Flats and houses 1958 : design and economy.

Contributors

Great Britain. Ministry of Housing and Local Government.

Publication/Creation

London : H.M. Stationery Off, 1958.

Persistent URL

https://wellcomecollection.org/works/rfzqhgqn

Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
https://wellcomecollection.org

Ministry of Housing and Local Government

Flats and Houses 1958

Design and Economy

London: Her Majesty's Stationery Office 10s.0d. net

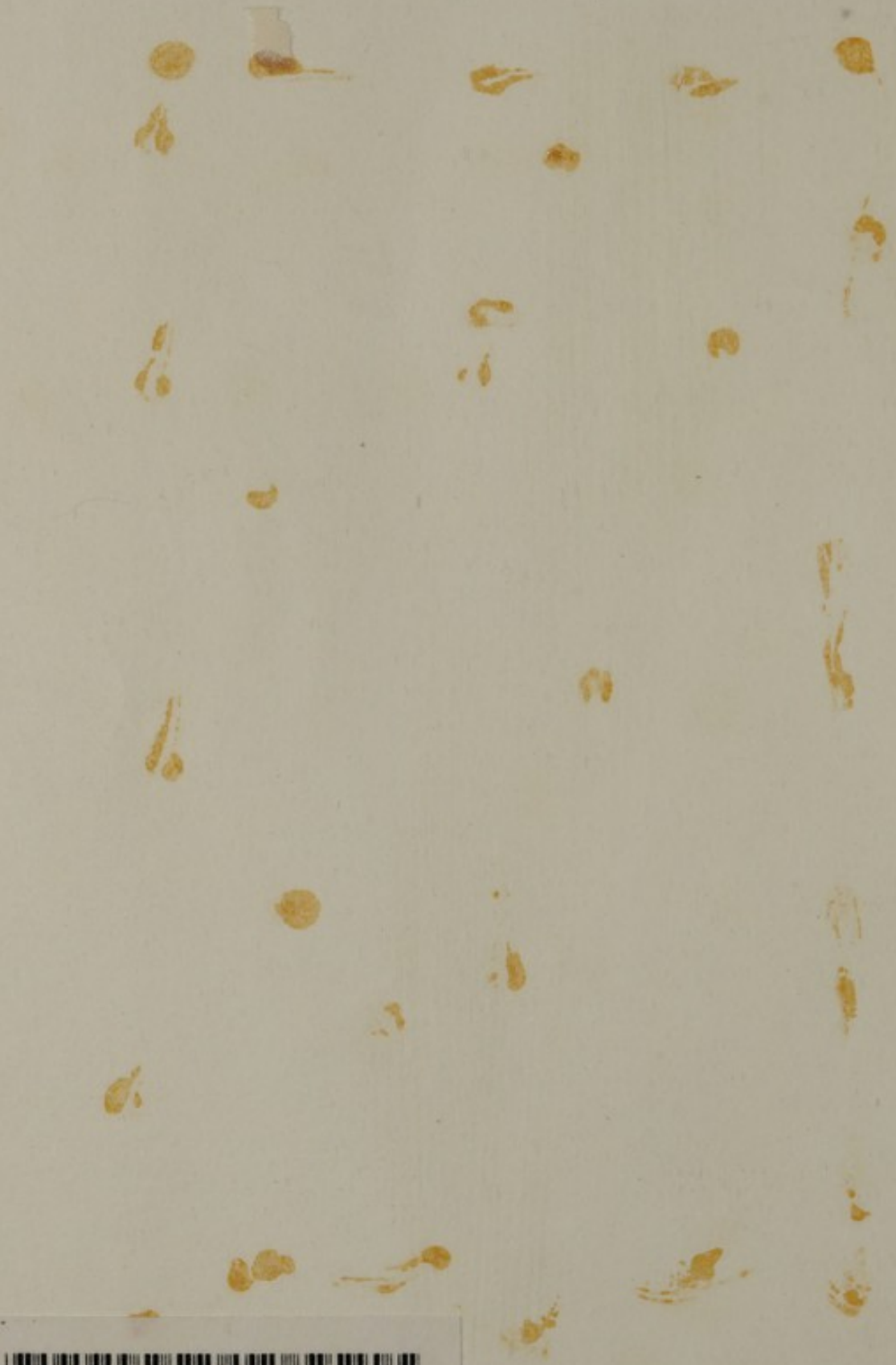


Figure 1

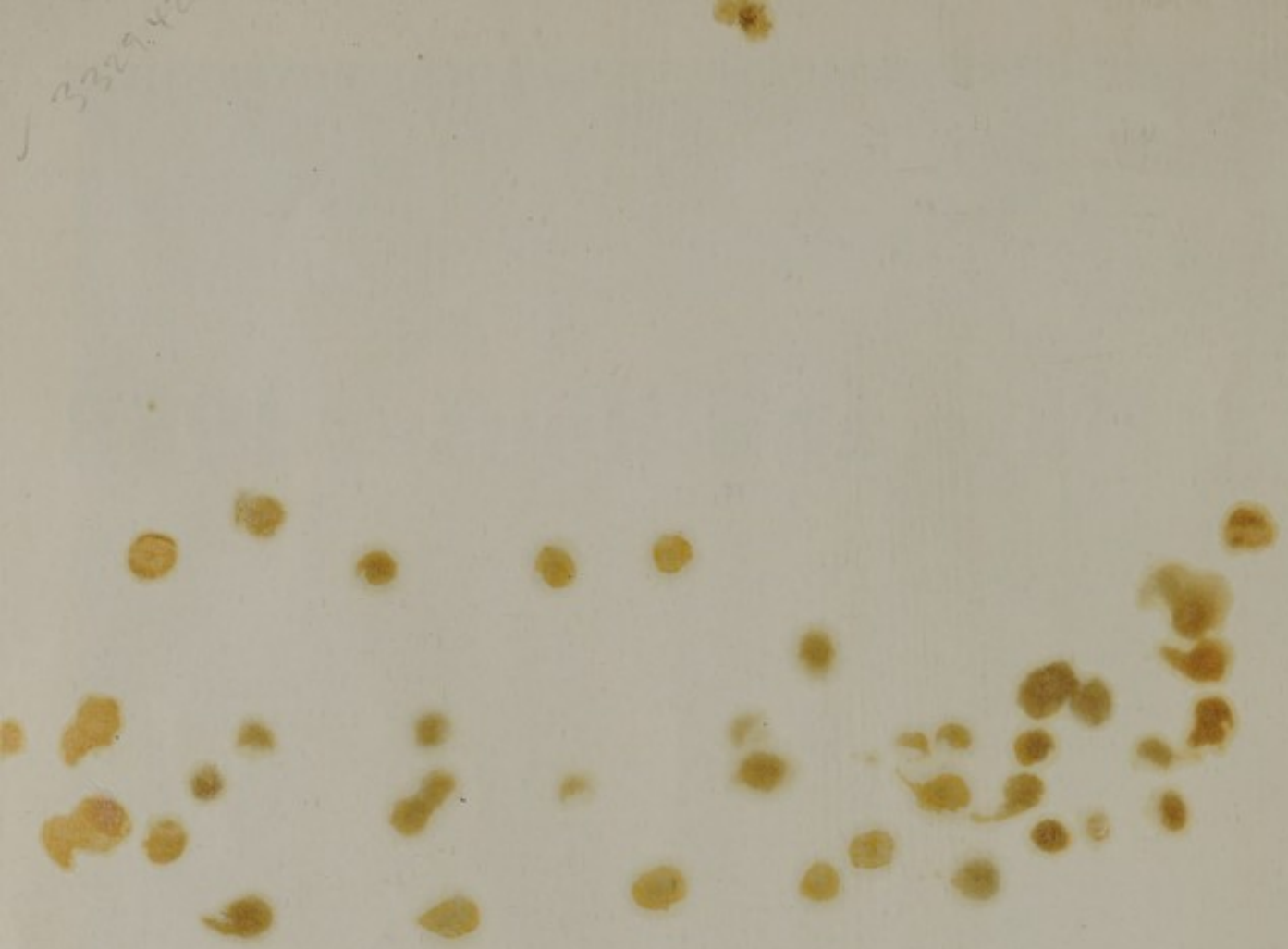
An 11-storey tower block of flats, 4-storey maisonettes and 2-storey terrace houses, on the Alton Estate, Portsmouth Road, Roehampton. London County Council.

MINISTRY OF HOUSING AND LOCAL GOVERNMENT

Flats and Houses 1958

Design and Economy

LONDON : HER MAJESTY'S STATIONERY OFFICE : 1958



Foreword *by the Minister of Housing and Local Government*

BETWEEN 1958 and 1970 in the towns and cities of England and Wales new homes are likely to be built on sites where no less than half a million older houses now stand or stood.

Many local authorities, in consequence, are facing what to them are novel problems of building at higher densities: densities where houses will need to be intermingled with maisonettes or flats.

The purpose of this book is to help in meeting these problems. I certainly do not mean it to encourage the use of higher densities or multi-storeyed buildings where they are not really necessary.

It sets out methods whereby remarkably large sums of public money can be saved if high building is not used except to the extent that it must be. It illustrates also the wide differences in capital cost between dwellings built in blocks of different types while providing just the same accommodation.

Those are the two aspects of the relation between design and cost which at the present time are the most rewarding to study. High-density building is frequently essential but never cheap, and I believe that local authorities will find some of the suggestions in this book indispensable to them if they wish to get value for money, as I am sure they do.

I should also like to see much more attention given to the treatment of space around buildings.

Of course no book can of itself show how to achieve the complete combination of attractive buildings, a happy variety of form and skyline, a satisfying massing of blocks, and a sense of space pleasingly planned. But perhaps this one will help. There is a simplicity in its approach to the achievement of economy in the design of layout and buildings—a simplicity which may, for example, help to free the creative energy of architects from oppressive anxiety about overall cost, an anxiety that can be deadening.

At any rate, my hope is that all who have these problems of high-density building to face, whether as elected members of councils or as local government officers or as professional men, will find something in this book that will interest and stimulate them. Reasonable cost and high architectural quality can both be secured, there is no doubt, if only one takes enough trouble to study how.

Henry Brooke

Contents

Introduction

1. Chapter I gives examples of ways in which, for specified densities on particular sites, various dwelling and block types can be used to provide the desired sizes of dwellings in the required proportions; and compares the overall estimated building costs of the various layouts for the site concerned. In Chapter II, some of the problems of using to best advantage the space around the buildings are considered. Chapter III returns to the main theme and shows how preliminary sketches for economical layouts can be quickly arrived at, while Chapter IV gives cost comparisons for various types of dwelling and block, with additional plans as well, and discusses some of the special features of dwellings for higher densities.

2. The material differs in kind from that in the Department's previous manuals, which have given guidance on standards and illustrated those standards in plans of dwellings and sometimes layouts. The plans and layouts in this book, on the other hand, are illustrated mainly for purposes of comparison. All the dwelling plans are in compliance with the Ministry's standards, and have been prepared with the assistance of a panel of architects appointed by the associations of local authorities, but some of them are included mainly to show how much more or less expensive they are than others. The aim is not to recommend, but to illustrate some results of recent experience.

3. The material here differs in another way from that in previous manuals, in the relative complexity of the subject. Even with two-storey houses, there is a wide range of possible solutions to any given problem in design or layout, but when it is a matter of providing good dwellings at high density the number of possible solutions becomes very large indeed. Accordingly the layout solutions arrived at are not claimed as necessarily the best possible solutions, or the least costly; but the range of layouts shown will, it is hoped, illustrate where economies can be found without reducing the quality of the dwellings or the architectural standard of design.

4. With the exception of Chapter II, the book concentrates on the selection of building types in a layout, and the use of economical dwelling and floor plans. The selection of these two aspects of the relation between design and cost means only that there is considered to be more to be gained at the present time by so doing. It does not mean that efficient structural design, new and economical techniques, good site organisation and management, or the intelligent use of mechanical plant are considered to be unimportant, for there is a great deal of work being done in these fields, and savings, which are over and above those made possible by the approach used in this book, are being realised, and

should be sought when schemes are worked out. The same is true of detailed design for low running and maintenance costs, though the general form of layout advocated in the following pages, by using the minimum of high buildings, will itself lead in the right direction for this, since high buildings, besides being more costly, are also more expensive to run and maintain.

General Note on Estimated Costs

5. All the estimates throughout the book are for buildings only, and exclude site clearance and levelling, roads, footpaths, sewers and public utility mains, abnormal foundations, abnormal external works and professional fees. The estimated costs compare approximately with the general level of the cost of buildings only in Provincial Tenders approved during the first half of 1958.

6. **None of the prices is necessarily equivalent to a price which a detailed estimate or a competitive tender would produce.**

7. This warning is necessary as, although the relative levels of all the estimated costs for the layouts in Chapter I and for the buildings in the cost comparisons in Chapter IV are indicated with a fair degree of accuracy, the absolute figures are subject to wider margins of error. This is partly because there are fewer difficulties in measuring differences between buildings than in assessing actual costs—which would require detailed drawings and bills of quantities for each building; and partly because actual costs depend upon location, size of contract and the level of local prices.

8. The figures for buildings in Chapter IV are approximate estimates, assessed on the basis of floor and dwelling plans and not of detailed working drawings and specifications. The figures for layouts in Chapter I are obtained by aggregating estimated costs for the buildings, assessed in the same way. Many of the building types used are shown in Chapter IV: but of course where a type shown there has been used in a layout in Chapter I in a different height or length of block the estimated cost has been adjusted accordingly.

Special Acknowledgement

9. The Ministry are indebted to the London County Council for permission to include an illustrated interpretation of their Code of Means of Escape in case of Fire, which has been worked out in collaboration with the Council's Officers.

Chapter I. Site Planning: the Dwelling in its Surroundings

Part 1. General

10. This Chapter shows how economy in layout depends upon the way in which the various types of dwellings and blocks are used together. The main determining factors are considered in Part 1. In Part 2 a series of layout studies are reviewed, and Part 3 gives a discussion of the various lessons which can be drawn.

11. The wide range of types of building now developed, which includes two- and three-storey houses, and both low and high blocks of maisonettes and flats, means that redevelopment offers far greater scope than existed before the war for variety in building design and high quality architectural work in layout and grouping, skilfully related to existing development and to the general course of future development set out in the Development Plan. Now, instead of a monotonous development entirely in flats, often of uniform height, redevelopment is taking the form of a "mixed" development of houses, low blocks of maisonettes and high blocks of maisonettes or flats. The task of designing such a layout economically largely revolves around the choice of types of buildings and of the proportions of each type.

12. The first step with a scheme is to agree with the local planning authority the number of people to be accommodated on the site. In this book, the number is expressed in terms of the accommodation, as the number of habitable rooms per acre of the housing site, and referred to as the density.*

13. With the advice of its housing manager, who should be closely associated with the design work throughout, the authority will decide on the proportions of the various sizes of dwelling that are needed. This will depend chiefly upon the range of existing dwellings; the family composition of those awaiting rehousing; the extent to which the authority's existing houses are under-occupied; the numbers and sizes of other dwellings being built by the authority; and the possibility of exchanges with families in privately owned accommodation.

14. Given the site area, the density figure, and the proportions in which the various sizes of dwellings are needed, the designer can calculate the number of dwellings of each size to be provided. (An example of the method is given in Appendix A.) Of course, a certain tolerance, of the order of 5 per cent., is to be expected in achieving the numbers and

* The references throughout to "density" are to the Net Accommodation Density. "h.r.a." means "habitable rooms per acre".

proportions in practice. And for small sites, the different sizes of dwellings should be as few as possible, because it is more difficult to plan economically for a wide range of sizes in a limited number of blocks.

15. The local authority will also wish to consider what proportion of houses the designer should aim to provide. The following Table shows, for site densities of 100, 140 and 160 h.r.a., the effect of providing various proportions of rooms in houses. The higher the proportion, the higher is the density which has to be reached on the rest of the site; but more rooms in houses can be provided as the density at which the houses themselves are laid out is increased.

Table 1. The effect of providing various proportions of rooms in houses

Overall Net Density for the whole site: h.r.a.	Proportion of rooms in the scheme provided in houses laid out at 60 habitable rooms per acre	Density which has to be achieved over the rest of the site (in maisonettes and flats): habitable rooms per acre	Proportion of rooms in the scheme which could be provided in houses for the same density over the rest of the site, if the houses were laid out at 80 habitable rooms per acre
100	20% 30% 40%	120 140 180	40% 53% 64%
140	10% 15% 20%	164 183 210	16% 24% 31%
160	5% 10% 15%	175 196 227	8% 16% 23%

16. Generally, at an overall density of about 100 h.r.a., the selection of a percentage of houses which does not necessitate a density for the rest of the site of more than about 110–120 h.r.a. will be desirable; for this density can probably be reached with four-storey maisonettes. If a higher proportion of houses is chosen, it will be necessary to use expensive high blocks. At higher levels of density, a proportion of dwellings in high blocks will in any case be necessary; and this can be kept to the minimum only by limiting the proportion of rooms in houses.

17. While it may be necessary to limit the number of houses in a scheme, the use of the four-storey maisonette block enables other dwellings as well as houses to have their own private gardens. Each dwelling in such a block can have its own private garden, the dwellings at the upper level having theirs behind the gardens to the ground floor dwelling, or on the opposite side of the block. Moreover, as compared with a block of four-storey flats one-half instead of one-quarter of the dwellings have their entrances at ground level. The Table below gives information,

extracted from layout studies which follow, showing that a large proportion of dwellings could have their own gardens even at high overall densities and even if the upper maisonettes do not have one.

Table 2. Proportion of Dwellings which could have Private Gardens

Net Density and Figure No.	A	B	C	D	E
	Total No. of Dwellings	No. of Houses with Private Gardens	No. of Ground Floor Maisonettes in four-storey blocks which could have Private Gardens	B + C	Percentage of Dwellings which could have Private Gardens
100 h.r.a.					
Fig. 3 .	327	63	112	175	53·5
Fig. 5 .	325	105	27	132	40·6
140 h.r.a.					
Fig. 9 .	456	47	109	156	34·2
Fig. 11 .	457	68	99	167	36·6
Fig. 12 .	457	69	58	127	27·8
Fig. 13 .	460	—	—	—	—
160 h.r.a.					
Fig. 17 .	520	78	76	154	29·6
Fig. 19 .	522	36	86	122	23·4

18. Experience has shown that because gardens provided for upper maisonettes are not so close to the dwellings they are used less than those belonging to dwellings at ground level. For this reason some authorities now allot less space to them, or provide a communal garden.

19. The local authority will also wish to do all they can to ensure that the space about buildings is well designed, and it is often helpful to appoint a landscape consultant to work with their architect from the beginning. Layouts at high density demand, for instance, special provision for play spaces, car parking and sheltered places where tenants can sit out of doors; and these requirements have to be co-ordinated from the start with the planting of trees, shrubs and lawns, and with the layout of footpaths and other paved areas (see Chapter II).

20. Given instructions on the matters considered above, the architect can make preliminary layouts for a scheme based on the necessary range of dwellings and types of block.

21. Almost every site has its virtues, and in evolving his design the architect will be influenced by the potentialities of the site and its surroundings, by existing buildings within or near the site, and by proposals for development in surrounding areas. He will be limited by

the size and shape of the site and the gradients, by the need to retain some existing streets and services, either for economy or to give access to existing development, and by the requirements of daylighting and sunlighting.

22. The two requirements of securing adequate daylighting and sunlighting impose exacting limitations in spacing the buildings, and consequently influence layout to a large degree. The methods for securing the recommended standard of daylighting, set out in B.S.C.P.3, were described in Appendix II of The Density of Residential Areas,* and they are dealt with further in this book in Appendix B. In the same appendix there is a description of a new Standard Sunlight Indicator, which has been devised for checking layouts for sunlighting in relation to the standard of sunlighting set out in B.S.C.P.3. The appendix includes a description of how the Sunlight Indicator is used, together with methods of constructing such indicators for various latitudes and for different sunlighting standards.

23. Even with so many requirements to meet and to reconcile, the possible variations in arranging a layout are still very numerous, and they will show wide differences in cost. In comparing these costs, the significant indicator is the overall average cost per dwelling, and not the cost per dwelling in particular blocks. A low overall average cost per dwelling depends on a proper choice of blocks of different types and heights, and as a broad generalisation it is true to say that at the densities dealt with in this book there is usually more money to be saved by attention to this than by economies in the dwellings and the blocks themselves.

24. This is not to say that the dwellings and the blocks need not be economical; of course they should. But comparison of similar dwellings in a building of three or four storeys and in a building of say eleven storeys shows a cost difference of something between £400 and £500. The key to economy by intelligent layout design is to get the required accommodation with the minimum use of high building.

Part 2. Layout Studies

25. To illustrate the broad approach, a series of layout studies have been prepared by the Ministry's architects on the basis of a site in Birmingham. The comparative studies for both 100 and 140 habitable rooms per acre were shown at the Public Works Exhibition at Olympia in 1956 and further studies have since been worked out for layouts at 160 h.r.a. The building densities used have been selected as covering a range which local authorities are most likely to encounter. The 12·3 acre site rises 70 feet (1 in 77) from west to east, and this gradient, together with the need to retain certain lengths of existing roads and a group of existing buildings, has to some extent dictated the general

* The Density of Residential Areas, H.M.S.O., 1952.

pattern of the layout. The proportion of dwelling sizes set out in the Table next to each plan has been taken as required in the redevelopment and each layout comes close to providing the dwellings in these proportions, although in some of the designs it has been found necessary, as will inevitably happen in practice, to make small variations. The types of dwellings used in the layouts are from plans that are illustrated in Chapter IV and in earlier manuals, and the spacing of blocks on the site has been governed by the daylight indicators referred to in paragraph 22 above. Where it is consistent with providing the required proportions of dwelling-types, or with a satisfactory grouping of buildings, a particular design of building has, for economy, been repeated.

26. After the studies of the Birmingham site, various ways are examined of attaining densities of from 80 to 136 h.r.a. on four other sites, of various shapes, and ranging in size from 3 to 6·5 acres.

27. In comparing the estimated costs of the various schemes reference should be made to the General Note on Estimated Costs in the Introduction.

Figure 2

The site in Birmingham taken as the basis of the first three studies, outlined in white.

FIRST STUDY: 100 HABITABLE ROOMS PER ACRE

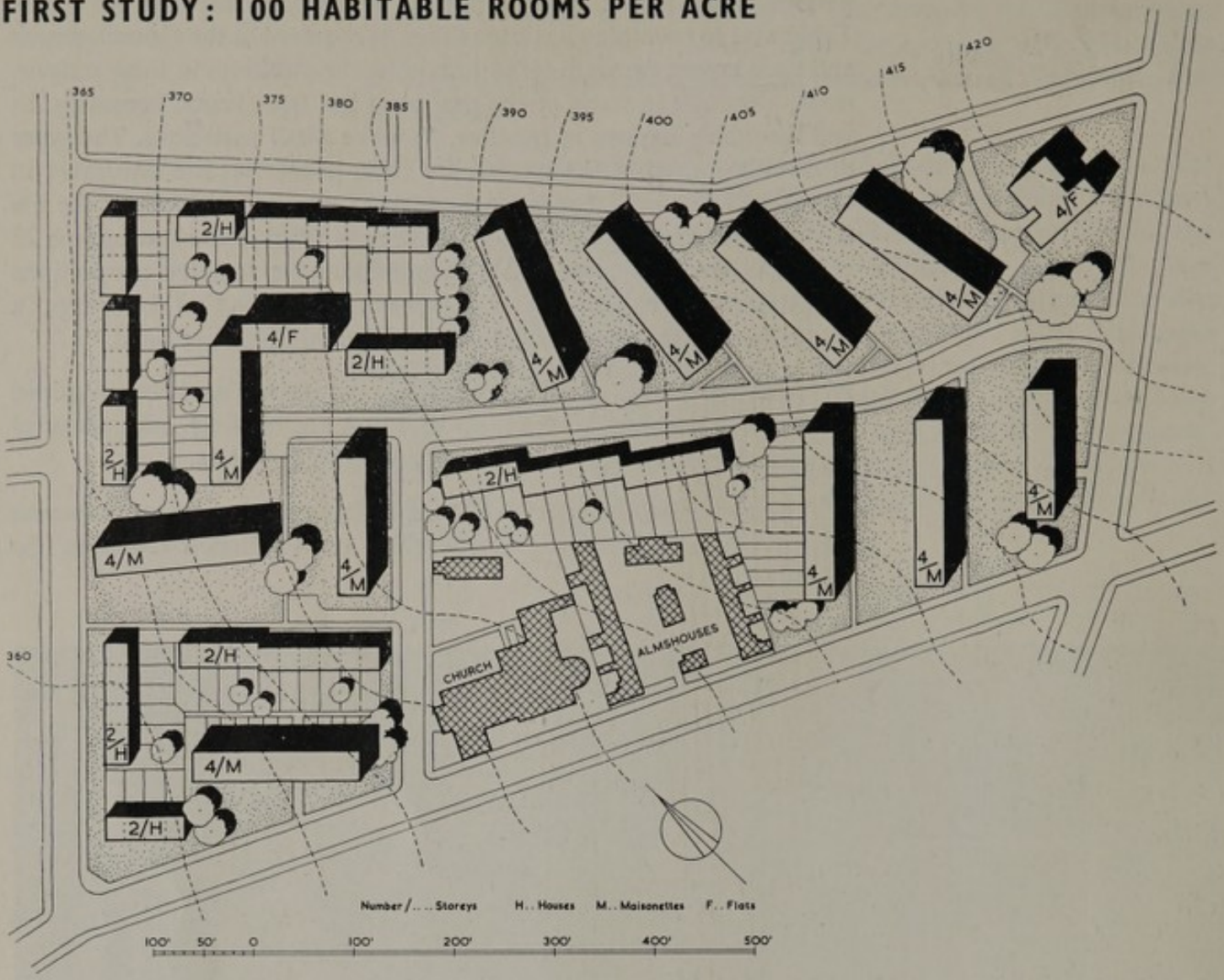


Figure 3

100 habitable rooms per acre: 12·3 acres: 1,234 habitable rooms: 327 dwellings.

Density: 100 habitable rooms per acre

No. of habitable rooms required . . 1,231
No. of dwellings required . . . 326

Type of dwelling and % required	2-Storey houses		4-Storey flats		4-Storey maisonettes		Dwlgs.	Rms.
	Dwlgs.	Rms.	Dwlgs.	Rms.	Dwlgs.	Rms.		
BSR. 1 p. 1 rm. 5%	—	—	16	16	—	—	16	16
1 BR. 2 p. 2 rms. 5%	—	—	16	32	—	—	16	32
2 BR. 4 p. 3 rms. 20%	—	—	8	24	58	174	66	198
3 BR. 4 p. 4 rms. 25%	—	—	—	—	82	328	82	328
3 BR. 5 p. 4 rms. 30%	14	56	—	—	84	336	98	392
3 BR. 6 p. 5 rms. 8%	26	130	—	—	—	—	26	130
4 BR. 7 p. 6 rms. 7%	23	138	—	—	—	—	23	138
Totals . .	63	324	40	72	224	838	327	1,234
Percentages .	19·3	26·2	12·3	5·8	68·8	67·9	—	—

28. In this layout the aims are to avoid the use of high buildings and to produce a scheme in which the maximum building height is four storeys.

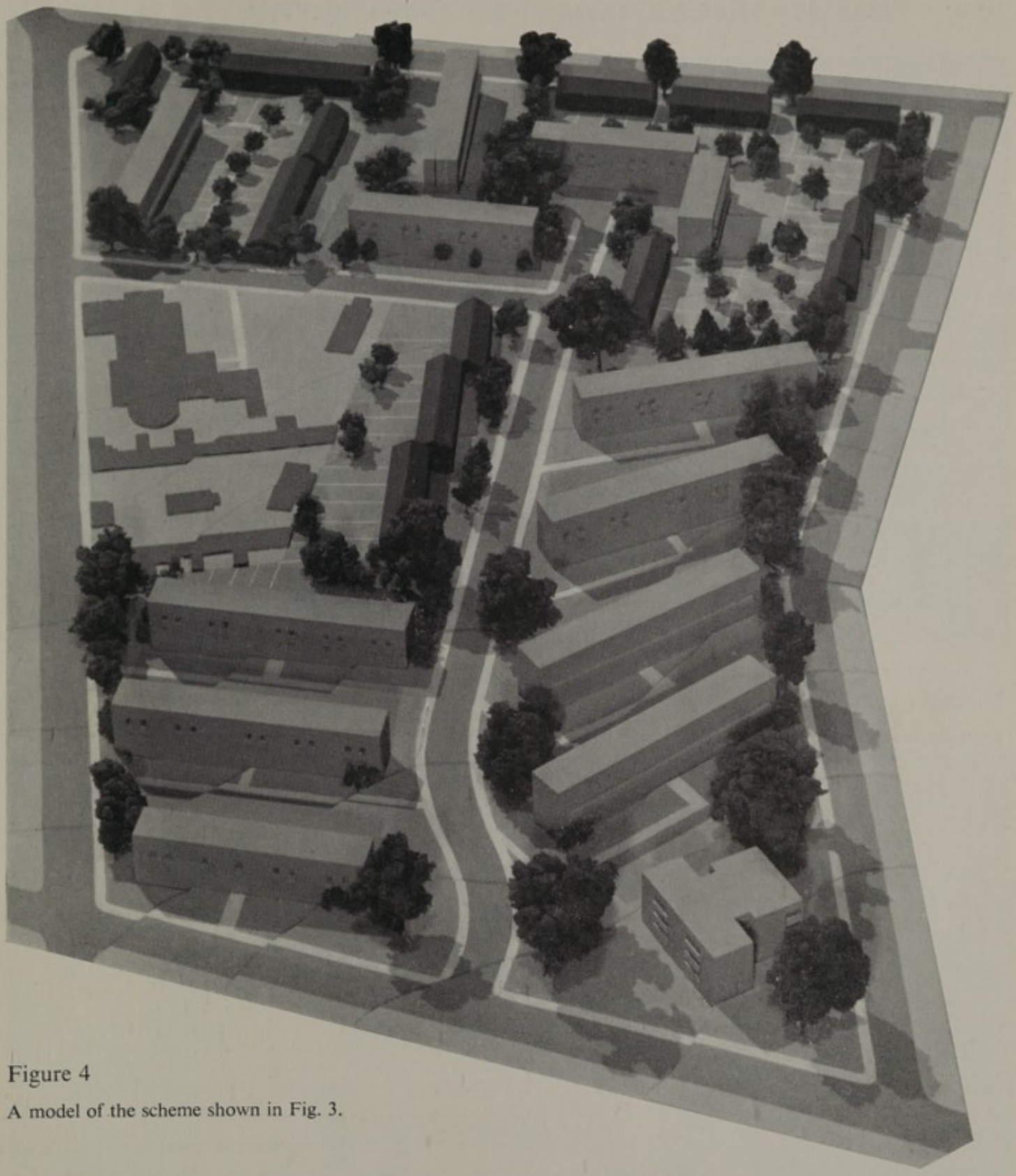


Figure 4

A model of the scheme shown in Fig. 3.

The proportion of two-storey houses is nevertheless as high as 19·3 per cent., and this allows all the six- and seven-person families, and one in seven of the five-person families, to live in houses. The remaining families are in the four-storey blocks, and those living in a ground floor maisonette can have direct access to a private garden.

29. The estimated average building cost per dwelling, with individual solid fuel appliances throughout, is £1,520.

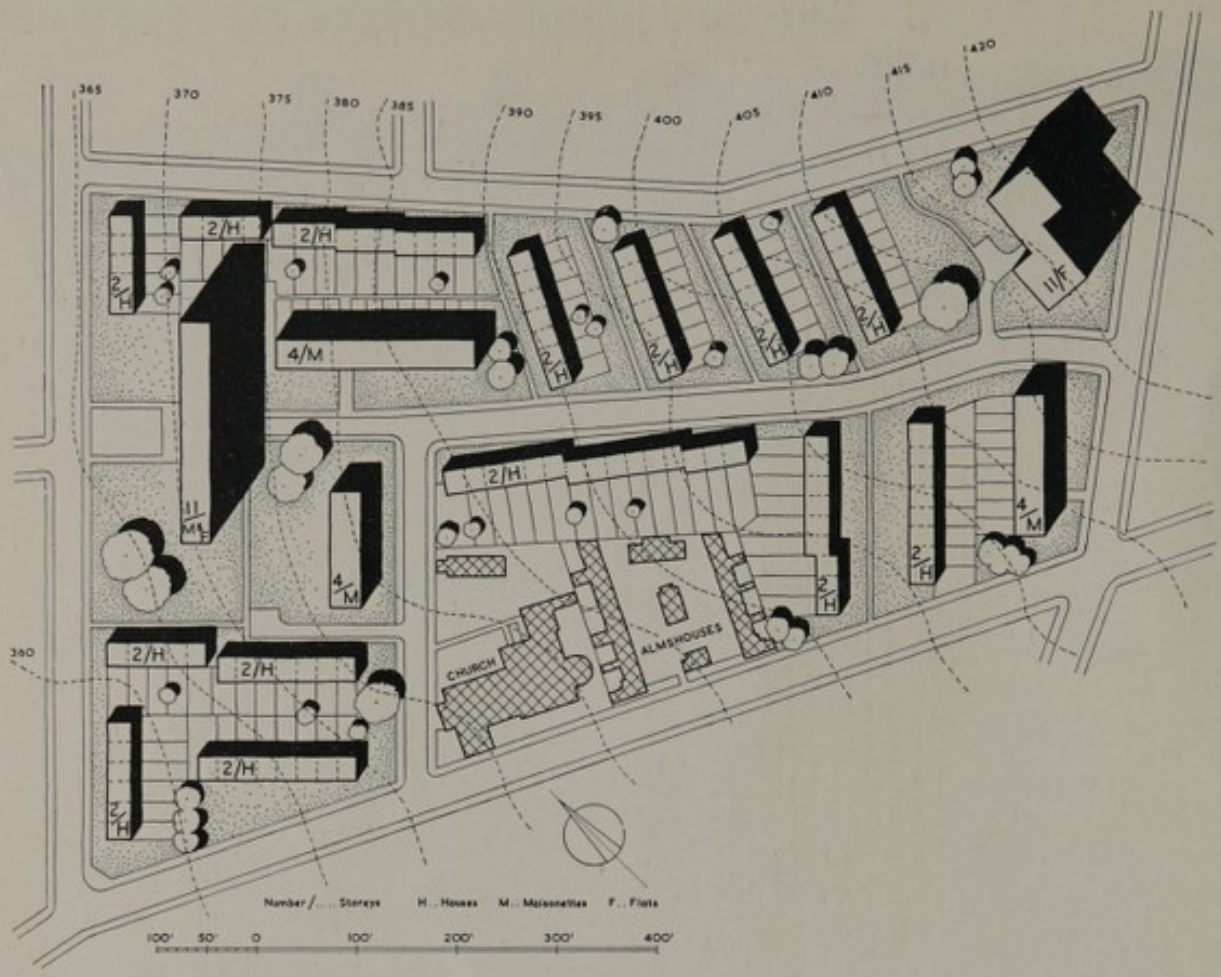


Figure 5

100 habitable rooms per acre.

Density: 100 habitable rooms per acre

No. of habitable rooms required . . 1,231
No. of dwellings required . . . 326

Type of dwelling and % required	2-Storey houses		4-Storey maisonettes		11-Storey flats		11-Storey maisonettes		Dwlgs.	Rms.
	Dwlgs.	Rms.	Dwlgs.	Rms.	Dwlgs.	Rms.	Dwlgs.	Rms.		
BSR. 1 p. 1 rm. 5% .	—	—	—	—	14	14	—	—	14	14
1 BR. 2 p. 2 rms. 5% .	—	—	—	—	18	36	—	—	18	36
2 BR. 4 p. 3 rms. 20% .	—	—	—	—	64	192	—	—	64	192
3 BR. 4 p. 4 rms. 25% .	—	—	12	48	—	—	70	280	82	328
3 BR. 5 p. 4 rms. 30% .	56	224	42	168	—	—	—	—	98	392
3 BR. 6 p. 5 rms. 8% .	26	130	—	—	—	—	—	—	26	130
4 BR. 7 p. 6 rms. 7% .	23	138	—	—	—	—	—	—	23	138
Totals . . .	105	492	54	216	96	242	70	280	325	1,230
Percentages . .	32·0	40·0	16·6	17·5	29·5	19·6	21·5	22·7	—	—

30. Figure 5 shows the effect if **the number of two-storey houses is substantially increased,** from 19·3 per cent. to 32 per cent. of the dwellings. They take up so much land that the designer has to use high buildings, in this case two 11-storey blocks, to accommodate the overflow. (In fact over half the number of dwellings are in these two blocks.) The estimated average building cost per dwelling, with all the heating by individual solid fuel appliances, is £1,775.* This is an increase of 16·8 per cent. over the cost of the previous scheme.

* With central heating in the high blocks, the figure becomes £1,834.

SCHEMES AT A DENSITY OF ABOUT 100 HABITABLE ROOMS PER ACRE

Figure 6 Ackroydon Estate, Princes Way, Wandsworth. London County Council.

Figure 7 Faraday and Dyson Roads Estate, West Ham C.B.

Figure 8 Claremont Estate, West Ham C.B.

SECOND STUDY: 140 HABITABLE ROOMS PER ACRE

31. This study has been arranged to show first a layout which is regarded as economical (Figure 9), followed by two variations of it, one economical and one not (Figures 11 and 12), and two versions of a layout with buildings of uniform height (Figure 13).

32. In the layout shown in Figure 9, the maximum use is made of four-storey maisonette blocks, which accommodate all the five-person families, three-fifths of the six-person families, and nearly a third of the four-person families. There are also 47 houses, which take all the seven-person families and the other six-person families. The rest of the four-person families are in the 13-storey blocks, which also accommodate the one- and two-person households.

33. The estimated average building cost per dwelling of this scheme, with central heating in the high blocks, is £1,811; and with individual solid fuel appliances throughout is £1,759. These costs are lower than the corresponding costs of any of those which follow, and the economy derives mainly from providing a large number of the dwellings in four-storey maisonette blocks, in this way keeping down the number of dwellings in high buildings.

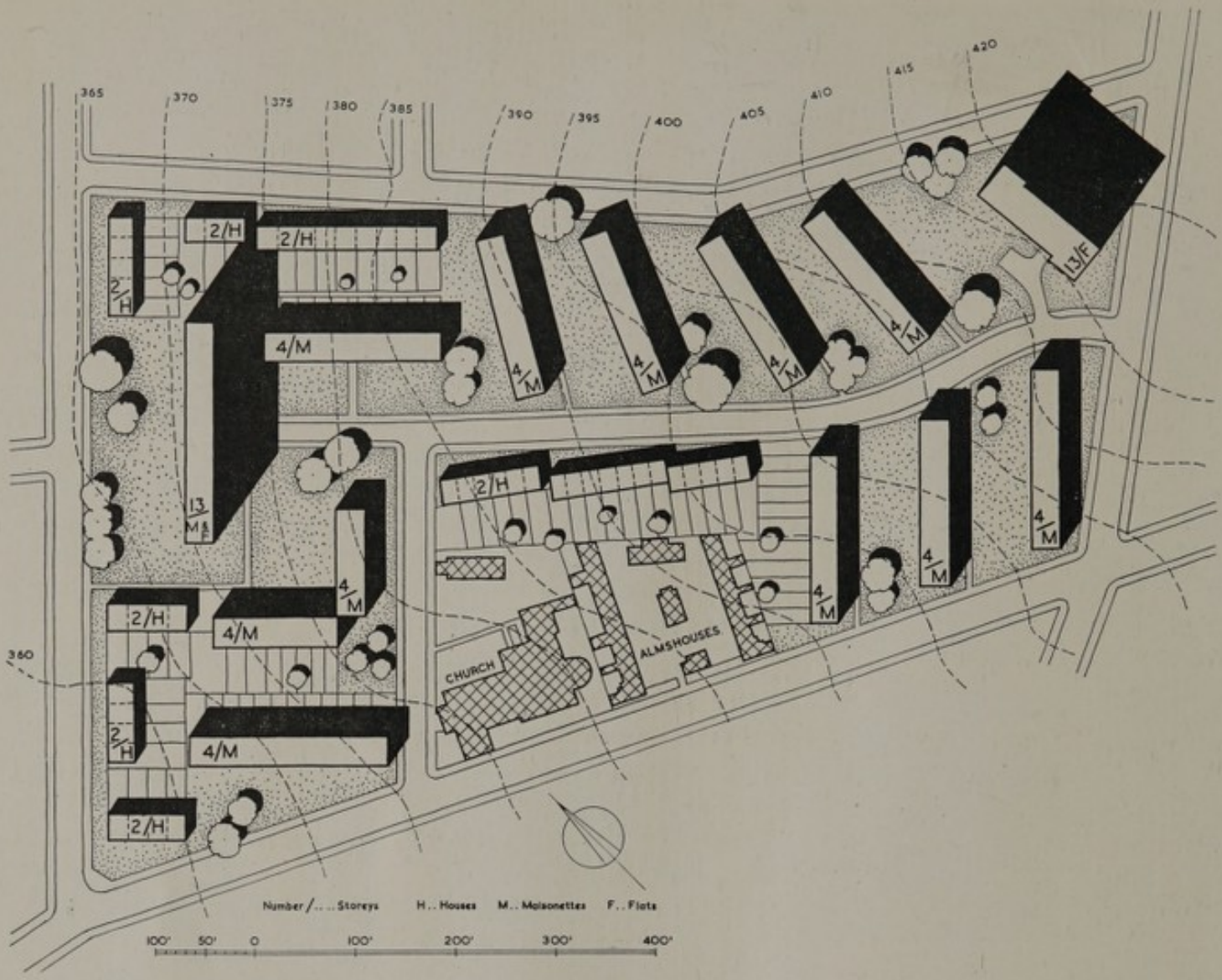


Figure 9

140 habitable rooms per acre: 12·3 acres: 1,716 habitable rooms: 456 dwellings.

See paragraphs 32 and 33 on page 13.

Density: 140 habitable rooms per acre

No. of habitable rooms required . . 1,718
No. of dwellings required . . . 456

Type of dwelling and % required	2-Storey houses		4-Storey maisonettes		13-Storey flats		13-Storey maisonettes		Dwlgs.	Rms.
	Dwlgs.	Rms.	Dwlgs.	Rms.	Dwlgs.	Rms.	Dwlgs.	Rms.		
BSR. 1 p. 1 rm. 5% .	—	—	—	—	24	24	—	—	24	24
1 BR. 2 p. 2 rms. 5% .	—	—	—	—	24	48	—	—	24	48
2 BR. 4 p. 3 rms. 20% .	—	—	30	90	59	177	—	—	89	267
3 BR. 4 p. 4 rms. 25% .	—	—	30	120	—	—	84	336	114	456
3 BR. 5 p. 4 rms. 30% .	—	—	136	544	—	—	—	—	136	544
3 BR. 6 p. 5 rms. 8% .	15	75	22	110	—	—	—	—	37	185
4 BR. 7 p. 6 rms. 7% .	32	192	—	—	—	—	—	—	32	192
Totals . . .	47	267	218	864	107	249	84	336	456	1,716
Percentages . .	10·3	15·5	47·9	50·3	23·5	14·5	18·4	19·5	—	—

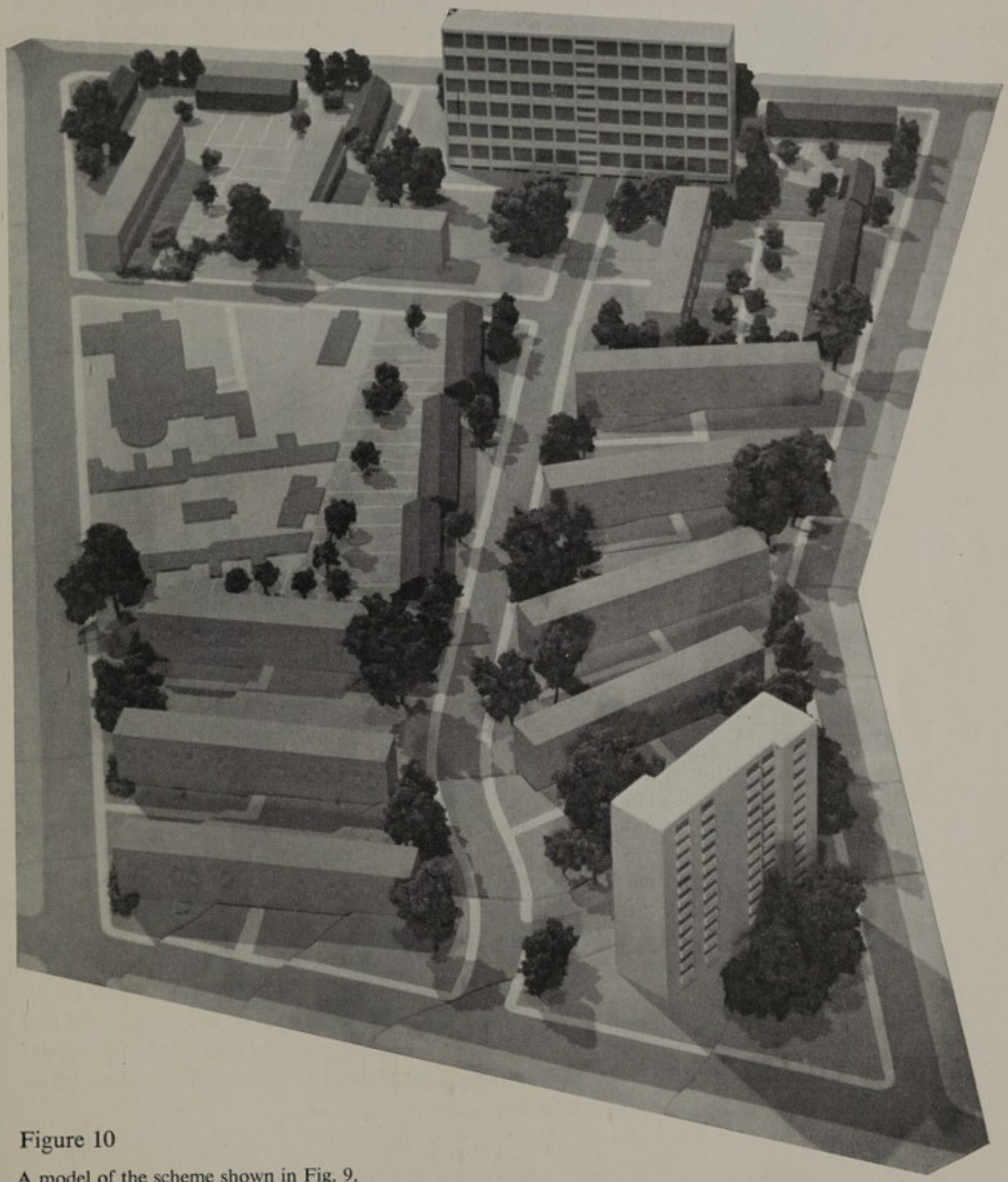


Figure 10

A model of the scheme shown in Fig. 9.

34. Figure 11 shows how, **by using three-storey types, a much larger proportion of houses,** enough in fact to accommodate all the six- and seven-person families, **can be provided in this scheme without very much extra cost.** It is done by replacing the 47 houses in two-storey terraces with 57 houses in the three-storey terraces (this can be readily achieved since the three-storey houses can be designed 20 per cent. narrower in frontage); and replacing one four-storey maisonette block of 20 dwellings with a further terrace of 11 three-storey houses. This leaves the total number of dwellings practically unaltered and brings the number of houses to 68, raising the percentage of houses from 10·3 to 14·5 per cent. The estimated average building cost per dwelling goes up by 0·6 per cent. to £1,823 for the version with central heating in high blocks and by 0·6 per cent. to £1,770 for the version with individual solid fuel appliances throughout. These very small increases may be considered well worthwhile for a scheme which affords the advantage of the extra houses.

35. Figure 12 shows the effect if **all the six- and seven-person families are housed in two-storey houses,** instead of only 47 as in Figure 9. So much extra land is required for the extra houses that the designer has to use another 13-storey slab block to provide the dwellings which there is no longer the space to accommodate in low blocks. This increases the percentage of dwellings in high blocks from 41·7 to 59·4 per cent., raising the estimated average building cost per dwelling to £1,917 for the version with central heating in high blocks, and to £1,847 for the version with individual solid fuel appliances throughout. These are increases of either 5·2 per cent. or 4·4 per cent. over the cost of the respective versions of Figure 11, which has the same number of houses, and comparison with Figure 9, which has fewer two-storey houses, shows an increase in cost of 5·8 per cent. or 5·0 per cent.

36. Figure 13 shows the type of layout which results from the use throughout of five-storey blocks of flats with lifts. The effect is monotonous, and it is illustrated mainly because this approach was widely used before the war and there may possibly be some thought that it costs very much less than other forms of development. This is not so. The layout can be costed for two types of block, (*a*) balcony access and (*b*) staircase access. If all the blocks are staircase access, the estimated average building cost per dwelling is £2,000; if they are all balcony access the estimate is £1,817. Heating is by individual solid fuel appliances throughout. Even the balcony access version is more expensive than the layout shown in Figure 9, which offers much better family living conditions.

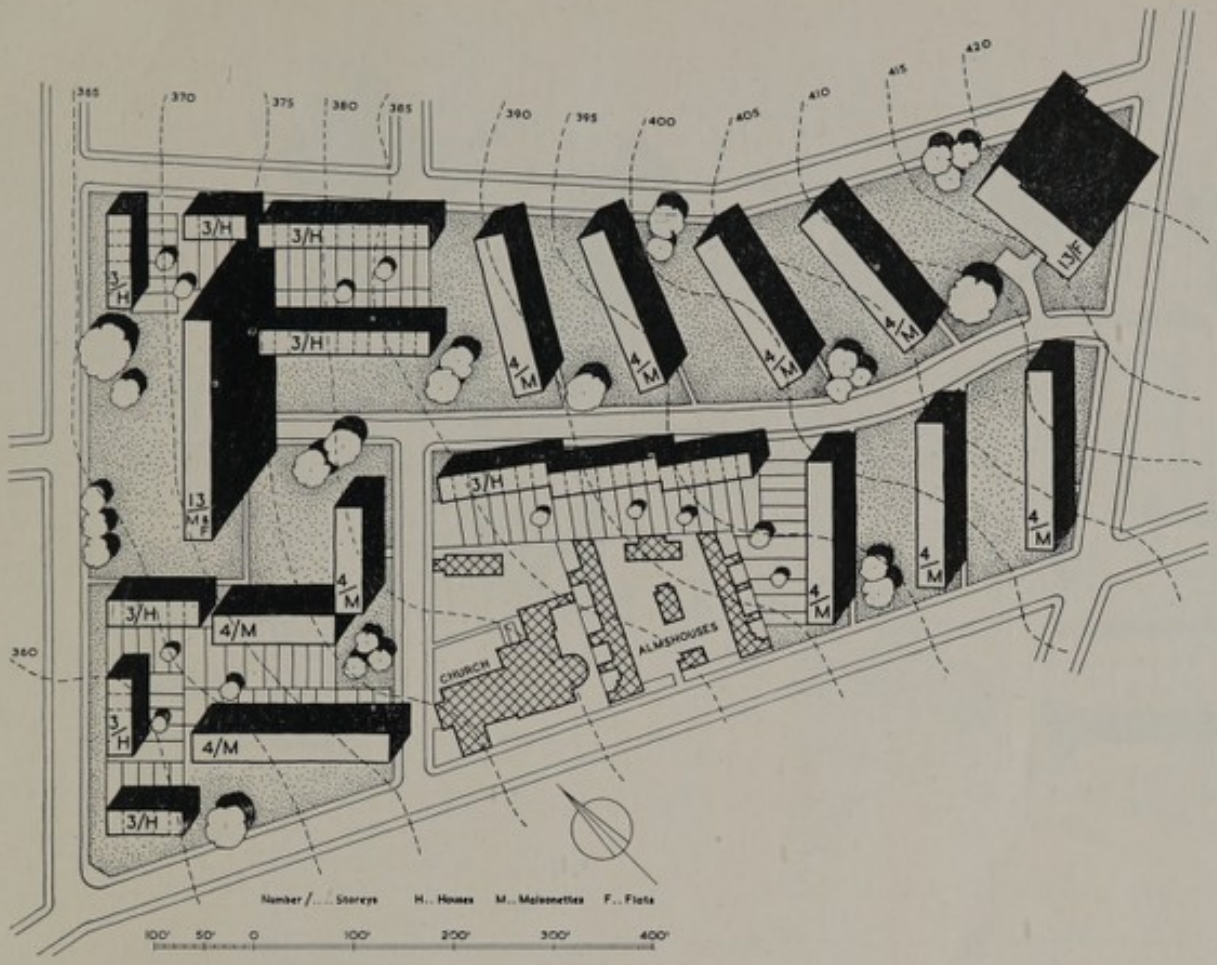


Figure 11

140 habitable rooms per acre.

Density: 140 habitable rooms per acre

No. of habitable rooms required . . 1,718
No. of dwellings required . . . 456

Type of dwelling and % required	3-Storey houses		4-Storey maisonettes		13-Storey flats		13-Storey maisonettes		Dwlgs.	Rms.
	Dwlgs.	Rms.	Dwlgs.	Rms.	Dwlgs.	Rms.	Dwlgs.	Rms.		
BSR. 1 p. 1 rm. 5% .	—	—	—	—	24	24	—	—	24	24
1 BR. 2 p. 2 rms. 5% .	—	—	—	—	24	48	—	—	24	48
2 BR. 4 p. 3 rms. 20% .	—	—	32	96	59	177	—	—	91	273
3 BR. 4 p. 4 rms. 25% .	—	—	30	120	—	—	84	336	114	456
3 BR. 5 p. 4 rms. 30% .	—	—	136	544	—	—	—	—	136	544
3 BR. 6 p. 5 rms. 8% .	36	180	—	—	—	—	—	—	36	180
4 BR. 7 p. 6 rms. 7% .	32	192	—	—	—	—	—	—	32	192
Totals . . .	68	372	198	760	107	249	84	336	457	1,717
Percentages . .	14·8	21·6	43·3	44·2	23·4	14·5	18·3	19·5	—	—

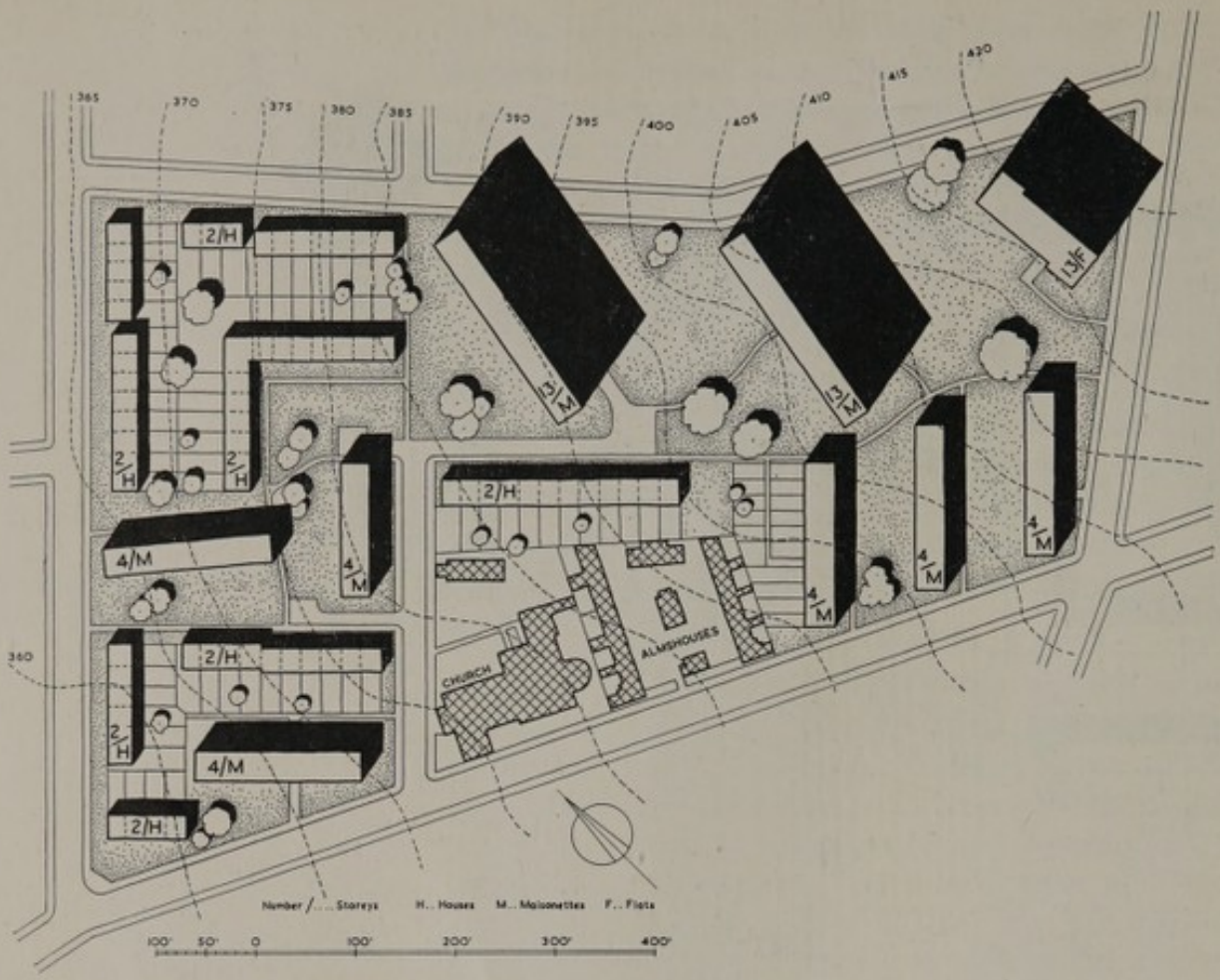


Figure 12

140 habitable rooms per acre.
See paragraph 35 on page 16.

Density: 140 habitable rooms per acre

No. of habitable rooms required . . 1,718
No. of dwellings required . . . 456

Type of dwelling and % required	2-Storey houses		4-Storey maisonettes		13-Storey flats		13-Storey maisonettes		Dwlgs.	Rms.
	Dwlgs.	Rms.	Dwlgs.	Rms.	Dwlgs.	Rms.	Dwlgs.	Rms.		
BSR. 1 p. 1 rm. 5% .	—	—	—	—	24	24	—	—	24	24
1 BR. 2 p. 2 rms. 5% .	—	—	—	—	24	48	—	—	24	48
2 BR. 4 p. 3 rms. 20% .	—	—	—	—	52	156	38	114	90	270
3 BR. 4 p. 4 rms. 25% .	—	—	—	—	—	—	114	456	114	456
3 BR. 5 p. 4 rms. 30% .	—	—	116	464	—	—	20	80	136	544
3 BR. 6 p. 5 rms. 8% .	37	185	—	—	—	—	—	—	37	185
4 BR. 7 p. 6 rms. 7% .	32	192	—	—	—	—	—	—	32	192
Totals . .	69	377	116	464	100	228	172	650	457	1,719
Percentages . .	15·0	21·9	25·3	26·9	21·8	13·2	37·6	37·7	—	—

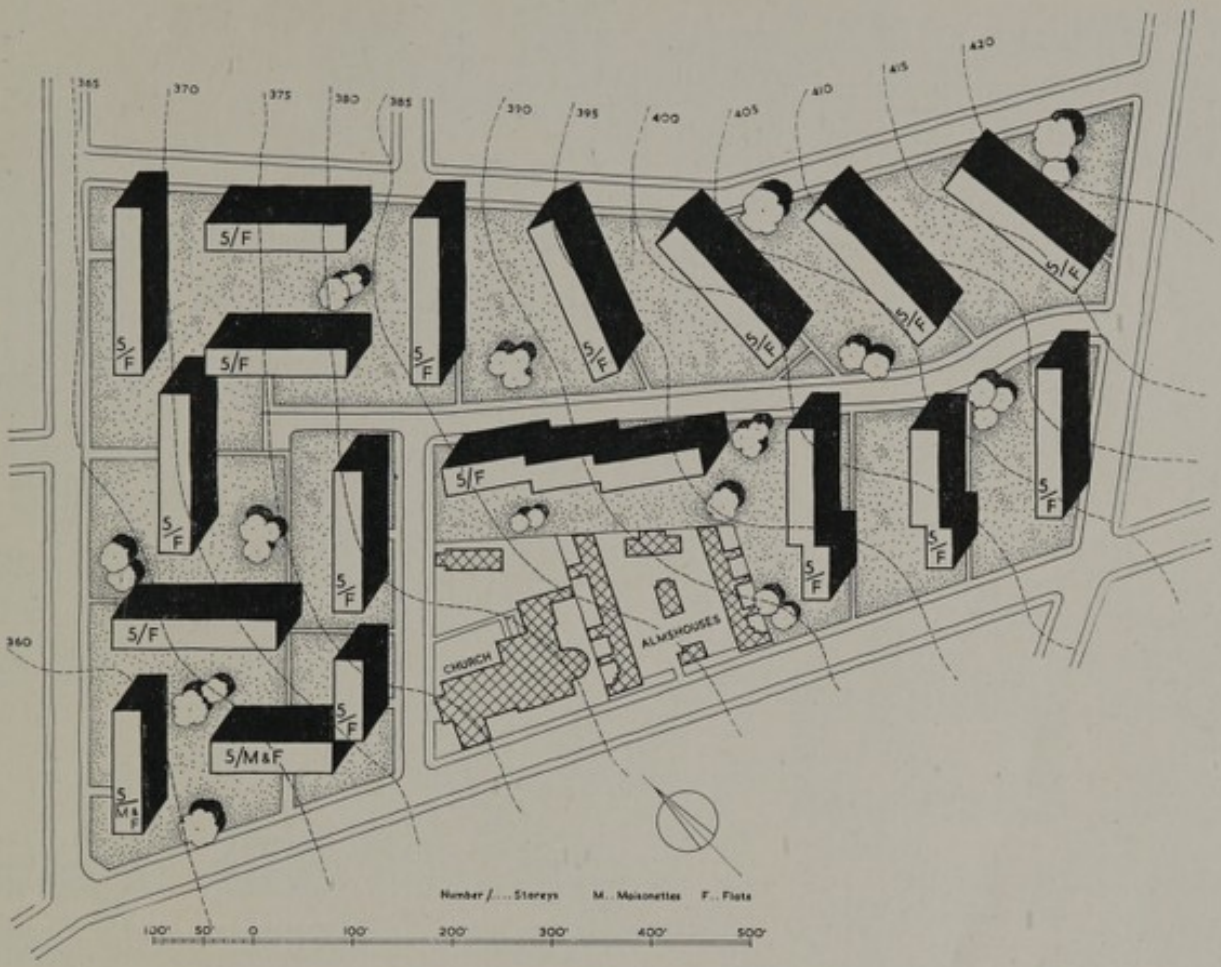


Figure 13

140 habitable rooms per acre.
See paragraph 36 on page 16.

Density: 140 habitable rooms per acre

No. of habitable rooms required . . 1,718
No. of dwellings required . . . 456

Type of dwelling and % required	5-Storey flats		5-Storey flats and masionettes		Dwlgs.	Rms.
	Dwlgs.	Rms.	Dwlgs.	Rms.		
BSR. 1 p. 1 rm. 5% .	25	25	—	—	25	25
1 BR. 2 p. 2 rms. 5% .	25	50	—	—	25	50
2 BR. 4 p. 3 rms. 20% .	90	270	—	—	90	270
3 BR. 4 p. 4 rms. 25% .	115	460	—	—	115	460
3 BR. 5 p. 4 rms. 30% .	135	540	—	—	135	540
3 BR. 6 p. 5 rms. 8% .	30	150	8	40	38	190
4 BR. 7 p. 6 rms. 7% .	—	—	32	192	32	192
Totals . . .	420	1,495	40	232	460	1,727
Percentages . .	91·3	86·5	8·7	13·5	—	—

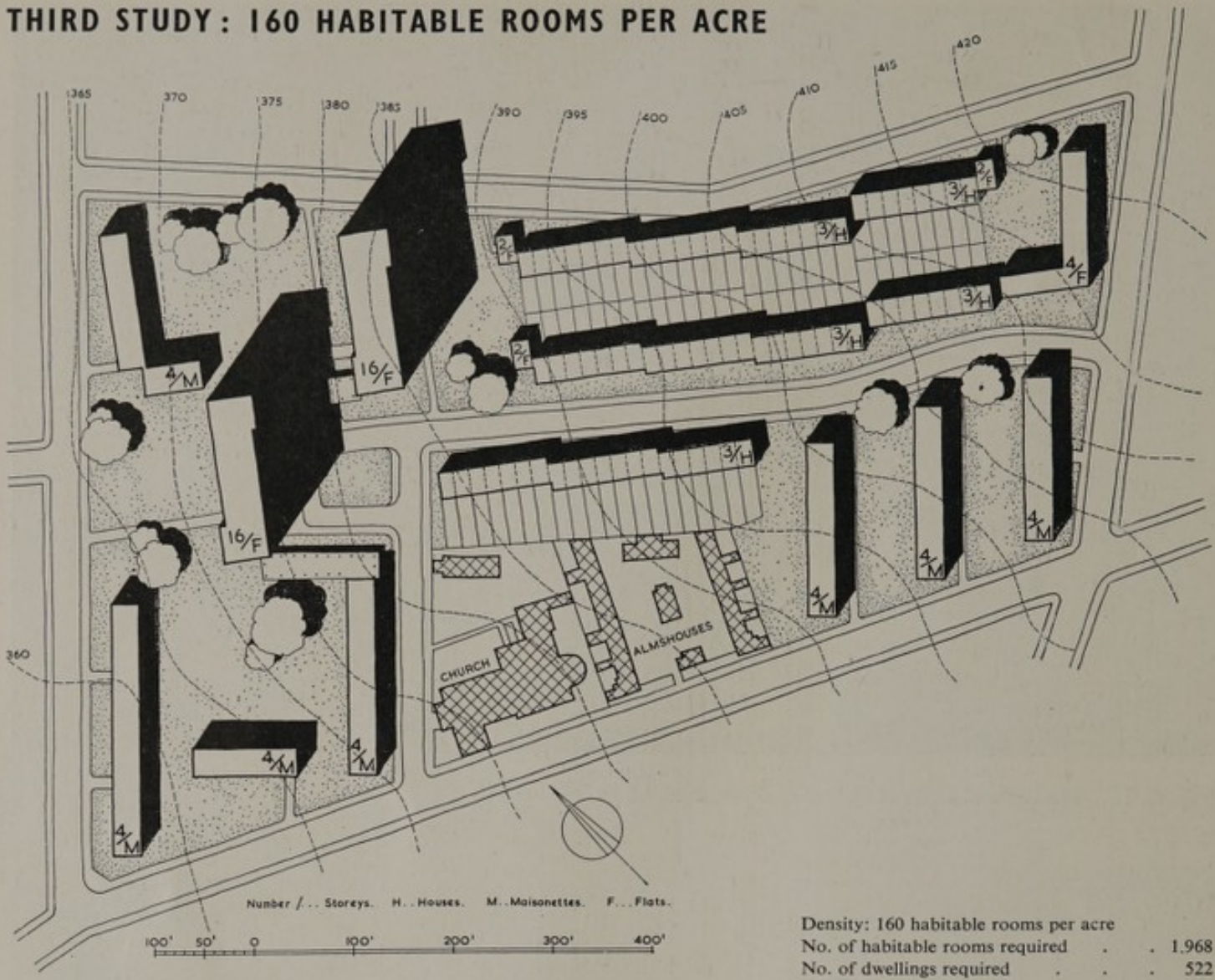
SCHEMES AT A DENSITY OF ABOUT 140 HABITABLE ROOMS PER ACRE

Figure 14 Loughborough Road Estate. London County Council.

Figure 15 Houses and Flats at Gospel Oak, St. Pancras M.B.C.

Figure 16 Loughborough Road Estate. London County Council.

THIRD STUDY: 160 HABITABLE ROOMS PER ACRE



Density: 160 habitable rooms per acre
No. of habitable rooms required . . 1,968
No. of dwellings required . . . 522

Type of dwelling and % required	2-Storey flats		3-Storey houses		4-Storey flats		4-Storey maisonettes		16-Storey flats		Dwlgs.	Rms.
	Dwlgs.	Rms.	Dwlgs.	Rms.	Dwlgs.	Rms.	Dwlgs.	Rms.	Dwlgs.	Rms.		
BSR. 1 p. 1 rm. 5% . .	—	—	—	—	24	24	—	—	—	—	24	24
1 BR. 2 p. 2 rms. 5% . .	6	12	—	—	16	32	—	—	—	—	22	44
2 BR. 4 p. 3 rms. 20% . .	—	—	—	—	—	—	—	—	112	336	112	336
3 BR. 4 p. 4 rms. 25% . .	—	—	—	—	—	—	—	—	128	512	128	512
3 BR. 5 p. 4 rms. 30% . .	—	—	—	—	—	—	152	608	4	16	156	624
3 BR. 6 p. 5 rms. 8% . .	—	—	42	210	—	—	—	—	—	—	42	210
4 BR. 7 p. 6 rms. 7% . .	—	—	36	216	—	—	—	—	—	—	36	216
Totals	6	12	78	426	40	56	152	608	244	864	520	1,965
Percentages . . .	1·2	0·6	15·0	21·7	7·7	2·8	29·2	30·9	46·9	44·0	—	—

Figure 17

160 habitable rooms per acre: 12·3 acres: 1,966 habitable rooms: 520 dwellings.

37. In this layout the aim is again to keep to the minimum the proportion of the dwellings that are in high blocks. Even at this density it has been possible to provide 51·3 per cent. of the dwellings in buildings of four storeys or less. The freedom to do so comes from the adoption of the two 16-storey short slab blocks of flats which contain all the four-person dwellings. Practically all the five-person families are in the

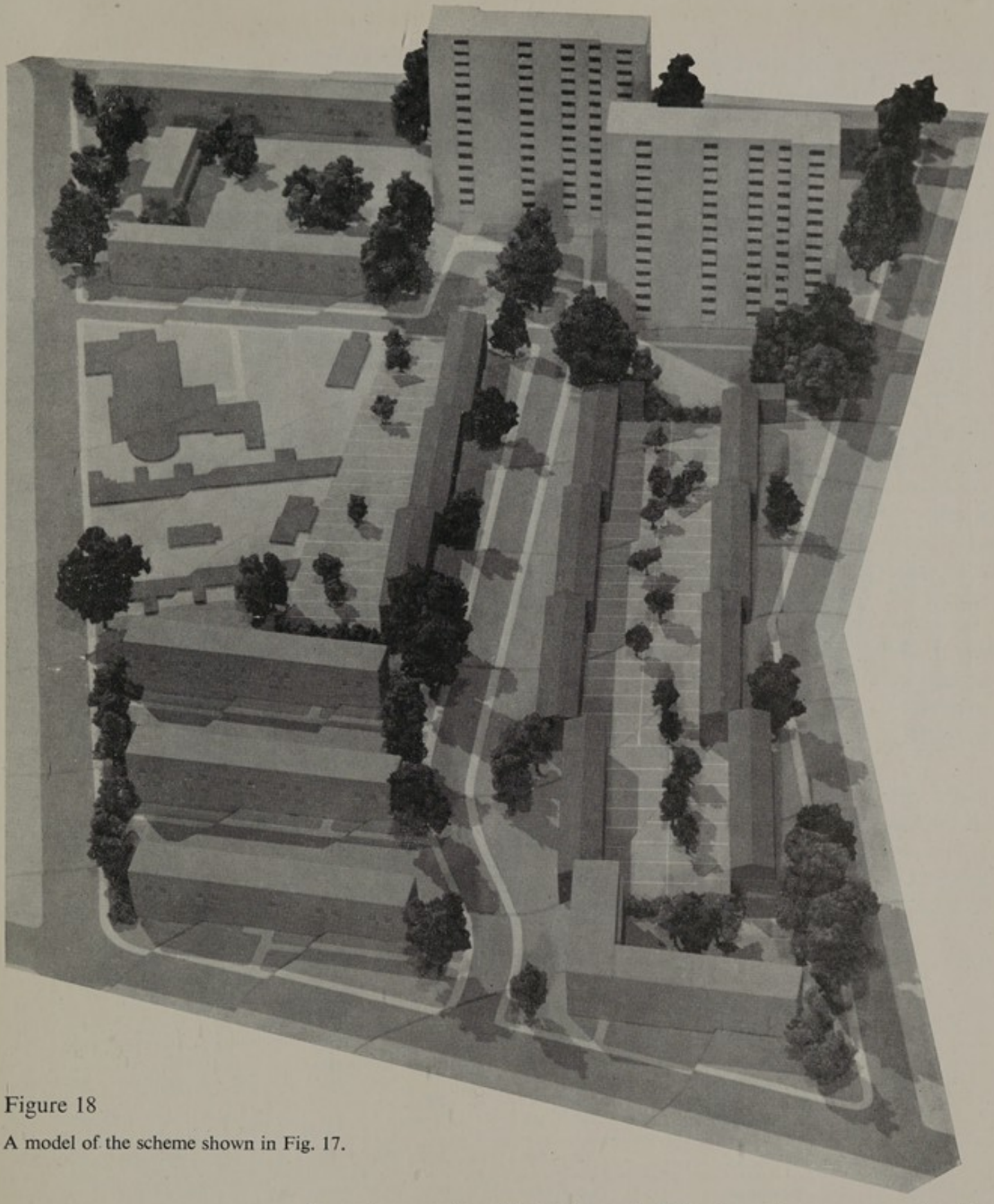
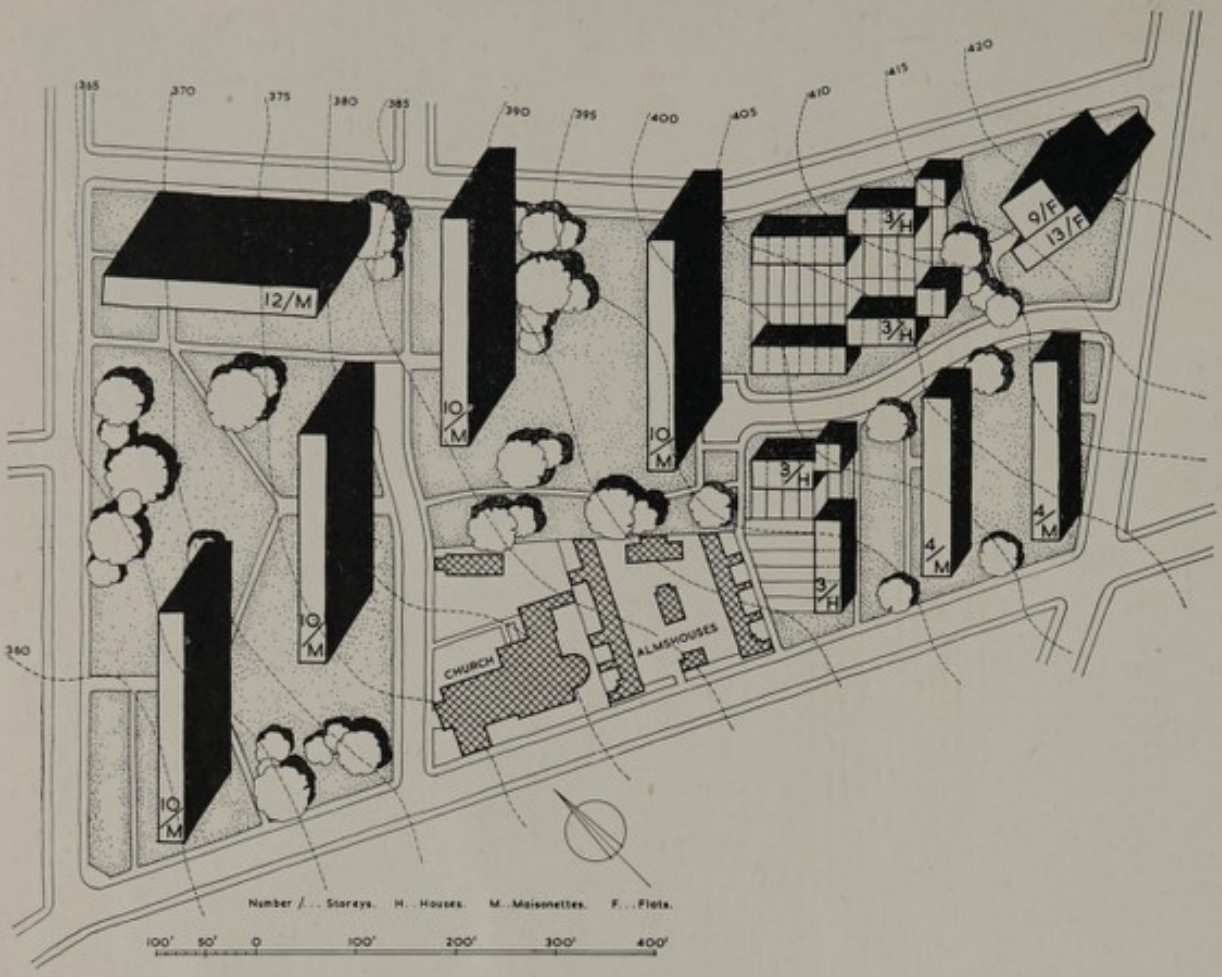


Figure 18

A model of the scheme shown in Fig. 17.

four-storey maisonette blocks, and all the six- and seven-person families are in the 78 three-storey houses. The estimated average building cost per dwelling with central heating in the high blocks is £1,938. A cost estimate for a version with individual solid fuel appliances throughout is not given because this type of installation would not be suitable in the 16-storey blocks. The cost of this layout is lower than that in Figure 19 which follows, and again the economy can be attributed to the placing of a relatively low proportion of dwellings in the high blocks.



Density: 160 habitable rooms per acre

No. of habitable rooms required . . 1,968
No. of dwellings required . . . 522

Type of dwelling and % required	3-Storey houses		4-Storey maisonettes		10-Storey maisonettes		9- and 13-Storey flats		12-Storey maisonettes		Dwlgs.	Rms.
	Dwlgs.	Rms.	Dwlgs.	Rms.	Dwlgs	Rms.	Dwlgs.	Rms.	Dwlgs.	Rms.		
BSR. 1 p. 1 rm. 5% . .	—	—	—	—	—	—	26	26	—	—	26	26
1 BR. 2 p. 2 rms. 5% . .	—	—	—	—	—	—	26	52	—	—	26	52
2 BR. 4 p. 3 rms. 20% . .	—	—	—	—	60	180	18	54	30	90	108	324
3 BR. 4 p. 4 rms. 25% . .	—	—	—	—	112	448	—	—	18	72	130	520
3 BR. 5 p. 4 rms. 30% . .	—	—	—	—	120	480	—	—	36	144	156	624
3 BR. 6 p. 5 rms. 8% . .	—	—	40	200	—	—	—	—	—	—	40	200
4 BR. 7 p. 6 rms. 7% . .	36	216	—	—	—	—	—	—	—	—	36	216
Totals	36	216	40	200	292	1,108	70	132	84	306	522	1,962
Percentages . . .	6·9	11·0	7·7	10·2	55·9	56·5	13·4	6·7	16·1	15·6	—	—

Figure 19

160 habitable rooms per acre.

38. Figure 19 shows **the effect of limiting the height of the buildings** to what in practice has been the limit hitherto for most local authorities, 10 to 12 storeys. The scheme has 85·4 per cent. of the dwellings in high buildings—one 12-storey maisonette block, four 10-storey maisonette blocks, and one tower block which is partly 13 storeys and partly 9 storeys. The six-person households are in two blocks of four-storey

maisonettes, and the seven-person households are in terraces of three-storey houses. All the five-person and smaller households are in the high buildings.

39. The estimated average building cost per dwelling goes up to £2,147 for the version with central heating in high blocks, which compares with the figure of £1,938 for Figure 17, an increase of 10·7 per cent. (For a version of Figure 19 using individual solid fuel appliances throughout the estimated average building cost per dwelling is £2,040.)

Layouts on other sites

40. The studies illustrated above relate to a particular shape and size of site, with the limitations which this implies. For both smaller and larger sites of different shape, with different requirements as to the retention of existing buildings, and with a different layout of existing streets and main services, comparisons of a similar nature could be prepared and would no doubt give different results. For instance, it is to be expected that, for a given density, the smaller the site the greater will be the volume of high building and therefore the greater the average cost per dwelling. Again, the particular location of some sites will rightly demand a type of development more costly than one which could be evolved if minimum cost were the only aim. Or it might be wise to increase the volume of high buildings above the minimum if this is necessary in order to preserve mature trees.

41. Some of these variations are considered in the four studies which follow. The sites are of different sizes and shapes, and are to be developed at different densities. Each study starts with a preliminary sketch layout, and shows ways in which the estimated average building cost per dwelling for the preliminary sketch layout could be reduced.

Figure 20

A scheme at a density of about 180 habitable rooms per acre.
Churchill Gardens, Pimlico, Westminster. Westminster City Council.

FOURTH STUDY: 80 HABITABLE ROOMS PER ACRE

42. These two layouts illustrate alternative ways of developing a small site (3·9 acres) which has fine groups of mature trees. Access to the site is by a connection to an existing road on the east and by footpath to a main road on the west.

43. The scheme in Figure 21 comprises **three 10-storey blocks,** each with two lifts and two staircases serving four flats on each floor, and 10 bungalows. The estimated average building cost per dwelling is £2,084 with central heating in the high blocks, or £2,023 if heating is by individual solid fuel appliances throughout.

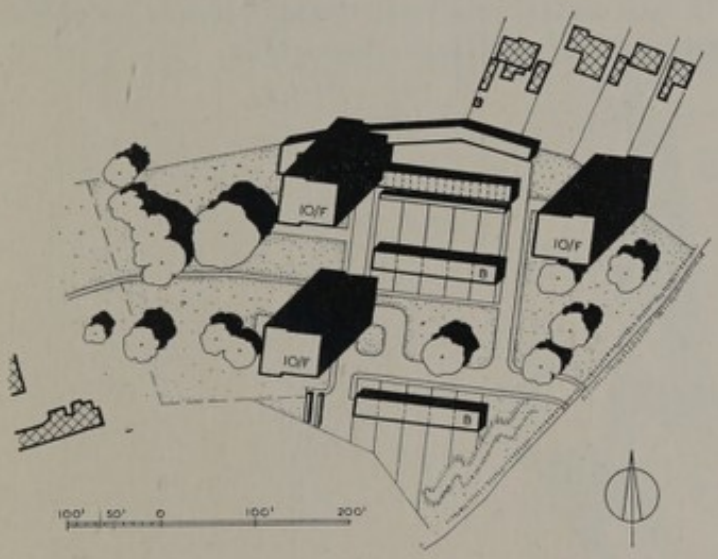


Figure 21

44. In Figure 22 **the volume of high building is reduced from 92 per cent. to 72 per cent.,** and whereas six lifts and six staircases are needed in Figure 21 only two of each are needed in the 11-storey double-tower block. A four-storey block of maisonettes, and a three-storey block of maisonettes and flats, contain the rest of the dwellings. There is less road work than in the scheme in Figure 21, and the group of garages is placed nearer to the entrance of the site. The estimated average building cost per dwelling is £1,857 per dwelling with central heating in the high block, or £1,794 if heating is by individual solid fuel appliances throughout. These figures are approximately 11 per cent. below the corresponding costs of the scheme in Figure 21.

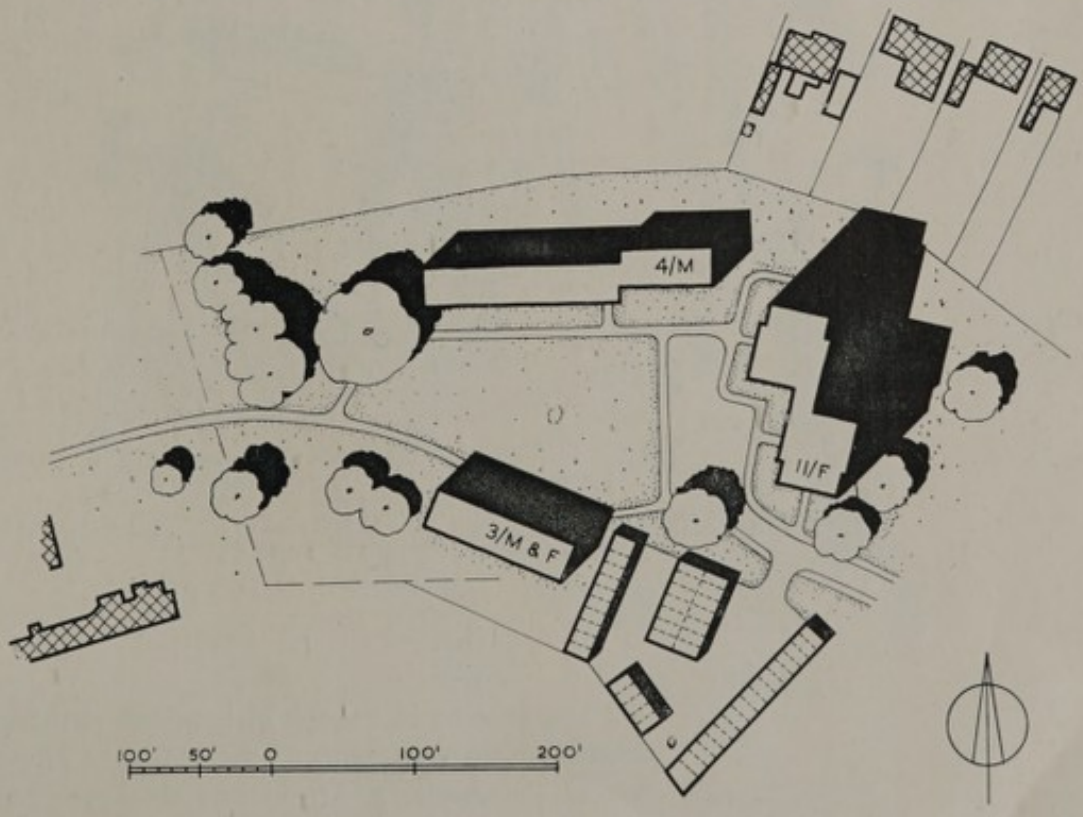


Figure 22

45. These two layouts illustrate alternative ways of developing a level site of 6·5 acres. It is bounded on the east by a large park and on the west by a main traffic road. An existing public house (shown cross-hatched) is to be retained.

46. The scheme in Figure 23 provides for **74 per cent. of the dwellings in 11- and 7-storey blocks,** 21 per cent. in four-storey maisonettes and 5 per cent. in two-storey houses. Eight lifts and eight staircases are needed in the high buildings, and the estimated average building cost per dwelling is £1,971 with central heating in the high blocks, or £1.916 if there are individual solid fuel appliances throughout.

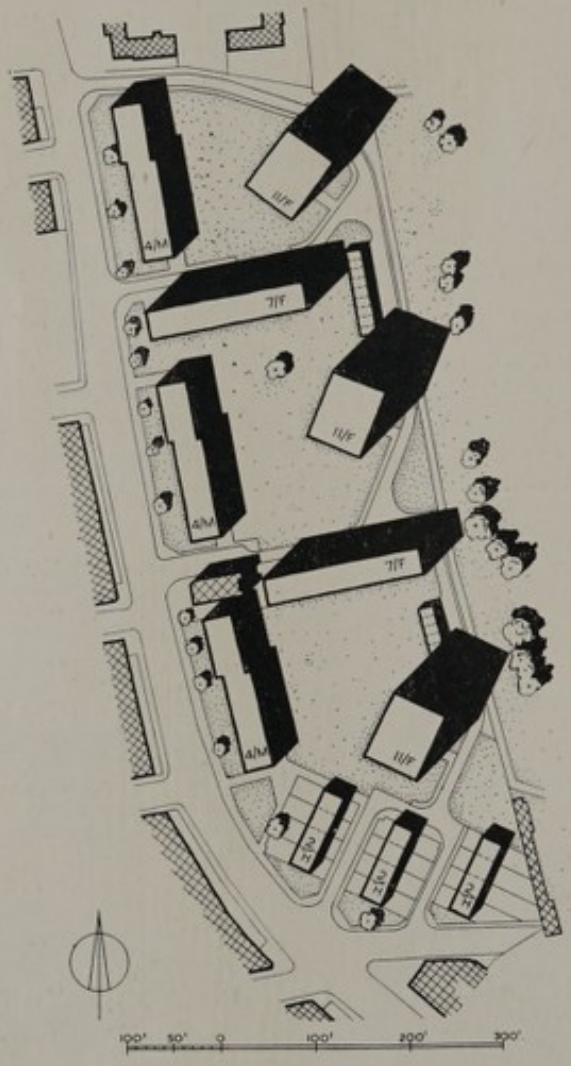


Figure 23

47. The scheme in Figure 24 uses **only one high building,** an 11-storey double-tower block with 88 dwellings, or 32 per cent. of the total. The rest of the dwellings are in one six-storey block of maisonettes, five

blocks of four-storey maisonettes, and 29 houses. This design requires only two lifts and two staircases in the double-tower block and one lift and one staircase in the six-storey maisonette block. The estimated average building cost per dwelling is £1,636 for the version with central heating in the 11-storey block, or £1,614 if all the dwellings have individual solid fuel appliances. These figures represent savings of 16·9 per cent. and 15·7 per cent. respectively on the corresponding costs of Figure 23.

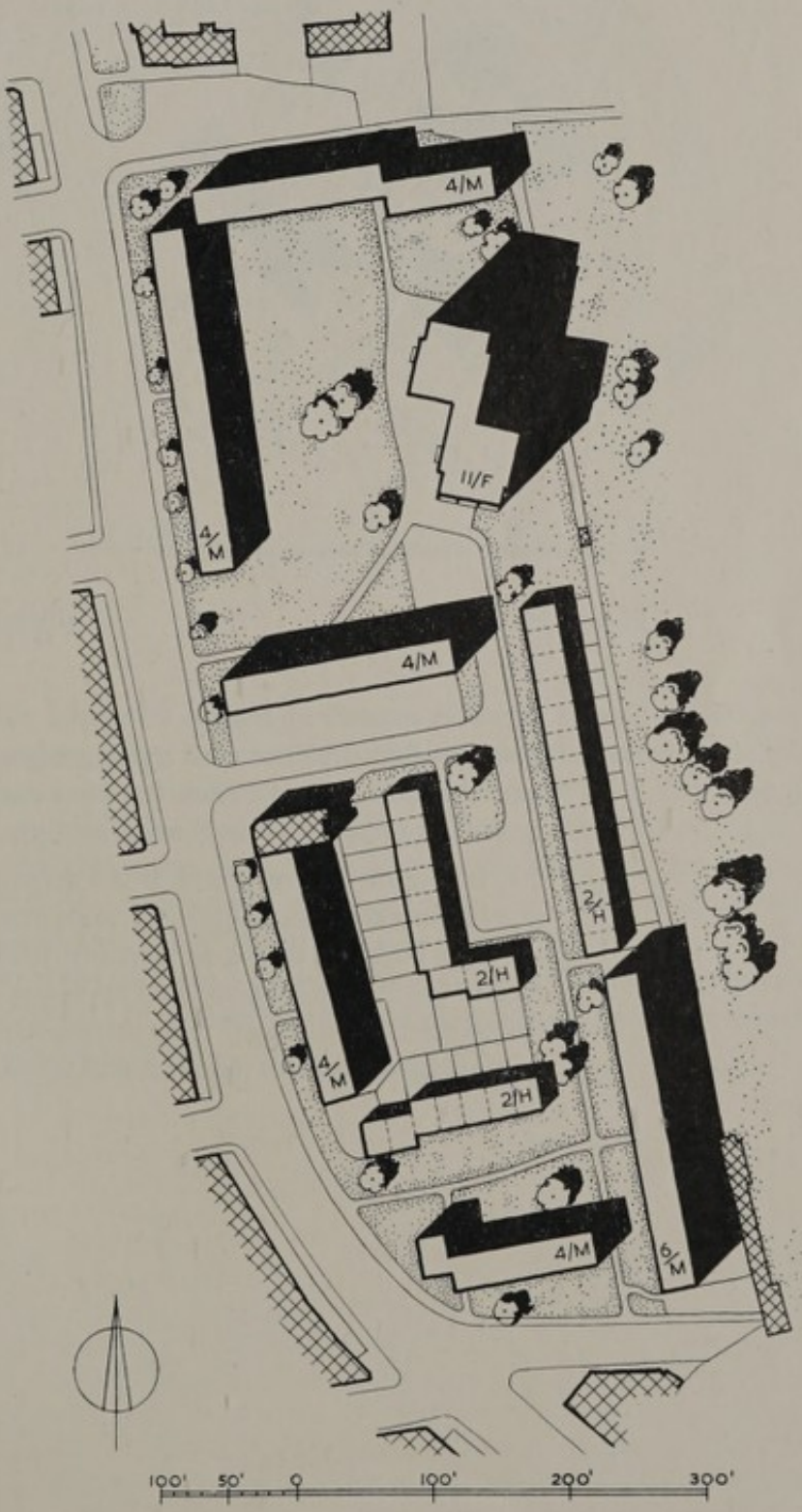


Figure 24

SIXTH STUDY: 78 HABITABLE ROOMS PER ACRE

48. This study shows three alternative ways of developing another small site (three acres) where 78 two-bedroom four-person dwellings are required to give a density of 78 habitable rooms per acre. The development, which is to complete a scheme of cottages, is situated in a prominent position alongside a main traffic road and a roundabout.

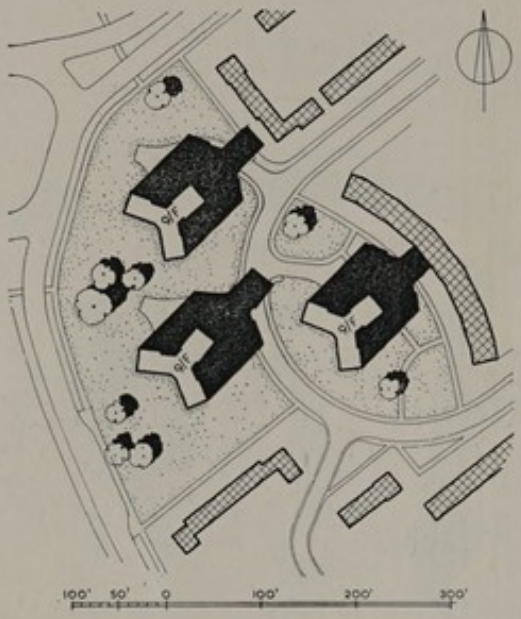


Figure 25

Figure 26

49. The scheme in Figure 25 shows the accommodation provided in **three Y-shaped blocks nine storeys high.** This design requires six lifts and six staircases and each dwelling costs £2,564 with central heating, or £2,462 with individual solid fuel appliances.

50. In Figure 26 the whole of the accommodation is shown in **one 10-storey short slab,** needing only two staircases and two lifts. The estimated average building cost per dwelling with central heating is £2,320, or £2,231 for individual solid fuel appliances. These are savings of approximately 9·5 per cent. and are attributable to the reduction in the number of staircases and lifts required and to the economy of the short slab.

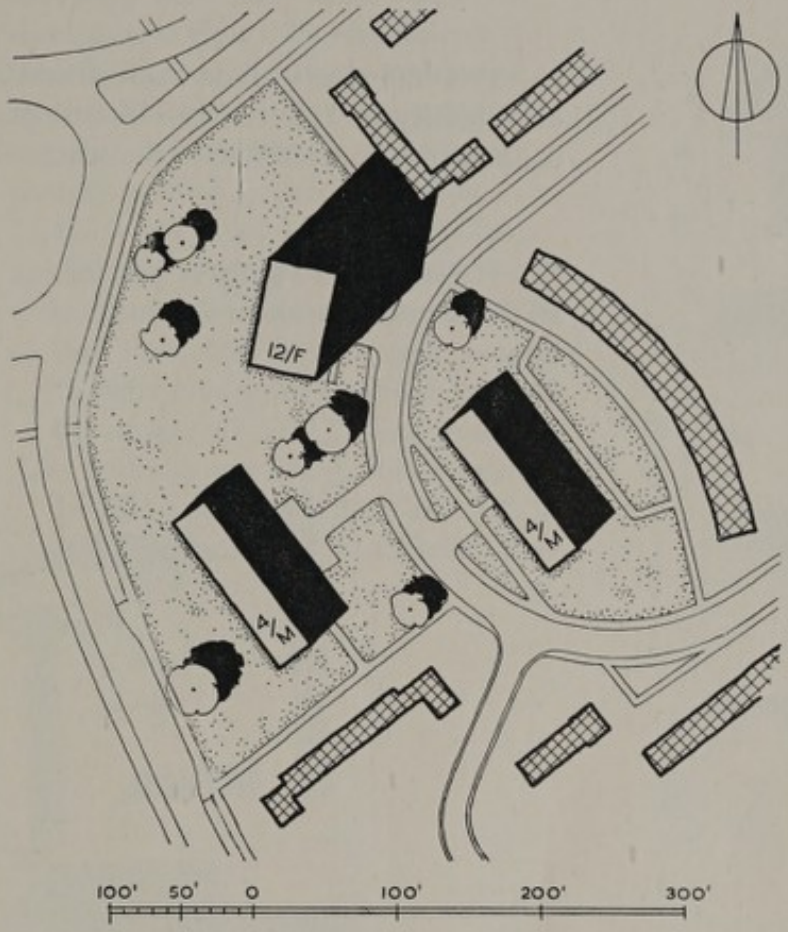


Figure 27

51. Figure 27 shows a scheme in which, **instead of 100 per cent. high building, 41 per cent. of the accommodation is provided in two blocks of four-storey maisonettes,** with the remainder in a 12-storey block using two staircases and two lifts and with four flats on each floor. The estimated average building cost per dwelling for this scheme is £2,026 with central heating in the high block, or £1,974 if all the heating is by individual solid fuel appliances. These are savings of approximately 20·9 per cent. and 19·8 per cent. compared with the respective versions of Figure 25, and are attributable to reducing the proportion of dwellings in high buildings.

52. This study shows four ways of developing a level site of 4·5 acres at a density of 111 habitable rooms per acre. There are two recently constructed blocks of flats in the centre of the site, shown cross-hatched.

53. The scheme in Figure 28 provides **all the accommodation in six blocks of eight or nine storeys**, each with four flats per floor and using altogether 12 staircases and 12 lifts. The estimated average building cost per dwelling is £2,255 with central heating, or £2,165 with individual solid fuel appliances.

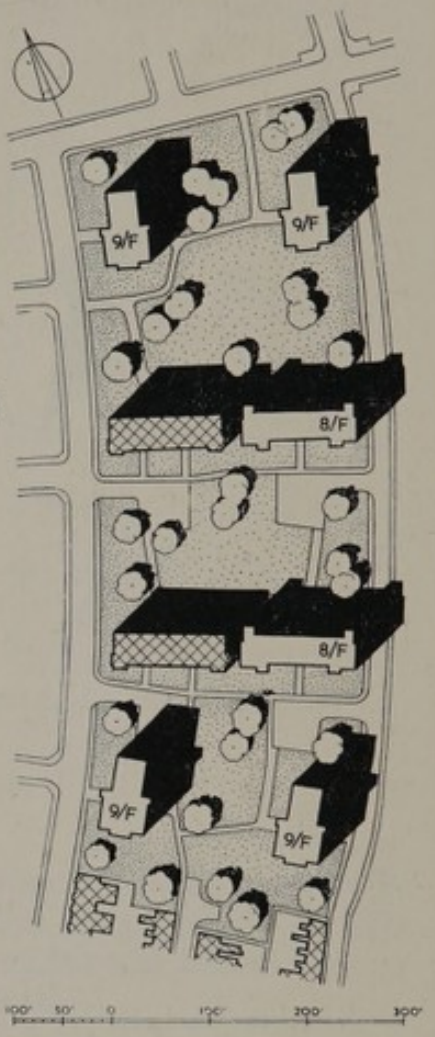


Figure 28

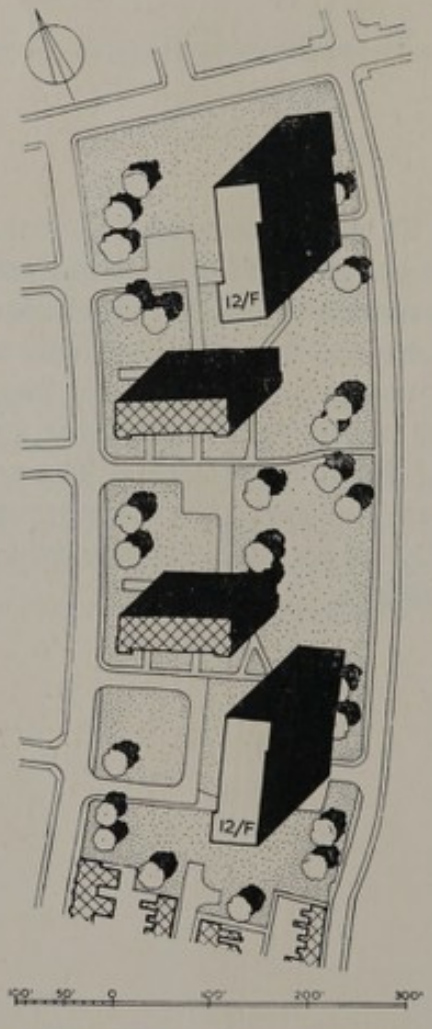


Figure 29

54. The scheme in Figure 29 provides **all the accommodation in two 12-storey short slab blocks** of flats, each containing 94 dwellings and having eight flats per floor and using altogether four staircases and four lifts. The estimated average building cost per dwelling is £2,058 with central heating, or £1,979 with solid fuel appliances. The savings of approximately 8·7 per cent. over Figure 28 are attributable to the reduction in the number of staircases and lifts required and to the economy of the short slab.

55. The scheme in Figure 30 has **one 12-storey short slab block similar to those used in Figure 29, with the rest of the dwellings in four-storey maisonette blocks.** The estimated average building cost per dwelling is £1,643 with central heating in the high block or £1,612 with individual solid fuel appliances throughout. These are

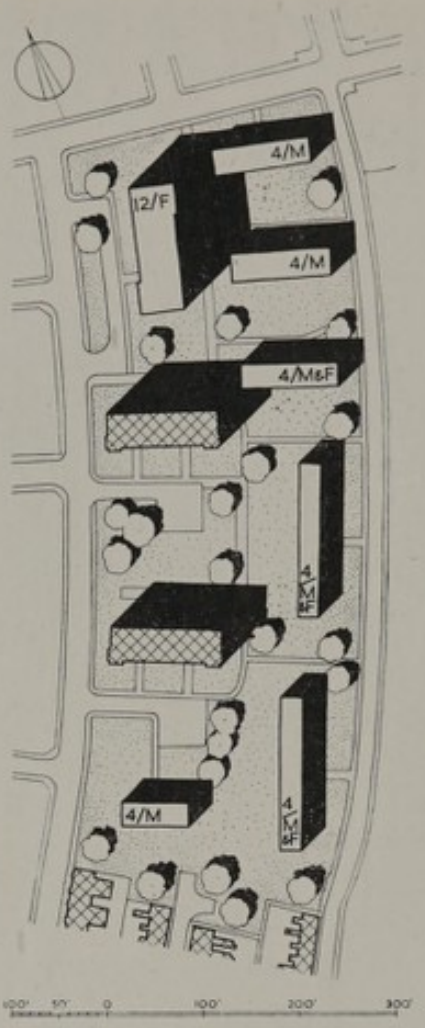


Figure 30

savings of approximately 27·1 per cent. and 25·2 per cent. respectively over Figure 28, attributable to halving the proportion of dwellings in high buildings.

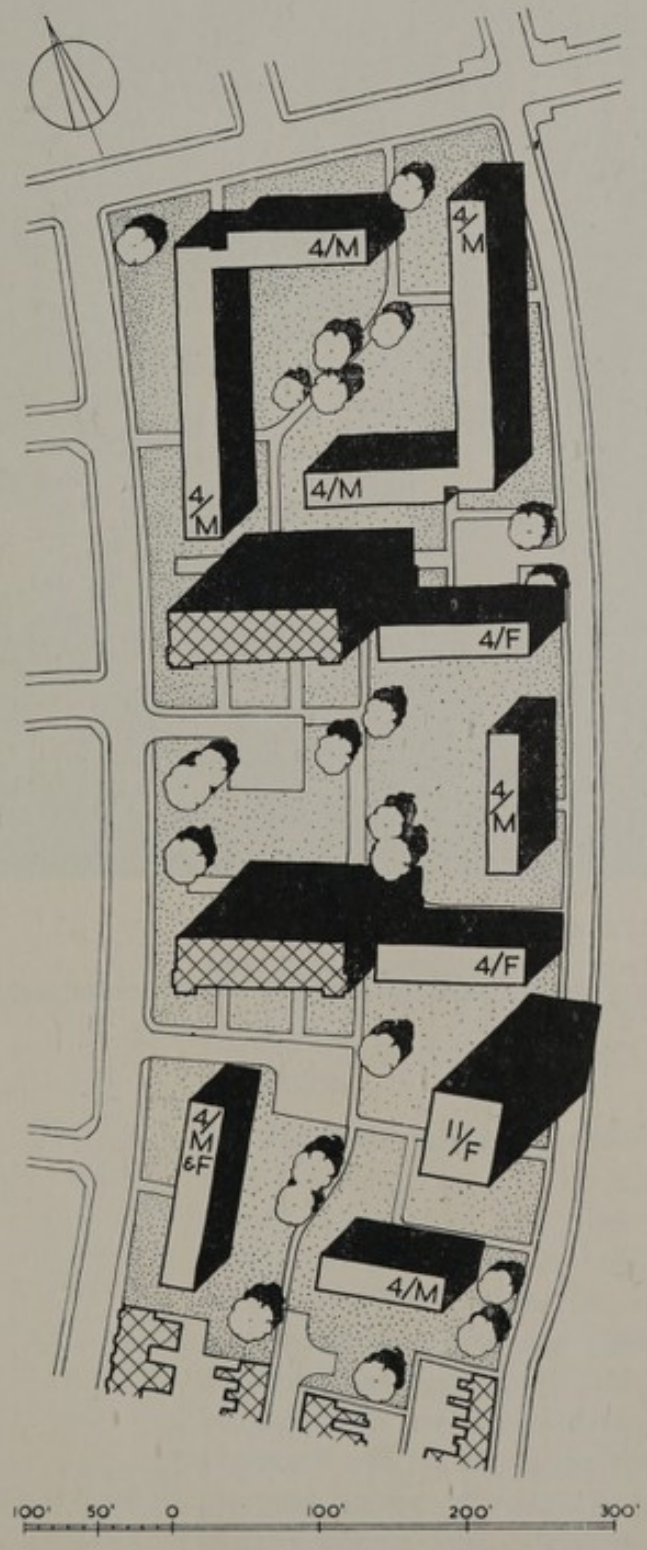


Figure 31

56. The scheme in Figure 31, which is the least costly of the four, uses **only one single-tower 11-storey building,** containing 42 dwellings and having four flats per floor, served by two staircases and two lifts. **The remaining 77 per cent. of the dwellings are in four-storey blocks of maisonettes and/or flats.** The estimated average building cost per dwelling is £1,521 with central heating in the high block or £1,511 with individual solid fuel appliances throughout. Compared with Figure 28 these figures offer savings of 32·6 per cent. and 30·2 per cent. respectively.

Figure 32

A scheme using tower blocks of flats, low blocks of flats and maisonettes, and two-storey houses; and designed to preserve much of the existing landscape.

Ackroydon Estate, Princes Way, Wandsworth. London County Council.

Part 3.

The Implications of the Studies

57. These studies have shown ways in which sites of various sizes and shapes can be developed at various densities, using in combination buildings of different heights; and in some cases the results are compared with layouts using buildings of uniform height, such as Figures 13, 25 and 28. The better family living conditions in the mixed schemes are obtainable at no greater cost and usually, when the mixed scheme is economically designed, at a lower cost.

58. **The basic objective** in designing mixed layouts as economically as possible at a given density is to keep down the proportion of dwellings in high buildings.

59. For instance, with densities of up to 100 h.r.a., or perhaps even a little higher, which can be reached with houses and blocks not more than four storeys in height, the aim is to provide the highest possible proportion of dwellings in houses, for these are between £200 and £250 cheaper than four-storey maisonettes and the more there are of them in such a scheme the lower is the overall average cost per dwelling.

60. Similarly, in a scheme at a much higher density using four-storey maisonettes and high buildings, the aim is to have the highest possible proportion of four-storey maisonettes, for these are £400–£500 cheaper than dwellings in high buildings.

61. This aim applies also when a scheme using four-storey maisonettes and high buildings includes a proportion of houses, with the additional consideration, illustrated by Figure 12, that, although houses are cheaper, if there are too many of them the volume of high building will rise sharply, and so will the overall average cost per dwelling. This means that in schemes using all three types of building the proportion of rooms in houses should be kept reasonably low. But Figure 11 shows that more houses can be provided by using three-storey types; and it follows that, for a given proportion of houses, three-storey types will require less land and therefore ease the problems of laying out the rest of the site.

62. **The basic method** of achieving a given density with a minimum of high building is to lay out each type of building used—houses, four-storey maisonettes, and high maisonettes or flats—at its maximum practicable density, having regard to daylighting and the characteristics of the site. Then, if the individual densities of both the four-storey maisonettes and the high maisonettes or flats are at their practicable maximum, as many as possible of the dwellings will be in four-storey blocks and as few as possible in the high blocks. Consider, for instance, Figures 9 and 12, which are both schemes for a layout at 140 h.r.a. Of the total number of rooms in high blocks and four-storey maisonettes in each scheme, Figure 9 has a third in the high blocks: Figure 12 has nearly two-thirds. The main reason for the difference is the very high

density attained in Figure 9 with the two 13-storey blocks. In Figure 12, the proportion of rooms in high blocks would have been even larger had it not been for the very high density at which, in this particular arrangement, it proved possible to lay out the four-storey maisonettes. (The figures are set out in Table 5 on page 38.)

63. It will be seen from the layout plans that the achievement of high densities with each class of building does not mean that they are cramped on the site. The spacing is controlled by the daylighting code referred to in paragraph 22 on page 6, and for houses by the need for privacy ; but where a large number of buildings of the same height are used together, the same densities should not be sought as where there are fewer such buildings, or the result may well be monotonous.

64. There are of course many sites on which, because they are small, or are cut up by existing streets which need to be retained, it may be necessary to have a comparatively large proportion of high building in order to reach the density required.

65. In other cases, high buildings may be necessary to preserve valuable existing trees or other landscape features, as in Figure 22; or to provide a visual focus on a large development, as in Figure 27; or again to take advantage of first-class views or other special features of the site. All these circumstances have to be judged on their merits, and the preceding paragraphs affect them only to the extent of showing the advantages, even in situations such as these, of keeping the proportion of high building as low as possible.

66. Most of the attention in designing layouts is rightly concentrated more on the disposition of buildings than on the planning of the buildings themselves, but, although buildings are dealt with in a later chapter, there are several ways in which the choice and planning of the buildings affect the overall cost per dwelling of a layout. For example, besides giving a lower cost per dwelling, larger buildings as compared with smaller ones demand less land to meet the daylighting requirements. It follows that the use of larger buildings rather than a greater number of smaller ones enables the high buildings to be laid out at a higher density. In consequence there needs to be a smaller total volume of high building, as noted in paragraph 62 above.

67. On the other hand, on a site of limited size, and at a density which requires only a small proportion of high building, a tower block with only four flats per floor, though not the most economical of high buildings, can help to reduce the overall cost per dwelling. A more economical block, such as a short slab, would give a lower cost per dwelling in high building; but would unnecessarily increase the number of expensive dwellings in the scheme, so that the overall average cost per dwelling would go up. This can be seen by comparison of Figures 27 and 26.

68. The need for the maximum density in each class of building explains why little use is made in the layout studies of blocks of seven, eight or nine storeys: it is usually better, from the aspect of overall cost, to go higher.

Table 3. Estimated Layout Costs

Based on INDIVIDUAL SOLID FUEL APPLIANCES throughout

	Figure No.	Number of dwellings	Percentage of dwellings in buildings of more than four storeys	Estimated total building cost	Estimated average building cost per dwelling	Excess over lowest
First Study:						
100 Habitable rooms per acre: 12·3 acres	3	327	—	£497,000	£1,520	Lowest
	5	325	51	£577,000	£1,775	+ £255 or 16·8%
Second Study:						
140 Habitable rooms per acre: 12·3 acres	9	456	41·9	£802,000	£1,759	Lowest
	11	457	41·7	£809,000	£1,770	+ £11 or 0·6%
	12	457	59·4	£844,000	£1,847	+ £88 or 5·0%
	13 (*a*)	460	100	£836,000	£1,817	+ £58 or 3·3%
	13 (*b*)	460	100	£920,000	£2,000	+ £241 or 13·7%
Third Study						
160 Habitable rooms per acre: 12·3 acres	19	522	85·4	£1,065,000	£2,040	—
Fourth Study						
80 Habitable rooms per acre: 3·9 acres	21	130	92·4	£263,000	£2,023	+ £229 or 12·8%
	22	126	69·9	£226,000	£1,794	Lowest
Fifth Study:						
124 Habitable rooms per acre: 6·5 acres	23	274	73·7	£525,000	£1,916	+ £302 or 18·7%
	24	275	32·0	£444,000	£1,614	Lowest
Sixth Study:						
78 Habitable rooms per acre: 3 acres	25	78	100	£192,000	£2,462	+ £488 or 24·7%
	26	78	100	£174,000	£2,231	+ £257 or 13·0%
	27	78	59·0	£154,000	£1,974	Lowest
Seventh Study:						
111 Habitable rooms per acre: 4·5 acres	28	188	100	£407,000	£2,165	+ £654 or 43·2%
	29	188	100	£372,000	£1,979	+ £468 or 30·9%
	30	188	49·0	£303,000	£1,612	+ £101 or 6·6%
	31	188	23·3	£284,000	£1,511	Lowest

Note: All the estimates are for buildings only, and exclude site clearance and levelling, roads, footpaths, sewers and public utility mains, abnormal foundations, abnormal external works and professional fees.

Table 4. Estimated Layout Costs

Based on CENTRAL HEATING and hot water service in high buildings and INDIVIDUAL SOLID FUEL APPLIANCES in houses and four-storey maisonettes

	Figure No.	Number of dwellings	Percentage of dwellings in buildings of more than four storeys	Estimated total building cost	Estimated average building cost per dwelling	Excess over lowest
First Study: 100 Habitable rooms per acre: 12·3 acres	5	325	51·0	£596,000	£1,834	—
Second Study: 140 Habitable rooms per acre: 12·3 acres	9	456	41·9	£826,000	£1,811	Lowest
	11	457	41·7	£833,000	£1,823	+ £12 or 0·6%
	12	457	59·4	£876,000	£1,917	+ £106 or 5·8%
Third Study: 160 Habitable rooms per acre: 12·3 acres	17	520	46·9	£1,008,000	£1,938	Lowest
	19	522	85·4	£1,121,000	£2,147	+ £209 or 10·7%
Fourth Study: 80 Habitable rooms per acre: 3·9 acres	21	130	92·4	£271,000	£2,084	+ £227 or 12·2%
	22	126	69·9	£234,000	£1,857	Lowest
Fifth Study: 124 Habitable rooms per acre: 6·5 acres	23	274	73·7	£540,000	£1,971	+ £335 or 20·4%
	24	275	32·0	£450,000	£1,636	Lowest
Sixth Study: 78 Habitable rooms per acre: 3 acres	25	78	100	£200,000	£2,564	+ £538 or 26·5%
	26	78	100	£181,000	£2,320	+ £294 or 14·5%
	27	78	59·0	£158,000	£2,026	Lowest
Seventh Study: 111 Habitable rooms per acre: 4·5 acres	28	188	100	£424,000	£2,255	+ £734 or 48·2%
	29	188	100	£387,000	£2,058	+ £537 or 35·3%
	30	188	49·0	£309,000	£1,643	+ £122 or 8·0%
	31	188	23·3	£286,000	£1,521	Lowest

Note: All the estimates are for buildings only, and exclude site clearance and levelling, roads, footpaths, sewers and public utility mains, abnormal foundations, abnormal external works and professional fees.

Table 5. Percentage and Density of Rooms in Houses, Four-storey Maisonettes and High Maisonettes or Flats

Selected from the first three layout studies

Figure No. and overall net density	Houses		Four Storey and High Blocks Together		Four-Storey Blocks		High Blocks	
	Percentage of total rooms in scheme	Density of rooms in houses	Percentage of total rooms in scheme	Density of rooms in the blocks	Percentage of total rooms in scheme	Density of rooms in 4-storey blocks	Percentage of total rooms in scheme	Density of rooms in high blocks
Fig. 3 } 100 h.r.a.	26·2%	82·5 h.r.a.	—	—	73·8%	108·6 h.r.a.	—	—
Fig. 5 } 100 h.r.a.	40·0%	68·6 h.r.a.	60·0%	143·6 h.r.a.	17·6%	102·0 h.r.a.	42·4%	172 h.r.a.
Fig. 9 } 140 h.r.a.	15·5%	96·0 h.r.a.	84·5%	152·0 h.r.a.	50·4%	122·0 h.r.a.	34·1%	238 h.r.a.
Fig. 12 } 140 h.r.a.	21·9%	91·0 h.r.a.	78·1%	164·0 h.r.a.	27·0%	125·0 h.r.a.	51·1%	198 h.r.a.
Fig. 11* } 140 h.r.a.	21·7%	107·0 h.r.a.	78·3%	152·0 h.r.a.	44·3%	119·0 h.r.a.	34·0%	238 h.r.a.
Fig. 17* } 160 h.r.a.	22·3%	122·0 h.r.a.	77·7%	175·6 h.r.a.	33·8%	115·0 h.r.a.	43·9%	298 h.r.a.
Fig. 19* } 160 h.r.a.	11·0%	114·0 h.r.a.	89·0%	168·0 h.r.a.	10·2%	143·0 h.r.a.	78·8%	172 h.r.a.

* 3-storey houses.

Chapter II. Space Around Buildings

Part I. The Amount of Space

69. The design of space around buildings in high-density schemes needs special care, more particularly because the space is mainly used in common, and many of the uses to which it is put derive from the lack of individual gardens. Within the space available the designer has to meet the requirements of access, off-street parking, garages, children's play spaces, and any special individual requirements of the scheme, such as community buildings: and at the same time he has to provide an attractive landscaped environment as a setting for the buildings and for outdoor activity.

70. The Ministry has shown in its handbook on the Density of Residential Areas that, for a given daylighting standard, the amount of space around buildings varies with the type of layout, the height and depth of the building and the net density of development.

71. Where the recommended daylighting standard is adopted, Table 3 of the same publication shows that for a level site the amount of space around buildings per habitable room varies little with the increase in density produced by increasing the height of buildings up to 10 storeys, the gross figure, including roads, being about 225 sq. ft. per habitable room at any level of net density, or 170 sq. ft. excluding roads.

72. This figure is calculated on the basis of theoretical layouts, using the minimum uniform height of building necessary to secure any given figure of net density. With mixed development, using buildings of various heights in the same scheme, but designed to keep the average height of building as low as possible, the same figures will apply: but if more than the minimum of high building is used, or if the density of each type of building is not as high as it could be, or if the site is not level or is small, then the result will be that more than these theoretical minimum figures will be obtained.

73. Measurements of the space around buildings obtained in the studies for the Birmingham site given earlier in Chapter I are as shown in Table 6 overleaf.

74. In so far as these figures exceed the minimum theoretical figure (225 sq. ft. for column (*a*): 170 sq. ft. for column (*b*)) they afford some measure of the extent to which the maximum possible density for the particular types of buildings used on this site has not been achieved (partly because the gradients enforce a wider spacing of blocks than the minimum necessary for daylighting); but they should be a useful guide to the results obtainable in practice in mixed development.

Table 6. Space Around Buildings

Figure No.	Net density h.r.a.	Number of habitable rooms	Space around buildings per habitable room in sq. ft.	
			(*a*) including roads	(*b*) excluding roads
3	100	1,234	358	270
5	100	1,230	369	281
9	140	1,716	258	196
11	140	1,717	256	194
12	140	1,719	260	213
13	140	1,727	262	203
17	160	1,966	219	165
19	160	1,962	238	190

Part 2. The Various Uses

75. The main functional uses of the space around buildings are to provide access to the dwellings, parking for vehicles, and spaces where children can play. The latter deserves special attention and must never be neglected. Part 3 of the chapter deals with landscaping, which in practice is inseparable from provision for the various functions.

1. Access to buildings

(*a*) *Vehicles*

76. In order to keep to the minimum the area of roads on the site, maximum use should be made of streets on the perimeter to provide access to buildings. In redevelopment areas the existing pattern of roads and services will, to some extent, impose limitations upon the form of layout and grouping since re-arrangement can be costly. On the other hand, because in these areas there are usually too many roads, the remodelling of the existing street system within the site will be necessary. To keep casual vehicular traffic to a minimum, it may be possible to arrange that roads needed for such vehicles as fire engines, refuse collection lorries, and ambulances, whose visits to the site are infrequent, are normally closed off, for instance by removable bollards or a gate, and thus for most of the time function as pedestrian ways. But if so, the space must be kept clear.

(*b*) *Pedestrians*

77. Paths should be laid out so as to follow the natural lines of traffic from the doorways of the buildings to the street, to other buildings on the site, and to children's play spaces. Generally paths should be at least 10 feet away from windows of habitable rooms. In working out pedestrian ways, it should be remembered that in places the traffic will be much heavier than on an estate of two-storey houses, and the materials must be chosen to stand the wear.

2. Parking of vehicles

78. About 220 sq. ft. of space is needed for parking each car, not counting the space in access roads to the parking areas. Taking the minimum amount of space about buildings per habitable room, excluding roads, as of the order of 170 sq. ft., and the average size of dwelling as approximately 3·75 habitable rooms (both probably typical figures), the minimum amount of net space about buildings, not counting roads, will be something like 637 sq. ft. per dwelling. From these figures the maximum proportion of the space taken up for parking, which depends on the ratio of the number of parking spaces to the number of dwellings, can be worked out:

1 car for each 1½ dwellings requires approximately 23 per cent. of the minimum net space about buildings.

1 car for each 2 dwellings requires approximately 17·3 per cent. of the minimum net space about buildings.

1 car for each 3 dwellings requires approximately 11·5 per cent. of the minimum net space about buildings.

1 car for each 4 dwellings requires approximately 8·6 per cent. of the minimum net space about buildings.

1 car for each 5 dwellings requires approximately 6·9 per cent. of the minimum net space about buildings.

79. In determining the provision of parking space that would be appropriate in a particular town, it is necessary to study the present local car-ownership figures (which vary widely at the moment*); to assess future trends in car ownership; and to find out by survey the extent to which vans, lorries and other business vehicles are brought home at night by tenants in existing local authority housing areas. It is suggested that, with local variations, layouts might be designed initially for parking spaces for one-third of the total number of dwellings and in any case so that it would be possible to double the provision later if necessary.

80. There are perhaps five well-known methods of providing for parking:

(i) **Off-street areas in the open.** This is the cheapest method, but the result is unsightly and does not get the cars under cover.

(ii) **Single-storey lock-up garages.** In high density areas there is not usually room for more than a small number of these.

(iii) **Garages in underbuilding.** This will be practicable only where the site slopes steeply, and will rarely allow many vehicles to be housed.

(iv) **Garages built-in with the houses.** As indicated on page 112, garages built into the ground floor of frontage-saving three-storey terrace houses can make a substantial contribution to the numbers

* In Oxford, Birmingham, Bournemouth and Coventry in 1957 there was 1 car registered for each 11 inhabitants, in Cardiff 1 for 13, in Leeds, Newcastle and Manchester 1 for 15 to 18, and in South Shields and Bootle 1 for 28 to 32.

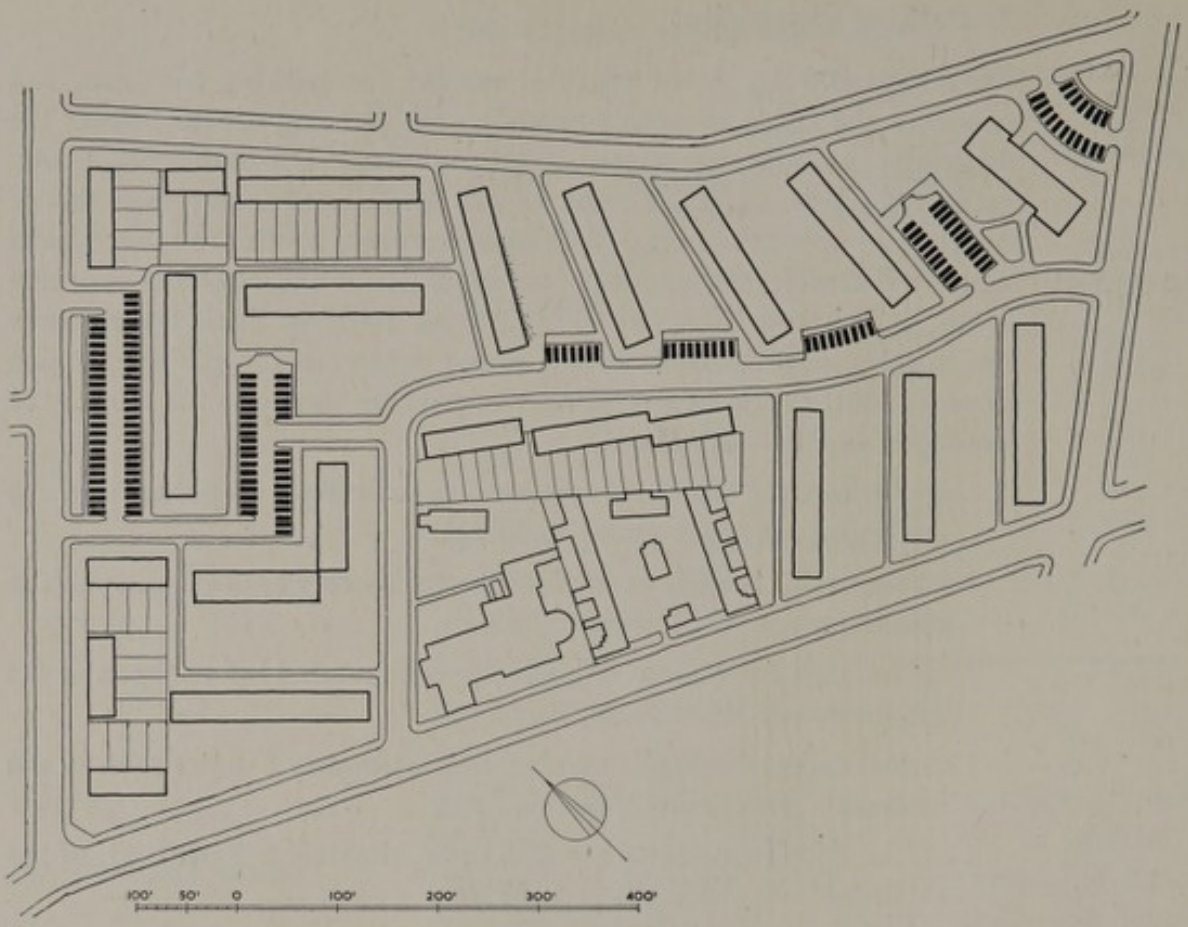


Figure 33

This diagram shows the amount of space occupied by cars when parked in the open air, on the basis of one parking space to every three dwellings. The lay-out is that shown in Fig. 9: 140 h.r.a.

required, though two-storey houses with a garage built-in would be much less useful because they would have too wide a frontage.

(v) **Multi-storey garages.** These are extremely expensive, and they take up too much space—not only because of the ground they occupy, but also because of the obstruction they offer to daylight and sunlight reaching other buildings. They can therefore be considered impracticable in this context.

81. It is unlikely that methods (ii), (iii) and (iv), even if used together, will allow garaging at the ratio of one car to three dwellings. A further method of getting cars under cover is therefore suggested, which provides for parking in large numbers. It is illustrated in Figure 34, and consists of roofing in spaces between buildings with living accommodation from the first floor upwards. This would be more costly than the first of the four methods suggested in paragraph 80, but much of the ground space occupied could be regained in the form of terraces at first floor level above the parking area. The idea is put forward only to stimulate thought on this subject, and matters which would need to be fully explored include means of dealing with the risks of fire and explosion, and ways of preventing pilfering and wanton damage to the vehicles. For comparison with Figure 34, Figure 33 shows the effect of

parking in off-street areas. Both plans are based on Figure 9, and a ratio of one car to three dwellings. The two plans taken together give some idea of double the ratio of one car to three dwellings, but it is worth noting that off-street areas can be added more easily than garaging, which would therefore need to be provided for at the start.

82. Other methods of dealing with car parking are being explored and further information may be made available in due course.

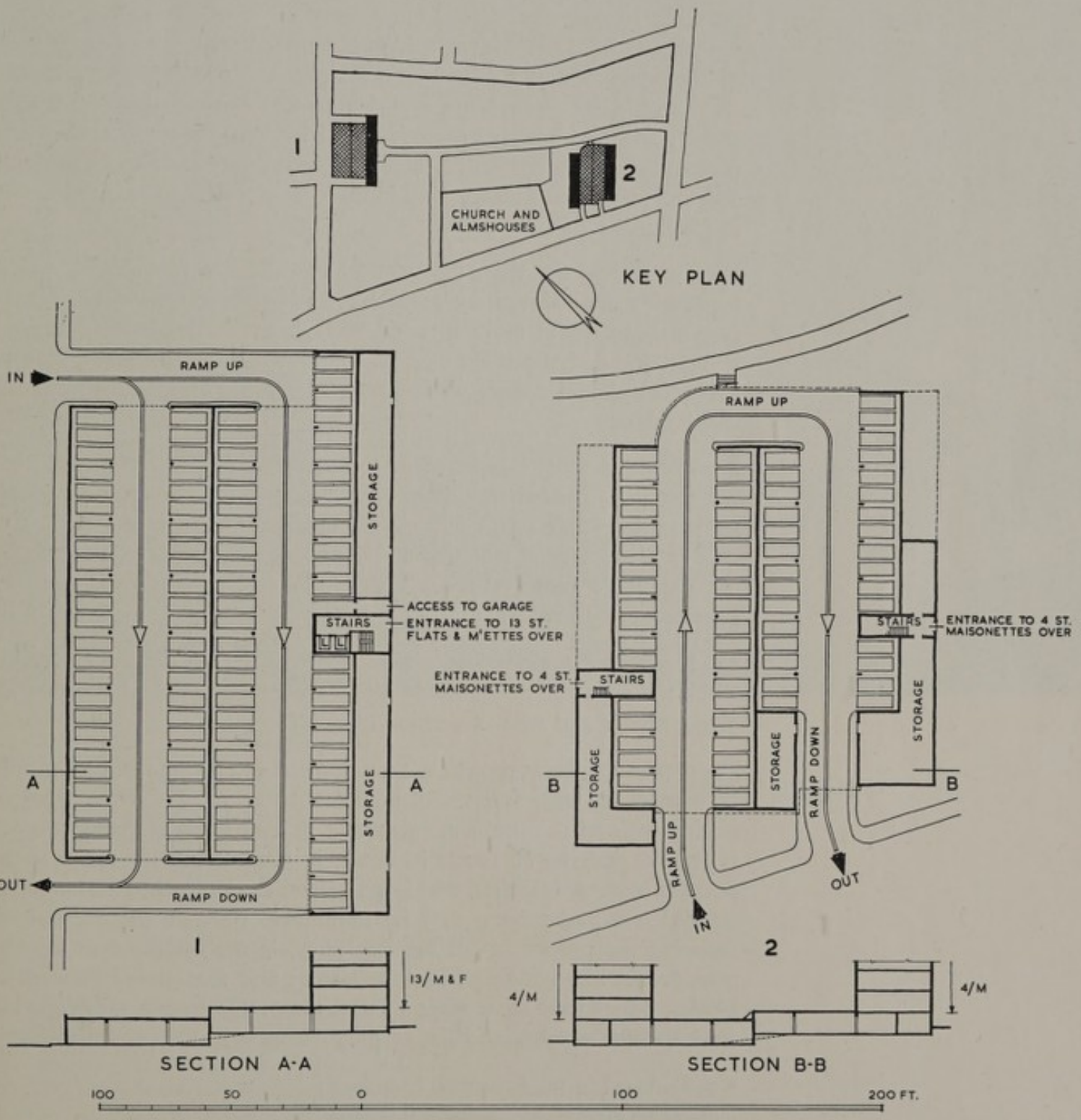


Figure 34

These diagrams show provision for approximately the same number of car parking spaces as in Fig. 33, namely one to three dwellings, in two covered car parks. See paragraph 81.

3. Play spaces

83. The provision of play spaces must be one of the first calls on the available space around dwellings in multi-storey development which do not have gardens of their own, though it is usually impracticable for major playgrounds, such as are provided in public parks, to be included on a high-density estate.

84. If readily accessible spaces surrounded with high wire netting are not provided where older children of 10 to 15 years can play games like football, cricket and netball, they play all over the estate, causing damage to windows and to trees and shrubs. Such fenced areas need not be expensive to lay out and it is false economy to omit them. Ideally they should be quite large, but where this is impracticable several smaller areas, at least big enough for back-yard versions of cricket and football, should be provided. These might be, for example, 10 yards by 30 yards, which will take a goal in the shorter side and also give room to play cricket.

85. The five to ten years age-group has quite different needs, and is reasonably well served by areas containing some simple equipment (preferably without moving parts) such as horizontal bars of various heights, knotted ropes for climbing and swinging, horizontal ladders and other simple apparatus designed to provide exercise by climbing and jumping.

86. Provision must also be made for toddlers, and the minimum here is a sandpit, or sandbox. Often it is difficult to provide a large sandpit to serve the whole estate and several smaller sandboxes should in that case be distributed at sunny sheltered spots on the estate, with seats for the children's mothers nearby. Sandpits and sandboxes should be covered at night against animals.

87. It is sometimes possible to take advantage of the different levels on a site to locate the playgrounds below the general level of the ground, giving shelter and some reduction of noise.

88. Generally, the approach to the provision of playing facilities should be a generous one, and useful advice is to be found on the types of equipment and the problems generally in a number of publications.* It should perhaps be borne in mind, in considering the space to be devoted to these facilities, that large spaces, as opposed to a number of smaller ones, may very well be obtainable only at the expense of reducing the proportion of the dwellings on the estate which can be provided in low buildings, such as houses and four-storey maisonette blocks, which can have their own gardens. Obviously therefore the choice of the number and size of play spaces calls for careful thought.

* Playgrounds for Blocks of Flats—National Playing Fields Association, 1952.

Housing Centre Review, issue for November–December, 1953.

Living in Flats: Report of the Flats Sub-Committee of the Central Housing Advisory Committee, H.M.S.O. 1952, Chapter 4.

Family Life in High Density Housing, with special reference to the Design of Space about Buildings. Report of a Symposium, R.I.B.A., 1957.

Figure 35

A children's play space at Churchill Gardens, Pimlico, Westminster, Westminster City Council.

The important thing is to recognise that the beneficial social effects of good housing conditions can be largely cancelled out if there is nowhere immediately near their homes where children find it enjoyable to play.

89. Attention is particularly drawn to "Playgrounds for Blocks of Flats" (National Playing Fields Association) which gives, among other suggestions, requirements for the various age-groups, with photographs of simple equipment.

Part 3. Landscaping

90. Many new housing schemes will constitute major civic improvements; but whatever their size, they will all exert an important influence in the areas where they are built—an influence which, if the scheme is properly handled, can enhance the value of surroundings which are good, or start an area which is declining back on the way to recovery. A pleasing setting for the buildings, besides giving pleasure in itself, can therefore be a source of justifiable pride to the local authority, and moreover, a source of profit by preserving or enhancing the rateable values of areas much wider than the scheme itself.

91. The landscaping of schemes is accordingly a matter to which time, trouble and reasonable expenditure are well worth devoting. A specialist consultant should be called in, for it usually needs a trained eye to see the full potentialities of the site, and to evolve a fresh approach to a site overlain by the pattern of old foundations and streets. The consultant should be appointed to work with the architect at an early stage, for a great deal can be achieved in the design of the buildings themselves, in their arrangement on the ground, and in the choice of materials, to provide the landscape architect with the fullest possible scope.

92. A careful and thorough examination should be made at the outset to find out what mature trees and other planting there may be on the site to form a nucleus for the work; to determine the soil conditions; and to decide what types of trees, shrubs and grass are most likely to flourish, bearing in mind the aspect of the site and the atmospheric conditions as well. The site survey necessary before the buildings themselves are designed will also be required by the consultant, since he will aim to create some of his effects by relatively simple remodelling, to fit the levels to the uses of the space.

93. In all this work, scale models are helpful in visualising the problems and conveying an understanding of the proposals.

94. The basic aim is to provide a setting of domestic character, enriched and integrated by the trees and the other planting; for example, large forest trees, beautiful in themselves, can successfully bring tall buildings into scale with the whole development. In other ways, it will be the contribution of the landscape specialist to transform into a unified and satisfying environment the pattern of shapes, textures and surfaces

which the major uses of the site—the buildings themselves, the paths, the roadways, the street furniture, the play spaces, the garages—will create. There are many ways in which planting and the treatment of surfaces can make their own contribution to satisfaction and workability; for some purposes trees, shrubs or hedges make a more suitable visual screen, or screen from noise, than do many architectural solutions; and there is much advantage to be gained from skilful variation in the dimensions and materials of paths and other surfaces. But the work of landscaping a new housing development is essentially a two-way process. The architect and the landscape consultant can only achieve the best results if their two aspects of the work are evolved in close accord.

95. Good intentions may be hampered, of course, if during site operations the root systems of mature trees are damaged by cutting trenches through them, or if there is lack of forethought in the preservation of useable soil. Equally, if there is any delay in completing the landscape work so that tenants have to move in to a rough site, it is often difficult to create a sense of respect for the work when it is eventually finished. Good supervision and good timing are therefore important.

96. Some successful examples of detailed landscaping treatment are shown in the acompanying photographs, though they do not pretend to be a comprehensive display of the possibilities. This is a field in which new ideas are constantly evolving, and every local authority has an opportunity to make its own contribution, which will reflect to its own credit and add to the range of possibilities which all can enjoy.

Figure 36 (*below*)

Cobble stones with paving, on a ramped footway. King's College, Cambridge.

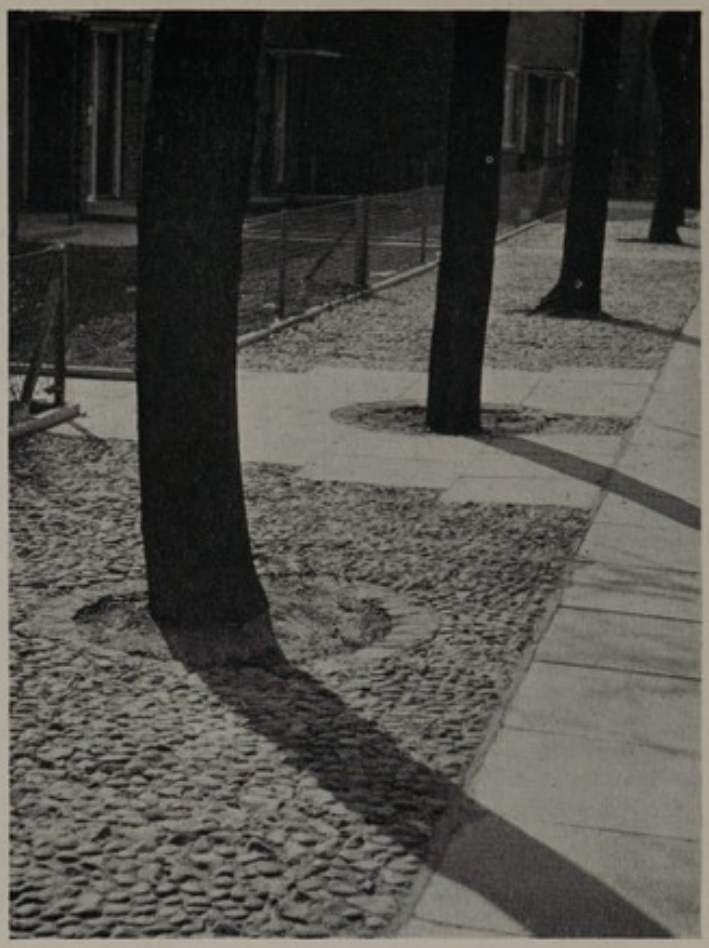


Figure 38 (*below*)

Surfaces and barriers to define different uses. Parkleys, Ham Common. Private enterprise.

Figure 37

Surface treatment to define the footway and entrances to the dwellings. Croydon Road, West Ham. West Ham C.B.

Figure 39

Low wall and railing to define front gardens of four-storey maisonettes. Ackroydon Estate, Princes Way, Wandsworth. L.C.C.

Figure 40

A pleasing treatment of surfaces. Quadrant Estate, Islington. L.C.C.

Figure 41

An attractive corner. Tor Gardens Estate, Kensington. L.C.C.

Figure 42

The large tree brings the tall block into scale with its surroundings.
Ackroydon Estate, Princes Way, Wandsworth. L.C.C.

Figure 43

Planting for the future.
Alton Estate, Clarence Avenue, Roehampton. L.C.C.

Figure 44

Shrubs planted at the entrance to the block.
Parkleys, Ham Common. Private enterprise.

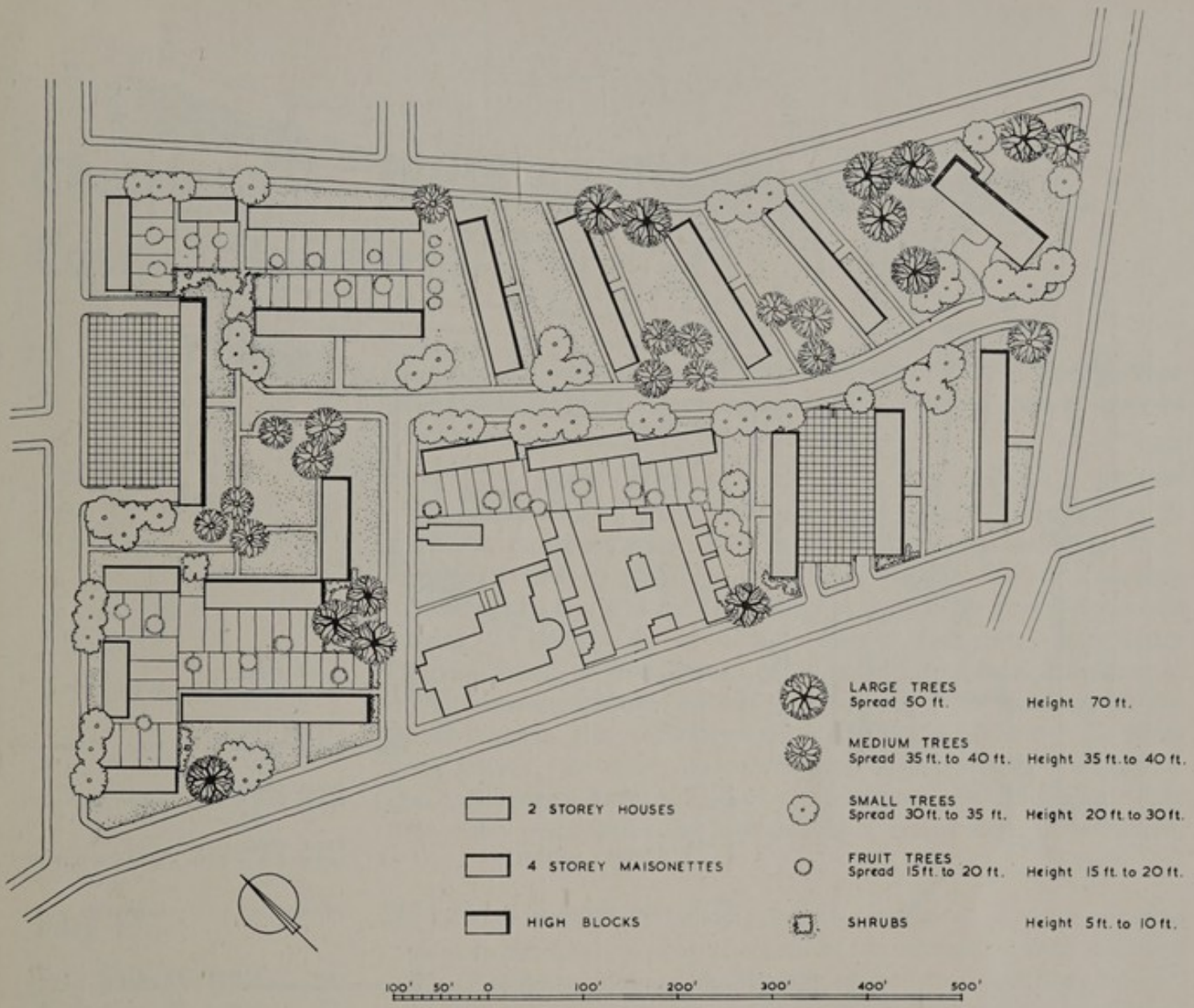


Figure 45

Suggested landscape design for the layout shown in Fig. 9.

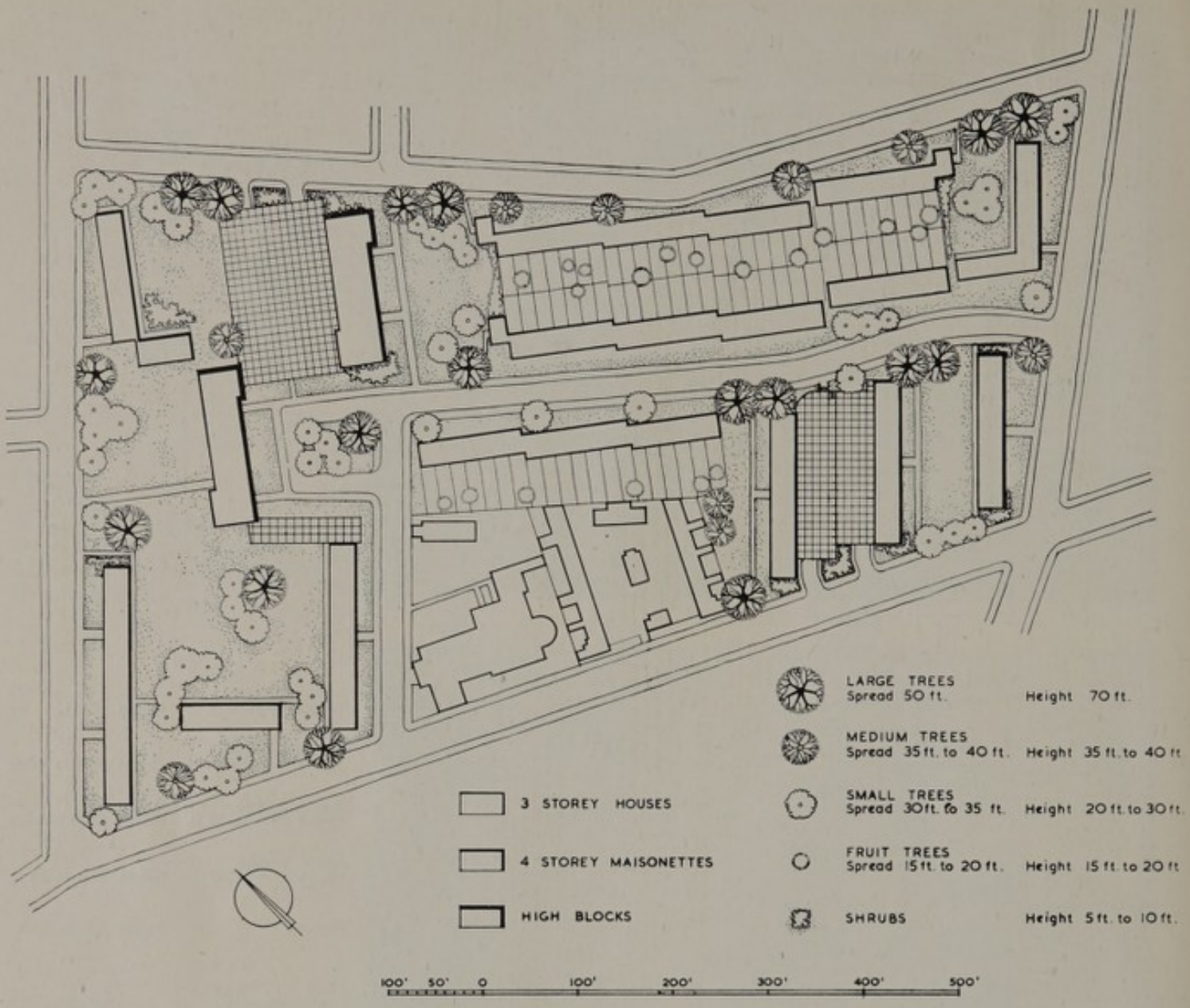


Figure 46

Suggested landscape design for the layout shown in Fig. 17.

Chapter III. Building Height and Cost of Buildings

97. Chapter I has shown that the achievement of a low overall average cost per dwelling in a layout at high density depends upon keeping to a minimum the proportion of high building.

98. This chapter first sets out a method of ascertaining, for different overall densities, the minimum possible proportion of high building in a scheme; and then gives comparative estimates of cost for dwellings of various sizes in buildings of different heights. The two sections together provide a method of finding, as a basis for preparing sketch studies, the proportions of rooms in houses, four-storey maisonettes and high blocks at given overall densities, and from that, of arriving at preliminary approximate estimates of the cost of the buildings for the whole scheme. The method which is illustrated below for a scheme using houses, four-storey maisonettes and high buildings is applicable also to layouts using only houses and four-storey maisonettes, or only four-storey maisonettes and high buildings, or any other combination.

Part I.

The Selection of Building Heights

99. In the selection of building heights, the basic requirement is to divide up the total number of rooms in the scheme between the three types of building—houses, four-storey maisonettes, and high maisonettes and flats—so that the overall net density for the site is achieved with the minimum of high building.

100. Three general principles will assist in making the division.*

(i) The houses, the four-storey maisonettes, and the high blocks should each be laid out at as high a density as daylighting and the characteristics of the site permit.

(ii) As much as possible of the accommodation should be provided in four-storey maisonettes.

(iii) The percentage of rooms in houses should be kept to a reasonably low figure.

101. The problem is to determine the percentage of rooms in each of the three types of building and the density at which each type is to be laid out, and although this can be done by arithmetic, or by trial and error on the drawing board, it is apt to be a time-consuming process. Graphs A and B, shown on pages 54 and 55, have therefore been worked out to provide a more rapid method.

* See also paragraphs 58 to 61 on page 35.

GRAPH A.* HOUSES/MAISONETTES AND FLATS

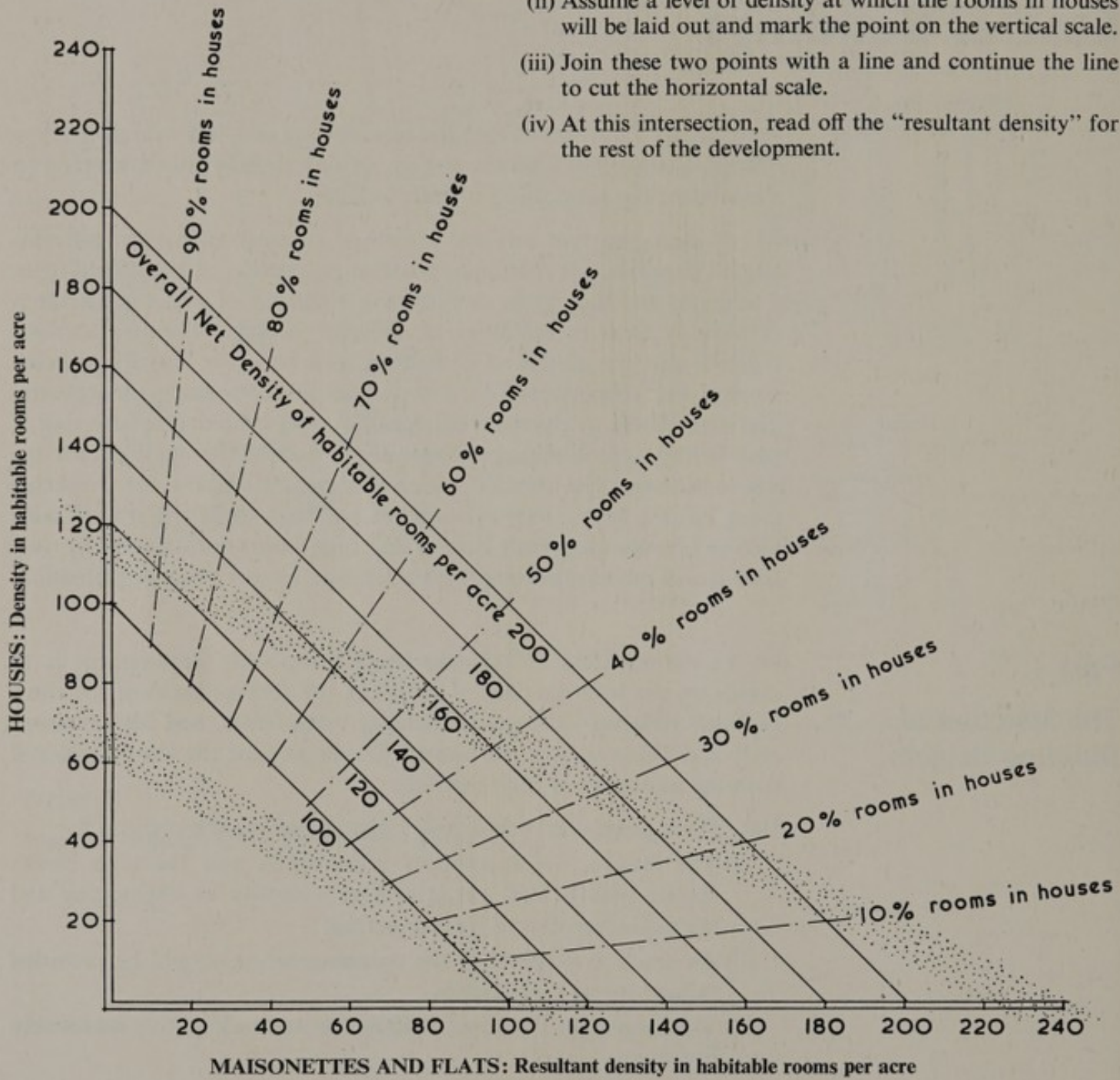
Method of use (*see also* paragraph 103)

(i) Mark on the diagonal line representing the overall density of the site the point which represents the chosen percentage of rooms in houses, as shown by the radial lines.

(ii) Assume a level of density at which the rooms in houses will be laid out and mark the point on the vertical scale.

(iii) Join these two points with a line and continue the line to cut the horizontal scale.

(iv) At this intersection, read off the "resultant density" for the rest of the development.



* For accuracy in reading off, it is preferable to enlarge the graphs. Setting out is to scale, with equal divisions on both vertical and horizontal scales. The radials are inserted *not* at 9° intervals, but by forming ten equal divisions of a diagonal.

Vertical Scale—Habitable rooms per acre in houses.

Horizontal Scale—Habitable rooms per acre of remainder.

Diagonal Lines—Overall density of the site.

Radial Lines—Percentage of rooms in houses.

GRAPH B.* FOUR-STOREY MAISONETTES/HIGH MAISONETTES AND FLATS

Methods of use (*see also* paragraphs 104 and 105)

(A)(i) Mark points of assumed levels of density for rooms in four-storey maisonettes on the vertical scale, and for high maisonettes and flats on the horizontal scale.

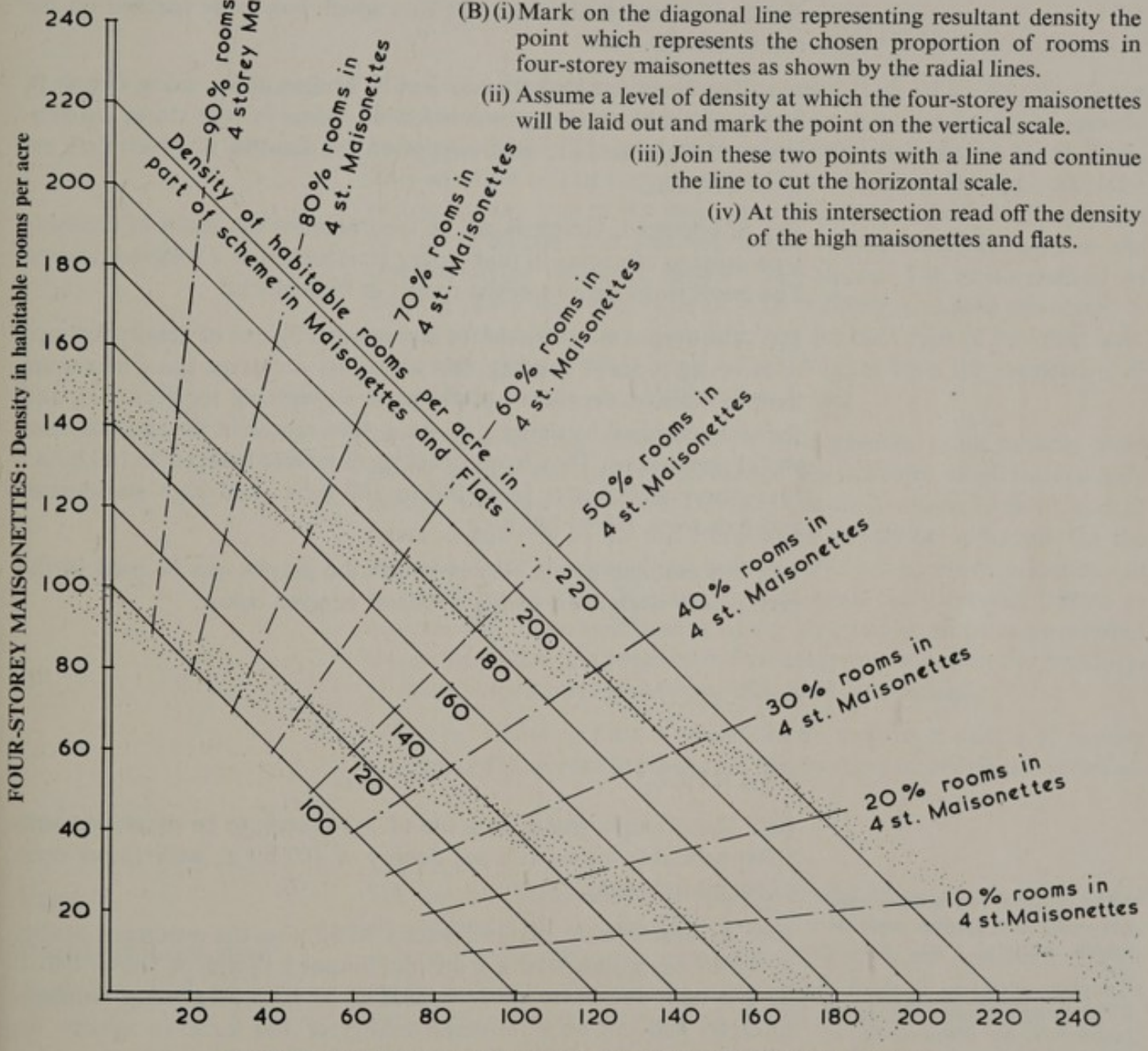
(ii) Draw a line between these points, and where this line intersects the diagonal line of resultant density read off the percentage of four-storey maisonettes as shown by the radial lines.

(B)(i) Mark on the diagonal line representing resultant density the point which represents the chosen proportion of rooms in four-storey maisonettes as shown by the radial lines.

(ii) Assume a level of density at which the four-storey maisonettes will be laid out and mark the point on the vertical scale.

(iii) Join these two points with a line and continue the line to cut the horizontal scale.

(iv) At this intersection read off the density of the high maisonettes and flats.



Vertical Scale—Habitable rooms per acre in four-storey maisonettes.

Horizontal Scale—Habitable rooms per acre in high maisonettes and flats.

Diagonal Lines—Resultant density obtained by Graph A. (If the scheme includes no houses and Graph A has therefore not been used, regard as overall density of the site.)

Radial Lines—Percentage of rooms in four-storey maisonettes.

* See footnote on previous page.

102. The general approach in using the graphs is to divide the problem into two operations:

(i) Houses *vis-à-vis* The Remainder—(Graph A);

(ii) Of The Remainder, four-storey Maisonettes *vis-à-vis* High Maisonettes and Flats—(Graph B).

103. For any given figure of overall net density of the site, in habitable rooms per acre, Graph A gives the result of choosing a percentage of rooms in houses at a selected density. This "result" is termed the Resultant Density, and is the density which has to be reached on the rest of the site.

104. The Resultant Density can next be broken down, using Graph B. This graph will show the proportion of rooms in four-storey maisonettes and high blocks respectively, given the densities at which they are to be laid out.

105. If preferred, Graph B can be used to show the result of choosing a percentage of rooms in four-storey maisonettes at a selected density. The result is the density of the rooms in high blocks.

106. The graphs may be used for any selected figures of density for each of the three types of building. But obviously each type has a maximum limit of density, dependent partly upon daylighting requirements, and the areas enclosed by shading on the graphs represent the areas of most useful application. They cover densities of houses from 60 to 100 h.r.a., four-storey maisonettes from 100 to 130 h.r.a., and high maisonettes and flats from 180 to 240 h.r.a.

107. An example of the way in which the graphs can be used in the preliminary steps for evolving a scheme is given below.

EXAMPLE*

108. The example relates to a site of 7·14 acres, to be developed with 1,000 habitable rooms at a net density of 140 h.r.a., with 15 per cent. of rooms in houses.

109. Assume that the designer selects 80 h.r.a. as the maximum density at which he proposes to lay out the houses.† Graph A shows that if 15 per cent. of rooms are in houses at 80 h.r.a., the other buildings must be laid out at a resultant density of 160 h.r.a. to achieve the overall density required.

110. This figure of 160 h.r.a. is next broken down by using Graph B. Perhaps the most convenient way is to select proposed densities for the four-storey maisonettes and the high buildings. Assume that they are taken as 110 h.r.a. and 200 h.r.a., which are both reasonable figures. Graph B then shows that the rooms on this part of the site split as to 32 per cent. in four-storey maisonettes and 68 per cent. in high buildings.

* The example has been worked out using the graphs, and the results include small reading errors.

† This density is higher than could reasonably be obtained in an estate of houses, but, in mixed development schemes where only a relatively small percentage of houses is to be provided, and where there will be quite large spaces between other buildings, densities of 80 h.r.a. and above can be obtained with two-storey houses, as can be seen from Table 5 on page 38.

111. With 15 per cent. of the 1,000 rooms in houses, 850 are in other types of building. Of this 850, 32 per cent. are in four-storey maisonettes and 68 per cent. in high buildings. Working out these figures gives:

150 rooms in houses . . .	15 per cent. of total rooms.
272 rooms in four-storey maisonettes (i.e., 32 per cent. of 850)	27 per cent. of total rooms.
578 rooms in high buildings (i.e., 68 per cent. of 850) .	58 per cent. of total rooms.
1,000	100 per cent.

112. These figures provide a starting point from which to prepare the first sketch layout. For this, a selection must be made of specific buildings which will provide the required numbers and sizes of dwellings. This selection will be only tentative, for in working through successive sketch layouts, one of the main aims will be to reduce the proportion of high building, and this will entail consequential changes in the distribution of dwellings between the blocks. The basic method of keeping down the proportion of high building, as noted elsewhere, is to secure the highest practicable density for each type of building; and, in layouts using all three types of building, to keep the proportion of rooms in houses to a reasonably low figure.

113. The foregoing example deals with schemes using houses, four-storey maisonettes and high buildings. For schemes which include only houses and four-storey maisonettes, Graph A above is used; and as much as possible of the accommodation should be in houses. On the other hand for schemes which include only four-storey maisonettes and high building, Graph B above is used, with the diagonals treated as representing the overall density of the site, and as much as possible of the accommodation should be in four-storey maisonettes. For buildings of other heights appropriate densities must be assumed.

114. The Tables in Part 2 below can be used as a means of rapidly estimating the overall average cost per dwelling of alternative schemes.

Part 2. Building Cost and Building Height

115. In the Comparative Estimating Guide below, Tables 7, 8 and 9 give estimates of the comparative costs of houses, flats and maisonettes in buildings of different heights. Table 10 gives the estimated cost of public staircases and common access space. Table 11 gives the estimated cost of lifts. Central heating is dealt with in the notes to Tables 8 and 9.

116. The data given permit comparative and approximate preliminary estimates to be worked out for alternative sketch designs, using particular selections of blocks when, in each selection, the specific buildings, with their numbers and sizes of dwellings, their numbers of staircases and lifts, and their method of heating, have been chosen.

117. All the figures in the Estimating Guide are for buildings only, and exclude site clearance and levelling, roads, footpaths, sewers and public

utility mains, abnormal foundations, abnormal external works and professional fees.

118. Comparisons between proposed buildings will in most cases not be far wrong, assuming normal standards of specification and finish in each, but the results should not be expected to collate exactly with estimates for buildings which have been evaluated in closer relation to the floor and dwelling plans concerned, for the Estimating Guide figures represent a set of generalisations, not by their nature or purpose related to specific plans of buildings. They nevertheless compare approximately with the general level of the cost of buildings only in Provincial Tenders approved during the first half of 1958, and in assessing differences in cost between selections of buildings in different sketch layouts they are therefore of considerable value.

119. These comparative figures will show an order of cost of buildings for each of the schemes and the relative costs of the buildings for each scheme can be expected to hold good in prices actually received—i.e., the lowest will be likely to give the lowest tender price (again for the buildings **only**).

120. The possibility of producing good housing layout designs is not incompatible with the use of combinations of blocks selected for economy in overall cost. The limitations in practice come much more from the characteristics of the site and the requirements of daylighting, and while on a particular site there may for these reasons be only a few workable alternatives, in principle and on a large site there is ample freedom, with a given selection of blocks, to achieve any one of a very wide range of arrangements of blocks.

COMPARATIVE ESTIMATING GUIDE

All the figures in this guide are for buildings only, and exclude site clearance and levelling, roads, footpaths, sewers, and public utility mains, abnormal foundations, abnormal external works, and professional fees. See also page 2.

Table 7

Houses, including heating by solid fuel and store of 50 square feet	2 Storey		3 Storey	
	Net area of dwelling plus area of store: in square feet	£ per dwelling	Net area of dwelling plus area of store: in square feet	£ per dwelling
4 person 2 bedroom: 3 habitable rooms	770	1,280	—	—
4 person 3 bedroom: 4 habitable rooms	810	1,330	—	—
5 person 3 bedroom: 4 habitable rooms	880	1,400	—	—
6 person 3 bedroom: 5 habitable rooms	1,000	1,540	1,100	1,700
7 person 4 bedroom: 6 habitable rooms	1,100	1,650	1,240	1,850

Table 8

Flats. Exclusive of the cost of access and staircase (Table 10) and lifts (Table 11), but including individual solid fuel heating and hot water installations and fuel store and average communal storage of 10 sq. ft. per dwelling	Net area of dwelling plus area of storage: in square feet	3 Storey £	4 Storey £	5 Storey £	6 Storey £	7 Storey £	8 Storey £	9 Storey £	10 Storey £	11 Storey £	12 Storey £
1 person B.S.R.: 1 habitable room	310	885	925	965	1,020	1,055	1,090	1,110	1,125	1,135	1,140
2 person 1 bedroom: 2 habitable rooms	510	1,120	1,180	1,240	1,320	1,365	1,410	1,440	1,460	1,475	1,485
4 person 2 bedroom: 3 habitable rooms	680	1,330	1,400	1,470	1,570	1,625	1,680	1,720	1,745	1,760	1,770
4 person 3 bedroom: 4 habitable rooms	720	1,380	1,455	1,530	1,635	1,690	1,745	1,785	1,815	1,835	1,845
5 person 3 bedroom: 4 habitable rooms	790	1,465	1,545	1,625	1,740	1,800	1,860	1,900	1,930	1,950	1,965
6 person 3 bedroom: 5 habitable rooms	910	1,620	1,705	1,790	1,920	1,985	2,050	2,095	2,130	2,155	2,170

Table 9

Maisonettes. Exclusive of the cost of access and staircase (Table 10) and lifts (Table 11), but including individual solid fuel heating and hot water installations and fuel store and average communal storage of 10 sq. ft. per dwelling	Net area of dwelling plus area of storage: in square feet	4 Storey £	6 Storey £	8 Storey £	10 Storey £	12 Storey £
4 person 2 bedroom: 3 habitable rooms	700	1,405	1,580	1,695	1,760	1,790
4 person 3 bedroom: 4 habitable rooms	720	1,430	1,610	1,730	1,800	1,830
5 person 3 bedroom: 4 habitable rooms	810	1,550	1,750	1,880	1,955	1,990
6 person 3 bedroom: 5 habitable rooms	960	1,750	1,975	2,120	2,195	2,235

ADJUSTMENTS FOR CENTRAL HEATING

The figures in Tables 8 and 9 include the estimated cost of individual solid fuel heating installations.

The net extra cost per dwelling of central heating and hot water supply over an individual solid fuel installation in blocks of flats and maisonettes will vary according to the kind of system to be installed, the scale of heating to be provided, the number of different sizes of dwellings in a block and the number of dwellings supplied from one plant. With these qualifications, and for the purpose of calculating approximate estimates on the basis of these tables, a figure of £125 per dwelling may be taken as the net extra cost of a full scale central heating (which is taken as one radiator per habitable room) and hot water installation for high blocks having an equal number of one- and two-bedroom dwellings. Adjustments should be made for any variation in the proportion of dwelling sizes, or the scale of heating.

It will be generally recognised that for similar accommodation in dwellings, the area of flats and maisonettes with central heating can be less than the area with solid fuel heating because chimney breasts and fuel storage are not required. This saving is allowed for in the figure of £125. In pricing similar accommodation planned from the start on the basis of central heating and hot water supply (i.e., without chimney breasts and fuel storage) the estimated cost per dwelling in the table should be adjusted, by interpolation, for the reduced floor area. The addition for the extra cost of central heating and hot water would then be £160 per dwelling instead of the above-mentioned £125.

Table 10. Estimated Cost of Access and Staircase

Including staircase, and an allowance for landings, corridors and common access space based on current average design practice.

Height of Building	3 Storey	4 Storey	5 Storey	6 Storey	7 Storey	8 Storey	9 Storey	10 Storey	11 Storey	12 Storey
FLATS . . .	£1,000	£1,400	£1,850	£2,300	£2,800	£3,300	£3,800	£4,250	£4,700	£5,150
MAISONETTES* . .		£1,000		£2,300		£3,300		£4,250		£5,150

* In blocks of four-storey maisonettes the staircase rises through two storeys only, though it occupies three storeys in cube. This is allowed for.

In blocks of six, eight, ten and twelve storey maisonettes the staircase has been taken as rising through five, seven, nine and eleven storeys respectively, to allow for an alternative means of escape from the bedrooms on the topmost floor. The staircase cost where this is done is therefore the same as for a block of flats of the same height.

Table 11. Estimated Cost of Lift

Eight-person lift stopping at all floors, inclusive of builders work, lift shaft, motor room, etc.

Travelling through	3 Floors	4 Floors	5 Floors	6 Floors	7 Floors	8 Floors	9 Floors	10 Floors	11 Floors
A lift is taken as "travelling through" 7 storeys (for instance) when this is the number of storeys between the floor levels of the lift car at the lowest and highest lift stops	£2,700	£3,000	£3,300	£3,600	£3,900	£4,200	£4,500	£4,800	£5,100

Note: For intermediate stops omitted deduct £150 per stop from the above costs.

Example: In an 8-storey block of flats each lift would travel through 7 storeys, and if it stopped at all floors would cost £3,900. In an 8-storey block of maisonettes each lift would travel through 6 storeys, with stops omitted at the 1st, 3rd and 5th floors. The cost would therefore be £3,600 minus $3 \times £150 = £3,150$.

Chapter IV. Dwellings for High Density

Part I. General

1. Introductory

121. High buildings cost more than low ones, and the lesson of Chapter I and Chapter III is that money can be saved in tens of thousands of pounds by planning for only the minimum of high building, or often none at all.

122. Large though they can be, savings of this kind are not the only possibilities. Attention to the planning of the buildings themselves is important, and that is the main subject of the present chapter.

123. With layouts, one of the designer's chief concerns is the creation of a satisfying external environment for living. Equally, with the buildings themselves he is concerned to create good individual dwellings, and a good arrangement of dwellings in their relation to one another in the blocks. The basic aim throughout is to ensure value for money, but this is by no means necessarily the same as lowest initial cost, for the architect will rightly aim to evolve economical designs of the highest quality out of the many possible ways of meeting the requirements, rather than merely producing designs which give the lowest cost.

124. Dwellings in layouts at high density are expensive even when the layout and the dwellings are efficiently and economically planned, and because considerations of first cost are important there is a temptation to save money by using the cheapest alternative. This approach can be unsound, for in the long run tenant preferences will determine value, and it is especially important to take account of this in choosing the plan arrangements for the individual buildings in a scheme. For instance, in high slab blocks, the least costly dwellings of the types studied in this book are those with balcony access, which is being widely used at the present time. It may well be that dwellings with this type of access, which at heights of more than a few storeys can induce giddiness and is exposed to high winds and driving rain, will become difficult to let as living standards rise in the years ahead, and that the preference generally will be for enclosed forms of access. The economy may therefore have been too dearly bought. In any event the cost comparisons in this chapter, and those which will be made for local conditions by the local authority's technical officers, must be looked upon, not as automatically determining the choice, but as showing the levels of cost difference which are involved. What follows in this chapter concerning the relative costs of different dwelling types must be read against this background.

2. Factors making for economy in the planning of buildings

125. The basic problem of planning a block can be looked upon as the problem of enclosing the required number of dwellings, themselves economically planned, within four walls and a roof; providing satisfactory access to them; and providing efficient means of escape in case of fire.

126. The economical planning of the dwellings involves much the same considerations as the economical planning of houses—it is a question of attaining the required room sizes, with rooms of convenient shape, suitably arranged in relation to each other, and forming together a comfortable dwelling within an economical overall area. Internal bathrooms and inner lobbies to bedrooms sometimes help with this. The enclosure of the dwellings within the four walls and the roof brings in less familiar considerations relating to the shape of the block. With straight walls the most economical shape of building for a limited particular floor area is in principle a square, but for buildings with more than about four dwellings per floor, a square shape would mean too great a depth to afford enough daylight to the rooms; so rectangular shapes as deep as daylighting allows are the most economical way of enclosing larger areas. It is, of course, also true that making a building larger by extending it lengthwise saves external walling, since the extra space is enclosed for the addition only of the extra front and back walls (plus roof and floor). Moreover, whatever the basic shape of the building, the more closely it approximates to that shape, avoiding breaks in the line of the external walling, the less costly it will be.

127. The means of access adopted has a marked influence on cost per dwelling, because the number of dwellings which staircases and lifts can serve varies over a wide range, and because some arrangements demand much more space on a floor to provide a way between the staircase or lift and the entrance of the dwellings. Notes on balcony access, cross-ventilated lobby access, staircase access and common hall or corridor access are given on page 116; notes on lifts are given on page 117.

128. The costs of providing for means of escape in case of fire can also vary widely, and it must be a matter for individual initiative to meet the local requirements as economically as possible. A Committee of the British Standards Institution is working on recommendations for a national means of escape code, but meanwhile there is no national set of requirements, and in this book the designs take account of the requirements of the London County Council. An interpretation of these requirements is included, by courtesy of the Council, as Appendix C.

129. The rest of the chapter is arranged as follows. Part 2 consists of a number of cost comparisons of types of multi-storey building of most interest in mixed development. Part 3 gives a selection of floor and dwelling plans to supplement those discussed in Part 2. Finally, Part 4 details some of the special features of buildings for use in high density work.

Part 2.

Cost Comparisons of Buildings

130. The following pages give examples of flats and maisonettes in various types of block, and compare their cost. The comparisons are not absolute comparisons and they hold good only where the L.C.C. Code on Means of Escape, or something substantially the same, applies. Where the local means of escape provisions differ substantially from the L.C.C. Code, it is important to undertake a set of comparisons such as that made in this chapter to establish figures that are valid in the local conditions. Moreover, the comparisons given here are to be relied upon only for the sizes of buildings as shown. If a building is made longer, the consequential changes in the number and positions of staircases and lifts are not the same for all plan types; and, similarly, if the number of storeys is increased or decreased, the effect on the estimated cost per dwelling is likely to be different for each type of block.

131. The cost differences which appear in the following cost comparisons each relate to different means of providing similar total amounts of accommodation. The studies are not concerned to advocate one solution as against another; they are concerned only to show how wide the cost differences can be when different types of plan are used to provide given amounts of accommodation. Of course in some schemes which are expensive there may be corresponding benefits, and it is for the local authority to decide whether these are really worth what they are shown to cost.

132. In comparing the estimated costs of the various schemes, reference should be made to the General Note on Estimated Costs in the Introduction.

FIRST COST COMPARISON: TOWER BLOCKS

133. On typical sites and at densities likely to be encountered, most schemes designed on the lines set out in Chapter I will, if they need any high buildings at all, probably need them to accommodate smaller families; for most of the larger dwellings will be in the houses or in the four-storey maisonettee blocks. Towers, which were originally evolved to accommodate smaller families, are accordingly dealt with first, in a cost comparison dealing with seven different floor plans.

134. Five of the designs are for four flats per floor, the other two are for eight flats per floor.

135. Those with eight flats per floor are useful mainly in the larger schemes, at relatively high densities, where both a larger number and a larger proportion of dwellings must be in high buildings.

136. All seven floor plans have been designed for 50 per cent. one-bedroom and 50 per cent. two-bedroom flats, and the dwellings have been planned to give as far as possible the same amount of living space per flat in each design.

137. All the designs are for 11-storey blocks, six of them with two staircases, the other with one. The dwellings are designed for central heating.

HIGH TOWER FLATS

Figure 47 (*right*)

Alton Estate, Clarence Avenue, Roehampton. L.C.C.

Figure 48 (*below left*)

Tile Hill Estate, Coventry. City of Coventry.

Figure 49 (*below right*)

Trinity Road Estate, Wandsworth. L.C.C.

Figure 50 Hugh's Tower, Harlow—Harlow New Town Development Corporation.

Figure 51 Golden Lane Estate, City of London.

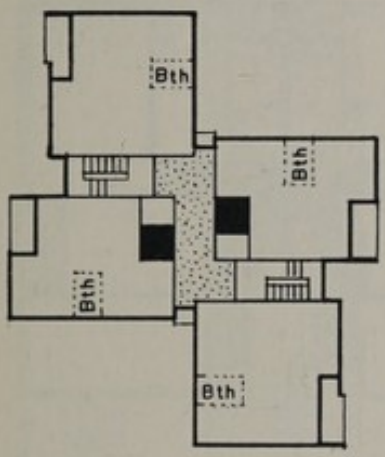
KEY TO ABBREVIATIONS USED IN THE PLANS

B	Bedroom	i.b.	Independent Boiler
B.S.R.	Bed Sitting Room	lc	Linen Cupboard
Bal	Balcony	L	Larder
Bth	Bathroom	L.R.	Living Room
c	Cupboard	p	Pram
ck	Cooker	r	Refuse Chute
d	Dresser	s	Sink
db	Dustbin	S.R.	Sitting Room
D.K.	Dining–Kitchen	St.	Store
D.S.	Dining Space	W.C.	Water Closet
F	Fuel Store	W.K.	Working Kitchen
H	Hall	G	Garage

11-Storey Tower Block

2 Stairs: 2 Lifts: 4 Flats per Floor

DAYLIGHTED COMMON HALL ACCESS



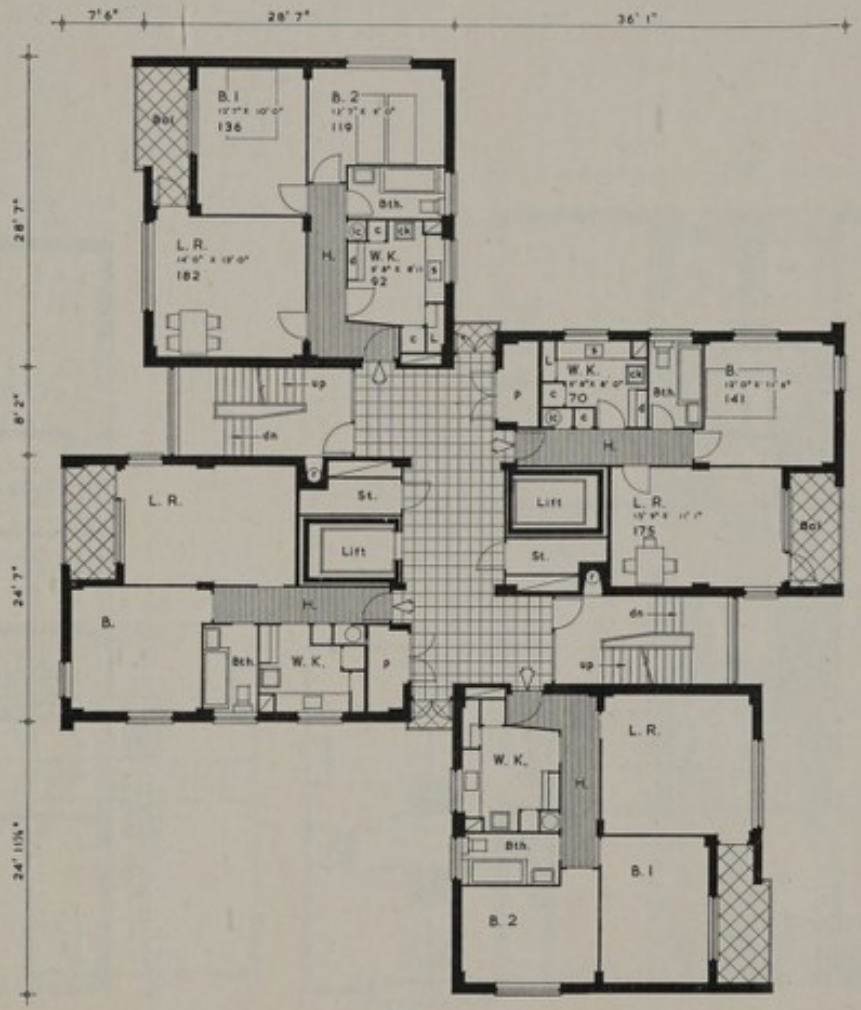


Figure 52

Net floor areas of flats.
1 BR. 2 person—495 sq. ft.
2 BR. 4 person—689 sq. ft.

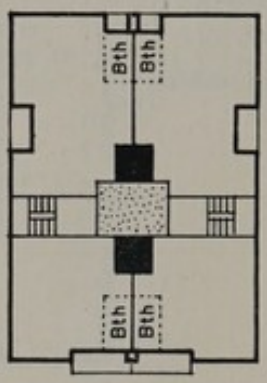
138. The cruciform design in Figure 52 is an economical example of its type, but the type has not been widely built. Each dwelling has through ventilation and the bathrooms are on outside walls. The common access space has direct natural light and is cross-ventilated. These features taken together demand a large area of external walling, and a large common access space, which result in a high cost. This building, in common with the rest of the designs in this comparison, has two lifts: for above about six storeys the inconvenience of having only one lift during maintenance and breakdown is usually regarded as unacceptable. There are two staircases, which offer alternative escape routes to the ground in case of fire.

139. The estimated average building cost per dwelling is £2,360, and local authorities who at one stage built blocks to similar designs have now adopted floor and dwelling plans which they have found more economical.

11-Storey Tower Block

2 Stairs: 2 Lifts: 4 Flats per Floor

ENCLOSED COMMON HALL ACCESS



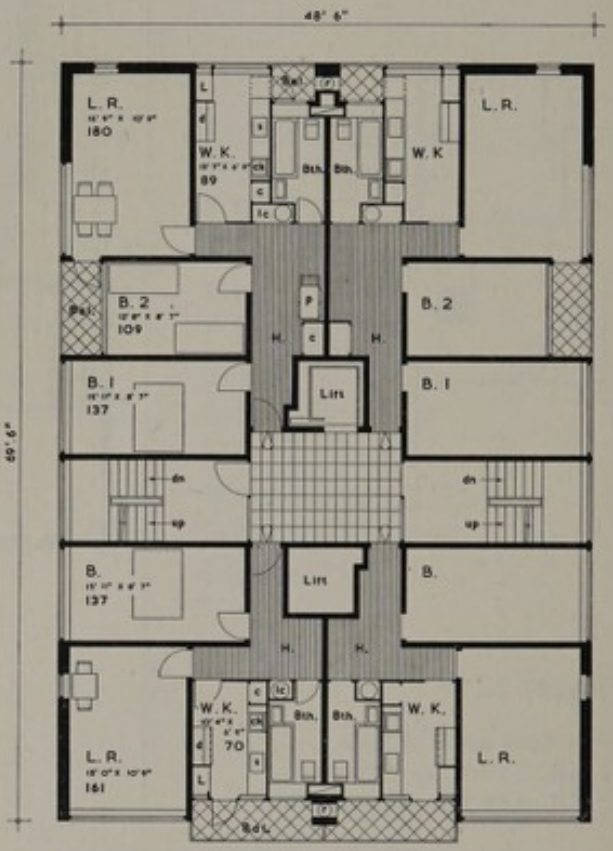


Figure 53

Net floor areas of flats.
1 BR. 2 person—519 sq. ft.
2 BR. 4 person—729 sq. ft.

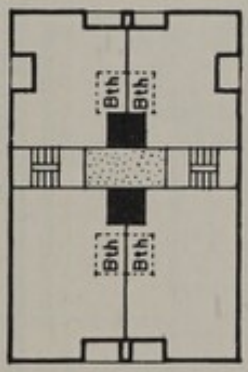
140. In the design shown in Figure 53 the building is rectangular in plan, with enclosed common hall access, and with corner ventilation for the dwellings. These changes permit large savings in common access space and in the area of external walling required. The dwellings are planned with access to all rooms from the hall of the dwelling. The bathrooms are on outside walls.

141. This design can be regarded a conventional modern example of a tower block, economically planned. The estimated average building cost per dwelling is £2,150, which is £210 less than Figure 52.

11-Storey Tower Block

2 Stairs: 2 Lifts: 4 Flats per Floor: Enclosed Common Hall Access

INTERNAL BATHROOMS



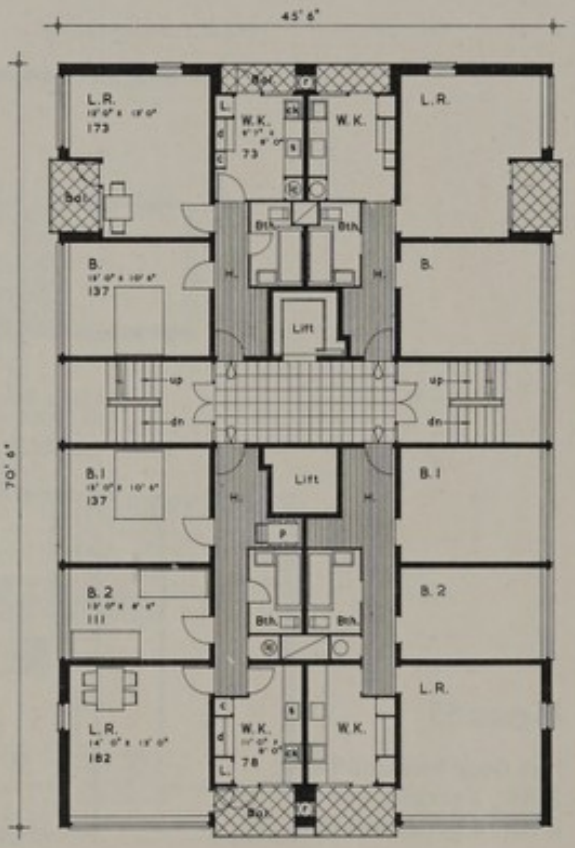


Figure 54

Net floor areas of flats.
1 BR. 2 person—498 sq. ft.
2 BR. 4 person—684 sq. ft.

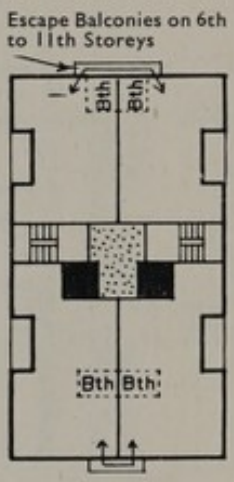
142. The design in Figure 54 differs from Figure 53 in having internal bathrooms, which are relatively new for local authority housing, although they are provided in some private enterprise houses and flats, and in hotels, and are widely adopted on the Continent and in the U.S.A. The internal bathroom, especially when planned next to the kitchen and in conjunction with the bathroom and kitchen of the adjoining flat, offers compact and frost-free plumbing, and allows the designer to arrange a dwelling within a smaller floor space and with less external walling. These two factors outweigh the cost of arranging for artificial ventilation.

143. The estimated average building cost per dwelling is £2,110, which is £40 less than Figure 53, some measure of the saving which internal bathrooms can achieve in high blocks of this kind, and £250 less than the cruciform block, Figure 52.

11-Storey Tower Block

2 Stairs: 2 Lifts: 4 Flats per Floor: Enclosed Common Hall Access

DWELLINGS WITH INNER LOBBIES



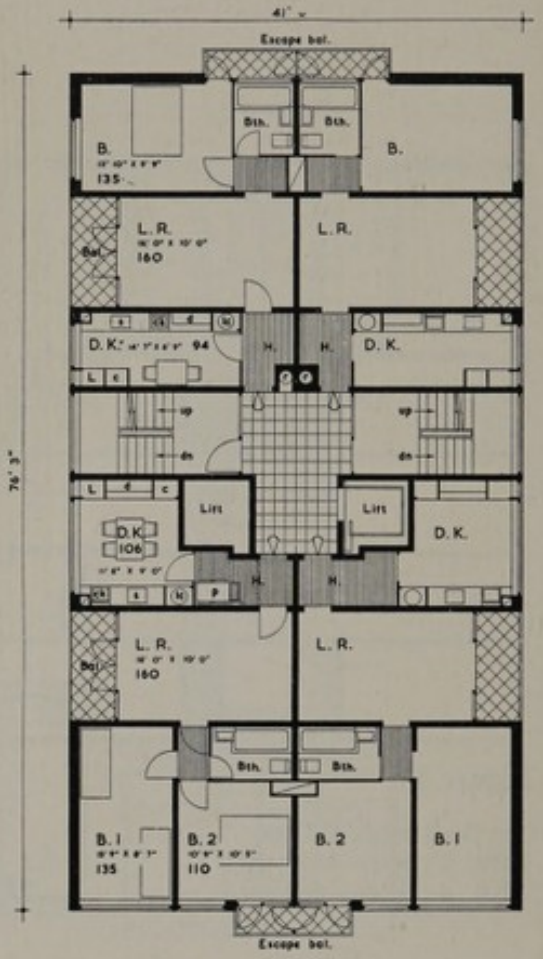


Figure 55

Net floor areas of flats.
1 BR. 2 person—499 sq. ft.
2 BR. 4 person—635 sq. ft.

144. The design in Figure 55 has the dwellings arranged so that, while access to the kitchen and living room is obtained from the hall of the dwelling, the bedrooms and the bathroom are reached by way of an inner lobby. The inner lobby, like the internal bathroom, permits a dwelling of given room areas to be planned within a smaller overall area. With this type of design it is necessary to provide balconies as shown, linking the bedrooms of one flat with those of the flat next door, so that there is an escape route in case of fire in, for instance, the living room.

145. The estimated average building cost per dwelling is £2,100, which is £10 less than the tower with internal bathrooms, Figure 54; £50 less than the conventional tower, Figure 53; and £260 less than the cruciform block, Figure 52.

11-Storey Tower Block

1 STAIRCASE: 2 Lifts: 4 Flats per Floor

Cross-Ventilated Common Hall Access

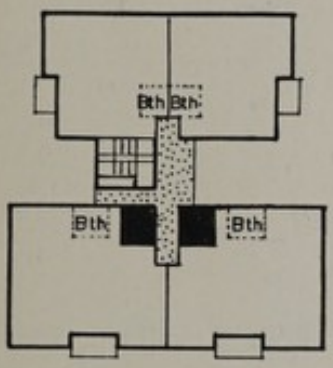
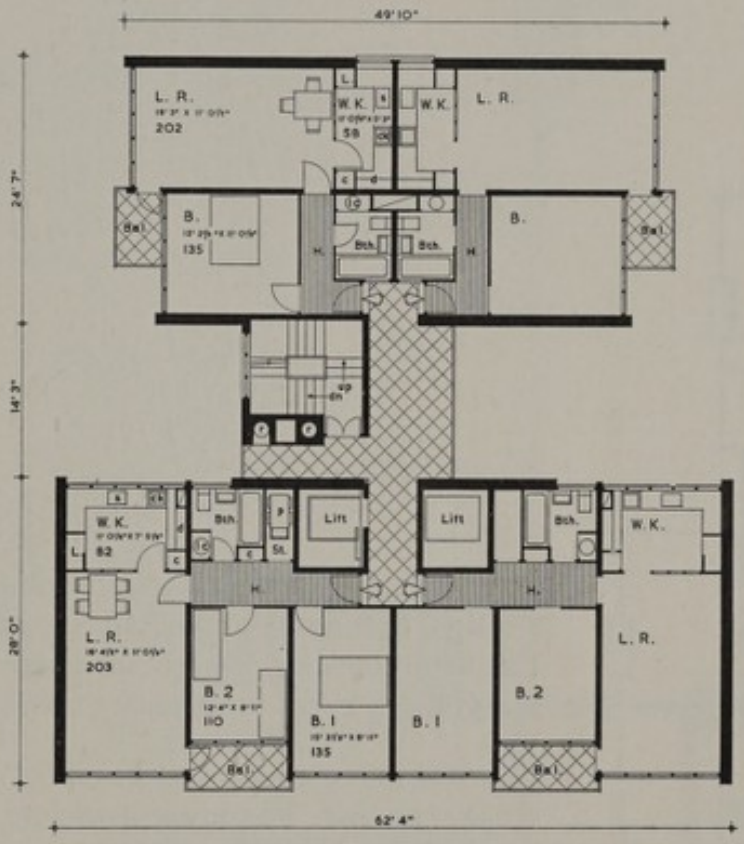


Figure 56

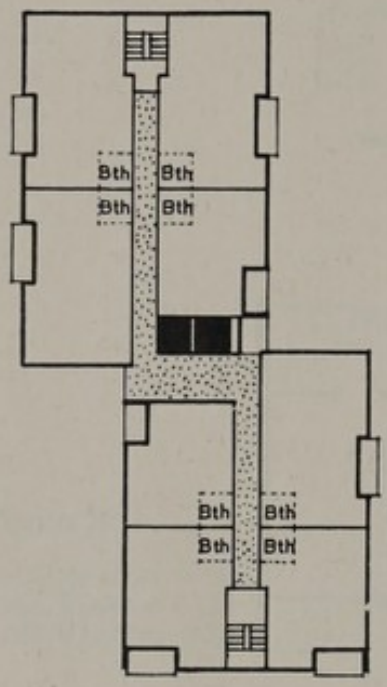
Net floor areas of flats.
1 BR. 2 person—493 sq. ft.
2 BR. 4 person—672 sq. ft.

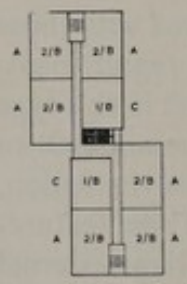


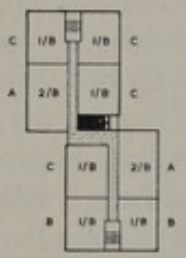
146. The design in Figure 56, saving one staircase compared with those in Figures 52, 53, 54 and 55, is of interest where the local requirements for means of escape in case of fire permit only one staircase in this type of block. Where this is so, it is normal to require the common hall to be cross-ventilated, as it is here. All the dwellings have cross-ventilation, and access to all rooms except the kitchens from a hall. These features and the common access arrangement result in a relatively large external wall area per dwelling, although the total floor area per dwelling is economical.

147. The estimated average building cost per dwelling is £2,040, which, compared with Figure 53, the conventional tower, shows a saving of £110. The saving derives largely from the fact that the estimated reduction in cost from omitting one public staircase exceeds the estimated cost of the extra external walling. It should be noted that the heat losses through the additional external walling would make the dwellings relatively expensive in running cost.

11-Storey DOUBLE TOWER Block
2 Stairs: 2 Lifts: 8 Flats per Floor
Enclosed Central Corridor Access







148. In Figure 57, the accommodation on each floor is doubled. There are eight flats per floor, but still served by two lifts and two staircases. The bathrooms are internal, and access to all rooms in the dwelling except the kitchens is obtained from the hall of the dwelling.

149. The estimated average building cost per dwelling is £1,920, which is £230 less than the conventional tower, Figure 53, and £190 less than the single tower with internal bathrooms, Figure 54. An 11-storey tower block of this design would therefore cost less than two towers to those designs, by £20,240 or £16,720 respectively. There would also be a reduction in running costs, as the heat losses are smaller, and as there are only half the number of lifts to run and maintain.

150. The two smaller floor plan diagrams show how the plan can be adapted for different numbers of one-bedroom and two-bedroom flats, using the dwelling plans shown as A, B and C in Figure 57.

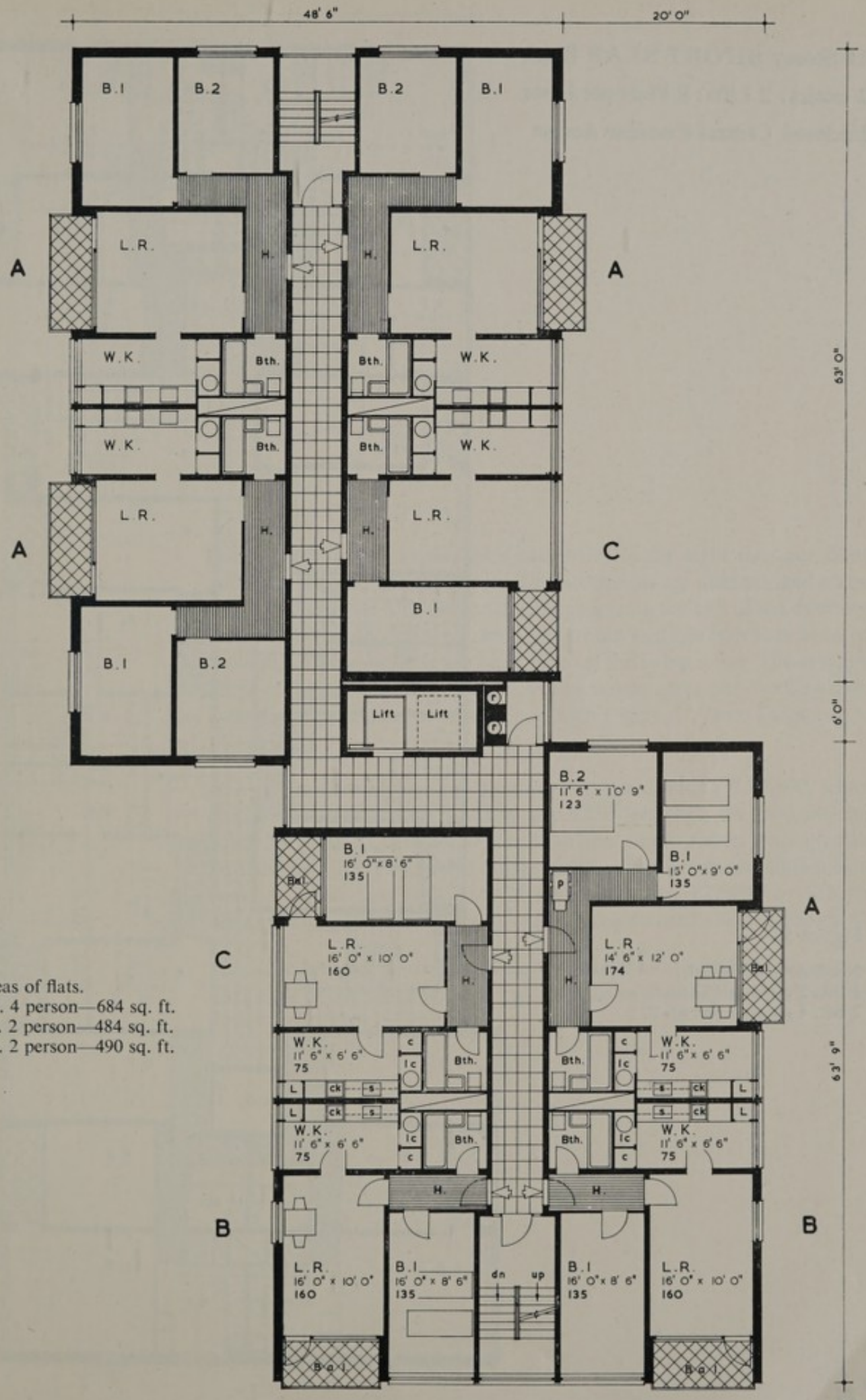


Figure 57

Net floor areas of flats.
Flat A 2 BR. 4 person—684 sq. ft.
Flat B 1 BR. 2 person—484 sq. ft.
Flat C 1 BR. 2 person—490 sq. ft.

11-Storey SHORT SLAB Block

2 Stairs: 2 Lifts: 8 Flats per Floor

Enclosed Central Corridor Access

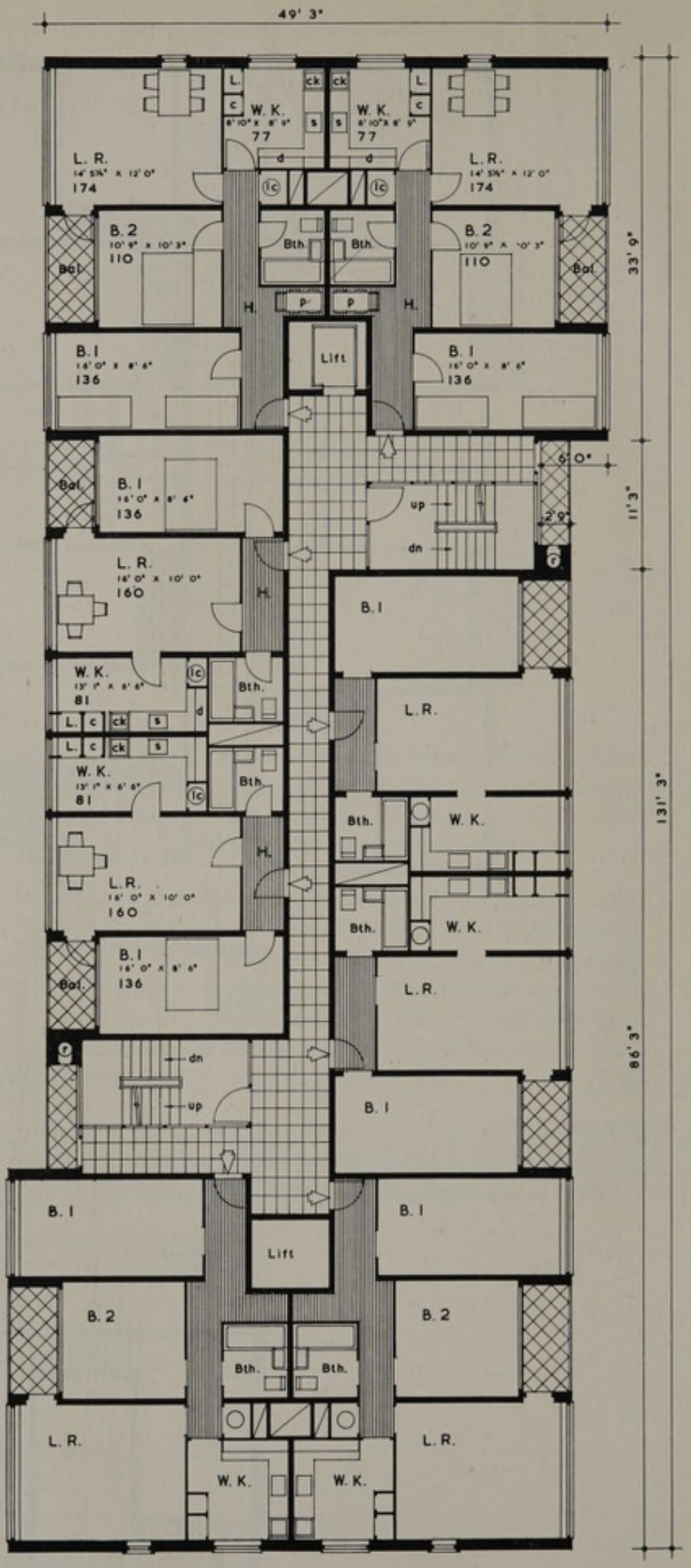
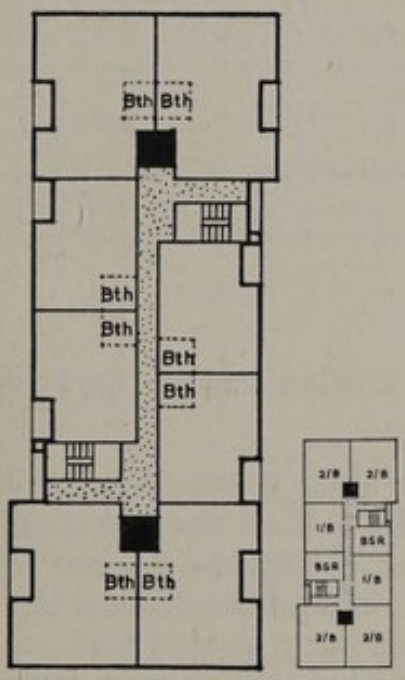


Figure 58

Net floor areas of flats.
1 BR. 2 person—480 sq. ft.
2 BR. 4 person—662 sq. ft.



151. The design in Figure 58 again provides for eight flats per floor, with two lifts and two staircases. The bathrooms are internal, and access to all rooms in the four-person dwellings is from the hall of the dwelling. In the two-person dwellings, the living room and the bedroom open off the hall, and the working kitchen opens off the living room. The arrangement of the end flats allows the common access space per dwelling to be substantially reduced in comparison with Figure 57, from 148 sq. ft. to 120 sq. ft.

152. The estimated average building cost per dwelling is £1,900, which is £20 less than Figure 57. It is also £250 less than the conventional tower, Figure 53, and £210 less than the single tower with internal bathrooms, Figure 54. An 11-storey block of this design would therefore cost less than two towers to those designs, by £22,000 or £18,480 respectively, with the savings in running costs noted also for Figure 57.

153. The smaller floor plan diagram shows how two-bedsitting-room flats may be provided if preferred in place of two of the one-bedroom flats.

Table 12. Effect of various floor plans on cost in 11-Storey Centrally Heated Tower Flats

	Flats per floor	Staircases and lifts	Arrangement	"A" Gross floor area—average per dwelling in sq. ft.	"B" Net floor area—average per dwelling in sq. ft.	Common access space (A–B)—as % of gross floor area	"C" Habitable floor area—average per dwelling in sq. ft.
Fig. 56	4	One staircase Two lifts	50% internal bathrooms; cross-ventilated common hall access	704	582	17·3	462
Fig. 52	4		Bathrooms with windows; daylighted common hall access .	830	592	28·7	457
Fig. 53	4	Two staircases	Bathrooms with windows; enclosed common hall access .	755	624	17·4	441
Fig. 54	4	Two lifts	Internal bathrooms; enclosed common hall access . .	713	591	17·1	445
Fig. 55	4		50% internal bathrooms; inner lobbies; enclosed common hall access	695	567	18·4	450
Fig. 57	8		(Double tower) Internal bathrooms; corridor access . .	731	586	19·8	439
Fig. 58	8		(Short slab) Internal bathrooms; corridor access . . .	691	571	17·4	437

For definitions and method of measurement see Appendix D.

Tower Blocks: Summary

154. Table 12 summarises the data on the buildings shown in the First Cost Comparison.

155. As indicated on page 63, the purpose of the Comparisons is not to advocate one type of building as against another. Nor should the buildings which show the lowest cost per dwelling be regarded as the automatic choice. For instance, towers with eight flats per floor give more accommodation in high building than many schemes need (see page 36). Also, some authorities may consider, after due thought, that a certain increase in expenditure is worthwhile to obtain particular benefits, such as access to all rooms from the hall of the dwelling.

156. All the buildings are as economically planned as the designer has found it possible to make them, and equal standards of specification and finish are taken for each. Differences in cost between the towers with four flats a floor derive mainly from either the saving of one staircase, or from differences in dwellings and common access space and differences in the area of external walling needed to enclose the block. In each block all four of these items is different; the differences in cost reflect mainly the net effect of these variations. Differences in cost between the buildings with eight flats a floor derive mainly from differences in

Common access space plus circulation and service space (A–C)—as % of gross floor area	External wall area —average per dwelling in sq. ft.	Gross floor area to external wall area —as a ratio	Habitable floor area to external wall area —as a ratio	Number of dwellings per storey height of public staircase	Number of dwellings per storey height of lift travel	Approx. estimate of cost per dwelling for building only *	Above or below basic plan by
34·4	660	1·07	0·70	4	2	£2,040	−£110
44·9	737	1·13	0·62	2	2	£2,360	+£210
41·6	531	1·42	0·83	2	2	£2,150	Basic
37·6	527	1·35	0·84	2	2	£2,110	− £40
35·3	527	1·32	0·86	2	2	£2,100	− £50
40·0	446	1·64	0·98	4	4	£1,920	−£230
36·8	442	1·56	0·99	4	4	£1,900	−£250

* All the estimates are for buildings only, and exclude site clearance and levelling, roads, footpaths, sewers and public utility mains, abnormal foundations, external works and professional fees.

common access space and the area of external walling. Differences in cost between the towers with four flats a floor and towers with eight flats a floor arise mainly because the latter have more dwellings per staircase and lift, but also because of differences in common access space and external walling.

SECOND COST COMPARISON: HIGH SLAB BLOCKS

PART I. 4-PERSON DWELLINGS

157. High slab blocks are mainly required where it is not possible to accommodate all the larger families in houses or four-storey maisonette blocks, since buildings of this type are mainly useful for providing larger numbers of such dwellings than fit readily into towers.

158. Each building in this comparison has 72 dwellings, and is designed for central heating. All the designs are for 12-storey blocks, and all the blocks provide as nearly as possible the same amount of space in dwellings.

HIGH SLAB MAISONETTES

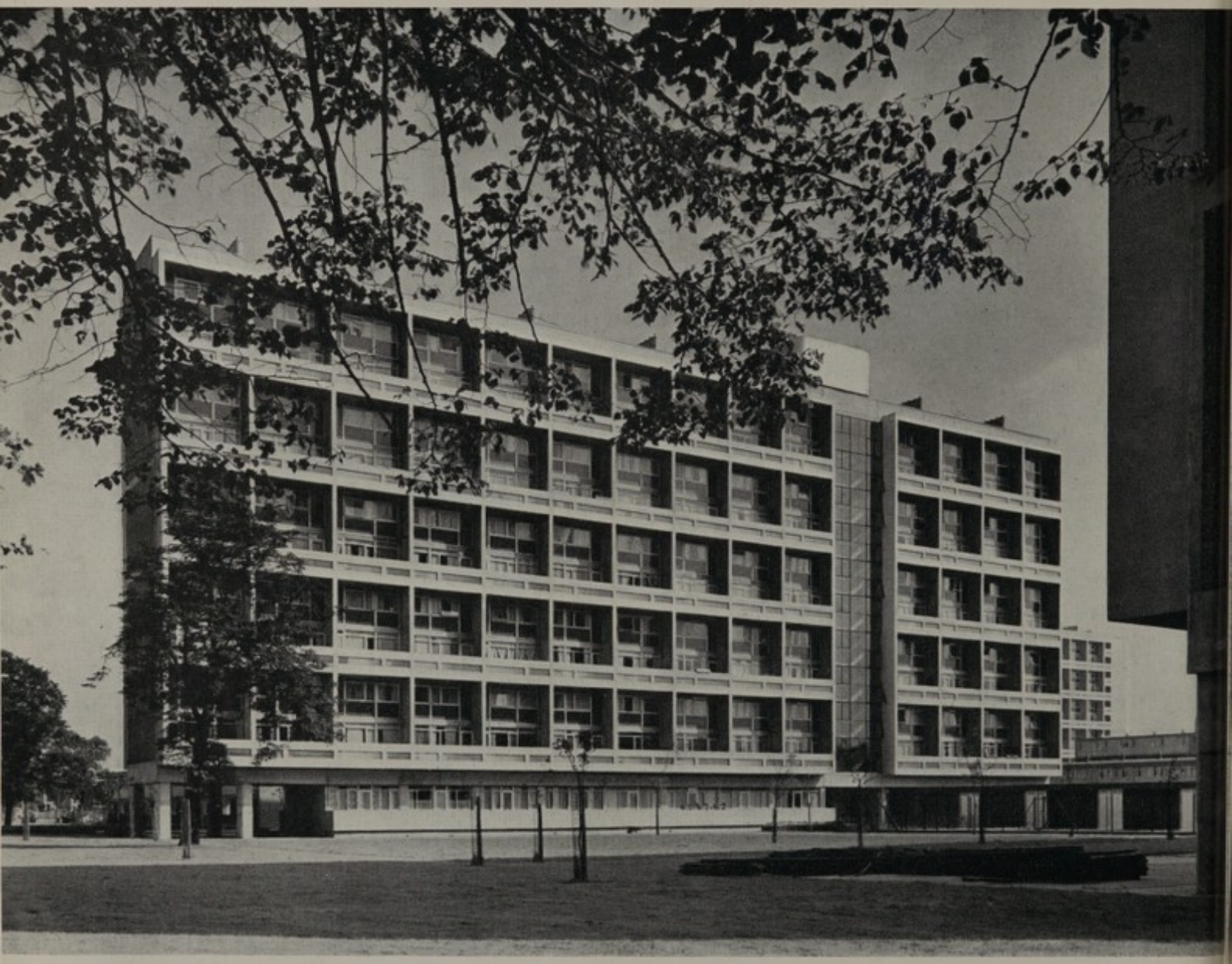


Figure 59 Loughborough Road Estate. London County Council.

Figure 60 Elden Street, Birkenhead. Birkenhead C.B.

Figure 61 Boyd Street, Liverpool. City of Liverpool.

Figure 62

Churchill Gardens, Pimlico, Westminster. Westminster City Council.

12-Storey Slab Block **4-Person Dwellings**

BALCONY ACCESS FLATS

1 Stair: 2 Lifts

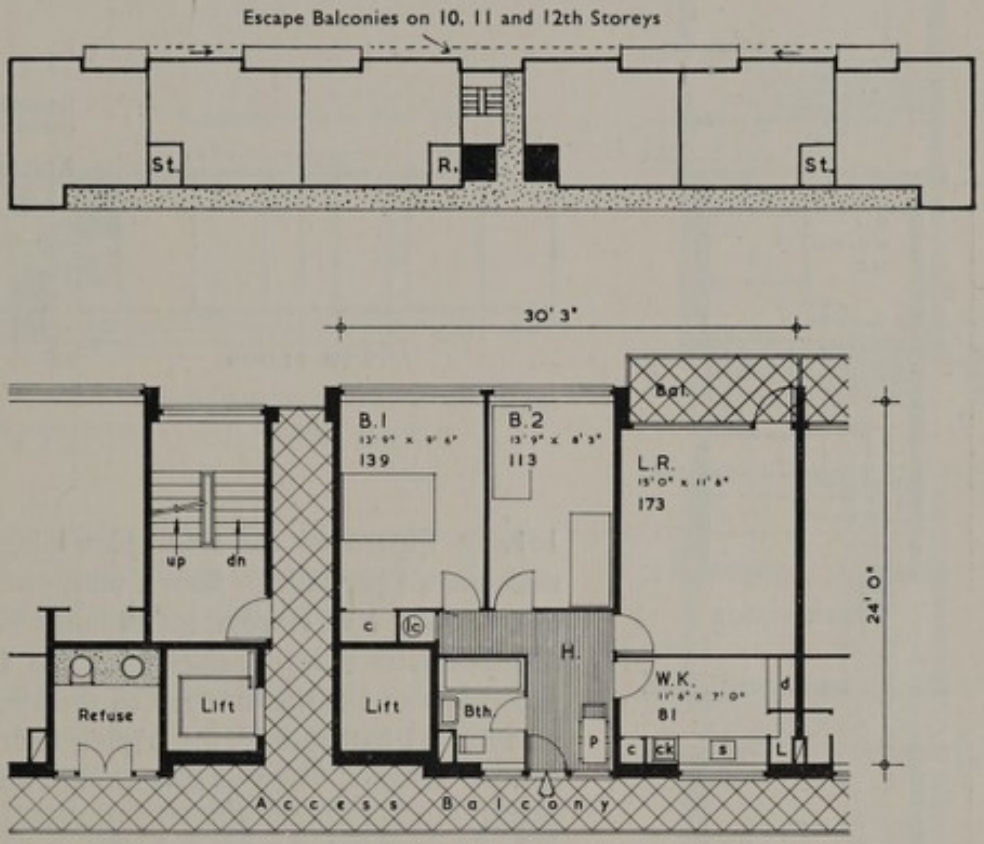


Figure 63

Net floor area of flat.
2 BR. 4 person—649 sq. ft.

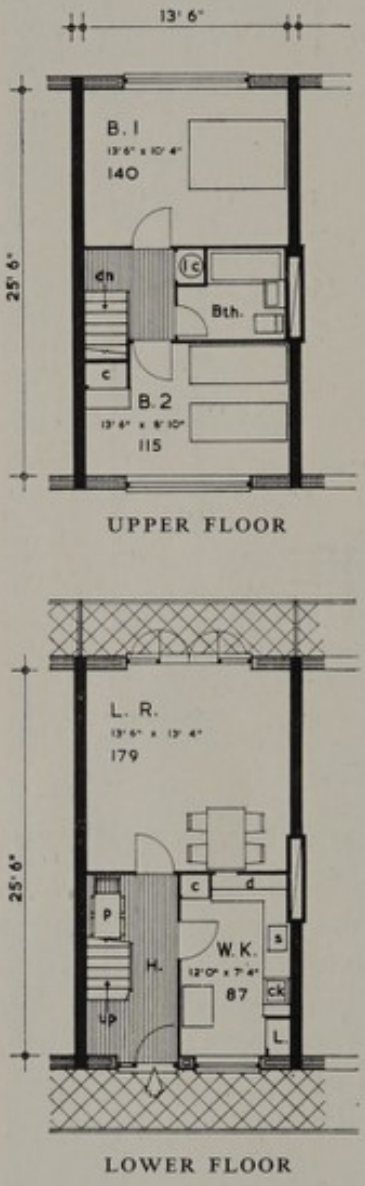
159. In Figure 63 the floor plan diagram shows six balcony access flats per floor, with one staircase and two lifts. On the 10th, 11th and 12th storeys, escape balconies are provided. The lobby giving access to the staircase is open to the air. The dwellings have access to all rooms from the entrance hall of the flat, and bathrooms on external walls. In order to avoid having the second bedroom alongside the balconies, two stores and a refuse-chute compartment are provided on each floor, which would otherwise have to be provided elsewhere.

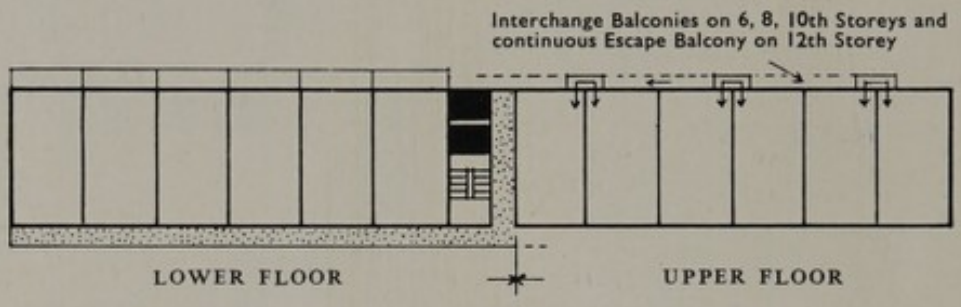
160. The estimated average building cost per dwelling is £2,120. £40 of this is the cost per dwelling of the storage. Deducting this gives the net estimated average building cost per dwelling as £2,080, the lowest of the group.

12-Storey Slab Block 4-Person Dwellings

BALCONY ACCESS MAISONETTES

1 Stair: 2 Lifts





161. In Figure 64 the floor plan diagram shows 12 balcony access maisonettes per pair of floors, with one staircase and two lifts. On the 6th, 8th and 10th storeys, interchange escape balconies are shown, with a continuous escape balcony on the 12th storey. The lobby by the staircase and the lifts is open to the air. The dwelling is planned* with an internal bathroom, two double bedrooms, and living room with a private balcony. There is a working kitchen.

162. The estimated average building cost per dwelling is £2,110, or £30 more than the net figure for balcony access flats.

Figure 64

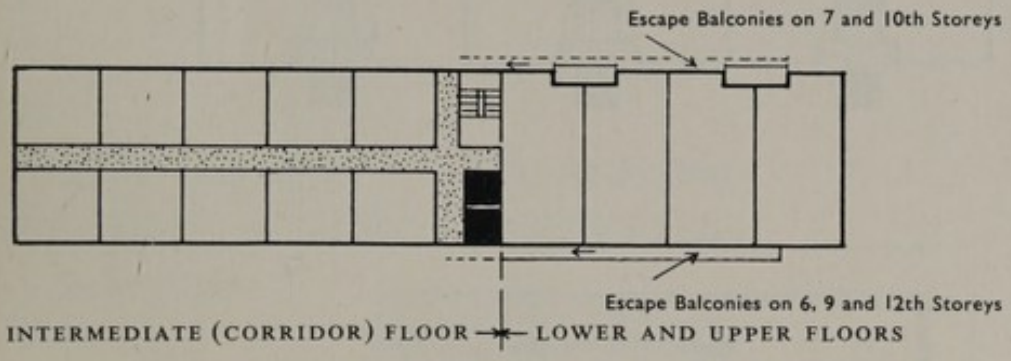
Net floor area of maisonette.
2 BR. 4 person—689 sq. ft.

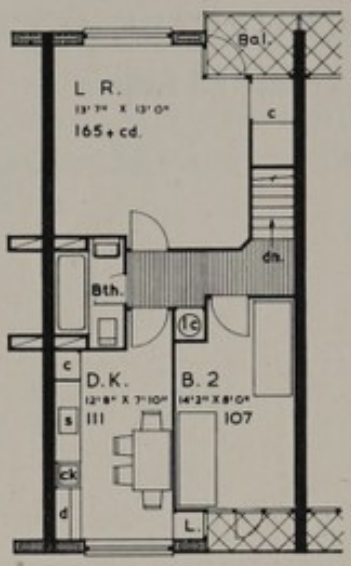
* For the 12th storey, extra provision is required for means of escape. See para. 23 (ii) of Appendix C on page 149.

12-Storey Slab Block **4-Person Dwellings**

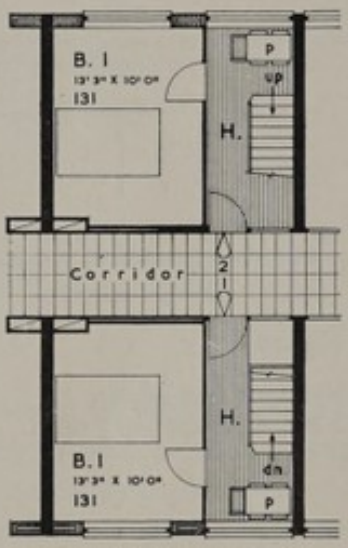
CORRIDOR ACCESS MAISONETTES (3-Floor Unit)

1 Stair: 2 Lifts

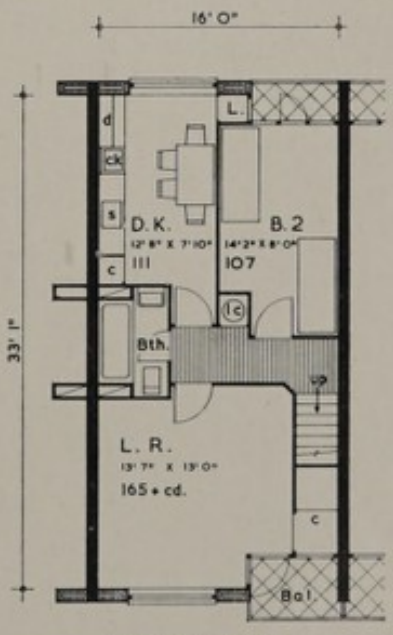




UPPER FLOOR



INTERMEDIATE FLOOR



LOWER FLOOR

163. In Figure 65 the floor plan diagram shows 18 corridor access maisonettes per set of three floors. The dwellings are arranged to occupy half a floor on one side of the corridor, and a full floor running through the block either above or below. There are two lifts and one staircase. The lobby by the lifts and staircases is open to the outside air, and the corridor is cross-ventilated also. From the sixth floor upwards the plan shows escape balconies at floors other than corridor floors. The dwelling is planned with an internal bathroom, two double bedrooms and living room with private balcony. There is a dining kitchen.

164. The estimated average building cost per dwelling is £2,250, which is £140 more than balcony access maisonettes and £170 more than balcony access flats. These increases arise mainly because the dwellings cannot be planned within as small an area as the balcony access types, and because the common access space per dwelling is larger.

Figure 65

Net floor area of maisonette.
2 BR. 4 person—715 sq. ft.

12-Storey Slab Block **4-Person Dwellings**

STAIRCASE ACCESS FLATS

3 Stairs: 3 Lifts

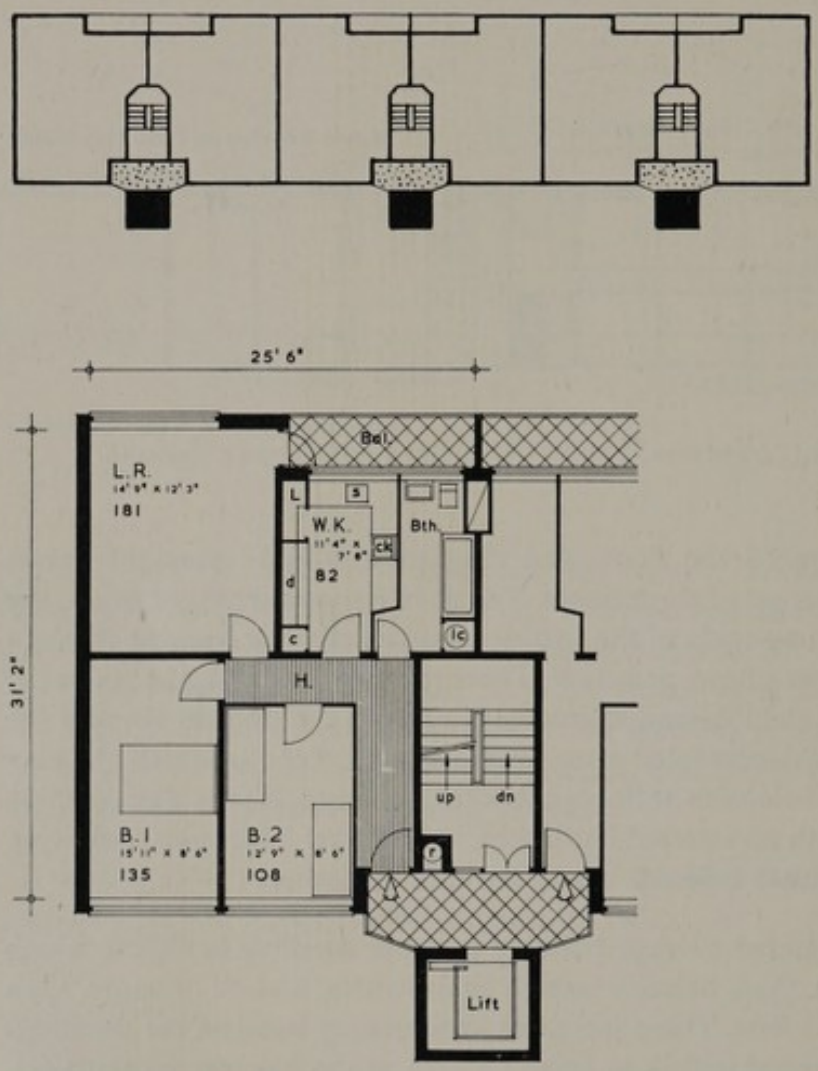


Figure 66

Net floor area of flat.
2 BR. 4 person—672 sq. ft.

165. In Figure 66 the floor plan diagram shows six staircase access flats per floor, with three lifts and three staircases. The lobby giving access from staircase and lift to the doors of the dwellings is open to the air. This arrangement avoids the need to have an expensive and space-consuming alternative means of escape in the form of a second staircase from the sixth storey to the roof, which the L.C.C. Code would otherwise require. The dwelling is planned with access to all rooms from the hall of the flat.

166. Staircase access shares with corridor access important advantages which balcony access does not have—shelter against wind and driving rain, and avoidance of the feelings of giddiness sometimes induced by heights. But the extra cost is higher, for the estimated average building cost per dwelling is £2,280, which is £30 per dwelling more than three-floor unit corridor access maisonettes. Moreover, there is one more lift to run and maintain than in the comparable corridor access block.

SECOND COST COMPARISON: HIGH SLAB BLOCKS

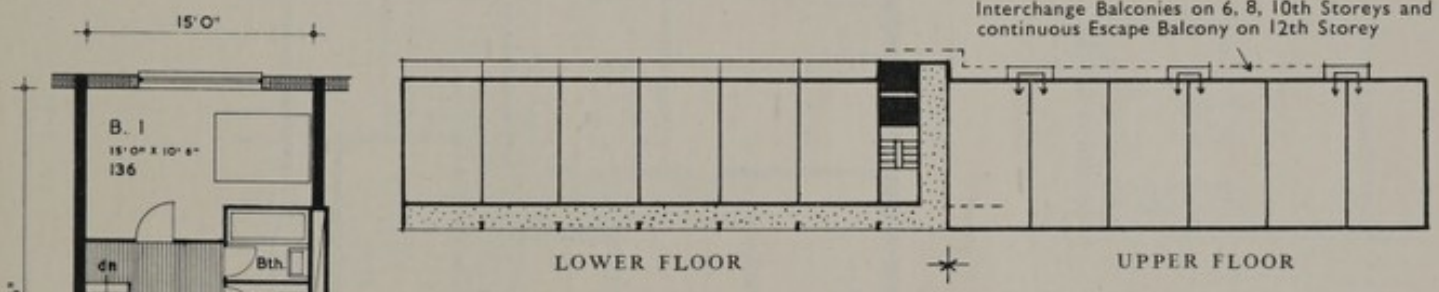
PART 2. 5-PERSON DWELLINGS

167. In the text of this part of the comparison, description of the blocks and the dwellings is given only if there is a significant difference from the four-person version of the same type of block.

12-Storey Slab Block **5-Person Dwellings**

BALCONY ACCESS MAISONETTES

1 Stair: 2 Lifts



168. The balcony access maisonette block, shown in Figure 67, is the cheapest way of providing five-person dwellings in slab blocks, because five-person balcony access flats cannot be satisfactorily planned without habitable rooms fronting on to the balconies.

169. The estimated average building cost per dwelling is £2,350.

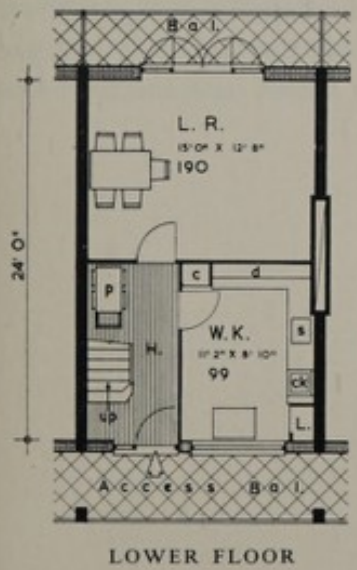


Figure 67

Net floor area of maisonette.
3 BR. 5 person—787 sq. ft.

12-Storey Slab Block **5-Person Dwellings**

STAIRCASE ACCESS FLATS

3 Stairs: 3 Lifts

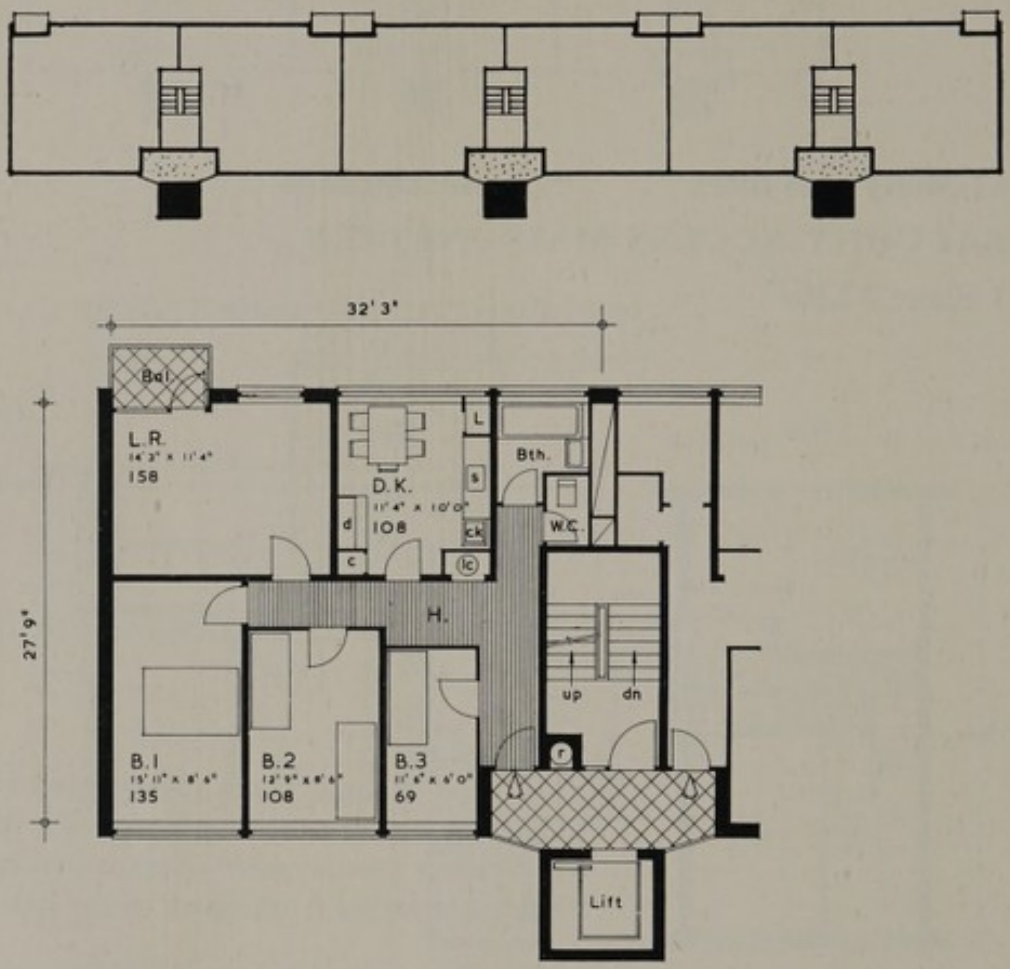


Figure 68

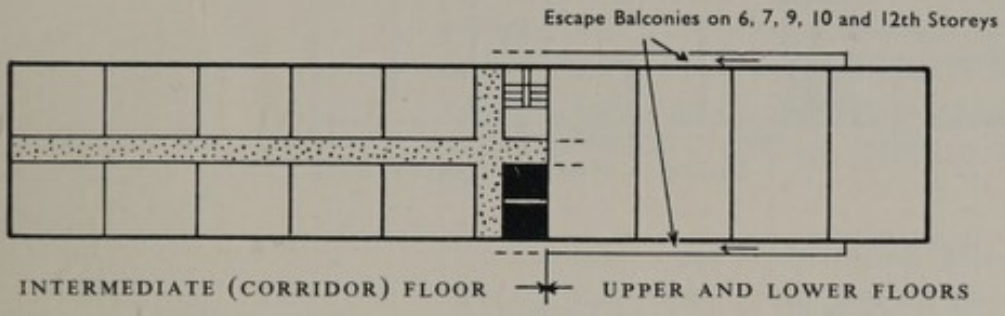
Net floor area of flat.
3 BR. 5 person—790 sq. ft.

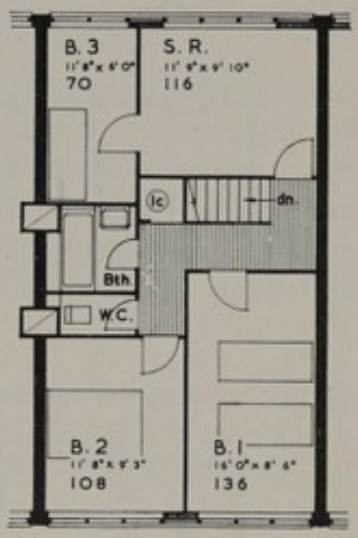
170. Staircase access flats in three-bedroom five-person form, shown in Figure 68, are again more expensive than the same accommodation in balcony access maisonettes. The estimated average building cost per dwelling is £2,480, or £130 more than balcony access maisonettes.

12-Storey Slab Block **5-Person Dwellings**

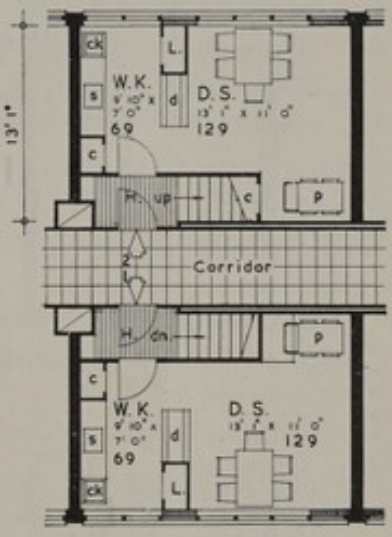
CORRIDOR ACCESS MAISONETTES (3-Floor Unit)

1 Stair: 2 Lifts



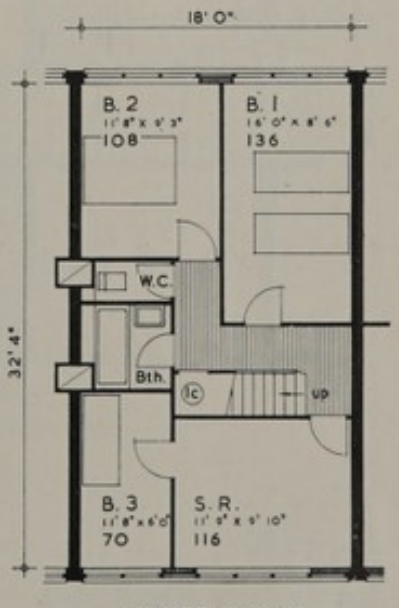


UPPER FLOOR



INTERMEDIATE FLOOR

171. This type of maisonette in five-person form, shown in Figure 69, has an estimated average building cost per dwelling of £2,490, which is £10 more than the staircase access flat, and £140 more than the balcony access maisonette.



LOWER FLOOR

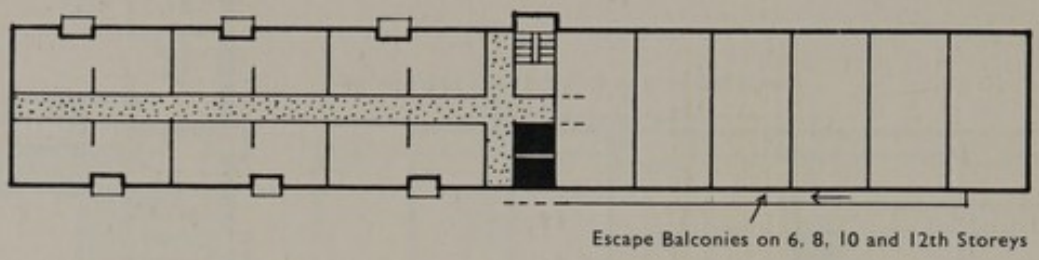
Figure 69

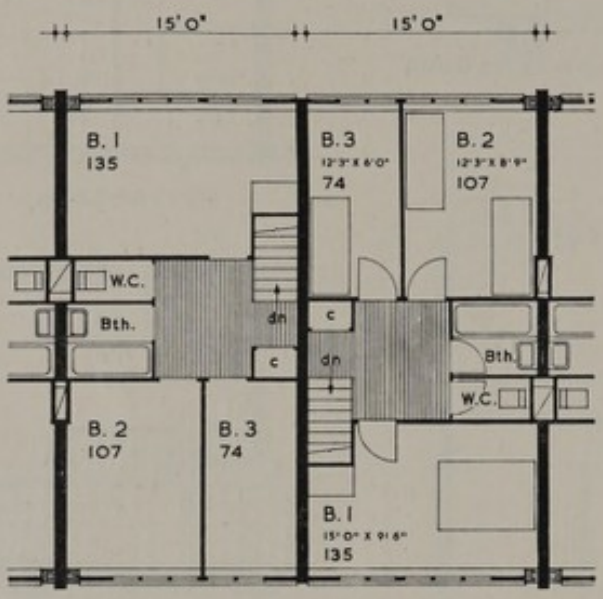
Net floor area of maisonette.
3 BR. 5 person—818 sq. ft.

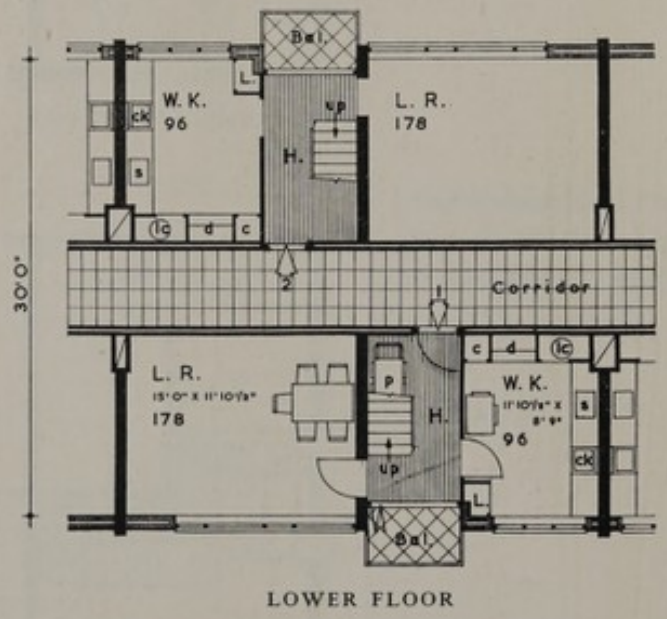
12-Storey Slab Block 5-Person Dwellings

CORRIDOR ACCESS MAISONETTES (2-Floor Unit)

1 Stair: 2 Lifts







172. In Figure 70 the floor plan diagram shows 12 corridor access maisonettes per set of two floors. The dwellings are arranged to occupy one rectangle of floor space alongside the central corridor, plus another rectangle on the floor above running through the block. There are two lifts and one staircase. The dwelling is planned* with living room, hall and working kitchen on the lower floor; and the bedrooms, and the internal bathroom, on the floor above.

173. The five-person two-floor unit corridor access maisonette has an estimated average building cost per dwelling of £2,470, which is £10 less than the staircase access flat, £20 less than the three-floor unit maisonette, and £120 more than the balcony access maisonette.

174. This type of block gives too large an area on the upper floor for four-person dwellings and was accordingly not used in the four-person section.

Figure 70

Net floor area of maisonette.
3 BR. 5 person—809 sq. ft.

* For the 12th storey, extra provision is required for means of escape. See para. 25 (ii) of Appendix C on page 150.

High Slab Blocks: Summary

175. Table 13 summarises the data on the buildings shown in the Second Cost Comparison.

176. As indicated on page 63, the purpose of the comparisons is not to advocate one type of building as against another. Nor should the buildings which show the lowest cost per dwelling be regarded as the automatic choice. For instance some authorities may consider, after due thought, that a certain increase in expenditure is worthwhile to obtain particular benefits, such as access to all dwellings from within the building.

177. The total areas of the rooms in the dwellings themselves, within both the four-person group and the five-person group, are planned to be as nearly the same as the designer could make them. The variations are very small, except that among the five-person dwellings the three-floor unit corridor access maisonette is slightly larger than the others.

178. All the buildings are as economically planned as possible, and equal standards of specification and finish are taken for each. The differences in cost in each group derive mainly from differences in the numbers of staircases and lifts, differences in areas of dwellings and common access space, and differences in the area of external walling needed to enclose the block. In each block all three of these items is different. The differences in cost reflect mainly the net effect of these variations.

179. Balcony access is cheaper than the enclosed forms of access, though it is not possible to plan a five-person balcony access flat economically without habitable rooms fronting on to the balcony, and it has therefore not been included. Of the enclosed forms of access, three-floor unit corridor access maisonettes for four persons are less expensive than the corresponding staircase access flats. In the five-person plans, two-floor unit corridor access maisonettes are less expensive than the corresponding staircase access flats. There is, moreover, a saving with the corridor access blocks in the running and maintenance costs of lifts.

Table 13. Influence of Means of Access on cost in 12-storey Centrally Heated Slab Blocks of 72 Dwellings

Two-bedroom dwellings for four persons	Number of staircases	Number of lifts	"A" Gross floor area—average per dwelling in sq. ft.	"B" Net floor area—average per dwelling in sq. ft.	Common access space (A–B)—as % of gross floor area	"C" Habitable floor area—average per dwelling in sq. ft.
Balcony access flats, Fig. 63 .	1	2	783	644	17·9	508
Balcony access maisonettes, Fig. 64	1	2	811	689	15·0	521
Corridor access maisonettes (3 floor unit), Fig. 65 . .	1	2	904	715	20·9	514
Staircase access flats, Fig. 66 .	3	3	780	672	13·9	506
Three-bedroom dwellings for five persons						
Balcony access maisonettes, Fig. 67	1	2	963	787	18·3	607
Staircase access flats, Fig. 68 .	3	3	913	790	13·5	578
Corridor access maisonettes (3 floor unit), Fig. 69 . .	1	2	981	818	16·6	628
Corridor access maisonettes (2 floor unit), Fig. 70 . .	1	2	1007	809	19·7	590

For definitions and method of measurement see Appendix D.

Common access space, plus circulation and service space (A–C)— as % of gross floor area	External wall area —average per dwelling in sq. ft.	Gross floor area to external wall area— as a ratio	Habitable floor area to external wall area— as a ratio	Number of dwellings per storey height of public staircase	Number of dwellings per storey height of lift travel	Approx. Estimate of cost per dwelling for building only*	Excess over lowest estimate
35·3	628	1·25	0·81	6	3	£2,120†	£10
35·8	578	1·40	0·90	6	3·27	£2,110	Lowest
43·1	542	1·67	0·95	6	3·27	£2,250	£140
35·4	675	1·16	0·75	2	2	£2,280	£170
37·0	648	1·49	0·94	6	3·27	£2,350	Lowest
36·7	765	1·17	0·76	2	2	£2,480	£130
36·0	589	1·67	1·07	6	3·27	£2,490	£140
41·4	662	1·52	0·89	6	3·27	£2,470	£120

* All the estimates are for buildings only, and exclude site clearance and levelling, roads, footpaths, sewers and public utility mains, abnormal foundations, external works and professional fees.

† Includes £40 for Stores on each floor.

THIRD COST COMPARISON: FOUR-STOREY MAISONETTE BLOCKS

180. Maisonettes in four-storey blocks are almost invariably planned with balcony access, and the object of this comparison is to show how the estimated average building cost per dwelling varies with the number of dwellings served by a staircase.

181. The first three blocks shown in Figure 80 contain 8, 12 and 24 dwellings served by one staircase. The fourth block has 24 dwellings served by two staircases.

182. The cost differences can be expected to be of about the same order with four-storey maisonettes of various sizes and designs. Here they are related to a three-bedroom four-person dwelling, a plan of which is shown in Figure 79.

183. In this type of block, where the entrance to the upper dwellings is on the second floor, a lift is not required.

184. The dimensions and plan shape of a maisonette are particularly suited to the cross-wall system of construction. Prototype buildings, using this method of construction and based on designs shown in Figures 98 and 99, have been built at Canterbury and at Sheffield, and others are to be found at Plymouth, Warwick, West Ham and Cardiff. This development work was undertaken by the Ministry in collaboration with the Councils of these authorities. At Canterbury a reduction in cost of the order of £140 per dwelling was found, due to the structural method employed and to the use of an economical plan.

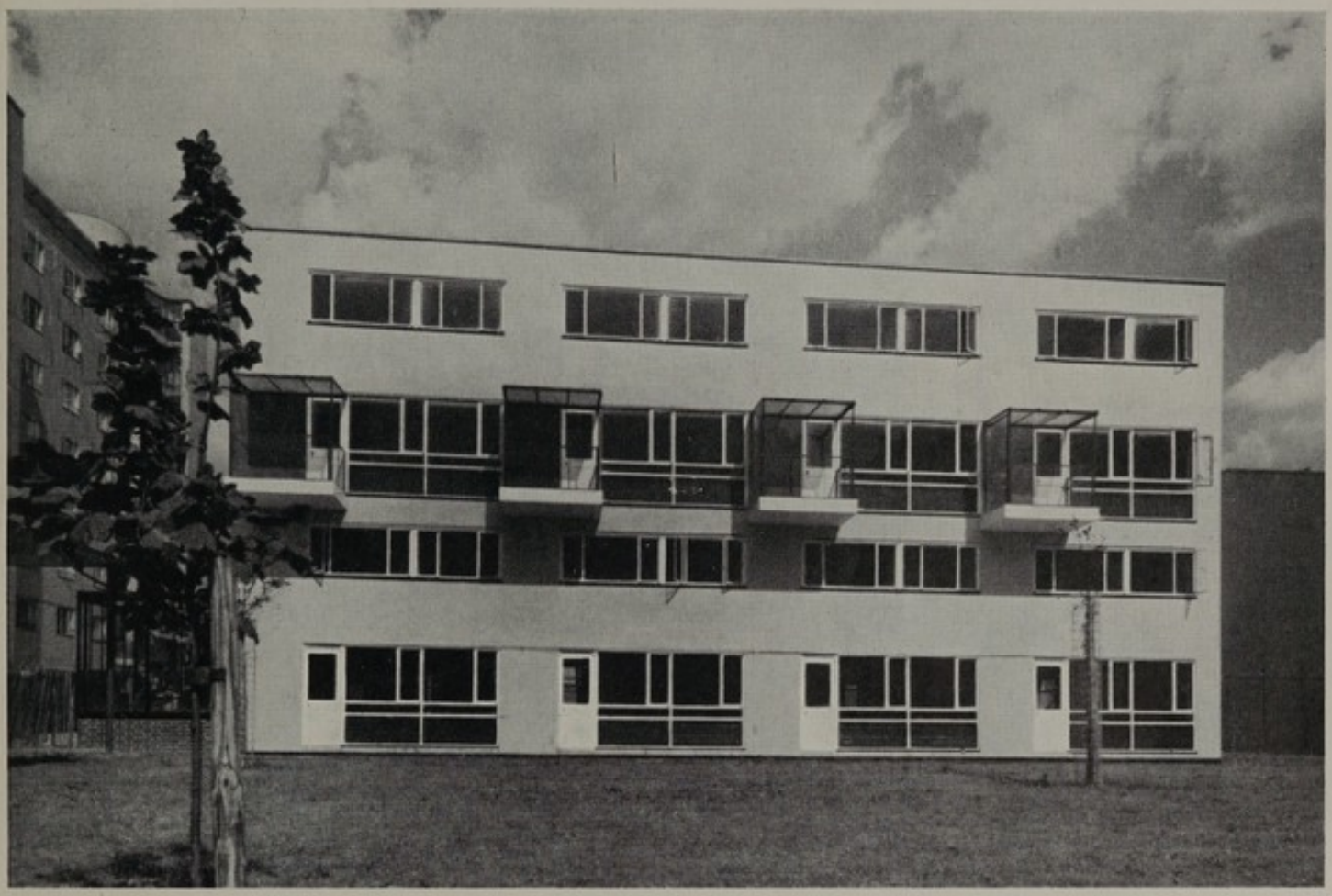


Figure 71 Churchill Gardens, Pimlico, Westminster. Westminster City Council.

Figure 72 Duddeston and Nechells Redevelopment Area, Birmingham. City of Birmingham.

Figure 73

Melrose Terrace, London, W.12.
Hammersmith M.B.C.

Figure 74

Forest Lane, West Ham.
West Ham C.B.

Figure 75

Tor Gardens Estate, Kensington.
L.C.C.

Figure 76

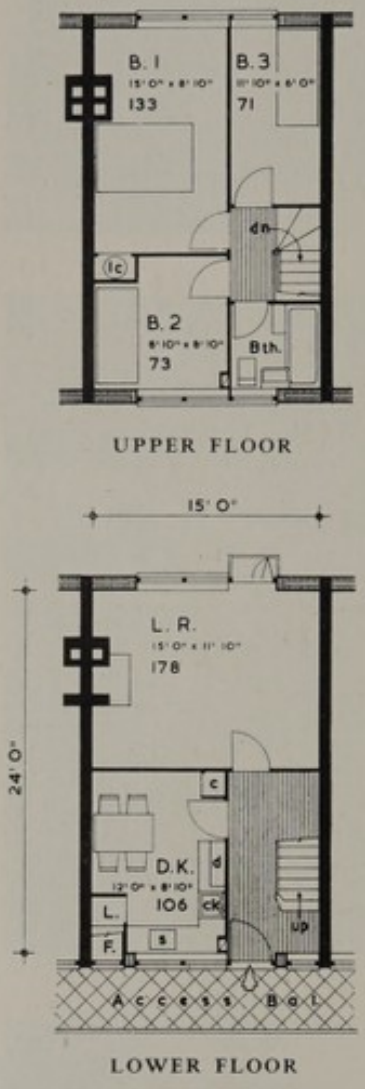
Military Road, Canterbury.
Canterbury C.B.

Figure 77

Picton Street, Camberwell.
L.C.C.

Figure 78

Busk Meadow, Sheffield.
City of Sheffield.



185. The dwelling shown in Figure 79, on which the costs are based, has one double and two single bedrooms, and a dining-kitchen. The living room in the upper dwelling has inward opening french windows. Heating is by individual solid fuel appliances. The four blocks in which the dwelling is used are shown in Figure 80.

186. The estimated average building cost per dwelling in the three blocks with one staircase is as follows:

(1) 8 dwellings £1,420.

(2) 12 dwellings £1,380. Saving over 1 . . £40.

(3) 24 dwellings £1,340. { Saving over 1 . . £80. / Saving over 2 . . £40.

187. The 24-dwelling block with two staircases has an estimated average building cost per dwelling of £1,370, which is £30 more than (3) above. But it is £10 less than (2) above because, in doubling the length of the block, a party wall is substituted for two end walls.

188. Additional plans, for other types of four-storey maisonettes, are given on pages 108 to 111.

Figure 79

Net floor area of maisonette.
3 BR. 4 person—720 sq. ft.

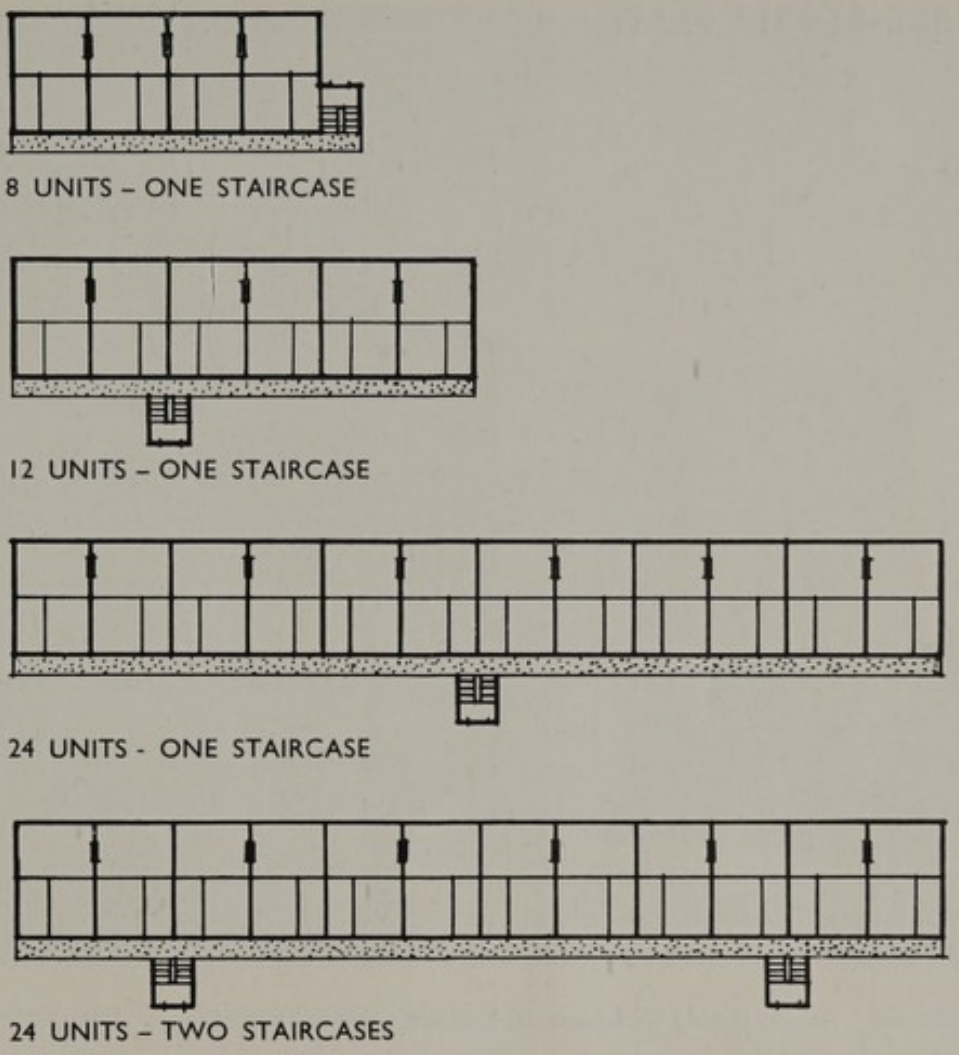


Figure 80

Block plans of four-storey maisonettes

FOURTH COST COMPARISON: THREE-STOREY FLATS

189. This comparison was designed to show whether internal bathrooms, and access to bedrooms by way of an inner lobby, both of which can give cost-savings in high blocks, will give similar savings in low blocks.

190. The plans are for Working-Kitchen and for Dining-Kitchen dwellings, in units of one four-person and one five-person dwelling. The estimates of building cost per dwelling are averages for the two. The pairs of dwellings are part of blocks containing 18 dwellings with six flats per floor, and each pair is planned to give as nearly as possible the same accommodation as the others. The plans envisage staircase access, which is usually considered worthwhile in blocks of this kind.

191. Blocks at this height do not require a lift.

Figure 81

Church Street, West Ham.
West Ham C.B.

Figure 84 Atkins Road, Wandsworth. London County Council.

Figure 82 Harlow New Town. Harlow New Town Development Corporation.

Figure 83 Nunhead Estate, Camberwell. London County Council.

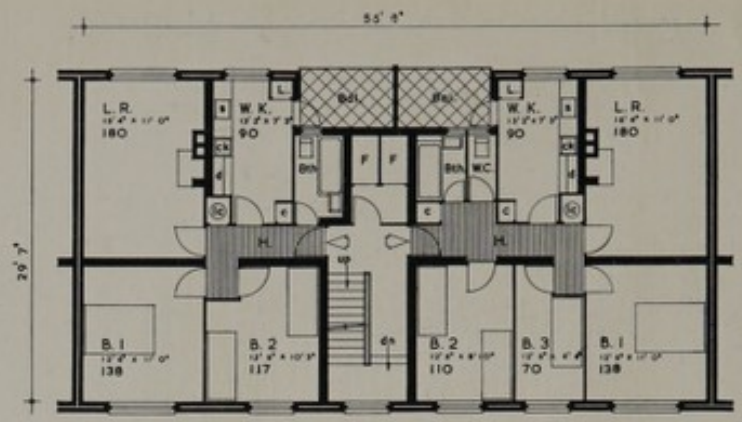
Three-storey Flat Blocks

WORKING-KITCHEN PLAN

Plan with access to all rooms from **entrance hall.** Estimated average building cost per dwelling £1,440.
Frontage 28 feet 4 inches.

Figure 85

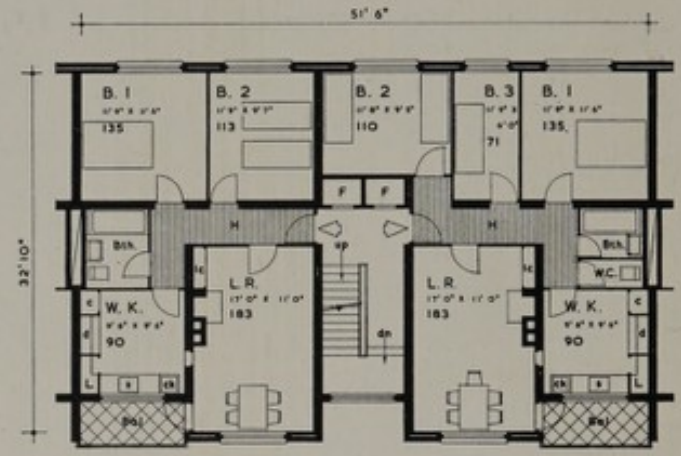
Net floor areas of flats.
2 BR. 4 person—652 sq. ft.
3 BR. 5 person—760 sq. ft.



Plan with access to all rooms from **entrance hall** and with **internal bathrooms.** Estimated average building cost per dwelling £1,445.
Frontage 25 feet 9 inches.

Figure 86

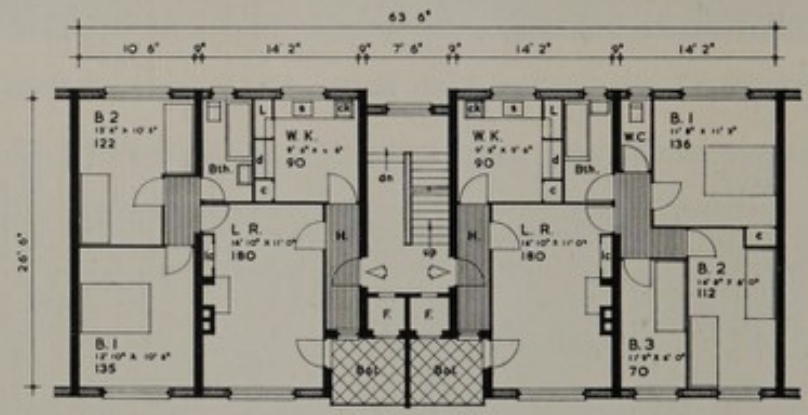
Net floor areas of flats.
2 BR. 4 person—672 sq. ft.
3 BR. 5 person—751 sq. ft.



Plan with access to bedrooms from an **inner lobby.** Estimated average building cost per dwelling £1,460.
Frontage 31 feet 9 inches.

Figure 87

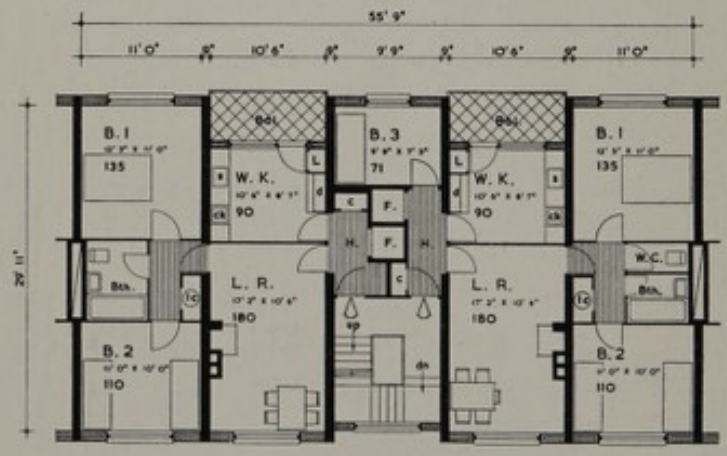
Net floor areas of flats.
2 BR. 4 person—672 sq. ft.
3 BR. 5 person—767 sq. ft.



Plan with access to bedrooms from an **inner lobby** and with **internal bathrooms.** Estimated average building cost per dwelling £1,445.
Frontage 27 feet 10½ inches.

Figure 88

Net floor areas of flats.
2 BR. 4 person—668 sq. ft.
3 BR. 5 person—748 sq. ft.



192. There is little significant difference in cost between Figures 85, 86 and 88, while Figure 87 is slightly more expensive. Figures 86 and 88, with internal bathrooms, require a significantly lower frontage, which will allow them to be laid out at a higher density.

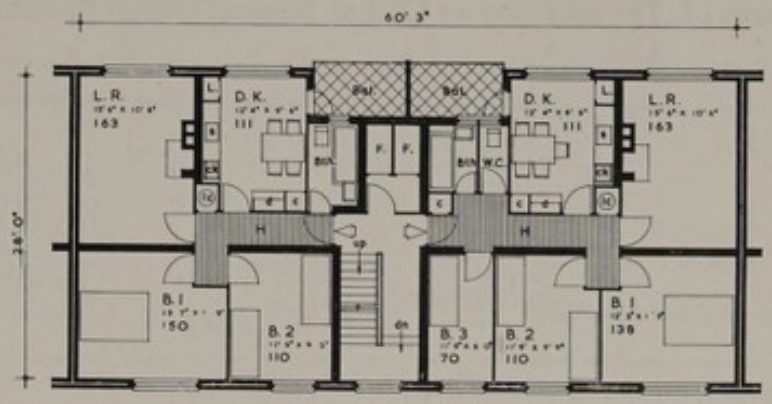
Three-storey Flat Blocks

DINING-KITCHEN PLAN

Plan with access to all rooms from **entrance hall.** Estimated average building cost per dwelling £1,445.
Frontage 30 feet 1½ inches.

Figure 89

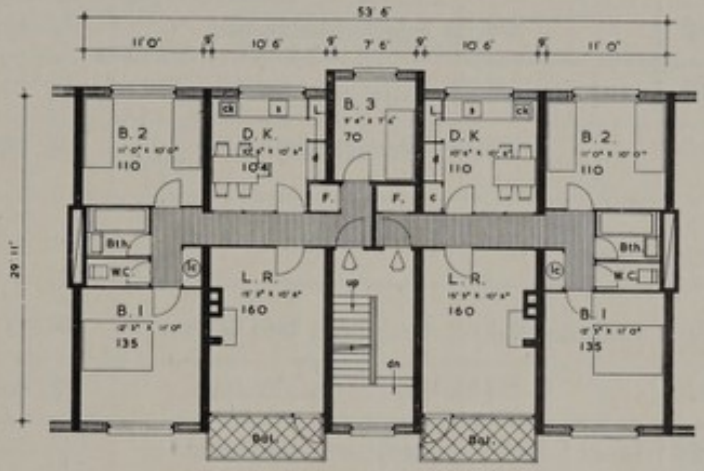
Net floor areas of flats.
2 BR. 4 person—670 sq. ft.
3 BR. 5 person—775 sq. ft.



Plan with access to all rooms from **entrance hall** and with **internal bathrooms.** Estimated average building cost per dwelling £1,455.
Frontage 26 feet 9 inches.

Figure 90

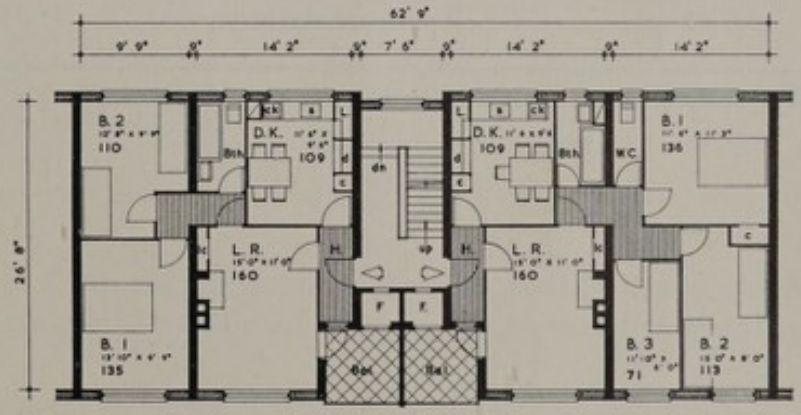
Net floor areas of flats.
2 BR. 4 person—681 sq. ft.
3 BR. 5 person—758 sq. ft.



Plan with access to bedrooms from an **inner lobby.** Estimated average building cost per dwelling £1,455.
Frontage 31 feet 4½ inches.

Figure 91

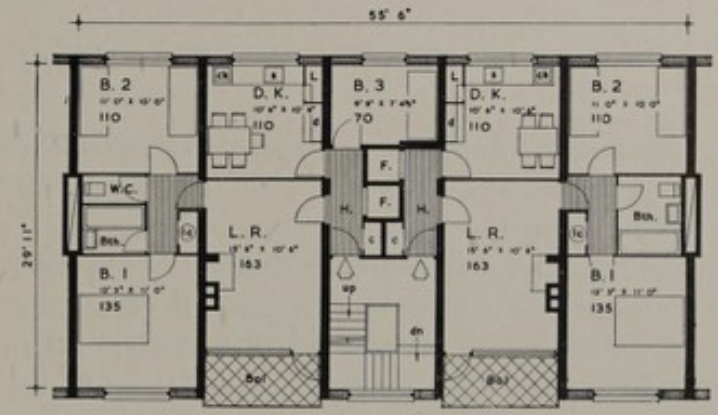
Net floor areas of flats.
2 BR. 4 person—650 sq. ft.
3 BR. 5 person—768 sq. ft.



Plan with access to bedrooms from an **inner lobby** and with **internal bathrooms.** Estimated average building cost per dwelling £1,455.
Frontage 27 feet 10½ inches.

Figure 92

Net floor areas of flats.
2 BR. 4 person—676 sq. ft.
3 BR. 5 person—754 sq. ft.



193. With this dwelling type also, there is little significant difference in cost, but again the units with internal bathrooms require a significantly lower frontage.

Table 14. The influence on Cost of Internal Design of Flats in Three-Storey Blocks

Estimates based on blocks of six flats on each floor with 50% 4-person and 50% 5-person dwellings

			"A" Gross floor area—average per dwelling in sq. ft.	"B" Net floor area—average per dwelling in sq. ft.	Common access space (A–B)—as % of gross floor area	"C" Habitable floor area—average per dwelling in sq. ft.
Working-Kitchen Plan						
Fig. 85	Entrance hall	Bathroom with window	799	706	11·64	556
Fig. 86		Internal bathroom .	801	711	11·18	555
Fig. 87	Inner lobby	Bathroom with window	801	719	10·17	557
Fig. 88		Internal bathroom .	788	708	10·15	550
Dining-Kitchen Plan						
Fig. 89	Entrance hall	Bathroom with window	811	722	10·91	563
Fig. 90		Internal bathroom .	802	719	10·29	547
Fig. 91	Inner lobby	Bathroom with window	792	709	10·48	551
Fig. 92		Internal bathroom .	794	715	9·95	553

For definitions and method of measurement see Appendix D.

Common access space, plus circulation and service space (A–C)— as % of gross floor area	External wall area —average per dwelling in sq. ft.	Gross floor area to external wall area— as a ratio	Habitable floor area to external wall area— as a ratio	Average frontage per dwelling	Approx. estimate of cost per dwelling for building only *	Excess over basic plan
30·35	594	1·35	0·94	28′ 4″	£1,440	Basic Plan
30·72	573	1·40	0·97	25′ 9″	£1,445	£5
30·4	657	1·22	0·85	31′ 9″	£1,460	£20
30·14	621	1·27	0·89	27′ 10″	£1,445	£5
30·59	613	1·32	0·92	30′ 1½″	£1,445	£5
31·79	557	1·44	0·98	26′ 9″	£1,455	£15
30·56	653	1·21	0·85	31′ 4½″	£1,455	£15
30·35	605	1·31	0·91	27′ 10½″	£1,455	£15

* All the estimates are for buildings only, and exclude site clearance and levelling, roads, footpaths, sewers and public utility mains, abnormal foundations, external works and professional fees.

Part 3.

Supplementary Dwelling Plans

194. This part of the chapter contains dwelling plans to supplement those already given in the cost comparisons. The plans are arranged in four sections:

(i) Tower blocks.

(ii) Slab blocks.

(iii) Four-storey maisonette blocks.

(iv) Three-storey houses.

195. There is no section on two-storey houses since detailed information is already available in "Houses 52", "The Quicker Completion of House Interiors" and "Houses 53". These publications all give frontage-saving terrace plans, which are particularly necessary in layouts at high density. Similarly, for three-storey houses, pages 47 to 49 of the Housing Manual 1949, give guidance; and examples of balcony access bed-sitting rooms and one-bedroom flats in three-storey blocks are shown in Figures 63, 64 and 76 of the same publication.

196. On pages 140, 141, 142 and 143 the illustrations to Appendix C on Means of Escape in case of Fire show over 50 skeleton block plans, which may be of general assistance in conjunction with the plans of dwellings given in this chapter.

DWELLINGS FOR TOWER BLOCKS

1 Stair: 2 Lifts: 6 Flats per Floor

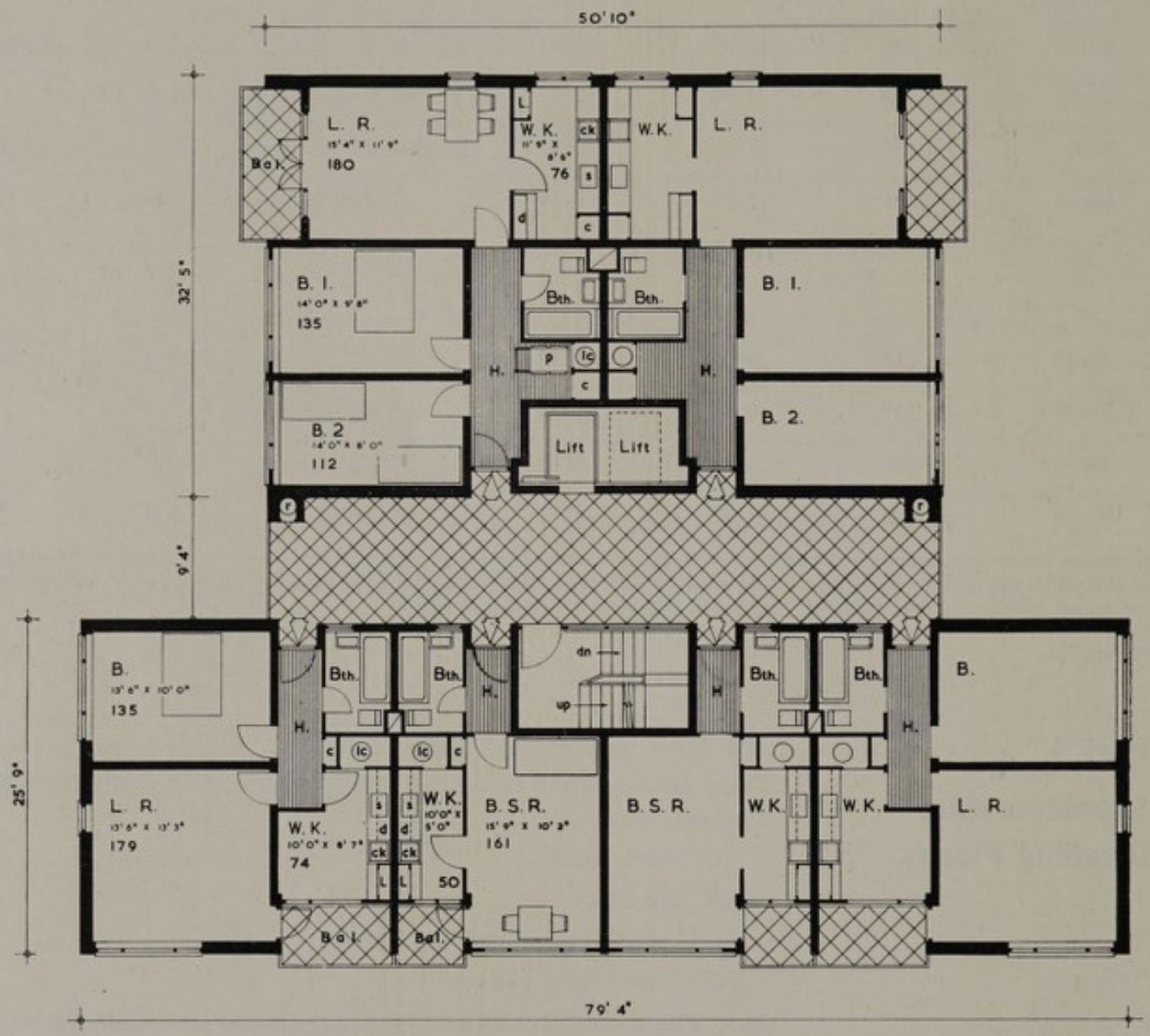


Figure 93

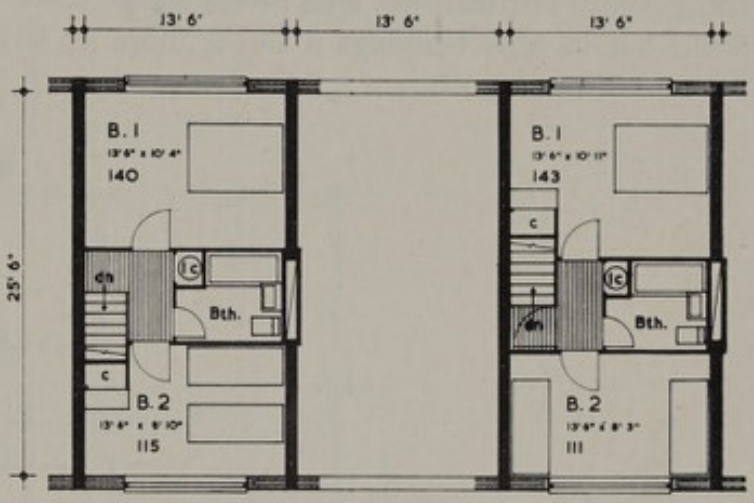
Net floor areas of flats.
B.S.R. 1 person—287 sq. ft.
1 BR. 2 person—501 sq. ft.
2 BR. 4 person—663 sq. ft.

197. Figure 93 shows a typical floor plan for a nine-storey tower block in which a single staircase and two lifts serve six flats on each floor. It is designed with a cross-ventilated lobby which gives access from the lifts and the staircase to the entrances to the dwellings. It is particularly suitable when there is to be a proportion of bed-sitting room flats on each floor. This plan was prepared in collaboration with the City Architect of Liverpool. The block shown here is limited to nine storeys in height because in the L.C.C. code for Means of Escape in case of Fire the number of dwellings accessible from each staircase is limited to four in buildings of greater height.

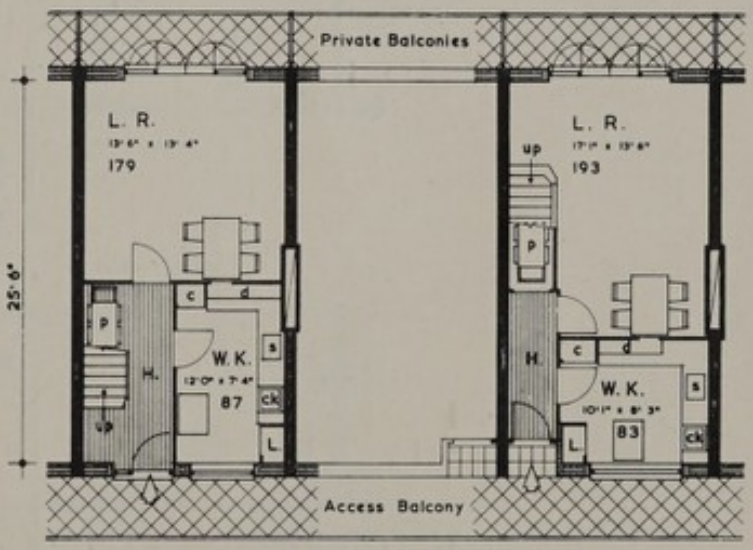
MAISONETTES FOR HIGH SLAB BLOCKS*

198. These plans, which incorporate internal bathrooms requiring mechanical ventilation, are frontage saving and therefore suited to high buildings, in which the aim is usually to keep down the length in relation to the depth. The limitations of balcony access in high blocks are noted on pages 61 and 116.

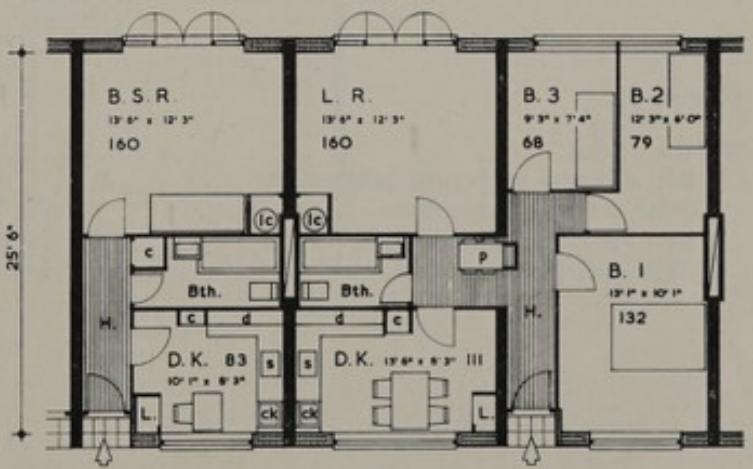
199. Figure 94 shows alternative plan arrangements of maisonette dwellings for four-person households, with the staircase rising to the bedroom floor either from the entrance hall or from the living room. Also shown is a ground floor plan of flats suitable where appropriate for use under maisonette dwellings on the upper floors. The means of access is by a projecting balcony. The projecting balcony is best suited to blocks in which the upper and lower floor of each maisonette can be conveniently planned with equal floor areas.



UPPER FLOOR OF MAISONETTE



LOWER FLOOR OF MAISONETTE



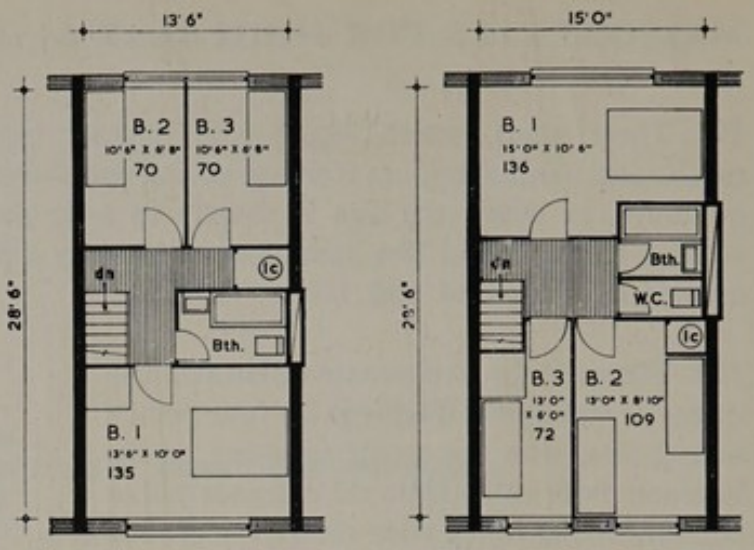
FLATS AT GROUND FLOOR LEVEL

Figure 94

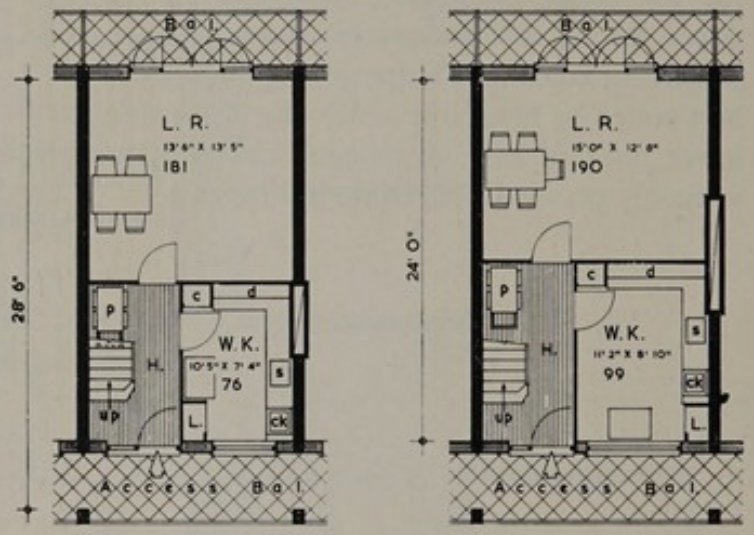
Net floor areas:
B.S.R. 1 person flat—344 sq. ft.
3 BR. 4 person flat—708 sq. ft.
2 BR. 4 person maisonette—689 sq. ft.

* The provision necessary for means of escape depends upon the detailed planning of the maisonette, upon the height of the block, and upon whether one or two main staircases are provided. The requirements for various circumstances are set out in Appendix C.

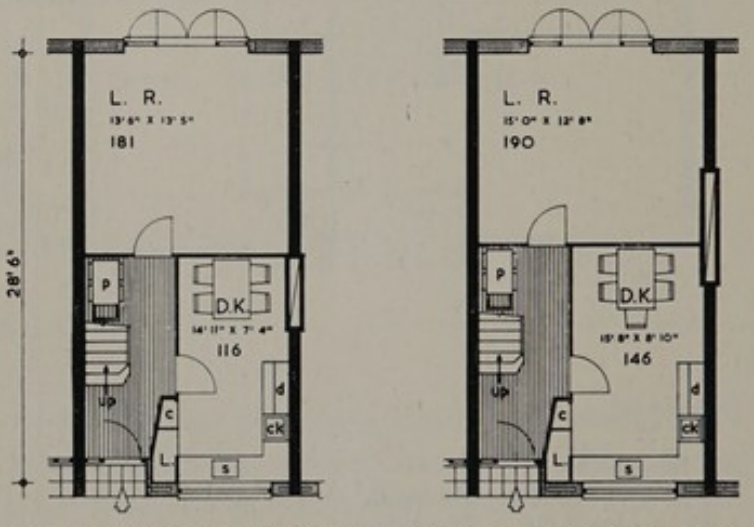
200. Figure 95 gives plans showing the inset type of access balcony for three-bedroom four-person and five-person maisonettes. Ground floor plans are also shown with the kitchens and entrance halls enlarged as compared with dwellings on upper floors. The inset balcony can be used only when the area of the lower floor of each dwelling can be conveniently less than the area of the upper floor, but in high buildings it is the more desirable arrangement.



UPPER FLOOR



LOWER FLOOR



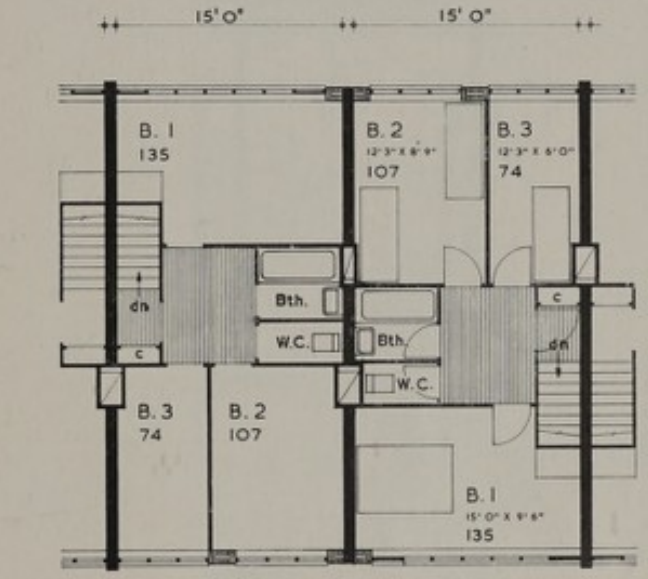
ALTERNATIVE LOWER FLOOR AT GROUND FLOOR LEVEL

Figure 95

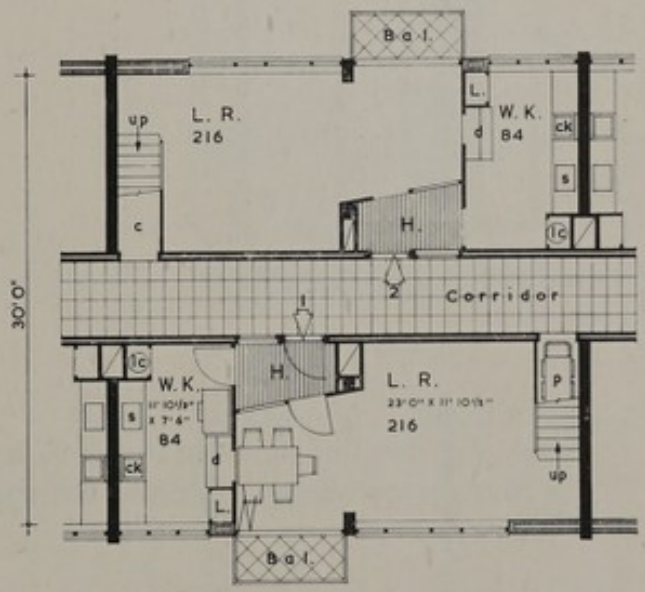
Net floor areas:
3 BR. 4 person maisonette—709 sq. ft.
With enlarged lower floor—770 sq. ft.
3 BR. 5 person maisonette—787 sq. ft.
With enlarged lower floor—855 sq. ft.

201. Figure 96 shows a maisonette plan for five-person households in which access is by central corridor on alternate floors. The staircase is open to the living room.

202. Ministry designs illustrating this principle of planning were shown at the Building Trades Exhibition in 1951. Since then Gateshead County Borough Council have developed and built a scheme on those lines, to the plan shown in Figure 70 on page 88, and other local authorities have also adapted the principle to suit their own requirements.



UPPER FLOOR

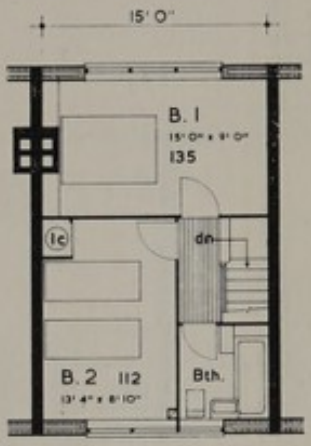


LOWER FLOOR

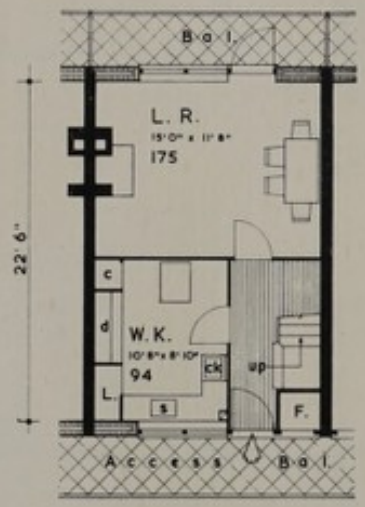
Figure 96

Net floor area of maisonette:
3 BR. 5 person—815 sq. ft.

203. In this type of block access to the lower maisonettes should preferably be through a small private garden to prevent overlooking of ground floor rooms. Access to the upper dwellings is from an access balcony served by a common staircase.



UPPER FLOOR



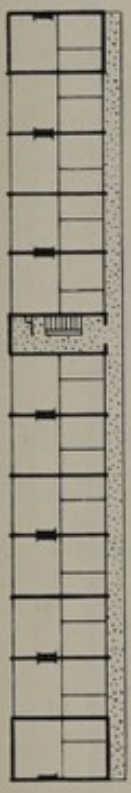
LOWER FLOOR

Figure 97

Net floor area of maisonette:
2 BR. 4 person—675 sq. ft.

204. The dwelling shown in Figure 97 is planned with two bedrooms for a four-person family. Access to the upper dwelling is by a projecting balcony.

205. The design in Figure 98, and that shown in Figure 99, formed the basis of the development work on cross-wall construction referred to at the beginning of the third cost comparison. The design is for a block of 24 dwellings with one staircase. There is a projecting access balcony, and the block provides accommodation for 18 four-person and six five-person dwellings.



Block plan.

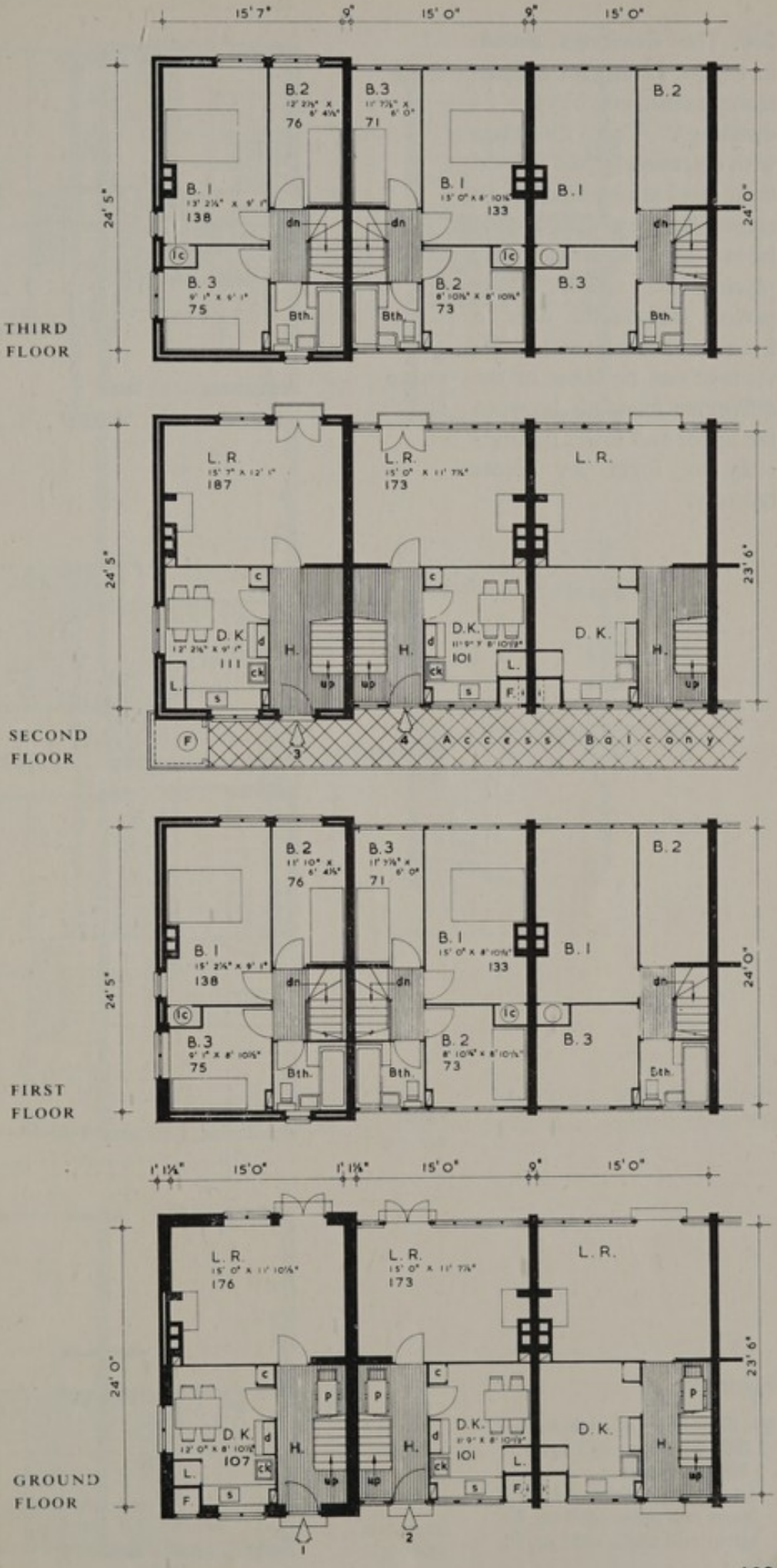


Figure 98

Net floor areas of maisonettes:
3 BR. 4 person:
intermediate units—713 sq. ft.
lower end units—740 sq. ft.
upper end units—761 sq. ft.

206. The dwellings shown in Figure 99 are for a four-storey maisonette block of 24 dwellings. The dwellings with entrances at the second floor level are entered off an access balcony approached from one staircase. By placing the smaller four-person maisonette over a five-person maisonette, advantage can be taken of the difference in depth between the upper and lower maisonettes to form an access balcony.

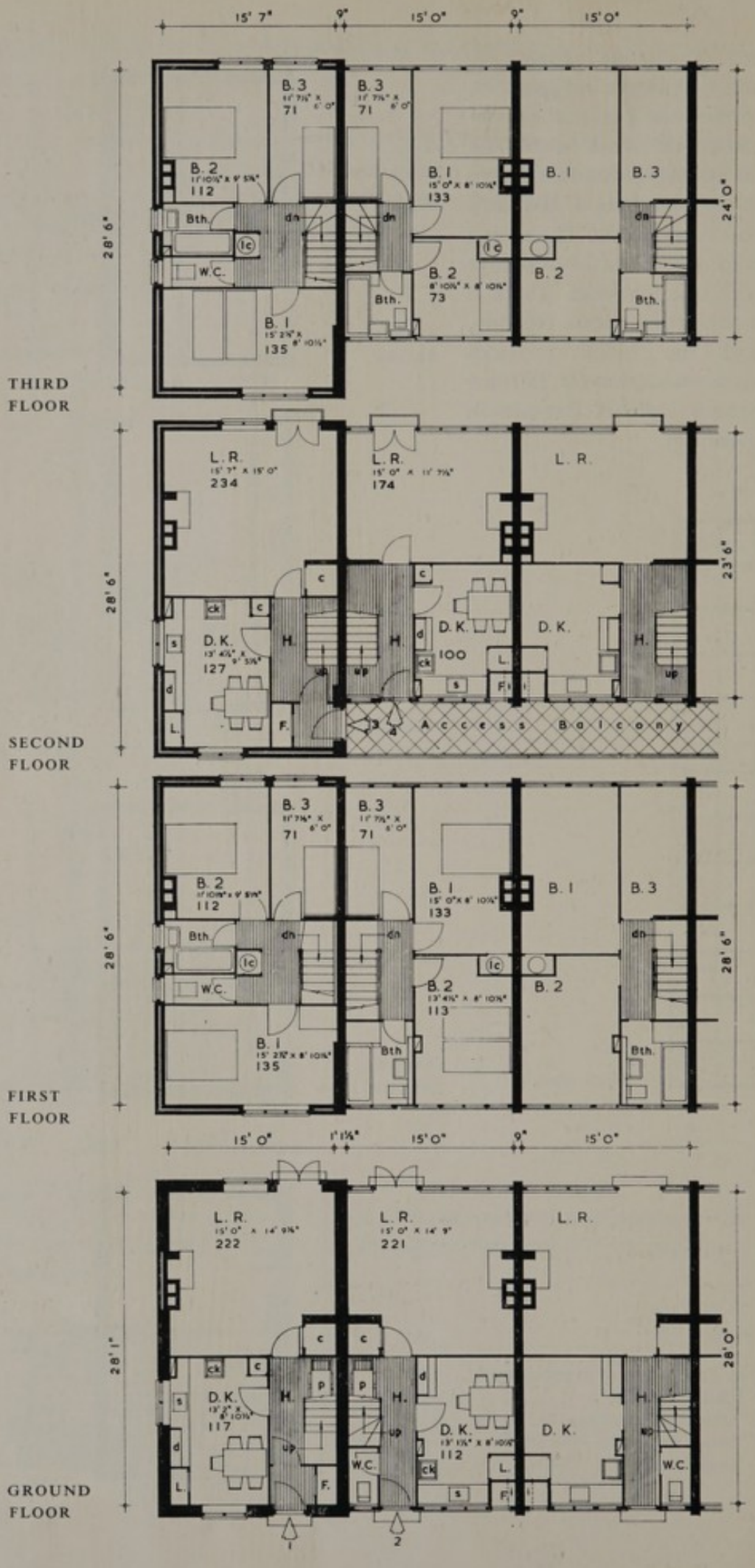


Figure 99

Net floor areas of maisonettes:
3 BR. 4 person—713 sq. ft.
3 BR. 5 person:
intermediate units—841 sq. ft.
lower end units—863 sq. ft.
upper end units—884 sq. ft.

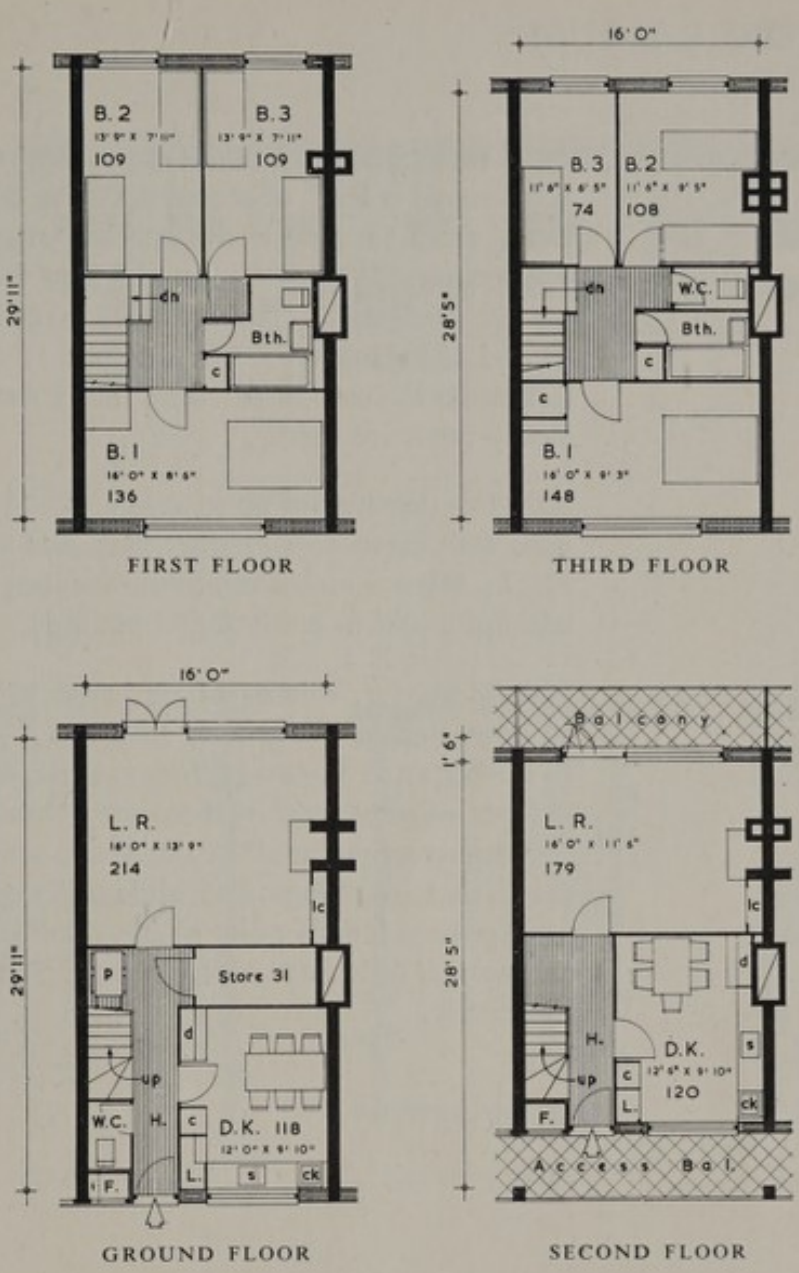


Figure 100

Net floor areas of maisonettes:
3 BR. 6 person—957 sq. ft.
3 BR. 5 person—841 sq. ft.

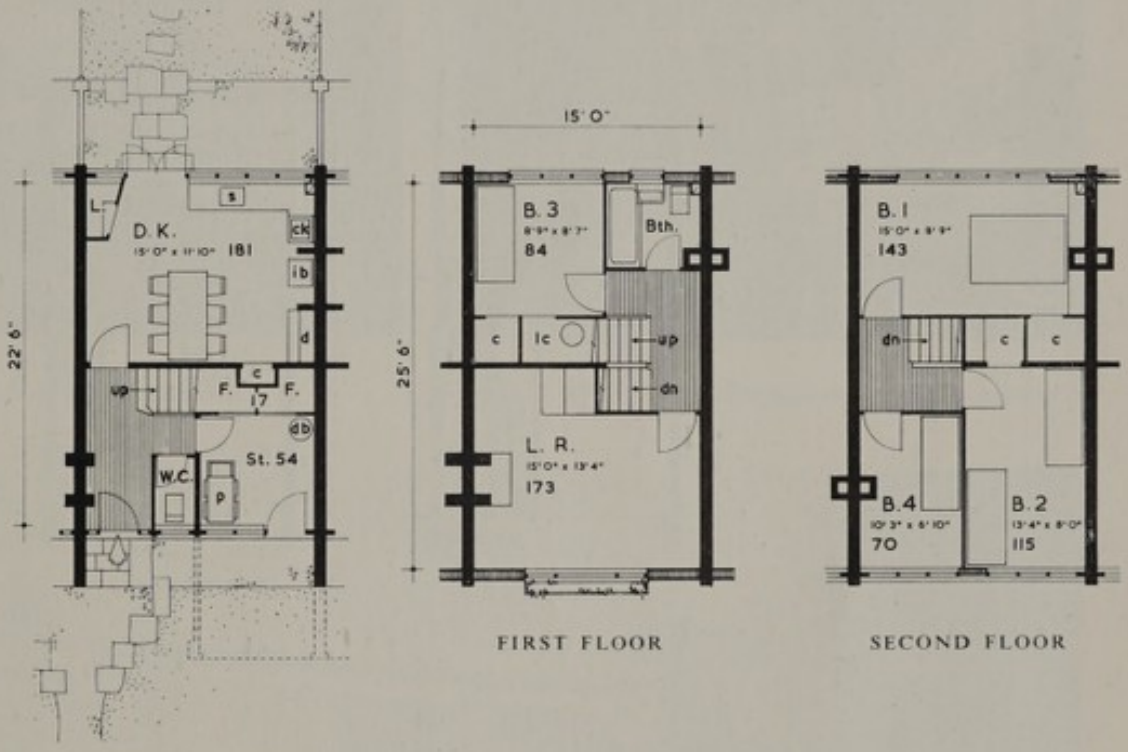
207. Figure 100 shows maisonettes for six-person and five-person families in four-storey blocks, suitable for cross-wall construction. The access balcony is inset.

208. Terrace houses of this type in any layout provide a convenient way, economical in land, of accommodating large families; but in re-development areas they have the special virtue of allowing a much larger proportion of families with children to live in houses, instead of in maisonettes or flats. This is illustrated in the layouts shown in Figures 9, 11 and 12 in Chapter I, where Figure 11 shows that, with relatively little difference in cost, 50 per cent. more dwellings can be houses if three-storey types are used.

209. For densities of up to about 100–115 h.r.a. the three-storey house, used with three-storey corner flats, and with maisonettes in four-storey blocks, offers a means of accommodating the largest number of families without resort to costly high buildings.

210. Moreover, houses of this type can conveniently have a garage incorporated in the ground floor, as in both the plans shown below. In the layout in Figure 11, for example, if all 68 three-storey houses had garages incorporated in them they would provide 45 per cent. of the parking space required for the whole scheme, assuming a ratio of one car to three dwellings; and while this would not necessarily be an ideal arrangement it does point to the value and the wisdom of providing in this way, at little extra cost, for some part of the future expansion of car ownership.

ELEVATION TO THE ROAD



GROUND FLOOR

FIRST FLOOR

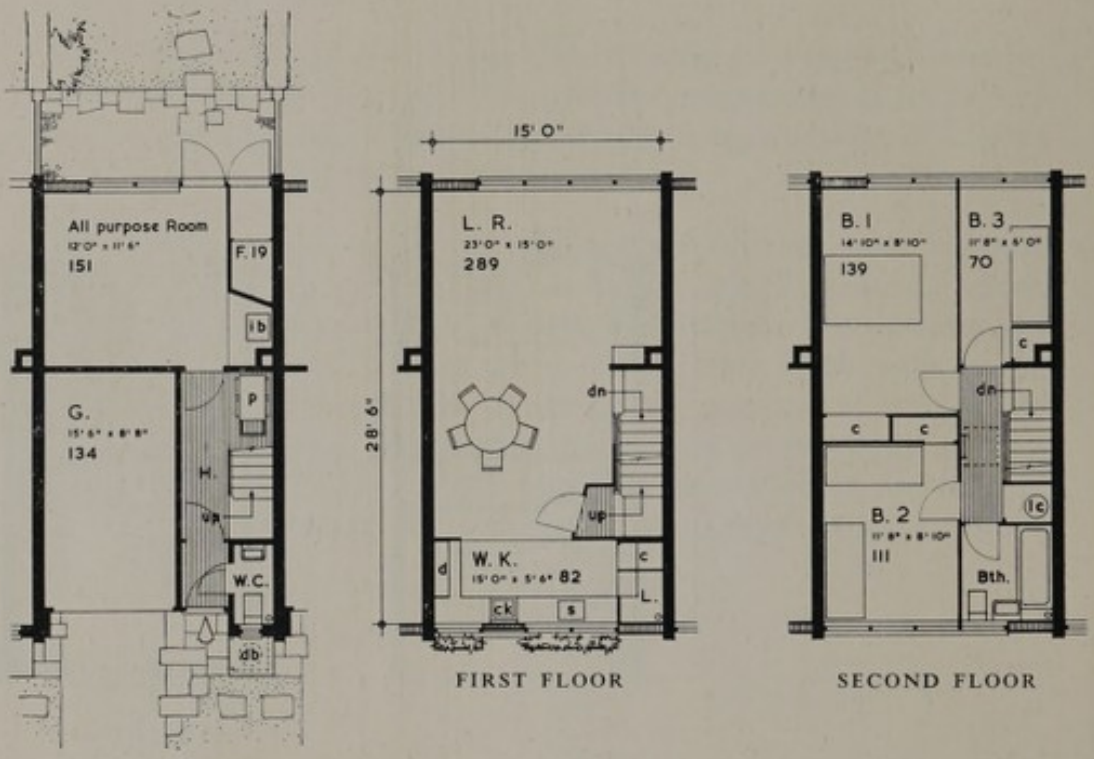
SECOND FLOOR

Figure 101

Gross floor area	1,103 sq. ft.
Store and fuel store	71 sq. ft.
Net floor area	1,032 sq. ft.
Aggregate living area	354 sq. ft.

211. The design in Figure 101 for a 15 ft. frontage house for six persons has a large family room on the ground floor and a living room on the first floor. It can be adapted to incorporate a garage by extending the store in front of the general line of the house.

ELEVATION TO THE ROAD



GROUND FLOOR

FIRST FLOOR

SECOND FLOOR

Figure 102

Gross floor area		1,269 sq. ft.
Garage	134	
Fuel	19	
		153 sq. ft.
Net floor area		1,116 sq. ft.
Aggregate living area		522 sq. ft.

212. The design in Figure 102 for a five-person household has a 15 ft. internal frontage. With a slightly wider frontage the plan of the upper floors could be adapted to provide four instead of three bedrooms. The main family accommodation is on the two upper floors; the ground floor is given up to service and includes a garage. The first floor is shown as an open plan with the staircase rising into the living space, which is combined with the dining space and the kitchen. Alternatively, the staircase could be cut off from the living area and enclosed by partitions. On the ground floor, the garage is incorporated within the line of the house. The all-purpose room at the rear, which could be adapted for use as a store or as an additional bedroom, or bed-sitting room, offers scope for meeting a variety of family needs. The design should be especially attractive to higher income families in urban areas.

Figure 103 Terrace houses. Southampton C.B.

Figure 104 Private Development at Blackheath.

Figure 105 Churchill Gardens, Pimlico, Westminster. Westminster City Council.

Part 4.

Special Features of Multi-Storey Dwellings

213. The most evident special feature of multi-storey dwellings is the means of access, including where appropriate the lift. Notes on this are given in Section I below.

214. Many household requirements, which in houses or low blocks of flats and maisonettes are fairly readily provided for in conventional ways, have to be met in layouts at higher densities by less usual methods. They include such things as heating, storage space, refuse disposal, and facilities for washing and drying clothes. All these items complicate the design problem, for they demand space which has to be allotted in the floor and dwelling plans of the buildings, or sometimes in the space around buildings. Section II suggests general lines along which they can be dealt with.

Section I (a). Types of Access

215. In the past flats and maisonettes have normally had either balcony access (sometimes called gallery access), or staircase access. Recently, other forms have been introduced, and there are now four main types. All four as listed below can be used for both maisonettes and flats, but some of them are more suited to one than to the other.

(*a*) *Balcony (or gallery) access:* suitable for flats and maisonettes alike.

216. Access balconies tend to be noisy, and because the balconies necessarily pass alongside the dwellings this type of access affords little privacy. They help, however, to promote social contacts.

217. With maisonettes, the balconies are only on alternate floors and the length of balcony is approximately halved. For this reason, fewer windows are over-shadowed by the balcony of the floor above. In blocks of any kind above a certain height, the exposure to wind and weather, though it varies with local conditions, makes this type of access undesirable; and the other main disadvantage, vertigo, cannot be eliminated, although it can be minimised by the design of the balcony itself (a high enough rail, vertical strips that create the illusion of a continuous barrier, and so on).

(*b*) *Access from cross-ventilated lobby or small semi-private balcony open to the air:* suitable mainly for flats.

218. This form of access has evolved from the acceptance by some authorities of one common staircase in high buildings, with dwelling entrances in the cross-ventilated lobby. While it gives a reasonable degree of privacy, the cross-ventilated lobby is draughty and encourages loss of heat from the building, since so much more walling is exposed to the air.

(*c*) *Staircase access:* suitable mainly for flats.

219. This form of access has been commonly used in blocks of up to five storeys in height in which the staircase gives access to two flats only on each floor. It gives full protection from the weather, and a high degree of privacy, but may in consequence create a sense of isolation. When it is used in buildings of more than five storeys the L.C.C.

Code requires an alternative means of escape to be provided from dwellings on the sixth storey and above. This has normally been done by installing a second staircase from the sixth storey upwards to the roof level; from this, across the roof, another main staircase can be reached serving adjacent flats. This can be a costly and space-consuming requirement, but an alternative is suggested in paragraph 165.

(*d*) *Common hall or corridor access, with an internal hall or corridor separated from the staircases:* suitable for flats or special forms of maisonettes.

220. The common hall form of access has been commonly used in tower blocks with four flats on each floor. More recently, the corridor form of access, which permits a larger number of dwellings on each floor to be served by the common lifts and staircases, has been used by some local authorities for either flats or maisonettes. In high blocks particularly it is often preferred to balcony access because it is not exposed to the weather.

Section I (b). Lifts

221. Lifts are necessary in buildings in which the entrance to any dwelling is on the fourth storey or above. This means blocks of flats exceeding three storeys, and blocks of maisonettes exceeding four storeys.

222. In buildings up to and including six storeys in height one lift is sufficient. In buildings of more than six storeys there should be two lifts; above this height the inconvenience of having no lift service during periods of servicing and repair is usually thought to be unacceptable. With two lifts it may be sufficient to have stops only at alternate floors. In staircase access flats it has been found convenient to install one lift in each section of a building and to provide a connecting way across the roof for use during servicing.

223. In the light of current practice, lifts will serve up to about 50 dwellings each. The lift car is usually designed for eight persons, so that it can handle prams and furniture, and the maximum distance from a lift to a dwelling entrance is normally taken as 150 feet. If maximum utilisation of the lift capacity were the overriding consideration a building with a maximum of six storeys and with one lift would contain 50 dwellings; and a building with more than six storeys and with two lifts would contain 100 dwellings. But this is of course a norm to work to, rather than an inflexible rule.

Section II (a). Heating and hot water installations

224. The planning of the dwellings and the blocks and the layout of the buildings are all affected by the type of heat installation used. The use of individual space heating appliances with back boilers restricts the internal arrangement of rooms in the dwelling, increases the floor area and the amount of external walling and necessitates the provision of individual fuel stores. If central heating is used, dwelling plans can be simplified, but the layout may be made more difficult because buildings

which are to be centrally heated from one boiler house should be grouped together in order to reduce heat losses and the length of hot water mains.

225. Recent experience of local authorities' practice suggests that for blocks of up to five storeys in height, a solid fuel fire in the living room with a back boiler, hot water circulating system, and either an electric immersion heater or a gas circulator for summer or emergency use, is the most satisfactory method of heating. It is reasonable in cost, the tenant has full control of the installation, and in blocks not exceeding this height the flues do not become an embarrassment. For blocks of six or more storeys in height, space heating and hot water from a central source is likely to be the most satisfactory, as it eliminates a multiplicity of flues, dispenses with the need for storage of fuel within the dwelling, and eliminates the considerable smoke that a large block of dwellings can produce. Where, on the grounds of expense or for other reasons, central heating and hot water is impracticable in high blocks, space heating and hot water services can best be provided by all electric or all gas systems, though these may be expensive to run.

Section II (b). Storage Space

226. For low blocks, general storage space usually takes the form of lock-up compartments, of about 20 sq. ft. in area, in outbuildings. For high blocks, the compartments are often provided in the basement, or take the place of the ground floor, or part of it; otherwise they would occupy too much space between the buildings. As a guide, about one store to two dwellings is sometimes found satisfactory, but other authorities provide more.

Pram Storage

227. The best place for prams to be kept is inside the dwelling, but this is only possible if the lifts are large enough to take them, and if the lifts stop at the same level as the entrance of the dwellings concerned. If the lifts will not take prams or in buildings where there are no lifts, stores must be provided at ground floor level, and should be accessible under cover from the building. If ground floor storage has to be used for prams it must be well ventilated and dry. It is useful if central heating pipes can pass through or near basement stores.

228. If the lift stops are not at the level of the entrance of the dwellings, as may happen when the lift stops at half-landings, for instance, stores may be provided at the levels of the lift stops.

Solid Fuel Storage

229. Each dwelling with a solid fuel burning appliance should have its fuel store inside the dwelling with a hatch for delivery outside. The compartment should be at least 9 sq. ft. in area unless auxiliary fuel storage space is provided elsewhere.*

* See "The delivery and storage of solid fuel in flats. Report of an enquiry by a Joint Committee appointed by London Regional Committee of the Coal Utilization Council and London Branch of the Institute of Housing".

Section II (c). Washing and Drying of Clothes

230. Small shared laundry rooms can be provided, equipped with a washing machine, a washboiler, a sink with wringer, and two or more drying cabinets. One shared laundry room can serve about 20 dwellings.

231. Generally local authorities have found that these laundry rooms are more popular than larger communal laundries. As they are used by only one person at a time, they afford privacy, and the mother can have her young children with her. It has been found, too, that less supervision is needed than with communal laundries, and that the cost of maintenance is lower because the machines are less intensively used.

232. Sometimes drying cabinets only are shared, on a basis of two cabinets for 12 dwellings; if this is done, each dwelling should have its own washboiler in the kitchen.

233. If all the facilities for washing and drying are to be in the dwellings, the washboiler and possibly the drying cabinet—which is very necessary where there is no outdoor clothes line—will normally be in the kitchen. If drying cabinets are not provided, a ceiling pulley rack in kitchen or bathroom should be supplied. Outdoor drying grounds, which should be suitably sited and screened, are usually well used by the tenants of flats reasonably near them.

234. In dining kitchen dwellings there is something to be said for having the laundry equipment in the bathroom so that meals do not have to be taken in a steamy atmosphere.

Section II (d). Refuse Disposal

235. The main factors to consider in selecting a refuse disposal system for a particular development are cost and hygiene. The choice may be influenced by local refuse collection practice, and an early opportunity should be taken to discuss designs with the local cleansing authority.

236. The various acceptable systems are:

(*a*) separate small containers or binettes kept in a suitable place in the flat and emptied daily into dust bins or refuse containers at ground level.

(*b*) a chute system, with hoppers at each floor level, discharging into a moveable container in an enclosed chamber at ground level.

(*c*) a "Garchey" or water-borne system of disposal.

237. In blocks of flats up to three storeys and in four-storey maisonette blocks the usual arrangement is to have separate small containers for each dwelling. But if the block contains many dwellings, served by a common access, refuse chutes are sometimes installed for convenience. In high buildings most local authorities provide chutes. One chute with hoppers on each storey will serve between 12 and 22 dwellings. Containers usually have a capacity of $1\frac{1}{4}$ cu. yds. and on the average are emptied 2–3 times a week. Hoppers located within a staircase are considered to weaken the fire protection. There is a British Standard for

refuse chutes (B.S. 1703) and for refuse containers (B.S. 1136). The Garchey or water-borne system is labour-saving and clean, though it is more expensive.

238. A Committee of the British Standards Institution is now drafting a Code of Practice on the storage and removal of refuse from residential properties.

Section II (e). Private Balconies

239. Dwellings that are likely to house families with young children should have a private balcony. It is best accessible either from the living room or from the kitchen or both: but it is an advantage if the mother can supervise a child on the balcony from the kitchen. There must be no gaps for toys to roll through and the general design should be such as to discourage children from climbing on the balcony wall. The access doors must be arranged so that a perambulator can be wheeled on to the balcony. To take a pram and also to take deck chairs, the minimum distance from the dwelling to the balcony railing must be at least 3 feet 6 inches.

240. Balconies should preferably not be smaller than about 40 sq. ft., and to give as much shelter as possible they should be at least partly recessed. Some form of screening should be provided between balconies to give privacy. A useful arrangement where for one reason or another private balconies cannot readily be provided is the arrangement shown in Figures 98 and 99, where there are inward opening french doors with a guard railing outside.

Section II (f). Safety Considerations

241. The designer of a high building has to take special care that the dangers from height are well guarded against, and every design for such a building should be detailed with this in mind. For example, the windows should be such that small children cannot readily open them, and as an additional safeguard local authorities should consider whether they can make suitable bars available to fix inside some or all of the windows of dwellings which have small children in them. There are dangers to children from balcony balustrades which are too open or which are not high enough or which can easily be climbed on, and some architects have devised suitable guarding meshes to install above the balustrades on private balconies. The thoughtful design of public staircases too can eliminate the risk of many accidents (and not only for children). This is by no means an exhaustive list, and its purpose is solely to invite attention to a subject whose importance is measured as much by the anxiety of parents as by the accidents to children which in fact occur.

Appendix A. Method of Calculating the Number of Dwellings of Different Sizes

When given:

(1) Site area.

(2) Net density in habitable rooms per acre.

(3) Required proportion of dwellings of different sizes.

The following example shows the method. The data used are drawn from the layout studies shown in Figures 3 and 5.

Data

(1) Net area of site . 12·3 acres

(2) Net density . . 100 h.r.a.

(3) Required proportion of dwellings of different sizes (to be decided by the local authority in each case):

B.S.R.	1 person	5%	3 BR.	5 persons	30%
1 BR.	2 persons	5%	3 BR.	6 persons	8%
2 BR.	4 persons	20%	4 BR.	7 persons	7%
3 BR.	4 persons	25%			

Calculation

(i) Find the number of habitable rooms per 100 dwellings, from (3).

Size of dwelling	No. of dwellings A	No. of rooms per dwelling B	Total No. of rooms (A × B)
B.S.R. 1 person . . .	5	1	5
1 BR. 2 persons . . .	5	2	10
2 BR. 4 persons . . .	20	3	60
3 BR. 4 persons . . .	25	4	100
3 BR. 5 persons . . .	30	4	120
3 BR. 6 persons . . .	8	5	40
4 BR. 7 persons . . .	7	6	42
		TOTAL	377

(ii) Find the average number of rooms per dwelling

Total number of rooms for 100 dwellings — 377

Average number of rooms for 1 dwelling is therefore

$$\frac{377}{100} = 3{\cdot}77 \text{ rooms}$$

(iii) Find the total number of dwellings.

(*a*) Total number of rooms for the site is found by multiplying the net area of the site by the net density:

$$12{\cdot}3 \times 100 = 1{,}230 \text{ rooms}$$

(*b*) Total number of dwellings is then found by dividing the total number of rooms by the average size of dwelling:

$$\frac{1{,}230}{3{\cdot}77} = 326 \text{ dwellings}$$

(iv) Find the required number of dwellings of each size, by applying the percentage of each size required to the total number of dwellings.

Size of dwelling	Percentage required A	Number required (A × 326)	Number required (rounded)
B.S.R. 1 person . . .	5%	16·3	16
1 BR. 2 persons . . .	5%	16·3	16
2 BR. 4 persons . . .	20%	65·2	65
3 BR. 4 persons . . .	25%	81·5	82
3 BR. 5 persons . . .	30%	97·8	98
3 BR. 6 persons . . .	8%	26·0	26
4 BR. 7 persons . . .	7%	22·8	23
		TOTAL	326

The total number of rooms to be provided in dwellings of each size can readily be calculated from the number of dwellings required, as follows:

Size of dwelling	No. required A	No. of rooms per dwelling B	Total No. of rooms in each size of dwelling (A × B)
B.S.R. 1 person . . .	16	1	16
1 BR. 2 persons . . .	16	2	32
2 BR. 4 persons . . .	65	3	195
3 BR. 4 persons . . .	82	4	328
3 BR. 5 persons . . .	98	4	392
3 BR. 6 persons . . .	26	5	130
4 BR. 7 persons . . .	23	6	138
		TOTAL	1,231

Appendix B. Daylighting and Sunlighting

1. Daylighting

The daylight indicator method for controlling the spacing of residential buildings on a site was recommended by the Ministry in "The Density of Residential Areas" Handbook and is now generally accepted. It provides a quick and approximate means of ensuring that buildings are so placed in relation to each other that it would be possible to attain the daylighting standards recommended in the British Standard Code of Practice (CP 3—Chapter 1 (A)) provided that in the design of the dwellings themselves the windows are properly positioned and of adequate size.

The site layouts illustrated in this handbook are designed so as to meet the recommended standards of daylighting as controlled by the daylight indicator method of testing given in Appendix 2 of "The Density of Residential Areas". The standards of daylighting recommended for kitchens, living rooms and bedrooms are given in paragraph 27 of Appendix C to the Housing Manual 1949 Technical Appendices, though the tables appended to the Code of Practice to which reference is made there have now been superseded by "Simplified Daylight Tables", National Building Studies, Special Report No. 26, from which window sizes can be worked out to comply with the recommended standards.

In designing housing layouts local authorities should do their utmost to ensure that their schemes meet the recommended standard.

For convenience the daylight indicators and the methods of using them are briefly described below.

The Indicators

The indicators shown in Figure 106 are intended to be used as a preliminary guide to satisfactory daylighting. They are for use at the stage when the general form of the buildings and the layout are being worked out, and are considered to be sufficiently accurate for this purpose.

The indicators are:

B1–B4 for testing from (i) centre lines of surrounding streets and
(ii) plot boundaries.

D1–D4 for testing from one building to other buildings on the same site.

Each indicator ignores daylight reaching a window at a horizontal angle with the plane of the window of less than 45°. Within the remaining

90° the four versions provide for daylight reaching the window through a range of wide to narrow angles—B1* and D1 to B4 and D4. The wide angle indicators are used mainly for testing for daylight reaching a window directly over the top of a building. The narrower angle indicators are used mainly for testing for daylight reaching a window past the side of an obstructing building nearby, and over the top of any other buildings farther away.

The indicators should be drawn out on tracing paper or linen to the scale of the layout being tested, the angles and the distances PB being shown in Figure 106 to allow this to be done. Any indicator can of course be extended to any distance required.

Each arc on an indicator traces the minimum distance from the window at which a building of the height shown would just allow the required amount of daylight to reach a ground floor window on the face of the building for which the test is being made. The permissible height of the obstruction is the height above ground level at the point being tested. Only if the site is level will the height shown on the indicator be the permitted height of the obstructing building. In other cases adjustments must be made for the difference in levels.

* The indicators for boundaries and street centre lines provide wing angles of 25° and have internal angles different from the other group of indicators. They work on the assumption that the plot boundary or the street centre line is mid way between the building receiving the light and the obstruction.

Permissible Height Indicators for Residential Buildings spaced for Daylighting

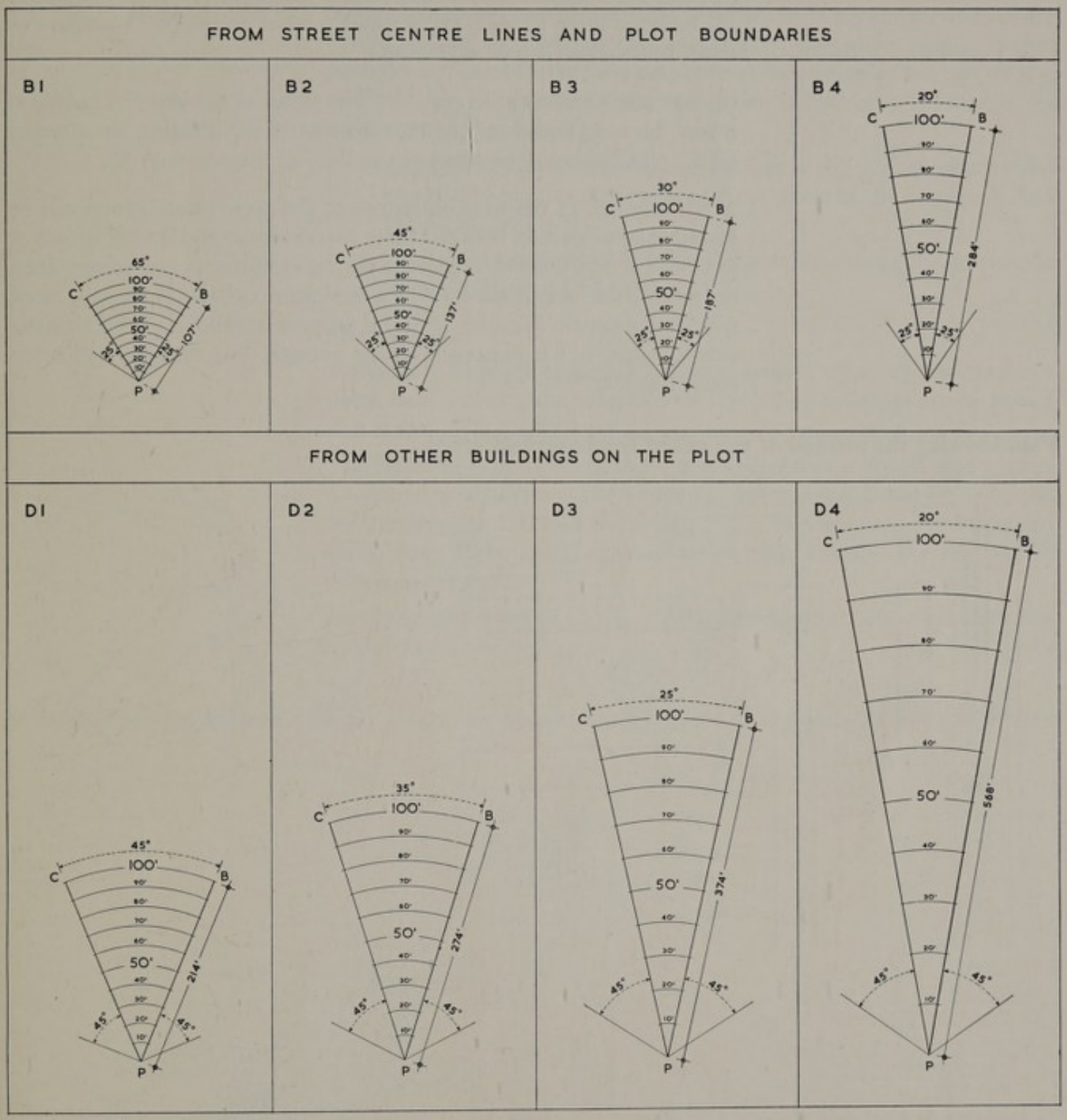


Figure 106

The distances PB are the distances at which an obstruction 100 feet high could be permitted.

Method of Use (see Figure 107)

(i) Place the indicator on the plan so that the point "P" is on the face of the building being tested (D type indicators) or on the plot boundary or street centre-line (B type indicators).

(ii) Swing the indicator on point "P" to either of the extreme positions where the wing lines coincide with the face of the building being tested or the plot boundary or street centre line, as the case may be.

(iii) If any one of the four indicators of the appropriate group can be placed in any position between these two extremes so that the height of any obstruction when it is crossed by the indicator is not greater than the permissible height shown by the indicator, sufficient light will reach the point under examination. For this purpose it is allowable to aggregate smaller gaps, not in themselves wide enough, but wide enough when taken together.

Plan showing the method of use of the Daylight Indicators

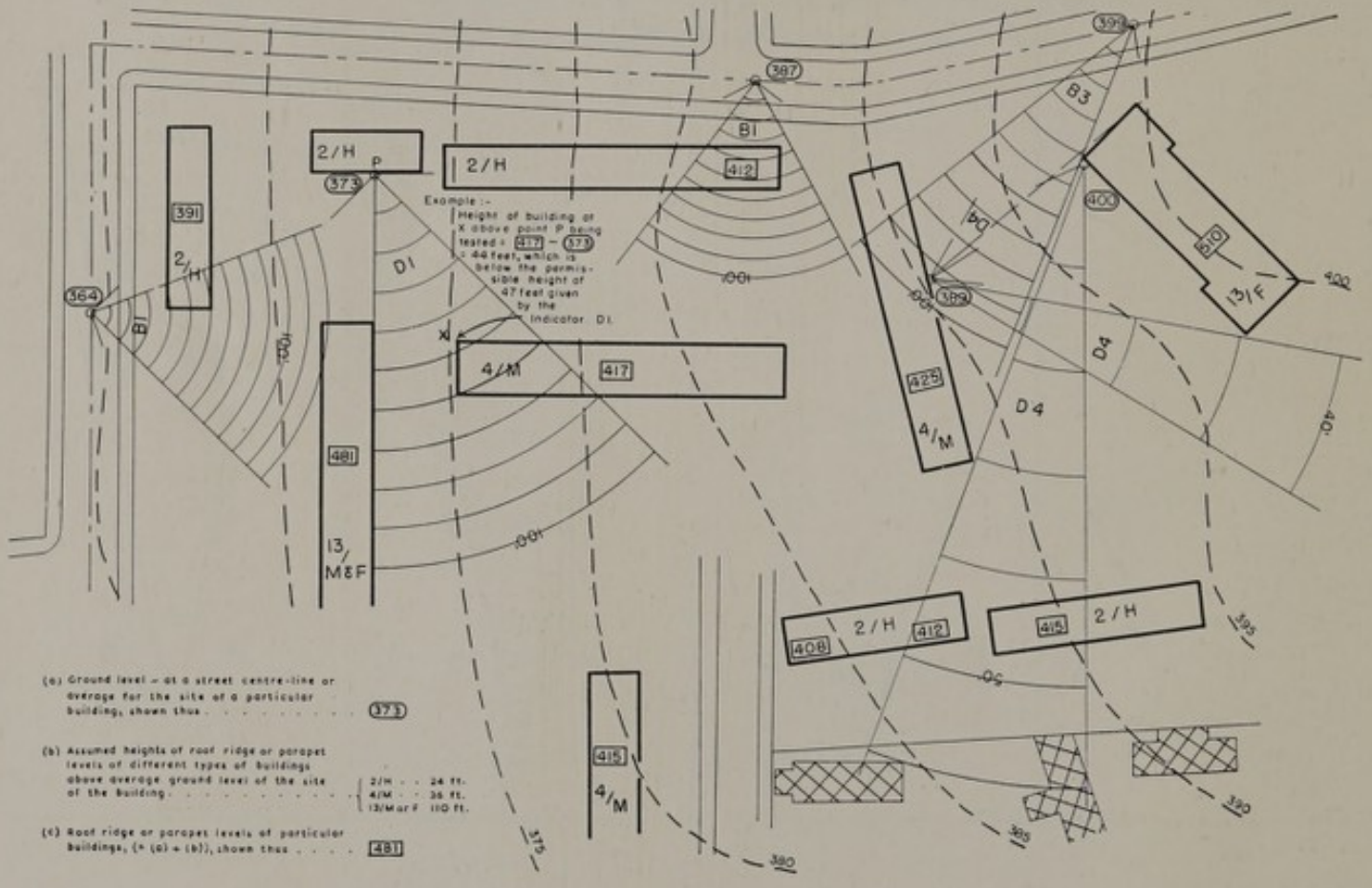


Figure 107

Note: This layout complies with the daylighting standards. For clarity the diagram shows indicators in selected positions only. Nevertheless **all** points on the centre lines of surrounding streets and on the plot boundary lines must pass the test with one or other of the four type B indicators, and **all** lengths of building face where there will be windows must pass the test with one or other of the four type D indicators. Compliance in either case may be attained if light reaches the point being tested either over a building (for which the wide-angle indicators are the most useful) or past a building (for which the narrow-angle indicators are the most useful).

2. Sunlighting

The Standard

The British Standard Code of Practice (CP 5: 1945, Chapter 1(B)) recommends that one of the main windows in living rooms and, where practicable, in kitchens and bedrooms also, should be so placed that sunlight can enter for at least one hour at some time of the day during not less than 10 months of the year from February to November. In arriving at this standard,

(*a*) sunlight is not considered as entering a room if the horizontal angle between the sun's rays and the plane of the window is less than $22\frac{1}{2}°$; and

(*b*) sunlight is not considered to be useful unless the sun has an altitude above the horizon of more than 5°.

The Indicator

A Standard Sunlight Indicator has been devised which can be used as a quick and approximate means of ensuring that buildings are so placed that it would be possible for the standard to be achieved.

The indicator is designed to show, when placed on a layout plan against a window of a building, for how long that window could be lit by the sun on January 21st and November 22nd. For the 10 months between these dates the number of hours of possible sunlight per day will of course be greater.

The indicator is made of transparent material and drawn at the scale of the plan to be examined.

Standard Sunlight Indicator for 51° 30′ N., the approximate latitude of London, Cardiff and Bristol

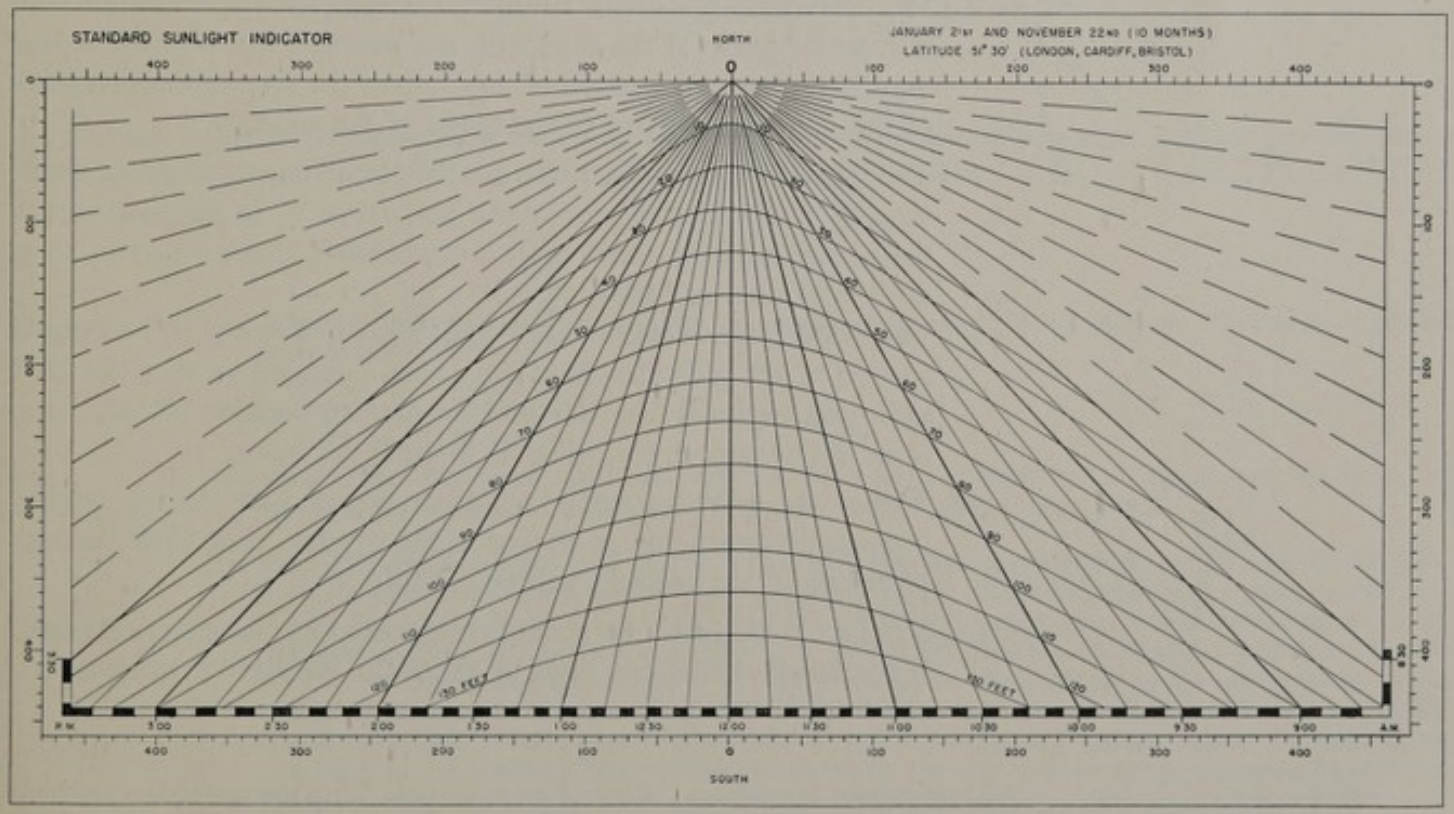


Figure 108

The indicator applies only to the latitude for which it is designed. The method of drawing out indicators for this and three other latitudes is given later. Indicators for all four latitudes, drawn to 1/500 scale, are available from H.M.S.O., price 6*s*. 0*d*. each. For practical purposes these four indicators will serve for almost the whole of England and Wales.

Each curved line traces the minimum distance from the window at which an obstruction of the height shown against the line would just allow the light of the sun to reach the window at different times of the day on January 21st or November 22nd. The height of the obstruction is the height above the **cill** of the window being tested, and not the height of the obstruction above ground level. Since the indicator is to scale, the distance from the window can be measured off along the radial lines.

Method of Use (see Figure 109)

(a) *Setting up*

(i) Place the indicator on the plan so that point "0" is at the centre of the window to be tested.

(ii) Arrange the indicator so that the radial line representing 1200 hours is pointing to true south. (When a number of windows are to be tested, a few parallel lines running north/south or east/west should be drawn on the plan. The indicator can be aligned to these with the aid of the divisions round its edges—which, for convenience in other ways, can be to a scale of distance.)

(b) *Finding the periods of effective sunlight*

(i) The Standard discounts sunlight reaching a window when the horizontal angle of the rays with the plane of the window is less than 22½°. To take account of this, ignore the six angular divisions of the indicator nearest to the plane of the window*.

(ii) The Standard also discounts sunlight reaching a window when the sun has an altitude above the horizon of 5° or less, and this is the reason why the times on this particular indicator do not start until 8.30 a.m. and finish at 3.30 p.m.
The additional broken radial lines drawn outside this effective section of the indicator have only been included so that the 22½° exclusion angle can be measured in whatever position the indicator is set up by simply counting six angular divisions.

(iii) Within the effective angle establish the periods during which, because obstructions are nearer to the window than their permissible height, the sunlight will be cut off.

(iv) Subtract these from the period represented by the effective angle. If the result equals one hour or more the standard is achieved.

* The divisions represent a quarter of an hour each. Since the sun travels approximately 15° per hour at these times of the year (January 21st and November 22nd), six divisions or 1½ hours equal approximately 22½°.

Plan showing the method of use of the Standard Sunlight Indicator

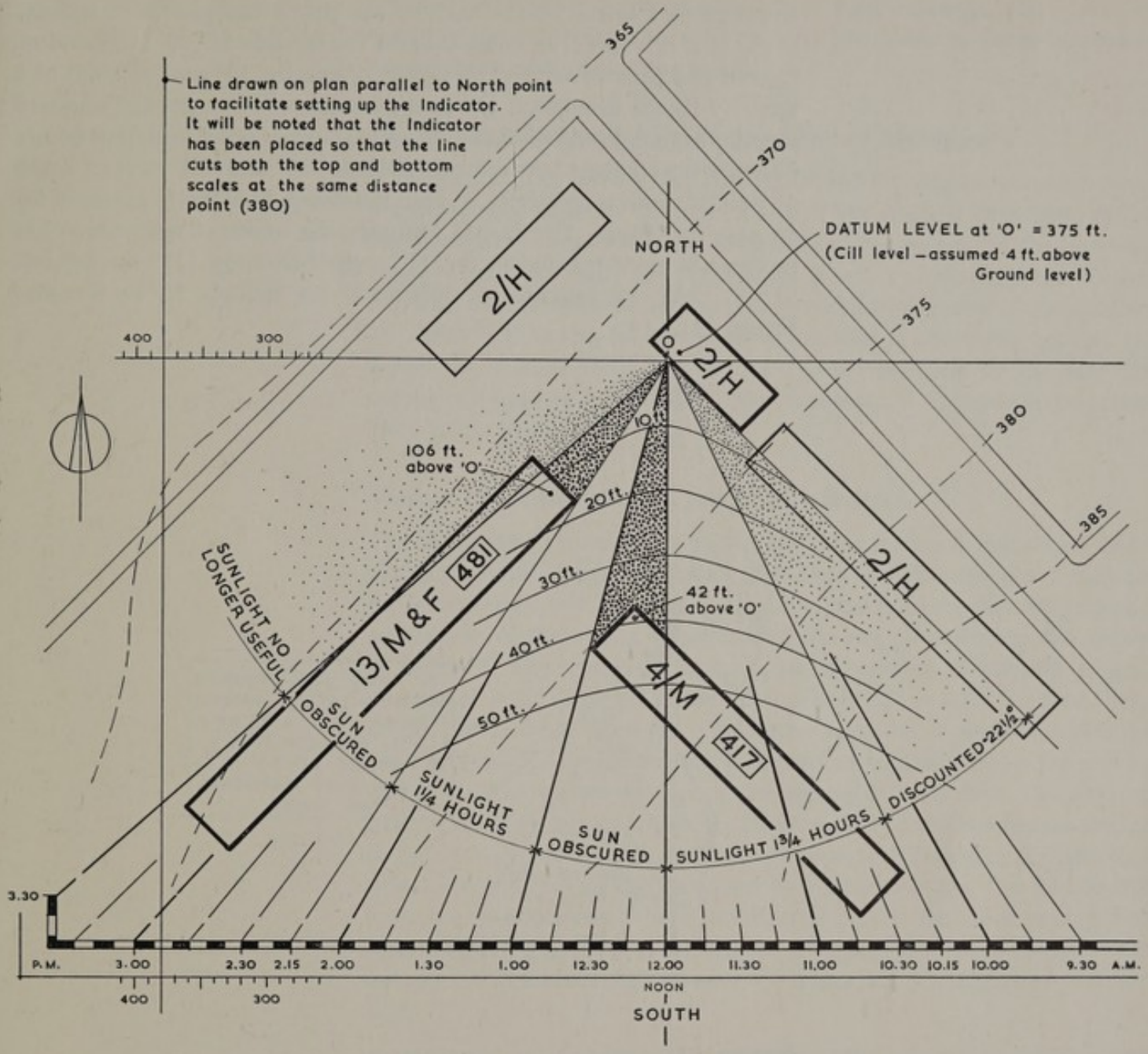


Figure 109 (*a*) Assumed heights of roof ridge or parapet levels of different types of buildings above average ground level of their sites:

2/H	24 feet
4/M	36 feet
13/M or F	110 feet

(*b*) Roof ridge or parapet levels of particular buildings (obtained by adding appropriate height of building, (*a*), to average ground level of the site of the building) shown thus 417

(*c*) The roof ridge or parapet level of a particular building, less the datum level (in this instance 375 feet), gives the height of the top of that building relative to the cill level of the window being tested at 0. Where this height is equal to or less than the permissible height represented by the curves of the indicator, sunlight will reach the window at 0. Where the height of the building is greater than the permissible height, sunlight will be obscured, as shown in this example by the northern end of the central four-storey maisonette block and by the thirteen-storey block. In addition, sunlight which strikes the facade within an angle of about 22½° (taken for simplicity as six angular divisions of the indicator) is not counted. The periods during which the sun is obscured or discounted are shown shaded on the plan. It can be seen that sunlight reaches the window continuously between 10.15 a.m. and 12 noon and again from 1 p.m. to 2.15 p.m., a total of three hours, which is considerably more than the one hour required by the Standard.

Orientation of Buildings

In designing a layout on the basis of one hour's sunlight for 10 months in the year it is useful to know that for the latitude 51° 30′ N. (London, Cardiff and Bristol) an easterly facade orientated 13° east of south or a westerly facade orientated 13° west of south will just get the standard amount of sunlight provided the lie of the land or other buildings do not obstruct the sunlight between orientations 35½° and 48½° east of south or west of south respectively. Figure 110 shows how this is achieved for an easterly facade. For higher latitudes the limits of orientation are necessarily more restrictive, the 13° angle becoming 11¾° for latitude 52° 30′, 10½° for latitude 53° 30′ and 8° for latitude 55° N. See also Figure 111.

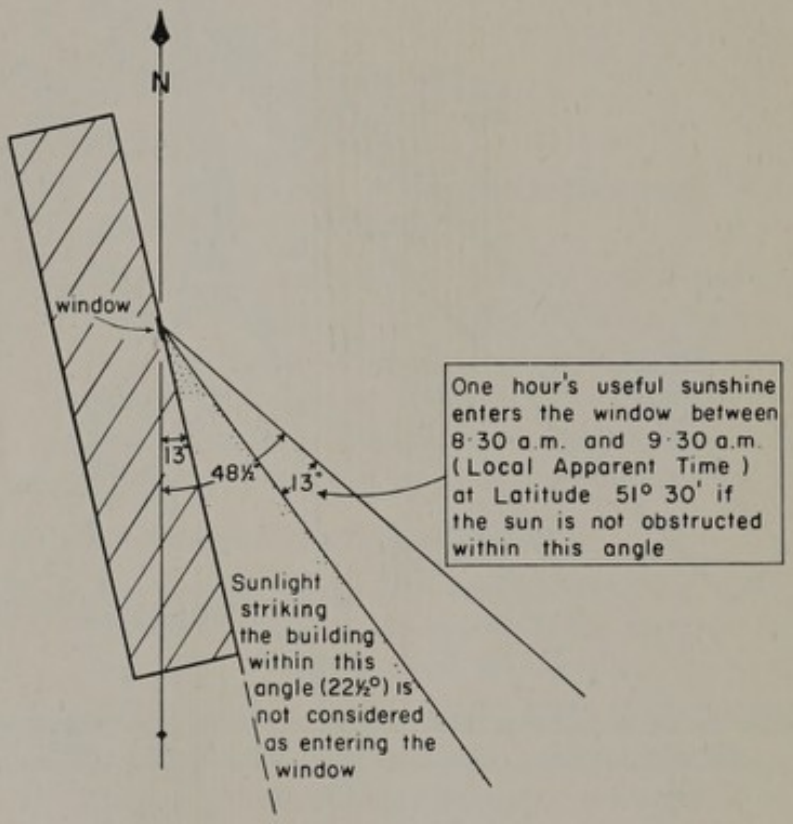


Figure 110

Plan of a building with its easterly facade orientated 13° east of south (Latitude 51° 30′ N.).

Application of the Standard

Local authorities should aim at achieving the recommended standard of sunlighting where this is reasonably practicable. For the development of fairly large sites at moderate densities (up to 100 habitable rooms per acre) in the southern part of England at any rate, it is not thought likely that the attainment of good sunlighting will normally demand a more generous spacing than daylighting. Careful attention to design and orientation should be all that is necessary in such cases to enable an economical layout with good sunlighting to be provided. In other areas

and at higher densities the achievement of the standard might well demand an increase in the proportion of high buildings, and it will be a matter for consideration whether it is justifiable to incur increased expenditure, and, if so, how much.

Use of the Indicator for Predicting Shadow Movements

If the indicator is turned 180° from its normal north/south orientation, it can be used to show the movement of the shadow cast throughout the day on January 21st or November 22nd by the part of the building being tested—normally the corners are taken. For example the 70 feet curve on the indicator would then represent the movement of the shadow of a building 70 feet (at the point being tested) above the ground on which the shadow falls. For the most convenient use in this way the curves will need to be cut out, so that a pencil can trace the appropriate lines on the plan.

Method of Construction of Sunlight Indicators

The information necessary for drawing these curves is calculated from the angles of altitude and azimuth of the sun at different times of the day on January 21st and November 22nd, the curves being derived from the cotangents of the angles of altitude of the sun plotted along the angles of azimuth. The angles of azimuth, to the nearest 15 minutes of arc, at quarter hour intervals are given in Table 15, and for each of these angles the distance from the window being tested is given at which an obstruction 100 feet high could be permitted and still allow the sun to enter the window over the top of it on these particular days. The 100 feet line on the indicator can thus be drawn directly from the figures in feet in the appropriate column B. The corresponding distances for obstructions of other heights can be found by proportion e.g., the line on the indicator representing where an obstruction 70 feet high would not interfere with sunlight is at a distance from the point "0" of the indicator equal to 70/100 times the distance of the line for an obstruction 100 feet high.

A particular indicator is only applicable to the latitude for which it has been designed. Sets of angles and distances are given for latitude 51° 30′ N. (approximately that of London, Cardiff and Bristol), and also for latitudes 52° 30′ N. (approximately that of Birmingham), 53° 30′ N. (approximately that of Liverpool, Manchester and Leeds) and 55° N. (Newcastle upon Tyne). Figures for other latitudes could be obtained by interpolation or by a limited amount of extrapolation.

In those circumstances where the attainment of the standard is not practicable and for other special design purposes it will be useful to know how much sunlight would enter particular windows of a proposed building for other periods of the year, e.g., for nine, eight, seven or six months (i.e., between the equinoxes). The relevant figures for the preparation of indicators for each of those periods are given in Table 16 for latitude 52° 30′ N.; similar information for latitudes 51° 30′, 53° 30′ and 55° N. can be made available on request.

Orientation of Buildings in relation to Plan Shape

The table with each plan gives the possible hours of sunlight on the facades on January 21st and November 22nd at latitude 51° 30′ N.

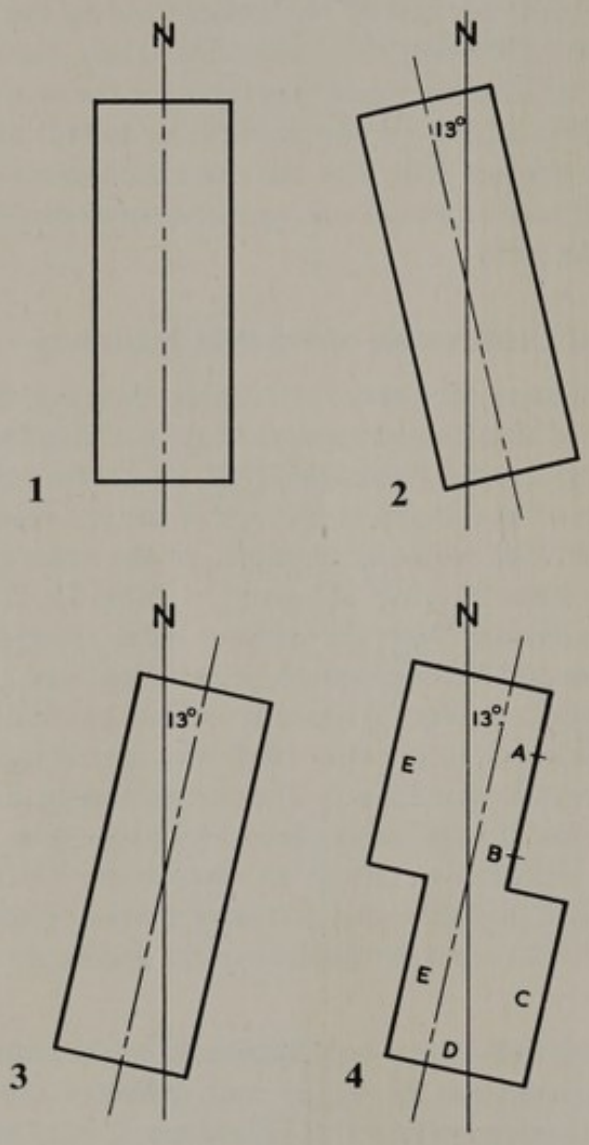


Figure 111

1

East and West . . 2 hrs.
South . . . 7 hrs. 10 mins.
On a North/South aspect.

2

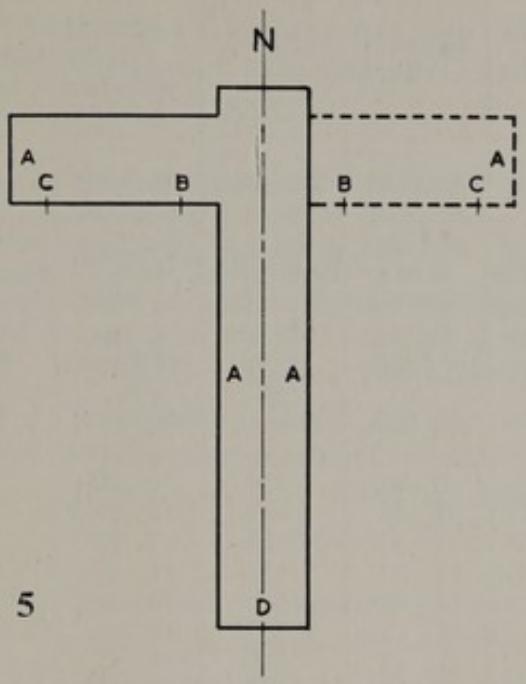
East . . . . 1 hr.
South. . . . 7 hrs. 10 mins.
West . . . . 2 hrs. 55 mins.
Recommended when there are living rooms on the West side only.

3

East . . . . 2 hrs. 55 mins.
South. . . . 7 hrs. 10 mins.
West . . . . 1 hr.
Maximum deflection from North/South axis when there are living rooms on both sides.

4

East . . . A, B, C 2 hrs. 55 mins.
South. . . D 7 hrs. 10 mins.
West . . . E 1 hr.
Recommended orientation.



5

5

East and West	A	2 hrs.
South	B	3 hrs. 55 mins.
	C	5 hrs. 5 mins.
	D	7 hrs. 10 mins.

6

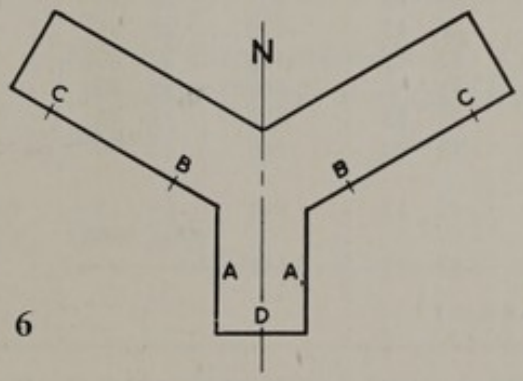
East and West	A	2 hrs.
S.E. and S.W.	B	4 hrs. 35 mins.
	C	6 hrs. 10 mins.
South	D	7 hrs. 10 mins.

7

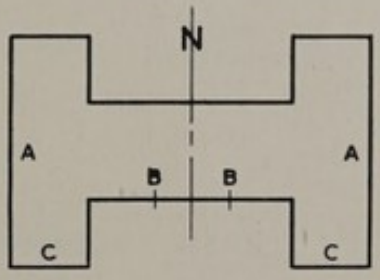
East and West	A	2 hrs.
South	B	6 hrs. 45 mins.
	C	7 hrs. 10 mins.

8

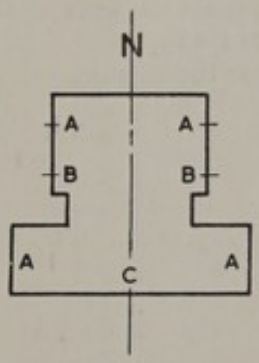
East and West	A	2 hrs.
	B	30 mins.
South	C	7 hrs. 10 mins.



6



7



8

Figure 111, *continued*

Table 15. Details necessary for the construction of Standard Sunlight Indicators for JANUARY 21st and NOVEMBER 22nd for latitudes 51° 30′, 52° 30′, 53° 30′ and 55° N.

Local Apparent Time†		Latitude 51° 30′ N. (London, Cardiff, Bristol)		Latitude 52° 30′ N. (Birmingham)		Latitude 53° 30′ N. (Liverpool, Manchester, Leeds)		Latitude 55° N. (Newcastle upon Tyne)	
		Azimuth angle of Sun East (a.m.) or West (p.m.) of South A	Distance from point 0 of permissible obstruction 100 feet high B	Azimuth angle of Sun East (a.m.) or West (p.m.) of South A	Distance from point 0 of permissible obstruction 100 feet high B	Azimuth angle of Sun East (a.m.) or West (p.m.) of South A	Distance from point 0 of permissible obstruction 100 feet high B	Azimuth angle of Sun East (a.m.) or West (p.m.) of South A	Distance from point 0 of permissible obstruction 100 feet high B
a.m.	p.m.	deg. min.	feet	deg. min.	feet	deg. min.	feet	deg. min.	feet
12 noon		0 00	299	0 00	318	0 00	338	0 00	373
11.45	12.15	3 45	301	3 45	319	3 45	339	3 45	375
11.30	12.30	7 30	305	7 30	323	7 15	344	7 15	381
11.15	12.45	11 00	312	11 00	331	11 00	352	11 00	390
11.00	1.00	14 45	321	14 45	342	14 30	364	14 30	404
10.45	1.15	18 15	335	18 15	357	18 15	381	18 00	423
10.30	1.30	22 00	353	21 45	376	21 45	403	21 30	449
10.15	1.45	25 30	377	25 15	402	25 15	431	25 00	482
10.00	2.00	29 00	407	28 45	436	28 45	469	28 30	528
9.45	2.15	32 15	447	32 15	480	32 00	518	32 00	588
9.30	2.30	35 45	500	35 30	540	35 30	586	35 15	672
9.15	2.45	39 00	573	38 45	623	38 45	683	38 45	795
9.00	3.00	42 15	679	42 00	746	42 00	826	42 00	988
8.52*	3.08*							43 30	1,143
8.45	3.15	45 15	843	45 15	941	45 15	1,068		
8.42*	3.18*					46 00	1,143		
8.35*	3.25*			47 15	1,143				
8.30*	3.30*	48 30	1,143						

* At these times the sun's altitude is 5° for the particular latitude under which the corresponding azimuth angle and distance are given.

† See note on facing page.

Note on Local Apparent Time

The "Local Apparent Times" (L.A.T.s) in this column are the times which would be given by a clock if it was adjusted each day to read 12 noon when the sun was due south of it. To obtain the correct "Greenwich Mean Time" (G.M.T.) for any place two adjustments need making to the L.A.T.

The first adjustment takes account of the fact that the length of the solar day is not constant throughout the year. The accumulation of small differences in the length over some months results in noon by the sun varying by up to about a quarter of an hour on either side of the "mean" noon which one would get if the solar day were of constant length throughout the year. The adjustment to correct for this is known as the "Equation of Time". For the dates with which we are concerned here it is necessary to add 11 minutes to L.A.T. to obtain "Local Mean Time" (L.M.T.), as it is called, on January 21st and to subtract 14 minutes from L.A.T. to obtain L.M.T. on November 22nd.

The second adjustment is to take account of longitude and this involves adding (for places west of the Greenwich meridian) or subtracting (for places east) four minutes to the L.M.T. for each degree of longitude.

For the towns mentioned in the Table, the longitude and the time adjustments which need making to L.A.T. to obtain G.M.T. are given below:

Table 15A

Town	Approx. Longitude	Time Adjustments for January 21st			Time Adjustments for November 22nd		
		Equation of Time	Adjustment for longitude	G.M.T.	Equation of Time	Adjustment for longitude	G.M.T.
		mins.	mins.	mins.	mins.	mins.	mins.
Birmingham	1° 55′W.	+11	+ 8	+19	−14	+ 8	− 6
Bristol .	2° 35′W.	+11	+10	+21	−14	+10	− 4
Cardiff .	3° 10′W.	+11	+13	+24	−14	+13	− 1
Leeds . .	1° 35′W.	+11	+ 6	+17	−14	+ 6	− 8
Liverpool .	3° 00′W.	+11	+12	+23	−14	+12	− 2
London .	0°	+11	0	+11	−14	0	−14
Manchester	2° 15′W.	+11	+ 9	+20	−14	+ 9	− 5
Newcastle upon Tyne	1° 35′W.	+11	+ 6	+17	−14	+ 6	− 8

Table 16. Details necessary for the construction of Sunlight Indicators covering nine, eight, seven, and six months of the year for latitude 52° 30′ N.

Local Apparent Time		9 Months (6th February–6th November)		8 Months (21st February–22nd October)		7 Months (7th March–8th October)		6 Months (21st March–23rd September)	
		Azimuth angle of Sun East (a.m.) or West (p.m.) of South	Distance from point 0 of permissible obstruction 100 feet high	Azimuth angle of Sun East (a.m.) or West (p.m.) of South	Distance from point 0 of permissible obstruction 100 feet high	Azimuth angle of Sun East (a.m.) or West (p.m.) of South	Distance from point 0 of permissible obstruction 100 feet high	Azimuth angle of Sun East (a.m.) or West (p.m.) of South	Distance from point 0 of permissible obstruction 100 feet high
a.m.	p.m.	deg. min.	feet	deg. min.	feet	deg. min.	feet	deg. min.	feet
12 noon		0 00	251	0 00	199	0 00	160	0 00	130
11.45	12.15	4 00	252	4 00	200	4 30	161	4 45	131
11.30	12.30	7 45	255	8 15	202	8 45	163	9 30	132
11.15	12.45	11 30	260	12 15	206	13 00	166	14 00	134
11.00	1.00	15 30	268	16 15	211	17 30	170	18 45	138
10.45	1.15	19 15	278	20 15	218	21 45	176	23 15	142
10.30	1.30	23 00	291	24 15	227	25 45	182	27 30	147
10.15	1.45	26 30	307	28 00	238	29 45	190	31 45	154
10.00	2.00	30 15	328	32 00	252	33 45	200	36 00	161
9.45	2.15	33 45	355	35 30	269	37 45	212	40 00	170
9.30	2.30	37 15	389	39 15	290	41 30	227	44 00	181
9.15	2.45	40 30	434	42 45	317	45 15	245	47 45	194
9.00	3.00	44 00	494	46 15	351	48 45	267	51 30	210
8.45	3.15	47 15	579	49 45	395	52 15	294	55 15	228
8.30	3.30	50 30	704	53 00	453	55 45	328	58 45	251
8.15	3.45	53 30	908	56 15	535	59 00	372	62 00	278
8.05*	3.55*	55 45	1,143						
8.00	4.00			59 15	657	62 15	431	65 30	313
7.45	4.15			62 30	858	65 30	514	68 45	358
7.33*	4.27*			65 00	1,143				
7.30	4.30					68 30	639	71 45	418
7.15	4.45					71 45	845	75 00	501
7.03*	4.57*					74 00	1,143		
7.00	5.00							78 00	627
6.45	5.15							81 00	837
6.35*	5.25*							83 30	1,143

* At these times the sun's altitude is 5° at the beginning and end dates of the particular period of the year under which the corresponding azimuth angle and distance are given.

Appendix C. Means of Escape in Case of Fire

An interpretation of the London County Council Code for Means of Escape in Case of Fire so far as it affects the planning of flats and maisonettes

Introductory

The L.C.C., with its long experience of implementing escape standards generally, and with the largest number of dwellings at risk, has recently reassessed the hazards in the light of post-war practice and trends and revised its code of practice relative to means of escape in case of fire. An outstanding feature of the new L.C.C. code is that under certain specified conditions one incombustible staircase only may be permitted in residential blocks of any height. Such permission would depend upon the protection of the staircase and its approaches against attack by fire and smoke. The interpretation that follows allows for this new feature.

The L.C.C. code is of course, based on circumstances within the built-up area of the County of London and on the ready availability of the London Fire Brigade with its range of equipment. Moreover, full compliance with the code would entail consideration of standards of fire resistance, extraction of smoke, detailed design of staircases, lobbies, corridors and balconies, access for fire brigade appliances, provision of dry risers, availability and suitability of lifts for firemen, and other details. They do not affect the broad features of a study of the influence of means of escape on the planning of blocks and they are not fully covered in this Appendix.

The detail and block plans illustrated in Chapter 4 of this handbook comply with the principles of the L.C.C. code and, together with this Appendix with its diagrams illustrating the effect of the code on block planning, afford local authorities the opportunity of studying in detail the application of the requirements of an escape code to blocks of flats and maisonettes. This should be of assistance when they come to apply the local requirements to their own designs.

General

The main principles of the L.C.C. Code for Means of Escape in Case of Fire, under Part V of the London Building Acts (Amendment) Act, 1939, so far as it affects flats and maisonettes, are: (1) that there should be ready access from all rooms within a dwelling to an escape route, and the access to the escape route should be open to a minimum risk of attack from fire within the dwelling; (2) that there should be an escape

route from all dwellings to a place of safety; and (3) that where there is risk of a person being trapped, and rescue is difficult, there should be an alternative escape route.

Buildings with two full height staircases suitably placed are acceptable, since they offer alternative escape routes to the ground. One fully enclosed full height staircase is itself a place of safety in buildings of any height, provided that it is approached only from an open balcony or cross-ventilated lobby and contains no possible source of fire or smoke risk (such as a refuse chute) and that it discharges direct to the open air, clear of any fire risk at ground floor level. It follows that where an alternative escape route is needed in single staircase buildings, it is needed only as far as the staircase.

In lower buildings with few dwellings on each floor this single staircase standard is relaxed to allow direct access from the staircase to the dwellings.

A fourth important principle derives from Section 20 of the London Building Acts (Amendment) Act, 1939 in respect of buildings over 100 feet in height; it concerns safe access and movement for firemen, and facilities for fire-fighting.

Although the L.C.C. code is devised to enable people to escape unaided, the need for rescue cannot be entirely disregarded. For this reason the ready availability of 50-feet wheeled escape ladders for buildings with no floor level over 42 feet in height and of 100-feet turntable ladders for higher buildings is considered essential.

Definitions

Protected Staircase: A staircase enclosed with solid fire-resisting walls and giving direct access to dwellings through self-closing, fire-resisting doors.

Open Staircase: A staircase separated from the dwellings by solid fire-resisting walls and giving access to external access balconies with no door between the staircase and the balcony.

Enclosed Staircase: A staircase enclosed with solid fire-resisting walls and giving access through self-closing fire-resisting doors to external access balconies or internal common access halls or corridors, i.e., with no direct access to dwellings.

Interchange escape balcony: A balcony serving two adjacent dwellings, and divided by a double swing fire-resisting door by which a person can reach an escape route through the adjoining dwellings should he be prevented by fire from doing so through his own dwelling.

Continuous escape balcony: A balcony connecting with and providing an alternative escape route from a number of dwellings in line serving also as a platform from which firemen can operate when the common access is at another level.

Balcony access maisonette: A dwelling entered from an external access balcony and having part of its accommodation on the storey above.

Corridor access maisonette: A two-storey dwelling entered off a corridor. It includes a dwelling interlocking with a similar dwelling and each entered from opposite sides of a central internal corridor and having part of the accommodation in a storey above the corridor level (two-floor unit), or part in a storey above or part in a storey below the corridor level (three-floor unit).

Illustrations

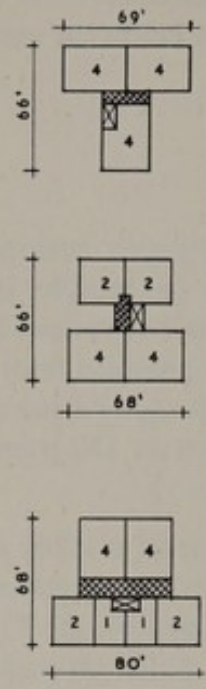
The illustrations to this Appendix (the four diagrams making up Figure 112) show against each block the relevant paragraphs of the interpretation of the code. In determining the form of the various block plan illustrations the aim has been to show them as practical floor plan designs and not simply as examples where there is full exploitation of the relevant parts of the code. In some examples, such as Diagram 2G, the code would permit a block of unlimited length.

The illustrations were at one stage employed as part of a study of lift and staircase ratios, and the data used, though strictly irrelevant to the illustration of means of escape, have been retained on the Figures so that the block plans can be put to the wider use, noted on page 103, of forming a background to the consideration of dwelling plans in blocks of flats and maisonettes generally.

POINT BLOCK FLATS EXTERNAL ACCESS

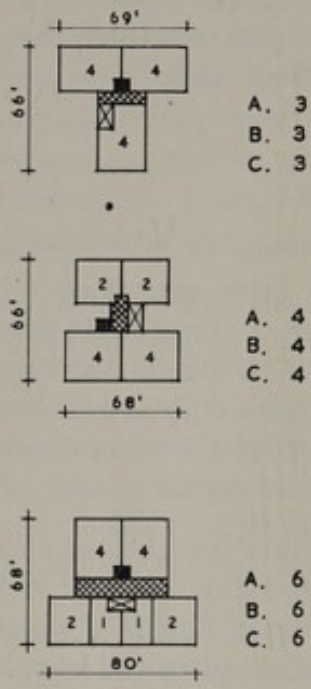
THREE STOREYS

A



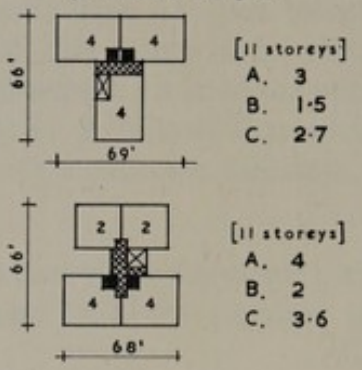
REF. PARA. 2.

FIVE STOREYS



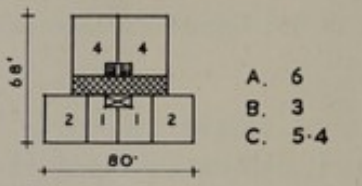
OVER FIVE STOREYS

C unlimited height



REF. PARA. 11.

D maximum height 9 storeys

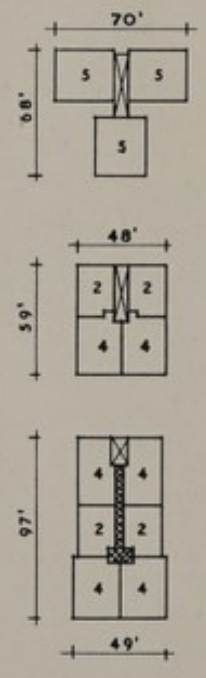


REF. PARA. 12.

POINT BLOCK FLATS INTERNAL ACCESS

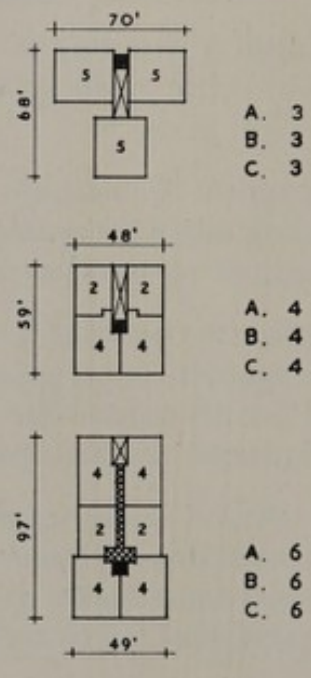
THREE STOREYS

B



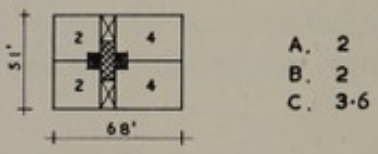
REF. PARA. 1.

FIVE STOREYS



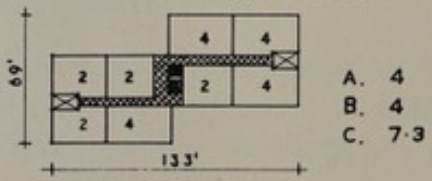
OVER FIVE STOREYS

E maximum height 11 storeys



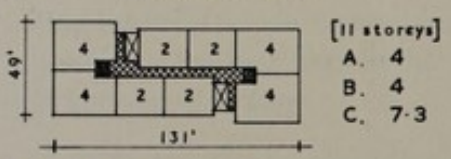
REF. PARA. 17.

F maximum height 11 storeys



REF. PARA. 18.

G unlimited height



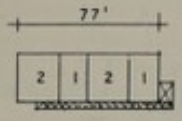
REF. PARA. 18

A.. number of dwellings per storey height of staircase ▣ . . . lift 2. 4. 5. . number of persons
B.. " " " " " " " = lift ⊠. . . staircase
C.. " " " = lift stop ▩. . common access

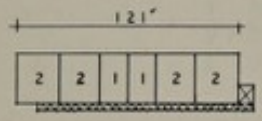
SLAB BLOCK FLATS EXTERNAL ACCESS

THREE STOREYS

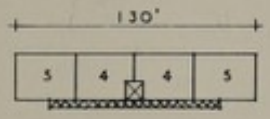
A



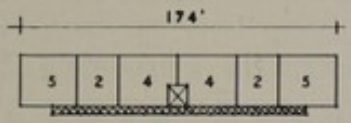
A. 4



A. 6



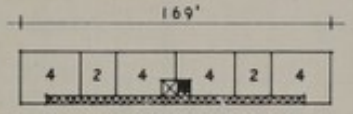
A. 4



A. 6

REF. PARA. 2.

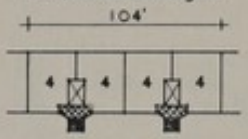
FIVE STOREYS



A. 6
B. 6
C. 6

OVER FIVE STOREYS

E unlimited height



[11 storeys]
A. 2
B. 2
C. 2

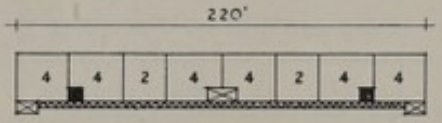
REF. PARA. 11.

F maximum height 9 storeys

A. 8
B. 4
C. 7·2

REF. PARA. 13.

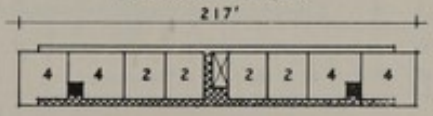
G maximum height 11 storeys



A. 5·1
B. 4
C. 7·3

REF. PARA. 13(i).

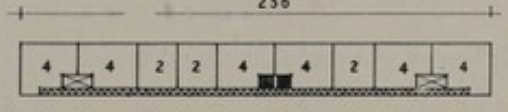
H unlimited height



[11 storeys]
A. 8
B. 4
C. 7·3

REF. PARA. 13(ii).

J unlimited height

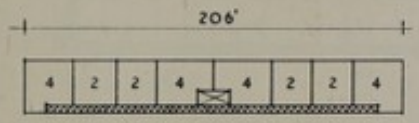


[11 storeys]
A. 4·5
B. 4·5
C. 8·2

REF. PARA. 19.

THREE STOREYS

B

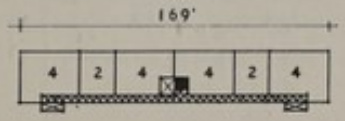


A. 8

REF. PARA. 4.

SIX STOREYS

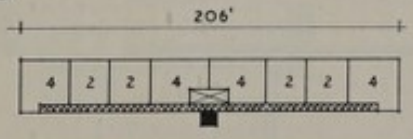
C



A. 4·5
B. 6
C. 6

REF. PARA. 9

D



A. 8
B. 8
C. 8

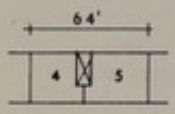
REF. PARA. 13.

A. . number of dwellings per storey height of staircase ■ . . . lift
B. . " " " " " " " lift ⊠ . . . staircase ═══ continuous escape balcony
C. . " " " " lift stop ▒▒▒ . . common access 2, 4, 5. number of persons

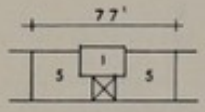
SLAB BLOCK FLATS — INTERNAL ACCESS

THREE STOREYS

A



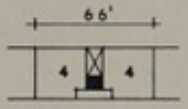
A. 2



A. 3

REF. PARA. 1.

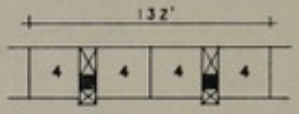
FIVE STOREYS



A. 2
B. 2
C. 2

OVER FIVE STOREYS

F maximum height 11 storeys



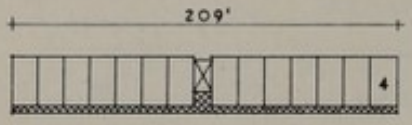
A. 1·1
B. 2
C. 2

REF. PARA. 14.

SLAB BLOCK MAISONETTES — EXTERNAL ACCESS

FOUR STOREYS

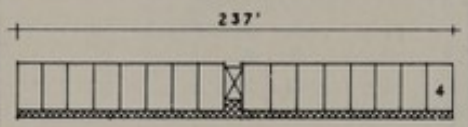
B



A. 9·3

REF. PARA. 6.

C

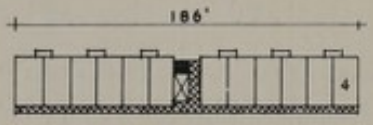


A. 10·6

REF. PARA. 7.

SIX STOREYS

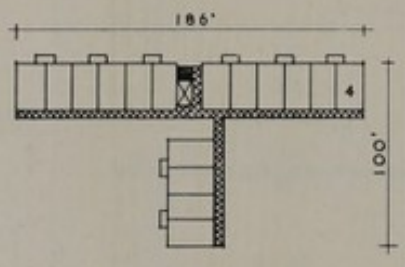
D



A. 7·2
B. 7·2
C. 12

REF. PARA. 10

E

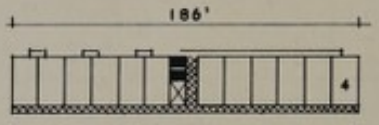


A. 9·6
B. 9·6
C. 16

REF. PARA. 10

OVER SIX STOREYS

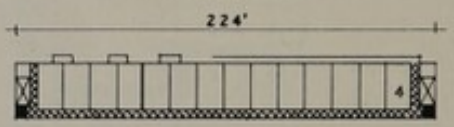
G unlimited height



[12 storeys]
A. 6
B. 3·2
C. 6

REF. PARA. 15.

H unlimited height



[12 storeys]
A. 3·6
B. 4
C. 7·3

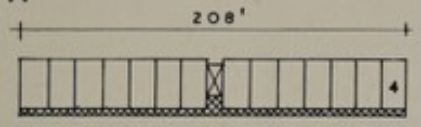
REF. PARA. 20.

A.. number of dwellings per storey height of staircase ■ ... lift ... interchange escape balcony
B.. " " " " " " " lift ... staircase ... continuous " "
C.. " " " " lift stop .. common access 2, 4, 5, number of persons

SLAB BLOCKS – COMPOSITE EXTERNAL & INTERNAL ACCESS

THREE STOREYS

A



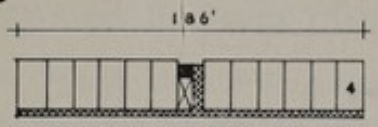
maisonettes
[14 1/P flats on top floor]

A. 9·3

REF. PARA. 3.

FIVE STOREYS

C

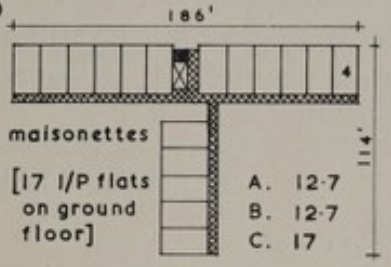


maisonettes
[12 1/P flats on grd. floor]

A. 9, B. 9, C. 12,

REF. PARA. 5.

D



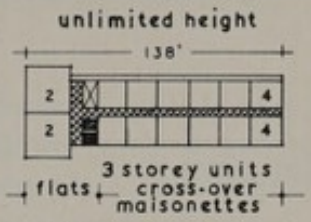
maisonettes
[17 1/P flats on ground floor]

A. 12·7
B. 12·7
C. 17

REF. PARA. 7

OVER FIVE STOREYS

F



[12 storeys] A. 8, B. 4, C. 8,

REF. PARA. 11 for flats, 16 for maisonettes

G

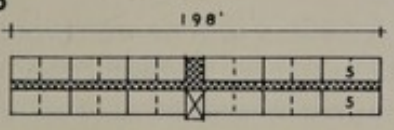
[12 storeys] A. 5·3, B. 5·3, C. 10·6,

REF. PARA. 11 for flats, 21 for maisonettes

CROSS–OVER MAISONETTES INTERNAL ACCESS

FOUR STOREYS

B



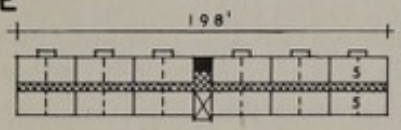
2 storey units

A. 8

REF. PARA. 8

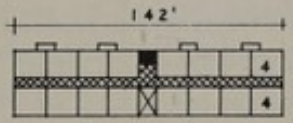
SIX STOREYS

E



2 storey units

A. 7·2
B. 7·2
C. 12



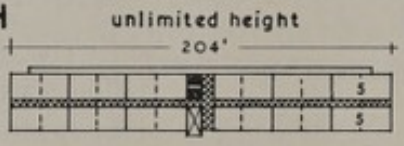
3 storey units

A. 6·4
B. 6·4
C. 10·6

REF. PARA. 10

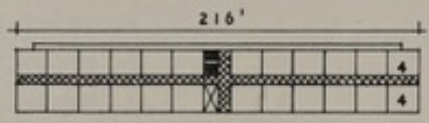
OVER SIX STOREYS

H



[12 storeys]
A. 6
B. 3·2
C. 6

2 storey units

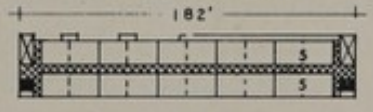


[12 storeys]
A. 8
B. 4·3
C. 9·6

3 storey units

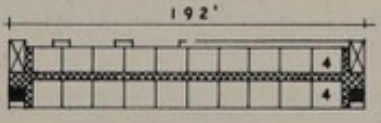
REF. PARA. 16.

J



[12 storeys]
A. 2·5
B. 2·7
C. 5

2 storey units



[12 storeys]
A. 3·3
B. 3·6
C. 8

3 storey units

REF. PARA. 21.

A . . number of dwellings per storey height of staircase ■ . . . lift ⊣⊢ . . interchange escape balcony
B . . " " " " " " " lift ⊠ . . . staircase ═══ continuous " "
C . . " " " " lift stop ▒▒▒▒ . . common access 2, 4, 5. number of persons

Part I.
Block Planning

Notes:

(i) In blocks over 100 feet in height lifts should be entered from the same ventilated common space as the staircase, so that one can be used to provide for the fireman's ease of movement about the building.

(ii) An acceptable alternative to interchange and continuous escape balconies in buildings up to 100 feet in height is the provision of staircases in each dwelling connecting with an escape route on the floor next above or below the dwelling, or connecting with the roof and thence to a main staircase.

Section I. One staircase blocks with no floor level over 42 ft. from the ground

FLATS

Protected staircase access

1. The number of dwellings on one storey is limited to four with wood floors and six with incombustible floors. The entrances to dwellings can be taken direct from the protected staircase, but where the number of dwellings or the plan arrangement necessitates a corridor, e.g., where there are more than four dwellings on one floor, the corridor also should be protected and the staircase enclosed with doors. (Reference Diagrams 1 (B) and 3 (A).)

Access balcony connecting with an open staircase

2. Where there is an access balcony at more than one floor level, the number of dwellings served by each access balcony is limited to four with wood floors and six with incombustible floors. (Reference Diagrams 1 (A) and 2 (A).)

3. Where there is an access balcony at one floor level only, i.e., one storey of flats over one tier of maisonettes, the number of dwellings on that storey is limited only by the length of the access balcony which should not exceed 100 feet in any direction from the staircase to the entrance of the farthest dwelling. (Reference Diagram 4 (A).)

Access balcony connecting with an enclosed staircase

4. The length of the balconies in any direction from the staircase and the number of dwellings served is unlimited. (Reference Diagram 2 (B).)

BALCONY ACCESS MAISONETTES

Access balcony connecting with an open staircase

5. Where there is an access balcony at more than one floor level, i.e., where the building is more than two tiers high, the number of dwellings served by each access balcony is limited to eight with wood floors separating dwellings and 12 with incombustible floors separating dwellings. (Reference Diagram 4 (C).)

6. Where there is an access balcony at one floor only (e.g., buildings containing two tiers of maisonettes, the lower being entered from ground level), the number of dwellings served by the access balcony is limited only by the length of the balcony which should not exceed 100 feet in any direction from the staircase to the entrance of the farthest dwelling. (Reference Diagram 3 (B).)

Access balcony connecting with an enclosed staircase

7. The length of the balcony in any direction from the staircase and the number of dwellings served is unlimited. (Reference Diagrams 3 (C) and 4 (D).)

CORRIDOR ACCESS MAISONETTES

Internal access corridor connecting with an enclosed staircase

8. The number of dwellings served by each access corridor is limited, (1) if the corridor serves two floors to eight with wood floors separating occupancies and 12 with incombustile floors separating occupancies and (2) if the corridor serves three floors to 12 with wood floors separating occupancies and 18 with incombustile floors separating occupancies. (Reference Diagram 4 (B).)

Section II. One staircase blocks with one floor level over 42 ft. from the ground

FLATS

Access balcony connecting with an open staircase

9. Subject to the permitted maximum number of dwellings as previously laid down, one storey with its floor level over 42 feet from the ground is permitted so long as the access balcony on the topmost storey is provided with an auxiliary staircase or staircases connecting with the balcony next below, such staircases being at the ends of the balconies farthest from the main staircase. (Reference Diagram 2 (C).)

BALCONY AND CORRIDOR ACCESS MAISONETTES

10. Subject to the permitted maximum number of dwellings as previously laid down, one storey with its floor level over 42 feet from the ground is permitted so long as the topmost bedroom storey is provided with interchange escape balconies between the bedrooms of adjacent dwellings. (Reference Diagrams 3 (D) and (E) and 4 (E).)

Section III. One staircase blocks with one or more floor levels over 42 ft. from the ground

FLATS

Cross-ventilated access lobby or open access balcony connecting with an enclosed staircase

11. Where the dwellings are entered direct from cross-ventilated lobbies and it is not necessary to pass other dwellings to get to the staircase the height of the block is unlimited. (Reference Diagrams 1 (C), 2 (E) and 4 (F) and (G).)

12. Where the dwellings are entered direct from cross-ventilated lobbies and it is necessary to pass another dwelling to get to the staircase the height of the block is limited to 80 feet from the ground to the top floor level. (Reference Diagram 1 (D).)

13. Where the dwellings are entered from open access balconies and it is necessary to pass other dwellings to get to the staircase, no limit is set to the length of balconies, but the height of the block should not exceed 80 feet from the ground to the top floor level. (Reference Diagram 2 (D) and (F),) except that:

(i) The height of the block may be increased to 100 feet to the top ceiling level if from all storeys with floor levels over 80 feet from the ground secondary enclosed staircases are provided at the ends of the open access balconies farthest from the staircase, descending and connecting with the balcony at or next below the 80-feet level. (Reference Diagram 2 (G).)

(ii) The height of the block is unlimited if on all storeys with floor levels over 80 feet from the ground continuous escape balconies connecting with all dwellings and communicating with the common staircase are provided on the side of the block opposite to the access balconies. (Reference Diagram 2 (H).)

Protected staircase access

14. In blocks composed of units having two flats per floor entered direct from a protected staircase there should be alternative means of escape from all storeys with floor levels over 42 feet from the ground. This may be provided by a secondary staircase in each unit, independent of the common staircase, directly accessible from each flat, rising from the floor next above the 42-feet level to the roof, and giving access to the common staircase in the adjoining unit. The height of the block is limited to 100 feet to the top ceiling level. (Reference Diagram 3 (F).)

BALCONY ACCESS MAISONETTES

Open access balcony connecting with an enclosed staircase

15. Where the dwellings are entered from open access balconies no limit is set to the length of balconies. The height of the block is unlimited if

alternative means of escape is provided at all bedroom storeys with floor levels over 42 feet from the ground, on one or both sides of the block in accordance with paragraph 23 below, (*a*) by interchange escape balconies between adjacent dwellings on all bedroom storeys with floor levels up to 80 feet from the ground, and (*b*) by continuous escape balconies connecting with all dwellings and communicating with the common staircase at bedroom storeys with floor levels over 80 feet from the ground. (Reference Diagram 3 (G).)

CORRIDOR ACCESS MAISONETTES

Corridor access with cross-ventilated access lobby connecting with an enclosed staircase

16. Where the dwellings are entered from central access corridors connecting with cross-ventilated lobbies giving access to the staircase the central corridors should not exceed 100 feet in length in any direction from the staircase to the entrance of the farthest dwelling. Alternative means of escape should be provided from all storeys with floor levels over 42 feet from the ground, other than storeys at access corridor level, on one or both sides of the block in accordance with paragraph 25 below, by continuous escape balconies connecting with all dwellings and communicating with the common staircase.

The height of the block is unlimited if, when containing storeys over 100 feet from the ground the central access corridors extend to the external walls of the block and are permanently ventilated on all floors at each end, and centrally by extract ducts if exceeding about 50 feet in length. (Reference Diagram 4 (F) and (H).)

Section IV. Two staircase blocks with one or more floor levels over 42 ft. from the ground

FLATS

Internal common hall access

17. In square blocks composed of four flats per floor with two enclosed staircases rising the full height of the building and connecting with an internal common hall from which the dwellings are entered, the height of the building is limited to 100 feet to the top ceiling level. (Reference Diagram 1 (E).)

Corridor access

18. Where the dwellings are entered from central access corridors the staircases should be enclosed, connect directly with the access corridors, rise the full height of the building, be no more than 180 feet apart and located one at either end of the corridors so that the distance beyond the staircase to the end of the block does not exceed one flat in depth. The height of the block is unlimited if, when containing storeys over

100 feet from the ground the central access corridors extend to the external walls of the block and are permanently ventilated on all floors at each end, and centrally by extract ducts if exceeding about 50 feet in length. (Reference Diagram 1 (F) and (G).)

Balcony access

19. Where the dwellings are entered from access balconies the staircases should be enclosed, connect directly with the balconies, rise the full height of the block and be located so that no more than one dwelling is entered beyond either staircase. The distance between the staircases is unlimited and so is the height of the building. (Reference Diagram 2 (J).)

BALCONY ACCESS MAISONETTES

20. Where the dwellings are entered from access balconies the staircases should be enclosed, connect directly with the balconies, rise the full height of the block and be located at the ends of the balconies, so that not more than one dwelling is entered from beyond the staircase. The distance between the staircases is unlimited. Alternative means of escape should be provided from all bedroom storeys with floor levels over 42 feet from the ground, on one or both sides of the block in accordance with paragraph 23 below, (*a*) by interchange escape balconies between adjacent dwellings in blocks up to 100 feet to the top ceiling level, and (*b*) in blocks of unlimited height by interchange escape balconies between adjacent dwellings up to 80 feet, and above 80 feet by continuous escape balconies connecting with all dwellings and communicating with the common staircases. (Reference Diagram 3 (H).)

CORRIDOR ACCESS MAISONETTES

21. Where the dwellings are entered from access corridors the staircases should be enclosed, connect directly with the access corridors, rise the full height of the block, be no more than 180 feet apart and be located one at either end of the corridors so that not more than two dwellings are entered beyond a staircase. Alternative means of escape should be provided in all dwellings from storeys with floor levels over 42 feet from the ground other than storeys at access corridor level, on one or both sides of the block in accordance with paragraph 25 below, (*a*) by interchange escape balconies between adjacent dwellings in blocks up to 100 feet to the top ceiling level, and (*b*) in blocks of unlimited height by interchange escape balconies between adjacent dwellings up to 80 feet, and above 80 feet by continuous escape balconies connecting with all dwellings and communicating with the common staircases.

In blocks containing storeys over 100 feet from the ground the access corridors should extend to the external walls and be permenently ventilated on all storeys at each end, and centrally by extract ducts if exceeding about 50 feet in length. (Reference Diagram 4 (G) and (J).)

FLATS

Note: Above 42 feet it is preferable for bedrooms to be planned to be nearest to the entrance to the dwelling.

22. All habitable rooms should communicate directly with the entrance hall of the dwelling except, (*a*) in flats with floor levels below 42 feet from the ground provided that one bedroom window in each flat is accessible to Fire Brigade rescue appliances and the bedrooms are entered from a lobby communicating with the remainder of the dwelling through a self-closing and fire-resisting door (Reference Figure 87), and (*b*) in some cases above 42 feet from the ground on condition that interchange balconies between the bedroom portions of adjacent dwellings are provided. (See Figure 55.)

BALCONY ACCESS MAISONETTES

Where the internal staircase rises from the entrance hall. (See Figure 94, orthodox plan.)

23. (i) **Blocks with sleeping floor levels up to 80 feet from the ground.** Where sleeping floor levels are more than 42 feet from the ground, or where, below 42 feet, bedroom windows are not accessible to the Fire Brigade by ladder, rooms opening into the entrance hall should have doors which are fire-resisting and self-closing, and the hall should be enclosed with solid partitions. An alternative means of escape from bedroom storeys with floor levels over 42 feet from the ground, by interchange or continuous escape balconies in accordance with paragraphs 15 and 20 above, is required on one side of the block only.

(ii) **Blocks with sleeping floor levels over 80 feet from the ground.** As (i) but in addition an alternative means of escape is required on both sides of the block at sleeping floor levels over 80 feet from the ground, unless either (*a*) it is possible to reach one side of the building from the other by means of pass doors without entering the landing, or (*b*) the landing is separated from the staircase by a solid partition and a self-closing fire-resisting door. In case (*b*), the entrance hall level of the maisonette staircase need not be protected by fire-resisting self-closing doors and solid partitions.

Where the internal staircase rises from the living room. (See Figure 94, open plan.)

24. The rooms around the top of the maisonette staircase should have self-closing fire-resisting doors in solid partitions and alternative means of escape from bedroom storeys with floor levels above 42 feet from the ground should be provided by interchange or continuous escape balconies in accordance with paragraphs 15 and 20 above on both sides of the block unless (*a*) it is possible by means of pass doors between bedrooms to pass from one side of the block to the other without entering the landing, or (*b*) the landing is separated from the staircase by a solid partition and a self-closing fire-resisting door, in which cases alternative means of escape is required on one side of the block only.

Where the internal staircase rises—or descends—from the entrance hall. (See Figures 65, 69 and 70.)

25. (i) **Blocks with sleeping floor levels up to 80 feet from the ground.** Where sleeping floor levels are more than 42 feet from the ground, or where below 42 feet bedroom windows are not accessible to the Fire Brigade by ladder, rooms opening into the entrance hall should have doors which are fire-resisting and self-closing, and the hall should be enclosed with solid partitions. An alternative means of escape from bedroom storeys with floor levels over 42 feet from the ground by interchange or continuous escape balconies in accordance with paragraphs 16 and 21 above is required on one side of the block only.

(ii) **Blocks with sleeping floor levels over 80 feet from the ground.** As (i) but in addition an alternative means of escape is required on both sides of the block at sleeping floor levels over 80 feet from the ground, unless either (*a*) it is possible to reach one side of the building from the other by means of pass-doors without entering the landing, or (*b*) the landing is separated from the staircase by a solid partition and a self-closing fire-resisting door. In case (*b*), the entrance hall level of the maisonette staircase need not be protected by fire-resisting self-closing doors and solid partitions.

When a bedroom in a storey above or below access corridor level is entered through a room other than another bedroom, and there are bedrooms at the same level on the other side of the block, an alternative means of escape on both sides of the block is required from any such storey with a floor level over 42 feet from the ground. (See Figure 69.)

Where the internal staircase rises from the living room. (See Figure 96.)

26. The rooms around the top of the maisonette staircase should have self-closing fire-resisting doors in solid partitions and alternative means of escape from bedroom storeys with floor levels over 42 feet from the ground should be provided by interchange or continuous escape balconies in accordance with paragraphs 16 and 21 above on both sides of the block unless (*a*) it is possible by means of pass doors between bedrooms to pass from one side of the block to the other without entering the landing, or (*b*) the landing is separated from the staircase by a solid partition and a self-closing fire-resisting door, in which cases alternative means of escape is required on one side of the block only.

Appendix D. Methods of Measurement

Definitions and method of measurement of areas in cost comparison Tables 12, 13 and 14

Gross floor area is the total space on one storey of flats, or on two or three storeys of maisonettes—according to type—contained within and measured to the internal face of external walls and includes (1) any public open air access space with occupied space on both sides, i.e., cross-ventilated lobbies, and (2) inset access balconies to maisonettes. It includes also half the area of any public open air access having occupied space on one side only, i.e., balconies on the face of buildings, measured from the external face of external walls to the internal face of the balcony front. The area of private balconies is not included in gross floor area.

Net floor area is the total space in dwellings on one storey of flats or on two or three storeys of maisonettes—according to type—contained within and measured to the inside face of walls enclosing the dwellings. The area of private balconies is excluded from net floor area.

Common access space is the difference between gross floor area and net floor area and includes public access space, lift and staircase space and the thickness of walls enclosing these spaces and the thickness of walls between dwellings.

Habitable floor area is the total space on one storey of flats or on two or three storeys of maisonettes—according to type—contained within and measured to the inside face of walls enclosing living rooms, bedrooms and kitchens.

Circulation and service space is the difference between net floor area and habitable floor area and includes entrance halls, bathrooms and the thickness of partitions between rooms.

External wall area is the total area of the walls enclosing one storey of flats or two or three storeys of maisonettes—according to type—assuming a dimension of 8 feet 3 inches from floor to floor. Where there is any public open air access space with occupied space on both sides or inset access balconies to maisonettes the external walls are assumed to continue across the face of this space in line with the general outline of the building.

Frontage is the clear distance measured between party walls.

Appendix E. Space Standards in Maisonettes and Flats

Individual Room Sizes

The standards of minimum room areas are the same as those required in houses for similar sizes of dwellings. Those given below relate to five-person family dwellings and whilst the bedroom areas remain the same for other sizes of household the areas of the living rooms and kitchens may be smaller or larger according to the size of the household. The figures in brackets are suggested as minimum areas for four-person dwellings.

The working-kitchen maisonette or flat:

Living room	180 (175) sq. ft.
Kitchen	90 (85) sq. ft.

The dining-kitchen maisonette or flat:

Living room	160 (160) sq. ft.
Kitchen	110 (100) sq. ft.

Bedrooms

1st bedroom	135 sq. ft.
Other double bedroom	110 sq. ft.
Single bedroom	70 (maximum 80) sq. ft.

In one-bedroom dwellings for two persons the living room should not be less than 160 sq. ft. Where the dwelling is intended for two old people the living room may be reduced to 140 sq. ft. minimum and the bedroom to 120 sq. ft.

Dwelling Sizes

The standards of individual room sizes given above can be achieved in dwellings having superficial floor areas of sizes given below. The areas given are measured to the inner faces of the enclosing walls of the dwelling and exclude the area of any private balconies.

Maisonettes	2 B.R.	4 persons (3 room)	700 to 750 sq. ft.
	3 B.R.	4 persons (4 room)	720 to 800 sq. ft.
	3 B.R.	5 persons (4 room)	820 to 870 sq. ft.
	3 B.R.	6 persons (5 room)	925 to 975 sq. ft.
Flats	B.S.R.	1 person (1 room)	300
	1 B.R.	1 person (2 room)	350
	1 B.R.	2 persons (2 room)	500
	2 B.R.	4 persons (3 room)	700
	3 B.R.	5 persons (4 room)	800

The **aggregate living area** requirement applies only to houses.

The buildings and examples of landscaping illustrated were designed by the following:

Architects to the London County Council: R. H. Matthew C.B.E., F.R.I.B.A. (to 1953) Sir J. L. Martin, F.R.I.B.A. (1953–6) Hubert Bennett, F.R.I.B.A. (from Oct. 1956) Principal Housing Architect: H. Whitfield Lewis, A.R.I.B.A.	Figures 1, 7, 14, 15, 32, 37, 39, 41, 42, 43, 47, 50, 60, 73, 77, 83, 84.
Thomas E. North, O.B.E., F.R.I.B.A.	Figures 6, 8, 40, 75, 81.
Powell and Moya, F./F.R.I.B.A.	Figures 16, 20, 35, 59, 71, 101.
Sir William Holford, F.R.I.B.A., P.P.T.P.I.	Figure 36.
Eric Lyons, F.R.I.B.A.	Figures 38, 44, 102.
Donald Gibson, C.B.E., A.R.I.B.A., succeeded by A. G. Ling, F.R.I.B.A., M.T.P.I.	Figure 48.
Frederick Gibberd, C.B.E., F.R.I.B.A., A.M.T.P.I., Architect Planner, and Victor Hamnett, A.R.I.B.A., A.M.T.P.I., A.R.I.C.S., Executive Architect	Figure 49.
Frederick Gibberd and Victor Hamnett in collaboration with Architects of the Ministry of Housing and Local Government.	Figure 82.
Chamberlin, Powell and Bon, A./A.R.I.B.A.	Figure 51.
Dr. Ronald Bradbury, F.R.I.B.A., A.M.T.P.I.	Figure 61.
T. A. Brittain, F.R.I.B.A., Borough Architect, Donald Bradshaw, F.R.I.B.A. Consulting Architect.	Figure 62.
A. G. Sheppard Fidler, F.R.I.B.A., A.M.T.P.I.	Figure 72.
Neville Conder, F.R.I.B.A.	Figure 74.
Hugh Wilson, A.R.I.B.A., A.M.T.P.I., succeeded by John L. Berbiers, A.R.I.B.A., A.M.T.P.I., in collaboration with Architects of the Ministry of Housing and Local Government.	Figure 76.
J. L. Womersley, F.R.I.B.A., M.T.P.I.	Figure 78.
William Crabtree, F.R.I.B.A.	Figure 103.

Thanks are due to the following for permission to reproduce photographs:

Architects Journal	Figures 6, 50, 76.
Architectural Review	Figures 16, 48, 59, 60.
Chamberlin, Powell and Bon, A./A.R.I.B.A.	Figure 51.
William Crabtree, F.R.I.B.A.	Figure 103.
A. G. Sheppard Fidler, F.R.I.B.A., A.M.T.P.I.	Figure 72.
Frederick Gibberd, C.B.E., F.R.I.B.A., A.M.T.P.I.	Figure 49.
Sir William Holford, F.R.I.B.A., P.P.T.P.I.	Figure 36.
London County Council	Figures 35, 37, 41, 73, 77, 83, 84.
Eric Lyons, F.R.I.B.A.	Figure 102.
Thomas E. North, O.B.E., F.R.I.B.A.	Figures 8, 40, 75, 81.
Powell and Moya, F./F.R.I.B.A.	Figures 20, 71.
Royal Air Force	Figure 3.
William Thornton & Son, Limited.	Figure 62.
Wimpey News	Figure 61.
J. L. Womersley, F.R.I.B.A., M.T.P.I.	Figure 78.

(74544) Wt. 2825 K.[illegible] 11/58 Hw.

Published by
HER MAJESTY'S STATIONERY OFFICE

To be purchased from
York House, Kingsway, London w.c.2
423 Oxford Street, London w.1
13a Castle Street, Edinburgh 2
109 St. Mary Street, Cardiff
39 King Street, Manchester 2
Tower Lane, Bristol 1
2 Edmund Street, Birmingham 3
80 Chichester Street, Belfast
or through any bookseller

Printed in Great Britain

C.B.H.31807-Wt.2825-11/58

S.O. Code No. 75-63*