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SOUTH AFRICAN ARCHITECTURAL RECORD

THE JOURNAL OF THE CAPE, NATAL, ORANGE FREE STATE AND TRANSVAAL PROVINCIAL INSTITUTES OF SOUTH AFRICAN ARCHITECTS AND THE CHAPTER OF SOUTH AFRICAN QUANTITY SURVEYORS

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VOLUME 36

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THE DESIGNING TEAM: Members of the Architects' Collaborative (T.A.C.) who designed Harvard University's new Graduate Centre, on the stair of the Harkness Commons building. They are, from left to right: Mrs. Sarah Harkness, Mrs. Jean B. Fletcher, Robert S. McMillan, Norman C. Fletcher, Professor Walter Gropius, John C. Harkness, Benjamin Thompson and Louis A. McMillen.

The Graduate Centre, Harvard University, Cambridge, Massachusetts

A description by C. Herbert

Problem: A group of buildings to provide living accommodation, social and recreational facilities for 600 graduate students in law, arts and sciences, divinity, design and education, at Harvard University.

Site Location: The site is an area of old Cambridge, an independent city within the Greater Boston Area, Massachusetts It is bounded by three streets, and is flanked by various engineering, nuclear and computation laboratories, and the Harvard Law School. Cambridge is a small city much on English lines, situated on the beautiful Charles River. Much of its area is taken up by various educational institutions, including Harvard University (containing, after William and Mary College in Williamsburg, probably the oldest college in America), Radcliffe College, and the Massachusetts Institute of Technology.

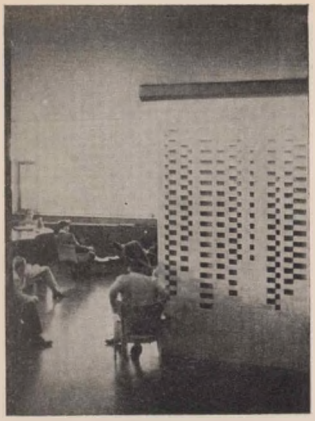
Solution: The primary problem in the extension of an existing university is the preservation of the character of the complex as a whole. Harvard is one of the "Ivy League" universities, and, as the name implies, its chief charm lies in its ivy-covered buildings set romantically in green lawns and tall trees. Its buildings have been erected over a very long period of time, and architectural character varies considerably. Nevertheless, the setting, age, and a liberal encrustation of ivy have combined to give a unity to these various buildings, and it is legitimate to speak of a definite Harvard "atmosphere."

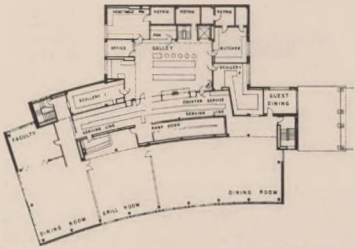
The architects of the Graduate Centre decided, on analysis, that this Harvard "atmosphere" depends primarily upon the grouping of the various buildings, and the nature of squares and quadrangles they enclose. While the architecture of the Graduate Centre is, both in construction and material, completely contemporary, yet in siting, the grass-covered, tree planted quandrangles of old Harvard have been repeated, and the new sits in comfortable and sympathetic relationship to the old.

The architecture of the various dormitory blocks, linked by covered ways, and the Harkness Commons building, is simple and straightforward, with no tricks or frills. Its simplicity is the simplicity of virility, directness and precision that one has come to expect from the master hand of Walter Gropius. Yet, if the exteriors show the influence of the European style of the thirties in the overall conception, yet there is much in their

OPPOSITE: General view looking North-West across the sunken court, with the Harkness Commons building at left and dormitory blocks 1 and 2 in the background. Visible at right is dormitory block 3 which contains meeting rooms, etc., on the ground floor. BELOW: View looking West across the sunken court with the Harkness Commons building in background and portions of dormitory blocks 1, 3 and 4 at right. The sunken court when flooded in winter may be used as a skating rink.

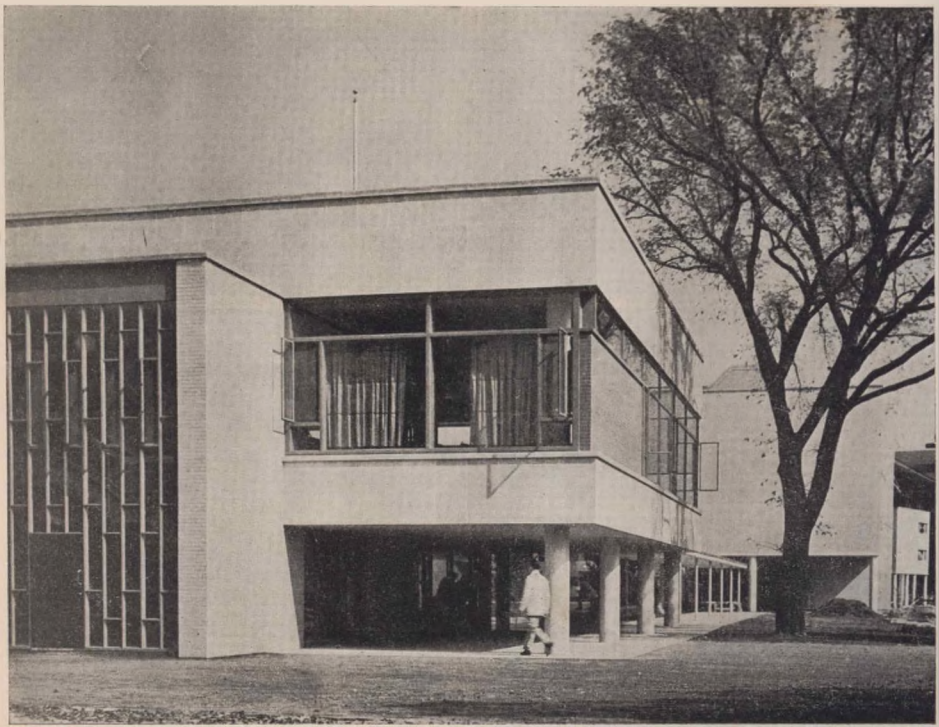


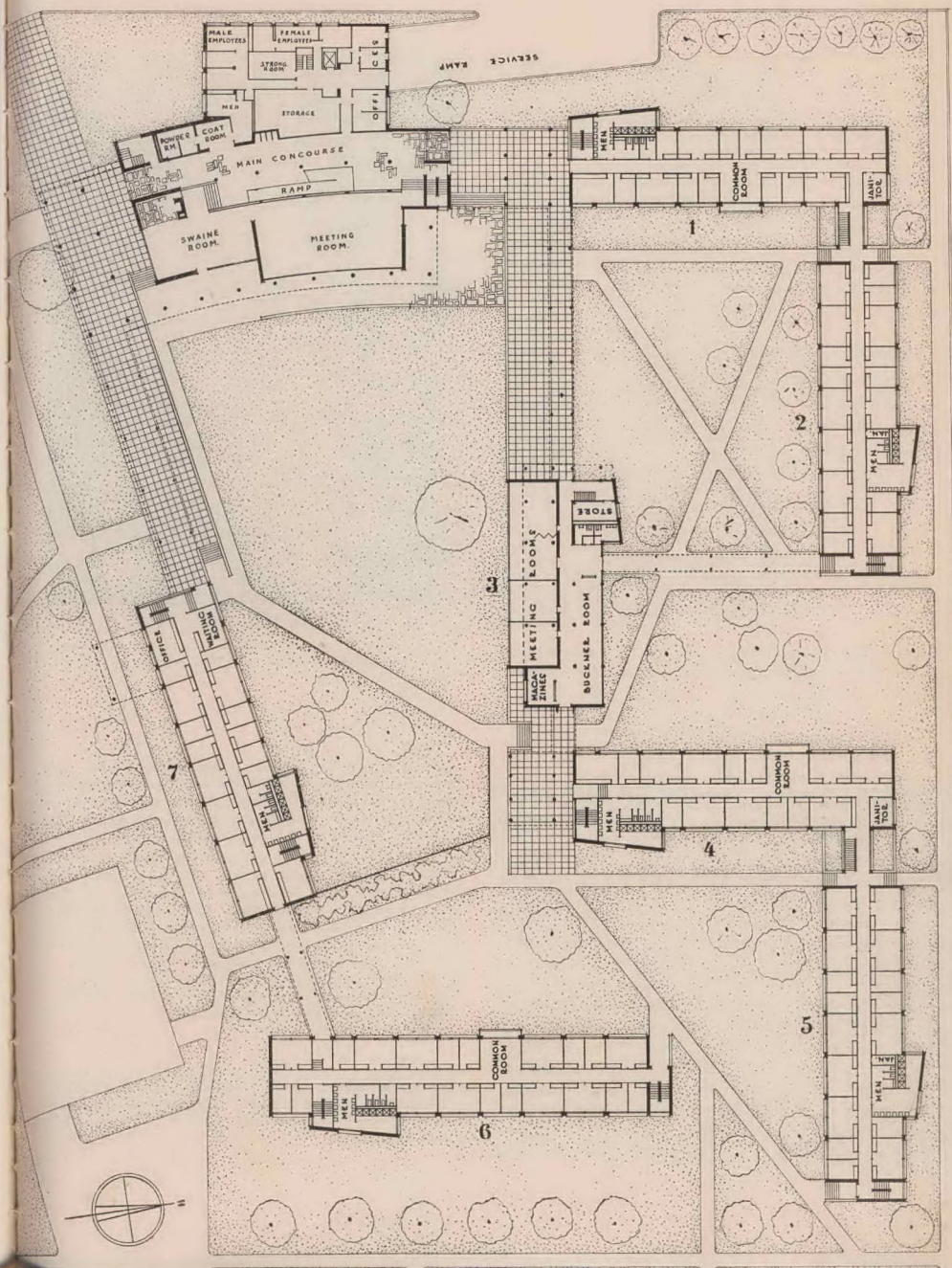




ABOVE: Upper floor plan of the Harkness Commons, which is shown related to the ground floor plan on the layout opposite. OPPOSITE: The layout of the new Graduate Centre, with the Harkness Commons at the top containing dining and meeting rooms and administrative offices, and the seven dormitory blocks. Further meeting rooms occur on the ground floor of block 3, the upper floors being dormitory accommodation.

LEFT: The rear wall of the fireplace in the Swaine Room with brick sculpture by Josef Albers. BELOW: Detail of the Harkness Commons, looking East. Limestone facing slabs and light coloured facing bricks are used on the exterior surfaces.




MALE EMPLOYEES
FEMALE EMPLOYEES
STRONG ROOM
OFFICES
SERVICE RAMP
MEN
STORAGE
POWDER RM
COAT ROOM
MAIN CONCOURSE
RAMP
SWAINE ROOM.
MEETING ROOM.
MEN
COMMON ROOM
JANITOR
1
2
MEN
JAN
STORE
3
MEETING ROOMS
MAGAZINES
BUCKNER ROOM
OFFICE
WAITING ROOM
7
MEN
COMMON ROOM
MEN
JANITOR
4
5
MEN
JAN
COMMON ROOM
MEN
6

finish, and especially in their interiors, with fine richness of colour and detail, which show that although Gropius has had a great influence upon the American members of the Architects' Collaborative, yet they in turn have unmistakably influenced his work in return.

The Graduate Centre is a sophisticated building of the New Architecture. It has much of the hallmark of the 30's about it. Yet, in its use of materials, of slate and textured brick and wood veneers, in its use of warm rich colours, it is a transfigured New Architecture, a new architecture which has added to the breadth of its original conception a new dimension of humanity.

Planning: The Graduate Centre consists of eigth buildings, linked at ground floor level by covered ways, and in two cases by glassed corridor and stair links. Six of the buildings are dormitory blocks, of either three or four storeys each, all planned on similar lines, having a central corridor flanked on either side by double rooms. These are so arranged that where desired they can be split by a simple partition into two single rooms.

On each floor there is a toilet and ablution block adjoining the stairs, and a common room, with projecting balcony, separated from the corridor by a corrugated glass screen.

In addition to the six dormitory blocks there is a seventh, in the heart of the scheme, which has its ground floor devoted to various meeting rooms.

The eighth building is the Harkness Common Building, which is a two storey structure. On the ground floor the main accommodation is a large concourse, and several lounges and reading rooms, glass-fronted and facing onto a sunken court, which is grass-covered in summer, but flooded in winter to provide a skating rink. From the concourse a gentle ramp rises to the floor above, where one passes past a long serving counter into the dining rooms, which are a grill room, a students dining room, and a staff dining room. From the dining rooms a direct stair leads out of the building, so that while students are passing up the ramp at meal hours, no down-traffic need occur.

Generally, planning is direct and simple. Architectural excitement is confined to the Commons building, as regard shapes, variations of colours and texture, rich materials, decoration, and changes of level. Aspects across the courtyards from all buildings are most pleasant, but orientation does not seem to have been a major consideration, as several blocks face both north and south.



Detail of block 4 looking south. Light coloured facing bricks are used on exterior surfaces, with limestone facing on the connecting link between this building and block 3 seen at right.

CONSTRUCTION: *Commons Building:* Steel frame fire-proofed with reintarced concrete floors. *Dormitories:* Reintorced concrete frame with two-way slabs and no internal beams. All buildings are faced partly in face-brick and partly in buff-coloured limestone. *Covered links:* Flat concrete slabs supported on 5" diameter steel lally columns.

FINISHES: *Commons building:* Floors to main lounge and dining room—rubber tiles; Ceiling to dining rooms—sprayed acoustic tiles; Ceiling over serving counter—aluminium eggcrate; lighting to dining rooms—continuous fluorescent strip lighting recessed into ceilings, with metal baffles; Panelling to concourse—oak vertical siding, tongued and grooved and V-jointed; Panelling to grill room—redwood; Panelling to fireplace alcove—sliced walnut; Ramp—reinforced concrete; Curved wall in concourse—matt-finished mosaic tiles; Screen at head of ramp—aluminium with translucent coloured plastic inserts.

The building is mechanically ventilated.

Dormitories: Floors to corridors—rubber tiles; Floors to rooms—asphalt tiles; Dividing partitions—painted cinder blocks; Wall finish to toilets—glazed tile; Panelling in meeting rooms—birch veneer plywood; Panels under windows—insulated steel; Ceilings to all rooms and corridors—accoustic tiles.



Photography: All photographs were taken and supplied by Walter R. Fleischer, except the interior on Page 78, which was taken by G. Herbert.

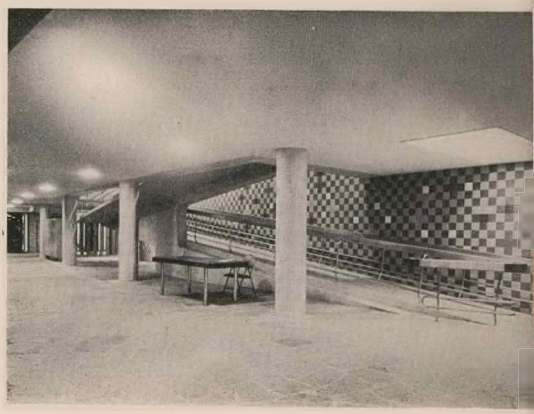
ABOVE: General view of the Main Concourse in the Harkness Commons. The panelled wall at left is finished in oak strips tongued, grooved and V-jointed. The wall on the right, flanking the ramp, is surfaced with matt surfaced glazed tiles to the design of Herbert Bayer. BELOW: Detail of the reinforced concrete ramp leading to dining rooms above.

Decoration: Mural in the staff dining room by Herbert Bayer; Mural in dining room by Joan Miro; Wood mural in grill room by Hans Arp; Stainless steel sculpture in sunken court by Richard Lippold; Mosaic tiled wall by Herbert Bayer; Brick sculpture on fireplace by Josef Albers; Interiors, colours and furniture by The Architects' Collaborative.

COSTS: *Commons building*: 420,000 cu. ft. for a total cost of $661,319, or $1.57 (11/3d.) per cubic foot. *Dormitories* (including links): 1,503,800 cu. ft. for a total cost of $1,783,043 or $1.18 (8/5d.) per cubic foot.

The cost worked out at $5,000 (approx. £1,785) per student, including all fees, site work, landscaping, furnishings, dining and recreation facilities for 600 students.

ACKNOWLEDGEMENT: The author wishes to acknowledge the great kindness and ready co-operation of Professor Gropius and Mr. Norman Fletcher, of the Architects' Collaborative, and Mr. Walter Fleischer, of the Harvard News Office, who supplied many of the facts and photographs incorporated in this article.



THE STUDY AND INTERPRETATION OF REGULATIONS 1-28 OF THE FACTORIES, MACHINERY AND BUILDING WORK ACT 22 OF 1941

SECOND PART

BY T. L. PEAGAM

The substance of this paper was originally delivered as an address to the Institution of Certificated Engineers at Kelvin House, Johannesburg, and was published in the Proceedings of that Institution. In view of the obvious interest which the matters dealt with hold for Architects, the Institution kindly acceded to the request for permission to reproduce this paper. We are also indebted to Mr. Peagham, who has substantially re-written the paper in order to cover those matters which are of particular concern to the Architect.

LIGHTING

Regulation 14. If eye strain and its consequent fatigue and inefficiency are to be avoided certain conditions are required for the eyes and this regulation lays down certain minimum requirements as regards the illumination, both natural and artificial, to which all factories and workrooms are expected to conform.

The initial provisions of this regulation are in regard to natural light and these are:—

(a) In all factories coming into existence after September, 1941, the means of obtaining natural light shall be equal to not less than 15 per cent. of the floor area and shall be suitably diffused.

(b) All factories pre-existing at this date are excluded from the foregoing provision subject to the means of obtaining natural light in the factory being equal to not less than 10 per cent. of the floor area, and subject to this being supplemented by artificial lighting approved by an inspector.

The lighting of a factory or workroom is all too often a neglected or an ill-considered item but it is a matter which should receive the special attention of occupiers and architects since it has a direct and important bearing on the health, safety and efficiency of the worker and on the general quality of the work.

In assessing the adequacy or suitability of the lighting of a factory or workroom probably the two main points that I consider are:

(a) That there are no lighting conditions prejudicial to the health, comfort and safety of the workers; and

(b) that it is sufficient for the proper carrying-out of the activity under consideration.

Two separate problems are involved with natural and artificial means though the same fundamental principles apply to each. The two problems, however, are quite distinct owing to the differences in character of the two kinds of light. In particular, in natural lighting, the positions of the sources, i.e., windows, etc., are definitely fixed and depend on the size and shape of the rooms whereas with artificial lighting there is almost unlimited scope in arrangement of sources. Their characteristics differ also in that natural light varies but artificial lighting remains constant.

Natural lighting is that provided by solar radiation, in other words daylight. This type of lighting is, as stated, extremely variable, being influenced chiefly by the season, time of day, meteorological conditions and the extent of the sky visible from within the building.

The problem of ensuring satisfactory natural lighting within buildings appears to be little understood or appreciated in technical circles generally and reliance is thus placed on such arbitrary rules as providing means of obtaining natural light (usually glass in windows) equal in area to a percentage of the floor area. The result is frequently a building improperly lighted with respect to all aspects of natural lighting.

This same rule as we have seen guides us in the regulations on this point. South Africa unfortunately has no standards of natural lighting design or performance and the design therefore depends upon the views of the architect, builder or occupier influenced by such factors as the roof pitch, nicety of balance between the solids and voids in wall surfaces and, of course, the factory inspector.

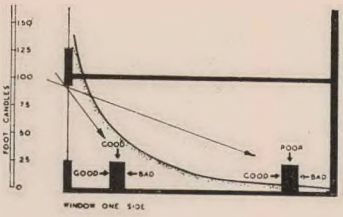
The natural illumination indoors depends principally upon the area of sky visible from each particular point of measurement and upon the transmission factor of the type of glazing used in the windows. Obstruction, which is a big factor, will depend on the types of window used and their maintenance, roof construction and adjacent buildings if any. The average loss due to dirt is taken as 10 per cent. to 20 per cent., but is considerably higher where dirty processes are carried on inside and outside the building.

At present new factory constructions usually receive a fairly well regulated amount of daylight distributed by continuous glazing in sawtooth, monitor or clerestory roof design or by the provision of roof lights or, more latterly, perspex roof sheeting. Direct sunlight entering through any of these means is to be avoided whenever possible however, and the principal reason for the wide adoption of south lighting of industrial buildings in our hemisphere, is to avoid the problems that arise from glare and from solar radiant heat.

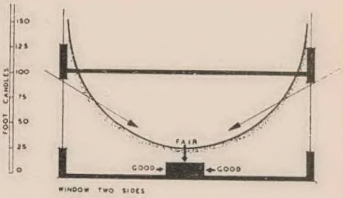
Figs. III—VII show how construction may influence lighting.

* * *

For a long time windows in walls were accepted as the usual method of lighting industrial buildings and in multi-

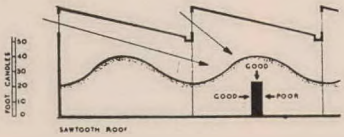


A—In rooms with windows on one side only it is impossible to have even illumination on the horizontal plane, and in wide rooms inner areas are poorly lighted.

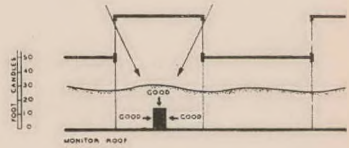


B—Cross-lighting from windows on opposite sides of a room helps to overcome deficiencies seen in A.

Fig. III

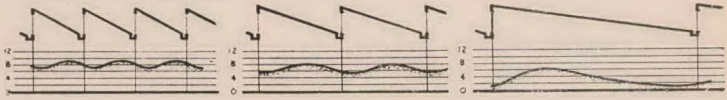


C—A workable ratio between maximum and minimum illumination values on the horizontal plane can be achieved with carefully-designed sawtooth roof-lights.



D—Even distribution of illumination on both horizontal and vertical planes can be obtained with monitor roof-lights of suitable proportions.

Fig. IV



A—*Influence of Variations of Truss Span.* Decreasing the span increases the minimum daylight-factor more rapidly than the maximum.

Fig. V



B—*Influence of Variations of Glass Height (i.e., height from floor to bottom edge of glass).* The distribution and value of the illumination is affected by the height of the glass above the working plane, a height in correct proportion to the span is necessary for successful design.

Fig. VI



C—*Influence of Variations of Glass Area.*

Figures V, VI and VII. *Influence of building proportions on the natural lighting performance of sawtooth roofs.* The performance of sawtooth roof lights is governed by three basic dimensions, (a) the span of the truss, (b) the height of the glass above the working plane, and (c) the area of glass in the roof lights. Each of these is illustrated in relation to a contour line showing the variation in the level of lighting on the horizontal plane in terms of the daylight factor.

Fig. VII

storeyed buildings to-day they must still be the main source of daylight.

Because an increase in the size of such windows will almost always result in increased illumination it came to be assumed that the specification of a certain glass area proportionate to the floor area would ensure satisfactory illumination, but this is not always so in buildings to-day.

The importance of the size of windows is closely linked with the depth of the room from the window wall, the shape and position of the windows and the existence of internal and external obstructions to light.

Changes in illumination due to the different shapes, positions and obstructions of windows all follow quite logical rules and a knowledge of them alone ought to go far towards ensuring good design practice.

Generally speaking, area for area of glass the high window is much more efficient, giving rather more daylighted area in the zones bounded by lines of equal illumination and allowing much more light to penetrate into the interior of the room.

When an area of glass is divided up into two or three windows, closely spaced, along one wall, as compared with one large window, the effect is to divide up and reduce the penetration of light in the areas of high intensity but the lower illuminations overlap and their penetration is not much affected.

The daylight contour from a window which is obstructed by a balcony overhead has a slightly reduced spread, due to the fact that the obstruction continues on either side of the window.

The sill height of a window above the floor level affects the peak illumination on the working plane against the wall. The higher it is above the working plane the lower will be the illumination directly beneath it but the values in distant parts of the room are raised slightly. Sawtooth and monitor roofs are examples of this but it is not an uncommon occurrence with windows in side walls.

Small windows in large wall areas cause excessive contrasts in brightness between the window openings on the wall surface. These contrasts are less likely to occur with continuous long windows. Figs. X and XI illustrate what I mean.

Obstructions, as we know, have a marked effect on daylight illumination and finally may cut it off altogether. If the obstruction has a horizontal sky-line such as when a continuous row of buildings stand opposite a window—then in cross-section the maximum penetration of daylight will be determined by a line through the top of the obstruction and the window head. Where this cuts the working plane a line can be drawn from beyond which no sky can be seen and where lighting may be said to be below the required minimum.

Fig. XII is an example of this.

The saw-tooth and monitor windows of modern factory construction permit an adequate and more uniform daylight illumination of the entire floor area and are desirable when practicable.

When rooms are illuminated through side windows it is often difficult or impossible to light satisfactorily all parts of the floor. If only one wall contains windows the width of the room perpendicular to this wall should be less than twice the height of the top of the windows above the floor; if windows are in two parallel walls the width of the room between these walls should not exceed six times this window height.

A monitor roof lighting gives best results when its width is about one-half the width of the building and the height of the windows in the monitor is one-half the monitor width.

In sawtooth roof construction the height of the windows should be equal to at least one-third of the span.

These are not rigid rules, but may safely be used as guides in assessing light penetration values on plan or when inspecting premises. The actual penetration differs with the aspect of the building, in the Southern Hemisphere north lighting has a much better penetration value but this is offset by the glare and heat that this aspect produces.

The lay-out of plant machinery in relation to north-facing windows should receive careful consideration. Wherever possible they should be placed at right angles to the windows or roof lights in a saw-tooth roof to ensure that the light falls on the task without subjecting the worker to direct or reflected glare.

Figs. VIII and IX picture actual contrast conditions of this nature.

When the production line is run parallel to the lighting one side will be well lighted but the other side will be in shadow except in the case of monitor rooflighting.

FACTORS INFLUENCING DAYLIGHT ILLUMINATION

(1) *Size of windows*—the larger the window the better the lighting

(2) *Size of glazing bars, frames, etc., in a window*—the contributing factor to daylight in a building in the *actual glass area*, not the total window area.

(3) *Shape of windows*—long low windows have different lighting effects from narrow high windows.

(4) *Position of windows*—i.e., near the floor or near the ceiling—vertical, sloping or horizontal glass.

(5) *Type of glass used*—different glasses have different transmission factors, e.g., clear sheet glass, 91 per cent.; wired rough cast, 79 per cent.

(6) *Maintenance of windows*.—Clean windows are always better than dirty ones. Accessible windows are more liable to be kept clean than inaccessible ones (in case of high saw-tooth or other window construction special provision may have to be made for cleaning of glass area). Vertical windows are much cleaner than sloping or



Fig. VIII. The running of assembly benches at right angles to the roof lights ensures that the light falls on the task without subjecting the worker to direct or reflected glare. Undesirable conditions would arise if employees were required to face directly into the roof-lights while working.

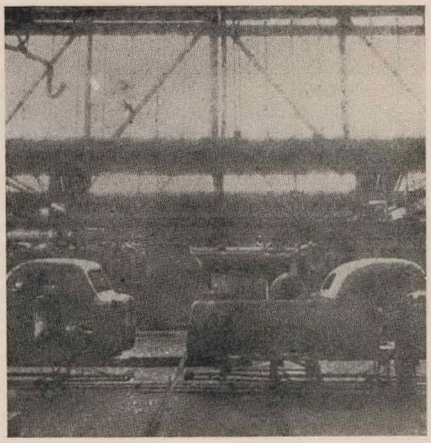


Fig. IX. When the production line is run parallel with sawtooth roof-lights, one side of the product will be well lighted, but the other side will be in shadow.

horizontal windows. Fig. XIII pictures a suitable cleaning arrangement.

(7) *Obstruction*, i.e., proximity of other buildings and their height, inside obstruction by partitions, machines or plant or storage either against walls or across roofbeams under sawtooth or rooflight lighting.

Siting of buildings should be arranged with a view to having minimum obstruction and obtaining maximum light. This normally results in a compromise with arrangements for production purposes.

Hard and fast rules are not possible but it may be taken that on the average staggered buildings give less obstruction than other arrangements, e.g. parallel.

* * *

Before passing on to the question of artificial lighting there are some points in regard to specific industries or processes and natural lighting on which the regulations are silent; I wish to say a word or two in lieu thereof.

As we all know there are a number of processes in industry to-day to which it is essential that only a small amount of natural light should be permitted to enter and even from which it should be excluded altogether; in some cases such as photographic dark rooms only a special kind of artificial light is tolerated. Wine and vinegar maturing rooms do not want natural light, portions of tanneries need only a small amount, inactive storage spaces have only a minimum requirement and there are probably many other instances such as these which are not provided for in the regulations. The answer is that each

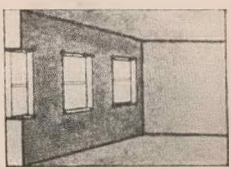


Fig. X. Extreme brightness contrast.

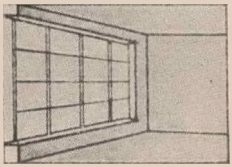
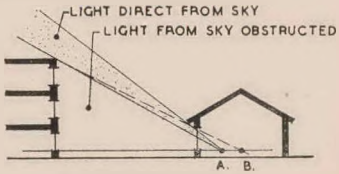


Fig. XI. Comfortable brightness contrast.



A—Daylight partly obscured.
B—Daylight completely obscured.

Fig. XII. Obstruction of direct light from the sky.

case is dealt with on its merits and if the process or use of the particular room or section concerned does in fact and necessarily need to reduce or eliminate the entry of natural light then there is no question about the relaxing of the requirements to suit the needs of the process involved. In respect of store rooms usually a minimum window area of 10 per cent. is required. In regard to door area and natural light the regulations are specific on this point to the effect that only such portions as are made of glass can be included.

To-day *Artificial Lighting* is part of the system of seeing and is no longer used in the old sense of being a substitute for daylight. To maintain good seeing conditions artificial lighting must be supplied when daylight fails, as on dark or cloudy days, for night work, for that period at twilight or dawn when it is not possible to obtain sufficient natural light or for those areas where an insufficient quantity of daylight penetrates.

The Factories Act makes the following provisions in regard to artificial lighting:—

(a) *Regulation 14(2).* In pre-existing buildings as mentioned supplementary artificial light as approved by an inspector must be installed.

(b) *Regulation 14(3).* No person may be required or permitted to work at night unless there is adequate artificial lighting.

(c) *Regulation 41(1).* Where natural lighting at any machinery is deficient or where machinery is used at night artificial lighting shall be installed so that external moving parts can be clearly distinguished.

(d) *Regulation 41(2).* Artificial light shall be so placed or shaded as to prevent direct rays from impinging on the eyes of the person operating the machine, in a manner which interferes with the efficient, or convenient performance of his work.

With these regulations we have our old friend's adequacy and approval or opinion of the inspector, but there is also some guidance on these points to be found in the detailed requirements of Regulation 41(1) and (2) as we have just seen.

The conditions determining whether a proposed or given system is satisfactory or not are very complex and vary with the class of work being carried on and it is only within my province to enunciate certain fundamental principles. Occupiers who have reason to think these are not fulfilled should consult a lighting engineer with special experience of industrial conditions.

The conditions to be fulfilled may be summarised under the following four headings:—

(a) The lighting sources should not be productive of glare.

(b) The light should be sufficiently intense.

(c) The light should not be productive of disturbing contrasts and therefore should not form harsh shadows capable of interfering with the vision, and should not be subject to unequal distribution.



Fig. XIII. The cleaning of sawtooth glass areas is made simple and safe by the use of a mobile cage, which can be moved by the window-cleaner as he works. The cage runs on grooved pulleys along the upper monorail, and guide pulleys in contact with the lower rail keep it steady during the cleaning operation.

(d) The light should be economical.

To provide some guidance and assistance in meeting these requirements there are certain approved types of reflectors which are designed to fulfil the statutory requirements and, other things being equal, take care of such things as glare, distribution and concentration. These are the dispersive reflectors for general lighting schemes which ensure the required minimum cut-off angle up to certain mounting heights and the concentrated and deep bowl shades for local lighting in specific areas or at machines.

In regard to the matter of intensity, the almost universally accepted unit of illumination is the footcandle and the illumination required for any particular process or type of work may be readily obtained by reference to the Inspector who has been issued with a schedule of recommended illumination levels

HYGIENE—WELFARE

Because of their relationship under this heading I am grouping Regulations 15, 16, 19, 20, 21, 22, 24 and 17 in that order.

In any industrial organisation questions of the human needs

and social relationship of the people engaged in it are bound to arise and must be considered alongside the technical requirements of production so that when talking of working conditions one refers not only to such things as ventilation, lighting, factory lay-out, etc., but also to the employee amenities and their ancillaries, which are generally dealt with under the name of Welfare.

It has been said by some that employees are expendable and not to be considered or specially provided for as regards safe and healthy conditions of work and amenities and that profit is all that matters.

Experience and practice by many progressively-minded employers has proved this wrong time and again, because, apart from any moral or humanitarian aspect, good, clean, healthy conditions of production mean good business, more dividends and greater profit.

Whatever individual feelings on the matter may be, however, the legislation we are discussing here which covers employees in industry is specifically designed to insure a minimum standard of conditions favourable to the general well being of all factory workers and as such it must be complied with. As a matter of fact our industrial legislation only enforces what the good employer has already practised for years, i.e., legislation lags behind good practice.

Modern industrial practice and legislation aim at enabling all workers in factories to go to work decently clad, change in well-appointed change and locker rooms, work under hygienic, safe and congenial conditions, have their meals in clean and neat dining-rooms, and wash, shower and change before returning home.

In practice this question of amenities is largely one of education; education of the worker, education of the employer and even education of the inspector. The Act is again silent in regard to some details about amenities and in other directions lays down minimum requirements such as ratios and sizes, but it permits the inspector a good deal of scope with those argument-producing words, "adequate," satisfactory," "suitable," "approval of the inspector."

Before proceeding on to the detailed requirements as contained in each regulation, there are a few points which should be raised at this stage.

PLANNING: ACCIDENT PREVENTION AND FATIGUE

Although it does not rightly belong here I am discussing this aspect of planning at this stage because it does come under the subject of Welfare.

There is no more effective means of preventing accidents (including damage to plant) and reducing fatigue than by good factory lay-out. Quite apart from the requirements of the Factories Act due allowance should always be made for the adequate and safe handling of material and control of traffic within the factory. Because of the number of accidents that occur when handling and transporting material, the lay-out of aisles and traffic ways and care in the design of stairs, ramps and floors generally are important.

Things to be avoided are doorways opening directly on to traffic ways, blind corners and blind intersections. It should be borne in mind that accidents are bred when workers are subjected to discomfort or constraint. The employee who must work in a constrained posture or face a glaring light, or who is subjected to noise, heat, cold or to irritant vapour or dust is predisposed toward accidents both physically and mentally.

Hand rails should be provided on *both* sides of stairs otherwise traffic tends to keep to the one side and if persons trip or fall on the side without a rail they have little chance of recovering themselves. Proper permanent gangways and ladders should be provided to give safe access to cranes and the space at the foot of such ladders should be protected against traffic

Drinking fountains and notice boards should not be placed in traffic ways or where suspended loads are carried overhead.

There should be space to allow the loading and unloading of material and its handling in and out of machines without interference with adjacent employees.

Proper facilities for the removal of waste products from machines, processes and the factory are often even more important to the avoidance of accident than the handling of the finished material.

FACTORY GROUNDS

There are still many instances where better use could be made of the unoccupied land within factory boundries. Roadways are not always adequately planned while free open spaces are not always used to best advantage or not used at all.

Roadways, car-parks etc. need to be properly graded and drained and constructed for the type of traffic they will have to carry. Surfaces which do not produce dust and are easy to hose down are particularly desirable outside factories where cleanliness is important to the process.

It is in the interest of accident prevention that pathways should be kept in good repair, free from puddles and cracked or broken surfaces and that the grounds should be adequately lit after dark where night work is involved. Where a factory is built well back from the street and employees have to wait about for transport, some sort of shelter against bad weather may be needed. Racks or sheds for bicycles may also be required outside the factory at some convenient point between the gate and the work-place.

Whenever space permits, the preservation of attractive natural features and the planting of grass, shrubs and trees will not only do much to prevent dust nuisance but will also greatly improve the appearance of the factory and encourage a general appreciation of order and tidiness. However small in area, gardens contribute to the well-being of employees by attracting them into the open air and sunshine during meal breaks.

CONSULTATIONS

Where additions, alterations and more particularly new premises are involved a great deal may be accomplished towards improvement in these matters by architects, engineers and occupiers consulting with the inspector on the project when it is still at the embryo stage.

SITUATION AND ARRANGEMENT

Amenities, and by amenities I mean sanitary and washing accommodation, changerooms, rest rooms and mess or dining rooms, can be planned satisfactorily only in relation to the factory as a whole and it is only by planning with this in mind that all the benefits to be expected from good amenities have a chance of being realised in practice.

Changerooms for instance are best located near the entrance to the factory with the sanitary block both convenient to them and accessible from the work place. In very large establishments it may be desirable to decentralise and provide each department with its own amenities at least as far as changing rooms, WC's and washing facilities are concerned. This would be desirable too, for instance, in factories with a mixture of processes such as clean, safe work and dirty hazardous work involving toxic substances.

Where very hot processes are involved such as foundries, melting shops, rolling mills, etc., all these facilities should be as close as possible to the department or section concerned to obviate or reduce exposure to sudden change in temperature.

The relationship of amenities to each other is also important, mess or dining rooms should not be too near sanitary arrangements or dirty processes and it is very desirable in many instances to so arrange things that workers have to pass the washing facilities to enter the mess room.

The management must ensure too that it is possible at all times to enter and leave the amenities safely, easily and quickly.

USE AND MISUSE

This is a problem confronting the management and the inspector daily and whilst theoretically the solution is fairly clear and easy, practically it presents many difficulties. The cause is not infrequently due to disregard of the points of planning just mentioned, quite often the management is at fault because the places are not kept clean or are used as storerooms and even workrooms (admittedly this is sometimes brought about because of the rooms concerned being not used or neglected by the workers but usually the reverse is the cause), vandalism rears its ugly head on occasion and if caught in the act can, of course, be easily and summarily dealt with, a kind of class distinction arises at times so that certain types of workers will not share facilities with others (I am not referring here to race distinction) this phase of the matter cannot be provided for or even considered by legislation though in practice it may sometimes be successfully applied e.g. apprentices and journeymen).

Example, perseverence and education are the only practical answers I know of for combating misuse of amenities providing other factors, such as planning and consultation (in this case with the workers themselves, particularly if moving to new premises or reconstructing existing ones) are included.

The Act and its regulations apply to all factory workers irrespective of race or sex, but in so far as the regulations covering amenities are concerned it is necessary for the inspector to indicate to what extent he requires them to be applied to non-Europeans, and with the exception of minor details no differentiation on the basis of race is made in applying the regulations.

REGULATION 15: SANITARY ACCOMMODATION

This often raises problems particularly in respect of existing buildings or buildings never originally intended for use as a factory. The provision of one WC to every 15 persons or part thereof sounds straightforward enough but more is involved as can be seen from the sub-regulations.

First of all one unit to every 15 persons applies only to a water-borne sewerage system, any other system must first be approved by the inspector and then, in the case of the pail closet, 1 to 10 persons is acceptable, except where a nightly service operates and fewer closets may be required. When this is so the ratio usually allowed is 1 to 12 persons.

Pit latrines are frowned upon somewhat but are allowed in special circumstances, but they should be well away from the source of any water supply.

In factories where there are employed only one or two of the one sex, arrangements may be made by the occupier for such persons to use conveniences in adjacent premises. Such arrangements must be approved by the inspector and permission in writing obtained from the occupier of the adjacent premises. Approval is granted subject to the facilities being readily accessible and to the number already using the conveniences not exceeding the ratios prescribed.

OTHER UNITS AND ALLOWANCE

The question of urinals and the allowances made in regard to the ratio for them is often raised. This is a point on which the regulations are being amended and it is definitely desirable that such fixtures be provided, particularly in those concerns employing large male staffs.

Urinals should be provided where 5 or more males are employed and one stall or 2 feet of channel allowed for every 50 persons. Where urinals are provided the number of WC's may be reduced by 25%.

SPECIAL PROVISIONS

LIGHTING AND VENTILATION

Naturally these facilities must be well lighted and amply ventilated and at least one wall should be an outside wall. In blocks of WC's each one should have its own window in the outside wall and this should not be obstructed by the flushing cistern.

CLEANLINESS

The first step in achieving this is the adequacy of the lighting and ventilation just mentioned. This is a part of the

premises that the occupier seldom visits and it is no inducement to proper use if the place is dark and dirty and evil smelling.

FLOORS

These must be impervious and properly graded for effective drainage.

FITTINGS

A clothes hook should be provided in each closet and, where females are employed, a bin with a close fitting lid.

The next provision is one that causes more headaches to everybody concerned than probably any other single regulation in the Act. It reads as follows:—

> "No water closet, earth closet or privy shall be within or communicate directly with any room in which people work."

This sounds straightforward enough and certainly does not usually cause any difficulties with any type of closet except water closets, as all other kinds are invariably physically separated from factory sections.

WC's, however, are very often inside the works building and this is particularly the case in multi-storied and other, especially older, buildings in built up areas.

An endeavour has been made to meet this requirement first of all in new premises or alterations and additions by persuading architects and others to place these amenities right outside any working section. Where this is not possible and in the other buildings referred to it is a case of making the WC's occupy a "Room within a room," in other words, to have them open into a lobby which acts as a buffer between the workroom and the WC's. The one stipulation to this is that the lobby itself must be independently and directly lighted and ventilated to the open air to ensure satisfactory removal of odours, and, as far as possible, prevent their entry into the workroom.

REGULATION 16: WASHING FACILITIES

Requirements: The Regulation first calls for one washbasin for every 15 persons and then goes on to say that where the inspector considers it necessary because of the type of industry additional facilities may be required by him with hot and cold running water laid on. This is an essential proviso as it is desirable from a health point of view to have additional units and to supply them with hot and cold running water in many trades, because of the ingrained dusts and poisons that are used and because with at least one type of occupational disease—dermatitis—personal hygiene is the main factor in prevention and control.

Some of the trades or activities where this is necessary are:—

1. All engineering works including motor, welding and sheet metal works.
2. Chemical works.
3. Painting works.
4. Any premises where poisonous substances are dealt with
5. Dry cleaning and laundry establishments
6. Food factories.
7. Hides and skins premises.
8. Woodworking establishments especially furniture.
9. Factories dealing with lead in any form.

Type. Except for the word "proper" the Act is silent in this respect but obviously washing fixtures should be easy to keep clean and should also look clean.

The individual or group unit is a case for discussion. In small concerns naturally the single basin or sink type is quite suitable but in larger concerns the more satisfactory method is the group one. This may take the form of a trough with a series of taps and used from both sides or one side only, or, for preference, a circular type of washfountain. This latter is the most suitable from all points of view for large premises and the ratio of persons is one unit to 50 persons for a 54" diameter and one to 30 for a 36" diameter, for dirty, poisonous trades and food factories, and 1—75 or 100 persons for other industries.

Situation and Additional Units. Most frequently, especially in the smaller firms, the washing facilities are provided in the changerooms and this is fairly satisfactory. They may also be placed in the sanitary block or the factory itself especially in respect of premises occupying a room or rooms in a large building such as a block of flats or offices. This arrangement is often quite suitable and in many cases the only one possible.

For the larger concerns particularly those in the groups already mentioned other arrangements are desirable and a separate washroom built off or adjacent to the changeroom is desirable.

Additional units except showers are required in specific workrooms or in toilet blocks. In food factories wash basins must be installed in workrooms, separate for races, ratio 1 — 25 persons.

Showers are needed where the work is of a specially arduous, dirty or dusty nature and where it is necessary for workers to make a complete change of clothing before leaving the factory.

Premises requiring showers are those where the following work is done :—

(a) Foundries.
(b) Welding.
(c) Dry cleaning and Laundry (Steam pressing).
(d) Abattoirs.
(e) Hides and skins (tanneries etc.).
(f) Noxious trades.
(g) Mills and cement works.
(h) Any premises where the process is excessively hot, wet, dirty or dusty.
(i) Food factories.
(j) General engineers.
(k) Motor Engineering.

(l) Lead works and refineries (metal).
(m) Textile Mills.
(n) Brick, Tile, Potteries.
(o) Fertilisers.
(p) Poisonous substances.
(q) Chemical works.

The showers should be placed in a separate washroom and should be in cubicles to prevent splashing and to ensure a certain amount of privacy.

The ratio for additional units is left to the inspector and it may be 1 to 10 persons in foundries, mills, tanneries and noxious trades and 1 to 20 or 30 in others, in specially hazardous processes such as lead 1 — 5 persons is required. All showers should be supplied with hot and cold running water.

REGULATION 19. CHANGEROOMS

These are required for all employees at all factories including offices, no stipulation is made about there having to be any particular number of persons employed before they are necessary, but it is laid down as to what size the changerooms must be according to the number of persons employed. A minimum allowance of 6 sq. feet per person is required and this space must not include the area taken up by lockers, benches or washing units. The smallest changeroom permissible is one having an area of not less than 72 sq. feet. Normally this is for the total number of employees but in the case of shift work changerooms must accommodate the total number of lockers and the clear floor space is then calculated on the maximum number on shift at any one time. This regulation makes allowance for circumstances and difficulties and gives the inspector the authority to accept other accommodation which he may consider satisfactory. Double changerooms may be necessary in very dirty or poisonous trades and should be provided at abattoirs, tanneries and lead works etc.

Facilities Acceptable. In the case just mentioned the main consideration in deciding the matter should be the type of work on which the employee is engaged. If a very dirty or poisonous trade or a food factory then a small changeroom is necessary.

In the small one-room factories where there are say two or three employees a proper changeroom is almost out of the question and a portion of the room may be partitioned or curtained off for use as a changeroom. This is especially so where there are two females and a native or vice versa. In both cases the Natives would be provided with lockers only.

Where, however, the process is one of those mentioned and a changeroom has to be insisted upon it may be necessary for the occupier to rent an additional room or rooms in the building for this purpose. Such rooms should, of course, be as close as possible to the place of work.

There is a special provision for certain industries and in connection with these it is laid down that the changeroom shall not communicate directly with any room in the factory: the specific exclusions are

(a) Hides or skins.
(b) Wool or mohair.
(c) Poisonous substances or
(d) Articles of food or drink.

Construction. Whenever possible, especially where non-Europeans are concerned, or where the process is a dusty, dirty or poisonous one, the floor, at least, should be of impervious material.

The Act makes mention of height but as a changeroom is a habitable room it is reasonable to accept Municipal standards in this respect and that is usually a minimum height of 8' 6".

Light and ventilation must be adequate and it is important that they are so. One of the reasons for the misuse of changerooms by employees is the fact that they are often uninviting, being dark and stuffy, without even artificial lighting.

Lighting. All changerooms should have at least 10% window area, be provided with artificial lighting capable of giving a reading of at least 5ft. candles.

Ample daylight is required to provide a cheerful as well as a healthy atmosphere and it should, as also should artificial lighting, be planned to give a good over-all lighting. Dark corners not only give gloomy appearance, but also tend to harbour dirt and discourage cleanliness.

Ventilation. They should be properly cross ventilated. For obvious reasons draughts must be avoided in winter. Inlet and outlet ventilation should be properly placed, the former near floor level and the latter near the ceiling. A good and fair working ratio for inlet and outlet areas is plus-minus 3 sq. feet for every 100 sq. feet of floor space for each inlet and each outlet.

They should be either whitewashed or painted with a light washable paint and, if necessary, have suitable means of heating. This is an especially important precaution in very hot trades or occupations and its omission may well be the cause of time lost through rheumatism or respiratory diseases.

Furnishings and Fittings. The Act calls for lockers and benches only but where the room is for combined use then tables and couches are necessary. The tables for use as a mess room and the couches when it is used as a rest room for female employees.

Lockers. Lockers have evolved out of the question of changing and storage of clothing For a long time only coat hooks, simple pegs and quite often nails were used for hanging the employees' outdoor clothes which were thus exposed to dust, pilfering etc.

Next it was thought to be enough to hide clothes so hung behind a sufficiently long curtain. A so-called improvement consisted of a sliding door which transferred the space into

a kind of general wardrobe, then smaller separate wardrobes were provided but it was found that this system gave rise to danger of contamination and that it led to an offensive smell.

Hence, only the separate clothes lockers, now so largely used, are to be recommended. These may be required for all employees in any industry according to Regulation 19 where the only stipulation is that they must be of a suitable type and capable of being locked.

Size. Although the Act does not lay down any size for lockers obviously some size must be determined for the purpose of uniformity and suitability and that size is 5' 3" high, 12" wide and 18" deep with a shelf 9" from the top, the whole placed on legs 6" high to enable cleaning of the area below to be carried out.

Type. There are various types of lockers in common use, most of which are satisfactory.

(a) Sheetmetal or steel lockers are best as they are easily cleaned and do not harbour vermin.

(b) Wooden lockers are suitable, but they should be painted or treated with carbolineum for vermin and it is not advisable to ask for them where non-Europeans are concerned.

(c) Wire-mesh lockers are very satisfactory but may be placed only in the changeroom.

All types must be soundly constructed, be provided with ventilation holes (wire-mesh type very suitable from this point of view) and should be easily cleaned and not have a small well at the bottom which collects dirt but be finished off flush with the door bottom.

All lockers must be capable of being locked, this means they must at least be provided with a hasp and staple, the employee providing the lock.

ALTERNATIVES.

Other methods for storing or hanging of clothes are in certain circumstances called for or accepted.

Pegs are regarded as satisfactory for non-European males in lieu of lockers where their changeroom is kept locked and under supervision of a responsible person.

Another way of storing clothes is the hook and pulley or basket and pulley method in which each employee is allocated a separate hook or basket and rope by which he hauls his clothes out of reach. In some cases the haulage may be on a common basis where at specified times the employees' clothes are raised and lowered. In the special trades mentioned previously double facilities are necessary. This may mean double changerooms (actually the best solution) or double lockers, lockers having two compartments, or lockers and pulleys. This method is also suitable for non-European males in lieu of pegs or lockers. Double-tier lockers, i.e. lockers one above the other are not acceptable.

Benches. Again the Act is silent as to type and size and here the inspector must judge for himself. Reasonable size for a bench would be 1' 2" for width of the seat, 1' 4" for height and length according to the number of persons, allowing plus minus 21" per person. The material of construction should preferably be wood.

Proper Facilities. Where the usual changeroom facilities are required the following points must require consideration:—

(a) The type of industry and the race and sex of employees,

(b) The situation of the changeroom.

(c) The use of the changeroom i.e. as a changeroom only, as a combined change-washroom or change-dining room.

(d) The construction of the room and the light and ventilation,

(e) The furnishings, i.e., lockers, benches or tables.

(f) The condition and arrangements for cleaning.

Industry. Dealing with each point in turn (a) does not bother us much as the Act makes no differentiation on account of race or sex except in so far as its situation is concerned. The type of industry affects it and in so far as food factories, poisonous trades and premises handling hides, skins, wool and mohair are concerned the changeroom may not communicate directly with any workroom.

SITUATION.

On the other hand it gives an inspector several points to look out for, one of which we dwelt on at the beginning of the paper, and that is the situation of the changeroom in relation to the factory and the other conveniences. Where different races and sexes are concerned the changerooms should be separated or, if joined, the common wall should go right up and not have any interconnecting openings. In the case of European females and non-European males the changerooms should be definitely separated.

They should have separate approaches and where placed inside a workroom have a screen wall in front of the door. It should not be necessary for any female employees to have to pass the male changerooms or working sections on their way to the changeroom, or vice versa.

Use. For reasons such as lack of space, temporary premises etc., it sometimes happens that the changeroom is also the washroom, the dining room, the rest room and the first aid room all combined and it is possible that it may be suitable as such.

In small concerns for instance employing only one or at the most two races or sexes and not being a poisonous trade, it would be permissible for a changeroom to be so used subject, of course, to its being of adequate size. In such cases 6 sq

ft. per person exclusive of space taken up by furnishing and fittings must be allowed. Whenever practicable though, even in small concerns, separate change and dining rooms should be provided and in large establishments or in certain industries (lead) all three should be separate. This is especially so where the changeroom is kept locked during working hours.

For Females. Throughout the Act particular references are made to female employees and special conditions or provisions required to cater for them. Here we have it that where more than three but less than ten are employed a couch must be provided, free of charge, for their use. It must also be maintained in good and clean condition and kept in a suitable position. The suitable position being, of course, subject to approval by the inspector. Where more than ten females are employed a special rest room is required in which to install couches and other suitable furniture.

The female employees shall have the use of such facilities :

(a) during any interval in work,

(b) if they become ill or faint while working.

Situation. A suitable position is naturally one that offers privacy, quietness and seclusion.

Very often the couch in these small places is in the changeroom, this arrangement may be acceptable depending on the position of the changeroom, if partitioned off the workroom it may be too noisy. The best place is, if possible, a small separate room.

Where a proper rest room is necessary such as in large premises it should be planned in relation to the other amenities and be suitably equipped.

Size and construction. The Regulation is entirely silent on these points again except to say that it must be approved by the inspector.

In construction it should, as previously remarked, ensure privacy, seclusion and quietness and should of course be well ventilated and suitably lighted. As it may be necessary to darken the room suitable curtains should be supplied for the windows.

It is not easy to lay down a specific size for these rooms or say how many couches should be provided and there do not appear to be any accepted standards. I think no such room should be less than 72 sq. ft. for up to 100 employees plus 20 sq. ft. for every additional 100 or part thereof.

Furnishings and fittings. First of all a couch, one for every 100 persons or part of 100 and the other suitable furniture should include easy chairs, a table and a glass with water bottle. It is also desirable that a wash basin be installed.

REGULATION 20 (4) : DINING AND MESS ROOMS

In any factory in which :—

(a) there is carried on any activity under Section 27 i.e. poisonous trades etc.

(b) if the sanitary conveniences communicate directly with the changeroom,

(c) where the inspector considers the changeroom unsuitable for use as a dining room,

then the Occupier must provide and maintain suitable dining room accommodation and shall suitably furnish such room so that those employees who do not habitually return to their homes for meals may takes their meals *if they so desire.* Change or rest rooms, where satisfactory, may be accepted as dining rooms, but in giving consideration to such combination the relevant points already mentioned must be borne in mind and it must be ensured that the room in question is large enough for such purposes, i.e. the 6 sq. feet per person required for a changeroom is not sufficient if such room is also to be used as a dining room. Notwithstanding what is actually required by the regulations an inspector has the power to accept other accommodation at his discretion providing it is not less favourable than what the regulations provide for. This may sound rather contradictory but in fact it need not be so. There may be instances when, for various reasons such as limited factory space in temporary premises, a small number of employees or employees working adjacent to homes or institutions or compounds, the full application of the regulations may be difficult or unreasonable and in such cases the inspector may approve of temporary or other accommodation where it gives the privacy or amenity aimed at by the Act.

In regard to the use of dining rooms, it is permissable (and may prove economical) to have one dining room for males and females of the same race.

Fig. XIV gives some examples of dining rooms.

Suitability. In addition to cleanliness, common experience has shown the value of rest and change of scene at a meal-break, as well as of sufficient time for the taking of food. A good messroom can be much more than simply somewhere for the workers to eat; it is a place where people from different sections of a factory may come together, where announcements and information can be given out, and where social groups and clubs may have their beginnings, and be a regular place to meet.

Where the number of employees is small, for example under 10 to 20, and the work is clean and healthy, a corner of the workroom may be set aside, partitioned off and furnished as a lunch place.

Workers will certainly seize every opportunity fine weather affords to get into the open air and it is good that they do and therefore seats in sunny positions out of doors are an additional asset even to the best equipped messroom.

Type and Size. The minimum requirements for a messroom are that it should be bright and attractive, adequately lighted and ventilated, warmed in winter time if necessary, and provided with tables and chairs. Other desirable features include

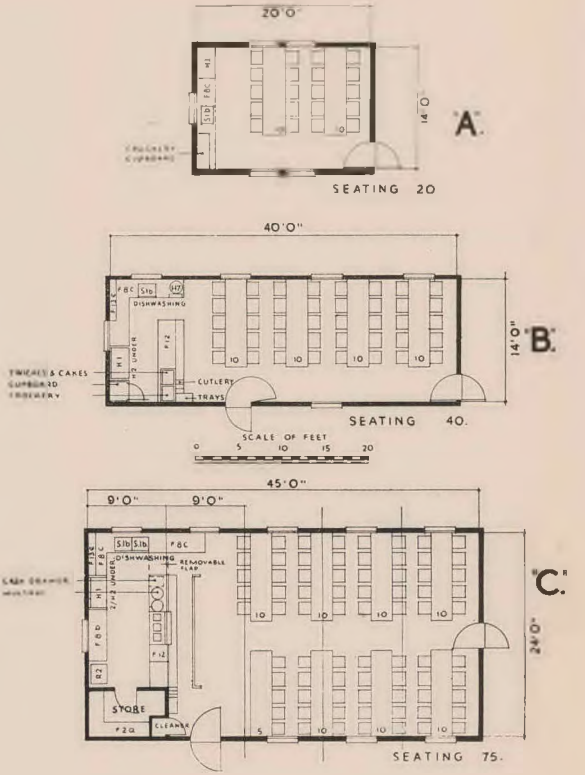


Fig. XIV. These plans show messroom layouts that have been found satisfactory in smaller factories. The plan "A" sets out the minimum amount of equipment—a sink, bench-top, cupboards and a small cooker, in addition to chairs and tables. Plan "B" shows an arrangement for larger numbers where it is practicable to employ an attendant to serve a hot dish and sell pies and cakes. Plan "C" shows a complete though economically planned cafeteria service.

facilities for making tea, warming food brought from home, washing up and disposal of scraps, and the storage of crockery and foodstuffs under hygienic conditions.

The size may be based on that of changerooms, i.e. 6 sq. ft. per person exclusive of furniture and fittings but where no allowance is made for these then 10 sq. ft. per person, where combined with the changeroom 12 sq. ft. per person.

Restrictions. Like changerooms, the dining room may not communicate directly with any room in which processes include the manufacturing of or dealing with

(a) hides and skins,
(b) wool and mohair,
(c) poisonous substances,
(d) food or drink.

REGULATION 21: DRINKING WATER

Requirements. All laws on hygiene and safety of workmen call for the provision of drinking water at the place of work and this Act in doing so makes certain stipulations.

(a) It must be provided free of charge,
(b) It must be suitable for drinking,
(c) It must be available in sufficient quantity for the number of persons on the premises,
(d) It must be reasonably accessible to all employees.

Points and Fixtures. Points where drinking water is available should be placed at various places in the workshops, each one being easily accessible and not interfering with the work. In such industries as foundries, steel works, and other hot processes it is very necessary that drinking water be handy.

Where water unsuitable for drinking is used on any premises it is important that notices be placed over taps indicating which is drinking water and which is not.

Taps or outlets should be so arranged that workmen cannot drink from the spout and for this reason the drinking fountain type of unit is most satisfactory. It is sometimes the practice to have a common cup, attached usually by a chain to the fitting, but this type of thing is not at all satisfactory and should be replaced by paper cups, each one of which is discarded after use, or, better still, instal a drinking fountain.

REGULATION 24: FIRST AID ROOM

A thousand times better than a first aid kit is a first aid or ambulance room and whenever space can be found for it such a room should be set up. In small establishments something could be achieved in the way of sharing a room such as an office which may meet the requirements of a first aid room.

Some people are upset by having to receive treatment in public and in any case the responsible first aid person should have a proper place in which to do his work.

Such a room can be simple and inexpensive and of a size sufficient to hold all equipment comfortably and with space to move around, not less than 72 sq. ft., wherever possible 120 sq. ft.

The proposed amendments to the regulations will require an ambulance room in factories employing 100 or more persons.

The requirements of a good first aid room are :—

1. Adequate heating, lighting and ventilation.
2. Washbasin with hot and cold running water laid on.
3. Quiet location but conveniently placed in relation to work and so situated that an ambulance can drive up to it.
4. Walls and ceilings to be painted with a light washable paint.
5. Floor to be of durable, impervious material.
6. Toilet facilities adjacent.
7. Portable partitions or screens for dividing the room into two parts, waiting room and treatment room. This is specially desirable in factories with male and female employees of different races.
8. Door wide enough to permit easy handling of stretcher case.

Fig. XV illustrates points to be borne in mind.

REGULATION 25: FIRE PRECAUTIONS

This is another serious matter which is so often treated all too casually, seemingly most people having the belief that "whilst a fire might occur at Jack Jones or Bill Smith's place it can never happen to me." Maybe it will not, nevertheless it must be anticipated and due preparations made. Now practically all provisions under the Act for the safety and welfare of persons are made with a view to prevention of accident etc. but here we are dealing with precautions made to provide for an event *after* it has occurred. They are the more important because of this, and should be checked up on the relevant points at regular intervals.

Requirements. The regulations require that where *more than six persons* work upon a floor situated above the ground floor:—

(a) The system of escape, shall be approved by the inspector. This means that the ways of approach to the escape must be suitable and also the size etc in relation to the number of persons to be provided for. It is also necessary to ensure that the escape does not lead down into a cul-de-sac or closed yard but that easy and free access to the street is provided *independent of the ground floor workrooms.* This may necessitate providing a separate passage along the side of or through a building.

(b) The door from any room or passage leading to means of escape may be required to open outwards — this should always be insisted upon.

(c) No such door just mentioned may be kept locked, fastened or obstructed during working hours.

(d) The requirements relating to doors just mentioned apply also to normal outer entrance doors as well as special exit or fire-escape doors.

(e) All staircases and steps leading from one floor to another or to the ground must be provided with substantial handrails i.e. mid-rails on each or one side.

(f) Staircases and passages may be altered to the satisfaction of the inspector if he so requires. In the case of the former he must consider points such as their being too narrow, steep, insecure or defective.

It is extremely desirable that all floors be provided with alternate exits, the number size and situation of which will depend upon the number of people involved and the fire hazard of the occupancy or use of *each section of the building.*

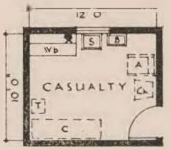
Generally speaking in large floor areas no person should be required or permitted to work at any point more than 75 feet from an exit door.

Access to the street from ground floor areas such as the foot of the fire escape or yard must be direct and quite independent of the occupied portions of the ground floor.

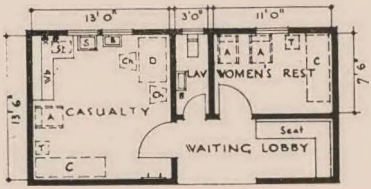
Construction. In regard to passages, they must be wide and clear and as straight as possible and both steps, stairways and passages must be well lighted. All fire-escapes must be constructed of fire-resisting material of suitable nature. We are not forgetting the ground floor and the requirements mentioned above apply to them.

REGULATION 26: VOLATILE INFLAMMABLE SUBSTANCES

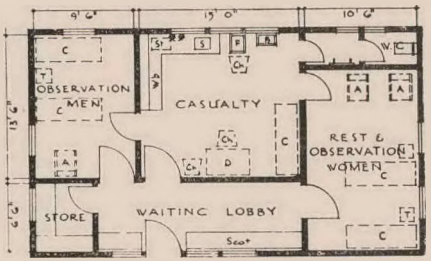
This regulation is another that gives rise to a great deal of heart burning and is one that is treated very seriously by both the Machinery and Factory inspectors.



TYPE A—100-250 per shift.



TYPE B—250-500 per shift.



LEGENDS:
A—Armchair.
B—Basin.
C—Couch.
Ch.—Chair.
D—Desk.
F—Footpath.
S—Sink.
St.—Sterilizer.
T—Table.
Wb.—Workbench, cupboards over and under.
X—Electric Power or gas point.

Fig. XV. Type A shows the minimum size of casualty room recommended. Where there are more than 50 women a rest-room will be required as well. Type B provides for the employment of a nurse, and the women's rest room is so placed as to be under her supervision. Type C suggests a layout for a large type of factory, but it should be noted that the component parts will vary with such factors as the proportion of men to women, and the types of injury most commonly treated in each particular industry.

Type C—500-750 per shift.

It contains the largest number of special provisions (namely 18) of any of the regulations and the first one ties up directly to the eighteenth one as follows:

1. (a) Whenever volatile inflammable substances are sprayed OR
   (b) *Whenever in the opinion of the inspector* the fumes of volatile inflammable substances are generated in sufficient quantities to constitute a serious risk of fire, the provisions of the other 16 sub-regulations shall apply.

(18) For the purpose of this regulation volatile inflammable substances means cellulose solutions (including solutions which contain cellulose acetate, cellulose nitrate or celluloid, petrol, benzine, benzoline or absolute alcohol. This regulation will be amended to exclude the necessity for an inspector to express his opinion as per (b) above.

Any other fume producing substance whatever its hazard must be dealt with under Regulation 13.

It will be seen then that whenever any spraying is done and any substance named under this regulation is used it is encumbent on the factory occupier to take the necessary steps to ensure that he complies with all details of this regulation.

Let us group the details to obtain a clearer picture of what is required.

(a) *Situation and Use.* Whether sprayed or used in any other way all such work in connection with the substances must be carried out in a separate room specially constructed for the purpose, of suitable fire-resisting material, or in the open air in a suitable place so that the fumes may easily escape.

It is generally desirable that the room should not communicate with any other factory section and in the case of dry cleaning rooms this is insisted upon.

The open air question usually arises with spray-painting operations and has much to commend it because of the great diffusion and dispersion of the fumes which take place. This location is, however, to be viewed with suspicion for a number of reasons such as that during inclement weather, wet or windy days, the work is moved inside where no special precautions are taken, the position may be open to sparks or heat from nearby sources or adjacent premises or the fumes instead of dispersing, find their way into the nearest workroom.

(b) *Ventilation.* One of the main features of control that is aimed at maintaining as low a concentration of fumes as possible to reduce the possibility of fire or danger to health is that of the special ventilation of the room concerned and there are several points about this special ventilation that must be observed. Incidentally this is the only part of the regulations where anything specific is laid down in regard to ventilation of a working section.

(i) The ventilation of the room shall be on the exhaust principle and must be adequate so as to effectively remove the fumes and prevent their return and must provide air inlets for fresh air replenishment.

(ii) Adequate for the one and only time in the Act is defined here and states that for the ventilation to be considered adequate it must provide at least 30 complete changes of air per hour for the room concerned.

(iii) The ventilation plant must be kept in full operation during the working period and for a full five minutes thereafter at least.

(iv) The means of ventilation i.e. air inlet points and air extraction points must be properly balanced and related to secure maximum extraction efficiency. The outlets, because these fumes are heavier than air, must be placed at or near floor level and the inlets placed as high as possible for the incoming air to assist in keeping the fumes at the lower level towards the outlets.

(v) In the case of the spraying of articles the work position must be so placed in relation to the ventilation exhaust points that it is not necessary for the operator to stand in the path of the fumes on their way out.

(vi) All ductwork, hoods, canopies etc. used for the collection and transporting of the fumes must be constructed of smooth fire-resisting material and in a manner to facilitate cleaning.

Fire Prevention and Control

(i) No fire, flame or open light or other agency likely to ignite the substances or their fumes is allowed in the room.

(ii) Electric light fittings must have fume proof enclosure.

(iii) All electric wiring must be in seamless tubing with screwed joints.

(iv) All tanks and vessels and pipe lines must be properly bonded to earth.

(v) An adequate supply of efficient fire extinguishing appliances must be provided in suitable positions in every building in which volatile inflammable substances are used or stored. This means they are required throughout the factory and not only in the spray room or dry cleaning section. In regard to their suitability and type the fire officer's opinion and recommendations are accepted for this purpose.

(vi) Notices in both official languages must be posted up prohibiting smoking on the premises and persons are prohibited from smoking in any room in which the substances are used.

General

(i) All cotton waste, rags or similar material must be removed daily.

(ii) Only a day's requirements of the substance is allowed to be kept in the room at any time.

(iii) All containers of the substance must be securely closed when not in use and when empty removed from the premises without delay.

(iv) All rooms, fans, ducts, canopies etc. used in connection with the substances must be kept clean and in working order. Only non-ferrous tools may be used for the purpose of scraping.

In connection with the keeping of fans, ducts and hoods, etc. clean, here is a useful tip. Have all these parts wiped over with old motor oil every few days and the material will be thrown off the fan blades before it accumulates there to any extent, if at all, and it will keep peeling off the other surfaces in thin layers.

It might be said that putting motor oil on these parts is creating a fire hazard in itself but a little thought will show that is not so. Its flash point is considerably below that of the substance and so it is safer to have the oil there than a heavy accumulation of the substance which is usually the case, in addition the oil ensuring a non-accumulation of the substance on fan blades and duct surfaces maintains the extraction system at a higher level of efficiency than would otherwise be the case.

REGULATION 28: WELFARE IN FACTORIES

We are not concerned here with general welfare matters as one might think, but only with certain defined aspects of it involving the physical, moral and social welfare of persons working in a factory where different races and sexes are involved. In short we are dealing with juxta-position.

The object of these regulations is to provide for the separation as far as possible, of persons of different races and sexes.

Where such persons are employed in the same room their respective machines or benches must, as far as practicable, be arranged so that they work apart from each other. This may require the erection of partitions in some cases.

As regards sanitary conveniences, changerooms, etc., where females are concerned they must be so situated and screened as to ensure complete privacy and segregation. In approaching these facilities it should not be necessary for the females to pass close to members of the opposite race or sex.

All female employees should have entrances and exits to the factory separate from those for the males or else start and finish at different times.

* * *

In conclusion may I thank your society for the opportunity of presenting this paper to you and my Department for the permission to do so. If it does nothing else I hope that at least it will have indicated in no uncertain manner that co-operation between the architect, engineer and the factory inspector is not only desirable but essential and will be of real benefit to both and to industry in general.

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Standard Codes — International Labour Office.

The Australian Foundry — Department of Labour — Australia.

Factory Planning—Department of Labour—Australia.

ILLUSTRATIONS

Figs. XIV and XV, Amenities in Factories — Department of Labour — Australia.

Figs. I — XIII, Factory Planning — Department of Labour — Australia.

THE STUDENTS' FORUM

PRACTICAL ARCHITECTURAL DESIGN TRAINING

Architectural Education is a subject that has come up for much discussion among groups of students at Wits. University recently, and was the main subject for discussion at the NUSAS Architectural Faculty Conference last July. Such discussions are all to the good; it must not be forgotten that Architectural Education as now practised at Wits. is something new, for it was the practice, within living memory, for prospective architects to be apprenticed to a master for a number of years; in essence this persists in a modified form to-day in the part-time course. This system has produced some brilliant modern architects—Frank Lloyd Wright, le Corbusier and Sullivan, to mention only three—and it has been submitted that many prominent architects in Johannesburg were trained as part-time students.

This failure to produce more than a few successful architects suggests something fundamental is lacking in the full-time course. I submit that the course is too isolated from the realities of building, that students produce only "paper schemes" that seldom go beyond the sketch-design stage, and that the student comes into contact with the actual problems of building far too rarely. Working drawings are produced for only a few schemes, and working details hardly ever attempted. The only limiting factors on these "paper schemes" are by-law conditions and hazy structural requirements, while considerations of cost and the limitations imposed by a headstrong client never fetter a free imagination. This may be all to the good in developing a free imagination, but the inevitable tendency is to regard a good "paper scheme" as an end in itself, rather than a means to an end. In other words, the student tends to concern himself with producing a scheme that looks well on paper, rather than a scheme that will, when realised three-dimensionally, make a fine building. The one will not inevitaby arise from the other.

Three-dimensional exercises, such as those undertaken at the Bauhaus and the Massachusetts Institute of Technology, give an excellent training in the understanding and handling of space, and inculcate a proper appreciation of the third-dimension. Model-making gives tangible form to these "paper schemes," and aids the student to think in three dimensions while working in two. Unfortunately we do not have the facilities for the former type of training at Wits., and a serious drawback to the latter form is the fact that structural difficulties are seldom realised.

In this respect, that of being able to see his drawing assume a three-dimensional form, the part-time student has the advantage over the full-time student. But an appreciation of three-dimensional qualities is not enough for the full-time student. Fine architecture can only result from fine building, and the student must never lose sight of the fact that the architect, as a co-ordinator of builders, must, to produce fine architecture, understand fine building in a practical sense. He must, in short, leave his ivory tower and learn to lay bricks.



LEFT: General view of the tennis shelter designed and built by the Second Year Students. Below: Progress photographs showing brickwork and shuttering.

This is precisely what happened at Wits. last year, when the second-year group designed and erected a tennis-shelter at the University.

The programme was a simple one, calling for a definition of a space for sitting and watching the game, while providing shelter from wind and rain. From the aesthetic point of view, the solution to this spacial exercise was admirable: two planes and a line of poles, with a third horizontal plane hovering above, defined the space, provided shelter from the elements, and defined the view.

Having produced a suitable design, with working drawings, the students then proceeded, under supervision, to construct the entire building, and in doing so met and dealt with many of the problems and processes that are encountered in everyday building. They set out and excavated for foundations, and mixed (mostly by hand) and poured concrete, casting-in bolts to secure the tubular steel columns that held up the roof slab. The walls were treated very simply: stock-brick bagged and colour-washed. They experienced the problems of shuttering design, and the need for good planning and co-ordination in casting the slab in one operation. Finally, they tried their hands at fitting seats, laying slasto paving, and painting.

The result was to their credit.

Though a simple project, it was an excellent exercise in practical building construction, well worth the intensive organisation put in by the staff and especially the Professor, and for that reason alone we hope to see this experiment repeated again.

But, I submit, the real lesson to be learnt from this experiment, on the part of the cloistered full-time student, is the appreciation of the role of the architect, through the medium of his drawing, as the co-ordinator of the actual processes of building in the creation of fine architecture. E.N.F.





WORK IN PROGRESS

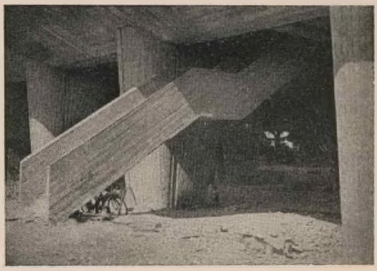
FLATS AT MARSEILLES
LE CORBUSIER, ARCHITECT





Corbusier's latest creation arises in a park-like setting. Alternation of single floors and duplex flats gives beat and rhythm to the long facade. Concrete facing slabs rise up the end of the facade, sheathing the framed structure behind.

Intricate patterning arises from complicated interpretation of one-storey and two-storey flats, and from precast concrete grilles fronting the balconies. The work is virile and strong, but much of the detailing is crude. Precast work is irregular, and joints uneven. The building stands on a concrete forest of supports of gigantic size, from which the escape stair emerges rather incongruously. At the left is the complicated roof of the detached entrance foyer, curved in three dimensions.



Concrete is left unplastered, as it comes from the shutter. Formwork has been carefully considered, and its patterning is deliberate rather than accidental. The depressing effect of this staircase disappearing into the cavernous gloom is as unsettling in actuality as it appears in the photograph.

BOOK REVIEW

The British Journal "Architectural Design" announces an important new series of articles as a contribution to their Festival year, and to mark also the event of the Journal's "coming of age." Under the title "The New Architecture in Great Britain," Edward Mills F.R.I.B.A. will be analysing in great detail the finest examples of contemporary British Architecture between 1945 and 1952. Although many of the best contemporary buildings are reviewed in technical journals, this is the first attempt so far to provide the architect with a fully documented and illustrated record of the technique underlying each design, from the point of view of planning, economic, technical and aesthetic considerations.

Great Britain's contribution in the post-war field of town planning and architecture has been considerable, but remains as yet insufficiently recorded from the above point of view. Mr. Mills' articles will do much to close the gap, and make available a comprehensive picture of the new British Architecture.

QUALITY SPECIFICATION FOR MINERAL STABILIZED ASPHALTIC ROOFING FELTS SURFACED WITH FINELY POWDERED MINERAL MATTER.

The Standards Council has recently published a quality specification for mineral stabilized asphaltic roofing felts surfaced with finely powdered mineral matter. This specification S.A.B.S. 92-1949 covers the quality of the constituent materials as well as the dimensions and physical properties of the finished product and includes a test for weathering which is a most important quality requirement.

The Public Works Department drew the attention of the Standards Council to the need for a South African specification laying down definite quality standards for asphaltic roofing materials and pointed out that many thousands of pounds were being wasted on roofing work for which inferior asphaltic roofing felts had been used and had to be replaced. The need for a code of practice for the proper application of asphaltic roofing materials was also indicated and it is intended that the preparation of such a code will be undertaken in the near future.

The committee appointed by the Standards Council to prepare the specification, was representative of local agents of overseas manufacturers of asphaltic roofing materials and of organizations which make extensive use of these materials, such as the South African Railways Administration, the Department of Public Works, Master Builders and Allied Trades Association, Institute of South African Architects and Association of City and Town Engineers. The committee were greatly assisted in their task by the co-operation of interested overseas manufacturers who were most helpful in supplying information necessary for the preparation of the specification.

In issuing this specification, the Standards Council has provided property owners, architects, building contractors and other interested persons with a known standard to which mineral stabilized asphaltic roofing materials of a quality thoroughly suitable for their purpose can be purchased.

As a general rule, property owners do not have a specialized technical knowledge of structural materials and the choice of building materials which do not play a direct role in the aesthetics of the proposed building is usually left to the builder or architect. Roofing felts vary considerably in quality and the selection of such materials has to be based on an intimate knowledge of the product and its performance characteristics.

Once a building has been completed, however, the responsibility for its maintenance falls entirely on the owner and it is therefore most important for him to ensure that the materials of which it is constructed will give satisfactory service and not have to be replaced, often at considerable expense, within a short period of time. This applies particularly to roofing felts, the selection of which can now be simplified by having the material to be purchased tested to S.A.B.S. 92-1949.

Agents of overseas manufacturers supplying roofing felts to this specification, may now have their products tested and certified as conforming to the requirements of the specification. The specification will also serve as a guide to prospective local manufacturers.

Property owners who ensure that the roofing felts to be purchased have been tested to the specification will therefore be amply repaid for the very little extra trouble taken as they will be assured of having obtained a material which will give satisfactory service and cost little in maintenance during the life of the building.

Copies of the specification priced at 5/- per copy post free are obtainable from the South African Bureau of Standards, Private Bag 191, Pretoria.

NATIONAL BUILDING RESEARCH INSTITUTE, BULLETIN No. 5.

With the great attention which has been focussed on the problem of building on clay by the experiences in the Orange Free State gold-mining area, the article by A. B. A. Brink, geologist, entitled *Foundations on Expansive Clays*, contributes a further scientific investigation of expansive clays. D. N. Calderwood, of the Architectural Division, discusses *Limiting Factors in High Density, Single Storey, Estate Layouts* in some detail and gives suggested areas and densities for a sub-economic neighbourhood unit. C. A Rigby of the Engineering Division presents a short preliminary report on the *Italian Building Industry*, with reference to comparison with the local industry. L. W. Le Roux, Materials Division, discusses the *Protection and Painting of Galvanised Iron*, and Keene Steyn, of the Engineering Division, presents a paper on *Reinforcement in Brick Walls as a Means of Preventing Excessive Cracking in Buildings*, which again has a direct bearing on the problems encountered in the Orange Free State.

NOTES AND NEWS

NUFFIELD DOMINION TRAVELLING FELLOWSHIPS

Applications are invited not later than 14th May, 1951, for the generous senior fellowships offered to South African Nationals by the Nuffield Foundation for the year 1952. These include one in Natural Science, one in the Humanities and two in Medicine. Applicants must be between 25 and 35 years of age, have high intellectual and personal qualities, and have shown capacity of an unusual order to advance knowledge and education. They must undertake to return to South Africa on the termination of their fellowships. Copies of regulations and application forms may be obtained by University students from the Registrars of their Universities; and by others from the Hon. Secretary, Nuffield Foundation South African Liaison Committee, c/o P.O. Box 395, Pretoria. Applications received after 14th May, 1951, will not be considered until 1952.

TOWN AND COUNTRY PLANNING ASSOCIATION

This Association announces a two-week general tour of Midland and Northern England for the benefit of overseas visitors attending the Festival of Britain celebrations. This tour will place emphasis on housing and town planning projects, but will also include visits to beauty spots and places of historical interest. The total cost of the tour is £35; a booking deposit of £5 is required, the balance being payable before the 18th June. The deposit will be refunded on cancellation subject to the vacancy being filled. Remittances should be sent to and further information obtained from: The Business Secretary, Town and Country Planning Association, 28 King Street, London, W.C.2.

SITUATION SOUGHT

A.R.I.B.A. at present in practice in London desires opportunity of engagement in the Union offering scope for experienced assistant. Age 38, 15 years' practical experience covering domestic, industrial and commercial projects.—Reply: A. E. J. Hastings, 19 Hanover Square, London, W.1, England.

APOLOGY

We regret that the author's name of "The Study and Interpretation of Regulations 1—28 of the Factories, Machinery and Building Work Act 22 of 1941" was incorrectly published as C. I. Peagham; this should have read "By T. L. Peagam."

SOME ADVANTAGES OF

MILLS

Patent

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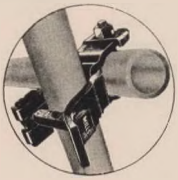

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