*	5·3	57·35
Shunting-tractor	—	—	1·5†	0·1	30·87
Diesel-Electric	—	—	—	—	41·58
Benzine	0·7†	0·07	1·0†	0·1	—
Fuel Oil	0·1†	0·004	5·2†	0·2	—
Electric	44·4‡	1·7	82·4‡	2·2	43·36

* Thousand tons (coal) ; † Million litres (liquid fuels) ; ‡ Million kWh (electricity).



Plate 78. Amersfoort railway station, looking west

Amersfoort is an important railway junction in the central Netherlands and serves a function not dissimilar to that of Utrecht, about 10 miles to the west.



Plate 79. A diesel-electric train

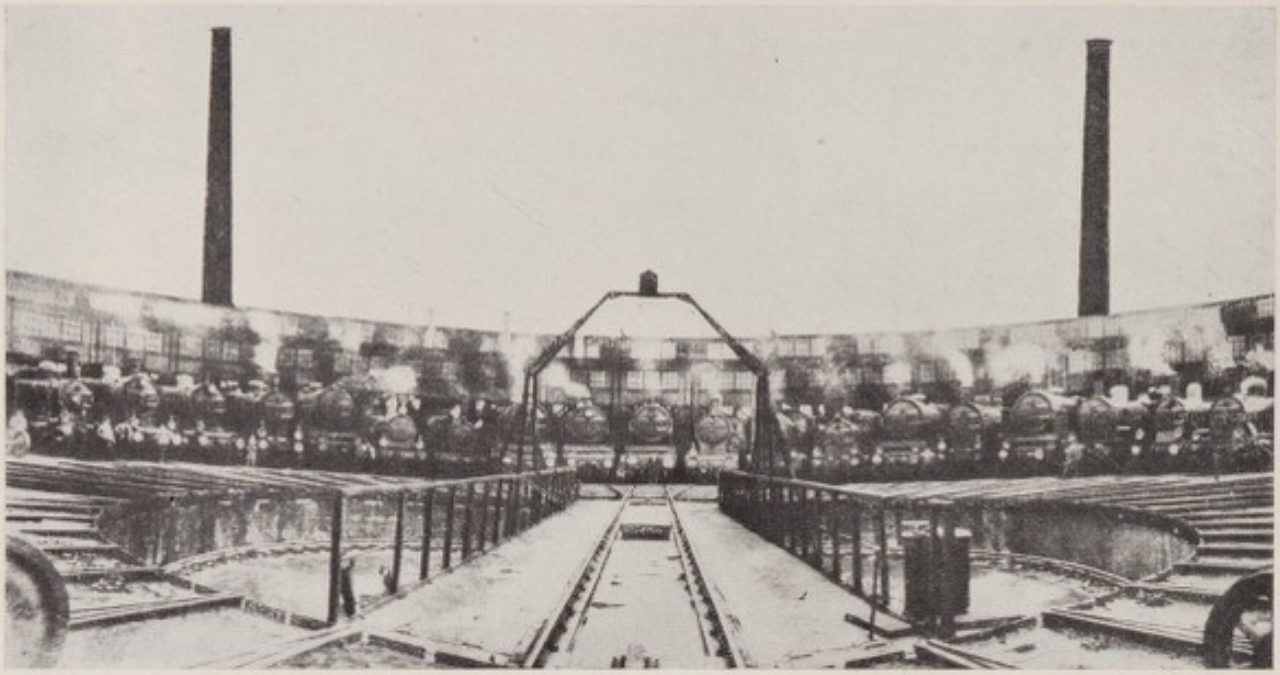


Plate 80. Eindhoven : locomotive depôt

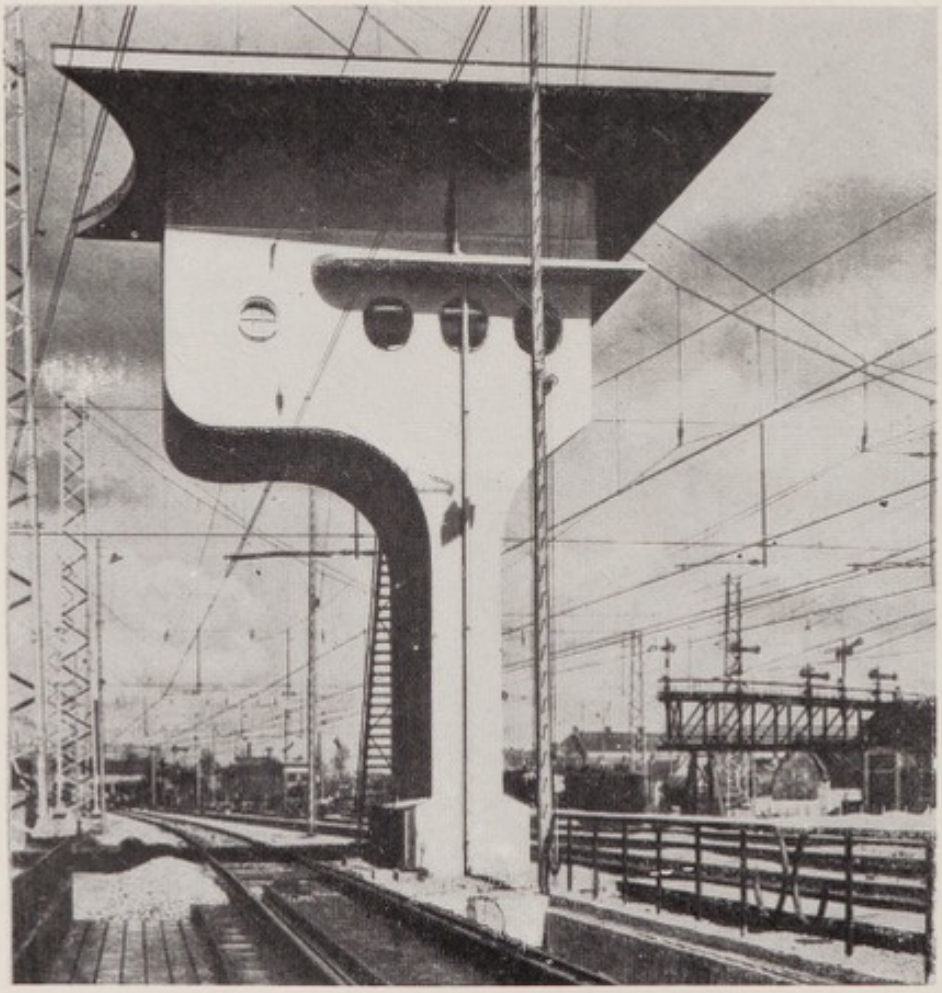


Plate 81. Utrecht : signal cabin of latest design

It is thus seen that the diesel-electric unit, speedier and more convenient in many respects than steam but less than electric, is the cheapest to run as far as fuel is concerned. Maintenance costs of diesel-electric units are high, however.

Locomotive Rolling Stock

The rolling stock in 1939 consisted of :

Steam Locomotives	*Petrol and Diesel-electric Units*	*Electric Units*
891	159 shunting tractors	153 motor vehicles
	40 diesel-electric 3-car units	161 trailers
	37 railcars	61 2-car units
		37 3-car units

The recent electrification has inevitably led, as in Sweden and with the Southern Railway in Great Britain, to both a scrapping and a non-replacement policy with regard to the steam locomotive stud. In 1938 this stud consisted of 901 locomotives of which 159 were of special types. The remaining steam locomotives were divided into the following classes :

No. of coupled axles	*Tender*	*Tank*
2	248	173
3	239	150
4	24	62
5	—	5

The limited number of engines with several axles coupled together is a reflection of the limited mineral traffic and of the easy gradients of the lines, whilst the considerable proportion of tank engines is due to the preponderance of short runs, for which this type is particularly suitable. The paucity of traffic is seen in the relatively small number of locomotives per unit length of line open (see table on p. 555).

Generally speaking, British traditions of steam locomotive design have flourished in the Netherlands. The S.S. railway used 4–6–0 locomotives built by Beyer Peacock, while H.IJ.S.M. adopted Sharp Stewart 4–4–0 locomotives and even continued these styles when locomotives were built in Amsterdam by the *Werkspoor* company, or ordered in the cheaper German markets. The re-constituted *Nederlandsche Spoorwegen* had built in Germany in 1923 and 1930 the 2–8–0 tender engines and the 4–8–4 tank engines for the Limburg coal traffic. For passenger traffic over the whole of the network 4–6–0 tender and 4–6–4 tank engines were provided. In recent years a small number of the engines have been streamlined.

One-man motor-engines (shunting-tractors) have been provided for shunting purposes. These shunting motor-engines are widely used over the Netherlands (Fig. 131), and with the sparse freight traffic have proved invaluable in reducing both overhead and operating costs.

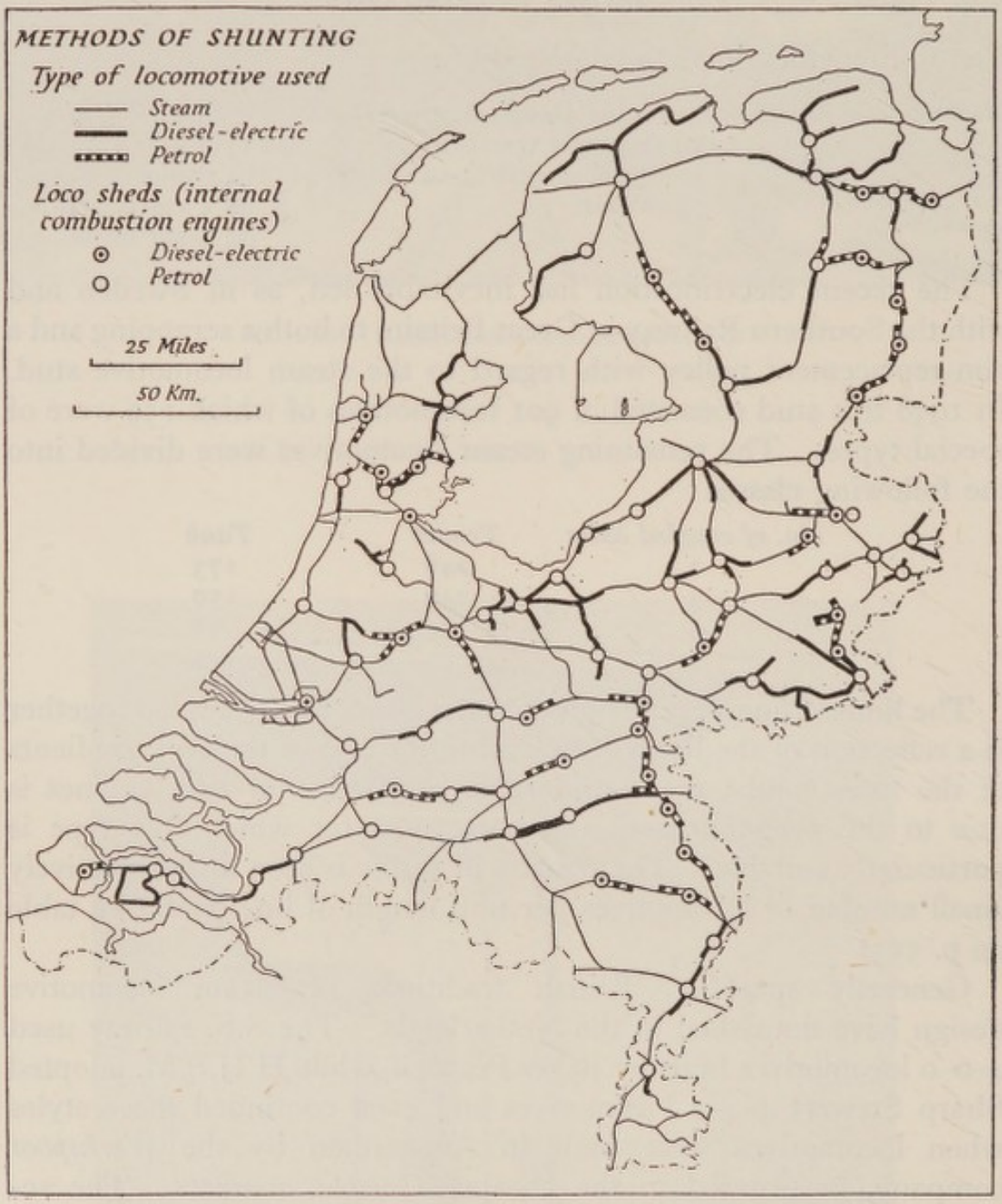


Fig. 131. Methods of shunting for goods traffic on the Netherlands railways

From : J. Ente, ' Nieuwe stoppen, etc. . . .' *De Ingenieur*, vol. 52, No. 46, p. 77 ('s Gravenhage, 1937).

The small goods traffic on the Dutch railway system has encouraged the use of internal combustion engines which are especially suitable and cheap for occasional duty. The centres of heavy traffic viz., Amsterdam, Rotterdam and south Limburg, mainly retain steam locomotives for shunting.

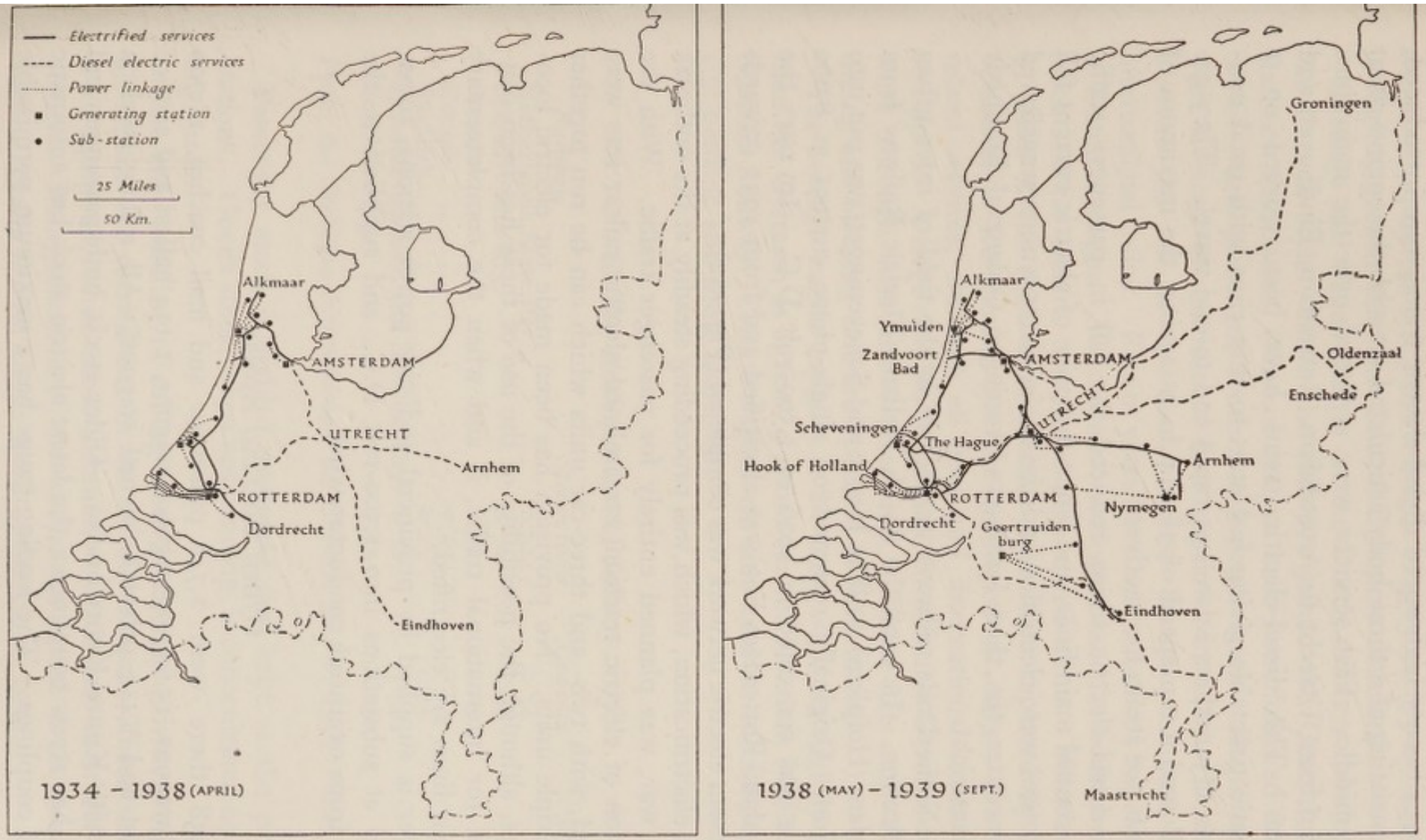


Fig. 132. Electrified and diesel-electric services

From official sources and from information in the *Railway Gazette* (various dates).
The first major electrification connected the two leading cities ; after the operation of diesel-electric tractors to Arnhem and Eindhoven had demonstrated that there was a demand for frequent fast services these lines were electrified. The diesel-electric units were then transferred to less profitable routes in the north-east and south.

In 1934 twenty high-speed diesel-electric trains were introduced, each consisting of a three-body articulated set with the engine-room in the middle. Fast services were arranged over the main lines radiating from Utrecht to Amsterdam, Rotterdam, Eindhoven and Arnhem. The diesel-electric trains have been worked on a systematic timetable giving fast start-to-stop runs with good connections at junctions as well as rapid end-to-end travel. They are now allowed a top speed of 78 m.p.h. as against the maximum of 62 m.p.h. for steam locomotives.

The diesel-electric trains reduced the fall in passenger traffic on the central main lines, and when the price of electric current fell these routes were electrified and the diesel-electric units transferred to other routes, viz., those leading to Groningen, Oldenzaal, Enschede and Maastricht.

The Netherlands railways were early in the field of inter-urban electrification. In 1908 the South Holland Electric Railway from Rotterdam (Hofplein) to The Hague and Scheveningen was put into operation. Originally operated on single-phase current at 6,660 volts, it was converted in 1926 to 1,500-volt D.C. In 1927 the Amsterdam–Rotterdam line was electrified and from 1931 onwards the present electric network was completed (Fig. 132).

The electrification, which was proceeding steadily at the outbreak of the war, was planned entirely for passenger traffic. With the extension of electric traction, streamlined electric railcar sets were adopted, with two- and three-car units which can be run together as multiple units. No provision has been made for electric locomotives, although the possibility of the use of these has been considered for international traffic, if and when the complementary Belgium lines are electrified.

Power is supplied by provincial and city power stations, transformed at substations into 1,500-volt D.C., and supplied to the trains from overhead conductor wires.

Other Rolling Stock

In 1938 there were 2,746 passenger and mail coaches, 11,700 closed wagons, 15,694 open goods wagons, 1,114 ballast and service wagons, and 1,444 privately owned wagons. All rolling stock is fitted with Kunze-Knorr brakes. Older stock, both passenger and goods, has screw couplings ; the latest electric stock has automatic central couplings. The loading gauge has a maximum permissible

width of 3·3 m. (10·8 ft.) and a height of 4·65 m. (15·25 ft.), and so is slightly greater than the Central European standard.

Carriage and wagon design on the Dutch railways developed on the French style. Since the railways joined the Central Europe Railway Association, German designs have been followed for some of the bogie passenger coaches and goods stock. Bogie carriages with lavatory compartments first appeared in 1886. During the nineties the use of end-door coaches became common on the international trains. Recent years have seen a marked improvement in Dutch carriages. Welded steel bodies are used for both new steam stock and for electric and diesel high-speed trains. Wooden seats in some of the third-class coaches have been replaced by leather upholstery. Restaurant cars are employed on only a few of the inland services, although all boat and international trains are so equipped. A large number of Belgian, French and German coaches work through into the Netherlands. *Wagon-Lits* and *Mitropa* dining and sleeping cars are operated in these trains.

The average wagon capacity is 8·1 tons, which is slightly smaller than the German, as against 5·9 tons for the London, Midland and Scottish Railway. Private wagons are only used for special purposes, e.g. benzine and meat transport.

Rolling stock per km. of railway, 1938

Railway	*Steam locos.*	*Coaches*	*Wagons*
Netherlands State Rly.	0·32	0·74	8·21
Belgian State Rly.	0·70	1·43	20·43
German ,, ,,	0·39	1·25	10·42
Danish ,, ,,	0·25	0·77	4·67
Swedish ,, ,,	0·13	0·25	2·55
London Midland and Scottish Rly.	0·70	1·59	25·55
Southern Rly.	0·53	1·93	9·50

From the *Statisque Internationale des Chemins de Fer*, 1938 (Paris, 1939).

Passenger stock is stabled overnight and kept at the principal stations. Goods stock, when not running, is concentrated at certain key yards.

The only building of rolling stock is done in private works, but all repairs are carried out in the railway shops. These shops are well equipped, while most locomotive sheds can cater for minor repairs. Reorganization of the workshops aimed at the concentration of repairs in four shops was in progress in 1939.

Repair workshops : Repairs carried out in 1937

Workshop	Steam Locomotives	Shunting Tractors	Coaching stock			Wagons	Notes
			Steam	Electric	Diesel		
Haarlem	—	80	3,061	280	168	13	
Tilburg	562	—	—	—	—	—	
Utrecht	—	—	2,943	—	28	331	In 1940 scheduled for closure.
Zwolle	270	12	21	—	—	—	Closed in 1939 but not dismantled in that year.
Amersfoort and Blerick (Venlo)	—	—	931	—	—	26,775	Modern shops. Blerick specializes in coal wagon repairs.

There are four private workshops in the Netherlands for building rolling stock, dating back to 1840, when the first Dutch-built locomotive was constructed in Amsterdam. The *Werkspoor* company has a shop at Amsterdam for building locomotives and one at Zuilen (Utrecht) which specializes in goods rolling stock. Coaches are built by *Beynes* at Haarlem and wagons as well as coaches by *Allan* at Hillegersberg.

Train Operation

Trains run on the right on double-track sections. The ' up ' and ' down ' rule in Holland is also the reverse of the British ; ' up ' trains run from and ' down ' trains run towards the main station of Amsterdam. The maximum train speeds are low, although the gentle curvatures and the low gradients are ideal for high-speed work. The relative slowness of the steam trains is said to be due to the poor quality of the Limburg coal used. There are contributory factors for this relative slowness, e.g. the cities are close together and facing junctions are very frequent. Numerous service slacks hinder the slow accelerating steam locomotives. In 1937 there were no runs over 60 m.p.h., but the following year saw the Netherlands participating in the world-wide acceleration of services, for there were 227 runs a day of at least 60 m.p.h., and all these were made with electric or diesel-electric power. The fastest steam run was scheduled 55·2 m.p.h. between Amersfoort and Zwolle.

Unfortunately for international travellers all expresses, e.g. the *Rheingold* (Hook–Basle–Milan), *Edelweiss* (Amsterdam–Zurich), *Etoile du Nord* (Amsterdam–Paris) and the boat trains carrying *Rotterdam-Lloyd* and *Nederland* passengers overland to Marseilles and Genoa were steam operated.

Train guards do not control the running of the trains except in emergencies. Trains are despatched by the stationmaster signalling direct to the engine driver.

None of the marshalling yards is as great as those at Brussels and Antwerp. The principal yards are those serving the ports of Amsterdam and Rotterdam and those at Amersfoort, Groningen and Susteren. With the exception of Amersfoort all the yards are of the hump type. These yards are more important for stabling goods trains and storing goods rolling stock than for actual marshalling, since the distributions needed are so small.

Marshalling yards with a storage capacity of over 750 wagons

Site	*Approx. No. of tracks*	*Storage Capacity No. of Wagons*
Amsterdam		
Watergraafsmeer*	50	3000
Rietlanden	30	1500
Rotterdam		
Ysselmonde*	45	2800
Feijenoord	10	800
Rechtermaasoever	20	1000
Utrecht	20	1200
Amersfoort*	40	2400
Arnhem	15	1000
Elst	20	1000
Nymegen	15	1000
Haren-De Punt (Groningen)*	40	2500
Roosendaal	20	1200
Eindhoven	15	1000
Susteren*	30	1800
Baarle Nassau-Dutch yard	15	800
,, ,, -Belgian yard	15	800

* The average number of wagons handled at each of these yards was 500 to 600 each day. At the other yards it was much smaller.

The capacity of the main lines is governed by the following factors :

(*a*) Track layout and signalling are designed for trains running at eight-minute intervals. Outside the larger termini as far as the first junction the interval may be reduced to three minutes.

(*b*) Passing loops and arrival and departure sidings 600 yards long allow for an engine, fifty four-wheeled wagons and a brake van. On the Delfzijl–Groningen routes only forty wagons can be accommodated in the loops.

(*c*) The locomotive power, sidings and loops and operating methods limit passenger trains to thirteen eight-wheeled coaches

(500 tons gross weight behind the engine) and goods trains to fifty wagons (1,350 tons gross).

Transport capacity of the railways is increased by the short distances involved; night passenger trains are not required and goods trains, therefore, have the freedom of the track at night and do not have to be shunted to permit the passage of faster passenger trains. In addition there is relatively little local goods traffic and only round Amsterdam and Rotterdam does a considerable tonnage have to be handled. The fact that water transport is cheaper and rail traffic quicker means that passenger and perishable goods have their transhipment point on the coast, but goods are taken as far inland as ocean-going ships can penetrate. For this reason Ymuiden, Hook of Holland and Flushing are well equipped for passenger movement, but goods traffic arriving by sea is handled at Amsterdam and Rotterdam.

In the summer of 1938 practically all the principal Dutch lines were given a two-hour express passenger service and certain lines a one- or half-hour frequency throughout the day. As a result the number of trains was increased: between Amsterdam and Groningen, for example, the number was increased from seven to eleven, of which five were diesels; the diesel time was only 2 hr. 25 min. against the steam time of 3 hr. 25 min. Again, on the Amsterdam and Maastricht route the six trains in each direction were replaced by ten new fast trains, of which five were diesels taking 2 hr. 57 min. as compared with 3 hr. 43 min. previously.

German engines in 1938 worked trains from Cologne to Nymegen, Venlo and other places, whilst Belgian engines worked to Roosendaal in turn with Dutch engines to Esschen. Dutch engines worked the local trains over the border in the south to Aachen, and in the east to Bentheim.

The South Limburg Coal Mines Railway System

All the south Limburg coal mines, whether state or privately owned, are connected with each other, with the main lines and with the south Limburg waterways by a system of railway owned and operated by a separate Mines Railways Department, with headquarters at Heerlen in the centre of the mining district. This railway system consists of a major single-track line, with branches to, and large sorting and storage yards at, each coal mine. The marshalling yard for the district is at Susteren. Junctions with the State Railway are at Lutterade, Simpelveld North, Schaesberg and Kerkrade. Three

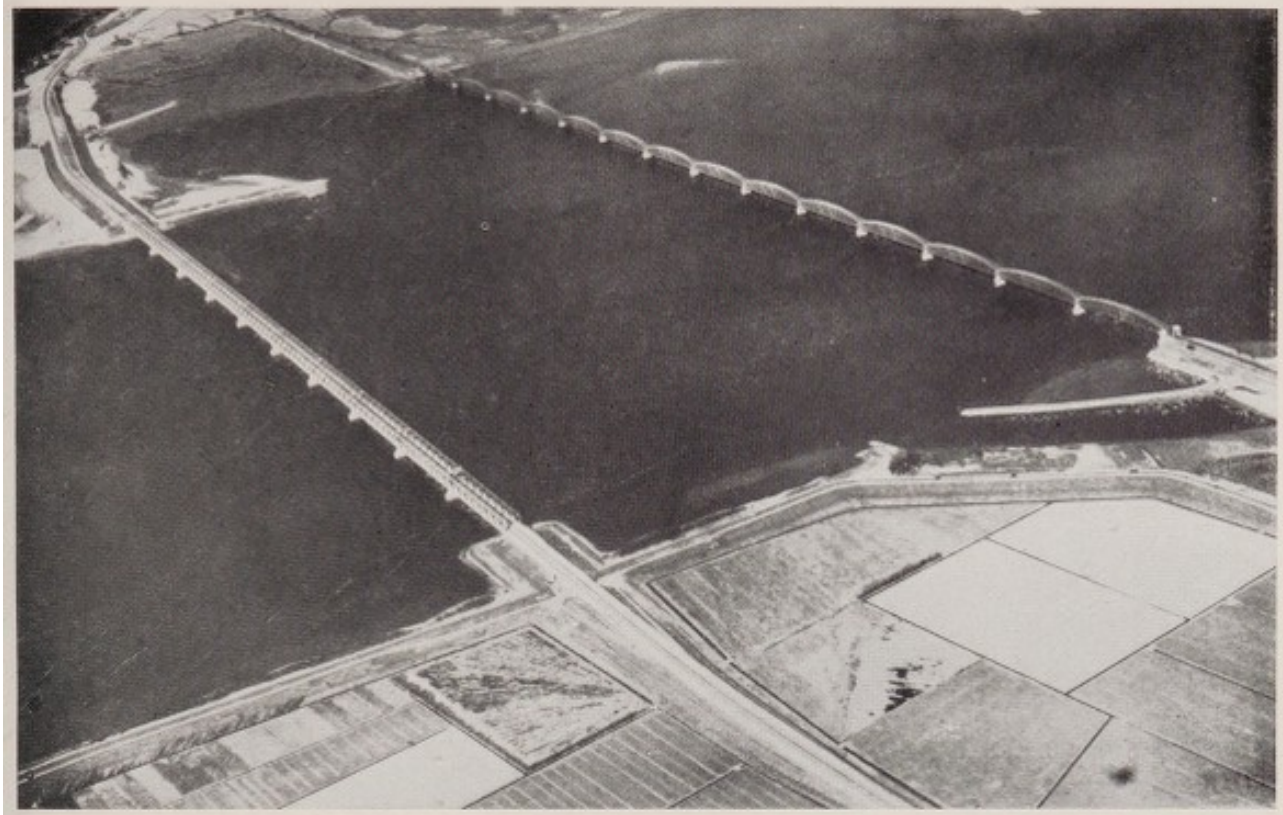


Plate 82. The Moerdijk bridges (Hollandsch Diep) from the south-west

These bridges carry the road and railway connecting Rotterdam with Antwerp. The railway bridge (single track) to the right, 5,000 ft. in length, is the longest in the Netherlands, and was built in 1868–71. The road bridge is an iron box girder type, with a total length of 5,806 ft. and a river span of 3,300 ft.

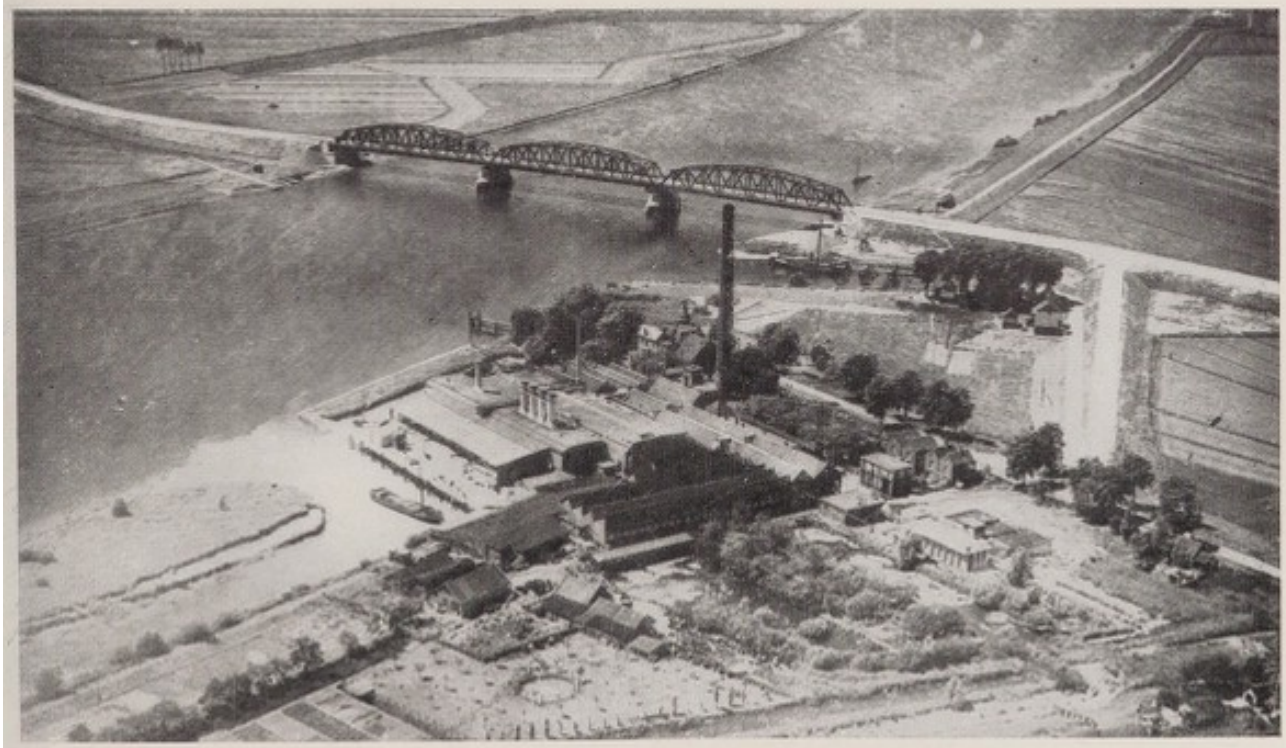


Plate 83. Keisersveer road bridge (Bergsche Maas)

This bridge, with a river span of about 840 ft., carries the road from Breda and Geertruidenberg to Utrecht via a ferry across the Waal at Gorinchem.



Plate 84. Zaltbommel bridges (R. Waal)

These bridges carry traffic between Utrecht and 's Hertogenbosch. The road bridge, to the right, has a river span of about 3,000 ft. The railway bridge to the left carries two tracks.

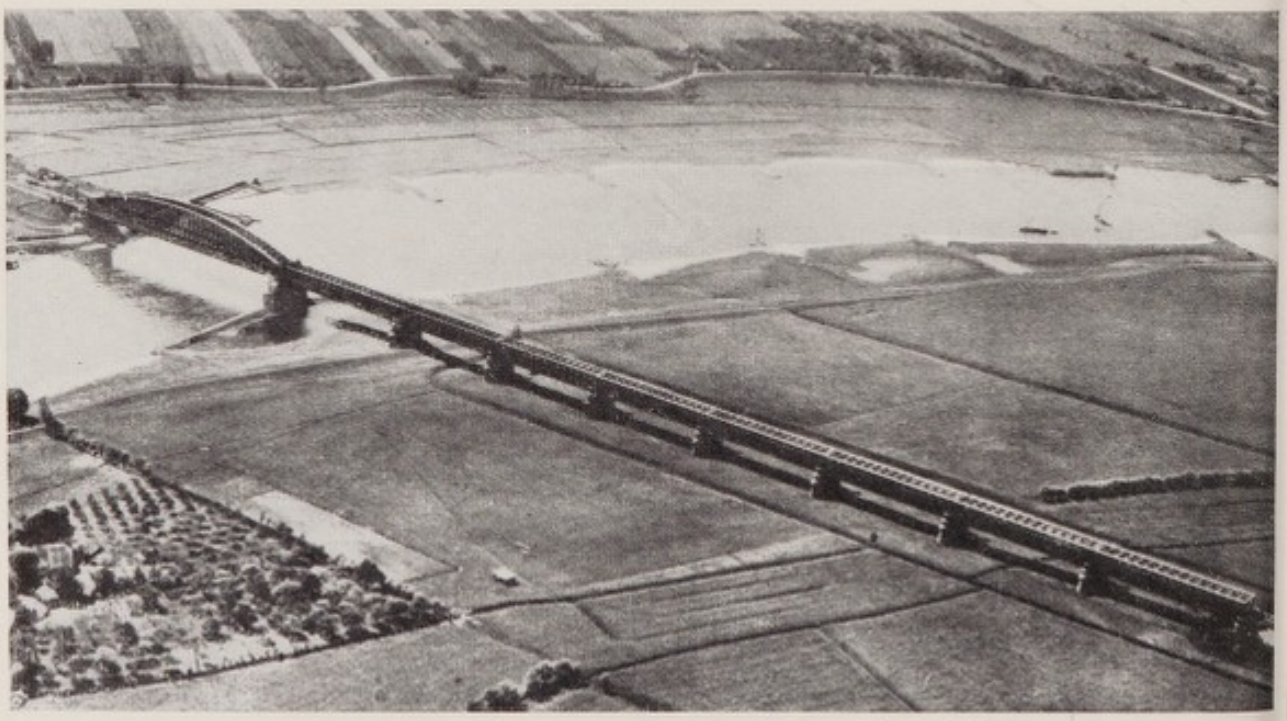


Plate 85. Culemborg railway bridge (R. Lek)

This steel lattice girder bridge with two tracks carries traffic between Utrecht and 's Hertogenbosch, and lies to the north of the Zaltbommel bridges. The total length is 2,300 ft. This picture illustrates how the great width of ground on each side of the river which is usually flooded in winter (*uiterwaarden*) necessitates the construction of long approaches to many bridges—the girder structure in the foreground (north bank), and an embankment of similar length on the south bank.

spurs connect the system with the Juliana canal at Stein, Born and Maasbracht (Fig. 133).

Some idea of the distribution of traffic can be gained from the fact that in 1937, 113,342 tons of coal were handled at the three State Railway coal hoists at Born, while in the same time all the remaining cranes and coal hoists operated by the State Railway only handled 105,495 tons. A further clue as to the traffic is the great weight of freight handled at the junction points with the State Railway. The 1937 statistics, given below for State Railway stations, principally comprise coal and pitprops, and most of this traffic passes over the south Limburg system. The working of the coal trains is aided by the absence of passenger traffic on the system.

State Railway traffic for selected stations in the Limburg Area
('000 *tons*)

	Departures	*Arrivals*
Heerlen	1,865	104
Kerkrade (Mijn Laura)	1,865	104
Kerkrade-Rolduc	771	12
Lutterade	1,345	193
Nuth	1,225	147
Schaesberg	4	1
Simpelveld and Simpelveld grens	52	2
Born	3	2,402
Eijsden	23	80
Maastricht	177	521

From : *N.V.N.S. Verslag, etc*, 1937, Table 18.

Light Railways and Tramways

Light Railways

In addition to the State and south Limburg systems there are in operation both light railways and tramways. Some of the light railways, which are often but branches of a main railway, can take standard rolling stock, whereas others, although of standard gauge, are restricted by a 12½-tons axle load limit. There are forty-three companies operating the light railways and in 1935 they owned 391 locomotives, 3,000 coaches and 42,000 wagons.

In France and Belgium the term ' light railways ' means those built principally by local authorities, but in the Netherlands the term means those built by railway companies according to laws of 1878 and 1889. These laws limited the speed of trains run on such tracks, but for compensation allowed lines to have unfenced track and permitted simpler working. The light track necessitates

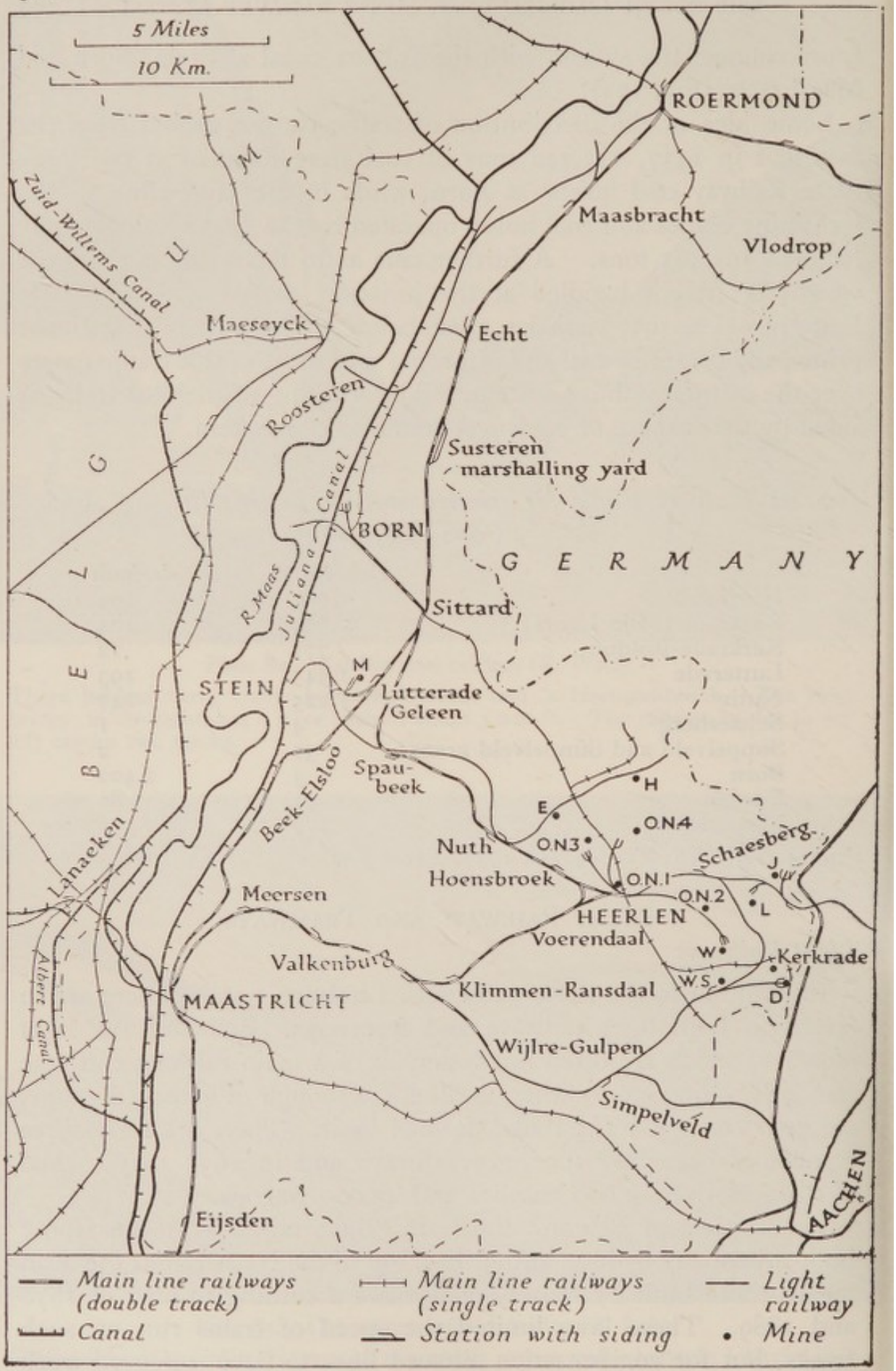


Fig. 133. The railways of south Limburg

From : G.S.G.S. 4183, 1 : 300,000 (1942).
The Limburg mines are served by light railways as well as by the main line system. The chief function of all these lines is to transport coal to the ports of Stein and Born on the Juliana Canal (Fig. 136). For the names of the mines see Fig. 83.

locomotives of lower weight than those of the main system. Despite their limitations, these railways were of considerable value in the past : the Gelderland–Overyssel line, for example, carried raw and manufactured material and coal between Rotterdam and the factories of eastern Overyssel.

The islands of Zealand and South Holland provinces have a 3 ft. 6 in. gauge railway system which connects by a ferry with a terminus at Rotterdam, with Feijenoord (Rotterdam) goods station and with Ysselmonde marshalling yard. The province of Gelderland, east of the Yssel, is served by a 2 ft. 6 in. gauge railway, only used for goods, which has several connecting points with the standard gauge system.

Tramways

In the Netherlands the true equivalent of light railways, as the term is commonly understood, are the tramways. Some of these are owned by the main railways, but most by small local companies. The gauge varies from 750 mm. (2 ft. $5\frac{1}{2}$ in.) to 1,455 mm. (4 ft. $8\frac{1}{2}$ in.). The very lightly built track makes it impossible to use main line rolling stock. Before the widespread closure resulting from bus competition in the last two decades many of the tramways never carried a great tonnage, although others proved invaluable in developing the sugar-beet industry.

Of the 2,500 km. of line in operation until 1934 over half has been closed or scheduled for closing, and most of the remaining lines carry only goods traffic. The most important lines for local transport are the Westland, Netherlands, and Gooi tramways. The Westland tramway, with 34 km. of track and a junction with the main line at Delft, has canal quays and sidings at Loosduinen for vegetables and fruit traffic. The Netherlands tramway in Friesland, Groningen and Drenthe, with 282 km. of line, makes several junctions with the main line. The Gooi tramway, with 19 km. of track, has a circular route which joins two main line stations at Bussum and Hilversum. These three tramways are all suitable for light main line goods stock, but need lightweight engines.

Conditions since the Occupation

During the campaign of May 1940 many bridges were destroyed, including fifteen major ones, e.g. the bridges at Culemborg and Westervoort, but by 1943 these had been replaced. The Germans took up a number of tracks for scrap, removing either the entire

track (as on the Delfzijl–Winschoten line) or else one track from double-track lines (as on the Haarlem–Zandvoort line). Various lines were closed, e.g. Tilburg–Turnhout, Eindhoven–Achel, Weert–Hamont and Maastricht–Hasselt. Some works in progress were continued, such as the completion in 1942 of the electrification of the Utrecht–Amersfoort and Utrecht–Hilversum lines.

Timetables, after an initial disruption, were gradually restored, and within a year of the occupation the following international services were in operation : Amsterdam–Paris, Amsterdam–Brussels Nord, Amsterdam and The Hague–Amersfoort–Rheine–Berlin and Dresden, Amsterdam and The Hague–Emmerich–Cologne–Vienna, Amsterdam and The Hague–Venlo–Heidelberg, Arnhem–Emmerich –Ruhr, Nymegen–Cleves–Cologne and Basle. By May 1941 there were important changes from the high pre-war standards. All services were below the previous frequency ; speed restrictions were severe on steam-operated lines ; all diesel-electric trains were withdrawn ; no proper connections were made at junctions ; closed branches have been reopened to offset the cessation of many country bus services ; trains now run earlier in the day but cease earlier at night, i.e. they now run from 5 a.m. to 10 p.m. ; the bus service across the Zuider Zee dam, which connected with the railways, has been suspended.

The changes in the services before and after the occupation are strikingly illustrated by comparison of the passenger services prior to May 1940 and those working in the summer of 1941, which shows that many services, more especially those operated by steam trains, have been slowed up, and that frequency, even of the electrically-operated services, has been substantially reduced.

Frequency and speed of trains before and after the Occupation

Frequency per day Pre-occupation	Summer 1941	*Route*	*Distance, km.*	*Journey time in minutes* Pre-occupation	Summer 1941
		Electrified			
61	43	Amsterdam–Rotterdam	(85)	70	76
37	18	Rotterdam–Dordrecht	(19)	17	26
38	16	Hook of Holland–Rotterdam	(40½)	31	31
39	16	Amsterdam, The Hague–Utrecht–Eindhoven	(119½)	60	79
36	23	Amsterdam, The Hague–Utrecht–Nymegen	(116½)	71	82
42	23	Amsterdam–Alkmaar	(39)	41	51
39	20	Amsterdam–Ymuiden	(31)	39	43
		Steam			
15	5	Flushing–Roosendaal	(75)	73	115
19	4	Dordrecht–Eindhoven	(89)	77	102
10	1	Roosendaal–Leeuwarden	(313)	304	423
13	5	Eindhoven–Maastricht	(98)	71	124
26	9	Maastricht–Heerlen	(23½)	36	46
6	1	Maastricht–Aachen	(36)	49	73
9	4	Dordrecht–Nymegen	(98½)	125	189
12	3	Utrecht–Groningen	(206½)	126	215
18	5	Harlingen–Nieuwe Schans	(126½)	166	257
13	8	Den Helder–Alkmaar	(41½)	43	61

BIBLIOGRAPHICAL NOTE

(1) Works relating specifically to the Netherlands railways include, besides the timetables, 100 *Jaar Spoorwegen in Nederland* (Utrecht, 1930); N.V. Maatschappij tot exploitatie van Staatspoorwegen te Utrecht, N.V. Hollandsche IJzeren Spoorweg Maatschappij te Utrecht, N.V. Nederlandsche Spoorweg te Utrecht, *Verslag over het Jaar* 1937 (Utrecht, 1938)—this is the annual report of the railways. A useful general study, referring mainly to railway history and traffic, is J. J. Stieltjes, 'De Spoor-en Tramwegen', *Tijdschr. Kon. Ned. Aardrs. Gen.*, vol. 50, pp. 420–78 (Leiden, 1933). A valuable paper is L. Wiener's 'Train speeds and services . . . in Holland', *Monthly Bulletin of the International Railway Congress Association*, vol. 17, pp. 275–304 (Brussels, 1935). Notes on the diesel trains will be found in the same periodical: vol. 18 (1936), pp. 657–8, 746–51 and vol. 19 (1937), p. 1740.

(2) General works with reference to the Netherlands railways include: Verein Mitteleuropäischer Eisenbahnverwaltungen, *Achsdruckverzeichnis* (Berlin, March 1942); Union Internationale des Chemins de Fer, *Statistique Internationale des Chemins de Fer*, 1938 (Paris, 1939).

(3) Convenient maps showing the railway system are G.S.G.S. Series 4183, 1 : 300,000, Railways and Waterways of Holland; G.S.G.S. Series 4438, 1 : 800,000, Europe Communications, Sheet 'Holland, Belgium and Central Germany'.

CHAPTER XIX

WATERWAYS

Introduction : Historical Outline : General Description : The Rhine System of Waterways : The River Maas, Juliana Canal, and Canals of North Brabant : The Merwede Canal and Amsterdam–Rhine Canal : The Secondary Waterways of the North-West : The Waterways of the Eastern Provinces : Technical Features : Waterway Craft : Traffic : Administration : The Future of the Netherlands Waterways : Coasting Trade : Conditions since the Occupation : Bibliographical Note

Introduction

Canals and navigable rivers in the Netherlands assume an importance which is unparalleled in any other country in the world. There are 240 miles of navigable waterway per 1,000 square miles of area, compared with 96 in Belgium, 42 in Germany and 35 in France. The length of waterways navigable by barges carrying 40 tons or more is 3,100 miles (5,000 km.), of which 1,240 miles are natural waterways and 1,860 miles are artificial. There are, further, 1,700 miles of narrow branch canals used by vessels of 20–40 tons. Twenty thousands vessels, operated by 43,000 men, serve this network with an aggregate carrying capacity of 4,450,000 tons ; 719 vessels have individual capacities over 1,000 tons, some attaining 3,400 tons. The entire fleet carries about 30 million tons of cargo annually, or 50% of the total domestic movement of goods, besides handling over one-quarter of the 50 million tons of transit traffic which passes over the Dutch canals.

The great mileage of waterways arises partly from the physical nature of the country and partly from the construction of many small feeder canals in connexion with the main arteries. The Netherlands form part of the north European plain, so that differences of level are not great. Furthermore, it includes the delta lands of the Rhine and the Maas (Meuse), where these rivers attain their greatest volume. The necessity of enclosing them by the building of dykes, in order to preserve the low lying land from flooding (see p. 278), has improved their navigability, although further regulative works have been necessary. The supply of water to canals does not as a rule, present any great difficulty. Of the two main rivers, the Rhine has a comparatively even flow, but the Maas undergoes much greater variation, and considerable works are necessary to conserve its

volume of water. In a normal winter freezing is sufficient to impede navigation on the waterways, although this obstacle becomes serious only in hard winters. Navigation in the Netherlands is affected almost more by ice conditions on the Rhine above the German frontier. In the stretch from Bonn to Emmerich ice occurs during twenty-one days on an average, with a maximum of ten days in January. Ice forms in the elbows where sandbanks reduce the depth. Dangerous floods occur, if a thaw takes place in the upper basin while ice jams exist lower down ; boats may be severely damaged, and hence refuge basins are provided, while such floods can rupture embankments. The use of ice breakers in winter is increasing, and special measures to dynamite ice blocks are now regularly applied.

Historical Outline

Before the present century

In the Middle Ages, before much of the present land surface was reclaimed (see p. 262), it was necessary to travel by water. Even before the thirteenth century important commercial centres, such as Nymegen, Tiel, Zutphen and Kampen, grew up on the banks of the Rhine and its branches, and during the thirteenth century an active trade passed along the Yssel, the most easterly distributary of the Rhine. In the sixteenth century the waterways were of considerable importance during the struggle for independence against Spain, and in the next century the Dutch travelled comparatively easily in their *trekschuit*, a horse-drawn barge, at a time when road communications in their low-lying country were often inadequate. For a considerable period water transport made use of canals which had been cut for purposes of drainage. Extensive works of hydraulic engineering were necessary even before the days of modern engineering appliances. Thus in 1710 the Pannerdensch Canal was cut to give the Rhine an improved bed above Arnhem. Maritime cargoes could be brought inland along the rivers while seagoing ships remained small.

With the nineteenth century came the construction of elaborate canals purely for transport purposes. Two canals which serve for barge navigation were designed originally for the admission of seagoing ships to the ports of Rotterdam and Amsterdam. The Voorne Canal, constructed in 1827–9, with a draught of 17 ft., was superseded by the New Waterway, 1865–76 (see p. 460). The North Holland Canal, constructed in 1820–5, to give access to Amsterdam from the sea at Den Helder, was superseded by the North Sea

Canal, 1865–76 (see p. 493). At the same time, however, the rivers of the country were becoming more convenient for navigation; works for flood prevention and maintenance of navigable channels achieved an increasing success, and after 1850 were undertaken with more and more assurance.

With the extension of the Netherlands railway network in the latter half of the nineteenth century the importance of the waterways declined for a time, but within a few decades attention turned again to barge transport as heavy industry expanded in north-west Europe. An important work was the construction of the South Beveland Canal, 1870, from Hansweert to Wemeldinge, to provide a waterway between the Scheldt and the Rhine, as a substitute for the old route between the island of South Beveland and the mainland, closed in 1866 by the construction of the Flushing railway. On the Rhine itself comparatively little large-scale work was necessary for river improvement. The Dutch had for many centuries maintained tolls on the Rhine traffic at the frontier, like other governments of territory in the basin of the river. In 1831 at Mainz the first international convention for Rhine navigation achieved a reduction of dues, and in 1868 all dues were abolished.

An important undertaking was the connection of Amsterdam with the Rhine. Earlier routes had been first by way of the Zuider Zee and the river Yssel and secondly by the Vaartsche Rijn to Vreeswijk on the Lek, first by the Vecht to Utrecht and later by the Amstel. In 1825, however, owing to shallowness in the Lek, it became necessary to prolong the canal to Gorinchem on the Waal, the new work being known as the *Keulsche Vaart* or Cologne canal. This, however, was too shallow, and traffic turned to the Hollandsch Yssel via Gouda. Eventually came the construction of the Merwede Canal, 1883–92, over the route of 1825, but with a permissible draught of $11\frac{1}{2}$ ft. The canalized Vecht was replaced by an artificial cut.

Developments in the present century

Towards the end of the nineteenth century came ambitious projects to overcome the difficulties of navigation on the Maas, and to reach the Belgian industrial district around Liége. The Zuid-Willems Canal between Maasbracht and the Maas below 's Hertogenbosch had been opened in 1826, and the Wilhelmina Canal from near Helmond to the Bergsche Maas at Gertruidenberg, passing through Tilburg, was opened in 1906. Recent years have seen the

comprehensive Maas improvement schemes—the canalization of the Maas from Grave to Maasbracht, which was completed in 1931, the construction of the Maas-Waal canal across the narrow neck of land between the two rivers, and the construction of the lateral Juliana Canal from Maasbracht to a point near Maastricht. Completed in 1936, the entire work cost *f.* 85 million, more than any other waterway undertaking in the Netherlands ; it permits the ascent almost to Maastricht of barges carrying 2,000 tons.

Two other important works had reached an advanced stage of completion in 1940. In order to give Amsterdam a more direct connection with the Rhine and to allow the passage of 2,000 ton barges the Merwede Canal is being enlarged as far as Utrecht and a new continuation is being constructed to the river Waal near Tiel. A second undertaking is the completion of the Twente Canal for 1,350 ton barges from Zutphen on the Yssel to Enschede and the Twente industrial district, while a direct canal connection to the Rhine near Lobith from Laren-Almen near Zutphen is under construction.

General Description

The length of waterways in each province is as follows :

Length of navigable rivers and canals, excluding canals navigable by vessels of under 20 tons, by capacity of vessels admitted, 1937

Province	Length in miles : Capacity of vessels in tons					
	Great rivers	Over 1,200	700–1,200	400–700	Under 400	Total
Groningen	—	—	34	31	544	609
Friesland	—	—	—	—	1,080	1,080
Drenthe	—	—	—	2	298	300
Overyssel	42	36	—	20	232	330
Gelderland	166	21	—	1	70	258
Utrecht	20	22	1	36	147	225
N. Holland	—	37	79	92	424	632
S. Holland	175	34	—	73	454	736
Zealand	149	27	2	8	1	187
N. Brabant	65	—	5	132	100	302
Limburg	90	22	1	27	15	155
Total	707	199	122	422	3,364	4,814

Of the total length of ' great rivers ' 200 miles are river mouths.

From : *Jaarcijfers voor Nederland,* 1938, p. 323 ('s Gravenhage, 1939).

The waterways of the Netherlands may be conveniently considered under five headings : (A) the Rhine system ; (B) the River Maas, Juliana Canal and canals of North Brabant ; (C) the Merwede Canal and the Amsterdam-Rhine Canal ; (D) the secondary waterways of the north-west ; (E) the waterways of the eastern provinces.

A. The Rhine System of Waterways

The Rhine is by far the best natural waterway in the Netherlands. At Emmerich, just above the Dutch frontier, its flow at low water is 50,500 cubic ft. per second, at mean water level 71,790 cubic ft. and at high water 388,482 cubic ft. The mass of water is so great, however, that the normal variation in level makes little difference to navigation. Low water occurs in September and October before the autumn rains and in January and February during the period of freezing, but is not enough to stop navigation. Winter floods occur after the autumn rains, and secondary floods occur in summer following the melting of snow in the upper reaches.

The Rhine enters the Netherlands at Lobith. A short distance below, at Pannerden, the river divides into two ; the southern branch, the more important, is called the Waal, while the northern branch continues as the Neder-Rhine (Neder-Rijn). At Westervoort above Arnhem the Rhine again divides into two. The main branch continues westwards as the Neder-Rhine, the other being the Yssel which flows northwards into the Yssel Meer (Zuider Zee).

At Wijk-bij-Duurstede the name of the Rhine changes into Lek, the old course of the Rhine via Utrecht to Katwijk, which is still called the Old Rhine, having been cut off many centuries ago. The Lek is rejoined by the Noord, a distributary of the Waal, at Krimpen a/d Lek and the joint stream, now called the New Maas, flows via Rotterdam to the sea by way of the New Waterway. The earlier outlet via Brielle (the New Maas) is now only secondary.

The Waal from Pannerden flows west to Gorinchem where it joins the old course of the Maas ; the joint river is then called Merwede. At Dordrecht the Merwede divides into three : the Noord flows northwards to rejoin the Lek (Rhine) at Krimpen ; the Old Maas, the original main stream, flows west past Brielle to the North Sea ; the Dordsche Kil leads southwards to the Hollandsch Diep and the North Sea. The New Merwede is a short cut, avoiding Dordrecht, from the Merwede to the Hollandsch Diep (Fig. 14).

	Name	From	To	Approx. length (miles)	Barge capacity (tons)
1	New Maas, Merwede, Waal	Rotterdam	Lobith	80	4,000
2	Lek, Neder-Rhine	Rotterdam	Millingen	89	2,000
3	New Merwede	Werkendam	Moerdijk	15	3,000
4	Dordsche Kil	Dordrecht	Moerdijk	10	4,000
5	Hollandsch Diep to East Scheldt	Moerdijk	Wemeldinge	40	3,000
6	South Beveland Canal	Wemeldinge	Hansweert	5½	4,000
7	West Scheldt	Hansweert	Doel (for Antwerp)	15	4,000
8	West Scheldt	Hansweert	Sas van Gent (for Ghent)	45	4,000

The waterways named in this and in the following tables appear in Fig. 134, each being designated by the number assigned to it in the tables.

1. *New Maas, Merwede, Waal* (*Plate* 87).

The river Waal is the most important channel of the Rhine by which vessels can reach Germany from the estuary ports of the Netherlands. The river carries two-thirds of the Rhine water to the sea.

Rotterdam is approached from the sea by the New Waterway and Scheur ; above Vlaardingen the river is known as the New Maas ; a few miles east of the city the Hollandsche Yssel joins it from the north (Fig. 14). A few miles farther east at Krimpen a/d Lek is the junction of the Noord from Dordrecht ; the main east-west stream above this junction is now known as the Lek. The Lek is the continuation of the lesser of the two main branches of the Rhine. It is the Noord which carries most of the Rotterdam traffic south-eastwards and leads it into the chief branch of the Rhine, known first as the Merwede, and eventually, over most of its length, as the Waal.

Dordrecht is a meeting point of four big waterways—the main river and three distributaries. Northwards the Noord connects with the Lek, New Maas and Rotterdam, southwards the Dordsche Kil connects with the Hollandsch Diep and the sea. Westwards the Old Maas (the original main river mouth of the Maas) leads towards the sea ; eastwards is the main Rhine stream—the Merwede and the Waal. At Hardinxveld, opposite Werkendam, a branch leads south-westwards to the Hollandsch Diep and is known as the New Merwede.

A few miles upstream at Gorinchem the southern part of the Merwede Canal, known as the Zoderik Canal, enters the river on the north by means of locks, and a short distance above a short branch of the Maas, the original main channel of the Maas, enters the Waal on

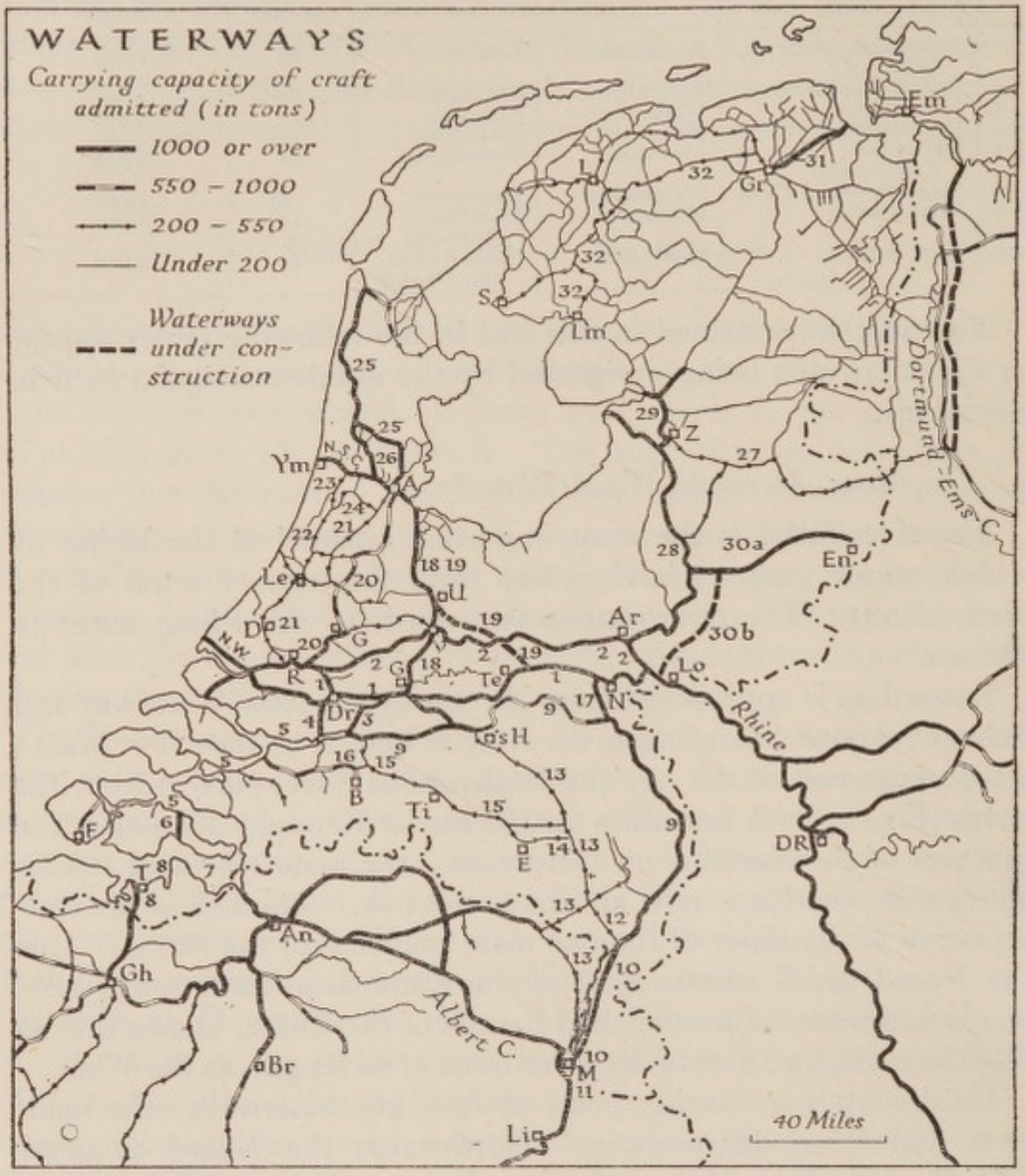


Fig. 134. The waterway network of the Netherlands

From : G.S.G.S. 4183, 1 : 300,000 (1942) ; G.S.G.S. Series 4438, 1 : 800,000, Sheet : Holland, Belgium and central Germany (1943), and other official sources. Each of the principal waterways bears a number corresponding to the number in the general description, pp. 568–83.

A Amsterdam ; An Antwerp ; Ar Arnhem ; B Breda ; Br Brussels ; D Delft ; Dr Dordrecht ; DR Duisburg-Ruhrort ; E Eindhoven ; Em Emden ; En Enschede ; F Flushing ; G Gouda ; G Gorinchem ; Gh Ghent ; Gr Groningen ; 'sH 's Hertogenbosch ; L Leeuwarden ; Le Leiden ; Li Liége ; Lm Lemmer ; Lo Lobith ; M Maastricht ; N Nymegen ; R Rotterdam ; S Stavoren ; T Terneuzen ; Te Tiel ; Ti Tilburg ; U Utrecht ; V Vianen-Veeswijk ; Ym Ymuiden ; Z Zwolle.

N.S.C. North Sea Canal ; N.W. New Waterway.

the south. The main stream is now known as the Waal. Farther upstream, Zaltbommel marks the farthest limit of the influence of the tide. Beyond Zaltbommel the Maas approaches very closely to the Waal and the two streams are joined by a short locked passage at St. Andries, improved in 1934. Below Nymegen the Waal is met by the Maas-Waal Canal, with a lock entrance at Weurt on the south bank. Above Nymegen are two important junctions on the north bank. The first at Millingen, is the Pannerdensch Canal, leading to Arnhem and the Lek, forming the first part of the more northerly of the two main branches of the Rhine. It is an artificial cut, constructed in 1710 to replace the natural branch of the river which was becoming difficult for navigation owing to a frequent shifting of the bed. A short distance above is the entrance to the new Twente Canal. From the Pannerdensch Canal junction the Rhine, now a single stream, is followed by the Dutch-German frontier.

The Waal is about 850 ft. wide at normal low water between St. Andries and Gorinchem. The Merwede is between 1,150 and 1,500 ft., widening towards Dordrecht. There are no locks in any of the sections of the rivers described, seasonal variations being felt along the whole length. The maximum dimensions of barges using the river Waal are : length 419 ft., width 47 ft., draught 10¼ ft., carrying capacity 4,300 tons ; there are also many of 2,500 tons capacity. The larger barges are especially employed in carrying coal from the Ruhr to Rotterdam and ore on the return journey. The maximum dimensions of sea-going steamers passing up the river into Germany are : length 272 ft., width 32¾ ft., draught 9 ft., carrying capacity about 1,300 tons. Loading places varying from well equipped river ports to wharves serving brickyards average about a mile apart as far up stream as Nymegen.

2. *Lek–Neder-Rhine* (*Rijn*)

The Lek–Neder-Rhine is the more northerly and less important of the two branches of the Rhine, offering a lesser depth and carrying much less traffic than the Waal. It is known as the Lek above Krimpen-a/d-Lek (where the Noord comes in from Dordrecht) as far as Wijk-bij-Duurstede. Twenty-three miles above Krimpen-a/d-Lek it is crossed by the Merwede Canal—the southern section of this canal, the Zoderik Canal, enters the river by the Wilhelmina Lock at Vianen and the northern section, or Vaartsche Rhine, as well as the new section constructed in connection with the improvement of the Merwede Canal, enter the river by two separate locks at

Vreeswijk. About twelve miles upstream, just below Wijk-bij-Duurstede, works are under construction for the crossing of the new Amsterdam-Rhine Canal on its way to the Waal above Tiel. The course of the river is known as the Neder-Rijn (Neder or Lower Rhine) from Wijk-bij-Duurstede upstream to the Pannerdensch Canal. Just above the important river port of Arnhem where the Yssel branches off the Rhine is called the Pannerdensch Canal, up to the junction with the Waal.

There are no locks on the Neder-Rhine and Lek. The level varies considerably according to the season and occasionally shipping is held up when the water is low. At Arnhem the river is over 300 ft. wide, the width increasing to 700 ft. below Krimpen a/d Lek. In winter the width may increase to 1,640 ft. Barges up to 2,000 tons can use this waterway, although draught has to be regulated according to the depth of water prevailing. Ports and loading places between Rotterdam and Arnhem average two miles distance apart.

3, 4, 5. *Estuary route to Wemeldinge*

From Moerdijk, which may be reached either by the Dordsch Kil or the New Merwede, lies a route through the Maas and Scheldt estuaries, for barges of 3,000 tons plying between the Rhine and Belgian ports. From Moerdijk the route passes through the Hollandsch Diep, the Volkerak, Krammer, Zijpe, Keeten, Mastgat and the East Scheldt to Wemeldinge, the northern entry of the South Beveland Canal.

6. *South Beveland Canal*

This canal probably carries the greatest traffic of any canal in Europe, about 28 million tons a year. It runs due north and south without a bend, entering the West Scheldt at Hansweert. As it connects tidal estuaries, locks are necessary, the largest of the three at each end being 498¾ ft. long, 52½ ft. wide, and 21¼ ft. deep (Fig. 135 ; Plate 86).

7, 8. *West Scheldt*

From Hansweert the West Scheldt estuary leads to Ghent and Antwerp. The route from Moerdijk to these ports suffers from the drawbacks that except in the South Beveland Canal, traffic is subject to hindrances imposed by fog, rough weather, tides and banks, while in the West Scheldt it has to meet the heavy sea-going traffic of

Antwerp. The locks at Hansweert and Wemeldinge also do not always permit easy handling of barges. As the Belgian ports have the greatest concern in this route, Belgian interests have often

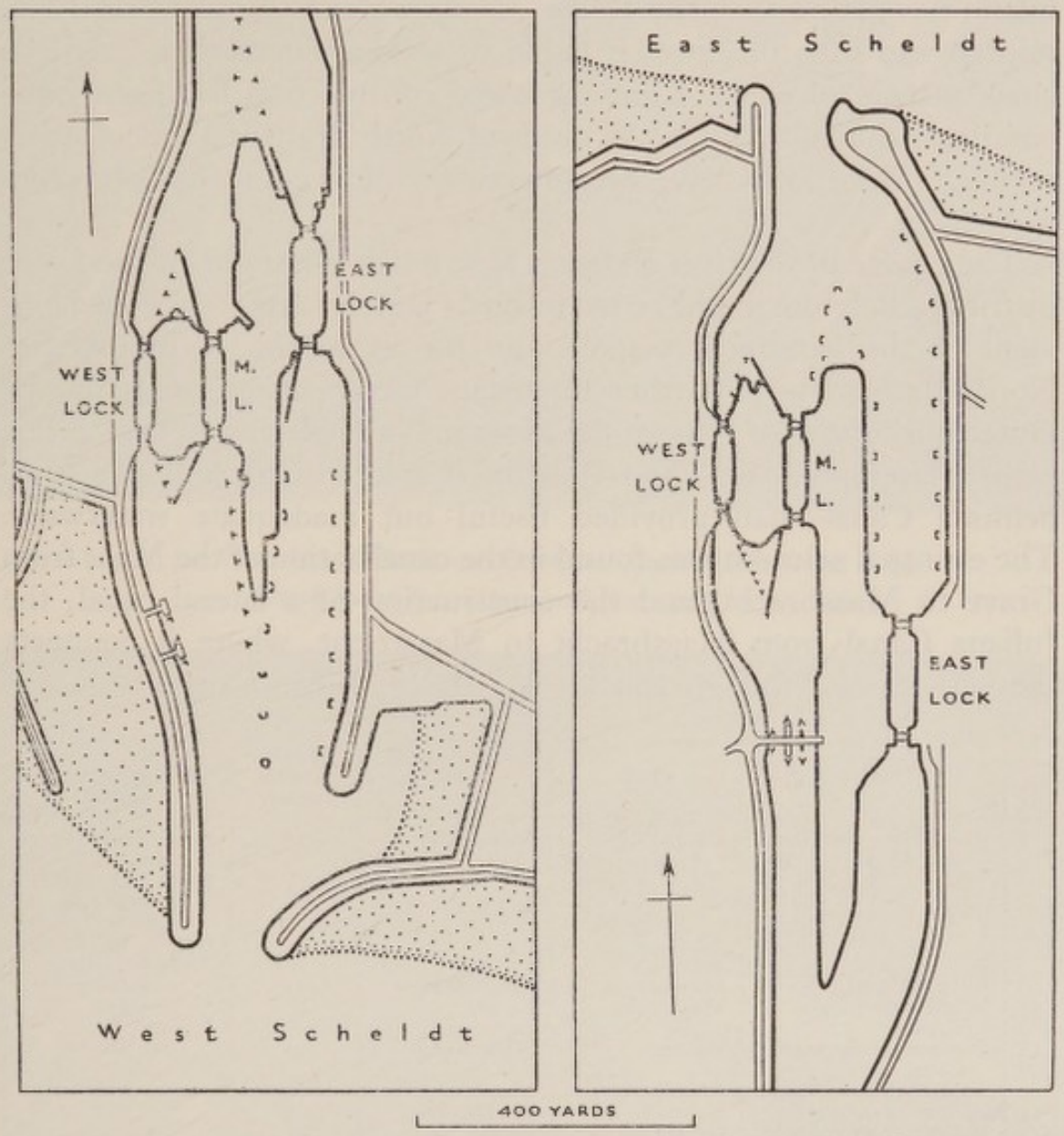


Fig. 135. The South Beveland Canal ports of Hansweert and Wemeldinge

From : *Zeemansgids voor de Nederlandsche Kust*, Bijlage III, Gegevens Omtrent Nederlandsche Havens 1936, pp. 13, 53 ('s Gravenhage, 1937).

M.L. Middle lock.

Hansweert lies at the south entrance to the South Beveland Canal and Wemeldinge at the north entrance. Owing mainly to the heavy traffic between Antwerp and the Rhine these are among the busiest canal ports in Europe.

attempted to secure Dutch agreement to the construction of a direct canal between Antwerp and Moerdijk, free from the problems of the tidal estuaries (see p. 598).

B. The River Maas, Juliana Canal and Canals of North Brabant

The Maas (Meuse) has presented a much more difficult problem for inland navigation than the Rhine, for its water is supplied solely by rainfall and thus the level is liable to serious fluctuations. In the chalk plateau of south Limburg canal construction has been comparatively difficult, and in the sands of North Brabant a loss of water occurs. More locks have been necessary on account of differences of level.

The course of the river suggests how much the traffic of the Liége district in Belgium might be led towards Dutch ports. The development of the Limburg coalfield and the expansion of industry in North Brabant were further important factors in encouraging the Dutch authorities to convert the Maas into a modern waterway. The earlier attempts—the Zuid-Willems Canal (1826) and the Wilhelmina Canal—had provided useful but inadequate waterways. The eventual solution was found in the canalization of the Maas from Grave to Maasbracht, and the construction of a lateral canal, the Juliana Canal from Maasbracht to Maastricht, where it connects the with similar though smaller Maastricht-Liége Canal.

	Name	From	To	Approx. length (miles)	Barge capacity (tons)
9	River Maas and canalized Maas	Geertruidenburg	Maasbracht	133	Below New Dieze, 2,000. New Dieze to Grave, 1,000–2,000. Grave to Maasbracht, 1,500.
10	Juliana Canal	Maasbracht	Maastricht	21	2,000
11	Maastricht–Liége Canal	Maastricht	Liége		450
12	Wessem–Nederweert Canal	Wessem	Nederweert	10	600
13	Zuid–Willems Canal	Engelen	Maastricht	80	450
14	Eindhoven Canal	Helmond	Eindhoven	9	450
15	Wilhelmina Canal	Geertruidenburg	Beek	45	
		Geertruidenburg	Oosterhout		700
		Oosterhout	Beek		500
16	River Mark, Mark Canal	The Volkerak	Breda	29¾	500
		Breda	Oosterhout		
17	Maas–Waal Canal	Weurt	Mook	8½	2,000

9. *River Maas*

This waterway connects the Hollandsch Diep (and thus Dordrecht and Rotterdam) with the Juliana Canal at Maasbracht: although the Zuid-Willems Canal and Wilhelmina Canal provide shorter connections between Geertruidenburg and Maasbracht, the

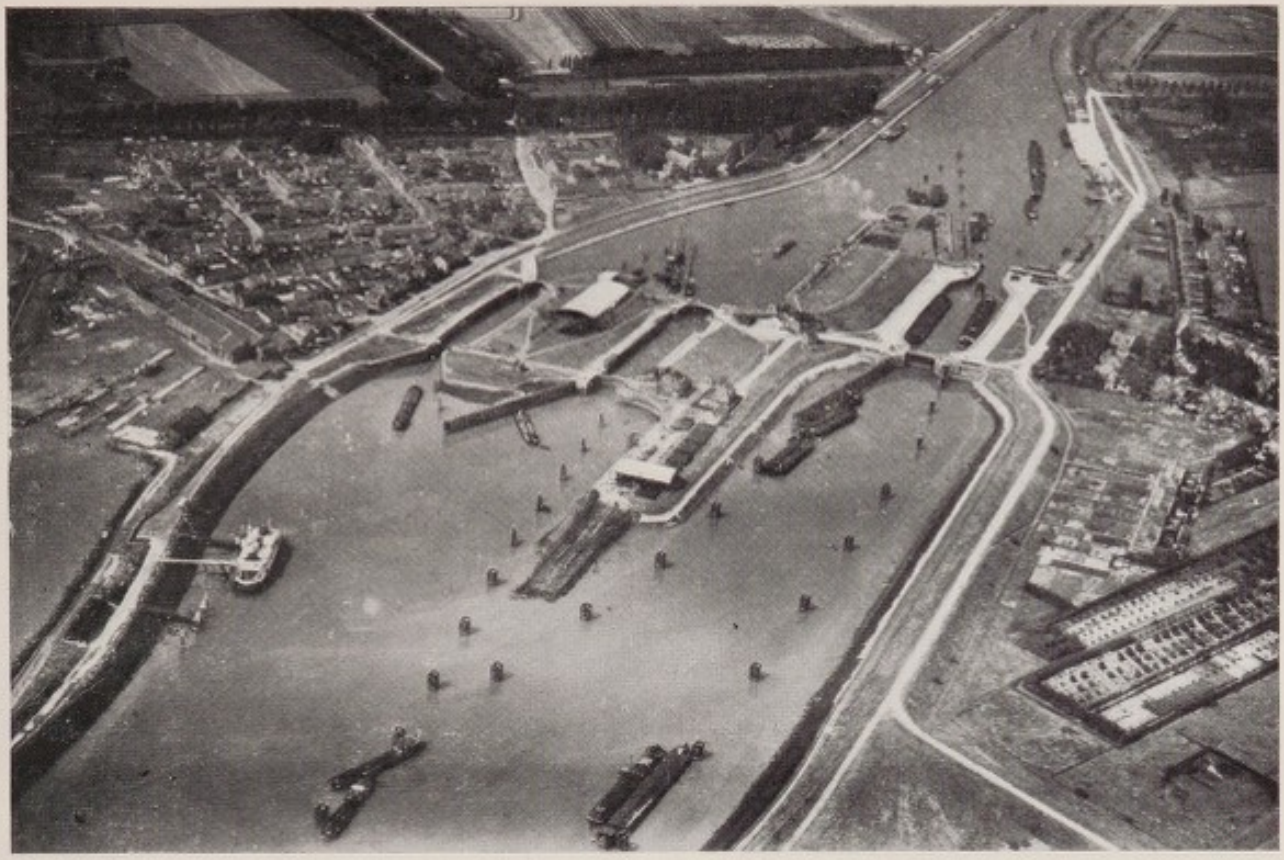


Plate 86. The South Beveland Canal, Hansweert locks
These locks form the south entrance to the canal.

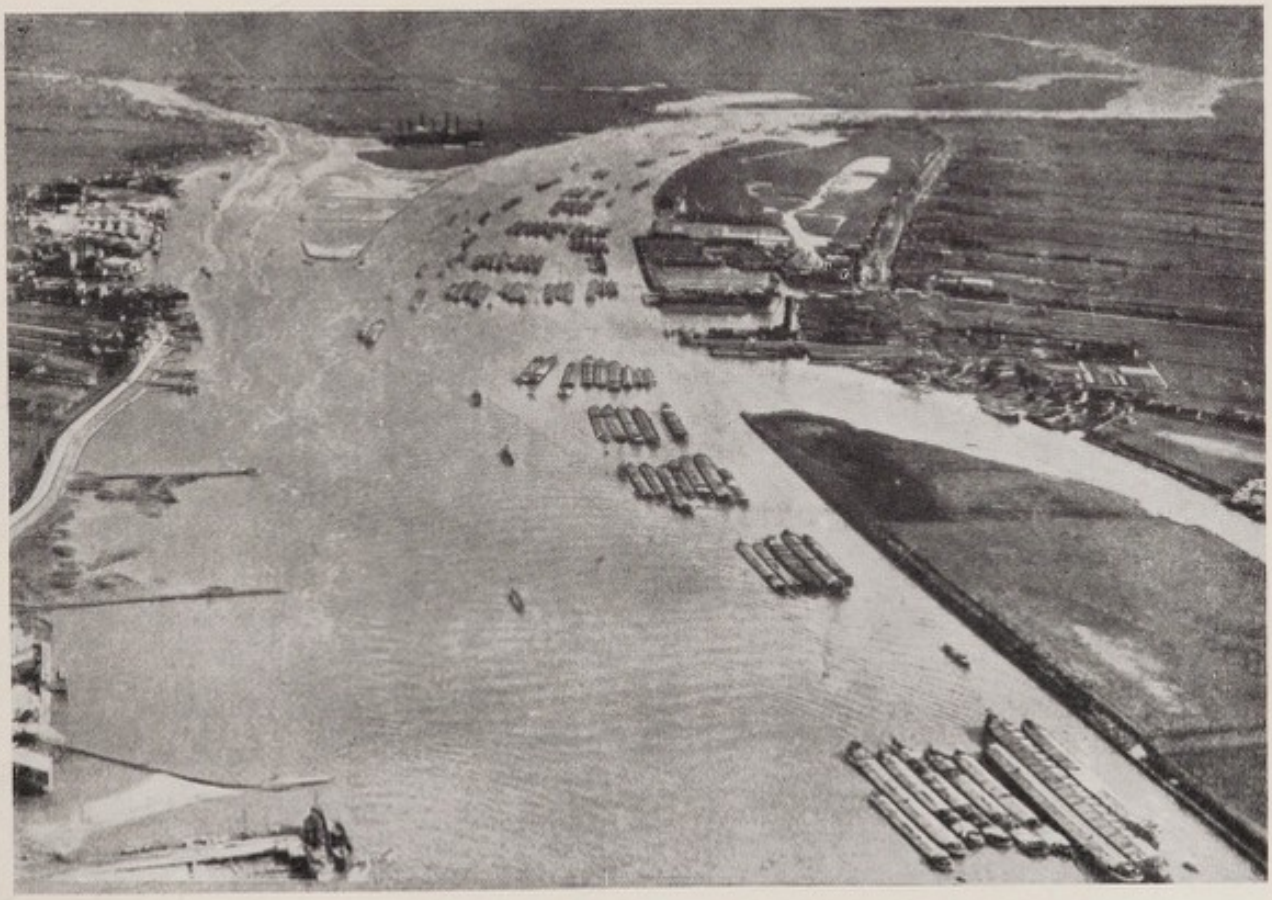


Plate 87. The New Maas above Rotterdam, looking east
In the background the Hollandsche Yssel can be seen to the left and the Noord, leading to Dordrecht and the Waal, on the extreme right. On the curve of the south bank can be seen the buildings of Bolnes, one of the more important secondary centres of shipbuilding and engineering.



Plate 88. Juliana Canal : the coal port of Stein, looking north
The three transporters each have a capacity of 20 tons.

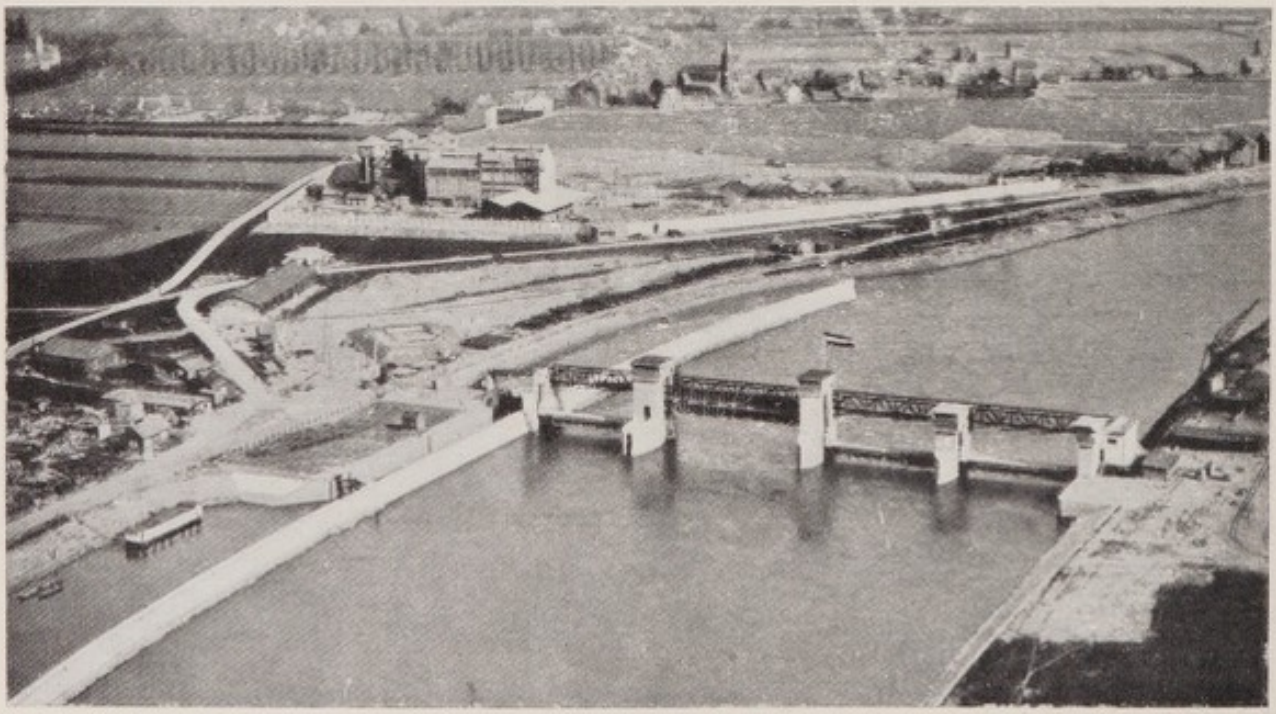


Plate 89. Borgharen : Bosscheveld barrage and lock on the Maas
The lock lies to the left. Since the photograph was taken the Juliana Canal has been cut between the barrage and the factory.

Maas allows the passage of large vessels—1,500 tons as a rule and up to 2,000 tons in places.

Above Moerdijk the river is known as the Amer, and beyond Geertruidenberg as the Bergsche Maas. At Geertruidenberg it is joined by the canalized Donge, leading to Oosterhout and the Wilhelmina Canal. Near Heusden an old course of the Maas branches north-west to the Waal ; near Engelen the Zuid-Willems Canal joins it from the south ; farther upstream is the St. Andries passage leading to the Waal. At Grave the first or lowest barrage and lock marks the beginning of the canalized Maas. A short distance above, near Mook, at the great turn in the course of the Maas, is the entrance to the Maas-Waal Canal. A second barrage and lock stands at Sambeek, 18 miles above Grave, a third at Belfeld, 47 miles above Grave, a fourth near Roermond, 59½ miles, and a fifth at Linne, 65 miles. Loading places are found at short intervals all along the river as well as seventeen ports, of which the most important is Venlo, equipped for the largest ships that can navigate the Maas ; Velden, a few miles below Venlo, is a subsidiary port.

The Maas rises and falls very suddenly after heavy rains, sometimes as much as 13 ft. in a few days. High flood-water at Maastricht reaches Grave two days later. Above Venlo the river is 3–400 ft. wide, and at Mook 650 ft. wide ; below Mook it widens to reach 1,000 ft. in the Bergsche Maas.

10. *Juliana Canal* (*Plate* 88).

Unlike most Dutch canals, this waterway lies mostly between steep banks. The level at Maasbracht is 67 ft. above N.A.P., at Maastricht 112 ft. : the difference in level is surmounted by four locks ; at Maasbracht (No. 1), at Roosteren (No. 2), at Born (No. 3), and at Limmel near Borgharen (No. 4). With a surface width of 152 ft., a bottom width of 51½ ft., and depth of 16½ ft., the canal takes 2,000 ton barges. Near Maasbracht the Wessem lock admits to the Wessem-Nederweert Canal and then to the Zuid-Willems Canal ; above the Limmel lock a cut leads off to the Zuid-Willems Canal and the Albert Canal.

A great part of the traffic on the Juliana Canal originates in the south Limburg coalfield. The two ports of Stein and Born are equipped with modern plant to load coal on to barges ; Stein, which serves the State mines, is designed to handle 1½ million tons of coal and coke annually, and has a total capacity of 4½ million tons. Born, which serves the private mines, has a capacity of 2 million tons.

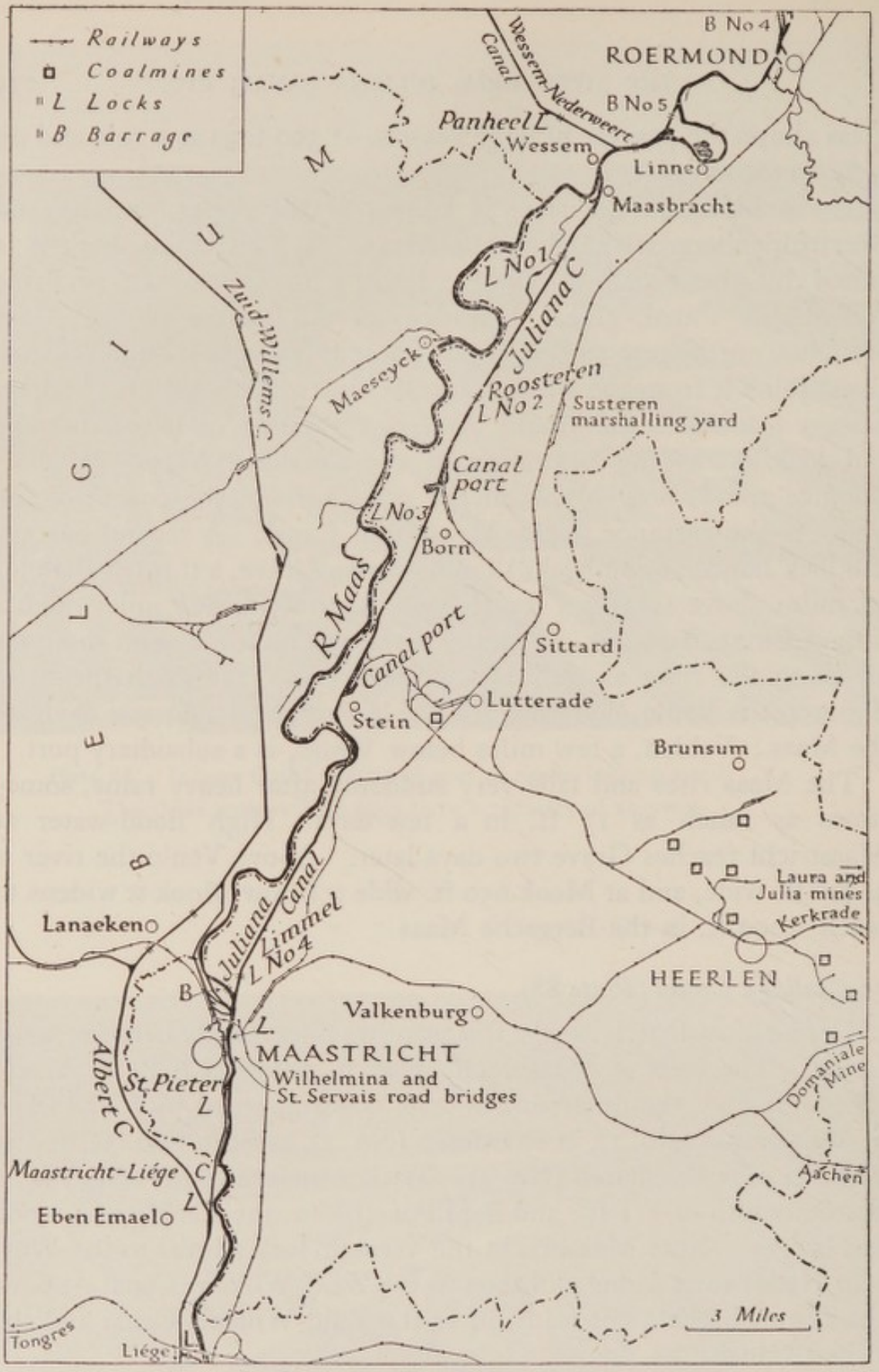


Fig. 136. The Juliana Canal

From : G.S.G.S. Series 4040, 1 : 50,000, Sheets 27 and 37, 47, 48, 58, 59.
A difference of level of 45 ft. between Maastricht and Maasbracht is surmounted by the Juliana Canal, with locks at Maasbracht, Roosteren, Born and Limmel. Below Maasbracht the Maas is canalized, with five barrage-locks. The Roermond and Linne barrages are shown on the map. From Maastricht the Zuid-Willems Canal runs northward, and to the west is connected with the Albert Canal by the Brigden–Neerharen Branch Canal through the Lanaeken locks : southwards, above Maastricht the Maastricht–Liége lateral canal, for 450-ton barges, provides a connection with the much larger Albert Canal. On the Maastricht–Liége Canal the St. Pieter lock will admit 1,000-ton barges, but the Ternaeyen (Lanaye) lock, near Eben-Emael, at the junction with the Albert Canal, forms a bottleneck admitting only barges up to 600 tons.

11. *Maastricht-Liége Canal* :

From Limmel to St. Pieter the Maas is not canalized ; the important manufacturing centre and waterway port of Maastricht stands on the left or west bank. Above the town, at St. Pieter, is the beginning of the smaller Maastricht-Liége lateral canal (15½ miles) with a capacity for 450 ton barges. Opened in 1850 and improved several times since, it represents an early attempt to divert the traffic of the Belgian Meuse towards the Dutch ports. Above St. Pieter the Albert Canal branches off from the canal to Liége. Opened in 1940 the Albert Canal represents the Belgian counter measure to the canalization of the Maas and construction of the Juliana Canal ; it provides a direct route for barges of 1,350 tons between Liége and Antwerp.

Dutch-Belgian Relations and the canals near the frontier

The Belgian plans for the construction of the Albert Canal involved a certain re-defining of the position between the two countries in relation to the canals near their common frontier. In 1936 the Netherlands Government, in agreement with the Belgian Government, submitted to the Permanent Court of International Justice the question as to whether the plan for feeding the Albert Canal from the old and new canals in northern Belgium (and hence ultimately from the Meuse) was reconcilable with the rights acquired by the Netherlands under the Netherlands-Belgian Treaty of 1863 in regard to the diversion of water from the Meuse.

The treaty of 1863 ensured that the diversion of the waters of the Meuse required to feed the Zuid-Willems Canal in Dutch territory and the Kempen Canal in Belgian territory and all Dutch waterways downstream from Maastricht should be confined to a canal (*rigole d'alimentation*) constructed for the purpose in Dutch territory near Maastricht. It was contended by some in the Netherlands that the feeding of the Albert Canal would reduce the volume of water in the Meuse (Maas) and prove detrimental to shipping lower down the river. The Belgian view was that the diversion would not be detrimental, and further, that the construction by the Dutch of the Juliana Canal leading off from the Maas at the lock near Borgharen was an infringement of the treaty of 1863. The Netherlands Government was also anxious that, in return for their acquiescence in the completion of the Albert Canal, the Belgian Government should consent to the construction of a lock at Ternaeyen, uniting the

Liége-Maastricht and Albert Canals, so as to enable vessels of heavier tonnage to pass from Liége to the Juliana Canal. In this way Rotterdam would be ensured at any rate a hypothetical share of the heavier traffic from Liége, which would otherwise have no other outlet to the sea but Antwerp.

By submitting the question to the Permanent Court of International Justice it was possible to secure a final settlement of a troublesome issue. The arrangements for the diversion of water were upheld and Belgian agreement to the enlargement of the Ternaeyen lock was secured. So far it has not been possible to observe how far the Albert Canal will succeed in diverting the Liége traffic to Antwerp away from the Juliana Canal and Rotterdam. The present tendency of relations between the two governments is towards closer co-operation, and this may well lead to a final solution of the outstanding waterway problems.

12. *Wessem-Nederweert Canal*

Opened in 1925, this canal provided a through waterway connection between the industrial regions of North Brabant and the Limburg coalfield. From Nederweert on the Zuid-Willems Canal, at a point where the canal makes its westward bend into Belgium, the Wessem-Nederweert Canal pursues a fairly straight course south-eastwards and enters the canalized Maas near Wessem, just below Maasbracht, and the northern end of the Juliana Canal. There is only one lock on the canal, at Panheel, 1½ miles from the Maas. Barges with a capacity of 600 tons may be admitted, but the canal could easily be converted to take craft of 2,000 tons.

13. *Zuid-Willems Canal and canalized Dieze*

This canal was built to obviate the long detours made by the Maas through Venlo and Grave, and to avoid the strong currents of the river. Of its total length of 80 miles, 33 lie in Belgian territory. It begins at Borgharen on the Juliana Canal three miles north of Maastricht and is connected to the Albert Canal. The course of the Zuid-Willems Canal in Belgium lies through the eastern part of the Campine coalfield. At Loozen, before leaving Belgian territory, it is joined by the Kempen Canal ; at Nederweert in the Netherlands it is joined by the Wessem-Nederweert Canal which leads back to the Juliana Canal, and by the short Noorder Canal. Just to the south of Helmond the Eindhoven Canal branches to the west, and north of Helmond the Wilhelmina Canal branches westward to Tilburg

and Geertruidenburg. From 's Hertogenbosch the Zuid-Willems Canal is continued to the Maas near Engelen by the canalized Dieze and New Dieze. Over the whole length from Maastricht to Engelen there are 22 locks. The canal will take 450 ton barges, and provides good connections between the manufacturing centres of North Brabant and the Limburg coalfield and eastern Belgium.

14, 15, 16. *The Eindhoven Canal, Wilhelmina Canal, River Mark and Mark Canal*

These canals admit barges of 450, 500, and 500 ton barges respectively. They provide heavy transport for the interior of North Brabant.

17. *Maas–Waal Canal*

This canal, 8¼ miles long, was constructed in 1928 and links the Maas at Mook with the Waal at Weurt. The locks at each end admit 2,000 ton barges. The banks are steep and the canal frequently runs in a low cutting or along a low embankment. It was an essential corollary to the improvement of the Maas ; it permits an easy passage for coal barges from Limburg to the north-west Netherlands, and facilitates traffic between the eastern Belgian industrial regions and Rotterdam. The design of the Weurt lock took into account the desire of the Nymegen town authorities for the eventual construction of a big river port entering the canal south of the lock and accessible to the largest Rhine ships. Consequently the lock, like that at Mook, has 51½ ft. clear width.

C. The Merwede Canal and the Amsterdam-Rhine Canal

	Name	From	To	Approx. length (miles)	Barge capacity (tons)
18	Merwede Canal	Amsterdam	Gorinchem	44	2,000
19	Amsterdam–Rhine Canal (uncompleted)	Amsterdam	Tiel	45	Largest Rhine craft

18. *Merwede Canal*

The Merwede Canal is the most important inland canal north of the Lek, as it forms the main connection between Amsterdam and the Lek and Waal. Running northwards from Gorinchem on the Waal it crosses the Lek at Vreeswijk, and continues thence through Utrecht northwards to Amsterdam. The stretch between the Waal

and Lek is known as the Zoderik Canal. From Utrecht northwards the River Vecht, running near the canal most of the way, provides an alternative route of slightly smaller draught than the canal itself. Many small waterways take off on either side, mainly to the west. A branch from the River Vecht eastwards leads eastwards to Hilversum, and another branch leads eastwards to Muiden on the Yssel Meer coast.

19. *The Amsterdam-Rhine Canal*

The Merwede Canal will take barges up to 2,000 tons. Although improved in 1893, it has proved insufficient for general traffic and is inadequate to sustain the interest in connections with the Rhine taken by the Amsterdam authorities. Work on a new connection was started in 1937. The route follows the Merwede Canal from Amsterdam as far as the Utrecht-Gouda railway. Southwards a new canal will run eastwards to Wijk-bij-Duurstede on the Lek, cross the Lek and continue to the Waal at a point just above Tiel. The Merwede Canal itself has been improved by the construction of a new branch running southwards from near Utrecht to enter the Lek at Vreeswijk above the old entrance. North of the Lek the work is approaching completion, and the section from Utrecht to Vreeswijk was opened in 1939 ; between the Lek and Waal the work is probably far from complete, except for the construction of locks. The new section from Utrecht to Tiel, besides serving the function of the canal as a whole, will favour the economic development of the towns near which it passes, and is expected to improve the drainage of the neighbouring area. When completed, the canal will take the largest Rhine craft.

D. Secondary Waterways of the North-West

Between the Waal-New Maas and the North Sea Canal there is a complicated network of waterways, important mainly for the north-south connections which it provides between Amsterdam and Rotterdam, but serving also The Hague, Leiden, Delft and Gouda, and enabling this important centre of population to be cheaply supplied with bulky goods. Northwards, beyond the North Sea Canal, there is virtually only one waterway of importance. All the larger canals of the north-west are navigable by barges of 500 tons capacity or over. The principal routes may be summarized as follows :

	Name	Towns Served	Approx. length, miles	Barge capacity, tons
20a	R. Hollandsche Yssel	Rotterdam—Gouda—Amsterdam	51	600
b	R. Gouwe			
c	Aar Canal			
d	Amstel-Drecht Canal			
21a	R. Schie	Rotterdam—Delft—The Hague—Leiden—Amsterdam	53	500
b	R. Vliet			
c	Old Rhine			
d	Ring Canal			
22	Ring Canal	Leiden—Haarlem	18	600
23	R. Spaarne	Haarlem—North Sea Canal	6	600
24	Haarlemmermeer Ring Canal	Circular route	37	600
25	North Holland Canal	Amsterdam—Alkmaar—Den Helder	49	900
26	Zaan Canal North Holland Canal	Ditto	47	1,000

The Haarlemmermeer Ring Canal, which provides a passage around the Haarlemmermeer Polder, is free of locks ; all the other canals and canalized rivers of this region have a considerable number of locks. An important improvement in recent years has been the construction of the Juliana Lock at Gouda, capable of accommodating 2,000 ton barges, with sills 13 ft. below N.A.P., in order to by-pass the difficult Mallegat Lock. The new lock will permit the progressive adoption of other improvements, several of which are in progress. Certain short sections of these canals can already accommodate barges above the minimum capacity, e.g. the Noorder Spaarne, from Haarlem to the North Sea Canal, can take ships up to 2,500 tons, and the Hollandsche Yssel from Gouda to the Lek at Krimpen a/d Lek can accommodate 1,000 ton barges. The North Holland Canal offers Alkmaar a connection with the port at each end.

E. Waterways of the Eastern Provinces

The canals of the eastern provinces are greater in number than those of any other region of the country. Most of these canals are small but they play an important part in the transport service of these mainly agricultural provinces and form a closer network of routes

than is provided by the railways. The principal waterways are as follows :

	Waterway	From	To	Approx. length (miles)	Barge capacity (tons)
28	R. Yssel	Westervoort	Yssel Meer nr. Kampen	75	2,000 (1,400, l.w.)
29	Zwarte Water	Yssel nr. Zwolle	Yssel Meer nr. Zwartsluis port	15	2,000
30a	Twente C.	(a) Zutphen	Enschede	35	1,350
30b		(b) Lobith	Laren-Almen	25	1,350
31	Ems C. (Eems C.)	Groningen	Delfzijl	20	1,800
32	Starkenborgh C.	Groningen	Lemmer		1,000

28, 29. *R. Yssel and Zwarte Water*

The Yssel forms the most north-easterly of the Rhine distributaries and carries 11–12% of the Rhine water. After leaving the Neder-Rhine at Westervoort just above Arnhem it flows northwards through Dieren, Zutphen, Deventer and Zwolle, to reach the Zuider Zee (Yssel Meer) at Kampen by a delta, and sending off a short branch, the Zwarte Water, at Zwolle, to reach the Yssel Meer a few miles farther north. The river will take large barges, except in periods of low water. It is not very important for through traffic but permits the towns along its banks to have easy communication with Germany and Limburg. The Overyssel Canal branches from the Yssel at Zwolle and Deventer to provide connections with the Twente region.*

30a, 30b. *The Twente Canal*

This canal, approaching completion in 1939, was designed to give the textile region lying around Enschede, Oldenzaal and Almelo a connection with the Yssel at Zutphen, later improved by a direct cut from Laren-Almen to the Rhine near Lobith. These two canals will take barges of 1,350 tons.

31. *The Ems (Eems) Canal*

Capable of accommodating 1,800 ton barges and small sea-going craft, this canal joins Groningen with the port of Delfzijl, and allows the inland city to function as a port and to build small coasting vessels (see p. 521).

The network of minor canals of the north-eastern provinces falls into three broad groups. From Meppel, Zwartsluis, Hasselt and Zwolle they diverge to the north and east, three crossing the German frontier to connect with the North-South and Dortmund-Ems canals.

* This canal appears in Fig. 134 as No. 27.

In Friesland waterways extend in all directions around Sneek and Leeuwarden, reaching the sea at Dokkumernieuwezijlen and Harlingen, and the Yssel Meer at Makkum, Workum, Stavoren and Lemmer. From Leeuwarden one canal runs eastwards to make a connection with the third group, the canals which radiate from Groningen. Of all these minor waterways the largest will accommodate barges of 270 tons capacity, but the majority are fit for barges of 100–200 tons.

32. *Starkenborgh Canal*

Works were recently undertaken to increase the capacity of the canals between Groningen and Lemmer, and on the route thence via the Yssel Meer to Amsterdam, to admit 1,000-ton barges. The work has been continued since 1940.

Technical Features

The Netherlands waterway system has been primarily developed, not for transport, but for defence against flooding, and the barge canals of recent construction have been designed to play an important part in the improvement of drainage in the surrounding countryside. Most of the canals in the provinces of North and South Holland, Utrecht and Friesland, outside the large navigation canals, are designed mainly to serve the drainage of the polders. They have no locks, whereas the canals built for navigation purposes only have locks.

Banks and Channels

The height of banks above water level varies considerably. On the older canals, such as the Mark Canal, Zuid-Willems Canal, Merwede, Leiden-Ring Canal, and North Holland Canal, the banks were kept as low as possible, so that sailing barges could avail themselves of the wind. In more recently constructed canals the banks are generally higher so that big barges in tow may have some protection from a side wind. The rivers are generally bounded by fairly high dykes, in many cases 15 ft. and more above the summer water-level. The banks of the older canals usually slope at an angle of 1 in 2 to 1 in 3, those of newer canals 1 in $1\frac{1}{2}$ or 1 in $2\frac{1}{2}$. The banks of most canals have some form of protection against wave action, such as wooden sheet piling below water level capped by concrete, brick or stone, by mattress work fascines, or by a stone revetment. Where the

canal lies above the level of the surrounding land the dykes enclosing it are wide and of great solidity. As a rule the sealing of canal bottoms and banks has been left to natural processes, and accumulated sediment is usually effective enough. When a seal has been constructed it nearly always comprises a layer of clay on the bottom and lower banks up to water level, covered with a layer of gravel. Heights and depths are usually given in relation to N.A.P. (Nieuw Amsterdamsch Peil) (see p. 22). It is the depth of water which usually limits the size of barge which can traverse a canal, although the dimension of locks are often controlling factors. In the rivers seasonal fluctuation of depth may permit only a lighter loading or a smaller barge in summer. Such limitations were most marked in the Maas, and the canalization works on this river have largely overcome them by a system of five weirs or barrages to impound water.

In the great rivers—Waal, Lek, Yssel, Maas—there is an enormous load of sediment derived from the extensive basins of the Rhine and Meuse. This sediment is kept clear of the navigable channels partly by dredging and partly by the construction of groynes and wing dams projecting from the banks, which narrow the flow of the stream and thus increase the scour. In many parts the rivers are above the level of the surrounding country. Breaches in the dykes could flood the neighbourhood, but would not drain water from the river's deep channels in the centre of the bed, for the bottom of the deep channel is at a lower level than the bed on either side, occupied when the level is above low water level, and is often separated from the deep channel by low ridges below the surface of high water.

Locks

Owing to the flatness of the country the waterways of the Netherlands do not require as many locks to overcome difference of level as the waterways of most countries, and elaborate lock series occur only in the south. Locks are required, however, to deal with the connections between navigation canals and polder canals, and between navigation canals and tidal waters of the great estuaries. Such tidal locks are those at Hansweert and Wemeldinge on the South Beveland Canal, the Wilhelmina lock at Vianen (where the Merwede canal crosses the Lek), and the lock under construction at Tiel on the Waal for the Amsterdam-Rhine canal. These tidal locks, and the larger locks on the Maas and Juliana canal, compare in size with the maritime locks of many seaports ; the lock chamber on the Amsterdam-Rhine Canal at Wijk-bij-Duurstede, for example, is 1,149 ft. long.

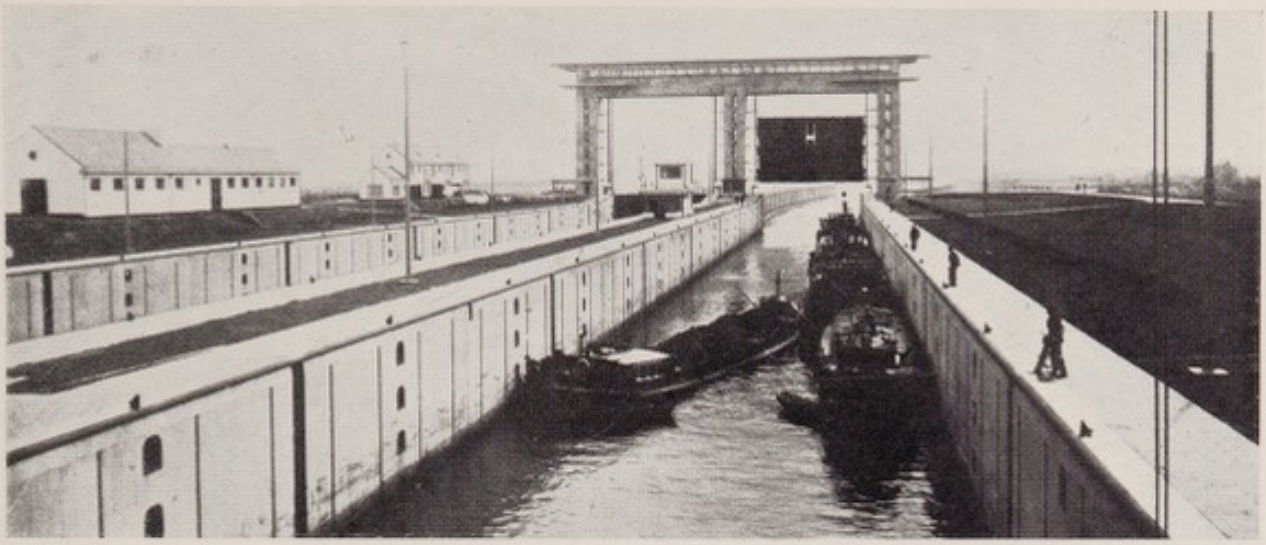


Plate 90. Vreeswijk : the Beatrix Lock

Locks are necessary to permit the passage of barges from one section of the Merwede Canal to the other, across the tidal Lek.



Plate 91. The canal between Delft and The Hague

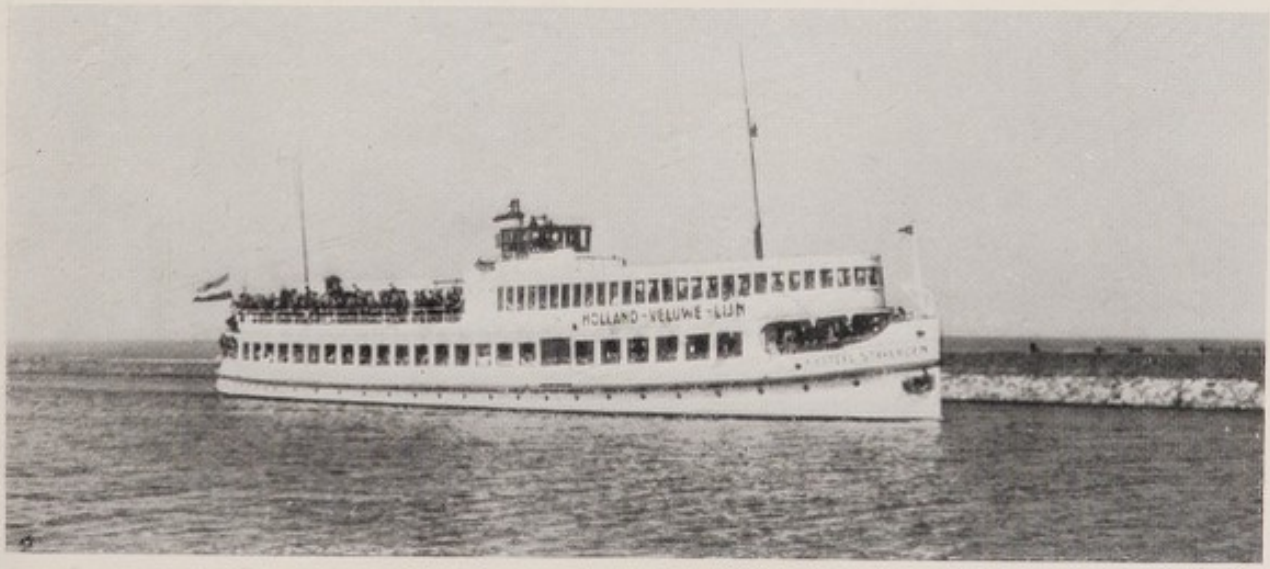


Plate 92. Inland waterway passenger vessel, at Harderwijk



Plate 93. Arnhem : the road bridge over the Neder-Rhine, looking south

This bridge was opened in 1939. The bridge carrying the railway from Arnhem to Nymegen is at Oosterbeek, a few miles to the west, i.e. the right of the photograph (Fig. 63).



Plate 94. Enschede : the town hall

The majority of Dutch canal locks employ hinged gates, although many of the newer ones employ vertically moving caissons, e.g. the locks at Bossche Veld and Limmel on the Juliana Canal.

Waterway Craft

In 1940 there were 20,076 craft, with a carrying capacity of 4,454,000 tons. Of these over 7,000 were not self-propelled (dumb barges), 6,000 were motor driven, 3,500 had both a sail and motor, nearly 300 were steam driven, and the remainder had other forms of power : most of the small vessels were drawn by horses, and a few even by manpower. The great majority of all waterway craft are of the smaller carrying capacities : exactly one-half carry no more than 100 tons each, and 17,504 out of the total of 20,076 carry no more than 500 tons. These 17,504 vessels, however, had a carrying capacity which was less than that of the 2,752 which carried over 500 tons each. The large craft normally used on the German Rhine and on the Waal carry 2,000 tons, and when loaded have only 3 or 4 ft. of water underneath. These barges have a draught of 9 to 10 ft., a width of 40 ft., a length of up to 350 ft., and a superstructure up to 12 ft. above the waterline. A small number carry up to 3,000 tons (Fig. 137).

Of the Dutch waterway fleet the tugs which are employed for

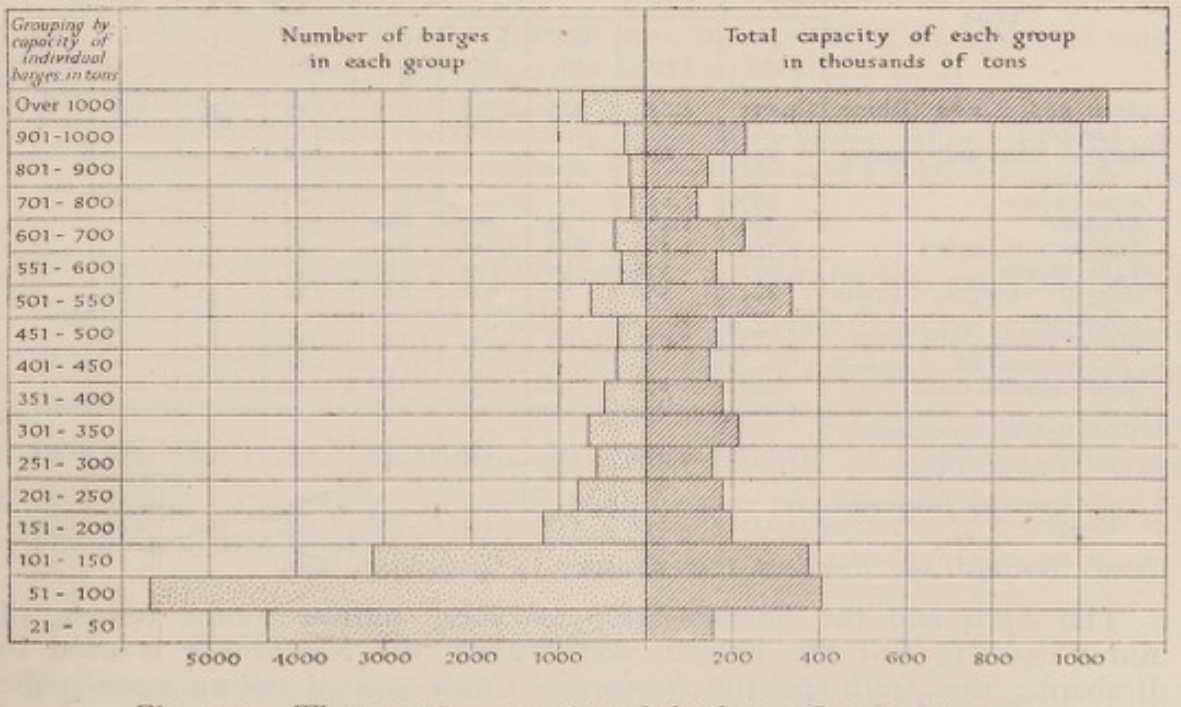


Fig. 137. The carrying capacity of the barge fleet, 9 May 1940
From : *Jaarcijfers voor Nederland*, 1940, p. 328 ('s Gravenhage, 1942).

moving strings of barges number 3,000. They are mostly steam-driven but many are now propelled by diesel engines. The power needed for towage up the Rhine averages 1 h.p. for 6 tons as far as Duisburg and 1 h.p. for 4 tons above Duisburg. On the Rotterdam route river tugs ply along the whole course ; on the Antwerp route from Dordrecht southwards specially constructed tugs, with surface condensers, take barges through the estuaries of the Maas and Scheldt.

Of the fleet of barges under Dutch ownership over one-quarter of the total carrying capacity was built during the seven years 1923–30, and the proportion of new craft with a large carrying capacity was continually increasing until 1930 (Fig. 138). The output of new construction is closely related to general economic conditions, hence in 1933–5 the annual construction was the lowest since 1918–19, and no greater than in 1885–7. In times of falling trade the proportion devoted to larger barges declines sharply. In recent years there has been greater emphasis on tank barges for liquid fuels than on coal and coke lighters. The entire Dutch fleet now has considerable surplus capacity : in former years barges used to circulate and compete freely in France, Germany and Belgium, but now these countries show a decided preference for their own vessels.

Numbers of Waterway Craft over 20 tons, by type and class of capacity
9 *May*, 1940

Type	Total	Total	Principal classes, capacity in tons						
	1934	1940	21–50	51–100	101–200	201–500	501–700	701–1,000	Over 1,000
Aken and *Kanen* (Rhine barges)	4,133	4,822	523	715	829	1,243	339	498	675
Belgian *Spits* and *Sambre Schepen*	194	661			5	656			
Kempenaars	763	1,051				208	832	1	
Klippers	1,370	1,471	43	209	864	354	1		
Tjalken and *Boeiers*	2,750	2,785	802	1,146	824	13			
Tank barges	271	378	80	55	67	97	28	27	24
Hopper barges, grain lighters	481	836	77	322	152	178	51	36	20
Motor vessels, not separately specified	3,523	3,910	1,023	1,407	1,142	318	15	5	
Steam vessels, ditto	327	279	40	56	132	41	1	9	
Total (including unnamed craft) : numbers	17,133	20,076	4,353	5,687	4,310	3,154	1,277	576	719
Total capacity (thousand tons)	3,117	4,454	157	405	578	1,028	730	494	1,062

From : *Jaarcijfers voor Nederland*, 1940, pp. 190-1 ('s Gravenhage, 1942).

The *Spits* and the *Sambre-Schip* are long, narrow motor vessels, of dimensions to suit the Belgian waterways ; the *Kempenaar* is used in Brabant ; the *Tjalk* and the *Boeier* are single-masted sailing vessels, the former being narrow, the latter being broad ; the *Klipper* is a two-masted sailing vessel.

The barges employed on regular cargo services on the Dutch waterways are usually small—100–200 tons. Besides the categories shown separately in the table on p. 586, the fleet includes a variety of other vessels—inland fishing boats, flat boats used in vegetable auctions, dredgers, mud barges and contractors' vessels, etc. Of

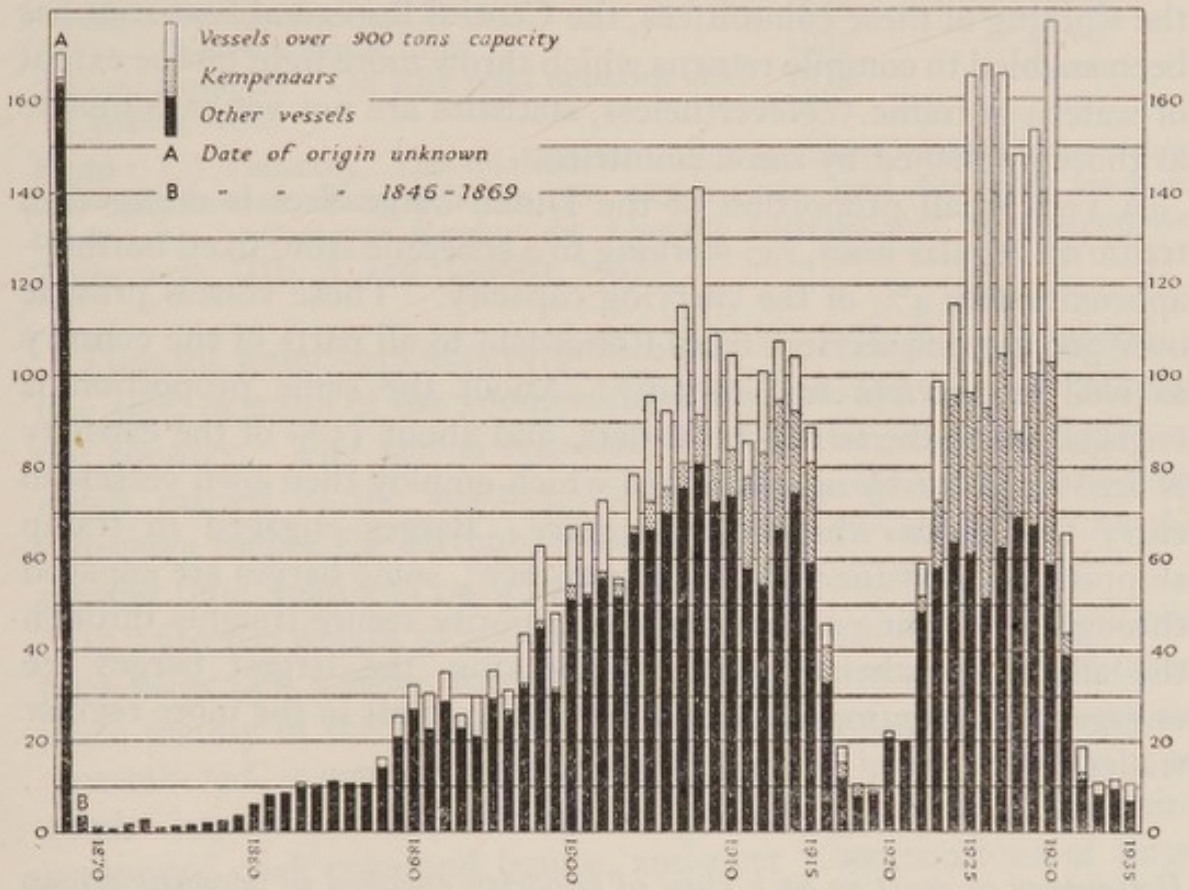


Fig. 138. Construction of the barge fleet, by capacity in thousands of tons

From: *Petite Manuel Statistique*, 1937, p. 143 (La Haye, 1938).
The curve of construction follows fairly closely the course of trade in western Europe. The increase in the proportion of the larger vessels reflects the expansion of the transport of commodities in bulk. A *Kempenaar* is a narrow vessel used on the canals of North Brabant.

all vessels the majority were owned by companies or individuals engaged in the carrying trade, and relatively few by commercial organizations operating their own boats. Company-owned vessels were manned by crews whose employment was governed by the general labour legislation. Privately-owned vessels were often operated by the owner himself, with one or two deckhands, or by the owner and his family.

Traffic

Before 1933 it was not easy to grasp the extent of waterborne traffic in the Netherlands. Through a combination of the effects of road

competition and industrial depression, waterway freights after 1930 fell so much that many skipper owners were unable to make a living. As a result, legislation was effected by which all domestic waterway traffic was to be assigned to barge owners in turn at rates fixed by committees appointed by Chambers of Commerce. As a result of the working of these committees, the Central Bureau of Statistics has been enabled to compile returns which throw more light on the extent of waterway traffic. Nevertheless, statistics are not yet as complete as those published by some countries.

A very small proportion of the Dutch barge fleet is engaged in traffic on regular lines, i.e. working to a schedule from fixed berths—approximately 4% of the carrying capacity. These vessels provide over 300 regular services from Rotterdam to all parts of the country as well as services to Germany. About the same proportion is engaged on traffic to regular orders, and about 15% of the capacity is accounted for by organizations which employ their own vessels to carry the goods which they require. Barges engaged in tramp shipping account for 75% of the capacity ; some barges are engaged through forwarding offices, but the majority secure freights through the allocation scheme. Broadly speaking, the largest barges are engaged in the tramp trade and the smaller craft in the more regular trades.

Percentage of craft in each class of capacity engaged in domestic tramp carrying trade, 1938

Class by capacity tons	21–50	51–100	101–200	201–500	501–1,000	over 1,000
Percentage	35	48	68	76	85	92

From : *Jaarcijfers voor Nederland*, 1938, p. 328 ('s Gravenhage, 1939).

Much of the apparent complexity of data relating to waterway carriage in the Netherlands arises from the complexity of the traffic. Broadly speaking this traffic may be divided into *domestic* and *international*.

Domestic waterway traffic

Figures of total carriage of goods in this category are not easily arrived at : the following is an estimate for a few years ago, with comparisons with land transport ·

Type of transport	Year	Quantity (thousand tons)
Waterway : Tramp barges	1936	8,709
Free barges on Dutch Rhine	1936	500
Liner barges	1933–4	7,240
Other waterway carriage	1936	14,000
Rail : Standard gauge lines	1935	13,889
Narrow gauge lines	1935	4,000
Road transport : On Rijk road network only	1935	10,000
Coasting trade	1937	250

From : J. J. Hanrath, ' Das qualitative und quantitative verhlätnis zwischen den verschieden transportarten, im allgemeinen und für jedes land im besonderen ', *Comptes Rendus du Congrès International de Géographie*, Tome 2me, IIIb, p. 100 (Leiden, 1938).

Thus the waterways were responsible for the transport of something like 50% or more of the goods which enter into the internal trade of the country. The fact is reflected in the extremely low figure of goods carried in the coasting trade. The proportion carried by waterway before the advent of motor transport was 80%. At the present time, road and rail roughly share the remaining 50%.

In 1939 the weight of goods carried by tramp barges—11,474,000 tons—was 25% greater than in 1935, although the increase had taken place mainly in the last year. This quantity of goods, it must be remembered, is confined to the produce of the home territory or to goods imported for consumption within it. Nearly one-third comprised coal, coke and lignite, and over 1,000,000 tons of cargo were provided by (i) earth, clay, etc., by (ii) stoneware, tiles, etc., and by (iii) grain. Fertilizers, timber and oilseeds made up the the greater part of the remainder. The movement of ores was very small, although iron and steel amounted to 336,000 tons. Of the twenty freight districts, south Limburg accounted for nearly one-third of the total freight, with 3,415,000 tons, cement and fertilizer providing considerable tonnages, although coal was much greater at 2,506,000 tons. Rotterdam provided 2,160,000 tons, largely derived from seaborne imports ; freight originating at Amsterdam amounted to 752,000 tons. The Arnhem district was the third area in which over a million tons originated—derived largely from tiles, bricks, etc. The fourth largest source of freight was the eastern part of Drenthe, partly owing to shipments of peat ; considerable quantities of freight appear for the Alkmaar district as it included the port of Ymuiden (Fig. 139).

Of the twenty or so million tons of cargo moved by all other categories ' barge, much comprised commodities which move

Traffic by tramp waterway navigation by district of dispatch (*see p.* 596) *and category of goods*, 1939, *with totals of traffic by category of goods*, 1935–9, *to the nearest thousand tons*

	Wheat	Maize and other grains	Oil-seeds, etc.	Sugar beet	Forage	Ores	Coal, Lignite, etc.	Chalk, Cement, etc.	Fertilizers, natural and artificial	Iron and Steel	Earth, Clay, etc.	Wood	Stoneware, Tiles, etc.	Total, including unnamed goods
Totals by category of freight for the whole country														
1934	628	758	510	149	203	33	2,054	320	964	171	965	427	1,479	9,852
1935	606	487	563	181	225	39	2,414	263	803	153	1,186	288	935	9,021
1936	579	539	518	294	225	77	2,865	290	713	181	514	331	721	8,709
1937	602	610	493	225	207	79	3,136	336	730	295	702	395	935	9,886
1938	584	591	438	218	195	67	2,812	312	723	214	962	334	1,070	9,542
1939	636	692	485	253	260	93	3,357	387	897	336	1,342	468	1,128	11,474
District in which freight originated, 1939 :														
1. Leeuwarden	10	12	1	35	2	—	53	—	40	9	44	15	1	306
2. Groningen	61	32	—	41	2	—	51	—	21	3	2	8	17	302
3. Veenkoloniën (E. Drenthe)	41	41	—	56	43	14	201	—	58	7	25	51	2	713
4. Meppel	3	22	—	16	6	—	—	—	25	2	26	4	12	145
5. Zwolle	5	24	—	7	12	—	4	10	41	16	67	8	40	357
6. Nymegen	8	3	—	1	—	—	2	10	2	5	367	2	663	1,068
7. Dordrecht	29	2	—	—	35	—	5	2	7	17	64	7	159	380
8. Venlo	4	6	—	—	—	—	—	—	1	—	28	—	19	61
9. Maastricht	14	4	—	2	—	—	2,506	257	221	5	376	2	23	3,415
10. 's Hertogenbosch	3	25	—	—	1	—	—	—	6	11	39	6	2	108
11. Breda	25	5	—	2	22	—	4	—	1	7	4	4	3	109
12. Terneuzen	44	22	—	4	29	—	33	—	109	3	—	6	—	322
13. Rotterdam district	14	1	—	1	20	6	14	2	75	22	20	4	2	227
14. Rotterdam city	318	240	337	—	30	38	318	7	163	57	88	164	—	2,160
15. Leiden	1	—	—	—	5	—	—	1	—	3	—	2	20	49
16. Utrecht and Amersfoort	2	1	—	—	4	—	24	—	1	33	6	4	115	205
17. Amsterdam district	1	23	—	—	30	—	—	—	1	1	—	82	—	155
18. Amsterdam city	29	2	145	—	13	34	134	3	37	22	67	96	2	752
19. Haarlem	6	—	—	35	1	1	6	93	86	108	115	1	34	512
20. Alkmaar	18	6	—	51	1	—	1	—	—	3	3	1	11	126

From : *Jaarcijfers voor Nederland*, 1940, pp. 192–3 ('s Gravenhage, 1941) ; *ibid.*, 1938, pp. 324–5.

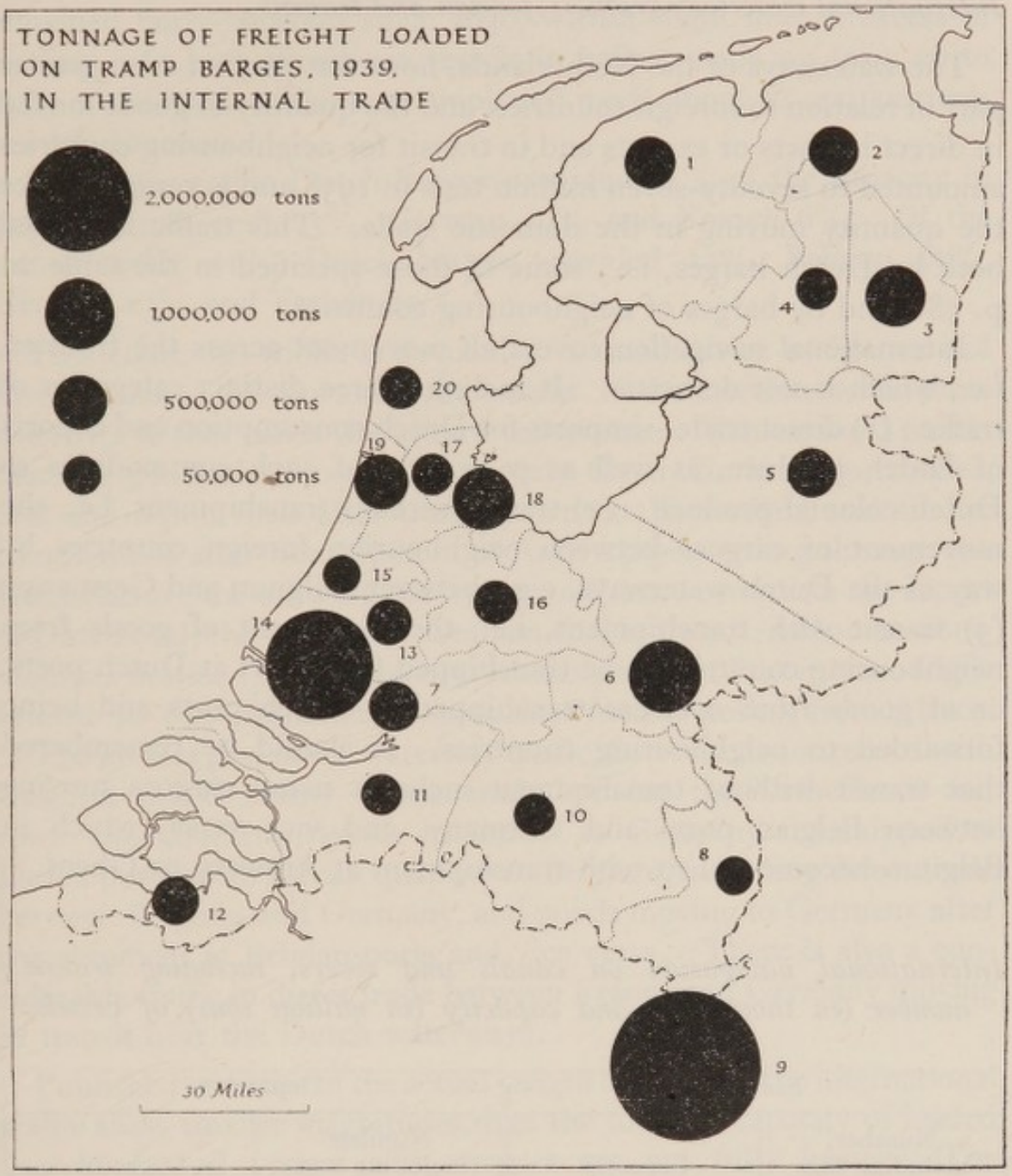


Fig. 139. Loadings of tramp barges in the internal trade, 1939

Data from *Jaarcijfers voor Nederland*, 1940, pp. 192–3 ('s Gravenhage, 1942). The districts are enumerated in the table on p. 590.

constantly throughout the year, such as liquid fuels, road-metal, or coal for factories, power-stations and gasworks. Much of this cargo movement was accounted for by organizations operating their own barges. The less bulky and more varied classes of goods carried by regular lines, etc., are those most liable to suffer from road competition.

International waterway traffic : foreign and transit

The waterways of the Netherlands, however, play an even greater part in relation to foreign countries, and the quantity of goods moved in direct imports or exports and in transit for neighbouring countries amounted to seventy-seven million tons in 1938 and is roughly twice the quantity moving in the domestic trade. This traffic is carried both by Dutch barges, i.e., some of those specified in the table on p. 586, and by barges of neighbouring countries.

International navigation covers all movement across the frontier, i.e., which is not domestic. It includes three distinct categories of traffic : (1) direct trade—imports for Dutch consumption and exports of Dutch produce, as well as re-exports of such commodities as Dutch colonial produce ; (2) transit without transhipment, i.e., the movement of cargoes between neighbouring foreign countries by way of the Dutch waterways, e.g., between Belgium and Germany ; (3) transit with transhipment, i.e., the movement of goods from neighbouring countries to be transhipped for export at Dutch ports, or of goods from overseas transhipped at Dutch ports and being forwarded to neighbouring countries. It should be remembered that transit without transhipment includes many cargoes moving between Belgian ports and Germany, and vice versa, which in Belgium become transit with transhipment at Antwerp or Ghent.

International navigation on canals and rivers, including transit ; number (in thousands) and capacity (in million tons) of vessels

Entries				Departures			
Number, including tugs		Capacity		Number including tugs		Capacity	
		Loaded vessels	Vessels in ballast			Loaded vessels	Vessels in ballast
1930	103	47	14	1930	128	46	15
1931–2 average	122	43	12	1931–2 average	121	38	16
1933	118	41	12	1933	117	39	13
1934	130	45	14	1934	129	45	14
1935–6 average	114	42	13	1935–6 average	112	39	14
1937	126	53	13	1937	135	50	15
1938	127	46	14	1938	125	48	10

From : *Statistiek van de Scheepvaart op het Buitenland over* 1938 (*Rivierscheepvaart*), p. 60 (Den Haag, 1939).

The magnitude of the combined traffic by capacity of vessels has remained fairly constant since 1930, with a slight inward excess of loading. In both directions vessels in ballast made up from 20 to 25% of the total. The tugs employed made about 24,000 journeys in each direction.

Of all this traffic Dutch barges provided 51% of the capacity in 1938, Belgian craft 25%, German 13% and French 6%. Of the transit traffic only, Dutch barges provided 22%, Belgian 49%, German 13% and French 10%.

This enormous traffic is devoted to a small extent to France and Switzerland; the outward movement in connection with these countries is four times the inward movement. The outward movement to Switzerland comprises largely the traffic in grain, timber, coal and liquid fuels after transhipment at Rotterdam, and similar commodities after transhipment at Antwerp proceeding through the Netherlands; the outward movement to France comprises the export of Dutch coal, the passage of German coal in transit, and some commodities destined for France after transhipment at Rotterdam; traffic inward to the Netherlands comprises mainly potash from Alsace.

The greater part of the waterway traffic, however, is concerned with Belgium and Germany—direct trade between the Netherlands and these two countries, goods in transit to Germany transhipped at Dutch ports, with a small quantity to Belgium, including direct trade between Belgium and Germany, and goods moving to Germany after transhipment at Belgian ports and vice versa. There is also a considerable traffic in direct trade between France and Germany moving in transit over the Dutch waterways.

Published statistics of the actual weight of goods in the international traffic show smaller magnitudes than the totals of capacity of loaded vessels, for all vessels with cargoes are not fully loaded. The figures of actual goods carried, according to customs declarations, are divided among those passing the Belgian and German frontiers, and thus include cargoes destined for France and for Switzerland respectively. In the following table the quantities moving by rail are given for comparison. The table shows that, of goods moving by waterway across the frontiers, the weight of goods in transit to Belgium is nearly twice the combined weight of exports to and imports from Belgium, while the weight of goods in transit to Germany is nearly six times the combined weight of exports to and imports from Germany.

Mode of transport employed for goods entering, leaving, and in transit, in thousands of tons, 1938

	Inward				Outward				Total
	Direct Imports	In transit		Total	Direct Exports	In transit		Total	
		With transhipment	Without transhipment			With transhipment	Without transhipment		
By waterway :									
Belgian frontier	3,564	108	5,230	8,902	4,452	356	6,777	11,585	20,487
German frontier	5,802	15,627	7,494	28,923	3,001	19,215	5,829	28,045	56,968
	9,366	15,735	12,724	37,825	7,453	19,571	12,606	39,630	77,455
By rail :									
Belgian frontier	573	57	3	633	1,985	137	4	2,126	2,759
German frontier	2,207	156	3	2,366	783	28	2	813	3,179
	2,780	213	6	2,999	2,768	165	6	2,939	5,938
By sea	12,212	20,850	665	33,727	5,802	17,051	782	23,635	57,362
Total*	27,764	36,801	13,401	74,966	16,524	36,801	13,401	66,726	141,692

* Including goods carried by road and by air.

From : *Jaarcijfers voor Nederland*, 1938, p. 302 ('s Gravenhage, 1939).

The total of all goods carried by waterway (Fig. 140), according to category, were as follows :

Direct trade, Imports and Exports		16,819
All transit trade		60,636
With transhipment	35,306	
Without transhipment	25,330	
All waterway trade		77,455

Of this total, therefore, the direct imports and exports with 17 million tons amounted to less than one-third of the 60 million tons. International rail traffic, though with less than one-twelfth the quantity of the waterway traffic, is almost entirely confined to direct import and export trade. In the domestic trade the waterway traffic is only about twice the railway goods traffic, so that the preponderance of the waterways over the railways is much more marked in the international than in the domestic trade. Compared with sea-borne trade, the total of international waterway trade exceeds the total of all cargoes loaded and discharged at the seaports by 20 million tons, although direct imports and exports by waterway are smaller by over 1 million tons.

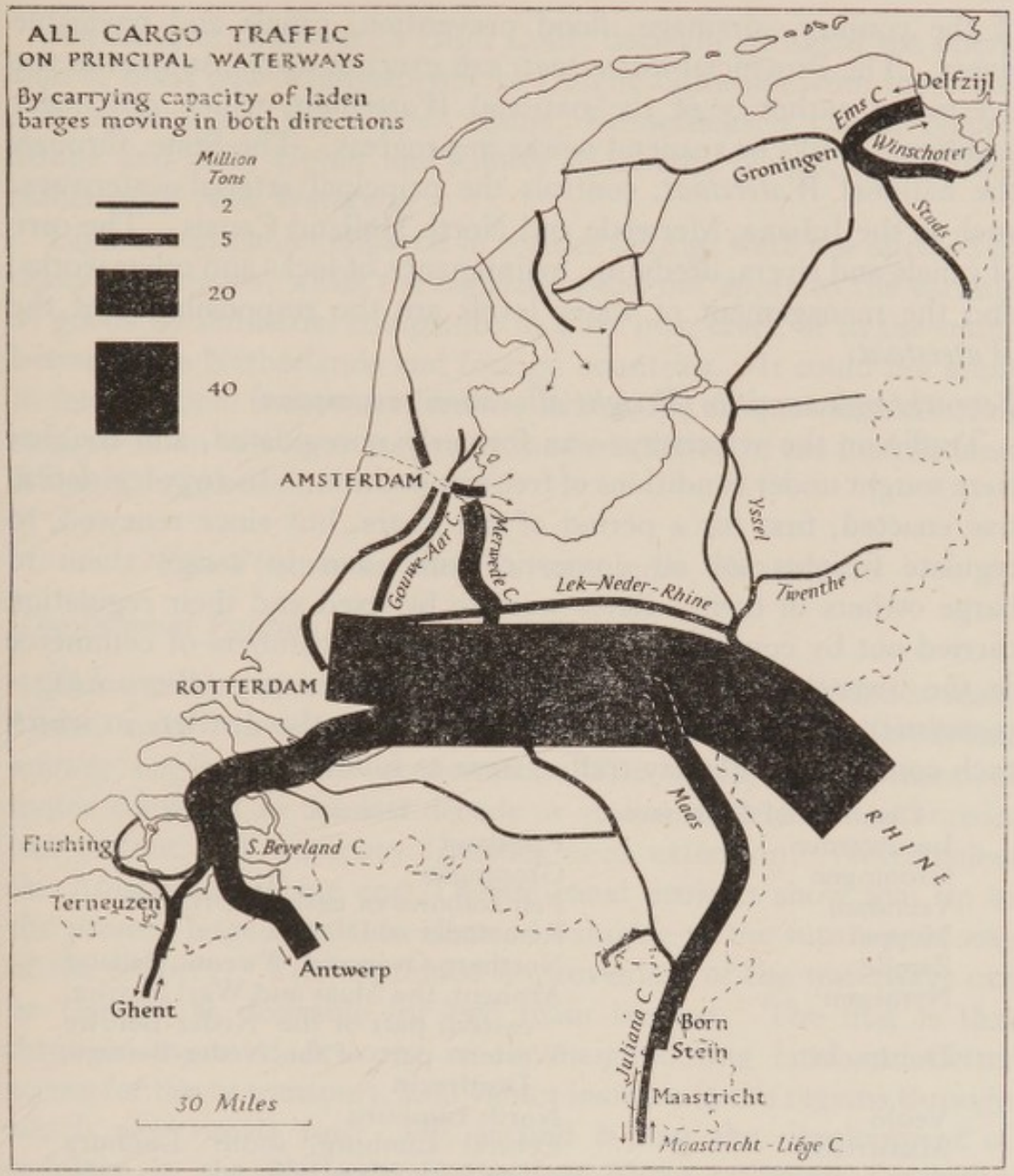


Fig. 140. All cargo traffic on principal waterways, 1939

Data from *Jaarcijfers voor Nederland*, 1940, p. 194 ('s Gravenhage, 1942). This is a diagrammatic representation based upon a table showing the quantity of cargo passing 51 observation points at the principal locks and junctions. The broken white lines represent the Maas–Waal Canal.

Administration

The Waterstaat

The authorities mainly responsible for waterways are those of the *Waterstaat*—national, provincial and communal, co-ordinated by the national authority, the *Departement van Waterstaat* or *Rijkswaterstaat*, under a minister. These authorities administer the waterways as part of their function of managing all aspects of the inland waters

of the country—drainage, flood prevention, canals and navigable rivers. The Provincial *waterstaats* can execute works, subject to the overriding authority of the national *Waterstaat*, which can order additional works or suspend works in progress. The State, through the national *Waterstaat*, controls the principal arterial waterways, such as the Juliana, Merwede and North Holland Canals. The care of canals and rivers, dredging, maintenance of locks and other works, and the management of water levels are the responsibility of the *Waterstaat*.

Bevrachtingscommissie (*Freight allocation commission*)

Traffic on the waterways was formerly unregulated, and freights were sought under conditions of free competition. In 1933 legislation was enacted, first for a period of five years, but since renewed, to regulate freights for all domestic traffic and to assign them to barge owners in turn. Rates were to be fixed and their regulation carried out by committees appointed by the chambers of commerce in the twenty districts covering the whole country (*Bevrachtingscommissie*). The chambers of commerce, and the districts in which each controlled waterway traffic, were as follows :

Chamber of Commerce	District
Leeuwarden	Friesland
Groningen	Groningen
Veendam	Fen colonies of eastern Drenthe
Meppel	Remainder of Drenthe
Zwolle	Northern Overyssel, Twente, Salland
Nymegen	Arnhem, the Maas and Waal district, eastern part of the Neder-Betuwe
Dordrecht	Western part of the Neder-Betuwe, Dordrecht
Venlo	North Limburg
Maastricht	Central Limburg, south Limburg coalfield, Maastricht
's Hertogenbosch	's Hertogenbosch, eastern part of North Brabant, Tilburg, and the eastern part of the Langstraat
Breda	Western part of the Langstraat, western North Brabant
Terneuzen	Zealand Flanders, Zealand islands
Rotterdam	Beneden-Maas, Delft, The Hague, Gouda, but not Rotterdam itself
Rotterdam city	
Leiden	Rijnland
Utrecht and Amersfoort	Utrecht, Amersfoort, Geldersche Vallei
Amsterdam	Gooiland, Zaanland, but not Amsterdam itself
Amsterdam city	
Haarlem	Haarlem
Alkmaar	Northern part of North Holland

A year later, however, a High Court decision withheld the operation of these new arrangements for freight allocation from the Waal-Lek system, i.e. the Upper Rhine, Pannerdensch Canal, Neder-Rhine and Lek, Upper and Lower Merwede, Noord, New Maas, Scheur and New Waterway.

Lighter companies engaged in regular sailings were less affected by these enactments, while the legislation did not apply to the carriage of goods by industrial companies in their own craft, or to the traffic between the Netherlands and foreign countries. It could not apply to international waterways like the Rhine, for all questions affecting navigation on this river are under the jurisdiction of the international Rhine Commission.

The Future of the Netherlands Waterways

The Internal Position

The question as to whether conditions in the Netherlands make further canal extensions desirable gives rise to considerable debate among engineers and economists. The rapid development of motor transport in the last decade or so has made some authorities less certain that waterway facilities need extension. Nevertheless the Amsterdam-Rhine and Twente canal projects show that up to the present large canals are deemed valuable to the future economy of the country. The continued improvement of the waterways can be claimed as desirable for two main reasons. The first is that through improved drainage of the neighbouring land and better access for heavy transport, land values increase in the regions through which new canals run. The second is that the development of industry in the Netherlands requires cheap transport for bulky goods. The value of the waterways can be seen in the fact that freight rates for German coal from the Ruhr to Rotterdam are lower than those to German seaports.

Some authorities stress the importance of the railways, and suggest that railways will always be essential for the transport of much of the passenger traffic of the country and that it would therefore be a more economic use of capital to divert fresh goods traffic to the railways. It should be remembered that goods can be carried by rail at all times and in all circumstances, and at greater speeds, while a severe frost is liable to paralyse all traffic by water. On the other hand, large sized consignments exceeding the railway loading gauge can always be carried by water.

Antwerp and the Rhine

The future of waterways in the Netherlands is bound up to a considerable extent with the policies of neighbouring countries. The construction of the Mittelland Canal and the projected Hansa Canal in Germany have as part of their object the diversion of German transit traffic through the Netherlands to German ports. This object can only be achieved in great part by the institution of uneconomically low freight rates on the German waterways, for the Rhine offers the cheapest export route. Of more immediate interest to the Netherlands is the Belgian desire for a more direct canal between Antwerp and the Rhine to obviate the long and inconvenient estuary route from Antwerp to the Merwede. An Antwerp-Rhine canal would inevitably reduce the comparative advantages for the Rhine traffic at present possessed by Rotterdam.

The Treaty of 1839, article 12, gave Belgium the right to build a canal towards the Rhine, with Dutch help where the canal crossed Dutch territory, but this right was renounced when Belgium secured the privilege of building a railway, partly across Dutch territory, to Gladbach. At that time the railway seemed likely to become a vastly more important means of transport than the river or canal.

Barge navigation to the Rhine passed through the channel between the mainland and the island of South Beveland. When this passage was closed by the Dutch in 1866 through the construction of the Flushing railway they were bound by the Treaty to provide an equivalent, and opened the South Beveland Canal, from Hansweert to Wemeldinge, leading northward to Dordrecht and Rotterdam through the Volkerak and Hollandsch Diep. With the development of heavy barge traffic from the Rhine, carrying especially the Westphalian coal which provides a return freight for sea-going ships at Antwerp, the drawbacks of the Hansweert route have become serious (see p. 572).

Proposals for an improved waterway to the Merwede at Moerdijk came to be made, as well as projects for other canals eastwards to the Rhine near Ruhrort in Westphalia (Fig. 141). The latter had the advantage of appearing to be related to a problem which first became evident in about 1910—the probability that the Dutch would improve the Maas so as to draw towards Rotterdam the traffic of the Liége district. Article 316 of the Treaty of Versailles imposed on Germany an obligation to complete the eastern half of the proposed Antwerp–Rhine canal if Belgium undertook the western half, a result regarded at the time as a triumph for Antwerp. Dutch assent

to this plan, as far as it involved Dutch territory, was not forthcoming, however, and Belgian interest turned again to the Moerdijk project, which has received most favour since 1919. The canal would make barge movements largely independent of tidal waters,

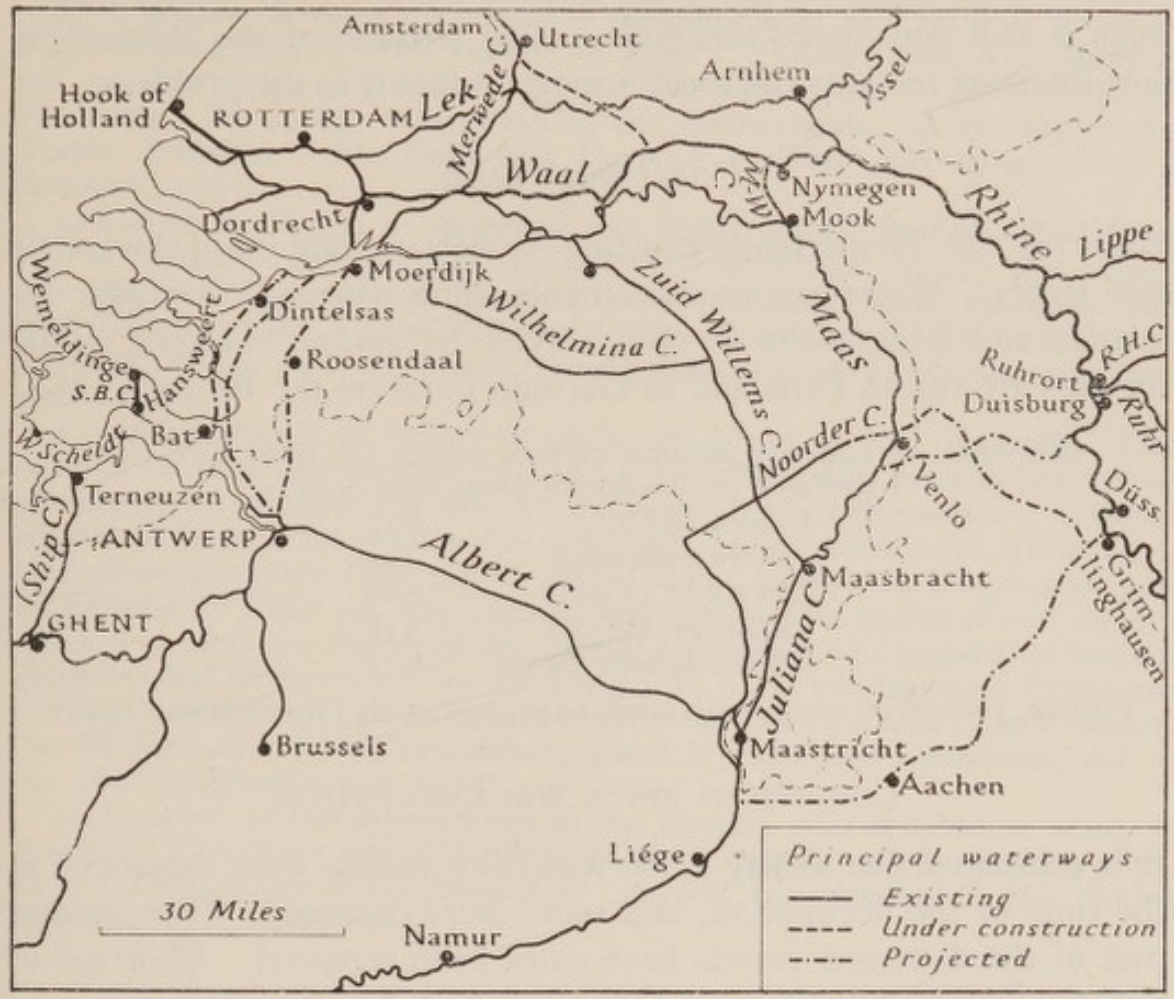


Fig. 141. Projected canals between Antwerp and the Rhine

From : R. Schuiling, *Nederland*, vol. 2, p. 420 (Zwolle, 1936) ; A. Delmer, *Le Canal Albert*, vol. 2, (Liège, 1939).
Düss. Düsseldorf ; M.W.C. Maas–Waal Canal ; R.H.C. Rhine–Herne Canal ; S.B.C. South Beveland Canal.
These projects—the Moerdijk canals in the west, the Venlo–Rhine canals and the Aachen route—all represent frequently discussed plans for an improved connection between Antwerp and the Rhine. The Aachen route, the only one which does not pass through Dutch territory, offers the greatest difficulties of construction.

and by permitting navigation at night, when the Rhine navigation is carried out mainly by day, would in effect reduce the advantage enjoyed by Rotterdam of a short connection with Westphalia. The Dutch, however, remained opposed to this project ; the Second Chamber accepted the draft agreement of 1925, but the First Chamber would not ratify it. As a result, the direct Antwerp-Rhine plan is now more in favour in Belgium, and many projected routes have

been examined, some envisaging a more southerly course so as to avoid the passage of Dutch territory. The development of the German waterways will cause Antwerp to aim at further improving its connections with the Rhine, and the completion of the Albert Canal shows that in Belgium the construction of large inland waterways is still considered desirable. The attitude of the Rotterdam port interests remains the most important factor in the problem.

Coasting Trade

Many of the Netherlands coasting vessels operate upon the canals and rivers. Waterway improvements allow them to navigate far inland, and Maastricht is now served by motor coasters, while services are run to Paris and to German ports on the Rhine.

Capacity of coasters passing certain points (in both directions together), thousands of gross tons, 1939

Lobith (Rhine)	672
Kornwerderzand	411
Doesburg (Yssel)	388
Millingen (Waal)	338
Pannerdensch Canal	334

From : *Jaarcijfers voor Nederland*, 1940, p. 194 ('s Gravenhage, 1942).

Conditions since the Occupation

It is estimated that nearly 2,000 waterway vessels were destroyed at the time of the occupation, and more were damaged. The greater part of the damaged vessels have since been repaired. Shortage of fuel has led to difficulties in moving barges on the waterways, and conversion to producer gas for propulsion has been attempted.

The section of the Amsterdam–Rhine Canal from Amsterdam to the Lek near Wijk-bij-Duurstede has been completed. Construction work on the second part, from Wijk to Tiel on the Waal, is proceeding. The reconstruction of the Starkenborgh Canal from Groningen to Lemmer, on the Yssel Meer, has been completed. Barges up to 1,000 tons capacity may now proceed from Delfzijl to Amsterdam. The canal is, however, more important for regular services by Groningen type motor-coasters from Belgium and the Netherlands to Baltic and Scandinavian ports.

BIBLIOGRAPHICAL NOTE

1. Details of all waterways in the Netherlands, with itineraries and dimensions of locks, etc., are given in two Dutch publications : *Wegwijzer voor de Binnenscheepvaart*, 3 vols., an official publication ; T. P. Keijzer,

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APPENDIX I

THE GERMAN OCCUPATION 1940-1943

General Features : Social Conditions : Dutch Resistance : Economic Conditions : German Flooding Measures : Bibliographical Note

General Features

The German assault in the Netherlands, and on Belgium, began early on 10 May 1940. The army, under General Winckelmann, put up a spirited resistance to the east, but it was greatly hampered by the confusion in its rear, caused by the state of alarm over real and imagined fifth-columnists and by the extensive landings of parachute troops, especially at Rotterdam. The ferocious bombing of the central part of the great port, on 13 May, was a final indication that further resistance was useless, and by mid-day on 15 May the Commander-in-Chief had surrendered.

The royal family, together with some members of the Government, had escaped to England soon after the invasion had begun, and eventually other ministers arrived. A Netherlands government in the United Kingdom was established of which Professor Gerbrandy is now (1944) Prime Minister.

There is some evidence that the Germans had a special interest in the occupation of the Netherlands. In the first place there had long been, in some quarters, a latent wish to reverse the events of 1555 and 1648, when the provinces which were to become the United Netherlands ceased to have any ties with the Holy Roman Empire. Secondly, on so-called racial grounds, the people of the country were held to be one of the most ' Germanic ' peoples outside Germany, and therefore likely to be more easily incorporated. The third attraction of an occupation of the Netherlands lay in the economic benefits which would accrue from the possession of productive dairy farms, efficient industries and coal mines, and the great port of Rotterdam, which had been for so long the outlet for much of the trade of western Germany. Finally, and more immediately, the airfields, ports and shipping of the Netherlands were expected to play an important part in any invasion of England.

It seems likely that the Germans considered at first that the Dutch people would acquiesce, to a considerable extent, in the occupation. The Civil Commissioner (*Reichscommissar*), Seyss-Inquart, stated that the country was distinguished in being placed under a civil

administration and not a military one. In spite, however, of an assurance that it was intended to maintain as far as possible the existing system, the process of *Gleichschaltung* soon began. The States-General was suspended on 22 June 1940 ; later the government departments were reorganized, and by 1941, with the establishment of the ' Peace Courts ', Dutch justice was aligned with that of Nazi Germany.

Government

Administration of the occupied Netherlands operates through a dual system—the authority of Seyss-Inquart, the Civil Commissioner, and the existing Dutch machinery of government, suitably directed and controlled by Seyss-Inquart. There is, further, an additional machinery for administration maintained by Mussert, the leader of the Dutch Nazi party. A separate military organization operates under General F. Christiansen.

In effect, there has been a gradual but extensive replacement of Dutch higher officials by Dutch Nazi party members, with the fading of the Germans' original hopes that the existing official class would acquiesce in the occupation, although the majority of the lower officials remain in their posts. The provincial States (*Provinciale Staten*) were suppressed in September 1941, and replaced by Provincial Commissioners. Other elected bodies such as communal councils suffered the same fate. The administration of the communes has been changed, each commune now having at its head a *Burgemeester* appointed and dismissed by the *Reichscommissar*, and a German special commissioner has been placed in each large town.

All political parties except the National Socialist have been progressively repressed. The National Socialist parties number three, the chief of which is the N.S.B. (*Nationaal Socialistische Beweging*), led by A. A. Mussert. The N.S.B., with headquarters at Utrecht, has an organization corresponding closely to the departments of a government. The Germans have so far given the N.S.B. machinery no great part to play in the administration of the country, regarding its part as mainly advisory. On the other hand, Dutch Nazi (i.e. mainly N.S.B.) individuals have been pushed increasingly into a variety of administrative positions in the existing Dutch official machine after the displacement of those Dutchmen who held positions at the time of the invasion.

Mussert, the leader of the N.S.B., is held to have ambitions to

rule the Netherlands as representative of the Germans, but has never been accepted to this extent. It was only in December 1942 that he was formally recognized as leader of the N.S.B. and of the Dutch people. Since January 1943 his influence has been declining in the face of increasing German annexationist tendencies. While the No. 2 N.S.B. member is G. van Geelkerken, much more notoriety attaches to a third member, Rost van Tonningen. Made Secretary General of Finance and Special Economic Affairs as well as President of the Netherlands Bank by Seyss-Inquart, and being at the head of economic organizations within the N.S.B., van Tonningen now holds a dominant position in the economic life of the country.

Justice

The machinery of the Dutch legal system remains virtually intact. Two new types of courts were instituted—the Peace Courts and the Economic Courts. The institution of the Peace Courts in 1941 brought an important change, for these courts have power to overrule the findings of the established courts. Contrary to the Dutch Penal Code, a person acquitted from a charge in an ordinary court can be convicted in the Peace Court on the same charge, or a convicted person can suffer an increase of sentence. Further charges included the replacement of judicial officers by Nazi sympathizers, the extension of the powers of judges, and the inter-connection of Dutch courts with courts established by the German civil administration and military authorities. In addition, a vast number of ordinances and regulations issued by Seyss-Inquart and Christiansen reflect simply the arbitrary methods of the Germans and admit of no effective check by the established laws of the country. The Economic Courts exist to deal with the special economic problems arising from the occupation, such as price regulation and black market offences.

The police system has undergone a progressive expansion and reorganization to meet the needs of the occupying power, under a German, W. Rauter.

Social Conditions

The Churches

The Protestant Churches early showed that they were opposed to the invaders' government, and in September 1940 they issued a declaration of loyalty to the House of Orange and the Dutch Government. In October the six leading Churches made a joint appeal to Seyss-Inquart against anti-semitic measures, an appeal which was

repeated five months later. In a variety of ways the Germans have attempted to reduce the significance of the churches in the national life ; the successive increase in anti-Church measures is a proof of the important part which the Protestant Churches continue to play in the resistance movement. A great part of the organization directed against them is controlled by W. H. Müller-Lehning, special commissioner for non-economic associations.

A significant feature of their position is the marked tendency towards co-operation and towards a common front ; for example, exchanges of preachers among the Protestant Churches have been arranged. The movement has gone still further in the direction of closer union between the Protestant Churches and the Roman Catholic Church in the Netherlands, and joint Protestant and Roman Catholic pastoral letters have been read. A principal example of this coming together was the joint protest to Seyss-Inquart, on the iniquities of German rule, read in February 1943 (see p. 610).

The conflict between the occupation government and the Roman Catholic Church has been continuous and bitter. The Church banned the N.S.B. early in 1941, and excommunicated its members. The Labour Service was banned as a Nazi institution. The Germans countered by repressing or absorbing all means outside the Church through which it kept in touch with the people—its societies, its schools, its press and its buildings. For refusal to comply with German orders many of the Roman Catholic clergy have suffered fines or arrest, the Archbishop of Utrecht being among the former.

Education

Under the pro-German, anti-Catholic Professor van Dam, who was appointed Secretary General for Education in November 1940, a systematic attempt is being made to denationalize the youth of the Netherlands and to prepare for their assimilation of German ideas. Early steps included the extension of the teaching of German, the introduction of new anti-Orange history textbooks, and the inculcation of German racial theories. Later measures comprise the establishment of a certain number of special schools for Dutch-Nazi and German children together. Separate schools for the children of Dutch Nazis have come to serve a purpose not originally intended, for in the state schools the life of such children was often made intolerable by their schoolmates. Special steps to secure suitable teachers in both state and confessional schools have been necessary.

The universities and technical high schools are either closed or

working with greatly reduced numbers. They have suffered through student resistance, imprisonment of both professors and students, labour conscription, dismissal of Jewish members of staff, and the appointments to chairs of Dutch Nazis, Germans, Flemish Activists, etc. In mid-1943 twelve professors and 2,000 students were in concentration camps. The University of Leiden was finally closed in November 1941, and the Free (Calvinist) University at Amsterdam and the Roman Catholic university at Nymegen were closed later.

Labour

After the disruption of economic life caused by the invasion the first measures taken by the Germans in connection with labour were aimed at resettling workers and at repairing damage to factories and public works. Under Woudenberg of the Dutch N.S.B., ' dangerous ' trade union leaders were replaced. With the increasing labour shortage in Germany, measures were applied, beginning in 1941, to persuade workers to go to Germany. Mobilization passed from voluntary to ' semi-voluntary ' measures, and was at first selective. By March 1941 it was claimed that 100,000 Dutch workers had been placed in Germany, although several thousands had come back. In February 1942 came a decree compelling people to accept work wherever it was offered.

Soon after, a further step to exploit Dutch labour was taken in the formation of the *N.O.C.* (*Nederlandsche Oost Compagnie*). This scheme aimed at attracting Dutch workers to join in the development of agricultural lands in the Ukraine assisted by the investment of Netherlands capital in the enterprise. It was expected that many thousands of workers could be sent eastwards, but the scheme was a complete failure.

To meet the ever increasing demands for labour in Germany the closing of non-essential establishments, such as shipping offices, was intensified. The evacuation of the population of coastal districts, which had begun in the autumn of 1942, was a foretaste of mass deportation of labour. The wholesale rounding up of students was the beginning of more widespread deportation of workmen. By April 1943 the position in the Netherlands could accurately be described as a Reign of Terror, with many people in hiding, deportations proceeding continuously, frequent arrests, and schools and universities closed. Sabotage was rife, and in March resisters had destroyed the building which housed the population register of Amsterdam.

The machinery of enforcement, however, was strengthened and extended. At the end of 1942 the number of Dutch workers in Germany was estimated at 250,000, but by the end of May 1943 the numbers were reported to have risen to over 500,000 or 1 in 18 of the entire population.

Anti-Semitic Measures

From a fairly early date, the Germans enforced a variety of anti-Semitic measures—in a country which had long been renowned for its tolerance. These measures culminated in the mass deportation or imprisonment of Jews, beginning in July 1942. Within less than a year most Jews not deported or placed in concentration camps were in hiding.

Social Conditions and Public Health

The food situation has not been as serious as in some occupied countries, but nevertheless, under-nourishment and its consequences to health are spreading. The findings of the Central Statistical Bureau claim to show that, while the general death rate had increased from 8·6 ‰ in 1939 to 9·5 ‰ in 1942, child and infantile mortality had declined considerably. The accuracy of these figures had been challenged by the underground press.

Several kinds of black markets are operated. Petty thieving has increased, as might be expected, but crimes against life and person have also increased by as much as 30%. It is not surprising that in the disturbed conditions of an occupied country there should be more cases of juvenile delinquency of various kinds. The increase of immorality among young persons in the large towns has been rather noticeable, and is a matter of anxiety even to Dutch Nazis.

The Press, Broadcasting and Films

After a few months of comparatively unmolested life the newspapers have passed under the German steam roller. The six leading independent papers survive, but most of the editors have been replaced, and one of the Catholic papers has been suppressed. The underground press is active and issues a number of publications, but it is less successful than in Belgium, where valuable experience was gained during the war of 1914–18.

The surrender of all Dutch wireless sets of the ordinary types was finally ordered in May 1943 ; before then the Germans had made attempts to use the broadcasting network for furthering their point of view. These efforts failed, while at the same time the possession

of a receiver permitted the owner to listen to prohibited broadcasts from London. The telephone relay system, which is easily controlled by the administration, has been encouraged.

Elaborate re-organization of the film industry has resulted in the production of a number of films, largely with the aid of German actors and actresses. Before the invasion cinema audiences numbered about 3,000,000 monthly, but have since dropped to a quarter of this figure.

Dutch Resistance

After the initial shock of invasion and occupation, followed by the profound effect of the collapse of France, the attitude of the Dutch was one of prostration. Hope revived with the news of the Battle of Britain, and the recovery of morale led to the beginning of demonstrations and other signs of opposition. This resistance movement grew in the first half of 1941 with the development of German anti-Jewish measures, and in the following months it assumed other forms—the slowing down of work in factories, the growth of clandestine newspapers, and many others. It became clear to the Germans that resistance was not only growing but becoming more organized.

In the period March–December 1942 they resorted to increasingly severe measures of repression. In May, officers of the Dutch army were re-interned ; in June hostages were arrested as a reprisal for acts of sabotage, and in August the first shooting of hostages was reported. This period saw the beginning of deportation of Dutch workmen, and the first steps in the evacuation of the coastal zone.

The first half of 1943 was marked by a heightening of tension which culminated in widespread outbursts. The removal of people from the coastal zone was accelerated, and fortification work by the Germans was extended as their fears of an Allied landing increased. Early in 1943 Dutch and German government offices began to move out of The Hague to such towns as Arnhem, Nymegen, Deventer and Apeldoorn. Dutch anger at the activities of the N.S.B. resulted in the shooting of several members of the organization. Deportation of workmen increased and, in retaliation, patriots destroyed several offices containing population registers. Student resistance, too, became more active. In April, the re-internment of all members of the Dutch army released in 1940 was ordered. Police martial law was proclaimed in several provinces, and later extended over the whole country, as a series of big strikes occurred at the Philips works and other places. A large number of executions followed throughout

May. Only gradually was a state of comparative quiescence restored, with a sullen people biding their time.

During the period of maximum outbursts two formal protests were addressed to the Germans. On 21 February 1943 a combined protest by the Protestant and Catholic Churches was read. The churches addressed Seyss-Inquart on the iniquities of ' the increasing violation of justice, the persecution of Jewish fellow-citizens even unto death . . . interference with free Christian teaching in schools, the enforced deportation of Dutch workers to Germany for labour, the execution of hostages. . . .' In June 1943 a large body of Dutch doctors protested to the *Reichscommissar* on the decline in health of the people, the effects of under-nourishment on the spread of disease, and the violation of the Hague Covenant involved in the deportation of workers of an occupied country to make weapons of war for use against members of their own people fighting overseas.

Economic Conditions

The German economic policy towards the Netherlands has been less ruthless than in some occupied countries ; their has been no wholesale confiscation of industrial companies, for example, and less purchasing of shares in Dutch concerns. Nor has there occurred so much pillage of stocks of commodities. On the whole, agriculture has suffered more severely than industry. Overseas commerce is stagnant (see p. 612).

Agriculture

Agriculture has suffered mainly from the virtual cessation of imported feeding stuffs, shortage of labour and reduction in supplies of chemical fertilizers. With the considerable slaughtering of animals required by the Germans there is less farmyard manure available as well, so that output is bound to decline progressively, although until 1942 it had been maintained fairly well. The arable area has been extended by 250,000 acres, or 10%, and larger areas devoted to potatoes and oilseeds. It is estimated that in 1942 the wheat output was equal to the pre-war average ; other cereals and sugar beet amounted to about 80%, and potatoes amounted to 130%. By the end of that year, the number of cattle had declined by one-third, pigs by one-half, and poultry by more than nine-tenths. Owing to the absence of oil cake milk yields have declined and, together with the decline in the numbers of the herds, milk output

is now little over half the pre-war quantity. Market-gardening, in contrast, has flourished.

The agricultural output has to meet the needs of the army of occupation and export to Germany as well as supplying the home population. Domestic requirements can be met partly by clandestine arrangements, so that the food situation is better than in some countries. For the Germans, Dutch agriculture is a wasting asset ; exports of meat, butter, cheese and eggs have declined, and only potato and vegetable exports have increased.

Fuel and Power

The powers of the *Rijkskolen bureau*, which formerly dealt with the administration of the coal mines, have been enlarged to cover the control of the production, transport and disposal of all coal and coke. Output was maintained until the second half of 1941, but thereafter remained below the pre-war level. The Sluiskil coke ovens are idle, and the output of the others (see p. 376) has fallen. An estimate of the trade in coal and coke for 1942 is as follows (thousand metric tons) :

	Coal		Coke	
	Import	Export	Import	Export
1939	5,880	2,740	370	2,300
1942	1,080	810	1	670

The shrinkage in the amount of coal available has been met by a system of rationing for household coal and by a priority arrangement for consumers.

The output of electricity has declined somewhat. Industry and the railways take a greater share of the output than in pre-war days. The Germans aim at carrying out interconnection plans which had been drawn up by the Dutch—(a) the interconnection of the power stations at The Hague, Rotterdam, Leiden, Delft and Dordrecht, (b) the linking of this network with the Limburg stations.

Liquid fuel imports have declined to a very low figure, and normal use of petrol and diesel fuel has almost ceased. The fishing industry in particular has suffered from a shortage of diesel fuel.

Industry

The iron and steel works at Ymuiden remain fairly active in spite of repeated bomb damage and difficulties in securing supplies of ore, but pig iron output amounts only to about 60,000 tons annually. Further steel furnaces have been constructed, making a total of four.

The *Vereinigte Stahlwerke* has secured a majority interest on the board of the *Nederlandsche Hoogovens* (see p. 491). Zinc output is very low and tin production has ceased.

In the metal industries, considerable activity continues. Most of the shipyards are busy on German orders, in spite of the slowing up of building by employers and workers. In the first two years after the occupation, the yards were employed on minesweepers, trawlers, barges and invasion craft ; later they were turned over to an extensive programme of merchant ship construction. The marine engineering industry is active in connection with the shipbuilding programme. The Werkspoor company is listed as a producer of standard locomotives for Germany. The Philips works, up to 1942, produced nearly one-third of the Axis output of radio valves, but following severe bomb damage output has declined and the works are being dispersed among towns in the southern part of the country.

The chemical industry has suffered from a shortage of raw materials. The output of textiles has fallen considerably owing to the cutting off of imports ; the flax and linen industries have been comparatively active, using the increased home flax production. The output of synthetic fibres has been increased.

Commerce

As a result of the occupation the surplus of merchandise imports over exports (see p. 410) has gradually been reversed until, in 1942, exports, valued at *f.* 710 million, greatly exceeded the *f.* 470 million of imports. The following table shows the direction of foreign trade in 1942 :

	Imports from (millions of guilders).	Exports to
Germany	320	575*
Belgium	52	44
France	18	26
Finland	10	4
Norway	5	6
Italy	13	7
Switzerland	10	7
Sweden	17	15
Total (including other countries)	470	710*

* Possibly underestimated

The preponderance of Germany in the foreign trade has doubtless increased since the abolition of the customs barrier between the two

countries in December 1942. Dutch trade with other countries is controlled by the Germans, and is mainly regulated by short term bilateral trade agreements.

Imports. Netherlands imports are of a similar nature to those of other occupied countries ; imports of commodities like oil, rubber, vegetable oils, fats, grains, fruit, coffee, cocoa beans and tin ore have practically disappeared, while raw wool and cotton have greatly declined. The large items are provided by coal, iron ore, timber, potash fertilizers and iron and steel manufactures, all goods which are frequently processed and re-exported.

Exports. The true picture of exports is difficult to determine, as it is complicated by ' unauthorized ' exports, which tend to be acquired by methods akin to looting, and also by requisitions for the use of the occupying forces. The main items in the period May 1940 to March 1943 were textiles, hides, leather and manufactures, iron and steel manufactures, tobacco manufactures and coal, while other items included tyres, timber, petroleum, vegetable oils, medicines and soap.

Transit Trade. As a transit country, the Netherlands still remains of considerable importance. Some important trade still passes from Scandinavia to Germany via Dutch ports, and Dutch inland waterways are an essential link in the European transport system.

Finance

The Germans have attempted to assimilate the whole financial system of the Netherlands to that of the Reich, by means of a Customs Union in November 1940, a Currency Union in April 1941, and the removal of the customs frontier in December 1942. The rate of exchange was fixed at 132·7 Rm. for *f.* 100, and either currency could be exported in unlimited amounts to the other country and exchanged without restriction.

Budget Revenue. The fiscal system has been reorganized on the German model, income tax being paid on current income and, wherever possible, deducted at source. The Municipal Funds Tax has been merged with the income tax, and excess profits have been tapped by new high level taxes on companies and property. Tax revenue has risen considerably as a result of these measures :

	1939	1940*	1941*	1942*	
Tax Revenue	606·8	925	1,219	1,400	million guilders
Total Revenue	918·1	1,150	1,500	1,700	

* Estimates

Income tax now provides some 25% of the total revenue, while import duties yield only 3%.

Budget Expenditure. There are three principal subjects of expenditure—administration, payment of Occupational costs, and the financing of trade (with Germany). Administrative expenditure, including public works and reconstruction, totalled *f.* 1,200 million in 1941, and *f.* 1,400 million in 1942. The Occupation costs are not fixed, but are claimed as and when they are needed ; a semi-official estimate for 1941 puts them at *f.* 1,200 million and it is probable that the same figure applied for 1942. This represents an annual burden on the Dutch of £17 per head, compared with £50 per head on the Norwegians.

The excessive German purchases of Dutch goods has led to an accumulation of Reichsmarks in the Netherlands Bank of such magnitude that the Treasury have been obliged periodically to relieve the Bank by purchasing some of these ' assets '.

Budget Deficit. The following table summarises the budgetary position in 1941 and 1942 :

	1941	1942
Expenditure :		
Administration	1,200	1,400 million guilders
Occupation costs	1,200	1,200
Financing of trade	400	700
Total	2,800	3,300
Revenue (excluding borrowing)	1,500	1,700
Estimated Deficit	1,300	1,600

These deficits had to be financed by borrowing, and the national debt has increased from *f.* 4,200 million in April 1940 to *f.* 8,509 million about two years later. The proportion of floating debt (short term loans and treasury bills) has risen very markedly.

Municipal Finance. In accordance with the policy of centralization, the Municipal Funds Tax and the local surcharges on the capital tax have been abolished and their place taken by direct grants. Any local government expenditure may now be disallowed by the Secretary-General for the Interior, who exercises a direct control. Many outstanding loans have been converted by municipalities to lower rates of interest as a result of the plentiful supply of money seeking safe investment.

Netherlands Bank. Under the auspices of a German commissioner

the Netherlands Bank more than doubled its note circulation between May 1940 and March 1943, largely as a result of the guilders issued in exchange for Reichsmarks. In April 1943, the statutes of the Bank were changed to allow Reichsmarks to be used instead of gold as backing for the note issue. In less than a year at least *f.* 325 million, amounting to nearly all the national reserve of gold, had left for Germany.

Other Banks. The loss of overseas commerce has led to a shrinkage in business and there has been some concentration amongst the smaller merchant banks. Mortgage banks have been seriously affected by the abundance of money, and they have undertaken a series of mergers among themselves and in some instances with insurance companies. German banks have taken the opportunity to extend their business activities and expand their holdings. Savings deposits fell rapidly during the first year of the Occupation, but with the shortgage of consumers goods they tended to rise again during 1943. The postal cheque and transfer service has expanded considerably as a result of the abundance of money and general rise in prices.

The banks are compulsorily organized in a group controlled by the Secretary-General for Finance.

Insurance. The Germans have arranged that at least half of the business formerly placed with British or French insurance companies must now be given to German concerns. In consequence, many German companies have set up branches in the Netherlands, and two of the largest Dutch social insurance concerns have been taken over by the Hamburger Volkfsürsorge, the insurance company of the German Labour Front. Dutch companies have in some cases amalgamated in order to put up a more strenuous resistance to this penetration.

General economic situation

German financial exploitation of the Netherlands has been severe, but not so oppressive as in some other occupied countries. The Occupation levy and the useless and ever-accumulating balance of Reichsmarks have augmented the strain on the financial structure which was created by the loss of normal foreign trade, the virtual stoppage of certain industries, and the growing shortage of consumption goods. German policy has been to raise the Dutch price level to the German level while keeping wages pegged at the pre-war level. To achieve this end, an efficient system of price control has

been instituted, and, despite the growth of a Black Market, the general price system has been effectively controlled. The cost of living has, of course, risen ; during the first year of Occupation it increased by about 25% and the rise has continued, though probably not quite so rapidly.

It has not been necessary for Germany to send any foodstuffs to the Netherlands, nor have any appreciable quantities of consumption goods been supplied. In consequence, the Germans have made a clear economic gain by harnessing Dutch industry to supply their own needs and systematically draining away the Dutch agricultural surplus.

German Flooding Measures

German defence plans early involved the flooding of considerable parts of the Netherlands. By midsummer 1944 evacuation of threatened areas had been in progress for several months. Aerial reconnaissance revealed that some districts were under water—parts of Tholen, Schouwen, Overflakkee, Putten and Beierland, together with smaller districts in South Holland, mainly in the neighbourhood of Rotterdam and Gouda, and others in North Holland between Alkmaar, Hoorn, Amsterdam and Haarlem. It is not easy to ascertain the precise extent of the flooding, because it is probable that in some areas water has been introduced sufficiently to render the ground soggy but not to cover it.

It seems probable that ultimately the greater part of the islands of Zealand and South Holland will be submerged. Most of the population of these islands have been evacuated to the interior, causing pressure on housing accommodation and food supplies. In all probability, habitation and cultivation in these parts are impossible, though communications can be kept open, for the roads are normally built along dykes. It remains to be seen whether the German defence measures will involve the flooding of anything like the maximum possible area (Fig. 54), but a considerable area is certainly under a threat. This territory includes much of the most productive agricultural land and the chief centres of population in the Netherlands. It should be remembered, however, that by July 1944 only a small part of this area had actually been flooded.

The incidence of damage to agricultural land would be uneven. In Zealand and South Holland the introduction of sea-water by the breaking of dykes would effect most damage. The movement of water between tides cannot be controlled, and complications could

arise through the deposition of marine silt. Furthermore, salt or brackish water has a much greater adverse affect on the soil than fresh water. After the floods in 1916, for example, it became clear that the time taken for soil to recover its productivity was largely related to the proportion of salt in the flood waters. Flooding by fresh water, on the other hand, can be controlled, as it is effected mainly by closing the sluices of the drainage canals and stopping the pumps. The water from the Yssel Meer is also fresh.

An important factor, also, is the possibility of further and more serious damage through the wrecking of sea-dykes and various drainage works. It is clear that the Netherlands economy has already sustained serious losses, and that the completion of the plans to flood large areas would result in a disaster of the first magnitude.

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APPENDIX II

THE SCHELDT QUESTION

Introduction

The ' Scheldt question ' is the product of two facts of history : first, that for the last five centuries Antwerp has been—potentially, if not in fact—one of the great ports of Europe ; and second, that throughout the greater part of this period the West Scheldt, which links Antwerp with the sea, was controlled by a foreign and economically rival power.

It was not until about 1400 that the stretch of water then known, at least for part of its length, as the Honte, assumed its present form of a broad estuary threaded by a continuous deep-water channel.* The name ' West Scheldt ' (Wester Schelde) came into use considerably later, to distinguish this estuary from that of the shallower East Scheldt. The advent of this new waterway combined with other factors, political and economic, to place Antwerp in the front rank of European ports. Yet in her greatness lay the seeds of her decay, for had Nature endowed her less richly she would never have excited the fatal jealousy of her rivals. Her swift rise to wealth and splendour was followed by her sudden eclipse. On 6 April 1572 the Sea Beggars captured Flushing, and with it secured the mastery of the Scheldt. From that day onwards, with the brief interludes of the Pacification of Ghent (1576–85) and of French

* Before the fifteenth century the present West Scheldt did not exist as a continuous navigable waterway. In its place there was an arm of the sea, broad in the centre but narrowing to a channel at each end ; one of these channels connected with the sea and the other with the river Scheldt. The latter channel, lying between the south-east of South Beveland and the north-west ' corner ' of Flanders, was known as the Honte. When, in the early fifteenth century, the present estuary came into existence, the name Honte was extended to connote the whole waterway so formed between the Scheldt and the sea ; this waterway also came to be known, from the sixteenth century, as the West Scheldt, and these two names, Honte and West Scheldt, were used interchangeably for it from then until the early nineteenth century. During the last hundred years, however, the name Honte in this sense has tended to fall into disuse, and the estuary is invariably known as the West Scheldt or Scheldt.

In recent years the more authoritative sources have applied the name Honte to the lowest or most westerly reach of the West Scheldt, namely, between Flushing and the Hoek van Borsele, e.g., Dutch chart ' De Schelde van Vlissingen tot Antwerpen,' 1 : 50,000, Netherlands *Ministerie van Marine, Afdeeling Hydrographie* (revised ed., 's Gravenhage, 1939), and British Admiralty Chart No. 120, ' West Schelde, Flushing to Antwerp ', 1 : 50,000, new ed., 1936, with large corrections to 31 March, 1944. Capt. J. Coopman, Assistant Harbourmaster of Antwerp, also uses the name Honte in this restricted sense in his *The port of Antwerp and its activity*, p. 172 (Antwerp, 1926).

domination followed by the Union with Belgium (1795–1830), the mouth of the Scheldt under Dutch sovereignty has been separated politically from Antwerp. For 200 years the Dutch used their position to strangle the city's trade. A century ago, in reviving the political dualism on the West Scheldt, the European Powers imposed the settlement which governed the river until 1940 and legally still does so. But changing circumstances have long made its revision desirable. The task was attempted, without success, after the last war ; it can hardly fail to be taken up again after this.

The Scheldt question before 1572

The modern Scheldt question dates, then, from 1572. But there was a Scheldt question, not essentially different, even before that time. It was fought out between the County of Zealand and the Duchy of Brabant, which in this respect stood to one another in the same relationship as the Northern and Southern Netherlands after the Revolt, or Holland and Belgium after 1830. Then, as later, the issue was whether Antwerp was to enjoy the free use of the Scheldt and, as soon as it became navigable, of the Honte. This earlier Scheldt question remains of more than purely historical interest, for the decision of the Great Council of Mechlin, adjudicating between Zealand and Brabant in 1504, that the Honte lay wholly within Zealand is still cited by Dutch writers to prove that Holland's sovereignty over the West Scheldt is older than, and owes nothing to, her acquisition during the Revolt of the territory known as Zealand Flanders.

It was in virtue of this territorial right that the Counts of Holland–Zealand levied tolls on the Honte. They had done so from early times, but it was not until the Honte became the highway to Antwerp that these tolls acquired major importance and provoked continual disputes between that city and the Counts, or the Zealand towns, notably Middelburg, acting in their name. (Besides the tolls themselves, one of Middelburg's weapons against Antwerp was its claim, first put forward early in the fifteenth century, to a right of staple over all goods entering the Scheldt from the sea). Only the fact that Zealand and Brabant acknowledged a common ruler, the Duke of Burgundy, prevented these disputes from leading to war ; as it was they could be settled by the rules of law, and so during the half-century preceding the Revolt the West Scheldt carried a greater share of the world's waterborne trade than any river before or since.

The Scheldt during the Revolt

During the Revolt the old provincial frontier across the West Scheldt was obscured by a military frontier, which in turn gave place to the state boundary settled in 1648. After the brief period during which Brabant allied itself with the Northern provinces, Antwerp was reconquered for the Spanish king (1585). The rebels thereupon ' closed ' the Scheldt, that is, they established a blockade upon it. But since the Northern towns partly depended for their livelihood on trade with the Southern provinces, this blockade had continually to be relaxed by the granting of licences to trade with the enemy, and these licences soon became one of the North's main sources of revenue. Thus while the war lasted, although no vessels were allowed direct access to Antwerp, cargoes could cross the military frontier, where they were usually transhipped. During the Truce of 1609–21 the closure was relaxed only to the extent of dispensing with transhipment ; despite Antwerp's entreaties, the Northerners maintained the ban upon direct communication from the sea. It was, indeed, the first threat that what was in origin a war-measure might be retained in peace.

The Treaty of Münster

When peace came in 1648, this threat became a reality. Article XIV of the Treaty of Münster provided that : ' Les rivières de l'Escau, comme aussi les Canaux de Zas, Zwijn, et autres bouches de Mer y aboutissants seront tenues closes du côté desdits Seigneurs Etats '. It was by this clause that Spain accepted the closure of the Scheldt which was to last until 1792. Now a river may be ' closed ' in a variety of ways : physically, by a barrier such as the bridge of boats which Parma had built below Antwerp during the siege of 1585 ; legally, by a declaration of its closure, enforced by policing ; or indirectly by economic measures such as the imposition of prohibitive duties. Thus, in merely declaring the Scheldt ' closed ', without explanation (doubtless because those who negotiated it knew well enough what it meant) the article quoted above provokes the question : what exactly was the closure of the Scheldt established by the Treaty of Münster ?

The closure was designed to cripple Antwerp by giving Dutch ships a monopoly of the Scheldt, and by making the city pay dear for what they brought. It followed that the Scheldt was to be closed only to foreign ships ; and throughout the 150 years of the closure (save occasionally in war) Dutch ships in fact enjoyed un-

impeded passage, although their cargoes paid heavy duties. It was to foreign ships, whether those from overseas seeking to pass up the Scheldt, or Antwerp ships attempting to pass down, that passage was denied. It is a remarkable fact that for more than a century-and-a-quarter no foreign ship attempted the passage. The nearest approach to it occurred in 1654, shortly after the first Anglo-Dutch War. Learning that some English merchants were planning to send two ships up the Scheldt, the States-General protested to Cromwell that this would be a breach of Dutch rights, and the Protector, anxious not to jeopardize the recent peace, saw to it that the scheme was dropped. Neither on this occasion, nor on any other down to 1784, did the Dutch have to back by force the paper closure of the Scheldt. They always maintained a guard-ship on the river at the frontier, where also stood their forts of Lillo and Liefkenshoek, but this was hardly more than a symbol. There can be no doubt, however, that any ship which had tried to enter the river would have been stopped, and that any organized attempt by a foreign state to force the passage would have been treated as an act of war, as was the attempt of the Emperor Joseph II in 1784, when the two ships which tried to pass along the river, one from Antwerp and the other from Ostend, were captured and taken into Dutch ports. For to the Republic the closure of the Scheldt was a vital interest to be defended at all costs.

It is usually stated that the Republic derived the right to close the Scheldt from Article XIV of the Treaty of Münster. But to that treaty the Republic and Spain alone were signatories and the clause in question did no more than secure the assent of Spain (including the Southern Netherlands) to the closure. Thus, while no Spanish or South Netherland ship could attempt to pass the river without infringing the treaty, any other ship could do so, for ' third parties ' were not legally bound to respect the closure. It was this fact which made the English venture of 1654 so ominous to the Dutch and which gives such importance to their protest against it. In that document the right to close the Scheldt is grounded, not upon the Treaty of Münster, but upon Zealand's ancient right of staple, by which, it is argued, all cargoes entering the Scheldt from the sea must be discharged and sold at Middelburg. Such a right had once been claimed by Middelburg ; but it was preposterous to suggest, as the Dutch did in 1654, that the exercise of this right had ever amounted to a closure of the Scheldt. However, the motive for this distortion of history is clear enough ; to base the closure of the Scheldt on

Dutch municipal law, which all friendly states must respect, instead of on a bilateral treaty which bound none but its signatories.

The end of the Münster Regime

The Republic had less need to resort to such shifts after the Barrier Treaty of 1715 gave her an Austro-British guarantee of the closure. But the alliance upon which this guarantee depended only lasted for about thirty years ; it was then replaced by new combinations in which the Republic, grown weak and timorous, fell into dependence upon France. Thus it was that in the 1780's the two Powers which had guaranteed the closure took the lead in trying to break it. Joseph II's attempt in 1784 followed British feelers during the Anglo-Dutch War of 1780. It was left to France to rescue the Republic ; in 1785 Joseph was persuaded to renounce his claim to the freedom of the Scheldt in exchange for minor concessions and an indemnity.

If it was France which preserved the closure in 1785, it was France—but a new, a Revolutionary France—which freed the river ten years later. On 16 November 1792 the French Republic, already master of Antwerp, proclaimed the freedom of the Scheldt on the ground that rivers were the ' inalienable common property ' of their riparians. In 1793 France invaded and overthrew the Republic, and in 1795, by annexing Zealand-Flanders and garrisoning Flushing, France secured the keys of the Scheldt.

To Antwerp the forcible opening of the river brought little advantage, for the British navy blockaded the estuary, while trade languished under the burdens of war. Only the Peace of Amiens, followed by Napoleon's development of the port as a naval arsenal, brought a brief spell of activity. Yet the moral effect of twenty years' freedom on the river was decisive, and no settlement of the Netherlands in 1814 which involved the reclosure of the Scheldt would have been possible.

The Settlement of 1814–15

The International River Commission set up by the Congress of Vienna concerned itself principally with the Rhine, but it also laid down, in a series of ten articles, the general principles which should govern all international rivers in Europe. The second of these articles declared that the navigation of such rivers ' shall be entirely free and shall not, with respect to trade, be denied to anyone '. Since the Scheldt furnished the classic example of those ' unnatural '

restrictions which were now to be abolished, the Commission specified the Scheldt as one of the rivers concerned. With the practical application of its principles to the Scheldt, however, the Commission did not deal, merely declaring that this was to be done in a manner ' most favourable to trade and navigation and as alike as possible to what has been fixed for the Rhine '.

These articles came into force on 9 June 1815, and that date therefore marks the formal abolition of the closure of the Scheldt. But the river was in fact already free. For when the Prince of Orange took over the government of the Southern Netherlands in August 1814 in preparation for their reunion with the North, the historic frontier was obliterated and the entire river from Antwerp to the sea came under one sovereignty. Moreover, one of the Eight Articles of July 1814 governing the constitution of the new Kingdom forbade any economic discrimination between its constituent parts, and for nearly a year before the Vienna articles came into force Antwerp had enjoyed the freedom which they stipulated. She continued to do so throughout the period of the Union, and by 1830 had attracted to herself such a large share of the Kingdom's trade that her commercial future seemed assured.

The Scheldt question reopened

The break-up of the Kingdom of the Netherlands in 1830 inevitably resurrected the Scheldt question. For the establishment of an independent Belgium not only restored the historic dualism on the West Scheldt ; it stirred up afresh in Holland that centuries-old jealousy of Antwerp which had in times past inspired the closure of the river.

There were two possible solutions of the Scheldt question as it presented itself to the London Conference in 1830. By tracing the Belgo-Dutch frontier, not across the Scheldt, but midstream down the river to the sea, the Conference might have forced Holland to share her sovereignty over it with Belgium. But this solution, involving the transfer of Zealand-Flanders to Belgium, was hardly practical politics in 1830. The Belgians were, indeed, aiming at it when they demanded Zealand-Flanders, clearly in the belief—a mistaken one if we accept the Dutch thesis that the Scheldt estuary is theirs no matter who holds its left bank—that this would give them equality of rights with Holland. In rejecting this demand the Conference ruled out the possibility of a settlement along these lines, and had to adopt the alternative, which was to confirm Holland

in her sovereignty over the river, at the same time limiting its exercise to ensure freedom of navigation. Certain things were clear from the outset ; no one, for instance, not even the Dutch (despite occasional Belgian statements to the contrary), envisaged the restoration of anything resembling the closure of the Scheldt. But to reconcile the perfect freedom expected by the Belgians with the respect due to her sovereignty claimed by Holland proved one of the hardest tasks of the Conference.

The Settlement of 1839

The Conference achieved that task in the ninth article of the Treaty of 1839. After confirming the application of the Vienna articles to the Scheldt and Maas, the article placed six main limitations on the absolute sovereignty of Holland over the West Scheldt and neighbouring waters ; the pilotage, buoying and dredging of the Scheldt below Antwerp were placed under Belgo-Dutch supervision ; the pilotage dues were to be moderate and equal for the ships of all nations ; Holland was to levy a single duty of *f.* 1·50 (1·12 for the upward, and 0·38 for the downward, passage) on all ships using the Dutch Scheldt to enter or leave Belgium, and this duty was to be collected at Antwerp or at Terneuzen ; the East Scheldt (the old Scheldt channel, now only used for navigation between Antwerp and the Rhine) was to be subject, as a maximum, to the Rhine duties of 1831 ; the other ' intermediate waters ' between Scheldt and Rhine were to be mutually free and subject to moderate and equal duties ; and finally, if any of these waterways ceased to be navigable from natural or artificial causes, the Dutch Government was under obligation to replace it by another.

That these provisions represented a compromise is clear, for example, from the clause fixing the rate of duty. The Dutch Government had at one time demanded *f.* 4 per ton, the Belgian had long refused its consent to any duty. One of the most important features of the article, and the one which gives it a leading place in the evolution of international river law, was that its benefits were extended to all ships navigating the Scheldt and not merely to those of the riparians. Of vital importance to Antwerp, four-fifths of whose overseas trade was carried in foreign ships, this principle was secured beyond dispute comparatively late in the negotiation, and then not without a struggle. This was partly due to the false analogy, arising from the wording of one of the Vienna articles, between the lower Scheldt, a highway of ocean commerce, and the

Rhine, essentially an interior waterway, on which the practical benefits of free navigation were confined to riparians.

The Scheldt question 1839–1919

During the last century the Scheldt question has become the question of adapting the settlement of 1839 to changing conditions. Two notable changes were made within fifty years of that settlement. In May 1863 the Belgian Government, which since 1839 had reimbursed the Scheldt duty to all ships paying it, concluded an agreement with Holland to redeem the duty by a capital payment of *f.* 17 million, to which, by a complementary treaty of June 1863, the maritime powers made contributions proportionate to their use of the waterway. Shortly afterwards the East Scheldt having been blocked by the construction of the dyke which carries the railway from Flushing to Bergen-op-Zoom, the Dutch Government, in accordance with the Treaty, constructed a canal across South Beveland to replace the earlier channel. The later years of the century also saw a series of agreements designed to improve the pilotage, buoying and lighting of the Scheldt. But during the present century, and especially since the last war, the quickening tempo of economic and technical change has set up a demand for something more than piecemeal revision. In particular, the creation of adequate water-communication between Antwerp and the Rhine, which would involve the replacement of part of the existing route, seems hardly feasible within the framework of the 1839 settlement (see p. 598).

But it is not only the economic terms of the problem which have altered in the last hundred years ; the political setting has also changed fundamentally. In 1839, while Belgium was, by the terms of its creation, a perpetually neutral state, Holland retained complete freedom of action. By the early years of this century Belgium, though still officially neutral and inviolable, was being forced to envisage herself as a possible belligerent, while Holland was fast becoming a neutral state. The war of 1914–18 completed the reversal of the position. Belgium, with Allied approval, renounced her neutrality ; Holland preserved and confirmed hers. These changes gave the Scheldt question an entirely new twist. From 1839 to the opening of this century the problem of the Scheldt in war had remained largely academic. But in the years before 1914 the status of the river in a war which involved Belgium but not Holland became a topic of urgent practical importance. When in 1914 the threatened situation arose, the Dutch Government settled

the matter by declaring that the use of the West Scheldt by belligerent warships or prize-vessels would be a violation of Dutch neutrality, a thesis which it successfully maintained against both parties.

The military aspect of the problem is bound up with the neutral status of both countries. The Belgians claimed that the defence of Antwerp in 1914 suffered because it could not be reinforced by sea ; that Belgian troops were denied exit by sea and thus suffered internment in the Netherlands ; that if Belgium were at peace and the Netherlands were at war the river would be closed to Belgian trade. The Dutch claimed that during the war of 1914–18 their neutrality prevented the use of the river by the Germans for naval purposes. It is probable that through the neutrality of the Netherlands the Belgians gained, on balance, as much as they lost.

The Scheldt question since 1919

Belgium attempted to bring the Scheldt question before the Versailles Conference as much for the commercial as for the strategic issues. The crux of the matter is that the final authority which controls the Scheldt and is responsible for its maintenance is another power, within the territory of which exist powerful interests in direct competition with the Belgian ports. Rotterdam is just as important to the Netherlands as Antwerp is to Belgium. The matter is complicated by the fact that the Dutch claim the sovereignty also of the Wielingen Channel at the entrance of the estuary, even within Belgian territorial waters (see p. 628). The pilotage in the estuary and the buoying and conservation of the channels are, according to the Treaty of 1839, subject to a joint superintendence exercised by an equal number of commissioners from each country. Moderate pilotage dues are fixed by agreement ; it was prescribed by the treaty that the pilotage dues in the West Scheldt were never to exceed those in force on the Maas from the sea to Rotterdam *in proportion to the distance*, so that pilotage dues for Antwerp always exceed those for Rotterdam.

The conservation of the channels is a task of considerable difficulty. The Dutch have always applied a strict interpretation of the treaty, taking care only of the maintenance and proper marking of the channels and in the past even contended that they were bound to maintain only such facilities for navigation as existed in 1839, although in practice they adopted a more reasonable attitude and refused no important request. The continued expansion of the

port of Antwerp before and after the war of 1914–18 suggests that its approaches were by no means inadequate. The Belgians claim, however, that the commission should take cognizance of the other matters on which the extent and security of the channels depend—dyking and drainage of adjoining land, encroachment on the river and its accessory waters, etc. In other words, the Scheldt should be treated as a single hydrographic problem. They allege that serious difficulties of drainage occur in Belgian Flanders through the raising of the level of the Dutch territory which separates it from the estuary. Belgium pays the entire cost of improvements but the consent of the Netherlands government is necessary. The commission has no authority to make recommendations and no neutral chairman with a casting vote.

Closely bound up with the Scheldt problem is the fact that the Ghent-Terneuzen Ship Canal, giving access to Ghent, lies in Dutch territory at its seaward end. The maintenance and improvement of the canal in Belgian territory are largely dependent upon Dutch agreement to the execution of works in Dutch territory. The canal was built by Dutch engineers at Belgian expense, and the Dutch part does not correspond with the Belgian part. As the designs were made in accordance with the views of Belgian experts, it can be argued that any prejudice which Ghent may have received as a port can hardly be ascribed to the Netherlands.

When the Belgians brought their claims for a revision of the Scheldt regime before the Versailles Conference, the Powers appointed a commission to report. The terms of reference, however, represented a triumph for the Dutch ; it could examine only ' proposals involving neither transfer of territorial sovereignty nor the creation of international servitudes '. Such proposals could do little to satisfy either those demands of the Belgians which were legitimate, or those, like the demand for Zealand Flanders, which perhaps took their origin in the heated atmosphere immediately following the German occupation. By 1920, however, more reasonable counsels prevailed and a new treaty, settling most of the questions at issue, was ready for agreement, when a fresh dispute arose over the sovereignty of the Wielingen Channel. By 1925 fresh proposals were put forward in a draft treaty—proposals which did not meet the main Belgian claims but which provided many concessions. It dealt also with the Terneuzen Canal, and the projected Rhine and Moerdijk Canals (see p. 598). In 1927 the treaty was accepted by the Belgian parliament and by the Second Chamber of the Netherlands, but was

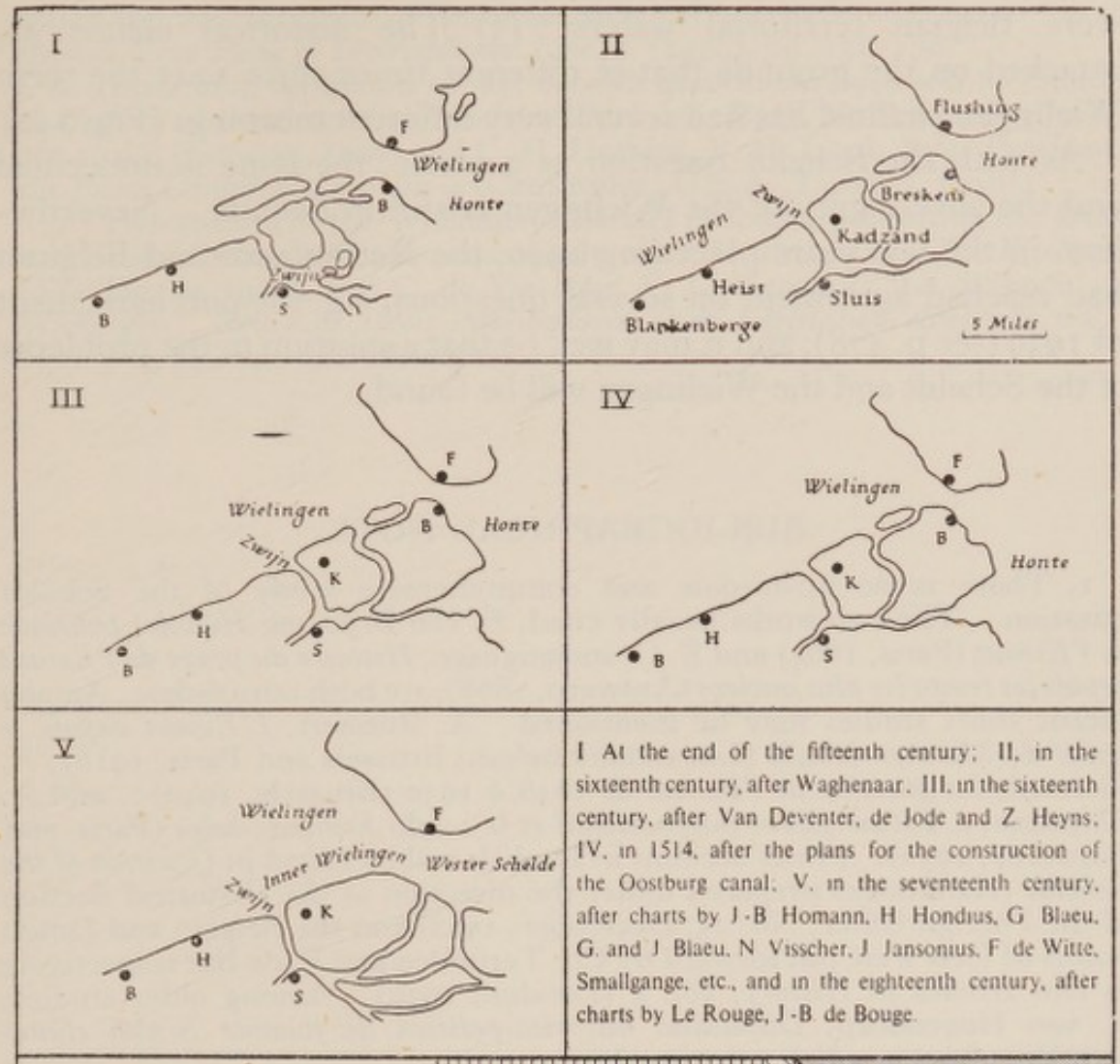
rejected by the First Chamber, partly through the powerful pressure exercised by Rotterdam interests, for two main reasons. The First Chamber held that the plans were too far reaching, and it would not give its assent to the proposed agreement on a separate issue which had been included in the general treaty, viz., Dutch consent to the construction of the Antwerp–Moerdijk and Antwerp–Ruhrort canals (see p. 598).

The proposals of 1925–7 concerning the Scheldt itself represented a considerable measure of agreement, and included provision for arbitration, extension of the competency of the Scheldt Commission and a stipulation that pilotage dues from the sea to Antwerp or vice versa should not be higher than those from the sea to Rotterdam or vice versa. From 1928–31 fresh conversations were opened but no results have ensued, and the Scheldt regime is still able to cause discontent in Belgium.

The Wielingen Channel

This channel, the most important entry to the West Scheldt, runs from Flushing westwards, first along the shore of Zealand Flanders, but later diverges from the coast at the Belgo-Dutch frontier. It extends westwards beyond Zeebrugge to the Wielingen Buoy, 2½ sea miles north of Zeebrugge, and off this port lies partly within the three mile limit from the Belgian coast. The Dutch claim the sovereignty of the entire channel, on the ground of historic rights dating from 1323, and on the ground that if the Scheldt estuary is within their jurisdiction the outlet must be also. The Dutch attitude was summed up by the Foreign Minister in 1920 when he said " Who strikes at the Wielingen, strikes at the Scheldt. Who makes an attempt on the Scheldt, threatens Zealand, who threatens Zealand aims a blow at the whole of the Netherlands ".

The Belgian case rests upon three main arguments. (1) In international law the channel west of the frontier is open sea outside the three mile limit and *Belgian* territorial waters within it. If the claim of the Dutch were admitted they would not only control the Scheldt but would also have a theoretical right to hinder the use in peace or war of Zeebrugge, a principal Belgian coast port. (2) During the war of 1914–18 the Netherlands government admitted that the channel beyond the frontier was not Dutch, explicitly in a note to the British Admiralty in 1916 and tacitly in 1917, when it declared that its neutrality had not been violated by the seizure of a Belgian fishing boat by the Germans, west of the frontier in what



I At the end of the fifteenth century; II, in the sixteenth century, after Waghenaar. III, in the sixteenth century, after Van Deventer, de Jode and Z. Heyns. IV, in 1514, after the plans for the construction of the Oostburg canal. V, in the seventeenth century, after charts by J.-B. Homann, H. Hondius, G. Blaeu, G. and J. Blaeu, N. Visscher, J. Jansonius, F. de Witte, Smallgange, etc., and in the eighteenth century, after charts by Le Rouge, J.-B. de Bouge.

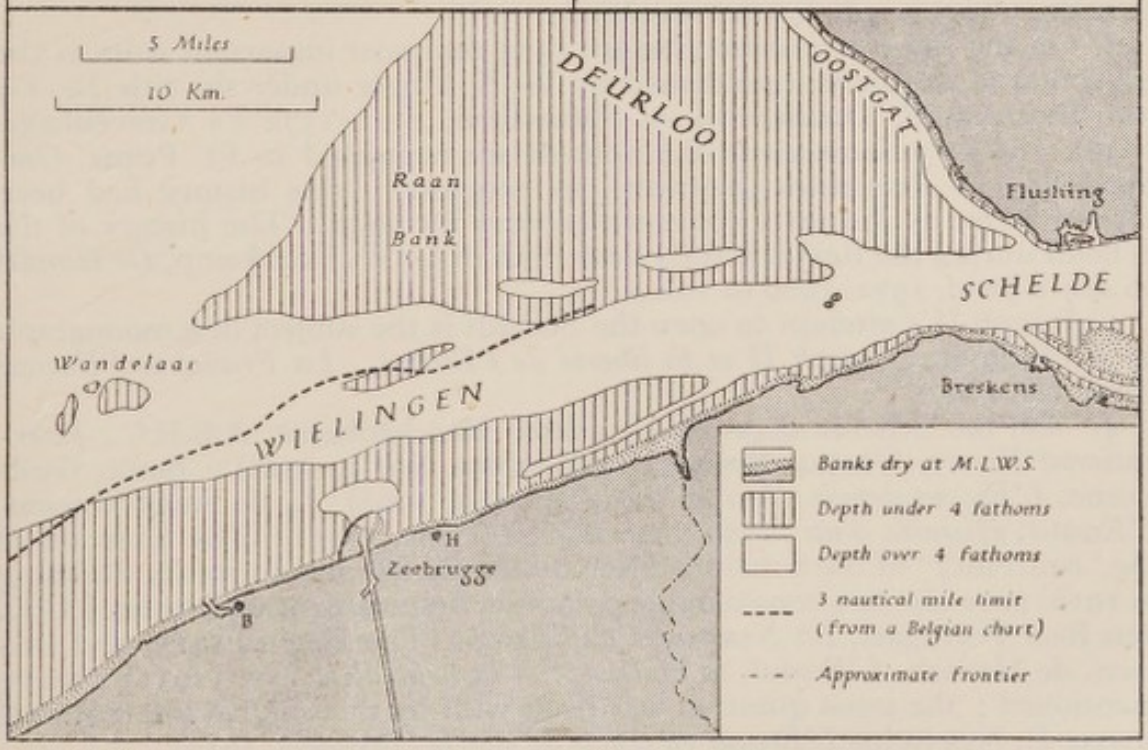


Fig. 142. The Wielingen Channel showing the position of the channel at the present day and the varying positions of the named channel in the past

Historical data from C. de Visscher and F. L. Ganshof, ' Le Différend des Wielingen ', *Revue de Droit international et de Législation comparée*, vol. 1, Nos. 3–4, p. 307 (Paris, 1920).

were Belgian territorial waters. (3) The historical claims are attacked on the grounds that at different times since 1323 the term Wielingen channel has had several very different meanings (Fig. 142).

As with the Scheldt question as a whole, the issue is undecided and the sovereignty of the Wielingen is still in dispute. Nevertheless, in the few years preceding 1940, the Netherlands and Belgium had reached agreement on several questions, e.g. the port agreement of 1939 (see p. 478), and it may well be that a solution to the problems of the Scheldt and the Wielingen will be found.

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APPENDIX III

DUTCH NAVAL HISTORY 1572-1797

The Sea Beggars and the Rise of the Navy

The Dutch Navy may be said to have come into existence in the latter part of the sixteenth century, to have reached the apogee of its greatness in the seventeenth, and thenceforward to have steadily declined until, by the latter part of the eighteenth, it had ceased to be an important factor in international affairs ; although as late as the Seven Years' War the Netherlands was still spoken of as one of ' the Maritime Powers '.

The beginning of a fighting navy was made when the Prince of Orange, during the Revolt of the Netherlands, issued letters of marque to a number of vessels to prey upon Spanish shipping. These ' sea guerilleros ' penetrated into the many rivers and estuaries, hung off the coasts, and captured the shipping engaged in the Spanish services of trade and military transport. As they had no foothold in the Netherlands they frequented the English harbours and the Huguenot fortress of La Rochelle until, in 1572, Queen Elizabeth, under pressure from Spain, forbade them the use of her ports. Driven by want and weather they went into the Maas and there, on 1 April, they found the town of Brill undefended, its garrison, fearing nothing from the sea, being absent on a punitive expedition. They promptly landed and seized the place, and repelled all attempts to recover it. Five days later Flushing threw in its lot with the rebels.

They now had what they needed, a well placed base, close to the rivers through which Spanish supplies passed and where Dutch land forces could be assembled. From Flushing those land forces reduced all the island of Walcheren except the defended city of Middelburg. Elsewhere on land things went ill for the rebels, but the effects of reverses on land were in a measure mitigated by successes at sea. A naval victory in the Zuider Zee enabled the siege of Alkmaar to be raised ; a Spanish attempt to relieve Middelburg was defeated by a Dutch fleet and the city was starved into surrender ; Leiden, whose fall would probably have led to the collapse of the revolt, was relieved in 1574 by the Sea Beggars after a terrible five months' siege.

On the sea the hopes of Dutch freedom rested. Spain therefore made greatly increased efforts to capture the Dutch sea ports, and, by the autumn of 1584 all west Flanders except the two ports of Ostend and Sluis were in Spanish hands : and those ports, too, were threatened. It was because the possession of those ports by Spain would constitute a threat to England that the Queen sent an army under the Earl of Leicester to assist in their defence, and so the ' Low Country Policy ' of this country was initiated (1585).

Dutch command of the sea gave the rebels the financial benefits of trade. The seat of commerce moved from Antwerp to Amsterdam. A new problem then arose which was in future years to provide a perpetual source of discord between the Dutch and the English. Arguing that trade furnished the sinews of war without which they could not continue their struggle, the Dutch conducted trade with the common enemy. Leicester, on discovering the existence of this commerce, forbade its continuance, since much of it consisted of grain and warlike stores which the Spaniards needed. The ' inland ' provinces, who did not share in the benefits of this commerce, gave him some support, but the ' maritime ' provinces, whose merchants drew their livelihood from it, insisted on the right and the necessity for trading with the enemy. Leicester's orders therefore became a dead letter, and their revival in 1596 by the Queen, though glumly assented to by the ' maritimes ', was systematically evaded in practice. This policy of trading with the enemy, with its corollary of ' free ships, free goods ', was an innovation in international law and was to form a permanent stumbling block to Anglo-Dutch relations and an eventual cause for war. The complaint of the English was expressed by the Elizabethan Admiral, Monson. Describing how, in 1591, Dutch ships had been met off the Spanish coast carrying Portuguese goods Monson observed : ' Therein may appear the abuse offered to us by the people of Holland, who though they were the first that engaged us in the war with Spain, and we bore the brunt of it eighteen years together, yet did they cunningly maintain their trade and supplied the Spaniards with ammunition, victuals and intelligence against us '. A further complaint, arising out of the same source, was that when the Dutch declared blockades of ports occupied by Spain, they permitted their own trading ships to enter and leave, a practice which, in English eyes, seemed to aim less at overcoming the common enemy than at conferring on the Dutch the monopoly of a most profitable trade.

Naval Administration

When the Seven Provinces declared their independence of Spain the resulting Dutch Republic was a loose confederation. It lacked unity in the control and direction of its several naval bodies. While the supreme control of the war at sea rested with the States-General, in which each province was represented, no disputed measure could be passed without reference to the Estates of a dissenting province. Unanimity was essential. Sovereignty rested with the provinces and was most jealously retained. The spirit of localism was supreme. In consequence, rapid decisions essential to the conduct of war were impossible and the whole system constituted, in the words of Gardiner, ' a cumbrous machinery quite unsuitable for the management of the war '. Five separate Boards of Admiralty, created in 1579, administered the several navies of the Admiralties of Zealand, Holland (which had two Boards, at Rotterdam and Amsterdam), West Friesland and Friesland, but while the ' maritime provinces ', Holland and Zealand, were interested in sea trade and willing to vote money for its defence, the ' country ' provinces who did not directly share in the benefits, were averse from spending money on the navy. There was lack of co-operation between the navies of the different provinces which caused opportunities to be missed through jealousy—one such occurred in the opening of the Third Anglo-Dutch War, the effect of which was highly unfortunate. The administration was both penurious and inefficient, many of its members being ignorant of the sea and of war. Lack of public attention to the needs of the sea was in some measure compensated for by some of the citizens. In 1631 a number of shipowners offered to fit out, at their own expense, an additional force of ships for the defence of trade. These were known as ' Directors' ships ' and, though originally provided for convoy, they were used later to reinforce the line of battle of the main fleets. They took part in all engagements until the end of the Second Anglo-Dutch War, when, as they had proved undependable and wanting in discipline, they were abolished by John de Witt in his naval reforms, and were replaced by regular men-of-war.

The Struggle for Colonies

Dutch trade expanded during the war with Spain but the Dutch had to fight their way into their new markets. In the East Indies they were opposed as interlopers when the Dutch East India

Company, founded in 1602, sent its ships into the Indian seas where Spain and Portugal had enjoyed a monopoly for a century. So, too, they had to fight their way into the Mediterranean trade. This led to many conflicts. In 1607 the Dutch, learning that a Spanish fleet was preparing at Gibraltar to attack their homeward-bound trade, sent out a fleet under Jacob van Heemskerk to deal with it. Heemskerk found the Spanish fleet in Gibraltar Bay and completely destroyed it. In the Narrow Seas, Dunkirk, then a Spanish port, became a nest of corsairs which preyed upon Dutch shipping and inflicted such losses that a Dutch expedition was sent to capture it. The expedition failed, however, and Dunkirk continued to be a thorn in the side both of the Dutch and the English.

During the Twelve Years' Truce between Holland and Spain (1609–21) relations between England and the Netherlands deteriorated. The reasons were many and all arose out of rivalry at sea. The rise of Dutch sea power in fighting ships and traders was regarded as a threat to England ; the Dutch laid claim to fishery rights in English waters which tended to reduce the English fishing industry which from Elizabeth's time had been cherished as a nursery of seamen and an element in English sea power. England revived a medieval claim for the ' Sovereignty of the Narrow Seas ' and the salute of all foreign ships ; the Dutch insisted on retaining a monopoly of the Far Eastern trade, for, though Grotius in 1609 had preached the doctrine of freedom in the eastern seas in opposition to the Portuguese monopoly, his countrymen, when they had established themselves in those waters, exercised a precisely similar monopoly. A Dutch West Indian Company, founded in 1621, aimed at establishing a similar monopoly stretching from Newfoundland to Magellan Straits.

The end of the Twelve Years' Truce brought further war at sea, and, in 1623, a Dutch expedition captured Bahia, which the Portuguese, however, retook in the following year. A Dutch fleet ravaged the South American coast in 1627, and in 1628 another, under Piet Hein, succeeded in doing what neither English nor Dutch had done in many years of war : it captured an entire Spanish treasure fleet. These attacks and injuries threatened Spain with financial ruin, as the attacks of the English had done in Elizabeth's war. The Spaniards sent a powerful fleet in 1630 to recapture Olinda, a city not far from Pernambuco occupied by the Dutch. It was met by a Dutch fleet of about the same strength and a savage battle took place with heavy losses on both sides : but the Dutch

held Olinda. In 1639 Spain made an even greater attempt to expel the Dutch from Brazil, sending a fleet of eighty-six ships carrying 12,000 men to make a definitive end of the intruders. It was met on its arrival by a weaker Dutch fleet and soundly beaten.

The Struggle with Spain in Europe

While the war was thus being fought in the western Atlantic it was being no less fiercely fought at home. The Dunkirk corsairs attacked Dutch trade and another unsuccessful attempt at its capture was made. A Spanish expedition sent from Antwerp to seize certain islands of Zealand was caught at sea and defeated with the loss of 5,000 men by the Dutch fleet. The Dutch had by then established the command of the sea so effectually that Spanish military reinforcements could only hope to reach Flanders by evasion, and the greater part had to travel by the long and costly land route through France and the valley of the Rhine.

The sea power of the Dutch brought them allies. France, which from the first had encouraged the revolt of the Netherlanders, since it weakened Spain, lent her weight to induce the Porte to admit Dutch shipping into Turkish ports. In 1624 she had concluded a treaty of mutual assistance (Treaty of Compiègne). The effect of this was to hamper the use by the Spanish armies of the land route to Flanders and thereby to make the sea the only line of communication. Though evasion succeeded on two occasions—in September and December 1637—the passage was precarious, and it was plain that drastic steps to break the Dutch command of the sea must be taken. Therefore an expedition rivalling the Armada of 1588 was prepared at Corunna. Consisting of seventy-five ships carrying 25,000 men, it sailed in August with the specific objects of destroying the Dutch navy and reinforcing the army in Flanders. It was encountered by a Dutch fleet under Tromp, driven into Dover Roads and there destroyed on 21 October 1639 under the eyes of an English squadron too weak to prevent this violation of its own waters. Fifteen thousand Spaniards were killed, drowned or taken prisoner for a Dutch loss of no more than a hundred men. The blow to Spanish sea power and to Spain's position in the Netherlands was vital. It was followed by another blow. Portugal, whose fleets had been the backbone of the Spanish navy, regained her independence in 1640. This, however, did not bring an end to the Dutch struggles in the Indies, for Portugal was as resolute as before to exclude the Dutch from the eastern trade.

The First Anglo-Dutch War, 1652–4

The Peace of Münster (1648) ended the long war with Spain, but trouble with England was brewing. It had been suspended during the English Civil War but revived under the Commonwealth and Protectorate. Attempts to compose differences failed and, in October 1651, came the famous Navigation Act which forbade the importation of goods into England except in English ships or in those of the country producing them (see p. 136). There were also other matters in dispute, e.g., the English claim to right of search of neutral ships in time of war, and also the claim that the English flag should be saluted by Dutch ships. As the English Government was unyielding the Dutch fitted out a fleet of 150 ships to supplement their existing navy of some seventy-five. The English took up the challenge and strengthened their navy. A brush occurred in the Straits of Dover between the fleets of Tromp and Blake, itself the result of a misunderstanding concerning the salute to the flag, attempts at reconciliation were in vain and war followed.

The Dutch fought under great disadvantages. To add to the cumbrous machinery of their naval administration, their ships, though more numerous, were, in general, weaker than those of the English. Their trade, on which their national life and prosperity depended, had to reach its destinations by way of the Channel and the north of Scotland, in each case running the gauntlet with English fleets on the flank. Reluctant to suffer the losses which laying up their merchantmen would entail, they at first attempted to do two things at the same time—defeat the enemy and continue their trade. Though they did succeed in convoying home two considerable merchant fleets it was at a heavy cost. Tromp realized that such a strategy would never bring about a decision. When he received orders from the States-General to destroy the English and protect trade, he expostulated at this attempt to do two things at the same time with forces sufficient barely for one. ' I could wish ', he wrote, ' to be so fortunate as to have only one of the two duties, to seek out the enemy, or to give convoy, for to do both is attended with great difficulty '. The Dutch were undoubtedly influenced by the belief that they could not continue to fight if their trade was interrupted, since it furnished the ' sinews of war '. The error of that belief is to be seen in the fact that though the trade was practically stopped in the latter part of the first and during much of the two later wars with England, the Dutch were able to fight so long as they had the supplies from the Baltic to fit out their fleets.

They recognized this in the second year of war. Thereafter they concentrated their fleet with the single object of defeating the English. The English did the same except upon one occasion for which they paid heavily. After a victory off the Kentish Knock (28 September 1652) in the belief that the Dutch navy was crippled and that it was therefore possible to spare ships from home to relieve the situation in the Mediterranean where trade was at a standstill owing to the Dutch superiority, they detached a squadron to the Straits. Now the Dutch were by no means crippled, and the result was that when Tromp put to sea with eighty-eight ships in the spring, Blake had no more than forty-two with which to fight him. The English were defeated, Tromp commanded the Channel, and Dutch trade sailed in safety through it ; the port of London was closed and the King of Denmark came to the aid of the winners, closing the Sound to the English shipping and so cutting off the Commonwealth's supply of naval stores.

The English Council of State learnt its lesson. It concentrated its fleet. The Dutch were beaten in a hard battle off Portland on 1 February 1653, a battle brought about through over-confidence on their part in believing it was now safe to resume convoys. Tromp, with a large convoy from France, was intercepted by an English fleet fresh from port. He fought with great courage and skill, and, though he brought most of his merchantmen to harbour, he suffered heavy losses. The advice he then gave his Ministers was that their merchantmen ' should lie still and not stir outward or homeward while the English are strong at sea '. When the English had been beaten ' our merchantmen may then securely go or come with small convoys '. Experience was to show the wisdom of this advice.

Two further battles followed. Off the Gabbard (1–4 June 1653) the Dutch were so hard hit that the English fleet was able to institute a temporary blockade, and off the Texel (29 July) the Dutch were not only defeated but Tromp himself, the source of their strength, was killed. Though preparations were made in both countries for a renewal of the struggle in 1654 both were greatly exhausted, and the Treaty of Westminster was signed in April 1654. The Netherlands' dominance as a sea power was shaken, her claims for ' free ships, free goods ' were rejected, and a heavy financial burden fell upon her. But that burden did not stand in the way of maintaining the navy. John de Witt set about restoring its strength and correcting the faults the war had disclosed. The fighting ships had proved too weak, the armed merchantmen were unfit for the battle line,

and there was a lack of frigates. At the same time, the conditions of the seamen—their pay, their prize money, recruitment, discipline and training—were in need of reform. As a result of De Witt's efforts the Dutch navy which fought in the two following wars with England was a far more formidable force than that which had fought in the war of 1652–4.

War with Sweden, 1658–60

Peace with England did not spell inaction for the Dutch navy. Dutch trade in the Mediterranean needed protection against French and Barbary pirates. War with Portugal, mainly concerning Brazil, broke out in 1657 : a Dutch fleet blockaded Lisbon, and Dutch forces captured Ceylon and Macassar. Dutch interests in the Baltic were threatened when Charles X of Sweden attacked Poland, seized Danzig (thereby cutting off Dutch supplies of naval stores and corn), and attacked Denmark, all of which pointed to an intention to make Sweden the master of the Baltic. In two successive years Dutch fleets carrying armies were therefore sent to protect Denmark. A defeat of the Swedish fleet in 1658 relieved Copenhagen, besieged by the Swedes. In the following year, when Sweden renewed her attack, a still more powerful Dutch fleet with a larger army was sent to the Sound. It inflicted so decisive a defeat on the Swedes that a blockade of the Swedish ports became possible, and Sweden made peace in 1660.

The Second Anglo-Dutch War, 1664–7

When, in 1660, Charles II was restored to the English throne, Anglo-Dutch relations at once worsened. A new Navigation Act was passed in that year, more rigorous than its predecessors. Rivalry in the West African trade arose, and old grievances were resurrected concerning the treatment of English traders in the East. Without a declaration of war, English squadrons attacked Dutch settlements in Africa and the Smyrna fleet (1661). There were other attacks and retaliations in 1664 but England did not officially declare war until March 1665.

The war opened with an English attempt to force the Dutch fleet to sea to protect some homeward-bound convoys. Unable to remain off the Dutch coast when the convoys, putting into neutral ports, did not arrive, the English fleet went to Solebay off the Suffolk coast to revictual. There it was attacked by the Dutch but the

sudden attack lacked the old vigour of Tromp, and the advantages of surprise were lost. The English weighed and, in the battle that followed, inflicted a defeat on the Dutch, who retreated to their harbours. The blockade of the Dutch ports was resumed, but it was not maintained. Under orders from the king the fleet transferred its attention from the enemy fleet to a convoy sheltering in Bergen. It was rebuffed with loss and the result of the strategical error was so to disable the English fleet that when the Dutch, repaired after their defeat, put again to sea, it was unfit to conduct a campaign. Winter came without further actions of importance.

At this point the French answered the Dutch demand for help under the terms of a defensive treaty of 1662. Encouraged by the obvious difficulties of the English—lack of money, discontent with the war, and the Great Plague—Louis decided that it was now safe to act and ordered a fleet into the Channel in the spring of 1666. The English fleet was now threatened by a Dutch fleet in the east and the coming of a French fleet from the west. In that situation the English ministers made a fatal error : they ordered the fleet to divide. A squadron was detached to meet the French and hence when the Dutch appeared they were vastly superior to the remaining force. A four-days battle was fought, in which the English, greatly outnumbered, were beaten with a loss of twenty ships, but not without having inflicted considerable losses on the enemy. Both fleets were again ready in a few weeks to put to sea. They met in approximately equal strength on 25 July in a battle in which the Dutch were severely beaten, the English suffering such slight loss—one ship only—that they could follow up the victory with an attack on the Dutch port and shipping in Terschelling. So the year ended with the English dominating the sea, gravely straitened though they were by internal difficulties, among them the Fire of London and the lack of money to pay their navy. In this situation, the king allowed himself to believe that the Dutch had been so decisively beaten that all that was needed to end their resistance was an attack on their trade by cruising squadrons. Against the advice of his sea commanders he laid up the great ships. The Dutch, however, were far from considering themselves at the end of their resources. They fitted out a fleet of eighty ships which put to sea in the early summer, ravaged the Firth of Forth, cut up the East Coast trade, attacked the Thames and raided Chatham (June 1667). They carried off some and burnt others of the fleet and blockaded the river, closing the port of London. It was this campaign which

secured the Dutch the favourable terms of the Treaty of Breda signed later in the year.

The Third Anglo-Dutch War, 1672–4

The Treaty of Breda was followed by a Triple Alliance of Holland, England and Sweden. Its object was to check the growing aggression of Louis XIV. The French king detached Charles from the alliance and engaged him in the secret Treaty of Dover for the despoilment and destruction of the United Netherlands. The plan of war involved one invasion of the Netherlands across the land frontiers by a French army of 120,000 men and another from England covered by an allied Anglo-French fleet. The essential preliminaries were a junction of the two fleets and then the forcing of a decisive battle with the Dutch fleet. Battle was to be forced by threatening Dutch trade and decisiveness was to be assured by obliging the Dutch to fight at such a distance from their ports that, when tactically beaten, they could be destroyed in the pursuit and not regain the shelter of their harbours as they had done in some earlier engagements, thus escaping destruction. The junction was made but the plan was upset. Under De Ruyter the Dutch took the initiative, caught the allied fleet at anchor in Solebay, and fought a skilful battle. The brunt of the action fell on the English divisions, for the French, either from incapacity or want of good will, took little part : though the battle was tactically indecisive it was a strategical victory for the Dutch, for it crippled the allied fleet and made the projected invasion impossible. Beyond doubt it saved the Netherlands, for the French armies had overrun several provinces and the simultaneous landing of an army on the coast could hardly have failed to be decisive. After some cruising on the part of the allied fleets aimed at the Dutch convoys, which escaped them, the fleets retired to winter in their home ports in France and England. On their return to harbour Dutch sailings were resumed.

In the following year, 1673, the allied plan was again to force the Dutch fleet to a decisive battle, this time by a threat of invasion. The Dutch made a bold attempt to forestall the junction of the allies by blocking the Thames with blockships, which failed. The allied fleet went off the Dutch coast, where their threat was met by a brilliant strategy of offensive sallies by De Ruyter, who seized every opportunity to attack, but never allowed himself either to be drawn far from his ports or to become so deeply involved that he could not disengage in time after inflicting all the damage possible on the

allies. A severe battle was fought in August off the Texel, when an allied threat both to the coast and to an important homeward-bound East India convoy had brought orders to De Ruyter from the Prince of Orange to engage in battle. The fleets met in full strength, but the French division held off in a manner so marked that even one of their own commanders protested, which confirmed, in the minds of many Englishmen, the belief that they had orders to withhold their help. Tactically, the battle was indecisive. Stragetically the Dutch attained their ends. No invasion was possible so long as the Dutch fleet was undefeated. By the end of the year public discontent with the war was widespread in England, where it was felt that English interests were being subordinated to the king's private animosity. At the same time the Dutch position was improved by the addition of Spain and Austria to the enemies of France. In February 1674 the Treaty of Westminster was made with England, which provided for a mutual restoration of conquests.

The Dutch Navy in the Mediterranean (1674–8)

Though the peace enabled reductions to be made in the Dutch fleet, there were still duties to be performed in widely separated seas. France, deprived of her English ally, and being too weak alone to face the Dutch in home waters, transferred the bulk of her fleet to the Mediterranean to meet the Spanish navy, while her corsairs from Dunkirk—now a French port—and from Martinique harassed Dutch shipping in the Channel, in the North Sea and in the West Indies. Dutch convoys provided defence in the home areas, but an attempt to stamp out the danger in the West Indies by the capture of Martinique failed. In the Mediterranean, where the Sicilians had arisen against their Spanish masters, French troops went to their assistance. Spain, too weak at sea to interrupt the passage, called on the Dutch for help. In response, a squadron was sent in 1675 under the command of De Ruyter with the primary object of recovering Sicily for Spain. Dictates of a mistaken economy prevailed over the protests of De Ruyter that the force—eighteen ships only—would be inadequate, and, in consequence, the admiral had to oppose the French fleet with forces that were both numerically inferior and individually weaker. He fought two battles, one off Stromboli in January with the object of stopping a French military convoy, and the other off Augusta in April. Though the Dutch fought with all their old skill and courage, the odds against them were too heavy. Both actions were indecisive, though in favour of

the French ; and in the second battle De Ruyter was killed. In a third battle, in which the French attacked the combined Dutch and Spaniards in Palermo harbour, they inflicted heavy losses on the allies. Alive at last to the need for stronger forces the Dutch sent out a reinforcement. It was too small and it came too late. It was intercepted by a superior French squadron off Cadiz and driven into port. So the French continued to hold Sicily until 1678, when an Anglo-Dutch treaty of mutual assistance was signed, to implement which Parliament ordered the preparation of a fleet of ninety sail. In the face of this combined sea power King Louis evacuated Sicily and the Treaty of Nymegen followed in August of the same year.

The War of the Grand Alliance, 1689–97

The territory of the United Provinces was still intact, but Dutchmen felt that they still lay under the shadow of a threat from France. Because of this threat, the Stadtholder—later king William III of England—used every effort to create a Grand Alliance to oppose French aggression. His attempts found little favour in the eyes of the Dutch trading community, who, bent on commerce and disliking expenditure on the navy, advocated a policy of rigid isolation and economy in armaments. French aggression, it was argued, need not concern the United Provinces. They should stand aside so long as they themselves were not attacked. In this spirit the Dutch navy was reduced to a shadow of its former greatness.

In spite of the opposition of the trading magnates the Grand Alliance was brought into existence and the war that followed (1689–97) found the two maritime powers acting together. The initial design for the war at sea was that their combined strength should be used with the object of bringing the utmost possible economic pressure to bear upon France. All French seaborne trade was to be stopped so that France might be deprived of the financial means of waging war. The old Dutch doctrines of ' free ships, free goods ' and the rights of neutrals were abandoned on this occasion. France, it was argued, was the common enemy of all nations, and therefore the interests of all nations were concerned with her defeat. The neutrals, even though they should take no active military part in the war, should make their contribution to the common cause by ceasing all commerce with France, and this they were requested to do. The request fell on deaf ears. None of the neutrals was more disposed than the Dutch themselves had been on earlier

occasions to deny themselves the profits of their trade. The proposed ' boycott ' of France therefore broke down, for, strong though the allies were, they were not strong enough to enforce their will on all the other powers.

Dutch fleets took part with English in all the major operations at sea in the first part of the war—the battles of Beachy Head and la Hogue, the cruises in the Bay and the defence of the Smyrna convoy. They fought as courageously as they ever had, but their antecedent economies and their cumbrous administration reduced their efficiency. They were invariably late in appearing at sea in the spring and their numbers fell short of their agreed quota. When the French, after their defeat at la Hogue, abandoned the ' war of fleets' and adopted the *guerre de course*, they inflicted heavy losses on both Dutch and English shipping. The Dutch, having the lesser resources, suffered most : their convoys were insufficiently defended. At length, in 1697, the Treaty of Ryswick was concluded.

The War of the Spanish Succession, 1702–13

Queen Anne's war again found the Dutch and English navies acting together in the task of curbing ' the exorbitant power of France '. The Dutch took part in the expedition to Cadiz and the capture of the galleons at Vigo, but, as in the earlier war, Dutch contingents were late in joining, and were less in quantity than their quota. Marlborough's designs for a Mediterranean campaign in 1703 were upset by the delay in the appearance of the Dutch squadron. In 1704, his plans for the capture of Toulon were opposed by the Dutch, who insisted on keeping their fleet for the purpose of defending their commerce, and who were strongly averse to engaging in what they called a desperate enterprise—a sad contrast to the spirit which had actuated the Dutch statesmen and seamen from the early years of the seventeenth century until the end of the war with France in 1678. Hence, at the battle of Malaga (1704) twelve Dutch ships only took place, in place of their quota of twenty or so. After the battle, when the French repeated their policy of the previous war and resorted to commerce destruction, Dutch shipping again suffered greatly. Their economies had reduced their forces below the strength needed for defence alone.

It should be remembered, however, that the Dutch were faced with the necessity of providing for land forces, which cut into their resources. Furthermore, being in alliance with England, they elected to look to her to protect their interests at sea. Their fleet

shrank from fifty-three of the line in 1702 to forty in 1711. This result was not wholly unfavourable to England, as it forced her to provide for the war at sea herself and made English statesmen realize the error of depending on another power in the vital matter of naval strength, but the Dutch failure to fulfil their obligations was greatly resented in London. A resolution was submitted in Parliament in 1712, pointing out that extra burdens had been thrown on the British navy which had been difficult to meet and had caused serious losses. The average shortage of the Dutch quota during the ten years of war was given as about 50%. The desire to maintain a navy had largely evaporated. The decline in the sea spirit of the Dutch was shown in their abandonment of Mauritius, which was promptly seized by France and shortly after converted into the principal French naval base in the Indian Sea.

The Decline of the Dutch Navy

The decline in the Dutch navy proceeded rapidly after the Peace of Utrecht. Opulence took precedence over defence in the Dutch mind. The provinces ceased building ships. Between 1713 and 1746, the admiralty of Friesland built one small ship only ; from 1713 to 1725, the admiralty of Rotterdam built none ; between 1700 and 1746, Zealand, a maritime province in the past, built only four and those were of small fighting value. Amsterdam took some steps for the protection of her trade against the Algerine pirates, but on a meagre scale only with half a dozen small ships, useless for any larger purposes. The naval career fell into contempt and officers had to be recruited from foreigners. The inevitable result followed. The Dutch were unable to protect their Baltic interests when Dutch commerce was interrupted by Charles XII of Sweden ; they stood aside when the Treaty of Utrecht, to which they were signatories, was flouted by Spain in 1718.

The Eighteenth Century

The occasion for fulfilling their obligations of mutual assistance with England (under the treaty of 1678) arose in 1744 when France attempted an invasion of England. The Netherlands was then called on to supply the agreed squadron of twenty ships. She was not able to send more than a fraction of the number, and those were so ill-equipped that they could not keep the sea for more than the shortest cruise. The Dutch fleet played no effective part in the war, even

though the Netherlands was threatened with invasion in 1747. After the Peace of Aix-la-Chapelle (1748) an attempt was made to remedy matters by reform of their admiralties, but it failed in face of the commercial spirit which disliked expenditure on the navy. In the Seven Years' War, England again called on the Dutch to supply the reinforcement laid down in the treaty of 1678, but again reason was found for not doing so ; and, while they denied their obligations, they claimed the right to carry French West Indian goods, to the detriment of the British measures for exercising economic pressure on France.

The Stadtholder made another attempt to restore the navy after the war. It failed in the face of the opposition of the ' country ' provinces. ' So nothing was done, and the Republic, torn by divided interests and with its ruling classes lapped in self-contented comfort and luxury, was a helpless prey which seemed to invite spoliation '.*

The Dutch ports in the West Indies became entrepôts for supplies to the revolting American colonies and the French fleets during the war of 1775–83. Enemy privateers were allowed to shelter and refit in Dutch ports. Holland again refused to send the aid provided for in the treaty of 1678. When, eventually, Britain declared war, the Dutch, with a diminutive fleet of some twenty ships, could protect neither their shipping nor their possessions abroad. Their trade, for which they had sacrificed their navy, ceased. Their West Indian entrepôt at Saint Eustatius was taken. Their Baltic trade, which in 1780 had employed 2,000 vessels, in 1781 employed only eleven.

In the French Revolutionary War, Holland threw in her lot with France. Thereby she lost her colonies. Her navy played a minor part in an attempted invasion in 1797, but was defeated off Camperdown by an approximately equal British fleet. Thenceforward the Dutch navy exercised a negligible influence on the war.

The Evolution of Naval Tactics

The Development of the Line of Battle. Tactics, in the sense of an ordered system of fighting, came into existence slowly in the Dutch navy ; there are no records, for instance, of formations corresponding to those employed by the galley fleets of the Mediterranean, evolved by generations of self-propelled fleets from Salamis to Lepanto. This absence of formation was common to all the early sailing navies

* G. Edmundson, History of Holland, p. 322 (Cambridge, 1922)

of the sixteenth and seventeenth centuries ; Captain Nathaniel Butler, in his dialogues on maritime affairs written in 1634, observed that the past afforded little help for concerting the ordering of a fleet in battle. In both of the battles between the Dutch and the Spaniards—in 1607 in Gibraltar Bay and in 1639 in the Downs—there was merely an onslaught of a mass, governed, in the main, by the principle of mutual support.

It was not until the First Anglo-Dutch War that any sign of a tactical system appeared, and even then there was no indication of a line of battle. Tromp's orders of June 1652 convey the impression of a fleet divided into three squadrons with each squadron in three divisions, the duty of each group being to support the others. Captains were enjoined to keep close to their admirals and ' each squadron when another is vigorously attacked shall second and free the other '. De Witt's instructions to his captains, a few months later, laid down that ' they shall keep close up by the others and as near together as possible to the end that thereby they may act with united force . . . and prevent any isolation or cutting off of ships occurring in time of fight ' ; they must ' stand by and relieve one another loyally, and rescue such as might be hotly attacked '. The first instance of a Dutch fleet forming a single line of battle appeared in the Battle of the Texel (July 1653) and this formation seems to have been borrowed from the English instructions of 29 March 1653 to their Generals at Sea.

Though the group system was replaced by the line, the Dutch formations were looser than the English. There was less military discipline and subordination. The extreme individualism that characterized the Dutch provinces filtered down into the navy. The captains, many of them merchant seamen without military training or tradition, were inclined to fight for their own hands, and preserved their freedom of action even to the extent of deserting the battle ; there were many complaints of desertion from the Dutch admirals.

One characteristic of Dutch tactical ideas in the first of the three wars with England was the desire to board. The English, since Henry VIII's time, had established the principle that a naval battle was an artillery affair ; they had accepted the gun as the decisive weapon. The Dutch had not reached that conclusion ; their artillery was, on the whole, lighter than that of the English, and their gunners were less well trained. The experience of the war of 1652–4 having showed them their weakness in this respect, De Witt

instituted reforms aimed, *inter alia*, at improving matters in both these elements.

The Use of Fireships. The Dutch attached considerable importance to the fireship, and the three Anglo-Dutch wars witnessed a steady development in its tactical employment. In the First War there was an almost complete lack of tactical combination between the capital ships and the fireships. Such attacks as fireships made were individual, without any methodical support from the heavy ships ; and, in consequence, they were a complete failure. In the Second War, the value of co-operation was made evident by the English in the battle of Lowestoft, when Lord Sandwich, having broken the Dutch with the fire of his heavy ships, threw in his fireships, which burnt eight Dutch ships and brought about complete confusion. Though this occurred by accident rather than by design, it evidently impressed the Dutch commanders, for in the next battle they followed up a heavy capital ship concentration on the English admiral with a fireship attack which came very near to success ; but, as they lifted their ' barrage ' before the defence of the English had been sufficiently overcome, the attack was beaten off. Neither in the Four Days' Battle nor in the Battle of the North Foreland (June and August 1666) did the Dutch establish a full measure of co-operation ; but the need was well recognized by De Ruyter in the Third War. His instructions for Solebay contained the following paragraph. ' Fireships will invariably move close behind another vessel in order that, under cover of her guns and their smoke, they may attack with resolution the capital ship or ships of the enemy '. His plans for the attack of Solebay included the formation of an advanced squadron, composed of eighteen fireships supported by eighteen capital ships, which was to be thrown upon the enemy at a favourable moment. The Dutch never committed the error of using the fireship defensively—to repel the fireships of the opponent. Their objective was always the enemy's capital ships. The same spirit of the offensive that coloured the use of the fireships coloured also the tactics of the capital ships. De Ruyter observed the sound military principle that weakness can only be compensated for by offence. He aimed at seizing the initiative, achieving surprise, and concentrating a superior force upon a portion of the enemy, while containing the remainder—the principles adopted by Suffren (who was a student of De Ruyter's work) and, later, by Nelson at the Nile and Trafalgar.

Though the Dutch navy declined in the eighteenth century, touch

was apparently kept with tactical principles. The principle of the combined use of all arms appears in de Winter's dispositions at Camperdown. In that battle he used his two larger frigates and seven smaller vessels to supplement the fire of his capital ships, making them into a kind of second line, firing through the gaps between the greater ships—an action which hampered Duncan's efforts to break the line.

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APPENDIX IV

MAPS AND CHARTS OF THE NETHERLANDS

HISTORICAL INTRODUCTION

The hundred years following the middle of the sixteenth century are often called ' the golden age of Dutch cartography '. The central position of the Low Countries, the interest of the Dutch and the Flemings in overseas lands, and their striking artistic as well as commercial ability, account for the prolific output of maps and charts during this period. Outstanding cartographers were Gérard de Cremer, better known as Gerhard Mercator, Gemma Frisius, and Abraham Ortelius, to whom the development of the science of map-making owes much. They were associated primarily with the Southern Netherlands, but soon the centre of cartographic activity was to move to the northern provinces.

During the sixteenth century, the cartographers of the northern United Provinces were concerned primarily with the production of charts and of sailing directions. In 1584–5, there appeared at Leiden the two volumes of the *Spieghel der Zeevaerdt* (' Mariners' Mirror '), which was compiled by Lucas Jansz Waghenaar of Enkhuizen. It became a standard work and as a result English chart-books for many years were known as ' Waggoners '. Waghenaar examined, revised and assembled large numbers of manuscript charts and ' rutters ' ; the latter were booklets, originally in manuscript form and later printed, which described courses and distances between various ports, and were illustrated by simple plans and sketches. Another book of charts, *Amstelredamsche Zee-Caerten*, which also appeared in 1585, contained detailed coast-maps from Dunkirk to Jutland.

Towards the end of the sixteenth century, Amsterdam became the dominant centre of European cartographical activity. In 1592, Petrus Plancius produced his famous world map, based on the results of the latest explorations. In 1604, Jodocus Hondius bought from Mercator's heirs the engraved copper plates from which the famous *Atlas sive cosmographicae meditationes* of 1595 had been printed, and several editions of the Atlas were subsequently produced by Jodocus, by his son Henricus and by his son-in-law Jan Janszoon ; probably the most interesting edition is Janszoon's *Nieuwe Atlas*, which was beautifully engraved and coloured.

The most famous map-producer during this period was Willem Janszoon Blaeu (1571–1638), a highly skilled navigator, geographer and cartographer. His prolific output included terrestrial and astronomical globes, maps, charts and atlases. He was given the title of ' Cartographer to the Republic ' and in 1633 was appointed ' Hydrographer to the East India Company '. Outstanding productions by Blaeu were his world map of 1606 on Mercator's projection, the four volumes of charts entitled *Het Licht der Zeevaert*, and the great six-volume *Atlas Novus* in 1634. This last work, originally produced with accompanying text and legend in German, appeared in many subsequent editions and in several languages ; his sons continued the work, which ultimately grew into a twelve-volume *Atlas Major*.

Throughout the seventeenth century, the Allards, Donckers, Van Loons, Valks, Schencks, De Wits and Visschers, the chief map-making families of Amsterdam, flooded Europe with maps, atlases, charts and ' sea-mirrors ' ; large numbers of these are still extant. There were also produced many

town plans ; a notable collection of these was Braun and Hoefnagel's *Civitates Orbis Terrarum*. In order to sell the maps and to meet ever-increasing competition, the majority were very attractively produced. Main features included the arrangement of the title, scale and legend in a decorative frame known as a ' cartouche ', and the striking use of colour. In order to avoid blank spaces on the maps, compilers unfortunately resorted to the use of dubious or incorrect information ; gaps were also filled with elaborately drawn ' monsters '.

The cartographical supremacy held by the Dutch gradually passed to the French and then to the English ; eighteenth-century maps were more accurate, less decorative and more prosaic, and appealed to the scientific attitude of the century. For a time Dutch charts maintained their reputation, and Johannes van Keulen and his family produced several chart-books in the eighteenth century. But when England became the leading maritime power and London the chief cartographical centre, many Amsterdam map-makers established themselves there ; a prominent example was Hermann Moll.

Modern Maps of the Netherlands

The modern mapping of the Netherlands began in effect during the French Revolutionary and Napoleonic period. The Southern Netherlands had been mapped by Joseph de Ferraris, who produced in 1777 a twenty-five sheet series on a scale of 1 : 86,400. The lack of a good general map of the Northern Netherlands was felt in 1798, when the Batavian Republic was formed. Lieutenant-Colonel (later General) C. R. T. Krayenhoff (Kraijenhoff), an engineer-officer on the General Staff at Amsterdam, was appointed to produce a map of the country on the scale of 1 : 115,200. His survey was based on a network of triangles which were fixed astronomically, and represented a considerable advance in triangulation methods (see p. 653). Three sheets of his map, the *Chorographische kaart der Hollandsche Departementen*, appeared in 1810. The series was completed in 1822 as the *Choro-Topographische kaart der Noordelijke Provincien van het Koninkrijk der Nederlanden*.

In 1815 was formed the *Topographische Bureau*, which has been ever since the official map-producing authority ; its name was changed in 1868 to the *Topografische Inrichting*, and in 1935 to the *Topografische Dienst*. Cadastral plans on the scale of 1 : 2,500 were begun in 1808 by a decree of Napoleon, and work on them has since proceeded continuously. The geodetic and triangulation surveys of the nineteenth century and the official series which have been produced are described on pp. 653–7.

DESCRIPTION OF MAPS

The maps of the Netherlands may be described under the following heads :

A. Netherlands Government topographical maps.
B. Maps issued by the Geographical Section of the British General Staff.
C. Netherlands Admiralty charts.
D. British Admiralty charts.
E. Geological maps.
F. Miscellaneous maps.
G. Atlases.

In each group, the maps are listed as far as possible in order of scale,

those on a large scale coming first. The following particulars are given where possible for each series :

(1) Scale and title.
(2) Authority responsible for its production.
(3) Date of production, with subsequent revisions.
(4) Number of sheets in the series.
(5) Size of sheets, measured to the margin of the area mapped.
(6) Projection.
(7) Meridian of origin ; grid and/or graticule.
(8) Miscellaneous marginal information.
(9) Whether coloured or in black.
(10) Method of representation of relief.
(11) Details of roads, of railways and of other features.

When a map has been issued in several editions, full details are given for the first edition only, and amendments are noted in the case of the others. A short note is sometimes added on the value of the map, its legibility and its accuracy.

A. Netherlands Government Topographical Maps

The organization of the Netherlands official survey services

The government department primarily responsible for the production of maps is the *Topografische Dienst*, a department of the *Ministerie van Oorlog* (War) at The Hague. In 1878, it was placed under a Director who was a civil servant, but remained directly under the control of the General Staff for the production of all maps of military importance. The cadastral plans on a scale of 1 : 2,500 are produced and constantly revised by the *Katasteramt*, a department of the *Ministerie van Financien*. Triangulation, precise levelling and geodetic work are carried out by the *Rijkscommissie voor Graadmeting en Waterpassing*, which is also under the *Ministerie van Financien*.

An annual list, *Catalogus van Kaarten, uitgegeven door den Topografischen Dienst*, published at The Hague, gives details of each current series and of the latest revisions of individual sheets.

Geodetic and Triangulation Surveys

The first triangulation survey of the Netherlands was begun in 1800 by Krayenhoff, whose methods represented a considerable technical advance. He measured a base 5,650 m. long on the frozen surface of the Zuider Zee between Monnikendam and the island of Marken, and from this observed the bearings of all visible steeples. He then extended his network over most of the present Netherlands, with the exception of Limburg ; this was similarly surveyed by J. Erzeij (Erzey) in 1816–19. In all, seventy-nine points of the first order had been calculated by 1822, and these served as the basis for Dutch topographical maps until the new triangulation, which began in 1866. During the period 1815–30, the Southern Netherlands were covered with a similar network, which was linked with the triangulation of Krayenhoff, with the French network to the south, and with the Rhineland network to the east.

No secondary triangulation accompanied Krayenhoff's surveys ; detail was drawn in and fixed to the seventy-nine points of the first order, which, of course, were far too few for an accurate topographical survey. A secondary triangulation was carried out between 1837–8 in North Brabant and Limburg for military purposes, and after the secession of Belgium was

recognized in 1839, it was decided to extend this work over the whole country. Krayenhoff's primary points were increased from seventy-nine to 145 by extending his network, and a further 1,500 points of the second order were fixed ; this gave an average of one fixed point to every 32·1 square km. Details of these surveys are contained in *Meetkundige Beschrijving van het Koninkrijk der Nederlanden*, published by the *Ministerie van Oorlog* in 1861.

Krayenhoff's triangulation survey served as a basis for the first edition of the 1 : 50,000 series. In 1861, the Prussian General J.J. Baeyer began his measurement of a degree of latitude, and the adjoining country of the Netherlands was invited to collaborate. One of the main points used was the observatory at Leiden ; as a result, its director, Professor F. Kaiser, decided that the degree of accuracy of Krayenhoff's survey was not sufficient for future cartographical work. A new triangulation was begun in 1866 under Dr. E. J. Stamkart ; the work, however, progressed slowly until the *Rijkscommissie voor Graadmeting en Waterpassing* was formed in 1884. The work at first was confined to the calculation of points of the first order. These were surveyed in three main groups ; it is interesting to note that the first two groups were derived from a base-line measured near Bonn by the *Trigonometrische Abteilung* of the *Preussische Landesaufnahme*. The results were published in 1903 as *Triangulation du Royaume des Pays-Bas, Tome* 1. The third group of points was completed by 1909. A base near Stroe in Gelderland was computed in 1913 as a check on the extended triangulation, and although the work was delayed by the war of 1914–18, the *Triangulation du Royaume des Pays-Bas, Tome II*, was published in 1921, thus completing the primary triangulation. Bessel's ellipsoid of 1841 was used for all calculations.

The computation of points of the second degree of accuracy, begun in 1899, was completed in 1928, and the results were published at Delft in the following year as the *Rijksdriehoeks-meting* (1885–1928). In all, 3,732 points were fixed. Between 1924 and 1927, the Dutch network was linked to that of western Germany, while in 1929, just after Belgium completed its new triangulation survey, there was published a *Comparaison des Réseaux de Triangles Belges et Hollandais*, which appeared in *Travaux de la Section de Géodesie de l'Union Géodesique et Géophysique Internationale, Tome* 7 (1931).

The levelling of the northern part of the country was begun by Krayenhoff, and was continued by the *Katasteramt* of the *Ministerie van Financien*. The first precise levelling was carried out in 1875–89, using as a datum the *Amsterdamsch Peil* (A.P.), a mean sea-level calculated at Amsterdam ; this had also served as Krayenhoff's datum. Between 1922 and 1936, a new precise levelling of the first order of accuracy was carried out ; it included a line of 72 km. between the maregraph at Terschelling and Den Helder (1922), a line of 81 km. between Maastricht–Roermond–Venlo and Stroelen (1923), and a line of 444 km. in the northern part of the country during 1924–7. Heights were calculated from the *Nieuw Amsterdamsch Peil* (N.A.P.) (see p. 22).

Constant latitude and azimuth observations have been made as part of the triangulation survey. Other important astronomical work included the calculation of the longitudinal difference between Leiden and Greenwich in 1880, and between Leiden and Paris in 1884.

Summary of main series

The first important official series to be produced was the 1 : 50,000 *Topografische en Militaire Kaart*, published between 1851 and 1864. It was followed by the attractive *Waterstaatskaart* on a similar scale between

1865 and 1892. A large scale series (1 : 25,000) was produced between 1884 and 1898, but its use was confined to the General Staff, and the series was not for public sale. Another series on the same scale, totalling 776 sheets, has been published gradually since 1904 ; many of the sheets have been revised several times. A new edition on this scale has been in course of publication since 1935 ; the most notable of the smaller-scale maps include the 1 : 200,000 series, the first edition of which was reduced from the 1 : 50,000 sheets in 1906. A completely new edition on this scale was produced between 1927 and 1938, while some sheets have been revised up to 1939.

List of series

(1) 1 : 25,000 *Chromo-topografische Kaart des Rijks*

Produced by the *Topografische Bureau* for the Dutch General Staff, not for public sale (1884–98, with frequent subsequent revisions). 707 sheets, 40 × 50 cm. No graticule or grid. Printed in black.

Relief shown by ' hairy caterpillars ' and spot-heights. Types of vegetation (wood, heath, swamp, etc.) and of various crops shown by tinting. Roads by double black lines (three grades), railways and tramways (one grade each).

(2) 1 : 25,000 *Chromo-topografische Kaart van Nederland*

Produced by the *Topografische Inrichting* (1904–34). Sheets 25 × 40 cm., numbered 1 to 776, but sixty-nine cover water areas and have not appeared. 236 sheets have had one or more revisions, but eighty sheets are still older than 1914. The series is gradually being replaced by No. (3). Bonne's projection. Graticule at 5 min. intervals, longitude from Amsterdam.

Relief shown in two styles : (*a*) black hachures and spot-heights ; and (*b*) brown contour lines at one metre interval, with interpolated form-lines. Roads shown by red and black lines (three grades), but on occasional sheets in orange and black. Railways in black (two grades), canals in blue. Woods shown by green tinting with stipple, houses in red. Dykes indicated by black shading.

Other editions of this series have been issued (*a*) in black, and (*b*) in black, with contours in brown.

(3) 1 : 25,000 *Chromo-topografische Kaart van het Koninkrijk derNederlanden*

Produced by the *Topografische Dienst* (1935–9). Only nineteen sheets had been published by 1939 of the intended 708. Areas so far covered are those of the 1 : 50,000 sheets 38 *Gorinchem* (eight sheets), 44 *Geertruidenberg* (eight sheets), and 49 *Bergen-op-Zoom* (three sheets). Sheets 50 × 40 cm. Stereographic projection.

Details as for No. (2), which it will ultimately supersede.

(4) 1 : 50,000 *Topografische en Militaire Kaart van het Koninkrijk der Nederlanden*

Produced by the *Topografische Bureau* (1851–64). Sixty-two sheets, usual size 80 × 50 cm., but ten are 40 × 50 cm. Also published in quarter sheets 40 × 25 cm., and some areas are in half sheets 40 × 50 cm. Graticule drawn at 5 min. intervals, with margins divided into minute intervals. Co-ordinates of sheet-corners given. Bonne's projection.

All detail printed in black.

(5) 1 : 50,000 *Waterstaatskaart van Nederland*

Produced by the *Topografische Bureau* (1871–1928). Several of the early sheets have been revised. 183 sheets, 40 × 25 cm., with a large

surround of text giving details of depths, areas, etc. of water surfaces. Bonne's projection. Graticule drawn at 5 min. intervals (longitude from Amsterdam), margin divided into minute intervals.

Relief shown only by spot-heights and depths. Water areas are tinted shades of green, grey, blue and brown to show depths. Detail in brown of mills, pumps, sluices, etc. Roads shown by a double red line.

(6) 1 : 50,000 *Chromo-topografische en Militaire Kaart van het Koninkrijk der Nederlanden*

First coloured edition produced by the *Topografische Bureau* (1889–1902, second complete edition 1904, and new series in course of production since 1935). Fourteen quarter sheets and five half sheets have not been revised since 1914. Sheet numbers and size as for No. (4). Bonne's projection, except for six recent half-sheets, which are on the Stereographic projection. Margin divided into half-minute intervals (longitude from Amsterdam). Graticule drawn at 2 cm. intervals, and numbered for reference.

Relief shown on early sheets by hachures and spot-heights to two decimal places, on the newer maps by contours in brown at 5 m. interval, each 10 m. accentuated, with spot-heights in black. Depths shown by the 25, 50 and 80 dcm. contour in blue. Dykes and undyked roads in red, orange, and black (ten grades), and detailed symbols for churches, etc. Roads alone coloured on extra-Dutch territory. Land utilization details (arable, meadow, dune, heath, etc.) shown by a range of tints and stipples.

A well-produced and informative series, especially the third edition.

(7) 1 : 50,000 *Topografische en Militaire Kaart van het Koninkrijk der Nederlanden*

Two other styles have been published of No. (6) : (*a*) in black, with hachures and spot-heights ; and (*b*) in black, with roads in red.

(8) 1 : 100,000 *Historisch-Statistische Schetskaart*

Produced by the *Topografische Inrichting*. Sheets 2 and 3 were published in 1910, but the rest in 1920–2. Twenty-nine sheets with a title sheet, numbered 1 to 30. Bonne's projection. No graticule or grid.

Printed in black, except for international and provincial boundaries in yellow. Relief shown in outline by simple hachures. Rivers, canals and dykes in black. Sites of battles, forts and other historical detail indicated.

(9) 1 : 200,000 *Topografische Atlas van het Koninkrijk der Nederlanden*

Produced for the *Ministerie van Oorlog* by the *Topografische Bureau* from 1905, by reduction from the 1 : 50,000 series No. (6). Nineteen sheets, 25×40 cm., printed in black. Bonne's projection. Margin divided into minute intervals, with no grid or graticule.

Relief shown by hachures with spot-heights in metres. Roads, both dyked and undyked (six grades), railways (two grades), towns (four grades), and a variety of stipples for woods, heaths, etc.

(10) 1 : 200,000 *Topografische Kaart van het Koninkrijk der Nederlanden*

Produced by the *Topografische Inrichting* (1923–31), with revisions 1927–38. Twenty-three sheets, 40×25 cm., with a few marginal sheets 25×30 cm. Sheets 20 (Gent) and 21 (Brussels) are entirely of Belgian territory, sheets 23 (Keulen) and 19 (Dusseldorp) are entirely German, while sheets 5, 8, 11, 15, 16, 17, 18, and 22 include large parts of adjoining countries. Bonne's projection, except for the new 1938 sheet which is on the Stereographic projection. Margin divided into minute intervals, and co-ordinates of corners added.

Relief shown by contours in brown at 10 m. interval, with light brown hill-shading, and spot-heights in black. Submarine contours shown by a black pecked line at 50 and 80 dcm. The sea is tinted blue, with a heavy blue line round the coast. Roads in orange and red (four grades), with tracks and paths in black, land utilization (heath, marsh, sand, arable land, etc.) by a range of tints and stipples, and rivers and canals in blue (three grades). Towns by red and black symbols (six grades).

(11) 1 : 200,000 *Topografische Kaart van het Koninkrijk der Nederlanden*

Two other styles have been published of No. (10). These are : (*a*) in black ; (*b*) in black, with contours in brown and water in light blue.

(12) 1 : 200,000 *Provinciekaarten*

Various pieces of No. (10) have been put together to form complete maps of the provinces. Eleven sheets intended, of which eight had appeared by 1939. Various sizes.

(13) *Wandelkaarten*

A series of sheets of tourist areas, assembled from the various topographical series. 358 sheets 10 × 25 cm., of which 235 are 1 : 25,000, nine are 1 : 50,000 and fourteen are 1 : 200,000.

Details as for the respective topographical series (Nos. (2), (6), and (10)).

(14) 1 : 340,000 *Kaart van Nederland*

Political map, with provinces coloured (n.d.). No relief or roads. Tramways in red, railways in black (two grades), rivers in blue and black. Towns shown in solid red.

(15) 1 : 400,000 *Gemeentenkaart van Nederland*

Produced by the *Topografische Dienst* (1937). Single sheet, 65 × 85 cm., in colours.

Sea and rivers in blue, all other detail in black. Railways (one grade), and international, provincial and communal boundaries by various black pecked lines. Towns shown in two grades.

(16) 1 : 600,000 *Hoogtekaart van Nederland*

Produced by the *Topographisch Bureau* for the *Ministerie van Oorlog* (n.d.). Single sheet, in colours.

Relief shown by contours at 1, 5, 10, 25, 50 and 100 m., with layer-tinting in seven shades of yellow, but no spot-heights. Submarine contours at −2·5 m. and −5 m., with layer-tinting in three shades of blue. Rivers and their names in black.

B. Maps Published by the Geographical Section of the British General Staff

In addition to the topographical maps listed below, the G.S.G.S. are producing (1944) facsimile reproductions of the Dutch 1 : 50,000 and 1 : 200,000 series, as G.S.G.S. 4323 and 4324 respectively. It should be noted that in the following list of the G.S.G.S. series ' Holland ' means ' The Netherlands '.

(17) 1 : 25,000 G.S.G.S. Series 4096. Holland (South)

Topographical series photo-reproduced directly from the Dutch official sheets (Nos. (2) and (3)). A reliability diagram is appended, showing date

of the latest revision of Dutch original. In course of publication (1940–), 131 sheets intended to cover western Holland. Usual size 80×50 cm., although marginal sheets are irregular. Kilometre grid in black. No latitudes or longitudes. Printed in black. The Dutch originals are highly coloured, and the reproduction in black is not very satisfactory, as much detail is obscured.

Relief shown by spot-heights in black, sometimes to two places of decimals. Roads (five grades), with dykes, ditches, etc., and railways (two grades). Dykes and ditches are so numerous in places that they obscure other detail. Canals, woodland, marshland, sand-dunes, buildings, pumps, windmills, cables, etc. shown by a wide range of stipples and symbols.

(18) 1 : 25,000 G.S.G.S. Series 4427. Holland

This series is in course of production (1943–) to supersede G.S.G.S. 4096. Number of sheets intended is 176. Sheets of this series have been taken from the most recent Dutch 1 : 25,000 sheets (Nos. (2) and (3)), brought up to date from air photographs and from information obtained from Dutch official 1 : 50,000 and 1 : 200,000 series where these are more recent than the original Dutch 1 : 25,000 series. Size of sheets, 60×40 cm. Lambert Conical Orthomorphic projection. Margins divided into 2 min. intervals. Kilometre grid. In colours.

Relief shown by brown contour lines at 10 m. intervals, with other significant contours and form-lines interpolated at various intervals, and spot-heights in black. Low-water mark by blue pecked line, submarine contours by black pecked lines at 2·5, 5 and 8 m. Coastline to low-water mark stippled brown, below L.W.M. tinted blue. Roads by double black lines filled red (five grades), unmetalled tracks and paths by pecked lines (two grades), railways and tramways by filled black and white lines (seven grades). Canals by double blue lines. Electrical transmission lines by pecked line. Various black lines for fences, hedges, and types of dykes and embankments. Woodland in solid green, orchards by green symbol. Various pecked lines for international, provincial and communal boundaries. Miscellaneous black symbols for mills, monuments, churches, cemeteries, etc. Marginal plans of air-cover and of adjoining sheets.

An extremely clear series.

(19) 1 : 25,000 G.S.G.S. Series 4414. Germany

Eastern Netherlands (i.e., east of 6° east of Greenwich) is not covered by G.S.G.S. 4427, and appears on 130 sheets of the German series on the same scale, in course of production (1944). The German series as a whole is copied directly from the German 1 : 25,000 *Topographische Karte*, but in fact the original sheets are skeleton or blank outside Germany itself. The sheets of Series 4414 in Holland are redrawn in the same style as Series 4427, but are on the sheet-lines of Series 4414.

(20) 1 : 25,000 G.S.G.S. Series 4041. North-east France and Belgium

Small portions of the Netherlands appear on twelve sheets of this series.

(21) 1 : 50,000 G.S.G.S. Series 4083. Holland

Reproduced from the Dutch official series No. (6), produced 1939–41. The Dutch sheets copied vary in date from 1911 to 1939, and no revision has been incorporated. Covers all Holland except Maastricht and other southern portions, which are included on G.S.G.S. Series 4040. Lambert's projection. Kilometre grid in black, numbered in blue. Latitude and longitude of four corners (longitude from Amsterdam). Fifty-two sheets,

80×50 cm. Marginal information is given in English, together with a glossary of Dutch abbreviations used on the sheets.

Relief shown by spot-heights in black, sometimes to two places of decimals. Roads in red and black (five grades), with dykes and ditches in black. The latter are so numerous in places that the maps are heavy and difficult to read. Navigation canals and rivers in blue, drainage canals in black. Buildings in red, woods in green with black symbols, marshland and sand-dunes by black stipple. Detailed symbols for pumps, windmills, cables, etc.

(22) 1 : 50,000 G.S.G.S. Series 4040. France and Belgium

The extreme south of Holland (Maastricht, the north-east Campine, and the area south of the West Scheldt) is included on nine sheets of this series.

(23) 1 : 100,000 G.S.G.S. Series 2541. Holland

Five sheets of the western Netherlands have been produced of the intended seven. First edition of south-west and central Holland produced in 1913, second edition (1939), third edition (1940–). The sheets are of various sizes. Lambert's projection. The oldest edition has a 5 min. graticule lettered and numbered to form a map reference system. The new edition has a kilometre grid in black, with figures in blue. Margin divided into 1 min. intervals (longitude from Greenwich).

Relief shown on second edition by contours in orange at 10 m. intervals, with spot-heights in black. Submarine contours by black pecked lines at 3, 5 and 10 fathoms. Dyked and raised roads in orange, other roads in red and black (four grades of each), kilometrages in red. Dykes shown in orange. Railways in black (two grades), and tramways in black (two grades). Canals, rivers, marshes, etc., in blue. Woods in solid green, with sand-dunes stippled brown.

On the third edition relief is shown by purple layer-tinting with revised and reclassified roads and railways.

(24) 1 : 100,000 G.S.G.S. Series 4336. North-east France and Belgium

The Netherlands appear on four sheets of this series, in the Army/Air style.

(25) 1 : 100,000 G.S.G.S. Series 4416. Germany

Parts of the eastern Netherlands appear on four sheets of this series, in the Army/Air style.

(26) 1 : 200,000 G.S.G.S. Series 4238. Europe road maps

Copied from the *Michelin Carte Routière* of 1938–40. Three sheets, *Holland North*, *Holland Centre*, and *Antwerp–Rotterdam*, of irregular size, with insets and extensions, cover the country. Approximate size 87×46 cm. Graticule drawn at degree (centesimal) intervals (longitude from Paris), inclined to the margin. No grid.

Relief shown by black spot-heights. Detailed road classification, comprising sixteen grades of dyked and undyked roads in red, orange and black, other roads and paths in black pecked lines. Details of bridges, ferries, toll-gates, etc. Kilometrages in red. Railways in black (two grades), and towns in black shading.

(27) 1 : 250,000 G.S.G.S. Series 4042. Northern France, Belgium and the southern part of the Netherlands

Topographical series produced in 1937–40. Holland appears on three sheets, 73×52 cm., and one 25×35 cm. Ten km. grid numbered in blue. Co-ordinates of latitude and longitude (longitude from Greenwich) given at each corner.

Relief shown by faint red contours at 50 m. intervals, with spot-heights in black. Main roads shown in red, secondary roads by fine double black lines, railways in black, rivers in blue, woodland in solid green.

Second edition, produced in Ground/Air style (1940–3), with layer-tinting in purple and roads in brown.

(28) 1 : 250,000 G.S.G.S. Series 4346. Germany

Portions of the eastern Netherlands appear on sheets K54 (Oldenburg) and K53 (Osnabrück).

(29) 1 : 250,000 G.S.G.S. Series 3982. Europe (Air)

Produced 1943. The Netherlands is covered by seven sheets of various sizes. Land detail as for G.S.G.S. Series 4042, Ground/Air edition (No. 27).

(30) 1 : 250,000 G.S.G.S. Series 5010. Europe (Air) Marine Contoured

Produced by A.D. Maps (1940–3). The coast of the Netherlands is covered by sheets 15, 16, 17 and 18.

Inland relief is not shown, and only skeleton detail is provided inland. Marine contours, layer-tinting, etc., as for G.S.G.S. Series 3982. Aeronautical information superimposed in red.

(31) 1 : 300,000 G.S.G.S. Series 4183. Netherlands—Railways and Waterways

Single sheet, 100×63 cm., produced 1940. Margin divided into 10 min. intervals, longitude from Greenwich, with graticule drawn every 30 min.

Coastline in blue, sea tinted solid blue ; rivers, canals and their names in blue. Railways and tramways shown by various black lines (seven grades), with miscellaneous symbols for stations, sidings, locomotive sheds, marshalling yards, railway workshops, railway bridges and power stations and substations. Navigable canals and rivers in blue (three grades).

(32) 1 : 380,160 G.S.G.S. Series 2517. Belgium and north-east France

The southern part of the Netherlands is included on this sheet.

(33) 1 : 500,000 G.S.G.S. Series 4072. Europe (Air). 4369. Great Britain (Air)

Produced 1940. North-east and east Holland appears on sheets NE 52/6 (Bremen) and NE 50/6 (Frankfurt) of G.S.G.S. 4072 Europe (Air). The rest of the Netherlands is shown on G.S.G.S. Series 4369, Great Britain (Air), 1 : 500,000, sheets 6 (North Sea) and 8 (Straits of Dover). Each sheet 55×67 cm. Conical orthomorphic projection. Outer margin divided into sections of 10 statute miles. Inner margin divided into min. intervals, longitude from Greenwich, with graticule drawn at 10 min. intervals. Scale given in kilometres, statute miles and nautical miles. Time relative to G.M.T. given in margin. Lines of equal magnetic declination (1940) are drawn across the map.

Relief shown by brown contours at 100 m. intervals, layer-tinting in various shades of purple, with spot-heights in black. Submarine contours in blue at 5 m. and 20 m. The area between high- and low-water marks

stippled in black, between low-water mark and −5 m. horizontal shading in blue, below −5 m. blue stipple. Roads in red (two grades), railways in black (one grade), rivers and lakes in dark blue, woods tinted green. Large towns shaded brown, small towns in black. Detailed technical aeronautical information in black.

(34) 1 : 800,000 G.S.G.S. Series 4438. Europe : Communications

This is the sheet 'Holland, Belgium and Central Germany', produced 1943. Size of sheet, 107×82 cm. Margin divided into degree intervals (longitude from Greenwich), with graticule drawn in brown. In colour.

Coastline, lettering and line detail in brown. No relief shown, sea tinted blue. Roads in red, classified according to various systems in each country, with detailed key. Railways and tramways in black (five grades). Waterways in blue (four grades). Frontiers by heavy brown dotted line.

This map is also produced in the following editions :

(1) Base map in brown, with waterways in blue.
(2) Base map in brown, with roads in red.
(3) Base map in brown, with railways in black.

(35) 1 : 1,000,000 G.S.G.S. Series 2758. Europe

Four sheets, sizes 41×45 cm., 39×45 cm., and two sheets 44×48 cm. (north margin), with International sheet numbers North N 31, N 32, M 31, and M 32. Also N 32 and the Dutch part of N 31 (with rectangular extension 13×22 cm.) are published as a single sheet. First edition, 1915–16, second edition, similar in format to the International 1 : M Map, produced 1939–40.

A third edition has been produced for Ground/Air purposes, with layer-tinting in purple.

(36) 1 : 1,000,000 G.S.G.S. Series 3964b. Railway map of Holland and Belgium

Produced in 1934, revised 1935. Sheet 67×67 cm. approximately. Graticule drawn at degree intervals, longitude from Greenwich. Margin divided into 5 min. intervals.

Railways shown in red and green (four grades), according to the gauge and the number of lines. Train ferries shown by green dotted line. Rivers in blue.

(37) G.S.G.S. 4458 Town Plans

A series of town plans is in course of production (1944), covering eighteen towns. Twelve of these have been redrawn ; the remainder are direct copies of local plans.

(38) G.S.G.S. (Misc.) No. 79. Holland : Throughway Town Plans

This volume, produced in 1943, contains fifty-five town plans. This type of plan is small and simple, and is primarily designed for motor transport in transit.

C. Dutch Admiralty Charts of the Coast of Holland

Dutch charts are published by the *Afdeeling Hydrografie* of the *Ministerie van Defensie* at The Hague. A complete list of charts, with index maps, is contained in the *Catalogus van Nederlandsche Zeekarten en Boekwerken*, published annually ; the latest edition is 1938. Details of charts are also given in the official Dutch Sailing Directions—*Zeemansgids voor de Nederlandsche Kust* ; the latest edition is 1936, with *Aanvullingsblad* (supplement) for 1938.

The following list contains the seventeen charts which deal with home waters :

No.		Natural scale	Date of publication and of latest revision
1	Tabel van teekens en afkortingen	—	1935
227	Nederlandsche Kust van West Hinder tot Texel	1 : 250,000	1931
226	Nederlandsche Kust van IJmuiden tot Eems	1 : 250,000	1932
203	Noordzee : Monden van de Schelde, met plan : Reede Vlissingen tot Antwerpen	1 : 50,000 1 : 20,000	1924 (1933)
214	De Schelde van Vlissingen tot Antwerpen	1 : 50,000	1924 (1932)
216	Wester Schelde van Hansweerd tot Antwerpen	1 : 30,000	1932
204	Noordzee : Zeegaten van Brouwershaven en Zieriksee	1 : 50,000	1926 (1933)
220	Veergat en Zandkreek	1 : 30,000	1924 (1933)
209	Haringvliet, Krammer, Volkerak en Hollandsch Diep	1 : 30,000	1924 (1933)
202	Noordzee : Zeegaten van den Hoek van Holland en van Goeree	1 : 50,000	1926 (1934)
219	De Maas tot Rotterdam en Dordrecht	1 : 30,000	1926 (1936)
201	Noordzee : Zeegat van Texel	1 : 50,000	1926 (1934)
212	Zuiderzee	1 : 100,000	1886 (1921)
224	Waddenzee	1 : 50,000	1935
205	Noordzee : Zeegaten van Terschelling en Ameland en Eierlandsche Gronden	1 : 50,000	1928 (1935)
206	Noordzee : Friesche Zeegat	1 : 50,000	1928
207	Noordzee : Monden van de Eems	1 : 50,000	1929 (1933)
228	Plannenkaart van Nederland		1927
	Havens van IJmuiden	1 : 12,500	
	Noordzeekanal	1 : 75,000	
	Havens van Amsterdam	1 : 15,000	
	Krabbersgat en havens van Enkhuizen	1 : 15,000	
	Zwolsche Diep. Kamperketel en Schokland	1 : 50,000	
	Eiland Urk	1 : 50,000	
	Pampus	1 : 50,000	

D. British Admiralty Charts of the Coast of Holland

A key to the charts of the Netherlands published by the British Admiralty will be found at the beginning of *North Sea Pilot*, Part IV, 9th edition (H.M.S.O., London, 1934). It should be noted that a number of new and revised charts have been issued since the date of publication of this *Pilot* and are noted in the *Supplements*.

A complete list of charts and a series of index maps to them will be found in *Catalogue of Admiralty Charts and other Hydrographic Publications* (H.M.S.O., London, annually, latest edition, 1943).

E. Geological Maps

The earliest series of geological maps was compiled by W. C. H. Staring for the *Geologisch Mijnbouwkundig Genootschap voor Nederland en Koloniën*, with the collaboration of the *Rijks Geologische Dienst*, on a scale of 1 : 200,000. This series has been revised several times, the latest edition being 1936–9. The other main geological series, the 1 : 50,000, together with explanatory text, has been in course of production since 1925 by the *Rijks Geologische Dienst*. In 1936, the two authorities concerned with the official geological services, the *Rijks Geologische Dienst* at Haarlem (primarily concerned with the 1 : 50,000 map), and the *Geologische Bureau voor het Mijngebied* at Heerlen, were combined, and now form *Afdeelingen* (divisions) of the *Rijks Geologische Stichting*.

Both the 1 : 50,000 and 1 : 200,000 are in course of production by the G.S.G.S., as Series 4323 and 4324 respectively.

(39) 1 : 50,000 *Geologische Kaart van Nederland*

In course of production by the *Rijks Geologische Stichting*. The geological detail is superimposed in colours upon the sixty-two sheets of the Dutch official topographical series (No. (6)), divided into quarter sheets, each 40×55 cm. Of the total of 232 quarter sheets, 139 had been published, with explanatory text, by 1939.

(40) 1 : 200,000 *Geologische Overzichtskaart van Nederland*

Produced by the *Geologisch Mijnbouwkundig Genootschap voor Nederland en Koloniën*, with the collaboration of the *Rijks Geologische Dienst*. Nineteen sheets, 40×25 cm., first edition 1868–9, with subsequent revisions. Geology is simplified and reduced from the 1 : 50,000 *Geologische Kaart van Nederland*, superimposed in colours upon the Dutch topographical series (No. (10)).

(41) 1 : 800,000 *Carte géologique des Pays-Bas*

Compiled by Dr. W. A. J. Oosting, Wageningen, 1937. Based mainly upon the 1 : 50,000 series of the Geological Institute, Haarlem. Surface geology is shown in colours. One sheet, approximately 38×50 cm.

This map has been reproduced as the 1 : 800,000 G.S.G.S. 4499, Geological Map of the Netherlands. In colours, one sheet, 38×50 cm.

A copy of this map is folded in the pocket at the end of this *Handbook*.

F. Miscellaneous Maps

Under this head are grouped semi-official topographical series produced by private Dutch firms, large-scale town plans, and communication maps produced by the official *Toeristenbond voor Nederland* and by motoring, flying and yachting organizations.

General and Topographical Maps

(42) District maps

A number of large-scale district maps, in colours, have been published by the *Algemeen Nederlandsche Wielrijders Bond* (*A.N.W.B.*). Examples include : (i) 1 : 5,000 *Kaart der Kagerplassen* (1933) ; (ii) 1 : 10,000 *Kaart van de Loosdrechtsche Plassen* (1933) ; and (iii) 1 : 10,000 *Hondsbossche Zeewering* (n.d.).

The *A.N.W.B.* has also published smaller-scale maps of special districts, notably (i) 1 : 50,000 *Hollandsch en Utrechtsche Plassen* (1939) ; (ii) 1 : 50,000 *De Noordzeekust* (*Zuidelijk deel*) (n.d.) ; and (iii) 1 : 100,000 *Wieringermeer Polder* (1934).

Communication maps published by the A.N.W.B. are listed on p. 666.

(43) Provincial Maps (*Provinciekaarten*)

Produced by J. Kuijper (1908–11). Nine sheets, 38×50 cm. Sheets are *Drenthe*, 1 : 170,000 ; *Friesland*, 1 : 180,000 ; *Gelderland*, 1 : 250,000 ; *Groningen*, 1 : 178,500 ; *Noord Brabant*, 1 : 250,000 ; *Noord Holland*, 1 : 240,000 ; *Overijssel*, 1 : 200,000 ; *Utrecht*, 1 : 115,000 ; *Zeeland*, 1 : 165,000 ; and *Zuid Holland*, 1 : 200,000. 6 cm. grid in light brown. Printed in brown and blue.

No relief shown. Area between low-water and high-water stippled blue, 8 m. submarine contour shown. Roads in black (two grades). Dykes and dyked roads by black symbols. Towns in black (seven grades).

(44) 1 : 200,000 *Atlas van Nederland van den Algemeene Nederlandsche Wielrijdersbond* (*Toeristen Bond voor Nederland*)

Thirty-five sheets produced by the *A.N.W.B.* (1917–22), each 19×22·5 cm. Every 5 mm. numbered in margin, but lines not drawn across.

No relief shown. Sea in solid blue with no detail, except for names of sandbanks, etc. Roads in green, red, orange and black (four grades), dyked roads indicated. Railways in black (two grades). Marsh in blue, canals in blue with details of sluices, etc., woods in solid green, sand-dunes by stipple, towns in black (three grades), detailed symbols for churches, windmills, pumps, etc.

A neat and attractive series.

(45) 1 : 200,000 *Ten Brink's Ideal Verkeerskaart van Nederland*

Produced by *Ten Brink* (Arnhem, n.d.). Twelve sheets 24×28·5 cm., with insets of islands. 9 cm. grid in faint green, lettered at bottom, numbered at side.

Land tinted yellow, but no relief shown. Blue submarine contours at 25, 30, 50 and 100 dcm., with spot-depths in black. Roads in red (three grades), with kilometrages in red. Water in blue. Towns shaded grey.

(46) 1 : 250,000 *Handelskaart van het Koninkrijk der Nederlanden*

Produced by the *Handelsinformatiebureau* (*Van der Graaf & Co.*) of Rotterdam and Amsterdam. First edition 1894, subsequently revised several times. Four sheets, 55×67 cm., with index, 5 cm. graticule, lettered and numbered for reference, drawn in black.

Land in white, with no relief, sea tinted blue. Waterways in blue, railways in red. Distances in km. from Amsterdam and Rotterdam to each main European port.

(47) 1 : 250,000 *Ten Brink's Al-Verkeer van Nederland*

Produced by *Ten Brink* (Arnhem, n.d.). Two sheets, *Nederland Noord* and *Nederland Zuid* ; the former has a folding additional sheet showing north Belgium on a scale of 1 : 500,000. Each sheet, 100×52 cm.

No relief shown. Rivers in blue, sea tinted blue. Roads shown in red and brown (three grades), tracks by brown pecked line, railways in brown (two grades). International and provincial boundaries by various brown pecked lines. A variety of symbols in brown, blue and red for ferries, mines, dunes, youth hostels, etc.

(48) 1 : 300,000 *Het Koninkrijk der Nederlanden*

Compiled by E. de Geest and published by *Leyffardt's Boekhandel* (Amsterdam, first edition 1893, revised periodically). Six sheets, of which four are 53×89 cm. and two are 51×45 cm. Also published in a four-sheet

edition, each 89×102 cm. Graticule in light brown at 15 min. intervals, longitude from Amsterdam, lettered at bottom, numbered at sides for reference.

Relief shown by simple hachures and spot-heights in black. Main roads in red, others in black. Railways in black (two grades). Waterways in blue (four grades), with details of locks, sluices, etc.

(49) 1 : 300,000 *Wandkaart van Nederland*

Produced by E. de Geest and T. P. Keijzer, and published by H. Born (Assen, n.d., but after 1932). A single sheet, 88×101 cm. Margin divided into 5 min. intervals, longitude from Ferro, with a graticule drawn every 15 min. in orange. There is a 40 pp. gazetteer, listing the 5,800 places shown on the map.

No relief shown. Roads in red and black (four grades), railways and tramways in black (one grade each), and waterways in blue (four grades). Provincial and international frontiers by various pecked lines, tinted orange.

(50) 1 : 300,000 *Rechthoekige coördinaten der Nederlandsche Nockhunten*

Produced by the *Technische Boekhandel* (J. Waltmann) for the *Rijkscommissie voor Graadmeting en Waterpassing* (Delft, 1929). Twenty sheets, 23×15 cm., with twelve sheets of town plans, on scale of 1 : 25,000.

(51) 1 : 320,000 *Karte des Königreiches der Niederlände*

Produced by *Eduard Gaeblers Geographisches Institut* (Leipzig, 1925). Single sheet, 98×82·5 cm., with inset gazetteer. Graticule in light blue drawn each 7·5 min., longitude from Amsterdam.

No relief shown. Provinces tinted. *Arrondissement* and *kanton* boundaries (*i.e.* judicial boundaries) shown. Main roads in black (three grades), railways in red (two grades), large rivers in blue, small rivers in black, towns by size of symbol and of lettering (seven grades).

(52) 1 : 500,000 Netherlands

Produced by J. Bartholomew & Son (Edinburgh, 1944).

A copy of this map is folded in the pocket at the end of this *Handbook*.

(53) 1 : 780,000 Holland and Belgium (with Luxembourg)

Produced by George Philip & Son (London, 1940). One sheet, 49×59 cm. Graticule at 30 min. intervals.

Each country tinted. No relief shown. Main railways, canals, roads and cables in black.

Town Plans

(54) Maps and plans in guide-books

Numerous guide-books containing maps and plans have been published by various firms. The most useful include :

(i) *Guide Bleu* (*Librairie Hachette*, Paris, latest edition, 1938).
(ii) *Muirhead's Holland and the Rhine* (London, latest edition, 1933).
(iii) *Baedeker's Holland* (Leipzig, latest edition, 1927).
(iv) *Grieben Reiseführer*, *Band* 98, *Holland* (Berlin, latest edition, 1934).

(55) A number of private firms produce large-scale town plans, some only of their own town, others a uniform series. Most of these plans are on scales between 1 : 5,000 and 1 : 15,000, in colours, with reference squares, and usually with a detailed street gazetteer in the margin or on the reverse side. The most prominent firms are *H. van Diehlen* (Amsterdam), *G. Eikelenboom* (Haarlem), *Van*

Holkema & Warendorf ('s Gravenhage), *W. J. van Hendel* (Rotterdam) and *Valkhoff* (Amsterdam).

(56) A number of town plans are produced by the *Bureau Openbare Werken*, some of which have been published.

(57) Some road atlases and tourist handbooks contain town plans. The most useful are :

(*a*) *Handboek van de Koninklijke Nederlandsche Automobiel Club* (Amsterdam, 1939), which contains a large number of town plans in black and red.

(*b*) *Ten Brink's Reisatlas van Nederland voor Sport en Handel* (Arnhem, n.d.), which contains thirty town plans in brown and a 22 pp. gazetteer.

(58) The 1 : 300,000 series of maps issued by the *Technische Boekhandel* (J. Waltmann) for the *Rijkscommissie voor Graadmeting en Waterpassing* (Delft, 1929), includes twelve sheets of town plans, on a scale of 1 : 25,000.

(59) The Geographical Section of the General Staff have produced or are producing a number of town plans (Nos. (36), (37)).

Communication Maps

(60) Waterway Maps

Numerous maps of the navigable waterways have been compiled by the *Bureau voor Watertoerisme*, and published by the *A.N.W.B., Toeristenbond voor Nederland*. They are of a variety of scales and sizes, are in colour, and show grades of navigable waterways, sluices and locks, etc.

Examples include (i) Strip map of the river Yssel from Arnhem to the Zuider Zee (no scale, n.d.) ; (ii) 1 : 50,000 *Waterkaart van Friesland* (n.d.), single sheet, which also has insets showing the water routes through the main towns ; (iii) 1 : 50,000 *Koninklijke Verbonden Nederlandsche-Vereenigingen*, eleven sheets (1939).

(61) 1 : 50,000 *Kaart van 's Gravenhage en Omstreken, ten dienste van Wielrijders en Automobilisten*

Produced by J. A. Sleeswijk (Bussum, n.d.). Single sheet in colours, 72×53 cm. Margin divided into minute intervals, longitude from Greenwich, and graticule drawn in orange every 10 cm.

Water in blue, roads in red (four grades), railways in black (two grades). Land utilization shown in detail by tinting—buildings in red, building land in pink, woodland in dark green, meadows in light green, agricultural land in white, and sand dunes in light buff with stipple. Miscellaneous black symbols for dykes, churches, sluices, etc.

(62) 1 : 100,000 *Kaart van de Veluwe, voor Wandelaars, Wielrijders en Ruiters*

Produced by the *A.N.W.B., Toeristenbond voor Nederland* (Amsterdam, 1938). Single sheet in colours, 57×65 cm.

Coast and other line detail in grey, rivers in pale blue, roads in yellow and red (four grades), railways in grey (two grades). Local and estate boundaries by dark blue line. All lettering in dark blue.

(63) 1 : 200,000 *Autokaart van Nederland*

Produced by the *A.N.W.B., Toeristenbond voor Nederland* (latest edition), Amsterdam, 1938). Three sheets, 113×49 cm. Reference numbers at sides at kilometre intervals, but no grid lines drawn. Legend in Dutch, French, English and German.

Relief shown by light hachuring, with spot-heights in black. Roads in

red, orange, yellow and black (six grades), kilometrages in red. Raiiways in black (two grades), rivers and canals in blue, woods in solid green. Churches, mills, collieries, etc., by black symbols.

(64) 1 : 200,000 *Carte Routière de la Hollande*

Produced by the *Service Géographique de l'Armée* (Paris, n.d.), for military use only. Two sheets, 107×47 cm., covering northern and central Holland ; southern Holland appears on *Carte Routière de la Belgique*. Legend, etc., in French and English.

Coastline, rivers and canals in blue, with names in blue. Roads in red, yellow, and by double black lines (eleven grades), railways and tramways in black (two grades). International and provincial boundaries by various pecked lines, emphasized in pink. Woods tinted green. A wide range of symbols for bridges, airfields, cemeteries, churches, lighthouses, hotels, etc.

(65) 1 : 300,000 *Reiskaart van Nederland*

Produced by *Ten Brink* (Arnhem, 1908, with subsequent revisions). Five sheets, of which three are 48×42 cm., and two are 35×45 cm. No grid or graticule.

Relief shown by simple ' caterpillars '. Roads in red, yellow, green and black (five grades), dykes indicated, kilometrages in red, railways in black (two grades). Chief rivers in blue, others in black, canals in black. Woods tinted green.

(66) 1 : 400,000 *Kaart van Nederland voor Automobilisten en Motorwielrijders*

Compiled by E. de Geest and published by H. Born (Assen, 1928). Single sheet, 66×78 cm., with a 21-pp. gazetteer. Graticule drawn at 15 min. intervals, longitude from Amsterdam, numbered and lettered for reference.

Sea, rivers, canals and their names in blue. Roads in red (two grades), with kilometrages in red, railways and tramways in black (one grade each), and canals in blue (two grades). Towns by black symbols (four grades). International and provincial frontiers by black pecked lines, emphasized in orange.

(67) 1 : 400,000 *Sleeswijk's Kaart van Nederland voor Handel en Verkeer*

Produced by J. A. Sleeswijk (Bussum, 1936). Single sheet, 74×100 cm., with a large marginal gazetteer. 5 cm. graticule in light brown, lettered at bottom, numbered at sides.

No relief shown. Roads in red and black (three grades), kilometrages in red, dykes indicated, railways in black (two grades), and rivers and canals in blue.

(68) 1 : 400,000 Dutch Waterways

Folded map prepared by Edward Stanford in T. E. Thorpe, *A Yachtsman's Guide to the Dutch Waterways* (London, 1931). Single sheet, 71×69 cm. No grid or graticule. Printed in black and blue.

Canals by thick blue line (two grades), with locks and sluices in black. The canals are numbered from 1 to 266 to correspond to gazetteer in margin. Rivers by double blue lines, names in blue. Main railway lines in black. Provincial and international boundaries by black pecked lines.

(69) 1 : 400,000 *Grande Carte Routière de la Hollande*

Produced by A. Taride (Paris, first edition, 1909, revised periodically). Single sheet, 71×83 cm. No grid or graticule.

No relief shown. Sea in blue, land tinted buff. Roads in red and black (five grades), with kilometrages in red, rivers and canals in blue, railways in black (two grades). Towns in red shading or by black circles.

(70) 1 : 400,000 *Nederland, met de Spoor-, Tram- en Scheepvaart-Wegen*

Compiled by E. de Geest and published by H. Born (Assen, 1931). Single sheet, 79×66 cm. Margins divided into 15 min. intervals, longitude from Greenwich, with graticule numbered and lettered for reference.

Railways and tramways in black (three grades), rivers and canals in blue (three grades), international and provincial boundaries by black pecked lines, emphasized in brown. Sluices and coastal lights in red. Towns by black symbols (four grades).

(71) 1 : 400,000 *Shell Autokaart van Nederland*

Produced for the *Shell* Company (n.d.), two sheets, 65×42 cm.

Land tinted buff, extra-Dutch territory left white, sea tinted blue. Roads in red and orange (five grades), with kilometrages in red, railways and tramways in black (one grade of each), rivers and canals in blue. International and provincial boundaries by black pecked lines. Woodland tinted green, heaths in purple. Large towns shown by black diagonal shading, small ones by black dots.

(72) 1 : 400,000 *Luchtvaartkaart van Nederland*

Produced by the *Bureau voor Luchttoerisme* (*K.N.V.v.L.*, *A.N.W.B.*, (Amsterdam, 1939). Single sheet in colours, 69×79 cm. Margin divided into 30 min. intervals from Greenwich, with graticule drawn across. Legend, etc., in English, French, Dutch and German.

No relief shown, land in white with extra-Dutch territory in buff, sea tinted blue. Roads in red (two grades), railways and tramways in black (three grades). Woods tinted green, dunes by black stipple, heaths tinted brown. A wide variety of black symbols for aeronautical information, such as airfields, lights, dangers, etc.

(73) 1 : 400,000 *Spoor- en Tramwegkaart van het Koninkrijk der Nederlanden*

Produced by the *Department van Waterstaat* ('s Gravenhage, 1931). Single sheet, 85×65 cm., in colours.

Sea tinted blue, rivers, canals and their names in blue. Railways and tramways in black, with green, yellow and blue tinting to distinguish companies (six grades). Steamboat routes by black dotted lines. International and provincial boundaries by black pecked lines, former emphasized in grey.

There are small insets of the railway systems of Amsterdam, Rotterdam, The Hague, Utrecht and Haarlem.

(74) 1 : 954,000 *Carte des Voies Intérieurs Navigables de la Belgique, les Pays-Bas, l'Allemagne-Ouest, le Rhin et le Nord-Est de la France*

Produced by W. Seghers (Antwerp, eleventh edition, 1934). Single sheet, in colours, 99×69 cm. Gives details of waterway dimensions, locks, ports, etc.

(75) 1 : 1,000,000 *Cartes de Voies Intérieurs Navigables de la Belgique, les Pays-Bas, l'Allemagne (Ouest), et Nord-Est France*

Produced by *Patria N.V.* (Antwerp, 1934). Single sheet, in colours, giving details of waterways, locks, etc.

Atlases

(76) *Schoolatlas der Gehele Aarde*

An attractive world atlas compiled by P. R. Bos, edited by P. Eibergen, and published by *J. B. Wolters' Uitgevers-Maatschappij, M.V.* Nine sheets, 39×32 cm., and two single pages, 18×23 cm., are devoted to the Netherlands—three sheets show the country as a whole (1 : 800,000), four sheets are regional maps showing geology (1 : 400,000), and the remainder show miscellaneous details, including plans of Rotterdam, Amsterdam and Ymuiden.

(77) *Schoolatlas van Nederlanden en zijne Overzeesche Bezittingen*

Compiled by A. A. Beekman and R. Schuiling (Zutphen, 1904). A useful but old general atlas of the Netherlands and colonial possessions.

(78) *Geschiedkundige Atlas van Nederland*

Produced by the *Commissie voor den geschiedkundigen Atlas van Nederland* ('s Gravenhage). Sheets were gradually produced between 1913 and 1934, and a bound atlas in two volumes containing all the sheets was published in 1934. Volume I illustrates Dutch history in great detail up to 1561, Volume II from 1648–1853. A further volume of maps illustrating colonial history was published in 1934. Size of sheets variable, the largest being 42×32 cm. Scales variable. Volume I contains eighty-four maps in ten sheets, Volume II contains sixty-five maps in nine sheets.

(79) *Leopolds Wereldatlas*

Produced by John Bartholomew & Son (Edinburgh, 1940) for *N.V. Standard Boekhandel* (Brussels).

Ninety-six sheets, 19×31 cm., of which four deal specifically with Holland. These sheets cover the country on a scale of 1 : 500,000.

(80) *Ten Brink's Reisatlas van Nederland voor Sport en Handel*

Produced by Ten Brink (Arnhem, n.d.). Twelve regional sheets, of which ten are on 1 : 350,000 scale, and two on 1 : 700,000. Usual size 24×18 cm., with a few larger folding sheets 36×18 cm. Numbered and lettered graticule. There is a 22 pp. gazetteer.

No relief shown. Sea tinted blue, rivers and canals in blue. Roads in red and brown (eight grades). All lettering and detail in dark blue. There are thirty town plans in brown on the reverse sides of the sheets.

APPENDIX V

POSTS, TELEGRAPHS, TELEPHONES

The Post Office : Telegraphs and Telephones : Cables and Wireless : Broadcasting : Note on Time

The Post Office

Organization

The postal, telegraph and telephone services in the Netherlands are operated by a State undertaking, the P.T.T. (*Staatsbedrijf der P.T.T.*) under a Director General, for which the Minister of the Interior is responsible. The central office is at The Hague. Excluding the post offices of Amsterdam, Rotterdam, The Hague, and Utrecht, the postal service of the Netherlands is organized in seven districts, with headquarters at Arnhem, 's Hertogenbosch, Groningen, Haarlem, The Hague, Middelburg and Zwolle. Three travelling post offices are controlled by a special inspector.

The Post Offices are divided into five categories :

(a) Principal Post Offices (*Hoofdkantoren*) : these conduct all classes of business ; 161 operate also telegraphs and telephones and 48 operate telegraphs	215
(b) Branch Post Offices (*Bijkantoren*) : 20 of these transact all classes of business	100
(c) Auxiliary Post Offices, performing all classes of business	812
(d) Postal Agencies (*Postagentschappen*) : managed by individuals such as shopkeepers ; the range of business is restricted	156
(e) Depots (*Poststations*) in rural areas. In 573 depots posts, telegraphs and telephones are combined	715

In addition to telephone and telegraph services the Netherlands Post Office provides parcel post, insured services, money and postal orders, postal cheques and transfers, collection of debt and subscriptions to newspapers and periodicals. Other services include the State Savings Bank, the State Insurance Bank, collection of Excise and Income Tax, the sale of stamps for various stamp duties, and the sale of printed matter produced by the State Printers.

Postal Traffic

The number of letters carried within the country has shown a fairly continuous increase, but has not risen proportionately with the growth of population. In 1937 54·8 letters and cards were carried per head of population : in 1920 the figure was 59·1. Printed matter sent through the post has expanded rapidly, and the quantity circulated in 1937 was double the quantity circulated in 1925. The parcel post has declined since 1930 ; dispatches of parcels abroad in 1937 were about half the dispatches in 1930. The number and value of financial operations such as postal cheques and *postquitantiën* carried out has declined since 1930 as well as post office money orders.

Telegrams and Telephones

Telegraphs

The telegraph equipment of the country in 1937 may be summarized as follows :

Number of circuits in lines above ground, including ' cailho ' circuits (telegraphic circuits operated through telephone lines above ground)	1,820
Number of circuits in telephone cables	37,698
Number of telegraph offices	2,154

From *Jaarcijfers voor Nederland*, 1938, p. 361 ('s Gravenhage, 1939).

Amsterdam and Rotterdam are responsible for the bulk of the telegraph business. The Netherlands railways operate their own telegraph lines.

Telephones

In 1937 401,000 telephones were in use, or 1 for every 21 inhabitants, compared with 1 for every 29 in France (1936) and 1 for every 16 in the United Kingdom (1936). About 60% of these were operated on 1,470 local networks directly worked by the State and 40% on 3 networks worked by concessionaires. The total length of interurban and international lines is 7,200 miles, of which 3,400 miles are aerial lines.

The largest number of telephone subscribers is in Amsterdam (42,000); The Hague has 39,000, but Rotterdam only 28,000. The use made within the Netherlands of the telephone system has increased rapidly—from 12 million conversations in 1923 to 47 million in 1937; in the same period conversations across the frontiers increased at a lower rate—from 984,000 to 2,320,000.

Cables and Wireless

Submarine Cables

Twenty-four submarine cables connect the islands in the north and in the south with the mainland and with each other :

	No. of conductors	Length (nautical miles)
Oostmahoorn—I. of Schiermonnikoog	4	6·8
Holwerd—I. of Ameland	4	5·2
,, ,,	8	7·4
I. of Terschelling—I. of Ameland	4	7·4
I. of Vlieland—I. of Terschelling	4	6·9
I. of Texel—I. of Vlieland	8	5·8
Den Helder—I. of Texel	12	2·8
,, ,,	5	2·9
,, ,,	48	1·8
Monnikendam—I. of Marken	1	1·5
Kampen—I. of Schokland	4	4·2
,, ,,	2	3·7
I. of Schokland—I. of Urk	4	7·3
I. of Voorne—I. of Overflakkee	48	5·8
I. of Overflakkee—Hoeksche-waard	14	1·0
,, ,,	4	1·8
I. of Overflakkee—I. of Schouwen	10	1·8
I. of Schouwen—I. of Tholen	21	1·2
I. of N. Beveland—I. of Schouwen	10	2·5
,, —I. of S. Beveland	21	0·4
,, ,,	7	0·4
I. of S. Beveland—Walsoorden	34	1·8
,, —Terneuzen	21	3·0
,, ,,	48	2·9

From *Nomenclature des cables formant le reseau sous-marin du globe* 14th edition, 1939, p. 34 (Berne, 1939).

Five cables are operated jointly with Great Britain for the North Sea crossing, of which the two latest were laid in 1937.

	No. of conductors	Length nautical miles)
Lowestoft–Zandvoort	4	111
Benacre–Zandvoort	4	109
	4	112
Aldeburgh–Domburg	16	82
	17	86
	1	81*
	1	81*

* Coaxial.

The four Domburg cables are all telephonic.
From *op. cit.*, p. 23.

There are no Dutch long distance cables : the N.E.I. are served by *Cable & Wireless Ltd.*, the N.W.I. by *All America Cables & Radio Inc.*, and Surinam by *Cie. française des cables télégraphiques*.

Wireless stations

The various services supplied by wireless stations are as follows :
Coast Stations (*open to general or restricted public correspondence*) *:* Flushing Roeierswacht, Scheveningen, Ymuiden, Kijkduin, Brandaris Lt. Ho., Terschelling Bank Lt. V.
Medical Advice : Scheveningen Radio.
Radio Direction Finding Stations : Maassluis, Flushing, Ymuiden, Willemsoord (Den Helder).
Radio Beacons : Hook of Holland, Ymuiden.
Radio Time Signals : Hilversum (broadcasting).
Radio Navigational Warnings and Ice Signals : Scheveningen.
Fixed Stations : The Haaksbergen, Maas and North Hinder Lt. Vs., Kootwijk, Vossegat (Utrecht), Flushing Roeierswacht, Scheveningen, Kijkduin, Brandaris Lt. Ho., Terschelling Bank Lt. V.
Aeroradio Stations : Amsterdam, De Mok, Eelde, Eindhoven, Rotterdam, Soesterberg, Twente, Flushing.

Broadcasting

There were four broadcasting stations in 1940 in the Netherlands, managed entirely by the State—Hilversum, Eindhoven, Jaarsveld, and Kootwijk. Kootwijk was State-owned, Hilversum and Eindhoven were owned by the Philips Company, who had operated them until 1930. Jaarsveld was a new station, not entirely completed in 1939 ; connected by cable to Hilversum, it was intended to replace Hilversum as the principal broadcasting station.

The development of broadcasting organization has proceeded on lines rather different from the system in Great Britain. Originally, the stations leased facilities to numerous political, religious and other broadcasting associations. These associations had no stations of their own : they enjoyed no State subsidy but depended entirely on voluntary subscriptions. They were financially powerful and produced programmes of a high standard.

There are five main groups within these associations—A.V.R.O. (neutral

and non-propagandist—about 200,000 members); V.A.R.A. (Socialist, 130,000 members), V.P.R.O. (Radical Protestant, membership uncertain), K.R.O. (Roman Catholic, 150,000 members), N.C.R.V. (religious, 125,000 members). In 1935 the State and four of the above groups—A.V.R.O., V.A.R.A., K.R.O., and N.C.R.V.—jointly formed a limited company known as N.O.Z.E.M.A. (*Nederlandsche Omroep Zender Mij.*), which has since controlled all broadcasting. Of the shares 60% are held by the State, and the remaining 40% are held in equal parts by the four groups. In 1939 the Minister of the Interior succeeded the Minister of *Waterstaat* in State control of broadcasts.

These four groups shared between them 95% of the broadcasting time, the remaining 5% being at the disposal of the Minister of the Interior, who could lease this time to small associations or use it for special broadcasts. Advertising was not allowed. There was no national licence for listening sets. In 1937 there were 630,000 direct receivers and 362,000 subscribers to the telephone relay. Three of the four stations provided the home service; while the Philips-owned station at Eindhoven, controlled like the others by N.O.Z.E.M.A., broadcast to the N.E.I.

Note on Time

The Netherlands was normally 20 mins. ahead of Greenwich Mean Time. At the time of the occupation a change was made to 2 hrs. ahead of G.M.T. to keep the same time as Germany, and thereafter changes followed those in Germany :

Till 15.5.40	20 mins. ahead of G.T.
15.5.40—2.11.42	2 hors. ,, ,, ,,
2.11.42—29.3.43	1 hr. ,, ,, ,,
Since 29.3.43	2 hrs. ,, ,, ,,

APPENDIX VI

CIVIL AVIATION

Civil aviation in the Netherlands is under the control of the *Luchtvaartdienst ressorteerende onder het Ministerie van Waterstaat* (the Aeronautical Service of the Department of Public Works) at The Hague. It regulates and supervises commercial and private aviation, prepares agreements with other countries, allocates subsidies, and issues the *Gids voor Luchtvarenden* (Air Pilots). A monopoly of all commercial aviation, other than private and club flying, is held by the *Koninklijke Luchtvaart Maatschappij voor Nederland en Koloniën N.V.* (K.L.M. or Royal Dutch Air Lines), founded by private enterprise but subsidized by the government. This company operates services in Europe, to the Netherlands East Indies, and in the West Indies and South America. An independent but government-subsidized company, the *Koninklijke Nederlandsch-Indische Luchtvaart Maatschappij* (K.N.I.L.M.), is concerned with the operation of air lines in the Netherlands East Indies, and with the establishment of connections between the N.E.I. and neighbouring countries.

Service aviation is under the control of the *Ministerie van Defensie*; there are three separate divisions—the *Commando Luchtverdediging* (Air Defence Command) at The Hague, the *Militaire Luchtvaart* (Army Air Service) at Soesterberg, and the Naval Air Service at Den Helder.

The Development of the K.L.M.

The K.L.M. was founded in October 1919 by a group of prominent business men who were convinced of the importance of the development of commercial aviation. From the first, close relations were maintained with the Netherlands government, which became responsible for the organization of airfields, of meteorological services, and of wireless telegraphic and telephonic services, and which further declared its readiness to cover by subsidy two-thirds of any loss incurred up to a certain maximum. The first service organized by the K.L.M. began in May 1920 between Amsterdam and Croydon; since that date, except for temporary cesssations during the winters of 1920–1 and 1921–2, this service has operated continually. In 1920 the K.L.M. owned no aircraft, but entered into a charter agreement with the two British firms 'Aircraft Transport and Travel Ltd.' and 'Handley Page Transport Ltd.', which supplied both machines and pilots. In 1920 a second service was inaugurated over the route Amsterdam–Hamburg–Copenhagen. During 1920, the *N.V. Nederlandsche Vliegtuigenfabriek Fokker* at Amsterdam produced their first commercial aircraft, and in the following year the K.L.M. bought from them a fleet of ten machines with which to operate their lines themselves. In 1923, the Netherlands government granted an annual subsidy for four years, which was renewed for seven years in 1926 and again in 1933. The European services were gradually extended, and agreements were made with the airlines of neighbouring countries for the operation of 'pool' services in conjunction with the K.L.M. Outside Europe, a regular service to the Netherlands East Indies was introduced in 1929, and in 1935 services were operated in the West Indies and in South America.

In 1938, the K.L.M. had a staff of seventy pilots, with a fleet of fifty-three aircraft, most of which were Douglas, Fokker or Lockheed machines.

European Services

The development of the air services operated in Europe by the K.L.M. is shown in the following table :

K.L.M. Air Services in Europe, 1929-38

	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938
Total distance flown (1,000 km.)	1,591·3	1,195·9	1,320·3	1,318·6	1,812·6	2,888·2	2,909·0	3,784·9	5,157·3	6,195·1
Passenger-km. (1,000)	7,088·6	4,320·1	4,860·0	5,407·1	10,355·0	18,691·6	17,813·6	23,410·6	28,268·2	35,852·6
Mails (1,000 ton-km.)	38·8	24·2	30·6	47·4	55·2	77·6	94·2	125·8	155·7	194·6
Freight (1,000 ton-km.)	328·6	273·0	342·0	237·9	363·8	309·7	367·9	415·7	475·2	664·3

From : *Statistical Yearbook of the League of Nations*, 1938–9, p. 206 (Geneva, 1939)

In 1937 the number of thousand passenger-km. accounted for by the other leading operators of civil aircraft in European services was as follows : Germany, 118,000 ; Italy, 69,000 (including North African services) ; France, 43,000 (including North African services) ; United Kingdom, 43,000

Thus in a period of eight years the total distance flown increased nearly five times, the number of passenger-kilometres more than seven times, the number of ton-kilometres of mail more than six times, and the number of ton-kilometres of freight nearly twice.

The routes operated have grown steadily from the original Amsterdam–Croydon service of 1920. From the first, K.L.M.'s policy has been to co-operate with other air lines, whereby the various routes are flown both by the K.L.M. machines and by those of the company operating in the country with which services were maintained. Thus the traffic frequency for some services was increased and the receipts pooled. The services operated in the summer of 1939 were as follows :

Route	Length miles	Frequency	Co-operating Company
Amsterdam–Rotterdam–London	244	8 times daily	—
Amsterdam–Copenhagen–Malmö	439	Daily	*Aktebolaget-Aerotransport* (A.B.A., or Swedish Air Lines)
Amsterdam–Hamburg–Copenhagen–Malmö	443	Daily	A.B.A. and *Det Danske Luftfartselskab* (D.D.L. or Danish Air Lines)
Amsterdam–Hamburg–Copenhagen–Helsinki	1,040	Daily	A.B.A.
Amsterdam–Christiansand–Oslo	603	Daily	*Det Norske Luftfartselskap* (D.N.L., or Norwegian Air Lines)
Amsterdam–Rotterdam–Brussels–Paris	276	3 times daily	*Air France* (A.F.)
Amsterdam–Berlin	379	Daily	—
Amsterdam–Rotterdam–Prague–Vienna–Budapest	785	Daily	Prior to 1939 with *Ceskoslovenska Letecka Spolecnost* (C.S.L., Czechoslovakian Air Lines)
Amsterdam–Rotterdam–Cologne–Frankfurt–Milan–Rome	910	Daily	*Deutsche Lufthansa* (D.L.H.) and *Avio Linea Italiane* (A.L.I.)
Amsterdam–Bremen–Hamburg	251	Daily	D.L.H.
Amsterdam–Rotterdam–Basle–Zürich	488	Daily	*Swissair*
Amsterdam–Rotterdam–Cologne	163	5 times weekly	—
Amsterdam–Doncaster–Manchester–Liverpool	360	Daily	—
Amsterdam–Rotterdam–Haamstede–Flushing–Knocke	104	3 times daily	—
Amsterdam–Rotterdam–Eindhoven	90	Twice daily	—
Rotterdam–Amsterdam–Groningen	133	Twice daily	—
Amsterdam–Leeuwarden	78	Twice daily	—
Amsterdam–Texel	59	Twice daily	—

From : *Jane's All the World's Aircraft*, 1939, p. 77 (a) (London, 1939)

The remarkable increase in the amount of traffic on the Amsterdam–Batavia air route is shown in the following table :

Traffic on the Amsterdam-Batavia route, 1930-8

	1930	1931	1932	1933	1934	1935	1936	1937	1938
Distance flown (1,000 km.)	182·9	892·7	1,540·2	1,521·0	1,457·8	2,329·2	3,043·5	3,314·5	4,472·3
Passenger-km. (1,000)	Not available	271·1	1,645·0	3,537·6	4,368·7	7,589·1	12,776·9	17,867·2	24,250·9
Mail (1,000 ton-km.)	39·9	211·4	379·1	484·8	500·0	618·9	771·9	1,292·9	1,668·1
Freight (1,000 ton-km.)	2·0	26·3	56·4	70·6	75·6	154·4	239·5	348·9	574·2

From : *Statistical Yearbook of the League of Nations*, 1938–9, p. 206 (Geneva, 1939)

In the period 1931–37 the British figure of passenger km. (000's) increased from 3,365 to 37,174. The increase in the Dutch totals is very largely a reflection, in the early part of the period, of the recovery from the economic depression, which reduced the traffic to and from the Netherlands East Indies very considerably.

The European air services of the K.L.M. carried in 1938 some 148,000 passengers, 161 tons of mail, and 2,191 tons of freight. As might be expected, by far the most important service was that of Amsterdam and London, which carried 35,000 passengers in 1938. The service with Scandinavia carried 17,000 passengers, that with Prague, Vienna and Budapest 16,000, with Berlin 15,000, and with Paris 12,000. A further 33,000 passengers travelled on the air routes within the Netherlands.

Air Services to the Netherlands East Indies

The first regular air service between Amsterdam and Batavia was opened in 1929, after several trial flights. Starting with a fortnightly service in each direction, it was increased until in 1939 three services a week were flown in each direction ; machines left both Amsterdam and Batavia on Tuesday, Thursday and Saturday. Technical improvements reduced the duration of the flight considerably ; in 1929, the scheduled time between Amsterdam and Batavia was eighteen days, in 1939 it was five and a half days (six and a half days were taken on the outward journey in winter). The route flown in the winter of 1938–9 was Amsterdam–Marseilles–Rome–Brindisi–Rhodes–Port Said–Damascus–Baghdad–Basra–Bushire–Karachi–Allahabad–Calcutta–Rangoon–Penang–Batavia ; in summer, the European section of the route was Halle/Leipzig–Budapest–Athens. At Batavia the K.L.M. service connected with those of the K.N.I.L.M. to other parts of the East Indies and to Australia.

The K.N.I.L.M. Services in the Netherlands East Indies

Air services in the Netherlands East Indies are maintained by the *Koninklijke Nederlandsch-Indische Luchtvaart Maatschappij* (K.N.I.L.M.), or Royal Netherlands Indies' Airways. Like the K.L.M., it is an independent company, with an annual subsidy from the government. It started operations in 1928 with daily services between Batavia and Bandoeng, and between Batavia and Semerang ; in 1939 there were services to Soerabaya, Singapore, Saigon, Medan, Balikpapan, Denpasar (Bali), Celebes and Sydney (Australia). Full details of the working of the K.N.I.L.M. are given in the Handbook to the *Netherlands East Indies*.

There is a considerable degree of co-operation between the K.N.I.L.M. and the K.L.M. The former supervises the technical arrangements at the eastern end of the Amsterdam-Batavia service, and operates connections at Batavia with the K.L.M.'s service. On the other hand, the K.L.M. acts as technical adviser to the K.N.I.L.M., and arranges for the purchase of aircraft, engines and spare parts.

Services in the West Indies and South America

The K.L.M. began the operation of air services in the western hemisphere in 1935, with a base at Willemstad in Curaçao. In 1939, the following services between the Dutch West Indian islands, the British West Indies, Venezuela and Colombia were in operation :

Curaçao–Aruba	Twice daily
Curaçao–Aruba–Maracaibo	Daily
Maraçaibo–Barranquilla (Colombia)	Daily
Curaçao–La Guaira (Venezuela)	Three times weekly
Curaçao–Trinidad	Weekly
Trinidad–Barbados	Three times weekly
Curaçao–Coro (Venezuela)	Weekly
Curaçao–Bonaire	Weekly

The following table shows the results of the West Indian services during the years 1936–8 :

	1936	1937	1938
No. of passengers	3,491	5,899	9,500
Freight (kilograms)	19,846	40,621	79,500
Mails (kilograms)	735	3,112	6,300

From : *Jaarcijfers voor Nederland* for respective years ('s Gravenhage)

It was intended by the K.L.M. to run a service between Amsterdam and the Netherlands West Indies, and to this end permission was obtained in 1938 from Portugal to allow Dutch aircraft to call at Lisbon and at the Cape Verde Islands. No progress was made with this scheme, however.

Airports and Civil Airfields

Seven airports—at Schiphol (Amsterdam), Waalhaven (Rotterdam), Flushing, Enschede, Eindhoven, Eelde (Groningen) and Ypenburg (The Hague)—are available for international civil and commercial aviation ; there is also a civil seaplane station at Schellingwoude, near Amsterdam. By far the largest airport is at Schiphol, which lies 5 miles south-west of Amsterdam. Owing to its central position in western Europe, to its considerable use by foreign air-lines, and to its function as the terminus of the route to the East Indies, it has become one of the world's most important air traffic centres. The following table shows the numbers of passengers using the airport in 1938 :

	Arrivals	Departures	Transit	Total
European services	17,468	15,657	20,917	54,042
East Indian services	340	306	1,210	1,856
Internal services	10,722	10,233	1,667	22,622
Total	28,530	26,196	23,794	78,520

From : *Handelsinrichtingen, etc.*, No. 28, p. 30 (Amsterdam, 1939)

Airfields at Haamstede, Teuge, Leeuwarden and Texel are available for Dutch civilian aircraft, but are not open for international air traffic except in emergencies.

There are also twelve emergency landing grounds, most of which are service airfields. These are at Arnhem, Bussum, Gilze-Ryen (near Breda), Harskamp, De Kooij (near Den Helder), Milligen (to the west of Apeldoorn), Oldebroek (near Zwolle), Soesterberg (near Utrecht), Venlo, Vught (near 's Hertogenbosch), De Mok (Texel) and Veere (Middelburg).

Airfields in the western hemisphere are situated at Willemstad (Curaçao) and at Oranjestad (Aruba) ; there is also a seaplane base at Schottegat (Aruba).

Mention may be made of the Pan-American Airways base on the Suriname river, near Paramaribo, which may be used by the K.L.M. in the future.

Private Flying

While private flying in the Netherlands is hardly as popular as in Germany or in France, there is a considerable number of flourishing clubs. These include the *Koninklijke Nederlandsche Vereeniging voor Luchtvaart* (Royal

Aeroclub of the Netherlands) and the *Bond von Nederlandsche Aeroclubs* (Union of Netherlands Aeroclubs), as well as local clubs in Amsterdam, Rotterdam, Delft, Twente, Eindhoven, Noord Nederland (Eelde), The Hague and Zealand.

There are also the *Amsterdamsche Studenten Luchtvaart Vereeniging* at Amsterdam, and the *Vrijwillige Organisatie van Sportvlieger* at Ypenburg. There are a number of gliding clubs and also two balloon clubs—the *Nederlandsche Ballonsport-Vereeniging* and the *Haagsche Ballonclub*.

The chief flying school is the *N.V. Nationale Luchtvaart School*, which has been in existence since 1927. It runs seven flying schools—at Ypenburg, Amsterdam, Eindhoven, Flushing, Eelde, Teuge, and in Twente. Other schools are maintained by the various aero-clubs.

APPENDIX VII

CHIEF CITIES AND TOWNS

According to the estimates of population for 31 December 1939 there were at that date twenty-one communes in the Netherlands each with a population exceeding 50,000 (Fig. 48). Descriptions of five of these will be found in Chapter XVI—(The Ports)—Amsterdam, Rotterdam, Groningen, Dordrecht, Schiedam. The remaining sixteen are described in this Appendix ; the population figures given are the official estimates for 31 December 1939, taken from *Jaarcijfers voor Nederland* 1940, p. 13 ('s Gravenhage, 1942).

Apeldoorn (72,600)

General Features

Apeldoorn is a market centre for a fertile agricultural region at the foot of the Veluwe. The commune, covering an area of 81,000 acres, is the largest in the Netherlands. To the west lies a well wooded belt of park land, of which much was a royal hunting ground in former times. On the northern outskirts of the town lies the royal residence of Het Loo, a building completed in 1685 ; nearby is the older castle of Oude Loo, dating from the fourteenth and fifteenth centuries.

Economic Importance

Apeldoorn is a manufacturing centre with a varied range of industries. There are a paper works, a bleachworks, the *Nimef* watch factory, light metalworks, ink and chemical works, a clog factory, a netting factory and manufactures of cigars, soap and knitwear. The development of industry has been reflected in the growth of population, which has doubled in the last thirty years.

Communications

Apeldoorn is on the important double track railway which runs eastwards from Utrecht to Enschede and the German frontier, and it has single track connections with Zwolle to the north, Zutphen to the south-east, and Dieren to the south—on the main line from Zutphen to Arnhem ; from Dieren westwards this line is electrified. The Apeldoornsche Canal, running north and south, is capable of admitting 100-ton barges, and links the town with the Yssel at Dieren (and thence the Neder-Rhine) and with the Yssel at Zwolle (and thence with the Yssel Meer). By road, Apeldoorn is connected with Amersfoort to the west, and with Deventer to the east, by N.R.29. The main road northwards from Arnhem to Zwolle, N.R.50, by-passes the centre of the town. There is a good road leading to Zutphen and the south-east.

Arnhem (90,500)

General Features

Arnhem is the capital of the province of Gelderland and the seat of a court of appeal (*gerechtshof*). It is situated on an admirable site formed by the lower slopes of the Veluwe on the right or north bank of the Neder-Rhine, which is here crossed by a road bridge. Two miles above the town the Yssel branches eastwards. It is an important route centre and its position, which has always made it of considerable administrative and strategic

importance, has encouraged the expansion of industry in recent years. With its neighbouring hills and pine forests in the Veluwe to the north, Arnhem is much favoured as a residential area by well-to-do Dutchmen retiring from business or returning from the colonies.

Among the outstanding buildings of the old town are the Town Hall, a restored late fifteenth-century house, and the *Groote Kerk*, commenced in 1452. The course of the Singel, which added materially to the defences of the old town, can now be traced in a series of flower gardens.

History

Arnhem, which may have been the Roman settlement of 'Arenacum', is first mentioned in 893. In 1233, Otto II, Count of Gelderland, resided here, conferred municipal rights on the town and fortified it. Later it joined the Hanseatic League. In 1505, Philip, son of Maximilian I, conferred upon it coining rights. The Emperor Charles V acquired Arnhem in 1543 and made it the centre of administration for Gelderland. In 1579, the city joined the Union of Utrecht and in 1585 came under the States-General. In 1672 it was taken by the French, who held the town for two years. During the eighteenth century it was refortified by Coehoorn (the Vauban of the Netherlands) but in 1795 it was successfully stormed by the French. With the weakening of French power it was taken by the Prussians in 1813, to be restored to the Netherlands in the settlement of 1814–15.

Economic Importance

At Arnhem there is a tin smelter which was opened in 1929 and is now one of the most important in the world (see p. 383). It has also one of the three chief rayon factories in the Netherlands, dating from 1911 (see p. 394), and one of the two chief rubber factories and a cycle tyre factory. Other industries include the manufacture of clothing, light metal work and engineering, the construction of river barges and tugs, radio valves and pharmaceutical chemicals (*Arnhemsche Chemisch-Technische Industrie*). Near Arnhem itself and along the Yssel and Neder-Rhine there are many brick and tile works. The town has one of the most important agricultural markets in the country, and is the headquarters of the *Nederlandsche Heidemaatschappij*, the organization which has done so much to develop the sandy wastes of the east.

Communications

The electrified railways from Amsterdam and Rotterdam join at Utrecht and continue to Arnhem, from which an important steam service is maintained eastwards over the German frontier through Emmerich to the Ruhr. Another double track line connects with Zutphen and hence to the north and east. Southwards there is an electrified line to Nymegen from whence steam services operate to Krefeld and Cologne, and to the southern part of the Netherlands. The Neder-Rhine provides waterway connections for the largest craft to the main waterways of the country and to Germany, while the Yssel leads to the Yssel Meer and the canals of the north and east.

Main roads radiate from Arnhem—N.R.12 to Utrecht, N.R.50 to Apeldoorn, N.R.48 to Zutphen, N.R.51 over the German frontier to Emmerich, and N.R.52 southwards to Nymegen. An alternative route to Utrecht is provided by N.R.25 which runs for nearly half the distance close to the Neder-Rhine. One road bridge now carries the traffic across the Neder-Rhine (Plate 93).

Breda (51,800)

General Features

Breda stands near the northern edge of the sandy region of North Brabant, overlooking the plain of the Maas. Situated at the confluence of the rivers Mark and Aa and encircled by a Singel, it has for many centuries been a town and fortress of importance. It is now a popular residential town for people of means, and is the seat of a Roman Catholic bishopric. Industry has expanded in recent decades.

The Cathedral or *Onze-Lieve-Vrouwe Kerk*, dating from the thirteenth century, has a fine fifteenth century tower. The Royal Military Academy dates from 1536, and extensive barracks are maintained.

History

During the later Middle Ages Breda was the centre of a barony, and the name ' Baronie ' is still applied to the district surrounding it.

The town played an important part during the revolt of the northern provinces against Spain. Subsequently it was captured by the Spaniards in 1581, retaken by Maurice in 1590, lost to Spinola after a nine months' siege in 1625 and regained by Frederick Henry in 1637. It was from Breda that Charles II issued his Declaration to the English people before his restoration in 1660, and in 1667 the Second Anglo-Dutch War was closed by a treaty negotiated here. The strategic position of Breda was evident during the French Revolutionary Wars, for it was taken in 1793 and again in 1795, to be recovered in the settlement of 1814–15.

Economic Importance

During the last thirty years various industries have grown up in Breda. There are four engineering firms which produce pumps, boilers, steam engines, electrical apparatus, railway wagons, metal bridges, heating equipment and machine tools. There are also a cocoa and chocolate works, a sugar refinery, a brewery, and one of the principal rayon factories in the Netherlands. The development of industry has been reflected in the doubling of the population in the present century. The adjoining communes of Prinsenhage and Ginneken add nearly 30,000 to the population.

Communications

A great deal of rail traffic passes through the town from Rotterdam via the Moerdijk bridge eastwards to Tilburg, Eindhoven and Nymegen. Twelve miles to the west the junction of Roosendaal provides double track connexions with Flushing and with Antwerp. Canal facilities are not outstanding ; the R. Mark leads (1) to the Mark and Dintel waterways running westwards to the Volkerak (2) northwards to the Maas at Geertmidenberg and (3) eastwards to the Wilhelmina Canal at Oosterhout. Over most of these waterways 500-ton barges can be admitted.

The main road from Antwerp into the Netherlands enters Breda from the south-west after joining that from Flushing just outside the town. Other important roads are N.R.16 to Rotterdam, N.R.27 to Utrecht and N.R.63 to Tilburg. Two secondary roads run southwards across the Belgian frontier to Turnhout and Oostmalle.

Delft (54,900)

General Features

Delft is a quiet and prosperous old town lying on the Schie, 8 miles north-west of Rotterdam and about 7 miles inland from the coast. The

centre is encircled by a defensive moat known as the Singel and is intersected by numerous small canals bordered with lime trees. The tomb of William the Silent and the Royal Mausoleum of the Orange family are in the New Church (founded in 1420), while the Old Church (founded in 1220), contains the tombs of Admiral Tromp and Piet Hein (see p. 635). Delft is an almost perfect example of a seventeenth-century Dutch town, and its streets and views figured in several of the paintings of Jan Vermeer (1623–75), who was a native of the town.

History and Economic Importance

Delft existed as early as the eleventh century, and in the Middle Ages grew to acquire some considerable commercial importance. The Prinsenhof was long one of the residences of the Princes of Orange, and it was here that William the Silent was assassinated in 1584. During the sixteenth and seventeenth centuries the pottery industry became world famous. After a long decline it has been revived. Other industries developed in the nineteenth century—manufactures of yeast, alcohol, gelatine, dyes, cigars, machinery and telegraph and telephone cables, and there is a large margarine factory here. It is the seat of a famous technical high school.

Communications

Delft stands midway between Schiedam and The Hague on a multiple track electrified railway and so has good connections with Rotterdam and Amsterdam. There is also a single track light railway running to the Hook of Holland. The Delfsche Canal permits the easy importation of heavy goods from Rotterdam.

The National highway from Rotterdam to The Hague passes just to the east of the town, but there is a good connection to both these cities by ordinary main roads. A minor road leads westwards to the Hook of Holland.

Eindhoven (113,000)

General Features

The largest centre of the industrial region of North Brabant, Eindhoven is, as a large city, the newest in the Netherlands. It has well planned residential districts, containing several examples of modern Dutch architecture. The rise of Eindhoven has been closely associated with the development of the enormous Philips electrical manufacturing trust.

History and Economic Importance

Eindhoven long carried on traditional industries of tanning, leather working and woollen manufacture, derived from local pastoral industries and supplies of pure water. At the coming of the railway in 1866 the population amounted to only 3,000. In 1895, when the Philips family established an electric lamp works there employing thirty men, the population was about 5,000. In 1920 the population had risen to 48,000, and since then has increased by nearly 250%. The Philips works lie mainly to the north-west, along the railway to 's Hertogenbosch. Employing 20,000 people in 1939, they are one of the largest producers in the world of lamps, valves and all types of radio and electrical apparatus, and have elaborate facilities for research. Other industries include four breweries, four brickworks, a match factory, a tobacco factory and seventeen cigar factories, as well as one

woollen and one cotton mill. A few miles to the north-west, at Best, lies the Netherlands factory of the *Bata* footwear concern.

Communications

The electrified double track railway from Amsterdam via Utrecht and 's Hertogenbosch joins the Flushing and Rotterdam lines at Bokstel and approaches Eindhoven from the north-west. One double track steam line connects Eindhoven with Venlo on the German frontier some 30 miles south to the east, while another runs south-eastwards to Roermond and Maastricht, with connections for Munchen-Gladbach at the former and Aachen at the latter. A single track line runs from Eindhoven in a southerly direction to cross the Belgian frontier for Neerpelt and Hasselt.

Waterway transport is provided by the Eindhoven Canal, which branches from the Zuid-Willems Canal at Helmond, and which will admit 450-ton barges.

Eindhoven has good road communication with Tilburg and 's Hertogenbosch by N.R.'s.63 and 64. N.R.'s.67 and 68 run east and south-eastwards to Venlo and Roermond, while to the south and south-west good roads cross the Belgian frontier to Hasselt and Turnhout.

Enschede (91,500)

Enschede, which lies about 4 miles from the German frontier, is the largest town of the Twente industrial region in south-east Overyssel. Its history has been largely one of industrial expansion ; the population in 1889 amounted to only 15,000, and since then has increased rapidly. The adjoining commune of Lonneker, with 31,000 people, was annexed in 1934. The town covers a considerable extent of ground, comprising a number of built-up areas largely separate from each other. Two other textile centres, Hengelo and Oldenzaal, are only about 5 miles distant.

Economic Importance

The origin of industry in this sandy area, far from navigable waterways, goes back to the establishment of the domestic woollen and linen industries in the seventeenth century. Shortly before the building of railways in the nineteenth century, a modern cotton industry had developed, and since then the industry has expanded steadily. Coal is brought from the Ruhr basin both by railway and by canal. Enschede, with 28 mills, is the largest centre of the cotton industry in the Netherlands (see p. 369). Other industries include machinery construction and the manufacture of furniture, footwear and cement products. Lonneker, besides engaging in the textile industry, is a centre of dairy product manufactures.

Communications

Rail connection with the central and western parts of the country is maintained by a double track line via Hengelo, Almelo and Deventer to Utrecht, and a single track line branching at Hengelo to reach Amsterdam via Zutphen. Two single track lines run over the German frontier, one due eastwards to Münster, and the other, a light standard gauge track, making connexion eventually with the railways of the Ruhr.

Waterway connections are of recent development. The Twente Canal, for 1,350 ton barges, was approaching completion in 1939, and reaches the Yssel at Zutphen ; a new canal from Laren Almen near Zutphen to the Rhine at Lobith is under construction.

Enschede has good road connexion to Hengelo by N.R.35 which then

continues to Zwolle, whilst other roads run to Apeldoorn and Arnhem. An important road crosses the German frontier and proceeds to Osnabrück and Münster. A secondary road runs southwards linking the small towns on the Dutch side of the frontier, but to the north its counterpart forks at Oldenzaal, to cross the frontier and reach Rheine and Lingen in the Ems valley.

The Hague (504,000)

General Features

The Hague (officially *'s Gravenhage*, but commonly known as *Den Haag*) is the seat of government of the Netherlands, and the capital of the province of South Holland. It is also the seat of the Supreme Court of the country, of an ordinary court of appeal (*Gerechtshof*), of an arbitration appeal court (*Raad van Beroep*), and of the supreme court martial. The Permanent Court of International Justice has met since 1922 at The Hague, in the Peace Palace, an ornate building erected in 1907–13 to house the international conferences which it was expected would follow those of 1899 and 1907.

The Hague is situated about three miles from the coast, but recent expansion has carried the north-western suburbs as far as the dunes and has linked The Hague with the watering place of Scheveningen, which forms part of the commune. The historic centre of The Hague is the Palace of the Counts of Holland (*Binnenhof*), around which are grouped the royal palace, government buildings, the town hall (*stadhuis*), museums, art galleries and libraries, and the principal churches. North-east of this central quarter stretches the two-mile long Wood (*Haagsche Bosch*), which separates the north-eastern and north-western residential areas, while midway between it and Scheveningen are situated another large open-space, the Scheveningen Wood (*Scheveningsche Bosches*) and its adjacent parks. The industrial and working-class area lies south and west of the centre.

History

The Hague owes its origin, and its name, to the hunting lodge which the Counts of Holland maintained from the beginning of the twelfth century in the wood (*haghe*) which then covered the site, and of which the *Haagsche Bosch* is all that remains today. In the thirteenth century this retreat assumed more and more the character of a court-residence, and a fortified palace arose, of which the present Knight's Hall (*Ridderzaal*), built by Count William II, who was also Holy Roman Emperor, about 1250, formed the principal building. Successive counts added to this palace. Under Albert of Bavaria The Hague tended to become the permanent seat of government, and the Court of Holland (*Hof van Holland*) was transferred there from 's Gravenzande. Meanwhile there was growing up around this official nucleus a community which by the close of the Middle Ages had reached urban proportions. Owing to its dependence on the court, however, it could not achieve the status of a town, but remained merely a village.

Under the Dukes of Burgundy and the early Hapsburgs the political centre of gravity of the Netherlands lay in the south, and The Hague lost rather than gained in importance. But the Revolt opened up a much greater prospect. The House of Orange began its long association with The Hague when Prince William came to the *Binnenhof* as stadtholder of Holland in 1559. But in 1566 the Prince broke with the Spanish government and left the country, and when he returned to The Hague it was as the leader of the Revolt. At first it appeared unlikely that The Hague would be chosen as the seat of the independent government. But from 1580, when

the States-General, after holding their sessions in various towns, began to meet regularly in the *Binnenhof*, and, following their example, the States of Holland too, the choice was made. In 1582 the States-General set up a High Court of Justice there, and a few years later Prince Maurice, William the Silent's son and successor, began to make it his usual residence, so that all the principal branches of government were assembled there. Its growing importance encouraged The Hague to make repeated efforts to be recognized as a town and given a seat in the States of Holland, but in this it was unsuccessful, and so earned its title of ' the largest village in Europe '.

During the seventeenth century The Hague became one of Europe's leading capitals, and was largely rebuilt on dignified and spacious lines. To this period belong the Chamber of the States of Holland and the Peace Hall (*Treves-saal*) in the *Binnenhof*, the *Mauritshuis*, which now houses the second finest collection of paintings in Holland, and, among thoroughfares, the Old Scheveningen Road (*Oude Scheveningscheweg*) planned by Constantijn Huygens in 1663. Many private houses of this period also survive, among them those of three of its greatest figures ; John van Oldenbarnevelt (see p. 127), John de Witt (see p. 136) and Benedict Spinoza (1632–77).

With the decline of the Republic in the eighteenth century, The Hague lost much of its international importance. In 1795 the old Republic collapsed under the impact of the French invasion, and The Hague became the capital of a new Republic, a client-state of France. But when in 1806 Louis Bonaparte became King of Holland he decided to move the seat of government to Amsterdam, and the change was actually made in 1808. It was at The Hague, however, that the leaders of the revolution of November 1813 set up their provisional government, and although William I took the oath to the new constitution and was formally proclaimed king at Amsterdam, the government of the new kingdom was carried on at The Hague.

The later history of The Hague was one of continued growth as a residential and cultural centre. It acquired a wider importance with the international conferences of 1899 and 1907, and the establishment in 1922 of the Permanent Court of International Justice. In recent decades the commercial importance of the city has grown considerably.

Economic Importance

The population of The Hague grew from 56,000 in 1830 to 271,000 in 1909, while in the following thirty years it grew further to 504,000. In the present century population has expanded much more rapidly than that of Amsterdam, Rotterdam or any other large Dutch city, except Eindhoven and Enschede. With a large population of salaried employees of government and other offices, of pensioners and retired persons, the average wealth is high, and the yield of direct taxation is greater in The Hague than in Amsterdam.

The Hague has become the seat of an increasing number of offices of banks and commercial undertakings, such as companies operating mines in the East Indies, and the Royal-Dutch-Shell group. Industry employs very few ; in 1930, when the population stood at 438,000, the industrial population numbered only 47,000. The building industry employed most, followed by clothing, metal manufactures, food-processing, printing and paper making. Other industries were the manufacture of furniture and tobacco. Metal manufactures were not large but included the production of wireless apparatus, electric motors, boiler accessories, machinery and metalware. The four important newspapers of The Hague (*De Nederlander*,

Haagsche Post, *Het Vaderland* and *Haagsche Courant*) are believed to have their own presses, while there are also two important government printing works—the government stationery office (*Algemeene Landsdrukkerij*) and the State map-producing agency.

The city now adjoins Scheveningen and is practically contiguous with Voorburg (25,000), Rijswijk (17,000) and Loosduinen. The newer suburbs to the south-west and south are notable for the high standard of their architecture and town planning.

Communications

Multiple track railways radiate eastwards to reach (1) Amsterdam via Leiden and Haarlem, (2) Amsterdam via Gouda, (3) Utrecht via Gouda, (4) Rotterdam direct, and (5) Rotterdam via Delft and Schiedam. The Vliet canal provides a connexion with the canals of South Holland and permits the easy importation of commodities such as coal for the gasworks. Main roads radiate to all neighbouring towns ; national highways, each with two carriage ways about 20 ft. wide, begin at Voorburg for Gouda and Utrecht, and at Rijswijk for Delft and Rotterdam.

Haarlem (140,500)

General Features

Haarlem lies about 4 miles inland from the North Sea coast, between the dunes and the River Spaarne. It is the capital of the province of North Holland, and the seat of a Roman Catholic bishopric. It is the fifth largest city of the Netherlands. A century ago it was exceeded in size by other towns which have since fallen behind it—Groningen, Leiden and Maastricht. While the population grew from 21,700 in 1830 to 69,000 in 1909, it doubled between 1909 and 1939.

The old town contains many buildings of interest. In the central market place are the Town Hall and the *Groote Kerk*. The Town Hall was originally a palace of the counts of Holland, begun in the twelfth century, and remodelled at the beginning of the seventeenth century. The *Groote Kerk*, dedicated to St. Bavo, dates from the late fifteenth and early sixteenth centuries. Early in the seventeenth century, Haarlem was famous for its school of painters and architects. The painters included Frans Hals, Jacob van Ruysdael, the Wouwermans and the brothers Ostade. The Frans Hals Museum was opened in 1913 to house the masterpieces of the great painter which were formerly housed in the Town Hall. Among the architects was Lieven de Key who designed the Meat Market at Haarlem.

History

Haarlem had been the home of the counts of Holland since the eleventh century, the present Town Hall being their old palace. The soft water from the neighbouring dunes was favourable to the early development of breweries, of cloth-bleaching, and of cloth weaving industries. By the middle of the twelfth century it was a prosperous town and received its first town charter from William II, Count of Holland, in 1245. It played a considerable part in the wars of Holland against the Frisians. In 1492 it was captured by the insurgent peasants of North Holland but was retaken by the Imperial Stadtholder and deprived of its privileges. In 1572 Haarlem joined the revolt of the Netherlands against Spain and in 1573 was forced to surrender to Alva's son Frederick. In 1577 it was recaptured by William of Orange and permanently incorporated in the United Netherlands. It was very prosperous during the seventeenth century but was impoverished by

economic crises during the eighteenth century. The latter part of the nineteenth century brought economic revival, and the opening of the North Sea Canal did much to encourage industrial expansion.

Economic Importance

The main industries comprise the construction of cranes and hoisting machinery, of railway wagons (*J. J. Beynes*), the building of small ships (*Werf Conrad*), general engineering, printing, the manufacture of pharmaceutical products and the production of electro-technical apparatus. Haarlem is also of some importance as the centre of a bulb-growing area. It is the site of important workshops of the Netherlands railway system.

Communications

Haarlem is an important railway centre at the junction of the electrified west-east route from Zandvoort to Amsterdam and the similar north-south line from Alkmaar to Rotterdam via the Hague. Standard gauge tramways connect Haarlem with Zandvoort, The Hague, and Amsterdam.

The River Spaarne provides a link with the North Sea Canal, and is navigable by large barges and smaller sea-going ships ; the canal also connects Haarlem with Amsterdam. Southwards the town has connextions with the waterways of South Holland, admitting barges of 500 tons.

The main road N.R.9 runs northwards by way of Alkmaar and then connects with the north-eastern provinces by the Ysselmeer dam ; N.R.5 joins Haarlem with Amsterdam, while N.R.8 proceeds southwards towards The Hague. There is a good secondary road leading to Zandvoort on the coast.

Heerlen (50,500)

General Features

Heerlen lies in the extreme east of south Limburg, only about 4 miles from the German frontier. It is the centre of the Limburg coalfield, and has grown in importance with the opening up of the mines. The late development of mining and industry in the region has permitted some degree of town-planning, so that the town differs in appearance from many coalfield towns.

History

Heerlen was a Roman town (Coriovallum) of some importance, lying at the crossing of the Cologne–Maastricht–Tongeren and Aachen-Xanten roads. From the end of the fourth century until 1061 there are no records relating to the town, but at that date Bishop Udo of Toul granted land at Heerlen to his church. In 1244 the count of Hochstade was authorised to build a castle there ; in 1364 it passed into the possession of the Duke of Brabant. Its position gave Heerlen some importance—it was beseiged in 1381, 1542, 1574, and 1580, and suffered severely during the Eighty Years' War. In 1661 it passed into possession of the States-General, remaining so until the period of the French occupation, beginning in 1793. From 1815 to 1831 Heerlen lay within the joint Kingdom of the Netherlands. As a result of the arrangement of 1831–9, it passed with part of Limburg to the king of the Netherlands. At the same time it became part of the German Confederation, and was not fully incorporated into the Netherlands state until 1866 (see p. 158).

With the coming of the railway in 1893, when Heerlen had a population of only 6,000, the exploitation of the neighbouring coalfield began, and the town, lying roughly at the centre, experienced a rapid growth of population.

During the period 1909–20, for example, numbers increased from 11,000 to 32,000 and from 1920–30 by a further 15,000.

Economic Importance

Both the state mining organization and private Oranje Nassau mines have their central offices at Heerlen, while the *Geologisch Bureau voor het Nederlandsche Mijngebied* is also situated here. Of the twelve mines of south Limburg, eight lie within the commune or near its boundaries ; at the Emma state mine there is a large coke oven and by-product plant. Other industries include a factory manufacturing boring equipment, a number of brickworks, a tannery and five breweries (Plate 97).

Communications

Two double track railways approach Heerlen from the west, one from Maastricht and the other from Sittard, which is on the main line from Maastricht to Roermond and the north. There are several single track lines linking the town with the surrounding mining district, and also a connexion to Aachen across the frontier.

The N.R.76 road runs through Heerlen on its way from Sittard to Aachen. A secondary metalled road connects Heerlen with Maastricht and another runs north-eastwards across the German frontier to Geilenkirchen.

Hilversum (74,000)

General Features

During the present century fast rail and road connexions with Amsterdam have led to the development of a group of residential towns in the Gooiland, within a few miles of the Yssel Meer, like Hilversum, Bussum, and Huizen. Of these Hilversum is by far the largest. It is pleasantly situated in the well-wooded region of the Gooiland hills, and is about 6 miles to the south of the Yssel Meer coastline. The town is well laid out, and possesses many fine examples of modern Dutch architecture—particularly the Town Hall by Dudok (Plate 98).

The history of Hilversum is uneventful, and was for many centuries the history of a village. In 1869 the population was 6,600, in 1909 it was 31,000 and in 1930, 57,000. In recent years growth has been very rapid, for by 1939 the population amounted to 74,000. Industry has grown considerably mainly in recent decades, and now includes the manufactures of radio components, light machinery, carpets, cigars, stoves and dye-stuffs. Hilversum is the site of one of the principal broadcasting stations of the Netherlands.

Communications

The double track electrified line from Amsterdam forks at Hilversum ; one branch runs via Amersfoort to continue as a steam-operated line to Zwolle, Apeldoorn and the north and east, and the other runs southwards to Utrecht. There is also a light single track steam railway serving Huizen a few miles to the north-east of Hilversum. The southern road from Amsterdam to Amersfoort, N.R.16, is joined at Hilversum by a narrow first-class road coming northwards from Utrecht. A national highway now under construction will replace the latter. A good local road crosses the northern road from Amsterdam to Amersfoort and leads to Huizen.



Plate 95. Haarlem : the Groote Kerk

This is the old church of St. Bavo, dating from the end of the fifteenth century. It lies in the centre of the city ; the new Catholic Cathedral of St. Bavo, erected about 1900, is situated in the south-western outskirts.

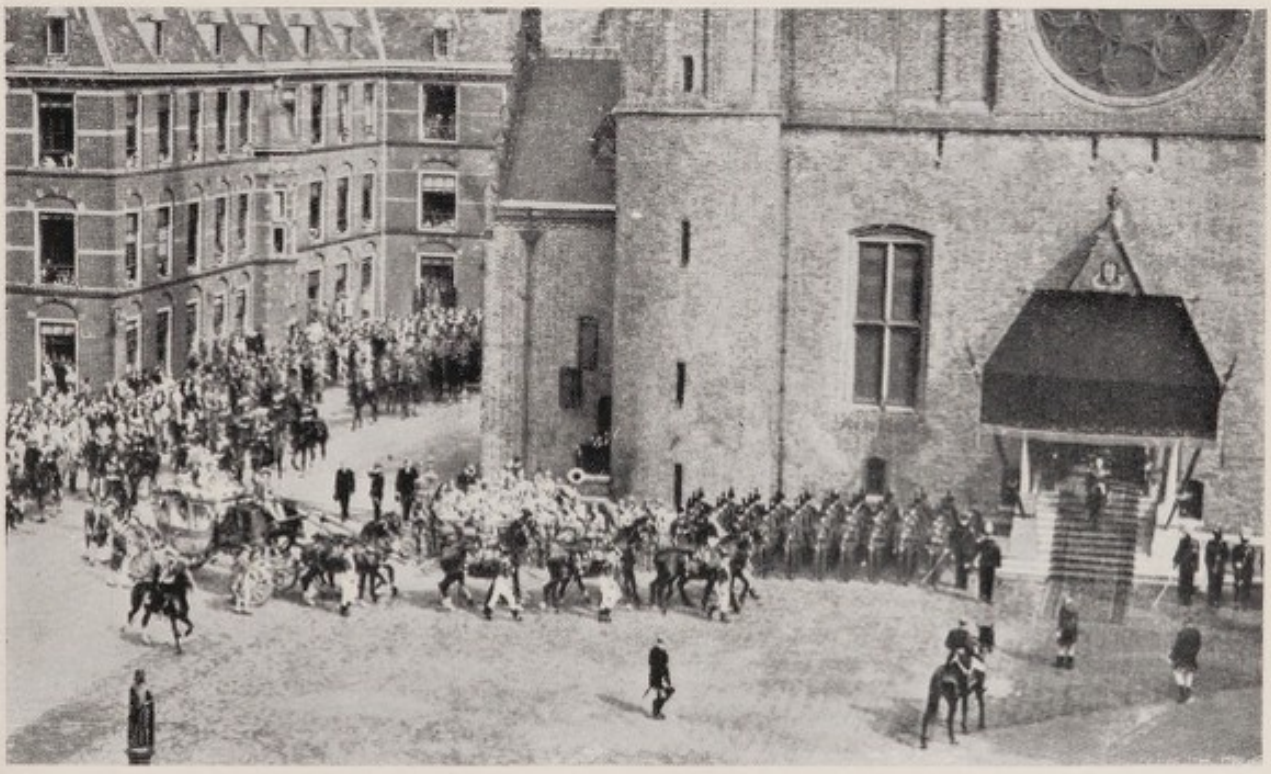

Plate 96. The Hague : royal procession at the opening of the States-General

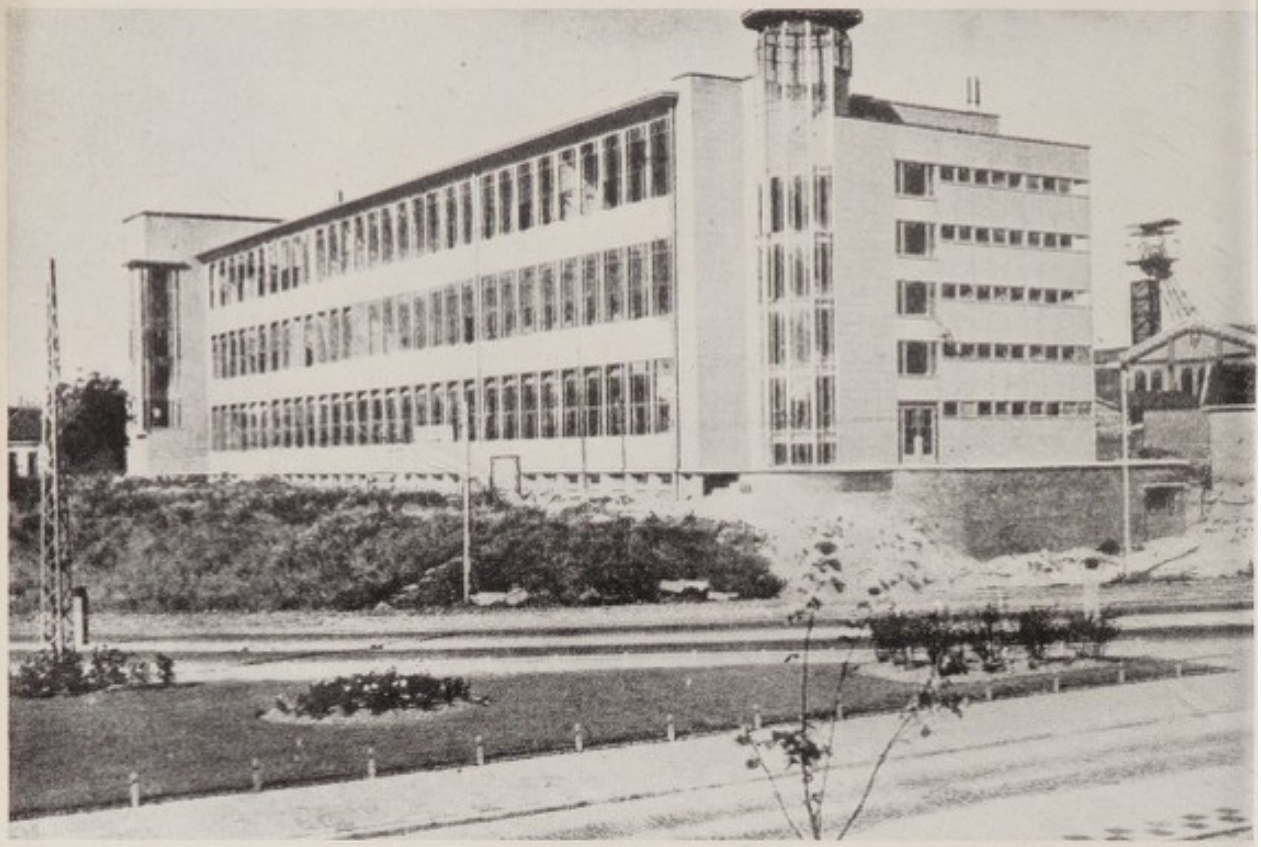

Plate 97. Heerlen : offices of the Oranje-Nassau mines organization

The four Oranje-Nassau mines account for the bulk of the coal output by the private mines in south Limburg.

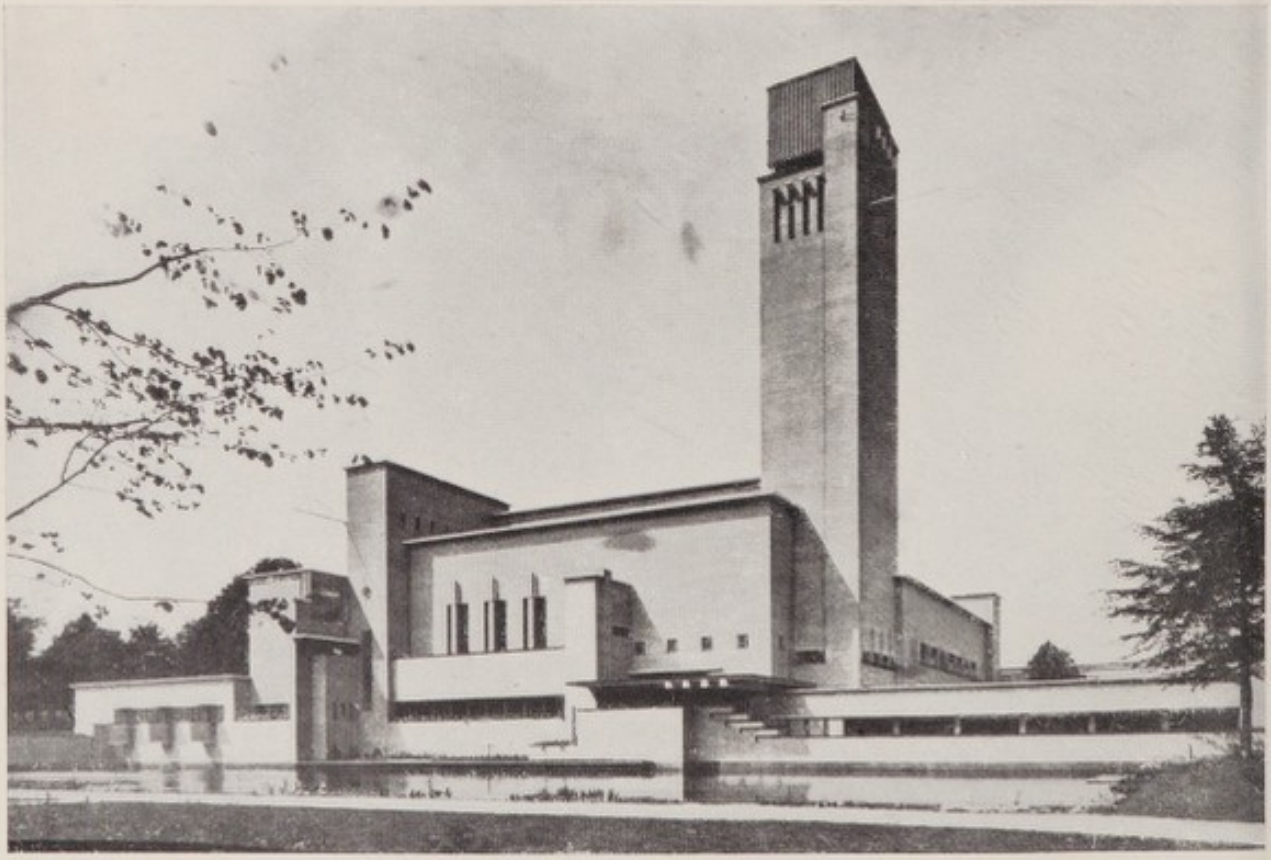

Plate 98. Hilversum : the town hall

This building is one of the best known examples of the work of W. M. Dudok, a leading architect of the modern Dutch school.

Leeuwarden (55,000)

General Features

Leeuwarden is the capital and market centre of the agricultural province of Friesland and the seat of a Court of Appeal. It is a pleasant town largely enclosed within the limits of the old Singel, and is noted for its parks and gardens. The Frisian Museum contains a comprehensive collection of the material culture of the Frisian people.

History

Leeuwarden was originally a seaport on the shore of the Frisian Middelzee, a narrow arm of the sea (Fig. 12), which, by silting and reclamation, had ceased to exist by about 1300. A fortress protected the route from the sea into the interior of the country, and by the twelfth century the town had acquired civic rights. Although its function as a seaport declined, it acquired a political importance as the residence of the stadtholders of Friesland and Groningen. In 1417 the Emperor Sigismund established a mint there. In 1507 a canal linking Leeuwarden with Franeker and Harlingen was completed.

From the sixteenth to the eighteenth century it was a prosperous town being both a commercial and administrative centre. There remain many historic buildings of this period, including the *Groote Kerk* dating from 1480, the *Stadhuis* (1715) and the Queen's Palace. The *Kanselarij* or palace of justice is an impressive building in the Renaissance style completed in 1571. The *Oldehove* is a gothic tower in stone and brick, intended as part of a cathedral, which was planned in 1529 but never carried further.

At the beginning of the nineteenth century it possessed a greater relative importance among the cities of the Netherlands than it does today. The growth of population since then has been steady, following such developments as the introduction of the railway and of technical improvements in Dutch agriculture, which affected Friesland in particular. The coming of motor transport has re-emphasized the function of Leeuwarden as capital of Friesland, for it is now the centre of an extensive system of bus routes.

Economic Importance

As the centre of an agricultural region, Leeuwarden has long been an important market town, and there are separate markets for butter, corn and cattle. The cattle market is exceeded in importance only by the market at Rotterdam. Long established local handicrafts have given way to a wide range of well-organized industries. There are now machine-works, a shoe factory, and bicycle, margarine, asphalt, electro-plate, paint, soap, vinegar, cheese, imitation leather and firework manufactures.

Communications

The main railway line from Amsterdam via Zwolle approaches the town from the south-east, but there is an alternative route via a single track line and the Enkhuizen-Stavoren ferry which enters from the south-west. In addition there are a single track line leading to Harlingen which will eventually be extended across the Yssel Meer dam, light railway connexions with the rural districts north of the Harlinger and Dokkumer canals, and a single track standard gauge line direct to Groningen in the east.

Leeuwarden is a focus of the Friesland canals, and barges of 200 tons can reach it from the port of Harlingen, about 25 miles to the west, from Meppel and Zwolle, and from Groningen by the Hoen canal.

The road N.R.9, after crossing the Yssel Meer dam, leads into Leeuwarden from Harlingen. Main roads run eastwards to Groningen and southwards to Zwolle and a good second-class road goes northwards to connect with the Ameland ferry at Holwerd.

Leiden (78,000)

General Features

Leiden, in the province of South Holland, is situated at the confluence of two arms of the Old Rhine (Oude Rijn), about 5 miles inland from the North Sea coast. It is a principal 'cultural' centre of the Netherlands, being the seat of the most famous university. The Botanical Gardens are well known for their collection of eastern plants, and the Royal Museum of Ethnography is one of the finest in the world.

History

Leiden was probably the 'Lugdunum Batavorum' of the Romans, a fortress on a low hill overlooking the Old Rhine. On this site there still stands the *Burcht*, a circular tower built on an earthen mound which is connected by legend and uncertain chronicles with Saxon days and generally attributed to the Romans. There are also gateways which survive probably from sixteenth-century fortifications. The most celebrated event in the history of Leiden was its siege by the Spaniards in 1573 and 1574. The siege, resisted with great fortitude by Burgomaster van der Werf, was raised by the cutting of the dykes and by the relief brought by small ships of the Beggars' Fleet which sailed up to the walls of the town. The University of Leiden was founded in 1575 by William of Orange as a reward for the heroic defence of the town against the Spaniards. The Botanical Gardens were opened in 1587. The Golden Age of Leiden was in the sixteenth and seventeenth centuries, when Dutch commerce spread to many parts of the world and Leiden cloth was in great demand. It is recorded that in 1640 the city had 100,000 inhabitants.

The once-famous cloth trade had declined by the early nineteenth century. The city remained the fifth largest in the Netherlands, however, until as late as 1869, but afterwards came to assume more and more the appearance of an 'historic' town, looking mainly to its past. In more recent decades it has come to rival The Hague as a tourist resort.

Economic Importance

Industry has become of considerable importance in the life of the city, however. Some activities are related to its educational functions, such as printing and publishing, and the manufacture of medical and hospital apparatus. The woollen industry survives in the manufacture of blankets and uniform cloth. There are also considerable engineering and boiler works, while other industries include the manufacture of perfumes, cigars, confectionery and distilling.

Communications

The main multiple track electric railway from The Hague and Rotterdam to Haarlem and Amsterdam passes through Leiden. There is also a single track steam line running eastward to Alphen a/d Rijn for Gouda and Utrecht. Leiden is well placed for waterway communication—the Ring Canal for 500-ton barges leads northwards, the Old Rhine (500-ton barges) eastwards, and the Rijn-Schie Canal (500-ton barges) southwards to The Hague and Rotterdam. The Old Rhine below Leiden to its mouth at Katwijk-aan-Zee is of no use for navigation.

The important national highway N.R.4 from The Hague to Amsterdam passes just to the west of Leiden, but the town is connected with it, and also to the highway from Gouda to Utrecht, by N.R.11, which runs for the most part beside the Old Rhine.

Maastricht (67,900)

General Features

Maastricht is the capital of the province of Limburg and an important route centre. Lying on the left bank of the Maas, the town is only 2½ miles from the Belgian frontier to the west. The bridges across the Maas give the town much of its importance. The *Oude Maasbrug* (St. Servais bridge) is a thirteenth century structure of nine arches rebuilt in 1684–1716 by Pére François Romain, architect of the Pont Royal in Paris. The *Nieuwe Maasbrug* (*Wilhelmina brug*) is some 300 yards to the north ; it was opened in 1932 and now carries the main road traffic route through the town. Farther north again is a railway bridge. Among the many churches and monuments, the Church of St. Servatius is an outstanding example of Romanesque architecture ; founded by St. Monulphe in the sixth century, it was destroyed in 881 by the Norsemen, but rebuilt, to be consecrated in 1039. Its position makes Maastricht different from other cities of the Netherlands—standing at the meeting point of French, Dutch and German speaking areas, it has more the character of a south Belgian than a Dutch city.

History

Maastricht derives its name from the ford across the Maas on the road between Bavai and Cologne used by the Romans—*ad Mosam Trajectum*. In A.D. 382 St. Servatius transferred his bishopric from Tongres to Maastricht, which remained its seat until 721, when it was moved to Liége. Maastricht was originally a possession of the Frankish kings, whose palace was at Meerssen, a few miles to the north-east. It became later a joint possession of the Dukes of Brabant and the prince-bishops of Liége. During the Revolt against Spain the town joined the North, and was ruthlessly sacked by Parma after a four months' siege in 1579. It was recovered by Frederick Henry in 1632. The town was captured by the French in 1673, 1748 and 1794. From 1815 to 1831 it lay within the joint kingdom of the Netherlands, but as a result of the arrangements of 1831–9, it passed with part of Limburg to the king of the Netherlands. At the same time it became part of the German Confederation, and was not fully incorporated into the Netherlands state until 1866.

The later history of Maastricht was one of industrial expansion following first, the introduction of railways and of the improvement of waterways, and later, the exploitation of the Limburg coalfield. Population during the nineteenth century increased very slowly—from 34,000 in 1830 to 37,000 in 1909, but in the following thirty years it increased by 30,000. Expansion of the built-up area has been mainly on the west bank, although there is a right-bank suburb of Wijk.

Economic Importance

The industries of Maastricht are most varied. The principal factories are two glass and pottery works, with an extensive range of products ; one of the largest paper mills in the Netherlands, and the largest cement works, using local supplies of calcareous rock. There are also eleven breweries, four brickworks, five tile works, three small rubber factories, a metal tube works, a wire-drawing mill, a woollen mill, and a tobacco factory.

Communications

Maastricht is joined to the rest of the country by a double track steam railway which runs northwards via Roermond to Eindhoven. Another important line links it with the coalmining district around Heerlen to the east, and continues as two single track lines over the German frontier to Aachen and Eschweiler. There is a main line running southwards to Liége in Belgium, while a single track makes a connexion westwards in Belgium at Bilsen for Hasselt. The station and sidings are on the east bank—only the single track line to Bilsen crosses the Maas.

Maastricht is a focal point in waterway communication. Southwards the old Maastricht-Liége Canal, for 400-ton barges, leads to the Albert Canal and thence to Liége and the Meuse. Northwards canal docks lead to the Zuid-Willems Canal. The Maas itself is now little used for navigation, its place being taken by the Juliana Canal from Maastricht to Maasbracht, capable of taking 1,000-ton barges, and giving the town easy transport connexions with the Limburg coal harbours at Stein and Born, and with the Rhine.

National roads radiate from Maastricht—N.R.75 to Roermond and the north, N.R.78 over the German frontier to Aachen, N.R.79 to Liége, N.R.80 to Tongres, and N.R.81 to Brussels via Hasselt. A good secondary road leads northwards on the Belgian side of the frontier to Maeseyck.

Nymegen (Nijmegen) (95,000)

Nymegen stands on a sandy, hilly promontory on the south bank of the Waal at the entrance to the Rhine delta. In its site and position it bears a remarkable resemblance to Arnhem on the Neder-Rhine, eleven miles to the north. The earliest settlement of the Batavi lay some distance to the south-east; the camp of the Tenth Roman Legion lay also to the east of the present town, on the hill, while the Roman settlement lay near to the river on the west. The medieval town lay between these sites and has expanded into the present built-up area.

Many medieval buildings of great interest can still be seen in the narrow, steep streets of the old town. In a corner of the small park—the Valkhof—is the oldest church in the Netherlands. Originally intended as a baptistry, it was incorporated in the castle built by Charlemagne and was consecrated by Pope Leo III in 799. Other old buildings are grouped around the *Groote Market*. The Weigh House (1612) and the Town Hall (1554) are excellent examples of Renaissance work. The church of St. Stephen dates from 1271.

History

This excellent defensive and strategic site has probably been occupied continuously from early times. Here was Noviomagus of the Gauls and Oppidum Batavorum of the Romans, while Charlemagne built a residence here. Ease of access by the Waal, however, left Nymegen open to raids by the Norsemen. Later, it suffered from its position on the frontier of the Empire, and experienced several sieges. Nevertheless, the position of the town had great advantages for trade, and Nymegen became a Hanse town. In 1579 it joined the Union of Utrecht; it was captured by Parma in 1585, but was retaken by Maurice in 1591. During the seventeenth-century French wars it was taken by the French in 1672, and was the meeting place for the representatives of France, Holland, Spain and the Empire at the signing of the Treaty of Nymegen in 1678. It fell to the French again in

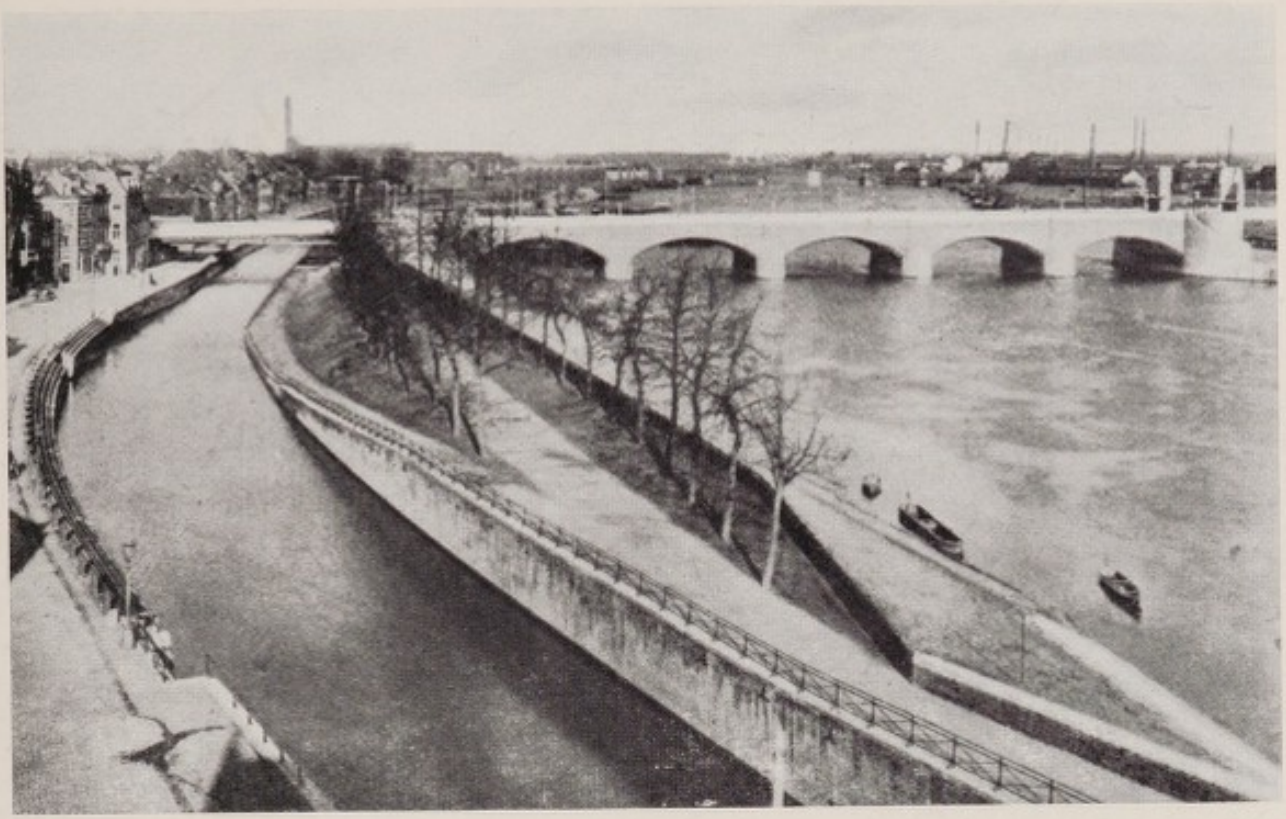

Plate 99. Maastricht : Wilhelmina bridge (R. Maas), looking downstream
The town lies on the left bank. The bridge was opened in 1932 ; upstream is the thirteenth century St. Servais bridge (*Oude Maasbrug*), reconstructed in 1932–3. Each bridge has, on the east side, a wide and high span to facilitate navigation. On the left bank is the lateral canal joining the Zuid-Willemsvaart and the Maastricht-Liége canal.



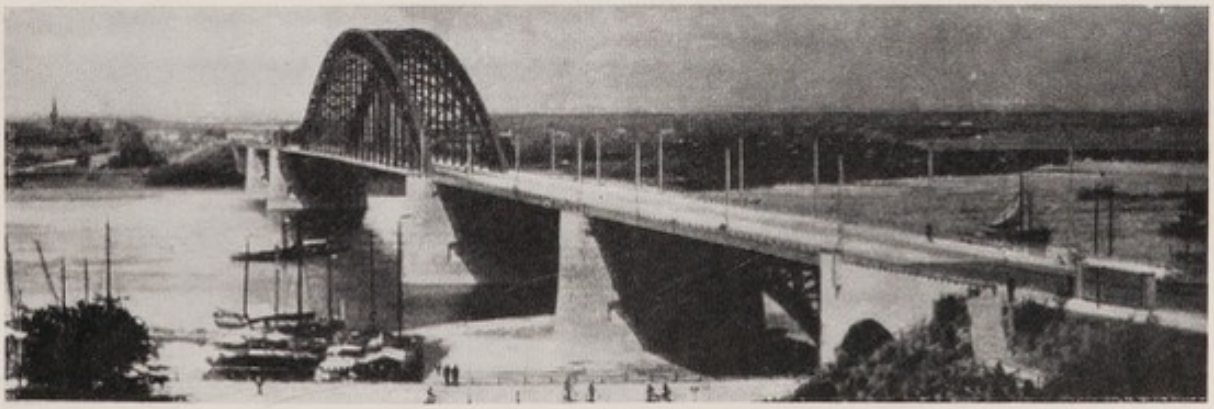

Plate 100. Nymegen : road and rail bridges (R. Waal)
The upper picture shows (looking west) the 1,500 ft. railway bridge, with lattice girder spans, carrying two tracks (electrified) ; the lower picture shows (looking north), the single arch bowstring road bridge, opened in 1936.

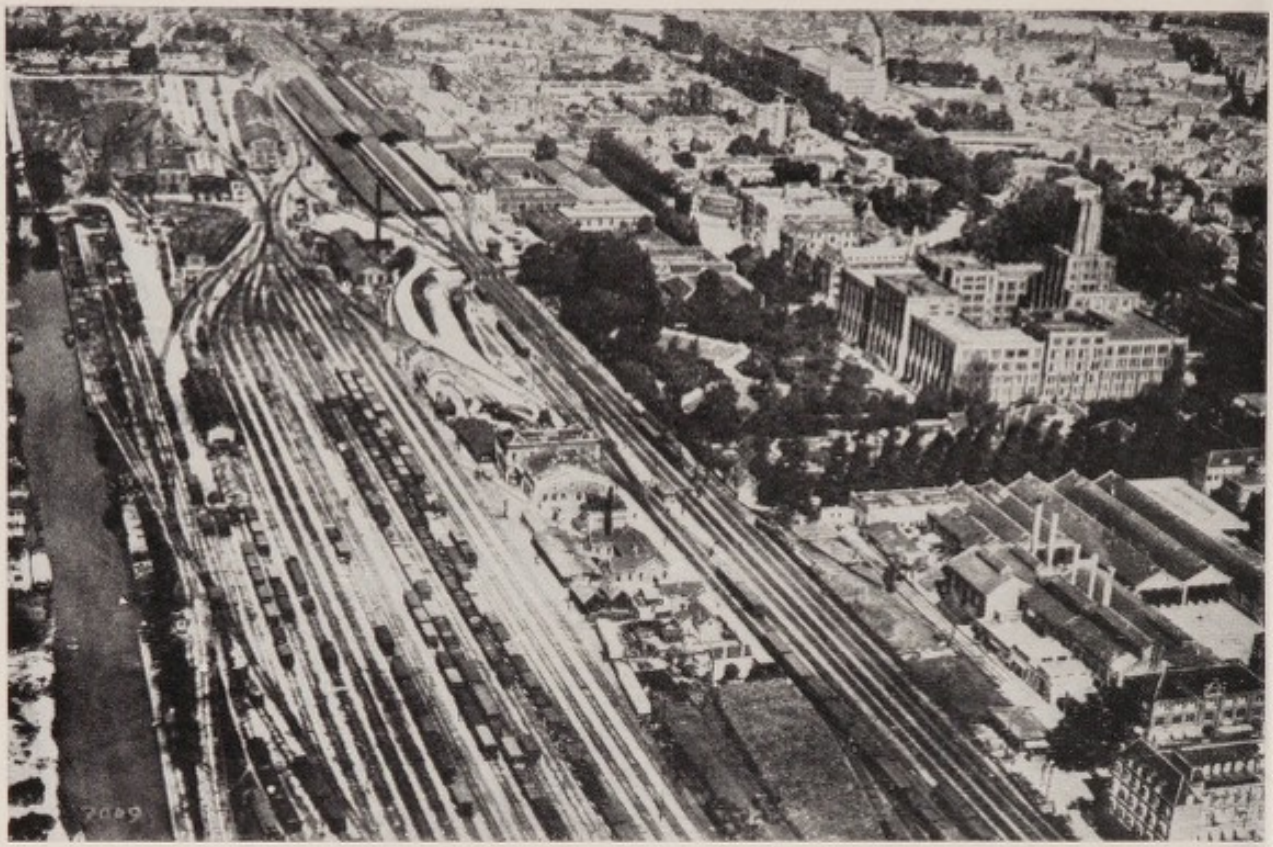

Plate 101. Utrecht : the main railway junction, looking north
The large square building on the right houses the central railway administration



Plate 102. Dunes and marram grass, Groote Keeten
Groote Keeten lies in the commune of Callantscog, south of Den Helder, where the dune belt is much narrower than along most of the coast of North Holland. Marram grass is an excellent dune builder.

1794, to be recovered in 1814–5. The nineteenth century was a period of commercial and industrial progress, related to the proximity of the Ruhr coalfield, while the improvement of the Maas navigation in the present century was a further impetus to growth. Between 1830 and 1909 the population increased by three times and in the following thirty years it has nearly doubled.

Economic Importance

Nymegen has shared in the development of the newer industries of the Netherlands, for it has important manufactures of tungsten wire, rayon, and electrical apparatus, including transformers. Other industries include engineering, sugar refining, the construction of river craft and the production of chemicals.

Communications

A bridge across the Waal carries the electrified double track line from Arnhem and Utrecht, and leads also to the eastern part of the Netherlands and to western Germany via Emmerich. At Elst, a short distance north of this bridge, a line branches to the west, to fork at Kesteren for Amersfoort and Dordrecht by single track lines. South from Nymegen three double track lines diverge—one eastwards to Cleves, one southwards to Mook, to cross the Maas and continue as a single track to Venlo, and a third westwards to 's Hertogenbosch—a single track section on this line is being doubled.

The waterway communications of Nymegen are unexcelled—the Waal and Rhine permit the largest barges to reach it from Rotterdam and Germany ; the Waal and Neder-Rhine permit 2,000-ton barges to reach the Yssel ; and the Maas-Waal Canal, opened in 1928, permits 1,000-ton barges to reach the Limburg coal ports via the Maas and Juliana Canal. The Nymegen authorities contemplate extensive developments of the river port.

Nymegen is served by four important main roads, N.R.52 leading by a bridge to Arnhem, N.R.53 crossing the German frontier to Cleves, N.R.54 skirting the frontier southwards to Venlo, and N.R.55 running south-westwards to s' Hertogenbosch and Eindhoven. A good secondary road leads westwards along the south bank of the Waal to Tiel, and thence to Utrecht.

Tilburg (97,200)

General Features

Tilburg is an important textile manufacturing town situated in North Brabant, about 5 miles from the Belgian frontier. It lies in attractive surroundings of woodland and heath. Tilburg has been called the Leeds of the Netherlands. Three technical institutes serve the neighbouring industries and facilitate commercial education. The outstanding building in the town is the *Groote Kerk*, a good example of modern Gothic architecture.

The medieval history of Tilburg was comparatively uneventful, and until the nineteenth century it was little more than a market centre. In 1830 the population numbered 12,000, and by 1869 had reached 21,000. Using local supplies of pure water, it had long been a centre of the tanning industry ; with the building of railways and the tendency for industry to move from North and South Holland into North Brabant and Overyssel, its future became bound up with manufacturing industry. In the forty years period 1869–1909 its population more than doubled, and in the next thirty years it almost doubled again.

Economic Importance

Practically all branches of the textile industry are represented in Tilburg. With forty-two firms engaged in various branches of the woollen industry it is the principal centre in the Netherlands. Five big firms carried out both spinning and weaving and one carried out spinning only. There are also cotton mills and flax spinning mills. The earlier industries of Tilburg survive in five tanneries and in four considerable factories which manufacture footwear. Other industrial establishments include two breweries, four brickworks, and a plant manufacturing electric lamps and accumulators which employs 1,500 people.

Communications

Tilburg lies on the double track line (steam) which crosses the southern part of the Netherlands from Flushing to Venlo and the German frontier. Westwards this line is joined by two other important double track lines—from Rotterdam via the Moerdijk bridge (at Breda) and from Antwerp (at Roosendaal). Eastwards this main line sends off a single track branch at Bokstel for Gennep and the German frontier. A second double track line from Tilburg joins it with 's Hertogenbosch, 10 miles to the north-east, whence similar lines make for Utrecht and Nymegen. A single track line runs south-westwards from Tilburg and crosses the Belgian frontier near Baarle Nassau for Antwerp via Turnhout and Herenthals. Although no great number of lines radiate from Tilburg itself, the greater part of the railway traffic of the southern Netherlands passes through it. The railway workshops are the main locomotive repair shops for the whole country.

Tilburg lies on the Wilhelmina Canal, which provides a connexion for 500-ton barges with the Maas estuary and with the Zuid-Willems Canal, leading eventually to Limburg.

In road connexions, two main roads cross at Tilburg ; N.R.63 connects Tilburg with Breda to the west and Eindhoven to the south-east, N.R.65 runs north-eastward to 's Hertogenbosch, and southwards crosses the Belgian frontier to Turnhout.

Utrecht (165,000)

General Features

Utrecht, capital of the province of Utrecht, is the fourth largest city in the Netherlands. It is situated on the Kromme Rijn (Crooked Rhine) where the river divides into the Oude Rijn (Old Rhine) and the Vecht. At this point the river is slightly entrenched, and the high banks offered good sites for settlement. The city lies at a junction of three regions of different soils and physical characters—to the west are the low peat lands, to the east the morainic hills of the Utrecht Heuvelland, and to the south are the river clay plains of the Waal and Maas. Furthermore, it lies at a controlling point of land routes in the Netherlands north of the great rivers, for it is in the opening of the bottleneck between the Zuider Zee and the Lek.

In some ways Utrecht is as much a metropolitan city of the Netherlands as Amsterdam or The Hague. It is the headquarters of the railway administration and the site of the central railway shops. The Mint, the Netherlands Historical Society, a Central Museum, the National Serological Institute, and the National veterinary school are situated here. It is the seat of Roman Catholic and Dutch Old Catholic archbishoprics. It is well known for its university, founded in 1636. The outstanding building in the city is the cathedral (Dom), although only the tower, chancel and transept

remain of the original structure. Dedicated to St. Martin, it was a gothic building erected between 1254 and 1267 on the site of the earlier church founded by St. Willibrord about 720. Attached to the cathedral by gothic cloisters is the university.

History

The site of Utrecht commanded the ford across the Crooked Rhine above the point where it splits into two arms. Here was founded the Roman station from which the town has probably derived its name (*trajectum ad Rhenum*, *trecht*). By means of the Old Rhine, formerly larger, the Romans were in communication with Germany and with Britain. Utrecht was a strong point of Roman power near the borders of the Empire. The later importance of the town began when St. Willibrord, the apostle of the Frisians, established his see there in the seventh century. The site was fortified against the heathen Frisians, and later against the Norsemen, and its security attracted settlers. After the destruction of Duurstede by the Norsemen in the ninth century, Utrecht became the chief commercial centre of the northern Netherlands. Early in the tenth century it was sacked by the Norsemen, but its defences were restored by Bishop Balderic (A.D. 918–976), and during his episcopate the town recovered its prosperity. During the Middle Ages, Utrecht, as the ecclesiastical capital of the northern Netherlands, played a part similar to that played by Cologne in northern Germany. During the eleventh and twelfth centuries, it was the home of the German Emperors. Towards the end of the Middle Ages, the silting of the Rhine caused some decline in the prosperity of the town, but the function of a regional and ecclesiastical capital remained. It took a leading part in the Revolt of the Netherlands, and the Union of the seven northern provinces, proclaimed at Utrecht in 1579, laid the foundations of Dutch independence. The French army penetrated as far as Utrecht during the invasion of the Netherlands in 1672. In 1713 it was the meeting place of the peace conference which ended the War of the Spanish Succession.

In later centuries the central position of Utrecht enabled it to prosper in trade and industry. At the opening of the nineteenth century it was the fourth largest city in the Netherlands. Population in 1830 amounted to 43,000 and has grown steadily since. The development of communications added to its importance, for it became the centre of the railway network, the half way point on the Merwede Canal between Amsterdam and the Lek, and it is now the junction between the Merwede Canal and the south-eastern section of the new Amsterdam–Rhine Canal. Its position as a road centre will be emphasized as the new national super highways are developed.

To the north-east two satellite industrial centres have developed, Zuilen and Maarssen, with a joint population of 20,000.

Economic Importance and Communications

The main industries of Utrecht are concerned with superphosphates and sulphuric acid, steel furnaces (*De Muinck Keizer*), zinc rolling mills, aluminium rolling and pressing, boilers and pumps, and electrical switch gear. The *Nederlandsche Werkspoor* railway wagon works is also situated here. There are two factories which construct machinery. Other industries include the manufacture of cigars and gold and silver ware. The markets for cattle and dairy produce are considerable.

Utrecht is the most important Dutch rail centre. Double track electrified railways connect it with Rotterdam, The Hague, Amsterdam, Zwolle, Arnhem and 's Hertogenbosch. The Merwede Canal provides a route for 2,000-ton barges to Amsterdam and the Lek and Waal ; the Amsterdam–

Rhine Canal will improve these connexions by admitting the largest Rhine craft (Plate 101).

A National Highway with two 20 ft. carriageways connects Utrecht with The Hague. It forks at Gouda where N.R.3 leads to Rotterdam. This highway meets the main road from 's Hertogenbosch just to the south of the city, and an important by-pass is planned to skirt around the east of Utrecht and connect with the National roads which lead to Arnhem N.R.12, Amersfoort N.R.23, Hilversum and Amsterdam N.R.2.

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(2) Studies of specific towns can be found in : F. Leyden, ' De hoofsteden der drie noord-oostelijke provincien ' (Leeuwarden, Groningen, Assen) ; ' Apeldoorn ' ; ' Drie Voormalige vestingen. Nijmegen, Maastricht, 's Hertogenbosch ' ; ' Het urbanisme in Twente ', *Tijdschrift voor Economische Geographie*, Twintigste Jaargang, pp. 1–14, 21–2, 81–96, 107–120 ; S. J. P. Overhage, ' Karten zur Beisedlung der Gemeente Heerlen in Süd-Limburg ', *ibid*, pp. 223–8 ; F. Leyden, ' Hilversum-Zeist-Amersfoort ', ' Utrecht ', *Tijdschrift voor Economische Geographie*, Dertigsten Jaargang, pp. 244–58, 285–7. ('s Gravenhage, 1939).

APPENDIX VIII

SHORELINE PROCESSES

The North Sea Coast

It is only within the last century or so that the effects of wind, wave and tide in modelling the Netherlands shoreline have been appreciably restricted by coast protection works. The present outline of the coast is an inheritance of the operation of these natural forces over thousands of years. It is still subject to them in great measure, and, indeed, may be regarded as a unique laboratory for the investigation of shoreline processes. In these processes which have brought about the present form of the Netherlands coast there are three main components—the formation of offshore bars, the movement of longshore drift, and the formation of sand dunes (see p. 701).

The formation of offshore bars

The essential elements of wave action on a sandy shore are a sharp forward and a slightly weaker backward motion, both swift enough to transport sand and shingle. Seawards of the breaker this is due to the orbital motion of the water particles in the wave—forward under the crest and seaward under the trough. Once the waves break this action is more marked, the alternating send and backwash being readily observable from the foreshore. The movement of sand is further assisted by being raised into suspension by the eddies of the breaking wave. The zone of action of the breakers travels up and down the foreshore with the rising and falling tide. In the simplest case this produces a gentle slope between tidemarks flattening slightly towards low water mark and steepening in gradient towards the top of the beach. The seaward beach gradient is due to the forward impulse of the unbroken waves being stronger than the return, and to friction rendering the backwash weaker than the send. Sand will therefore tend to be driven up the foreshore until a beach gradient is attained which neutralizes the difference in strength between the forward and seaward components of wave action. The natural result of this, when the initial gradient is small, is to build a sand bar just to the landward of the line of storm breakers. This is steadily built up until, near the landward limits of wave action, i.e. at the top of the bar, it is thrown above high water mark. The stage is then set for the building of dunes on the parts of the bar free from the wash of storm waves.

The uniform slope between tidemarks is sometimes broken by a series of undulations, in effect miniature bars superimposed on the seaward face of the main bars. These travel slowly inshore and, although their precise mode of origin is not clear, they seem to form when sand is being added to the shore.

Such were the processes which resulted in the formation of the great offshore bar after the breaching of the Straits of Dover (see p. 12).

Longshore Drift

Waves travel more quickly in deep than in shallow water. Thus when waves approach with fronts oblique to the shore, the more forward parts get retarded as they enter shallow water. As a result the waves tend to swing round so as to approach the shore head-on. Some obliquity nevertheless remains, especially with smaller waves, and these oblique waves move the sand in a zig-zag path along the shore. This is probably the main cause of

longshore drift, but tidal and other currents play some part. The effect of currents, which unaided might be able to raise little sand off the shore, is greatly enhanced by their ability to drift sand which has been lifted into suspension by wave action.

The longshore drift northwards from the Hook of Holland to within 15 miles of Den Helder is fairly constant and has been estimated at 1,308,000 cubic yards (1,000,000 cubic metres) per annum. It increases to the north and north-east until approximately 2,616,000 cubic yards per annum pass Borkum. This increase is related, in part at least, to the greater power of the prevalent south-westerly waves as the amount of open water for the development of these waves increases to the north.

Submarine Deltas (*Fig.* 143)

This longshore drift by oblique wave and by current action is interrupted at a gap in the shore such as that at Den Helder. Wave action is essentially

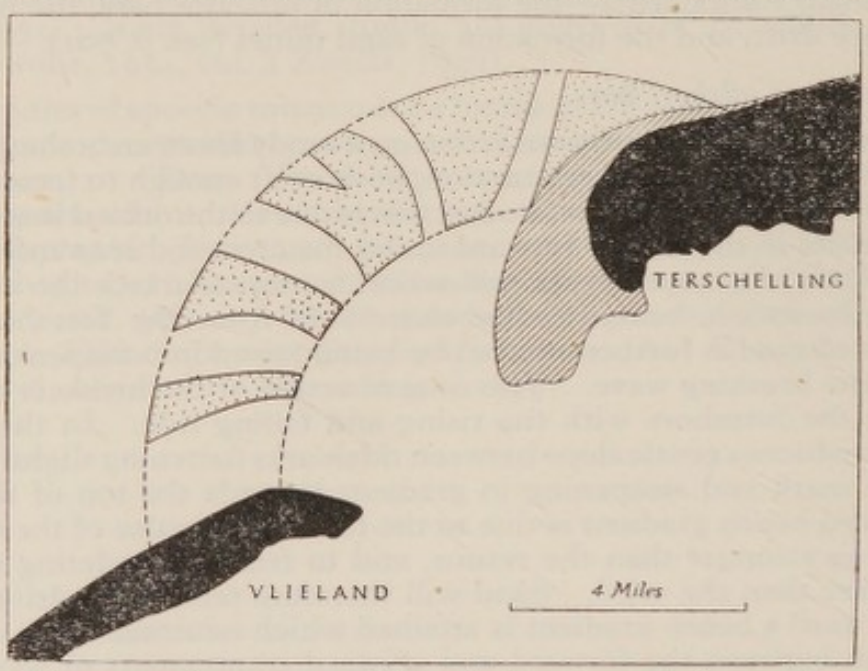

Fig. 143. Diagrammatic representation of the channels in a submarine delta From : J. van Veen, *Onderzoekingen in de Hoofden*, p. 137 ('s Gravenhage, 1936). The line shading indicates a sand-flat and the stipple submarine banks. In the tidal conditions prevailing in and off the gaps in the coast such as the Terschelling Zeegat shown here, the channels in the submarine deltas are widest and deepest towards the south-west.

a surface phenomenon : it falls off rapidly with increasing depth below the surface, and so is unable to move material across the deeper water of the transverse channels. Furthermore, longshore currents are completely overwhelmed by the powerful sweep of the tides into and out of the Wadden Zee. Thus sand drifted into these gaps is swept seawards to form great fan-shaped submarine deltas, rising at their landward apices to within 16 ft. of low water mark, and sloping steeply seawards for 6 to 8 miles (Fig. 143). As the tidal wave approaches from the south, the gradient (and therefore the current) between sea and Wadden Zee is strongest towards the south side of the entrance. Thus on this side the deltas are intersected by wide radial channels kept clear by the tides. The sand which drifts into these channels and is swept swiftly seawards during the ebb is returned to the leeward (i.e. northern) side of the deltas by the prevalent south-westerly waves.

This accounts for the asymmetry of the deltas. Similar but smaller deltas exist on the landward side of the entrances to the Wadden Zee.

The Formation of Sand Dunes

Dunes form from sand blown up from the foreshore. Wet sand does not readily move in a wind, but when the sand dries, after the tide has left it bare for some hours, it is easily transported. It moves in a series of hops or flat bounces and will continue to drift as long as the wind blows with sufficient force, or until some obstacle is encountered, such as a clump of marram grass, a plant with rush shaped leaves. This plant grows with great avidity in such sandy areas, and is an excellent dune builder, for it thrives best when continually receiving supplies of fresh sand, though which it grows upwards. Its long and complicated root system spreads further and further as the dune increases in height, and serves to bind the sand. When such dunes are attacked by the sea, the marram roots can be seen to extend downwards through the full thickness of the dune—frequently 20 or 30 ft. Marram is often planted artificially to help in stabilizing dunes (Plate 102).

As a result of this holding up of sand drifted up from the foreshore, a line of dunes tends to develop at the top of the beach. The crest-line is serrated, culminating in many pointed summits, and broken by numerous amphitheatre-like hollows called blow-outs. The cover of marram is discontinuous, and if the plant covering is thinned by trampling, by rabbits, or by natural causes, and if the position is very exposed, the wind removes more sand, and so enlarges an initial scar or hollow into a blow-out. This usually exposes still more bare surface, and the blow-out is further enlarged, a process which continues until the dune-line is breached if it is thin. If the dune-belt is wide, the blow-out recedes into the dune mass until it becomes partly sheltered from the wind. Then if erosion slows down sufficiently for marram to spread once more, the surface becomes stabilized —but a permanent hollow is left in the dunes. The shape of dune complexes is often closely related to this sculpturing of blow-outs. They generally occur in the seaward face of dunes, as the strongest winds usually blow off the sea, but dunes sheltered from the sea might develop blow-outs facing in other directions.

The dunes themselves offer little resistance to wave attack, for their steep slopes can be readily combed down and undercut by storm waves at high spring tides. Also sand is the grade of material which is most easily removed by water action, lacking the cohesion of finer and the inertia of larger particles. Thus the dunes get cut parallel with the storm breakers—the direction of these breakers in turn largely depends on the direction of open water and on the arrangement of sand flats offshore. If deposition occurs on the lower foreshore and offshore, the storm waves exhaust their energy on the extensive sand flats, and the send does not extend quite as far up the shore. The dunes can then grow farther seawards, or little clumps of marram grass are constantly attempting to gain a foothold on the backshore. If they succeed sand gathers round them, a dune is initiated which grows in size provided it is left free from subsequent storm attack. Thus with continuous deposition, line after line of dunes are added to the backshore, forming dune complexes many square miles in extent.

The Formation of the Coastline

The gentle seaward bulge of the islands of Zealand is due, not to the deposition of river sand, the seaward limits of which are 30 miles inland, but to submarine deltas of marine sands formed off the inlets from longshore

drift, like those to the north of Den Helder. Three large submarine deltas off the mouths of the Rhine, Maas and Scheldt combine to form a composite feature. The resulting shallow water deflects the fronts of large waves which in turn influence the run of the coastline behind, and enables the outer margins of the islands to project seawards of the general line of the coast.

The present coastline swings in a gently sweeping arc from the Hook of Holland to Petten, 15 miles south of Den Helder (Fig. 144). Farther north, it recedes slightly, thus leaving the coast at Petten as a slight salient. This is probably due to remnants of an ancient submarine delta off Petten marking the site of an old outlet of the Zuider Zee. The almost perfect arc from the Hook to Petten probably represents a section of coastline closely adjusted to

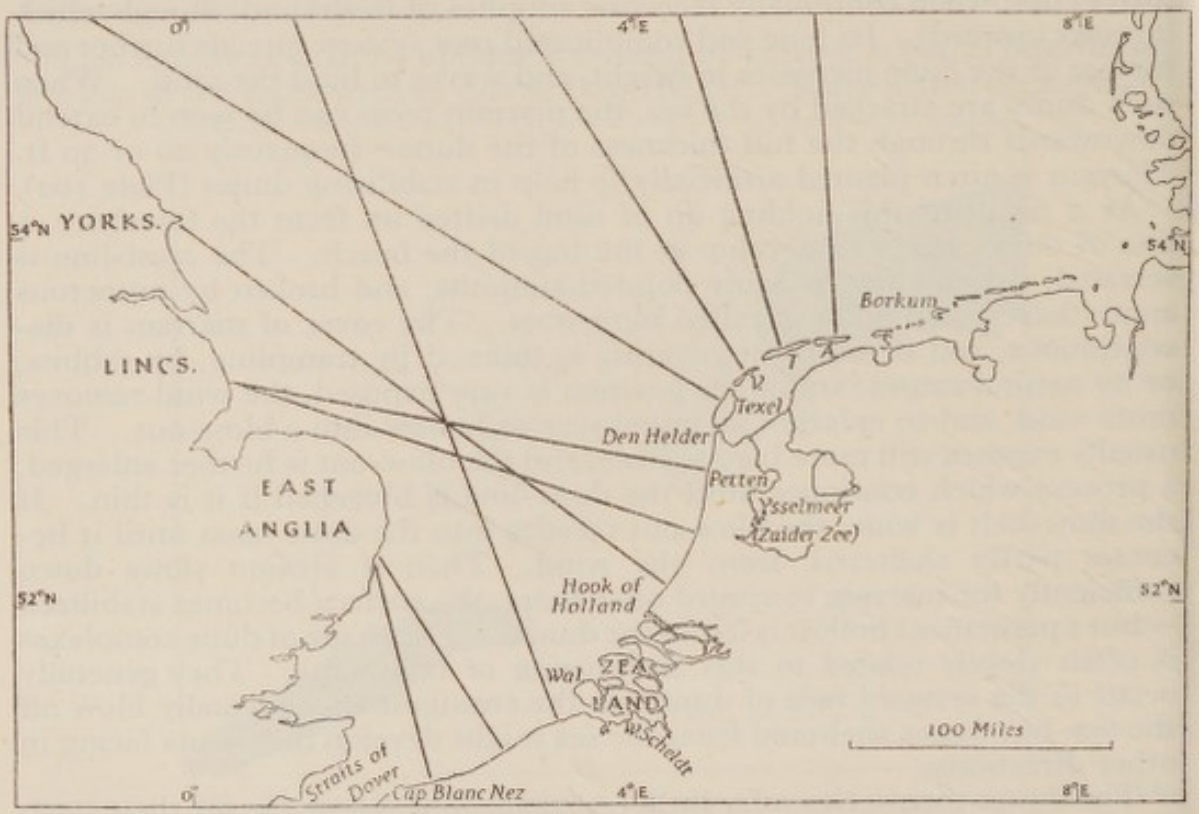

Fig. 144. The Netherlands coast : wave exposure

The rays, each of which is perpendicular to a section of coast, show the length of fetch for the storm waves which exert the most powerful influence on the coastline.
A. Ameland ; T. Terschelling ; V. Vlieland ; Wal. Walcheren.

wave attack. Such shores generally tend to face the dominant waves, i.e. those waves which produce the most powerful breakers on that particular section of shore. The alignment of this shore illustrates this arrangement, for everywhere except south of the ancient delta off Petten it faces a direction just clear of East Anglia and so on to the Lincolnshire and Yorkshire coasts (Fig. 144). This is the direction of the greatest fetch of water not too oblique to the general run of the shore. The largest waves just offshore come from between north and north-north-west—a direction open to the Arctic Ocean—but these are too oblique to exert their full power on these particular beaches.

The island of Texel consists partly of glacial drift, and this relatively more resistant mass seems to have acted as the corner-stone of the north-west Netherlands coast during the formation of the offshore bar, the basis of the

present outline of the coast. In this task it might well have been assisted by a triangular-shaped mass of shingle occupying the sea floor off Vlieland and north Texel, perhaps the hard remnant of a considerable seaward extension of the Texel glacial deposits, the finer material having been removed by wave attack. Wieringen, which also consists in part of glacial drift, served a similar function to that of Texel, and acted as a node to the earlier line of the offshore bar which ran south-by-west to the mouth of the Rhine and can still be traced as the belt of older dunes (Fig. 11).

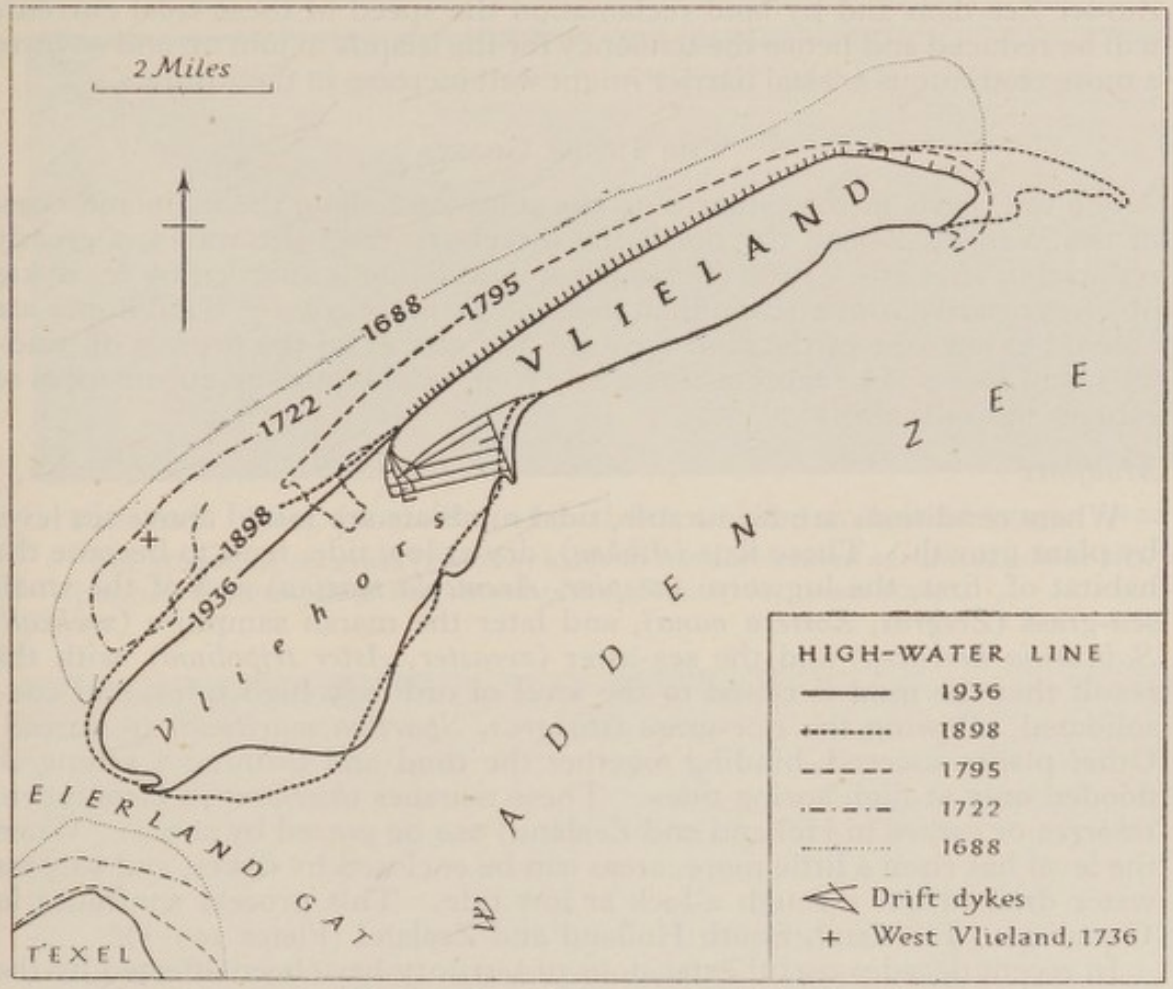

Fig. 145. Changes in the coast of Vlieland, 1688–1936

From : J. van Veen, *Onderzoekingen in de Hoofden*, p. 141 ('s Gravenhage, 1936 ; J. H. van der Burgt, ' *Veranderingen in den zeebodem, van het Zeegat van het Vlie en in de kustlijn der Waddeneilanden Vlieland en Terschelling,*' *Tidschr.Kon Ned Aardrs. Gen*, vol. 53, pp. 802–23 (Leiden, 1936).

The map illustrates the retreat of the coast in two and a half centuries, and shows the characteristic ' curling ' inwards of the sand-flats at each end.

Texel faces west-north-west, a direction distinctly more northerly than that faced by the mainland coast to the south. This alignment, due in part to the influence of the powerful north-westerly storm waves, is also partly due to the submarine delta off the Texel. An island, being free at both ends, is more readily adjusted to storm wave attack than a section of shore tied to the mainland. The greater part of Vlieland and the whole seaward shore of Terschelling face north-west, and the remaining Dutch islands to the east face slightly west of north, directions which must be very close to those from which the dominant waves approach. As these islands slowly recede (Fig. 145) under wave attack, the material removed from their fronts

is drifted round either side and forms spits curling back landwards. These somewhat ephemeral spits are the parts of the islands most liable to change according to the severity of storm wave attack from different directions, and to the supply of material by the smaller, less spectacular, but far more persistent waves of calmer weather. Two spits growing towards each other from adjacent islands tend to join up, but the tidal currents increase in speed as the channels narrow, and so generally serve to keep the latter clear. With the restriction of the area of the Wadden Zee by the construction of the Zuider Zee dam and by land reclamation the speed of these tidal currents will be reduced and hence the tendency for the islands to join up and so form a more continuous coastal barrier might well increase in the future.

The Inner Coasts

Along the coasts in the estuaries to the south and along the mainland coast of the Wadden Zee to the north the direct attack of the waves is greatly reduced in strength. Protection against inundation is afforded by sea dykes of a less massive construction than those of the outer coast. Sand dunes are absent; extensions of the land area are due mainly to the growth of mudflats, and losses of territory arise mainly from tidal scour and subsidences of estuary banks (*vallen*).

Mudflats

Where conditions are favourable, tidal mudflats are raised above sea level by plant growth. These flats (*slikken*), dry at low tide, tend to become the habitat of, first, the lugworm (*zeepier*, *Arenicola marina*) and of the small sea-grass (*Zeegras*, *Zostera nana*), and later the marsh samphire (*zeekrall*, *Salicornia herbacea*) and the sea-aster (*zeeaster*, *Aster tripolium*), with the result that the mud is raised to the level of ordinary high tides, and consolidated, allowing the rice-grass (*slijkgras*, *Spartina maritima*) to spread. Other plants succeed, binding together the mud and forming a saltmarsh flooded only at high spring tides. These marshes (*kwelders* in Groningen, *schorren* or *gorzen* in Holland and Zealand) can be grazed by sheep. When the level has risen a little more, areas can be enclosed by dykes, and surplus water drained out through a lock at low tide. This process continues in Groningen, Friesland, South Holland and Zealand (Plates 103–5).

In recent decades useful extensions of territory have been effected by the virtual creation of mudflats. Long lines of wooden or wickerwork pales are erected at an angle to the shore and 100–300 yards apart. Silt accumulates between these obstructions and can be consolidated by plants and eventually converted into farmland. In time a fresh dyke is constructed outside the newly reclaimed land, and the process is repeated seawards of this dyke. Since 1853, for example, three such polders, covering about 4,000 acres, have been added to the twenty miles of coastland between Kloosterburen and Spijk in Groningen, and the work is going on at several more localities (Fig. 146; Plate 106).

Vallen

In estuaries and branches of the sea tidal scour, if unchecked, can lead to losses of territory through the removal of material on foreshores. It is countered by measures of coast protection (see p. 708).

A much more serious threat is the tendency for sections of the estuary shores in Zealand, in certain conditions, to slip downwards. There are two types of subsidence. The first arises from undercutting of banks. The action of the currents and of the tides have scored gullies in each estuary,



Plate 103. Plant colonization of mud-flats (*slikken*) in Zealand (stages 1 and 2)
The spread of eel grass (*Zostera*) leads to the accelerated accumulation of silt, which permits the growth of marsh samphire (*Salicornia*), seen above.



Plate 104. Plant colonization of mud-flats in Zealand (stage 3)
Replacement of *Salicornia* by sea aster, etc.; the *Salicornia* can be seen in the background on the seaward edge of the flats.



Plate 105. Plant colonization of mud-flats in Zealand (stage 4)

As the deposition of silt at high tides raises the level of the flats sea-thrift, rushes and grasses succeed, to be followed by a turf which makes excellent pastures.



Plate 106. The Lauwerszee : reclamation of tidal mud-flats

The accumulation of silt and the growth of plants are accelerated by the construction of low wicker-work fences on the flats.

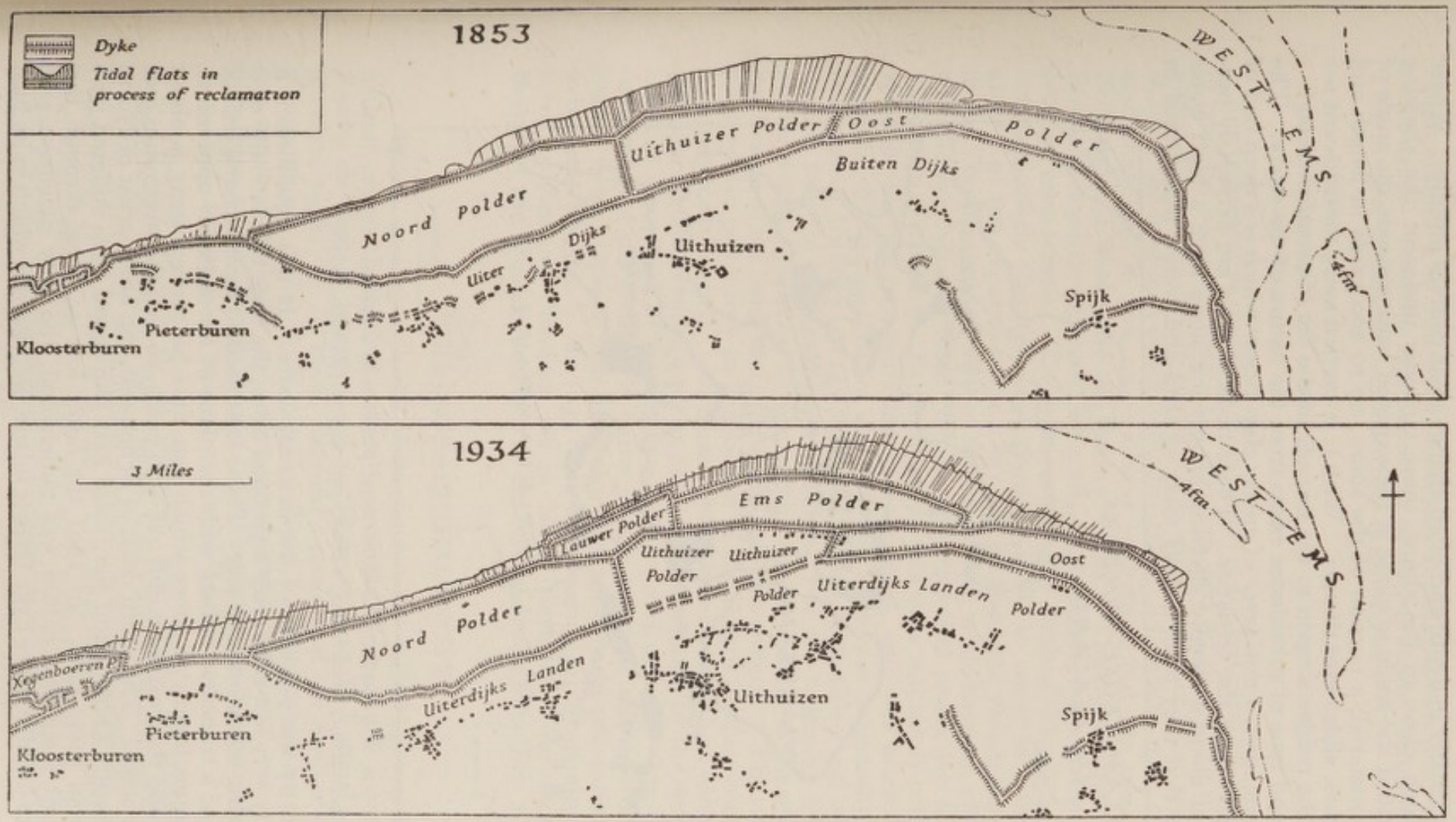

Fig. 146. The reclamation of tidal flats, Groningen, 1853–1934

From : *Topographische en Militaire Kaart van het Komingrijk der Nederlanden*, 1 : 50,000, Sheet 3, Uithuizen (from a reconnaissance of 1853) : G.S.G.S. Series 4083, 1 : 50,000, Sheet 3, Uithuizen (reproduced from a Dutch map of 1934).

In the course of reclamation by the fixation of tidal mud the Ems, Lauwer and Xegenboren polders have been added to the land area. In 1853 the inner dykes of the Noord, Uithuizer and Oost-polders were still intact, but by 1934 it was no longer necessary to maintain the section along the Uithuizer polder, since the reclamation had involved the construction of a further dyke outside the north dyke of this polder. The settlements do not, in general, extend beyond the earliest dyke of all, remnants of which can be traced in the map of 1853.

which vary greatly in depth and often change their courses rapidly. Where they approach close to the shore, these currents undercut the shelving margins, and if the angle of slope at the exposed bank exceeds the angle of rest of the material, a portion of the shore, up to 200 yards in length and 15 yards wide, slides into the sea. With it is carried away the adjacent sea dyke, and the polder is open to the inroads of the sea (*Oeverafschuiving*).

The second type of subsidence arises from the nature of the strata. The low peat rests upon a thin layer of greasy clay, below which is a deep bed of alluvial sand above the tertiaries. These beds of sand are extremely permeable, and along a steeply shelving submarine slope have a high water content, so that they form a fluid mass of sand and water, maintained in

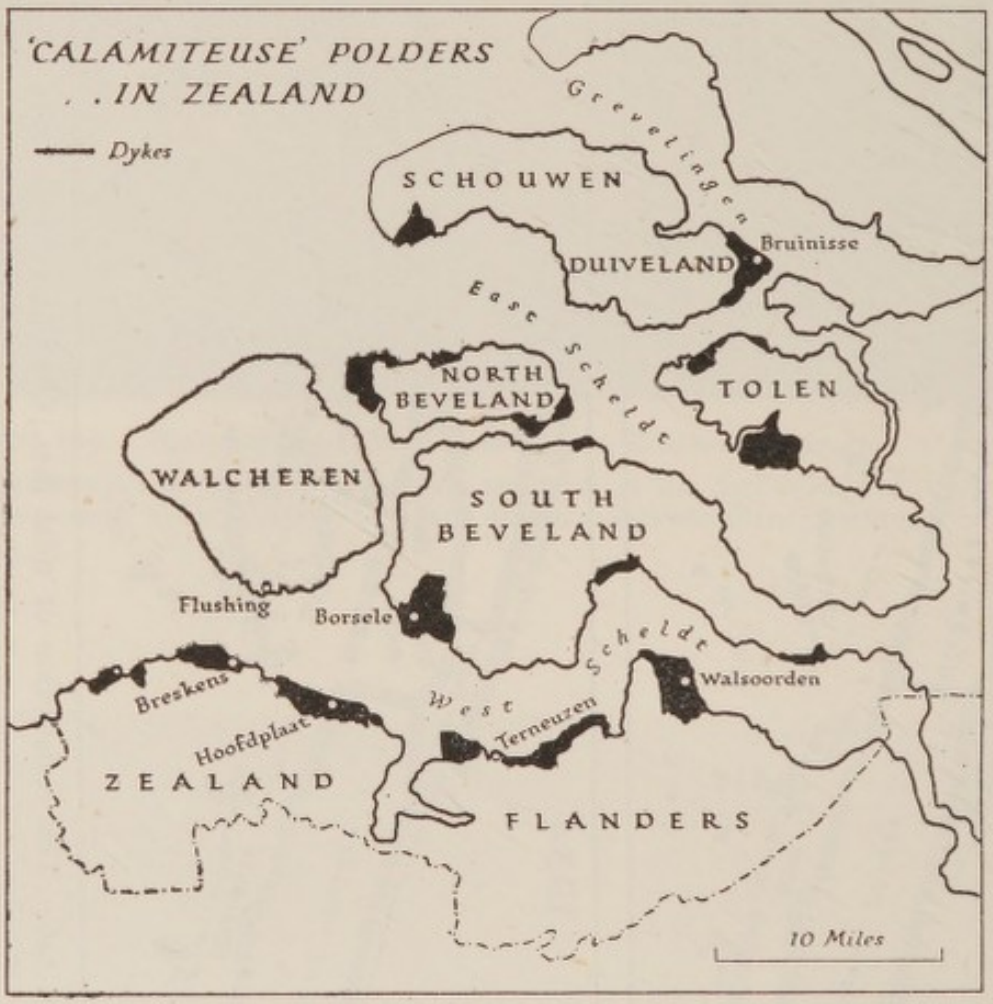

Fig. 147. ' Calamiteuse ' polders in Zealand

From : R. Schuiling, *Nederland*, vol. 2, pp. 424–5 (Zwolle, 1936).

equilibrium by the pressure of the external water. If this equilibrium is disturbed by very low ebbs after high flood tides, the beds ride laterally over the underlying strata into the sea. These falls (*vallen*) have a characteristic form, that of a truncated sphere with the plane of the segment uppermost. The maximum length of shore which can thus be carried away is about 550 yards, and the greatest width 220–270 yards, so that the maximum area is about 25 acres. The south coast of Schouwen, the north coast of North Beveland, south Tholen, and south and east Duiveland have suffered particularly from these falls. In 1891 the latter lost 44 acres through this cause. Until their true nature was understood, the only defensive step taken was to build another dyke farther inland (*inlaagsdijk*) which in its turn

might similarly be destroyed, especially if nothing was done to repair the outer dyke. Thus the encroachment of the sea might continue unchecked. The number of falls in recent decades is as follows :

1882–92	137	1912–1922	35
1892–1902	76	1922–1932	19
1902–1912	53		

Active protective measures were begun in the last century, by the building of training walls to control sea currents, and by depositing masses of clay mixed with stones off projecting points and the ends of fallen sea dykes so as to limit the length of possible further falls. The south coast of Schouwen and Duiveland is now more or less stationary, but the coasts of North Beveland and Tholen are still liable to *vallen*. The eastern portion of South Beveland is partly protected by extensive mudflats, the remains of sixteenth century inundations. The worst sufferer is Zealand Flanders, where falls are particularly threatening as they are liable to occur in a few restricted areas : of 106 experienced in 1887–96, no less than twenty-one took place in the Thomaespolder, west of the Braakman, while between 1862 and 1881 the Nieuwe Neuzenpolder, to the east, required protective work costing more than *f.* 2 million. Expenditure on this scale was rarely justified by the value of the polders immediately concerned, and was often beyond the capacity of the inhabitants, so that the state was eventually obliged to intervene. Under a law of 1870 a polder thus threatened and burdened can declare itself to be a *calamiteuse* polder. For the following five years the polder pays a *dijkgeschot* corresponding approximately to the average leasehold value of the land, and afterwards half this amount. The neighbouring polders also pay a levy in proportion to the length of their common dykes and the area protected. All these polders form a *calamiteus waterschap* with a special administration, under a president nominated by the *dijksraad* (dyke council) composed of leading landholders and others. One-third of the remainder of the charges is borne by the province and two-thirds by the State. After a lapse of time, the polder can apply to the provincial authorities to be declared ' free '. In 1935 there were twenty-three calamiteuse polders: seven in Zealand Flanders, six in North Beveland, four each in South Beveland and Tholen, and two in Schouwen-Duiveland (Fig. 147).

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2. General works : R. A. Bagnold, *The Physics of Blown Sand and Desert Dunes* (London, 1941) ; A. E. Carey and F. W. Oliver, *Tidal Lands* (London, 1918) ; D. W. Johnson, *Shore Processes and Shoreline Development* (New York, 1919) ; W. V. Lewis, ' The Evolution of Shoreline Curves ', *Proc. Geol. Assoc.*, vol. 49, pp. 107–27 (London, 1938) ; J. A. Steers and H. D. Thomas, ' Vegetation and Sedimentation of the Norfolk Salt Marshes ', *Proc. Geol. Assoc.*, vol. 40, pp. 341–52 (London, 1930).

APPENDIX IX

COAST PROTECTION

From an engineering point of view the coast of the Netherlands may be divided into two : the North Sea coast (mainly dunes), and the inner coast (mainly dykes). The dykes of the inner coast serve to prevent inundation, because the land is below or but little above sea level, and occasional storms are powerful enough to raise heavy seas within the estuaries and the Wadden Zee. Along such coasts the dykes rarely have to meet any massive attack by the sea ; the danger is inundation and hardly at all the retreat of the shore. Along the North Sea coast, however, the storm waves of the sea exert a continual erosive effect on most of the dune-backed shore, and without carefully maintained protective works, the dunes would be washed away, the land flooded, and the shore would retreat (see p. 262). Although the Dutch coast is being heavily attacked at certain points the situation is not unfavourable on the whole. In general the coast is open to more powerful wave action than the Belgian coast, which derives considerable protection from the Flemish Banks. In Belgium repair work on groynes can be carried out in winter, but in the Netherlands such work can be done only in summer, as a rule, owing to the violence of the winter storms. At some points, on the other hand, accretion takes place, and sand spits or flats are being extended.

The North Sea coast is 275 miles (422 km.) in length from the Zwin to the West Ems, and includes 121 miles of unprotected dunes and 69 miles of protected coastline. It is under the control of twenty-five different authorities and is divided for working purposes into nineteen coastal sections, each section being named according to the island or district in which it occurs (see Fig. 148).

Principal Protective Works

Westkapelle (*I. of Walcheren*). In recent centuries this coast has been retreating ; it is protected by a very large sea-dyke (Fig. 150), maintained at great expense by building out short groynes in front. In places the belt of dunes has been reduced to little more than a thin line by earlier attack of the sea.

Hook of Holland and Delfland. South of the port of Hook of Holland there has been a considerable enlargement of the spit of sand known as the Beer, owing to improvements in the New Waterway, while across the Brielle Gat there has been a retreat of the Brielle (Brill) estuary. North of the Hook, to a point beyond Scheveningen, protection by means of groynes is necessary, although this section is less expensive to maintain than sections farther north, because wave action is weaker. Around Scheveningen there is outer protection of the dunes by means of stonework walls.

North coast of North Holland. Off this part of the coast the sea drops quickly to great depths and the waves are therefore of considerable power. There are three main dykes here—the Hondsbossche and Pettemer sea walls in a gap in the line of dunes, and the Heldersche (Den Helder) sea wall along the north of the peninsula (Fig. 150). All are protected by groynes. The retreat of the Helder shoreline has been considerable in recent centuries (see p. 710, Fig. 149).

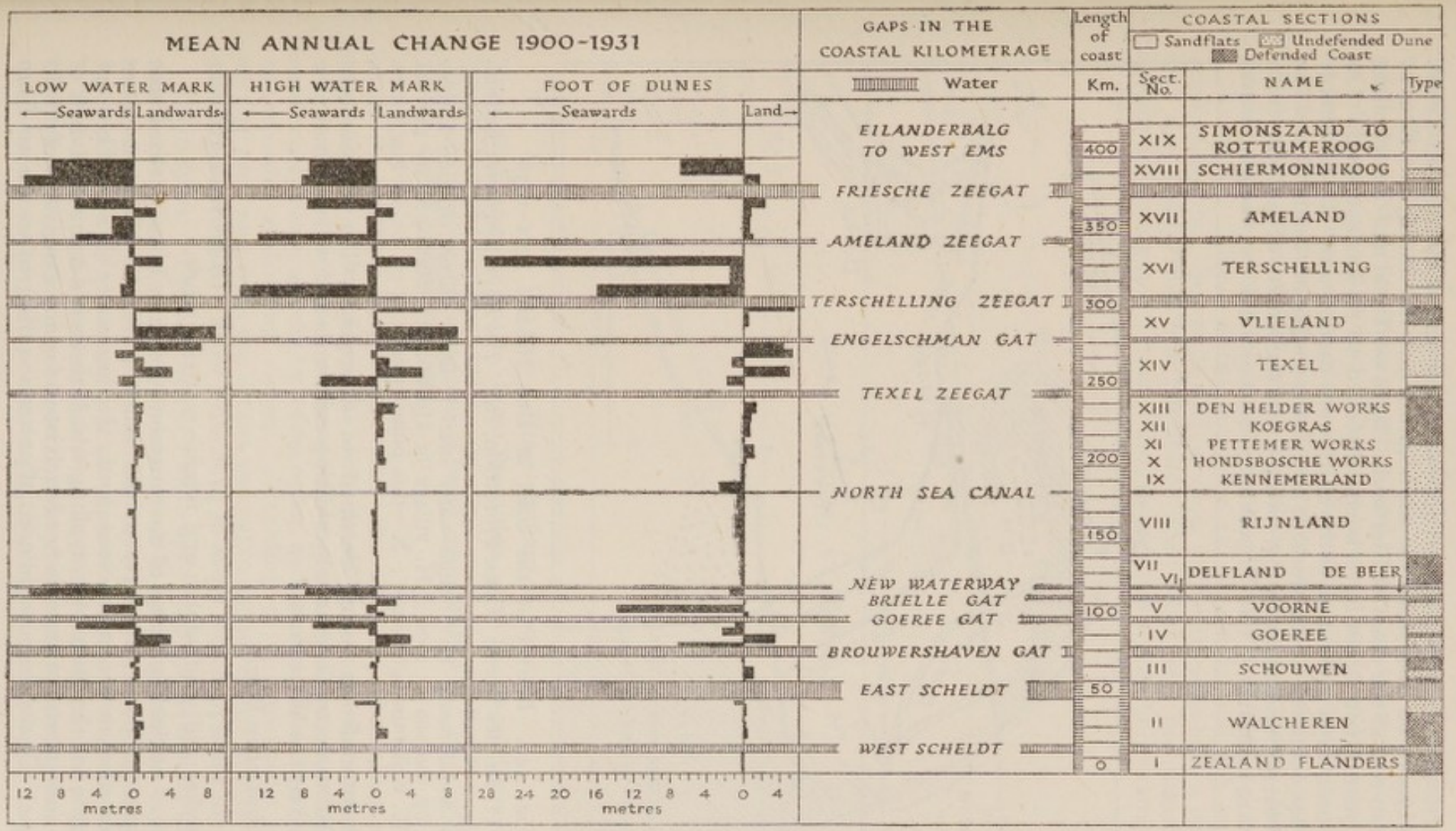

Fig. 148. The movement of the low-water mark, high-water mark and the foot of dunes, 1900–31

From : J. H. van der Burgt, ' Coast Protection on the North Sea coasts of Holland, France, Belgium and Germany ', *The Royal Engineers Journal*, vol. 51, pp. 4–5 (Chatham, 1937).

The divisions in the right-hand column represent sections of the coast, and the vertical shading represents the estuaries, etc., which break it. The black lines indicate the movement of h.w.m., l.w.m., and the foot of the dunes. The coast between the New Waterway and the Texel (sections 7–13) and the coasts of Schouwen, Walcheren and Zealand Flanders (sections 1, 2, 3) show little change. The coasts of the Frisian Islands, owing mainly to the fluctuations of sandspits, exhibit marked changes.

Frisian Islands. There is a short section of sea-wall at Horntje on Texel. Near Den Hoorn on this island the sea is eating into the dunes, as well as at the northern end of the coast of Eierland. Both on Texel and Terschelling in recent years drift dykes have been employed to fix surface sand. On Vlieland outer dune protection is the chief work carried out. Considerable accretion has occurred at the western and eastern ends of Ameland and the western point of Schiermonnikoog, owing to the movement of sandflats from neighbouring estuaries. The Engelsmanplaat sandbank between Ameland

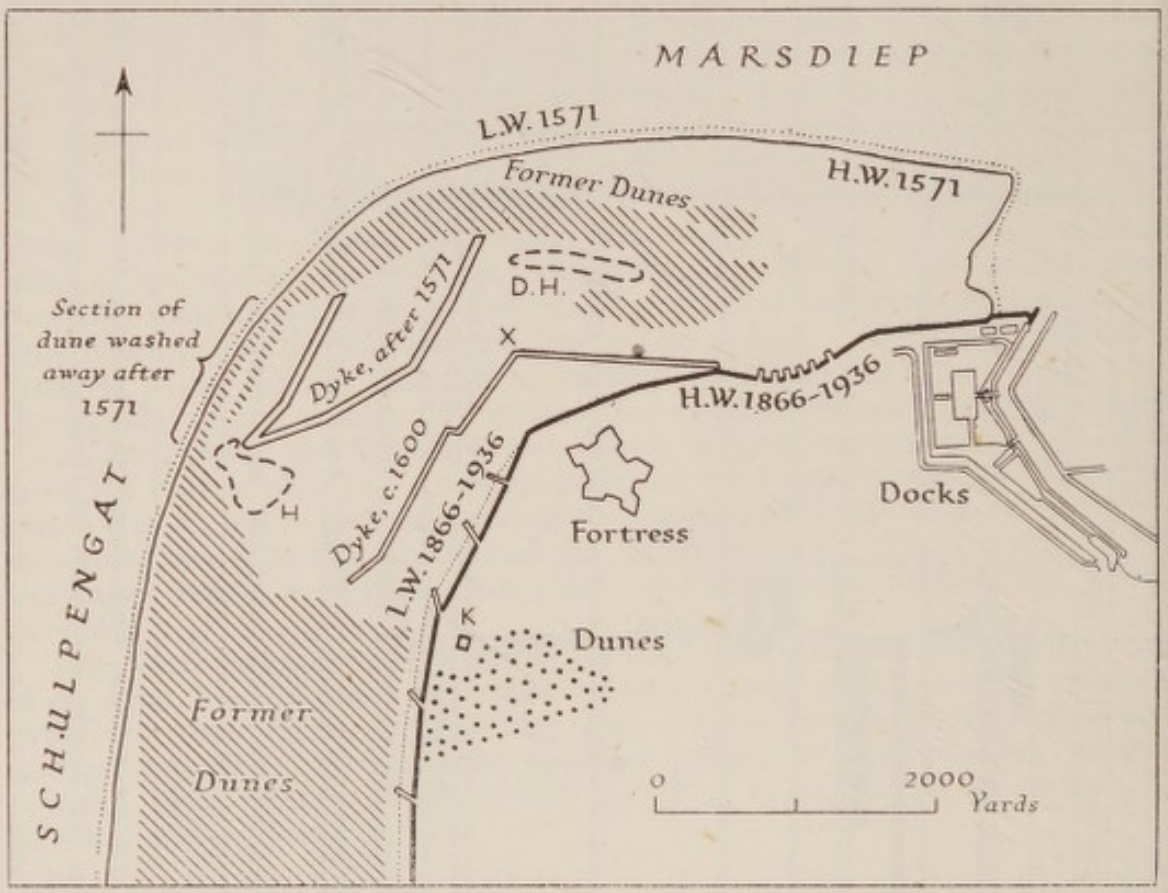

Fig. 149. Retreat of the coast at Den Helder, 1571–1936

From : J. H. van der Burgt, ' Coast Protection, etc. ' *The Royal Engineers Journal*, vol. 51, Fig. 1 (Chatham, 1937).
L.W. Low-water mark, H.W. high-water mark ; D.H. village of Den Helder destroyed by the sea *c.* 1600 ; H. village of Huisduinen destroyed by the sea *c.* 1600 ; K. Kijkduin lighthouse ; X—this point is now 45 m. below low water.

and Schiermonnikoog seems destined to disappear. The unprotected island of Rottumeroog is gradually shifting eastwards and will eventually be submerged by the West Ems.

Types of Protective Work

There are three principal types of protective work—(i) groynes, (ii) sea-walls or dykes, (iii) drift-dykes and fascine mattress work.

Groynes. At the beginning of the nineteenth century it was realized that groynes erected perpendicularly to the shore at regular distances apart provide an efficient protection to a gently sloping sandy shore. They are very suitable for the Dutch coast, along which there is a northward drift of material, and at present there is not much need for any extensions of works of this type. On a dune coast in need of protection the groynes are run from

the foot of the dunes to just below the low-water line. The form of groyne varies and improvements are constantly being tried. Wooden and metal piles, dumped stone, stone revetting and fascine mattress work are all used in different circumstances. There are now no reinforced concrete groynes on the Netherlands coast, for concrete is not successful in withstanding wave action. In recent years the application of extensive fascine mattress work (*Bezinking*), covered with heavy stones, in front of and alongside the toe of groynes has been very successful in the Delfland and Vlieland groynes.

Sea-walls. These works comprise (*a*) sea-walls and (*b*) outer dune reinforcements. Sea-walls such as those at Westkapelle have a great width and rise slowly from the low-water line ; they rely on magnitude and solidity for strength. Those of the Netherlands are the only examples found

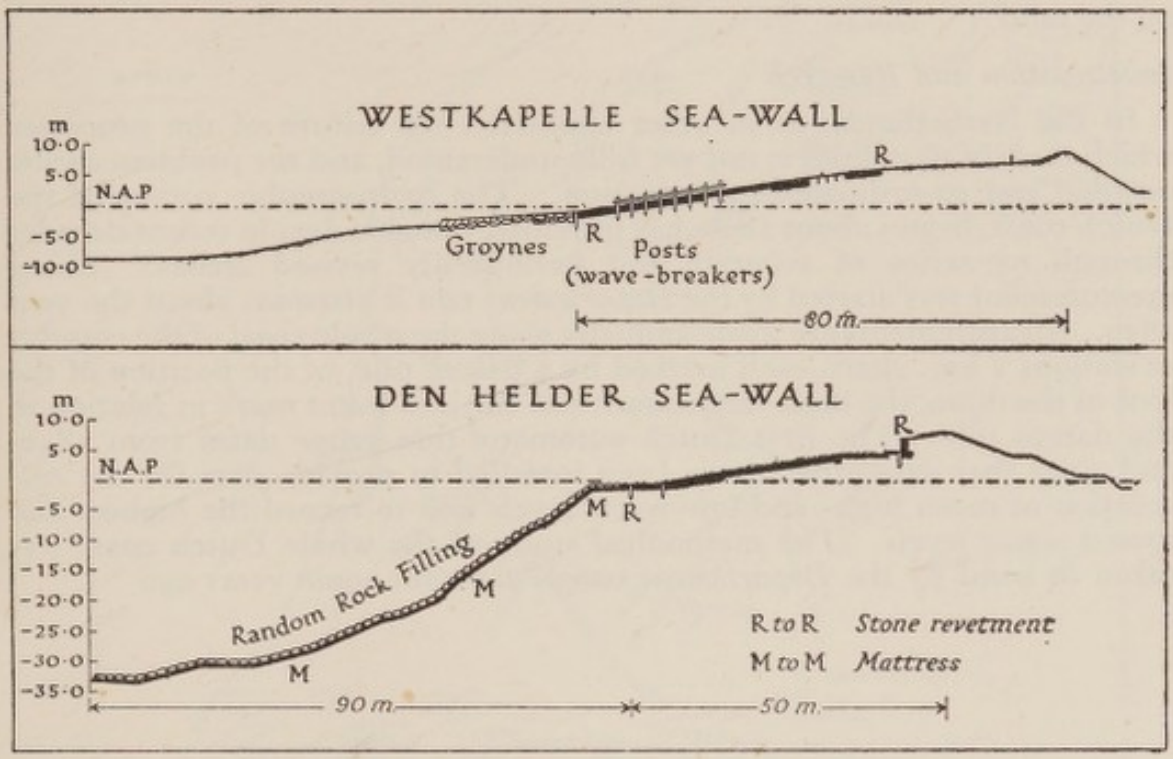

Fig. 150. Cross-sections of sea-walls

From : J. H. van der Burgt, ' Coast Protection, etc.', *The Royal Engineers Journal*, vol. 51, Fig. 10 (Chatham, 1937).
The stone revetment is composed of basalt columns, Tournai stone or Norwegian stone ; N.A.P.—mean sea level.

along the southern North Sea coast. Sea-walls are often given additional protection by means of groynes along the whole or part of their length.

Outer dune protective works are stone walls and facing employed where moderately heavy attacks by waves occur, and are sometimes built to serve as promenades at bathing resorts. According to circumstances, the cross section may vary from the almost vertical to a great extent of gently sloping protected outer toe.

Drift-dykes. The building of a drift-dyke (*stuifdijk*) is mainly of value on sandflats and other extensive low areas of sand which are in danger of movement. By erecting a line of objects such as fences of osier or pinewood branches, in conjunction with lines of marram grass and straw bundles set in the sand, wind-blown sand accumulates. A second fence is planted on the first drift-dyke, and so on, and by the planting of marram grass more and more sand can be held ; eventually, if all goes well, the drift-dyke in a

summer may grow sufficiently large to withstand moderate or even strong storm tides, and finally a broad chain of dunes will develop. This process has been particularly successful on the Boschplaat, the sandflat on the western shore of Terschelling, and on the beach at Hors at the south end of Texel, but less successful on Rottumeroog.

Fascine mattress work. In estuaries or arms of the sea groynes are often inadequate for the maintenance of foreshore owing to the existence of tidal 'swills', along which powerful scouring currents rapidly remove sand; serious lowering of a beach can occur between groynes in this way. The retreat of the sandflat shore of Eierland, in the north of Texel, is due to the existence of a swillway close inshore. The means employed to obviate scour is the fascine mattress, weighted with stones to establish it underwater on the sand.

Investigation and Research

In the Netherlands, as in other countries, the nature of the processes which modify shorelines is not yet fully understood, and the problem awaits detailed and co-ordinated investigation. The hydrographic survey of the Dutch coast, begun about 1800, has provided valuable data in recent decades through its series of accurate and periodically revised charts. Shore measurement was started by the *Departement van Waterstaat* about the year 1850. Measurements are made annually along the whole coast of the country at stations 1 km. apart, each marked by a datum pile, of the position of the foot of the dune, the high-water mark and the low-water mark in relation to the datum pile. The first Dutch automatic tide gauge dates from 1850, and since that date others have been installed to provide data for the calculation of mean high- and low-water levels and to record the highest and lowest water levels. The methodical study of the whole Dutch coast was taken in hand by the *Departement van Waterstaat* some years ago.

APPENDIX X

REGIONAL NAMES OF THE NETHERLANDS

In spite of the restricted area of the Netherlands, a great variety of regional and district names is in use (Fig. 151). There is no standard list of such names; their existence derives mainly from custom, but a great many survive and are in current use. They are often employed in official and other

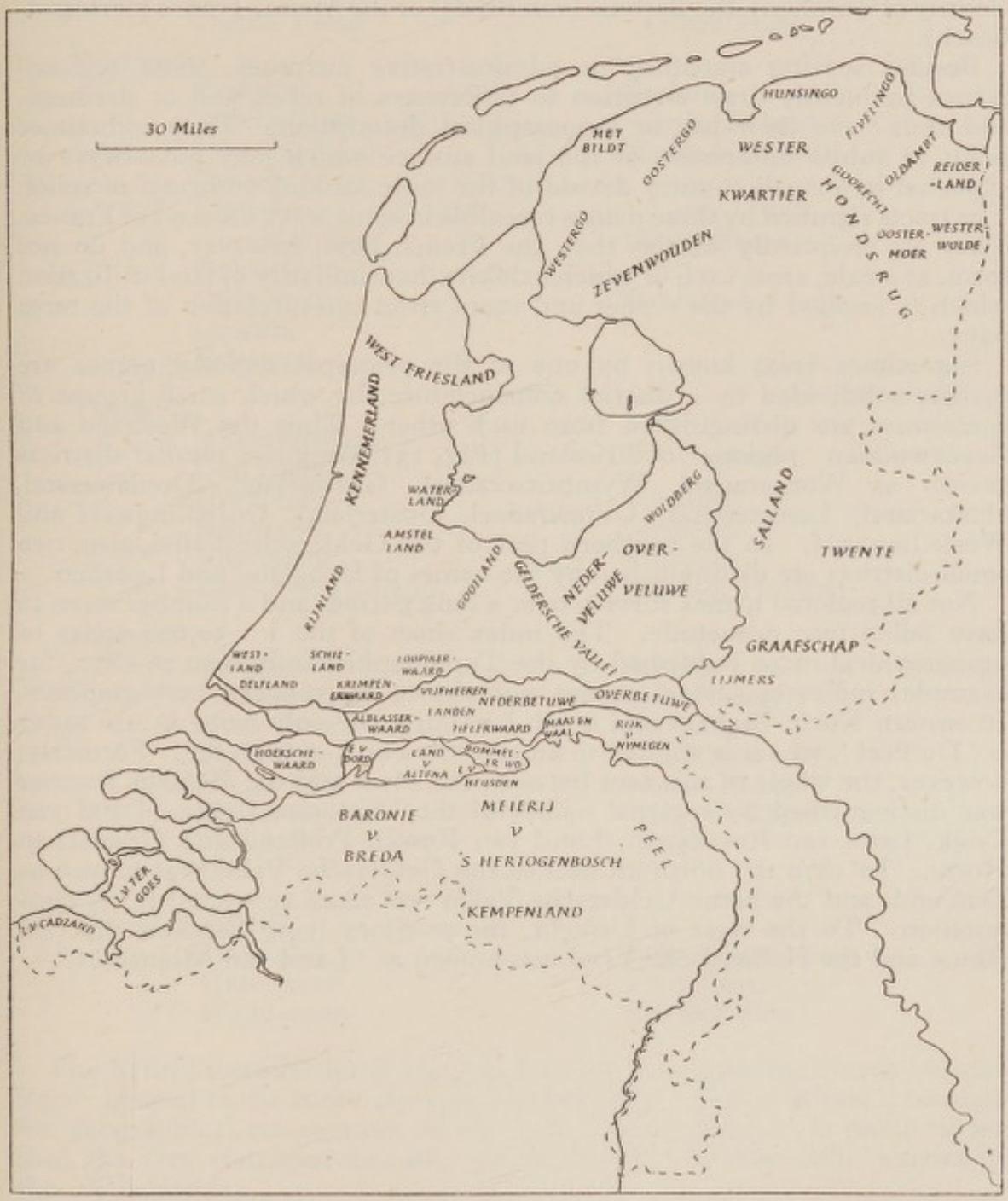

Fig. 151. Principal regional names in the Netherlands

From: P. R. Bos and J. F. Niermeyer, *Schoolatlas der Gehele Aarde*, plates 13–16 (Groningen, 1936); *Leopold's Wereldatlas*, plates 12–15 ('s Gravenhage and Brussels, n.d.).

surveys for statistical purposes. Some, like the Meierij or the Veluwe, apply to considerable areas ; others, like the Land van Altena, apply to much smaller territories. Some of these names refer to pronounced physical features such as the Hondsrug or the Geldersche Vallei, or to the great *boezemgebieden* of the polder country, like Amstelland, Delfland, Kennemerland, Rijnland, Schieland. The Kempenland is a tract of sandy heath along the Belgian frontier, similar to the Kempenland (Campine) of Belgium, though much smaller. Other regional names take their origin in historical rather than geographical circumstances. A number are survivals of former territorial divisions, going back to feudal times, like the Graafschap (or County of Zutphen), the Baronie (van Breda) or the Meierij (van 's Hertogenbosch).

Besides serving statistical or administrative purposes, these regional names frequently draw attention to differences of relief, soil or drainage, and thus have their use in topographical description. They sometimes point to subtle differences of the land surface which may not always be expected in a small country devoid of the more striking contrasts of relief. The tracts signified by these names resemble in some ways the *pays* of France. They are frequently smaller than the French *pays*, however, and do not form, as a rule, areas each of which exhibits that similarity of land utilization which is implied by the earlier and more strict interpretation of the term *pays*.

Sometimes areas known by one of the principal regional names are further subdivided by a district nomenclature, by which small groups of communes are distinguished from each other. Thus the Westergo and Zevenwouden ' regions ' of Friesland (Fig. 151) comprise smaller districts known as Wonseradeel, Wymbritseradeel, Gaasterland, Doniawerstal, Haskerland, Lemsterland, Utingeradeel, Opsterland, Oostellingwerf and Westellingwerf. In the northern part of the Geldersche Vallei, also, two small districts are distinguished by the names of Hoogland and Leusden.

Not all regional names survive over a long period, and a number seem to have fallen into desuetude. The index sheet of the 1 : 50,000 series of topographical maps published by the Topographische Bureau in 1870, for example, indicates several names not shown by modern cartographers. In eastern North Brabant and north Limburg, the only name in use today is ' De Peel ', which is applied to an extensive area of high fen. Formerly, however, the whole of this area between the Maas and the Belgian frontier was distinguished by regional names of the ' historical ' type—Land van Cuijk, Land van Ravenstein, Land van Kessel, Peelland and Graafschap Horne. In 1870 the northern part of the Geldersche Vallei was known as Eemland, and the name Geldersche Vallei was more restricted in its connotation. To the west of Utrecht, the territory lying between the Old Rhine and the Hollandsche Yssel was known as ' Land van Montfoort '.

APPENDIX XI

THE PLACE NAMES OF THE NETHERLANDS

In this Handbook conventional English forms have been used where they exist, i.e. for the names of the provinces, of certain towns, and of the larger rivers and bodies of water. These conventional forms are as follows :

Dutch Form	Other Form
Provinces	
Zeeland	Zealand
Zuidholland	South Holland
Noordholland	North Holland
Utrecht	—
Limburg	—
Noordbrabant	North Brabant
Gelderland	—
Overijssel	Overyssel
Drenthe	—
Friesland	—
Towns	
's Gravenhage / Den Haag	The Hague
IJmuiden	Ymuiden
Nijmegen	Nymegen
Vlissingen	Flushing
Hoek van Holland	Hook of Holland
Rivers	
Schelde	Scheldt
Nieuwe Maas	New Maas
Oude Maas	Old Maas
Oude Rijn	Old Rhine
Neder Rijn	Neder-Rhine
Boven Rijn	' Upper Rhine '
IJssel	Yssel
IJ	Y
Bodies of water	
Zuiderzee	Zuider Zee
IJsselmeer	Yssel Meer
Waddenzee	Wadden Zee

The hybrid form Neder-Rhine has been employed for the Dutch ' Neder Rijn ', instead of the more obvious English form ' Lower Rhine ', because the geographical connotation of the term ' Lower Rhine ' is much wider than the very restricted meaning which the term ' Neder Rijn ' carries in the Netherlands.

The larger artificial waterways have also been given in the English form, e.g. ' North Sea Canal ' for ' Noordzeekanaal ', ' New Waterway ' for ' Nieuwe Waterweg '. For offshore channels, etc., an Anglicized form has been used where possible, e.g. ' Goeree Gat ' for ' Goereesche Gat '.

The Dutch names follow those of G.S.G.S. Series 4083, 1 : 50,000 (these maps are copied from Dutch maps of various dates—they do not cover the south of the Netherlands), and Leopold's *Wereldatlas*. Supplementary sources employed are volumes of the 1930 Census and the Bos-Niermeyer *Schoolatlas*. The folding map at the end of the volume gives Dutch forms throughout.

It should be noted that, while the name ' Holland ' is frequently employed in English to designate the country as a whole, the name Netherlands (*Nederland*) has always, and the term Holland never, been used to designate the country in Dutch official language.

CONVERSION TABLES

Metric and British Units

It is customary to think of the ' metre ' and the ' yard ' as representing unalterable units of length. This is not so. The metre was originally intended to be the 10,000,000th part of the earth's meridional quadrant. But the accurate determination of this length proved to be extremely difficult—partly for technical reasons, and partly because of different conceptions of the ' figure of the earth '. In view of these difficulties it became necessary to define the length of the metre in terms of suitable metal bars measured under specified conditions of temperature, pressure, humidity, etc. Similar standard bars were also used to define the length of other units such as the yard. As all these metallic standards are subject to change, conversion tables differ according to the date of comparison between different bars. The tables that follow are based on the comparison between the yard and the metre made in 1895. This made 1 metre equivalent to 39·37013 in.

Metric System. List of Prefixes

Deca means ten times.	Deci means a tenth part of.
Hecto means a hundred times.	Centi means a hundredth part of.
Kilo means a thousand times.	Milli means a thousandth part of.

In abbreviations the Decametre, etc., is Dm., and the decimetre, etc., dm.

Note on ' Nautical ', ' Geographical ' and ' Statute ' miles

A British ' nautical mile ' is the length of the minute of the meridian at any given latitude, and is therefore a variable unit. It is given in feet for Clarke's 1880 spheriod by the formula :

$$60771 \cdot 1 - 30 \cdot 7 \cos 2 \text{ Lat.}$$

This is the sea mile of the scale of latitude and distance of the Admiralty Charts. From the above formula it will be found to vary from 6,046·4 ft. at the equator to 6,107·8 ft. at the poles, being 6,077·1 ft. at latitude 45°.

The so-called ' international nautical mile ' of 1,852 m. or 6,076 ft. is the length of the minute of the meridian at latitude 45° on the international spheroid. This corresponds to the 6,077 ft. for Clarke's spheroid.

A ' geographical mile ' is a fixed unit, being defined by some as the length of a minute of the equator and by others as that of the minute of the meridian at latitude 45°. According to the former definition its value on Clarke's spheroid is 6,087 ft. and according to the latter 6,077 ft. The round figure 6,080 is usually adopted for the purposes of ordinary navigation.

The British ' statute mile ' measures 5,280 ft.

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Table 1. *Length*

Nautical mile	Statute mile	Kilometre	Metre	Yard	Foot	Inch	Centimetre
1	1·152	1·853	1853	2027	6080*	72,960	185,300
0·8684	*1*	1·60934	1609·34	1760	5280	63·360	160,934
0·5396	0·621372	*1*	1000	1093·61	3280·84	39,370·1	100,000
0·0005396	0·0006214	0·001	*1*	1·09361	3·28084	39·3701	100
0·0004934	0·0005682	0·0009144	0·914399	*1*	3	36	91·4399
0·0001645	0·0001894	0·0003048	0·3048	0·33333	*1*	12	30·48
0·0000137	0·0000158	0·0000254	0·0254	0·02778	0·083333	*1*	2·54
0·0000054	0·0000062	0·00001	0·01	0·0109361	0·032808	0·393701	*1*

* This is the customary British practice, and not the ' international nautical mile ', which Great Britain has not adopted.

Table 2. *Area*

Square mile	Square kilometre	Hectare	Acre	Square metre	Square yard
1	2·58998	258·998	640	2,589,980	3,097,600
0·386103	*1*	100	247·106	1,000,000	1,195,990
0·003861	0·01	*1*	2·47106	10,000	11,959·9
0·0015625	0·0040469	0·404685	*1*	4046·85	4840
0·00000039	0·000001	0·0001	0·000247	*1*	1·19599
0·00000032	0·00000084	0·0000836	0·000207	0·836126	*1*

Table 3. *Yield per Unit Area*

Tons per acre	Metric tons per hectare	Quintals per hectare
1	2·51071	25·1071
0·398294	*1*	10
0·0398294	0·1	*1*

Table 4. *Volume and Capacity*

Kilolitre	Cubic metre	Cubic yard	Bushel	Cubic feet	Imp. gall.	Litre	Pint
1	1·000027	1·30799	27·4969	35·3157	219·976	1000	1759·80
0·999973	*1*	1·30795	27·4962	35·3148	219·970	999·973	1759·75
0·764532	0·764553	*1*	21·0223	27	168·178	764·532	1345·43
0·0363677	0·0363687	0·0475685	*1*	1·28435	8	36·3677	64
0·028316	0·028317	0·037037	0·778602	*1*	6·22882	28·3160	49·8306
0·0045460	0·0045608	0·0059461	0·125	0·160544	*1*	4·54596	8
0·001	0·001000	0·001308	0·027497	0·035316	0·219976	*1*	1·75980
0·0005682	0·0005863	0·0007433	0·015625	0·020068	0·125	0·56824	*1*

Table 5. *Weight*

Ton	Metric ton or millier	Quintal	Kilogram	Pound
1	1·01605	10·1605	1016·05	2240
0·984207	*1*	10	1000	2204·62
0·0984207	0·1	*1*	100	220·462
0·0009842	0·001	0·01	*1*	2·20462
0·0004464	0·0004536	0·004536	0·453592	*1*

Table 6. *Temperature : Equivalent of Fahrenheit and Centigrade Scales*

°F.	°C.	°F.	°C.	°F.	°C.	°F.	°C.	°F.	°C.	°F.	°C.
100	37·7	79·25	26·25	58	14·4	37·4	3	17	− 8·3	− 4	−20
99·5	37·5	79	26·1	57·2	14	37	2·7	16·25	− 8·75	− 5	−20·5
99	37·2	78·8	26	57	13·8	36·3	2·5	16	− 8·8	− 5·8	−21
98·6	37	78	25·5	56·75	13·75	36	2·2	15·8	− 9	− 6	−21·1
98	36·6	77	25	56	13·3	35·6	2	15	− 9·4	− 6·25	−21·25
97·25	36·25	76	24·4	55·4	13	35	1·6	14	−10	− 7	−21·6
97	36·1	75·2	24	55	12·7	34·25	1·25	13	−10·5	− 7·6	−22
96·8	36	75	23·8	54·5	12·5	34	1·1	12·2	−11	− 8	−22·2
96	35·5	74·75	23·75	54	12·2	33·8	1	12	−11·1	− 8·5	−22·5
95	35	74	23·3	53·6	12	33	0·5	11·75	−11·25	− 9	−22·7
94	34·4	73·4	23	53	11·6	32	0	11	−11·6	− 9·4	−23
93·2	34	73	22·7	52·25	11·25	31	−0·5	10·4	−12	−10	−23·3
93	33·8	72·5	22·5	52	11·1	30·2	− 1	10	−12·2	−10·75	−23·75
92·75	33·75	72	22·2	51·8	11	30	− 1·1	9·5	−12·5	−11	−23·8
92	33·3	71·6	22	51	10·5	29·75	− 1·25	9	−12·7	−11·2	−24
91·4	33	71	21·6	50	10	29	− 1·6	8·6	−13	−12	−24·4
91	32·7	70·25	21·25	49	9·4	28·4	− 2	8	−13·3	−13	−25
90·5	32·5	70	21·1	48·2	9	28	− 2·2	7·25	−13·75	−14	−25·5
90	32·2	69·8	21	48	8·8	27·5	− 2·5	7	−13·8	−14·8	−26
89·6	32	69	20·5	47·75	8·75	27	− 2·7	6·8	−14	−15	−26·1
89	31·6	68	20	47	8·3	26·6	− 3	6	−14·4	−15·25	−26·25
88·25	31·25	67	19·4	46·4	8	26	− 3·3	5	−15	−16	−26·6
88	31·1	66·2	19	46	7·7	25·25	− 3·75	4	−15·5	−16·6	−27
87·8	31	66	18·8	45·5	7·5	25	− 3·8	3·2	−16	−17	−27·2
87	30·5	65·75	18·75	45	7·2	24·8	− 4	3	−16·1	−17·5	−27·5
86	30	65	18·3	44·6	7	24	− 4·4	2·75	−16·25	−18	−27·7
85	29·4	64·4	18	44	6·6	23	− 5	2	−16·6	−18·4	−28
84·2	29	64	17·7	43·25	6·25	22	− 5·5	1·4	−17	−19	−28·3
84	28·8	63·5	17·5	43	6·1	21·2	− 6	1	−17·2	−19·75	−28·75
83·75	28·75	63	17·2	42·8	6	21	− 6·1	0·5	−17·5	−20	−28·8
83	28·3	62·6	17	42	5·5	20·75	− 6·25	0	−17·7	−20·2	−29
82·4	28	62	16·6	41	5	20	− 6·6	− 0·4	−18	−21	−29·4
82	27·7	61·25	16·25	40	4·4	19·4	− 7	− 1	−18·3	−22	−30
81·5	27·5	61	16·1	39·2	4	19	− 7·2	− 1·75	−18·75	−23	−30·5
81	27·2	60·8	16	39	3·8	18·5	− 7·5	− 2	−18·8	−23·8	−31
80·6	27	60	15·5	38·75	3·75	18	− 7·7	− 2·2	−19	−24	−31·1
80	26·6	59	15	38	3·3	17·6	− 8	− 3	−19·4	−24·25	−31·25

Table 7. *Pressure : Equivalents of Millibars, Millimetres of Mercury, and Inches of Mercury at 32° F. in Latitude 45°*

Mercury in.	Millibars	Mercury mm.	Mercury in.	Millibars	Mercury mm.	Mercury in.	Millibars	Mercury mm.	Mercury in.	Millibars	Mercury mm.	Mercury in.	Millibars	Mercury mm.
27·02	915	686·3	27·82	942	706·6	28·62	969	726·8	29·41	996	747·1	30·21	1,023	767·3
27·05	916	687·1	27·85	943	707·3	28·65	970	727·6	29·44	997	747·8	30·24	1·024	768·1
27·08	917	687·8	27·88	944	708·1	28·67	971	728·3	29·47	998	748·6	30·27	1,025	768·8
27·11	918	688·6	27·91	945	708·8	28·70	972	729·1	29·50	999	749·3	30·30	1,026	769·6
27·14	919	689·3	27·94	946	709·6	28·73	973	729·8	29·53	1,000	750·1	30·33	1,027	770·3
27·17	920	690·1	27·97	947	710·3	28·76	974	730·6	29·56	1,001	750·8	30·36	1·028	771·1
27·20	921	690·8	28·00	948	711·1	28·79	975	731·3	29·59	1,002	751·6	30·39	1,029	771·8
27·23	922	691·6	28·03	949	711·8	28·82	976	732·1	29·62	1,003	752·3	30·42	1,030	772·6
27·26	923	692·3	28·05	950	712·6	28·85	977	732·8	29·65	1,004	753·1	30·45	1,031	773·3
27·29	924	693·1	28·08	951	713·3	28·88	978	733·6	29·68	1,005	753·8	30·48	1,032	774·1
27·32	925	693·8	28·11	952	714·1	28·91	979	734·3	29·71	1,006	754·6	30·51	1,033	774·8
27·35	926	694·6	28·14	953	714·8	28·94	980	735·1	29·74	1,007	755·3	30·53	1,034	775·6
27·38	927	695·3	28·17	954	715·6	28·97	981	735·8	29·77	1,008	756·1	30·56	1,035	776·3
27·41	928	696·1	28·20	955	716·3	29·00	982	736·6	28·80	1,009	756·8	30·59	1,036	771·1
27·44	929	696·8	28·23	956	717·1	29·03	983	737·3	29·83	1,010	757·6	30·62	1,037	777·8
27·46	930	697·6	28·26	957	717·8	29·06	984	738·1	29·86	1,011	758·3	30·65	1,038	778·6
27·49	931	698·3	28·29	958	718·6	29·09	985	738·8	29·89	1,012	759·1	30·68	1,039	779·3
27·52	932	699·1	28·32	959	719·3	29·12	986	739·6	29·92	1,013	759·8	30·71	1,040	780·1
27·55	933	699·8	28·35	960	720·1	29·15	987	740·3	29·94	1,014	760·6	30·74	1,041	780·8
27·58	934	700·6	28·38	961	720·8	29·18	988	741·1	29·97	1,015	761·3	30·77	1,042	781·6
27·61	935	701·3	28·41	962	721·6	29·21	989	741·8	30·00	1,016	762·1	30·80	1,043	782·3
27·64	936	702·1	28·44	963	722·3	29·24	990	742·6	30·03	1,017	762·8	30·83	1,044	783·1
27·67	937	702·8	28·47	964	723·1	29·26	991	743·3	30·06	1,018	763·6	30·86	1,045	783·8
27·70	938	703·6	28·50	965	723·8	29·29	992	744·1	30·09	1,019	764·3	30·89	1,046	784·6
27·73	939	704·3	28·53	966	724·6	29·32	993	744·8	30·12	1,020	765·1	30·92	1,047	785·3
27·76	940	705·1	28·56	967	725·3	29·35	944	745·6	30·15	1,021	765·8	30·95	1,048	786·1
27·79	941	705·8	28·59	968	726·1	29·38	995	746·3	30·18	1,022	766·6	30·98	1,049	786·8

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GEOLOGICAL MAP OF THE NETHERLANDS

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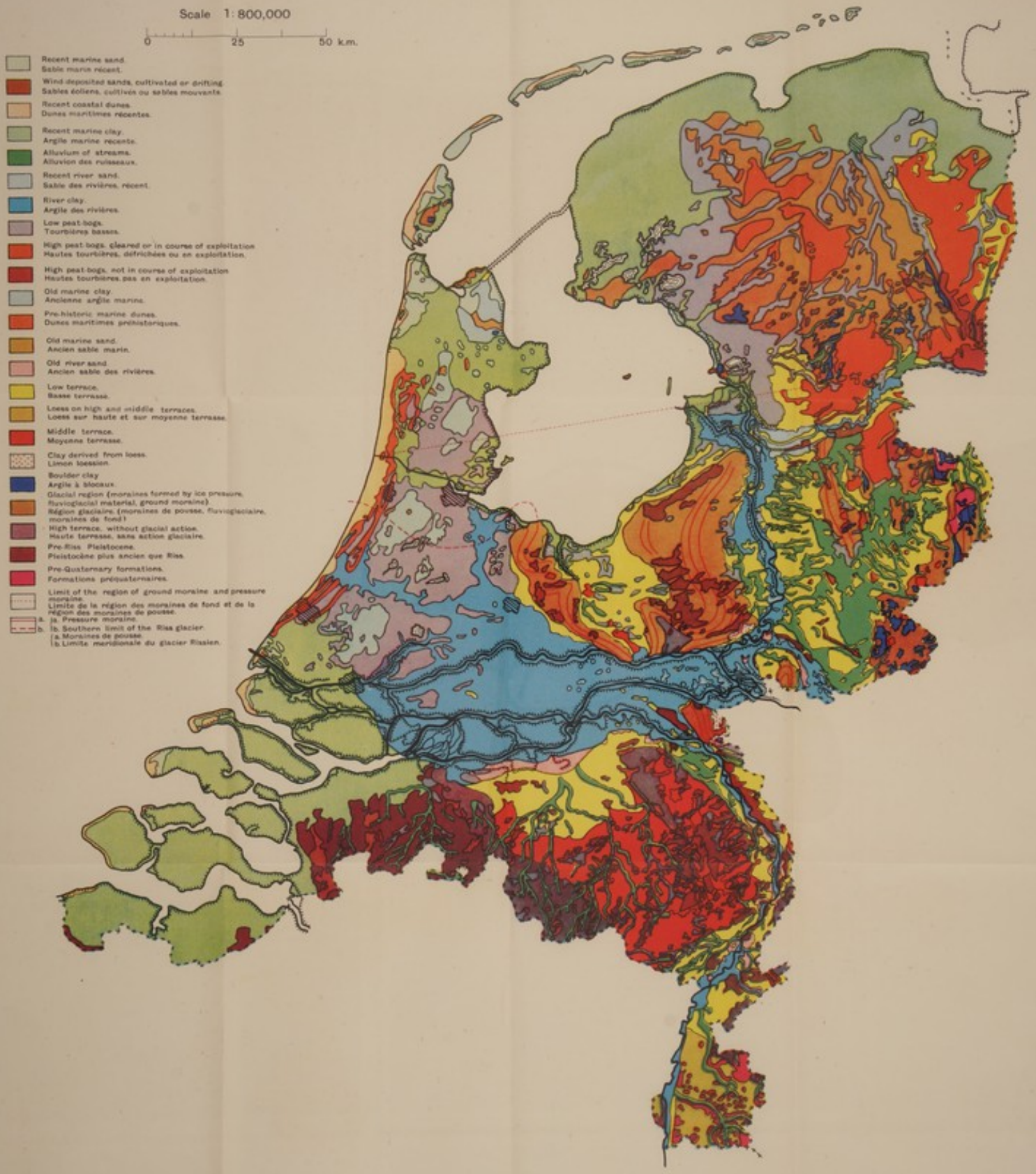
Prepared by Dr. W. A. J. Oosting. 1937



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