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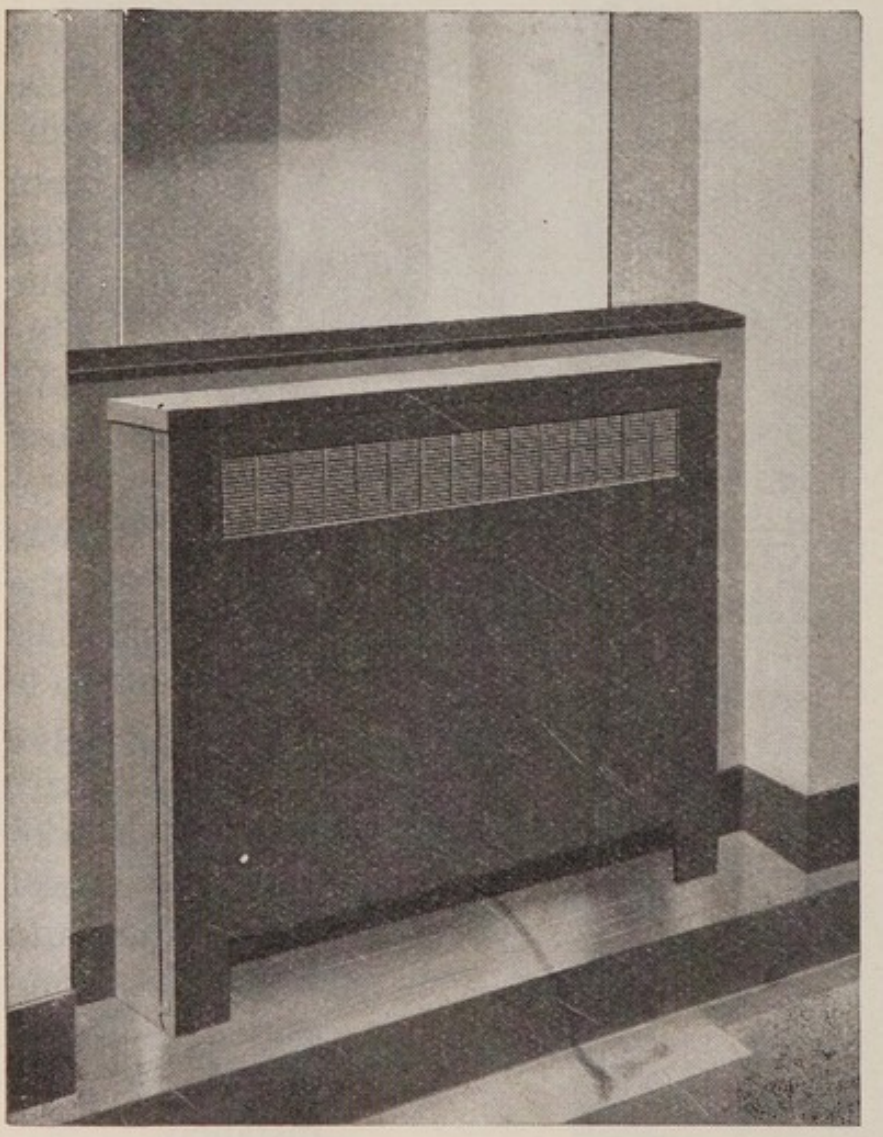

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BOARD OF EDUCATION
EDUCATIONAL PAMPHLETS, No. 107

SUGGESTIONS FOR THE PLANNING OF BUILDINGS FOR PUBLIC ELEMENTARY SCHOOLS

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SUGGESTIONS FOR THE PLANNING OF BUILDINGS FOR PUBLIC ELEMENTARY SCHOOLS

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PREFACE

1. The last issue of the Board's Building Regulations for Public Elementary Schools appeared in July, 1914. They were described as " partly a statement of principles of school planning upon which the Board proceed in criticising the plans submitted to them, and partly a statement of what the Board believe to be the best current practice in the application of these principles." They were the outcome of the Board's experience during the previous six years and embodied the modifications in the previous Building Regulations of 1907 which that experience had shown to be necessary. These modifications related principally to " design as affected by ventilation, to disposition of buildings on the site, to size and organisation of Departments, and to extent and character of facilities for physical exercises, play and organised games whether for older or younger children." Almost immediately after their publication, however, the War virtually put a stop to the building of Elementary Schools and in the years following the War there was such a rapid development in both the theory and the practice of elementary education that the need for some restatement of the various additional activities, for which a school building is intended to provide, became clear. Indeed, as long ago as 1926, the Board had found it necessary to withdraw the 1914 regulations, as they had become inapplicable. Since then, however, numerous representations have been made to the Board as to the inconvenience caused to Local Education Authorities, Managers and Architects by the absence of any reasonably accessible indication either of the principles which should now govern the planning of new schools, especially those for the education of senior children, or of the advances which have been made on the technical side in construction and materials.

2. These Suggestions are intended to furnish such an indication. In framing them the Board have taken into

account the proposal to raise the school leaving age to 15. The matter on which guidance appears to be most required is the nature of the provision to be made for senior boys and girls over the age of 11 years. The expenditure involved in making such provision may be considerable. It is, therefore, important that Authorities and Voluntary School Managers should plan and construct the necessary buildings with the utmost care, so as to get from that expenditure the fullest possible educational value that is compatible with a due regard to economy of cost in initial provision and subsequent maintenance. The Suggestions have been drawn with this aim in view and, bearing in mind the financial considerations which must condition the plans both of Local Education Authorities and of Voluntary School Managers, the Board have set out in Chapter III what they regard as the reasonable minima for various types of school. These are, however, minima, and the Board hope that all parties will endeavour not to allow their provision, especially in the case of new schools, to fall below the standard there indicated.

3. The question of the adaptation and alteration of existing buildings is one which must be met by consideration of the peculiar circumstances of each school, but in making such alterations Authorities and Managers should be guided so far as possible by the general considerations set out in these Suggestions.

4. The Board recognise that the Suggestions do not constitute a final stage in school development. They will, therefore, be glad at all times to place their experience at the disposal of Authorities, Managers and Architects for the purpose of considering any alternative proposals which may be suggested, by way of modification or development, so as to secure most effectively their joint aim of combining efficiency with economy. It is suggested that the most useful moment for such consultation will usually be found to be before the actual preparation of the plans, or while the drawings are still in a preliminary state.

CHAPTER I—SCHOOL ORGANISATION

5. The general acceptance of the principles laid down in the Hadow Report involves the corollary that new schools will no longer be planned as all-age schools (except where, e.g. in rural districts, a combination of circumstances may make such schools inevitable), but as schools for infants, for juniors, or for infants and juniors, and for seniors.

6. The close approach of the date by which it may be anticipated that the school leaving age will be raised to 15 renders it inevitable that during the next three years the bulk of new Elementary School building will be directed to the provision of new Senior Schools and the needs of these schools, therefore, are dealt with in special detail in these Suggestions. Certain main general principles applicable to all types of Public Elementary Schools may, however, be laid down. For juniors, and still more for infants, who cannot be expected to walk long distances to and from school, the size of the school will be governed mainly by the population within a relatively restricted area. For these younger children, however, it may be said that a school with an annual intake of two classes, i.e. a school of five to six classes for infants or a school of seven to eight classes for juniors, represents a convenient size from the point of view of organisation and of the necessary intimacy of supervision by the Head Teacher, while, in the case of schools with an annual intake of one class only, a Junior and Infants' School of six to seven classes will probably be found a convenient size. The problems of accommodation in the case of infants and juniors are substantially similar. In both cases the main need is for plenty of space for the children's activities, and at both the infant and junior stages many of these activities will be linked with the classwork of the children and will not require special rooms. These considerations point to the adoption of a classroom with a floor space of

520 square feet. It will still be desirable, as at present, to include a rather larger room for the class of new entrants in the Infants' School (see para. 17), and also in the Junior School for the introduction of more definite craftwork (see para. 20). In addition, both Junior and Infants' Schools require a Hall, large enough for assembly and for physical training. (See paras. 19, 21 and 30.)

7. In Senior Schools the problem is a different one; variety of curriculum and elasticity of organisation are essential, and these requirements should be reflected in the nature of the premises. In planning such schools it should be borne in mind that the new school-leaving age of 15 envisages a four-years' course. On this basis, and up to the limit of three classes in each year of the course, with approximately 40 children in each, the larger the concentration of senior children the easier it should be to provide, through appropriate classification, for the needs of the individual child. A school of this size would have a yearly intake of 120 pupils, and when it has a complete four-years' course a total number of 480, which may be regarded as the normal maximum number over which a Head Teacher can exercise the necessary personal attention which is of such value to the adolescent child at this critical period of his development. Further, as the numbers approach 480 the possibilities of reclassification for special purposes increase enormously. The existence of three parallel classes in each year will enable the children to be provided for according to their potentialities in a way which is impossible where the annual intake is smaller, and will admit of regrouping so as to assign due weight in each individual case to the several subjects of the curriculum, particularly if such large schools are single sex schools. It is, however, realised that local circumstances may on occasion render large concentrations impracticable and smaller schools taking in less than two classes each year will be necessary. The peculiar requirements of these smaller

schools should be considered in the light of the general principles which form the basis of these Suggestions, with such modifications as the size of the school and the particular circumstances of the locality may justify.

The new Senior School should make provision for a curriculum that has four outstanding aspects, to each of which due attention must be paid if the training given is to be properly proportioned. Thus normally the Senior School should contain the school Hall as a centre of corporate life ; accommodation for physical training ; classrooms where the child will have his ordinary class lessons ; and practical rooms, not only for the traditional subjects of Handicraft and Housecraft, but also for the various forms of Science and Craftwork to which so much attention has been given in the schools in recent years. The wider area upon which these schools will draw will, in many cases, also render particularly important the provision of special accommodation, in school canteens or otherwise, for the midday meal of children coming from a distance.

8. Here reference should be made to an administrative question which has always been one of difficulty, the assessment of accommodation. In the past this has been carried out by a formula based on the detailed measurements of individual rooms. The result is clearly seen today in many existing schools, where the " nominal " accommodation differs widely from the " effective " accommodation. The resulting apparent surplus of school places, which does not in practice exist, is one of the most serious barriers to effective re-organisation. It is, therefore, suggested that a more rational conception may usefully be adopted, and that a school may be regarded as providing so many teaching spaces, which, while affording not less than the usual allowance of 10 square feet for each younger child and 12 square feet for each senior, are primarily designed to give proper room for one form or group of the normal size and one only. If this conception and the minima suggested

below are adopted, it may be hoped that the old bugbears of educational administration—the unduly large class and the two classes in one room—will, in the course of time, automatically disappear. The removal of these impediments will at last enable proper value to be obtained from the most important, as well as the most costly, part of school provision, the teaching staff itself.

CHAPTER II—SITES AND THE REQUIREMENTS OF GAMES AND OUTDOOR ACTIVITIES

9. The two primary considerations in selecting sites for new schools should be adequacy and suitability. In making a final choice it is important that architectural advice should be sought and that consultation with the Town Planning Authority should not be omitted. Particular attention should be given to the relationship of the site to existing or future traffic routes, with a view to minimising the danger to children on their way to school.*

In determining the amount of land needed in any particular case, regard should be had both to the size and to the organisation of the schools that are to be put on the site. In selecting it, as in planning the building, the total accommodation that may be expected to be needed ultimately should be the first consideration, rather than the necessity of the moment. Then it should be remembered that a site that is to take seniors at some future time needs a good deal more land for the consequential developments, e.g. larger gardens and playing fields, than one that is to take juniors only. As it is nearly always very difficult to add to a site that is too small and as new buildings are generally in developing districts, an unduly restricted site is to be avoided, so far as considerations of economy permit. Where the shape of the site is irregular there will be waste and a larger area is required than in the case of a well shaped piece.

That it is necessary to contemplate for the future the purchase of sites considerably larger than those of the past will be apparent when the plan and lay-out of the modern school are thoroughly appreciated, since they are conceived

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*See the Report of the Inter-Departmental Committee (England and Wales) on Road Safety Among School Children. Published by H.M. Stationery Office (1936). Price 6*d*.

on altogether more open lines than was formerly the case. The ideal should be envisaged as a single-storey building, opened out to the air and sunshine in every part. Playgrounds should be placed well away from the school buildings, space being reserved for school gardens and for open-air work; some also for flower borders and shrubs. School buildings, moreover, should not be close up to the noise and dust of roads, nor should playgrounds be too closely overlooked from roads, or so near to them that children would debouch directly upon the traffic.* The school, in fact, should be afforded a measure of quiet and privacy from the outside world, and, inside, should have ample space for its activities.

Large sites are frequently found to be economical where land is not expensive. To level uneven ground usually costs more than the ground itself and to pave irregularly shaped pieces of playground is a waste of money. Small sites may force buildings and playgrounds close up to roads or adjoining property, in which case high solid fences become necessary, whereas on large sites fences of the lightest and most inexpensive patterns can be employed.

10. With all these considerations in view the Board have had in mind a desirable standard for sizes of sites for new Elementary Schools. They are of the opinion that the standard at which to aim should be not less than two acres per department. For a large department, or even for a small one which is likely to grow, there is little doubt that two acres is not unnecessarily large. In the case of the Senior School, two acres allows nothing for playing fields (see para. 14), but for juniors there will be the desirable margin required to supplement the hard-surfaced playground. Even in the case of small schools in rural districts a smaller site would render it quite impracticable to offer adequate

*See the Report of the Inter-Departmental Committee (England and Wales) on Road Safety Among School Children. Published by H.M. Stationery Office (1936). Price 6*d*.

facilities for the teaching of horticulture and the valuable practical work in Science and Handicraft that can be connected with a school garden. Where, however, circumstances render it unavoidable that two or more departments should be built upon the same site, the standard of two acres per department may be somewhat lowered. Cost of land must, of course, be always a guiding factor. In built-up and congested areas it may not always be possible to satisfy the standard suggested, but it is strongly recommended that Authorities and Managers should make every effort to approximate to it.

11. Sites should be chosen so that the school can be placed where no shadow can fall upon the buildings and where every available ray of sunshine can play upon them. On the other hand, unduly exposed sites should be avoided and regard should be had to the direction of the prevailing winds. Sites should be reasonably level and, if sloping, the slope should be towards the south. There should be no undesirable surroundings which might be noisy or detrimental to health, and care should be taken to avoid land which is lowlying, made-up, damp, or subject to floods or subsidence.

The site should be conveniently accessible by road and there should be access, if possible, from more than one side, entrances from main traffic routes being avoided. Where entrances from busy thoroughfares are unavoidable they should be recessed and fitted with crush barriers so as to minimise the danger when children are leaving school.* Every effort should be made to avoid an excess of road frontage, which is disadvantageous from the point of view both of expensive road charges and of the likelihood of noise and dust. Care should be taken to see that all public services, sewers, water, gas and electricity are readily available. Sites which are subject to embarrassing restrictive

*See the Report of the Inter-Departmental Committee (England and Wales) on Road Safety Among School Children. Published by H.M. Stationery Office (1936). Price 6*d*.

covenants should not be acquired. The most should be made of any natural features which the site may possess.

12. No precise measurements can be laid down for playgrounds, as their dimensions must be governed to some extent by the shape and nature of the site, every case being treated on its merits. It is of the utmost importance, however, if the syllabus of physical training is to be carried out effectively, that hard paved playgrounds of adequate size and suitable shapes should be laid down. Playgrounds should always be rectangular in shape, and in no case less than 50 feet wide. The area of paved space necessary is governed not by the size of the school alone, but by the number of lessons a week given to each class in physical exercises, taking into account the provision made for indoor gymnastics. A convenient standard for calculating the desirable amount of space to be assigned to this purpose is set out in Appendix I.

13. Playgrounds should be paved with a hard, dry, even surface. If the surface is gently sloped, it will be unnecessary to break it by any central drains or gullies. A sufficient foundation should be prepared upon which a surface not inferior to tarmac, asphalt, or concrete, should be laid. Gravel, even when tar sprayed, and surfaces of the nature of finely graded burnt ballast, are not suitable, as they pick up in frost and are alternately dirty and dusty in very wet or dry weather. Thin bituminous surfaces, laid hot or cold, and substitute forms of asphalt are sometimes used but have a short life and are often lifted by the growth of weeds underneath.

From the point of view of physical training, flower beds and grass borders should not be placed too close to the pitches ; in other words the paved space should allow an ample margin.

Playgrounds should normally be separate for senior boys and girls and have separate entrances. Complete

and permanent separation however, is not essential. The division, for example, can be by a white line or movable barrier, if thereby the two together, treated as one, have the advantage of providing a commodious area for physical exercises. In the case of younger children there may be joint use of the playground by both sexes if preferred, provided that the position of the offices makes this a suitable arrangement; but it is advisable always to provide a separate playground for the infants, and it is essential where Nursery Classes are included in the school.

14. *Playing Fields.*—As has been indicated in the Board's pamphlet on playing fields (Educational Pamphlet No. 80*), every new Senior School may be expected to have either its own playing field attached to the school or easy access to a central playing field. It is most desirable that no Senior School, however moderate in size, should have a playing field of less than two or three acres. For a school of 300 or more, not less than four to five acres would be found desirable, or six to seven acres where the numbers approach 500. It is important that the playing fields, whatever their area, should be kept in proper condition. It is very desirable that the playing field should be on the same site as the school, in order that there may be easy and convenient access to it, not only for games during school time, but also for the use of the children during the midday interval. In congested areas where it is not possible to provide a playing field on the actual site of the school, every effort should be made to place the school within reach of any public park or central playground in which there are opportunities for open-air education and organised games.

The table set out in Appendix II contains suggestions as to the nature and number of pitches desirable for Senior Schools of different sizes, having regard to the recommendations contained in Educational Pamphlet No. 80 (page 21).

* Published by H.M. Stationery Office (1930). Price 4*d*.

CHAPTER III—SCHEDULES OF ACCOMMODATION

(1) Infants' Schools

15. It will be generally admitted that modern methods of educating young children must be taken into account in the planning of Infants' Schools if these are to provide an appropriate environment for really sound training. These methods agree in requiring sunny, well lighted, warm and airy premises, sufficiently spacious to allow room for activities of mind and body ; suitable accommodation for the necessary training in personal hygiene ; and opportunities for safe and interesting play out of doors.

In normal cases children under five years of age may be expected to derive more benefit from being in their home than in school. There are, however, many instances in which mothers, through no fault of their own, are unable to give their young children at home the care and attention which they need. The physical or mental requirements of a child may justify his admission to school in such circumstances, and he will also there derive the educational benefit which flows from the companionship of other children and from the activities and training which can be found in a Nursery School or in the Infants' Department of an Elementary School. It is generally agreed that the earliest admissions to an Elementary School require specially designed accommodation, and a Nursery Class is the method often adopted as the first introduction of these very young children to an Elementary School. Children are usually admitted to a Nursery Class from the age of three years and upwards. Such a class, although it would be smaller than the usual infants' class, should nevertheless be housed in a large room, for the advantage of space cannot be overestimated. In addition to adequate space, the essentials of the Nursery Class, so far as buildings are concerned, are

suitable provision of indoor sanitation and lavatory accommodation, so placed that their use can be supervised by the teacher, and free access to an outside playground.

(a) *The Nursery Class*

16. The main characteristic, however, of the accommodation to be provided, whether by new building or by adaptation of existing premises, should be simplicity, which will not only make for reasonable economy but also has educational advantages. At the same time, care should be taken, in order to secure the best return from the expenditure on staffing and maintenance, to plan such accommodation in units of an economical size. The future development of the local population should be carefully estimated, in order to avoid any excess of provision. Inadequate provision, on the other hand, may involve the following educational disadvantages: (1) demands for admission in excess of accommodation may lead to the overcrowding of the Nursery Class to the detriment of the training of all the children in the class, or (2) the children who are approaching five may be pushed up prematurely from the Nursery Class. Where two Nursery Classes are justified, it will be found economical and advantageous to place them next to each other. Not only can some of the equipment be in common, but this arrangement will enable the teachers to co-operate in the supervision of the two classes. Though the simple essentials secured by the three requirements set out at the end of the preceding paragraph will often prove a sufficient nucleus for the teachers' personal schemes of development, some further details may be mentioned.

(i) *The Nursery*

As well as being of appropriate size, it is desirable that the room for the Nursery Class should, if possible, have a south-east aspect, with large windows low enough for the children to see out and fitted always with clear glass. French windows are acceptable, provided that the fittings are

sufficiently secure to eliminate the possibility of draughts. (See para. 104.) There should be an open fire, which will always be covered by a fireguard, but this form of heating should be supplemented by a central heating system, since it would hardly suffice by itself to heat adequately a room of the size contemplated. The floor should be of such material as can be readily cleaned, and for this reason rubber composition or cork linoleum are more satisfactory than scrubbed boards, which demand more thorough and frequent attention than it is often possible to obtain. Mats should be available for the children to sit on when playing games on the floor or out of doors. The room should be furnished with small chairs and tables, preferably painted in light shades of cellulose which can easily be touched up if it is chipped. Ample storage space is needed by the teacher, and for this purpose built-in cupboards are best, as making for economy in space and freedom of safe movement. Some parts of the cupboards should be low enough to be accessible to the children.

The afternoon sleep is a regular feature of the Nursery Class, and for this purpose beds will be required, sufficient and convenient storage being available for the beds when not in use. Where possible a store room, adjacent to the Nursery, is the most convenient place for the housing of beds, bedding, and overalls required by the children, and this room should be properly ventilated, and heated by the school system of heating. The type of bed which has a tubular metal frame will be found most suitable ; in any case the beds should be sufficiently light to ensure easy handling, but strong enough to be safe and durable.

A " kitchenette," or some simple means of heating water or milk, will be needed. The provision of milk during the morning is particularly valuable. Apart from the nourishment which it affords, the mid-morning lunch offers an excellent opportunity for training in social habits.

The decoration of the Nursery is clearly a matter for individual opinion, but the trend towards simplicity in colour and decoration and the avoidance of over-elaborate friezes and nursery illustrations is probably sound. The same principle may be applied to the choice of the furniture.

(ii) *Lavatory, Offices and Cloakroom*

Lavatory

It is essential that provision for washing should be made. In ideal conditions the lavatory accommodation should be adjacent to the Nursery and consist of not less than five or six wash bowls of suitable size and height supplied with running hot and cold water, with proper precautions against scalding. (See para. 67.) Racks for towels, mugs and toothbrushes should be placed within the children's reach. An arrangement of the lavatory so that the basins are placed in the centre of the room, back to back, and the towels hung round the walls, has been found to allow of easier circulation in the room than the more usual plan. The walls of the lavatory should be tiled half-way up, and the floor should be suitably paved. A cupboard for the teacher's use, to contain first aid materials and other necessities, is a valuable addition.

Where a separate lavatory is not practicable and the Nursery is sufficiently large, provision for washing may be made in the room itself by means of portable basins, but this arrangement deprives the children of opportunities of learning to manipulate taps, which is a useful and normal accomplishment. Where portable basins are used it is an advantage to provide, if possible, one fixed lavatory basin as well. A sink should be provided, and this may take the form of a sink bath, which would undoubtedly be useful.

Offices

The office accommodation should be indoors, and should be provided on the scale of one closet for every twelve children. The closets should be in separate compartments

with low doors. The offices should be as near the Nursery as is reasonably possible, in order to allow of adequate supervision and training. It is necessary to see that the flushing chains are long enough for the children to use, and, for purposes of instruction, the flush and refill of the cistern should be as rapid as possible. Where it is impracticable to provide exclusively indoor sanitation, at least one indoor closet should be available for the Nursery Class.

Cloakroom

The cloakroom should be adjacent to the Nursery, but separate from it. It should be sufficiently large to enable each child to have his own peg and shoe-cage. The pegs should be 30 to 36 inches from the ground and should be so designed as to avoid injury to the eyes. They should be sufficiently far apart, at least 12 inches, to facilitate the drying of wet clothes and to form a safeguard against the spread of infection.

(iii) *Playground*

A separate playground for the youngest children is highly desirable, not only on the grounds of safety, but as affording the opportunity for constant and ready access to the open air. It is, therefore, suggested that, even if the space available is not very extensive, it is an advantage to reserve it for the use of the Nursery Class children, and to ensure for them easy access to it at any time of the day. It is more important that the children should have uninterrupted access to the playground than that it should be large. If there is a separate playground it will be possible to give it a special character, and, in the larger playgrounds, to provide certain irregularities of surface, little paths, flowerbeds and grass plots which will serve as a constant source of interest to the children. If there are trees in the playground the Nursery Class may be regarded as having the best claim to their retention. In suitable areas and under careful supervision there are great educational

advantages in a sand pit. This will normally have to be covered and protected when not in use; where possible, it should be filled with sea-shore sand, which is cleaner and easier to dig than river sand.

(b) *The Infants' School*

17. While increasing numbers of children have the opportunity of coming at an earlier age than five, the majority of children make their first school attendance at this age. It is clear, therefore, that the schools will have the responsibility of providing the type of education most suited to the particular stage of development which the children have reached when they first attend, and that the accommodation should vary in character according to this principle. The suggestions already made in detail on the provision of suitable premises for children attending school at three years can be modified gradually to suit the needs of older children.

This broad conception of an Infants' School as providing suitable environment for the growing potentialities of its pupils has led to the formation in some areas of specially planned rooms for those children who first attend school at the age of five. These Reception Classes should, where possible, be housed in rooms rather larger than the ordinary classroom and should approximate to some extent to the ideals of the Nursery. The type of training in a class of newly admitted children will undoubtedly have many of the characteristics of that given in the Nursery Class, although the special design of offices, lavatory, cloakroom, storage and playground may be adapted to suit the needs of children of five. As a whole it may be said that the minimum needs of a Reception Class are space; easy access to suitably planned lavatory, offices and cloakroom, and to the playground; and equipment with such furniture, toys and apparatus as the age and outlook of the children demand.

18. The varied activities which form the main part of the education of the child in the Infants' School obviously require above everything spacious classrooms. No room for children of this age should be less than 520 square feet in area. In view of the fact that the size of the children in this age group varies considerably, all the classrooms should be equipped with furniture of varying sizes. The size and height of the children should similarly be considered in such matters as the placing of the door handles, which should be low down and may preferably be of the latch type rather than rounded. The windows, if not made to provide complete access to the open air, should be brought down to the eye level of the children, and should invariably be of clear glass. The furniture should be light and easy to move, and for this purpose dual tables and chairs are usually found most convenient. These may be fitted with some form of rubber tips in order to minimise the noise of constant movement. Since this type of furniture is to be preferred to desks with lockers, there will be need of cupboards to house materials, books and toys, and these must be placed at a suitable height from the ground to enable the children themselves to keep them in good order. It will be necessary also to provide adequate storage for the use of the teacher.

19. The requirements of physical training, music, rhythmic work and general assembly cannot be adequately met in an Infants' School without a Hall, though there may be some schools so small as to justify the acceptance of some alternative provision in the shape of a large room. Moreover, the widely increased interest and co-operation of the parents go far to necessitate the provision of a Hall for meeting and entertainment. In a large Infants' School a Hall of 1,800 square feet will probably not be excessive. In a small school of two or three classes a room of 1,000 square feet, divisible if need be into two ordinary classrooms, would constitute a workable substitute for a Hall. (See para. 31.)

Though there is no necessity to provide a stage in the Infants' School Hall, a small platform will undoubtedly be convenient, and a piano is a necessary piece of equipment. Many schools now make valuable use of large toys and apparatus which cannot easily be stored in the classrooms, and a store room for such equipment near the Hall will be of great service.

The offices, lavatory and cloakroom in any Infants' School should be very carefully planned in view of the fact that training in personal hygiene and good social habits is an important side of the work. (For further details, see paras. 63, 67 and 69.)

Every Infants' School should have a separate playground and the site should be adequate for this purpose. In the case of infants the playground is in a special sense an educational space and it is, therefore, very desirable that some portion of it should be laid out with grass and flower beds ; wherever possible any trees which exist on the site should be preserved and it is not necessary to level any gentle slopes. Sufficient, level, hard surface will, of course, be needed for purposes of physical training out of doors, but the real value of the playground to young children will be lost if it consists merely of a bare asphalted space.

(2) Junior Schools

20. It is not perhaps an exaggeration to say that the Junior School, as a separate entity, is still in process of development, and for this reason any dogmatic statement as to its character and requirements is inadvisable. The Junior School caters for a period of rapid physical and mental growth, and during this period the idea of education through activities will be carried on from the Infants' School, while, at the same time, the children begin to acquire certain definite accomplishments or skills and a certain body of

knowledge, both of which will gradually assume a more marked significance as the children approach the Senior School stage.

The bearing of this conception of the aims of the Junior School on the size and design of the classrooms is clearly of great importance. In the classroom a large group of children will carry out a considerable variety of activities and will need accommodation for books, materials and equipment. No classroom of less than 520 square feet will be fully serviceable, since the appropriate furniture consists of chairs and tables which occupy more space than desks. (See para. 34.) Moreover, it is essential that there should be sufficient floor space to make possible a variety of teaching methods and to meet the common criticism that there is inadequate room for cupboards for the necessary storage. (See para. 60.) The Junior School will also need some rooms of rather larger proportions, up to an area of 700 square feet, more particularly fitted for adventures in elementary crafts. (See para. 54.) It should contain a sink with hot and cold water, large cupboards for the storage of materials and unfinished work, and at least one table of rather greater weight and solidity than the children's individual tables. One such room to every four classrooms would be a great asset in a large Junior School, and in the smaller school one of the classrooms should be large enough to provide accommodation for the appropriate crafts. Both in the classroom and the craft room allowance should be made for the very different sizes of the children, and, indeed, in every room of the school the size and height of the children should be carefully considered when chairs, tables and cupboards are being selected. The substitution of tables for the traditional desks in the classroom brings into prominence the importance of a satisfactory provision of lockers or cupboards to house the children's own books and apparatus. The need for keeping the furniture of the room sufficiently light to admit of easy re-arrangement

suggests that some form of wall locker is preferable to locker tables or desks. (See para. 64.)

21. A Hall is an essential part of the accommodation, for many of the needs and interests of the Junior School cannot be served in the classroom. In very small schools, with three classes or less, however, it may be possible to regard the Hall as one of the normal class spaces. (See para. 31.)

The considerations set out above apply also to those cases where there is not a separate junior department, the juniors and infants being taught in the same school. Where such an organisation results in a large school, in addition to the Hall a large room should be provided where the infants can play.

22. In considering the playground of the Junior School certain particulars should be stressed. The playground space should include a suitably paved surface which can be used for physical training and games in good weather. But it will be unfortunate if there is not, in addition, adequate garden space, the cultivation of which can be a very practical part of the children's activities and give pleasure to the whole school. In this connection attention is directed to para. 56.

23. In the provision of cloakrooms and offices certain essentials should be secured. (See paras. 63 and 69 respectively.) The cloakrooms should be sufficiently warmed to make it reasonably possible to dry wet clothes. For the emergency of really wet weather, and especially in those districts where the children walk far to school, it will be found advisable to provide a separate drying room for wet garments. (See para 65.)

In the offices of the Junior School separate provision must be made for boys and girls. The offices should be attached to the building, or reached by a short covered

approach. Following the careful training in personal hygiene which forms a vital part of the Infants' Schools' task, the lavatory provision must be such as to allow the continuance of this training. (See para. 67.)

Where there is no demand for a canteen a "kitchenette," or some suitable arrangement for heating milk is desirable.

(3) Senior Schools*

24. When the question of the accommodation to be provided for Senior Schools is considered, the problem is somewhat changed. The main task of these schools is to develop the character and intelligence of children according to their very different capacities and tastes, and to provide them with a mental and physical equipment, suited as far as possible to the ability of the individual, on which they can rely when they go out into the world. It will still be necessary, as in the Infants' School, to stimulate the child's activities and, as in the Junior School, to combine that stimulation with the acquisition of a certain amount of formal knowledge; but it will be no less important to create tastes and interests which will remain with the pupils after they have left school, and to give them means and occasions for understanding their own place and function in an ordered community. For this purpose the Senior School should, in the words of the Hadow Report, itself form an "Ordered Society."

Thus a Senior School is visualised as having an organisation very largely concerned with bringing out and providing for the particular powers and activities of the individual child. In the sections and schedules* that follow, the term "classroom" is used to denote a room in which the pupils are normally engaged in regular classwork of a sedentary

* See Appendix III for schedules of Senior School accommodation set out in tabular form.

character, while the term " practical room " is used to cover all the larger teaching spaces. When it is realised that the practical rooms include not only those appropriated to Manual or Domestic Work, but also those devoted to Science in all its aspects, to Art and to Crafts in their various forms, it will probably be not unreasonable to suggest that the accommodation of a Senior School should be divided almost equally between classrooms and practical rooms. It should be noted that, as the practical rooms, besides being no less important than the classrooms, are far harder to plan, their number and arrangement is one of the first points to consider in designing a new Senior School.

25. New Senior Schools should be planned with a school-leaving age of 15 in view ; and though it may not always be possible to estimate the number of children who will remain to that age, or beyond it, and account must be taken of special local circumstances, it will be reasonable to take a four-years' course as the normal standard of provision.

It is probable that in many cases new Senior Schools will be built in areas where there is a sufficiently large population to justify a comparatively large concentration ; but it may be convenient in the first instance to illustrate the application of these principles to a medium sized type of school, namely, the " two-stream " school with an annual intake of approximately eighty children.* Each intake can be divided, normally on a basis of ability, into two classes or streams for the assignment of teaching spaces ; and this " two-stream " organisation may be expected to persist in outline during the school course, though there will, it is hoped, be considerable fluidity of organisation throughout. With a complete four-years' course there will be eight forms in the school.

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* See Appendix III for Schedule of accommodation.

Every Senior School of this size should have a Hall of not less than 1,800 square feet ; and, as the use of the Hall for an adequate programme of physical training would seriously militate against its usefulness for other purposes (see para. 30), the provision of a gymnasium or a physical training room in addition would be most advantageous.

Such a school will need accommodation for a whole class in Science and, unless a " mixed " school for boys and girls, for a whole class in Manual or Domestic Work. There is still some difference of opinion as to whether children should be taken for Science in a whole class of forty in one large room of not less than 960 square feet, or in two half-classes of twenty in two smaller rooms of 600 square feet each ; but it would appear that on the ground both of economy and of educational advantage the single large room is in many ways preferable. (See paragraph 37.) Similarly, as regards Manual Work, there may be some difference of opinion as to whether the space provided, which should be not less than 1,500 square feet in all, should be divided into two separate rooms for half-classes of twenty or kept as one large room for a full class. For Housecraft two rooms are required, of not less than 750 square feet each. In mixed schools of this size the room provided for Manual Instruction should be 850 square feet (see para. 41) and that for Housecraft not less than 750 square feet (see para. 46.) In this case each room would be intended to take a half class.

In such a two-stream school the remainder of the accommodation should be divided in the proportion of four classrooms and three practical rooms. The size of the classrooms will depend to some extent, both on the nature of the furniture with which they are to be filled, a point that is often considered at too late a stage in the preparation of plans, and on the nature of their fittings. While the classrooms fitted with chairs and tables and other furniture will normally require an area of 520 square feet,

it should not in any case be necessary to exceed that area. (See para. 34.)

In the case of the remaining practical rooms it may be assumed that one will be primarily devoted to Art and to certain kinds of Craft Work, for which a room of 900 square feet is desirable (see para. 49) ; the needs of the remaining crafts and practical work can be met by two rooms of 700 square feet. (See para. 52.)

Where circumstances warrant the provision of any accommodation in excess of this, the addition may take the form of a Library fitted with bookshelves, tables and chairs. (See para. 55.)

26. As has already been indicated, it is to be hoped that in many areas it will be possible to effect larger concentrations of the senior children in three-stream schools with 12 forms in a complete four-year's course.* Generally speaking for such a school the same provision as in a two-stream school will be required for Science, Manual Instruction and Housecraft, together with a Hall of 1,800 square feet, with a stage in addition, and the necessary provision for indoor physical training. The remainder of the accommodation will be divided between six or seven classrooms and four practical rooms on the lines indicated in the preceding paragraph.

If special conditions in some districts lead Authorities to contemplate the possibility of still larger concentrations in four-stream schools with 16 forms in the complete four-years' course, the accommodation required will be approximately double that required for a school for 320 children. In such cases the amount of accommodation required must be decided on the particular conditions, but the Board consider that, although such an organisation may have its advantages, these are more than counterbalanced by its disadvantages.

27. The case of the small single-stream Senior School, with an annual intake of not more than 40 children and a

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* See Appendix III for schedule of accommodation.

maximum roll of 160 for a complete four-years' course, is one of special difficulty. Such schools will almost invariably be mixed schools in rural areas. That such a school needs a Hall for assembly and for the purposes outlined in para. 30, as well as for physical training, admits of no doubt and, in a school where the numbers on the roll are likely to be nearer 200 than 100, the Board would be reluctant to approve proposals that did not provide for a Hall of at least 1,250, and if possible, 1,500 square feet.

In the Board's view, however, the most important feature of the small Senior School should be its practical rooms, of which there should be at least two. The allocation of these rooms will no doubt vary to some extent with circumstances, but it is clear that they will have to be multiple-purpose rooms. The arrangement and use of a practical room for two or more differing activities is never easy, but it is perhaps most difficult and wasteful when the room is to be used for Manual Instruction and Housecraft, and the Board hope that this combination will be avoided. On the assumption that the rooms will be assigned, one to Manual Instruction and Science and one to the various Domestic Crafts—an arrangement which the Board are disposed to think less open to objection than any other—neither room should be smaller than 750 square feet, and one room at least, that for Manual Instruction and Science, if not both rooms should be not less than 900 square feet preferably based on a width of 24 feet. (See para. 42.)

In addition, a minimum of three other teaching spaces will be required. In single-stream schools with a small annual entry, where there is a Hall which can be used, with suitable furniture, for teaching purposes in addition to its normal functions, two classrooms of normal size may complete the provision. Where, however, there is no Hall, or in single-stream schools with a normal entry, three classrooms will be needed, and it is desirable that unless there is a Hall, one of these three teaching spaces should be a practical

room of 750 square feet, suitable for Art and its allied crafts. It should perhaps be pointed out that in schools where the practical rooms have to be used for several purposes, including some classwork, it is particularly important that the question of the furniture and fittings to be used and the provision to be made for the storage of books should be settled when the size and allocation of the rooms is decided.

28. In certain conditions distance and difficulty of transport may render impossible the concentration of even the small number of senior children necessary to form a single-stream Senior School.* In such cases, the minimum which the Authority or Managers concerned should aim at securing is that the group of children between 11 and 15 years of age should be assured of proper provision for the practical work which will form for them, as for other senior children more fortunately situated, the most essential part of their course. In the second place, separate accommodation should, so far as is possible, always be arranged for the senior children.

These " Senior Tops " are likely to fall into two main categories, those with an annual intake of 10 to 20 children and a total number of 40 to 80 seniors, and those with an intake of less than 10 and a total of less than 40. It would be undesirable and indeed impossible to lay down any rigid line of demarcation, but it may be generally said that for the first category the provision needed for practical work is substantially the same as in the case of the one-stream Senior School. (See paras. 27 and 42.) Not only is this amount of accommodation needed for the effective instruction of the children, but it is the only way of securing economy in staffing. These " Senior Tops " will normally be served, so far as the teaching of Handicraft and Housecraft is concerned, by visiting teachers, and it is obviously desirable that the classes should be as near the normal size

* See Appendix III for schedule of accommodation.

of 20 as possible. This can only be secured if the accommodation is sufficient for such a number. In the second category, the total numbers are likely to be so small that their requirements in the way of practical work may be met by one multiple-purpose room of about 750 square feet.

If the practical work of these children can be arranged for on the scale suggested above, the remaining accommodation to be reserved for them need not in the case of either category exceed one additional classroom of the normal size.

29. Where a considerable number of children stay at school for dinner in the middle of the day, the nature of the accommodation to be provided for midday dinners will have an important bearing on the total amount of accommodation. A separate kitchen, placed conveniently near the room in which dinners are to be eaten, will be necessary in such cases, unless the number of children staying for dinner is very small indeed; and, similarly, it is on this number rather than on the size of the school that the justification for a separate dining room will rest. Considerations of economy require, provided that a proper standard of order and cleanliness can be secured, that the dining accommodation should be so arranged as to serve also, to the greatest possible extent, as an instructional part of the school premises.

There appear to be three possible methods of making this provision:—

(*a*) In small schools the Housecraft room may be used as a dining room. Where the number of children staying to dinner is more than twenty, however, there are very serious objections to this arrangement, and in any case it is very desirable that there should be separate facilities for cooking the daily school dinner.

(*b*) In many cases the Hall may be used, and if this is not big enough to accommodate all the children staying to dinner at one "sitting", two shifts of dinners may be arranged.

(*c*) If the use of the Hall for dining would prevent its effective use for other necessary purposes, especially for physical training when there is no special room for this purpose, a separate dining room may have to be provided. This need not be of an expensive form of construction; it could also, if large enough, serve as additional accommodation for use as a room for needlework or for other forms of practical work during the period when it is not needed for the preparation or serving of dinner.

If arrangements for providing school dinners are not required and there is no kitchen, there should be some facilities for heating milk or other hot drinks. A simple "kitchenette" centrally situated, where the bottles in which milk is now usually delivered could be heated, will be sufficient for this purpose.

CHAPTER IV—DETAILS OF TEACHING ACCOMMODATION AND EQUIPMENT

(1) Hall

30. For many years past the Hall has been a prominent feature in the design of most new schools of any size. Even so, however, it may be doubted whether its possibilities of service are yet appreciated to the full. It is, indeed, generally recognised that the existence of a Hall, in which the whole school can be assembled, plays a great part in developing that tone and sense of corporate life which are the very core of a good school ; but it is perhaps less widely realised that a Hall can help to satisfy many other needs that are felt in the development and training of the child and the adolescent alike.

One of the points emphasised in the Hadow Report is the value of music as a corporate activity. Not only does the Hall provide for the practice of simple rhythmic exercises, but it is generally agreed that the value of class-singing is greatly intensified when two or three or even more classes can be grouped for the purpose, and for such a grouping a Hall is almost essential. Similarly, a Hall offers in most cases the only chance of developing such other joint activities as dramatic performances, celebrations of national events or the display as a whole of some work to which each section of the school has contributed its share. Such occasions, if properly utilised, are of real and lasting value, not only in promoting a sense of co-operation and social harmony, but also in developing the appreciation of good manners and of social responsibilities and pleasures. In training classes of children in the art of clear speech and correct enunciation, a fundamental part of good English teaching, the Hall affords by its greater size an opportunity that the ordinary classroom does not give.

The Hall may also well afford an opportunity for making use of modern scientific aids to education. In it a number of classes may be grouped for purposes of listening to suitable wireless talks; or for seeing cinematograph films and lantern slides, as illustrations of geography, history and nature study lessons; or even simply as an aesthetic experience. For it must be remembered that the period of adolescence is essentially that in which sense discrimination can be formed and educated, and that without training of this kind children may grow up insensitive and incapable of appreciation.

Under present conditions the possible use of the Hall for the purposes outlined above tends to be restricted to a considerable degree by the necessity of using it also for physical training. The maintenance of a thoroughly sound system of physical training is of such importance that it is scarcely possible to criticise this tendency, and it is in part with the object of setting the Hall free for other activities that special stress has been laid in paras. 25 & 26 on the desirability of providing a separate gymnasium in Senior Schools. (For details see Physical Training Series, No. 14*.)

The social uses of a Hall, as distinct from its educational uses, are perhaps even more marked in rural than in urban areas. Everywhere the needs of such occasions as Anniversaries, Parents' Days and Exhibitions of school work can only be adequately met in the Hall; but in rural districts it is to be hoped that the school Hall will tend more and more to become the focus and centre of life in the village or small town. In these districts, apart from the use of the Hall as giving houseroom on occasion to such activities as those of Women's Institutes, it is inevitable that schools that take seniors, especially with a lengthened school life, will become social and cultural centres for the interests of their former pupils. Though

* Published by H.M. Stationery Office (1936). Price 1*s.* 0*d.*

the Village College must, for some time at any rate, remain an ideal to be attained by private munificence, there is no reason why the village school should not be developed on similar lines as far as possible.

31. A Hall should, therefore, be provided for all Senior Schools, except perhaps for those very small one-stream schools that are dealt with in paragraph 27. Where the Hall is to be used for physical training 1,800 square feet of free floor space should be regarded as a minimum; and, since the schools where a separate gymnasium is provided are likely to be too large for a smaller Hall to be acceptable on other grounds, it will only be possible to reduce this size in small Senior Schools, which will usually be mixed schools and where the consequent organisation, the number of children and the staffing conditions all combine to guarantee quite small classes for physical training.

In Junior Schools the Hall is hardly less important, since the provision of free space will normally be on a smaller scale than in Senior Schools. For a Junior School of six classes or more, a Hall of not less than 1,800 square feet is necessary, and for a smaller school one of 1,500 square feet, which may count as a class space in schools of three classes or less. (See para. 21.)

In large Infants' Schools, also, a Hall of 1,800 square feet will not be excessive for the needs of the school. In smaller schools a reduction in this size will be possible and in the very small school of three classes or less a room of 800 to 1,000 square feet may be accepted (see para. 19).

32. For dramatic work it will normally be found desirable in Senior Schools and in the larger Junior Schools to provide some kind of stage or platform in addition to the body of the Hall. A platform or practicable stage of 20 feet by 30 feet will not spoil the proportions of a Hall

of 60 feet by 30 feet, and some suggestions are made in Appendix IV as to the principles on which, without undue expense, a stage of this kind can be simply constructed.

The question of preparation for the exhibition of silent or talking films is one which should engage the consideration of Authorities. This can conveniently be done by placing a small room for the cinematograph operator at the end of the Hall opposite to the stage. This would involve an electric power plug for the lantern, some kind of drop screen at the stage end of the Hall and, for talking films some loud speakers. In new Halls, therefore, a beam, should be installed above the front of the stage from which the apparatus could be suspended.

It is very important that there should be at least two separate entrances to the Hall, so that the children can disperse quickly in the event of fire.

33. In all cases it is desirable that the Hall should be so placed that the noise of physical training or singing lessons does not disturb the work in the classrooms, and for these reasons, as well as to secure ventilation and freedom from dust, the classrooms should not open directly from it. The Hall may, therefore, with advantage be altogether or partly detached from the main building.

The Hall should be well lit, warmed and ventilated. (See paras. 101, 102 and 103.) Expert advice is desirable as to the position of the lights and the form of their shades.* Arrangements should be made for darkening the windows, as and when required for lantern or cinematograph exhibitions.

Acoustics. (See also para. 91.) The question of acoustics is of importance in all halls. Authorities should bear in mind the following points :—

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* For expert advice The Illuminating Engineering Society, 32, Victoria Street, S.W.1 should be consulted.

(*a*) The larger the cubic capacity of the Hall in relation to the numbers occupying it, the greater the reverberation. Excessive height, therefore, is inadvisable.

(*b*) Ceilings should be flat, with or without coves. If curved, it is important to avoid the dome, the barrel, and the segmental curve struck from near floor level: the radius of a curved ceiling ought to be not less than twice the height of the room.

(*c*) Floors should not be of jointless material. Wood blocks give a suitable, moderately silent, floor. Boarded floors are the noisiest.

(*d*) Hard plasters used over all wall surfaces in a hall will increase reverberation, and one of the following absorbent treatments is suggested:—

(i) All walls, above a dado height, and ceilings should be finished with a lime plaster without a finishing coat and left undistempered.

(ii) A strong hygienic sound-absorbent, such as perforated fibre slabs or some form of porous plaster, should be placed on the rear wall behind the audience. Where there is a gallery the front should be treated in the same way and a cord carpet laid on the floor.

(2) Classrooms

34. The classrooms in all types of school may conveniently be planned upon the same basis and be of the same superficial area. The classroom should in no case have a superficial floor area of less than 480 square feet, and 520 square feet is the figure which in general practice has been found most suitable. Classrooms should never be less than 20 feet wide, measured at right angles to the main window wall, and in order to allow space for heating pipes and radiators, when they cannot be hidden

or recessed, it is advisable that the width should not be less than 21 feet 6 inches. A room in which the dimension measured at right angles to the window wall is less than that measured at right angles to the blackboard wall, results not only in better natural lighting, but also in a narrower and easier angle of vision both for the pupils and the teacher, always bearing in mind, however, that distances much greater than 25 feet or less than seven feet from the blackboard may give rise to trouble in obtaining a clear view of it.

For pupils of all ages, modern practice shows a marked tendency to furnish classrooms with chairs and flat-topped tables, for which rather more space is required than for desks. Whether the furniture be desks, or chairs and tables, it should be so arranged that every pupil may be able to leave his place without disturbing others and that the teacher may have easy access to every pupil.

35. So far as storage space is provided in the classroom it can most conveniently be arranged in fixed shallow cupboards, not deeper than 12 inches, on either side of the blackboard and underneath it. The problem of providing adequate locker space for the pupils may, however, become one of considerable difficulty, since it is not always possible for pupils to return to a classroom in which they are not working at the time, in order to get the necessary books for the next lesson. It may, therefore, in the future become the practice to discontinue the use of desks or tables which include lockers. When lockers are not fitted in the desks they may be placed in the classroom. Alternatively, they may be placed in recesses in the outer or even in the inner walls of the corridors, where the corridors are enclosed, or in separate locker rooms, or partly in the corridors and partly in locker rooms, care being taken always to see that the width of the corridors is ample and that the locker rooms are large enough for the free

movement of the children. Another solution of the problem of placing lockers is found in the adoption of the unit system of cloakrooms. (See paras. 63 and 64.)

36. The height of classrooms need not be more than 11 feet if the room has a flat ceiling, except in those cases where windows on one side only are provided and the width of the room exceeds 20 feet. If rooms are ceiled at the collar-beam, the height may be 10 feet at the wall-plate and 13 feet to the ceiling, the latter extending flat over at least half the area of the room. In classrooms having large windows on opposite sides these heights may be reduced by one foot, and where one or more sides open entirely the heights may be as low as is consistent with adequate natural lighting. (See para. 100.)

The windows should be so distributed as to light every table or desk and the whole of the room evenly and sufficiently. The last vertical glass line of the window furthest from the blackboard should be on a level with the back of the last row of desks and the heads of all windows should be carried close up to the ceiling. The main lighting should be on the left of the pupils when seated. Windows directly facing either the pupils or the teacher are to be avoided.

(3) Science Room

37. Some difference of opinion still exists with regard to the question whether Science instruction should be given to a full class of 40 children or to half classes. Generally speaking, however, considerations of economy in building, equipment and staffing render preferable the building of one large Science Room in which instruction can, if desired, be given to a whole class. This leaves it open to the school and the Authority to adopt whichever policy ultimately appears desirable, whereas, if smaller rooms are provided, the half-class policy is necessarily forced upon the school. As a rule, the course for boys and girls in Senior Schools

will be the same in the earlier stages, though in the later years there will tend to be some differentiation between the sexes in the content of the syllabus. The requirements so far as buildings, furniture and equipment are concerned will, however, be fundamentally the same for both boys and girls.

Dimensions of 38 feet 6 inches by 25 feet, giving a total area of approximately 960 square feet, have on the whole proved most satisfactory for the large Science Room; a width of not less than 24 feet is, perhaps, the most practicable, but no width below 22 feet 6 inches should be contemplated. A room of this size allows space for store cupboards in the room, but some Authorities prefer to provide a separate room which may be used for store purposes and also as a preparation room. The Science Room can then be reduced to 900 square feet. The additional accommodation should adjoin the Science Room and extend its whole width, having a depth of about eight feet. It should be well lighted and ventilated for preparation purposes, but there should be facilities for converting it into a dark room when desired.

It is essential that the Science Room should be well lighted; the whole of the outside wall should be treated as a "window wall," with windows coming down almost to the level of the benches and reaching upwards almost to the ceiling. Preferably this window wall should face south or thereabouts. For purposes of cross-ventilation and lighting, the wall opposite the window wall should also have windows, but there are great advantages in leaving the greater part of this wall space free. It is important to ensure good artificial lighting in Science Rooms, particularly where the rooms are used by evening students.

38. In furnishing a Science Room the principal aim should be simplicity. The only special furniture necessary is the demonstration bench. This should be at least eight feet long by about two feet, or at most two feet six inches wide and two feet nine inches high. It can conveniently be

fitted with flaps at either end so as to increase its total length to 10 feet or 12 feet. It must also have a sink, which need not be let into the bench, but may well be an extension at one end. It should also be supplied with gas and, if possible, with electric light or power points. On the teacher's side it should contain drawers and opening on to the pupils' side there should be cupboards. The benches for the pupils need not be of an elaborate type. Ordinary solid tables with drawers are much better than the heavier type of furniture. It may be worth the extra cost to use good seasoned teak for the tops. They should not be more than two feet nine inches high and the width should be two feet for single benches and three feet six inches for double benches. If the length is short, say five feet, it is easier to make changes as need arises than if they are longer. There should be gangways of not less than three feet between single benches and not less than four feet six inches between double benches. These have a distinct advantage over single benches, in that they economise space and facilitate traffic and supervision. The type of bench described above has the added advantage that it is suitable for classwork other than Science, such as geography. Even the wall benches need only be solid tables with drawers. There should be a carpenter's bench in the Science Room at which woodwork and metalwork can be done. This need not be more than a solid table, fitted with a carpenter's vice at one end and a vice for metalwork at the other. On the wall above it, there would naturally be a rack or case for tools. These things are needed apart from the provision in the Handicraft Room, as the Science teacher has, or should have, constant need to do odd jobs in connection with the Science teaching.

A first aid cabinet should be at hand.

It is unnecessary to fit sinks to the pupils' benches and the provision of two in addition to the one on the demonstration bench will be sufficient. One of these should be of

the large household type with an arrangement for providing hot and cold water. The other should be about a foot square and eight inches deep, of white glazed ware. Nor is it necessary to fix points for gas to the tables. A few points should be provided in the walls or in the floor, flexible connections being used to bring a supply to the places where it is needed. In addition to the one on the demonstration bench, there should be a few electric points carefully placed with a view to the work to be done. In places where gas is not available, such alternatives as the use of a petrol air mixture or acetylene gas should be considered; the former is perhaps more satisfactory, since acetylene gas has an unpleasant smell.

Where the school is to be used for adult evening work consideration should, of course, be given to the suitability of the planning and equipment for the needs of the older students.

39. The inside walls of the Science Room should preferably be left unplastered. The door, which will normally be found in the wall opposite the main window wall, should not be placed in the corner, close up against the wall behind the demonstration bench, but about eight feet should be left to allow space for a screen to take projections from the lantern; this could then be operated from the demonstration bench. When not in use, the best place for the lantern is at the end of the demonstration bench, on its own stand with wheels; if it is kept in a cupboard, there is a danger of its falling into disuse. In connection with the use of the lantern, arrangements should be made for partly darkening the Science Room with opaque blinds.

Three suspension beams, running the full length of the Science Room, will be valuable for purposes of display and demonstration. They should be about three inches wide and nine inches deep and be fixed by iron bolts to the ceiling joists with the longer side vertical, so as to be solid

enough to support the head of a ladder when necessary for the suspension of apparatus. Behind the demonstration bench there should be a blackboard, for which 12 feet long by four feet deep will be found a convenient size.

40. While the Science Room should be primarily equipped for general Science, the increasing importance of biology in Science teaching justifies particular reference to certain fundamentals in equipment for this subject. Accommodation for long term experiments on growing plant or animal life will be needed. A small glass house is valuable in this connection, but, to be effectively used, it should be very close to the Science Room and accessible from it ; it can then be included in the school heating system and will be usable throughout the year. Some aquaria may be kept in the glass house, but space for others will also be necessary in the Science Room. A strong, wide shelf about bench height and near a sink, preferably on a shaded wall, would meet this purpose. Similar provision for insect- or larvae-cases would be found useful. Where it is not possible for the Science Room to be near the garden and the glass house, it is useful and not expensive to fit a Wardian case in the bottom half of one or even two windows. This is little more than a double window, the space between the front and back windows being about two feet, the front one projecting a foot or more from the surface of the building. It is probably cheaper and better to include this item in the builder's contract.

Where a separate store room is provided, the amount of cupboard space in the Science Room will not, of course, be so great as where this provision is absent. It must however, be remembered that, generally speaking, the equipment and apparatus of the Science Room is part of the furnishing ; much of it can, therefore, be most conveniently kept in the room where it will be readily available for use. Where the separate store room is not provided, about 15 to 20 linear feet of cupboarding can be installed. These

cupboards can be about seven feet high with a bottom section one foot nine inches deep, with wooden doors, and a top section one foot three inches deep, with glass doors. One shelf in the bottom section and several in the top will be required. A bookshelf is desirable, and there should be other open shelves fixed at a height of about six feet. They should be about one foot wide, and where there are benches against the wall there may well be more shelves coming down to about the five foot level. As a general rule, however, there is much to be said for leaving as much as possible of the furniture, such as cupboards, to be put in after the school has started, so that the views of the Science teacher may be obtained. Much of it can, moreover, often be arranged and provided by the school itself in the Handicraft Room, and the interest in the Science teaching which is thus created is a valuable educational asset.

(4) Handicraft Rooms

41. Generally speaking, one Handicraft Room, holding a half class of boys, may be regarded as providing for the needs of 200 boys, as it enables each boy to have a full half-day session per week in the Handicraft Room. While it has already been stated (see paras. 25 and 26) that two- or three-stream boys' Senior Schools require two of these rooms, or provision on an equivalent scale, it will not be unreasonable to allow one such room for each stream in the school, as this would give a margin of accommodation which would then enable older pupils, or those who would derive most benefit, to have the use of the Handicraft Room for more than one session in the week.

The importance of providing adequately for this side of the Senior School curriculum is now generally appreciated, but it is perhaps permissible to emphasise the particular significance of this feature in relation to the raising of the school-leaving age.

Where numbers justify Handicraft accommodation for a full class, it may be made either in one large room, to hold a full class at one time, or in two smaller rooms, each to hold a half class. Where the former arrangement is adopted the room should be not less than 1,500 square feet. Equipment for metalwork should be concentrated in one part of the room, as separate woodwork and metalwork classes may be in progress at the same time. Where two rooms are provided, it is not contemplated that normally they will be exclusively devoted to wood and metalwork respectively, though this arrangement may be appropriate in some areas ; 850 square feet will not be too large a size for each of these two rooms.

In a mixed two-stream school one Handicraft Room to accommodate 20 will be justified ; wood and metalwork equipment will both have to be accommodated in this room, but an area of 850 square feet should be sufficient.

42. The mixed single-stream school presents a more difficult problem. In such schools the provision of a special room to be used exclusively as a Handicraft Room can hardly be expected. Nevertheless, it is very important that practical instruction should be given on the school premises, and should form an integral part of the curriculum. Admittedly the instruction in Handicraft will only occupy a limited number of sessions a week. There should, however, be a room of dimensions not less than those recommended for a school where it will be in full-time use for its specific purpose of Handicraft instruction. The objection that a Handicraft Room is not justifiable because it will not be sufficiently used in the small school will be met by equipping the room so that it may serve, not only as a Handicraft Room, but also as a Science Room for the whole school. In these circumstances the room should be larger than the normal size for a Handicraft Room and not less than the usual size for a Science Room, namely 900 square feet. The fact that the practical instruction room in a small rural

school will probably be useful for evening technical classes should also be remembered ; and this consideration may be regarded as further justification for the provision of a large Handicraft Room. Special attention should be paid to the need for separate and adequate storage when day school premises are to be used for evening classes. Similarly, where the one room serves the dual purpose of Handicraft and Science Room for the School, it is essential that proper storage facilities should be provided for the materials connected with each subject.

43. The question of storage is, indeed, one of the greatest importance in planning Handicraft Rooms. Two stores are needed, one for timber, and another for general stores, quite apart from Science storage requirements in the case of the dual-purpose room. The timber store should be not less than 15 feet long to take a length of wood. If the store is situated at the end of the Handicraft Room, or between two Handicraft Rooms, it is suggested that the width of the Handicraft Room, i.e. about 24 feet, by a depth of about 12 feet, would afford sufficient space for both stores to be placed side by side. An area of about 180 square feet would be appropriate for the timber store, leaving about 108 square feet for the general store. It is important that there should be some access to the timber store from outside, even if it is only a window through which the timber can be put. There should be no hot water pipes in the store room.

44. It is desirable to design Handicraft Rooms round the working benches, due consideration being given to the position of radiators, cupboards, wall racks, sawing space, etc. Generally speaking, benches may conveniently be for two boys and should then measure about five feet by two feet six inches. There should be gangways between them of three feet six inches sideways, and three feet endways. Here, as in the Science Room, consideration should be given to the adaptability of the benches for boys of varying

heights. Alternatively, benches may be provided in the three initial heights of 28, 29 and 30 inches. An additional bench or benches along one side of the room will be useful. The lighting of the room is of the greatest importance. The arrangement by which the Handicraft Room is detached from the main school building has sometimes been recommended, on the ground that this ensures good lighting and safeguards the rest of the school from the noise which is inseparable from Handicraft. Such special precautions should not be necessary, however, unless the room is not on the ground floor and if due attention is paid to the lighting arrangements. When the Handicraft Rooms are to be used for evening work care should be taken to ensure that the artificial lighting is adequate and that the lamps, while powerful, are placed so as not to cast disturbing shadows. (See para. 101.)

The floor should be non-resonant and of a material which will not blunt tools if they are dropped on it. Tongued and grooved boards, laid on concrete, are most suitable ; moreover, they are what will normally be found in an ordinary workshop outside the school. There should be plenty of blank wall space and sufficient wall blackboards. There should be gas points for the brazing hearth, the soldering stove and the gas ring for heating glue. A separate glue stove is expensive and quite unnecessary. A gas point and a sink should be fitted in the wall bench.

It may be found useful to have some pegs for the boys to hang up their jackets while working. A small first aid cupboard is desirable to deal with the minor accidents which may occur in spite of every precaution, and a woollen blanket and chemical extinguishers or fire buckets should be provided.

The special equipment for metalwork may be provided at very reasonable cost. Most of the work can be done with vices and benches round the room or down the centre. The additional equipment will consist of lathes and drilling

machines, grinding equipment and a vice of four or four and a half inches across the jaws for each boy. The lathes will need to be back-geared, screw-cutting, not less than three and a half inches centre and the drills should be hand-driven bench drills. The tools should generally be kept in a locked cupboard, for the convenience of supervision by the teacher, with the minimum tools on each bench.

45. An adequate course in Handicraft can well be provided in elementary schools without the use of power-driven machinery. Nevertheless, where a substantial course in metalwork is proposed, the provision of such machinery would, with advantage, eliminate much repetitive labour, thus saving time and enabling the course to be widened in scope and enriched in content. Moreover, it is clear that familiarity with simple machinery is often useful to boys in after-life. It is, however, of first importance that power-driven machinery should not be used in any way to weaken the essential training in the use of hand tools. In no case should machinery be suggested that is of an inherently dangerous type, e.g. circular saws and band saws ; and it must be remembered that any power machinery requires careful guarding. Where it is provided it may include the following :—

(a) One or two motorised back-geared screw-cutting lathes.

(b) One electric drilling machine. (Where this is installed, bench hand drill machines should also be fitted, so as to ensure that the boys receive sufficient preliminary training in hand drilling.)

(c) One power grinder.

In some exceptional cases the equipment of the wood-workshop might include a power-driven wood-turning lathe.

Whilst the provision of this equipment will involve increased initial outlay, experience has already shown that, under the direction of the right type of instructor, ultimate

economy is possible, because, with the aid of the power equipment, hand tools may be produced which will, in due course pay for the installation of the power equipment.

(5) Housecraft Rooms

46. Suggestions as to the number of Housecraft Rooms in proportion to the size of the school are to be found in the Chapter on the Senior School (see para. 25).

For the teaching of Housecraft sufficient space must be provided in each room for the active work of about 20 senior girls during each session, with due regard for the fact that every Housecraft Room must of necessity contain a considerable amount of fixed equipment which is in constant use.

It must be remembered that, owing to the nature of the work, overcrowding, collisions, cross traffic, lack of light or ventilation may be a positive source of danger to the pupils. These facts make it evident that, for a class of 20, no room of less than 750 square feet should be contemplated, while 800 or 850 square feet will undoubtedly give more satisfactory accommodation. It should be stated, however, that where there is more than one Housecraft Room, each room should be equipped for both cookery and laundry work. A convenient entrance for the deliveries of tradesmen should be considered. The larder and store, which form essential parts of the accommodation, must be carefully planned so as to be easily reached and properly ventilated, and the larder in particular should have a north aspect.

47. The Housecraft Room should be well lighted and well ventilated. The windows should be of a kind that can be opened without difficulty by the girls, and a through draught should be ensured by means of windows high up on the opposite wall. In view of the frequent use of such rooms for evening work, good artificial light must be

provided, and this should be so fixed that the maximum light falls on the tables (see para. 101).

The most suitable kind of flooring for a Housecraft Room remains a matter for experiment, but clearly the main essential is that it should be easily kept clean. Wood blocks, with a border of tiles, are still usually considered the most practical type of floor. A washable wall surface should be provided behind cooking stoves, sinks, etc., where there is likely to be grease.

It is very important that the size and placing of the equipment should form a part of the original plan for the Housecraft Room, for it has been found that the fixed position of drains, radiators, electric points, etc., often makes it impossible to get the best arrangement for the equipment when that is eventually added. The correct placing of the equipment contributes a great deal to the practical value of the teaching. For instance, by placing copper, sinks, and wringer in proximity, the proper sequence of activities ensues, and, incidentally, the pupils learn something of the order of a well planned home.

The Housecraft Room should contain not less than two sinks (each fitted with draining boards) of the approximate size of three feet by one foot eight inches by ten inches, and one low slop sink in another part of the room. The type of stove to be provided will depend on the district in which the school is situated and the local supply of gas or electricity, but Authorities will bear in mind the desirability of making provision in advance of existing conditions in view of the rapid development of electricity and gas in rural areas. There should, in any event, be a coal range, with a hot-plate for economy in heating and boiling operations. If the hot water cylinder is enclosed, it will be possible to provide a warm cupboard for drying and airing purposes. The number of additional stoves will depend upon the size of the range and the number of ovens it contains. With a class of 20 girls it is necessary to have

four good working ovens. If the coal range has two ovens there should be in addition one gas stove and one electric stove, or, alternatively, two gas stoves. In rural districts oil stoves may be provided in addition to the coal stove. All gas stoves must be adequately ventilated. Some Authorities will prefer to rely on a domestic boiler for heating water and use the coal range for cooking only. If there is a supply of hot water from the coal range, one 12 gallon boiler will suffice, otherwise two coppers will be required, fitted with taps and wooden lids and heated by gas if possible.

Wherever possible, points should be fitted for some electric irons. It may be found advisable to fix the flexes for these irons from the ceiling to obviate the possibility of accidents which occur when they are fixed to the wall. In any case the points should be placed with due consideration for the probable position of the tables. It is not desirable that all the ironing should be done by electric irons ; gas, or ordinary flat irons, should also be provided. The heater for the flat irons should be sufficiently large to take 30 irons, and preferably should be heated by gas.

The arrangements for drying washing, when it is not practicable to dry it out of doors, may take the form of racks on pulleys attached to the ceiling.

Fixed furniture should be avoided in the Housecraft Room. Movable tables of sufficient number and size to allow adequate working space for each pupil should be provided and it has been found to be a saving of time and movement to fit these tables with drawers for holding the small collection of utensils necessary for the general work of each girl. Seats are necessary, and it is highly desirable that these should be of a kind that can be folded, or otherwise readily stored when not in use.

48. In view of the fact that the Housecraft Room by its nature is a place in which a class of girls learns the technique of a craft, it has been found that an element of greater

reality is introduced into the subject by adding to the accommodation some smaller rooms of the more home-like character which are usually adjacent to the Housecraft Rooms. These rooms provide opportunities for applying many of the lessons in Housecraft and for learning to plan and carry out an independent piece of work such as might occur in the routine of a small home. The care of such rooms as a living room, bedsitting room, bathroom and water-closet forms a very practical addition to the general training. It is important, however, that these rooms should serve a genuine purpose in the life of the school, for, if this is the case, the upkeep and repair made necessary by frequent use will prove a very real interest to the girls. These rooms cannot be regarded as in any way a substitute for the proper accommodation necessary for the teaching of Housecraft, but if used in a practical way will prove a useful addition to it. Usually these rooms will form part of the school building, but some Authorities may prefer to provide a more concentrated course by the use of a house rented for the purpose.

(6) Art Room

49. Except in the smaller schools, where the work in Art and the Crafts may be carried on in any one of the larger rooms in the school in which the necessary furniture and equipment are available, a large room specially devoted to Art will be required. On the assumption that a full class of pupils may be receiving instruction at one time, it is desirable that the Art Room should be not less than 900 square feet in area. The shape of the room should be approximately square ; a long narrow room is to be avoided. A breadth of not less than 26 feet is recommended, and the ceilings should not be less than 12 feet high. Such a room will provide the ample floor and wall space which are essential if the instruction in this subject is to be given under satisfactory conditions. The room should be easily accessible to the Craft Rooms, but in order to obviate any

disturbance which might arise from the proximity of the Handicraft Room, either the Art or the Handicraft store room should be placed between the two rooms. The Art store should communicate directly with the Art Room and measure about 13 feet long and seven feet broad ; it should have a tiled floor and be fitted with a deep sink, draining board and racks.

50. The Art Room should be well lighted, either from one large window or from windows set close together carried up to the ceiling. Lighting from the north side is desirable, if it can be easily obtained, but in any case windows facing other aspects will also be required, not only for adequate cross-ventilation, but also to secure that the lighting of the room can be made as bright and cheerful as possible. The sills of these smaller windows should not be lower than eight feet from the floor. When it is necessary to screen windows, use should be made of curtains, which are not only quite as effective as blinds, but are less expensive. For artificial lighting the use of daylight lamps might be considered.

The walls should be decorated in a light and neutral colour. Care should be taken to preserve as much wall space as possible for the purpose of display, and for this purpose a picture rail round the room would be useful. Other facilities for display which might be mentioned are slotted fixtures on the walls for standard frames or mounts, and swinging screens, on which it will also be possible to do drawings ; for this purpose it will be found advantageous if the screens are adjustable and capable of being fixed at a reclining angle.

It would be an advantage if the cupboards were built into the walls as part of the initial equipment of the room. Cupboards should be shallow, varying in height from three to five feet, and should preferably have sliding doors. A solid bench fitted with drawers down the wall under the windows would be useful, particularly for some of the Craft

Work which will be done in the Art Room, and additional cupboard space could be provided under this bench.

One or two sinks, with draining boards alongside, should be provided. These might be incorporated in the bench mentioned above. There should also be racks for water pots. Alternatively a trough, fitted with spray taps, might be provided. If work in clay is to be done in the Art Room it would be an advantage to have a part of the floor tiled.

51. Heavy desks are neither necessary nor desirable for the Art Room. A light trestle, at which the pupil can sit, using a drawing board resting on the knees, and provided with a stretcher on which the feet are placed, gives an ideal position for drawing and has the advantage of being easily removable from place to place. If table tops are provided, so that they can be firmly fixed on the trestle when required, benches would be available for all the lighter forms of craft work. With the long bench under the windows already recommended, the addition of two solid movable benches, each six feet by three feet, would complete the equipment necessary for the general Art and Crafts teaching which may be expected to be carried on in the Art Room. Chairs with ordinary sloping backs are preferable to stools, as a back rest is desirable. In order that they may be suitable for children of different sizes, the chairs should not be all of the same height.

Treatment of the furniture with a transparent cellulose, which retains the natural character of the wood, is worth consideration as one means of contributing to a more cheerful and pleasing effect than is sometimes found in rooms where the furniture is stained or painted a dark brown.

(7) Other Practical Rooms

52. Practical work, other than the woodwork and metalwork, Housecraft and Science, now forms an element of growing importance in school work. This other practical

work consists not only of many different forms of Craft Work, including needlework, but of work done in the way of illustrating lessons (e.g. history and geography) and in connection with such activities as dramatic work. Owing to the close connection between Art and the Crafts, it will often be the practice for some of the Craft Work to be taken in the Art Room (see para. 51) as well as in the Craft Room, and consequently, when a separate room for each is provided, it is convenient for teaching purposes if the two rooms adjoin one another.

For the class teaching of Craft Work in any of its forms the main requisite in the way of accommodation is space. For much of the Craft Work now done in schools—weaving, fabric printing, lino-cutting, bookcraft, for instance—freedom of movement is essential. There should be room for the children to work either sitting or standing. The difference between elbow room and cramped conditions may sometimes be due to the type of furniture provided, but it is due more often to the shape and size of the room. In general it is advisable that a Craft Room for a Senior School should be not less than 700 square feet, and that in shape it should be approximately square rather than long and narrow. Such a room should be fitted as simply as possible. Gas and water are essential, e.g. one or two sinks and three or four gas points. If possible, provision should be made for the installation of electric points and plugs.

The importance of adequate storage space is emphasised. This is required not only for storing new materials, but for keeping work which the different classes using the room have actually in hand. There should, if possible, be direct access to the storage space from the room itself. This arrangement saves time during the lessons, and makes for a readier use of equipment.

53. The nature of the Craft Work done will vary from school to school. The furnishing should take the form of tables steady enough for practical work, but not too heavy

to move, and either chairs or stools. It will often be convenient to have a fixed bench running along a wall under the main window, and to have the sinks provided with draining boards and racks to hold water pots.

In a small school, though the importance of practical work is not less, the provision of separate rooms for Art and Crafts will not always be possible. (See para. 27.)

54. Practical work in the shape of both Art and light Craft Work is playing an increasingly important part in Junior Schools, and it is desirable that every large Junior School should provide accommodation for the development of this practical work. It is advisable that such a room should be of 700 square feet (see para. 20). It should, as in the case of the Senior School Craft Room, be furnished as simply as possible with tables and chairs rather than desks, and fitted with gas and water : and it is advisable to have the necessary storage space adjoining.

(8) Library

55. The increasing belief in the personal development of the individual pupil in the Senior School suggests the advantage of having a Library in which boys and girls can read quietly, or follow up some line of research in which they are interested. Where a Library has been established it has proved to be a civilising and often a cultural influence, and in those schools in which pupils spend an hour or two at midday before the beginning of the afternoon session, a Library is a most valuable asset.

The size of the Library depends largely upon the use that is proposed for it. Where it is intended that a whole class shall use the Library at one time, a room larger than the ordinary classroom would clearly be needed in order to provide sufficient wall space for bookshelves as well as floor space for tables and chairs. The Library may, however, be visualised as a reading room or private study room for

smaller groups of children who work there unsupervised ; in this case there will be no reason to provide a specially large room, and the main requirements are adequate lighting and bookshelves, so designed that the children can see and choose the books for themselves.

(9) School Gardens

56. Every type of school, whether in town or country, should have a school garden. In the case of schools for infants and juniors, and for girls, the garden will usually be smaller and simpler than in the case of school gardens for senior boys, as it will be necessary to limit the amount of manual work involved in its upkeep ; but in every case the garden should be made a pleasant place, its layout attractive and interesting, a source of pride and enjoyment as well as of instruction for all the children in the school.

In the case of the Senior School the garden should be large enough to provide for a properly graded four-years' course, with provision for instruction in flower, fruit and vegetable culture, and with special plots for experimental work. For all the purposes which a properly arranged garden for a Senior School ought to serve, a site of approximately one acre will normally be required, but additional ground will be needed if such activities as the keeping of small livestock, such as bees and poultry, are to be encouraged. Moreover, if the school is to have a definitely rural bias, and to utilise fully its special environment, it will be prudent to provide at the outset a sufficient margin of land to secure that future developments are not likely to be cramped or prevented for lack of space. For schools for younger pupils, or for schools containing a limited number of senior pupils in addition to juniors and infants, a garden of from a quarter to a half an acre will normally suffice.

The school garden should form part of the site of the school and, if possible, be approached from the school playground. In planning the school garden the aim should

be, with due allowance for the interests of the school and the locality, to design an attractive garden, not merely a group of small individual plots. Use may be made of such features as rock-gardens, sunk gardens, lily ponds, lawns, rose plots, herbaceous borders, winding paths of stone or concrete, sun-dials, bird-baths ; and flower borders and shrubs should be employed to mask the less ornamental features of the garden. Where provision is to be made for senior pupils, adequate space should be set aside for the cultivation of fruit and vegetables, together with plots for experimental work which can usefully and profitably be related to the characteristic products of the district.

57. A place for the storage of tools and garden supplies, e.g. seeds, artificial manures, plant supports, pots, etc., will be required. For this purpose a garden shed, measuring not less than 20 feet by 12 feet, should be provided in the garden. The shed should be fitted with a long bench under the window and, if a woodwork bench is provided, the pupils can use it to carry out a number of tasks connected with the garden, such as repair of tools, construction of greenhouses, frames, pens for poultry, bee-hives, fruit storage requisites and so on. In larger gardens, or where advanced work is undertaken, it may be desirable to provide a separate tool- and potting-shed.

The place occupied by the school garden in the training provided in the schools is an important one. In the case of the rural schools its place is pre-eminent. In the garden lies the main link between the school and the countryside.

CHAPTER V—DETAILS OF NON-TEACHING ACCOMMODATION

(1) Entrances

58. In general there should be at least two entrances to every school or department and in schools of considerable size it is convenient and adds dignity to the building, if, in addition to the entrances for the pupils, a principal entrance is provided at the main avenue of approach, designed to give ready access for visitors to the Head Teacher's room and for parents and the public to the Hall on the occasion of school functions.

(*a*) Admission to the main building should never be through doorways leading directly from the outside into a school Hall or other room, though doors are sometimes necessary as emergency exists. Entrances should not be used as cloakrooms.

(*b*) Entrances should be separate for each Department and separate for the sexes in each Department except in Infants' Schools.

(*c*) All external entrance doors should open outwards.

(*d*) An external door approached by outside steps needs a landing at least as wide as the doorway between the door and the top step.

(2) Staircases

59. In schools of more than one storey there should be at least two staircases and each Department should have its own staircases.

The number of staircases must be sufficient not only for daily use, but also for rapid exit in case of fire or panic. In order to secure a safe exit in case of fire, staircases and

exits should be placed as near as possible to the ends of the several wings of any school building, intermediate staircases being provided as necessary in order that the maximum distance to reach them may not exceed about 120 feet.* External staircases of iron should be avoided in new buildings.

All staircases should be of fire-resisting material, well lighted throughout and so planned that an easy view can be obtained right up or down. They should not be less than four feet wide and should not have more than 14 steps to a flight ; the landings should be unbroken by steps. Treads should be from 11 to 13 inches wide, and risers not more than five and a half to six inches high. Winders should not be used. It is desirable to have a hand rail on either side of a staircase.

The artificial lighting of staircases should be carefully planned to minimise the danger of accident. Each flight of stairs should be illuminated both from above and from below, so that the shadows of risers on the treads are avoided.

(3) Corridors

60. Corridors and verandahs should be from six feet to eight feet wide, according to the size of the school, and well lighted, especially where there are short flights of steps between different levels. Their primary use is for access and circulation, but subject to sufficient room being left for this purpose, they may often be valuable, if they are enclosed, for the exhibition of models and other finished work, or, where necessary, for pupils' lockers, so as to secure the maximum amount of free floor space in the classroom. Where lockers are provided in the corridors, they may be made accessible both from the classroom and the corridor, but it is important that they should not

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* See " Fire Precautions in Schools " (Home Office). Published by H.M. Stationery Office (1935), price 2*s.* 0*d.* Net.

encroach upon the general settled width of the corridor and, if necessary, they should be fitted in recesses. Corridors should not decrease from their settled width towards the main exits and it may be necessary to increase their widths at certain points where traffic converges or is likely to be temporarily concentrated.

Corridors of excessive length, especially when they continue the lines of entrances at both ends, are apt to be objectionably draughty and to result in the banging of doors. Breaks in the line near the entrances and the provision of doors, which should be made to swing both ways, at points along the length will do much to alleviate this nuisance. Cul-de-sac corridors should in any case be avoided.

(4) Staff Rooms

61. The Head Teacher's Room should preferably be placed near to the entrance of the Department most convenient to visitors. A separate cloakroom with lavatory and closet should be provided, preferably adjacent to the room, but not communicating with it. A small waiting room or seating for visitors near at hand is a desirable addition.

Where there is a staff of both sexes, adequate and separate cloakroom, locker, lavatory and closet accommodation should be provided near to, but not opening out of, the Common Rooms for the Assistant Staff. The closets should be completely partitioned. Where possible, the office accommodation for the staff should be on the following total basis :—

A staff of six to nine requires two basins, hot and cold water, and two closets.

A staff of ten to fifteen requires three basins, hot and cold water, and three closets.

One Common Room can be shared by a small mixed staff, but where there is a large staff of both sexes it may often be desirable to provide separate Common Rooms

for each sex. The Common Room for the Assistant Staff will clearly be larger than the Head Teacher's Room, and in planning it its probable use for staff meetings should be borne in mind. An allowance of about 30 square feet per head is reasonable.

It has been the practice in Senior Mixed Schools under a Head Master for a special position to be held by the Senior Mistress or chief woman assistant. In such cases the provision of a separate room for her may be considered. This may be quite small and in the nature of an office furnished with a table and some chairs, but the provision of such a room will mark effectively the position of the Senior Mistress and her special responsibility for the girls, and will enable her to interview parents and children in privacy. In those cases where local circumstances may necessitate the placing of a Head Master in charge of a Junior Mixed and Infants' School, it will be desirable for similar accommodation to be provided for the mistress who will be in special charge of the infants. In a Junior Mixed School with a Head Master, the requirements of the chief woman assistant could probably be adequately met if there were separate Common Rooms for the two sexes.

The provision of a " kitchenette " adjoining the Common Rooms is a convenience for cooking or heating food where the staff stay for a midday meal. If a " kitchenette " is not provided, a small cooker or combination cooking and heating stove should be fitted in the Common Rooms.

(5) Store Rooms

(see also paragraphs 37, 43, 46, 49 and 52 for the requirements of special rooms)

62. There should be ample space for storage, which should be separate and convenient for various purposes. Quite apart from the storage needed in connection with

the rooms for practical instruction to which reference has already been made in Chapter IV, other storage accommodation will be required, not only for books and stationery but also for general school purposes, e.g., in connection with the use of the Hall. If this is inadequate or inconvenient it involves much waste of the teachers' time. Even now it is too often the case that an inadequate amount of space is provided, and that the effective organisation of the school is thereby seriously handicapped.

Books and stationery can be stored most conveniently in a small room provided with shelves and with suitable arrangements for lighting.

When walls are thick enough, space may be saved throughout the school, and especially in the Handicraft and Housecraft Rooms, by building shallow cupboards into the walls for storage of tools and utensils. This can readily be done in the case of framed timber buildings.

On educational grounds it appears to be desirable that the cupboards, if installed at the time when the school is built, should only be provided in skeleton, leaving the teacher to arrange the fittings in order to suit the particular requirements of the room. These fittings can, in many cases, be made as part of the Handicraft instruction in the school ; such a method has not only great educational advantages, but helps to create interest on the part of the pupils, who can see the practical utility of the things which they have made.

(6) Cloakrooms and Lockers

63. The concentration of cloakroom accommodation on conventional lines has the disadvantage of leading to the congestion of large numbers of children at particular points in the building, and the Board will be prepared to consider experiments in attaching cloak and locker rooms to classrooms. If, however, the concentrated cloakroom

accommodation is preferred, the following points should be borne in mind :—

(*a*) Cloakrooms are, as a rule, most conveniently placed near the pupils' entrances, and the number of gates or doors should be sufficient to allow of free movement in and out. In any event, cloakrooms should not be passages from one part of the building to another.

(*b*) In Senior Mixed Schools there should be separate cloakrooms for each sex and also in Junior Mixed Schools where there is no separate changing accommodation.

(*c*) In schools to be used also for evening classes regard should be had to the needs of these evening class students in the arrangement of the cloakroom accommodation. (See paragraph 78.)

(*d*) Thorough ventilation and disconnection are essential, so that smells do not penetrate into the school.

(*e*) Cloakrooms should be amply lighted, ventilated and heated. Where hot pipes are placed low down on the walls and stands, it is advisable to fix them so as to avoid too close contact between them and the boot-cages and the consequent deterioration of leather by drying in too high a temperature. Where the actual cloakrails are heated, it should be noted that high temperatures on the rails are apt to encourage bacteriological infection and also to injure rubber garments and boots.

(*f*) The floors should be of asphalt, or other impervious material, and the walls should be lined to a height of about five feet with a hard, smooth surface which can readily be washed down.

(*g*) Doors (with open, wired panels if desired) or collapsible metal gates may be provided, if it is thought necessary to lock up the cloakrooms.

The essential equipment consists of shoe- or boot-cages, the tops of which can be used as seats by the children when they are changing their wet boots or shoes (see (*e*) above) ; and of racks or pegs for hats, and provision for hanging coats, which may be in the form of pegs or of shoulder hangers sliding on a bar clear of the walls. Whether the pegs are arranged in a zigzag or in one row the horizontal intervals between any two of them should be at least 10 inches for boys and 12 inches for girls. They should be fixed on battens on the walls, or to stands arranged at right angles to the windows. On hygienic grounds shoulder hangers are to be preferred to pegs as affording greater facilities for drying wet coats. The pegs in infants' cloakrooms should be well within the reach of young children, and so designed as to minimise the possibility of accidents to eyes. Gangways should not be less than five feet wide measured between the stands, or the stands and the walls.

64. Where cloakrooms (which would contain lockers) are attached to classrooms, they need not be more than nine feet wide and, like the ordinary cloakrooms, can be fitted with collapsible gates or open-wire-panelled doors at the end next the corridor. The centre part of the cloakroom can be occupied by a stand for book lockers containing in three or four tiers the necessary number of lockers for a class, the lockers opening alternately to different sides of the stack. The space beneath the lockers might be used for hanging towels. Ample cross-ventilation and satisfactory heating (see (*e*) above) can be secured in the same way as in the classrooms. Since these locker-cloakrooms would ordinarily be of the same height as the classrooms there would be considerable head room above the coat hangers. It is suggested that the space might be utilised for fixed cupboards bracketed to the walls, or for strong shelving, both of which could be reached by light collapsible steps or short step-ladders. There may

be objections in mixed Senior Schools to the sharing of such cloakrooms by boys and girls. These objections could be overcome by allocating one cloakroom to the girls of two forms and another to the boys of these forms, so that the total provision would not have to be increased.

(7) Drying Facilities

65. The requirements of reorganisation often render it necessary for children to come to school from greater distances than has been the case in the past. For this reason it is most important that adequate provision should be made for the drying of clothes, especially in rural schools. The ordinary warming of cloakrooms is not sufficient to dry very wet garments which, for thorough drying, require a separate drying room, specially heated and adequately ventilated. The provision of hot water for the lavatories may make it convenient to place a drying room close at hand, or, alternatively, near the hot water boiler in the basement. The possibility, however, of using gas or electricity for this purpose should be explored where cost permits. In small rural schools it is sometimes found possible to provide a large stove, which should be properly guarded, in a cloakroom or in an opening between two adjoining cloakrooms, and to supply racks on which the wet clothes can be hung.

(8) Changing Rooms

66. Where no other changing rooms are available it will be necessary for the pupils to change their clothes for physical exercises and games in the cloakrooms. It may, therefore, be well sometimes to consider the position of the cloakroom, in relation to the places, indoors and out of doors, where physical training and games are to be taken. When cloakrooms are the only provision for changing, the need, especially in the case of senior children,

for an adjacent but inexpensive installation of shower-baths and foot-baths is apparent. If, however, changing rooms and shower-baths are provided on the playing fields or in connection with a gymnasium, it should not be necessary also to provide bathing facilities in connection with the cloakrooms.

(For detailed suggestions for planning changing rooms and shower-baths reference should be made to the Board's Pamphlet, Physical Training Series No. 14*).

(9) Lavatories

67. In considering the following sections, which deal with lavatories and offices, it must be remembered that the hygienic standards of the community as a whole have risen noticeably in recent years, while at the same time it must be admitted that the provision of lavatories and offices in Public Elementary Schools has not advanced at the same rate. The greatest importance must, therefore, be attached to the proper training of children in these matters.

A generous supply of basins and towels is essential to serve the needs of a full class after exercise or other practical activity. A minimum of 12 basins should be provided for the first 100 pupils and each additional 100 will need four extra basins.

For Infants' Schools the lavatory basins should be of varying heights; probably 14, 17 and 20 inches from the ground would meet all needs. For juniors and seniors a system of troughs and sprays which is rapidly coming into favour, may be adopted. Circular spray washing fountains are also suitable. Care should be taken to install basins or troughs at convenient heights for the children who are likely to use them. Wherever possible hot water with control taps to prevent scalding in the case of the younger children, should be provided. (See paragraph 99.)

* Published by H.M. Stationery Office (1936). Price 1*s.* 0*d.*

A plentiful supply of hot water throughout the school year, with an adequate quantity of soap and towels, is one of the most effective aids in the social instruction given in the school.

Except in small schools, lavatory basins should not be placed in cloakrooms and they should also preferably be separate from the offices.

68. In all schools an adequate supply of drinking water is essential, and this can now most conveniently and effectively be provided by hygienic white porcelain drinking fountains of the bubble or spray type, whether in the lavatories or in the playground, due precautions being taken against frost in the latter case. The safest and most suitable patterns are those in which the water is delivered obliquely from a covered orifice. Special fitments combined with an ordinary lavatory tap and basin can be obtained. Drinking fountains should be provided at the rate of one for about every hundred children in large schools, but in small schools there should be at least two. The provision of a sink with water taps at convenient heights for filling jugs, etc., is desirable. There should also be some means of collecting rain-water, which will prove specially useful for Housecraft purposes, particularly where the local water is hard.

(10) Offices

69. Where a water carriage system exists, the offices should either form part of the main building or be so close to it that they can be connected with it by a covered way. There are advantages in being able to reach the offices from the playground without having to pass through the school, so long as the approaches to them are capable of supervision from the school in order to prevent their use by unauthorised persons. Where they are lit by electric light, a control switch should be situated in the school.

In buildings of more than one storey covering a considerable area it may be desirable to provide part of the offices on an upper floor. Where playgrounds are on a roof offices should be provided on the same level.

The offices and the approaches to them must be wholly separate for older boys and girls. For infants there may be an approach in common, but it is desirable that there should be internal separation of the boys' and girls' accommodation. In a combined department of juniors and infants the offices and approaches should be separate for the sexes, though there is no objection to the accommodation for infant boys being adjacent to that for the junior and infant girls. Apart from the division of the offices as between boys and girls, it is desirable that blocks should be split up where large numbers of children are involved, so as to avoid too large concentrations at one point. Where the opening to the closets is screened, there should be an entrance at each end of the screen and every block of closets should have at least two entrances which should be widely separated. Care should, however, be taken that in no case are offices placed in such a position that they can be seen into from any window. In many schools internal sanitary accommodation has been provided in immediate proximity to the Nursery Classroom or the new entrants' room. (See paragraphs 16 and 17.)

Each closet must be not less than two feet three inches wide, nor more than three feet. Each must be fully lighted and ventilated and have a door, which for older pupils should always have a fastening on the inside. The door should be at least three inches short at the bottom and at least six inches short at the top. If, as in infants' offices, there is no fastening and the door opens inwards there must be a handle on the inside. The closets are best divided by partitions carried up six feet only. In the case of water-closets each closet should be fitted with its own flushing apparatus, which should be of an instantaneous

type. It is very important to secure an adequate supply of water, for purposes of social training, and in infants' offices the chains should be of a length which can conveniently be used by the small children. The walls should be finished by some smooth, hard surface upon which writing is impossible. The height of the seats and the size of the openings should always be regulated to suit the ages of the children. The accommodation provided should be on the following scale :

Boys.—Four closets for the first hundred, and three for each succeeding hundred with urinals in the proportion of at least 10 feet run per hundred boys. In the case of senior boys it is desirable for the urinals to be divided into stalls. Urinals should be arranged in long straight lengths without re-entrant angles. They should have porcelain or cane glazed back, stalls, and channels, the floor being laid with a hard impervious surface, preferably asphalt or vitrified tiles. Urinals should be planned with a way in and a way out, to allow quick circulation and they should be in an enclosure of their own, quite apart from the closets. Urinals should always be fitted with flushing apparatus and sparge pipes where there is a water supply.

Girls.—Six closets for the first hundred and four for each succeeding hundred.

If the number of children in the school is not large, a block of offices common to older girls and younger children can be approved. A proper proportion of the closets should then be made of suitable height and dimensions for the smaller children.

70. *Dry Systems.*—If a water supply is not available earth closets and urinals of an approved type may be employed in country districts, but the type employed is less important than the insuring of an adequate service.

In any case drains for the disposal of slop and surface water from the school will still be necessary. Activated earth closets* are also frequently adopted. Such closets must, of course, be placed sufficiently far from the school to avoid any unpleasantness.

Generally speaking, chemical closets are unsuitable for use in schools.

71. *General.*—The provision of an adequate supply of toilet paper in the offices is as important as the supply of soap and towels in the lavatories.

A small cloakroom with lavatory and water closet conveniently placed for the use of the Kitchen Staff is to be recommended where a canteen is provided.

Drains.—Attention is drawn to Appendix V (2) regarding arrangements for drainage and disposal of waste matters and for water supply at Public Elementary Schools.

(11) Medical Inspection Rooms

72. In all schools accommodation should be available for the Doctor, Dentist and Nurses to conduct Medical Inspections under satisfactory conditions. In the larger schools, and in schools consisting of two or more departments, a special room for Medical Inspection purposes should be provided. It should be suitably lighted and, wherever practicable, provide a length of 20 feet in one direction for purposes of sight testing. If, however, this is impracticable, the necessary facilities for sight testing may be secured by the use of two communicating rooms, or the use of a smaller room with a portion of the passage or, in the last resort, by a suitable arrangement of mirrors.

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* For descriptions, see Appendix V. Memorandum by the Ministry of Health on the arrangements for drainage and disposal of waste matters and for water supply at schools.

A room of approximately 170 square feet (13 by 13) is to be preferred to the entire absence of special accommodation. A supply of hot and cold water is essential.

As it is improbable that even in the largest schools the Medical Inspection room will be in anything approaching full-time use, it may properly be employed for any subsidiary school purposes; among these an obvious use is as a rest room. Whatever subsidiary use is made of the room, however, the Medical Officers' priority of claim to its use should be undisputed.

The growing interest taken by parents in the result of Medical Inspection increases the desirability of ensuring suitable arrangements for their reception on the day of inspection. While the provision of a special waiting room would be extravagant, in view of the comparatively limited period when it is required, the need for improvising suitable arrangements for parents should be borne in mind in the initial choice of a position for the Medical Inspection room.

Where a school is some distance from the Clinic and a Nurse visits to give treatment for minor ailments, the case for special accommodation for Medical Inspection purposes is strengthened. There will, however, be small schools where a special room would be used for such short periods in the year that its provision cannot be justified. In these cases, it is important that the best possible arrangements should be made to enable the officers of a School Medical Service to conduct their inspection in comfort.

(12) Bicycle Sheds

73. Where the number of children coming from a distance justifies the provision of bicycle sheds, these should be light and inexpensive. Their aspect should be away from the direction of the prevailing wind and their depth should be sufficient to give ample protection.

CHAPTER VI—SCHOOL PLANNING

74. Briefly stated, the Architect's task in planning a school is to secure compactness for convenience, and ample light and air for health. He should plan also for the abatement of noise from without and within the school and for safe evacuation of the premises in case of fire or panic. Compactness is the surest method of obtaining economy in initial cost and efficiency in subsequent working, but should not be carried, as for instance by placing rooms on both sides of a corridor for its entire length, to the point of sacrificing free cross-ventilation, quietude, and the admission of sunlight. The provision of ample natural lighting, ventilation and warmth for every room is the ground-work of all reasonable hygienic conditions for education. It is, of course, desirable that the design of a school should be well balanced, but the fact that educational convenience is more important than symmetry of elevation should never be lost sight of. The true architectural plan should not sacrifice convenience to symmetry.

Where the area of the site is sufficient, single-storey buildings are preferable in that they make it easier to approach the ideal plan for every room. While two-storey buildings are more compact and are admissible on small or steeply sloping sites, it will be found that the dimensions of rooms on one floor inevitably influence those on the other, and that the provision of light and airy rooms, which are now rightly demanded, is rendered more difficult. In the case of Infant's Schools and buildings of light construction it is expedient to adopt the single-storey plan. On the question of cost, given a reasonably level site, a single-storey building need be not more expensive

than a two-storey building, if attention is given to the greater lightness of structure and of foundations which is possible in the former.

Whether any particular type of plan can be recommended as being generally the most suitable is doubtful. It can, however, be said with certainty that no type will fit every case. The most popular type is the one in which the rooms are arranged round four sides of a central court, a corridor (sometimes an open verandah) running round the inner sides of the rooms. The principle is sometimes expanded to embrace more than one court. When the site is level this plan presents an orderly and pleasing appearance and in the case of large schools avoids an unwieldy length of building. On the other hand it has very definite drawbacks, namely that it occupies over-much ground, since the inside court is useless for play or physical exercises, it does not lend itself easily to expansion and it frequently results in an unsatisfactory aspect for the rooms on at least one of its four sides. It is only fair to say that in nearly every type of plan applied to the large, widespread school of today the court, whether it be entirely or only partly enclosed, will occur in some shape or form. The quadrangle completed, however, and sealed at its four corners should not be used indiscriminately.

75. Having appreciated the principles of school design, the Architect can plan in forms of almost endless variety, but he will allow the conditions of the site to direct him as to which particular shape his plan should take and whether it may be expedient to plan on more than one floor. There has been a noticeable divergence of opinion as to the best position for the corridor, and again on this point local circumstances and the site must decide. Generally speaking, the classrooms and other rooms for teaching should face the warmer and less exposed positions on the particular site in question. The corridor on the other side will then act as a protection against cold

and boisterous winds. It is only in the exceptional circumstances, in which the warmer aspect coincides with the direction from which the prevailing strong winds blow, that the corridor may have to be placed on the sunnier side Open-sided verandahs are apt to lead to complaints, except in sheltered positions or on exceptionally well sheltered sites, for rain and snow sooner or later will be driven across them, and they tend to make the school uncomfortably cold and draughty. When used, they should be on the stiller and warmer side of the schoolrooms. Even so the contrast of temperatures, between a warmed classroom and a verandah open to every condition of weather, is attended with a risk of chills when the children and teachers are constantly moving from one room to the other.

If the ground is uneven, the slopes should be followed within reason. A few short flights of steps here and there are not serious drawbacks so long as they are well lighted ; the desire to maintain a level floor throughout in buildings covering a large area has often resulted in needless expense. Plans of simple outline, without breaks, re-entrant angles and circular work, involve less labour and are the least expensive. For the sake of economy it is advisable to concentrate sanitary accommodation as far as possible, in order to save drainage and plumbing, and there will usually be a saving in the cubic contents of a building if sanitary offices, cloakrooms, lavatories, staff rooms and other small rooms, all of which may be low, are grouped together apart from the larger and higher rooms. Generally speaking, heights need not be greater than the needs of good light and ventilation require. On the other hand, it is not economical to reduce heights to such an extent as to involve breaking the roof by a succession of dormer windows.

76. The satisfaction of the considerations set out in Chapters III, IV and V, which should be carefully studied, must be the Architect's primary object. The distribution

of the various types of rooms may generally be left to his discrimination and it will be sufficient to note the following points :—

(i) The school Hall should be placed in a central position. While the Hall and its approaches should not be lacking in dignity, it can be treated more simply if kept in the background. Halls and rooms used for physical exercises should not be surrounded by, or placed unduly close to, classrooms, to avoid disturbance from noise.

(ii) Since Art should be allied with the Crafts, there will be advantages in placing together the rooms in which this work is carried on. (See paras. 49 and 52.) It may also be an advantage for the Science room to be easily accessible from the garden.

(iii) Rooms for practical instruction, Science, Art and Crafts, all of which will be wider than classrooms, should as far as practicable, be grouped together in order to avoid breaks in walling and roofs.

(iv) A Gymnasium, being a noisy room, may be placed in a detached block, if desired. A suitable position will be somewhere near the playing fields.

(v) Classrooms should preferably face south or a little east of south. Every room in the school, however, should be so disposed that it may enjoy the benefit of some sunshine at some part of the day.

With a view to flexibility and adaptability to possible changes and developments in the future, there are advantages in planning school buildings in multiples of a unit of length and width, thereby facilitating and reducing the cost of subsequent alterations. It would be an advantage if partition walls were exempted from carrying loads, so that they could be moved if, at some future date, it should become desirable to rearrange the rooms.

77. Schools should be planned so as to enable them to be well kept, with the minimum of trouble and expense. Attention to such details as the rounding off of all corners and the tiling of window sills, so as to facilitate the removal of dust, will produce buildings which are not only easier and cheaper to keep clean than the older schools, but also furnish an object lesson to the children in the importance of a bright and clean environment. Ample accommodation should be provided for the caretaker. His function has usually been underestimated in a school. It can, and should in fact, assume a great importance in the social training imparted by the school; dirty and ill-kept premises are a poor example for the teachers in their attempts to train the pupils in clean, tidy and healthy social habits. Apart from the paramount need for scrupulous cleanliness in the lavatories and offices, Authorities and Managers will be well advised to ensure that the floors, walls and windows of schools are kept clean. For this purpose it will be helpful to have at least one slop sink and water tap for the use of the caretaker, and where there is a considerable distance to walk from one end of the school to the other, it may even be desirable to have such a sink attached to each set of lavatories. These sinks will be of considerable value also for such purposes as the cleaning of inkpots and the changing of water for flowers in the classrooms, both of which tasks are often performed in the ordinary wash basins with unfortunate results.

Provision should also be made for cupboards for the caretaker's necessities. The heating chambers should be properly ventilated and so arranged that the fuel is easily accessible. Where the caretaker is employed full-time, but does not reside on the school premises, sanitary accommodation should be provided for him.

A covered space for dust-bins is necessary, so contrived that they are concealed from view.

On the one hand, a school that is now built may need enlargement in the future and in cases where an early extension, owing to an increase in numbers, is likely to be required, the future additions should be forecast on the plans as part of the scheme. It may be desirable to build at once where an extension will be needed within a comparatively short time. On the other hand, if there is the possibility that numbers may decrease in the future, it may be desirable to erect some of the classrooms in temporary construction.

78. *Consideration of the requirements of evening and technological work.*—Considerations of economy have always led to a certain amount of dovetailing in the past between the day and evening user of school buildings ; but, in planning, sufficient attention has not always been paid to the requirements of evening or technological work, and it is becoming increasingly important to bear this point in mind. The general development of the Senior School as indicated herein is, however, in line with the modern development of the Evening Institute. While these Institutes generally give students no less practical work than in the past, they are tending to become social centres and, therefore, to consist, in the same way as the Senior School, of more than classrooms and practical rooms. There are, however, certain practical points which should be particularly borne in mind.

(*a*) Dual desks of the common type are unsuited in size and uncongenial to adult students. This fact provides an additional argument for the increasing use of tables and chairs for the furnishing of the day school. Any form of seating should, however, be so arranged that all the pupils can have a clear view of the blackboard.

(*b*) Similarly, if handwork benches are of the size suited to children they will be too low for adults. Some adjustments will be necessary to make them suitable

for older pupils. (See para. 44.) Whatever form this may take, it is essential that the firmness of the bench should be secured.

(*c*) There should be separate stock and store rooms for the day and for the evening work, and, if there is a substantial amount of evening work, it is desirable for the Science, Handicraft and Housecraft Rooms also to have separate stores. The work of evening students is often bulky and remains as work in progress over a long period, so that, unless it can be put away in a separate store, it will tend to encroach upon the free space available for the ordinary day school work.

(*d*) Access by evening students to the practical rooms will be simplified when the latter are built in separate blocks.

(*e*) Where a Senior School is to be used for evening work by both sexes, it is necessary that separate office accommodation should be available for each sex.

(*f*) Special attention should be paid to artificial lighting where there is evening work. It is especially important to have the entrances and exits well lit. This makes them more attractive to the students and facilitates supervision. In addition to the general considerations as to the lighting of practical rooms set out in para. 101 it may be worth considering whether for drawing and other activities reflected or indirect lighting should not be installed.

(*g*) Where the volume of evening work is sufficient to require the services of a special Principal, a room will be required for him. As, however, the use of the room will not normally be needed by him during day school hours, it may be possible to utilise for the purpose the waiting room suggested in para. 61 or the Medical Inspection room. (See para. 72.)

CHAPTER VII—TREATMENT, CONSTRUCTION AND MATERIALS

(1) General

79. That schools should be attractive features in the architectural layout of a neighbourhood, in harmony with their surroundings, is obviously desirable. It is equally desirable that schools should be designed in the best possible taste, not only in external appearance, but in every respect, even to details of furnishing, equipment and decoration, for in this way only can they create the environment best calculated to arouse the artistic sensibilities of the pupils and lead them to appreciate beauty in the common objects of their everyday life.

In skilled hands these aims can as well be attained by simple treatment, good composition and cheerfulness of colour as by eleborate ornamentation and expensive material. Nor is it necessary to follow architectural styles which are often needlessly costly and difficult to adapt to changing ideas of hygiene and education. The best results, it is hardly necessary to say, will follow the employment of trained Architects, preferably those with some experience in the requirements of schools.

If Authorities and Managers are in doubt as to the fitness of design for a school occupying a particularly important position in a locality, the Board would remind them that there is available the advice of the Royal Fine Arts Commission, brought into being in 1924 for the express purpose of advising the Government and Local Authorities on all matters of Art, including the elevations of buildings. It is desirable, moreover, especially in rural areas, that they should consult the advisory panels set up with the approval of the Ministry of Health under the Town and Country

Planning Act, 1932, whereby expert advice is available and specially directed to the preservation of the general amenities of a locality.

(2) Types of construction

80. In the building of schools the governing principles should be sound (but not unduly heavy) structure and good sanitation, both combined with economy. Subject to these overriding principles, the Board would wish to leave Authorities and Managers and their architectural advisers free to choose such methods of construction and materials as seem best fitted for each particular case.

From time to time the Board have instituted inquiries as to whether the employment of methods of construction and materials, different from those in ordinary use, was practicable and economical and, if so, what steps should be taken to facilitate their adoption. They have not, hitherto, been supplied with sufficient evidence to enable them to press for the employment of particular alternative methods. They have thought it worth while to give every encouragement to experiments, and sympathetic consideration to such results as seemed to offer savings in initial cost sufficient to counterbalance extra charges for upkeep, and at the same time to maintain those standards of convenience and comfort which are expected in the modern permanent school building. Legislation (Education (Administrative Provisions) Act, 1911, Section 3; now Education Act, 1921, Section 166) was invoked to exempt new school buildings from the operation of local building bye-laws; the Board's Building Regulations were amended, and the loan periods for schools erected in certain novel and lighter methods of construction were lengthened, in order to remove the main obstacles in the way.

Despite the fact that interest was stimulated, the number of such schools has been comparatively small, the explanation being that as schools became more and more "open-air" in character, the walling upon which alternative

methods mainly relied for savings became less and less, and as the output of bricks increased after their scarcity during the War and the years following the War, the substitution of material other than brick resulted in no appreciable saving. Other deterrent reasons were the well known objections to concrete and the fact that it was only cheaper than brickwork in mass production, and the anticipated heavy maintenance charges on these more lightly constructed buildings. The periods of redemption for the loans on such buildings were also shorter and the annual payments therefore heavier.

Of the alternatives to traditional methods of brick construction, the only one which has produced a substantial saving in first cost is timber. Without wishing unduly to influence Authorities and Managers, the Board would remind them that the timber school is recognised as part of the permanent school supply for as long as its structural condition justifies recognition. Timber buildings can be planned and equipped on the same lines as those built of brick and concrete, and can be artistically treated. If built upon brick or concrete foundations and of specially selected woods, there is every reason to believe that they would have a useful life of 40 years or more, and need not be expensive in upkeep, since there are now Empire grown timbers to be had that need few or no preservatives, the cost of which has hitherto been the main item in the bills for maintenance.

The timber-built school shows the greatest saving when timbers and boards are employed to the maximum extent, e.g. timber framing, boards or shingles, or both, as external wall coverings, shingles on the roof, and boarding internally on the floors and on the walls and ceilings. It can also be employed merely as an alternative to brick in the walls, the framing of which may be covered externally and internally by various materials, but used in that way it saves very little of the cost of brickwork, without the advantages

of the older and tried material. There are certain disadvantages, such as liability to risk of fire, or to attacks of dry rot. The former must be countered by the provision of double exits from every room and by confining the buildings to the ground floor storey, and the latter by selection of suitable woods. Care must be taken also to guard against quick changes of outside temperature, losses of heat and the passage of sound from room to room, and it will be advisable always to build the sanitary offices in light brick-work or concrete. On the other hand the advantages of timber buildings are rapidity of erection and adaptability and, even if they have to make way for new buildings before their useful life is run, a large sacrifice of capital expenditure is not involved. Many difficulties in modern educational administration are due to schools built to last a century, and too solid for adaptation, without excessive cost, to the inevitably changing requirements of education.

In special circumstances, as for instance, in colliery districts, where owing to mining operations there is no site available upon which a building of the ordinary type can be safely erected, or in areas with a moving or changing child population, e.g. on Housing Estates, the light timber-framed or all-timber school is especially appropriate. Rooms for practical instruction, physical exercises, or canteens may often wisely be erected on these lines.

In the case of buildings, or parts of a building, intended for purely temporary purposes, the all-timber school is suitable and cheap. It can be constructed in the lightest possible manner on simple foundations and may be heated by coal or gas stoves or inexpensive electrical installations. (See paragraph 96.) If constructed in sections, they can all the more easily be transferred to other sites. Comfort is increased if ceilings are provided, but roofs may be covered with ruberoid, asbestos sheets or tiles, or other cheap material. If follows that temporary buildings are eligible

for only short loan periods, but the capital cost can be reduced to a minimum.

81. Although it seems unlikely that substantial savings can be looked for in the future from new materials and alternative construction (unless it be timber to which reference is made above), the Board, in their inquiries and scrutiny of the many sets of plans and specifications submitted to them, have been impressed by the savings which can be effected in the ordinary brick-built school by lightness of structure, by standardisation of units and constructional members, by attention to detail and finish and by judicious selection of materials and fittings of every kind; and they believe that in careful attention to such matters lies the secret of the inexpensive and serviceable school building.

Where traditional methods of building are continued, therefore, the Board will expect such economies as experience has shown can be effected without jeopardising the standards of the present day school. It will be necessary, of course, to strike a fair balance between those initial capital savings, which may involve increased maintenance charges, and needlessly durable and expensive methods of construction. The exemption of school buildings from local building bye-laws was made for the express purpose of encouraging lightness of structure and of experimenting with new patented materials, proprietary articles and processes which might be employed as a means of reducing cost. If Architects are now in doubt as to the strength and weathering properties of these new materials and processes, it is suggested that they might obtain useful information by applying to the Director of the Building Research Station at Garston, Hertfordshire, and by reading the Station's publications.

The Board would at the same time urge the desirability of using Empire materials wherever possible.

(3) Particular points in construction and use of materials

82. It is fully recognised that the structural details of any building must be left to the judgment of the Architect, but special consideration is invited to the following items.

(i) *Foundations*

83. On level sites and stable ground, light single-storey buildings can be built on a concrete raft, re-inforced as required, which can be made to serve for the underflooring and thus save expense on needlessly heavy foundations and footings. Generally speaking, single-storey schools involve only light weights and on good ground can be carried on quite light foundations.

(ii) *Walls*

84. In the case of single-storey buildings eleven inch cavity, or nine inch solid, brick walls, strengthened with piers if necessary, or re-inforced with wire mesh, are found to be sufficiently weather-resisting for external walls, if the bricks are of good quality. If the bricks are poor, such walls can be rendered with cement or rough cast. In the case of two-storey buildings it may be advisable to provide 14 inch solid, or 16 inch cavity, walls on the lower storey, though nine or eleven inch walls are possible, if they are strengthened with piers or steel stanchions. For cross walls thin, hollow, interlocking blocks, six inches thick, or the thinner, specially made pumice partitions, are suitable. Ordinary breeze concrete blocks, though they save space, do not sufficiently resist the passage of sound. Though sometimes necessary, the division of rooms by wood and glazed partitions is not to be recommended: they are expensive, are not sound resisting nor conducive to privacy and interfere with the fitting of blackboards. The value of the light they transmit, moreover, is not greater than would be obtained by reflection from a lightly coloured corresponding wall surface. Partitions or partition walls, however they may be constructed, should as far as possible

be independent of floors and roofs, so that they can be removed if necessary without interfering with the main structure.

(iii) *Floors and floor finishings*

85. All floors should be of fire-resisting construction and material and, generally speaking, solid floors laid on concrete are suitable, except in rooms used for physical exercises, which require some measure of resilience. Hollow-tile construction is useful for upper floors, since it reduces noise from above. Red deal, beech and oak blocks laid in mastic, are commonly used, and red deal or some of the Empire grown hard woods can be employed as boarding, if grooved and tongued and secret-nailed to fillets embedded in the concrete. In order to guard against dry rot, it is advisable to pour a thick layer of bitumen directly upon the concrete under the boards, which may be dipped in creosote as a further precaution. The life of boards, though not so long as that of blocks, has been found to be long enough for all practical purposes and worn boards are easy to replace. Experiments with linoleum, cork lino and rubber, stuck down directly on concrete, have proved them to be not unsatisfactory. For corridors, cloakrooms, lavatories, and offices six inch or eight inch quarry tiles, fine coloured asphalt or cement, finished with a granolithic surface in various colours, have been found to be sufficiently serviceable. Composition floors of the magnesite variety are apt to crack and exude damp. Terrazzo, if laid in large areas, also cracks and should be freely broken with bands of the same material in the form of pre-cast tiles, or should be laid entirely in the form of tiling.

(iv) *Steps and Staircases*

These are best made of re-inforced concrete, or pre-cast artificial stone treated with carborundum ; quarter-inch special lead plugs let into the surface of the treads prevent slipping.

(v) *Roofs*

86. In timbering of roofs economy can be effected by specifying shippers' sizes. Spans should be varied as little as possible so as to standardise timbers and trusses. In short spans, roof-trusses can be dispensed with by coupling up and bolting together two or more ordinary rafters and collars. Tiles can be hung on feather-edged boarding, laid with the thicker edge upward, without the provision of battens, or it may be possible to dispense with rafters if the purlins are diagonally boarded, felted and double battened. Seconds Welsh slates are more sightly than firsts and cheaper than other varieties. Clay pantiles, interlocking concrete pantiles, and corrugated asbestos in the form either of pantiles or large sheets are possible for large roof surfaces, being serviceable, cheaper and lighter than ordinary flat tiles. For timber buildings, Canadian red cedar shingles are light and pleasant in appearance, and for temporary use coverings of the nature of ruberoid, or asbestos-cement slates are suitable. Galvanized iron (Colonial pattern), when painted, is not unsightly, but is liable to rust and perish if not attended to and is pervious to extremes of temperature. There should be access to all pitched roofs for the periodical painting and cleaning of all steel roof-trusses.

(vi) *Flats*

87. Flats covering very large surfaces are usually constructed of concrete, covered with rock asphalt in two layers. They are expensive and, unless protected from extremes of temperature, are apt to crack. Modern practice, however, has evolved materials and methods of construction, whereby lighter and cheaper flat roofs can now be relied upon. Felt and bitumen in two or more layers, or even asphalt or concrete laid upon boarding, or flat roofing slabs, of hollow-construction asbestos, provide sound roofs, if carefully laid and protected against a hot sun. A cheap and not unsuitable covering for the roofs of verandahs is wired glass.

(vii) *Ceilings*

If it is desired to eliminate lath and plaster, it is possible to substitute some form of plaster boarding or ceiling boarding, of which there are many varieties on the market.

(viii) *Doors and Windows*

88. Flush panel doors, ready made of standard sizes, are obtainable, as are standard metal casement windows of many sizes and varieties. Sills of wooden windows should always be of oak. All expensive forms of gearing and fittings should be eliminated.

(ix) *Internal Wall Finishings*

89. Expensive glazed bricks or tiles, or terrazzo finishings are unnecessary except for part of the height of cloak-rooms, lavatories, offices, and rooms used for the teaching of cookery and laundry work. Light and inexpensive forms of ply-wood panelling, metal-faced wood, specially hard pressed wall boards, or linoleum (which will take a wax polish), cork lino, leatherette or rubber (all four stuck with a special adhesive to cement) enable the temperatures of a room to be quickly raised and can be reasonably decorative. As a rule, however, dadoes of hard cement, either smooth or with a stippled textured surface, or finished with a rippled cement glaze, are sufficient. If thought advisable, two courses of glazed bricks or hard wood skirting may be provided immediately above the floor level. If it is desired to eliminate wall plastering, sand-lime-bricks, or even fair-faced brickwork, flat-pointed and distempered, may be used, provided the walls are not thinner than 11 inches. Lightly constructed buildings can be lined with asbestos wood, which is fire-resisting.

(x) *Eaves-gutters, heating pipes and radiators*

90. These should always be so fixed that it is possible to paint them all round easily. Eaves-gutters and down-pipes can be obtained in asbestos and so save painting.

(xi) *Sanitary fittings*

These can be white or cane glazed. Continuous trough flushing cisterns for water closets are quick in action and save water and plumbing.

(xii) *Acoustics**

91. Outside noise affecting work in Schools can be avoided by choosing quiet sites wherever possible and in any case large sites. Noise from traffic on a hill, owing to gear changing, is especially penetrating and ought to be avoided. The school building should retreat from the sources of disturbance rather than arm itself against them : a school is justified in turning its back on a noisy thoroughfare, notwithstanding some sacrifice in appearance.

Noise within the main buildings can be reduced to some extent by careful disposition of the rooms. (See para. 76 for general considerations in planning.) It will still, however, be necessary to consider acoustically rooms of any magnitude, e.g. Halls, to which reference is made in para. 33, and also whether treatment of the general structure with a view to preventing the conduction of noises from one part of the building to another will be economical. Because of its open windows and light construction the modern school building is prone to sound transmission, and a reasonable expenditure to check the growing menace of noise is justifiable. Modern research and experiments have now made it easier to reconcile good hygiene and good acoustics. Washable and sound-absorbent materials can be substituted for the hard modern plasters and for glazed surfaces and linings, which are all highly reverberant. An increase of mass and rigidity in a wall is the surest way to reduce sound transmission, provided the wall is not penetrated by doors, hot water pipes, chases, vents, etc.

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* For further advice on the abatement of noise and acoustic treatment of buildings Architects are invited to consult the " Anti-Noise League ", 66, Victoria Street, London, S.W.1.

In the interest of good acoustics, therefore, partitions should be built of heavy rather than light blocks, and walls of four and a half inch brickwork are found to be more satisfactory from this point of view. Double partitions are held by some authorities to be more generally efficient, but the air space must not be bridged by ties at any point and such partitions are improved if the leaves are of different thicknesses and if each leaf is placed on an insulating layer of cork or fibre board. All partitions, whether solid or hollow, are improved by five-eights-inch plaster on both sides, because in practice plaster adds weight and serves to caulk: but the plaster ought not to cross the insulating layer. Care should also be taken to flush up hollow partitions on the inside and to caulk at ceiling level by means of a layer of quilt or building blanket. Quilt, in the air space of a double partition, can be used with advantage over the whole of one leaf.

Noise transmission through floors can be minimised in new buildings by combining anti-impact floor finishings, such as rubber, or cork, or linoleum on a cork slip, with a structural floor somewhat thicker than usual. All thinly constructed floors, even if structurally safe, tend to transmit sounds of impact. Separate ceilings can be effective if suspended from insulated pads, or if placed on separate bearings insulated at the junctions with the walls. Floating floors are now made which are able to resist a high degree of impact noise. All sound-proofing is cheaper on the ground floor, where solid walls rest on the ground, than on floors above.

Doors should be hung carefully, so as to fit tightly when closed, and ought to be thick and heavy. Doors should not be placed opposite each other, for the sake of an axial treatment, as that arrangement transmits noise.

A little attention to the acoustics of classrooms can often prevent those highly reverberant conditions which to some teachers are particularly irritating. Such devices as an

anti-impact floor, rubber-tipped chairs, etc., reduce noise at its source, but there remain the reinforcing of certain tones of the voice above others and the magnifying of any intruding noise by reverberation. This can be reduced by using a lime plaster everywhere above a hard dado, and by introducing curtains, pictures, maps, etc., as sound absorbents. If very hard hygienic plasters are used on the walls, a sound-absorbent upon the ceiling is desirable. Where there is panel heating in the ceiling, a central panel of absorbent in the ceiling and the same treatment of a deep frieze on the walls can be substituted for treatment of the whole of the ceiling area. Hygienic sound absorbents suitable for schools are now available.

(xiii) *Decoration*

92. Such experiments as have been tried appear to indicate that bright and harmonious decoration exercises a stimulating effect upon the mentality of the pupils. It tends also to be a valuable adjunct to social training in raising their standard of cleanliness and appreciation of colour especially in the case of younger children. Colour schemes should be restful as well as cheerful. The ideal is to pitch the scheme of colour on a pleasing note, neither unduly stimulating nor unduly depressing. The pitch, once decided upon, should prevail throughout, the necessary measure of variety in different rooms being obtained by slight, subtle changes of tone and colour.

Particular attention should be paid to the light-reflecting quality of various tones of colour. (See para. 102.) Experience has shown that, if certain expensive colours are eliminated, bright, harmonious or suitably contrasting colour schemes are little dearer than the conventional buff or other drab tones, and the expense of upkeep will not be considerable, provided the colours are carefully selected to exclude those which do not stand up against sunlight, wear and dirt. It will be obvious that where such schemes are adopted the furniture and woodwork should be stained or painted to harmonise with the general tone.

CHAPTER VIII—SERVICES

(1) General

93. The general services in a school will be heating, ventilation, artificial lighting, hot and cold water supply; and in addition there may be gas, electric power, and electricity for bells, internal telephones, and synchronised clocks. It is of great importance that the needs of each of these services and the positions of the principal fittings should be considered in advance by Architects, on the advice of specialists if necessary, since the construction of the building will inevitably be affected. Services should be designed with special regard to the alterations which may become necessary in the future. Easy access to all hidden services and fittings is essential, and where they are exposed they should be so placed that they can be kept free of dust and dirt. Heating pipes and radiators are sometimes so placed that it is difficult, or almost impossible, to brush or dust behind them, with the result that dust accumulates and they become centres of infection. In practical workrooms of various kinds, radiators should not be so placed as to interfere with the equipment and furnishing. Sectional control of each service is important, and records should be kept, in the shape of plans, which should show the run of all services on every floor of the building.

(2) Heating

94. With the possible exception of the smallest schools, a system of central heating will be necessary. A single fireplace or stove is insufficient to warm thoroughly a classroom of the standard size, and needs to be supplemented either by air heating or by additional sources of radiant heat on the sides of the room remote from the fireplace. Slow

combustion stoves and gas stoves, fitted in every case with guards, may be used for temporary buildings, and in small rooms for intermittent use, if the heat is distributed as evenly as possible, but are unsuitable for schools generally. Combined systems of mechanically driven and heated air are not appropriate to the ordinary public elementary school, which is almost invariably designed on open-air lines.

The amount of heating required should be considered carefully in reference to the system of ventilation proposed, since the full use of fresh air openings is largely governed by the facilities for warming the school quickly. The heat supplied should always be evenly distributed. With regard to temperature, no hard and fast rules can be laid down as to the degree required for comfort, since it will vary in different circumstances. For example, in rooms facing a southerly direction, or in which children are actively engaged or do not work for considerable periods without movement, an air temperature of 56° to 60° F. is in practice found to suffice. On the other hand for continued sedentary work, and in rooms upon which the sun seldom or never shines and which therefore receive no radiant heat, an appreciably higher air temperature may prove to be necessary.

High pressure water systems are obsolete and high pressure steam heating systems are unsuitable for school purposes. If a hot water system is employed, it should be at medium or low pressure. It is preferable to employ two boilers as a precaution against breakdown. One of these alone will suffice to supply the necessary heat in milder weather. In systems involving a long circulation, means of accelerating the flow are desirable. The most effective position for radiators is under the windows, where they tend to warm the cold incoming air and to direct it upwards, but in certain circumstances, as for instance where work of a specialised kind has to be done on window benches, heated air rising from radiators underneath is found to be unpleasant, and injurious to the materials.

95. The growing tendency to design schools on open-air lines, with the consequent frequent change in the air of the rooms, has led to the adoption of methods producing a high percentage of radiant heat, which is to some extent independent of air heating. Where adequate radiant heat is supplied, whatever the source may be, the temperature of the air in the rooms is of less consequence, and comfort may be obtained at 56° F. or even less, under moderately dry and quiet atmospheric conditions. The system most often used, known as the "panel system," is operated from ordinary boilers and the heat is obtained by embedding panels of pipes of special design in the surfaces of the ceilings or walls, or of both, all surfaces being heated to a low temperature only. Alternatively, the floor is sometimes heated, but where this is done warmth is mainly produced by convection and conduction and may require supplemental air heating at a higher level. Such systems are well suited to the open-air school and incidentally enable the pipes and radiators which would be required in the ordinary heating system to be dispensed with. Heating panels may also consist of flat iron plates with water channels behind them connected to ordinary circulating pipes, the panel being fixed flush with the wall or ceiling surfaces. Such panels, however, when fixed on the walls are not free from the well known objection of blackening caused by convection currents.

96. Gas or oil may be used as alternatives to coke for firing boilers. Their use, however, requires careful precautions against the danger of fire and their adoption must be considered in relation to local circumstances and costs of gas and oil as compared with that of coke or coal. They save labour in stoking and are clean. The oil-burners, however, require a certain amount of attention in keeping them clean and should be given regular, periodical, expert inspection.

Electricity also may be employed for low pressure hot water heating systems in place of boilers. Installations,

however, are costly unless current can be obtained at night, as well as by day, at a very low rate.

Electricity can also be used for heating direct by various methods. Direct electrical heating combines cleanliness with the minimum of attention and some saving of building. It is, however, as yet comparatively seldom that current can be obtained at rates low enough to enable an efficient electric system to compete from the point of view of cost with a low pressure hot water system, which, if circumstances render it desirable, may be automatically stoked with coal or coke. An electric system can be installed in the form of tubular heaters, or of panels of several varieties, within the substance of which fine wires are embedded, the heat being radiated from panels attached to the walls or ceilings or from above, by combining heating panels with lighting fittings. Though heating by electricity tends at present to be so expensive as to preclude its general use for schools, it may be useful, especially when tubular heaters are used, as an auxiliary to ordinary methods, or for intermittent heating or in particular positions in which it is difficult to install ordinary types of heating.

97. If ventilation is reasonably well regulated, thermostatic control not only results in a saving of energy, but also has the advantage of regulating the temperatures of different rooms to different degrees, if required. It has now been so far developed that it can be fitted in some form to almost every type of heating apparatus, though it is most easily applied to direct electrical heating.

Mechanical stoking may be employed to reduce the cost of labour and is now practicable (where electric current is available) for installations of the size met with in school buildings. Such stokers are capable of dealing with cheap low grade coal, and where that is easily obtained their use results in substantial savings in the cost of fuel. In certain cases gravity, or self-feeding boilers burning coke may be

considered suitable. It must be remembered, however, that, though they save superficial space for fuel storage, they require greater height for the hoppers and the initial cost of installation is heavy. They are most suitable when a cheap grade of coal is not easily obtainable and the saving of labour is an important factor.

98. *Furnace Rooms.*—Boiler chambers and storage for fuel should be of ample capacity and a walled-in store for chips and caretaker's waste materials should be provided. Thoroughly good ventilation is essential and it is necessary to ensure that the stoker may not be trapped in case of fire, smoke, or fumes. Boiler chambers and fuel stores should always be cut off from the rest of the building by fire-resisting construction and should be approached from outside.

(3) Hot Water Supply

99. The provision of a proper supply of hot water for lavatories, shower-baths, medical inspection and cleaners' sinks, etc., must be considered apart from the heating, since a supply will be required throughout the year, and in any case it is inadvisable to draw hot water directly from the hot water heating system. Usually the most satisfactory method is found to be that of an independent boiler which, as suggested in para. 65, may be used to provide facilities for the drying of wet clothes. Heating and hot water supply systems may, however, be combined by the use of calorifiers in which the domestic supply is warmed by hot water coils connected to the heating circulation. By this means it can be arranged for one boiler to maintain a supply of hot water when the boilers' central heating system is not in use. Where gas or electricity, or both, are available it is possible to use them in the form of small independent water heaters, placed near the points at which hot water is needed.

Some form of mixing-valve under control is necessary for shower-baths and even for the lavatory basins used by young children, in order to prevent scalding. (See para. 67.)

(4) Daylight Lighting

100. No position in a classroom is fit for use as a school place unless the sky is visible from it at desk or table height. The area of sky visible should be sufficient at least to offer an illumination on a horizontal plane at desk or table height equivalent to a daylight factor of point five per cent, i.e. point five per cent. of the illumination from a complete hemisphere of sky all parts of which are equally bright, such as would illuminate the surface of an unobstructed flat roof. This value should, however, be regarded as a minimum which might be materially exceeded in new schools, where a daylight factor of one per cent. should be aimed at. In ordinary circumstances, where there is uninterrupted sky-shine, the rough and ready proportion of one square foot of clear glass in windows to every five square feet of floor area in a room will produce the daylight factor of point five per cent. It should be remembered, however, that in rooms, the breadth of which is more than 20 feet from the window wall and the height not more than 12 feet, it will always be necessary to utilise the width of the available wall space to the fullest extent for windows if this factor is to be reached.

Special attention should be paid to the position of the blackboard, so as to ensure its adequate illumination and to avoid the reflection of light into the eyes of the pupils. Blackboards which can be set at varying vertical angles are useful in avoiding glare.

Clear glass should be used in windows. All kinds of glass which diminish the light and are difficult to keep clean should be avoided.

(5) Artificial Lighting

101. Electricity has proved to be the most satisfactory means of artificial lighting, but in those isolated schools where some other illuminant has to be used the general considerations set out below will equally apply.

The installation should fulfil three conditions. It must provide a sufficiency of light, it must distribute it evenly over the whole area of the room, and it must not produce glare. In general, the tendency in the past has been to install too few lighting points, and lamps of insufficient power.

In the following table the approximate minimum general illumination in foot-candles required in working positions in various rooms is given :—

Room.	*Intensity.*
Class Rooms	10 at desk or table level.
Library	10 ,, ,,
Crafts Rooms	10 ,, ,,
Needlework Rooms ..	12 ,, ,,
Staff Rooms	10 ,, ,,
Art Rooms	10 on the working plane.
Science Rooms	10 ,, ,,
Housecraft Rooms ..	10 ,, ,,
Workshops	10 ,, ,,
Physical Training Rooms	8 at floor level.
Assembly Halls ..	8 ,, ,,
Dining Rooms	8 ,, ,,
Corridoors and Staircases	6
Cloakrooms, Lavatories, etc.	6

Light should so be distributed that the ratio of illumination of the lightest to that of the darkest part of a room is not higher than one point five to one, though it will usually be necessary to make special arrangements for lighting the blackboard.

Glare is best avoided by so arranging and enclosing the lighting units that no bare filaments are visible to the pupils. They should not normally be at a lower height than 10 feet from the floor, subject to such arrangements as may be necessary in Craft Rooms for focussing light, by movable or extensible lamps, or otherwise, on special pieces of work. The general aim should be to reduce shadows to a minimum and to secure that the line of vision for both teacher and pupils is free from the glare of the lamps. Glare from smooth-surfaced walls is as objectionable as glare from a lamp. Consideration should be given to this point when local lights are planned.

102. The light reflected from walls varies a great deal with their colour and this has an important bearing both on day and artificial light. White paint reflects 75–80 per cent. of the incident light; light plaster and aluminium paint 70–75 per cent.; cream, ivory and primrose 60–70 per cent.; light green, grey or pink 45–50 per cent.; dark green or dark grey 20–25 per cent.; and red 10–15 per cent.

The point which will concern the Architect at an early stage is the number, position and power of the lighting units necessary to produce the required intensity of illumination. Four suitable units distributed symmetrically above the desks will normally be sufficient for the standard classroom, but supplementary illumination for the teacher's area and the blackboard by two additional units is sometimes desirable; such supplementary lights should be suspended high enough to avoid glare.

The arrangement and position of switches need careful attention. A single control switch for the whole of the lighting, easily accessible, is required in those rooms in which a lantern or cinematograph will be used.*

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* For further information as to the design of an efficient lighting system and the results of their investigations, the Illuminating Engineering Society, 32, Victoria Street, S.W.1, should be consulted.

(6) Ventilation

103. Mechanical ventilation or methods of combined hot-air heating and ventilation are generally to be deprecated. In certain circumstances, for instance in Halls, Lecture Rooms, or any rooms in which lantern or cinematograph lectures are held and it is necessary to draw the blinds, it may be necessary to resort to wall inlets and electrically-driven extracts in order to keep the rooms fresh when the window openings are covered, unless the blinds are specially made and fixed so as to preserve a measure of window ventilation. In addition to the valuable object lesson afforded to the children by keeping windows open, natural ventilation through open windows has now been proved to produce perfectly satisfactory results, provided that the window openings are properly regulated so as to avoid strong direct draughts and that there is sufficient heating power to maintain a comfortable temperature.

The normal school plan to-day provides for cross-ventilation by windows on opposite sides of all rooms used for teaching. In many cases, moreover, the " open-air " principle has been carried to the extent of replacing the corridors by open-sided verandahs (sometimes on both sides of the classroom) and the window walls of the classroom itself by folding and sliding partitions, or folding glazed doors, which can be partly or entirely thrown open at will. It should, however, be remembered that such free movements of air demand special methods of heating (see para. 95).

Adequate cross-ventilation should be extended to every part of the school. Cloakrooms and offices should be separately cross-ventilated, preferably by windows, independently of any corridor from which other rooms draw their supply of air.

Ideal cross-ventilation depends primarily on the provision of windows opening directly into the open air on opposite

sides of the room, both sets of windows being on the same low level. Where the communicating link between the various rooms is the open verandah, ideal ventilation can be obtained. Indirect cross-ventilation can, however, be relied upon across a corridor, provided that low-level, freely opening windows are provided between the class-rooms and the corridor and between the corridor and the open air. In single-storey buildings and in the top storey of buildings on more than one floor it is possible to supplement indirect cross-ventilation across a corridor by high-level windows opening into the outer air above the corridor. Such windows, however, are apt to cause down-draughts of cold air ; they are, moreover, expensive to construct and, by reason of their shape, difficult to open. Cross-corner ventilation is possible where the provision of windows on opposite sides of a room is not always practicable. In such cases the window should be well in the corner out of the direct line of sight of the teacher or pupils and the sills should be brought down to the same level as those of the principal windows.

104. Windows may be of several types. They should, as far as possible, conform to the following principles : (1) it should be possible to throw open at once at least half, and preferably the whole, of their area ; (2) the openings should be so arranged that the amount and direction of the incoming air can be regulated to the changes of the wind ; and (3) all elaborate or expensive fittings and gearing should be eliminated and the openings should be easily adjustable. Double-hung, vertically sliding sashes, with or without a pivot-hung casement, above a transom, are in common use, but they do not allow more than about one-half of the area to open : when used, they may be fitted inside across the bottom of the lower sash with hopper screens which can be removed in warm weather. A more suitable type of window is one divided horizontally into three lights, the centre and

upper ones being hung on pivots to swing horizontally and the bottom one opening on the hopper principle. If subdivided vertically, the centre lights instead of opening on pivots may open outwards as side-hung casements, one of the bottom lights opening in the same way and the other as a hopper. Where hoppers are used, they should be so constructed that the width of the opening at the top, when the light has fallen back, is about four inches, measured horizontally from the face of the window: the hoppers should be fitted with glazed cheeks to prevent draughts from the sides and with a vertical, glazed baffle-plate three inches high to deflect the air upwards. The height of the windows should be such that the top of the hopper when open is approximately five feet above the floor line. Hoppers should not be used for the upper lights of windows, because the air striking on the ceiling causes down draughts. The upper lights of windows should always open to the fullest extent. Another type of window which has found favour is the double French casement, extending down or close down to the floor. The advantages claimed for this window are that one of the lights may be set open at any angle to back on to the force of the wind blowing along the wall in either direction, and that in still, warm weather the whole of the windows can be thrown wide open. Two points, however, should be safeguarded; namely a tendency to draughts along the floor and the contingency of a strong wind blowing directly on to the windows. The first can be obviated by allowing the casement to continue below a step, against which it can close, or by stopping the casements short of the floor; and the second by the provision, above a transom, of casements hung horizontally on pivots.

The benefits to be derived from the free passage of fresh, sun-permeated air through the methods of cross-ventilation described are so generally appreciated that it is not necessary to lay further stress on them. There is, however, one minor reservation. Experience has shown

that the " open-air " system of building, when carried to its extreme form of providing two opening sides of a room, is not conveniently applicable, owing to serious practical disadvantages, to rooms for the teaching of Science, Handicraft or Housecraft. The provision of one opening side, however, in such rooms is free from objection.

CHAPTER IX—WATER SUPPLY*

105. In all schools adequate and wholesome drinking water should be readily accessible to the pupils. Where it is not taken from the mains of an Authority or Company authorised to supply water, care should be taken to ascertain (*a*) that the supply will be constant and sufficient, and (*b*) that the water will be of suitable character and not liable to pollution in any way, e.g. by surface drainage, or by leakage from sewers, drains, cesspools or other receptacles.

Any cistern used for the storage of water should be properly covered and ventilated and should be placed in such a position that the interior may readily be inspected and cleaned. Water supply pipes should be laid and fixed so as to be properly protected from frost and so that, in the event of their becoming unsound, the water conveyed in them will not be liable to be fouled or to escape without observation. Provision should also be made for completely emptying any exposed pipes and cisterns, or in emergency the entire system.

There should be no direct connection between any pipe or cistern from which water is drawn for domestic purposes or drinking and any water-closet or urinal.

All water-closets and urinals should be supplied with proper service cisterns and flush pipes which together are capable of providing a sufficient flush.

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* See also Appendix V for the requirements of the Ministry of Health, as stated in their Memo. 163, § VII.

APPENDIX I

PLAYGROUND AREAS SUGGESTED FOR PHYSICAL TRAINING IN SENIOR AND JUNIOR SCHOOLS

Size of School.	Normal Space.		Minimum Space.	
Seniors	With indoor accommodation.	Without indoor accommodation.	With indoor accommodation.	Without indoor accommodation.
One Form Entry (160 pupils).	1 pitch	1 court 1 pitch	2 courts	2 courts
Two Form Entry (320 pupils).	1 court 1 pitch	2 pitches	1 pitch	1 court 1 pitch
Three Form Entry (480 pupils).	2 pitches	2 pitches	1 court 1 pitch	1 court 1 pitch
Juniors.	With playing fields.	Without playing fields.	With playing fields.	Without playing fields.
One Form Entry (200 pupils).	1 pitch	1 court 1 pitch	2 courts	2 courts
Two Form Entry (400 pupils).	1 court 1 pitch	2 pitches	1 court 1 pitch	1 court 1 pitch

Notes.—(*a*) One court measures 110 × 60 feet = 6,600 square feet.
One pitch ,, 160 × 100 ,, = 16,000 ,, ,,

(*b*) " Indoor accommodation " means the use of a Hall or Gymnasium.

(*c*) The space suggested applies equally to single-sex and mixed schools.

APPENDIX II

NUMBER OF PITCHES, ETC., REQUIRED FOR SENIOR MIXED SCHOOLS

	Size of School.		
	One Form Entry (160 pupils).	Two Form Entry (320 pupils).	Three Form Entry (480 pupils).
Approximate Acreage of Playing Fields.	2–3 acres.	4–5 acres.	6–7 acres.
Football—Hockey.			
Medium 80 × 50 yds.	1	2	2
Small 70 × 45 yds.	1	1	2
Cricket, Rounders, Stoolball.			
Medium Radius 40–50 yds.	1	2	4
Small Radius 30 yds.	1	2	—
Rugby Touch, Shinty, Handball.			
60 × 30 yds. ..	1	1	2 (alternative to 1 football pitch).
Netball, Skittle Ball, Pillar Ball.			
100 × 50 ft. ..	1	1	2
Practice Goals	2	2	2
High Jump	1	1	1
Long Jump	1	1	1
Track for Athletic Practice.			
100 × 10 to 15 yds.	1	1	1

APPENDIX III

The schedules of accommodation suggested in paragraphs 24–29, which deal with the Senior School, and amplified in subsequent paragraphs are here set out for convenience in tabular form :—

Senior Schools with an annual entry of three classes (maximum roll 480).	*Senior Schools with an annual entry of two classes (maximum roll* 320).	*Senior Schools with an annual entry of one class (maximum roll* 160 *boys and girls). (See para.* 27).
(i) A Hall of 1,800 sq. ft. plus stage. (See paras. 26 & 31.)	(i) A Hall of not less than 1,800 sq. ft. plus stage. (See paras. 25 & 31.)	(i) A Hall of 1,250–1,500 sq. ft. or an additional practical room. (See paras. 27 & 31.)
(ii) A room for physical training. (1,800 sq. ft.) (See paras. 26 & 30.)	(ii) A room for physical training. (1,800 sq. ft.) (See paras. 25 & 30.)	
(iii) A Science Room of 960 sq. ft. or two rooms of 600 sq. ft. each. (See paras. 26 & 37.)	(iii) A Science Room of 960 sq. ft. or two rooms of 600 sq ft. each. (See paras. 25 & 37.)	(ii) One room for woodwork, metalwork and Science of 900 sq. ft. (See paras. 27 & 42.)
(iv) (*a*) In boys' schools accommodation for a full class for woodwork and metalwork in one room of 1,500 sq. ft. or in two rooms of 850 sq. ft. (See paras. 26 & 41.)	(iv) (*a*) In boys' schools accommodation for a full class for woodwork and metalwork in one room of 1,500 sq. ft. or in two rooms of 850 sq. ft. (See paras. 25 & 41.)	
(*b*) In girls' schools two rooms each equipped for cookery and laundry work of not less than 750 sq. ft. (See paras. 26 & 46.)	(*b*) In girls' schools two rooms each equipped for cookery and laundry work of not less than 750 sq. ft. (See paras. 25 & 46.)	

Senior Schools with an annual entry of three classes (maximum roll 480).	*Senior Schools with an annual entry of two classes (maximum roll 320).*	*Senior Schools with an annual entry of one class (maximum roll 160 boys and girls). (See para. 27).*
(c) In mixed schools one room for woodwork and metalwork of 850 sq. ft. and one for cookery and laundry work of 750 sq. ft. (See paras. 26, 41 & 46.)	(c) In mixed schools one room for woodwork and metalwork of 850 sq. ft. and one for cookery and laundry work of 750 sq. ft. (See paras. 25, 41 & 46.)	(iii) One room equipped for cookery, laundry work and needlework of 750–900 sq. ft. (See paras. 27 & 46.)
(v) Four practical rooms, one of 900 sq. ft. and three of 700 sq. ft. each. (See paras. 26, 49 & 52.)	(v) Three practical rooms, one of 900 sq. and two of 700 sq. ft. each. (See paras. 25, 49 & 52.)	(v) A practical room of 750 sq. ft. or a Hall. (See paras. 27, 49, 52 and 53.)
(vi) Six or seven classrooms of 520 sq. ft. each. (See paras. 26 & 34.)	(vi) Four classrooms of 520 sq. ft. each. (See paras. 25 & 34.)	(v) * Two classrooms of 520 sq. ft. each. (See paras. 27 & 34.)

APPENDIX IV

NOTES ON THE STAGE IN THE SCHOOL HALL

The design of the stage in the school Hall should be simple and inexpensive, but should conform to a few well recognised principles, viz. :—

(i) The platform should take up the full width of the Hall.

(ii) The depth from the front of the proscenium to the back wall should not be less than 20 feet.

(iii) An acting area of not less than 20 feet by 17 feet is desirable. If these overall dimensions and space for acting are secured there will be spaces of five feet on both sides for the switchboard and wings and a space of three feet between the backcloth and the back wall.

(iv) There should be exits from the stage, by doors about three feet six inches wide in the back wall (placed as near the side

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* One only in very small schools.

walls as possible), to rooms conveniently near for dressing purposes.

(v) The platform should be no higher than will enable a spectator in the back row of the Hall to get a good view; three feet six inches is a good height. The platform should be flat and the provision of access to a space beneath the stage is a convenience. This space is usually provided for storage of the chairs in the Hall.

(vi) An apron stage is useful for school plays. As the projection of the desirable width of five feet into the Hall would be out of the question, apron stages should be so constructed that they can be removed when not wanted.

(vii) A solid proscenium is not essential so long as curtains can be rigged to do the work of concealment of the wings and a deep pelmet cloth can be hung across the front to hide the ceiling of the stage.

(viii) The desirable height of between 15 and 20 feet above the stage will not always be practicable in a school Hall. A flat ceiling above the stage is necessary. An ample number of strong screw-eyes or other fixings should be provided and left projecting below the ceiling so as to provide points of support for battens to which curtains, backcloth, lights, and scenery can be hung, possibly on pulleys and lines.

(ix) There should be an adequate power electric cable run to the switchboard. A number of plug points distributed round the stage and wired to the switchboard will be found useful.

APPENDIX V

MEMORANDUM* BY THE MINISTRY OF HEALTH ON THE ARRANGEMENTS FOR DRAINAGE AND DISPOSAL OF WASTE MATTERS AND FOR WATER SUPPLY AT SCHOOLS

I—*Generally*

At a school, even where no one resides on the premises, provision will have to be made for the disposal and removal of the following matters :—

1st.—Excremental matters. (On the boys' side the urine may be in part dealt with separately from the fæces, but this will not usually be practicable on the girls' side.)

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* Memo. 163.—Published by H.M. Stationery Office, (1932). Price 3*d*.

2nd.—Waste water, as from lavatories, sinks and floor washing.

3rd.—Surface-water from roofs, yards, etc.

The best means for disposing of these several matters will vary in different places according to facilities of drainage and water supply and other local conditions, and in selecting the site and choosing the most suitable arrangements, careful regard will have to be paid to the circumstances of each case.

The drainage and closet arrangements should be planned on the general lines embodied in the model Byelaws of the Ministry of Health.

II—*Water Carriage System*

(*a*) Where an efficient system of public sewers and a constant water supply under pressure are available, water-closets should be provided and their contents conveyed into the public sewers by drains, which should also receive the liquid waste from urinals, lavatories, laboratory and kitchen sinks, and, where permitted, the surface-water.

Water-closets should be of a suitable and efficient type, with adequate separate flushing arrangements for each closet.

(*b*) Where a water supply for flushing is available but there are no sewers, if water-closets are adopted they should be drained either into a watertight tank with an overflow discharging on to an efficient filter or on to a suitable area of land for surface irrigation, or they should be drained into a watertight cesspool without overflow, as described below.

In no case can disposal of sewage or foul wastes by subsoil irrigation or any system of leakage into the subsoil or by its discharge untreated into a ditch or watercourse be regarded as satisfactory.

Where drainage is into a cesspool, rain-water should be excluded from the sewage with a view to lessening its volume, and avoiding the need for frequent emptying.

III—*Dry System*

Where sewers are available but no supply of water is laid on for flushing, it will generally be best to adopt some form of dry closet as described hereafter. Hand-flushed water-closets do not work satisfactorily. The foul waste water and urinal drainage should be discharged to a sewer if available, or to a cesspool.

(*a*) *Dry Closets.*—Where neither sewers nor water service are available, as is often the case in small villages, some form of dry closet will be necessary.

These closets may be of two types :—

(i) Closets with movable receptacles or pails. The pail should be of galvanised iron and wooden seats should be provided at such height that the tops of the pails come as close as possible to the seats. A slot should be provided to ensure that the pails, when placed under the seats, coincide with the hole in the seat. The floor should be of hard impermeable material suitably sloped to the front. A sufficient number of pails should be provided to allow of those which have been used being taken away, cleaned, washed out, dried and wiped with crude Cresol, paraffin or similar heavy oil. A receptacle for storage of dry earth, ashes or other absorbent and means of sprinkling this over the dejecta should also be provided. Where the pails are emptied by a local conservancy system, it may be possible to use a small quantity of Cresol solution—½ oz. to gallon of water—instead of dry absorbent. This process is useful in checking flies, but generally the use of chemical closets is not desirable.

(ii) Closets with fixed receptacles, on the lines set out in the model byelaws with respect to new buildings and certain matters in connection with buildings.

The receptacle should be of small capacity and watertight construction ; privies with large deep pits or open middens cannot be approved.

The bottom of the receptacle should be at least 3 inches above the level of the ground with arrangements to facilitate the application of dry earth or other absorbent and the removal of the contents. The absorbent may be dry earth, ashes, sawdust or peat-moss ; a shed or other suitable accommodation should be set apart for the drying and storage of the absorbent, and arrangements will have to be made for its supply and application. In some instances an arrangement known as the " Swanmore " or " Hampshire " system, in which the same earth is used repeatedly, has been found to work satisfactorily when careful attention is given to the proper carrying out of the process.

In the above cases (excepting the Swanmore or Hampshire) arrangements must be made for the periodical—preferably daily—removal and disposal of the night soil. This should be conveyed, without spilling, in a suitably covered water and airtight receptacle to a site where it can be disposed of without risk of nuisance or pollution. If it is to be dug into garden ground in connection with the school it is essential that a sufficient area of ground be provided and that no risk of the pollution of well water be caused.

(*b*) *Foul Wastes.*—Even where dry closets are provided and rain-water is separately dealt with, there will still be need for some means of disposing of foul waste liquid as from urinals, sinks, lavatory basins, lavatory sinks and wash pails. If sewers are not available these liquids may be taken by drains to a filter or irrigation area, or into a small cesspool constructed as mentioned hereafter.

In some instances, where there is no ground belonging to the school sufficient for the placing of a tank or cesspool, it may be necessary to use movable receptacles for the reception of waste liquids from lavatories, urinals, etc., the receptacles for urine being filled with some absorbent such as sawdust or peat-moss. Such expedients, of course, require constant attention—at least daily—if nuisance is to be avoided. In new schools and, where possible, in all other cases, sufficient ground should be provided to render resort to them unnecessary.

(*c*) *Cesspools Contents.*—This should be disposed of as often as may be necessary, in the manner described above in respect of night soil.

IV—*Surface Water*

Where there is no public water service, rain-water from the roofs may often be usefully collected for washing purposes, being softer than well water. Where not so collected, if there is no sewer into which to take it, it should be excluded from the sewage, and may be discharged in any convenient method, as into a ditch or water-course, or where the soil is porous, into a soakaway pit at a sufficient distance from the building so as not to cause dampness of the foundations.

V—*Teachers' and Caretakers' Houses*

Where possible, it is desirable that the sewage from the house should be dealt with by the same system as that from the school buildings, but where this is not feasible, one or other of the methods for the disposal of excretal matters and liquid waste already mentioned should be adopted.

Where sewers and public water service are not available, it is desirable that there should be in connection with the house plenty of garden ground on which to dispose of refuse matters.

VI—*Construction of Works and Supervision*

In connection with the drainage and sewage disposal works for schools, the following points should receive special attention.

(*a*) *Drains.*—The drains for foul water should be laid in straight lines between inspection chambers, and so as to be quite watertight; they should be properly ventilated and be disconnected, by means

of a trap in an inspection chamber from any cesspool into which they discharge. Should a drain have unavoidably to be laid near a well or other source of water supply, or under any building, the drain, if of stoneware pipes, should be surrounded with cement concrete at least 6 inches in thickness ; or should be of cast iron pipe with lead joints. It is desirable that pipes of 4 inches diameter should have a fall of not less than 1 in 48, and 6-inch pipe of not less than 1 in 60. A sufficient number of inspection chambers or rodding eyes should be provided and suitably placed to enable the drains from W.Cs. to be rodded and kept clear.

(*b*) *Cesspools* should have walls and floors so constructed as to be quite watertight and no overflow should be provided. They should be not less than 50 feet distant from the school or from any dwelling-house and should be as far as possible, and in any case not less than 60 feet, from any well or other underground scource of drinking water which might be in danger of being polluted by leakage.

Cesspools should be properly ventilated by a vent pipe and fresh air inlet and provided with a suitable pump, and should be in positions conveniently accessible by a tank cart for the purpose of emptying. The capacity should be at least one week's flow of sewage.

(*c*) *Sewage Disposal Works.*—The application should state the estimated daily volume of sewage for which the scheme is designed ; the dimensions and capacities of the works proposed ; and if the final effluent is to be discharged into a ditch or water course, a brief description should be given stating whether the stream has a continuous flow or dries up on occasions, and whether any water supplies are taken from it below the proposed outfall.

The sewage disposal works should be fenced in so that they cannot be interfered with by the children.

The capacity of tanks which overflow on to a filter bed need not exceed about one day's volume of sewage ; this may generally be assumed at 2½ gallons per head of the accommodation provided (including teachers) at the school, if water-closets are used ; or at 1 gallon per head where only urine and slop water have to be dealt with. Means should be provided for draining off and disposing of the sludge from the tank. Filter beds should not be less than 3 feet in depth, and the filtering medium should consist of some hard and clean material, care being taken that the liquid is evenly distributed over the surface of the filter bed by a suitable apparatus. Filters should in all cases have free outlets so as to drain the whole of the filtering media. When the effluent is discharged into a water-course a humus tank should be provided to intercept any solid

matter passing away from the filter. If no land treatment is provided, the area of the filter bed should be sufficient to deal with the liquid at a rate not exceeding 40 gallons per square yard per day for a filter three feet deep or at a proportionally greater rate for a deeper filter. When subsequent land treatment of the effluent is adopted, a rate of filtration twice as rapid as the above may be allowed and no humus tank is required.

(*d*) *Irrigation Areas.*—Where sewage is to be treated on land, without passing through a filter, a settlement tank of a capacity of about half-a-day's flow should be provided, and the tank effluent should be irrigated on the surface of the land.

Subsoil irrigation is not regarded as satisfactory.

Land for irrigation should have an adequate area and suitable soil, and should be at a sufficient distance from any inhabited building or sources of water supply, so as not to create a nuisance or to pollute the water. The available area and nature of the soil should be stated in the application.

(*e*) *Land.*—Where land outside the school premises is required for tanks, filter beds, irrigation, etc., its use should be secured by a definite legal agreement, and if the works are to be carried out by means of a loan the land should be purchased or leased, the purchase or lease being made conditional on the Ministers' sanction being obtained to the loan.

(*f*) *Need for Supervision.*—It is very important that the sanitary arrangements of schools should be kept in a cleanly and proper condition, not only for the sake of the health of the children while at school, but also as an object lesson in cleanliness which they may carry into practice in their own homes. But this cleanly condition cannot be maintained without supervision. It may be necessary to employ an efficient attendant to see to the cleanly keeping of the sanitary conveniences as well as of the school premises generally. This will be especially necessary at schools where, in the absence of sewers and water service, methods have to be adopted which involve hand removal. Thus, where dry closets are adopted, it will be necessary to appoint someone to supply absorbents, to empty the closets at frequent and regular intervals—say every Saturday, or more often if necessary—and to remove the contents to a suitable place of deposit. Where a cesspool is used the contents will have to be pumped out from time to time and distributed over land in a proper situation. Filter beds and irrigation areas will also need supervision from time to time to keep them in proper working order.

Where a public supply is not available, and a supply from a spring, well or bore is proposed, the quantity of water required for a school may be estimated at about 5 to 7 gallons per head per day as a desirable standard in order to provide against exceptional droughts and other contingencies.

The application should be accompanied by the following particulars :—

(*a*) An Ordnance Map showing the position of the proposed source.

(*b*) Information as to the probable strata and depth for a well or bore.

(*c*) Information as to any necessary way-leaves and terms of acquisition of any water rights.

(*d*) Analyses, chemical and bacteriological, as soon as samples of the water are obtainable.

(*e*) A brief report by the County M.O.H. as to the purity and sufficiency of the supply and any risk of pollution.

Where other suitable sources are not available rain-water may, with advantage, be used. The use of such a supply will necessarily be restricted, e.g., the provision of water-closets would usually be inadmissible.

The storage tank should be of adequate size having regard to the rainfall of the district and roof area available and the estimated consumption. There is necessarily great uncertainty in regard to the rainfall, and it is suggested that a minimum of 40 days' storage, at a restricted consumption of one gallon per head, should be provided.

The tank should be constructed of impervious material such as concrete or metal and the use of wooden water-butts should be avoided ; the rain-water pipe from slate or tile (not metal) roofs should discharge within the tank ; the supply tap (if above ground) or suction of the pump (if below ground) should be about 3 inches above the bottom to minimize the disturbance of sediment ; the tank should be ventilated in such a way as to exclude birds or animals, and should be provided with adequate means of access and clearing out. The over-flow should be to the open air and not directly connected to any drain, and in such a position as not to cause dampness to the building. The over-flow must be designed so as to prevent access to the tank by mice or vermin.

If constructed wholly or partly underground the tank should be not less than 60 feet from any cesspool or privy, or any area used for digging in their contents, or from any dung heap ; the tank should be lined with impervious material and the sides brought at least 6 inches above the highest part of the adjacent ground. The cover if above ground should be of more permanent material than wood ; and if below ground should be of impervious material with a covered manhole brought 6 inches above ground level.

The roofs, gutters and downpipes used for the collection of the water should be inspected and cleaned from time to time, and the tank should be emptied and cleaned out at least once a year, preferably in the winter months.

Filters should be provided and all rain-water used for drinking should be filtered.

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