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ABSTRACT

Research for this comparative study consisted of school visits and discussions on the school building industry with leading men in the field in England, West Germany, Switzerland, and Italy. The study explored the use of prefabrication and modular school design, which provide economical and flexible school buildings to accommodate an increasing school population and changing methods of instruction brought about by the use of audio-visual aids and a new teaching philosophy. (TC)

RESEARCH STUDY OF MODULAR DESIGN OF SCHOOL BUILDING IN EUROPE

April 30, 1968 – May 20, 1968

Revised 1969

S.T. Orlowski,
Chief Research Architect
School Planning and Building Research

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RESEARCH STUDY OF MODULAR DESIGN OF SCHOOL BUILDING IN EUROPE

Introduction

With the rapidly increasing population of Ontario, building economy is a major consideration. Our aim is to build modern schools at a reasonable cost, schools that will serve our youth in acquiring knowledge and skills, schools that will serve our adults in continuing education and in retraining programs required to keep abreast of technical advances in business and industry.

Many European countries have similar problems. There is a growing tendency towards fuller co-operation in solving problems shared by different nations. The Ontario Department of Education welcomed the opportunity for this comparative study, consisting of school visits and discussions of vital questions pertaining to the school building industry with leading men in the field in England, West Germany, Switzerland and Italy.

The research study was carried out in Europe, and explored the use of modular design of school buildings. We are constantly in search of the most economical and flexible school building designs to accommodate our increasing school population and changing methods of instruction, brought about by the use of audio-visual aids and a new teaching philosophy.

As these conditions of change exist in all levels of education, it is equally important that buildings for education; elementary, secondary, vocational and higher learning alike be flexible.

The research study lasted 21 days, starting April 30th, 1968 and finishing May 20th, 1968.

ITINERARY FOR RESEARCH STUDY OF MODULAR DESIGN OF SCHOOL BUILDING IN EUROPE

April 30	Departure from Toronto
May 1	Arrive London Airport A.H. Anderson Ltd., 235 Vauxhall Bridge Road, London, SW 1 Meeting with officials of Department of D.E.S. at Curzon Street Travel to Winchester
May 2	Visit to SCOLA building. Travel to London
May 3	Visit Sanders & Forster Ltd., Cooks Road, Stratford London, E. 15 and Messrs. Crittals Ltd.
May 4	Visit A.H. Anderson Ltd., 235 Vauxhall Bridge Road, SW 1
May 5	Travel to Taunton
May 6	Lecture and discussion on METHOD building Visit to local manufacturers
May 7	Visit Method projects. Travel to Nottingham
May 8	Lecture and visit to CLASP buildings, Nottinghamshire
May 9	Visit to Loughborough University of Technology
May 10	Visit to University of Leicester Visit to Town Planning Office, City of Leicester
May 11	Coventry - Departure to London Visit to Lancaster Technical College and Civic Centre
May 12	Departure for Bonn, West Germany
May 13	Meeting with Officials of Permanent Conference for the Ministry of Culture Visit to New Campus of the Faculty of Law and Economics, University of Bonn, new main library of University of Bonn, Bonn Technology and Manpower Training Centre
May 14	Departure to Zurich, Switzerland Visit to Zurich Technical University, Riedhof Primary School, Zurich

May 15	Visit to Freudenberg Higher Secondary School, Zurich Visit to Le Corbusier Centre Departure to Rome, Italy
May 16	Visit to Telescuola and meeting with Prof. Italo Neri
May 17	Visit to University of Rome, elementary school and other buildings
May 18	Visit to Monte Cassino
May 19	Departure for London Visit to Hertfordshire School
May 20	Visit to a local architect's office Departure to Toronto

LONDON, ENGLAND

May 1st, 1968

Meeting with the Officials of the Department of Education and Science

The Modular Design Study tour of the school buildings in England was organized by the British Department of Education and Science on request of the Edmonton Board of Education.

On arrival at London Airport we were greeted by Mr. A.H. Anderson, founder of his own modular system for buildings, A75. After attending a lecture as well as attending an exhibition analysing the A75 system, we attended a meeting at the headquarters of the Department of Education and Science and met with the officials of this Department.
The meeting was headed by John Kitchener and assisted by members of his staff. The subjects we discussed are as follows:

1. organization of the research tour of the territories using and developing the SCOLA, METHOD and CLASP systems.

2. development and achievements of system buildings in Britain.

3. organization and achievements of the architecture and building branch of this Department which consists of five working groups:

    1) development group
    2) group for further education
    3) research laboratory group
    4) brief cost analysis of system - It has been noted that main cost saving is achieved by reducing the time of erection and cutting the labour force, also some saving is achieved by using a standard component unit
    5) problems examination

The duties of the architecture and building branch are:
a) investigation; b) preparation of the regulations and programme briefs; c) study of national problems; d) assessment of projects; e) advice and control of spending within the budget.

SCOLA SYSTEM

HISTORICAL DEVELOPMENT

"SCOLA" is the Second Consortium of Local Authorities, created in 1961 in Hampshire (district of Winchester). It is the second client-sponsored system to be used for school building in Great Britain although various commercially based systems were in use and being introduced at that time.

There are at present 11 full members and 13 associate members in the Consortium. The members are mostly County Councils, City Council and Diocesan Education Commissions. The Chairman of the Board of Chief Architects of the Consortium is Mr. H. Benson Ansell, C.B.E., T.D., ARIBA.

During its existence, two systems were developed; Mark I and Mark II. Mark I has to its credit a total of some 250 buildings and Mark II, existing only since last year, has already 60 projects under construction, some of which are now complete.

This system is accepted with great enthusiasm and is now primarily concerned with preparation for the Metric system which will be introduced in Great Britain in 1972.

It is worth mentioning that all existing Consortia are co-operating fully with each other and the relationship between them is sponsored by the Department of Education and Science of Great Britain, under the Chairmanship of Mr. Lacey, the Chief Architect.

PRINCIPLES OF THE SYSTEM

General Principles

The construction of the building above the foundation slab is generally dry, comprising of a light steel frame, precast concrete floor slabs, wood composition roof slabs and range of finishes. Glazed cladding is in galvanized steel sections used as a curtain walling or as individual windows. Solid claddings are of a light type and a heavy type. Light claddings include: stud frames with slates, tiles and boarding. Heavy claddings include: brick and concrete block. For interior use, the system developed light weight partitions, W.C. cubicles, ceilings, floor finishes, built-in furniture, sanitary fittings, internal doors and finishing hardware.

Modular Planning Grid

Modular planning grid is 1 ft. equivalent to 3 modules of 4 in. each.

Modular Structural Grid

Modular structural grid is 2 ft. (6M). Columns may be located on any 2 ft. position in relation to the lengths of beams and span economy.

Perimeter Structural Support Spacing

The perimeter columns are spaced in any 2 ft. increment up to 12 ft. The widest spacing of the structural support gives greater economy.

Floor to Ceiling Heights: Normal Span - For single storey buildings are 8 ft., 9 ft., 10 ft., 12 ft. for spans up to 30 ft.

Floor to Ceiling Heights: Long Span - For single storey buildings are 14 ft., 16 ft., 18 ft.; for selected spans from 36 ft. to 54 ft.

Floor to Ceiling Heights: Multi Storey Buildings - Both 8 ft. and 9 ft. up to 4 storey, and combination of 8 ft. and 9 ft.

Floor Depths

Depths of upper floors and roof joists are 2 ft. for the spans up to 30 ft. and for longer spans, 3 ft. long span joists are used.

Steel Frame

A pin-jointed steel frame with columns, beams, ties, vertical and horizontal wind bracing is being used. The columns are 6 in. x 6 in. box. The floor beams are on 4 ft. centres and the roof beams are on 6 ft. centres for normal spans and 12 ft. centres for long spans.
Water storage tanks or heavy mechanical equipment are normally supported at any close grouping of columns such as a staircase, or by alternative means, on single storey roof beams.

Foundations

The standard foundations for one, two and three storey buildings are mass concrete pad foundations. For four storey buildings, strip foundations are used.

Roof

Felt and asphalt with or without falls is used.

Upper Floors

Formed of precast concrete units, generally 4 ft. x 2 ft. in size, laid on $\frac{1}{2}$ in. thick continuous cork strips glued to the upper chord of the beam. Continuous steel rods are grouted into the joints and the floor is finished with a latex levelling screed of 1/8 in. average thickness.

Staircases

The standard stairs consist of steel stringers, precast concrete treads and prefabricated balustrades. Enclosures are standardized at 20 ft. x 10 ft. and 22 ft. x 10 ft. The width of the stairs is approximately 4 ft.

External Walls

Glazed cladding consists of galvanized steel mullions with a range of fixed and opening lights in galvanized steel or aluminum. The windows can also be used individually in solid walling. Timber stud framing upon which can be fixed tile, slate, boarding and sheet materials, and brick and precast concrete acting as exterior cladding, are in use.
Fascia units are made of timber or of precast concrete.

Internal Partitions

Double skin plasterboard is used commonly. Where a high impact finish is required, double skin vermiculite-surfaced chipboard is used. Sound reduction factors range from 28 db to 45 db.

Heating and Hot Water Services

There is a Consortium range of heating units including a free standing cabinet type, an under-bench unit and an 8 in. thick unit that can take the place of a partition panel.

Other Items

Internal doors, suspended ceilings, sanitary fittings, finishing hardware and elementary and secondary classroom fittings are part of the Consortium design standards.

Procedures

A number of standard procedures have been adopted to rationalize general administration, the use of drawing office time and the integration of suppliers' work.

ADVANTAGES AND DISADVANTAGES

1. Advantages
   a) The system is largely non-combustible and thus well-suited for schools.
   b) In comparing SCOLA system with any other system, there is no doubt that its dimensional options make it the most flexible so far designed. This flexibility is achieved with 250 different components, 75 of which are commonly used.

2. Disadvantages
   With the large number of different components, the production planning is not easy and therefore strict control of delivery must be maintained. Further, what is even more serious - and this applies to all school systems in the U.K. and not just SCOLA - is the problem of peaks in the production programme due to the fact that schools have to be scheduled to start within a financial year ending on the 31st of March. With large jobs which need all of the preceding 12 months for pre-contract work and allowing for errors in on-site forecast, there results an accumulation of jobs all starting within a few weeks of each other at the end of the programme year. This creates difficulties in the component factories and delays in deliveries to sites. While, in theory, components can be stockpiled, this is expensive to the manufacturer when they are bulky or very complex and also, several components such as windows and parts of the structural frame can only be produced on a job-by-job basis.

COMMENTS

SCOLA system is constantly being improved. From the beginning, improvements must have been considerable since there exists two systems within SCOLA, Mark 1 and Mark II, with Mark I already being discontinued. Members of this Consortium are open-minded, ready to compare notes with other known Consortia of Great Britain. Also in preparation for the change to the Metric System, certain changes are being made and by 1972 SCOLA system will be ready for it.
From the aesthetic point of view, SCOLA buildings are amongst the best.

PRACTICAL APPLICATION OF THE SYSTEM

On May 2nd our group was welcomed by Mr. H. Benson Ansell, County Architect of Hampshire and his senior staff. The meeting was held in the Queen Elizabeth Court of the Castle in Winchester. During the morning session, we were presented with the principles and development of the system. This was followed by a film on the Consortium's SCOLA buildings. A representative of the Consortium steel frame supplier was also present. Manuals and drawings were on display.

We visited the following projects:

1. Fair Oak Secondary School
   This school is a completed Mark I SCOLA project and is occupied. It is a three storey building with a large area of windows and a contrasting horizontal floor emphasis. Well planned with minimum areas allotted for circulation – no waste.

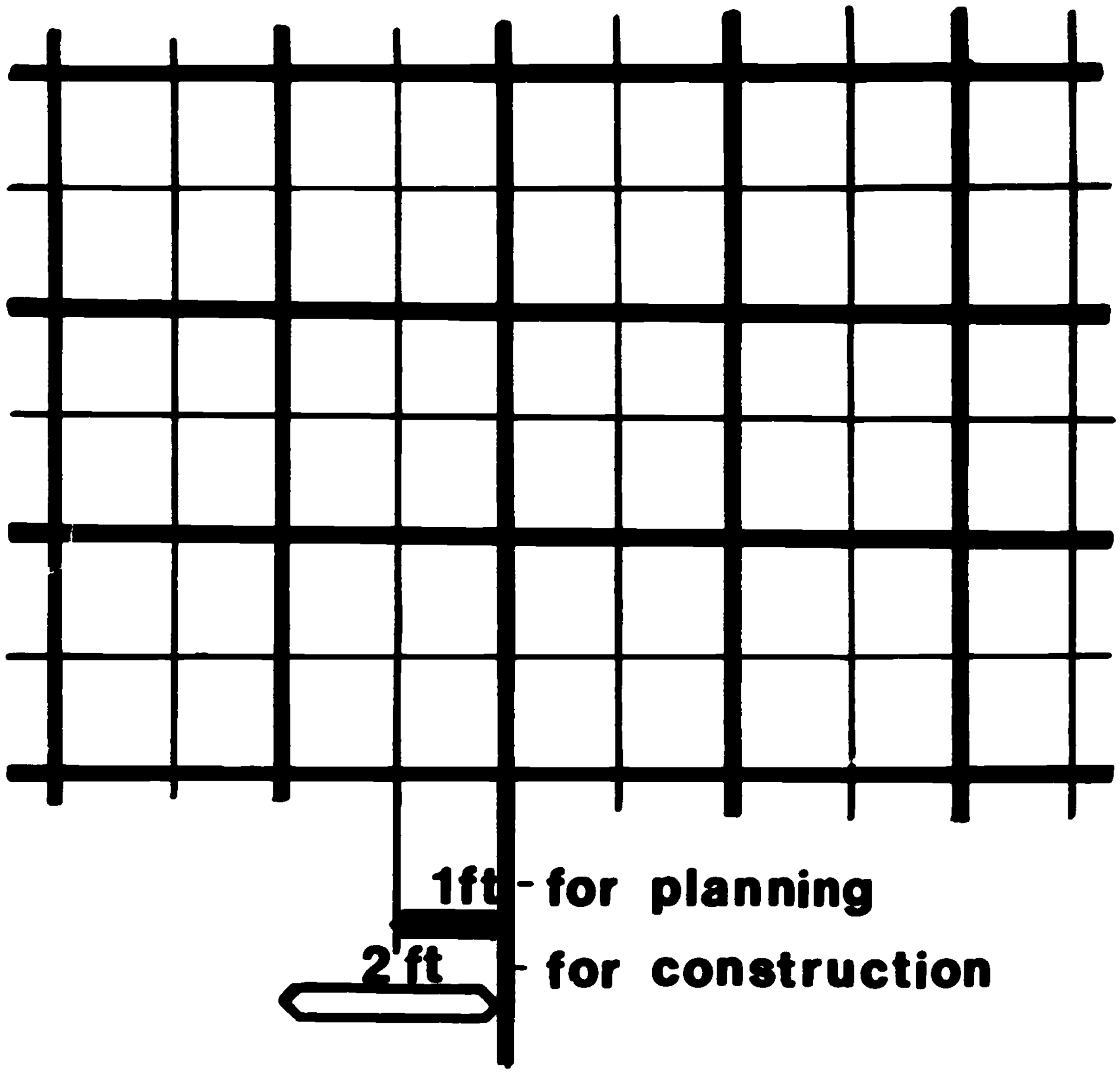
2. Fair Oak Junior School
   This school is a Mark II SCOLA project under construction. At present only steel framing has been completed. The work has been done by 6 workers in 5 days, under the general supervision of Mr. Brocksom, Manager of Messrs. Sanders and Forster's 'Open Web Steel Joist Division'.

3. Wickham Primary School
   It is another Mark II SCOLA project under construction, 80% completed. Workmanship, as in most of the schools, is good and it is an open plan building.

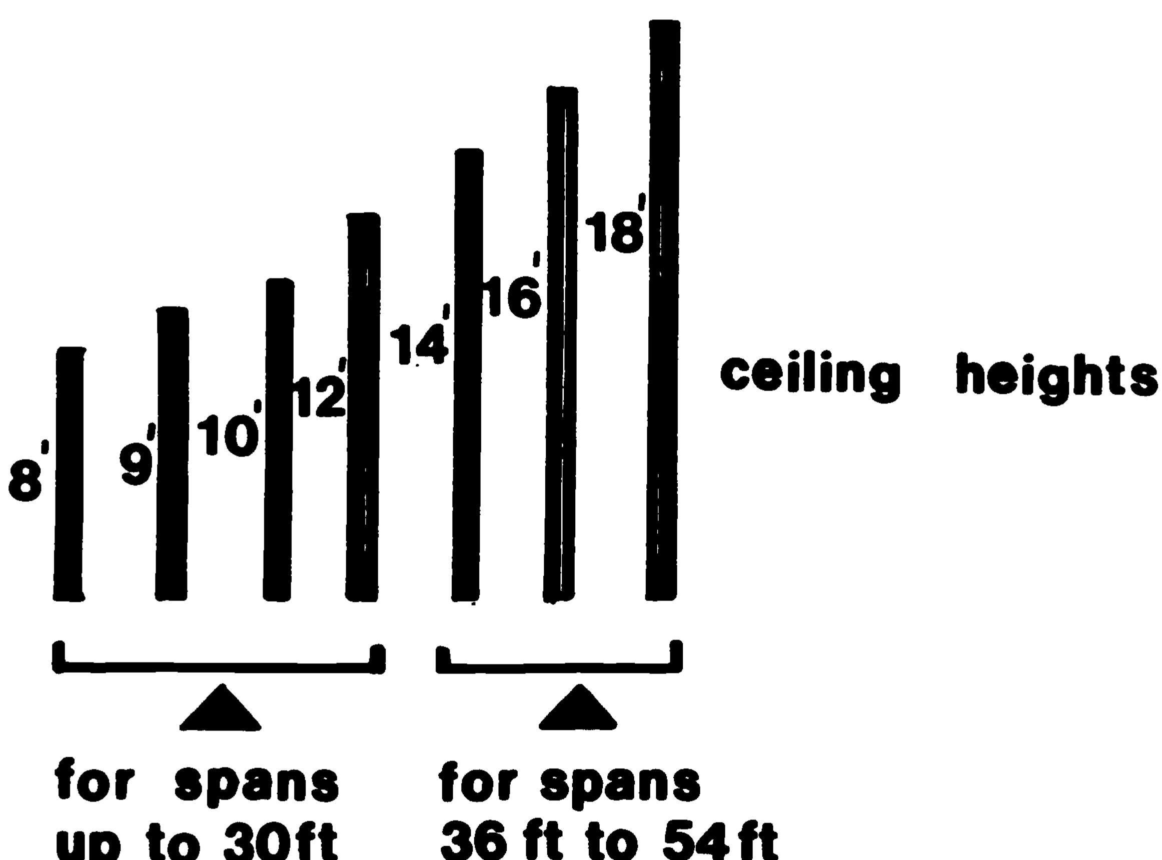
4. Havant Wakeford Copse Secondary School
   This school is Mark I SCOLA project, almost completed, but not yet occupied. It is multi-storey with large window areas, very attractively decorated both inside and out. Built-in and loose furniture were designed and finished in natural wood. Wood is well used for interior finishes.

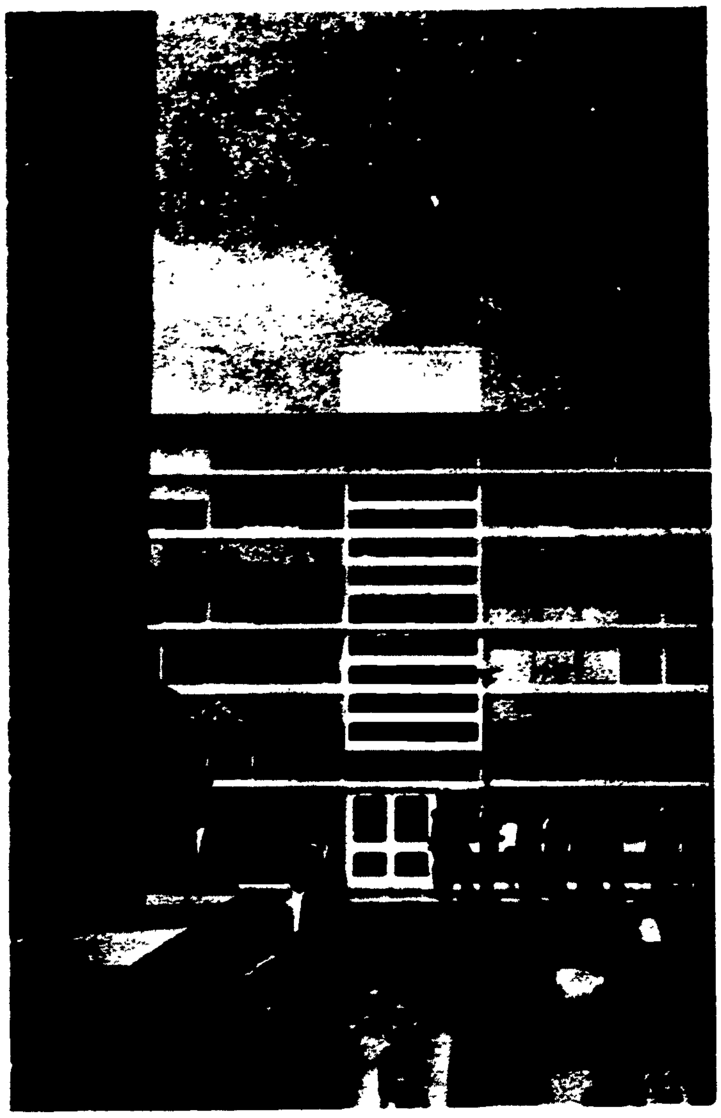
5. Steel Plant, London
   During our visit, we were welcomed by the executives of this Company, who arranged for us to tour the premises. The plant manufactures columns, beams, and castellated floor and roof joists for the SCOLA system.

horizontal



vertical





"Scola" Secondary School
District of Winchester
Hampshire, England

"Scola" Secondary School
District of Winchester
Hampshire, England

M E T H O D   S Y S T E M

HISTORICAL DEVELOPMENT

The origin of Method as an idea goes back to 1960. In 1961, the first active steps were decided upon and by 1963 enough development had been done to launch Method officially on its first programmes.

Component buildings and methods were developed in 1965-66 and in that time, 25 school buildings were constructed with this system for £2½ million. Its current third year programme is for some £7 million. The fourth year programme starting next April is in the amount of £10 million.

Method building is controlled by a committee made up of chief county architects with the county architect of Somerset acting as chairman.

A working party meets at frequent intervals to give close guidance to programme control and the development work which is undertaken by the central team in Taunton under the leadership of G.M. Fullman, the Co-ordinating Architect.

PRINCIPLES OF THE SYSTEM

Method Building has from its beginning aimed to be a co-ordinated system backed by organization. Method seeks to combine the advantages of system organization with more open attitudes towards design and supply.

Method system ensures the freedom of design and technique that stems from its underlying dimensional and organizational discipline.

Method provides an architect with an organized, co-ordinated modular component vocabulary ranging across the techniques from the light steel frame to the pre-cast concrete frame and several forms of composite and load-bearing construction. This system puts at the architect's disposal a modular, dimensionally co-ordinated range of primary and secondary components which may be used, at choice, to design with considerable and increasing freedom a very wide range of building types.

All this is backed up by supply and management organization and cost advantages.

Component Development

1. Concrete Frame:
   Final development of the concrete frame is proceeding. The first two buildings to use this frame will be constructed this year, to be followed by two next year.

2. Concrete Claddings:
Development of these is being undertaken for the steel and concrete frames.

3. Factory Finishing:
External joinery partly painted in the factory has been introduced this year to assist in reducing site labour and raising standards. This is regarded as a step in the direction of fully factory-finished components. Progress will be made in this direction as economy and efficiency indicate.

4. Foundations:
It is proposed to continue studies towards reducing costs and time required for foundations by using precast foundation units.

5. D.E.S. Partitions:
This Consortium together with others has, through the agency of the Department of Education and Science, taken part in the preparation and publication of a performance specification for internal dry partitioning and the appraisal of the design and price tender stages, both of which are completed. The system is known as the IBIS partition and consists of two separate skins of P.V.C. coated steel sheet backed with a plaster and sand mix. It is supplied finished, completely dry-erected, will reduce site labour and meets very high performance standards with cost limits. This national co-ordination has led to the development of a new partitioning technique which no one Authority could have managed alone.

6. Mechanical Services:
Whilst the Consortium's general policy on Mechanical Services remains that no commitments to any one particular supplier or system should operate, two developments have taken place. The first is a system of percentage discounts with a firm of boiler manufacturers; the second is with a heating engineering firm who are making available their latest techniques and devoting resources for further development on a small programme of work.

7. Future Development:
The most significant event ahead for the Consortium and for others in the construction industry is the change to metric system.
The first metric programme of method building will be in 1970-71 which complies with the timetable of the British Standards Institution - the Consortium studied the use of the most suitable computer system. Studies are in progress for this purpose to apply it at an appropriate time.

ADVANTAGES AND DISADVANTAGES

1. Advantages
   a) Method building aids productivity in the drawing office and on the site. A five classroom school at Nailsea was built in 6½ months using Method system, while 11 months are needed to build a school of the same size with traditional construction.

   b) Five freedoms of design and technique:
      - modular dimensional freedom
      - freedom from fixed grids
      - freedom of structural form
      - freedom of design
      - freedom from supply monopolies

2. Disadvantages
   a) Dimensional rigidity
   b) Single structural form
   c) Cost increase - because the choice in the system is great, quantity discounts are less.

PRACTICAL APPLICATION OF THE SYSTEM

During my research study in Great Britain I visited the following projects:

1. Public Library, Wells, Somerset
   The architect for this project - B.C. Adams, ARIBA, County Architect, Somerset
   Approximate floor area 2,825 sq. ft.
   Mixed steel and load-bearing structure, standard components.
   A typical urban project, built on the site of an old building.
   Stone used as a wall material to match surrounding houses.

2. Junior School, Worle, Somerset
   The architect for this project - B.C. Adams, ARIBA, County Architect, Somerset
   Steel frame, standard components.
   Capacity of school - 60 students, 40 sq. ft. per student.
   The school has very pleasant character and is designed within human scale.

3. Selworthy Junior Training Centre, Taunton, Somerset
   This centre is for educating and training of abnormal children. The centre has an open plan. Space is very well chosen for these children to help them to be active members of society.

4. Ainsham School, Oxfordshire
Architect - A.E. Smith, ARIBA, County Architect, Oxfordshire
This school was built using standard components. Design with an open plan, departure from classrooms.

5. Gordono Comprehensive School
In Great Britain a reform is taking place now in the educational system to convert secondary schools to new comprehensive schools, to allow the graduate of these schools to attend a University. The Gordono School Plan is very well organized. Laboratories are very well equipped especially the language laboratories. The school has a special building devoted to sport activities. This building has a main game floor and also a mezzanine used for weight lifting and other such gymnastic activities. It is made up of long span joists, simple type of a roof and cladding.

Also during my research study, I had an opportunity to visit manufacturers.

1. We visited a large and modern aluminum plant in Weston-Super-Mare. We were guests of Mr. Jim Rush, President of this company. The plant produces windows as well as complete wall panels. Average size component window is manufactured in 52 minutes. This company competes with 30 other aluminum window manufacturers in Great Britain.

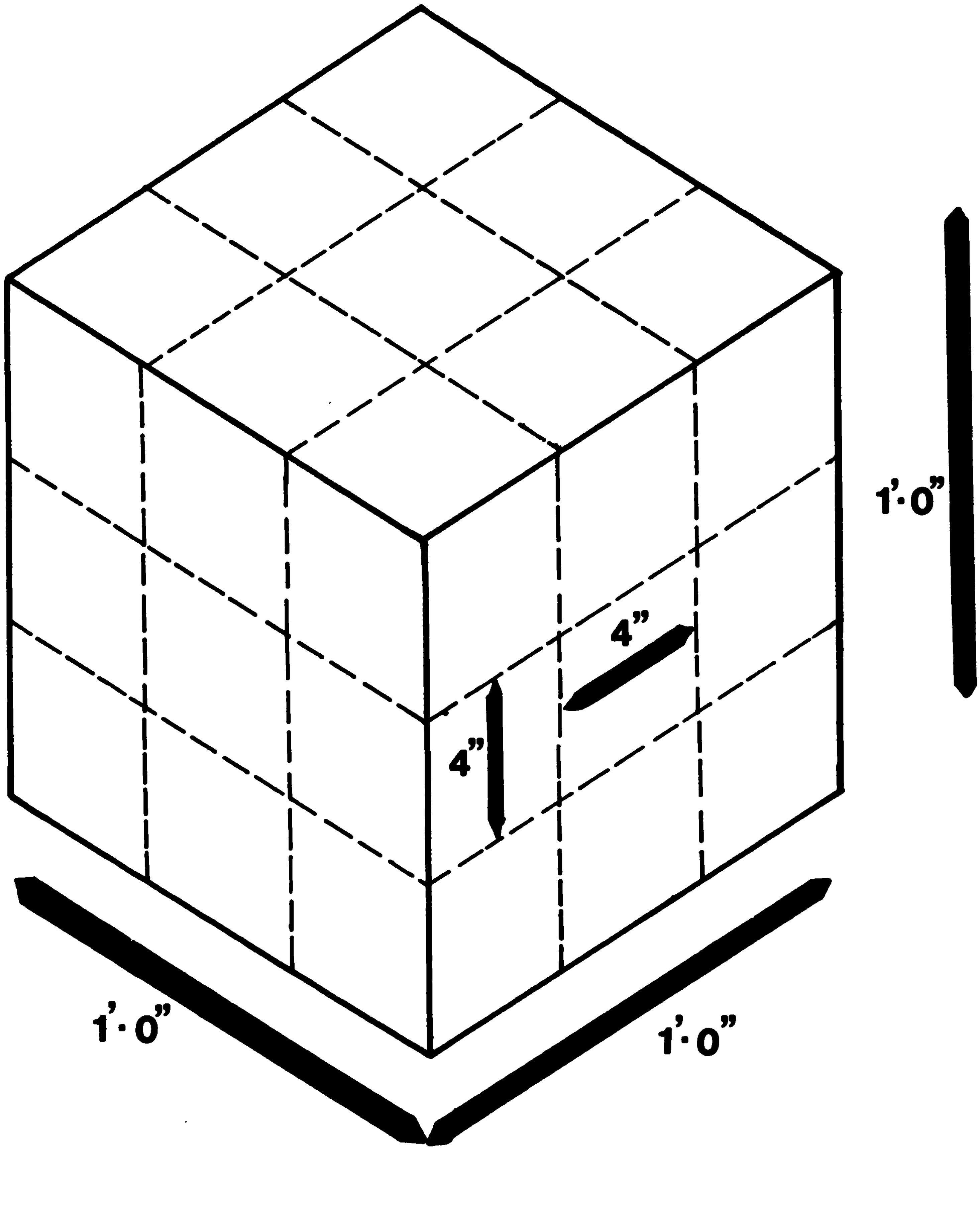
2. Pratten Buildings & Joinery, F. Pratten and Co. Ltd., Midsomer Norton, Bath
Manufacturing wood windows, doors, complete component wall panels for exterior use and portable classrooms and office units. Plant is completely mechanized in spite of being housed in old buildings. Factory employs approximately 250 workers and takes an active part in manufacturing components for Method System.

COMMENTS

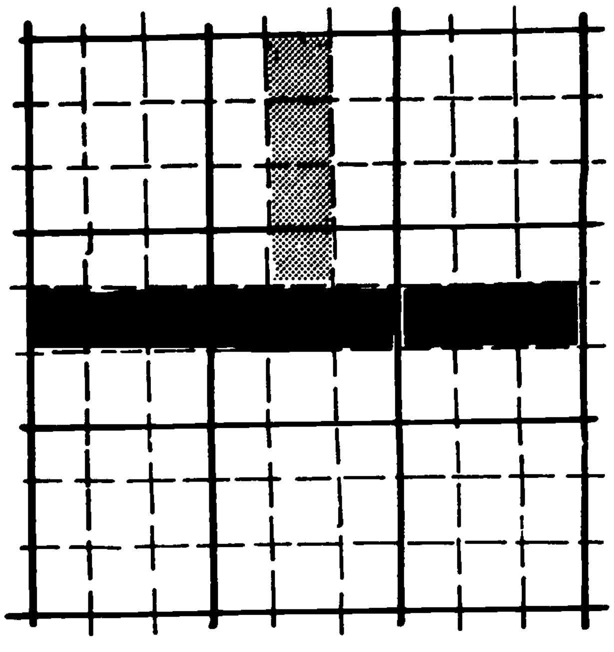
1. Method cuts time of producing working drawings in architect's office in half. It also saves time and labour during construction. During the last year, the Consortium noted 11% saving in steel cost. Further saving in steel is expected.

2. This system also has provision for steel pitched roof trusses to suit local requirements (Wiltshire school).

3. Schools built with Method could be very flexible and architecturally attractive.

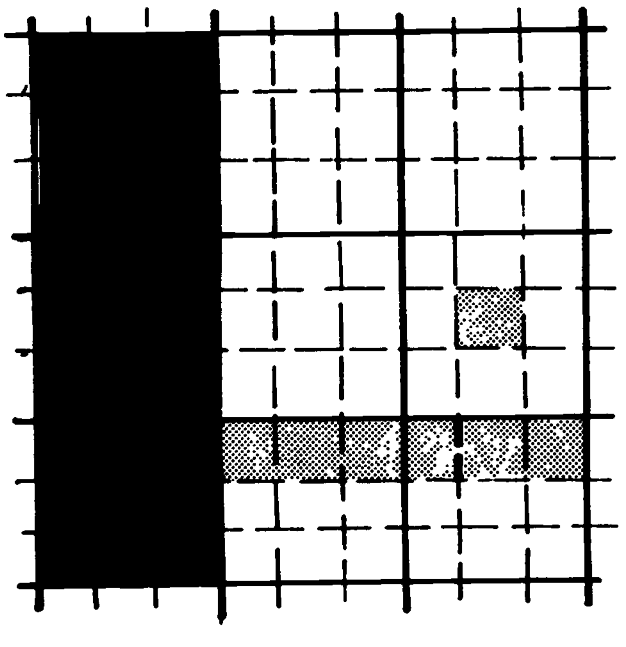


Dimensional Basis
Method building is based on reference lines one foot and four inches apart, vertically and horizontally.
This forms a dimensional framework for positioning structural and related components.



Component dimensions are usually in foot increments, while the 4" framework is mainly reserved for positioning.

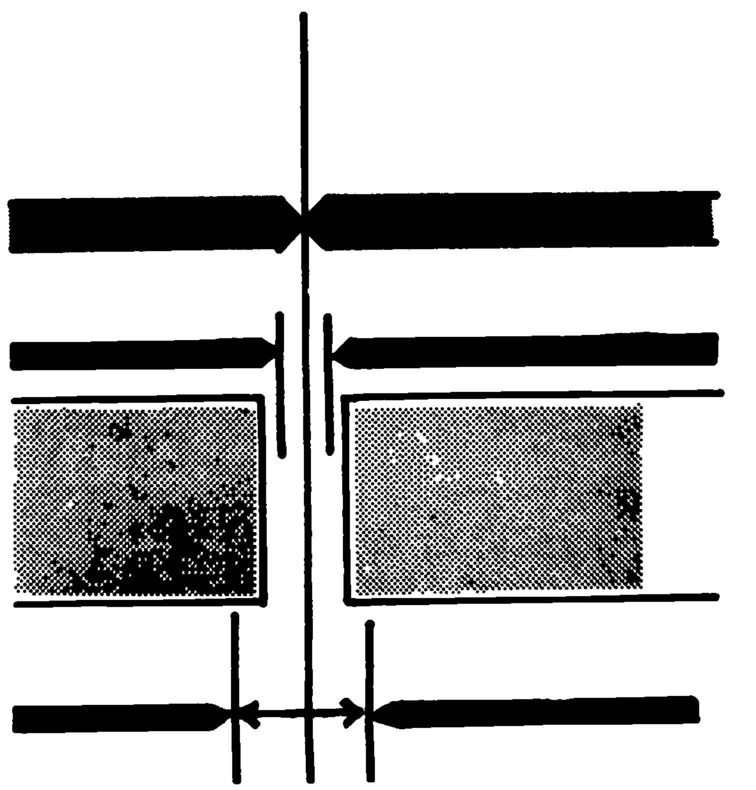
i.e. partitions, window transom height etc.



SIZE OF COMPONENTS

Components are referred to by nominal size but usually manufactured within this to allow for joint thickness and tolerance. Lengths and width are generally related to whole feet dimensions or are designed to aggregate to foot units.
Thicknesses depend upon material and construction but are positioned in relation to 4" and 1'-0" zones.

Windows and cladding have an additional range of 6" increments to facilitate a change of position from reference plans to centre of columns where necessary.

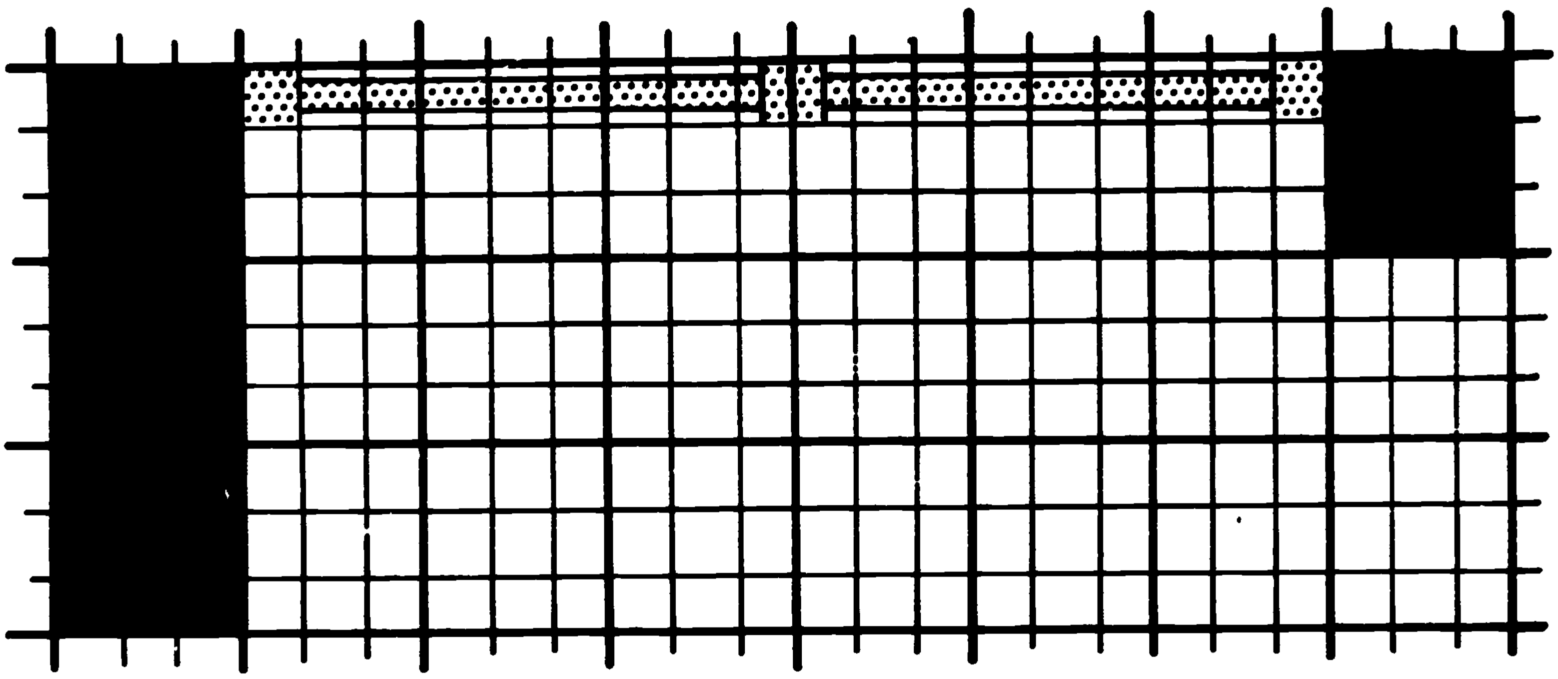


Nominal modular size

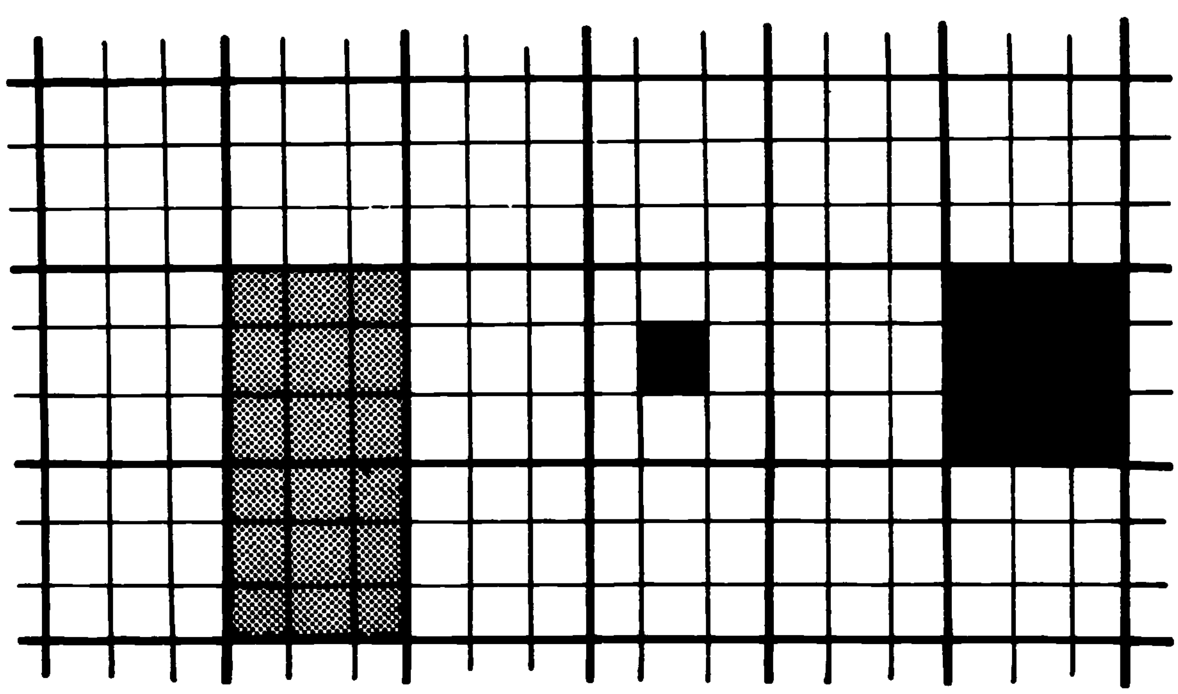
Minimum joint thickness

Component manufacture size with ± tolerance

Minimum manufacture size maximum joint thickness

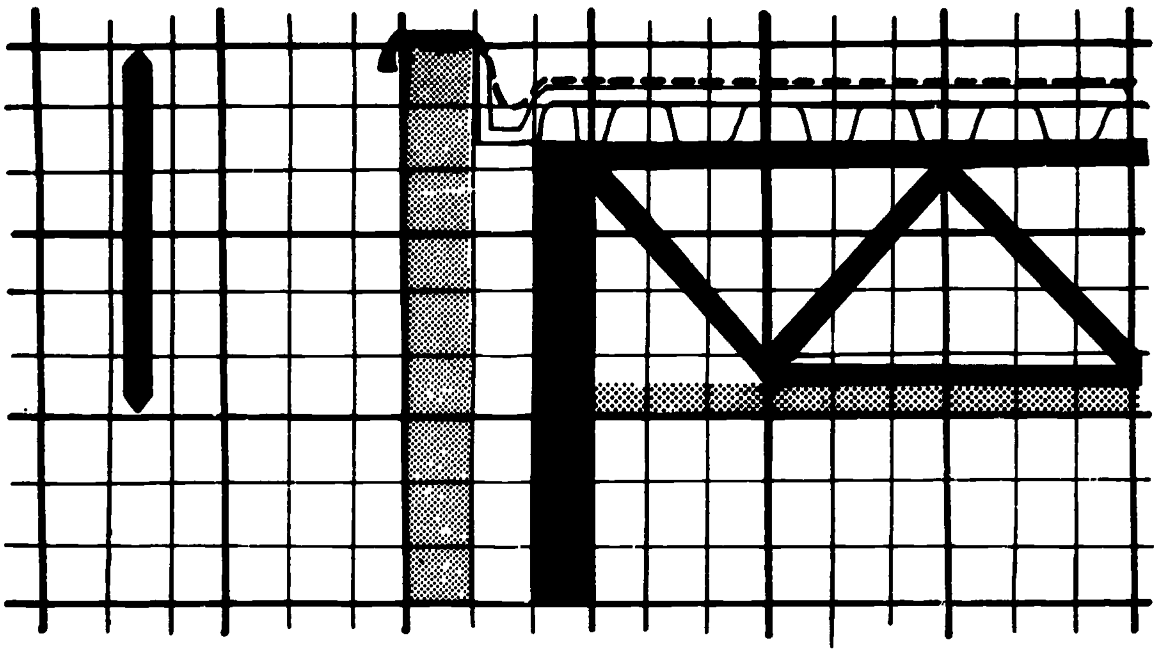


Window sizes are generally in one foot increments (3m) and relate to reference lines.



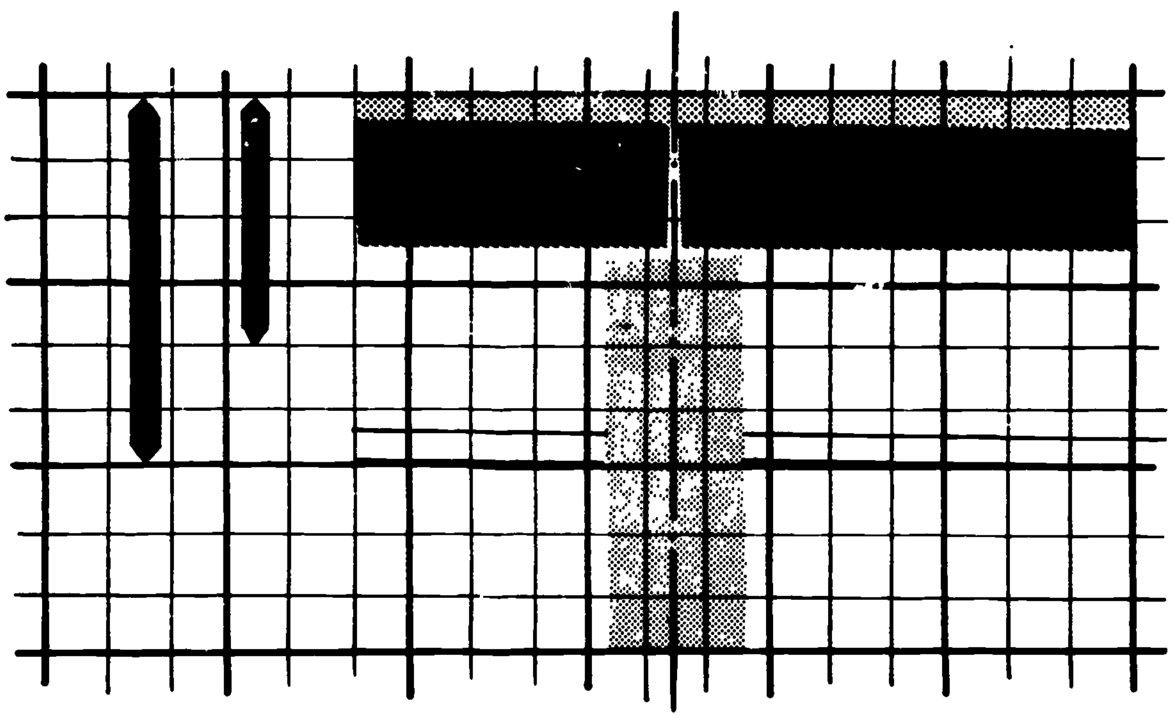
METHOD SYSTEM

Uses three basic types of structures, steel frame, precast concrete frame and load bearing walls. The structural zone principle was adopted to co-ordinate these, and secondly to integrate components for use with each form of structure.



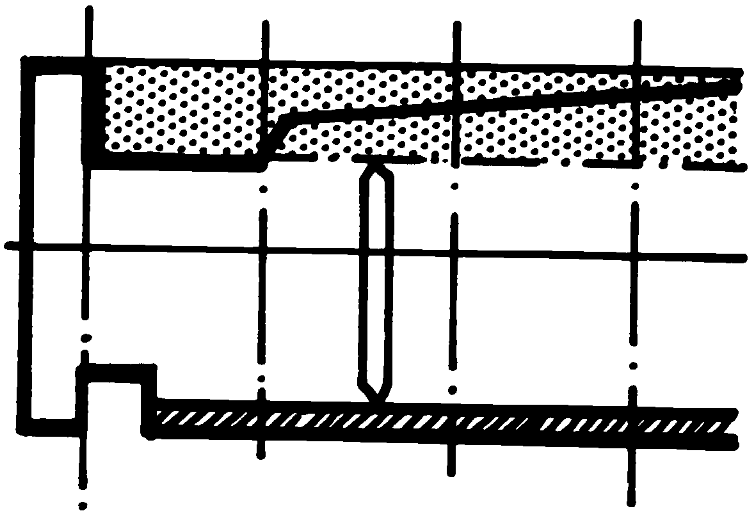
ROOF

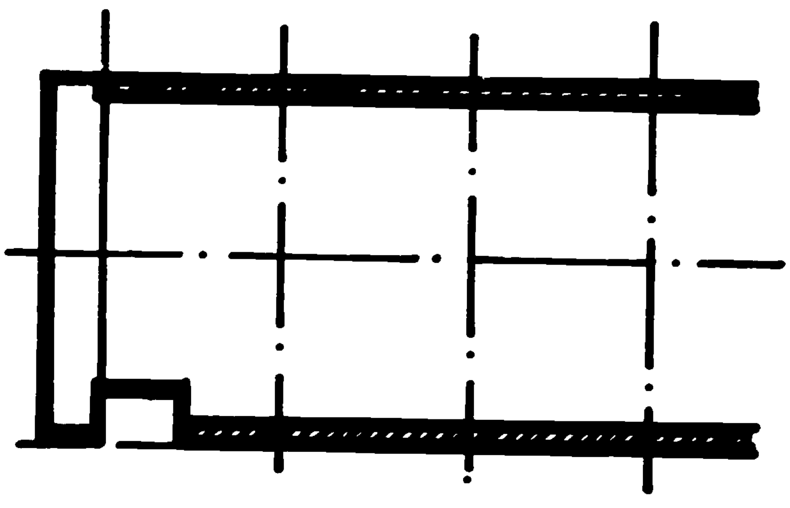
Section showing standard steel roof beam used in load-bearing construction with brickwork extending to top of roof zone externally. Perimeter gutters are optional.

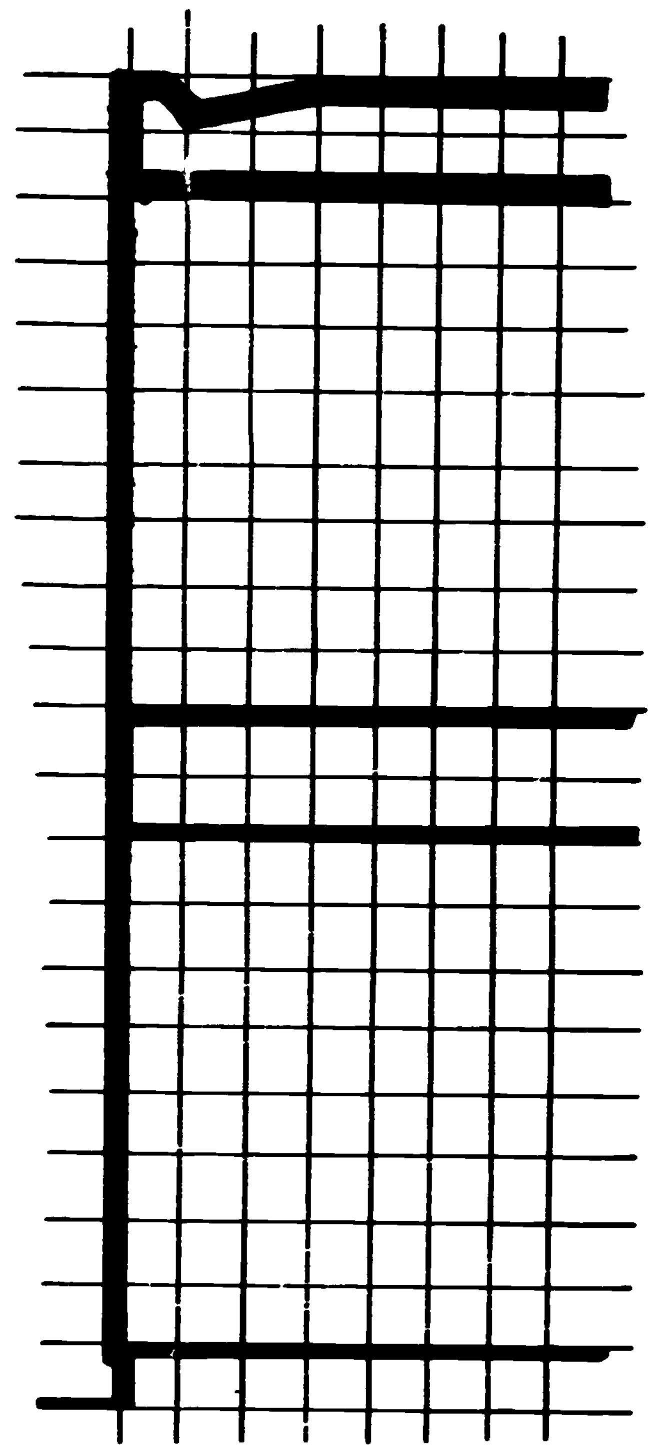


FLOOR

Section showing 8" deep precast reinforced concrete floor troughs supported by an 8" thick load bearing block wall in a standard position. Either one foot or two foot floor zones can be used.



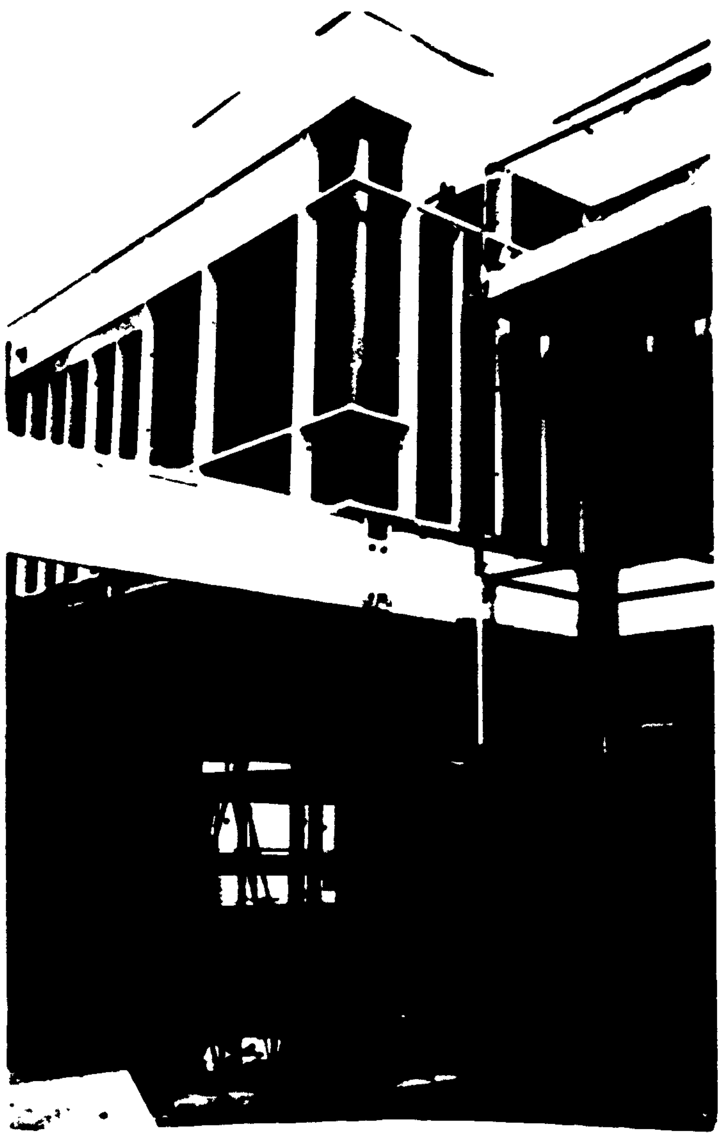




FLOOR TO CEILING HEIGHT

Finished floor and finished ceiling levels are on the one foot reference lines. Floor to ceiling heights are in one foot increments, with preferred heights of eight, nine and ten feet.

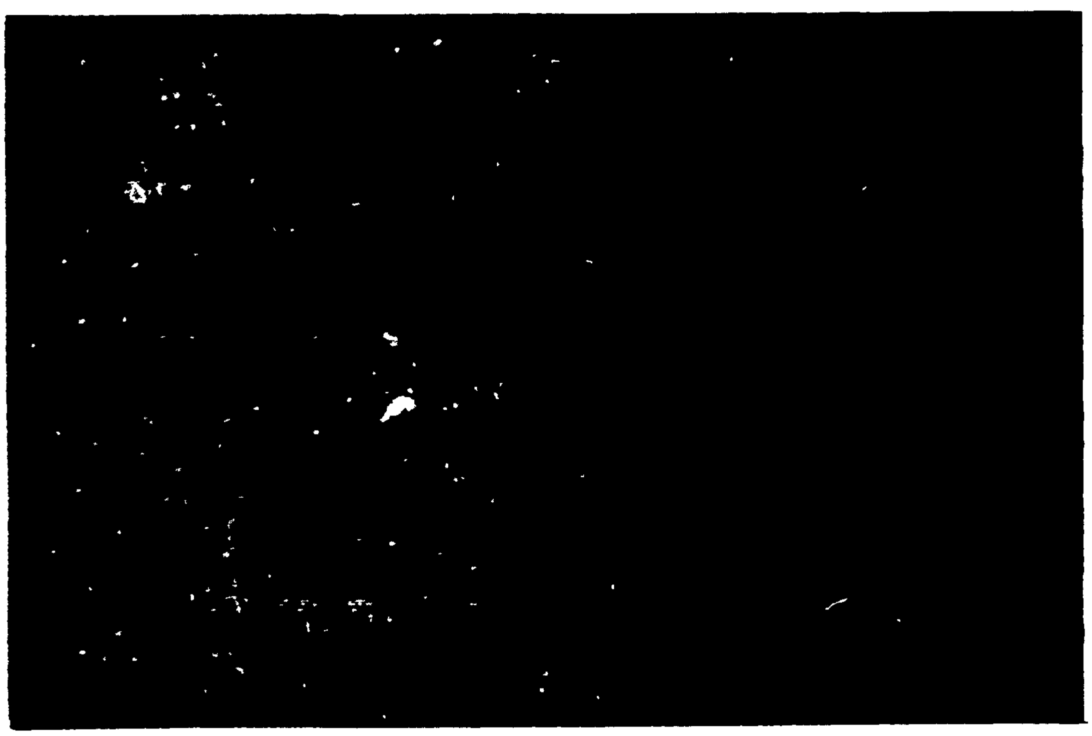
Intermediate floors and roofs are allocated zones in foot increments, according to type and plan. Floor zones are usually two feet, and roof, though usually two feet may be one, three, or four feet. Roofs have a 6" space at the top to accommodate falls, decking and gutters, where required, and a 2" space to underside, to accommodate suspended ceilings. Floor zones have a 2" space at the top to accommodate reinforced screed and floor finish, and a 2" space to underside, to accommodate suspended ceilings.



"Method" Portishead Comprehensive School
Somerset, England
(under construction)

"Method" Yatton Junior School
Somerset, England
(under construction)

"Method" Woroughton
Wiltshire, England



"Method" Worle Junior School
Somerset, England

"Method" Luxulyan School
Cornwall, England

"Method" Nailsea Infants School
Somerset, England
Classroom 8, Domestic Space

A75 METRIC SYSTEM

HISTORICAL DEVELOPMENT

A75 Metric System is privately developed in contrast to other systems that are sponsored by the Local Authorities.

A.H. Anderson Limited was founded in 1955 for the specific purpose of developing and promoting industrialised building systems.
Mr. A.H. Anderson is the founder of this system and he personally controls the staff of architects and engineers who perfected this system during the last three years.

A75 was originally developed as an all timber system applicable up to two storeys, based on a 6 ft. 3 in. (75 in.) structural and planning grid. In 1959 lattice steel beams were adopted in lieu of box timber, and a steel frame and concrete floor was developed to take the system up to five storeys.

In 1965 it was decided to review A75 and to bring it into line with the latest developments in both building technology and in dimensional co-ordination. The result is a new system, A75 Metric, which, while breaking new ground in design, is based on 12 years practical experience with the original A75.

The system is used for the design of schools, office and industrial buildings.

The programme shows that, starting in 1969 some designers will begin producing working drawings in metric measures. During 1969-71 some products will be unchanged in size, though expressed in metric terms, others will be available in new metric dimensionally co-ordinated sizes.

PRINCIPLES OF THE SYSTEM

A75 Metric is a system of industrialized building for structures up to 5 storeys. This system is designed to metric dimensions with a basic module. This system was developed in accordance with the announcement of the English government supporting the change to the Metric System.

Basic Sizes

All components are in multiples of the basic Module M = 10 cm (3.927 in.)

Structural Grid

The structural grid is 36M (11 ft. - 9.732 in.)
Columns are normally spaced at intervals of 36M around the perimeter of the building. It is possible to reduce the column spacing to 18M or to increase it to 54 or 72M.

Vertical Dimensions

Standard Ceiling Heights are: 24M, 27M, 30M, and for halls: 36M, 48M and 54M.
Floor and ceiling depths are constant, equal to 6M.

Suspended Floors

Prestressed concrete beams and light weight concrete hollow block.

Columns Coating

Fibrous plaster providing a fire protection rating of up to 2 hours.

Roof Deck

A structural metal roof deck is wedded with sandwich construction on the upper surface to provide insulation, a vapour barrier and weatherproofing.

Wall Panels

Prefabricated solid, glazed and louvred wall units.

Foundation

Poured concrete bases with two inverted down bolts for attaching the steel columns.

Method of Operation

The Company's service assumes that the normal procedures for the design and construction of a building are pursued.

Its basic service consists of:

1. Providing full information on the application of its systems of construction and consultation with the architect and professional advisors.

2. Scheduling and ordering all selected components for a particular project.

3. Ensuring delivery and assembly of components. The company contracts as sub-contractors for the supply and assembly of the building shell, or as suppliers of the components. For a large project, the service can be provided on a fee basis. Assembly may be executed by the company or by the builder.

ADVANTAGES AND DISADVANTAGES

1. Advantages

   a) All components of the system are multiples of the basic module M.
   b) It was found in practice that the metric dimensional system is extremely simple to apply. Only the application of dimensional co-ordination in the building industry will result in economics - the actual use of metric has no cost advantages over imperial measure, but it is a convenient time to introduce it. Economies due to dimensional co-ordination may not become apparent for several more years.
   c) The planning grid of this system is small and therefore, gives complete flexibility in adjusting to the space requirements.

2. Disadvantages

   We were not able to see sufficient usage of this system to evaluate it properly. But it would be fair to say what is true of all systems - that the greater the degree of standardization, the less the design freedom.

PRACTICAL APPLICATION OF THE SYSTEM

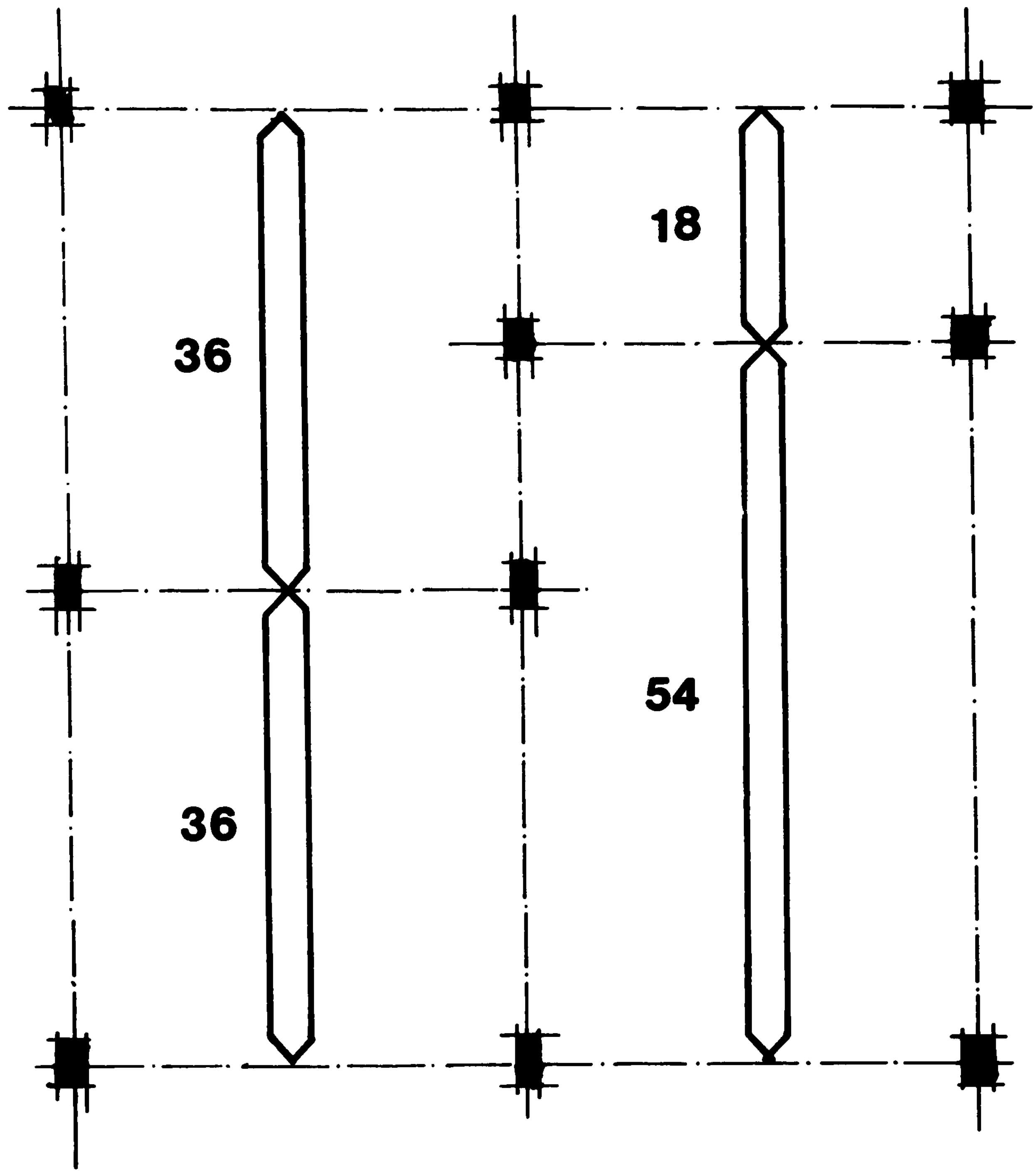
During our visit to London we had an opportunity to examine the following projects:

1. Technical College, London
   A large addition has been added to this college using the system. The building and its construction proves that the components of this system are well made and properly joined together. The building is multi-storey with prefabricated open stairs, large areas of glass and pleasantly landscaped grounds.

2. Administration Building in London Docks
   This is a two storey building, steel frame with wide spans, providing flexibility for office planning. Most of the exterior cladding is wood. This building was constructed in the minimum of time.

COMMENTS

The theoretical development of this system is sound. It has great possibilities for practical development both in Europe and in this country.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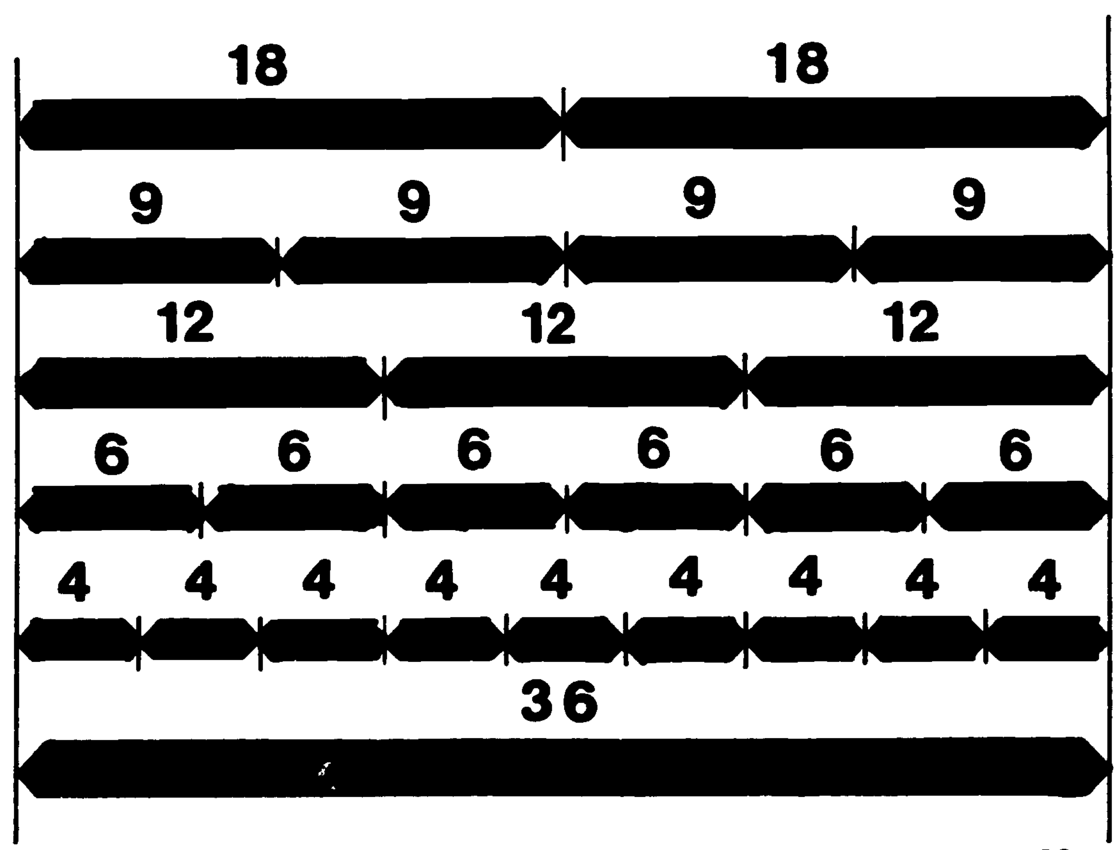
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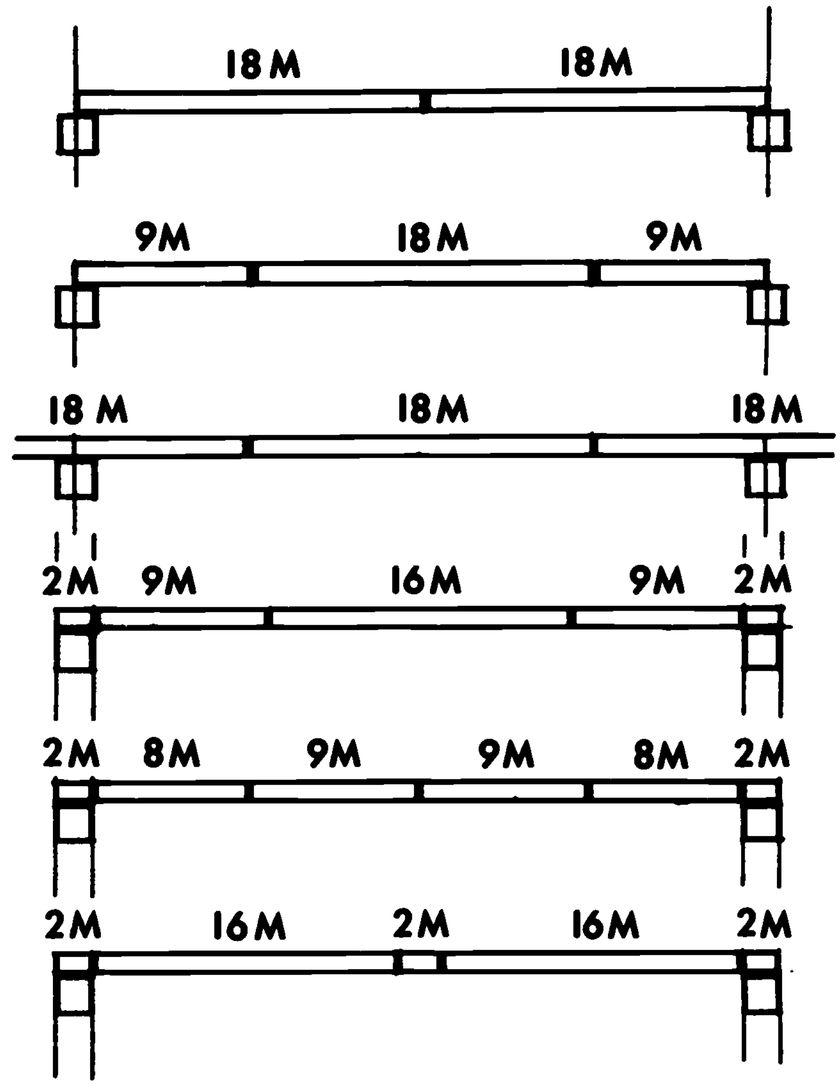
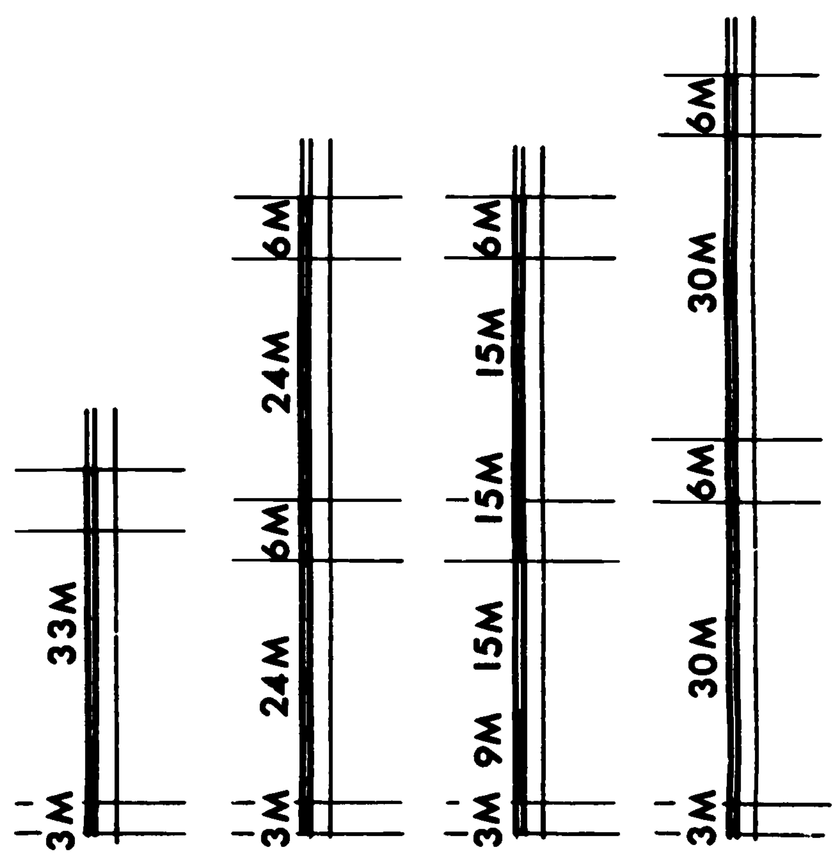
Walling Combinations in Plan

The external walling units may be arranged in plan in many different ways. They may be terminated on the centre-line of columns, or allowed to pass across the face of the columns, or stopped either side of a column. Care should be taken in the location of doors and windows so that columns do not obstruct their opening. They should not be placed in both adjacent faces of a re-entrant corner.

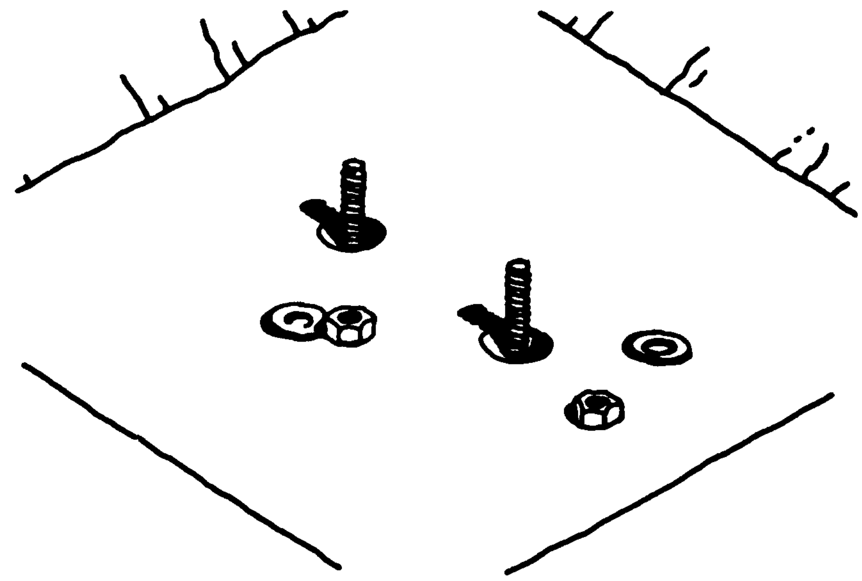


Walling Combinations in Section

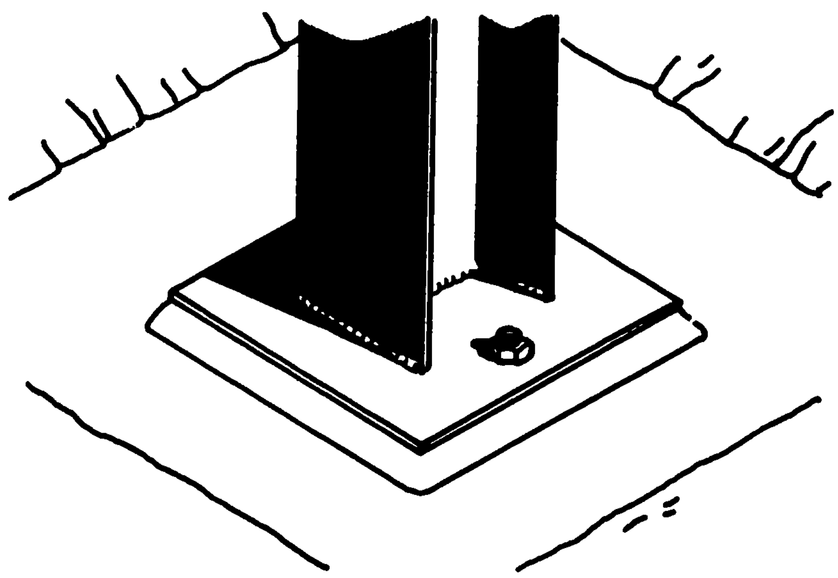
The external walling units in section may span from floor-to-roof or from floor-to-ceiling.
Panels for single-storey buildings normally span from floor level to roof line and incorporate the fascias. Panels for upper storeys normally span between fascias or may span between spandrels and fascias.



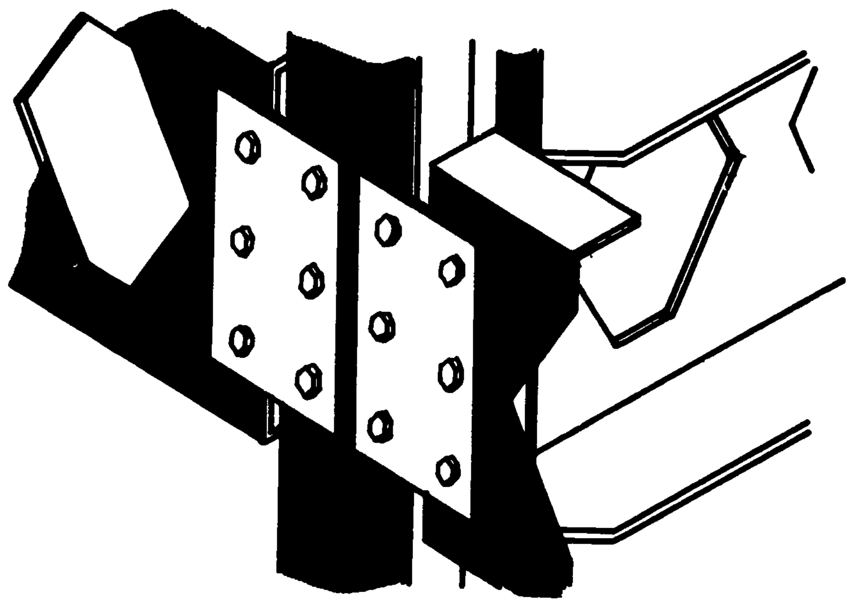
The site is stripped and individual holes are excavated to the dimensions required by the structural engineer; concrete bases are then cast with two holding down bolts inserted.



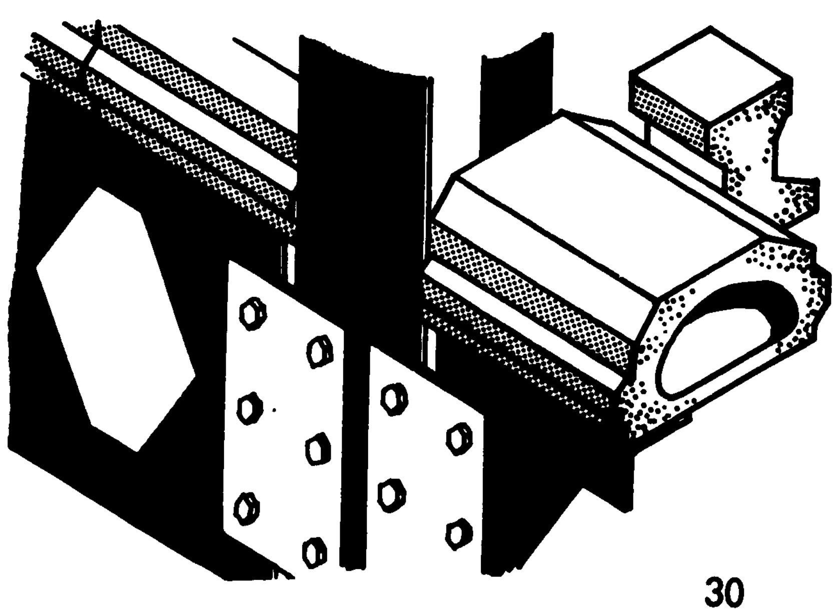
The steel columns are placed in position.



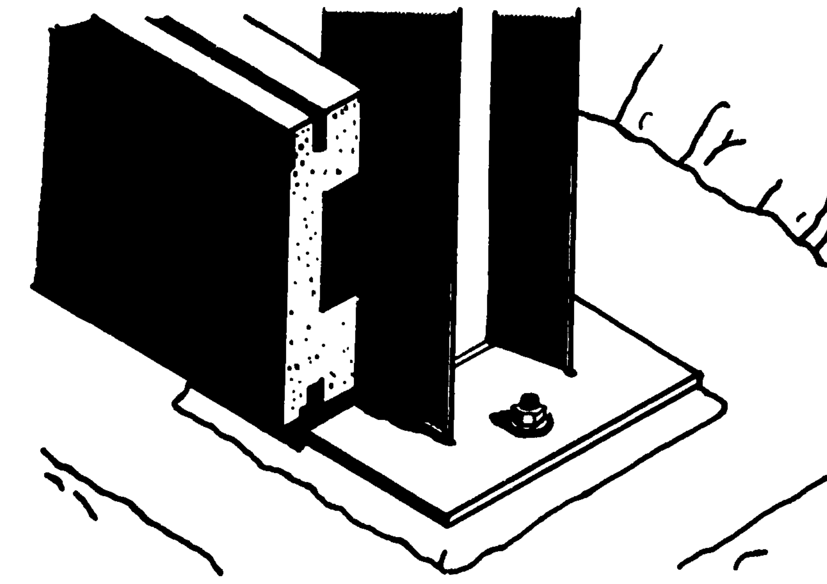
As each column is erected, perimeter ties and beams are connected at floor and roof levels, bracing is fitted, the frame levelled and plumbed, and bolts grouted. Temporary steel guys are erected to retain the steelwork plumb and true until structural floors are fixed.



Suspended floor units are laid and grouted forming working platforms for the fixing of the fascia panels and for carcassing work of other trades.



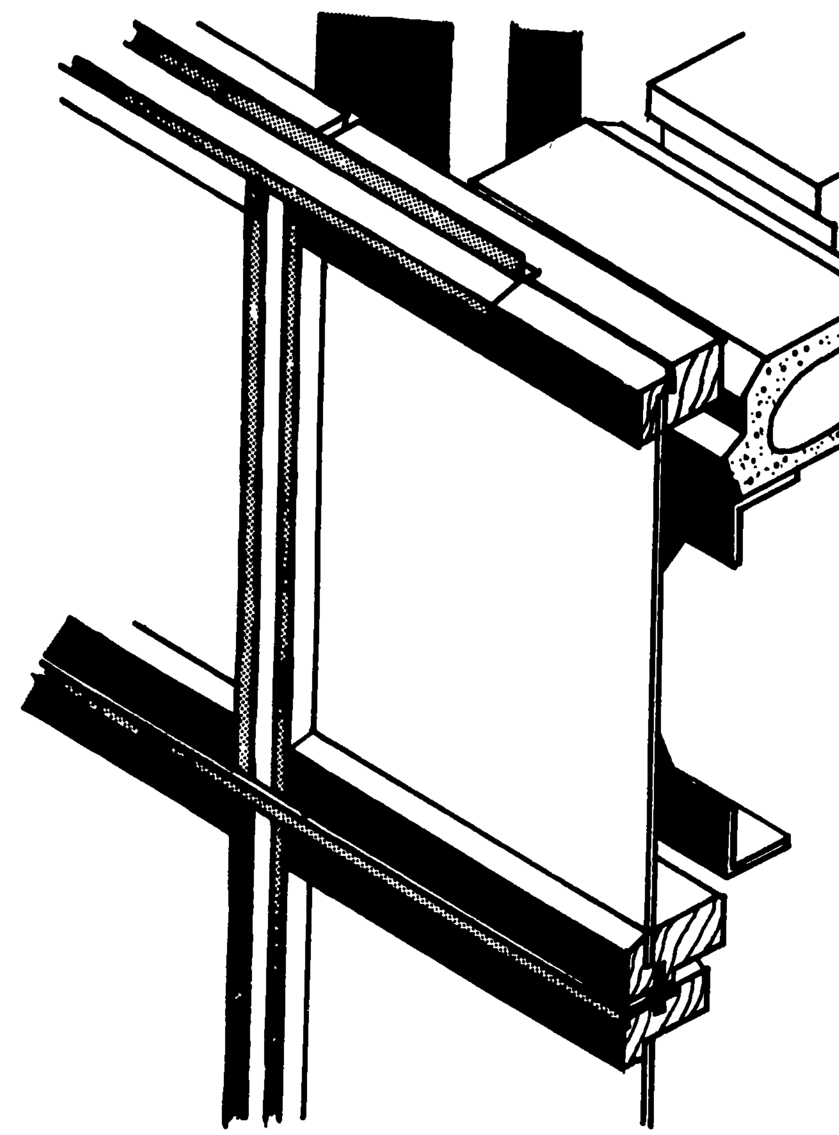
By this stage drainage and other underground works should have been started, concrete edge beams are erected, leaving out units for access of mechanical equipment. Hard-core is placed, and ground floor slab cast, using the edge beams as permanent shuttering.



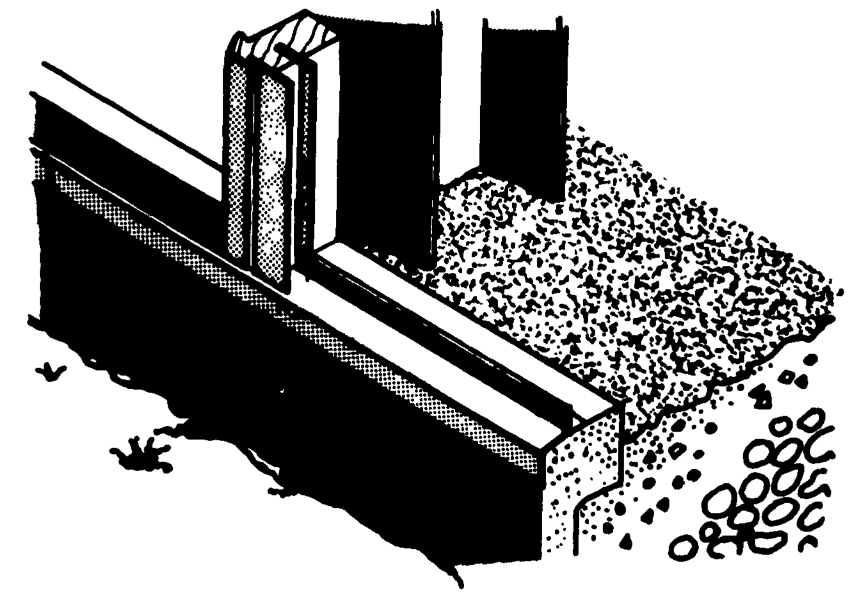
Fascia panels are located and fixed working from first floor to top floor. Roofing may now commence, including fixing rainwater sumps, pipes and roof lights. Where a cradle is required for subsequent cleaning purposes, it may also be used to aid assembly.

Walling units are fixed, and column casings fitted.

Aluminum verge cappings may now be fixed over the head of panels at roof level and remaining elements completed under cover.



Note: This is a preferred sequence of assembly; other sequences are feasible to suit particular requirements.



CLASP SYSTEM

HISTORICAL DEVELOPMENT

Formation of the Consortium

On July 24, 1957 a meeting of interested local authorities was convened under the Chairmanship of Lord Hailsham who was then Minister of Education.
The authorities were asked if they would like to join a larger group to utilize the system of construction developed by Nottinghamshire. It was decided that full membership of the proposed Consortium would be open to any authority prepared to build three jobs in the system during the following year and that an associate membership would be open to others. As a result of the meeting, the "Consortium of Local Authorities Schools Programme" was formed - an organization now known by the cryptic word CLASP from the initial letters of its title.

This name was changed to "Consortium of Local Authorities Special Programme" a few years later when it was realized that the system was being used for many building types other than schools.
CLASP was created because there was a great need for new buildings while the resources at the disposal of local authorities were limited both in men and in money. The traditional method of building was too slow and if one turned to prefabrication, the only way to make it pay would involve an order much larger than local authorities could afford. Through this organization, a way was open for economy, speed and quality of building.
The founder members were: City of Coventry, Derbyshire County Council, Durham County Council, Glamorgan County Council, County Council of the West Riding of Yorkshire, City of Leicester and Nottinghamshire County Council.
Not all new ideas are practical, but this one was proven to be better than could be expected. Figures speak for themselves and show that; in the first 10 years of CLASP, there were already 703 buildings completed and 129 under construction. The total value of all projects was £75 million. The initial group that consisted of 7 local authorities grew to 18 members and include at present, besides the local authorities, some universities and public bodies which include: Bath University, York University, University Grants Committee, Department of Education and Science and Ministry of Public Building and Works. Membership is open to any Authority who wants to participate in the programme.
Since its beginning, the system has been vastly improved. Many European countries have also adopted this system.

Nottinghamshire

Visiting Nottinghamshire was of great value as it has the most important role in developing the use of CLASP system in school building. The Canadian group also had an opportunity to meet with members of the Central Group Staff: S.E. Bell, Principal Architect; G.G. Phillips, Development Group Leader; I.G. Bobbett, Senior Development Architect; and J. Bennett, Senior Quantity Surveyor.

The first experiment for a prototype was decided in 1946 by building the infant's section of Cheshunt Primary School consisting of three teaching spaces with their associated laboratories and cloakrooms. In this school, light steel construction, precast concrete roof, floor and wall units were used.

In 1947, the Ministry approved the building of 11 public schools in Hertfordshire taking into consideration all problems faced in Cheshunt School and developing and improving the components. Special objectives were used to increase standardization and to reduce the variety of components, to simplify and cheapen factory production while retaining freedom in design by versatility in assembly.

The system developed in Hertfordshire in 1946 was known simply as the HERTS system and has since developed into the SEAC system. Two or three Architects from Hertfordshire office joined Donald Gibson in 1955 to develop CLASP and some of their experience rubbed off onto the new system but the CLASP development started very much from first principles.

In Nottingham in 1955, the need for school building throughout the county was acute. It was clear that the demand would not be met in time unless schools could be planned and built much more quickly than in the past.

Many steps were undertaken to improve and develop the sytem. In the 1957-58 Building Programme, The Nottinghamshire Authority committed all its new schools to the newly developed system. Eleven educational projects were started for a total value of about £8,000,000. On this occasion I should mention that Sir Donald Gibson, the Nottingham County Architect who planned and rebuilt Coventry, has played a most important and effective role in developing the system by his sheer determination.

PRINCIPLES OF THE SYSTEM

Basic Technical Information

CLASP system is a method of building based on the rapid assembly on the building site of standardized, factory made components. It aims at:

- improving the quality
- speed and economy of building by mechanization thus reducing the need for source types of building labour and securing the economy of large scale factory production.
- freedom in designing each building, still to be designed individually to meet variation in site conditions and in functional requirements.

The only condition that an architect has to respect in his design is the planning grid of 3 ft. 4 in.
Please note, that the 1 ft. 4 in. grid applied to Marks 1, 2 and 3 but Mark 4 which was introduced in 1966 changed to the 1 ft. 0 in. planning grid and 3 ft. 0 in. structural grid. A new Mark automatically supersedes the previous Mark and the end of a programme year on March 31st is used as the time to make the change. The reason for the change of structural grid from 3 ft. 4 in. to 3 ft. 0 in. was in order to comply with the Ministry recommendation that grids should be in multiples of 1 ft. 0 in.

The structure is completely pinjointed and is stabilized by spring loaded diagonal wind braces so it can be easily deflected sufficiently to follow any movement caused by site settlement. The structure as a whole rests on a slip surface on the ground, which can stretch or contact without transmitting stress to the structure. The flat slab on a compacted layer of sand or other granular material is the only foundation.

The factory made components are the specially designed parts of the building which need quantity production if they are to be cheap. They include:

- steel frame units
- heating systems
- precast concrete cladding
- window frames
- aluminum sliding windows and ventilating louvres
- rubber floor finishes
- eaves units
- roof lights
- steel vitreous enamelled panels
- doors - external and internal
- prefabricated partitions
- sanitary fittings

Further Technical Development

a) Partitions

At first plasterboard panels were in use. Present systems employ pre-coated sheet steel panels with applied backings to give high sound and fire insulation ratings and they will have good impact resistance and low maintenance. This improvement will speed erection and also the fixing of sanitary fixtures.

b) External Walls

CLASP is co-operating with Brockhouse Steel Structures to produce new pre-coated sheet steel cladding with insulation backing. This should provide a high quality, light weight and exterior walling at a moderate cost.

c) Staircases

CLASP is planning to alter the geometry and framing of stairs, using three basic types: a 3 ft. 6 in. wide straight flight, a 3 ft. 6 in. dog leg, and a 5 ft. 0 in. wide dog leg.

d) Furniture

CLASP co-operates with industry to produce furniture for the schools. At present CLASP concentrates on development of mobile, easy to transport furniture. Wall storage units for classrooms, laboratories, etc., are being developed.

Building System for Higher Education and Mark 4

In the further development of the CLASP system, new kinds of components were introduced which could be used in the building of Universities. The CLASP system that originally was meant only for primary and secondary schools, due to new developments has now reached wider scopes of usage, including libraries, laboratories and others.

The new version of the system was designed for higher education. It is called JDP (Joint Development Project). It has a steel frame with concrete floor deck for heavy loads, thus the ability to go to 6 storeys. This version was developed separately about 2 years ago and it is now gradually incorporated into CLASP and the term JDP will eventually be dropped.

In single storey buildings within the CLASP Mark 4 system, clear spans of up to 60 ft. for roofs and heights for gymnasia up to 26 ft. are possible with a fire resistance rating up to 1 hour. Aggregate faced concrete and vinyl-coated steel panels can be used. Also special attention has been paid to the distribution of services within the building.

The structural grid is 3 ft. and the planning grid for positioning internal partitions or windows is 1 foot. The basic module is 4 in. and the columns in external walls can be placed at 6 ft., 9 ft., and 12 ft. centres.

The main vertical dimensions are in 2 ft. increments and rooms on upper floors can be 8 ft. or 10 ft. high.

ADVANTAGES AND DISADVANTAGES

1. Advantages

a) The Consortium and its special purchasing procedure, makes it possible to build good schools in the CLASP system at a price well within the cost limits laid down by the Ministry of Education.

b) Buildings can be individually designed to meet the user's requirements and provide a high standard of finishes.

c) It is possible to erect buildings more rapidly with a small site labour force. The erection time in comparison to the traditional method is cut by approximately 50%.

d) The system dispenses with the need for costly special precautions against site subsidence.

e) Steady growth in the overall size of a system building programme and the continual process of development leads to a price reduction. In the last year, further reduction in steel cost has been noted and is in the amount of 11%.

f) Although the system was not designed with relocation of buildings in mind and it has not been tried as yet, in principle a relocation is possible due to a high proportion of the components that could be reused after taking them down. Dry jointing techniques in the external wall adds benefits in this case. The details of the relocation system would have to be appraised and amendments made, thus opening a new field of research in the system building.

g) System allows for flexibility to meet changing needs.

h) System could be used for single and multi-storey buildings.

i) Aesthetics and dignity in design can be easily achieved by an architect.

There are some further advantages which are applicable to most systems and not just to CLASP.

a) The design of most components and all junctions in the system, embodied in anything up to 200 drawings, leads to a halving of the time spent in an Architect's office on working drawings.

It should be noted that this only applies when the Architect uses the system in the way intended; some architects try to improve on parts of the system for their own job and succeed in greatly exceeding their income in fees as it actually takes longer to undo part of the system and re-design it than it does to design something from first principles as in traditional building;)

b) Periodic analysis of site erection procedures leads to amendment of component design to achieve maximum productivity;

c) Documentation (drawings, schedules etc.) is being continuously developed to improve communication between all people involved in the building process;

d) Components are periodically checked in the factory by Consortium members for quality resulting in fewer rejects on site;

e) The large size of the total programme ensures the interest and co-operation of suppliers in the smallest of jobs;

f) The predominance of dry construction ensures the minimum of delays from drying out and bad weather;

g) The gradual replacement of traditional materials by materials requiring little or no maintenance. (If the materials involve new techniques and properties then their introduction is only after extensive testing which could not be afforded on one building.)

h) The fixing of prices for components at the beginning of each programme year and the negotiation of erection prices on a serial basis with General Contractors ensures accurate forecasting of the cost of projects.

2. <u>Disadvantages</u>

Although this system as other systems, has to be used on a large scale, it is in fact an added advantage, for the degree of refinement and sophistication of a system is in direct ratio to the size of the programme.

a) the performance of the system has been raised over the last few years to cope with a wider range of buildings, e.g. Universities, and the extra cost of this within the system has made it difficult for Architects to produce small primary schools within cost limits using the same pieces. One system cannot expect to be economical for all types of building;

b) the system in some respects is too well developed and integrated with the result that there is little cost flexibility. An Architect wishing to make savings on his particular job will have very little scope for substituting cheaper, non-system components as this would cut across agreements on quantities between the Consortium and the suppliers of standard components.

c) The tendency for peaks to occur in the programme as described earlier.

PRACTICAL APPLICATION OF THE SYSTEM

In Nottinghamshire, we had an opportunity to visit several schools:

1. Frederick Harrison Infant School
   This school accommodates 240 students, 5-7 years of age. It has a one storey open plan with good space organization. There is simplicity in the design which creates the right atmosphere for young children.

2. Eastwood Brockhill - Leys - Infant School
   This school is small but well planned. It is an open plan with no corridors. Some areas are carpeted and have extensive areas of warm, wood panelling.

3. Comprehensive School at Bingham
   The architect for this project is H.T. Swain, FRIBA.
   This large multi-storey school is under construction. Steel frames with diagonal bracing and large areas of exterior cladding of hanging red clay tiles, which are typical of CLASP schools.
   It is designed in such a way that part of the school can be used for community activities.
   The grounds surrounding the schools are all well landscaped.

COMMENTS

1. Some architects may feel that when using the CLASP system he has nothing to do with the design. But in fact, the role of an architect in designing a school building or any other in this system will remain as important as ever. The system certainly does not produce a complete and ready-made solution as in the case of portables or pre-engineered buildings. There is a freedom to design and plan in any form within the planning grid and components of CLASP. The variety of materials of exterior and interior is great but dimensionally co-ordinated. Working within the CLASP system, an architect may devote himself more to the design as he is able to save up to 50% on preparation of working drawings.

2. The design of building components and assembly methods have improved through the better use of resources, better use of labour and quicker and more efficient methods.

3. Considerable progress has been made in integrating the computer into the work of the Consortium, thus simplifying it and saving time.

4. The building industry using CLASP has not only brought new techniques of building and organization, but it also offers benefits of continuity.

5. I consider CLASP as the most developed and best building system. This view has been shared by the Central Educational Authorities and their technical representatives in West Germany, Switzerland and Italy. These three countries are introducing this system for the construction of their own schools.

6. In my opinion, CLASP could be adopted in this country and would prove to be beneficial. The reasons are as follows:

   - it is well designed architecturally
   - it could be adapted to our climate. As developed for the U.K. and France with milder climates, some modifications would be required. But the climatic conditions of parts of Germany approximate closely to the majority of Ontario and the German version would be directly suitable.
   - it lends itself to flexible planning
   - it may be erected quickly
   - it might prove to be more economical in Canada than traditional building techniques.
   - it may be open for free competition in tendering

CLASP SYSTEM ABROAD

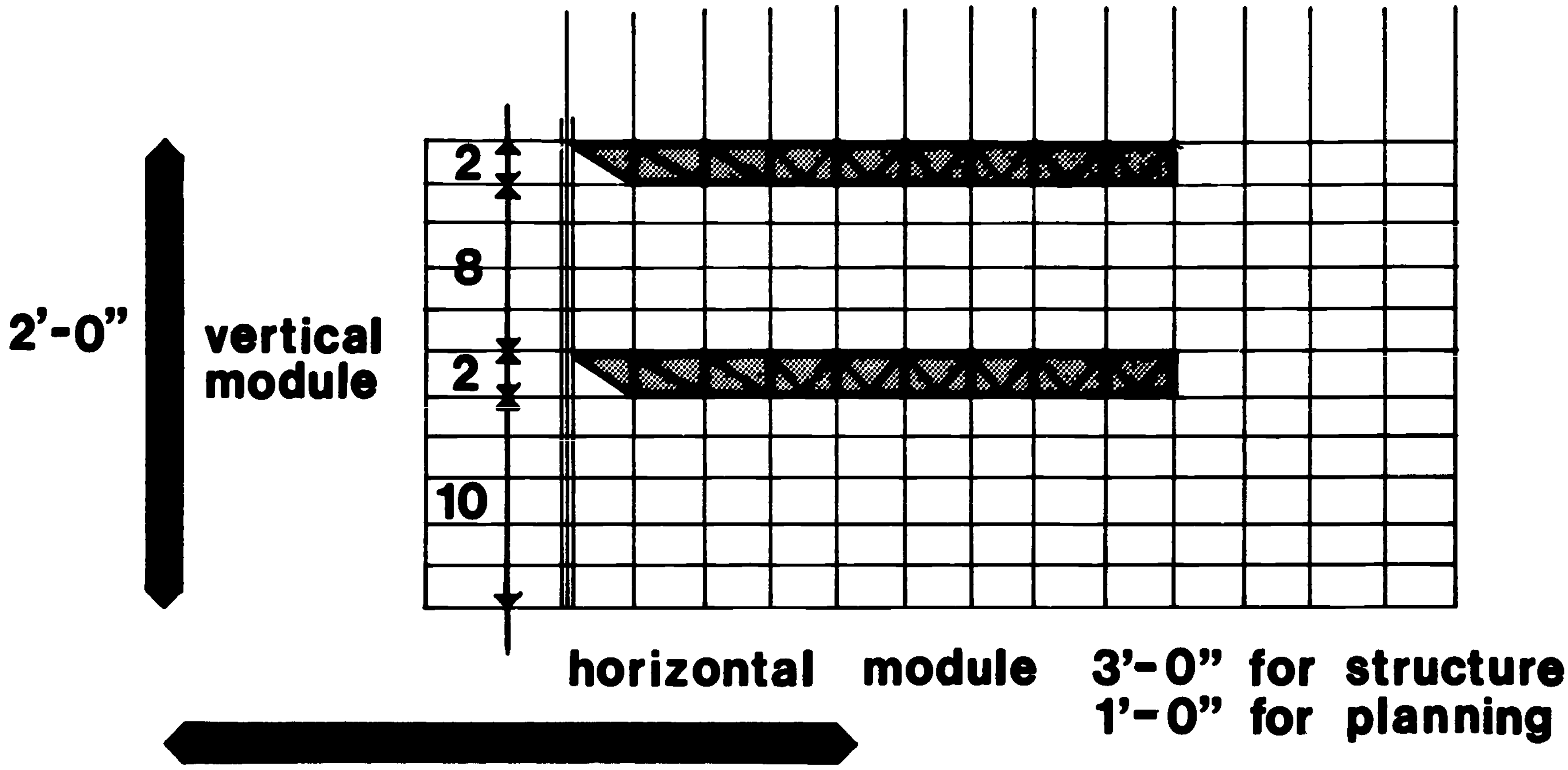
1. Germany
   West Germany adopted this system and CLASP schools are being built by Brockhouse Systembau. Germany is also introducing some changes and improvements to suit the local building regulations.

2. Switżerland
   Switzerland adopted this system from Germany with slight modifications to suit local requirements. The first school constructed with this system was built in Berne last year.

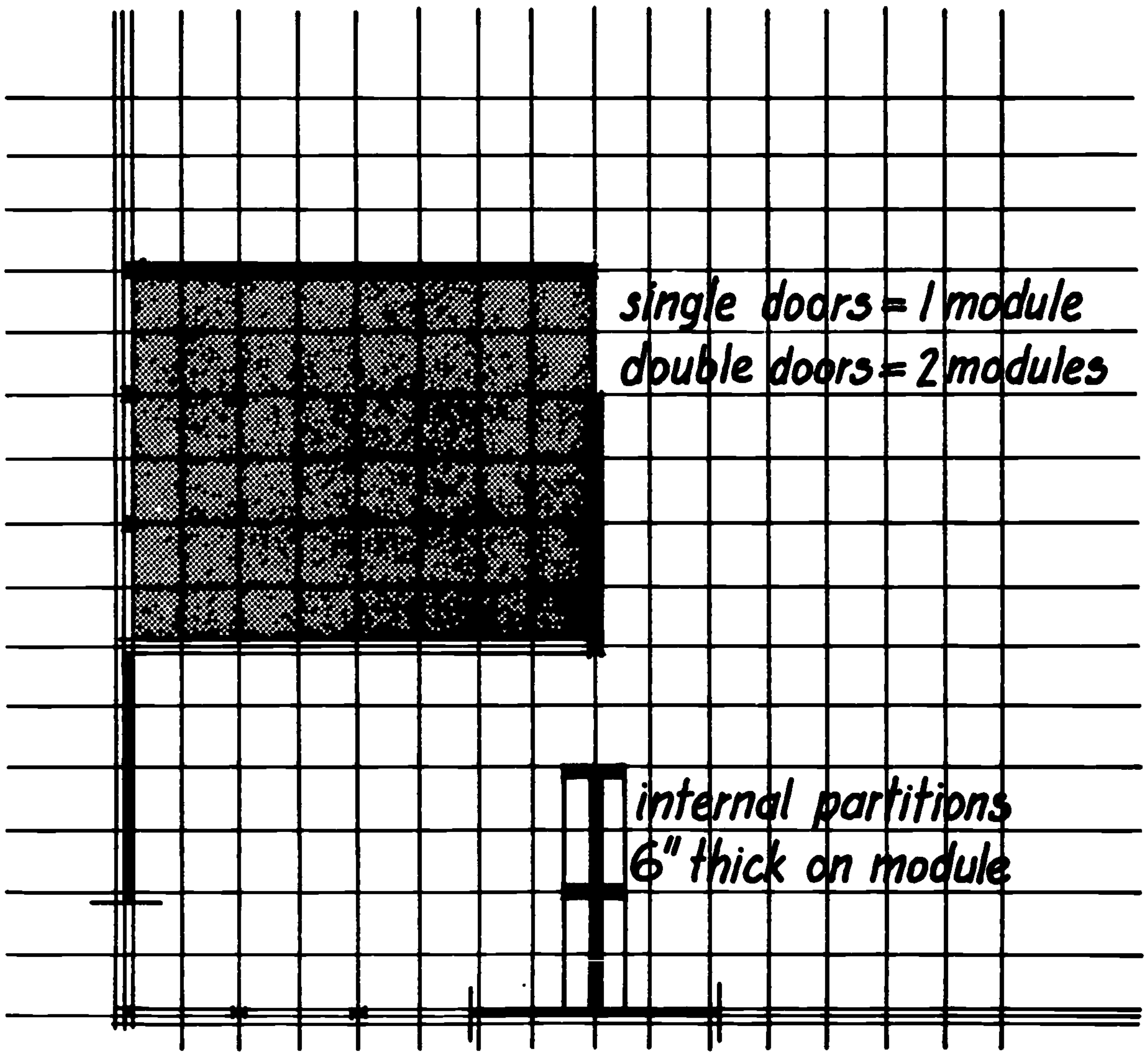
3. Italy
   In 1960 a CLASP school won first prize in the Milan Triennale, the leading exhibition of design in Europe. This success was followed by its use in Italy and other countries. This system has been spreading slowly and the new school building regulations issued by the Italian Government forecasts an increase in school building using this system.

   France and Israel are also using CLASP in the construction of schools.

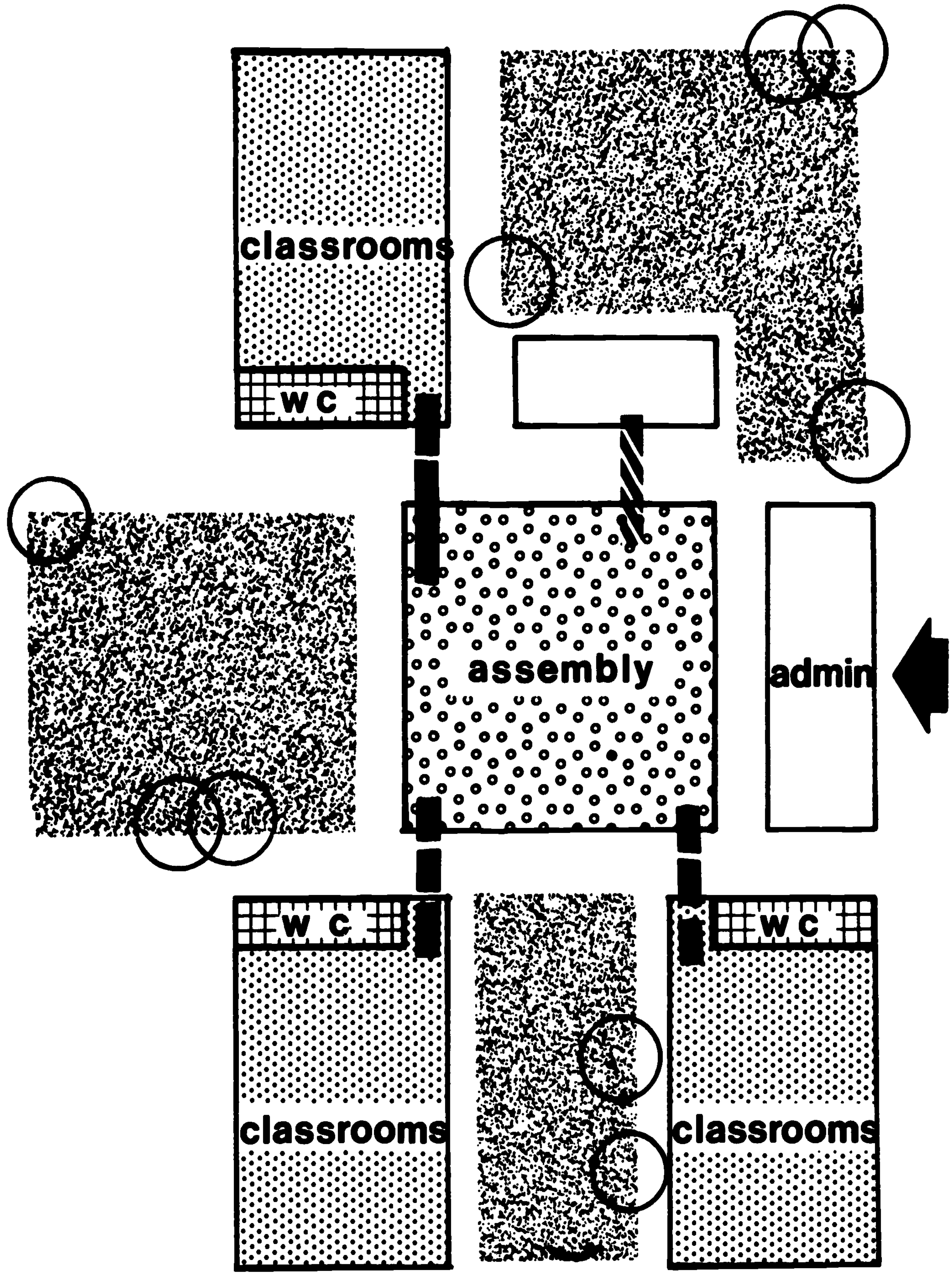
SECTION



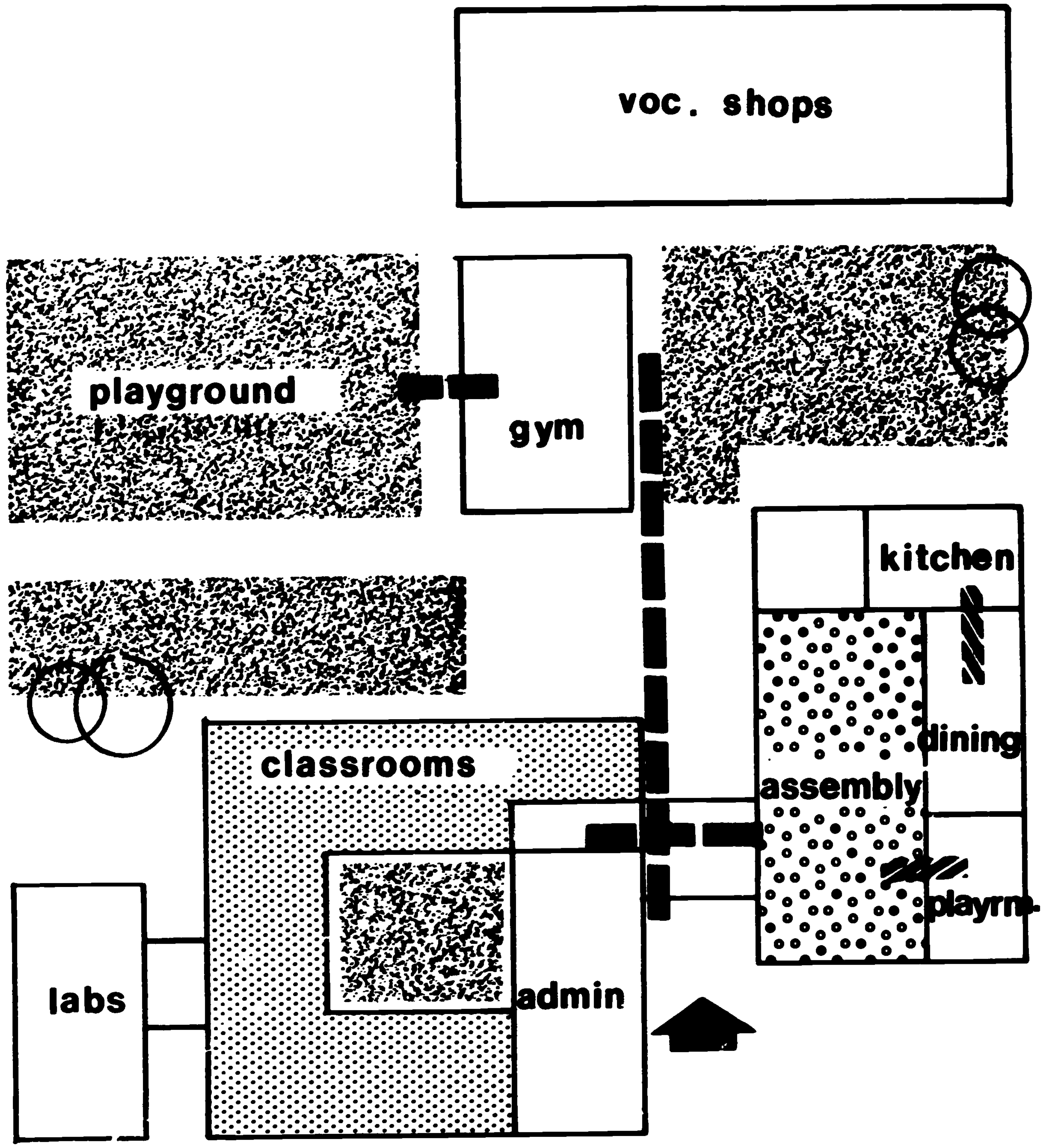
2'-0"
vertical
module
2
8
2
10
horizontal module 3'-0" for structure
1'-0" for planning



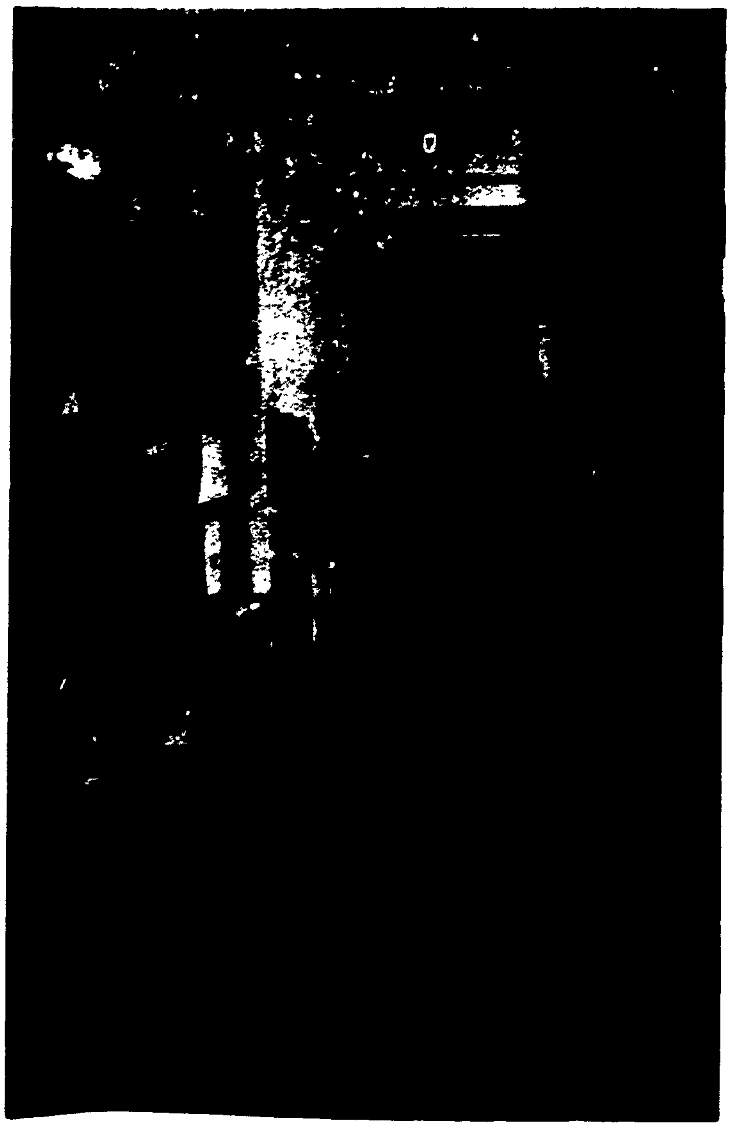
single doors = 1 module
double doors = 2 modules
internal partitions
6" thick on module



Name of School	Hebburn Toner Ave.
Type	Infant
Number of Cost Places	250
Total Floor Area (sq. ft.)	9,663
Square Feet per Place	38.7
Total Teaching Area per Place	23.2
Net Cost per Place (Sterling)	£142.9 (figures for 1959 comparable cost in 1969– £203.2)
Net Cost per sq. ft. (Sterling)	£3 14s (figures for 1959 comparable cost in 1969– £5 5s)



Name of College	Arnold and Carleton
Type of Education	Further Education
Student Capacity	616
Total Floor Area (Sq. Ft.)	48,162
Net Cost per Square Foot	£3 15s 7d



"Clasp" Junior School
Nottinghamshire, England

COLLEGES REVISITED

UNIVERSITY OF TECHNOLOGY, LOUGHBOROUGH

On May 9th, Mr. Robert J. Howrie, Head of the Leicester School of Architecture took me to Loughborough. At the time when I was living in England, Loughborough was known for its excellent Technical College. This College produced during the war, many first class engineers and technicians. Strange as it may seem, this College did not concentrate only on teaching. It also produced many aeroplane engines, which were so much needed during the war years.

All this is now changed. In the last few years, a new campus has been developed and the College became the first University of Technology in Great Britain.

The new campus consists of a number of well planned and designed contemporary buildings. The heart of the campus is made up of a group of three buildings, set in a wide and open space which is sensitively landscaped to form an attractive environment. The Architects - Richard Sheppard, Robson and Partners who designed this complex won the Royal Institute of British Architects 1967 Award. The over-all design and detailing coupled with skillful use of colour, simple materials and good interior planning creates a very pleasant atmosphere.

This campus and its buildings can serve as an excellent example for our planners of new colleges.

LANCASTER TECHNICAL COLLEGE, COVENTRY

Lancaster College is a part of the new civic centre in the rebuilt city of Coventry. The simple buildings of the College are in harmonious relationship to the neighbouring Cathedral. The College is well-planned and its laboratories and well-equipped workshops give evidence of the good co-operation between the educational body and the heavy engineering industry of the district.

The most striking feature of the new civic centre is the glazed, covered swimming pool that serves both the College and the community of Coventry.

UNIVERSITY OF LEICESTER

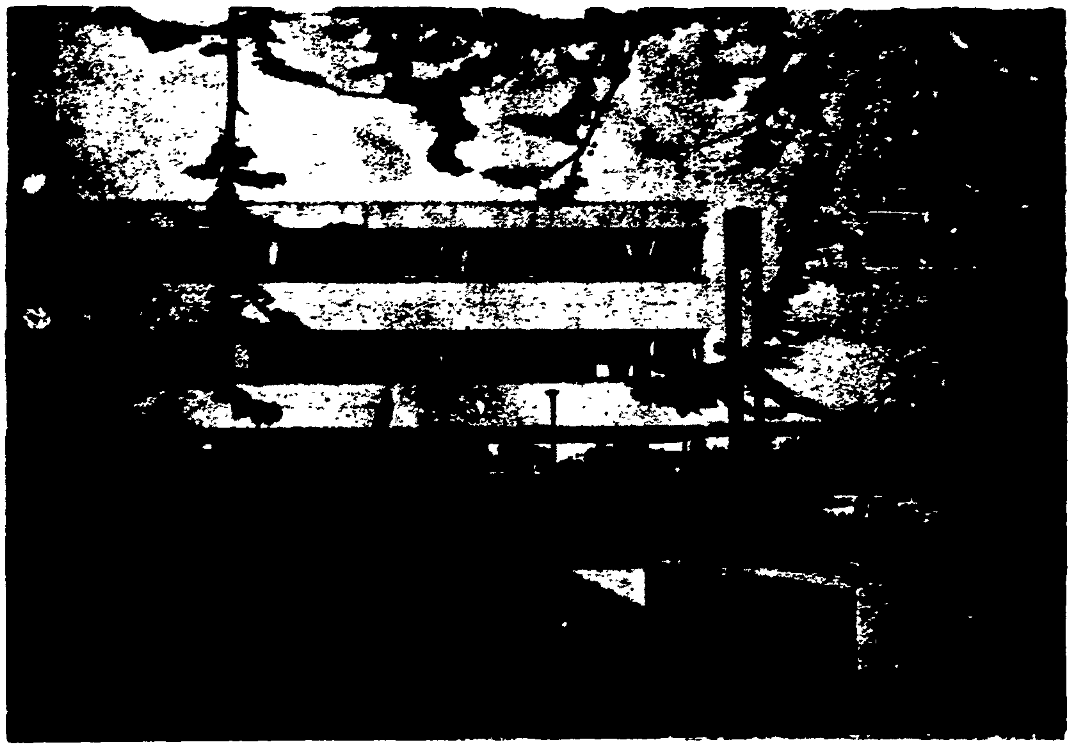
Leicester University is another example of a University growing from the tradition of the University College.

The city of Leicester is developing rapidly and complete changes in planning are taking place. Leicester University was an initiator in this movement. In 1956, the College appointed Professor J.L. Martin as its Consultant and Planning Architect, to advise on the development of all the land at its disposal. In consultation with him, the new campus is now being developed. The campus buildings have been built along a main landscaped, pedestrian axis. The University is identified by its two dominating towers. One tower building houses the students' centre, where different students' educational and social activities are provided for. There are also students' and academic staff cafeterias and common rooms, which are tastefully panelled in wood. The second tower building includes a crystal-shaped glass-roofed building which contains laboratories and workshops for the faculty of engineering. This building was designed by Mr. Stirling. The remaining buildings are designed in a contrasting manner with the emphasis on horizontal lines.

The University has plans for further expansion. Contracts are being awarded for a multi-storey students' residence and a new school of medicine is to be built in Leicester. During my stay in Leicester I was the guest of Professor Arthur Humphreys and had an opportunity to discuss with him and other members of the University staff many educational problems. I noticed that there are no physical-education facilities at this University, but under the leadership of Professor Humphreys a new prefabricated Shakespearian Theatre has been built by the city.. At this Theatre, I had the pleasure of seeing the play, Henry V.

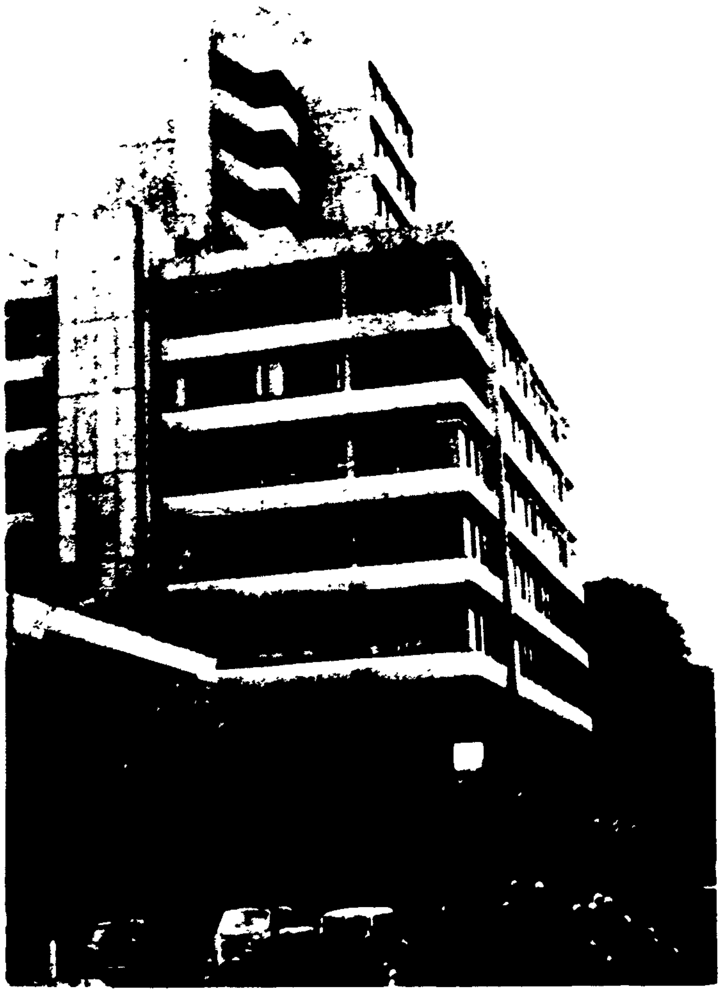
While in Leicester, I had the chance to visit the town planning office which has developed under Professor Smigielski, the most advanced plans for the city.

Loughborough University of Technology
England

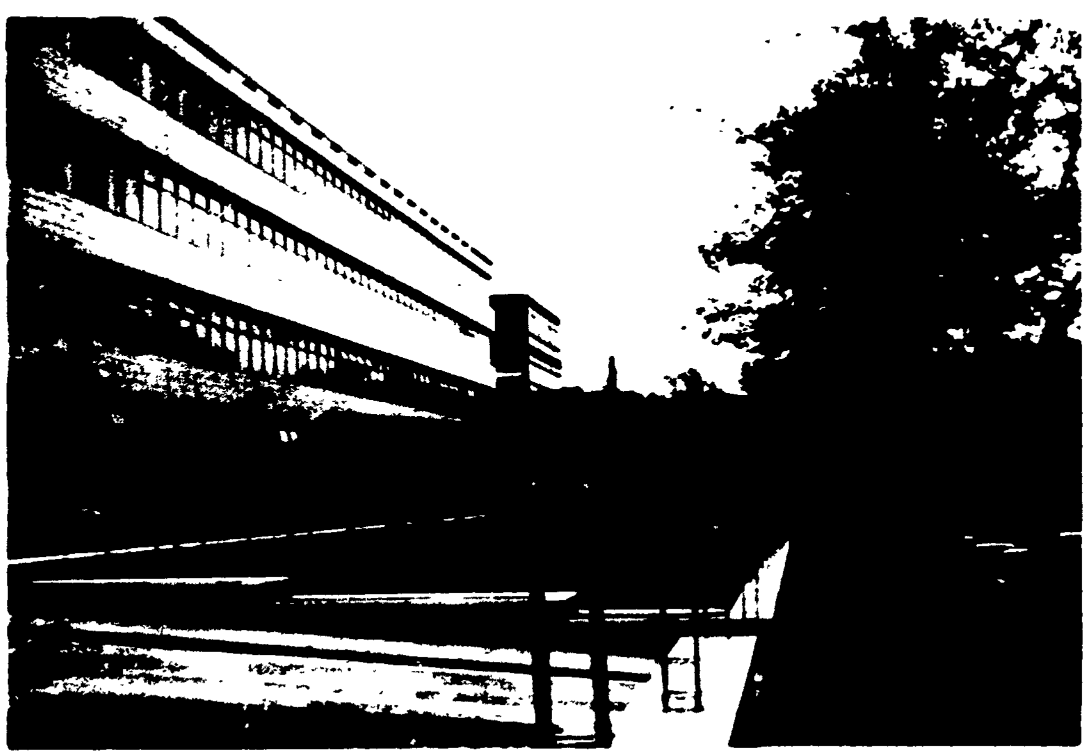


Loughborough University of Technology
England

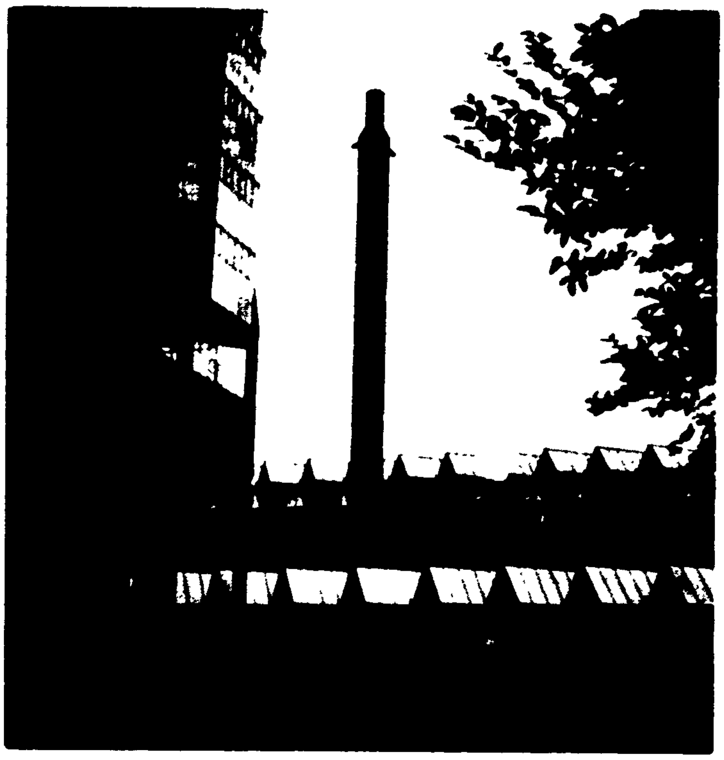
Loughborough University of Technology
England



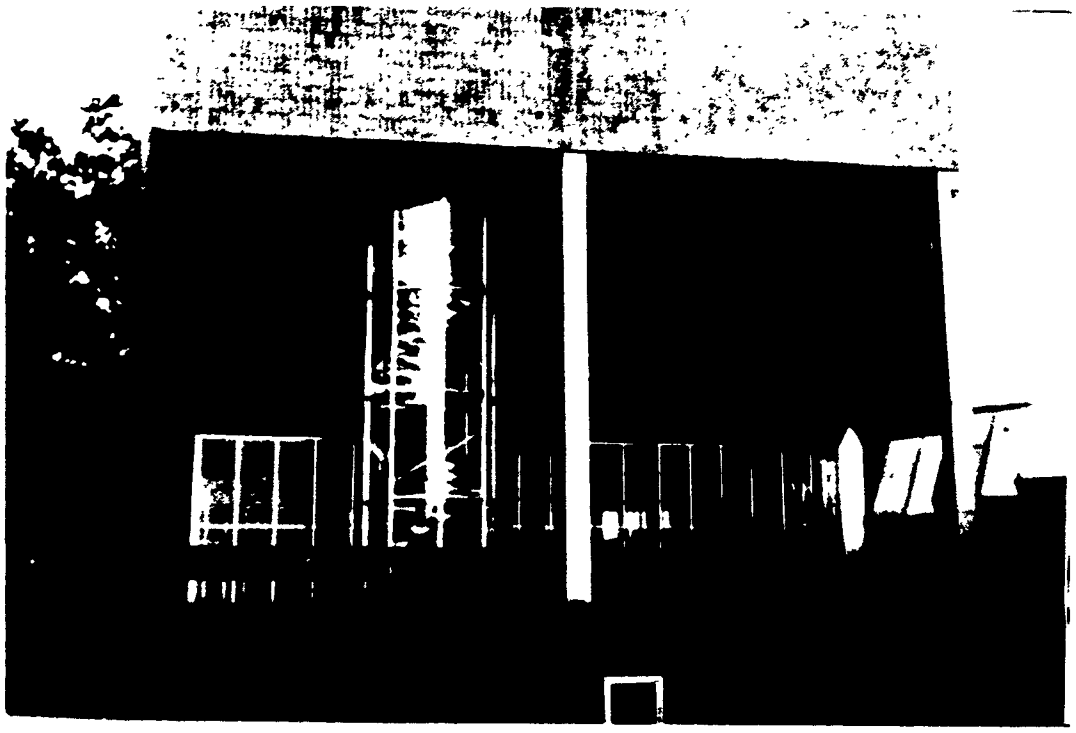
New Campus Student Centre
Leicester University
England



New Campus
Leicester University
England



Engineering Building
Leicester University
England



Engineering Building
Leicester University
England

Interior of a Common Room
Student Centre Leicester University
England

WEST GERMANY - BONN

On May 12 and 13, I met with members of the Secretariat of the Permanent Conference for the Minister of Culture. I had the opportunity of discussing with the General Secretary, Mr. Kurt Frey, many problems concerning education, school design and the development of building system methods for building schools. It was a great pleasure to hear his compliments for the publications of the School Planning and Building Research Section and for other activities of the Ontario Department of Education.

Our discussion was constructive, in that it gave me the opportunity to assess on a comparative basis, our educational problems. The main topics of discussion were enrolment increase and fluctuation, changing educational programmes and the provision of school facilities.

UNIVERSITY OF BONN
New Campus for the Faculty of Law and Economics

Accompanied by Dr. Jores of the Secretariat and by Dean Wernicke and Dr. Kewenig of the Faculty of Law and Economics, I visited the campus of this faculty. The capacity is over 2000 students.

The buildings have been very well planned, with particular attention given both to the internal spatial planning and to the surrounding landscape. The main entrance is highlighted by a large panel designed by the artist, Vasarely. Large circular stone benches, placed near the buildings, provide excellent areas for gathering and conversation.

The best developed part of the campus is the library which is built around a landscaped court. This internal court gives the library a very pleasant and transparent atmosphere and provides natural light. The noise factor for the library has been reduced by the provision of full carpeting. The reading tables which are designed for individual use are of particular interest. The table is cantilevered from a single metal leg, 3 in. x 6 in. which contains electrical wiring and an air-conditioning duct. Each table is provided with its own lighting fixture.

Main Library

The new library of the University of Bonn was shown to me by Dean Wernicke. This library was designed by the architects, Messrs. Bauerman and Voget, who won an International Competition for the design of the Berlin Memorial Library. This library is situated on the banks of the Rhein. The side of the building facing the river has extensive window areas. On the street side a sculpture by Jean Arp provides a highlight in front of a windowless, mosaic facade. Thus the focus toward the river and away from the street is emphasized.

The library contains two million volumes. Its interior design has been planned to provide a suitable atmosphere for study and research. Carpets are used everywhere to reduce the noise factor. Reading tables, for the use of two people, are made of teak supported by metal legs. There are separate areas for graduate students where individual desks are provided. The slatted ceiling is made of wood and is used for partial illumination.

Many of the ideas and suggestions gained during my visits to these libraries will be used in our studies into the provision of educational facilities.

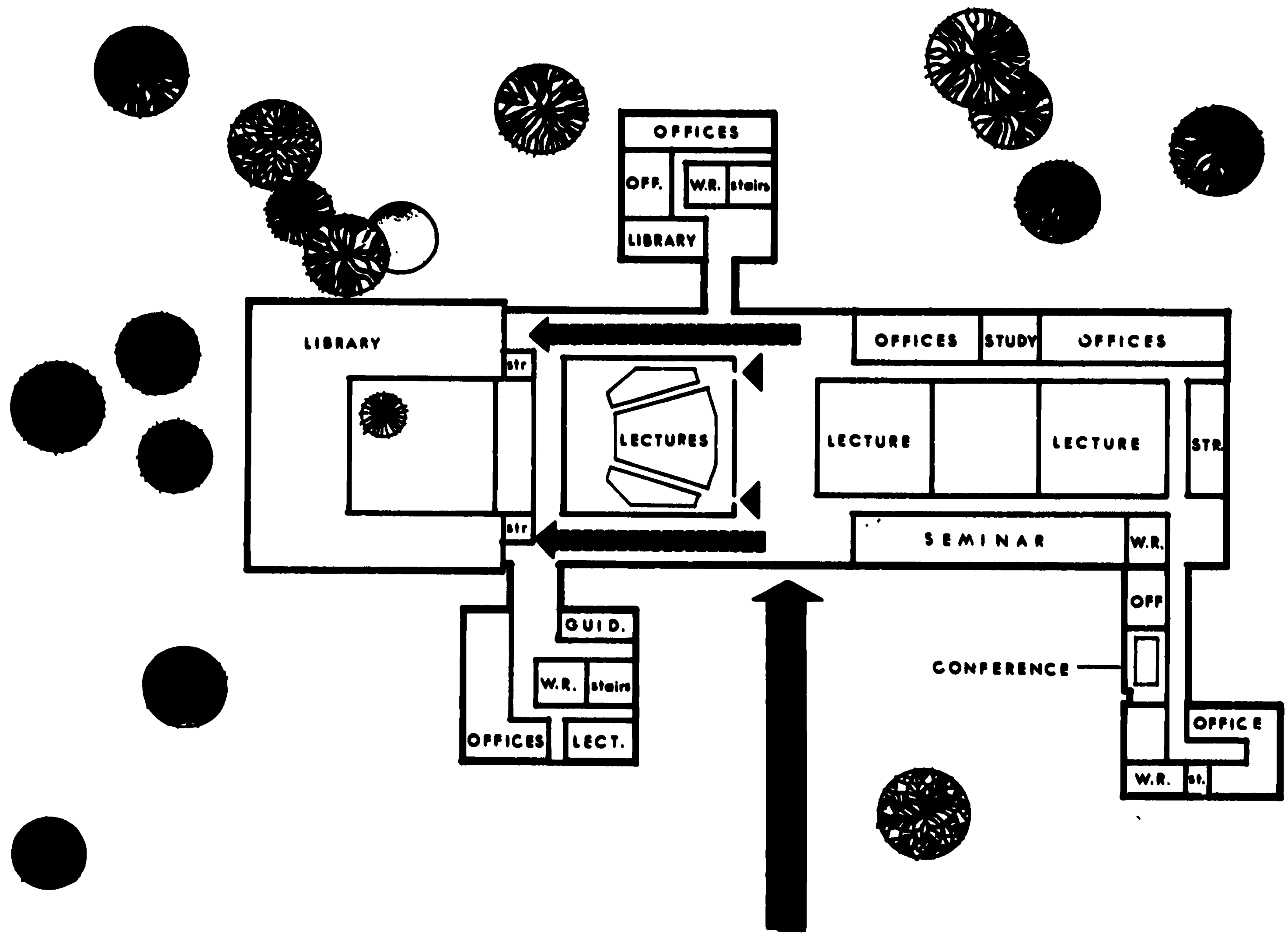
BONN TECHNICAL AND MANPOWER TRAINING CENTRE

Rapid industrial development in post-war Germany demanded greater provision of skilled manpower. Considerable attention has thus been given to vocational school programmes and facilities. Industries co-operate with the schools, giving financial and technical support and supplying them with equipment.

The staff of the school attends training courses in the factories which explain new techniques, materials and machines. Students learn the theoretical principles of their chosen skill in this modern well-equipped school and practice the techniques in an industrial plant. Their practical experience makes up 30% of the school programme.

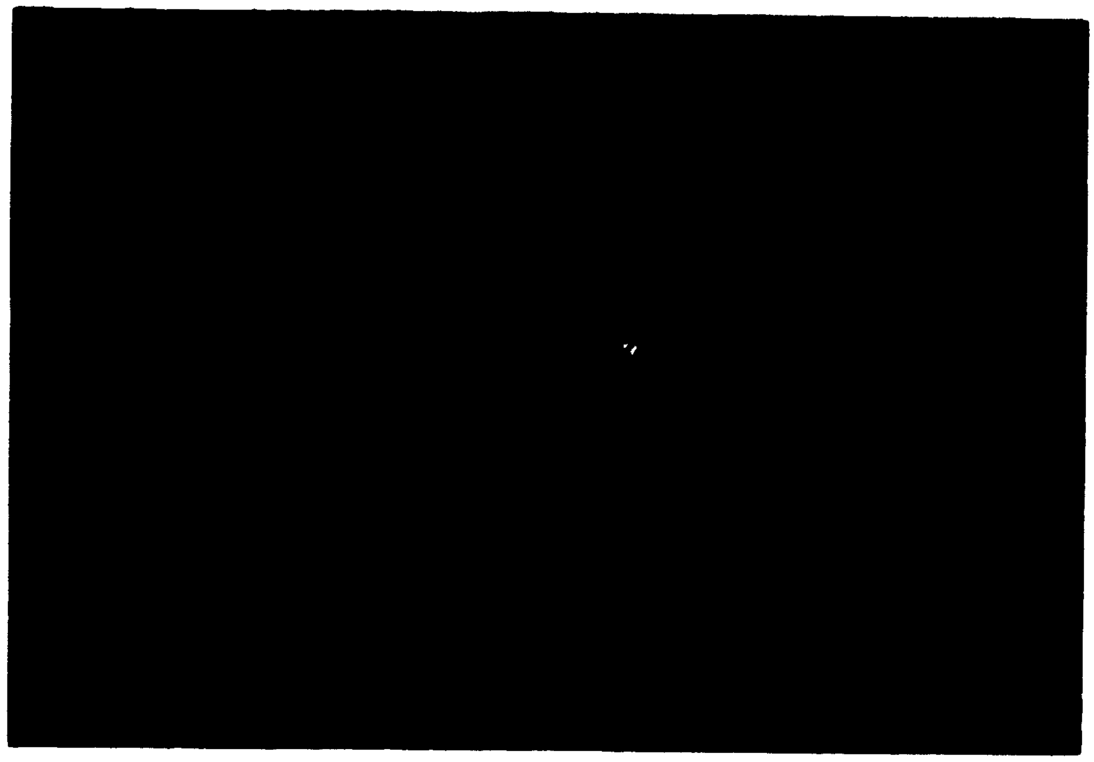
This school is extremely large, providing facilities for 6000 students. The student body is divided into units of 2000. Courses for metal and electrical workers, for building construction and wood-working and for automotive engineering are among the programmes provided. There is also a wide Industrial Arts Programme.

Classroom units have been developed with both lecture and workshop areas for each type of programme. Overhead services have been used in all areas to increase the flexibility of space. In workshop areas the overhead ducts allow for immediate exhaust of dust or waste particles. Colour marked lockers are provided for the storage of the students' protective overalls. Great care has been taken in the detailed planning of facilities for each type of instruction.

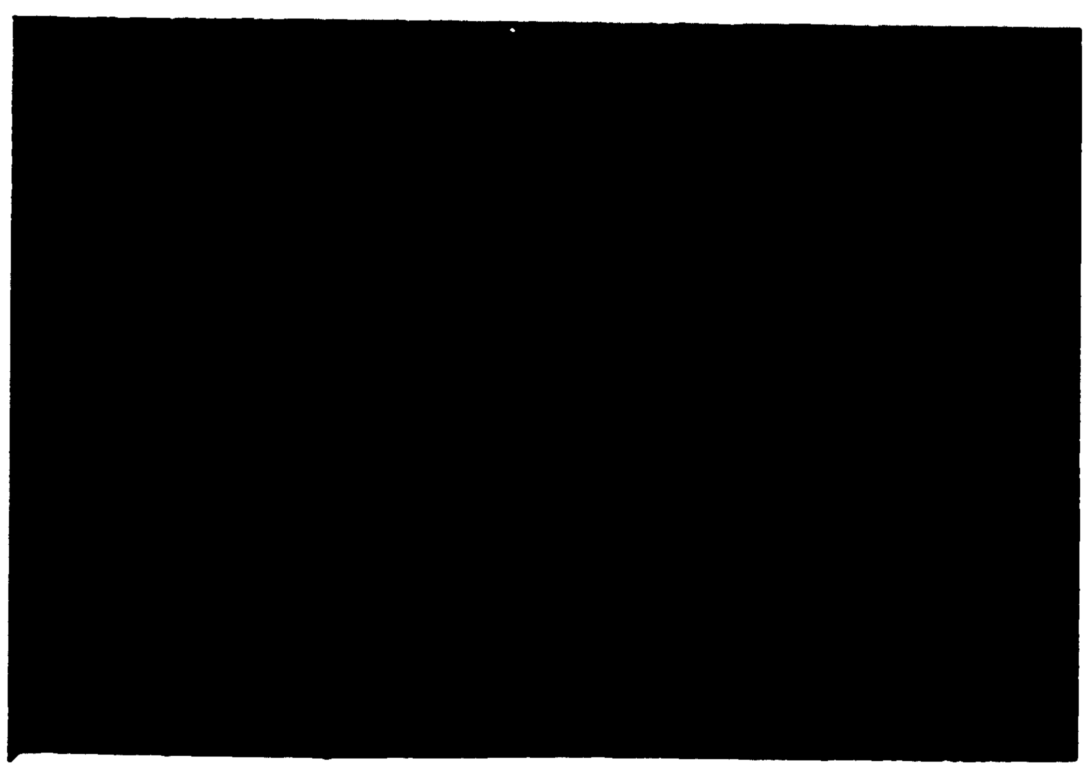


FACULTY OF LAW
BONN, WEST GERMANY

SCALE: 1" = 96'



Technical and Manpower Training Centre
Bonn, West Germany



New Campus for the Faculty of Law
and Economics
Bonn, West Germany

University Library
Bonn, West Germany

SWITZERLAND - ZURICH

On May 14 and 15 I met with Prof. Alfred Roth, former Dean, and Prof. Jacques Schader of the School of Architecture of the Zurich Federal Technical Institute. I visited several schools in Zurich designed by these men.

Prof. Roth is one of the world's pioneers in school building research. He is the author of 'The New School' and a jurist for the Quebec school building competition. He has designed a climate-controlled school in Kuwait and a school building in Skoplje, Yugoslavia whose form was dictated by earthquake zone requirements. The School Planning and Building Research Section has had previous contact with him through myself and through his use of our publications. Our brochures have been studied by the architectural staff and they are used in the Library by the students of the School of Architecture.

My discussions with Prof. Roth were very useful, covering such topics as school planning problems and solutions and building methods. He was very aware of our problems and of the constructive steps being taken in Ontario to provide enough suitable schools. Prof. Roth is very interested in strengthening the connection between our department and his office, through visiting the department and receiving further information about our activities. He hopes to have an opportunity to visit us during his next visit to Quebec.

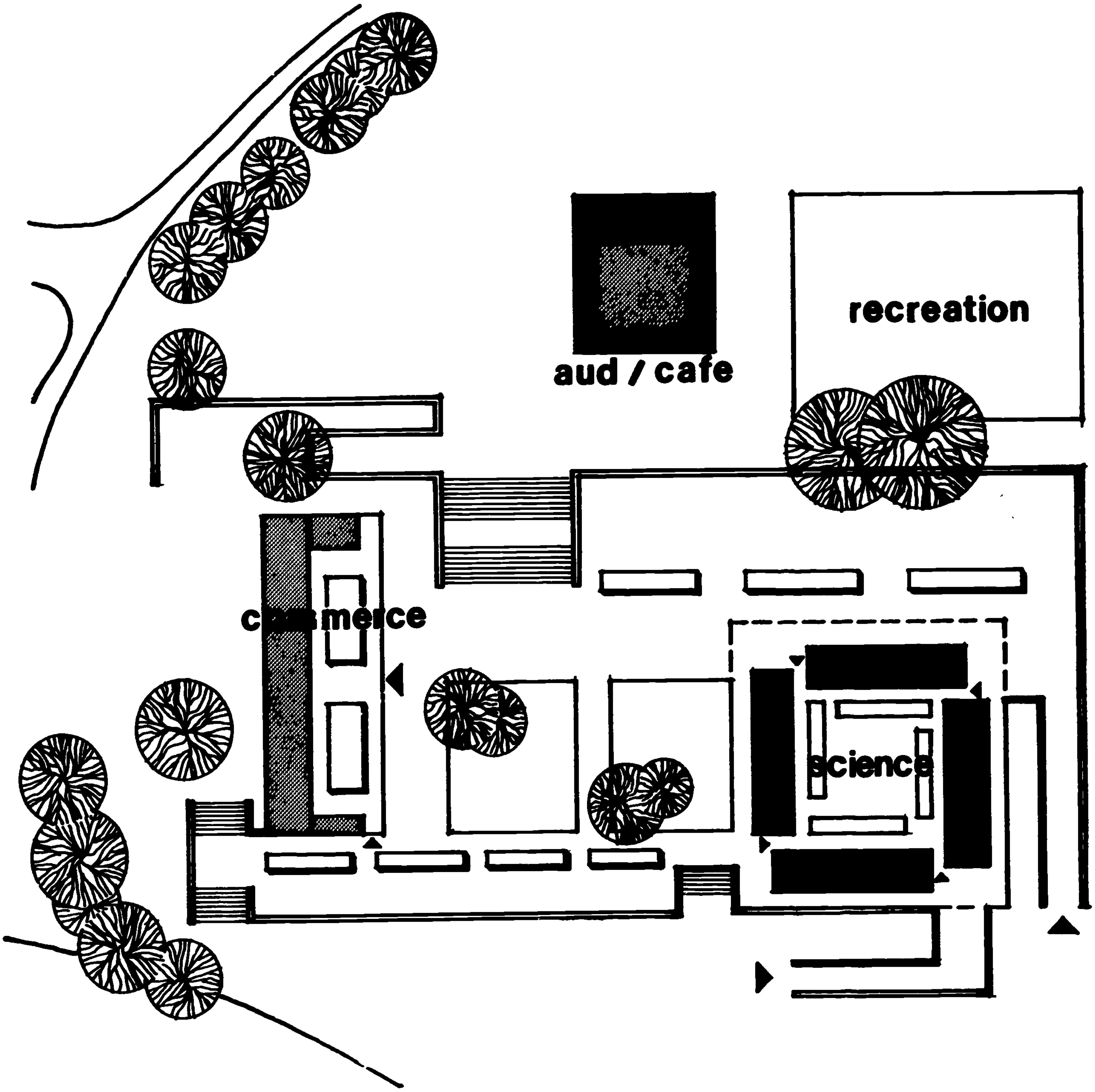
RIEDHOF PRIMARY SCHOOL - ZURICH

This primary school designed by Prof. Roth has 12 classrooms for 400 pupils and a kindergarten for 70 children. The school is built on 3.5 acres of smoothly sloping land. The terraced grouping of buildings results from the topography with all buildings laying parallel to the slope. There are two classroom wings joined together by a recreation hall. The classroom units are 28 ft. x 27 ft. 7 in. giving a total area of 730 sq. ft. per unit with a work alcove of 160 sq. ft. The classrooms have been very well equipped with furniture which is light, adjustable yet durable.

FREUDENBERG HIGHER SECONDARY SCHOOL - ZURICH

Prof. Schader was the designer of this school which comprises two colleges, exclusively for boys. The total enrolment of 1,30C is made up of a scientific college for students of the 12 - 18 age group and a commercial college for students of the 14 - 15 age group. The school, which was subsidized by the Federal Government, is located in a magnificent park and its design, the winning design in a competition, can only be described as extravagant.

Although the scientific and commercial colleges are clearly separated, there is a strong concentration of building masses. The colleges share common facilities which ties the campus together. Changes of level, ramps and staircases add drama to the composition. The school has been well located in its marvellous landscape.



Name of School	Fruedenberg H.S.S.
Type	Higher Secondary
Student Capacity	1300

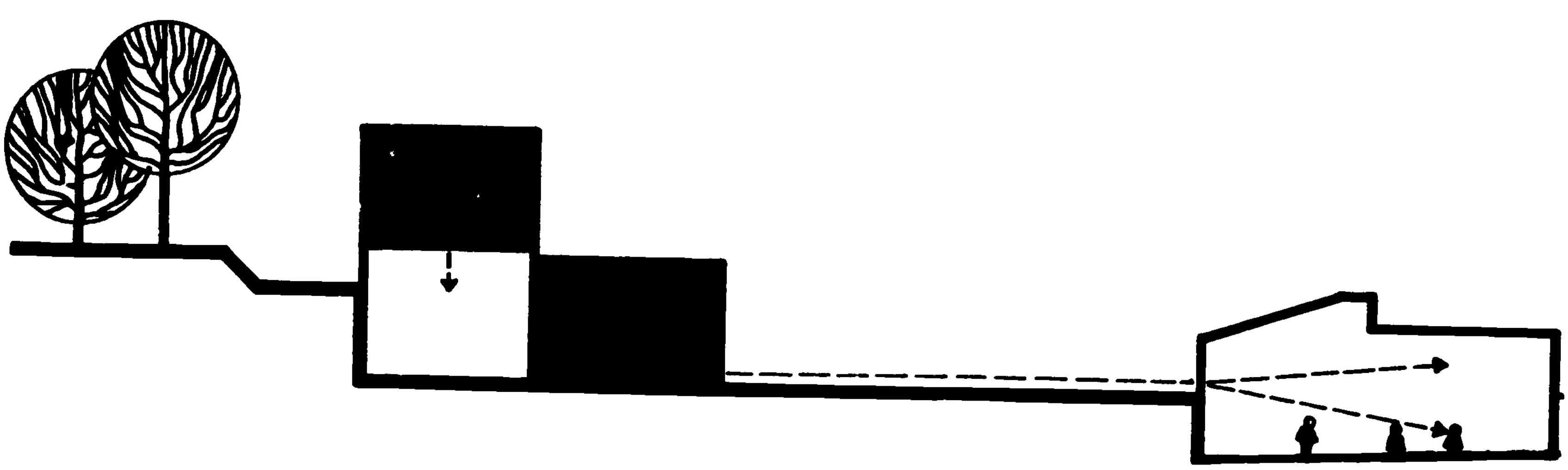
Type of School Primary
Student Capacity 450

Advantages of Design 1
More intimate atmosphere
Cross ventilation possible
Better lighting conditions – quantity, quality and distribution

Design 1 – Riedhof School

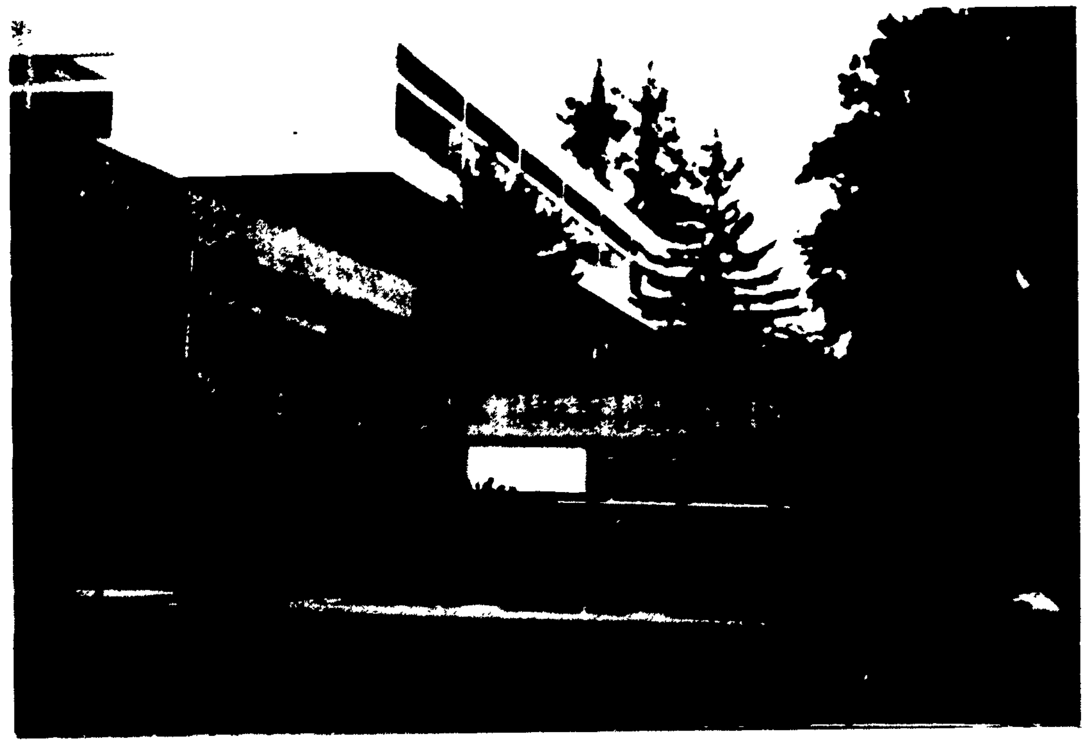
Design 2 – Typical School

Teaching Area	sq. ft.	% of total	circulation area	% of total	total area
Design 1	2592	90	288	10	2880
Design 2	2592	76	828	24	3420



Acoustic and Space Organization Within the School

1. Noise transmission, reduced by locating gymnasiums between outdoor recreation and classrooms, also aided by eliminating windows on elevation of gym nearest to classrooms. No classrooms above another, making unnecessary use of sound isolation material. Play area on a higher level than classrooms, also trees help in the isolation of noise from classroom areas.



Freudenberg Higher Secondary School
Zurich, Switzerland

Le Corbusier Art Centre
Zurich, Switzerland

ITALY - ROME

On May 16 and 17, I visited various institutions in Rome. I met with Dr. Italo Neri of Telescuola. We had a long discussion about school facilities, and in particular about the use of television and other audio-visual aids in the school. The development of an ETV network has been slow in Italy, no doubt due to the peculiar educational situation in this country. Telescuola, which was set up to deal with the very great problem of illiteracy in Italy, made use of the state TV network from its inception. The methods developed by the people at Telescuola were very advanced, but Telescuola was a means of providing schooling to those who had none rather than a means of enriching an existing school programme. Dr. Italo Neri of Telescuola who was a representative to UNESCO was very familiar with the programmes of the Ontario Department of Education.

I visited a new elementary school near the Mussolini Forum. Italy has the usual problem of providing school facilities at the proper time to satisfy an increasing and fluctuating enrolment. New schools are being planned along traditional lines but new prefabrication systems and the English CLASP system are being adopted.

I paid a visit to the Rome School of Architecture for discussion of architectural problems. I also visited the small Olympic stadium and the Railway Terminus which are the works of Prof. Neri.

To close my Italian Tour, I chose to visit the Monastery of Monte Cassino on May 18, the twenty-fourth anniversary of its caputre. I paid homage to my many dead comrades in arms who lie at rest in the sculptural setting of this beautiful cemetary.

Olympic Stadium, Rome Italy

GREAT BRITAIN

On my return to England May 19 and 20, guided by Mr. Clerk, a partner of Mr. J. Johnson Marshal, who designed the new York University using the CLASP system, I visited the Hertfordshire school. This school, which has been built as a prototype, was constructed of precast concrete panels. We were able to discuss use of the CLASP system for design-construction of colleges and universities.

SUMMARY

The early post-war period in Great Britain showed a critical need for an intensive school building programme. The immediate problem was an acute shortage of building materials, particularly steel.

The Hertfordshire Research Institute, established in early 1945 to examine this problem, developed a variety of solutions, out of which came the concept of a prefabricated system of components, that could be incorporated into primary school construction programmes.

The first two schools to be constructed using this component system, were built in Cheshunt and Essendon. This was one of the earliest developments of its type and represented the introduction of standardized building components into the Building Industry.

The advantages of the systems approach to building programmes was quickly recognized and generated considerable co-operation between educational authorities and manufacturers.

Production of prefabricated building components could only be made economical if they were produced in relatively large quantities.

The Ministry of Education encouraged manufacturers to develop new prefabricated component systems, and also to establish close co-operation between educational bodies and research groups.

Thus in 1957, the first "Consortium of Local Authorities on Special Programmes" was completed. There are currently several systems being employed in Great Britain, and some of them have been adopted in other Europen countries.

Various research groups are now co-operating in an attempt to develop components that could be used by different systems.

The three major difficulties to overcome are dimensional variations, different performance standards, and different construction techniques. Both local authorities and manufacturers realized that the introduction of inter-system standardization, would increase the flexibility of the systems and enlarge the market for the products. Whether there is incentive for suppliers to widen their markets is questionable, however, and the more complex the components, the smaller the incentive becomes. The widening of a market implies loss of control of that market, and demand on the supplier could become unpredictable to the extent that the price of his products would rise rather than fall.

The development of the school building industry has numerous implications; however, it is realized that closer co-operation between research organizations and all those concerned with school building programmes, will result in better and more economic schools.

As has already been mentioned earlier in the systems detailed analysis, some of these systems have been adopted in Europe.

In my opinion, it would be possible and practicable to introduce the concept of systems design into the building industry of Canada and particularly the province of Ontario. I would again stress the need for intensive co-operation between Industry and Educational authorities.

We have gained considerable knowledge of this type of co-operation in the planning of our school buildings and especially in the current building programme for Colleges of Applied Arts and Technology.

There is unquestionably a place for the systems design concept in the school building programmes of Ontario. The immediate problem would be in generating sufficient interest to promote and inject this concept into the Canadian Building Industry.

A debatable area would be the source of initial financing and development capital. However, it seems apparent from the survey of these systems in Europe that adoption of this concept would ultimately prove highly beneficial to both Industry and Educational authorities.

Systems design could reduce the burden on the taxpayer, schools could be constructed with greater economy, flexibility, and a drastically reduced construction time.

Educators conduct a perpetual search for improved methods of teaching. The advances made in Educational philosophy must be reflected in the Architecture and technology of our school buildings.