THE DEVELOPMENT OF SCHOOL CONSTRUCTION SYSTEMS IN HERTFORDSHIRE 1946-64

M. P. K. KEATH

Ph. D. 1983

THE DEVELOPMENT OF SCHOOL CONSTRUCTION SYSTEMS IN HERTFORDSHIRE 1946-64

A thesis presented

by

MICHAEL KEATH, B.Arch., RIBA.

to

The Council for National Academic Awards

in partial fulfilment of

the requirements for the degree

of

Doctor of Philosophy

in the subject of

The History and Theory of Architecture

in the 20th Century

Thames Polytechnic

London

March 1983

TABLE OF CONTENTS

PART THREE: SECONDARY SCHOOLS, COLLEGES, CHANGING NEEDS AND POLICIES

APPENDICES

BIBLIOGRAPHY

ACKNOWLEDGEMENTS

Thanks are due to the staff of the Hertfordshire Record Office, especially to Graham Higginson, archivist responsible for the County Council records; to the Librarians and staff of the following libraries: Royal Institute of British Architects (the British Architectural Library); The London Borough of Harrow Central Library (holding the main architecture collection of the London Boroughs); the Hertfordshire County Architects Department technical library; the London Borough of Harrow Department of Architecture and Planning technical library; the Building Research Establishment, Garston; the Royal Institute of Chartered Surveyors.

I am indebted to the former County Architect J.L.S. Digby (1973-77) and to both his predecessor G.C. Fardell, MBE (1959-73) and his successor J. Onslow for support and encouragement over many years. Numerous members of the department, past and present, have given me their time unstintingly. Information, anecdote and discussion, not to mention friendly dispute, have assisted and inspired me over a period of nearly twenty years. In particular, Bruce Martin who, apart from permitting hours of discussion to be recorded on tape, generously loaned me much valuable material from his personal archives, including photographic negatives, diaries, notebooks, sketches and other papers.

P.H. Arnold, research assistant at the University of London Institute of Education (Dept. of Educational Administration) kindly allowed me to see annotated bibliographical material assembled in connection with a book in preparation on education policy.

I am grateful to the Controller of Architecture, London Borough of Harrow for recommending this study to be completed under the Council's post-entry training scheme; for the facilities of the typing bureau, xerography and bindery.

Above all I would thank my supervisors at Thames Polytechnic, Dr. Anthony Quiney and Mr Stanley Smith of the Departments of Architecture and Surveying, respectively. Without their guidance and encouragement this study would have been immeasurably poorer.

FOOTNOTES, REFERENCES AND ILLUSTRATIONS.

Throughout the work footnotes are kept to a minimum; where they occur they are indicated by conventional superior symbols (*). References, indicated by superior numerals ([1]), are placed at the end of each chapter. In order to avoid unnecessary duplication, bibliographical data in the notes and references are abbreviated to the minimum required for proper identification of sources; full information may be found in the Bibliography, which contains all items referred to in the text. The illustrations are numbered serially throughout the study and are grouped, with their captions, at the end of each Chapter.

ABBREVIATIONS.

The following abbreviations are widely used in the literature of the subject and occur with some frequency in the text. However, where ambiguities can be foreseen, or where clarity may be enhanced in context, the full expression is used.

A and BN	Architect and Building News.
AJ	Architects Journal.
AR	Architectural Review.
BRS	Building Research Station.
CA	County Architect.
CEO	County Education Officer.
CLASP	Consortium of Local Authorities Special Programme.
DES	Department of Education and Science.
dpc	damp proof course.
FE	Further Education.
F.E.	Form entry.
HCC	Hertfordshire County Council.
HMSO	Her (His) Majesty's Stationery Office.
HORSA	Hutted Operation for Raising School Leaving Age.
JM, JMI	Junior, mixed. Junior, mixed, infants.
LA	Local authority.
LCC	London County Council.
MOE	Ministry of Education.
MOHLG	Ministry of Housing and Local Government.
MOPBW	Ministry of Public Building and Works.
MOW	Ministry of Works.
OAAP	Official Architecture and Planning.
OECD	Organisation for Economic Co-operation and Development.
RIBA	Royal Institute of British Architects.
RIBAJ	Journal of the Royal Institute of British Architects.
r.c.	Reinforced concrete.
r.s.j.	Rolled steel joist.
SEAC	South Eastern Architects Collaboration
SM	Secondary Modern.
t. & g.	Tongued and grooved.

Abbreviations commonly used in bibliographical data as recommended by BS 1629: 1950, or in ordinary language e.g. viz., etc., are not listed.

THE DEVELOPMENT OF SCHOOL

CONSTRUCTION SYSTEMS IN

HERTFORDSHIRE 1946-64

M.P.K. KEATH

Ph.D. 1983

ABSTRACT

Though no comprehensive study has been made of them previously, the post-war Hertfordshire Schools are well known for progressive design and for pioneering prefabrication on a large scale. In Part 1 the background to Hertfordshire's building programme is examined in the light of the 1944 Education Act and post-war population growth coupled with severe shortages of conventional building materials and labour. Part 2 explores Hertfordshire's response to this challenge: rejecting the use of war-time hutting for new primary schools, construction offering more permanency, and freedom to design a proper teaching environment was sought. A prototype was built and a vital process of "development," informing both construction and design, emerges as the key to progress. The process is shown to have begun with the adoption of a set of novel, but existing, building components; continuing analysis, modification and selective substitution led to the evolution of an integrated constructional system. Close collaboration with both clients and manufacturers ensured that optimum fitness-for-purpose in relation to cost was achieved. The interest created by this new type of architecture is discussed before turning, in Part 3, to its extension to the more complex needs of secondary schools and colleges. It is shown that once the approach was established the main challenge was organisational; alternative materials and modules, together with internal questionings of its validity in changing conditions, were all absorbed by the development process. The approach was emulated by others who introduced the consortium idea to ensure economical component manufacture; the period reviewed ends with the formation of the South Eastern Architects Collaboration (SEAC). It is strikingly clear that the influence of modernist architectural precepts, per se, was negligible. Yet by a remorseless objectivity of design the schools achieved, perhaps uniquely, the fullest realisation of Modern Movement principles, a matter of significance to architectural history.

INTRODUCTION

The Hertfordshire Schools of the early post-war period captured the imagination of idealists in the fields of architectural design, education and building production; their praises were sung in the professional journals and radical student papers alike.[1] Interested architects and teachers flocked from all over the country, indeed the world, to see them. Few architectural books of the period ignored them and no serious discussion of modern British schools could avoid reference to Hertfordshire. Sir James Richards, writing in the 1953 edition of his popular Introduction to Modern architecture, described them as "a series of schools that are probably the most advanced, and aesthetically the most attractive, of any contemporary buildings in Britain."[2] Richards backed up the accolade by putting his finger on the essential reasons for their success:

> Faced with the need to build a large number of schools quickly, the Hertfordshire County Architect, C.H.Aslin, and his deputy, S.Johnson-Marshall, devised, with the help of a manufacturer, a constructional system based on a light framework and consisting of standard structural and walling units which could be produced in large quantities and delivered on the site ready for use. This was the first attempt on a large scale to apply industrial methods to the technique of building, and resulted not only in speed and economy but in efficiently planned buildings with a delightfully fresh and airy character.[3]

and Sir John Summerson, writing of the burden which fell upon the Education Authorities in and around London, where there had been the greatest bomb damage to pre-war schools and where housing was being expanded at the greatest rate, said:

> Among these counties Hertfordshire has come to be the one most frequently mentioned for its school-building achievement, partly because of the technical interest of its use of prefabrication and partly because of the aesthetic interest of its results. The position in Hertfordshire was not greatly different from that in other counties near London, but it happened that the county architect, C.H.Aslin, and the team he assembled in 1945-6 attacked the problem with conspicuous drive and were first in the field with innovating ideas.[4]

The Hertfordshire schools were prodigious; yet, on the face of it, they were designed by near-anonymous architects in a local authority department to standards set by bureaucrats and to the approval of civil servants and elected committees. Thus, considering the low expectations that the architectural profession and the general public maintained in respect of public or official architects at the time,[5] their success is all the more remarkable. Such praise was rare then and it is hard to imagine such comments being made of architecture, whether produced by the private or by the public sectors, today.

Most architects, historians and commentators today are aware that Hertfordshire played some important part in post-war school building. Few, however, can relate the County's achievements to present-day experience or to the history of the Modern Movement, mainly because of the lack of a comprehensive account of the events which centred on Hertford in the late forties and fifties.

The numerous articles on the schools, which have appeared over the years in technical and professional journals deal, in the main, with particular aspects of their design and construction; even taken as a body they leave much of the story untold. Moreover, few of the architects concerned did themselves work in Hertford for the whole of the period under discussion, which ends with the formation of the South East Architects Collaboration (SEAC), thereby changing the County Architects Department's frame of reference.

Thus the story is diffuse and its memories scattered: coming across comments such as those of Richards and Summerson there is a sense that some vital constituent of architectural history is missing. The lack is the more ironic in that it is a success story which a beleaguered profession and a sceptical public need to hear or be reminded of. The present study attempts, first and foremost, to fill an important gap in the history of modern architecture. It will, however, have a double justification if it succeeds in giving hopes for it will be seen that the schools and the methods of producing them were achieved not by acts of individual genius but by the concerted effort of a group of dedicated men and women who got themselves organised to do a job well. And that, given leadership, is something all mankind can do.

We shall see how existing building components and technologies were adapted to suit the needs of an organising activity which we may define as the Development Process[6]; the structural techniques and their implicit methodology laying the foundations of what has become known as System Building.[7] The methods arose as a positive response to a particular set of circumstances. Now, with conditions quite unlike those which pertained in 1945, one might query their relevance in today's world. Apart from having in mind their historical importance, in that they explain how much of what we take for granted today came about, this study has been written in the belief that the approach pioneered by Hertfordshire still has relevance in other fields, if not in schools, and in other societies, if not in our own.

It is an unfortunate fact that System Building, and its close relative Industrialised Building, have fallen into disrepute in recent years, particularly as a result of their failure to produce satisfactory housing. The full reasons for this failure must be the subject of further research but there is ample reason for believing that the methods were misused in the housing field on account of the political failure to gear them to the needs of people, rather than those of factory or site production.[8] If, in housing, the relationship between the system designers and their clients had been similar to that of the Hertfordshire architects vis-a-vis the teachers and educationists, the results might have been very different indeed.

Throughout this study the term Hertfordshire Schools or variously Herts or simply Hertfordshire is used as a shorthand for the work of the County Architects Department of the Hertfordshire County Council. The study does not include school building in the county which took place on behalf of other agencies, such as private institutions. It does however, include work done by private architects in association with the County Architect and his staff. In most cases, schools built under these auspices were built in the same construction and to similar standards as those produced by the County Department. The List of Schools appended to this study gives the names of all the projects in the various annual programmes together with the names of staff architects or private firms responsible for them as the case may be.

Notes to the Introduction.

1. The Journal of the Architectural Students Association, Plan, was a spearhead of radical student thinking in the post-war years. Its contributors in those years included such names as Kenneth Campbell, Stephen Gardiner, Oliver Cox, Andrew Derbyshire, Bill Howell, John Killick, John Turner, John Voelcker and Michael Ventris (the decipherer of Linear B). A heady mixture of poetry, politics, sociology and architecture, Plan 6 (1949) employed the Herts schools as a vehicle for a manifesto on the place of the architect in society and related burning issues.

2. J.M.Richards, Introduction to Modern Architecture, Cassell, London, 1953, p.117.

3. Ibid.

4. J.Summerson, introduction to Exhibition Catalogue: Ten years of British Architecture, Arts Council, 1956, p.20.

5. See Henry Morris's letter to Jack Pritchard quoted in Design 302, February 1974, p.48.

6. The nature of Development work and the idea of Development Group working are discussed in the penultimate Chapter (24).

7. Dr.A.F.L.Deeson in his introduction to: The Comprehensive Industrialised Building Systems Annual, 1965 (the 1st.) defined a system as "any means of building which makes use of factory manufacturing techniques, either on or off the site, replacing traditional methods to a varying degree, but with the common aim of achieving greater speed of erection." It is suggested that this definition is altogether too loose; clearly many buildings throughout history would qualify as "system built". It will be demonstrated in the course of this study that the concept is far more comprehensive.

8. The housing systems were invariably sponsored and developed by the larger contractors and manufacturing interests tended to favour large wall-panel techniques. Such construction in itself inevitably encouraged repetitive large-scale towers or slab-like blocks. The ideal prefabricated unit was the dwelling wall, complete with windows, insulation and external (if not internal) finishes; the amount of compromise necessary to make such units "economical" was reflected in the inadequacy and monotony of the results.

Part one

Chapter 1

BRITISH SCHOOL DESIGN IN THE NINETEEN THIRTIES

Little more than a decade previously Henry Morris, the secretary to the Cambridgeshire Education Committee, was looking for an "outside" architect to design a new Village College at Histon. He was clearly hoping to do better than entrust his vision to an official architect. In a letter to Jack Pritchard[1] he described his brief for the proposed college and went on to make a remarkable comment on the state of public building and on the importance of good architecture to the educational environment:

> In such a building as I have briefly described the fundamental importance of architecture and the opportunity for the architect are obvious. In this connection there are three points I should like to make:
> 1. If there is any place where the art of architecture is of supreme importance it is the buildings for public education - in their design and in every detail of their decoration and furnishing.
> 2. The architectural intelligence of England, whether of the scholarly academic type of the contemporary modern school, is wholly divorced from the buildings of the State System of Education - owing as you know to the tradition of official architects.
> 3. There has been no public architecture in the English countryside since the Parish Churches were built - that is, since the Middle Ages.
> Having in mind these considerations, and the potentialities of the Village College as a community institution, I should like to see the Village College at Histon entrusted to an outside architect who would contrive an instrument for the satisfaction of present-day social and educational needs in terms of modern architectural possibilities in structure, design, materials, decoration and hygiene. No one, in my opinion, could do this better and bring to bear on the solution of the problem all that is best in modern Eropean practice combined with a realistic English approach than Professor Gropius (who is now in England) in association with Mr.Maxwell Fry.[2]

The letter is significant not only for its perceptive comments on the state of architecture but, also, because it was a preliminary to the creation of one of Britain's first modern schools. It turned out not to be established at Histon but at Impington, not very far away. Morris indeed secured the services of Gropius and Fry and their college was finally completed in 1939 after Gropius's departure to Harvard. Impington was an advanced concept educationally and socially and, as architecture, was one of the inspirational springboards to post-war school design (figs.9-10).

Contemporary with Impington and perhaps more significant as a stimulus to new thinking, and more influential in its effect, was the competition for new ideas in schools design sponsored in 1936 by the national daily newspaper the News Chronicle. There was tremendous interest in this opportunity to bring together the generally unrelated ideas on the subject which had gradually evolved between the two world wars.[3] Some 250 entries were received and it was won by a young Architectural Association graduate, Denis Clarke-Hall. His winning design (fig.8) was the basis for the school completed at Richmond, Yorkshire, in 1939. Embodying current thinking, particularly with regard to classroom design, lighting, ventilation and acoustics, it helped to establish standards far beyond the offical Board of Education requirements.[4] The Richmond design (figs.11-13), together with Impington, illustrated that schools were beginning to free themselves from the institutional inheritance of the past and that the need for space, light, colour and a friendly, sympathetic atmosphere was being recognised. J.M.Richards called it "the first example of a modern school design in England" and Anthony Jackson, in his history of modern architecture in Britain, The Politics of Architecture, remarks:

> His design has similar components to... Impington Village College but is substantially lighter in form, space and structure.[5]

and points out that this competition demonstrated in its results that

> The new style had replaced commonsense eclecticism as the au courant standard before Gropius had built anything in Britain.[6]

However, Impington and Richmond were exceptional.[7] On the whole very little attention was paid to educational trends in deciding the size, shape or function of teaching spaces as opposed to the physical standards of lighting, ventilation and sound reduction. In building technique too there were, as we shall see later, some notable experiments, particularly in West Sussex and Middlesex.

The reaction was against the type of plan which, in one form or another, had dominated school design since Victorian times and was still much in evidence in the 1920s. Typically, this plan grouped classrooms on three sides of a centrally positioned assembly hall; the classroom doors opening directly off the hall (fig.2). In urban areas, where ground space was at a premium, there were frequently two or more upper floors. These "three decker" schools dominated the scene in many parts of London and other large cities. They were open to serious criticism in three respects. Cross-ventilation was inadequate on account of most rooms having only one external wall for windows; aspect was poor and classrooms received little direct sunlight, and because they were so closely packed into the simple overall form, noise transmission between classrooms was intolerable at times.[8]

The type of plan which deliberately set out to remedy these defects became aptly known as the "finger plan".[9] Classrooms and practical rooms were positioned in series with a corridor connection along one side. Frequently several such rows were planned like fingers at right angles to a "palm" and parallel with each other. The "palm" contained the assembly hall, administrative offices, cloak rooms and lavatories. It enabled all teaching spaces to face south and by means of a clerestory window over the corridors, obtain high level cross-ventilation. The rows were well spaced apart and storerooms, interposed between classrooms, reduced sound transmission to a minimum.

But it was not all a matter of rationality or of quantifiable physical standards based on scientific measurement and observation. Architecture was still in the "art or science?" agonies; it was still possible for the <u>RIBA Journal</u> to publish articles with such titles as "The Place of Science in the Art of Lighting". Modern Architecture was still being fought for in a field of pioneers, manifestos and heroes. The converted imposed a modernistic formalism on their design solutions, striving to subjugate regional vernaculars beneath an all pervading veneer of the International Style. With wit and perception Richard Sheppard put it thus:

> I think it is true to say that the design of schools was dominated by what might be called architectural considerations. The architectural features visually, and architectural principles technically, dictated the design. Both of these are abstractions derived from the study of irrelevant problems arising out of the interest the early Renaissance men took in perspective. They have no particular relation to school building. Thus circulation, the arrangement of corridors by which the teaching spaces were linked, was most carefully considered and the intersection of these received a visual accent. Where the two main traffic routes intersected was the tower, while the entrance hall received a

special and often arbitrary architectural treatment. I say arbitrary because the occupants of the building, you will recall, entered and left through the lavatories.[10]

Sheppard was himself an entrant in the News Chronicle competition and sums up its significance to that generation thus:

> For architects it was important in focusing attention publicly on the requirements of the children and teachers. Most of us who entered it bemused ourselves by working at circulation patterns and found out how little we actually knew about the activities in the classroom and elsewhere. Mr.Denis Clarke Hall won the major award largely by his conception of the classroom as a teaching space,and foreshadowed later developments. But this competition may be taken as illustrating the stage that was reached at this time, and the mere diversity of solutions is evidence of our confusion.[11]

Whilst the 1939-45 war suddenly stopped school building and broke the continuity of its development, it can be said that the pause gave an opportunity for reassessment of progress in the light of past experience and future needs. It was clear that when the war was over the need and opportunity would be greater than ever before. The policy document that was to be the vehicle of that challenge was the Education Act of 1944.

Notes to Chapter 1.

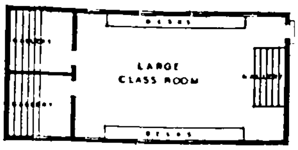
1. J.C.Pritchard, furniture designer and manufacturer, founded the Isokon Furniture Company in 1931 and was the client for Wells Coates's Lawn Road flats in Hampstead, London, where Gropius took accommodation as a guest.
2. Letter from H.Morris to J.C.Pritchard, 3 March 1936. Published in "Gropius and the making of Impington." Design 302, Feb.1974, p.48.
3. See "News Chronicle schools competition." AJ, vol.85, 1937, pp. 511-544.
4. Board of Education, Suggestions for the planning of buildings for public elementary schools. Educational pamphlet no.107, 1936.
5. Anthony Jackson, The politics of architecture, 1960, p.59.
6. Ibid.
7. For a good general view of progressive pre-war school design (including some international examples) see H.Myles Wright and R.Gardner-Medwin, The design of nursery and elementary schools, 1938.
8. Ministry of Education pamphlet no.33, The story of post-war school building, 1957, p.33. See also (i) Godfrey and Castle Cleary, School design and construction, pp.23-35.

(ii) M.Seaborne and R.Lowe, The English school: its architecture and organisation (vol.2, 1870-1970) 1977, passim.

9. MOE pamphlet no.33, op.cit., p.33.

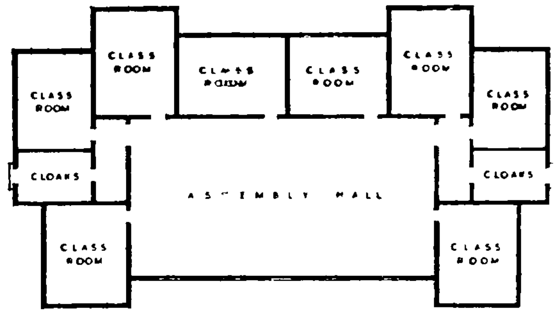
10. Richard Sheppard, "Post-war development in school design" RIBAJ, June 1953, p.313.

11. Ibid., p.314.



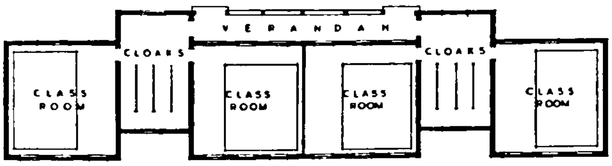
STOWE SYSTEM

1. 1826



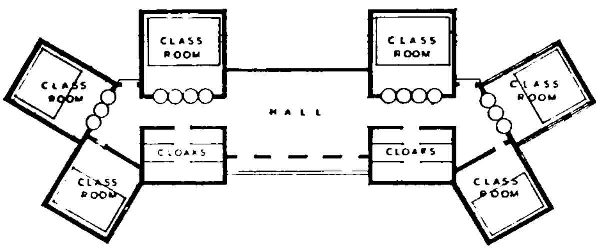
CENTRAL HALL TYPE

2. 1871



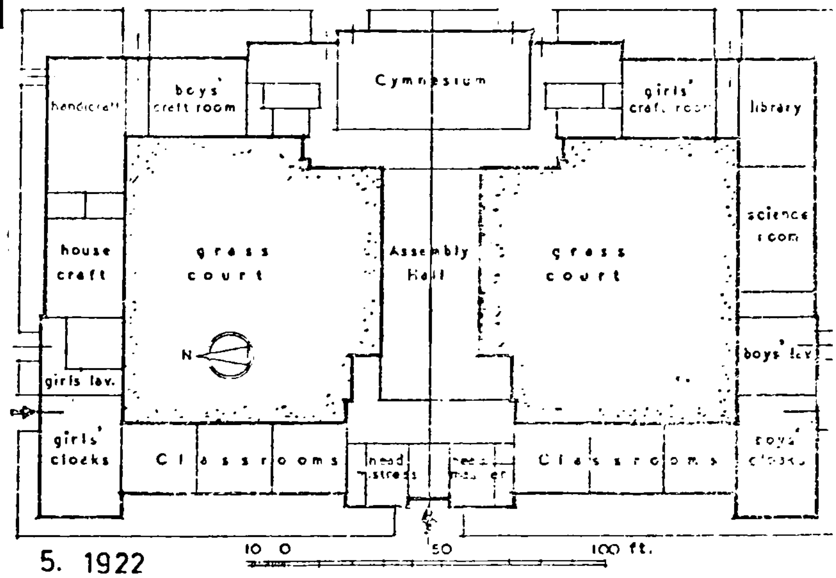
STAFFORDSHIRE PAVILION TYPE

3. 1906

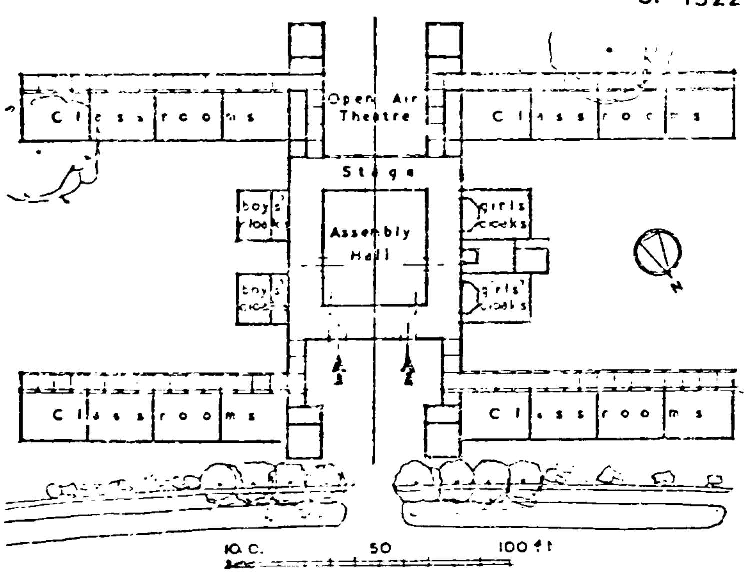


DERBYSHIRE CROSS VENTILATED TYPE

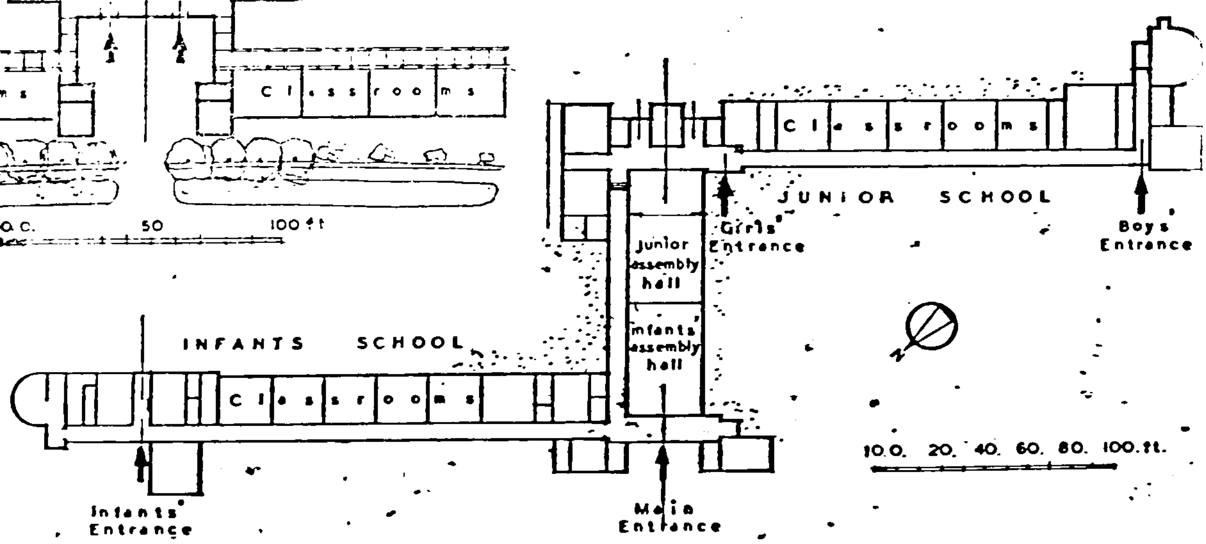
4. 1907



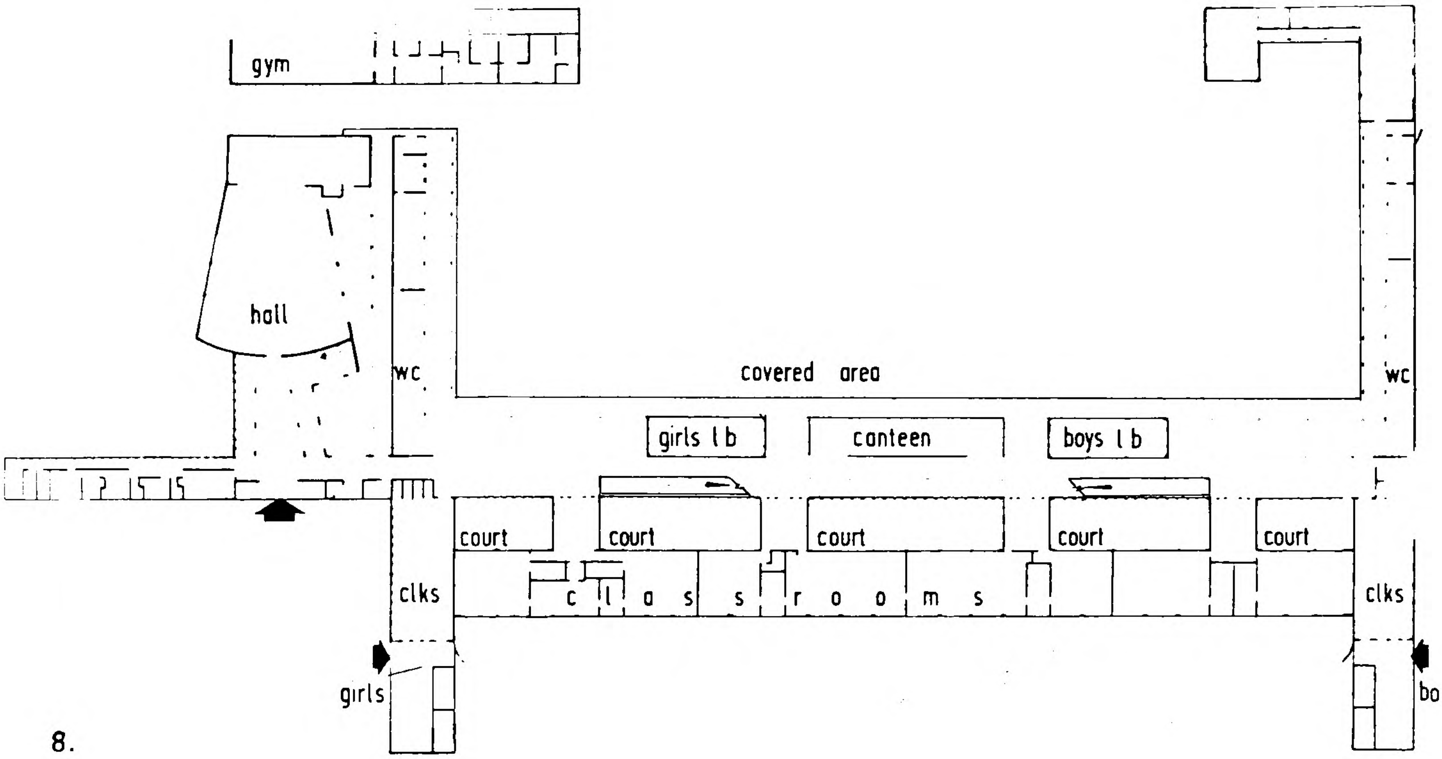
5. 1922



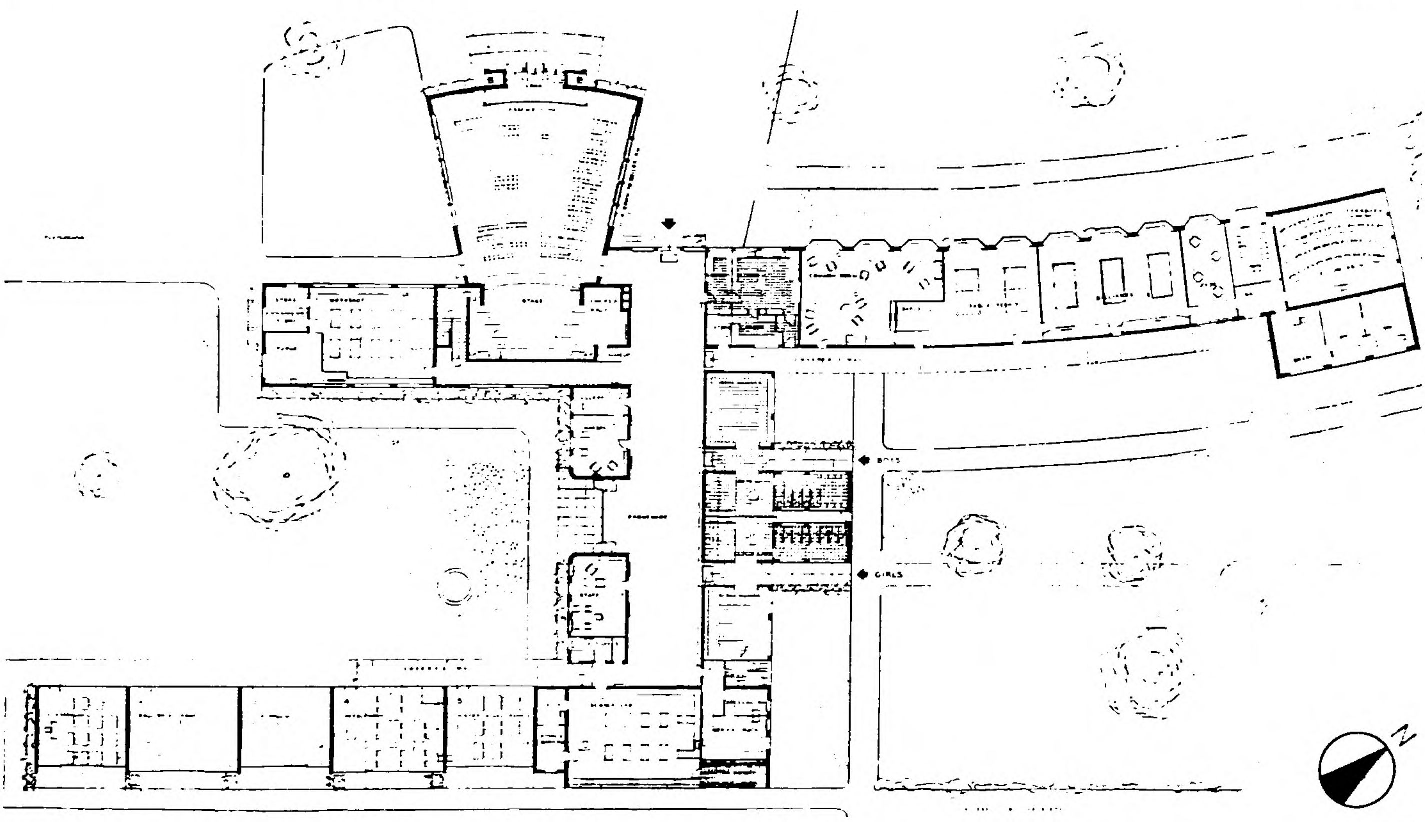
6. 1922



7. 1941


gym
hall
wc
covered area
wc
girls l b
canteen
boys l b
court
court
court
court
court
clks
c l a s s r o o m s
clks
girls
bo

8.



9.

10.

Figures 1-13.

1. Stowe system plan, 1826. (RIBAJ July 1947, p.460)

2. Central hall type plan, 1871. (ibid.)

3. Staffordshire pavilion type plan, 1906. (ibid.)

4. Derbyshire cross-ventilated type plan, 1907. (ibid.)

5. Double quadrangle type plan on a restricted site, 1920. (Godfrey and Castle Cleary, School design and construction, p.29)

6. Welwyn Garden City, Hertfordshire. Plan of Sir Frederick Osborn School by Louis de Soissons, 1922. (ibid.,p.29)

7. Stoke-on-Trent, Staffordshire. Plan of Meir Primary School by J.R. Piggott and W.I. Watson, 1941. (ibid.,p.30)

8. News Chronicle competition 1937. Plan of winning design by Denis Clarke-Hall. (Jackson, The politics of architecture, p.110)

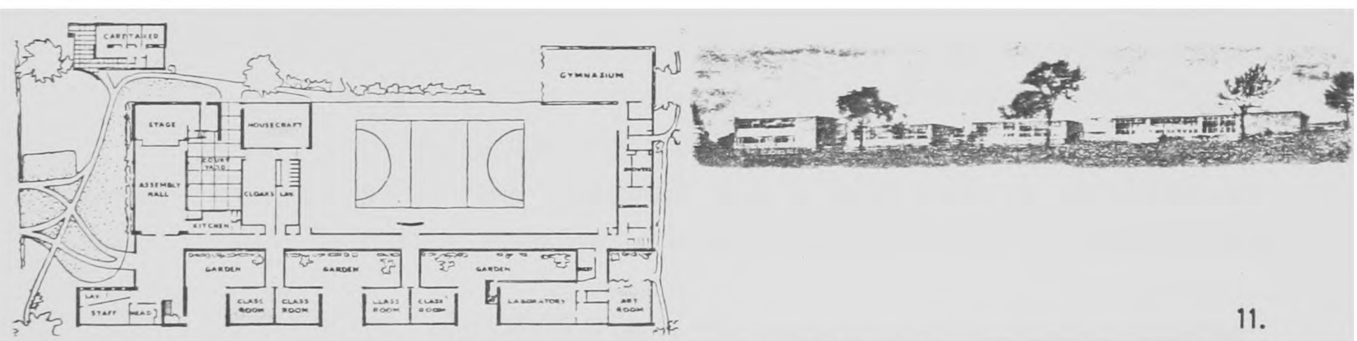
9. Impington, Cambridgeshire. Plan of Village College by Walter Gropius and E.Maxwell Fry, 1939. (ibid., p.109)

10. Impington Village College, view from the north. (ibid., p.108)

11. Richmond, Yorkshire. Plan and view of High School for girls by Denis Clarke-Hall, 1939. (Tubbs, R., The Englishman builds, Penguin Books, Harmondsworth, 1945, p.53)

12. Richmond High School, gymnasium. (ibid.)

13. Richmond High School, classroom. (ibid.)



11.

12.

13.

Chapter 2

THE EDUCATION ACT 1944

The history of educational reform in England and Wales is signposted by Reports invariably known by the names of the Chairmen of the Committees appointed to investigate topics with closely defined terms of reference. In recent years the names of Newsom, Plowden and Robbins among others have been given to reports on Secondary, Primary and University education respectively.[1] In the years between the two world wars the name of Sir W.H.Hadow, given to three separate reports,[2] likewise symbolised fundamental changes of attitude and direction in the recommendations they made. If the Reports are the signposts then the milestones are the Education Acts.

The Report of the Hadow Committee of 1926 on The Education of the Adolescent laid down a policy for the reorganisation of elementary education which was subsequently adopted and was still in process of implementation up to the outbreak of war in 1939. The Report defined the limits of elementary education thus pointing to the need for a great number of new secondary schools to avoid the ills of the indeterminate "All-age" school. The division of elementary education into two phases, Junior and Infant, and the desire to separate senior pupils from junior ones (the over elevens from the under elevens) all required far more buildings than were then available. The reorganisation proceeded but was restricted due to lack of money available for educational building, a consequence particularly of the financial crisis of 1931.

The Education Act of 1936 gave the reorganisation further impetus by making provision for raising the school-leaving age to fifteen at some future date and empowered local education authorities (LEAs) to contribute to the building of new schools and improving existing premises for senior children in voluntary schools.

The war years brought great improvements in the school meals service, medical and dental services,[3] and the evacuation of thousands of schoolchildren was carried out with only minimal disruption to their education. The significance of the evacuation programme as a catalyst in the process of change is described by H.C.Dent in his book

The educational system of England and Wales:

> ... almost certainly the habits and behaviour of some of the mothers and children evacuated in 1939 from slum areas was the spark that set off the conflagration, for they revealed the fact that children were still being brought up in ignorant and sordid fashion. And with true instinct public opinion realised that the key to the cure of this was better education.
> By 1940 teachers and social workers were clamouring for reform. The Board of Education reacted promptly, and in 1941 sent to numerous bodies... proposals... inviting suggestions, comments, and criticisms. The response was almost overwhelming.... It quickly became apparent that about purely educational reforms there was little substantial difference of opinion; what did take time, however, was the reaching of an agreement with the Churches about the future position of voluntary schools.
> In July 1943 Mr.Butler presented to Parliament a "White Paper", entitled Educational Reconstruction, which set out the Government's proposed reforms. Following discussion of these he introduced into Parliament in December 1943 a Bill which on 3rd August the following year became law as the Education Act, 1944.[4]

The Education Act of 1944, popularly known as the Butler Act, signalled a radical change in the State's attitude to education. With the establishment of the Board of Education in 1899 the State had accepted full responsibility for elementary education but it was not until 1944 that this was extended to every stage of education from Nursery School to University or Further Education College.[5] "Post Elementary" education had hitherto been confined to a comparatively small proportion of children who were either educated privately, as in the Public Schools, or in Secondary Grammar Schools (frequently old foundations) which were subsidised either by the central or local authority. University places were financed either by fee-paying students or by State or College scholarships and benefactory bursaries. This was not altered by the 1944 Act but the number of state scholarships was increased considerably. At the opposite end of the scale the provision of Nursery school places was left to the discretion of local education authorities.

The Butler Act both widened the scope of State Education and placed the control of educational policy more directly with the central authority:

> The statutory system of public education shall be organised in three progressive stages to be known as primary education, secondary education, and further education; and it shall be the duty of the local education authority for every area, so far as their powers extend, to contribute towards the spiritual, moral, mental, and physical development of the community by securing

> that efficient education throughout those stages shall be available to meet the needs of the population of their area.[6]

The emphasis was on continuity and the provision of sufficient variety of educational establishments to cover the needs of pupils of varying ages, aptitudes, and abilities. In addition the organisational framework to direct educational policy was changed. The old Board of Education was abolished and a Government Department under a Minister of Education was established.[7] The Consultative Committee to the Board was replaced by two Central Advisory Councils (one for England and one for Wales) to advise the Minister on educational theory and practice. The LEAs remained the County Councils and County Borough Councils, but whereas the old Board of Education had only advisory powers, the new Ministry was able to issue directives in the form of statutory regulations and in circulars addressed to the local authorities. The number of LEAs was reduced to 146, consisting of 62 Counties, 83 County Boroughs and one "joint board" for the Soke of Peterborough. One of the first duties of these authorities was the preparation of Development Plans for the future organisation of primary and secondary education in their areas, into which they were to integrate all existing and future voluntary schools. Thus, although administration remained decentralised, the effective power of control by the central authority was considerably increased. The Universities remained independent and were to receive direct Treasury grants.

The Minister's duty under the new Act was defined as being:

> ... to promote the education of the people of England and Wales and the progressive development of institutions devoted to that purpose, and to secure the effective execution by local authorities, under his control and direction, of the national policy for providing a varied and comprehensive educational service in every area.[8]

The most immediate and comprehensive change, apart from the administrative clauses, consisted in the provision of secondary education for all children and in raising the compulsory school-leaving age. In fact it was made compulsory for all LEAs; before that individual authorities only provided such accommodation as each thought was necessary and there were wide variations between one authority and another in the numbers of children receiving secondary education.[9]

Furthermore the Act provided that the school-leaving age should be raised to 15 not later than 1 April 1947 and thence to 16 as soon as the Minister became satisfied that adequate buildings and sufficient trained teachers were available. Secondary education itself was seen in a new light. Whereas hitherto it had been almost exclusively of the most academic Grammar school type, intending to prepare pupils for University, the Act showed a realisation that this type of education was not necessarily best suited to each child:

> ...the schools available for an area shall not be deemed to be sufficient unless they are sufficient in number, character, and equipment to afford for all pupils opportunities for education offering such variety of instruction and training as may be desirable in view of their different ages, abilities and aptitudes, and of the different periods for which they may be expected to remain at school, including practical instruction and training appropriate to their respective needs.[10]

Secondary schools were thus to be divided effectively into three categories: "Grammar", "Technical" and "Modern". The "Grammar School" curriculum would remain largely unchanged. The "Secondary Technical" schools were to be developed from the small number of Junior Technical schools which already existed to provide vocational training, and although they were to continue to give a general education it was to be largely related to industry, commerce and agriculture. Schools of this type were considered useful not only in supplying industrial needs but also in providing for children of a more practical turn of mind who feel happier when their work can be seen to relate more directly to concrete applications.

Those children who showed no special aptitude for either academic or technical education were to attend the "Secondary Modern Schools". Merton Testor drew attention at the time to an inherent flaw in the proposed system, one which successive Labour administrations have been attempting to eliminate ever since.

> It has been argued that the sense of superiority at present enjoyed by the old Grammar schools will now be shared by the technical schools with an implied inferiority accruing to the modern schools. This is certainly a danger, and the division of secondary schools into their three new categories has been further criticised as being too watertight. But any such defects will no doubt be remedied when the system is in action.[11]

Each category of secondary schooling was to be accommodated in self-contained, separate buildings. On restricted sites, where this might not be possible, provision was made to cater for all three types in one set of buildings; "multi bias" schools of 1,500 - 2,000 pupils. It was recognised that such schools, the "Comprehensives" of later years, would be most economical in terms of teachers and equipment if somewhat unwieldy and, possibly, too impersonal.[12]

It should be noted that the 1944 Act in recognising the differing needs of children did not specifically define the differing kinds of school required to meet those needs. The terms Infant, Secondary Modern, Secondary Technical and Grammar, as descriptions of these kinds of schools, did not appear in the Act. Nor did such jargon as Bilateral Grammar/techs, Multi-lateral schools or Comprehensive Schools.

The Ministry of Education in an information pamphlet put it thus:

> These types of school are all attempts to give expression to the spirit of the Act calling for schools sufficient in number, character and equipment for children of varying ages, abilities and aptitudes. The facts that the law does not lay down what kinds of schools shall be built, that there are several different kinds being built, and that there are still sharp controversies about how children differ in aptitude and abilities and to what sort of school each is best suited are all evidence of the typical British instinct to let matters of this kind work themselves out in the light of experience and experiment.[13]

The terminology under the new Act provided for the pre-secondary school stage to be known as "Primary Education" as a reflection of the will towards continuity of education, and Primary Education was to cover the needs of all children of 11 years and under, including nursery schooling as required. Likewise the post-secondary or "Further Education" stage was covered laying down that:

> ...it shall be the duty of every local education authority to secure the provision for their area of adequate facilities for further education, that is to say:-
> (a) full-time and part-time education for persons over compulsory school age; and
> (b) leisure-time occupation, in such organised cultural training and recreative activities as are suited to their requirements, for any persons over compulsory school age who are able and willing to profit by the facilities provided for that purpose...[14]

Thus a vast expansion in the field of State education was launched. It would necessitate a wide review of the educational plans and requirements of the local authorities, who were required by the Act to submit development plans to the Minister by 1 April 1946 in respect of primary and secondary education, and by 1 August 1948, in respect of further education.

The standards of accommodation and amenities which were to be provided in new school premises were described in the Ministry's Building Regulations. These were statutory rules and orders compiled by the Minister after the enforcement of the Act.

Notes to Chapter 2.

1. Sir John Newsom, Half our future, 1963; Lady Plowden, Children and their primary schools, 1967; Lord Robbins, Higher education, 1963.
2. The education of the adolescent, 1926; The primary school, 1931; Infant and nursery schools, 1933.
3. John Newsom, The child at school, 1950, p.152. passim.
4. H.C.Dent, The educational system of England and Wales, 3rd ed., 1966, p.30.
5. Central Office of Information reference pamphlet no.7, Education in Britain, 1955, p.8.
6. Education Act 1944, Section 7, p.4.
7. Ibid. Section 2 (i), p.2.
8. Ibid. Section 1 (i), p.1.
9. H.C.Dent, op.cit., p.29.
10. Education Act 1944, Section 8 (i) b, p.5.
11. Merton Testor, "The Education Act", A.J., 20 May 1948, p.456.
12. Ibid.
13. M.O.E. pamphlet no.33, The story of post-war school building, p.11.
14. Education Act 1944, Section 41, p.33.

Chapter 3

NEW STANDARDS FOR SCHOOL PREMISES
THE BUILDING REGULATIONS 1944

It would have been impossible for the local authorities to produce the development plans required by the 1944 Education Act unless they had an accurate idea of the standards of accommodation to be provided in the various types of school in their area. Moreover, if uniformity between authorities were to be achieved it was necessary that the same standards should be adopted throughout the country.

In 1914 separate Building Regulations for public elementary schools and for secondary schools had been issued but without statutory authority. Intended as a guide to general principles of good practice in school design the standards they suggested were not expressed as minima and were withdrawn in 1926, eventually to be superseded by Handbooks of Suggestions.[1]

With the Education Act of 1944 the Minister was required to prescribe by regulation the standards with which primary and secondary school premises should comply.[2] Accordingly, draft standards were published in November 1944 and on 1 April 1945 the Standards for School Premises Regulations 1945, commonly known as the Building Regulations, came into formal operation. The new regulations had statutory force and prescribed minimum rather than maximum standards, being intended to safeguard rather than restrict.[3]

The standards were applicable to both new and existing schools and covered County and Voluntary Schools, Nursery Schools and Classes, Special Schools and Boarding accommodation. They required plans to be prepared on the basis of an eventual school leaving age of 16, but, in view of building restrictions after the war, it was not envisaged that the projected construction should in all respects be completed for the extra, over 15, age group in the immediate future. Special attention was drawn to the possibility of prefabricated construction, a point of fundamental significance which will be discussed later.

The areas of teaching accommodation were the fundamental part of the regulations and the table[4] below provides a comparison between the pre-war standards suggested by Educational Pamphlets 86 and 107 and the post-war prescribed minima.

No. of form - entries (F.E.) for which school was designed(a)	Minimum areas (Sq. ft.) of teaching accommodation provided under			
	Pre-war Standards (approx.)	1945 Regulations	1951 Regulations	1954 Regulations
INFANTS				
1 F.E.	2,540	2,700	2,760	2,760
2 F.E.	4,980	4,760	5,300	5,200
3 F.E.	7,020	7,256	6,850	7,080
JUNIORS				
1 F.E.	3,670	4,280	3,880	3,880
2 F.E.	6,230	7,152	6,400	6,260
3 F.E.	8,500	10,428	8,800	8,640
SENIORS				
1 F.E.	4,700(b)	8,549	8,660	6,680
2 F.E.	10,500(b)	16,507	14,180	13,080
3 F.E.	12,300(b)	22,186	20,680	19,830

(a) The size of schools was conveniently described in terms of the number of new forms (or classes) which could enter a school each year. In infant and junior schools the size of classes was taken as 40 children and in secondary schools as 30. Thus, two classes (80 children in all) entered a 2 F.E. junior school each year, and two classes (60 children in all) a secondary school.

(b) These schools provided only a 3 year course for children from 11 to 14 years of age.

After six years of use, in 1951, the regulations were found to be in need of their first revision. Some relaxation was allowed, partly on account of the financial stringencies of the period, and partly to allow Local Education Authorities a greater latitude in the type of accommodation to be provided.

The order and the period of time in which compliance with the Standards was to be secured in any particular school was to be proposed in the local authority's Development Plan and governed by the directions of the Minister of Education for execution of the plan.

The regulations provided the objective physical criteria for all post-war school building. Their influence, as we shall examine, extended well beyond the schedule of accommodation brief. They became one of the principal determinants of school design, thus a brief survey of this context is essential to an understanding of the architecture which was developed in Hertfordshire, as elsewhere, to meet their requirements.

It was a primary objective of the new legislation that the size of classes should be reduced progessively and as quickly as possible to a maximum of 40 in Primary and 30 in Secondary Schools. Up to that time the standard class size in Elementary Schools had been 50 for Juniors and Infants and 40 for Seniors. To reduce both these figures by 10 would involve a large increase in the teaching staff and buildings and therefore a greater reduction was not regarded as immediately practicable, even though ultimately desirable.

In the selection of sites for new schools attention was to be given to avoiding those adjoining main traffic routes and to ensuring that children were not compelled to cross dangerous traffic routes in getting to and from school. In size, every County and Voluntary School site, including playground space, was to range between half an acre for the smallest Primary School to three acres for a 3-form entry Secondary School. In addition, playing fields (as distinct from playgrounds) were to be provided, ranging from half an acre for the smallest Primary Schools containing junior children to fourteen acres for large Secondary Schools. Where curricula included gardening, growing fruit and vegetables, keeping live stock or similar activities, sites were to be larger still. It was advised that consideration should be given to avoiding sites which had restricted sunlight or undue exposure to prevailing winds; the environmental value of trees and other features was also stressed.

With regard to construction, detailed standards for heating, lighting and ventilation, hot and cold water supply, drainage and sanitation, sewage disposal, floor loading and the planning of staircases and corridors were laid down.

In the design of all schools staffrooms, medical-inspection accommodation, drying facilities and adequate storage spaces were to be provided. The requirements for cloakrooms, washing and sanitary accommodation were specified for each type of school and adequate kitchen accommodation was to be provided in day as well as boarding schools for the preparation and serving of school meals. One or more dining rooms, accommodating at least 65 per cent of the pupils in not more than two sittings, were to be provided in all schools except the smaller Primary Schools.

The Draft Building Regulations were accompanied by a Memorandum which gave more detailed guidance to aspects of the requirements. Three Appendices to the Memorandum dealt respectively with: the planning and construction of schools, the suggested distribution of practical accommodation in secondary schools, and, kitchen and dining-room planning and equipment.

Of all the physical standards prescribed by the regulations the Daylight Standards for Classrooms was to have the most far reaching consequences for design and requires further discussion. The standard required was defined by the following clause in the Building Regulations:

> At each desk or place of work in every teaching room in every school or department the Daylight Factor shall not be less than 2 per cent.[5]

In fact the desired intention was an even higher daylight factor* standard: the 5 per cent level recommended by the Post-war Study Committee on the Lighting of Buildings.[6] But recognition of the difficulties of applying the higher standard to both new and existing schools led to the compromise of defining it as 2 per cent in the Regulations, but including the following note in the accompnaying Memorandum:

> The 2 per cent Daylight Factor prescribed in the Regulations for teaching rooms is the minimum, and a higher figure of up to 5 per cent should if possible be secured, e.g. in rooms where Clerestory or top lighting can be arranged.[7]

If, therefore, the general objective in design was to achieve a daylight factor of 5 per cent there were going to be practical difficulties; as William Allen and John Bickerdike observed:

> It will be seen that no classroom of normal height and with a greater width than about 15 or 16 feet will reach the prescribed standard of 2 per cent daylight factor. It would require a

---

* The term "daylight factor", as used in Post-War Building Studies, No.12, refers to the ratio between the illumination at any point indoors (usually measured on a horizontal plane) and the illumination which would be received at the same moment outdoors from an unobstructed view of the sky. It is expressed as a percentage.

> window about 14 feet high to provide 2 per cent daylight factor at the worst lighted desk in a classroom of normal depth with moderate external obstructions.[8]

The Post-war Building Study on lighting gave a number of examples of the amount of light in different types of classrooms. A school dated 1880, for example, with Gothic windows, had illumination values varying from 4.0 per cent to 0.5 per cent near the farthest wall; the comment was that this "could be quite pleasant, the deep splayed reveals reducing glare".[9]

Predictably the matter stimulated a great deal of controversy and comment in the professional press; there was a strong feeling among some commentators that the enthusiasm for improved standards had been carried too far. P.J.Waldram even suggested that daylight factor measurement was a dubious criterion for visual comfort:

> A point which seems to have been completely overlooked is that, although in a typical pre-war modern classroom the real intensity of daylight may increase considerably from the back desk to the window wall, perhaps a hundred fold, there appears to be no material difference. If such an obviously well lit interior has 0.5 per cent. on the desk furthest from the windows, I defy anybody to say without an instrument whereabouts the light will come up to five per cent., fifty per cent., or any other figure. You simply cannot see it... as a mariner in a boat drawing six feet is, without sounding apparatus, unconscious of whether he is sailing in water ten fathoms, twenty fathoms or one hundred fathoms deep. Yet merely because top lighting - at one time specifically forbidden by the Board of Education - will give ten times the amount of light given by side lighting, the well-proven pre-war requirement has been multiplied by ten, although you cannot see it when you get it. There is not a single shred of evidence given in the Report from any school doctor, teacher or anybody else, that the eyesight of a single child has ever deteriorated in the slightest degree from the natural lighting in modern classrooms.[10]

and R.S.Wilshire put it, prophetically, thus:

> I, personally, am not aware of any conclusive evidence that... this very high standard of lighting is essential to protect the eyesight, and there are, of course, experts who definitely disagree with its necessity. It may yet prove this excessive zeal for light may have to be modified as have other ideas which have dominated school design from time to time.[11]

In fact the 2 per cent daylight factor held its dominance for over twenty-five years; it was formally relaxed by the Department of Education and Science in 1971 after a long battle for greater flexibility.

Notes to Chapter 3.

1. Board of Education, Educational pamphlets:
No.86 Suggestion for the planning of new buildings for secondary schools, 1931.
No.107, Suggestions for the planning of buildings for public elementary schools, 1936.

2. Education Act, 1944, Section 10, p.6.

3. M.O.E. Circular No.10, Draft building regulations, 1944.

4. M.O.E. Pamphlet No.33, The story of post-war school building, 1957, p.22.

5. M.O.E., S.R. and O. No.345, Regulations prescribing standards for school premises, 1944.

6. Post-war building studies no.12, The lighting of buildings, 1944, p.77.

7. M.O.E. Memorandum, Draft building regulations, 1944, p.14.

8. W.A.Allen and J.B.Bickerdike, "The daylighting of classrooms under the new regulations", RIBAJ, September 1946, p.493.

9. Post-war building studies no.12, passim.

10. P.J.Waldram, in discussion following paper by C.G.Stillman, "School planning and construction", RIBAJ, January 1949, p.77.

11. R.S.Wilshire, "Modern school buildings", RIBAJ, July 1947, p.461.

Chapter 4

THE MINISTRY OF WORKS HUTS

The immediate post-war years, up to 1949, were spent in dealing with emergency needs and creating an organisation to deal with the heavy commitments of the full-scale school building programme ahead. A good picture of those difficult years, when the country was readjusting to a peacetime economy, is drawn in The Story of Post-War School Building:

> There had been no school building on any scale for about seven years. The staffs of local authorities were on a minimum basis at the end of the war. As local government officers, demobilised from the forces, returned to their desks they found a vast and difficult job awaiting them. If their ideas about school building were somewhat rusty, at least they formed a cadre of experienced men and women ready and able to make quick adjustments. But the recruitment of new officers - administrators, educationalists, architects, quantity surveyors, engineers - to enable staffs to expand, was dependent upon many people completing, and some starting, their professtional training....
>
> They were the years of austerity - the years of ration books, clothing coupons and utility furniture. And yet they were the years in which, in education, there were emergency needs to be met.[1]

What the Ministry of Education called a "four pronged attack" was made on the emergency needs.[2] Firstly, the Hutted Operation for the Raising of the School Leaving Age (HORSA) was initiated in 1945. Secondly, local education authorities were encouraged to make small additions to existing schools, by means of minor works costing not more than £5,000 each. Many of these additions were standard huts supplied by the Ministry of Works.

Thirdly, an Operational Programme was instituted in 1946 with the aim of expediting the new schools required by September 1947 in connection with raising the school leaving age and, by the end of 1947, to keep abreast of new housing development. To this was added a further batch of projects, designed to accommodate the following year's pupils staying on at school, required by September 1948. In order that this work might be implemented in the shortest possible time Ministerial approval was given on the basis of preliminary plans and estimates of costs, unusual relaxations which were replaced by stricter controls from 1949 onwards.

The fourth "prong" was the Short Term Programme which was to provide projects, other than those in the HORSA or Operational programmes, which it was hoped would start building during 1947 and 1948. About half of these were projects connected with the school meals service, teacher training, further education and special education.

The school leaving age was to be raised by terminating the Compulsory School Age (Postponement) Order, on 1 April 1947; it was clear to the Ministry of Education that normal design and construction processes could not possibly provide the additional accommodation required to house the resultant increase in school population. For this reason Ministerial directions concerning a temporary hutting programme were issued to local education authorities and discussion was not encouraged.[3]

Understandably there were aspects of the directions which gave rise to wide misgivings regarding the "strictly temporary character" of the buildings, as indicated by a MOE memorandum in October 1945.[4] The RIBA Committee on School Design and Construction observed that no such definite reference to the projected life of the huts had been made in MOE Circular No.64, where the word "temporary" did not appear.[5] Vaguer still was the advice to local authorities contained in Circular No.19, issued by the Ministry of Town and Country Planning, to disregard time limits of usability in formulating their standard hutting requirements.

Notably, the RIBA Committee were concerned that the scope and urgency of the school accommodation programme made the policy of "temporary" building inevitably a long-term one. Raising the school leaving age was the primary cause of the hutting progamme but this, they emphasised, was not the whole of the additional accommodation problem:

> It is probable, therefore, that a further instalment of substitute buildings to eliminate overcrowding and to reduce class sizes, would follow upon the present three-year-plan; but the Government may not be content to wait upon the completion of the first part of its rebuilding programme before it issues directions for further standard huts to be built to meet the second contingency of overcrowding. Thus it may be that towards the end of the three-year term, the further programme would be running concurrently with the first. These two phases of expansion would constitute a building venture of very considerable magnitude involving the erection of thousands of standard huts the extent of which must, perforce, be spread over a much longer time than

> than that suggested in the MOE directives. As a result, a large percentage of the child population of this country for many years to come, will be compelled to receive its education in new structures of a sub-standard, improvised character which were originally designed for war-time, army-hutting purposes. Further, there will be little or no possibility of implementing the provisions of the 1944 Education Act relating to improved standards of accommodation and quality of buildings and equipment within a measurable distance of time.[6]

Typically, the huts supplied and erected by the Ministry of Works provided an additional pair of classrooms, and often a practical room, to an existing school; they were usually positioned on the playground.[7] The standard structure made no provision for access corridors, these were to be provided ad hoc but no allowance was made for supporting a corridor roof where it abutted the main structure. The eaves level, at 7'6" from floor, and the fact that windows did not span the full width between portal frames, made day lighting conditions sub-standard. With the top of the glazing at 7'3½" and a room width of 18'6" (where there was no access corridor and windows were on both sides) the highest percentage daylight factor for any working position was 2.12, with an average of only 1.8 per cent. When an outside corridor was provided these figures dropped to 1.55 and 1.25 per cent respectively and in the wider 24'0" wide versions the figures were lower still.[8]

Similar criticisms were made of the heating and ventilation provisions. Slow combustion stoves were generally installed, central heating being permissible only where the huts included new sanitary accommodation. Unequal heat distribution, dust and draughts together with fluctuations in room temperatures following regular stoking all had to be contended with. The insulation value of the 4" thick hollow block or, when unavailable, 4½" brick, was low.

In considering the economics of the programme the Committee drew attention to the high maintenance costs of the huts and reported a comparative cost exercise carried out on a permanent structure of equivalent floor area, good appearance and low maintenance.

> The permanent building consists of steel stanchions and roof trusses at 12 ft. centres with external 11 in. cavity brick walls, R.P.M. roofing and flat, fibre-board ceilings. The rooms are 11 ft. from floor to ceiling, and the class-room windows fill the bays between the stanchions. The M.O.W. hut is standard in every respect except that in this case 11 in. brick cavity external walls have been substituted for the usual 4 in. clay block or 4½ in. brick. The comparable total man-hours of normal site-building

labour are: For the permanent building 4,057. For M.O.W. standard hutting 3,972. To the total of 4,057 man-hours for the permanent building must be added 667 man-hours expended in steel-work erection by specialist sub-contractors, which labour is not normally employed on house-building...
The conclusion to be drawn from the foregoing analysis of cost (sic) is that the M.O.W. hutted school is comparatively more costly since it provides sub-standard accommodation and must be written off as a total loss at the end of its term of usefulness.[9]

Finally, the Committee's report contained the following recommendations,

(a) Where additional accommodation is required as part of permanent school reorganisation under the raising of the school leaving age scheme, every encouragement should be given to local authorities to build additional accommodation in permanent construction with local materials as an instalment of the ultimate and permanent building.

(b) When additional accommodation is clearly of a temporary nature, it should be provided, in a large measure, by specially designed, transportable huts which will be of considerable salvage value to the local authority at the end of their term of usefulness. Transportable huts are capable of easy removal to new positions if found to be obstructive to siting of the permanent extensions; there is less likelihood of their becoming permanencies as happened to much of the temporary hutting erected after 1918; it is possible to move them and erect permanent accommodation on their foundations if they are sited in proper positions for the purpose (the foundations of the standard hut must be largely destroyed in removing the portal frames).

(c) M.O.W. standard hutting should be used only in extreme emergency and should be confined solely to the initial stages of the programme whilst arrangements under (a) and (b) are being put into effect.[10]

The Committee summed it all up thus, "Except for the portal framework (which was in fact too adequate for the supposed temporary nature of the building) the general construction is inadequate and is more appropriate to a storage-shed building than to a school."[11] If the RIBA were disingenuous, wishing to ensure that the large potential workload went to the profession, perhaps they could not be blamed. They had a professional responsibility and the dangers seemed real enough. C.G.Stillman in a talk at the RIBA in January 1946 expressed the doubts of one who had seen it all before and drove home the environmental point tellingly:

Once up, it will be many years before we shall be in a position to scrap these huts and expend the double labour and materials in replacing them. We had the same experience after the last war and the huts then built still remain to-day. I have no doubt that many of you have had experience of this sort of thing and could quote cases going back even further of temporary buildings

still standing to-day...
A headteacher in charge of a hutment school recently admitted some children from the Belsen Horror Camp. When asked, What was it really like at Belsen? the children looked around and said: Just like this, teacher.[12]

A large number of the huts are indeed still in use in many parts of the country. Whatever the educational environment, it was none the less an expediency that succeeded in providing 136,000 places by early 1949, reaching the full yield of 167,880 by the beginning of 1952.[13] In Hertfordshire some 600 units (providing 1,200 classroom spaces) were erected at secondary schools between 1947 - 50, adding places for 40,000 children.[14] The reaction of the County Architect to the use of hutting on new school sites and the endeavour to find an alternative form of construction is discussed in Part 2.

Notes to Chapter 4.

1. M.O.E. pamphlet no.33, The story of post-war school building, 1957, p.17.
2. Ibid., p.18.
3. The Ministry's attitude is clearly indicated in personal correspondence between John Newsom (C.E.O.) and Sir John Maud (of the M.O.E.), with memorandum containing reactions of C.H.Aslin (C.A.), Oct. - Nov. 1946, E473F (47 -48) 197.
4. M.O.E. Administrative Memorandum no.98, 23rd October 1945.
5. M.O.E. Circular no.64, 27 September 1945, para.2.
6. Report of the RIBA Committee on school design and construction, "Ministry of Works standard hutting for schools", RIBAJ, Feb.1946, p.131.
7. M.O.E. Circular no.64, op.cit., para.3.
8. RIBA Committee, op.cit., p.132.
9. Ibid.
10. Ibid., p.133.
11. Ibid.
12. C.G.Stillman, "School planning and construction", RIBAJ, Jan.1946, p.68.
13. M.O.E. pamphlet no.33, op.cit., p.18.
14. HCC 21 (24) Item 47, "Provision for raising the school leaving age", 2 October 1944, p.109;
HCC 21 (25) Item 82, "Raising the compulsory school age," 14 Jan. 1946, p.190;
HCC 21 (25) Item 100, "Raising the compulsory school age - provision of accommodation," 8 April 1946, p.271. See also E473F (47 - 48) 197.

Chapter 5

STANDARD CONSTRUCTION FOR SCHOOLS
THREE REPORTS

During the early years of the war various professional and other institutions connected with the building and civil engineering industries expressed a desire to assist the Ministry of Works with its plans for post-war reconstruction and development. By the end of 1941 the Minister of Works had decided to take advantage of these offers by establishing a series of Committees to investigate and report on the major problems which were likely to affect peace-time building. In order to secure a uniform direction of policy and to avoid duplication of effort he also offered to provide the necessary staff and organisation to co-ordinate the various inquiries.[1] The Committees were either appointed by a Government Department or convened by a professional institution, research association or trade federation, as appropriate. They were so constituted "as to ensure that the Reports contained the considered views of experts and others closely concerned with the subject."[2]

The resultant series of reports were published under the general title of "Post-war Building Studies." The Studies were not official publications in the sense that the Government was responsible for, or accepted, the views expressed but it did highly recommend their contents as "of great value to all concerned with preparations for building after the war."[3] The first to be published was on House Construction; the second on Standard Construction for Schools. Subsequent subjects included Plumbing, Gas Installations, Lighting of Buildings, Electrical Installations, Heating and Ventilation of Dwellings etc.

Post-war Building Studies, No.2, Standard Construction for Schools, was undoubtedly the most important single influence on its subject. The Committee responsible was set up in March 1943 under the Chairmanship of Sir Robert Wood of the Board of Education, and given the following terms of reference:

> With a view to facilitating the planning and erection of school buildings after the war, to consider the possibilities of applying some measure of standardised construction to schools and to make recommendations as to their planning, layout and equipment.[4]

The Committee completed their work in November 1943 and the report was published in April 1944. Known as the "Wood Report," it lay down the fundamental considerations for standardisation with model thoroughness and clarity. Its findings had a direct bearing on the initial decisions made in Hertfordshire; for this reason we will now look at these in some detail.

After defining its terms of reference the Committee paid tribute to earlier work which had been begun on the subject by a small group of officials of the Board of Education and the Ministry of Works, assisted by a representative of the Royal Institute of British Architects. They stressed the immense leeway which would have to be made up after the war, to which was added the demands for new and improved accommodation arising from the adoption of any policy of educational reform and reconstruction. All obstacles to rapid progress had to be removed as far as possible and, recognising the competing claims on the building resources of the country after the war, they emphasised the value of saving time, labour and materials in using resources to their best advantage.

The Report then acknowledged the comments of the County Architects' Society whose suggestions on improving adminstrative procedures were contained in a lengthy appendix to the main report. In fact the County Architects' Society expressed doubt on how far conditions after the war would be such as to make it either "necessary or expedient to abandon traditional materials and methods of building in favour of any standardisation of planning or use of prefabricated construction."[5]

The Wood Committee took a different view but were glad that the representatives of the County Architects "were in accord with us to the extent that they agreed that, should traditional methods prove insufficient to meet the... situation, then the suggestions ... should prove of assistance to local education authorities and their architects."[6]

Stressing the need to speed up the planning and approval process, they pointed out that standardisation itself would make a significant contribution to saving time in administrative procedure. Less justifiably the report adds:

> for schools of the same type, and for the same numbers, requirements can be met by accommodation which, in the great majority of cases, is the same; provided that in each case the site is

> suitable, there is no reason in principle why the same plan should not serve for two or more schools of the same type and size.[7]

In an attempt to ease anxiety about uniformity (although somewhat contradictory to the point it made about reusing complete school plans) it said, "there is no reason to suppose that the application of a measure of standardisation to the construction of schools would involve an undesirable degree of rigidity or uniformity."

Two distinctly different approaches to standardisation were outlined in the Wood report:

> The problem before us obviously admits of more than one solution, according to the degree of standardisation in construction that is desired. Two approaches have been selected for study and investigation. The first conceives of the school as a connected structural whole, to which any dimensional factor adopted can be applied throughout. Itproceeds direct to the plan scheme. The second conceives of the school rather as a group of separate plan units, which may be left unconnected, or connected by in situ work, as desired....
>
> The first approach presupposes a general and connected framework to which the whole of the structure must conform. The choice of a unit dimension for this purpose, applicable throughout, is not easy, but, as one of the most generally accepted measurements recurring in a school plan is the length of a classroom, this length - 24 ft. in the clear - is considered to offer a good guide for the selection of such a unit. More than one sub-multiple of 24 ft. might be chosen, but the diagrams... illustrating this part of our report have been drawn to a unit dimension of 8 ft. 3 in. Three times this unit dimension gives a length of 24 ft. 9 in., and when allowance has been made for wall or partition thickness, three such units would give a clear classroom length of about 24 ft. It is true that the application of this unit to the width of the room would give a clear dimension in excess of the 21 or 22 ft. usually assigned. We are, however, satisfied that, if the necessary dimensions of, e.g., the practical and special rooms are to be observed... classrooms of this size are inevitable. They would in fact be quite appropriate for the junior school, in which space is a prime requisite. In Modern Schools, with classes of which the maximum size will be 30, they will give more than the 16 sq. ft. per child recommended hitherto for Secondary Schools; but the excess of space over existing standards, which is likely in itself to be welcome, will be very small in comparison with the school as a whole, and would in our opinion be compensated by the other advantages which this method of standardisation offers.[8]

The report then considered how the basic dimensional unit of 8' 3" might best be adopted, and firmly pointed in the direction of a steel frame solution, observing that the steel industry had already (before the war) produced successful standardised units for the framed construction of schools. Once the frame was erected, the report reassuringly went on:

> ... the architect will have virtually complete freedom as to the infilling walls and partitions, and the formation of roof and ceiling surfaces.[9]

The seeds of dimensional co-ordination as the industry later came to know it were contained in the observation that because,

> All these infilings would have a nominal length or span based on the same basic dimensional unit, the process of standardisation could readily be applied to them. There is nothing to prevent the architect from using brick, masonry or blocks of any material for the wall structure below the window sills whatever their height, or for the whole wall panel where it is solid, but there seems little doubt that time and labour may be saved in so far as prefabricated standard-sized wall units could be utilised.[10]

The report then summarised the advantages to be derived from the proposed methods; these are quoted in full:

> a. The structural elements for a steel framework could be produced in large quantity by mass production to standard size or sizes. Actually, the steel uprights, while differing in length according to requirements, would all have the same width so as to permit generally the use of the same infilling panel units. For two-storey construction the design of stanchions may have to be somewhat modified, but it is intended that they should be adapted to permit of the use of the same walling units as the one-storey buildings. As regards roof trusses, which would in any case have to be produced in some two or three spans, we think it desirable that they should also provide a variety of pitch to permit a variety of roofing finishes suitable to different parts of the school, or in keeping with the setting of the school, or local tradition.
>
> b. The adoption of the same basic unit of dimension in either direction - for both length and width - would make it possible to project the layout of the school in any direction desired as a connected whole, and would further make it possible to use prefabricated wall panels or window frames of the same size in either direction.
>
> c. The use of a framework would enable roofing to be taken in hand while walls were still in course of erection, thus saving time on the process of drying out.
>
> d. While we have so far envisaged the school as a whole and as a connected structural unit, the framework contemplated could equally well be used for separate blocks of classrooms or practical rooms, or for separate halls, gymnasia, etc., where additions are required to existing accommodation, or where the site levels are such as not to permit of a continuous framework being erected for the complete school.[11]

The second approach to the problem was then outlined but significantly, the discussion included the remark: "we incline generally to the view that the first suggestions discussed in... this Report are most likely to repay further expert investigation" i.e., the first approach.[12]

Alive to the possible prejudice which prefabrication might meet with they added a caution:

> ... the idea of standardisation in connexion with school building, if unaccompanied by reasoned explanation of its objects and effects, is liable to give rise to misconceptions and to encounter quite unnecessary hostility. We accordingly recommend that steps should be taken to bring before local education authorities and others concerned, the considerations which appear likely to govern school building in the early post-war period, and the consequent desirability of adopting some system of standardisation for school construction.[13]

On furniture and equipment, the last part of their terms of reference, they had nothing specific to say, pointing instead to the work of other Committees and recommending that a separate group be set up to study the specialised requirements of school furniture.[14]

The report concluded with illustrating of typical school plans and layouts of specialist teaching spaces, such as housecraft rooms, science laboratories and wood and metal work rooms. Though not intended as standard solutions these plans, too, had enormous influence on the design of teaching spaces; their elements recurred persistently in the succeeding years (figs. 15,16).

In November 1946 the Ministry of Education set up, under the Chairmanship of Sir William Cleary, a Technical Working Party on School Construction. Its terms of reference were:

> To consider and make recommendations on the technical details of the principles of school construction suggested in the 1943 Report on Standard Construction for Schools in the light of the present materials position and of the long-term building programmes required by the Education Act, 1944.[15]

In the intervening years between the Wood Committee and the Ministry of Education Working Party a number of important developmentshad taken place: the Education Act itself, the Building Regulations made under the Act and the announcement of definite educational building programmes. These gave the Working Party a clearer idea of the quantity and kind of school building to be completed in the following 10-20 years, and the standards to which the buildings would have to conform. But developments in the building industry and in the materials industries appeared to make the performance of the task increasingly difficult. For example, shortages had not been confined to any single material at any one time, making reliable forecasts of availability impossible. It would mean that materials could not be prescribed; a free hand in their choice would be necessary and, indeed, last minute changes might need to be considered.

For this reason the 1946 Working Party considered it unwise to commit the entire school building programme to a system of construction which relied on one particular material being available in the right quantity at the right time. Furthermore, their report observed that as educational building projects were subjected to time limits, and as labour supplies varied regionally according to competition from other large programmes of equal urgency, the use of prefabrication was inevitable. It agreed that prefabrication might persist even when normality returned: the long-term programme might simply be too large to be executed by traditional methods of construction in reasonable time. Investment in design work on prefabrication would pay off later on, not only in the offices of the Ministry and the LEAs, but in the factories in the shape of substantial economy in shop drawings.

On the subject of rising building costs the report stated that economy seemed to lie in the direction of (i) a review of the Building Regulations made under the Education Act, 1944; (ii) any contribution which standardisation, bulk ordering and prefabrication might be able to make; (iii) economy in architectural design, expressing the hope that room areas prescribed in the Regulations might be rationalised to avoid small differences such as between 520 and 540 sq. ft. and 700 and 720 sq. ft. to assist economical standardisation. Reduction of cube content to minimum requirements was also referred to together with "economical disposition of the accommodation".

In the section on standardisation the report said the uncertain supply of materials alone made it unwise to select any one particular system of construction as the best general solution; nor was the production of something like a "national school" favoured. Rather, it observed that the building shell (structural framework, walling, roofing, windows and doors) was well suited to bulk ordering and mass production. It pointed out that producers would require steady demand to undertake long production runs, which called for either a national standard or a standard to be used by more than one local authority.

The Working Party analysed the alternative approaches of the Wood

Committee. They observed that the 8'3" module, a central feature of the Wood report, was inherently inflexible for school planning purposes and recommended that consideration be given to a smaller 3'4" unit, a dimension we shall discuss again in Part 3.

It is clear that the two Committees, Wood and Cleary, considered the problem largely with the object of treating teaching spaces economically in terms of labour and materials, and based their recommendations upon classroom sizes laid down by the Regulations. As Richard Sheppard remarked in reviewing the significance of the reports to developments of the period:

> The result of this approach is to consider school design as a matter of the construction of rectangular spaces of uniform dimensions. It confines school development to activity within a series of cells, rather than to activity in the whole area of the building.
>
> Useful space is the enclosed space - enclosed, that is, within four walls; and unenclosed spaces are wasteful, uneconomical and unspecialised. The object of both committees was to reduce or eliminate them and in this they succeeded. Circulation areas were certainly reduced.
>
> Both committees had unconsciously in mind a definite type of plan and design, and thought of a school building as being ideally of one or at most two-storey construction. In this light an attempt was then made (1945-47) to find a series of standard dimensions and structural units. Several of the larger authorities, facing building progammes of what the papers call 'unparalleled magnitude' were extremely interested in the work of these committees. Altogether the way was cleared for a coherent development in planning and structure. The influence of their reports was considerable.... The principal architectural effect, apart from the one I have just mentioned, is that they led to more dispersed plans, to a greater separation of the different parts of a school - classrooms, assembly hall and so on.[16]

Indeed it would have been difficult for the two Committees <u>not</u> to have been influenced by the best of pre-war school design, Impington and Richmond in particular. Denis Clarke-Hall, the Richmond competition winner and Henry Morris, the Impington "client", both served on the Wood Committee; C.G.Stillman, County Architect of West Sussex (whose pre-war contribution to school planning and construction will be touched on later) was on both the Wood Committee and the Ministry of Education Working Party. He was Chairman, too, of the third Committee whose report is now discussed.

The RIBA Committee on School Design and Construction was appointed by the Council of the Institute in February 1945 "to consider and report as quickly as possible on the subject of School Design and Construction."[17] Of its nine members four were County Architects and one, Donald Gibson was the Coventry City Architect. It was clear that this Committee was more guarded in its acceptance of the new methods of building, which seemed inevitable if the needs were to be fulfilled. The Committee reported in June 1945 under the following headings:

A. The General Problem

B. The Architect's Contribution

C. Delays in Administrative Procedure

D. Methods of Construction, available Materials and supply of Labour (With a note on war-time hutting.)

E. Improvement of Existing Buildings.

The report had remarkably little that was new to say. In its statement of the General Problem it made the following observations, illustrating the essential conservatism of the report:

> (a) Until building trade conditions are fully restored to pre-war standards a limitation on the range of materials and availability of labour will inevitably place restrictions upon design. The enforced adoption of substitute materials and their effect upon construction and design may well result in buildings of unconventional appearance and to some extent of untested character as regards durability and resistance to hard wear. On the other hand, greater apeed and facilities for future alterations can be expected.
>
> (b) Rigid uniformity in constructional methods and the use of substitute materials irrespective of the diverse climatic conditions which prevail in the north and south of England, is undesirable.
>
> (c) Equally undesirable is an absolute standardisation in planning and design which fails to observe site conditions, local building traditions and the customary practice of skilled building craftsment.
>
> (d) In districts where there may be a sufficiency of materials such as brick and stone and an adequate supply of labour, there should be no reason for the adoption of temporary expedients in construction. Where no such initial advantages occur, substitute materials at first used for wall-cladding, may have to be replaced later by those of better and more durable quality as and when they become available...[18]

In its discussion of the Architect's Contribution ways were suggested of making the most of a bad job by reminding architects of the value of landscaping, colour and texture:

> It is probable that we are entering a decade of strictly utilitarian building. The success of utility building, from the architect's viewpoint, lies in the assemblage of the component

> elements of the plan into a well-organised composition, in the full and correct use of colour and texture and in a pleasant treatment of the site layout. Much can be done to enhance the appearance of a simple building by imaginative planting of trees, shrubs and flower beds and the arrangement of approach ways to the school.
>
> Whatever may be the form of the chosen system of construction, it is of the utmost importance that it is expressed in a rational, yet seemly, architectural manner. The School is the physical background to the early and impressionable years of a child's life and the environment of the building and its site-setting created by good design will exert a beneficial influence in character forming at the most receptive age. The child's mind is receptive to the appeal of simplicity in line and form and reacts with enthusiasm to the influence of colour and texture.
>
> As simple form will be the chief characteristic of post-war school design, it is reasonable to expect that the children will be attracted to their new environment. Upon the architect's degree of insight into the mind of the child, will depend the success of his work. A school should not become so detached, architecturally speaking, from its primary purpose as to bear oppressively on the minds of the young.
>
> It is, therefore, of importance that local authorities should be urged to avail themselves of the guidance of qualified architects in the planning and design of their school-building projects. Each individual site presents a new problem in planning and the exercise of architectural skill.[19]

On delays in Administrative Procedure it added nothing to the statements made one and a half years earlier by the County Architect's Society, appended to the Wood Report.

On Methods of Construction, Available Materials and Supply of Labour the fears about the undesirable consequences of standardisation and prefabrication were again stressed in conjunction with some advice on architectural composition redolent of C.G.Stillman's West Sussex pre-war schools:

> As the largest section of a school building is composed of teaching rooms, cloak and changing rooms and lavatories, it may be expedient to adopt the steel or concrete frame for their construction in combination with load-carrying brick or masonry walls with plastered internal finishings for the construction of assembly halls, staff and administrative rooms and main entrance halls. By this means architectural significance will be imparted to the focal grouping of the composition and allow the architect a greater freedom of expression.
>
> Wherever the steel or concrete frame is used... it should be designed as the permanent framework of the building. Although it may be necessary to use utility cladding materials of a short-term life at first, these should be regarded as temporary expedients only and should be replaced by permanent materials of a better

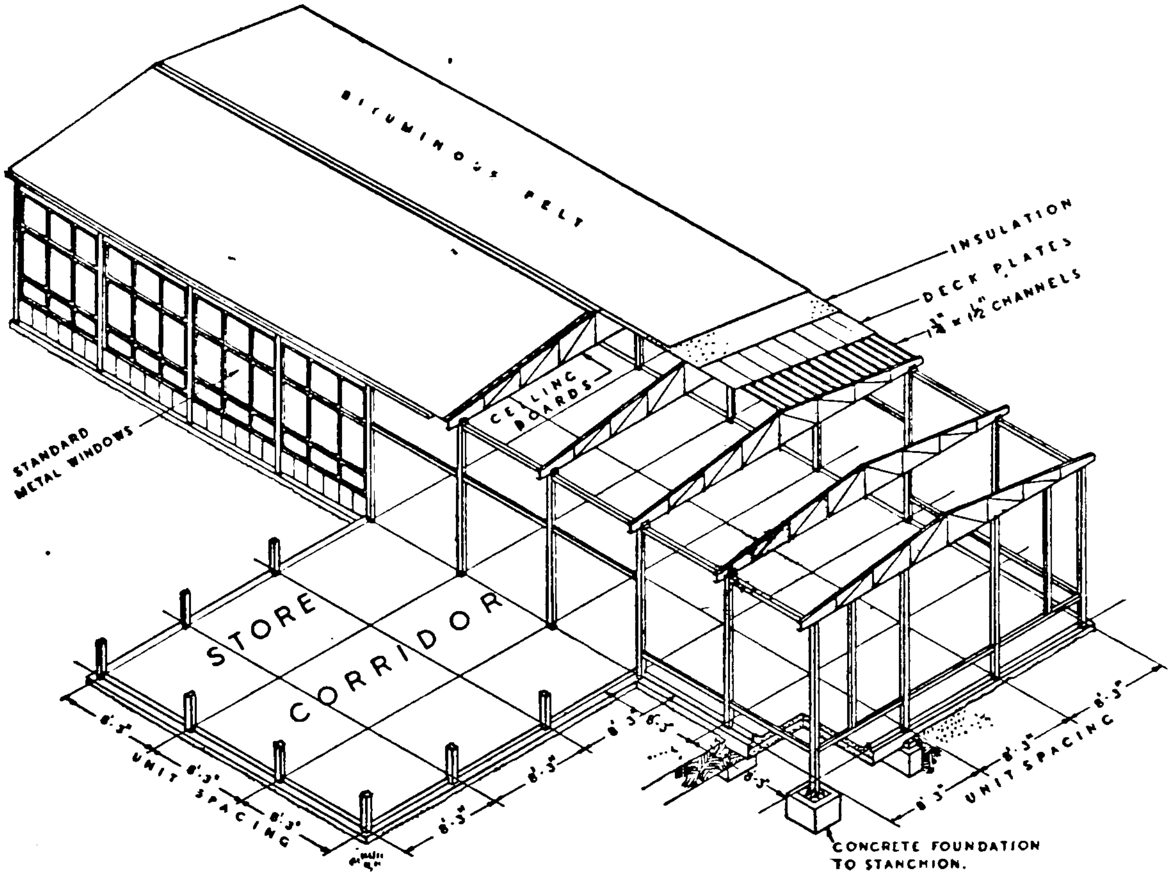
quality in appearance and durability when conditions permit.

Heavy external maintenance costs are inevitable with temporary facing materials and this recurring item of expenditure will be saved when substitution is effected.[20]

The fears were understandable in view of the unpredictable course of development. Certainly any proliferation of the Ministry of Works prefabricated hut type of solution to accommodation problems was to be resisted, if at all possible. And if the Royal Institute of British Architects failed to signal the possible environmental consequences, who would?

Notes to Chapter 5.

1. M.O.W., Post-war building studies, Preamble to No.1, House Construction, 1944, and several subsequent reports. See also F.M.Lea, Science and building: a history of the Building Research Station, 1977, p.91. passim.
2. Post-war Building Studies preamble.
3. Ibid.
4. M.O.W. Post-war Building Studies, No.2, Standard Construction of schools, 1944, pp. 1 and 30.
5. Ibid., p.1., para.6.
6. Ibid.
7. Ibid., p.2., para.11.
8. Ibid., p.4., para.18 and 19.
9. Ibid., p.5., para.22.
10. Ibid.
11. Ibid., pp.5–6, para.23, a - d.
12. Ibid., p.6., para.27.
13. Ibid., p.7., para.32.
14. Eventually published as Post-war Building Studies, No.24, School furniture and equipment, 1946.
15. M.O.E., Report of a technical working party on School construction, (Cleary Report), 1948. Summarised in RIBAJ, Nov.1948, p.11. See also M.O.E. Circular 134, 19 Dec.1946 for official statement.
16. Richard Sheppard, "Post-war development in school design", RIBAJ, June 1953, pp.314, 315.
17. "The report of the RIBA committee on school design and construction", RIBAJ, Aug.1945, p.292.
18. RIBA report, op.cit., p.293.
19. Ibid.
20. Ibid. pp.293, 294.

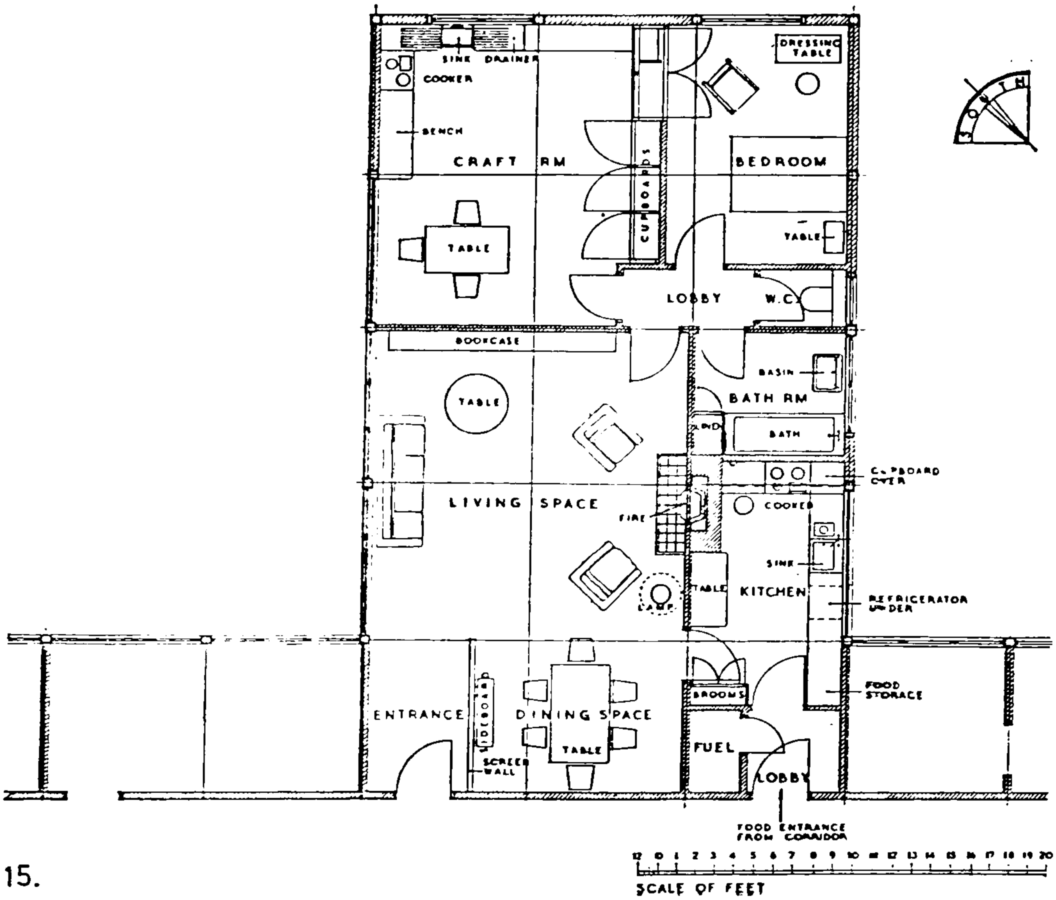


14.

Figures 14-16.

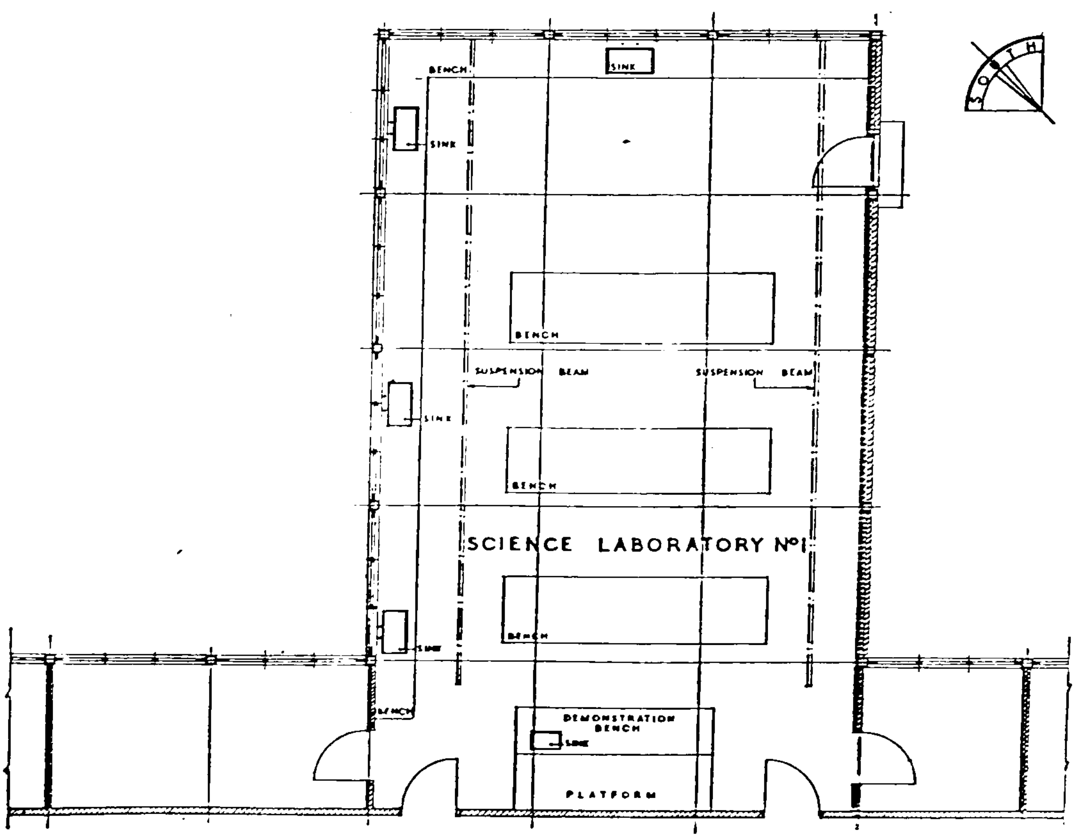
14. Isometic drawing of "the structure of the skeleton of a sample plan unit ... consist(ing) of a light form of steel stanchions and roof trusses and transverse members." Post-war Building Studies, No.2, Standard construction for schools (Wood Report) p.16.

15. 16. Domestic Subjects flat and Science Laboratory: these and other diagrams each showing a "suggested detailed layout of a practical room, based on a unit dimension of 8'3" ... planned to give the commonly accepted approximate (24') net width." op.cit., p.24 and 25.



SINK DRAINER
COOKER
BENCH
CRAFT RM
TABLE
CUPBOARDS
DRESSING TABLE
BEDROOM
TABLE
LOBBY
W.C.
BOOKCASE
BASIN
BATH RM
BATH
TABLE
LIVING SPACE
FIRE
CUPBOARD OVER
COOKER
SINK
TABLE
KITCHEN
REFRIGERATOR UNDER
LAMP
ENTRANCE
SIDEBOARD
DINING SPACE
TABLE
SCREEN WALL
BROOMS
FUEL
LOBBY
FOOD STORAGE
FOOD ENTRANCE FROM CORRIDOR
SCALE OF FEET
SOUTH

15.



BENCH
SINK
SINK
BENCH
SUSPENSION BEAM
SUSPENSION BEAM
SINK
BENCH
SCIENCE LABORATORY Nº1
BENCH
SINK
BENCH
DEMONSTRATION BENCH
SINK
PLATFORM
SOUTH

16.

Chapter 6

POLITICS, IDEALISM AND TECHNOLOGY
SOME ASPECTS OF THE BUILDING INDUSTRY 1920-47

During the inter-war period three main types of technical improvement in building were discernable. Firstly, new materials were introduced, the most notable of which were common Fletton bricks and concrete tiles, asbestos-cement sheeting, fibre and plasterboards, steel and reinforced concrete products. But, as Richardson and Aldcroft observed in their study of Building in the British economy between the wars,

> in most cases new materials were simply substitutes for, or variations of, older traditional materials. Moreover, their introduction did not lead to improvements in the efficiency of the assembly process, though in so far as they were cheaper than the older products they did help to reduce the overall cost of building construction.[1]

Secondly, new structural techniques in place of brick and stone were developed. Here standardised, prefabricated structural components using steel, reinforced concrete and timber were used in growing quantities, generally on large-scale projects in order to speed up construction. In house building, however, new techniques rarely got further than the experimental stage.

Thirdly, progress was made in the introduction of labour-saving equipment designed to speed and improve assembly on site, including "cranes, hydraulic and pneumatic riveters, rock drills, steam shovels, hoisting engines, concrete mixers, woodworking machinery, cement-guns and paint sprays." The delaying effects of bad weather were reduced by means of "braziers, artificial light and by the erection of the roof at an earlier stage of the proceedings."[2] Nevertheless it was estimated that these improvements related, at most, to about one-quarter of the value of the output of the building industry in that period.

However, most contemporary authorities believed the industry was grossly inefficient on account of a conservatism that pervaded both industrial management and design. Richardson and Aldcroft draw attention to the problem of taste, a point frequently overlooked as an influence on industrial efficiency:

> Apart from the lack of incentive from the supply side... new materials and methods of construction often created changes in the

> design of buildings which the general public were slow to accept. Even had prefabricated or industrialised systems of building been really commercially viable it is unlikely that they would have been used extensively in residential construction since the demand was largely for the traditional type of house.[3]

And yet the building industry was at a peak of production in 1938; not only were more houses built than in any previous year (except 1937), but luxury flats, offices and a quantity of building connected with re-armament, were under construction. During the period 1920-38 the number of houses built had totalled 4.359 million, compared with 5.418 million built in the equivalent period of 1947-65. Indeed it was not until 1964 that the 1938 peak was surpassed.[4] However, during that pre-war period of prosperity some 15 per cent of the total number of insured building workers were actually unemployed; this figure was "greater in 1938, when the numbers unemployed were at a maximum, than in 1924, when the numbers in employment were substantially less."[5]

That the pre-war building industry had borne such an apparently large wastage of manpower at a time of maximum demand was a matter of great concern to critics of industrial relations, particularly to those looking towards the post-war social and building needs of the nation. Common in Fabian and socialist writing was the theme of a nationalised building industry, an organisation which would, it was felt, make the best use of the limited resources of labour available to build the new, better Britain. In making his case for a National Building Corporation, Harry Barham argued that inefficiency was due to a "fear of unemployment" and that

> the industry is backward in research into new materials and new methods; that one of its favourite methods, "speculative building," has become almost synonymous with "jerry building"; that it organised a "ring," not for greater efficiency but for greater profit; that it moves about plant and men alike as the unorganised and unco-ordinated tools of private owners.
>
> No sensible and unbiased person would say in the light of these facts that this industry is "well organised" or efficient, and our task is then to find the cause of its inefficiency with a view to propounding a remedy.[6]

In a White Paper the post-war labour Government had laid down its broad aims in the matter of national planning; it was seeking to develop a system, the chief elements of which were:

> i. An organisation with enough knowledge and reliable information to assess our national resources and to formulate the national needs.

ii. A set of economic "budgets" which relate these needs to our resources, and which enable the government to say what is the best use for the resources in the national interest.[7]

The Labour Party's election manifesto, Let us face the Future,[8] had expressed the commitment to achieving a "tremendous overhaul, a great programme of modernisation and re-equipment of its homes, its factories and machinery, its schools, its social services." These were sentiments few would argue with; more contentious was the declaration that it was "prepared to achieve it by drastic policies of replanning and by keeping a firm constructive hand on our whole productive machinery; the Labour Party will put the community first and the sectional interests of private business after."

Thus the Fabians would have it that the building industry must take its place in the plan as part of the organisation of the nation:

> There must be a central planning body, which will examine the whole of the actual and potential resources of the country, both of a material nature and of labour, prepare a schedule of the national needs, and make its plan accordingly.... Thus there will emerge... a national plan for building construction, both long term and short term, embracing domestic, industrial, commercial and civic building.[9]

The fact that the post-war building industry would have such a volume of work to contend with that the fear of unemployment could be eliminated for many years to come did not seem inconsistent with such ideology. Clearly there would be manpower shortages and special training schemes would be necessary to meet demands; with or without nationalisation it was vital that the industry should improve its efficiency and rationalise its methods. Still more vital was the need for architects, engineers and other technologists to put forward the ideas and the means to effect such an improvement. Although the spirit of the New abounded in the politics of the Left and in the theory of the Modern Movement in Architecture, and indisputably the two were linked, in practical terms the real changes were brought about by neither: we shall see in succeeding Chapters how profound changes could be wrought from the most thoroughly pragmatic approach to relatively ordinary problems.

The lack of consensus among the various elements of the Left was perhaps the main reason why, in the end, pragnatism achieved what idealism could not. Whereas the Modern Movement suggested the social purpose of architecture would best be served by industrialisation and prefabrication, Fabian socialism placed its faith totally in organisational change; particularly in the direction of centralised control and planning. Barham roundly asserted that:

> The large number of prefabricated and other experimental dwellings being erected at the present time in no way invalidate this argument, for these are due to the present emergency, must be regarded as highly experimental, and are mostly regarded with hostility by the bulk of the industry, employers and operatives alike.[10]

However true much of that statement may have been at the time it is certainly lacking in sympathy for what many would have considered to be the architectural counterpart of Fabianism, as expressed by Walter Gropius and his British followers. A Report to the Minister of Works on Placing and Management of Building Contracts, in contrast, indicated a calm acceptance of realities:

> New materials, new processes and new methods of construction have been developed in recent years and have come into practical use on a large scale. As a result specialist firms have come into existence and are now operating on a substantial scale.[11]

Again, the report was referring mainly to development in the construction of houses; as we shall see in the brief account of significant antecedents in the field of prefabrication and industrialisation that follows, housing led the way.

In the present context our starting point is Gropius's statement that "modern practice in house construction is increasingly approximating to the successive stages of a manufacturing process"; in an English translation of 1935.[12]

The history of prefabrication is a curious one; the word appears to belong, as a catchphrase, to a period spanning no more than about thirty years; 1920-50. Before that time prefabrication had indeed been used in the construction of buildings, wherever it was realistic to do so. For example, the iron buildings exported to the Empire overseas in the 19 C; the Crystal Palace of 1851 was the most celebrated prefabricated building of all time. Much earlier still, the ancient timber "crucks" for cottages and barns were prepared at, or near, the site of felling. Since 1950, the distinction between "prefabricated" and "conventional" (or "traditional") construction has gradually become meaningless as countless windows, doorframes, kitchen units, roof trusses, concrete floorings and components of every kind course the motorways in every direction.

As an ideal, prefabrication corresponds in time with the Modern Movement in Architecture, where it became a precept principally through the Bauhaus teaching of Walter Gropius on the relationship between architects and industry.[13] R.B.White in his definitive study of prefabrication in Britain comments that when the Movement spread later to this country, "as with all new trends that begin either with an idealistic or rational approach, or a mixture of both, it became obscured by a new kind of romanticism, which appealed to architects with a progressive outlook, who saw the true machine a habiter, comparable with industrial consumer goods, but whose undeniable imagination was insufficient to visualise clearly the social and financial difficulties that lay in the way, and whose knowldge of engineering and production methods was unequal to the design problems. The romantic character of this approach appeared to offer a short-cut to an avant-garde architecture..."[14] Indeed in just that way the Modern Movement became more a set of new styles, reflecting the superficial appearances of industrial products, than the true realisation of a strict rationalism.

In Great Britain it was the two world wars that gave the greatest impetus to prefabrication and mass production, when "almost any house at almost any cost was acceptable so long as it was a functional proposition and could provide a reasonable substitute for traditional materials and labour that were temporarily scarce."[15]

We have seen in the previous Chapter how three Committees perceived post-war construction needs; we shall now briefly examine the immediate antecedents to the use of prefabrication as a major instrument in achieving the aims of the 1944 Education Act.

In the 1930s the West Sussex County Council Architects Department, under C.G.Stillman, had demonstrated that a light steel framework of lattice roof beams, or low-pitched trusses, was applicable to the design of classroom "fingers."[16] The long wings of repeating units lent themselves to the second approach of the Wood Report and were convenient for carrying the light-weight claddings which were becoming available. Their standard spacing dimension and lattice beams made them in a sense precursors of the schools that were to follow in the '40s and '50s. However, the assembly halls and administration areas of these schools were comparatively remote from the classroom fingers and were built in more traditional, brick construction.[17] Towards the end of 1945 C.G.Stillman moved to the post of Middlesex County Architect and between 1947-49 nineteen schools were designed in his department. It was the first programme actually to get started after the war.

The resemblance between the first post-war Middlesex schools and those in pre-war West Sussex is clearly recognisable. The same type of "finger-plan" and a similar form of construction (steel frames at 8'0" centres) was used. Typically the infilling walls were of glazing, with brickwork up to sill level; the classroom "fingers" were, in the words of R.B.White:

> ...terminated by "book-end" walls of rendered brickwork carried above roof level: later, halls and administrative quarters were built of brickwork with facing bricks externally, giving that part of the school complex a more "permanent" and important look than the classroom wings, the latter having the appearance of being designed for adaptation or extension.[18]

The Ministerial restrictions of cost per place soon forced the "finger" type of plan to be abandoned on account of its high proportion of circulation to teaching areas. Compact planning became essential and, in turn, made dimensionally co-ordinated component design on a grid more easy, favouring prefabrication.[19]

Middlesex did not have the acute population problems that counties with new town influxes had, such as Hertfordshire and Essex. Undoubtedly this was a factor in failing to launch a long term programme of prefabrication, with an integrated organisation similar to that adopted by Hertfordshire and later by others such as the schools consortia of local authorities. Middlesex continued to employ standardised prefabricated components in annual programmes, e.g. gypsum panel partitions and hollow plastics ('Holoplast') for external and internal walling panels. Orthodox methods of competitive tendering were retained and for several years the County Council purchased, in advance, materials which were scarce and issued them to contractors from a store at Harrow. R.B.White suggests that although they were not in the mainstream of post-war developments in standardisation and prefabrication, they

> provide an interesting link with the nineteen-thirties and show a typical attempt to carry on, in very different social and economic conditions, the type of planning and construction developed as a novelty in those pre-war years. The developments that

followed were in direct line with the pre-war work of Clark Hall and Stillman.[20]

But the more important experimental strand to be picked up from the pre-war period concerned, as might be expected, not schools but housing; more than any other type the subject of Bauhaus teachings on Standardisation and Rationalisation.[21]

The work of one firm is of particular importance to this subject: Messrs Hills (West Bromich) Ltd. The company took its name from Bernard Hill who, in partnership with E.D.Hinchliffe, set up the firm of "Hills Patent Glazing Ltd." in 1932. In the pre-war period the firm began to diversify beyond the patent glazing and to manufacture steel windows, lantern and rooflights, lay-lights, office partitioning, verandahs and domes. Among the associated companies formed, in 1936, was Universal Steel Doors, making large sliding doors for aircraft hangers. During the war the firm turned to various light engineering Government contracts such as anchors, Bailey bridge components, rocket guns, invasion equipment, pulley blocks and gun mountings. Of particular significance was the establishment of a subsidiary of Hills named Chain Development Ltd. This company was to manufacture electrically welded steel chains for the Admiralty and the chains used by the flail tanks of the Royal Armoured Corps, giving the firm considerable experience in welding, especially jig welding.[22]

When the Ministry of Works was investigating with various manufacturers the problem of post-war housing in connection with the Post-War Building Studies series Hills were able to report some experience in this field. In 1942 Ernest Hinchliffe had designed components for a light welded hut structure and had built the first prototype at the West Bromich works, known then as the "Black Hut." He had also taken out several patents on welding methods and on the production of the steel beams and columns that were to become typical of Hills structures.[23]

In 1943 a prototype for a two-storey house was erected at the works. This used the round lacing bar as the web of light steel joists and column sections and was developed into the Ministry of Works' demonstration house at Northolt in 1944. Shortly after this several dozen such houses were built for the Ministry at Bushey. Still in 1944, two prototype houses were built at Alum Rock for Birmingham

Corporation leading to larger contracts.

The pair of houses were described in Post-war Building Studies, No.23, House Construction Second Report, published in 1946.[24] In that Study, eight experimental prefabricated houses were reviewed individually but no generalised conclusions were reached. Named in the report as the "Birmingham Corporation Steel Framed House" the report discussed in detail all its constructional elements; the frame was described thus:

> The steel frame is of proprietary design (Hills Patent Glazing Co. Ltd.) and consists of stanchions, floor and ceiling hoists and roof trusses formed by welding steel rods, bent to form a lattice pattern web, to flat steel flanges. Small flat sections have later been used in place of rods. The stanchions and roof trusses are spaced generally at 3 ft. centres, but stanchions occur immediately on each side of the party wall and support a roof truss in the cavity. All stanchions are set in the external wall cavity and they are bedded on a pad of fibreboard and bolted to the concrete foundations.
>
> The total weight of the steel frame per house is about 30 cwt. It is protected against corrosion by sand blasting and two coats of hot bitumen.[25]

The steel frame was a success; it was also remarkably graceful and neat (fig.17-19). The claddings had problems that need not concern us here but the concept of the building was sound. Its potential was sufficiently apparent for the prototype to lead to several contracts with that authority, with the London County Council and for 500 houses for the Scottish Special Housing Association.[26]

The technique used for all these houses was fundamentally the same and became known as "Hills Presweld Steel Framework." The grid dimension principle had not yet been established and the truss spacings varied to suit individual needs, ranging between 2'0" and 3'6". Nevertheless, the classic advantages of a factory-made, framed system were immediately apparent: early completion of a roof whereunder work could proceed protected from the weather and site labour reduced by employing sub-assemblies as finished components, such as windows with integral surrounds and sills; all combining to ensure a shorter contract period. Hills were now keen to extend the use of their steelwork into other fields; they had the experience and capability to tackle something bigger and were soon to get the opportunity.

Notes to Chapter 6.

1. Harry W.Richardson and Derek H.Aldcroft, Building in the British economy between the wars. University of Glasgow Social and Economic Studies. London, 1968, p.156.

2. Ibid.

3. Ibid., p.158.

4. Ibid., p.322.

5. Commitee of the Central Council for Works and Buildings, Report on Training for the Building Industry, Cmd.6428, 1942-43.

6. Harry Barham, The building industry: a criticism and a plan for the future. Industrial Democracy Series No.1. London, 1947, p.10.

7. Economic survey for 1947, Cmd.7046.

8. Labour Party, (manifesto) Let us face the future, 1945.

9. Barham, op.cit., p.44.

10. Ibid., p.6.

11. Ministry of Health, The placing and management of building contracts. HMSO, 1944.

12. Walter Gropius, The new architecture and the Bauhaus. London, 1935. p.39.

13. Ibid., passim. See also Gropius, The scope of total architecture. London, 1956.

14. R.B.White, Prefabrication: a history of its development in Great Britain, 1956, p.4.

15. Ibid.

16. C.G.Stillman, "School planning and construction." RIBAJ, Jan.1946. pp.70-5. See also C.G.Stillman, "Schools." AJ, 26 Nov.1942, pp. 342-51.

17. See examples from RIBA Schools Exhibition (26 May-19 June 1948) in RIBAJ, Dec.1947, pp.70-4 and Jan.1948, pp.115-119. See also Exhibition Handbook, 1948.

18. R.B.White, op.cit., p.226.

19. M.O.E. Circular 209, 28 Oct.1949, introduced the cost limitations which were to have a profound effect on the design of schools.

20. R.B.White, op.cit., p.228.

21. See Walter Gropius, "Programme for the establishment of a company for the provision of housing on aesthetically consistent principles." Manuscript, 1910. Also "How can we build cheaper, better, more attractive houses?" in Die Form (Berlin), vol.2, 1927, pp.275-77. Both papers are translated and published in Tim and Charlotte Benton with Dennis Sharp, Form and function: a source book for the history of architecture and design 1890-1939, London, 1975.

22. Robert Post, "Architect/Manufacturer co-operation: 2." AR, Dec.1954, p.410.

23. Ibid.

24. This study discussed eight experimental house types; see No.4, "The Birmingham Corporation steel framed house," pp.20-26 and plates 11-14.

25. _Ibid_., p.21.

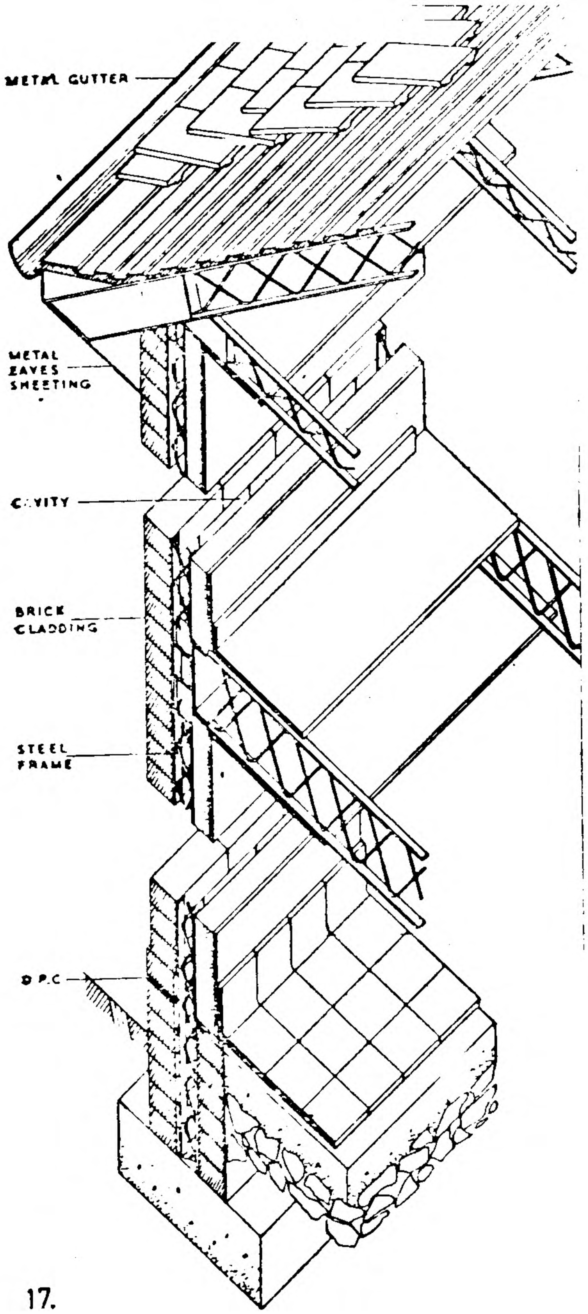
26. Robert Post, _op.cit_., p.410.

Figures 17-19.

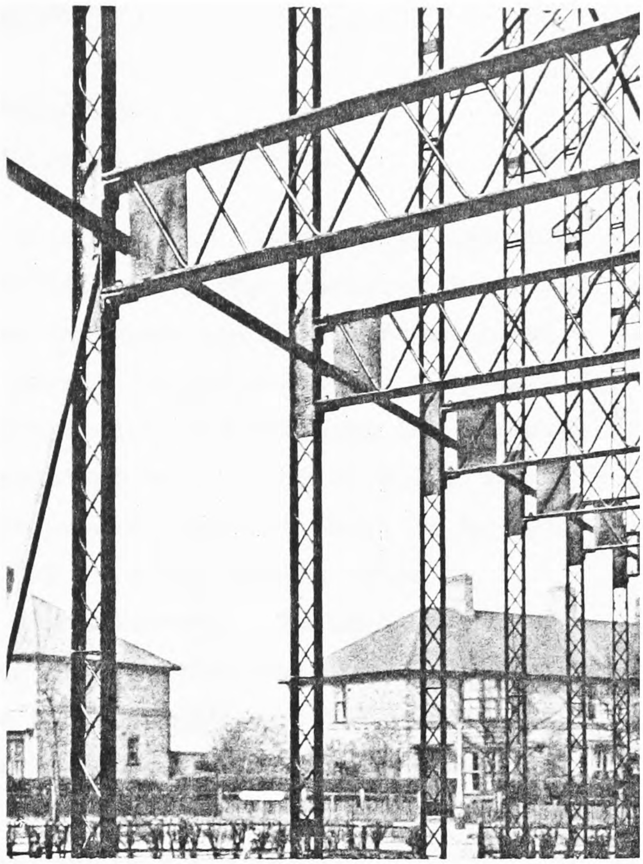
17. The Birmingham Corporation Steel Framed House, isometric view of construction. (Post-war building studies no.23, "House construction second report." 1946, p.23.)

18. Lightweight lattice frame by Hills Patent Glazing Co. Ltd., view of stanchions and floor joists. (_ibid_., plate 12.)

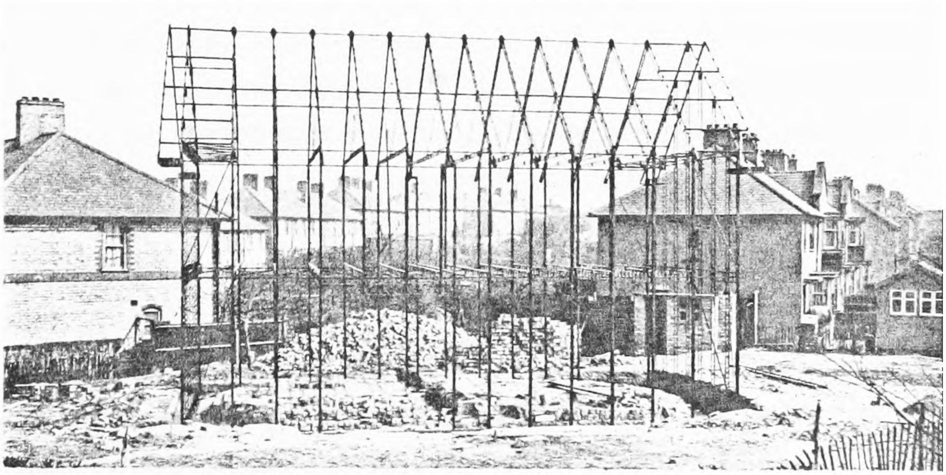
19. Hills frame for semi-detached pair of houses. (_ibid_., plate 11.)


METAL GUTTER
METAL EAVES SHEETING
BRICK CLADDING
STEEL FRAME
D.P.C

17.



18.



19.

Chapter 7

HERTFORDSHIRE
EDUCATIONAL AND BUILDING REQUIREMENTS

The Hertforshire County Council, along with all other local education authorities, was required under Section 11 of the Education Act, 1944, to prepare a Development Plan: the immediate and future educational needs of each area of the county were to be estimated and proposals for meeting those needs were to be submitted to the Minister for approval.[1]

All Development Plans were required to be drawn up along pre-determined lines. Changes in the school population were to be estimated and consideration given to how existing schools would be affected, some of which would be discontinued. The additional new schools, nursery schools, boarding arrangements and special educational facilities, where necessary, were to be specified; arrangements for free transport, shared playing fields etc. had to be worked out. Finally a time scale for putting each part of the plan into effect was to be prepeared and the capital expenditure estimated.

The problem for the LEAs was immense and it was recognised that the submissions would be more accurate in their forecasting of the more immediate future than for later years. The task took much longer than expected; by 1948 only some twenty Development Plans had been approved by the Ministry of Education.[2] But the acknowledged object of the exercise was to ensure that first things were tackled first; in a direction, and on a scale, consistent with the long-term aims of an agreed plan. Thus in most authorities analysis and discussion of the problems were sufficiently far advanced for a clear picture, at least of the immediate priorities, to be seen.

All LEAs had some increase in population due to the rising birth-rate to deal with. In Hertfordshire, however, the siting of several London County Council "overspill" housing estates, and the planned growth of the new towns designated in the county, made the proportionate increase considerably larger than in most comparable areas in England.

In 1945 it was predicted that Herfordshire's primary school population would increase by approximately 7,000 within the following six years and that by the summer of 1952 it would reach 10,000. This meant that some fifty new primary schools would need to be provided within a period of seven years. Looking further ahead, the requirement would rise to 175 new primary schools during the next fifteen years.[3]

The priority areas for the county's first primary school programmes tended, logically, to be those at the heavily populated southern corners of the county, adjoining Middlesex and the Greater London area, together with the soon to expand new town areas. In building terms the educational needs were almost overwhelming; the priorities were set as objectively as time and circumstances allowed. It could be said that the strict order of implementation was of less importance than making a quick start and getting on with the job, modifying plans as trends became clearer and successes, or failures, could be counted.

The yearly translation of the county's educational development needs into new schools is implicit in the list of schools (Appendix 5) and does not need to be examined in detail here. However, the Education Committee decisions regarding schools 1 and 2 on the list are of particular interest, historically, on account of their positions as prototype and co-runner to start the programme stream, and for the policy and technical precedents they established.

Even before the outbreak of war a scheme of reorganisation for schools in the Cheshunt and Waltham Cross district had been drawn up and approved in principle by the Education Committee. But there had been delays in reaching agreement on aspects of the proposals and nothing had materialised before 1939. The minutes of the Finance and General Purposes Sub-Committee meeting of 24 July 1944 record:

> There is, therefore, a good deal of leeway to be made up before the facilities for education match those in many other parts of the County, and it will accordingly be only reasonable if the Committee place the needs of Cheshunt high on their priority list for attention when school building is resumed.
>
> The district of Cheshunt is likely, after the war, to undergo rapid development which makes the correct long-term policy in school building especially difficult to determine. Since, however, the appropriate clauses of the Education Act, 1944, will call for the County Development Plan to specify the prospective as well as the present needs of each district, the effect of this rapid growth of population on school accommodation must be assessed.[4]

The position of Essendon was dramatically different. In the same month that the case was being made for Cheshunt to be given priority status, a flying bomb struck and totally destroyed the Essendon County Elementary

Mixed and Infants school. Rehousing accommodation was found but it was not a lasting solution. On 31 May 1946 the Primary Sub-Committee approved the following report, illustrating well the complexity of educational development planning:

> The Essendon C.E.M. and I. School was totally destroyed by a flying bomb in July 1944. At the time of the incident there were 80 children on the roll in the age-ranges 5 to 14. The conditions under which the children are now taught are unsatisfactory. The Infants are in the Village Hall, Essendon, and the Seniors and Juniors in the premises of the old Little Berkhampstead (sic) C.E. School (closed 1943).
>
> The arrangements in the County Development Plan provide Secondary facilities for the Senior pupils in a new school to be erected at Brookmans Park and for a Primary school in the village of Essendon. The Managers of the C.E. School had hoped to provide the Primary school as an Aided school but have now decided that the task must be left to the County Council.
>
> The provision of a new Primary school in Essendon is a matter of urgency for two reasons; first on account of the unsatisfactory arrangements for the local children and secondly because the Royal Patriotic Corporation's school for girls is shortly to move into Bedwell Park and will require places in the local school. The County Council has agreed as a temporary measure to maintain a school in Bedwell Park, but it would obviously be more satisfactory to erect a new school which would take the Essendon Juniors and Infants together with those from Bedwell Park.
>
> There are 50 local children and 40 girls from the Royal Patriotic School. Account must also be taken of the Rural District Council's housing development and the fact that the number of girls at Bedwell Park is ultimately to be increased.
>
> It will be necessary to provide a four-class Primary school to accommodate a total of 120 pupils.
>
> The County Architect estimates that the cost of providing the building will be £12,000 and the necessary equipment £1,500.[5]

In September 1945 the Education Commitee considered the question of the County Primary School site in Blindman's Lane, Cheshunt, and decided to erect a hutted school "owing to the poor condition of the present buildings and the fact that temporary accommodation will shortly be withdrawn."[6] In line with their thinking on emergency needs the Ministry of Education had already approved in principle a proposal for one double classroom hut to replace temporary accommodation. The County Council, in November 1944, had approved the erection of two additional classrooms at either the Blindman's Lane site or another nearby in College Road. Consequently, on 21 December 1945, the Primary Sub-Committee adopted the recommendation:

That two additional classrooms for the College Road School be erected on the County Council's site in Blindman's Lane, Cheshunt; this accommodation to form part of a hutted school to replace the College Road premises.[7]

Less than three months later, on 15 March 1946, the Primary Sub-Committee approved the following report and recommendations:

The Committee at its last meeting approved a proposal for a new junior mixed and infants' school at Blindman's Lane, Cheshunt, to replace the present unsatisfactory premises at College Road. Plans for a light construction school have been prepared by the County Architect and have been submitted to the Ministry of Education and returned for minor alterations.

The County Architect estimates that the cost of the school will be approximately £100 per place, a total of £32,000. An additional £2,600 will be needed for furniture and equipment.

The erection of this school is a matter of the greatest urgency and the Committee are asked to approve the following recommendations so that the work can proceed without delay.

Recommendations:- That a sum not exceeding £32,000 be provided to meet expenditure on the work involved in erecting a light construction school for 320 children at Blindman's Lane, Cheshunt.
Recommended.

That a sum not exceeding £2,600 be approved for furniture and equipment.
Recommended.

That the common seal of the County Council be affixed to any necessary agreements.
Recommended.[8]

The wording is, as usual, matter of fact but what was to prove the most influential step in the history of British school construction had been taken. The investigations, which led to this alternative proposal and enabled the Committee to reverse a decision forced by expediency, will be discussed in detail in Part 2.

It remains here to discuss the most important factor behind them: the human factor of professional idealism and the refusal to accept a palpably inferior product without a real effort to find an alternative.

Indeed the question of how the programme was to be implemented was dependent as much, if not more, on such human factors rather than the crude statistics of materials shortages and the like. Much would depend on the outlook, capability and imagination of the officers charged with the responsibility.

The architectural team will be discussed as events are described; it was a complex, varying machine of diverse talents, changing with the years. A constant factor through all these initial years was the officer representing the client, the County Education Officer.

Guy Oddie, writing in 1964, attempted to set down "for the purposes of historic record", the sequence of events by which prefabrication became the key fact of the post-war school-building programme.[9] Events, says the preamble to his article, "from which all the present day activities have sprung, centred chiefly on the work of the Hertfordshire County Council and the Ministry of Education." Oddie's colourful account dwelt largely on the main personalities involved in what he calls "The Hertfordshire Miracle."

> The miraculous element amounted to one of those fortunate accidents of history which bring together two individuals in one place at the opportune moment, in this case an architect and an educationist who both believed that they could make the future better than the past and who shared none of the prevailing desire for things to get "back to normal". There the miracle ended; the rest was hard work, determination, an element of genius and optimistic faith.[10]

The architect was Stirrat Johnson-Marshall, the deputy to C.H.Aslin, County Architect. The educationist was J.H.Newsom, the County Education Officer.

John Newsom, born in 1910, was in his early thirties when appointed County Education Officer in 1941. Educated at Imperial Service College and Queens College Oxford, he came to the post with a background of unusual experience: soldier, university lecturer, publican, social worker and civil servant. Guy Oddie said of him:

> Perhaps some biographer will some day find the time to discover and say what made him tick, but tick he did; and the basis of his approach was that education was inseparable from environment, so no huts for him. He wanted schools designed for new and continuing developments in teaching, not repetitive railway carriages in which children and teachers would have to adapt themselves as best they could. But he had no blue-print for the ideal school; he would be content to learn as he went along.[11]

This view is borne out more soberly by Newsom's own writings, both in his official and private capacities. His views on the relationship between the practice of education and the physical environment in which it takes place were to be crucial to the Hertfordshire schools architects. Moreover his open mindedness in giving architects a free hand in the interpreation of educational requirements, his desire to see good architects produce good architecture for his schools must have made him a client to whom an architect could respond positively and creatively.

Early in 1944 the County Council's Finance and General Purposes

Committee instructed the County Education Officer to prepare a report on the employment of outside architects for post-war schools and to submit a list of names for consideration.[12]

In his report Newsom made the point that the Committee would first need to decide on the proportion of new building which they considered should be undertaken by the County Architect, as this would clearly affect the size of the panel of private architects. The pressure of work in dealing with the backlog of painting, maintenance and repairs, and the calls made by other Committees of the County Council were also factors to be considered. The new Education Bill was still before Parliament but it was obvious that a considerable amount of new school building would be necessary. He doubted whether this should all be placed in the hands of one architect, however competent, "not only because of the need for speed but because the Education Committee should have the services of architects of a wide variety of experience both of school and other types of building." He suggested that fifty per cent of the Committee's building programme should be designed by the County Architect and fifty per cent by outside architects drawn from an approved panel.

In deciding on the qualifications that these outside architects should have he suggested three essential qualities should be investigated. Experience of school building, particularly the "most modern type of school design and construction", a readiness to adapt personal theories of construction to the needs of the school together with a willingness to accept advice from the users, i.e. teachers and educationalists, were the first two qualities. Newsom's concern for the educational relevance of design is clear. On architectural quality his open mindedness of how that was to be achieved was well expressed in his third requirement:

> The third quality is less easy to define. A great responsibility rests on the shoulders of the Education Authority in their school buildings to ensure that, consistent with a proper regard for economy, the buildings erected on their responsibility are architecturally distinguished. To put it crudely, if the Authority responsible for education produce an ugly building there is little hope of expecting either other organisations or individuals to erect what is beautiful. It is also suggested that it is the responsibility of the Education Authority to encourage good modern architects and to give the younger of them a chance of showing what they can do in the way of school building. Unless this is done school architecture will become sterile and will follow patterns laid down by architects of a generation or

more ago. It is, of course, difficult for Public Authorities to take risks, but unless they are prepared to be imaginative there will be no progress in the development of school design because the patronage of this particular form of building rests almost wholly in the hands of Education Authorities.[13]

Significantly, his report concluded with the observation that the principles contained in the recently published report of the Board of Education Committee on School Construction (the Wood Report) will clearly affect the technique of school building after the war. The recommendation that "the firms and persons whose names are set out... be appointed... to assist in the planning of future school buildings" was adopted after the addition of the following final words: "This recommendation to be reconsidered after the appointment of the County Architect."

In 1950 Newsom published his fifth book, a parents guide to some of the problems and principles of education, entitled The Child at School. In a chapter on educational environment he described the dreary surroundings, the lack of teaching equipment, cultural and sports facilities and the overcrowded classrooms still prevailing in so many schools inherited from the pre-war years. He went on to make an ambivalent comment on the image projected by the progressive schools of that period:

In contrast to these shocking places - and shocking is a mild word to describe the environment in which tens of thousands of our children are incarcerated - a fair number of new Senior Schools were built before the war with standards as high or even higher than those of many Grammar Schools. They had at least space, light, air and colour, hot and cold water, indoor lavatories, and playing fields, even if they were at times rather too "hygienic" in their architecture and fittings. If the old schools are indistinguishable from H.M.Prisons, some of the new are indistinguishable from toothpaste factories.[14]

Although the book is illustrated with photographs of some of the newly completed Hertfordshire schools the text was actually written in the spring of 1948 at a time when he was reflecting that the prospects of building anything were apparently remote.[15] Hertfordshire's first schools to be built in "light construction" were already under construction at Cheshunt and Essendon but still some months from completion. His open mindedness may have prevented him from writing optimistically about the new methods as they were not yet proved.

Notes to Chapter 7.

1. Education Act, 1944, p.6., para.11 (1).

2. M.O.E. pamphlet no.33, The story of post-war school building, p.20. See also M.O.E. Circular No.90, 8 March 1946, granting three months extra time for submission of plans, and Circular No.122, expressing Minister's dismay that authorities outside the "red" areas had responded so badly to plans for education work where labour was not required elsewhere.

3. C.H.Aslin, "School building in Hertfordshire." Education, 27 April 1951, p.631. See also E518A, Education Survey 1945.

4. HCC 21, vol.24, p.71.

5. HCC 21, vol.25, p.18.

6. Referred to in minutes of Primary Sub-committee meeting of 21 Dec. 1945. HCC 21, vol.25, p.181.

7. Ibid., p.182.

8. HCC 21, vol.25, p.261, items 68-71.

9. Guy Oddie, "The new English humanism." AR, Sept.1964, pp.180-182.

10. Ibid., p.180.

11. Ibid.

12. HCC 21, vol.24, pp.22-24.

13. Ibid., p.23.

14. John Newsom, The child at school, 1950, p.164.

15. Ibid., p.23.

Part two

Chapter 8

PRELIMINARY RESEARCH IN HERTFORDSHIRE

Part One examined the background to the requirements of the Hertfordshire County Council's school building programme, resulting from the Education Act 1944, and discussed the theoretical possibilities available for its implementation. Such a programme would have been demanding even in years of tranquillity and prosperity; in a climate of extreme stringency and urgency it was a daunting prospect. Toynbee observed: "Encounters taking the form of challenge and response are the most illuminating kinds of events for a student of human affairs... (they) are the occasions in human life on which freedom and creativity come into play and on which new things are brought into existence."[1] The response of the County Architects Department was to produce in Hertfordshire a new technique and a new methodology to serve it. This response evolved directly from the recognition and analysis of the prevailing conditions in the construction industry. The course of the development of this technique and its methodology is the central topic of this study; its thesis is that the success of the response lay in the logical analysis of these conditions and the imaginative synthesis of existing ideas, generating a new concept of building.

The department was under the direction of Charles Herbert Aslin, who was appointed the first County Architect of Hertfordshire in September 1945 at the age of fifty-one. Qualified as a structural engineer as well as an architect, he had a wide experience of local government architecture.[2] Since his war service ended in 1919 he had served alternately with County Borough Councils and County Councils and had been responsible for Education buildings, Housing, Police, Hospitals and Municipal Offices. In addition he had held office in several professional organisations, being President of the Notts, Derby and Lincoln Architectural Society, 1941-3. Before retiring from the Hertfordshire post in 1958 he was to become President of the Royal Institute of British Architects, be awarded the CBE and became the best known name in school building of the decade. The department he built up around him will be discussed more fully in Chapter thirteen. He has been described as the ideal "umbrella man" under whom a team of gifted and dedicated professionals could thrive.[3] These included, late in 1945, Stirrat Johnson-Marshall (Aslin's Deputy), Bruce Martin, David Medd and Mary Crowley.

The first requirements for Hertfordshire had already been identified as Junior, Mixed and Infants schools for 320 children at Cheshunt and 120 children at Essendon. The first series of plans for these and following projects were initially considered in terms of Ministry of Works huts; in September 1945 the County Education Committee had actually approved hutted accommodation for a new JMI school at Cheshunt.

The Wood report had predicted the problems of post-war building with remarkable accuracy, recognising that the county would be lacking in the normal materials of permanent construction and, above all, lacking in the labour essential to building. For this reason, as mentioned in Chapter four, "light construction" had been recommended. However, no comprehensive system capable of building complete schools had yet been established and for that reason the controversial Ministry of Works huts were generally being recommended for schools. Despite the objections to such solutions, schemes using these huts were submitted to the Education Committee and approved. Notwithstanding such approval, the architects' research proceeded in parallel, in the hope that a more satisfactory solution would be found before the programme had advanced very far, if not before it began.[4]

The first step in the analysis was taken in November 1945 when a programme of "preliminary research" was embarked upon, continuing until July the following year.[5] This research was conducted under the broad headings of Spatial requirements, Dimensional surveys, Lighting, Heating, Materials and Labour availability. As it was immediately obvious that existing methods could not cope with such a programme a new, perhaps untried, method was necessary. This became particularly clear when the problem was viewed by the architects as a whole, rather than as a series of independent school building projects. A prototype would be necessary before long-term decisions could be made, if indeed commitment to a single method was desirable at all. Thus the main object of the preliminary research was the selection of a prototype method, or at least a clear definition of the design and constructional requirements of the building programme.[6]

Whilst the isolated examples of pre-war progressive school design were available for inspiration, they offered little help towards construction, being built as they were in largely traditional materials, however expressive of the new age their architecture was. The county had a deep reluctance not to build in permanent construction meaning brick or rendered concrete as the principal walling material. But of all the shortages of labour and materials, those of bricks and bricklayers were the most acute on account of the greatest part of all public spending on new building being directed towards housing. The figures for England and Wales illustrate this point:[7]

CAPITAL EXPENDITURE BY LOCAL AUTHORITIES IN £ million

	1949	1953	1958
Housing	263	399	251
Education and Child Care	38	72	122
Total	301	471	374
All other building	12	21	25

Early in 1946 the quota of bricks was limited to 20,000 per school, approximately a quarter of what would have been required to build a school in traditional construction.[8]

The investigations were made with the help of the Building Research Station[9] (conveniently situated within the County at Garston), the Ministry of Works and a number of specialist firms, as well as other architects and local authorities concerned with prefabricated housing. All available information was collated and sifted but, with the short time available, short cuts had to be accepted, refinements could come later. Research therefore concentrated on those aspects of design which would have the greatest bearing on constructional technique. The space requirements were broadly outlined in the Ministry regulations but their interpretation needed to be more fully explored with the collaboration of the County Education Department. The latter accepted the need for a flexible and free use of space as an adaptable background to the wide variety of activities described in the Education Act:

> A school is no longer to be an institution for formal education only, but is to provide a human and gracious environment for the many-sided development of the whole child.

So declared one of the earliest statements of their evolving philosophy published by the County Architects Department in October 1947.[10]

With regard to Dimensional Surveys it was immediately apparent that insufficient information existed to determine room shapes and sizes, sill heights and dimensions of furniture and fixtures. For this reason dimensional surveys of large numbers of children were undertaken with the co-operation of the County Education Department. The surveys, instituted to collect information required by the architects, were financed in a manner enabling measurements to be taken and set down by the children themselves as an educational exercise. This was an early example of the dialogue developing between teachers and architects.

It was appreciated that apart from the criteria of space and dimensions, some early thought would need to be given to physical comfort standards; in particular, to lighting both natural and artificial, and to space heating and ventilation. Knowing that considerable further research on school lighting would be done by other agencies, certain interim conclusions would suffice to enable basic window-design objectives to be determined. For example, contrast between the lightest and darkest surfaces in the classroom should be free of glare, but that did not imply a flat daylight factor curve for its satisfaction. It was asserted that, "if children show no desire to move from one part of the room to another in order to see better (satisfaction) will have been achieved".[11] Most important it was felt that main windows, to the south or south-east, should span the full width of the room, with large clerestory windows opposite. It was concluded that this arrangement would give ample light on each reflecting surface and minimise glare. Furthermore, it was accepted that, with a southerly aspect, uncomfortable sunlight and sky glare would be present for short periods during the year unless some precautions were taken. The adoption of "complicated sections and other devices incompatible with a simple structural form" were not felt to be justified; simple metal venetian blinds would give sufficient control.[12] We shall see that the clerestory ideal was dispensed with before long and that daylighting and window design were to remain a dominant influence on Hertfordshire schools architecture. Artificial lighting, having little effect on structure and planning was given only the minimum of study at this preliminary research stage.

Heating by means of the usual radiators had disadvantages with regard to heat distribution, it was held. With the assistance of the Building Research Station a firm was found which had in production a system of ductless warm air heating which was new to Britain. After testing an experimental installation in an existing classroom, and after the experiment had been viewed by representatives from the Building Research Station and the Ministry of Education, it was decided that this method of heating should be used in the prototype school.

The investigations briefly recounted here were necessarily tentative and a great deal of further development was to take place as experience was gained in these fields. Of all the problems considered, those concerning the availability of labour and materials were the most intractable. Delay in the delivery of building materials was the most important factor influencing the high cost and slow production of buildings in 1946. Manpower shortages in industry, rationing and the quota system aggravated the position and housing priorities commanded the bulk of available traditional materials nationally. In Hertfordshire this was exacerbated by the newly designated New Towns of Stevenage Hemel Hempstead, Hatfield and Welwyn Garden City. In addition the London County Council overspill housing estates within the county and the effect of Harlow New Town, just across the county boundary in Essex, put an even greater strain on local construction resources. Hertfordshire's capacity for providing school buildings by traditional means (or conventional as they then were), was thus relatively very small indeed.

Normally it was not until a contract had been let that the contractor was able to place orders for his materials, with the effect that distant delivery dates for materials which were in short supply, plus the fact that delivery dates were not always adhered to, caused slow building. This in turn led to contract organisation being dislocated and even brought about complete stoppages at times. Naturally contractors felt obliged in tendering to cover themselves against such risks.

Clearly the recommendation of the Wood report that a system of "light construction" as an alternative to brickwork, and therefore bricklayers, was a logical answer. If brickwork as a load bearing construction method were to be excluded, some kind of frame would be necessary for the basic structures. Frames could be of steel, concrete or timber. Timber was in short supply and concrete uneconomical for the single storey structures envisaged, when compared with steel; besides, the precedent of Hills's steel-framed houses had shown how a lightweight steel frame of lattice construction could lend itself to plan shapes involving relatively short spans. Thus the shortage of craftsmen in the key trades of conventional building, and of the traditional materials associated with permanent construction, pointed to the production of the component parts of schools in the factory. Here, in space now freed from producing the necessities of war, skilled labour could be concentrated. If school building could be rationalised the very size and duration of the school building progamme would mean that large orders and long runs could help offset the high overheads and jigging costs of factory production.

Inevitably such rationalisation would mean that considerable standardisation would be necessary. But standardisation of what? To standardise the whole school was educationally undesirable and quite unsuited to the varied and irregular sites in the county. An alternative would be to standardise classroom units, but this too was considered unsuitable, firstly because classrooms of varying shape and size were required and secondly, because classrooms constituted only about one third of the accommodation in the average school.[13] A further possibility was the standardisation of structural bays; this would lead to one-directional "ladder" plans which were too restrictive and wateful of circulation space. Thus standardisation methods of these three types were rejected; they could not produce all the types of educational building, from infants playrooms to technical workshops, required on a wide variety of sites.

In Hertfordshire, standardisation was acceptable as a means if it could be applied to the smallest components that could conveniently be put together, Meccano-like, in a wide variety of ways and with a minimum of skilled labour on site. Educational ends had to transcend the means of factory production. The precept was crucial: "The way in which it (standardisation) was tackled is the key to subsequent developments in Hertfordshire."[14]

The Wood report's recommendations to use "light construction" as an alternative to traditional means seemed to offer the only real way out. Steel was available in limited supply and concrete was a reasonable alternative to brick, particularly if it could be factory-cast into easily handlable components and thus reduce site labour. The question of how to use these materials in economic balance was the fundamental one now. No component standardisation, or prefabrication, could proceed along mass production lines without the discipline of dimensional co-ordination. Much discussion was already taking place on this subject elsewhere and the Hertfordshire architects did not see it as their task to resolve the issues.[15] More importantly, there was simply no time for the necessary studies at this stage.

Notes to Chapter 8.

1. Arnold Toynbee, A study of history. (vol.12, Reconsiderations) London, Oxford University Press, 1961, p.256.

2. See "Charles Herbert Aslin." RIBAJ, May 1948, p.302. Also, Konstantin Bazarov in Contemporary architects, 1980, pp. 46-48. Aslin was born in Sheffield, Yorks., 15 Dec.1893 and died in Hertford, 18 April 1959.

3. Guy Oddie, "The new English humanism." AR, Sept.1964, p.181.

4. Newsom (CEO) wrote to Aslin (CA) on 1 March 1946 requesting a "report of the present position": Aslin replied on 5 March 1946 "...It is my intention to erect the building (Cheshunt) in a new form of unit construction...in hand at the moment and erection will commence as soon as the necessary parts have been produced by the factory...hoped to complete this first section of the school within six months." E444 (41-48) 185.

5. HCC Architect's Department, "On the design of primary schools." AJ, 16 Oct.1947, pp.339-347.

6. Ibid., p.340.

7. Elizabeth Layton, Building by local authorities. 1961, p.16. Op.cit., p.31 gives more detailed breakdown.

8. MOE Administrative memorandum no.51, 8 May 1946, Educational building work - economy in the use of bricks.

9. BRS Note no. C302, Sept.1954. See Gen.55, Box 425.

10. AJ, 16 Oct.1947, p.341.

11. Ibid., p.340.

12. Ibid.

13. Regulations prescribing standards for school premises 1945, S.R. and O., No.345.

14. BRS Note no.C302, p.1.

15. Bruce Martin's The co-ordination of dimensions for building, 1965, contains a comprehensive bibliography on this subject.

Chapter 9

THE CHESHUNT PROTOTYPE

During the preliminary research it became evident that the steel fabrication firm of Hills Patent Glazing Company Limited had the basis for a prototype in their experimental classroom unit. The company, as we have seen, had gained some experience during the war in producing light steel framed structures and, anticipating a drying up of the market following the war, had designed a school classroom unit on an 8' 3" planning grid; the module derived pragmatically from classroom sizes and recommended by the Wood Committee in their report, Post-War Building Studies, No.2, discussed earlier. Hills had employed their Presweld beam as the basis for a light steel frame and had astutely formed an associate company, called Hilcon,[1] to manufacture precast concrete components for roof, floor and wall construction to go with their frame.

Lacey and Swain* recalled the appointment of Hills for the prototype construction stressing the grounds of a "common approach" which the firm shared with the Hertfordshire architects, rather than the simple fact that Hills had already designed the most promising product so far available:

> The County Architect first learned of this firm through its activities in housing. Preliminary discussions were arranged with the directors of the firm to consider in detail the housing work which they were doing and structural possibilities for the school building problem.
>
> At these meetings it became apparent that the manufacturer's approach to the problems of building was similar to that of the County Architect and his staff. This similarity of approach to problems ranging from policy to detail proved to be an important point in the development process, because it established the basis for a working partnership between the architects and the directors,

---

* Dan Lacey and Henry Swain were members of the Hertfordshire County Architects Department, designing several of the earliest schools until their departure to Nottingham at the inception of CLASP (See Chapter 24 and Appendix 5). They together wrote a series of technical articles for the Architects Journal on the development of the 8' 3" system. As a primary source these have proved invaluable, explaining as they do, reasons for changes which are not apparent from the reading of project files.

design engineers and production engineers in the firm. As a result of these meetings it was decided to build a prototype school using the system developed by Hills for their housing and factory work.[2]

Undoubtedly, the ability of Hills to provide components for a complete shell for a prototype was highly influential in Hertfordshire's decision. For Hills it meant not only more business but a great opportunity to extend the Presweld frame to further uses. There was in fact no gap between the steel house and the school building programmes. The steel houses for Scotland were built in 1946-7 and the first contact was made between Ernest Hinchliffe and Hertfordshire in 1946.[3]

A prototype in the true sense of the word would have meant constructing a special structure in advance of, and forming no part of, the programme proper. As there was not considered to be time for such a luxury it was decided to regard the Infants section of the high priority Cheshunt Junior, Mixed and Infants (JMI) School as the prototype and to reap the earliest possible benefit from the experience.

> By limiting the prototype to a building containing three classrooms, lavatories, cloaks and corridor only, it was hoped to obtain practical experience of the structure more rapidly than if the system were to be used for the whole school, it was realized that the problems involved in the larger spans and heights of assembly halls and dining rooms would not be dealt with, and that school planning would call for a more versatile system of building than that afforded by the prototype. For these reasons it was decided that a start should be made on the drawings of the Junior School as soon as possible after the prototype was launched.[4]

Thus Hills were invited to submit a quotation for the supply of components to build the prototype accommodation "with the proviso that its necessarily high cost was spread over subsequent orders placed with them."[5] They were officially instructed to proceed in January 1947; the contractual arrangement was that the work should be sub-contracted to them through a General Contractor. A local firm of builders, Gee, Walker and Slater Limited, was appointed for this overall responsibility.

The financial arrangement between the parties was clarified in a memorandum from the County Architect to the County Accountant on 18 February 1947 in this way:

> Messrs. Hills are in the position of "nominated Sub-Contractors" and they are bound by agreement to and receive payment from the General Contractor in the nominal (sic) manner. The Council has therefore no direct liability as far as they are concerned .... It is proposed to continue this procedure in the case of the other

new Schools in the programme and although it will be necessary in certain cases to place orders with Hills before the General Contractor is selected, they will revert to the position of Sub-Contractor as soon as the main Contract has been signed. This matter was dealt with more fully in the report presented to the Finance and General Purposes Committee on Jan 31st ... (the) firm's accountants will produce figures showing the cost of the materials, labour, overheads and profit whenever called upon to do so.[6]

The plan of the two stages of the JMI School in Blindmans Lane, Cheshunt, later to be named the Burleigh School is illustrated in fig.31 Hills were to design the steel frame, the walling in precast concrete units, the suspended floor and the roof, both similarly in precast concrete. The architects would provide the sketch design, using the 8' 3" grid and would check the manufacturer's drawings. The design of the components required to construct the shells of these three simple, repeating structures was thus completely the responsibility of the manufacturer. The architects' contribution was to sense their potential for development and to harness them to the purposes of the programme; they did not create the embryonic system themselves but acted rather as midwife to the birth of the system.

The target date for prototype completion had been the end of July 1946 but this proved far too optimistic, "manufacturing problems, and the fact that the immediate post-war years were a difficult period for building, slowed down the anticipated rate of progress."[7] Wisely, before delivery of the steel frame to site, a trial erection of part of it was carried out under cover at Hills's new Presweld factory. This trial was completed by the beginning of August 1946 and enabled the positions of cleats, bolt holes etc., to be checked before leaving the factory. The probable site erection delays thus avoided "proved the value of full size factory mock-ups in development work."[8] As the steel frame was the principal element of the system all other components had to be dependent on its accuracy and adaptability. By mid September a gleaming steel frame was standing where, a year before, it was proposed to erect the Ministry of Works huts. Progress could now accelerate; design work and other matters were already in hand for the completion of the Junior Section of Cheshunt and for a simultaneous start to be made on the Essendon JMI School in March 1947.

The frame steelwork was constructed of "re-rolled" sections rather than the less readily available, and heavier, rolled steel joists.

The stanchions were made up from four 2" x 2" x $\frac{1}{4}$" angles welded into an I formation (figs.20, 26). The beams were formed by welding a web of bent, round-section rods to flat-section top and bottom chords: the lattice beam (fig.28). As there was no rigidity in the frame joints, certain panels were reserved for wind bracing. All the steel frame components were on the 8' 3" module and the pre-cast concrete roof, floor and wall units were designed to fit the steel frame accordingly. Roof and floor units were 8' $2\frac{1}{2}$" x 1' 4" x 4" and wall units were 8' $2\frac{1}{2}$" x 1'4" x $2\frac{1}{2}$" (dished). The wall units were faced with a Leighton Buzzard spar, bedded horizontally in mortar and clipped back to the stanchions at 8' 3" centres, the joints being subsequently pointed with cement-sand. The window openings were lined with pressed steel subframes, fixed to the stanchions, into which were fixed galvanised steel windows. All internal linings to the walling, frame and the partitions were constructed in prefabricated fibrous plaster (fig. 27).

This was the basic construction of the prototype. On the strength of the prototype evidence the Ministry of Education formally approved the redesigning of the hutted schemes for Cheshunt and Essendon in similar construction. So far, a group of three teaching spaces had been catered for but the problem of a design for a whole school was more formidable. Almost immediately improvements were sought; simplification with the object of improving the product and reducing the number of differing components required. The main structural modifications made to the prototype construction, to complete the Junior section of Cheshunt JMI and the Essendon JMI, were thus the second stage of development.

In considering the simplification which was necessary, two main factors immediately stood out. Firstly, since the Cheshunt site was relatively level, the suspended ground floor did not provide the advantages expected; such excavation as would be necessary for laying a concrete floor slab in situ would require little more labour than that required for stripping off the top soil. Moreover it would enable steel to be saved and obviate unnecessary heat losses. Secondly, the classroom unit which Hills had initially produced was provided with a pitched roof and this had been retained for the Cheshunt prototype mono-pitch version. This roof complicated and extended the range of components, both in the steel frame and the walling, more than any other aspect of design. To take account of the sloping roof additional column lengths were required, special sloping cladding panels were needed and the junctions between parts of the building which differed in height were severely restricted where pitched roofs abutted. Consequently, for the second part of Cheshunt and at Essendon, flat roofs at constant height (except for the assembly halls) were introduced. It was the Essendon project which demonstrated that the system worked and had the necessary flexibility for planning complete schools.

As assembly halls (requiring greater ceiling heights than the smaller teaching spaces) would normally rise above the rest of the plan, the double pitched roof was not thought to be a serious inhibiting factor at that stage (figs.29 -32); elsewhere, by changing to a completely flat roof for the remaining section of the Cheshunt School, the range of stanchion heights was greatly reduced. Along with this came the first two modifications to the frame design. Firstly, the introduction of a pressed steel gutter to the roof perimeter meant reversing the cantilever bracket support so that the toe pointed downwards. Secondly, the method of holding down the stanchions was revised on account of the complicated process of lining and plumbing the frame with a single holding-down bolt to each stanchion; though this had been structurally acceptable, a second bolt was added to ease erection problems.

Because the frame had been designed in the "normal" manner, with stanchions varying according to their loading conditions, practically every stanchion had to be individually investigated and separately designed, involving an enormous amount of work both in the drawing office and in the factory. Matters were not helped by the fact that stanchions were not symmetrical about both axes; the position of bracing and windows, the number of wall blocks (and whether they were at internal or external corners), the eaves and so forth, all contributed to the differences. In addition, differing loadings meant using different steel sections, a factor which led to considerable complication. Lacey and Swain commenting on this aspect wrote:

> The use of various sections had several ramifications adversely affecting the economical production of ties, windows and wall linings. Separate shop drawings had to be prepared by the manufacturer for each stanchion in order to locate the connections,

and the architects also found it necessary to detail the conditions at every stanchion in order to design the fibrous plaster casings.[9]

In fact out of a total of 50 of the 8' 0" high stanchions used in the prototype 30 were different in some respect. Clearly some way of rationalising this situation had to be found if mass production were to be achieved: the ideal solution would be to design, as near as was practicable, a stanchion capable of meeting every possible case.

If standardisation held the answer, mass production had its own problems at this stage, leading to unsatisfactory conditions on site:

> Over a period of 2 months erection was restricted because of the difficult steel supply position ... (and) handmade manufacturing technique was unavoidable in such development work. For example, beams were found on delivery to be 1½ in. out of straight and consequently it was necessary to straighten these on site. It was also found that setting out with a steel jig was not an infallible method of working, for an accumulated error of 1 in. occurred at an intermediate bay of the grid.[10]

Understandably, the County Architect felt constrained to write to Hills on 19 July 1947 saying "we are in serious difficulties at Essendon owing to the complete lack of progress to date on the steelwork erection ... (several stanchions) are a good inch out of straight. Also a number of beams are out of straight and cannot be used."[11]

The roof over the prototype was based, like the frame, on Hills's housing and factory components. The 8' 3" long concrete units proved to be a convenient two-man load, but wadding a fibrous plaster ceiling to the underside of the roofing blocks was a slow process. As a result, a separate ceiling component was introduced for the Junior section of the school. This consisted of 8' 0" x 4' x ½" panels of insulation board screwed to timber battens. Where beams occurred over partitions, which they frequently did because of the grid planning, they were enclosed with fibrous plaster beam casings and cornices, covering the open lattice web of the roof beams. On the drawing board all seemed to co-ordinate well, promising to obtain a good standard of finish more easily. However, it was difficult to fix these battens accurately to the cast-in timber inserts because the latter were flush with the concrete ribs. It was therefore impossible to trim them in situ to take up inaccuracies accumulated during casting or erection. Moreover, the upper side of the roofing blocks presented an even greater problem. Lacey and Swain commented:

Casting irregularities in the depth of the blocks also meant that the surface for the laying of the roofing felt was not very satisfactory, variations occurring between the surface of one block and another. It was obvious that this would need further consideration for future jobs and regrettably the idea of obtaining a dry concrete roof without screed would have to be shelved for the present.[12]

With regard to external walling, the decision to abandon the pitched roof simplified details throughout and reduced the range of concrete wall units, but several problems still needed solving after the prototype erection. Manufacturing inaccuracies created difficulties in fixing and production tolerances had to be agreed with the manufacturer. These were + 0" - ¼" in thickness for the remainder of Cheshunt; variations of up to ½" had been noted earlier. The standard of finish was considered to be generally satisfactory but differential thermal movement between steel frame and concrete cladding had led to cracking and loosening of the pointing. Generally, the metal window surrounds were found to be inaccurate, with fixing dowels on the wrong centres and some surrounds arriving on the site bent and distorted, which meant straightening them on site before concrete wall units and, subsequently, fibrous plaster inner linings could be fixed. Furthermore, the corner wall blocks required modifying to improve the joint detail where a corner block was adjacent to a window surround (fig.26) Although the window fixing details remained basically the same, it was felt that the profile of the metal surround should be modified to lighten, visually, the heavy framing of the windows. It was accepted by the architects that:

> the inaccuracies in the pressed metal window surrounds on the Infant School were manufacturing "teething troubles" due to the handmade nature of the construction and that jig production would no doubt give a better standard of workmanship on the forthcoming Junior School.[13]

Again due to inaccuracies in manufacture, it had proved difficult to fix the pressed steel fascia to achieve a straight line, thus a heavy steel gutter was substituted for the fascia on the Junior section, which seemed to improve matters in practical terms but had a significant effect upon appearance.

As the design for the Junior section of Cheshunt progressed the architects made the following observations concerning the exterior:

1. Window openings of less than a full 8 ft. 3 in. bay width were desirable for many positions in the school.

2. The erection of horizontal block walling necessitated an uneconomical amount of scaffolding on a single-storey building.

3. The frequency of the horizontal joints was thought to produce an unnecessary number of possible danger points to water penetration.

4. The overhanging eaves were an expensive detail necessitating a considerable amount of work and careful supervision on site.

5. The standard of workmanship in laying site concrete suggested that it would be difficult to obtain a satisfactory fair face to the outside of the edge beam.[14]

Within the building the main problem the architects faced was finding a suitable form of partition construction; one which could be factory produced rather than require the skilled site labour which all in situ methods hitherto had required. Durability in school use and site handling were also important considerations. Lacey & Swain recalled that:

> It seemed possible that fibrous plaster would meet these requirements, and since several of the architects had worked with a fibrous plaster firm (Dejong Ltd.) during the war, it was decided to approach this firm. After some collaborative work a series of honeycombed panel units were developed; the requirements, in terms of the thickness, length, height and fixings to be provided, were supplied by the architects and the structural details of the panels were designed by the manufacturer.[15]

Indeed its very flexible nature suggested the material was most suitable for partitions, cornices and sundry linings as it could easily be moulded to conform to the shapes dictated by the structure. However, the erection process was slowed down by the size and weight of the partition units. This, and complications in manufacturing the honeycomb core, made it more expensive than anticipated. It was therefore proposed to Dejongs that a woodwool core should be substituted for the honeycomb. This reduced the thickness and weight, simplified manufacturing and brought down the cost. After several mock-up panels had been made up by Dejongs and tested by the architects for toughness, rigidity and durability, the improved partition was used on the Junior section. Although manufacture and erection went smoothly, the finished product depended on the number of plasterers available and still was not as speedy as had been wished (fig.27).

If there was no time to stand back and admire their work, there was good reason to be optimistic. The "traditional materials" hurdle had been cleared and it seemed that every aspect was sound even though it could be improved upon. As far as labour was concerned the process produced an unexpected bonus, as Eric Bird wrote in 1949:

> A not unimportant feature of the general scheme is that in several instances the suppliers fix their own products; for example, the steelwork supplier erects the framework. This results in the suppliers themselves taking great care that their units are accurately made and delivered quickly; it also widens the field of labour beyond the county, because much of the total man hours expended on a school is of labour in other parts of the country; it also avoids argument between the general contractor and the suppliers.[16]

The modifications made to the prototype construction in the remainder of the Cheshunt school were necessarily minor; there was to be no break in operations between the two sections. Essendon JMI School was constructed concurrently with, and from the same "kit" of components as the Cheshunt Junior section. Architecturally it was the more pleasing of the two, set in idyllic rural surroundings and relating sensitively to its south-sloping site (figs.34 - 38). It was completed in September 1948, four months after Cheshunt.

The joint exercise of examination and analysis, by architect and manufacturer, was possibly no more than logical, or even obvious. It can however be pinpointed as the beginning of Development Group Working which was soon to become an important part of the post-war school building programme in Britain.[17] The commencement and completion dates show how the programme phases overlapped; development analysis began before each phase was completed in order to influence the following batch of projects already at the design stage. Cheshunt JMI, Hertfordshire's first post-war school, took a total of fourteen months (two years if the preliminary investigations are included) to build but by the time it was completed in May 1948, all the schools of the 1947 Operational Programme had been designed, approved and had been actually under construction for at least six months.[18]

Notes to Chapter 9.

1. Hilcon products continued to be marketed by Hills for many years to other Education Authorities who required complete systems of construction, whilst fabricating only the steel frame for Hertfordshire.
2. W.D. Lacey and H.T. Swain, "Hertfordshire schools development."

AJ, 12 May 1955, p.646.

3. Letter from Towndrow and Ransom (consultant architects to Hills) offering to set up a first meeting at Hills's factory. 1 Jan. 1946. Gen.13

4. W.D. Lacey and H.T. Swain, op.cit.,p.648.

5. HCC Architects Department "On the design of primary schools," AJ, 16 Oct. 1947, p.341.

6. CA letter to County Accountant, 18 Feb.1947. E444C.

7. W.D. Lacey and H.T. Swain, op.cit., p.648.

8. Ibid. 9. Ibid., p.650.

10. Ibid.

11. CA letter to Hills 19 July 1947. E456C

12. W.D. Lacey and H.T. Swain, op.cit., p.650.

13. Ibid., p.651. 14. Ibid.

15. Ibid., p.649.

16. Eric Bird, "The post-war schools of the Hertfordshire County Council." RIBAJ, Sept. 1949, p.476.

17. MOE, The story of CLASP, Building Bulletin no.19, June 1961, pp. 5 - 10.

18. HCC, New schools Building Programme, See Appendix 5.

Figures 20-28.

20. Isometric diagram of steel frame components used in prototype, Cheshunt Burleigh School Infants section. (Architects Journal, 12 May, p.648)

21. Steel roof beams and concrete roofing blocks. (ibid.)

22. Steel window and concrete wall block construction. (ibid,p.649)

23. Fibrous plaster internal walling construction. (ibid,p.649)

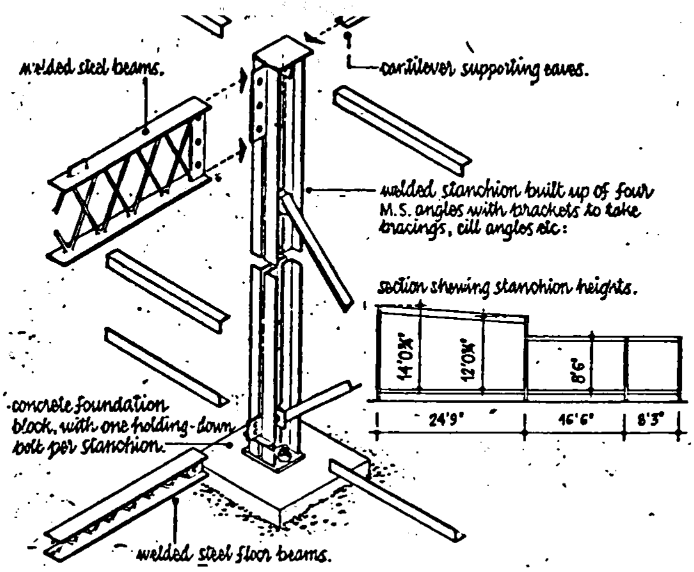
24. Cheshunt Burleigh School Junior section: development of the prototype construction; also used at Essendon JMI School. cf. fig.20. (Architects Journal,12 May 1955, p.650)

25. Development of roof construction. cf. fig.21. (ibid,p.650)

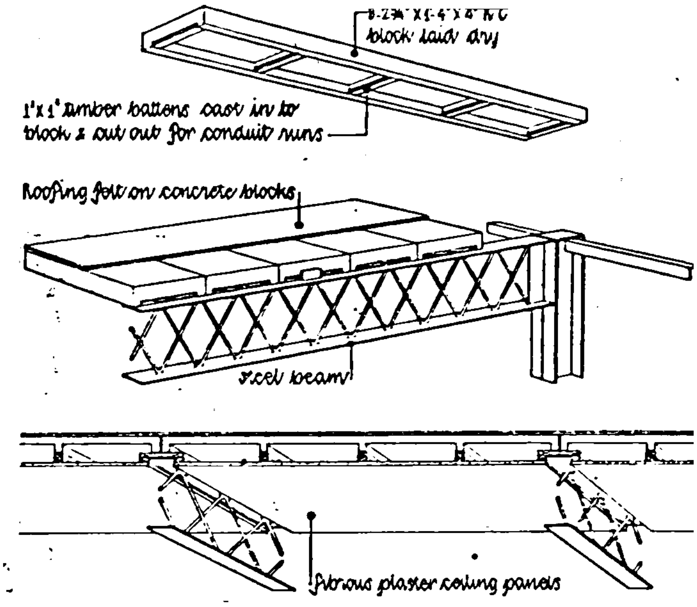
26. Development of external walling. cf. fig.22. (ibid,p.651)

27. Development of internal walling. cf. fig. 23. (ibid, p.651)

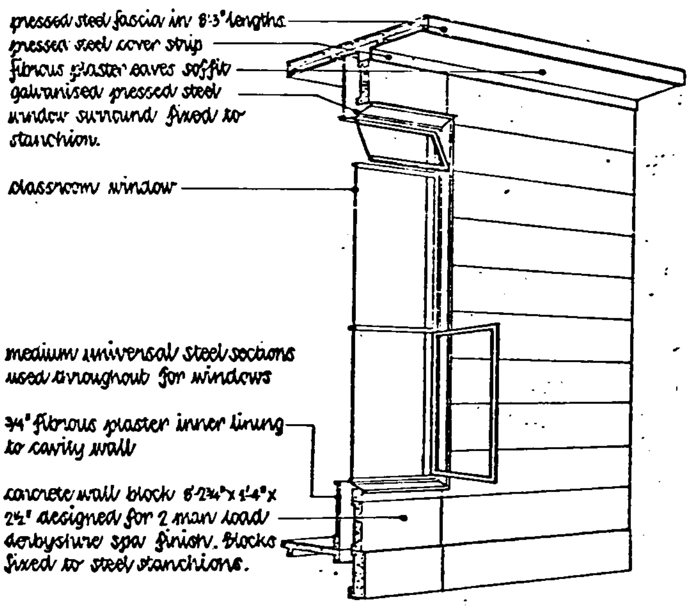
28. Burleigh school frame of Junior section with Infants prototype in the background. (Architects Journal, 16 Oct. 1947, p.340)


welded steel beams.
cantilever supporting eaves.
welded stanchion built up of four M.S. angles with brackets to take bracings, cill angles etc:
section showing stanchion heights.
14'0¾"
12'0¾"
8'6"
24'9"
16'6"
8'3"
concrete foundation block, with one holding-down bolt per stanchion.
welded steel floor beams.

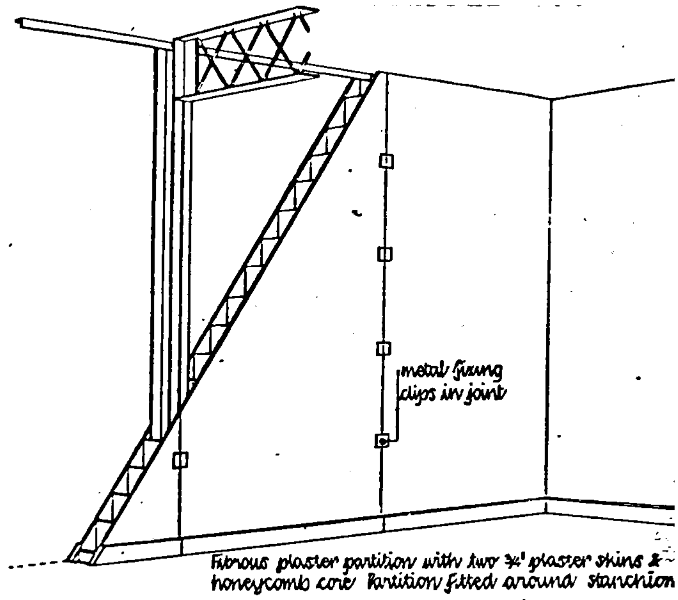
20.


block laid dry
1"x1" timber battens cast in to block & cut out for conduit runs
Roofing felt on concrete blocks
steel beam
fibrous plaster ceiling panels

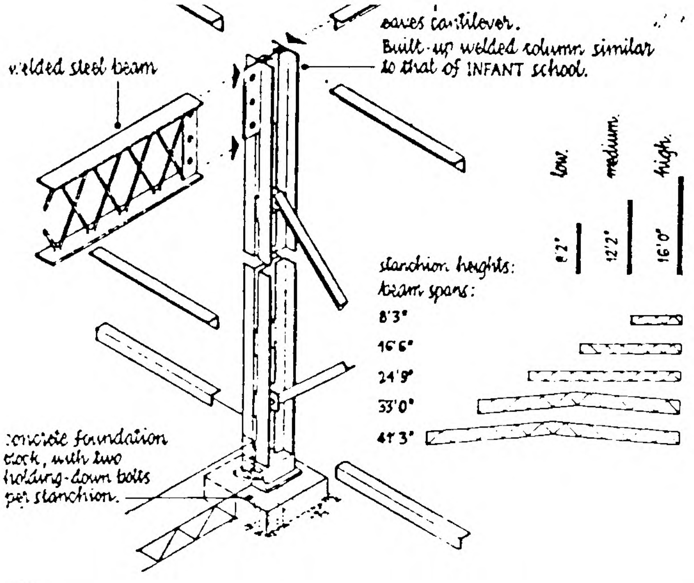
21.


pressed steel fascia in 8'3" lengths
pressed steel cover strip
fibrous plaster eaves soffit
galvanised pressed steel window surround fixed to stanchion.
classroom window
medium universal steel sections used throughout for windows
¾" fibrous plaster inner lining to cavity wall
concrete wall block 8'2¾"x1'4"x 2½" designed for 2 man load derbyshire spa finish. Blocks fixed to steel stanchions.

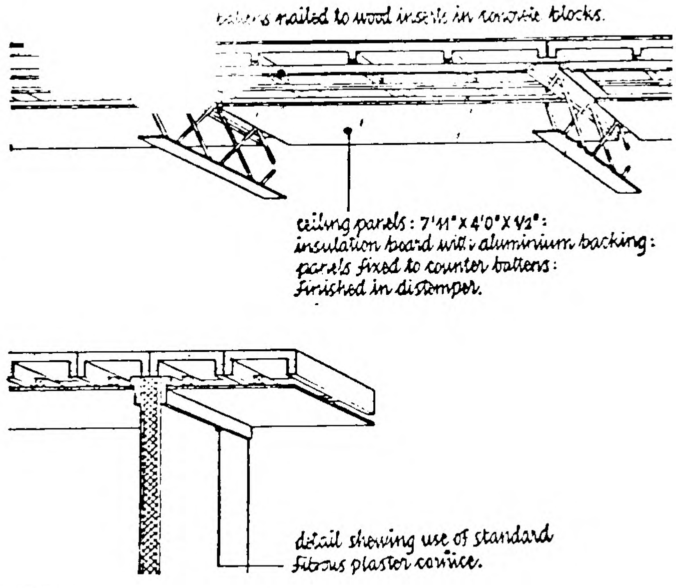
22.


metal fixing clips in joint
fibrous plaster partition with two ¾" plaster skins & honeycomb core. Partition fitted around stanchion

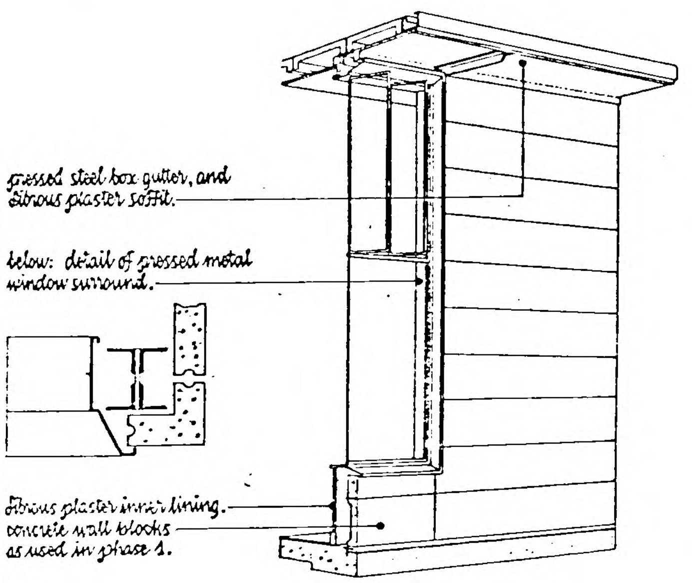
23.


eaves cantilever.
Built-up welded column similar to that of INFANT school.
welded steel beam
low.
medium.
high.
8'2"
12'2"
16'0"
stanchion heights:
beam spans:
8'3"
16'6"
24'9"
33'0"
41'3"
concrete foundation block, with two holding-down bolts per stanchion.

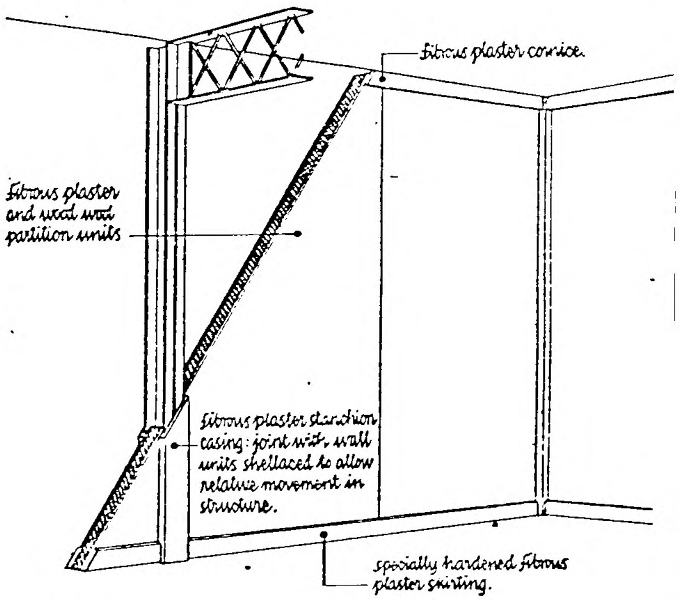
24.


nailed to wood inserts in concrete blocks.
ceiling panels: 7'11" x 4'0" x 1/2":
insulation board with aluminium backing:
panels fixed to counter battens:
finished in distemper.
detail shewing use of standard fibrous plaster cornice.

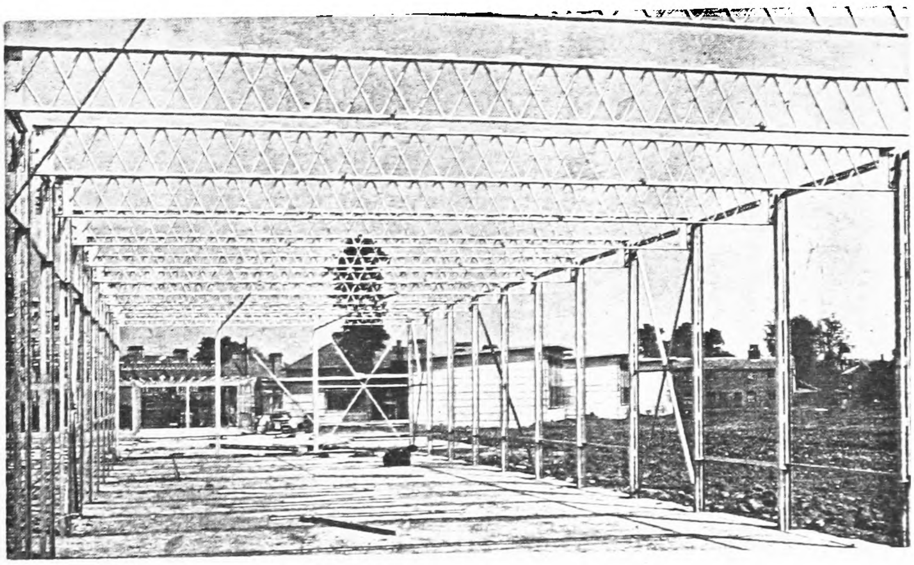
25.


pressed steel box gutter, and fibrous plaster soffit.
below: detail of pressed metal window surround.
fibrous plaster inner lining.
concrete wall blocks as used in phase 1.

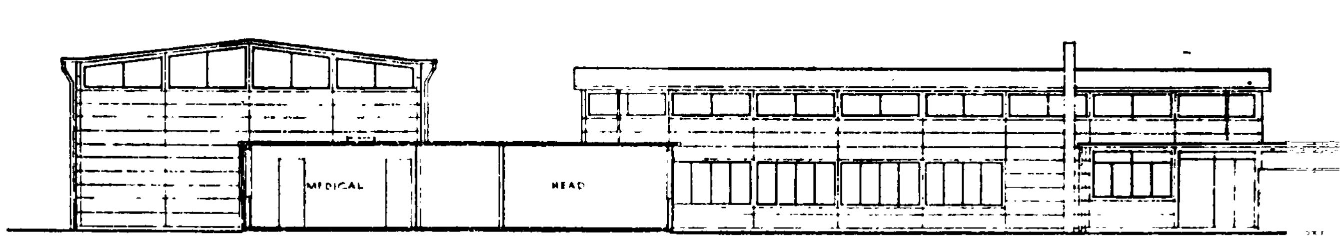
26.


fibrous plaster cornice.
fibrous plaster and wood wool partition units
fibrous plaster stanchion casing: joint with wall units shellaced to allow relative movement in structure.
specially hardened fibrous plaster skirting.

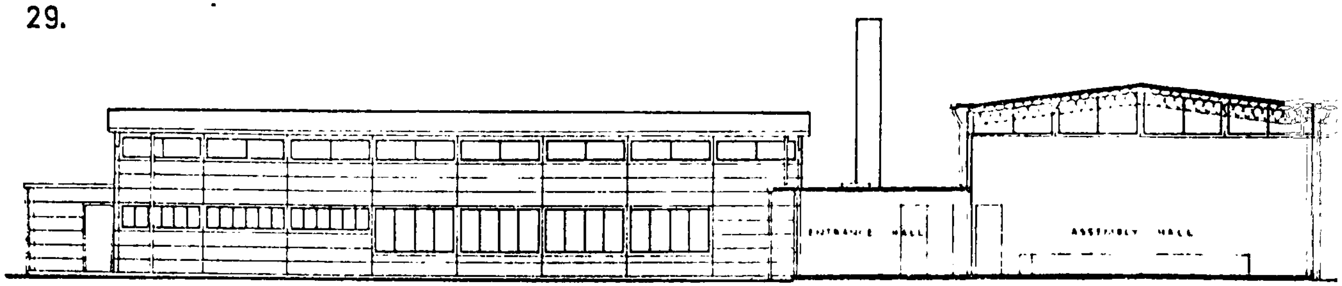
27.



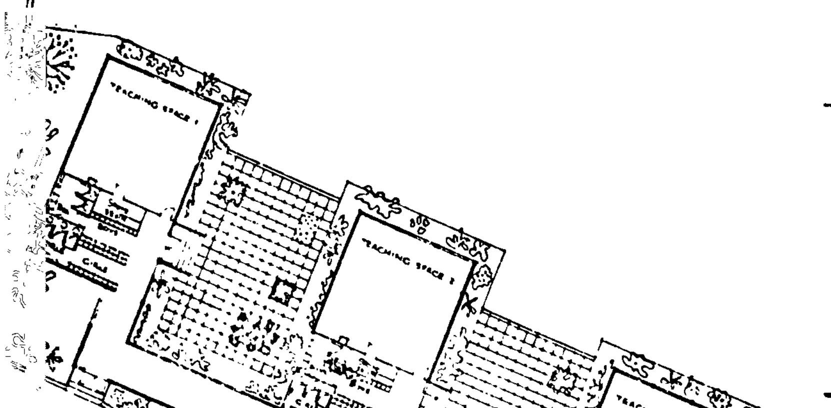
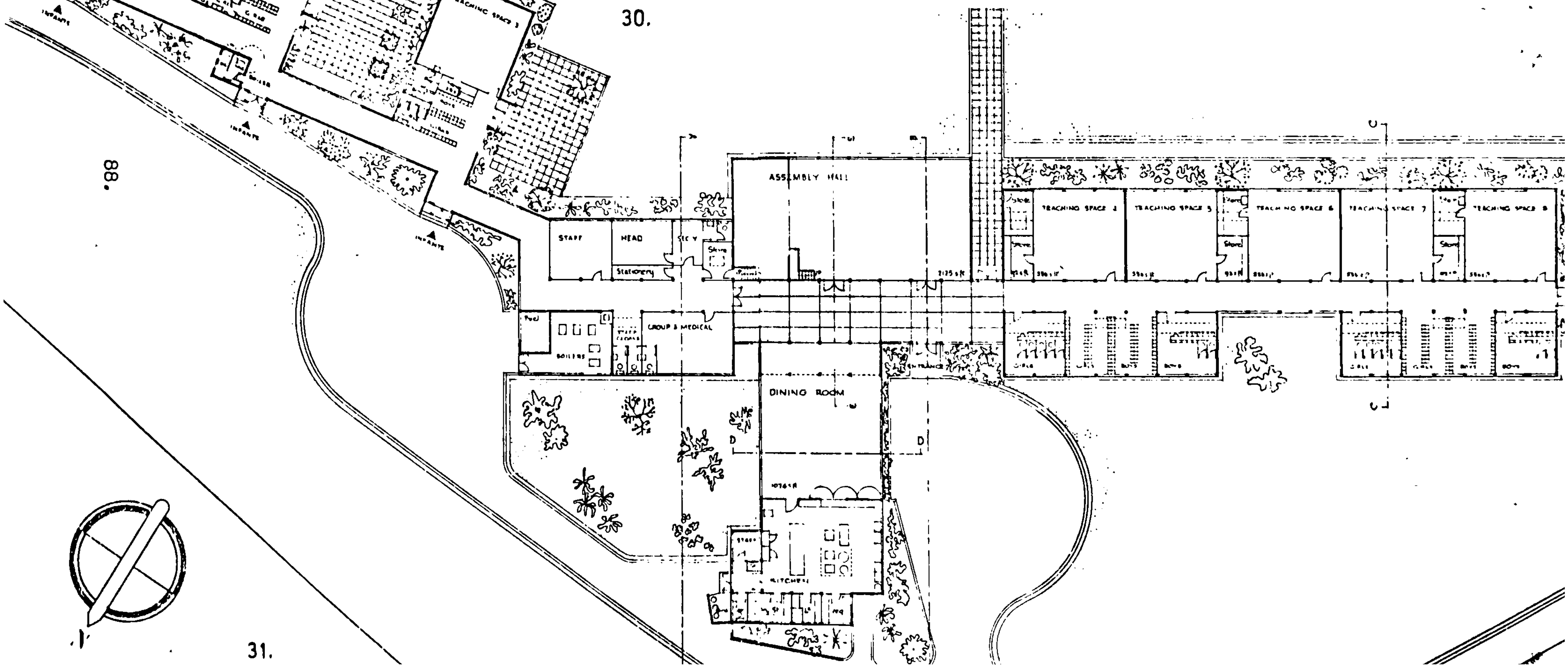
28.


MEDICAL
HEAD

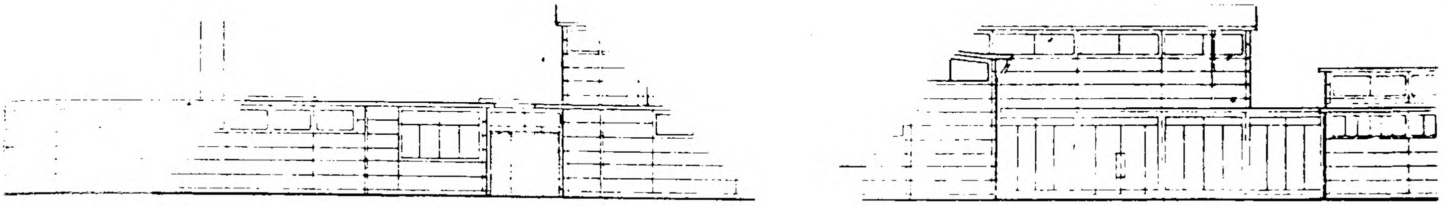
29.


ENTRANCE HALL
ASSEMBLY HALL

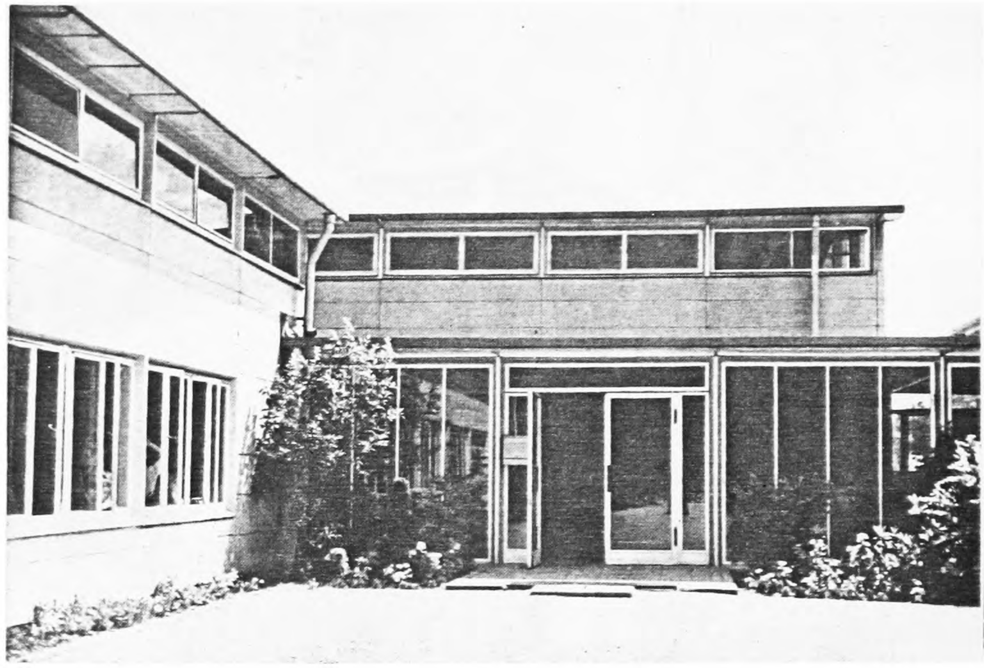
30.



TEACHING SPACE 1
TEACHING SPACE 2
TEACHING SPACE 3
INFANTS
ASSEMBLY HALL
STAFF
HEAD
SEC'Y
Stationery
Store
GROUP & MEDICAL
BOILERS
Fuel
DINING ROOM
KITCHEN
ENTRANCE
TEACHING SPACE 4
TEACHING SPACE 5
TEACHING SPACE 6
TEACHING SPACE 7
TEACHING SPACE 8

31.



32.



33.

Figures 34-38.

29. Burleigh School sectional elevation A-A. (HCC Drg.no.E444/A 34)

30. Burleigh School sectional elevation B-B. (ibid.)

31. Burleigh School: plan of complete school. The Infants section comprises the three angled classrooms to the north east. (HCC Drg.no. E444/A 33)

32. Burleigh School, north-west elevation to Junior section. (HCC Drg.no. E444/A 34)

33. Burleigh School, view of main entrance; see fig.32. (HCC Building for education 1948-61, p.7)

34. Essendon JMI School, cross-section. (HCC Drg.no. E456/13)

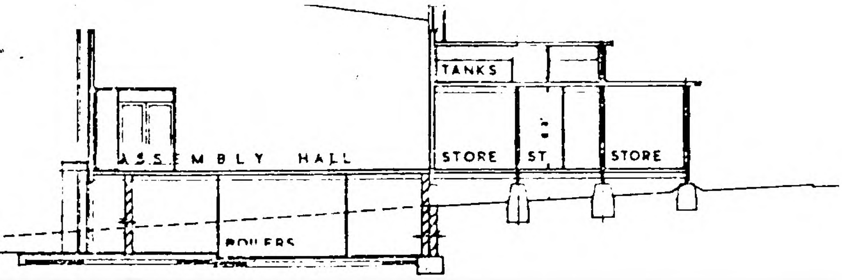
35. Essendon School, view from south. (Architectural Review, Sept. 1949, p.161)

36. Essendon School, assembly hall. (ibid., p.162)

37. Essendon School, entrance hall with sculpture, (ibid.)

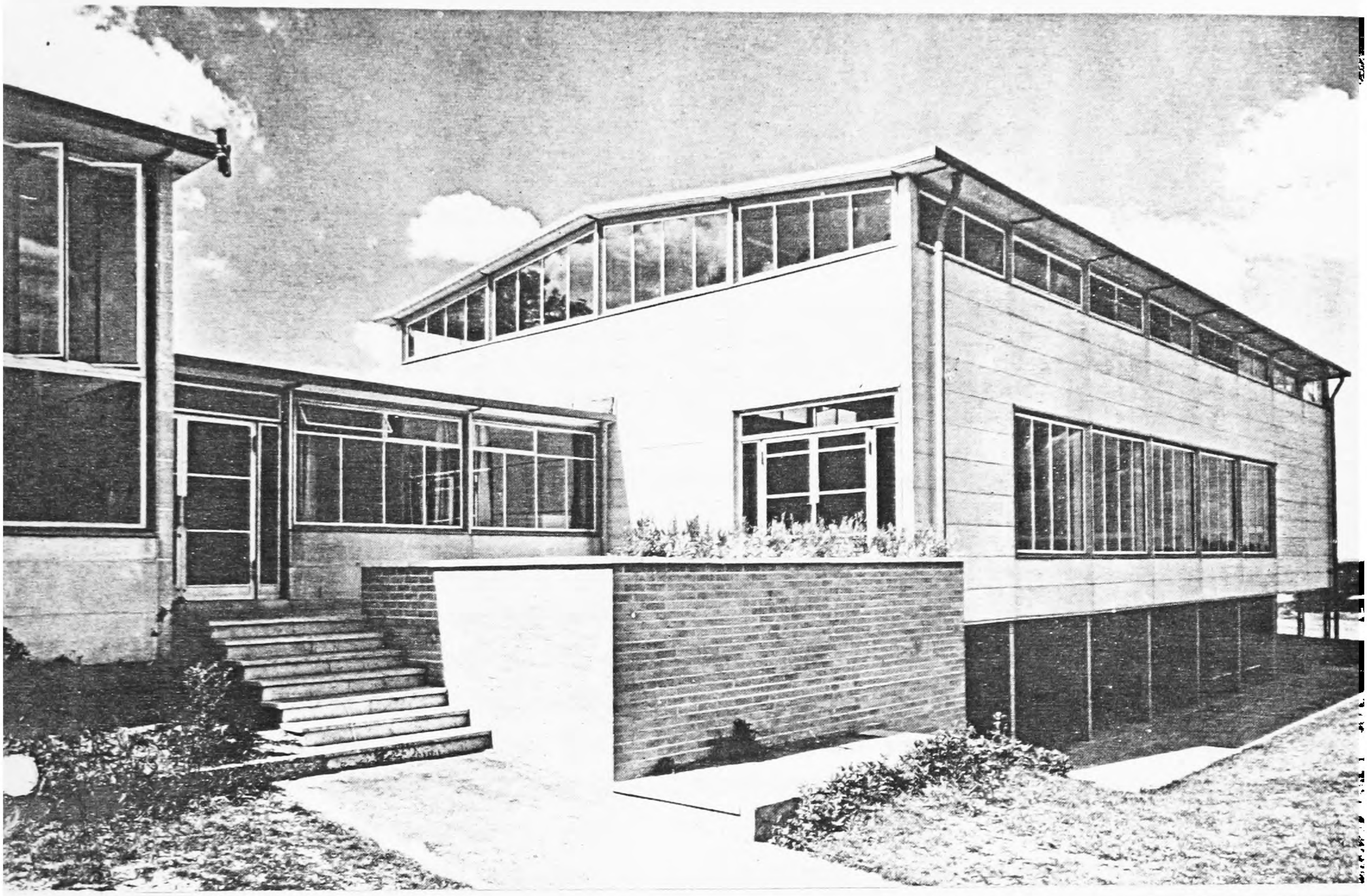
38. Essendon School, plan. (HCC drawing originally published in Architects Journal, 16 Oct. 1947 p.341.

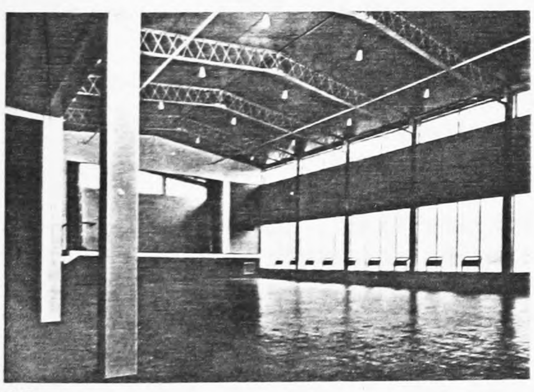
35.



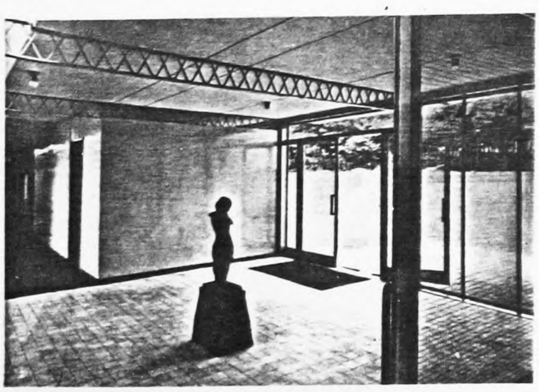
TANKS
ASSEMBLY HALL
STORE
ST.
STORE
BOILERS

34.

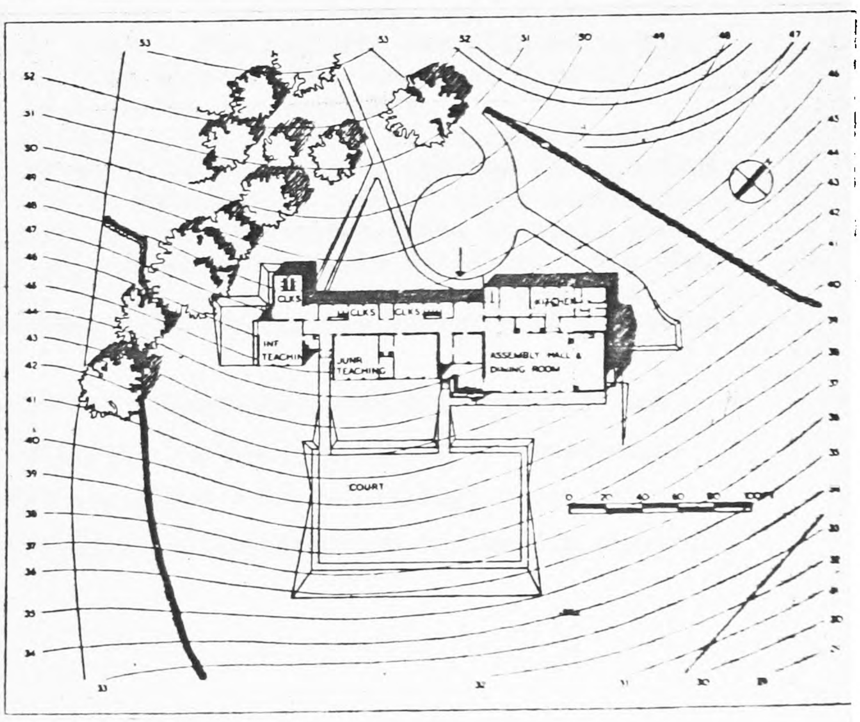




36.



37.



KITCHEN
INT TEACHING
JUNR TEACHING
ASSEMBLY HALL & DINING ROOM
COURT

38.

Chapter 10

THE 1947 OPERATIONAL PROGRAMME

We have seen that Cheshunt had been identified in September 1945 as the top priority area for building a new primary school, with Essendon coming next after the flying bomb incident. In the south-west corner of the county there was similar urgency and a design had been prepared for an Infants School in Malvern Way, Croxley Green. In his report to the Primary Sub-Committee meeting of 21 December 1945 the County Architect advised:

> It has become clear that the four temporary classrooms envisaged a year ago will not now be sufficient and that since some considerable time is likely to elapse before building in permanent material can take place, the County Council ought to proceed at once with the erection of a hutted school.[1]

However, the report concluded with the proviso that because the huts were only 24 feet wide, it would be more advantageous to defer the building of the assembly hall to a date when "some better method of construction can be employed." Nearly fourteen months after the Sub-Committee had approved the change to "light construction" at Cheshunt he reported again on the Croxley Green project; the minutes of the meeting, held on 30 May 1947, summarizing the progress which had been made. May was the month when work on Cheshunt's second phase, and on Essendon JMI started on site:

> Plans and the schedule of accommodation for an Infants' School for 320 pupils, at Malvern Way, Croxley Green, were approved by the Committee in April, 1946. The building was planned in Ministry of Works Standard Huts since at the time that form of building appeared to be the only one available.
>
> Subsequent discussions at the Ministry of Education made it clear that the Ministry would be prepared to approve the erection of the School in the County Architect's form of light construction. This was obviously a great advantage since it would give a permanent school as opposed to a temporary building. The plans were therefore redrawn, though no alteration was made in the schedule of accommodation, submitted to the Ministry of Education and approved.[2]

All the schools for which hutted schemes had been prepared were now reprieved. At the same Committee meeting, schedules of accommodation were presented for a further eight schools, making up the total of eleven intended as Hertfordshire's contribution to the Ministry of

Education's first Operational Programme.

The chief object of this national programme was to complete as many classrooms as possible in each school during 1947.[3] The request for Hertfordshire's programme to be submitted to the Ministry was made in August 1947. By that time, sufficient progress had been made on the Cheshunt and Essendon Schools for it to be apparent that the steel quota allowable for classrooms would be sufficient for a whole school built in their experimental method, a fact which must have given great encouragement to the architects. The County Education Department, for their part, being so far advanced with their Development Plan, were able to say immediately what schools were required for the 1947 building programme.[4] Approval had already been given to the redesign of Cheshunt in light construction, and also to Essendon. These two, together with nine other complete primary schools, formed the first building programme and the first production run for the prefabricated construction system. Although there were some doubts as to whether or not the existing administrative machinery could cope with it, the prototype work had shown that it was at least technically possible.

The process of analysis and appraisal, which had started immediately the prototype began, was continued without a break; the structure employed for the 1947 programme can thus be regarded as stage three of development of the Hertfordshire method. However arbitrary the dimension of 8' 3" was in its origins, a grid of that module appeared to be a satisfactory basis for design; but the architects were under no illusions about any special virtues being attributed to the dimension. In January 1948 they wrote:

> Indeed, it was selected rather arbitrarily, firstly because it was recommended in the Wood Report, and secondly because the manufacturers had some plant already jigged for it.[5]

A common criticism made by detractors of grid planning was that grid dimensions can seldom equate with required floor areas, and that consequently, building and room plans must inevitably be under or over sized. The ability of the 8' 3" grid to provide the flexibility required in adapting to differing site conditions is well illustrated by the plans of the schools themselves (figs. 43 - 48).

Although bearing some resemblence to pre-war antecedents at

Impington and Richmond (figs. 8, 9) in the open-aspect character of the plans, they projected a simple honesty of expression that is refreshing even today. The response of the teachers to these schools will be discussed in Chapter 16. For the moment we will examine the further development of their construction technique.

The foremost development task, after the experience of Cheshunt and Essendon, was to standardise the steel frame and, in particular, to reduce the number of stanchion types. One of the Hertfordshire architects actually worked at Hills's works for several months during this period, ensuring by on the spot supervision that drawings and components matched realistically.[6]

After several meetings between architects, production engineers and design engineers at Hills it was agreed that the web and four 2" x 2" x $\frac{1}{4}$" angles which had gone to form the I section of the stanchion should be rearranged in "open square" box form.[7] This meant a better distribution of steel and, most important, that identical connection to any face was possible. This, in turn, meant that not only could the stanchions be standardised, but so could the lengths of beams carried by them. The beams were themselves modified by substituting a single instead of double lacing to the webs (figs. 39, 49).

The remaining changes were mainly concerned with the cladding and roofing elements: horizontal cladding blocks were changed to vertical (for reasons to be discussed presently) and the projecting eaves feature was dispensed with for the 1947 programme (fig.41). Vertical cladding blocks required horizontal rails, spanning between stanchions, to carry them and cantilever brackets at roof level were not required. The advantages of these changes to the steel frame were listed as follows:

(1) All possible combinations of beam connections, windows, wind bracings and cladding rails were catered for. Drawing office work was simplified by punching the shaft with the maximum number of holes necessary to deal with any combination of parts.

(2) The number of stanchion types for a single storey building was reduced to 3 (low, medium and high).

(3) A convenient change of level, 3 ft. 5$\frac{1}{2}$ in., between parts of the school could be achieved with the standard heights.

(4) Cables and pipes up to 1$\frac{1}{2}$ in. dia. could be passed through the stanchion vertically and horizontally.[8]

As far as design was concerned, steelwork drawings became simply layout drawings; one set of details applied to all conditions:

> This approach has meant a reduction in the number of steelwork drawings for each school from 60 - 70 to 2, one showing the setting out for the jig and the other the general arrangement of the steel components.[9]

Likewise, all the attendant fibrous plaster linings and coverings could be standardised.

For the manufacturer, it meant that he could produce standard components as best suited him and stockpile them against future site requirements. The steelwork was more straightforward to manufacture and significantly quicker to erect because of the greater speed with which components could be identified by steel erectors on site. However, the steel frame now required pad foundations which meant that some of the time-savings had to be offset on account of the time taken to hand-excavate and pour the concrete pads.

The steelwork had advanced from the position on the prototype (where almost every component was unique) to there being, in addition to the three basic stanchions, just six beams. Including ties, braces and half-stanchions there was now a total of 27 parts.[10] All could be mass produced irrespective of the school in which they were destined to be used. As with Meccano, the architect could assemble these components to suit his particular design.

One thing militated against these advances: the shortage of materials and skilled labour. In order to see just what the time-saving potential was at this stage, the architects and Hills jointly mounted a carefully planned and controlled experiment on two schools. Using the greatest feasible number of steel erectors, they found that:

> Half of the steel frame of a 2,000 sq. yd. school was put up in one day. A considerable labour force was employed, and yet no undue overcrowding was experienced. This was done for two schools, but, of course was something of a "stunt" and was not an economical proposition for the steel erector. The steel frame of one of these schools was then roofed and walled in with concrete slabs in 10 days. One bricklayer and one labourer can bolt up, grout in, and point up, approximately 212 sq. ft. of walling in one day.[11]

Clearly the revised frame was capable of very speedy erection but site economics prevented repetition of such a performance. Every means of shortening overall time was sought and a welcome aid was received when the Ministry of Education arranged for soil surveys to be made for each site by the Ministry of Works Soil Survey Section. This was not a common practice in those days and it enabled considerable savings of time and money to be made.

Replacing the suspended floor with a solid in situ ground slab (for the reasons of economy of steel and improved thermal insulation) meant that sites had first to be excavated to form level platforms before steel erection could proceed. After this operation was complete a steel jig, consisting of a framework designed to locate the holding-down bolts accurately, was used. The jig was capable of being used in several combinations, to produce any plan shape, and was adaptable for use on sloping (stepped) sites. Two such jigs were in use for this programme, being transported from site to site as required.[12]

It was noted on the prototype that the 1' 4" wide roofing blocks did not have a modular relationship with the 8' 3" steel frame. This discrepancy resulted in some 5 - 10 per cent of the roof deck having to be cast in situ, taking nearly as long to lay as the precast remainder. A dimensional design change was highly desirable but Hills were unable to take on the manufacture of a new roof unit on account of the other commitments of their concrete subsidiary, Hilcon.[13] At this point it seemed sensible to introduce, for the first time, a second sub-contractor: a local firm, Millbank Floors Limited, who were already producing a similar roofing unit of their own, were approached and rapidly appointed.

A new range of standard blocks was designed in collaboration with the firm's managing director, who was also their designer. By the simple expedient of making every seventh joint in the roof deck coincide with a steel frame grid line, all in situ work was eliminated.[14] The softwood inserts, cast-in for fixing the ceiling battens, were dropped below the level of the ribs, enabling trimming to be completed in situ to take up fixing and casting irregularities (fig.40). As a block now always occurred in the centre of a bay, the cast-in inserts served also for mounting electric light fittings; by introducing a notch in the ribbing it became possible for electrical cables to pass to any point on the plan without chasing. Speedier handling was facilitated by casting-in carrying loops enabling accurate lowering into position to proceed without damage to neighbouring units.[15] Once laid, the deck was covered with a vermiculite-and-sand levelling screed, providing insulation equivalent to that achieved by the lightweight concrete panels formerly provided in the units. This enabled both panel and ribbing to be cast in the same mix of dense concrete. The soft insulating screed was found to need more control of workmen to avoid damage before the felt-laying was completed.

Again, national shortages impeded production; in this case steel bar reinforcement. Millbank Floors sought to keep up with site demand by salvaging mesh reinforcement from war-time aerodromes and cutting it into bars to place in their blocks; unfortunately blocks reinforced in this way were found, on testing,to be incapable of withstanding the required loading.[16] Despite these problems a new standard block was produced; capable of carrying a constant 30 lb per sq. ft. and which, together with a range of accessories for trimming around rooflights and other apertures, enabled all in situ concrete in the roof deck to be eliminated. It was seen at the time as "contributing to the inevitable tendency of the transfer of skill from the assembly to the design stage."[17]

It appeared that most of the problems of the external walling could be overcome by changing from horizontal cladding blocks to vertical blocks. Vertical blocks could be laid dry and the joints pointed up on completeion and, with a 10" x 2½" thick (dished) unit, they could be laid ten to the 8' 3" bay instead of one. As the main thermal movement of the steel frame was horizontal, it was envisaged that the eleven joints were better able to accommodate this (and manufacturing tolerances) than were the two joints in the horizontal blocks of the previous year.[18] Moreover, the provision of the necessary additional fixing-rail enabled some adjustments in relation to the frame steel to be made. A further important reason for the change to verticality was that openings with horizontal cladding units above or below them (as with windows) were restricted to the full 8' 3" bay or nothing. With vertical units, however, openings could be varied according to how many "make-up" units were used per bay.

As with the roof blocks, Hills were unable to undertake the manufacture of the new vertical range of cladding blocks and, after advice from the Cement and Concrete Association, arrangements were made with Uniment Limited to produce them. All the design work, including the design and scheduling of reinforcement bars, was done by the architects themselves.[19] On the first projecets in the 1947 programme problems were faced on account of the manufacturer failing to appreciate fully the standards of tolerance and finish required. To remedy this a clerk of works spent some time at the factory inspecting units before they were despatched. Furthermore, it became apparent as the projects progressed that no proper allowance for thermal movement had been made at the junction between roof and wall. This resulted in some hair-cracking in the vertical and bed joints of the cornice blocks.[20] To complete the set of cladding components separate 2" thick blocks were designed to cover the stanchions on the external corners. In all, a typical school employed some 26 - 30 different types of cladding unit which was considered to be no more than on a prefabricated concrete house.[21]

In performance they were an improvement; although still rigidly connected to the stanchions, the cracking in the more numerous vertical joints was noticeably less. But in appearance they were disappointing. The prototype blocks had been faced with a ½" thick, rolled-in, Leighton Buzzard sand facing. For reasons of economy the architects now decided to use a white exposed aggregate facing set in ordinary grey, instead of white, cement which had apparently looked quite satisfactory on a small sample block. Unfortunately the result was far less pleasing than had been hoped; the walls now appeared rather drab, "flat" and uninteresting. Moreover:

> The absence of projecting eaves simplified the detail at the high-low junction and angles, and reduced the number of components required in the eaves and roof steel and concrete units. However, the more severe weathering to which the walls were subjected and the harsher texture of the ballast facing to the blocks gave the schools a severe appearance that seems out of character with their use.[22]

Technically, the difference in manufacturing tolerances between the precise steel frame and the coarser concrete units justified the change. However, though it was never fully exploited in the individual school designs, the flexibility which would allow a closer match with supposed design needs, was sought assiduously.

Appearance came into it too. The architects believed the horizontally laid units "destroyed the light, steel frame aesthetic" and that "a vertical system of wall cladding would to some extent overcome both aesthetic and technical objections."[23] Despite the drabness, with the stanchions and corners now covered by separate units of a plain, grey cement colour, the steelwork was"expressed" and the bay panels were defined within the frame, resulting in a much improved scale to the overall structure. Although the programme commenced at Cheshunt and Essendon with no preconceived ideas as to the outward appearance of the buildings, a simple philosophy of architectural expression immediately began to emerge in parallel with the technical development. From 1947 onwards there was much heartsearching in choosing external walling and finishes and in reconciling practical realities with aesthetic ideals:

> the ideal element for external walls in the Hertfordshire type of structure would seem to be a light-weight panel with insulating and weather-resisting qualities, which would serve as both external and internal facing and would fit into the frame in the same way as a window. Suitable materials do, in fact, exist but they are either not yet available in sufficient quantity or are too expensive.[24]

No indication as to what these materials were was given, but it can be assumed that the "Holoplast" panels had been noted and indeed experiments were soon to be made with this material.

The fact that Cheshunt and Essendon were some six months from completion when the designs for the 1947 programme were being prepared (and because partitions are invariably erected in the later stages of construction) meant very little experience had been gained from the earlier work. For this reason no changes were made to the partitions for the coming programme. It was obvious that the labour force of a single fibrous-plaster firm simply could not cope with the work required on eight schools. Even though arrangements were made for several additional firms to be engaged, the severe shortage of skilled fibrous-plasterers made delays inevitable. It was therefore decided to build the internal walls surrounding the assembly hall, dining and kitchen areas with clay blocks (plastered in situ) as an expediency to ease the labour problem.

As far as main contractors were concerned, the programme provided experience of the system to four further contractors in addition to Gee, Walker and Slater. All eight contracts commenced on site between June and December 1947 and all were completed by May 1949.[25]

We have examined the beginnings of technical development but what of the schools produced by this first production run, the object of it all? Fundamentally, because "the architect had controlled all aspects of planning and technical research he was able to direct them to serve his design."[26] This key statement provides the clue to the successful application of system building to the school building programme in this country. Equally important was the acknowledgement that "the child and his activities were always the starting point of the plan,"[27] or to paraphrase Le Corbusier, the child was the generator of the plan.

The 1947 programme contained three types of primary school: Infants, (I) Junior Mixed (JM) and Junior Mixed with Infants (JMI); the plans of the JMI schools being designed for eventual conversion to Infants whilst their temporary use as JMI schools was an essential part of the County Educational Development Plan. As all the sites were up to the maximum areas required by the Regulations, it was always possible to plan all of the accommodation at ground level. However, certain limitations accompanied this apparent advantage:

> The Department believes that the largest schools (up to 360 children) have extended single floor planning to its limit. In schools for more than 360 children there seems to be a case for two floor planning. The aim has always been to arrange those parts of the school most frequently used to face both the best aspect and the pleasantest view and at the same time avoid overlooking hard surfaced play areas.[28]

The plans tended to resolve themselves into three distinct groups of accommodation: a nucleus of communal areas such as entrance space, assembly and dining halls; the teaching spaces with their associated cloakrooms and lavatories; and the staff accommodation. Despite the comment made by the architects in 1949 that "an attempt has been made to avoid long, unbroken lengths of corridors and classrooms by suitable grouping of teaching spaces about the communal section,"[29] long circulation spaces are characteristic of the 1947 plans (figs. 43 - 48). However, in none of them is there that institutional feeling often experienced in the progressive pre-war Middlesex schools. The use of colour in the articulation of functional areas had much to do with this, a matter we will examine in detail in a later Chapter. In the words of the architects:

> It was thought to be necessary that the school should have a scale appropriate to the child and his environment, and for his environment to be an interplay of exterior and interior spaces; to have freedom, intimacy, lightness, colour, gaiety and surprise.[30]

Unlike their elders had done, the children entered the schools through the main entrance halls and not through the dingy back doors of cloakrooms and lavatories. The infants were provided with separate entrances to their own indoor and outdoor teaching spaces, cloakrooms and lavatories, usually grouped as self-contained units. All the teaching spaces were three (8' 3") bays square in order to provide the most flexible area in which a variety of furniture groupings could be arranged. (fig. 49).

The teaching environment and the architectural values of the early Hertfordshire primary schools will be discussed more fully in later Chapters of this study. They will be examined particularly in terms of architect-teacher relationships and their impact as a new architecture in which functional requirements were paramount will be seen through the eyes of contemporary commentators.

Notes to Chapter 10.

1. HCC 21 (25) item 64, p.182, Croxley Green School accommodation. Malvern Way Infants School, Primary Sub-C., 21 Dec. 1945.
2. HCC 21 (26) item 7 p.3 Croxley Green Malvern Way Infants School Primary Sub-C., 30 May 1947.
3. MOE Circular No.122, 22 Aug. 1946: Building projects for the Calendar year 1947, and Circular No.134, 19 Dec. 1946: The educational building programme 1947.
4. County Development Plan Survey, E 518A (1945) 638.
5. "Planning the new schools", A & BN, 16 Jan. 1948, p.50.
6. Robert Post, "Architect/Manufacturer Co-operation" AR Dec. 1954, p.411. See also HCC "On the design of primary schools" AJ, 16 Oct. 1947, p.342.
7. E 555 D (47 - 48) 181.
8. W.D. Lacey and H.T. Swain, "Hertfordshire schools development: 2," AJ, 26 May, 1955, p.720
9. HCC Architects Department, "On the design of primary schools", AJ, 16 Oct. 1947, p.344.
10. Ibid.
11. Eric L. Bird, "The post-war schools of the Hertfordshire County Council", RIBAJ. Sept. 1949, pp. 474 - 5.
12. HCC Architects Department, Op.cit. (16 Oct. 1947) p.346.
13. W.D. Lacey and H.T. Swain, op.cit., p.720.

14. E 555I (47 - 49) 437.

15. W.D. Lacey and H.T. Swain, op.cit., p.720.

16. Ibid.

17. HCC Architects Department op.cit. (16 Oct. 1947) p.345.

18. Ibid., p.344.

19. E 555L (47 - 51) 437.

20. W.D. Lacey and H.T. Swain, op.cit., p.721.

21. HCC Architects Department, op.cit. (16 Oct. 1947) p.344.

22. BRS Note no. C.302, Sept. 1954, p.4.

23. HCC Architects Department, op.cit.(16 Oct. 1947) p.342.

24. "Schools in Herts. building programme" AJ, 20 Oct. 1949, p.432.

25. HCC New schools programme. Appendix 5.

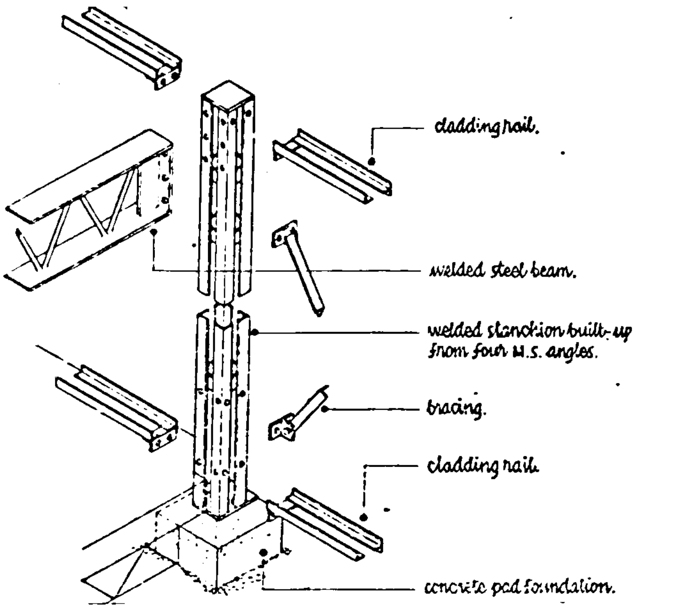
26. HCC Architects Department, op.cit., (16 Oct. 1947) p. 342.

27. Ibid.

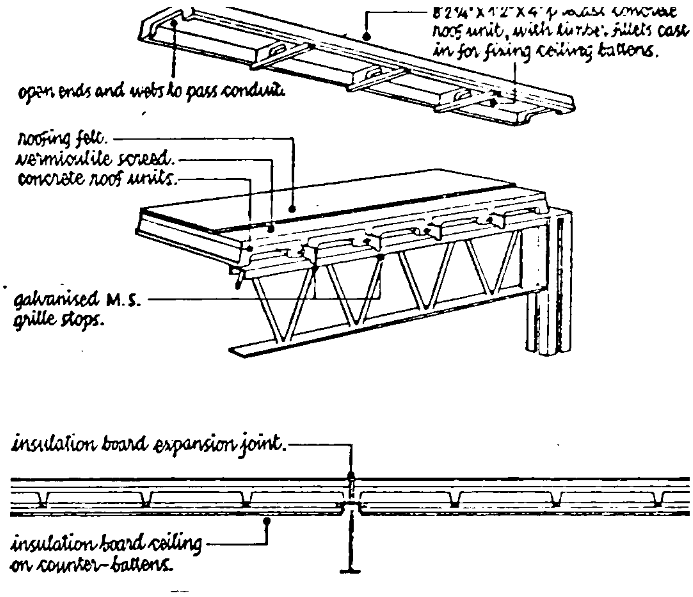
28. Ibid.

29. Ibid.

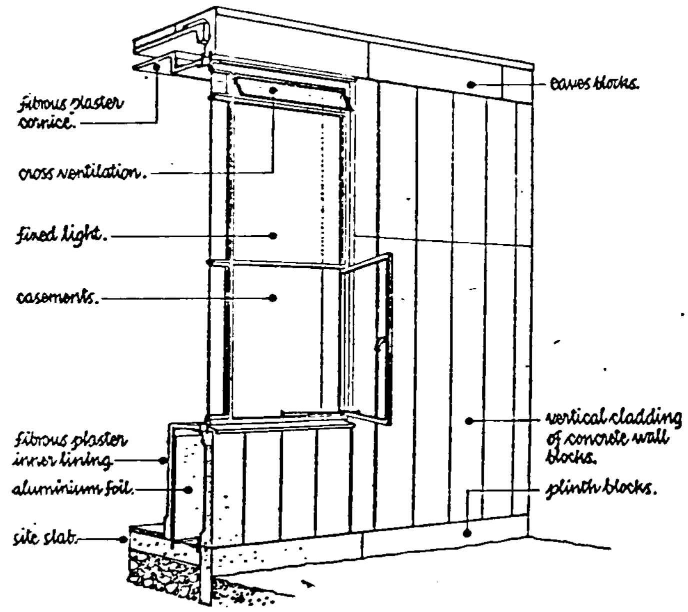
30. Ibid., pp.342, 343.



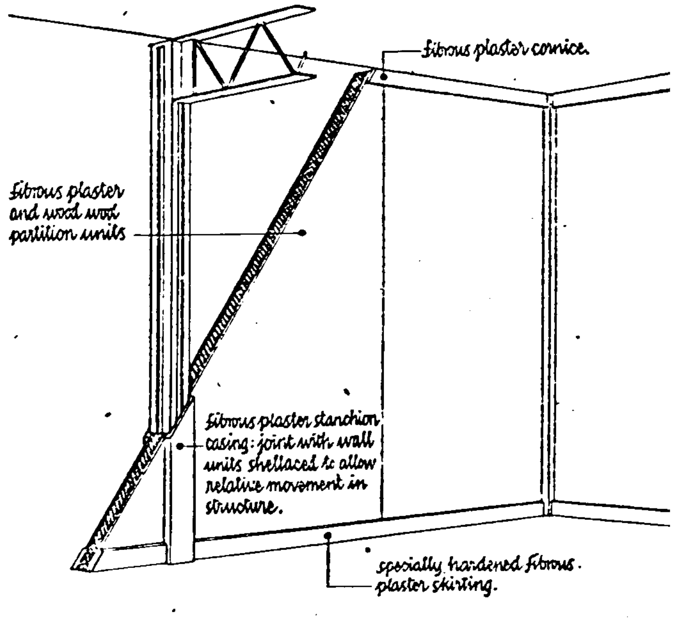
39.



40.



41.



42.

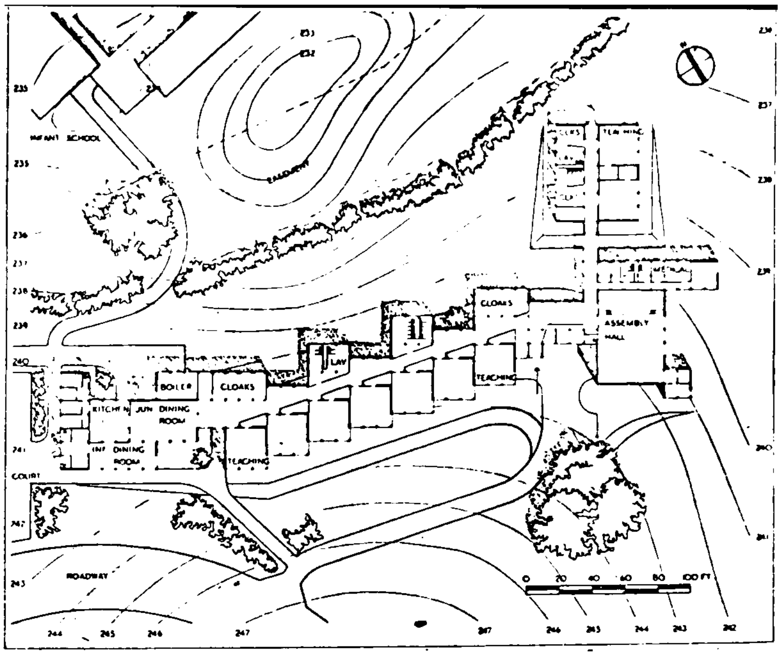
Figures 39-42.

39. Isometric diagram of steel frame components used in the 1947 Programme, cf. fig.24. (Architects Journal, 26 May 1955, p.720)

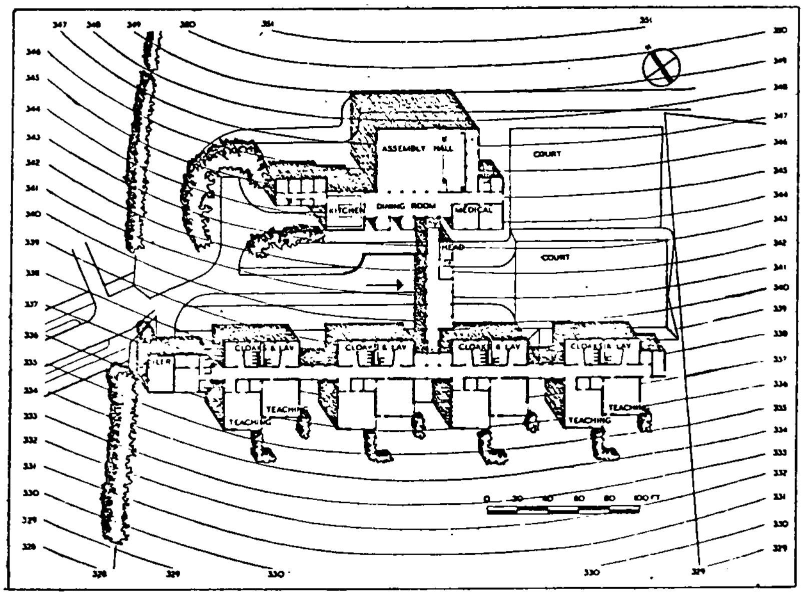
40. Development of roof and ceiling construction, cf. fig.25. (ibid.)

41. Development of external walling, cf. fig. 26. (ibid., p.721)

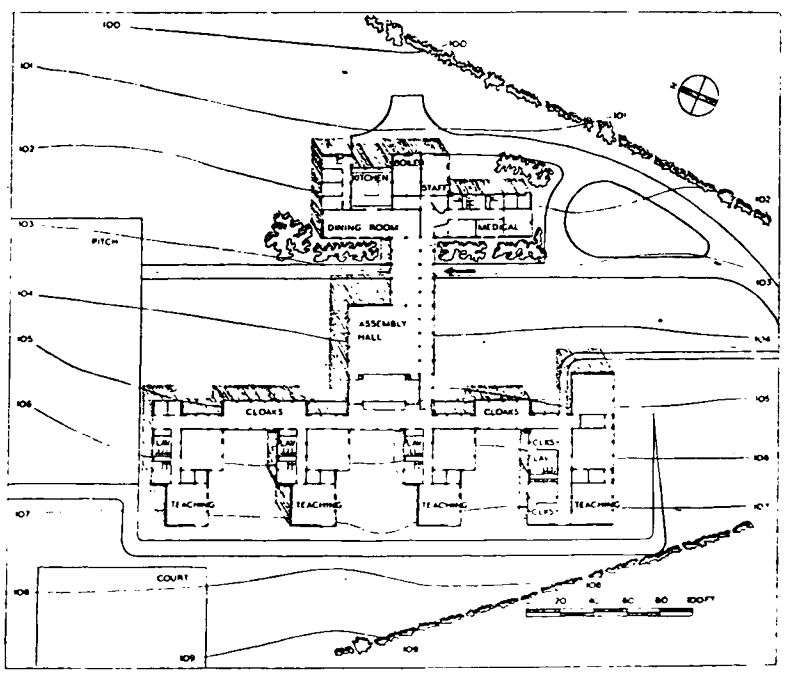
42. Development of internal walling, cf. fig.27. (ibid.)


INFANT SCHOOL
CLKS
TEACHING
CLOAKS
ASSEMBLY HALL
LAV
BOILER
CLOAKS
TEACHING
KITCHEN
JUN DINING ROOM
INF DINING ROOM
TEACHING
COURT
ROADWAY
0 20 40 60 80 100 FT

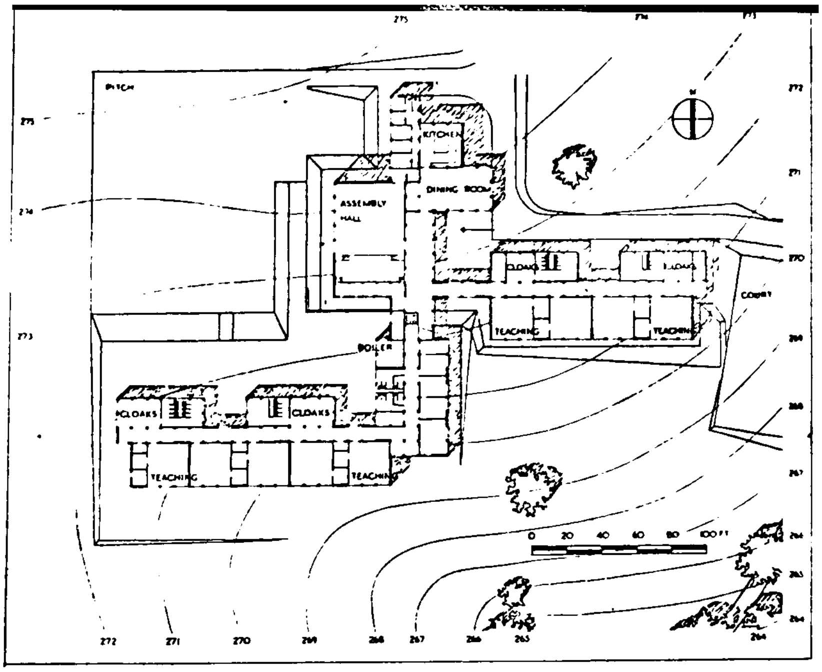
43.


ASSEMBLY HALL
COURT
KITCHEN
DINING ROOM
MEDICAL
HEAD
COURT
CLOAKS & LAV
CLOAKS & LAV
CLOAKS & LAV
CLOAKS & LAV
TEACHING
TEACHING
TEACHING
TEACHING
100 FT

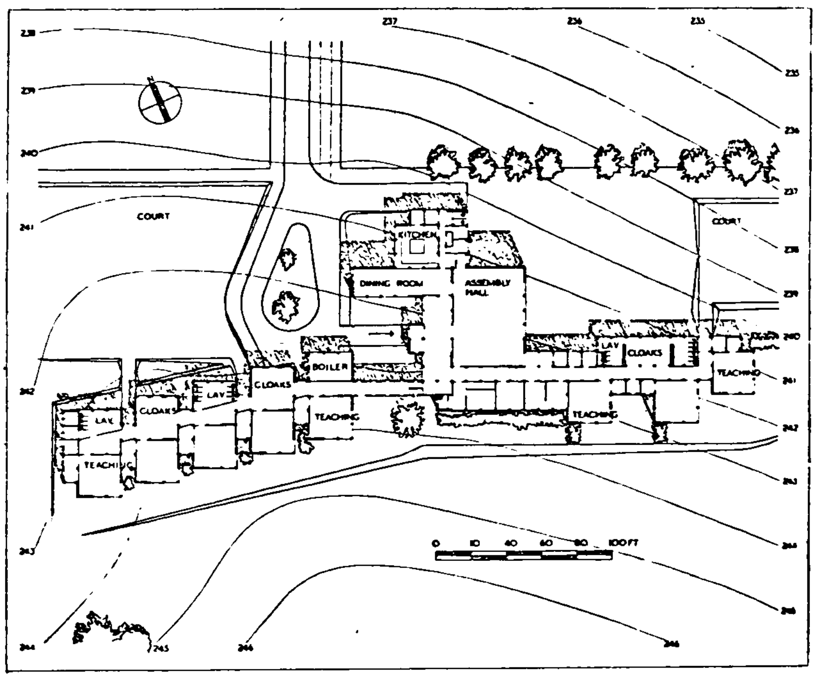
44.


BOILER
KITCHEN
STAFF
DINING ROOM
MEDICAL
PITCH
ASSEMBLY HALL
CLOAKS
CLOAKS
TEACHING
TEACHING
TEACHING
TEACHING
COURT
100 FT

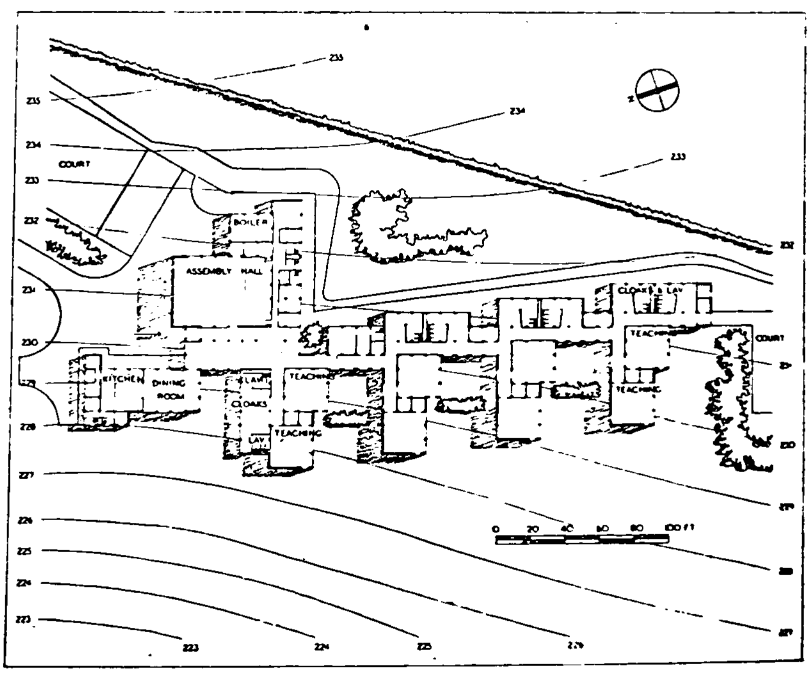
45.


PITCH
KITCHEN
DINING ROOM
ASSEMBLY HALL
CLOAKS
CLOAKS
COURT
TEACHING
TEACHING
BOILER
CLOAKS
CLOAKS
TEACHING
TEACHING
0 20 40 60 80 100 FT

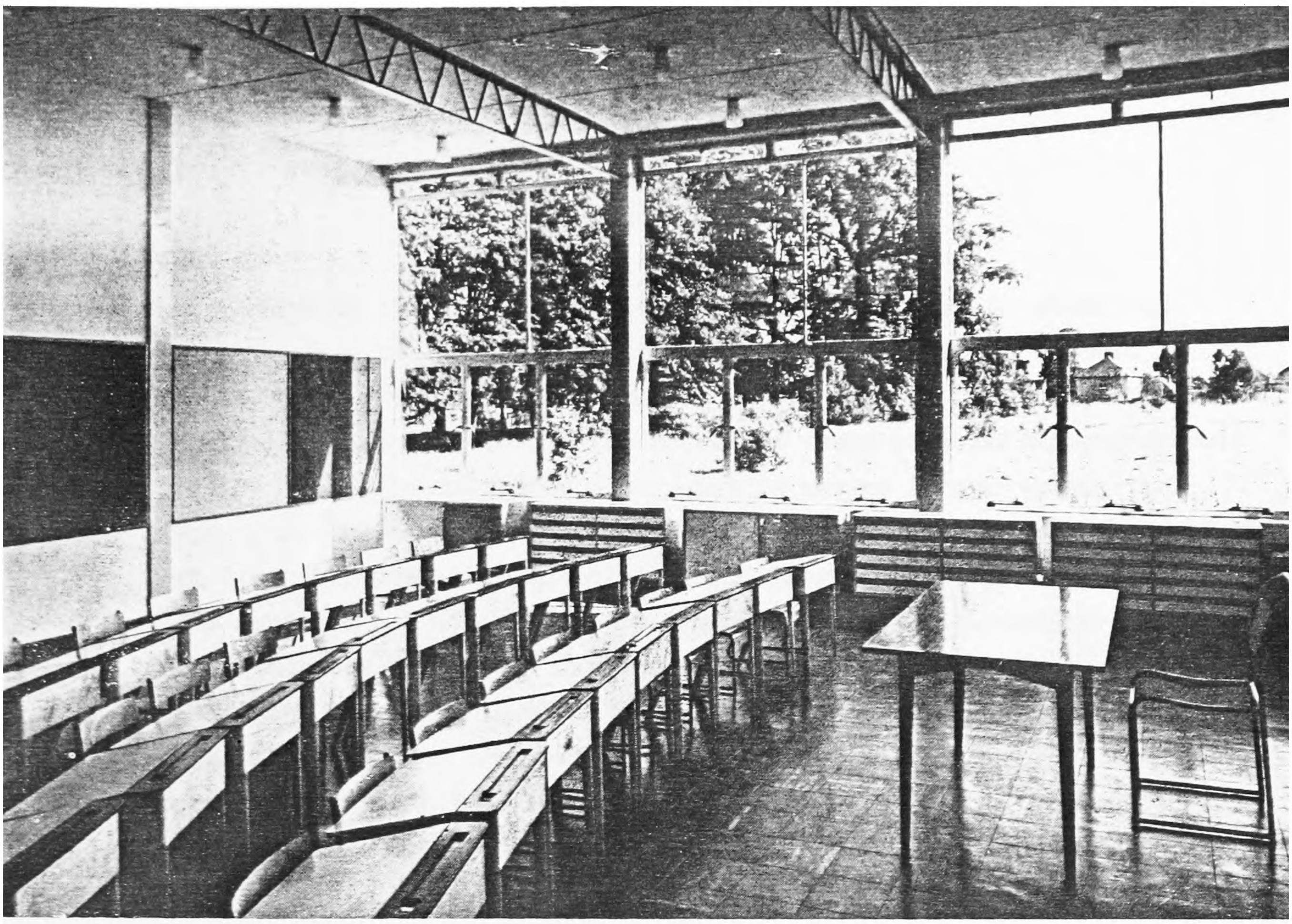
46.


COURT
KITCHEN
DINING ROOM
ASSEMBLY HALL
COURT
BOILER
CLOAKS
LAV
CLOAKS
LAV
CLOAKS
LAV
TEACHING
TEACHING
TEACHING
TEACHING
0 10 40 60 80 100 FT

47.


COURT
BOILER
ASSEMBLY HALL
CLOAKS & LAV
TEACHING
COURT
TEACHING
KITCHEN
DINING ROOM
CLAV
CLOAKS
TEACHING
LAV
TEACHING
0 20 40 60 80 100 FT

48.



49.

Figures 43-49.

43. Oxhey, Warren Dell Junior School, plan. (HCC Drawing originally published in Architects Journal, 16 Oct. 1947, p.342)

44. Hemel Hempstead, Belswains Junior School, plan. (ibid., p.343)

45. Hitchin, Strathmore Infants School, plan. (HCC Drawing originally published in Architect and Building News, 16 Jan. 1948, p.52)

46. Croxley Green, Little Green Lane Junior School, plan. (HCC Drawing originally published in Architects Journal,16 Oct. 1947, p.341)

47. Letchworth, Wilbury JMI School, plan. (ibid., p.341)

48. Bushey, Highwood JMI School, plan. (ibid., p.342)

49. Little Green Lane School, view of classroom interior. (RIBAJ, Sept. 1949, p.471)

Chapter 11

THE 1948 - 49 PROGRAMME

The schools of the first Operational Programme were still under construction when scheme designs for the twenty-five primary schools of the following programme were begun. Spread over two years, the 1948 - 49 programme was affected by the increased tempo of building throughout the country. The volume of work meant it was no longer within the scope of a single manufacturer to develop and supply all the ranges of components required to build a series of programmes. Hertfordshire, still cautious and mindful that their method was in its infancy, had in fact already moved away from reliance on a single manufacturer and in 1948 the County introduced the practice of inviting tenders from specialist firms for the various components. Hills, however, continued to provide a full range of their own components to meet certain other markets, such as the London County Council whose programme started that year.[1]

The construction used in the 1948-49 programme was the fourth stage in the development of the 8' 3" system. Although no fundamental changes were made to the components, the architects' appraisal led to several refinements and economies being introduced, after being worked out jointly by the architects and engineers. In particular, the steel frame was modified in the interests of greater standardisation and interchangeability of its components.

The three stanchion types (low, medium and high) remained 5½" square, formed from four 2" x 2" angles welded onto open battens, but were now multi-drilled in the factory (fig.57). The 104 holes provided in the "low" stanchion, 168 in the "medium" and 264 in the high, provided for connections to be made to any face and at any level which was a multiple of 6" from the floor. Drillings in such quantity arose from the use of bolting for all site connections and the desire to achieve total interchangeability.[2] With regard to the practicality of this "ideal" stanchion, the architects commented:

> An interesting situation was now reached where this standardisation had almost eliminated the drawing office work but had overburdened the "hole-punching" shops; therefore a compromise between drawing office and shop was made, which resulted in a small

increase in the number of stanchions.[3]

The compromise brought to the surface a general truth concerning standardisation for mass production. As the Building Research Station report on Modular Co-ordination in Hertfordshire commented:

> It seems that as component production runs lengthen, as in this programme, it becomes economically possible to differentiate the single multi-purpose standardised component into a number of components each better suited to its own particular function and yet each with runs long enough to cover its own jig costs.[4]

To the foot of the stanchions was welded a 6" x 6" base plate which was drilled to take four holding-down bolts. The latter were grouted into pockets cast in the site slab after locating their positions with the steel jig. After the stanchions had been jacked-up to the required level, by back-nuts on the holding-down bolts, the grouting was completed (figs. 58-61). Such an anchorage offered what was, in essence, a "pin-jointed" base. Positioning the bolts within the stanchion meant the base plate could be raised to floor level (without any projecting plates or bolt heads visible) giving a reduction in foundation depth. It meant, too, that on sites with good bearing capacity the edge beams themselves were adequate for carrying the perimeter stanchions, and only shallow pads were required for internal ones. Furthermore, the entire site slab could be laid prior to frame erection, giving the steel erectors a firm working base in bad weather; erection times decreased appreciably, especially in the winter months. For reasons we will discuss presently, projecting eaves were reintroduced for this programme, making some modification to the top of the stanchions necessary for bolting-on their supporting cantilever brackets (fig.50).

Beam types were also reduced in number, from six to five, and the beams adopted what was described as "unconventional construction."[5] The earlier technique of diagonal bent-rod lacing was replaced by the use of cut rods, graded according to the shear stress distribution in the beam, and welded between an inverted-channel top chord and a flatbar bottom chord. A "tee" section member was welded to each end of the beam and wás drilled for stanchion connection by means of bolting (fig.57). No mechanical plant was required for their erection; it was possible for the largest beams to be lifted into position by three or four men using a simple tackle (fig. 55). The lattice beams, by design or necessity, introduced a visual interest which became characteristic of the early Herts schools; the architects considered the exposed beams to be a positive asset;

> The open lacing does not obstruct the view and therefore can be exposed and painted (giving an instance of the decorative value of a straightforward structural object) and allows free passage for heating pipes.[6]

Although manufacturing tolerances (now set at + 0 and - $\frac{1}{8}$") were still a problem in the fixing of secondary components, the goal of all steel frame components being welded and galvanised in the factory, with all site connections being made by bolting, was at last attained.[7]

The reintroduction of cantilever brackets for projecting eaves added to the range of steel components, the number of which was already high on account of the ancillary rails and support posts necessary for carrying the vertical cladding blocks in $\frac{1}{2}$ bay and $\frac{2}{3}$ bay-width openings. There were now, for example, eighteen different cladding rails.[8]

Britain was now facing a national shortage of steel and, on top of that, the Ministry of Education had introduced a cost limit of £140 per place on primary schools.[9] Both factors suggested that some further rationalisation would be necessary. The introduction of a satisfactory rooflight for classrooms enabled the architects to dispense with high ceilings and clerestory windows, whilst still maintaining the required two per cent daylight factor throughout the classroom. The general use of the medium height stanchion was thus unnecessary, except where changes of level occurred.

The structure of the roof (decking) was still causing some dissatisfaction; it was, the architects admitted,

> ... in its present form at least, by no means an ideal solution to the problem. Although concrete can be, easily moulded to the various shapes required and is comparitively cheap, the finished product is crude in appearance, liable to fracture, heavy to handle and difficult to chip away when minor adjustments have to be made. As yet, however, no satisfactory alternative has presented itself.[10]

For these essentially simple, single -storey, structures a heavy concrete roof seemed incompatible with the light steel frame; clearly some lightweight method of roofing would be preferable. However, it was decided to continue with the precast concrete units of the previous programme for the time being, introducing certain refinements in respect of the screed above and the ceiling below.

As the blocks were laid, flat metal ties (notched at either end to hook over the steel beams) were dropped into the joints to counteract tensional forces; subsequent grouting of the joints made the roof monolithic in compression. In addition, before grouting, small tapered wood fillets were placed in the joints as grounds for fixing the ceiling, enabling the previous, cast-in, softwood battens to be omitted (fig.51). Nailable grout was tried as a substitute for the timber fillets but proved to be ineffective,[11] thus to the fillets were fixed 1" x 1" softwood battens, to which was screwed $\frac{1}{2}$" thick insulation board backed with aluminium foil. In the case of the assembly hall and dining areas, a woodwool ceiling was introduced to provide a greater degree of sound absorbtion, fixed in the same way as the insulation board. It was soon found that the schools were rather too noisy in use; there was no doubt that the general use of a more absorbent ceiling material would help considerably if it could be found. The method of fixing ceilings proved to be the slowest single operation in the roof construction, involving as it did, "overarm" working.[12]

On top of the roof units was laid a $\frac{3}{4}$" to $\frac{1}{2}$" (minimum) vermiculite and cement screed, falling to rainwater sumps. The screed was very soft and required some form of protection against traffic and weather until the felt covering was laid in position, but it was found that a $\frac{1}{2}$" sand and cement, hard surfaced, topping to the screed provided this protection adequately. Altogether the thermal insulation was much improved; the "U" value for the complete roof and ceiling structure was calculated to be 0.23 (BTU/sq.ft./hr./degree F).

At the perimeter the roof was now extended to provide two eaves projections; one of 1' 4" for building forms of low and medium height; the other of 2' 4" was intended for assembly halls (figs. 73,74). The widened block had timber fillets cast into its outer edge, to which the pressed-steel fascia plates were screwed. The fascia and closure piece, which mastered the top of the cladding, supported an asbestos composition soffit board $\frac{1}{2}$" thick (fig.52). The eaves blocks themselves were supported by steel brackets which were cantilevered from the steel frame; the brackets each consisted of a "tee" section welded to a cropped channel which was bolted into the head of the stanchion. This fixing proved to be difficult to level and immediate consideration was given to modifying it for the next programme. The concrete roof units continued to be manufactured by Millbank floors on the first four schools but, for the rest of the programme, the sub-contract was awarded to Dow Mac Ltd.[13]

External walling continued to be assembled from vertical cladding blocks, similar to the 1947 programme, which were bolted to cladding rails (fig.62). The rail types were devised according to their position and the nature of the internal lining, consisting of one or two angles and "tee" combinations, or single tees, to which were welded fixing cleats for bolting to the stanchions.

The cladding had been disappointing in the 1947 programme, both on account of the unfortunately dull colour of the block and the absence of any form of roof expression, such as the cantilevered eaves had imparted to Cheshunt and Essendon. It was in recognition of these deficiencies that the architects strove particularly to improve the appearance in the 1948 programme. Thus the projecting eaves came back in a much improved version, assisted by the significant improvements Hills had made in their pressed metal work. A further improvement in appearance was brought about by adopting a white cladding block, including stanchion covers, in two forms: Derbyshire spar in white cement for the first four schools and, for the remainder, a white cement and sand finish textured with a wire brush after application; subsequent pointing was completed in a matching colour. The latter blocks were manufactured by Orlit Ltd. and the sparkling white effect achieved was a great improvement.[14] The ability to introduce windows which were narrower than full bay width (fig.52) was still not exploited and, in view of the large range of steel rails which had been created to support vertical claddings, doubts began to be raised about their efficiency.[15]

The windows and external doors in this programme were of galvanised steel, manufactured both by Hills and by the firm of Williams and Williams in a range of about forty types, varying in height from 2' 3" to 17' 0" and wide enough to fill $\frac{1}{3}$, $\frac{2}{3}$ or full 8' 3" bay widths.[16] Their frames were bedded in mastic and screwed to angle sub-frames which fitted into the rebated edges of the concrete cladding blocks. In teaching areas, side-hung opening lights were used between sill height (2' 0") and door-head height, with ventilators above where required. Metal infill panels were generally substituted for fixed-light glazing, particularly below windows (figs. 70 - 74).

At the base of the external walling a continuous concrete sill, in block form, was introduced as a result of the changes made to the stanchion bases. These "plinth blocks" were reinforced, mainly to take account of handling stresses. The firm of Ove Arup and Partners were the consulting engineers engaged to assist the department in these matters, and with structural design generally, on this programme.

Internally, a range of glazed doors and screens was developed to complement the solid partitions. The screens ranged in size from full bay width to smaller panels for use above doors and partitions, or at clerestory level. Full bay-width door units were made up from three leaves; one fixed and the other two hinged. Where bays were required to be opened up fully, three-leaf sliding doors were used, replacing the pivoting units of the 1947 programme (fig. 69); it was possible to substitute a medium hardboard for the glass in their metal frames where additional pin-board area was required. Other internal doors were of standard (British Standard Specification) sizes and hung in steel frames.

The shortage of fibrous plasterers continued to be a problem for internal linings and partitions. The film industry in the county was no doubt partly to blame for the shortage and efforts were made to find alternatives.[17] After the first few schools had continued with the in situ woodwool slab and plaster method (fig.53), later schools resorted to plastered clinker block but the ideal of a light and dry, factory made, partition unit was as elusive as ever. No substitute could, however, be found as yet for the fibrous plaster stanchion and beam casings, cornices, sills, window heads and skirtings. Thus the available capacity of the industry for work in this medium was restricted to these components. Internal walling was consequently "wetter" than before but it had the saving grace of being cheaper.

In this programme some 42 different fibrous-plaster components were necessary. In one typical school, Letchworth Grange Junior, the fibrous-plaster casings accounted for seven per cent of the total building cost and as much as two-thirds of the cost of the steel frame they were covering. Moreover, a good many of them broke on site before they were ever fixed in position.[18]

It seemed that as one element approached perfection in economy or standardisation, it was found to be achieved at the expense of some other element:

> It has been said that in most prefabricated systems the process of standardising components tended merely to transfer certain problems from one component to the next until one element of the structure becomes heir to the accumulated snags of the others. In the H.C.C. structure this burden falls upon the stanchion casings of which many profiles are required, and no clear system of coding has been evolved. Between floor and ceiling a single casing may take up as many as 5 profiles.[19]

Thus the steel frame and the external cladding were still the most advanced elements of the structure in this programme. Experience and confidence, and a firm belief in the method, were growing:

> It is not claimed that the current version of the structure used by the Hertfordshire County Council is the final one. Prefabrication is no more than a means of building and it must ultimately face a test, not only of its efficiency, but of its capability of being used to produce good architecture. As a technique, however, prefabrication (or at least that type of system used in Hertfordshire) is in its infancy and its exploitation both by architect and manufacturer is still extremely experimental. For this reason the Hertfordshire system, which allows not only considerable planning flexibility but also variation in the materials used within the frame, has distinct advantages.[20]

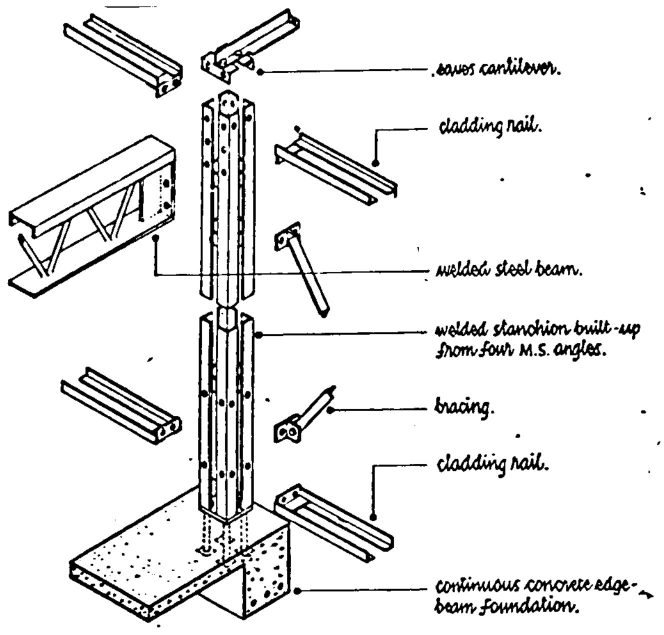
The schools in the 1948-49 programme brought the total completed to thirty-one. At the end of this programme the architects were able to express qualified satisfaction with the 8' 3" module. It was the discipline of modular co-ordination, coupled with consistency in design of component and elemental interfaces, which allowed "the variation in the materials used within the frame" without having a chain reaction effect on the remainder. The module had certain drawbacks on account of its size but it had some unexpected bonuses too; it was commented:

> In practice it has proved reasonably satisfactory for primary school planning, although sometimes extravagant for cloakrooms and corridors. It has been possible, with increasing experience, to produce satisfactory plans for sites as difficult as any normally met with and the vocabulary of architectural effects obtainable with the present type of structure has been by no means exhausted in the thirty-two schools so far designed. At its best the grid system has proved a valuable discipline for the planner and, although it cannot redeem a bad plan, it may lend coherence to a mediocre one.[21]

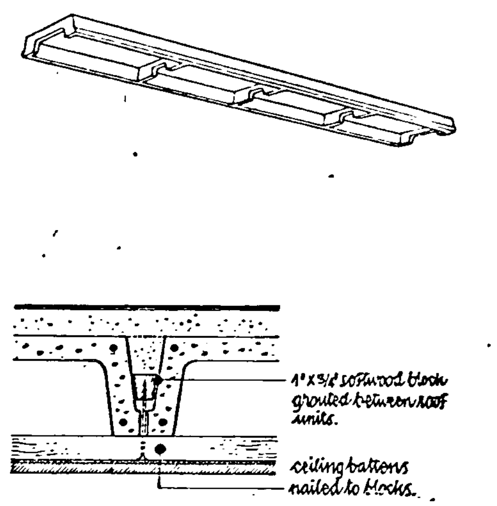
Morgans Walk JMI, Hertford (fig.56) is the exemplar of 8' 3" planning in all its aspects. Perhaps above all the system had engendered a total approach to design: manufacturing technique, component design, the methodology of co-ordination and range reduction (or optimisation), standard and project drawings, and administration, all became integral parts of a total process. In Chapter 13 we shall examine these interrelationships in more detail.

Notes to Chapter 11.

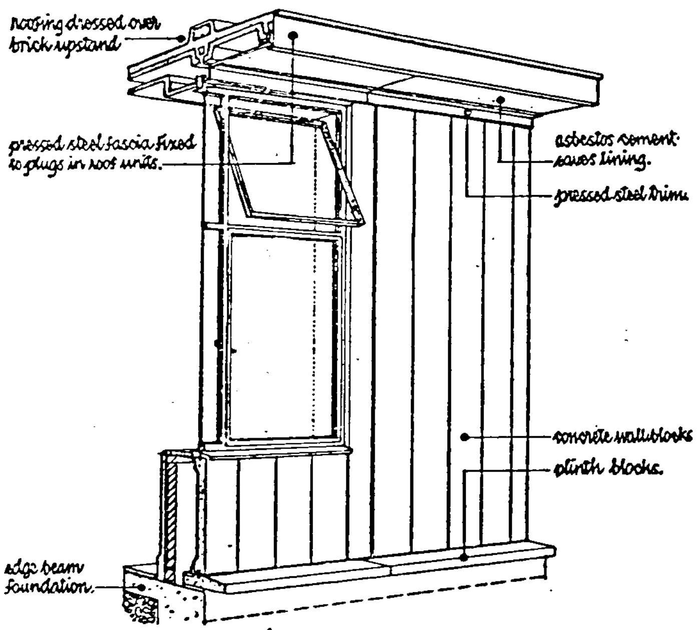
1. London School Plan 1947, LCC, (June) 1947. See also The London Education Service, 11th Ed., LCC, pp. 94-96.
2. BRS note no. C302, 1954, p.5 (Note: para 1(b) contains a misattribution: date of reference should read 16 Oct. 1947, not 20 Oct. 1949).
3. HCC "On the design of primary schools" AJ,16 Oct. 1947, p.344.
4. BRS note no. C302, 1954, p.5.
5. "Schools in Herts. building programme", AJ,20 Oct.1949, p.432.
6. Ibid., p.433.
7. E6110 (48-49) 212.
8. W.D. Lacey and H.T. Swain, "Hertfordshire Schools development: 2," AJ,26 May 1955, p.722.
9. MOE pamphlet no. 33, The story of post-war school building, 1957, p.26.
10. "Schools in Herts. building programme" AJ,20 Oct. 1949, p.433.
11. E555 I (47 - 49) 437.
12. W.D. Lacey and H.T. Swain, op.cit., p.722.
13. E 555 I (47 - 49) 437; E611M (48-51) 450.
14. E 555 L (47 - 51) 437.
15. W.D. Lacey and H.T. Swain, op.cit., p.723.
16. E555 K (47 - 49) 437; E 611K (48 - 52) 450.
17. W.D. Lacey and H.T. Swain, op.cit., p.723.
18. E 611G (48 - 50) 449.
19. "Schools in Herts. building programme" AJ,20 Oct. 1949, p.436.
20. Ibid., p. 432.
21. Ibid.



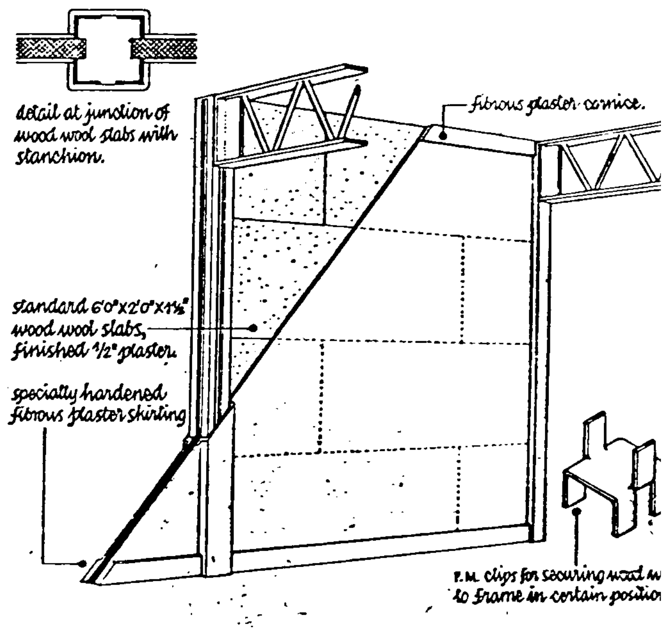
50.



51.



52.



53.

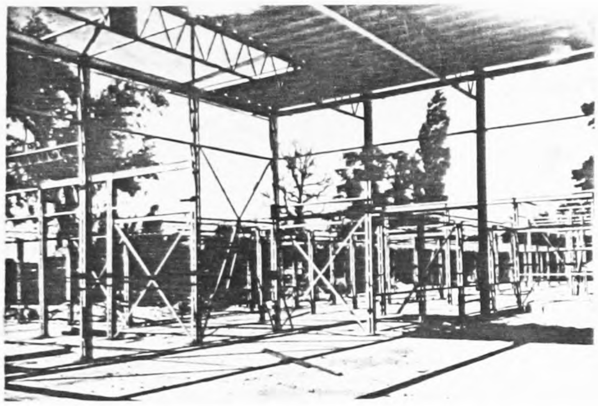
Figures 50-53.

50. Isometric diagram of steel frame components used in the 1948-49 Programme and the 1950 Primary Schools Programme, cf. fig.39. (Architects Journal, 26 May 1955, p.722)

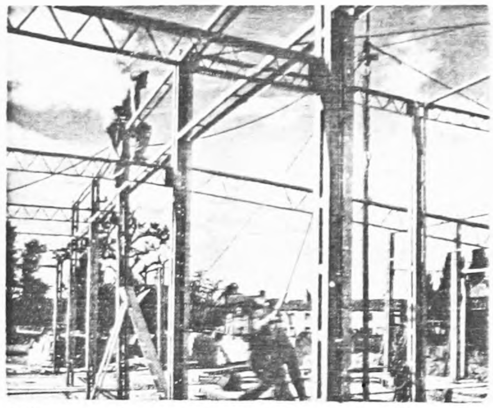
51. Development of roof and ceiling construction, cf. fig.40. (ibid.)

52. Development of external walling, cf. fig.41. (ibid., p.723)

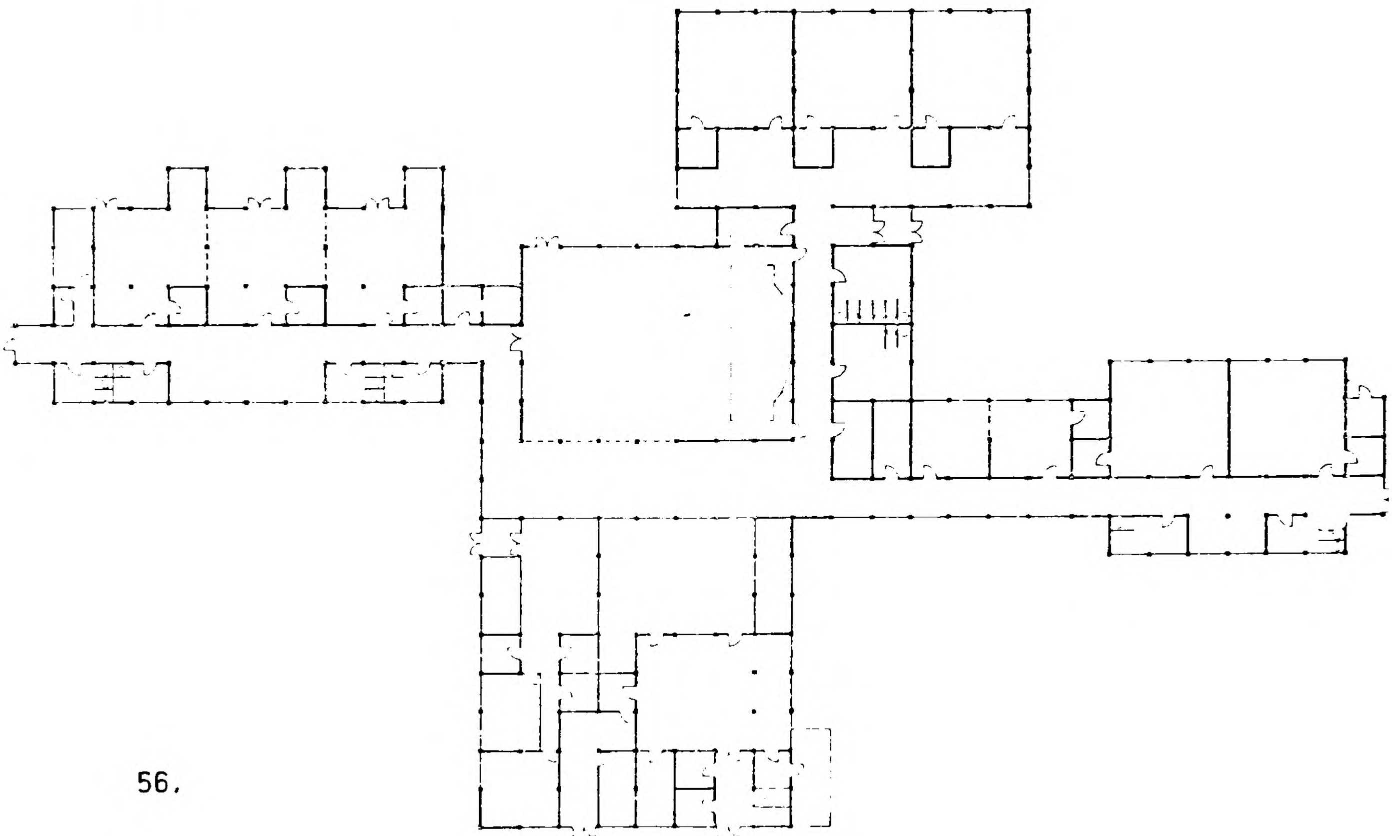
53. Development of internal walling, cf.fig.42. (ibid.)



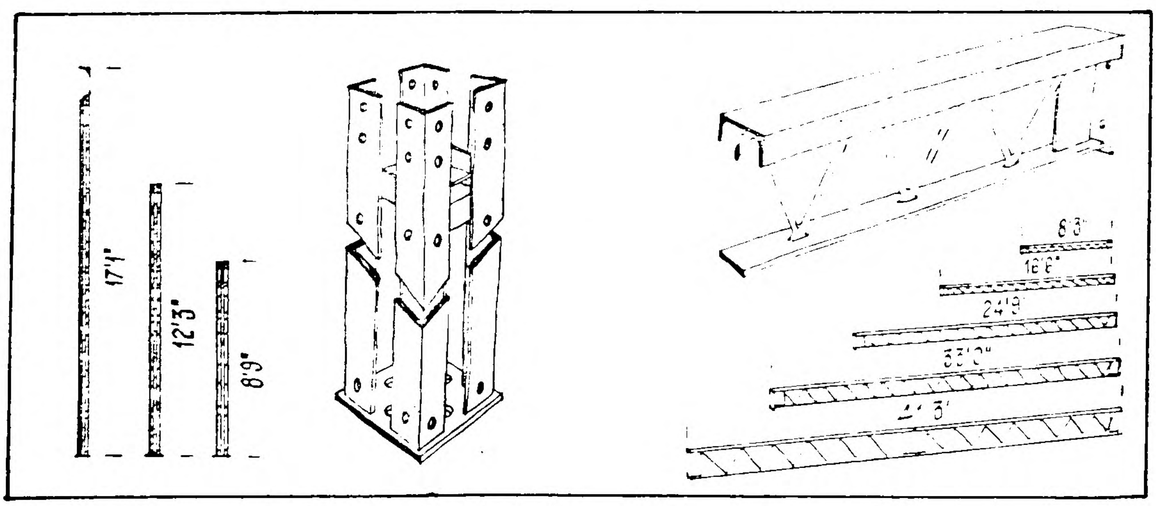
54.



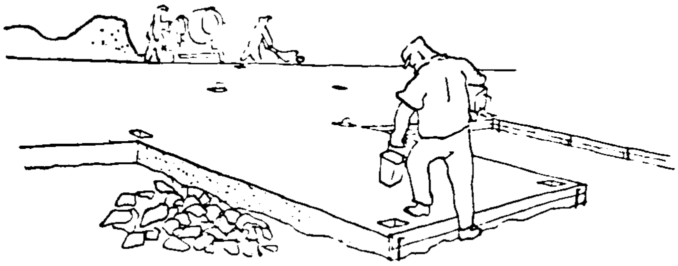
55.



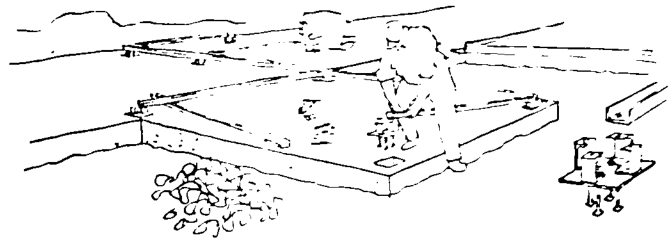
56.



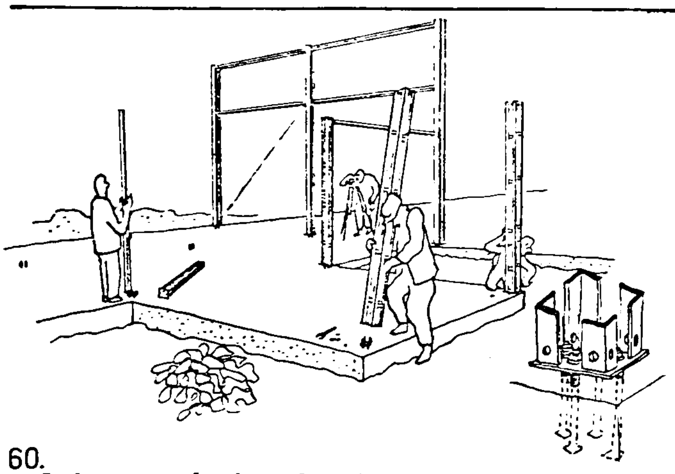
57.



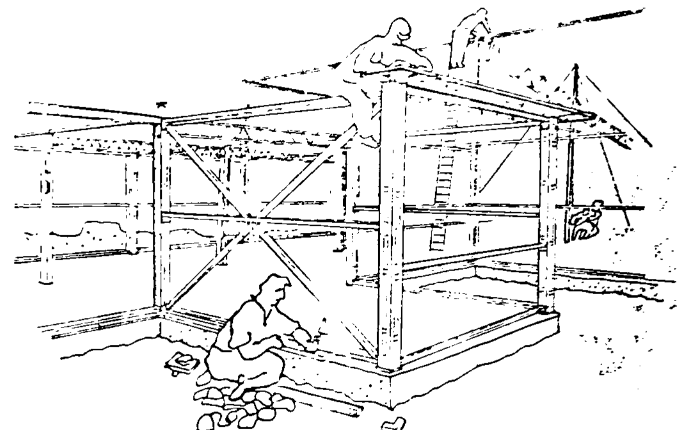
58.
Site slab is poured with deepened slab at edges and reinforced to form an edge beam. Forms are left in at stanchion position and later removed to form mortices for the holding down bolts.



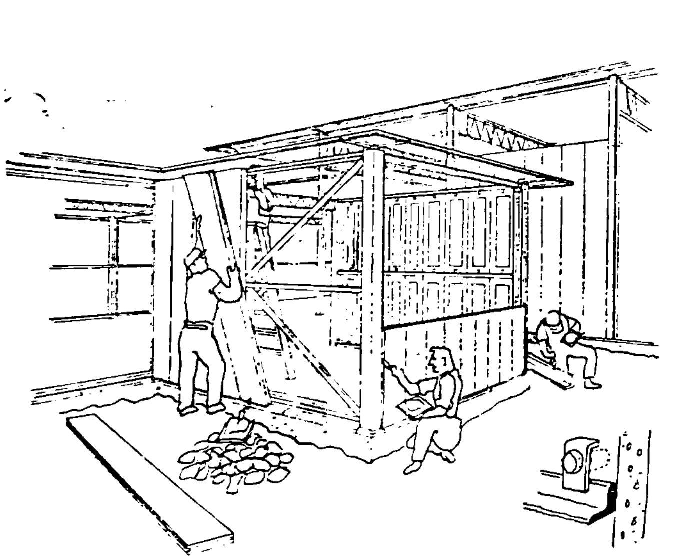
59.
Holding down bolts are located by a standard jig and dropped into the mortices with nuts above the baseplate adjusted to give required depth. The mortices are then fitted around the holding down bolts with cement grout.



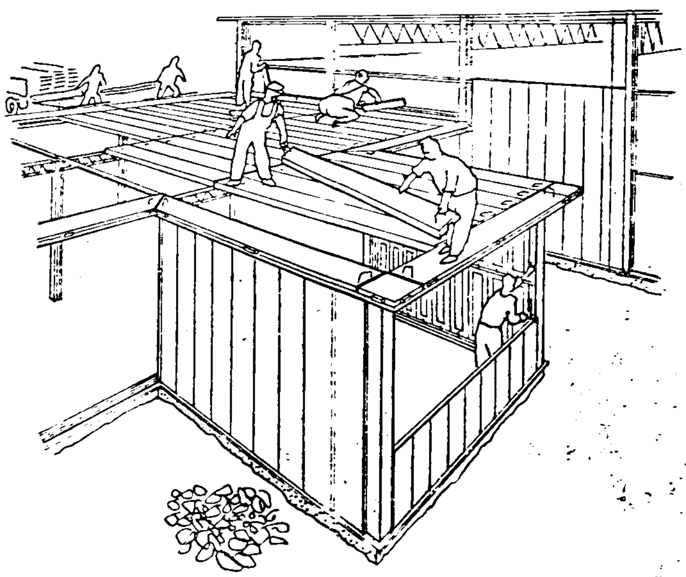
60.
Locknuts are placed on the holding down bolts and levelled up. Stanchions are then dropped over the holding down bolts and held down with a further set of nuts above the baseplate.



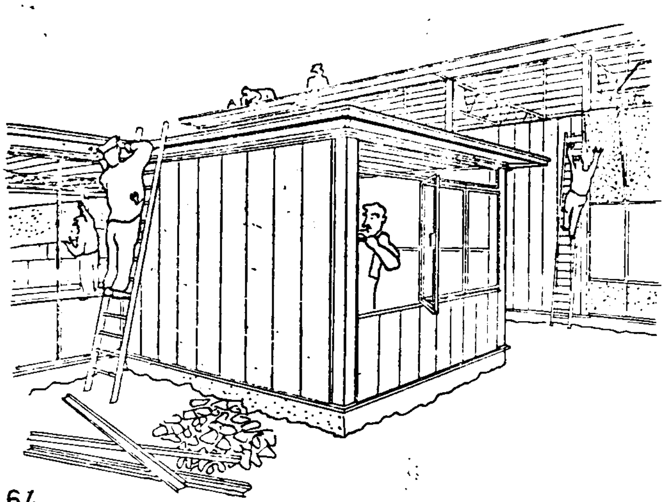
61.
Cladding rails, beams bracing and eaves cantilevers are fixed and the frame lined up. The space between the stanchion base and the side slab is fitted with a cement grout. Concrete cills are laid on the edge of the concrete slab to take the cladding blocks.



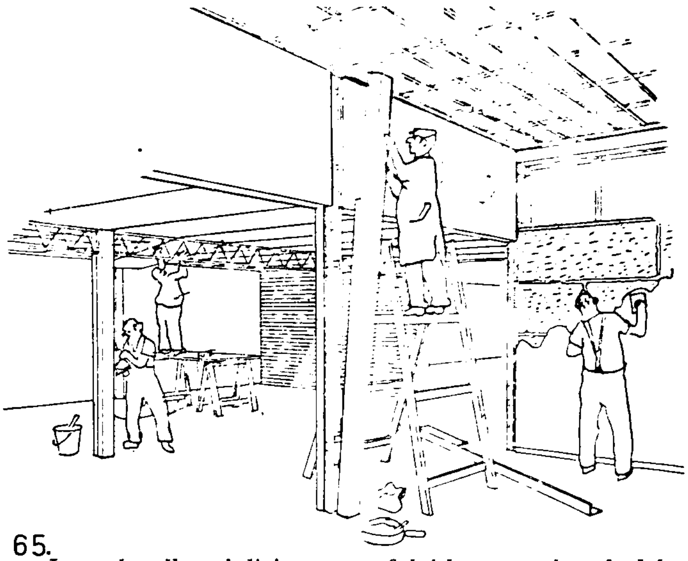
62.
Grooves in the edge of cladding blocks are " buttered " with mortar and the blocks bolted to the cladding rails. Joints are painted in white cement. The detail shows the method of bolting the slab to the cladding rail angle, with the threaded ferrule shown ted.



63.
Concrete roof blocks are off loaded up a ramp on to the roof, and laid across the steel beams. The special eaves blocks are provided with wooden lugs to which the fascia is screwed. At junctions between blocks of different height horizontal cladding blocks are laid on top of the lower roof blocks, a damp proof course laid over them and vertical cladding blocks fixed above. Joints between blocks are grouted up and the whole roof covered with a vermiculite screed laid to falls. Angle surrounds to windows are placed into the grooves in the cladding blocks and bolted to the steel frame.



64. *Metal fascias are fixed to the eaves and the bituminous felt roof covering dressed over them. Soffits are lined with asbestos. Window frames are screwed to the angle surrounds and the openings glazed or fitted with metal inserts consisting of two metal dished panels with glass silk filling.*



65. *Internal walls and linings are of brick or wood-wool slabs, with precast fibrous plaster panels as the internal lining at clerestory level. Cornices of stanchion casings are in ¾ in. precast fibrous plaster with the joints made up with fibrous plaster. Ceilings are of insulation board screwed to the battens.*

Figures 54-65.

54. Watford, Kingsway Junior School, view of assembly hall frame partly roofed with classroom frame in the background. (RIBAJ, Sept. 1949, p.475)

55. Kingsway School, view of two men hoisting lattice beam with simple block and tackle. (ibid.)

56. Hertford, Morgans Walk JMI School: total 8'3" on-grid planning. See fig.66, annotated plan. (Martin, Standards in building, Plan inverted)

57. Steel frame components: stanchion and beam construction and range of sizes. (Architects Journal, 20 Oct.1949, p.432.)

58. Site slab preparation. (from a series of HCC Drawings showing sequence of site operations, first published in Architects Journal,20 Oct. 1949, p.434-5)

59. Holding-down bolts positioned with locating jig. (ibid.)

60. Erection of stanchions. (ibid.)

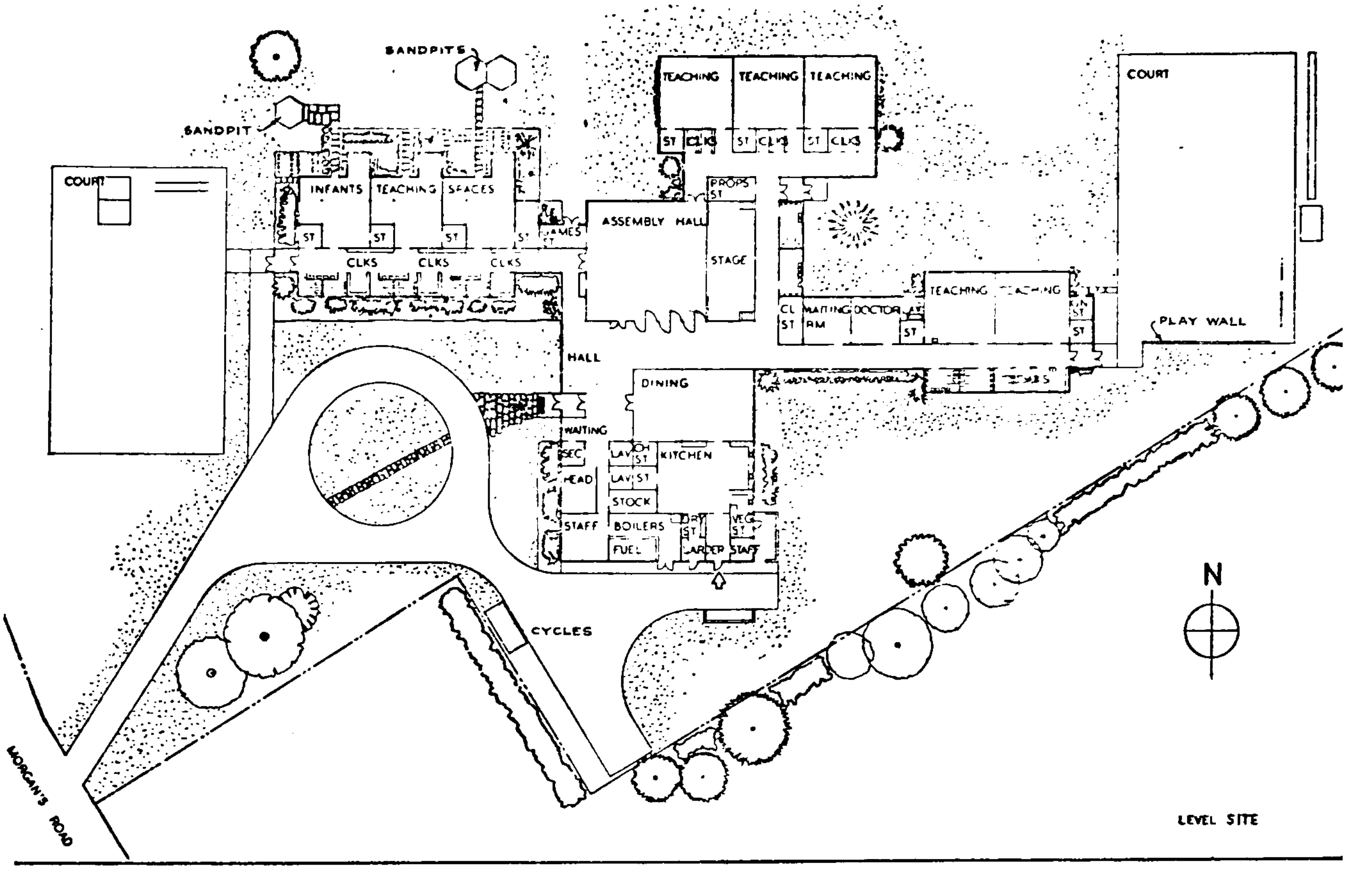
61. Fixing of beams and secondary steel components. (ibid.)

62. Erection of wall (cladding) blocks. (ibid.)

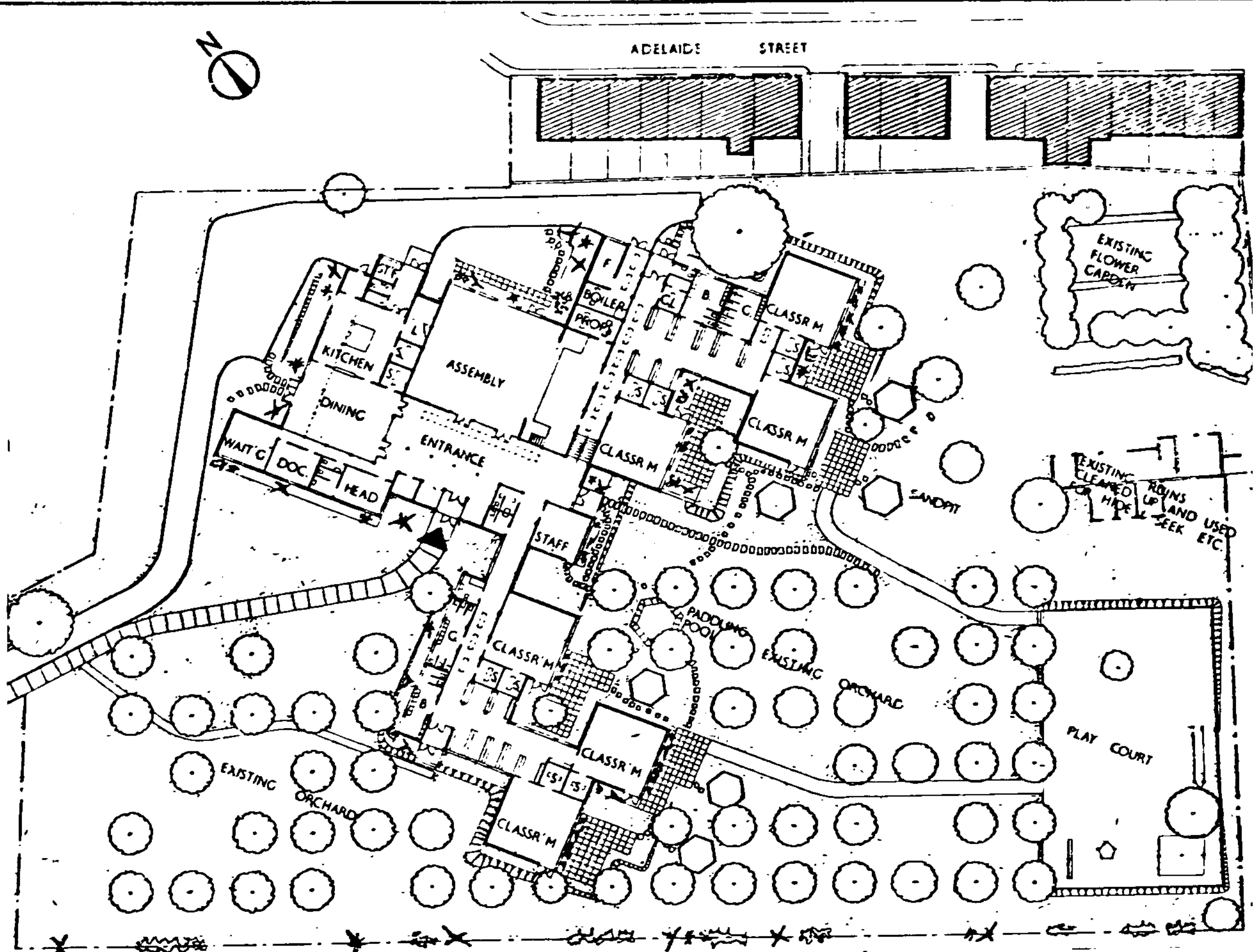
63. Laying roofing blocks and fixing window surrounds. (ibid.)

64. Fixing fascias, eaves and window frames. (ibid.)

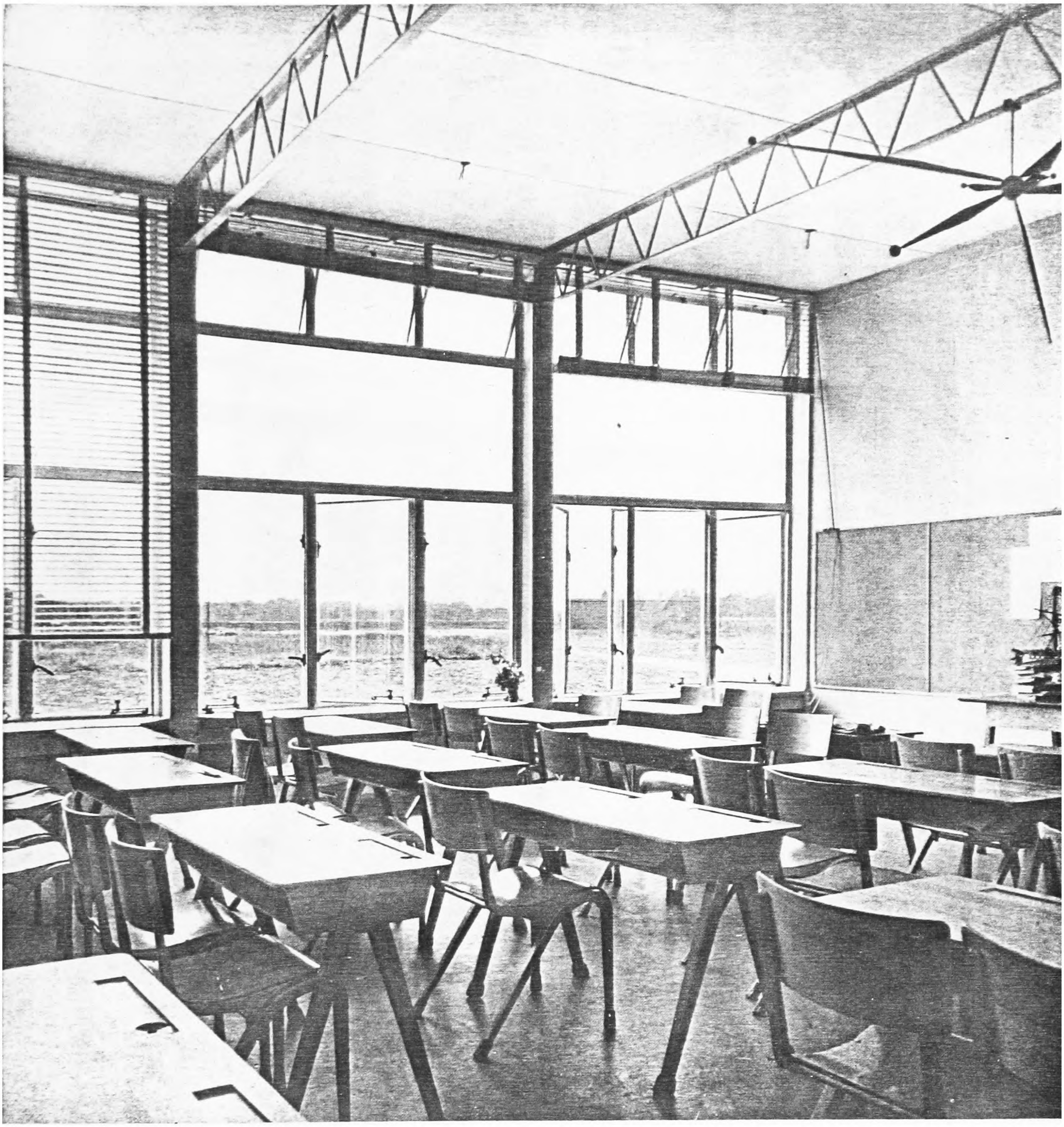
65. Constructing internal walling, linings and ceilings. (ibid.)


SANDPITS
SANDPIT
COURT
TEACHING
ST
CLKS
INFANTS
TEACHING
SPACES
PROPS ST
GAMES
ASSEMBLY HALL
STAGE
WAITING RM
DOCTOR
PLAY WALL
HALL
DINING
WAITING
SEC
HEAD
STAFF
KITCHEN
STOCK
BOILERS
FUEL
LARDER
CYCLES
N
MORGAN'S ROAD
LEVEL SITE

66.


ADELAIDE STREET
N
KITCHEN
BOILER
PROPS
ASSEMBLY
DINING
ENTRANCE
WAIT'G
DOC.
HEAD
STAFF
CLASSR'M
EXISTING FLOWER GARDEN
SANDPIT
PADDLING POOL
EXISTING ORCHARD
PLAY COURT

67.



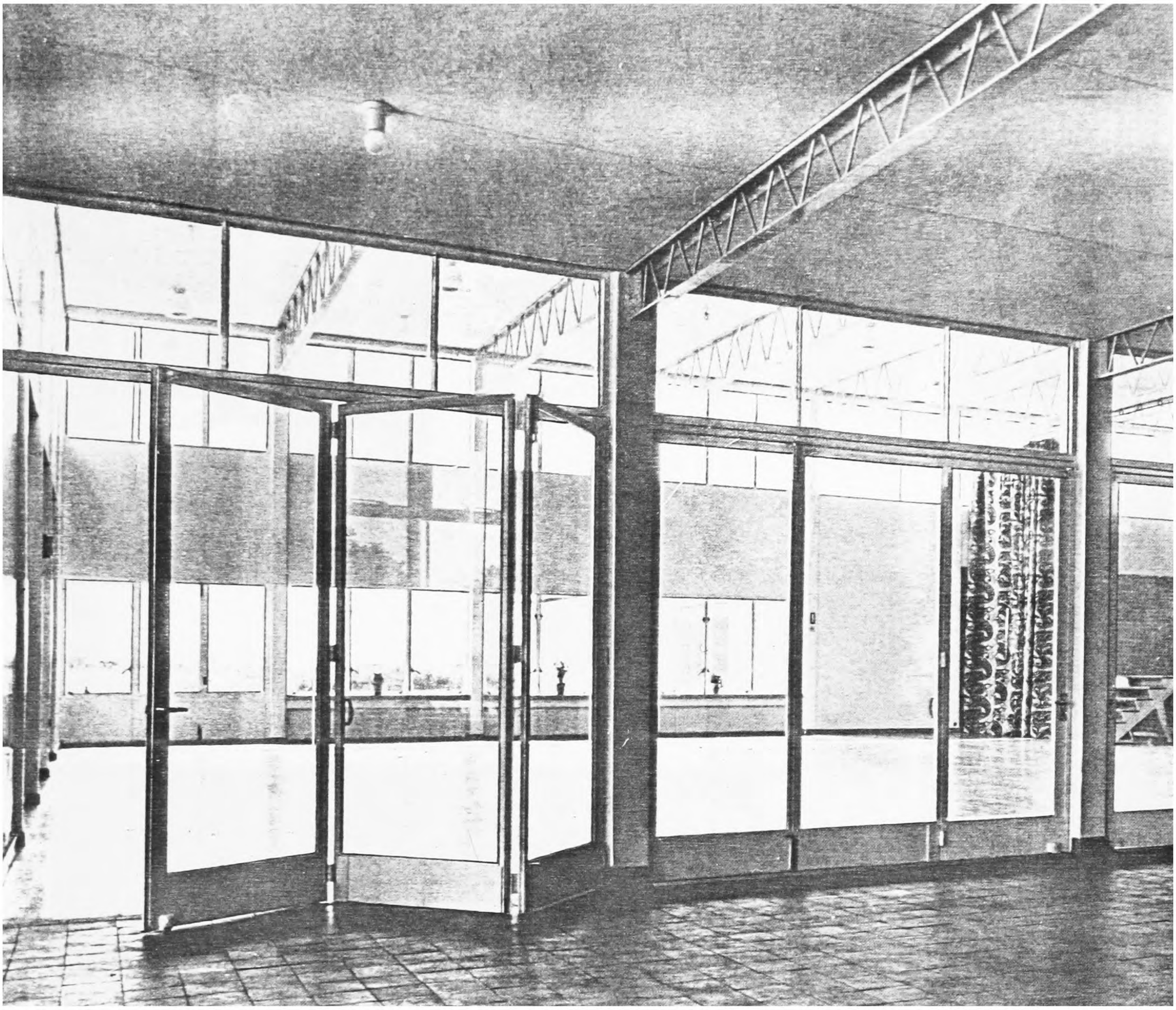
68.

Figures 66-68.

66. Hertford, Morgans Walk JMI School, plan. (RIBAJ, Sept.1949, p.478).

67. St.Albans, Aboyne Lodge Infants School, plan. (AJ,12 May 1960, p.733).

68. Hertford, Morgans Walk JMI School, view of classroom interior. (Williams and Williams steel windows catalogue, c.1960).



69.

Figures 69-74.

69. Hertford, Morgans Walk JMI School, view from entrance hall into assembly hall. (Williams and Williams steel windows catalogue, c.1960)

70. St.Albans, Aboyne Lodge JMI School (HCC Building for education 1948-61, p.11)

71. Ware, St.Mary's Infants School, view of classroom wing. (photo. M.P.K. Keath)

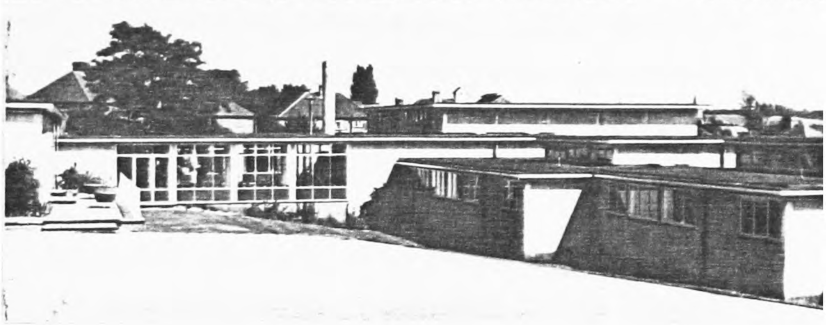
72. St.Mary's School, view of rear of school. (ibid.)

73. St. Mary's School, view of assembly hall and entrance. (ibid.)

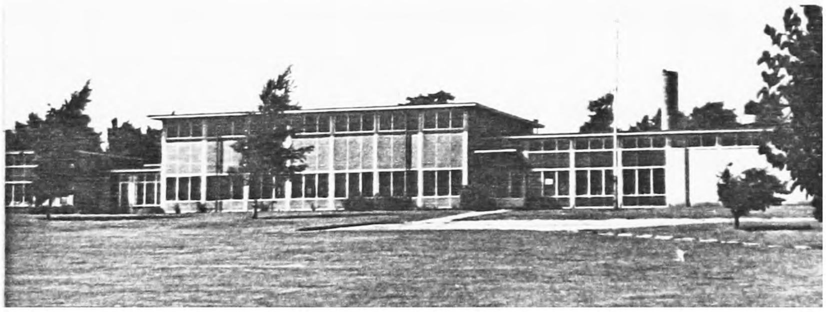
74. Welwyn Garden City, Templewood JMI School, exterior view. (Godfrey and Castle Cleary, School design and construction, p.77)

70.

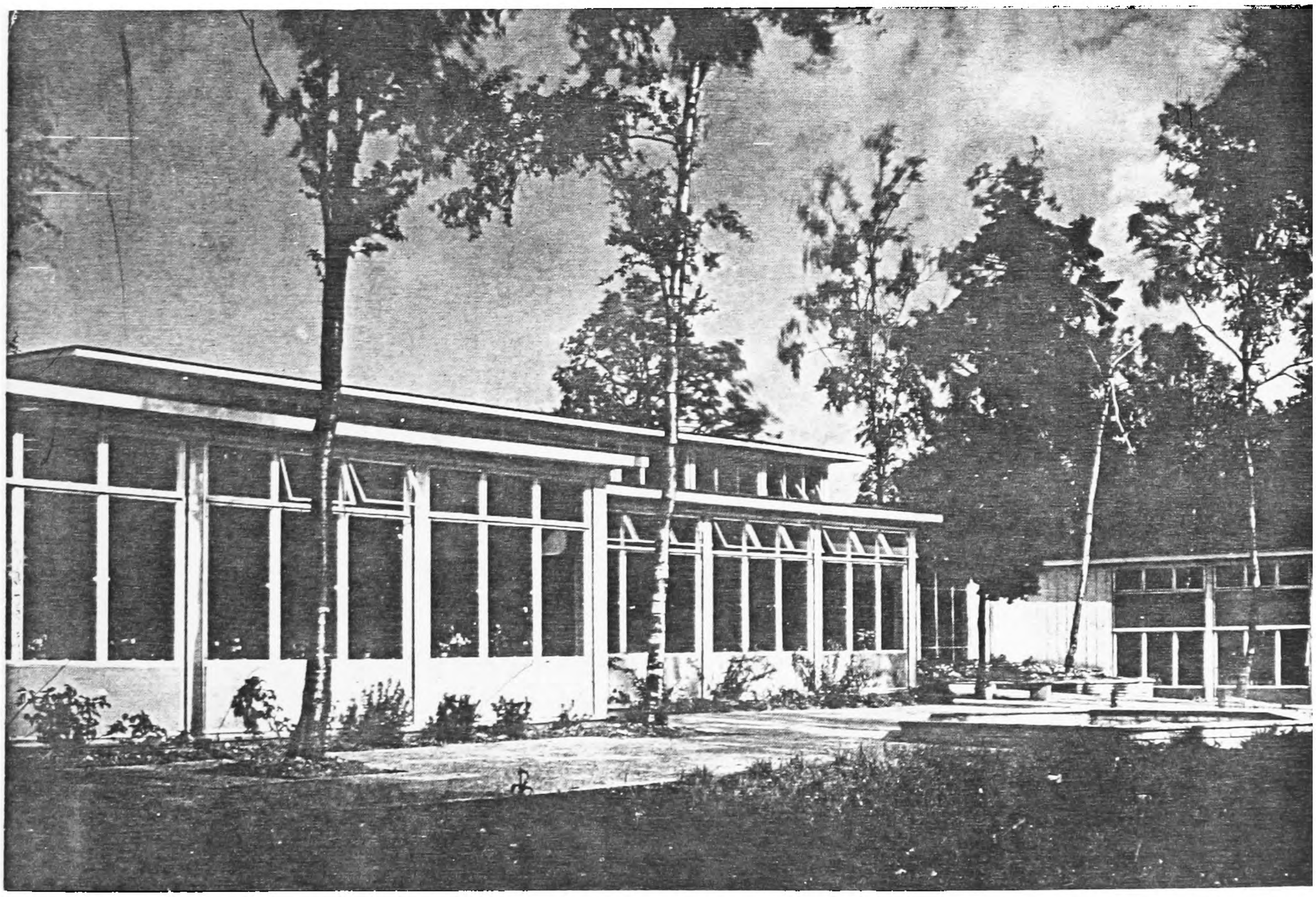
71.



72.



73.



74.

Chapter 12

PRIMARY SCHOOLS AND THE 8' 3" SYSTEM 1950 - 55

The planning of the first thirty-one primary schools was characterised by the wide circulation spaces and the separation of cloaks, storage and lavatory spaces from their associated classrooms. 1950 was to be the last year in which such generous space standards would be possible. The severe shortage of steel, which developed nationally owing to the war in Korea, was to foster a more exacting attitude to design and construction in future years. Coupled to this shortage of a basic material, the Ministry of Education were planning to reduce both their cost limits and the required area per place. We shall see in Chapter 13 how these reductions led to a fundamental reassessment of teaching spaces, involving architects and teachers alike.

The workings of the department were affected also by the fact that in 1950 the county was, for the first time, faced with a large secondary school building programme.[1] To meet this situation it was decided to form two separate architect groups: one for primary schools and the other for secondary schools. Whilst it was possible for the primary group to persevere with the same structural details as had been used in the 1948 - 49 programme, the secondary group had to break new ground. The work in connection with the secondary schools (which will be discussed later) resulted in a separation of development and standard drawings into what were effectively two related systems, a division which continued until the 1956 programme when they were merged into a single 8' 3" system for both primary and secondary schools.

Bearing in mind that the secondary school development was proceeding concurrently, the work which will now be discussed related mainly to the primary schools based on the 8' 3" module. The major departure from 8' 3" at the Oxhey Clarendon Secondary School prototype and the Summerswood Junior School, both on the 3' 4" module, will be discussed in Part 3. Another reason for keeping the development separate was that the secondary schools were relatively large, and "in view of the fact that future primary school programmes were of a considerable size, it was considered that the supply field for components should be widened if hold-ups were to be avoided."[2] Importantly, progress had made it possible for the primary schools of the

1950-51 programmes to be completed without significant changes in design approach or construction, enabling the major development effort to be concentrated on the five new secondary schools of that year. The steel shortage and tighter cost limits made it important to consider the tonnage of steel employed on each school. This new pressures on resources and the effects of the increased scope of the two-storey buildings, helped by the experience gained in the previous programmes, led to several further modifications to the system and manner of its use.

The introduction of a vertical module of 8" gave a new discipline to the positioning of holes, cleats and ring battens (which replaced the built-up battens): stanchions were holed at 8" centres throughout their height for window-head and sill fixings, and provided with the usual connections for floor and roof beams. The multi-punching of single-storey stanchions was reduced to 38 holes, replacing the 264 of the previous "high" stanchion. This was made possible largely by the reversion to horizontal cladding blocks and, therefore, the omission of all cladding rails.[3] In the effort to reduce the weight of steel wherever possible, the standard 2" x 2" x $\frac{1}{2}$" angles, which made up the stanchions, were replaced by 2" x 2" x 3/16" (or $\frac{3}{8}$") angles, depending on the loading conditions. In overall size, the single-storey stanchion remained constant and so avoided effects on the length of beams. Dispensing with the cladding rails and refining the stanchion design made substantial savings in the tonnage of steel used. However, some extra costs were involved in adapting manufacturing jigs to cater for the increased range of beam lengths, the number of which was trebled as a result of the non-square (two-storey) $5\frac{1}{2}$" x $6\frac{1}{2}$" stanchion. The BRS study observed a trend in this change, it was "perhaps inevitably, a step away from the interchangeability of the square connector toward the directional portal frame."[4] Although the full range of steel components now covered two as well as single-storey construction, the number of purely single-storey components was not affected.

The cumbersome precast concrete roof units were replaced in 1950 by a structural decking of woodwool slabs, reinforced with pressed steel channels along their edges and able to span the full 8' 3" bay width. These slabs had the advantage of providing a soffit which was suitable for direct painting, obviating the need for a suspended ceiling. Screeding above was continued along previous lines with all the disadvantages that the use of "wet" work brought with it (fig. 78).

In 1952-54 a deck assembled from 8' 3" long, asbestos-cement, cavity units with a suspended fibreboard ceiling was introduced. Ceilings of this type, using $\frac{3}{4}$" thick fibreboard panels which were normally manufactured to the full nominal dimensions, without tolerance, produced difficulties when applied to a modular grid of timber suspension members. At Hobbs Hill, Hemel Hempstead, where the problem was acute, it was pointed out that "it was easier to cut eight inches off a board than $\frac{1}{8}$ inch".[5]

With the return to horizontal claddings the concrete wall units were again bolted direct to the stanchions, speeding up erection time by the avoidance of a sub-assembly of cladding rails and posts (figs. 75, 76). Stanchions occurring between windows, which had hitherto been covered by pressed-steel window jambs in the standard Hills system, were now clad with separate concrete cover-blocks. For the 1951 programme the cladding blocks remained unchanged but, for the 1952-54 programmes, some important developments were made.

The mortar joints had never proved to be wholly satisfactory and were still liable to cracking as a result of thermal movement of the steel frame. For this reason, a mastic sealant strip was introduced into the joints to prevent water penetration. The sealant, however, required the blocks to fit together tightly to be effective and some difficulty was experienced on account of inadequate tolerances. In one extreme instance (Hobbs Hill) some of the blocks were so bowed that the sealant was left lying loose in the gap;[6] naturally, any inaccuracies in the lining up of joints was far more noticeable than when the joints were simply pointed up.

In the same year, an experiment was conducted in the interests of developing a more heavily textured surface treatment. By means of relief patterning in the mould it was demonstrated that some interesting effects were obtainable (figs. 79, 80). The technique was never taken up however; standardised components were generally expected to have a neutrality about their appearance, and such strong figuring in units did not meet with much favour among project architects.

In 1950, aluminium windows, manufactured by Gardiner Sons and Co.

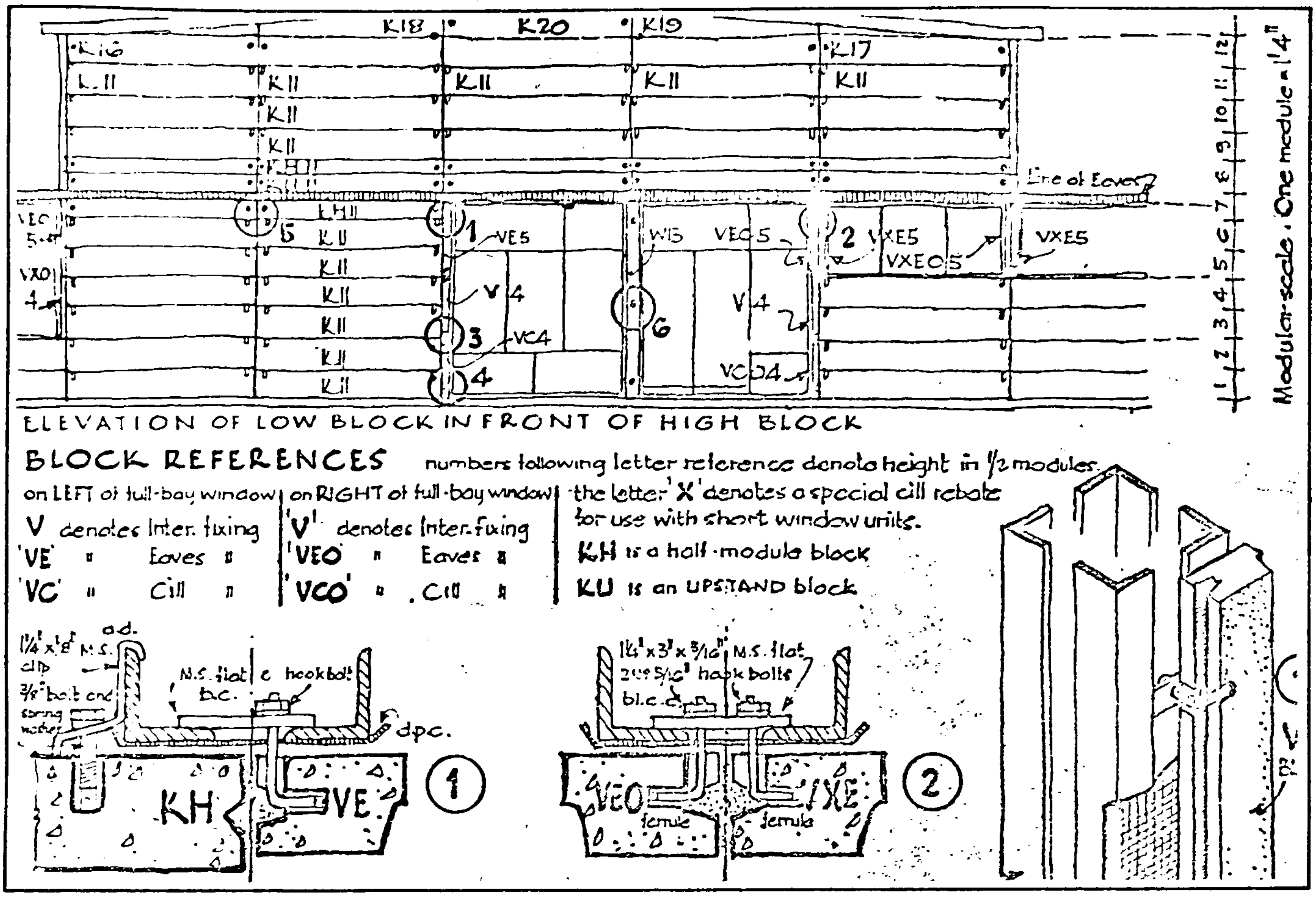
Ltd., were used for the first time. These were mill finished and were now bolted direct to the stanchions, omitting Hills's sub-frames. Subsequently, in the period 1952-54, the aluminium windows were made "fully modular" and designed to meet on the grid centre-lines, instead of between the stanchions as hitherto. A reduction in the cost of the window element was achieved by reducing opening lights to a maximum of 50 per cent of the total glazed area, as a matter of design policy.

Plastered clinker block remained the internal partitioning material for the 1950-54 programmes generally. In 1951 attempts were made to prevent plaster cracking from occurring as a result of differential movement between the stanchions and the partitions: a fibreboard pad was inserted in the joint but, as the pad was plastered over, some of the disadvantages of the wet-applied, rigid connection remained. Significantly, these partitions, though not strictly modular in the sense of having been made in standard incremental lengths, were regarded as such and, in designing, were placed on grid lines in order to standardise connection details generally. This discipline in the use of "traditional"materials will be seen again when brick-and-timber developments are discussed in Part 3.

The 8' 3" primary school system can be considered to have reached its maturity in the 1951 programme. The illustrated details which follow have been selected from a 1951 set of office Information Sheets. Concerned with the structural shell, they amplify the foregoing Chapter and demonstrate the use of simple coding in the identification of components.

<u>Notes to Chapter 12</u>

1. HCC New schools programme; see Appendix 5.
2. K.C. Twist, J.T. Redpath and K.C. Evans, "Hertfordshire schools development, 5." <u>AJ</u>, 19 April, 1956, p.381.
3. BRS Note no. C302, 1954, p.6.
4. <u>Ibid</u>.
5. <u>Ibid</u>., p.8.
6. <u>Ibid</u>., See also E746C (54-57) 808 and E800L(1) (54-55) 736.



75.

Figures 75-81.

75. Concrete wall blocks: component selection and assembly details for line conditions; standard drawing fragment. (HCC Information Sheet no.4, Primary Schools Programme)

76. Concrete wall blocks: component selection and assembly details for corner conditions; complete standard drawing trimmed to A4 size.
(ibid., sheet no.5)

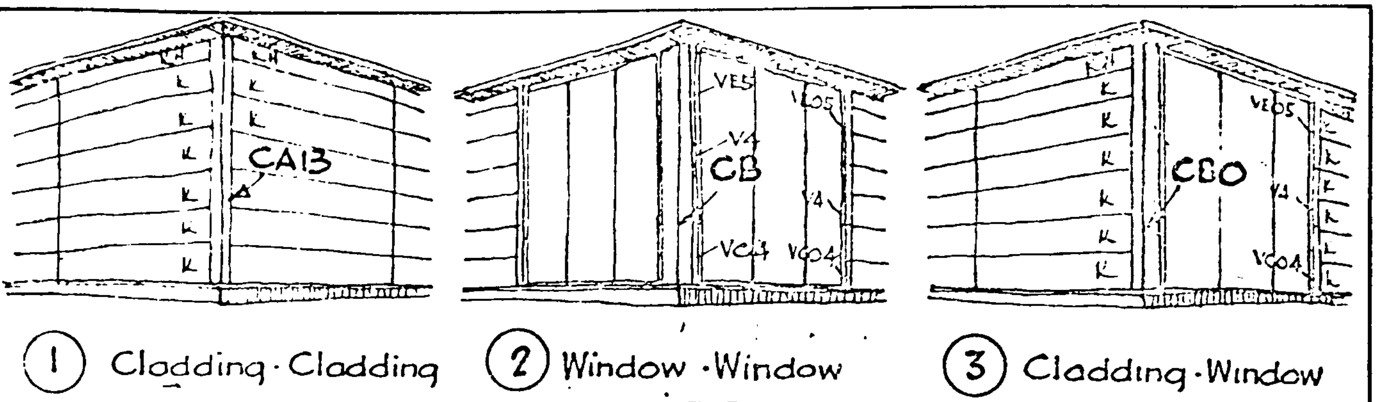
77. Steel frame assembly and coding diagram.
(ibid. sheet no.2, redrawn without component codes by Architects Journal, 3 April 1952, P.423)

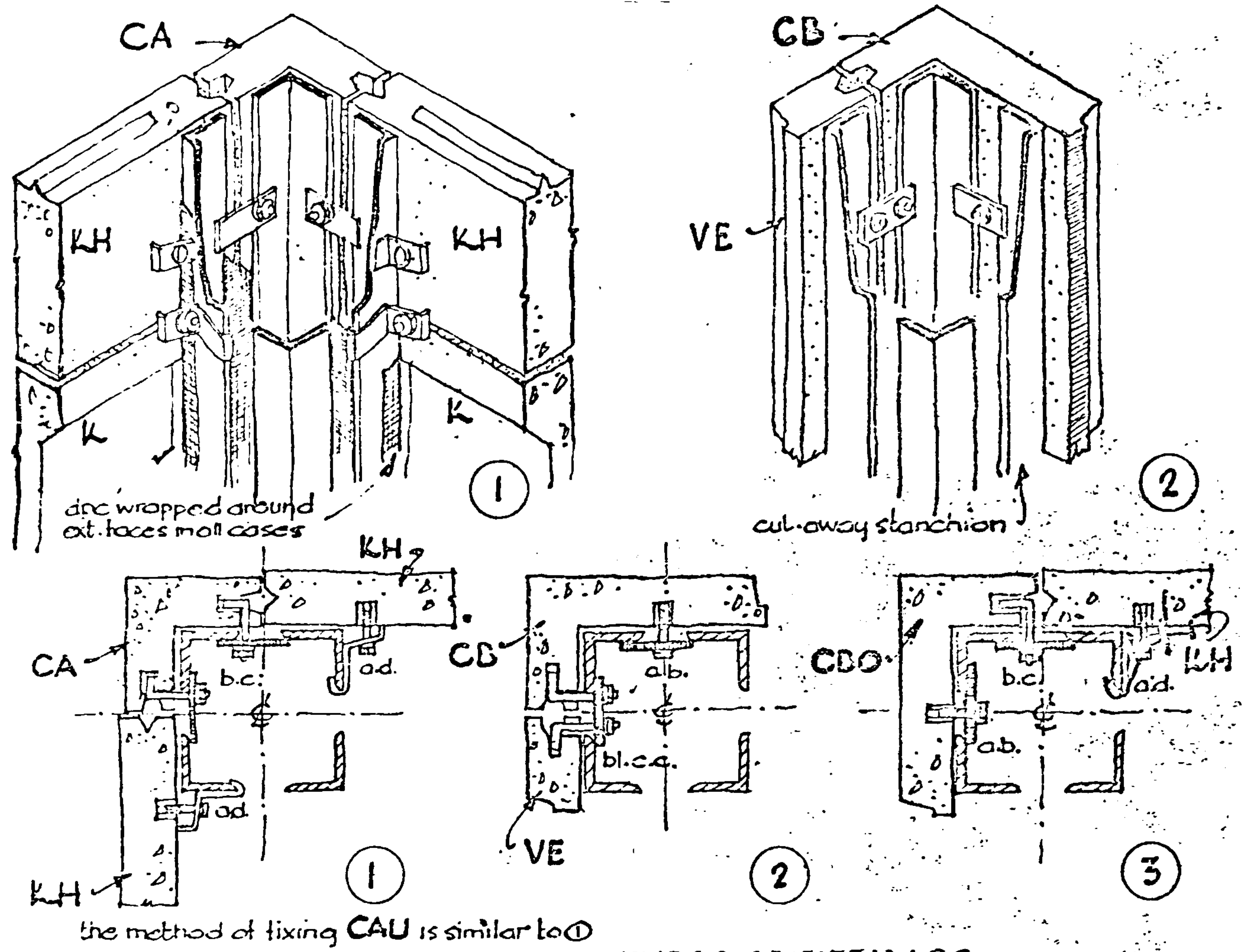
78. Cantilever eaves construction detail.
(ibid., sheet no. 8, redrawn)

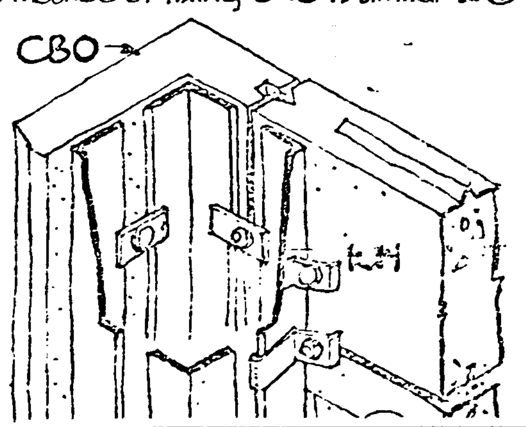
79. Close-up view of pattern textured concrete wall block.
(Architectural Design, Nov.1954, p.323)

80. Hemel Hempstead, Chambersbury JMI School, view of end wall of assembly hall showing moulded precast concrete blocks in fig.79.
(ibid.)

81. Oxhey, Greenfields JMI School, fixing of concrete wall blocks to assembly hall walling.
(Architects Journal, 3 April 1952, p.420)



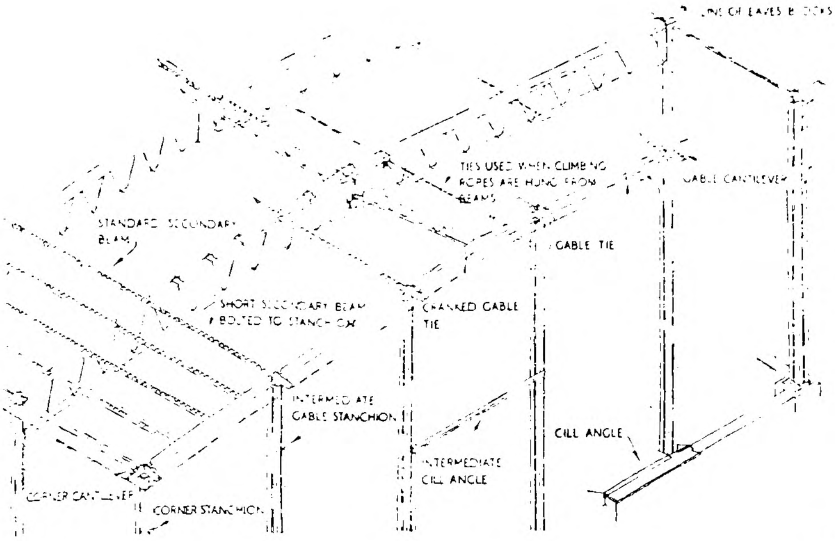




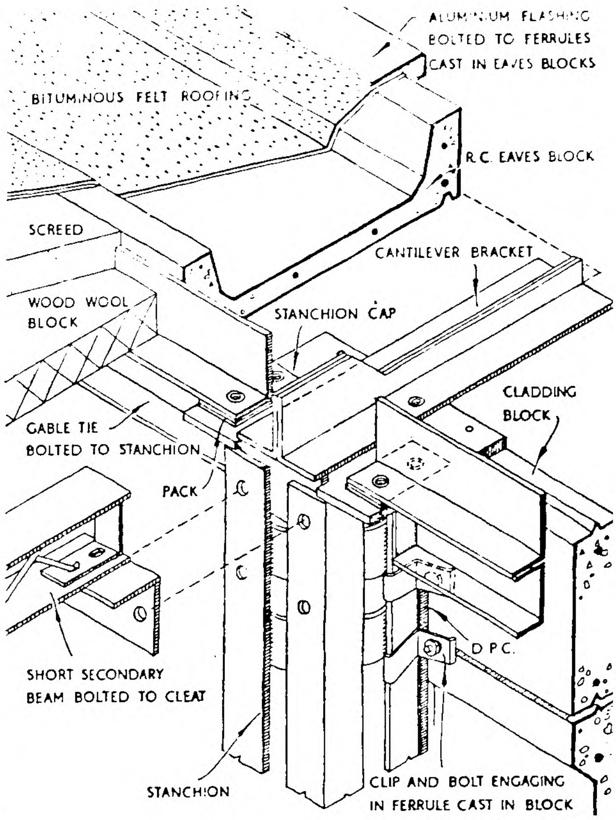
TYPES OF FITTINGS

a. hexagon headed set screw 1½" x ⅜" including spring washer
b. MS flat 3" x 1¼" x 3/16" with 7/16" drilling..
b1. ditto. but with 2 drillings.
c. hook bolt 3½" x 5/16" dia. incl. nut & spring washer
d. galv MS pressing 1¼" x ⅛" x 5", bent 3 times, drilled once.
d1. ditto. but once bent & drilled
e. MS dowel 3" x 5/16" dia.
f. galv. MS tie ¾" x ⅛" x 5" long, ragged one end, drilled one
g. Raking clip (ex. 2⅞" x 4⅞" x ⅛" sheet) bent 3 times, drilled once, right hand
g1. ditto but left hand.

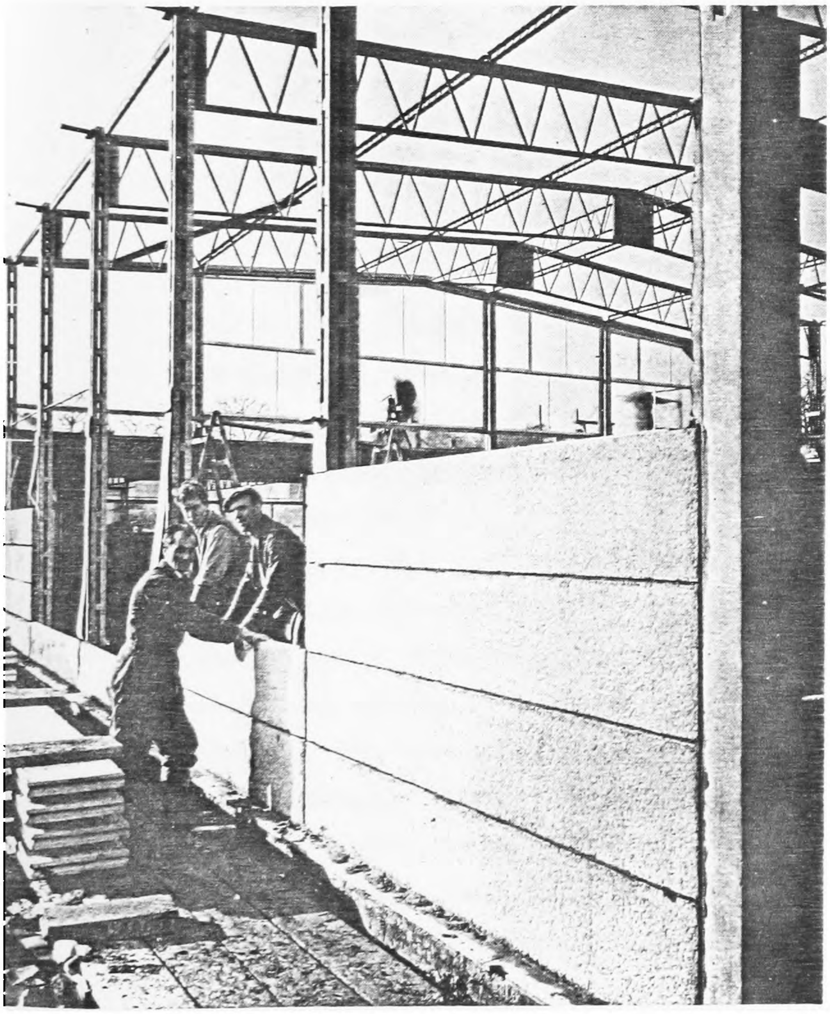
76.


LINE OF EAVES BLOCKS
TIES USED WHEN CLIMBING ROPES ARE HUNG FROM BEAMS
GABLE CANTILEVER
STANDARD SECONDARY BEAM
GABLE TIE
SHORT SECONDARY BEAM BOLTED TO STANCHION
CRANKED GABLE TIE
INTERMEDIATE GABLE STANCHION
CILL ANGLE
INTERMEDIATE CILL ANGLE
CORNER CANTILEVER
CORNER STANCHION

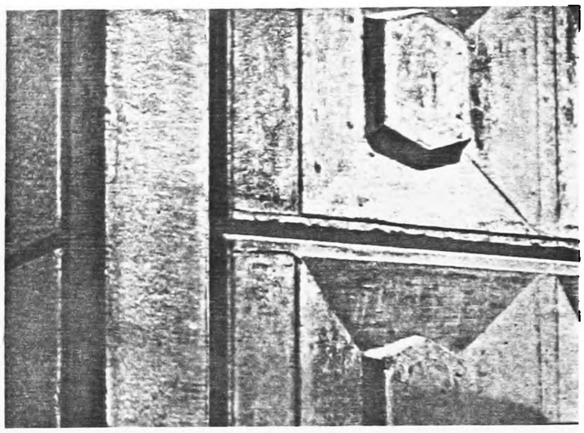
77.


ALUMINIUM FLASHING BOLTED TO FERRULES CAST IN EAVES BLOCKS
BITUMINOUS FELT ROOFING
R.C. EAVES BLOCK
SCREED
CANTILEVER BRACKET
WOOD WOOL BLOCK
STANCHION CAP
CLADDING BLOCK
GABLE TIE BOLTED TO STANCHION
PACK
D.P.C.
SHORT SECONDARY BEAM BOLTED TO CLEAT
STANCHION
CLIP AND BOLT ENGAGING IN FERRULE CAST IN BLOCK

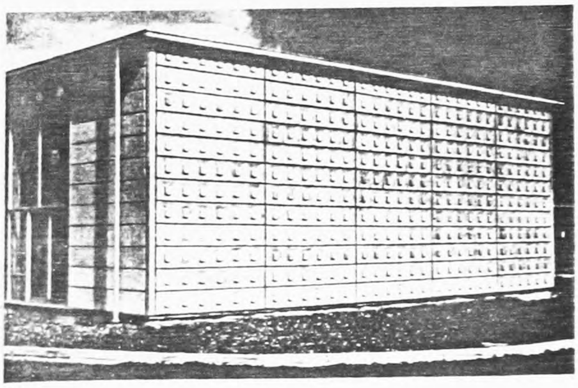
78.



81.



79.



80.

Chapter 13

ARCHITECT-TEACHER COLLABORATION
THE DEVELOPMENT OF PRIMARY SCHOOL PLANNING

During the preparation of its Development Plan the Hertfordshire Education Department, "tried to visualise the sort of environment we thought the children should have." Thus when "the time came to 'brief' the architects we were able to present them with a fairly objective set of requirements, without, however, laying down any architectural ideas."[1] Indeed the architects regarded themselves as fortunate in their clients who, "having prepared a detailed programme and stated their educational requirements gave them a clear mandate to get on with the job."[2] The classic problem for the architect in interpreting the requirements of teachers was clearly understood by the educationists in Hertfordshire:

> The educational world, however, is a difficult one for the architect to deal with, for, apart from the inevitable conflict between the requirements for teaching one subject and another, educationists themselves hold widely differing views, and those views are continually changing. In one way this is all to the good, as it means that we are continually experimenting and trying out ideas; but it is dangerous if an architect, after talking to one educationist, imagines that he can devise a formula for school design and impose it upon others.[3]

The answer was seen to lie in the architect visiting as many schools as possible, spending time with children and teachers, both indoors and out. Furthermore, "where there is an Architects Department and an Education Department in the same building, they can easily have that daily contact which is absolutely essential."[4]

One of the earliest, and most significant, ideas to emerge in the formulation of the primary school brief was that, in scale, schools should avoid resembling institutions in every way possible: the number of pupils should be kept as small as feasible; no more than 500 for seniors, 360 for junior and 240 for infants. This was interpreted most literally by the architects of the early programmes where, in certain cases, two schools had to be put on the same site. Though sharing dining facilities, efforts were made to keep them as distinct as possible. At Oxhey, the junior and infants schools were "sited ...

so that one is screened from the other by natural features."[5]

After the overall size of the school had been established the notion was extended to the sub-division of space internally. Keeping down the scale to something a young child could comprehend had a marked effect on planning. For example, from the very beginning it was held that each classroom should have its own lavatories and cloak space and its own external access. These requirements were of course in reaction to the ubiquitous "rows of insanitary conveniences" through which the children had entered in earlier years, to be "assailed by the smell of wet mackintoshes (entrance halls were for visitors only)."[6] Not unnaturally, the concept of the teaching space and its ancillaries, forming a unit, was the most influential factor in the development of the primary school plan.

In the autumn of 1950 a survey was made of the first fourteen post-war schools to be completed, many of which had been operating for a year or more.[7] The main reason for this survey was the reduction in "cost per place" required by the Ministry of Education for the forthcoming 1951 programme. Firstly the structure was examined, but it was evident that the savings which might be made in construction would still require to be augmented by reductions in floor area if the quality of finishes was to be maintained. A cut in finishes was resisted because, "it was felt that the educational and architectural success of the (early) post-war schools had been largely determined by the standard of finishes adopted."[8] Although there was no possibility of reducing areas below those set out in the Regulations, it was clear that circulation spaces had been over generous and had potential for making economies.

The aspect of the survey concerning school planning was a joint exercise; each school was visited by an education officer and an architect, with a previously prepared questionnaire designed to obtain "factual information rather than personal impressions" from the head teacher and staff.[9] The survey succeeded not only in suggesting reasonable economies but also in highlighting aspects of planning which required further development for educational reasons. As far as teaching spaces were concerned the survey identified a need for improved facilities for practical work. For many of the plans examined, the adjacent corridor had been used for this purpose, making the supervision of two areas difficult for the teachers; where folding screens had been provided for this purpose they had not been fully exploited.

The self-contained "classroom unit" was thus introduced for the first time in the 1951 programme. In plan it consisted of the normal 480 sq. ft. classroom, a practical annexe, an individual lavatory unit, a separate cloak space with its own external door to play areas, through which the children arrived in the morning (fig. 86).

Great attention was given to achieving an economical integration of functions in the design of the lavatory unit. It was skillfully contained within a single 8' 3" square bay and provided one w.c. and urinal for boys, two w.c.'s for girls, and the necessary lobbies (fig. 87). A full size mock-up was built to establish minimum sizes for cubicles, door widths, warm air heater cabinet and calorifier for hot water. The unit was lighted and ventilated by means of a large, opening rooflight which tests proved to be more than adequate. On the outside wall of the unit, facing the practical area, was positioned a sink with draining board and two wash basins (figs. 86 - 88). Positioning the toilet facilities within the overall confines of the classroom had an additional benefit: it enabled supervision and, on occasions, help from the teacher to be greatly improved. Though essentially practical in its intentions, the development of the unit made a most important contribution to the avoidance of institutional atmosphere:

> The decision to make each teaching unit self-contained is a further realization in plan form of the need to increase the domestic character of the school and reduce still further its institutional feeling. This idea has influenced the planning of all post-war schools and it has been expressed by dividing the school into small units not greatly different in scale from the child's home.[10]

Each classroom was provided with hanging facilities for forty hats and coats in a recess off the practical area. Separating shoe lockers from the coat hanging, and positioning them back-to-back under a work-top, enabled a 50 per cent reduction in the cloak space floor area to be made. Separate classroom stores were discarded at the same time: it had been revealed that storage facilities were regulated more by the amount of shelving provided than by the floor area of the store-room. The area was thus thrown into the teaching space and double-sided cupboard units, equivalent to the area of the shelving, were provided instead.

The new classroom unit, together with the general omission of corridors, produced a fundamental revision to the overall plan pattern of the school. Corridors had proved to be unsuccessful spaces for practical work. Moreover,

> A study of the use of the practical corridors in the 1949 programme indicated that so long as no class of children had to pass through more than one practical space to reach its own room, the use of the practical space of the inside teaching unit would not be invalidated by its very limited use as a corridor.[11]

From the evidence of the planning survey, the main circulations in the school were from classroom to outdoors; from classroom to dining area; and from classroom to assembly hall. Generally, the latter two movements involved the whole school simultaneously, so the inconvenience of having one class passing through the practical area of another was expected to occur infrequently and create minimal disturbance. Furthermore, the external doors could be used in fine weather to permit circulation, through courtyards or along external paths, to other parts of the school.

The 12' 0" high ceiling, with clerestory and high-level natural lighting, which had earlier been regarded as vitally important, was now reconsidered. Not only would a reduction in height produce a corresponding reduction in cost but a ceiling at 8' 9" would enable a far more "domestic" character to be achieved. Introducing rooflights at the back of the classroom, or at any point where illumination values fell off, was considered to be a far more pleasant and flexible solution. In addition, the new approach to planning made it possible to position windows in the (hitherto solid) back wall of the classroom. Economy, scale, illumination and ventilation were thus all greatly improved in a single move. Far from stereotyping the plans, considerable variation was possible in the detailed layout of the teaching and practical space surrounding the lavatory unit, and in the relation of teaching units to each other (figs. 82 - 84). The lavatory unit, after passing through a variety of "marks", became standardised and, as such, was regarded almost as a "component" (fig. 88). Designs were prepared accepting the fixed dimensions of the unit from the out-

set, much in the manner that an architect would accept any large mass-produced article of equipment (or component) for integration into the overall design.
Although it was not regarded as a serious disadvantage, in fact a lot of planning ingenuity went into avoiding circulation through the backs of classrooms, whilst still meeting the objective of making a drastic reduction in corridor area. For example, the plan of Kenilworth Drive, Boreham Wood (fig. 83) illustrates the use of one end of the assembly hall in doubling up as circulation space. This approach, however, tended to transfer such nuisance as there was to activities going on in the assembly hall. Given the choice between circulation and more teaching space, or between less frequently used "luxury" areas and teaching space, the teachers would always choose to have larger classrooms. In time the loss of corridors was regretted by some teachers who had found them useful for display purposes. Likewise, in later years the return of walk-in classroom stores would be pressed for, but for the moment the changes were warmly welcomed in Hertfordshire and, in due course, emulated by other local authorities.

There were several other planning changes made in 1951. The initial brief from the Education Department required that the entrance hall "should be the child's way into the school and for his daily use as much as for anyone else's."[12] In fact experience had shown that it was used rather infrequently; the children tended to enter the building through their respective classroom exits which adjoined their cloak areas; the pre-war practice of "entering through the lavatories" had come full circle! Thus, with the proposal to develop the self-contained teaching unit, suggestions were made that the entrance hall should be contiguous with the dining area to preserve the spatial continuity.

The plans most favoured were those which had grouped entrance, dining and assembly hall spaces, enabling them to be used separately or together for evening functions. The opportunity to extract architectural interest from these combinations was seldom missed; they lent themselves particularly well to bright wall and ceiling colours and strongly patterned curtain fabrics. The use of wall colour in such circumstances will be discussed more fully in the following Chapter.

A common request for the omission of permanent raised stages was revealed in the survey; the preference was for portable stage units which could be assembled, by the children themselves, anywhere in the hall to suit teaching requirements. The resulting large, unbroken floor area, level with the curtained-off property store brought, once more, teaching advantage with cost economies and a less imposing scale. The main function of the property store was the storage of games and physical exercise equipment and the stage units, but if positioned as a wide shallow bay off the centre of one of the assembly hall walls, it could be improvised as a more formal curtained stage most successfully.

Following the desire for more ambitious equipment such as climbing ropes and horizontal bars, assembly halls were adapted accordingly. However, teachers and architects alike felt that a "gymnasium or drill hall atmosphere" should not be allowed to replace the informal character of the earlier halls of the post-war programme. Efforts were made to make all the gymnasium equipment demountable so as to reduce its visual impact. The ring-battens in the free-standing stanchions were used to support horizontal bars, placed in position by the children at any required height up to 8' 8" and in any number. Climbing ropes were hooked onto lowered yards which were then hauled up by halyards to guide on the lower flange of main beams. The halyards were then made fast to cleats. After use the process was reversed and the yards were hauled up to the roof to be out of the way. The architects' drawing (fig.85) illustrates the ropes and horizontal bars being prepared and in use.

As far as administrative accommodation was concerned, the survey suggested the redundancy of a separate secretary's office. The school secretary attended, on average, only five to ten hours per week and could therefore be accommodated in either the head's or the medical inspection room. The waiting room was likewise omitted on the grounds that inspections could be timed so that only three or four parents were waiting at any one time; these could be seated in the adjacent circulation space without inconvenience. The self contained teaching unit and the design of flexible, multi-purpose space throughout the school with the elimination of circulation space per se were the keynotes of the 1951 primary schools programme. The innovations which followed in future years were minor by comparison with this watershed.

In both planning and construction terms, development reached its peak at a time when attention required to be diverted to the needs of the coming Secondary schools. Indeed it is likely that the levelling off occurred not only because the architect-teacher team appeared to have attained their goal but because of that diversification of effort and imagination.

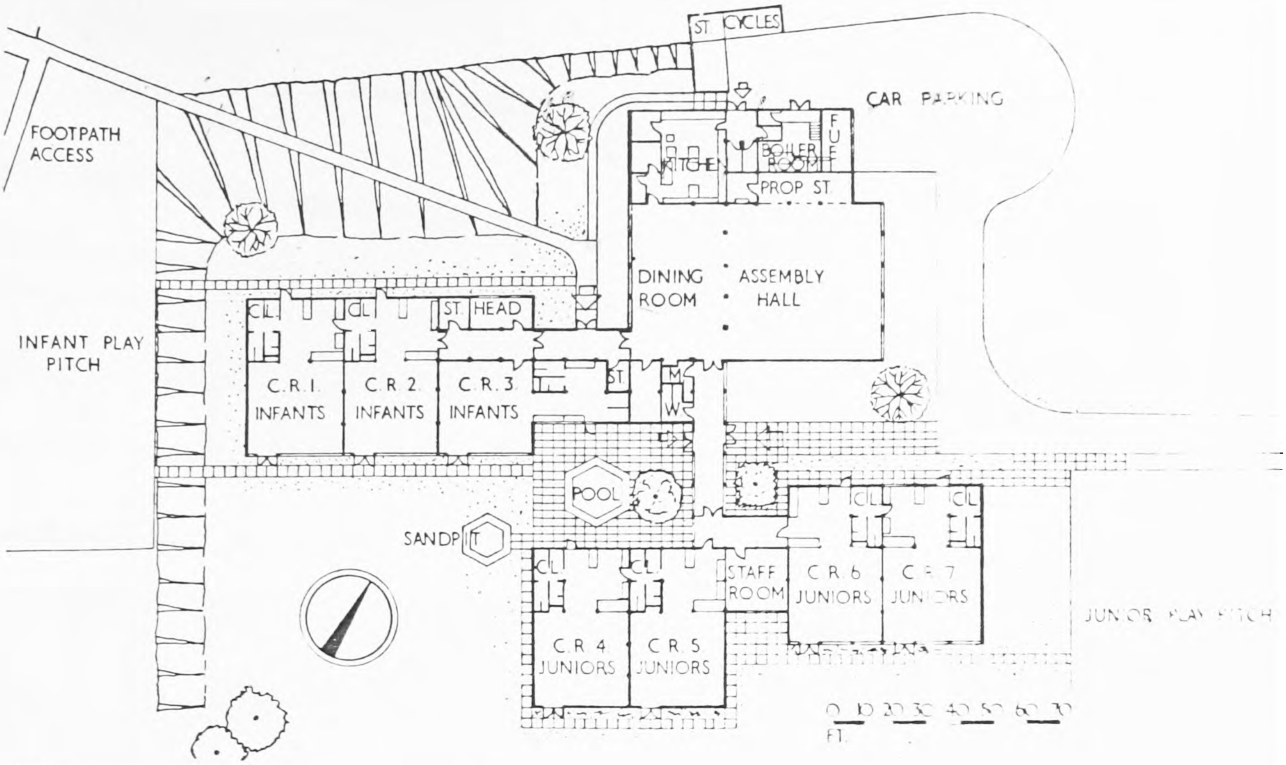
The consultation process continued with every school design. Although the brief was more or less constant, the architectural solution for each site was unique and, inevitably, unprecedented situations arose when the advice of the educationist and his checking was essential. Eric Bird summed up the relationship at an early stage thus:

> A special point is made of consultation with "the client", that is to say, with the County Education Officer, his staff, specialists, teachers, etc. These form a first-rate client, because the programme is formulated in the clearest and broadest terms from the inception. Further, after a building is occupied and its staff appointed, meetings are held with the teachers to discover any improvements which may be made or defects avoided in future projects. This works very happily, and several suggestions made by teachers have been adopted.[13]

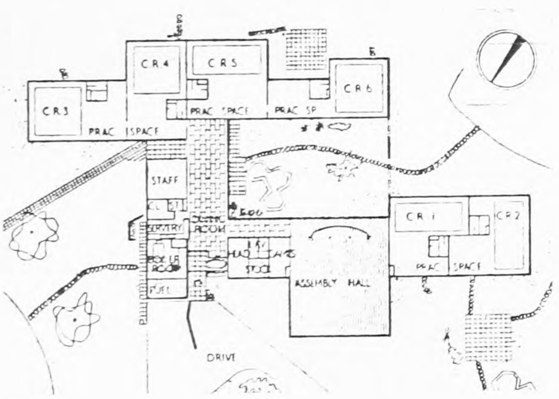
The meeting Bird referred to became known as the "post mortem" and the file of headmaster's invited reports, followed by the notes of post mortem meetings, became essential reading for the architect embarking on a fresh design.

Notes to Chapter 13.

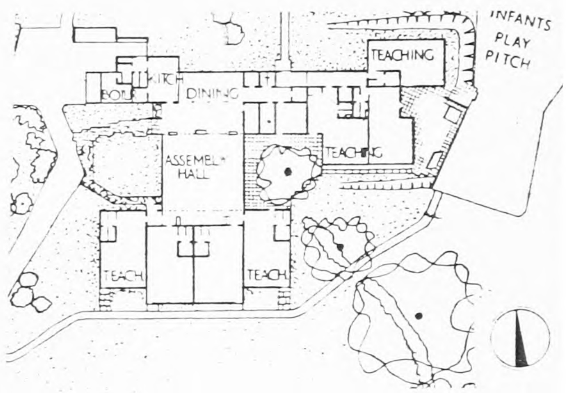
1. HCC Educationist, "User requirements in school design: a brief account of an experiment in collaboration in Hertfordshire with illustrations from the school programme." A and BN, 30 Sept. 1949, p.322.
2. Ibid., p.333.
3. Ibid., p.321.
4. Ibid.
5. Ibid., p.323.
6. Ibid., p.319.
7. E651 (50 - 51) 259.
8. W.D. Lacey and H.T. Swain, "Primary schools in Hertfordshire." AJ, 3 April 1952, p.421.
9. Ibid.
10. Ibid., p.423.
11. Ibid.
12. A and BN, op. cit., p.325.
13. Eric Bird, "The post-war schools of The Hertfordshire County Council." RIBAJ, Sept. 1949, p.478.



82.



83.



84.

Figures 82-88.

82. Oxhey, Greenfields JMI School, plan.
(Architects Journal, 3 April 1952, p.424)

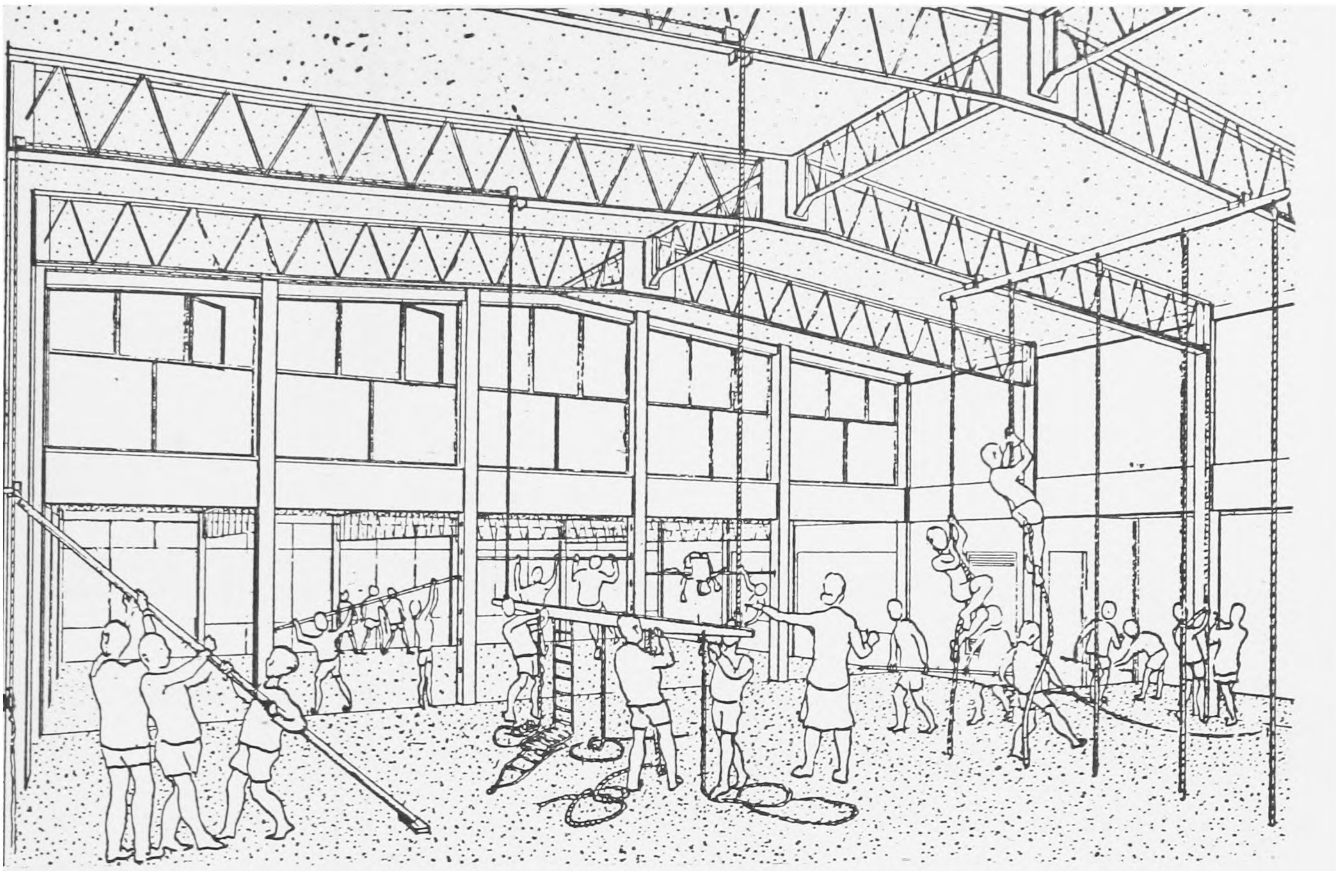
83. Boreham Wood, Kenilworth Drive JMI School, plan.
(ibid., p.425)

84. Hatfield, Cranbourne JMI School, plan.
(ibid., p.426)

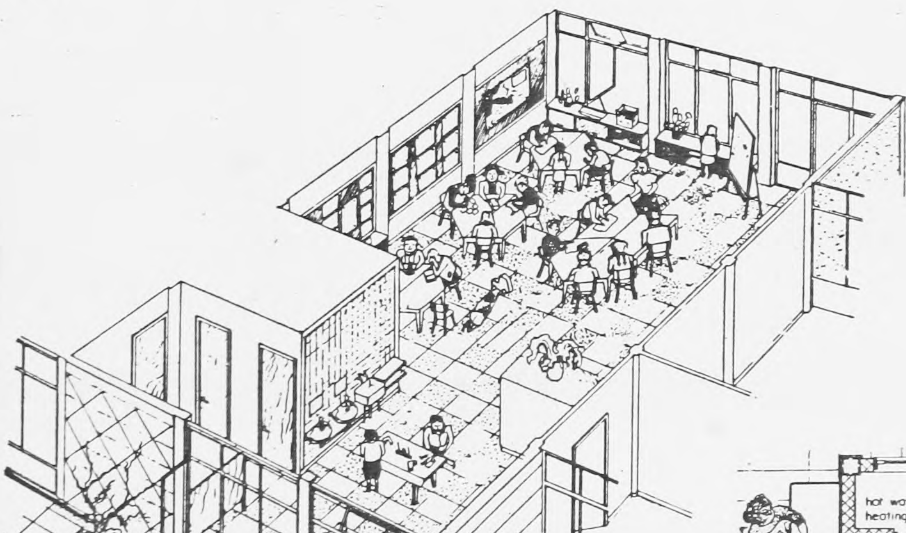
85. Greenfields School perspective drawing of assembly hall.
(ibid., p.425)

86. Typical teaching unit in the 1951 Programme; perspective drawing illustrating relationship between teaching space, practical space, cloakroom and lavatory.
(ibid., p.424)

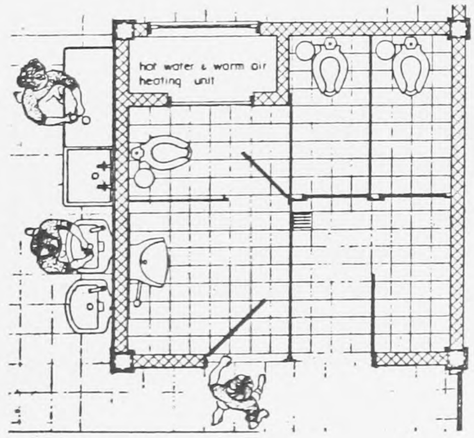
87. Typical teaching space lavatory unit, plan.
(ibid.)



85.



86.



87.

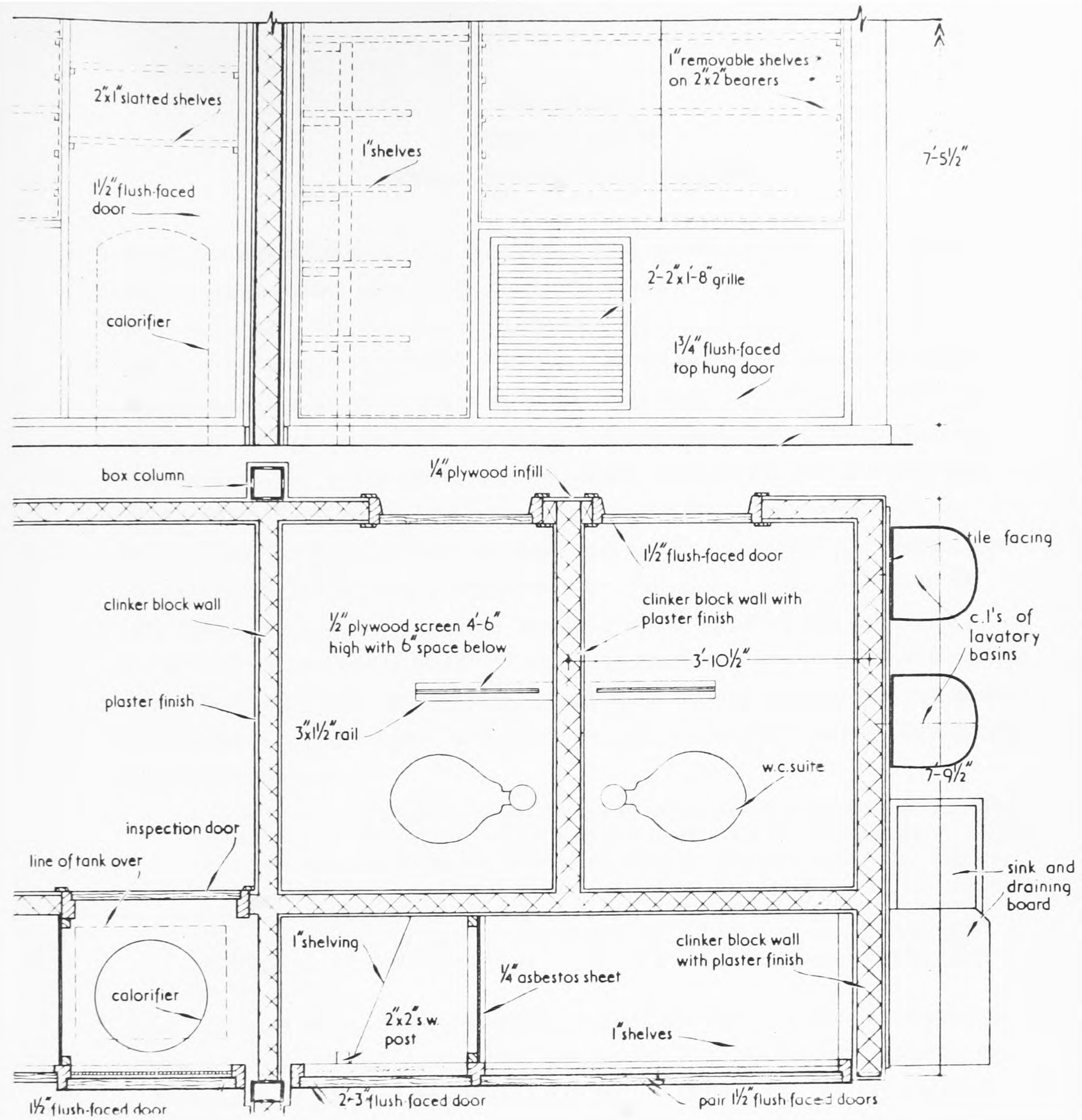


Figure 88.

Classroom lavatory unit: integration of structure and services. Note the "weatherfoil cabinet" ductless warm air heater, freeing valuable wall space of radiators, pipes, etc. (figs. 94,95,117,229). Re-circulated air was propelled through car radiator-like cabinets fed by piped hot water from oil-fired (solid fuel in early examples) boiler. System developed by Herts with George Fowler of Weatherfoil Ltd., from Cheshunt onwards. See Lacey and Swain "Hertfordshire schools development:3" A.J., 11 August 1955, pp.197-201. See also J.B. Dick, "Experimental and field studies of school heating" Journal of Institute of Heating and Ventilating Engineers, June 1955, pp.88-123.

Chapter 14
INTERIOR DESIGN
COLOUR, FURNITURE AND FITTINGS

With the refinement of the constructional system and the development of the primary school plan came an improvement in the quality of detailing and finishes. Experience in component building enabled the Hertfordshire architects to achieve a fluency in bringing the parts together. The apparent ease with which this was done and the seemingly inevitability of conjunction which resulted was described by Richard Llewelyn-Davies and John Weeks as "a technological conciseness which owes more to industry than craft tradition in building."[1] The interiors, in particular, avoided by this process the intensely individual solutions so common in the modern architecture of the time. The character of the interiors was derived from the full expression of the component, be it column, pilaster or 8' 3" wall panel; each part articulated rather than fused with its surroundings. Frequently the components and their differing functions were emphasised by use of colour; as Llewelyn-Davies and Weeks put it:

> Colour is always used in an architectural rather than in a decorative manner. Ceilings, floors and structure are treated as neutral, ceilings generally being white, structure always grey, and floors generally kept to mottled shades of brown and grey. In the assembly and circulation spaces a large proportion of the wall surfaces is painted in strong colours, but generally the choice and placing of colour is such as to separate and divide, rather than to unify.[2]

This approach was well illustrated at Pentley Park, Welwyn Garden City, where a series of walls appeared one behind the other, each painted in a differing colour. The "teaching units" introduced in 1951 tended to use colour to emphasise their self-contained nature. Within them, walls of different colours were used in harmony; contrast was used between one such unit and another. Just as the omission of the high-level glazed strip over the party wall between classrooms had broken down scale, so was colour used to induce a domestic rather than institutional scale.

Although the importance of colour in creating the total school environment was appreciated from the Cheshunt prototype onwards, there were problems in applying it in a rational manner consistent with the developing structural philosophy. Colour specification, before the days of British Standard Colour Ranges, was a chaotic field dominated by the paint manufacturers who, understandably perhaps, had more interest in selling paints than co-ordination (or standardisation) of colour ranges. The Hertfordshire architects, in developing a total approach to design, had become highly responsive to the discipline of rationalisation and were doubly aware of its benefits. Though the object of rationalisation was ostensibly the simplification of the architects's task, by reducing his range of decision making in an area which was prone to arbitrary choice and uncertain result, there was perhaps another, unconscious, motive. The urge to reduce this chaos to some kind of order must have been great, and standardisation for its own sake (when all else had proved amenable to it) must have been tempting. Writing in 1952, Jack Howe described the background to the problem thus:

> Colour design has always been a somewhat haphazard process due on the one hand to the varied personal taste of designers, and on the other to the lack of a universally accepted colour scale. For many years architects have urged that such a scale be established and used as a basis for colour design in the same manner as musical notation. In this way it would be possible to specify and reproduce within predetermined limits, any tone of any colour by means of numerical references and be sure of getting the desired result. Unfortunately such a scale does not yet exist and colour matching is still a matter of trial and error.[3]

Perhaps because the deployment and appreciation of colour in architecture is inherently subjective, at least in part, its theoretical use in Hertfordshire assumed an importance verging on the dogmatic. This is evident from two sources, both connected with David Medd.

In September 1949, not long after he left the County Architects Department to join the Ministry of Education (under its chief architect, also ex-Herts, Stirrat Johnson-Marshall), Medd wrote a note on Colour in Schools as an addendum to an article in the <u>Architectural</u> Review, illustrating three of the first batch of primary schools: Cheshunt, Essendon and Hitchin.[4] Medd had himself been co-designer (with Bruce Martin) of the Cheshunt prototype and (with John Redpath) of another in the 1947 programme. Medd's premise was that, as the Hertfordshire Schools were designed on a group basis, involving "standardization of means, not ends," the method of working made it necessary to evolve a rationale for the use of colour that could be appreciated by all the members of the group and not by merely one or two. His rationale assumed that there were three main approaches to the use of colour in building:

a. Decorative: unimportant details are usually exaggerated. It would be mistaken to condemn this approach outright, but it cannot be considered a rational one.

b. Camouflage: colour is used to change the existing conditions (for instance, lightening a dark space or simplifying a complicated space); a process most often necessary in treating existing buildings.

c. Organic: colour and form are considered as inseparable. All surfaces are subject to certain natural and functional conditions, such as the degree of daylight falling upon them, and the functions for which they provide a background. Because colour must be related to these conditions, the architect must realise that, at early sketch design stage, he is determining the nature of the colour. If this relationship is not maintained, and colour does not "speak the truth," it will not be a clear expression of the architect's original intention, and will probably rely too much on either a decorative or a camouflage approach.[5]

He then gave the following procedure for analysis of the building as a guide to the appropriate use of colour:

1. The aesthetics of the structure: different structural methods present different visual patterns, which should be clearly expressed by colour. The frame construction used for the schools gives a visual pattern of beams and columns with panels inserted between them. This aesthetic is one that imposes a natural discipline to the interior, and its recognition by the colour treatment will prevent a conflict between the two. The structural members have been consistently painted a pale grey throughout the schools in order to avoid an inappropriately decorative treatment, while the panels receive colours appropriate to the spaces they enclose.

2. Light and shade: the architect, by his arrangement of windows, can create a conscious pattern of light and shade in the interior. This pattern should vary according to the use of space; therefore, when colour is applied, it should conform and not conflict with the original conception. There can be a definite relationship between the light reflectivity of the colour (as distinct from hue) and the degree of light falling on the surface. However, a corrective use of colour may often be necessary where sky glare has to be reduced.

3. The children: the children must determine the character of the colours. With their quick movements, bright coloured clothes, high-pitched voices, they will create a sparkling pattern, whatever they are doing. Also they like, and tend to use, bright primary colours, without a lot of thinking and mixing. In so many schools these qualities fail to be reflected in the use of

colour, which so often are dirt-concealing, dull or at best sophisticated.

4. Activities in the building: a primary school can, for convenience, be divided into four kinds of space:
(a) Entrance halls and circulation areas. Here is constant movement, and children do not stay for any length of time. This suggests that colour can be used boldly, and in the most stimulating schemes.

(b) Assembly halls and dining rooms. Here there will be considerable activity and movement, with larger groups of children. This suggests a bright and jolly colour treatment, although perhaps rather more dignified than in the entrance or circulation areas. Because the assembly hall is the one common meeting place for the whole school, it is psychologically valuable to create something more than a merely passive background - a character which will catch the imagination on entering.

(c) Class spaces. Formal teaching is giving place to a wide variety of informal activities, which need a domestic rather than an institutional, setting.

(d) Staff rooms, etc. These will be occupied by adults, and a domestic character is appropriate.[6]

Medd acknowledged the oversimplification of the statement and stressed that there was plenty of opportunity for the interesting use of colour in the primary school and "no reason for the dull uniformity which is so common." He was particularly concerned about co-ordination of colour and pointed to the "urgent necessity for research into how a standard system of terminology can be established, and how a small number of basic reliable colours can be selected so that, when intermixed, they can provide a comprehensive colour scale." The philosophy is thus essentially that of small-component system building. Medd's ideas, which had been linked with those of William Gloag (of the Building Research Station) from the earlier Hertford-Garston relationship,[7] became particularly influential when he moved to the Ministry of Education. There, the Building Branch eventually produced Building Bulletin 9, Colour in Schools, and the rationale it disseminated was a direct descendant of the preceding work in Hertfordshire.

Further insight into the importance attached to colour theory can be gained from a document which has never been published.[8] In 1951 the County Architects Department prepared, and circulated within the office, a set of guidance notes on the use of colour in schools. The notes were very comprehensive and constituted a remarkable treatise on the architectural use of colour; they are included here as Appendix 1.

Devised for their own use, and intended to be applied rigorously to a limited field of building, they provided a vocabulary which matched the broader language of school design which they had created.

Despite the notes and their intention, the architects were not always able to resist the temptation to break the rules. There had been criticism of certain colour schemes by "councillors and other laymen." Ironically the very completeness and conviction of the theory made it easier "to criticize schemes and comment unfavourably when radical and inexplicable departures are made from the approach developed in the office, and used on the majority of schools to date." For this reason architects were formally instructed that all colour schemes had to be approved by the Deputy County Architect before being put in hand.

In February 1956 at a group leaders meeting, complaints that schemes were "too dull" or, "too strong in the wrong places," were discussed. The office's involvement in the work which had led to Building Bulletin 9 (BB9) was recalled and, in case of ignorance, newcomers were referred to the office files on colour and, in particular, to the guidance notes (see Appendix 1). The minutes of the meeting record:

> Recent departures from the ideas set out in these notes are:
>
> 1. Use of too high chroma colours in classrooms, leading to excessive contrasts within the field of vision of teachers and children.
>
> 2. Use of high chroma colours of too low tone value against windows, leading to bad brightness contrasts and glare.
>
> 3. Excessive use of dull colours and dark colours in general. These are examples of bad functional use of colour.
>
> 4. Loss of colour expression and articulation of the frame-and-panel nature of most of our jobs.
> This may be a matter of opinion, but seems to be a very doubtful development.[9]

Two months later the minutes of a similar meeting reaffirmed the office's support of BB9, once more alluding to its origins, and introduced the long-awaited standard range of colours:

> The office policy is to support and use the BSI/RIBA "101" Colour range. The use of the old Archrome range will therefore cease and colours will be specified from the "101" range ...[10]

and pointing out that the revised edition of BB9, "which will appear shortly, will contain a revised Archrome range (Archrome 2) which is a reduced range of 50 (sic) colours selected from the 101 range and recommended for use in schools."[1] With the publication of BB9 the departmental notes on the use of colour were forgotten. Along with schools architects throughout the country they used the culmination of thinking which had had its origins in their own office.

Examples of how the systematic coding of colours enabled precise communication to take place are the articles which appeared in journals, where, in the discussion of current architecture, precise colour references were given in the technical descriptions. The published plan of Summerswood Junior School (discussed in Part 3), showing Munsell notations (fig.122), illustrates a typical example of the use of colour in the primary schools of the 1951 programme. Similarly, in the Architects Journal description of the Ravenscroft Secondary School (Hertfordshire's one hundredth school) colour notation is given in the very full technical description.[11]

In a normal sense furniture and fixtures are rarely regarded as parts of a building's construction system. In Hertfordshire they became an inseparable and logical extension of it. Like colour, the furniture complemented the building fabric: light fittings could not be considered separately from ceilings (either visually or physically, or in terms of illumination performance); wall fixtures, "built-in" worktops etc., were extensions of the partitions (via shelving, pin board, chalkboards and so forth); loose furniture had to relate to the fixed in size, materials and utility. And so the continuum progressed.

Tables and chairs, desks and storage units, wash basins, taps and cloak fittings; every item of furniture and every fixture was subjected to the same scrutiny to determine its suitability for inclusion. Where compatible selections could not be made from existing ranges, it was purpose-made. All the items found their way onto "standard drawings" and information sheets so that consistency from job to job and from architect to architect could be maintained. The reduced drawing (fig. 89) showing a representative selection from the 1950-51 range, is too small for the notes and dimensions to be read but it does give a further impression of the comprehensive design approach. To illustrate this aspect of development work, two contrasting examples will now be discussed: the early development of a primary school cloak fitting and a washbasin which became a classic, the Adamsez "Bean".

With the intention of avoiding the institutional character of the traditional tubular steel and wire mesh coat rack, cloak stall units in the Cheshunt prototype were formed in fibrous plaster "partition" construction. The solid end panels (fig.92) tended to shield the hanging coats from view in the circulation areas and helped to reduce the scale of these areas by forming a series of small, low-walled, enclosures. Hot water heating coils were embedded in the fibrous plaster panels. Timber, being almost impossible to obtain for construction purposes, was confined to the hardwood hinged seats.

The first modification eliminated the heating coils, which had proved to be rather expensive, and introduced a fixed seat thereby saving unnecessary hardwood framing. The hollow fibrous plaster stall panels were changed to woodwool core (fibrous plaster faced), to accord with the change in partition construction generally (Chapter 9). Heating by means of adjusting the general space heating provisions seemed to be a reasonable alternative. But the fibrous plaster surface failed to withstand satisfactorily the wear and tear it received in use. Moreover it was difficult to paint on account of the mould oil on surface and mineral salts in the material. Because the locating spiggots for the bench legs were positioned by the builder, before the bench arrived on site, accurate fitting proved difficult. Finally, as there was insufficient space under the shoe baskets for sweeping, the omission of the hinged seat imposed cleaning difficulties and required reconsideration.[12]

By the middle of 1949 timber was becoming more readily available and its use in a self-finished, simplified unit seemed logical. Instead of the dividing panel between adjacent benches, a hardwood hook-rail was introduced and the hinged seat returned. The problem for the programmes that followed was one of fitting the units in as they occupied rather more space than could be afforded within permitted cost limits. However, it was not until the early sixties that a completely mobile cloak unit was introduced on the grounds that a pair of them could be parked compactly, and conveniently out of the way until needed. In practice such units proved cumbersome to move, and there was always a handkerchief or something which a child needed to retrieve from a coat pocket during a teaching period. Somewhat defeating their purpose, they were consequently often used as free-standing, space consuming but accessible, units.

In 1946 the most suitable wash basin available was the BSS basin for schools. After a trial installation in the Infants' section of Cheshunt, the basin was considered to be unsatisfactory. The relatively small, square shaped, bowl was ergonomically unsound; both the soap tray and the overflow were positioned on the sides, under the wrists when in use, and involving an excessive volume of fireclay in its manufacture. The basin had a large integral splashback and a deep slab-like front which added to its clumsy appearance and cost of production. Soap and dirty water tended to collect on the large horizontal surfaces and the separate hot and cold taps added to the clutter and surface area to gather dirt.

The sanitaryware firm of Adamsez Ltd. were approached and agreed to collaborate in the development of a small, rounded, bowl-shaped, basin specially designed for young children. After hand-shaping experimentation in clay the architects and Adamsez created the appropriately named "Bean" basin (fig. 93) which became the standard fixture in many counties for years to come.[13] Premixed water at constant temperature, supplied through a single tap speeded up the use of basins, reduced the risk of scalding and reduced running costs: bonuses to add to the main objectives of reducing manufacturing and installation costs and improving appearance. Adamsez proceeded to develop a range of related basins suitable for each age-range and these became standard use in Hertfordshire. Elsewhere, these "logical fittings for schools, rimless for cleanliness, designed as part of the architecture,"[14] exercised enormous influence on sanitary ware design.*

Along with the basin came a reconsideration of the plumbing which clearly did not conform to the standards desired in children's lavatories. In the 1947 programme, when the Bean was introduced, it was

*The architect Alison Smithson is quoted in Design, June 1977, recalling Adamsez sanitary ware: "We liked them at a time when "design" was a pejorative word, in the late "forties"and early "fifties". They belong to a hopeful period; Adamsez kept this flame of hope alive until it was closed down in 1975. The shapes were commonsensical and sturdy. They represented an indigenous regeneration of industry (the clean white hope of the north east). The ware was useful both to us and to those who, it seemed, might be on the threshold of a cool industrialised architecture".[15]

individually trapped and the waste pipes taken through the wall into a walk-in duct space. Figs.43 - 48 illustrate the space occupied by such ducts and, not surprisingly, they were omitted in the 1948-49 programmes and never reappeared. Instead, improvements were made by introducing prefabricated, copper waste assemblies, factory-made by Econa Ltd. These were standardised in a range of assembly designs which could be used in all schools and achieved a far higher standard of finish than was previously possible with the site-made lead waste, which discharged over unhygienic open gullies. The prefabricated wastes allowed for the provision of a trap at the end of each run,[16] rather than at individual basins, and allowed adequate tolerance for fitting to the drain floor-connection, positioned in a much earlier site operation (fig.95).

These examples of the complementary nature of construction and interior design development in Hertfordshire must serve as representatives of many more. As the student authors of PLAN 6 wrote:

> The post-war Hertfordshire schools are among the first in which a real attempt has been made to provide an active background for children. A great degree of free movement within the schools is possible - the entrance, assembly, eating and communication spaces flow freely into one another.
>
> The structure is light, gay, and logical - completely without pomposity. Colour has been used for what it is - an integral part of the light and space of the building. Free at last from the cream wall andgreen dado, the circulation spaces in these schools sparkle and glow with large areas of bright colour.
>
> These schools - clean and lively places stimulating the same qualities in the children who use them - are at the beginning of a new understanding of the child in his society and his building.[17]

But what did this new teaching environment do for its occupants? Clearly the functional and ergonomic design of furniture and equipment made for greater facility of use and comfort at work and play. But much was done out of sheer belief in its inherent rightness; with regard to colour, BB9 recognised that it was:

> obviously impossible to give any exact proof of the effect on children and teachers of this new approach to colour, but there has been sufficient experience to provide both educators and architects with some evidence that daily work can be made more enjoyable when the colour scheme is a positive rather than a neutral element in the environment. It is reasonable to assume also that colour used in this way can have an important effect both on the happiness of children while they are at school and on their taste and feeling for colour and form in later years.[18]

The assumption was tentatively confirmed by Margaret Willis's facinating investigation, among two groups of young people brought up in post-war Hertfordshire, of the effects of their school environment on their tastes and interests.[19] In the study, over a hundred recent school leavers from two small towns of equal size, Royston and Baldock, were contacted. Whereas the Royston group had attended a post-war Hertfordshire secondary-modern school, the Baldock group had been to a traditional type pre-war school. They were randomly selected but, to avoid home influence factors, none were living in modern, recently built houses.

Although all the young people wanted their own future homes to be "modern" there was no doubt that the clean, bright, colourful atmosphere of the newer shcool was memorable to the former pupils of Royston. The group had moved from a very old primary to the new secondary school and were understandably most impressed by the greater amenities, such as the gymnasium, internal toilets, hot and cold water, workshops, craftrooms and library. But after these amenities it was the windows, sunlight and colour that were appreciated most, as is clear from the following extract:

> What impression did you have when you moved from the old primary school? "I think the atmosphere, lot of light, cleaner, knocked the old one into a cocked hat. There was no comparison, cleaner, lighter, better ventilated and more facilities." NEIL ENOCH
>
> "Well, it's very well planned out. The classrooms were light and airy, plenty of windows so you have more sun, the sun was in every corner of the room, lovely in the front. In summer time you have all the windows open and it was really warm. I loved everything about it." LYNDA COSTELLO
>
> "I went to a very old school until I was twelve - it used to be a hospital - and then I went to this modern school. It was beautiful. I noticed everything, it was new, all glass. The other one had very high windows, you couldn't look out. It had old-fashioned desks, dark brown ones with the seats that lift up." RITA FREEMAN

Colour was not mentioned spontaneously but when prompted they appeared to like it:

> "The school has got a coloured ceiling and different coloured walls. I like that, it's very nice." LYNDA COSTELLO
>
> "It wasn't done all out in the same colours, all the classrooms - as far as I can remember - were in a different colour." NEIL ENOCH
>
> "I don't mind walls of a different colour, I grew to like that at school." COLIN ABREY

and Vic Morley at her pre-war school in the other town criticised it for lack of colour and pictures:

> "I didn't like the classrooms very much. They were bare, there was just the desks. It was noisy, you could hear everything echo. It was too cold, a cold sort of place. Some classrooms were painted green and white, some blue, some ordinary stones (sic) painted a grey colour - just seemed bare, the classrooms, just the desks, didn't have many things on the walls."[20]

The investigation would, no doubt, have come up with similar comments in counties other than Hertfordshire. Moreover, a present day survey among people of similar age might be expected to have different results, after nearly thirty further years of change in the design of the everyday environment. Although inconclusive, the survey's interest to us here lies in Willis's remark that:

> In some respects the way these people described their school was reported when they described their "ideal house" ...[21]

Notes to Chapter 14.

1. R. Llewelyn-Davies and J. Weeks, "The Hertfordshire achievement", AR, June 1952, pp.366-387.
2. Ibid., p.372.
3. Jack Howe, "New schools in Britain", in Architects Year Book 4, 1952, p.77.
4. David Medd, "Colour in Schools" (HCC) AR, Sept.1949, p.166-168.
5. Ibid., p.166.
6. Ibid.
7. See Appendix 1, p.294.
8. HCC Primary school programme, Information Sheets Section B2, "Wall finishes: colour" (Sheets 4 - 14). Included here in full as Appendix 1.
9. HCC Team Leaders Meetings, No.6, 27 Feb. 1956,item 5(g).
10. HCC Team Leaders Meetings, No.8, 26 April 1956,item 9 (b).
11. "Secondary school in Barnet Lane, Barnet" AJ,24 Feb. 1955, pp.265-278 and 284.
12. W.D. Lacey and H.T. Swain, "Hertfordshire Schools Development,4." AJ, 22 Dec. 1955, p.850 - 853.
13. J. Beresford Evans, "Towards better ceramic sanitaryware (Adamsez)." Design, Oct. 1954, pp.20-25.
14. "In praise of pace-makers, 25 year review 1952-1977." Design, June 1977, p.52.

15. Ibid.

16. W.D. Lacey and H.T. Swain, op.cit., p.853.

17. Architectural Students Association Journal, Plan No.6, 1949,p.22.

18. MOE, Building Bulletin 9, 3rd Ed. 1962, p.4.

19. Margaret Willis, "Design for boys and birds." AJ, 16 Jan.1963, pp. 150-160.

20. Ibid., p.158. 21. Ibid., p.160.

Figures 89 - 98.

89. Birmingham School of Architecture 2nd.yr. study sheet of HCC school furniture by J.L. Kitchen. Various students recorded and analysed different aspects of the Herts schools and their equipment. (Architects Year Book 4,1952, p.88)

90. Standard Infants locker unit. (RIBAJ, May 1948, p.285)

91. Standard desk for Juniors. (ibid.)

92. Essendon JMI School, corridor classrooms opposite classroom doors. (Architectural Review, Sept. 1949. P.163)

93. Adamzez "Bean" lavatory basin final development. (Adamzez sanitaryware catalogue, c.1968.

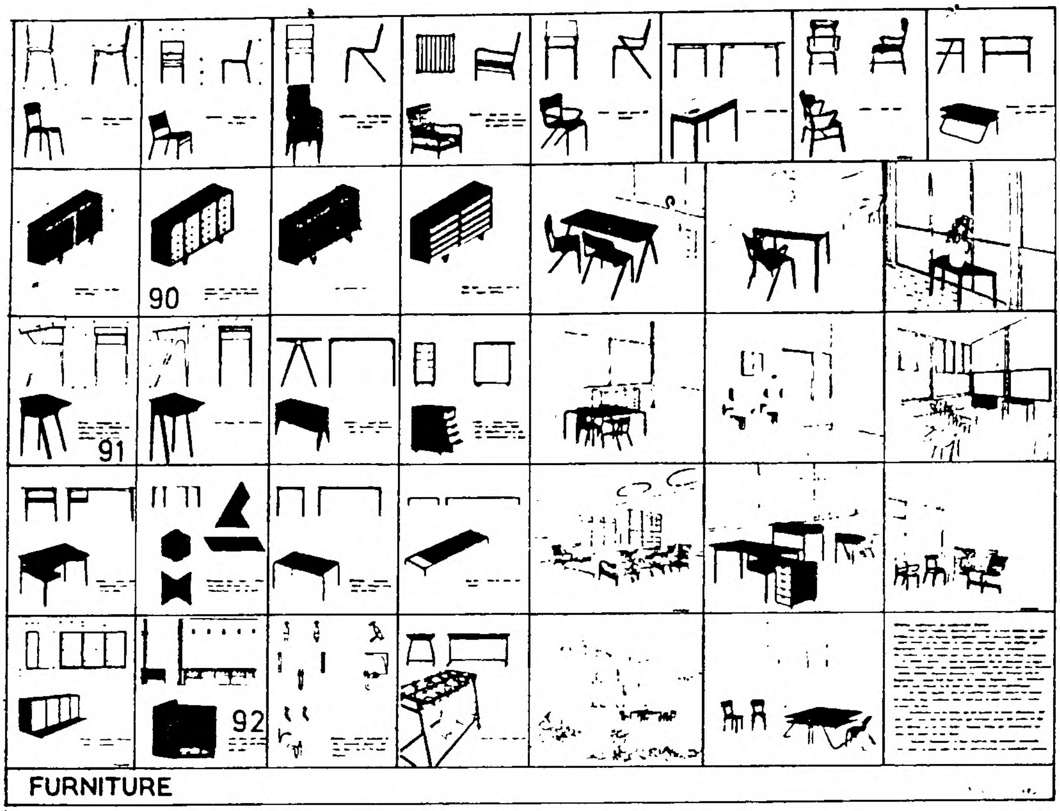
94. Calorifier cupboard, heater unit by Weatherfoil Ltd. and general storage cupboard. View of exterior of lavatory unit shown in fig. 88. (Architects Journal, working detail series, 5 July 1961)

95. St. Albans, St. Lukes Day School, 1963 development of standard lavatory unit in DISC, brick and timber construction. (photo. M.P.K. Keath)

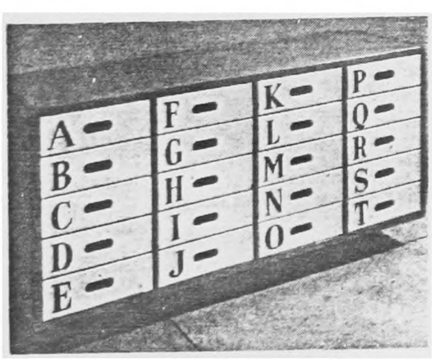
96. Cheshunt, Brookland JM School, shoe locker unit. (Architects Journal, working detail series, 18 May 1961)

97. Brookland School, cloakroom fitting. (Architects Journal,working detail series, 25 May 1961)

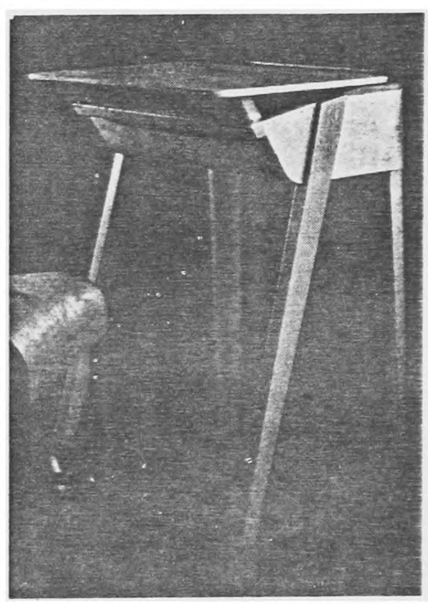
98. Standard mobile cloak and shoe unit. (HCC 1963 standard Primary School Brief, detail no.6)



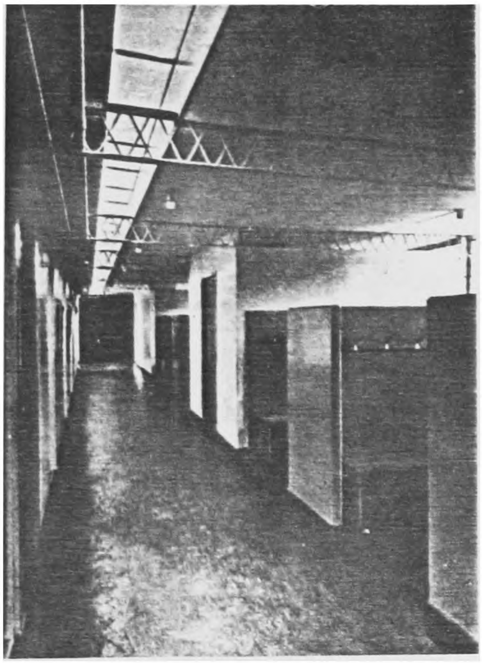
89.

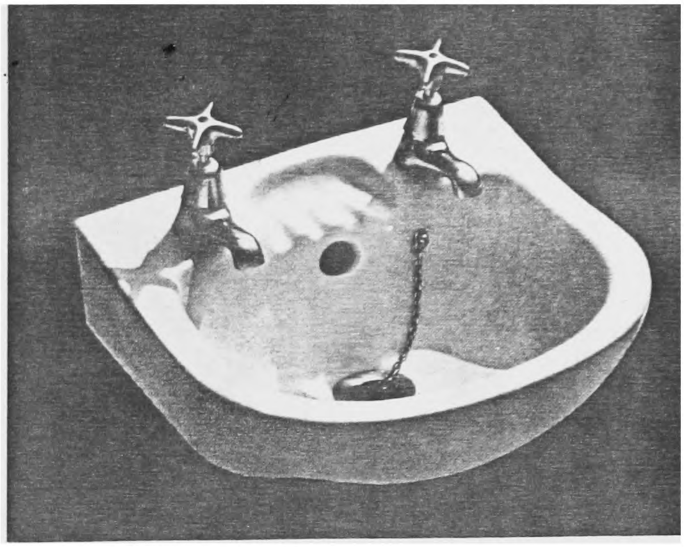


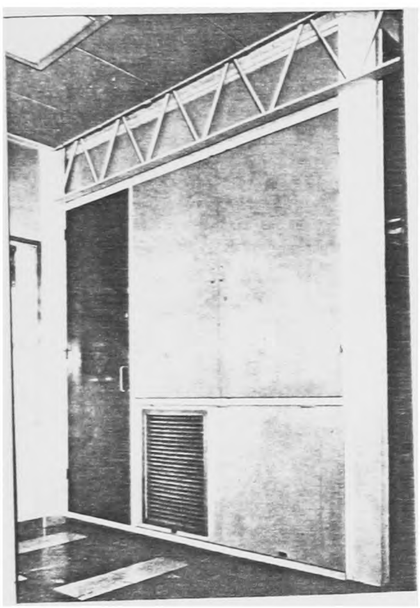
90.



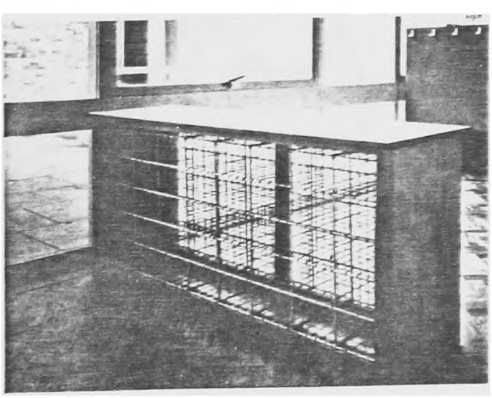
91.

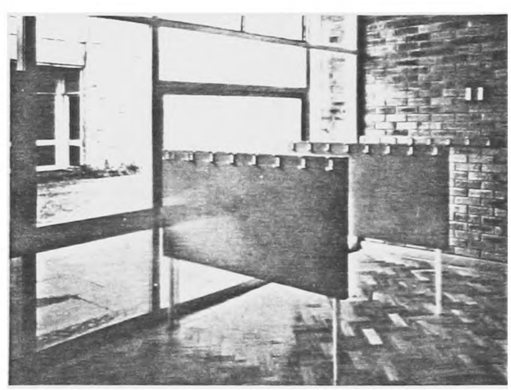

92.


93.


94.


95.


96.

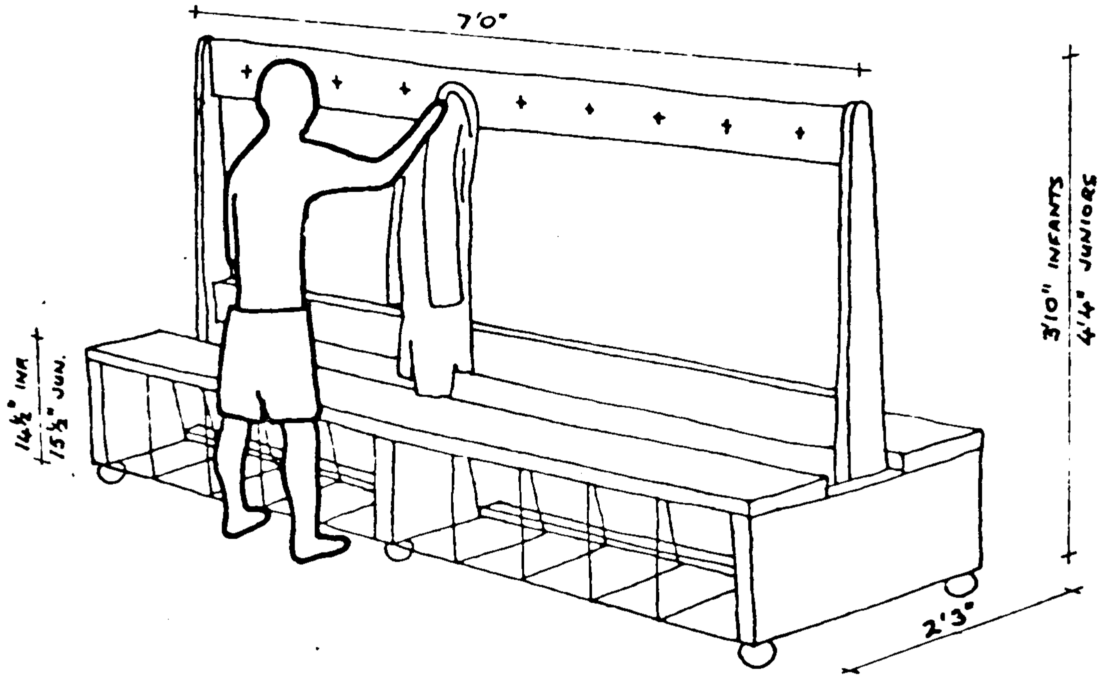

97.

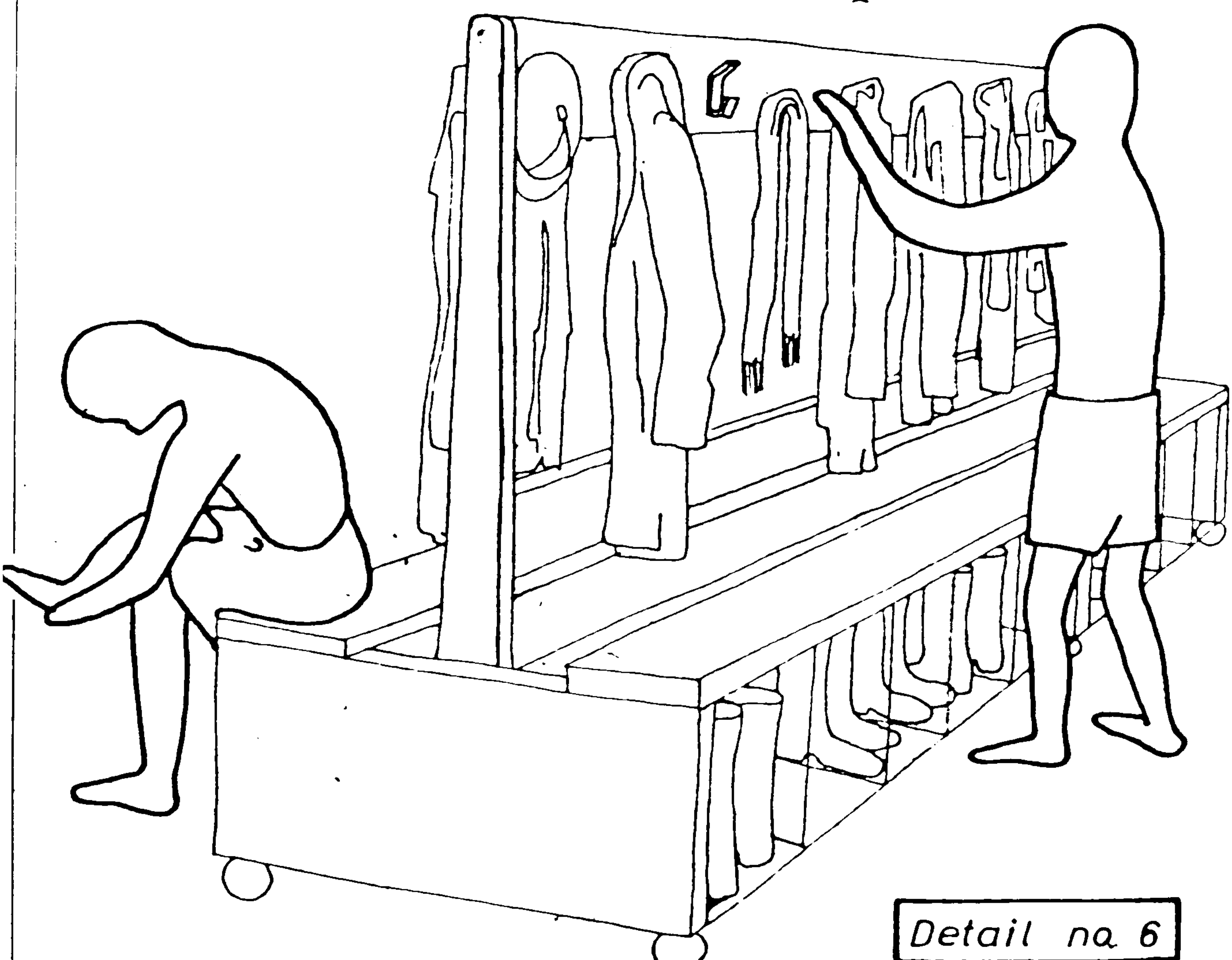
HERTFORDSHIRE COUNTY COUNCIL
COUNTY ARCHITECTS DEPARTMENT
COUNTY HALL, HERTFORD

2 F.E. INFANTS SCHOOL
1 F.E J.M.I. SCHOOL
2 F.E JUNIOR SCHOOL

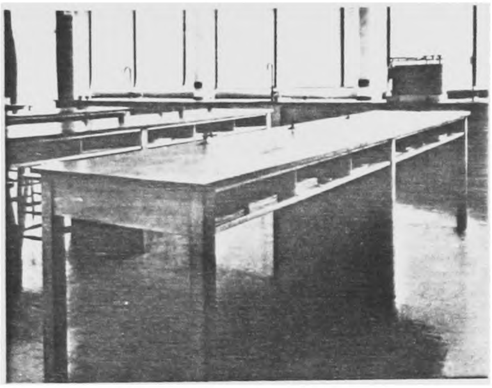
2 no. MOBILE PER CLASSROOM

MOBILE CLOAK AND SHOE UNIT

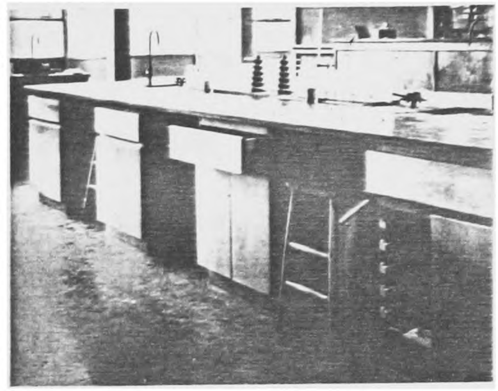




Detail no. 6

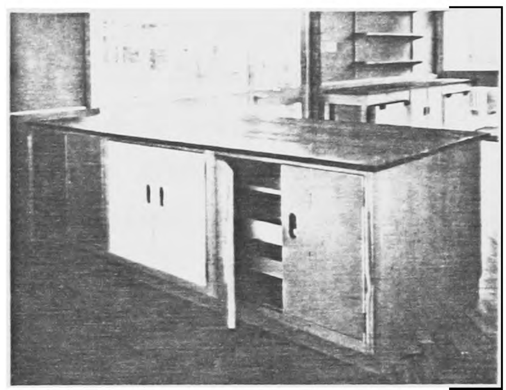


99.



100.

101.



102.

Figures 99 - 102.

99. Science table with services. Constructed from HCC std. drg. White Basic M122. (Architects Journal, working detail series, 2 Aug. 1961)

100. Senior laboratory unit island bench. Constructed from HCC std. drg. White Basic M117 and M118. (ibid., 30 Aug.1961)

101. Domestic science room sink unit. Constructed from HCC std.drg. White Basic M152 and M153. (ibid., 19 July 1961)

102. Primary school classroom storage unit assembled from six standard low level units, back to back, with worktop over. (ibid., 1 June 1961)

Chapter 15

OFFICE ORGANISATION AND ADMINISTRATION

Having examined how primary school design and the 8' 3" system developed in parallel, in Part 3 we shall see the ways in which, from 1951, the development principles were extended to secondary schools and, subsequently, to further-education colleges in the late fifties. By 1954 the 8'3" system had become fully established: thereafter it changed only in minor respects until the last school to be built in the system was completed in 1964. Before tracing the development of the construction systems further we shall now consider, briefly, the contemporary organisational structure of the County Architects Department; then, in the following chapter, we shall mirror the view held by the outside world of the county's achievements.

A sound administrative and organisational framework, able to serve and sustain the processes of design and construction, is a fundamental requirement for the success of large, continuous building programmes. Axiomatic as that may be, the part it plays in their achievement is seldom given full recognition. In Hertfordshire, office organisation and method not only supported but became inseparable from, the building processes. As Stirrat Johnson-Marshall put it:

> In 1949 it became evident that the solution of many of our problems which were labelled "building" lay somewhere between administration, education and techniques, and that they would yield far more readily to a combined attack by these skills than by a series of separate attacks.[1]

Three main categories of administrative and organisational development can be identified: firstly, the procedure for securing Ministerial approval to schemes; secondly, contract organisation in relation to the ordering and production of industrialised building components; thirdly, and of special interest to us here, the organisational structure of the architects department.

At the beginning of the century very few local authorities employed salaried architects; the vast majority of all building works was undertaken by private enterprise. Between the two world wars as more and more work became the responsibility of central and local government, Architects Departments were set up by local authorities. Starting with the municipal housing programmes of 1919, their work gradually extended to every kind of building for which local authorities became responsible. By 1937 there were forty-four counties with separate Architects Departments; in the rest of the sixty-two counties the County Surveyor was usually responsible for architectural as well as engineering services. By 1951 the number had risen to sixty. The change was due to an increasing realisation of the contribution of the architect to good design and because, historically, the County Surveyor had been associated with a narrower range of functions than the Borough Engineer.[2]

The growth of the public sector of the profession caused resentment among many private practioners; in 1937 even the RIBA President, in his inaugural address, made the tasteless assertion that the only use for government offices was that they gave "regular employment to a number of people that might otherwise have to compete for it in our already crowded market."[3] Nevertheless by 1938 public service architects accounted for 31 per cent of the profession, reaching a peak of 45 per cent in 1955 and dropping to 39 per cent in 1964.[4]

With the 1944 Education Act the burden of work placed on local authorities reached a new peak and the now familiar pattern of high public spending on new building was begun. Moreover, the work load due to the size and urgency of the school building programme had to be carried out alongside the smaller load imposed by the other client departments. In Hertfordshire, as elsewhere, the main departments served by the County Architect were divided in much the same way as the main committees and included the Education, Health, Police, Fire, Welfare and Children's Departments.

The work carried out for other departments lies outside the scope of this study but it should, nevertheless, be recognised as having made its own (and contrasting) demands on resources. Wherever feasible, the County Architect used the methods and components devised for educational buildings, but the special requirements of these other buildings were not permitted to compromise the system. Elizabeth Layton, writing of the contrasting relationships which existed generally in County Architects departments in the 1950s observed:

> Into this long-term and fairly secure programme of educational projects the Architect can fit in the less predictable requirements of the other client departments. Unless there is some

major scheme, such as new county offices, no one project from another department is likely to be larger than a single secondary school and most of them will be much smaller. The problem for these other buildings has been not so much the allocation of staff to carry out the design, but the risk that the design will be pigeon-holed at the last moment for lack of final Ministry approval. As every architect and client knows, the design taken out of the pigeon-hole twelve months later never looks so good and there is an expensive inclination to make changes. Having suffered from such set-backs in building police stations, health clinics or community centres, the Architect has learned to treat his other client's demands with caution.[5]

Although something of a "poor relation" the work for other departments clearly benefitted from the organisational development brought about principally by the needs of the Hertfordshire schools programme.

In laying down its 1947 Operational Programme, the Ministry of Education posed a problem for itself: under pre-war conditions the minimum period, from the choice of site to the occupation of a new school, was $3\frac{1}{4}$ years; a disproportionate amount of this time being spent on obtaining Ministerial approvals.[6] Clearly procedures would require drastic curtailment if the Operational Programme were to have any hope of success. Eric Bird described the typical County Architects department experience thus:

> As regards the machinery for approval of school building, hitherto it has been a common experience for the preliminary work, from a council's decision to build a school up to actually starting work, to take as long as 12 months. Sketch plans had to be prepared, approved by the education committee of a council and forwarded to the Ministry for their approval. On this being received, the working drawings, specification and quantities had to be prepared and tenders obtained. These were then submitted to the Ministry for final approval. Only when this was received could work start.[7]

The Ministry was quick to appreciate the absurdity of this situation and it became necessary only for preliminary designs and estimates to be submitted before final approval was given. In achieving the improvements which followed, the method of construction that Hertfordshire was proposing played a significant role:

> The Ministry decided, at the suggestion of the Hertfordshire County Council, that they would approve projects in sketch plan form, after which work could go ahead, the contract figure being reported to the Ministry subsequently.... It (the arrangement) has been greatly facilitated by the fact that the prefabricated construction is already well known to the Ministry and has already been approved by them, so that in approving a sketch plan, the Ministry have only to give approval on questions

> of size, siting, layout and accommodation. The County Architect asked us to say that the Ministry have been very co-operative and helpful in this arrangement. The important point is that preliminaries now take two months instead of twelve.[8]

Having established the site and obtained a survey, the architects prepared a preliminary design for each school: the design, in outline only, was drawn to a scale of 1/16" to 1' 0". The design drawing had three main purposes: it formed a basis for Ministry approval; it established the technical and structural implications; and it formed a basis for discussion with each local education committee and head teacher concerned. Until each of these three stages had been completed no plan could be finalised.

In the County Architects Department, the manner and speed of drawing office production was determined very much by the nature of the organisation developed to implement the work load. The Department was responsible for the design, construction and maintenance of all schools, police and fire stations, health buildings and old peoples' homes. It was the policy of the County Architect to maintain a strength of about fifty architects plus supporting skills, such as quantity surveying and services engineers. Any work above its known capacity was put out to private architects. The structuring of the department and the interrelationship of architects to other skills in the department is shown in fig. 103. This pattern remained fairly constant throughout the 1950s.

The composition of the architectural staff was unusual in that there were very few unqualified assistants. In 1954 there were only two, all the rest were qualified architects, the majority coming straight from the schools of architecture. Bird remarked that new entrants were quickly trained in the office and were soon competent to act as job architects:

> A new man entering the Architect's Department takes his place in a group producing working drawings for a number of schools. As he masters the technique of the system of construction he is given a school to design upon which he, in turn, receives working drawing assistance from other members of the group. Similarly the method with a private architect is to invite him first to carry out working drawings on a sketch plan already produced by the department. This familiarizes him with the system and he is afterwards invited to carry out a similar job from the beginning.[9]

It was held that the arrangement compared favourably, both in terms of professional supervision on site and in office productivity, averaging one £40,000 school per architect each year, with the more usual office practice whereby senior assistants supervise projects (for which they have not done the working drawings) and numerous unqualified juniors who rarely saw the jobs they had detailed, but not designed or planned. Aslin was alive to the capabilities of individual architects:

> The old method of designing at thetop and passing the work down the office ... does not produce the best results. This is due to the fact that the qualified architect is not fully used to the capacity of which he is capable. The pattern to seek, therefore, is one in which the assistant architect is given charge of the project from the sketch plan stage. It might be said that this method is bound to produce a varied quality of work from the office, because naturally the skill of each individual member is a varying factor. On the other hand the friendly rivalry which this method creates stimulates the individuals, and causes the general standard of the work in the office to be much improved; such standard being inevitably much higher than that which can be produced by the pyramidal office.[10]

Morale was kept high by ensuring that each architect was a member of a design group in which he shared equal responsibilities with other members of the team, under the general leadership of the Group Architect. The working method was made possible by, and indeed arose out of, the use of standardisation.

The sketch design for each primary school was done by one group member in about 4 man-weeks; he then submitted his design for criticism by the whole group. The production of working drawings was shared by the whole group, something not feasible on a conventional project where one individual would have to know the whole job. Eventually the original designer became the site architect, supervising the erection of his own design. Thus, as several projects overlapped, each member of the group was likely, in the course of a year, to design and supervise at least one school and do working drawings for several. In addition, he would assist with the standard drawings for the following year's programme, possibly investigating new structural developments and materials.

This highly democratic arrangement meant that each architect was in turn responsible for a scheme with the assistance of all the others, and alternatively became assistant himself to the other members of the team. The professional advantages of the method were summed up by Aslin:

> Each member of the staff gets an opportunity of acting in his proper capacity as a fully qualified architect, and consequently he both deserves, and is justified in expecting, higher pay* than would formerly have been given to an assistant doing hack work.[11]

In Aslin's view the maximum size of group in which the method could be successful was ten members. He recognised, too, that another necessity for ease of working was that the jobs should be relatively small, "say about £50,000 each", of similar character and, of course, continuous. Aslin recognised that precisely the same method was a little more difficult to operate with larger projects, such as secondary schools, which were four to five times the cost.

In the primary school group, which averaged eleven schools in each year's programme, the system used was developed from the previous year but unchanging (except in exceptional circumstances or emergency) during the programme year; in this way members of the group worked on a standard set of component drawings for a programme, which were then used in all the designs in that year. The set comprised 60-70 drawings covering all aspects of structure, finishes and equipment; in addition, the steel frame manufacturers prepared a similar set of standard detail drawings. Each project had, in addition to the various standard drawings, about fifteen assembly drawings, which were little more than visual schedules.[12] These were not dimensioned because component sizes and positioning were clearly located by the overall grid (fig. 104).

Thus each primary school produced about one hundred drawings; this comparing favourably with the number of drawings needed for a traditionally constructed school of comparable size and even more so as the standard drawings were spread over the whole programme. In total the

---

* In an editorial entitled "The nation's cheap profession", the Architects Journal for 27 January 1955 commented on the value for money given by the Hertfordshire architects department. It pointed to the low salaries earned by men who were "saving the nation vast sums of money" contrasting their remuneration with those in industry who were performing a similar service.

number of architect man-hours on each primary school up to the invitation of tenders, was about 1,000 to 1,200 spread over about four months.[13]

The time spent on a typical secondary school was proportionately longer. The Ravenscroft School in Barnet Lane, Barnet completed in 1954 and the one-hundredth post-war Hertfordshire school, took some 6,000 man-hours for the job drawings, which totalled 180 in number. In addition, just over 200 standard drawings were prepared before (or in parallel with) the job drawings, under twenty-two section headings. Outside the office a further 150 standard steelwork component and layout drawings and about fifty window-system drawings were prepared by the respective manufacturers. Ravenscroft school was built for a gross cost of nearly £189,000.[14] Caution should be exercised in comparing the numbers of drawings on account of their varying size; standards and information sheets, at that time, were prepared on foolscap-size paper. However, both primary and secondary schools appear to have expended, on average, between thirty-one and thirty-four man-hours per thousand pounds of cost at 1952-54 prices.[15]

Clearly the high level of productivity was not won at the expense of quality of professional work; indeed, although the total time spent on each project was less, the proportion of time spent on design was greater. Aslin summed this aspect up:

> It is difficult to assess the saving in drawing office time achieved by the rationalisation which a programme procedure permits. Records indicate that where this has been adopted architects spend about half as long on the drawing board as they would were each job treated as a separate structural problem. This means that a great deal more time is available for the analysis of clients' requirements, development and research, decoration and colour treatment - aspects of an architect's work which are normally skimped or omitted altogether.[16]

Higher productivity was made possible for the whole design team, including the quantity surveyor and administrative support staff; drawing office flexibility, resulting from any member of the office being able to do most of the drawings for any job as easily as any other, made the effects of contingencies, such as sickness, much less of a production problem.

The use of standard drawings was implicit in the use of standardised construction but standardisation enabled an even greater advantage to be gained: pre-ordering at known prices, within reasonably known quantities, enabling costs to be predicted and therefore controlled.

> Within the office the standardisation of details has led to considerable economies in architects' time, not only on the drawing board ... but at the desk. Instead of ordering steel work or concrete blocks or windows separately for each individual school, they can be ordered for a programme of ten or twenty schools. And they can be ordered in advance before the schools have been designed. Because of the high degree of rationalisation in the number of different parts that have to be manufactured, it is possible to forecast the number of each that will be required. The manufacturer can, therefore, plan his production run at the same time as the architect is planning his building, so that at the time the general contractor requires the parts on the site, and places a firm order, they have already been manufactured and are ready for delivery.[17]

This meant steady production runs leading to economies which could be passed to the client; and furthermore:

> A peculiar advantage of a standardised structure with inter-changeable components is that it allows a stock pile to be built up on which individual jobs can draw as required, and thus the risk of jobs being held up for lack of components is minimised.[18]

Hertfordshire had clearly demonstrated that the organisation of prefabricated building required an approach that was radically different from that to traditional building. Unlike the production of a number of isolated buildings it was more one of <u>organising an operation</u> for providing new schools throughout the county. In such an operation a total approach was called for:

> The architectural and contracting services have to be varied from what is customary in traditional building and the whole programme has to be kept in view and planned a long time ahead; the completion of each school is no more than an incident in the whole operation. Failure to realise the nature of the <u>organizational</u> problem inherent in prefabricated building is probably behind the failure of so many attempts at prefabricated building to cost less than traditional building.[19]

<u>Notes to Chapter 15</u>.

1. S.A.W. Johnson-Marshall, "The architects' contribution to value for money in school building and the role of the Ministry of Education." <u>RIBAJ</u>, June 1953, p.310.
2. Elizabeth Layton, <u>Building by local authorities</u>, 1961, p.110.
3. Inaugural address by H.S. Goodhart-Rendel, <u>RIBAJ</u>, Nov., 1937, p.9.

4. Figures published by the RIBA as a result of surveys made in 1949, 1958 and 1964. See Jackson, The politics of architecture, 1961, p.212: notes 144 and 145.

5. Elizabeth Layton, op.cit., p.112.

6. MOE Circular no. 130, 15 Nov. 1946, "School sites and building procedure" contained recommendations for speeding up procedures.

7. Eric Bird, "The post-war schools of The Hertfordshire County Council" RIBAJ, Sept.1949, p.472.

8. Ibid.

9. Ibid., p.478.

10. C.H. Aslin, "How the local authority works" RIBAJ, June 1953, p.320.

11. Ibid.

12. BRE Note no. C302, Sept. 1954, p.16.

13. HCC "Schools in Herts building programme", AJ,20 Oct. 1949, p.438.

14. See "Secondary school in Barnet Lane, Barnet," AJ,24 Feb.1955, pp. 265-278 and 284.

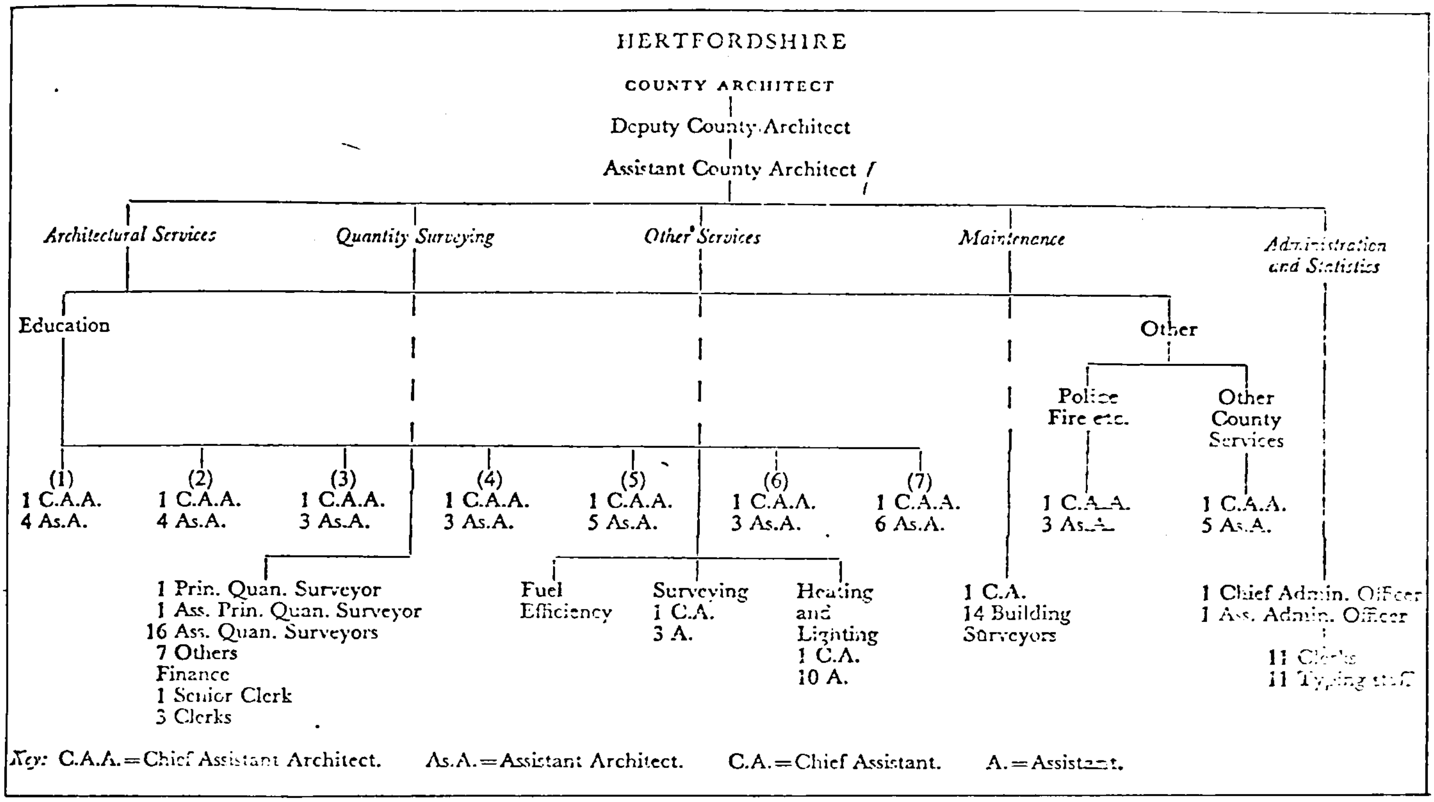
15. Figures derived by interpolation.

16. C.H. Aslin, "School Building in Hertfordshire," Education, 27 April 1951, p.641.

17. Ibid., p.634.

18. HCC, "Schools in Herts Building Programme". AJ, 20 Oct. 1949, p.437.

19. Eric Bird, op.cit., p.478.

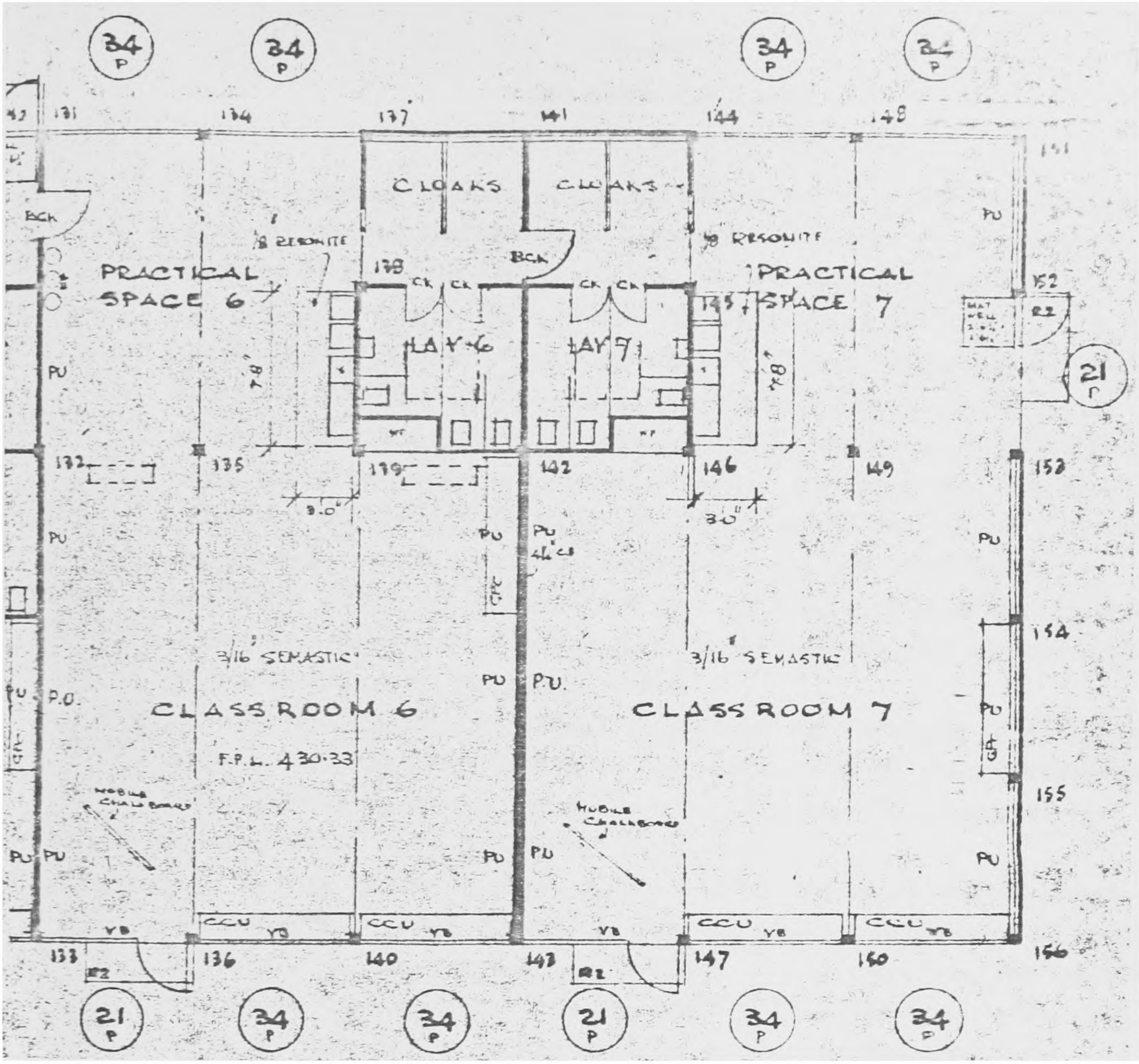


103.

Figures 103-104.

103. County Architects Department, structure diagram c.1956. (Layton, Building by local authorities, p.111)

104. Fragment of a job (project) drawing showing component coding methods used as standard procedures in the Hertfordshire County Architects Department in the 8' 3" system. (Architects Journal, 8 Dec.1955, p.784.)


CLOAKS
CLOAKS
PRACTICAL SPACE 6
PRACTICAL SPACE 7
LAV 6
LAV 7
1/8 REXONITE
1/8 REXONITE
3/16 SEMASTIC
3/16 SEMASTIC
CLASSROOM 6
CLASSROOM 7
F.P.L. 430.33
MOBILE CHALKBOARD
MOBILE CHALKBOARD

104.

Chapter 16

EFFICIENCY AND BEAUTY
ASPECTS OF CONTEMPORARY CRITICISM

In the autumn of 1954 the one hundredth new school of Hertfordshire's post-war building programme was completed. "How did you," asked the Minister of Education on the occasion of the opening early in the following year, "contrive to be both businesslike and beautiful?"[1] The County Council marked the occasion by publishing a commemorative booklet describing the achievement in remarkably modest terms, entirely consistent with the spirit of co-operative effort which had characterised the years in which the schools were built. The story was less than half over but, as we have seen, the primary school and the 8' 3" system had by then reached a plateau of maturity. By way of an interim assessment of the achievement thus far, and before turning our attention to the development of secondary schools, we shall briefly discuss some of the reactions of the outside world.

If the Minister had perhaps exaggerated the dichotomy prevalent in post-war architecture, finding the emergence of beauty from a businesslike approach remarkable, he had put his finger on the diversity of interest which Hertfordshire had stimulated.

In this Chapter we will examine aspects of comment and criticism which have been drawn principally from two widely contrasting, but each highly significant, contemporary sources. Taken together, the articles illustrate the influence exerted by the Hertfordshire Schools on architects and architecture during the late forties and throughout the fifties. Firstly, the Journal of the Architectural Students Association, Plan 6, of autumn 1949,[2] which devoted the major part of the issue to a socio-political critique of the contemporary architectural scene. Secondly, the Architectural Review for June 1952, in which Richard Llewelyn Davies and John Weeks discuss the architecture, per se, in an article entitled, "The Hertfordshire Achievement."[3]

The message of Plan 6 was that modern architecture and the new social order were inseparable. This notion was by no means original but it was stated with such passion, and at times innocence, that however dogmatic the statements they still read with a freshness that suggests today non fulfilment rather than misjudgement.

Critical of the detachment of the architectural student from the "chaos" of the outside world, Plan 6 quoted R. Townsend in Focus 4:

> Throughout the Bauhaus literature we are overwhelmed by "creative" and "creativeness"; we get but little clue for whom and for what end. There is the entrance to the blind alley into which the ideas of the Bauhaus have led. We have creative individuals, liberated and integrated - and nowhere to go!"[4]

But Plan 6 attached even more importance to the fact that architecture was a middle-class profession, entry to which was restricted "almost entirely to members of the brain-working class as opposed to the hand-working class, due primarily to the economic divisions of our social system - which is not only unjust but inefficient." Those who by dint of hard work and good luck entered the professional class "are often quickly convinced that brain work is superior to hand work - a ridiculous but remarkably effective argument for the perpetuation of social and economic inequality."[5]

Not surprisingly, Plan 6 did not concern itself with architecture as a traditional art form. Defining it as "the design of shelter for the activities of our contemporaries," the word is not used in relation to the approach they would see followed.[6] The Hertfordshire work is discussed, consciously or coincidentally, without any recourse to the word "architecture."

However, understanding of the essential nature of the Hertfordshire methods is implicit throughout:

> The mass production of components which can be fitted together in a great variety of ways, has speeded up both production and assembly. On one site an entire structural frame for a school was erected in one day by a skilled team who came from the factory 120 miles away. These schools are assembled from components made by many different factories who may send their men to install or erect their particular part of the building. Therefore, the amount of work done on the site is reduced and actual building operations are speeded up.[7]

But the one-day wonder is described as if it were a regular occurrence, or at least as if it ought to be. Alas, not even the simplicity of the 8' 3" frame could achieve that, except in a controlled experiment. Noting the changing role of the main contractor they perceived a revolution which was more a wished-for ideal than an accomplished fact:

> There is a tendency for work to be done on the site by many small teams of specialist sub-contractors. In this situation the role of general contractor is changing. His staff is decreasing and

> his duties on the site are becoming restricted to those of co-ordination and administration only.
>
> As methods of organisation and building develop, the cost of these schools begins to fall. The economy of new methods is evident. The Hertfordshire schools already cost 25 per cent, less than those of orthodox construction.[8]

As the argument develops so the tone of the writing becomes more stridently that of the manifesto:

> The first results of the Hertfordshire programme are prototypes for the whole of the building industry. They show new directions in building practice and point to future development in the organisation of building production. The direct supply of building materials can bring prices nearer to actual costs. The process of construction is becoming a matter of the efficient co-ordination of many different work teams. The general contractor will ultimately exist to draw off his percentage on work done on his behalf by the sub-contractors. Like the clerk of works he will become unnecessary and will be supplanted by a site co-ordinator - a member of the design team.
>
> To fulfil their function in the community our builders must learn to employ contemporary techniques. The potential exists, the experience does not. We must learn from the experiments of the most courageous and imaginative builders, and, most of all, from the more developed allied industries.[9]

On the implications of change for the concept of group working and the implications for communication within the group, and beyond, they wrote:

> The constant development of new techniques and new forms of human activity demands that architecture must become a group function and that the design group should work in close relationship with all others concerned with building. This implies that the architect must be able to express himself clearly in simple words and drawings in order to make himself completely understood by those with whom and for whom he works. Group working also demands that each conclusion reached in the design process should be recorded graphically, kept for comparison with earlier and later conclusions and for analysing the evolution of the design. The inarticulate architect who designs by sudden inspiration and cannot develop his design rationally stage by stage, cannot possibly work as a member of a group. He is an anachronism.[10]

Enthusiasm for the collective ideal becomes intollerance: there is no place for the individual, the lone "genius" and any kind of middleman is an anachronism:

> If the design group is to work successfully the architect must be a designer and an administrator at the same time. Whenever an administrative problem comes into the office it is almost always fatal for it to be dealt with only by a professional administrator - problems of design and administration are inseparable. In

> a programme such as that now being tackled at Hertford, the professional administrator and the manufacturing firm's agent come between the designer and the man who constructs the building. Like the inarticulate "inspiration" architect, they are anachronisms.[11]

If the Hertfordshire schools were a demonstration of the socio-technical ideal for building schools they were made to serve other polemics willy nilly:

> The Hertfordshire schools are a working demonstration that the right kind of buildings can be produced in sufficient quantities by economical methods.
>
> We have an indication of an industrial technique which is economic in the human as well as the financial sense of the word. With a sufficiently decentralised industry and social needs effectively expressed, modern technics can more than satisfy the huge demand. It is fantastic that anyone who enjoys the beautiful efficiency of a bicycle should be content to live in a crude brick and timber box.
>
> Modern man accepts such anachronism because it is difficult for him to see what contemporary living could be like. Modern domestic life demands privacy and, at the same time, an informal and flexible setting. Eighteenth-century technics provided admirable spaces for eighteenth-century living, but they are no longer adequate to-day.
>
> The structural system developed at Hertford shows clearly what can be done. The fact that a "meccano set" has been produced instead of a ready made "doll's house" is the key to the twin problems of flexibility and variety.[12]

With hindsight the simile of the mass produced dolls house is superb. It sheds light on a paradox which will be touched on in the conclusions of this study: the universally acknowledged, national success of system-built schools and the contrasting, widespread dissatisfaction with system built housing.

They saw clearly that from flexibility comes variety.

> All screens can be potentially free, spaces can be enclosed or opened at will, increased and decreased, and the entire internal shape of the building can change and change back again. A life with increased privacy and increased freedom of movement and association can be achieved in a smaller total volume. The mass production of "pre-fabs" - completely rigid shells unrelated to the site - not only forfeits the advantages of factory production but imposes an appalling uniformity. A system using relatively small and highly differentiated components makes for an almost unlimited variety of shapes. A new system would always be economic for a planned building programme. The danger of imposing one particular system would be avoided by a reasonable degree of industrial decentralisation. At all events, different systems would be needed for

different regions and for different functions.[13]

Each member of the design group was concerned with the whole process: component development for the future; working drawings for the present design, whilst, at the same time, supervising construction of a previous design: "In this way he was part of a number of constantly changing groups with responsibilities ranging from the general to the specific, from the development of a form to the development of an idea." But it was still not enough:

> Briefly, then, here is the genesis of group working in an industrial age. The re-orientation must be complete. It affects everything we do or think. The way we draw must be compatible with industrial forms - a move towards the diagram and the symbol. The way in which we learn to understand children must be a move towards our comprehension of growth and the vitality of life. At Hertfordshire a relatively crude and undifferentiated form of working has emerged. It will come to nothing unless it can develop. It is not enough to produce factory-made components for schools alone. Machine production is now universal. If the way in which a building component can be developed is limited by factors such as time ordering, a particular form of development is imposed upon the whole programme and the development of education and the child is restricted by the form of industrial development. Expediency takes control and synthesis is not achieved.[14]

The Plan 6 group made a point which was consistently played down in the various published accounts of Hertfordshire's architect-client relationship: "The Architect Group at Hertford, through its understanding of space, materials, and structure, can visualise developments in education which are not yet evident to the teacher or to the educationist." The architects would have considered this a little arrogant and valued their client relationship too much to endanger it by making such a claim; the educationists played it down perhaps because they thought they ought to be able to lead in the educational brief. The truth, however, lay between the two in a "chicken and egg" situation. The Plan 6 group acknowledged that "the irregular form of teaching space developed at Hertford to encourage group activity was a development that could be visualised only by the architect and had wide repurcussions in educational circles." But it was not enough that, "At Hertford, designing has achieved the full relationship between the child and the techniques of industrial production, at present the relationship is static, it is not developing", because:

> Development is looked on as subsidiary to design, and because of this situation, the development group has become isolated. This group realises that industrial technique must be developed as a whole in relation to all aspects of living. If it is restricted to the service of an isolated activity, and if the form of development is determined by limiting factors of expediency related solely to industrial technique, then it cannot be a whole development.
>
> The men who design and build the prototypes of cars and buses, aeroplanes and radar, fully understand the function of their work. The Hertfordshire Schools Group has shown that the same can happen in the production of buildings. The system of prefabricated steel frame components was actually designed in the factory with the makers themselves. Such close and productive co-operation can only be realised through the co-ordination of work teams; and the flexible organisation which results can accommodate and anticipate changing human needs far better than large centralised organisations which frustrate direct contact between people and suffer considerably when forced to change.[15]

With regard to what Plan 6 saw as the emerging role of the architect in society the optimism and self confidence is exhilarating:

> Being an architect will become one of the ways of living. Depending upon the way that a person directs his thoughts with others who are directing their own thoughts towards a particular activity, he will be amongst many other things a teacher, a builder, and an architect. Those who are concerned directly and are responsible within the community for the provision of shelter will interpret activities in terms of materials, structure and form. The architect as a teacher and as a builder will not only analyse activity in thought, he will also feel activity as rhythm. He will be conscious of growth and development; only by thinking, feeling and doing, can he live and develop within himself, and within the community. The architect will be an artist-technician.[16]

Thus from the early examples of the Hertfordshire Schools a whole new philosophy of architecture was extrapolated.

As representatives of the first post-Bauhaus generation the Plan 6 group saw in the post-war situation an opportunity for integrating the new social order with what they were encouraged to see as inevitable changes in the design and construction process.

Seldom has there been such a concurrence of youthful idealism with the real achievements of a section of contemporary architectural practice.

> The Hertfordshire schools are the product of a new attitude to life, and many aspects of their construction, as well as the designs themselves, are signs of this new economy. The function of a life economy is to regulate growth: if the product is to be fully related to human activities it must develop. Human activ-

ity leads to experience. Experience leads to the widening of activities. Each new form which really suits its function is the prototype of a further development. Ordered development of form, and not the form itself, is the measure of creative work. Such creative work is also the measure of social health. The co-ordination of craftsmen, scientist, administrator, and artist, is to the social organism as the integration of hand, mind, heart, and will is to the wholeness of a person.

> Architects will be responsible for providing people with an environment with which they can develop their lives. A new technique of calculation, a new material, must all be related immediately to human living. The word "architect" will come to be a symbol for a group of men entering into a relationship from which the form of shelter emerges. The group will be a microcosm of the community. Knowledge of biology, of material, of industrial techniques and the services of the painter and sculptor, will all be co-ordinated and directed towards a synthesis in building. Every man will be an architect during the time when his knowledge and his understanding of living are directed towards the provision of shelter. Living people relating their specific knowledge to their common understanding of a human need - this is the new architecture.[17]

In contrast, where Plan 6 studiously avoided discussing the schools in the classical formalist tradition of architectural criticism, two and a half years later the Architectural Review made a virtue of it:

> The starting-point in this discussion is that the Hertfordshire schools are important as architecture. This is already widely accepted, and indeed, no sensitive critic can fail to be deeply moved by these lovely buildings. As architecture, however, they show a quality very different from what we are used to, different even from what we are accustomed to regard as modern design. The object of the analysis which follows is to discover in what this special quality consists, and to relate it to the general body of modern architecture.[18]

Llewelyn Davies and Weeks regarded them as a very great achievement "by almost any standards," placing them in history as being the first completely modular system "to go into production on a large scale in this country and, perhaps, in the world." Their distinction being that they were the first examples of prefabrication not to be designed and manufactured as a whole or of units "designed to give buildings of standardised section but unlimited length." Emphasising that each school was a unique design solution for a given site, in terms of orientation and local conditions,they observed that the principles which were "established at the very beginning of the programmes by the architects, working closely with the educational authorities ... have been unchanged since ..."

Having acknowledged that the technical aspects of the schools had been widely discussed by others, the authors immediately launched into an analysis of the massing:

> Monumentality is avoided by splitting up the schools into a series of small blocks, linked by corridors, and in many of the infants' schools each classroom is a building by itself. The classrooms are often further broken into bays so that a room may have alcoves for small group activities in addition to a central space for larger groups.

On the general impression given by the schools they remark on the difficulty one has in remembering any individual school as a complete building. Whilst applying more to the visitor taken to see a number of schools in a single day, the point is valid as a measure of the consistent informality of interior arrangement:

> What remains in the mind is a general impression and individual snapshots, such as a series of passages, the angle of a classroom, an enclosed courtyard. These snapshots are not linked to any individual school, but build up a composite picture of all of them.

Llewelyn Davies and Weeks found the schools sometimes disappointing from a distance. Appearing "confusing and muddled," giving an impression of several buildings irregularly put together with a "large number of roof planes appearing one behind the other." Again, as visiting critics, they contrast these impressions with what might be expected from a previous study of the plans: "which nearly always show certain formal qualities, and, despite an irregular outline, give a feeling of deliberate architectural control." They found, too, that the entrances were often "weak", but

> Closer to, the buildings become progressively more delightful, as the eye is able to rest on small groups of individual parts rather than on the whole ...
>
> The schools really come to life, however, as one walks round them. Then the isolated blocks which seem a little dull in themselves, and a jumble when all seen together, begin to show a logic in their placing with relation to each other.

Once one has passed through the entrance and is actually inside the school,

> A profound impression must be felt by any sensitive observer - an impression very much more powerful if the school is visited when actually in use by the children. The impression is hard to describe in precise terms; it is not unlike the sensation of emerging after a night in a train into the sunshine and snow of the Alps; there is a feeling of tremendous exhilaration - a sensation

> created solely by space, light and colour...
>
> Most of the normal elements of architecture are missing. There is no recognizable formal element whatever, proportions seem almost accidental, spaces and planes are divided in the most elementary manner.

There followed a fine critical description of the early Hertfordshire schools:

> The basic wall and window panels, 8 feet 3 inches wide, are repeated everywhere, and every wall consists of several of these units put together. There is an utter and refreshing absence of conscious detailing. There are no materials except glass, steel and plaster. So much glass is used internally that the spaces become completely fluid and flow into one another, dissolving away the formal relationships drawn on the plan. Standing at any point one can often see through two or three different glazed walls and out into open country beyond and simultaneously the reflection of spaces behind citing for example, the interiors of Pentley Park school. Such solid walls as there are are broken up into panels separated by pilasters, and the consequent disruption of the wall is emphasized even more by the decoration ...
>
> The fluidity of space and the disintegration of the wall are not balanced by any continuity in the plane of the ceiling. Flat ceilings, running continuously across a series of spaces, have been used by Neutra and other architects to restore the form dissolved away by breaking down the walls. Here there is no continuity, the ceilings, at several levels, with glittering clerestory windows between, hardly read as planes at all, being completely broken by the irregular arrangement of the openwork lattice beams, of various sizes and shapes, running some in one direction and some in another. Even the fact that the whole building is planned rigidly on a grid has little unifying effect internally owing to the freedom to use a variety of spans. It is astonishing that, despite all this, the predominant quality has more calmness than chaos.
>
> The question arises: how has such a fascinating and strange architecture come about?

They answered the question they posed by pointing out that although the architecture may have been the "expression of prefabrication" it was not the automatic product of using prefabricated units:

> It is the outcome of long and patient effort by a group of architects determined to accept the fact of industrial production and to design honestly in it and for it ...
>
> Having determined on a system with a certain degree of flexibility, they chose to design rigidly within its limitations. Throughout the programme they have resisted any temptation to conceal the essentially additive nature of the elements with which they worked, and have sought to find a method of design in which these qualities were accepted and exploited.

They saw perhaps one exception in the vacilation over projecting eaves, as we discussed earlier. Llewelyn Davies and Weeks refer to Croxley Green as having a very much more "integrated" appearance on account of its having no projecting eaves with the vertical cladding units. Of the 1948-1949 programme schools they find, too, in their planning "a somewhat greater formality," in that "classrooms are sometimes arranged in straight rows and the massing of the different parts of the building is more architectural." Furthermore they see it as significant that the most successful use of murals (which they considered to be open to question in designs without formal composition) found in these schools "of the no eaves period, where the architecture was more formal." They remarked on the lack of murals in the later schools, connecting it to "the rejection of most of architectural design in the formal senses," but ignoring the plain facts of tighter budgets. In the attempt of some architects to impose formal composition on buildings composed of prefabricated parts, resulting in devices such as closing a run of standard units by a solid wall in brick or stone, they saw the essential contradiction "between the new method of building and traditional aesthetics":

> The main stream of architectural tradition, continuous since the Renaissance, does not provide an adequate framework for design in unit construction. Architects such as Le Corbusier and Asplund, whose ideal is the brilliant individual work, have remained in this stream. Although they make use of new materials and are influenced by modern sociology, their design is achieved by processes not essentially different from those which produced the Parthenon. The problems raised by the industrialization of building are not susceptible to solution by these processes.

They then introduced the alternative "theoretical groundwork for an appropriate aesthetic," appearing first in the writings of De Stijl group and then at the Bauhaus,

> Where new design methods were first specifically applied to the problems of unit construction. Gropius himself was working on similar lines, though uninfluenced by the Stijl mannerisms, and in his house at the Stuttgart exhibition in 1927 ... deliberately chose to design within the limitations of a unit construction, even though it had not then appeared as an industrial reality.
>
> The key to his work, to that of many other architects who passed through the Bauhaus, and, perhaps, most of all to that of Mies van der Rohe, its last director, lies in the very problems raised by the Hertfordshire schools. To solve these problems the traditional, formal vocabulary has been abandoned in favour of an

> architecture consisting solely of relationships between aesthetically neutral elements, and between the resulting volumes. Their design typically derives from the interplay of endless rhythms rather than from any formal or finite composition. It is striking that this early and largely theoretical work should have foreshadowed so exactly the achievements of the Hertfordshire architects, who set themselves to design honestly and cleanly within the limits of a prefabricated system unhampered by aesthetic prejudice.

The article continued with a discussion of the smaller module of 3' 4" with which Hertfordshire had recently been experimenting (and is fully discussed in Part 3) and concluded:

> The Hertfordshire architects have begun to explore the possibilities of this new architecture. The immediate tasks facing them and others working in the same field are two. First, to improve still further the design of the individual elements, and second, to develop greater power and understanding in the assembly of the units into an architectural whole. The essential tools of the classical designer, proportioning and finite composition, cannot be used; instead, balance and harmony must be sought in new ways, in the words of Mondrian " ... not from the particular character of the form, but from the dynamic rhythm of its inherent relationships, or from the mutual relations of forms."

Even at this early stage the Hertfordshire schools clearly had a powerful capacity to inspire, made all the more fresh and attractive by their patent truthfulness to purpose. It is as if the modern movement had finally arrived unheralded through the back door whilst the false prophets were being embraced in the hallway. Ove Arup, the structural engineer most associated with the development of modern British architecture, commented in later life on a 1935 MARS document which, in text-book fashion, set out the design characteristics of modern movement ideology: "It appalled me, it wasn't functionalism at all, how could the various injunctions be justified in terms of function?"[19]

It has often been remarked upon that the modern movement's radical phase happened abroad and that by the time it arrived in Britain it was already an established idiom. That the Hertfordshire architects were aware of the ideology of the international style there is, of course, no doubt. But there is equally no doubt that they were indifferent to its stylistic precepts per se; the schools could hardly be regarded as composed according to idiomatically modern principles. As Summerson put it, "Often they seem little more than friendly collocations of 'prefabs' which a sympathetic and ingenious schoolmaster has fitted exactly to his needs."[20] Neither is it the case that there was any perceptible hostility to the idiom, "The question of style quite genuinely did not arise."[21] The consideration given to the question of projecting eaves, or to horizontal versus vertical cladding blocks, was a simple aesthetic matter of a quite traditional kind and not dictated by style. It is true that as a group the schools have a common likeness that might be described as a Hertfordshire "style", but if any party can be credited with the creation of such a "style", it must surely be Hills, the firm which supplied the original set of components and the embryonic methodology for their assembly. From the events we have traced thus far it could be argued that the schools would have happened as they did without modern movement theory or the idiom which that theory gave rise to, however falsely it may often have been. Again in the words of Summerson:

> The real point about the Hertfordshire achievement was its remorselessly objective approach to a problem involving at the same time extremely economical planning and the prefabrication of structural components, prefabrication initiated and controlled by architects. If, at first, a rather humble kind of architecture was produced, it certainly was architecture; and it was produced by a grapple with hard material conditions - no holds barred.[22]

Thus the Hertfordshire response to the modern movement was essentially minimal; instead of following the style they began a search for principles, "not ... theoretic principles, but principles embodied in actuality, principles announced as buildings."[23] How successfully these principles could be applied to the greater complexities of Secondary and Further education, and to a changing world, will be the subject of Part 3.

Notes to Chapter 16.

1. "Hertfordshire's hundredth new school" RIBAJ, Feb.1955, p.134. Quoted in Anthony Jackson, The politics of architecture, 1970, p.194.

2. This issue was arranged in an unusual manner requiring the explanation: "The three horizontal chapters, Building, Architecture and Education, which run simultaneously through the magazine, may be read in the usual way (i.e., vertically down the pages). Each chapter may also be read separately as a horizontal section of the magazine." (p.32). See Note 1 to present Introduction for Plan contributors at this time. In Plan 6 editors acknowledged HCC departmental assistance in preparing issue. Bruce Martin's office diary records completing an article for Plan in March 1948 on subject of "Group work in practice."

3. Vol.111, pp. 366 - 387.

4. Plan 6, Architecture, p.14.

5. Ibid.

6. Ibid., p.15.

7. Plan 6, Building, p.23.

8. Ibid.

9. Ibid., p.24.

10. Plan 6, Architecture, p.24.

11. Ibid.

12. Plan 6, Building, p.25.

13. Ibid.

14. Plan 6, Architecture, p.25.

15. Ibid., p.26.

16. Ibid., p.27.

17. Ibid., p.28.

18. Richard Llewelyn Davies and John Weeks, "The Hertfordshire achievement," AR, June 1952, p.366, et sec.

19. Ove Arup, "Arup associations: the engineer looks back." AR, November 1979, p.319.

20. John Summerson, Introduction to catalogue, exhibition: Ten years of British Architecture 45-55, 1956, p.9.

21. Ibid.

22. Ibid.

23. Ibid.

Part three

Chapter 17

DIMENSIONAL CO-ORDINATION AND THE 3' 4" MODULE, OFF-GRID FRAMES AND HOLOPLAST, 1948 - 51

In Britain the early post-war search for some system of dimensional co-ordination in building arose from the progressive introduction of factory produced components.[1] From the point of view of production, some standardisation in the size of such components seemed inevitable. Apart from ensuring that components could be assembled on site in an efficient and economic manner, dimensional co-ordination had additional objectives such as simplifying the preparation of drawings and bills of quantities, assisting in general setting out and in the location of components on site.[2] Furthermore, it was hoped among proponents of co-ordination, that the establishment of such a system would encourage the development and manufacture of new products by providing them with a dimensional framework in which their acceptance was certain.

In America and parts of Europe a considerable amount of theoretical study had already been done before 1950.[3] The American brick was not standardised but 8" x 4" was a common size and most timber construction was built around the 4" x 2" stud. Thus the United States Bureau of Standards favoured a 4" module with components, such as windows, designed in 4" multiples. Likewise the various planning grids used in American house construction were multiples of four inches. Walter Gropius had designed a system using a 40" planning grid and others were using 48", dimensions of this order being necessary to simplify production problems. In Sweden, France, Belgium and other countries, 10cm. (very closely approximating to 4") was used, often in conjunction with one-metre planning grids. However, in these countries the theory and practice of modular co-ordination had sprung from traditional brick and block construction. By contrast, in Britain it was the shortage of such materials that had encouraged the use of new types of components, made in factories and assembled on site, which gave a particular emphasis to modular co-ordination.

In 1951 the British Standards Institution published a report recommending the 40" module, referring to American and European use of 4"/10cm. as "misconceived" for the reason that smaller modules laid stress "on just that part of building work in which there is least to be gained from modular co-ordination."[4] This echoed the conclusion of the MOE Technical Working Party which had recommended in 1948 that 3' 4" was likely to be "more suitable than any other as a grid dimension for educational building."[5]

Despite the growing body of theoretical knowledge on the subject, Hertfordshire did not consciously apply the idea in the early days: the Wood report recommendation had been accepted simply because it was expedient to do so through the medium of the Hills frame. Hertfordshire had quickly and convincingly demonstrated that 8' 3" was a reasonably manageable dimension and this had been widely acknowledged.[6] Indeed in 1953 the BRS research programme on modular co-ordination concentrated much of its investigation on the 8' 3" experience of Hertfordshire.[7] As early as 1947 the County Architects Department was aware of the need for greater flexibility in the forthcoming Secondary School and, eventually, Further Education Programmes.

Hertfordshire initiated a 3' 4" prototype in 1948 concurrently with producing the first school in the 8' 3" system. As before, the dimension used was chosen because it had a degree of acceptability to other authorities, rather than as the result of original research by the County Architects Department.[8] Being smaller than 8' 3" it would inevitably provide greater planning flexibility; its advantages to component sizing, beam spans, standard building board widths etc., were however by no means proven.

In fact the origins of the 3' 4" grid dimension were only a little less arbitrary than those of 8' 3". According to the MOE Technical Working Party, 3' 4" had been recommended because it was considered to meet most closely the following requirements:

a. Adequate flexibility in planning schools.

b. The space standards required by the (school) Building Regulations.

c. An economic spacing of structural members.

d. Suitability for other building types.[9]

In addition, the report argued that the dimension had "human scale" and also that it approximated the metre (39.37"). More important was the Ministry's long term aim of inter-changeability between the components of different manufacturers, and for this to be achieved (it appeared to them) the widespread acceptance of a single grid dimension was necessary.

Because very little evidence was offered as to why 3' 4" met these requirements better than any other dimension, the recommendations lacked conviction. Besides, Hertfordshire had clearly shown that 8' 3" was capable of fulfilling these selfsame objectives, at least as far as the primary schools were concerned. But the County's reaction was really based on the fact that there was insufficient time, and limited resources, to produce a fully fledged alternative to the 8' 3" system: experience had shown that a prototype would be required and a great number of new standard drawings would need to be produced.

Late in 1948 the County Architect set up a small group to initiate the development of a construction system suitable for secondary, multistorey schools. At a meeting early in January 1949 they summed up the implications of the jump from primary to secondary school construction thus:

1. The limitation of the particular technical solution to the primary school design problem using a large 8' 3" grid for single storey buildings.

2. The importance of designing for programmes, not "ad hoc" jobs, and the necessity of avoiding the standardisation of the whole building.

3. That secondary schools would mean a big variety of building types whose components could have a wide application outside the field of schools, thus reducing their cost. "It is important that the pattern set in the early stages should not jeopardise those who follow on".

4. That Hills steel frame and the 3' 4" module should be assumed from the start, as time did not permit long research, and no other manufacturer or technique seemed as suitable.

5. That "the structure must be capable of growing out of itself in all possible ways ... the complicated building must use the same components as the most simple."[10]

The group recommended that the external cladding and the internal partitions should be clear of the structural frame and that all beams should be of constant depth and open-webbed to carry services. Hills were asked to quote for a 3' 4" module frame along these lines.[11]

In view of possible delays in delivery by Hills, an alternative "conventional" steel frame was also considered. The latter being composed of box stanchions, r.s.j. beams and prestressed concrete floor beams spanning full bay width. Bays of 23' 4" square and 23' 4" x 13' 4" were compared in both lattice and conventional construction. Although the conventional frame was slightly heavier (nevertheless still under the 15 lbs. per square foot standard set by Hertfordshire)[12] the price per ton was quoted as two-thirds that of the lattice beam frame. The BRS study remarked on the comparatively low cost of the conventional r.s.j. frame:

> although the figures could not be checked, and the flexibility of the r.s.j. frame was probably less. However with the narrowing of the difference between labour and material charges in steelwork the frames with a low labour content will have an added advantage.[13]

The cost comparison might have been shattering to the development if a single school was contemplated. But the fundamental objective remained: to get quantities of well designed schools into operation by the programme dates. This demanded flexibility in design together with speed in erection and predictable performance, qualities which the "one-off" approach could not hope to achieve. It was the system as a whole that had the advantages of speed of production at all stages, from inception to completion; it would have been mistaken to conclude that the Herts-Hills frame development was economically dubious purely on account of the frame's cost.

The frame proposed by the manufacturer was in fact developed with Richard Llewelyn Davies, who was Hills's consultant architect at the time. On the basis of this frame an operational prototype was designed in the same way as Cheshunt JMI had been designed to be used in 1946.

The 3' 4" prototype started on site in October 1949; it formed the first installment of the Clarendon Secondary Modern School, situated on the LCC housing estate at Oxhey. Planned as a series of pavilions to avoid what was felt to be the "institutional sprawl inseparable from continuous two-storey construction",[14] the layout enabled a block to be isolated for experimentation. The accommodation it provided was an art room, a light craft room with modelling bay, four classrooms arranged in pairs on two floors, ancilliary storage and lavatories for boys and girls (figs. 108, 109). Access to the flat roof of the single storey block was provided for outdoor sketching from a fine elevated viewpoint overlooking woodland to the west, with the ground sloping away in the other three directions.' Each of the two-storey blocks was provided with a completely separate steel frame. Although this meant having two rows of columns only 40" apart where they abutted the lower section, it was accepted in the prototype because it enabled each block to constitute a separate structural entity.

The stanchions were quite different from any that had gone before, being cruciform-shaped and consisting of four 4" x 4" (some 3" x 3") angles, connected every 10" or 12" vertically, by welding to steel battens. The stanchions were spaced at 10' 0", 13' 4", 16' 8" and 20' 0" centres and enclosed with the usual fibrous plaster casings for fire protection. The stanchions supported the main lattice beams which, in turn, supported secondary beams at 3' 4" centres. Thus the components assembled into a portal type of frame in a manner similar to the 8' 3" frame.

Constant-depth beams were used throughout to simplify the dimensional disciplines for internal walling and external claddings. For the first time this permitted continuously level ceilings and therefore constant partition and screen heights. It was felt that the small wastages in steel which would occur on the shortest spans, and the limitations imposed on maximum spans, were acceptable in view of the far greater simplicity of such a frame and its associated components. The beam depth was 16" and variations in strength were provided by varying the flange thickness. The beams were positioned at 3' 4" centres but, unlike any 8' 3" frames, the partition or planning grid was offset from the steel frame grid by half a module (figs. 111, 116).

Whilst the principle did enable columns to be freed from the on-grid walling (with advantage to the standardisation of walling components), it brought them into the usable floor area of the room, where they might possibly impede furniture positioning unless great care was taken in planning them out of such positions. The Oxhey plan (fig. 108) shows the majority of the off-grid columns "lost" in storage areas; but even in such places effective use of space could be jeopardised. As before, all the steel components were manufactured and erected on site by Hills.

The collaboration between the Architects Department and the firm of Holoplast Ltd., in the development of a new plastics walling panel, produced the most remarkable innovation of all.[15] It was a development which was to bring the dream of a prefabricated wall panel, equally suitable for external or internal use, close to realisation.

The panel was a cellular plastic board formed by connecting two outer skins with webs at 2" centres; effectively a series of connected "box girders" (figs. 115 and 118 - 212). The material used for both skins and the webs was a plastic laminate of Kraft paper, (impregnated with phenolic resin and bonded under pressure). Being hollow, impervious and rot proof, the required thermal insulation or sound-attenuation characteristics could be achieved simply by filling the cavities with glassfibre insulation, or sand, according to its position on plan.[16] Furthermore, its light weight and small size together with the demountability inherent in its fixing detailing provided the potential to rearrange internal spaces with a minimum of skilled labour, delay and disturbance. It could bring such work well within the compass of a man in a white coat with a screwdriver.

The panels were only 1" thick and were manufactured in standard widths of 4' 0", from which the 3' 4" units were cut in the factory. The 8" wide remainders were used for sundries, such as shelving, on the project. To resist water penetration at the joints the panels were edged with mastic tape and fixed between extruded aluminium alloy posts (mullions), shaped to receive the various units, glazed or otherwise, and to enable 1,2,3,4-way or corner junctions to be formed.

In the prototype some difficulty was experienced in obtaining rigidity of the aluminium window casement frames on account of the aluminium section being based upon a typical steel window section. The problem was subsequently avoided by use of vertical sliding windows. Erection was slowed down on account of the tight fit of the taped panel within the aluminium extrusions. The architects observed:

> this prefabricated building is an accurate "engineered" job, and there is no need for putty, mastic, tape or any other packing materials to fill up the gaps one had in early prefabricated buildings.[17]

The approach was clearly naive as water penetration is almost certain to occur in such joints when full allowance is made for essential manufacturing and erection tolerances. The only way of avoiding mastics is to employ sophisticated internal drainage arrangements to get the water away; the antithesis of the steel-type sections that were used.

As the prototype was nearing completion it was decided to proceed further with the 3' 4" development and to complete phase two of the Clarendon school as part of the 1950 programme. In addition, a Junior school would be built in similar construction as part of the 1951 Primary Schools Programme. The school selected was to be situated in Furzehill Road, Borehamwood, and was in due course named Summerswood JM School. As part of the Health Service Programme a small day nursery was planned at Garston, also using the same components. Summerswood commenced on site in November 1950, thirteen months after the Oxhey Clarendon prototype began.

The main difference in construction between the prototype and Summerswood lay in the concept of the steel frame. Again an off-grid frame was proposed but at Summerswood the experiment of having only the columns off-grid, with all beams and walling on a common 3' 4" grid was tried. This was achieved by means of a "mushroom-headed" column which, whilst centred on a 3' 4" square bay, made it possible for both main and secondary beams to be made to the same length, reducing production costs and simplifying erection. The mushroom head, or cap, held the beams at a distance of 1' 8" from the centre of the stanchion on either side, thus although all the beams were positioned on a 3' 4" grid the columns were "off-grid" and therefore centred in the 3' 4" square bays (fig. 111, 116). It was the first and last school to be built on an off-grid frame of this type, with the exception of the Garston Day Nursery which did not form part of the education building programme.

On analysis the principal advantage of separating the stanchions from the walls appeared to be the dissociation of detailing. In many of the early schools components had tended to "pile up" at grid intersections, often leading to elaborate and expensive details.[18] The wall-to-column junction also demanded an increased range of panel sizes.

Against these advantages should be set the degree of extra work and expense where details were dissociated more widely than was strictly necessary. Furthermore, the smaller module and the demountable four-way junctions at 3' 4" centres assisted the latent flexibility in planning and in use., But the very frequency and complexity of the connections made them an expensive part of the walling.

During the design of Summerswood an analysis of the number of times each type of connection occurred showed that the use of the full four-way connection was very infrequent. The option of omitting the universal joint and having clean straight runs with simple joints was therefore tempting. The question of balancing initial cost against long term flexibility in use remained imponderable so long as feedback on the users exploitation of the flexibility remained unobtainable. At the beginning of a programme the experience could not be there; a desire for the unproven rightly gave way to the urgent pressures of economics and the need for speed.

The Summerswood design incorporated a wide variety of types of wall panel, consisting of arrangements of glazed and solid doors, vertically sliding sash windows, horizontally sliding ventilators, heating grilles, fixed glass and laminated plastic panels (fig. 112). The panels were now increased from 1" to 1 $\frac{5}{8}$" in thickness. These were all assembled into finished panels, including glazing, in the factory.

Assembly on site was very rapid; the laminated Holoplast panels weighed only 65 - 70 lb. and were fixed by means of a $\frac{3}{8}$" bolt in the top corner, between each panel. In addition, two or three angle brackets were fixed on each side of the frame, after which cover strips were clipped into place. The windows were most unusual for that time in that they were made by manufacturers of bus windows. Finely detailed and highly efficient they were most compatible with the crisp detailing of the panel assemblies.

When filled in the factory with glassfibre the external walling panels achieved a U value of 0.20 (the 1" thick prototype panels had achieved 0.32). Although the internal panels were filled with sand in some instances in the prototype (the walls separating the classrooms from the entrance hall) this was not considered necessary in the junior school, though the potential to do it remained.

Whereas the external panels were fixed down to a slate perimeter sill, all the internal panels were placed directly on and screwed down through, the floor finish (fig. 120). Like the prototype, in the Summerswood school the flooring was $\frac{1}{4}$" thick cork throughout, except for the kitchen lavatories and boilerhouse; the cork contributing greatly to a quieter overall environment.

On the prototype both the floor and roof decks were of precast, lightweight concrete, ribbed blocks, 3' 4" x 1' 8" in size. The floor blocks were $1\frac{1}{2}$" thick and laid on cork insulating strips placed on the top flanges of the steel beams to reduce sound transmission; they were then grouted in with steel continuity rods and covered with a $\frac{3}{4}$" cement-sand screed. The roof blocks were $1\frac{1}{4}$" thick, laid without strips or continuity rods, on which a vermiculite thermal insulating screed (of average thickness $2\frac{1}{4}$") laid to a fall and covered with "mineralised" bituminous felt incorporating a topping of granite chippings.

At Summerswood the roof was a proprietary system of corrugated steel decking, covered with $1\frac{1}{2}$" insulation board and finished with one layer of mineralised felt, both bedded in hot bitumen, all by Ruberoid Ltd. (fig. 113). Laid without falls, the roof was to prove troublesome in the future.

The Oxhey prototype had ceilings of plain insulation board suspended on aluminium tees and in one of the classrooms perforated hardboard fixed to timber battens was used. Sound absorbing ceilings were taken a stage further at Summerswood where four different surfaces were used: plain and perforated hardboard; $\frac{1}{4}$" thick Asbestolux (asbestos-wood composition board) used plain for the external soffits and perforated with a bitumen-bonded glassfibre backing where sound absorbtion was desired. For the purpose of experiment plain composition board was used also in one of the classrooms and found to be "satisfactory".

The use of applied colour in the Summerswood school has been discussed earlier but most of the wall panels were left in their "self-finished", natural mid-brown colour. These harmonised well with the cork flooring and, together with the aluminium trim, produced a remarkably crisp appearance, fully expressive of its advanced technology and yet a delightful background for teaching and learning.

Sir Nikolaus Pevsner illustrated Summerswood as an example of what "would be merely an achievement of engineering and organisation if the composition and finishes were not the work of a team of exceptionally sensitive modern-minded designers".[19] Ian Nairn found it "taut and close-knit" but "the freshness and delicacy have been spoilt by painting it in soft muddy colours, giving a spurious cosiness like an extravagant embrace from a heavily-built aunt."[20] The line of development culminating with Summerswood had certainly produced some interesting architecture along with its innovative technology. The Holoplast panels and the off-grid steel frame clearly had great potential; what then was the reason for abandoning the system?

Technically the system as exemplified by Summerswood was open to criticism of account of the limitations of the steel frame. Being designed as a portal, the beams not being simply supported, meant that over the required spans it had less planning flexibility than previous frames. The full four-way flexibility which had been sought was not possible with a frame of this type: indeed it was only really suitable for plans with a simple outline. Furthermore, in the Summerswood school, the bending moment in the stanchions caused by eccentric loading of the mushroom caps on the edge and corner columns, together with the large bay sizes requested, increased the amount of steel used and needed special additional components (fig. 116). As a ratio of the floor area the amount of steel in the frame was far higher than in any comparable 8' 3" structure, being 10.4 lb per sq.ft. as compared with 7.9 lb per sq.ft. for 8' 3".[21] Other factors contributing to its high cost included the difficulties created by changes of level in floors and roofs (fig.113) and the higher than usual cost of fabricating jigs in the factory.

The events described in the following chapter were beginning to overtake the 3' 4" development: the Secondary Schools Programme simply could not wait whilst the problems were overcome. To make matters worse Holoplast Ltd. ceased production soon after Summerswood and another promising line of development came to an untimely end. While Hertfordshire shelved 3' 4" steel in favour of further 8'3" development the module was used on a limited number of concrete and timber framed projects, when pressure to find an alternative to steel during the national shortage in 1951 was great. These developments are described later in Chapter 20. As it turned out, Hertfordshire constructed only a handful of schools on the 3' 4" module; it was left to architects who left Hertford and went to Nottingham to initiate the CLASP system to make the country's biggest contribution to 3' 4" development.[22]

Notes to Chapter 17.

1. Report of the RIBA Architectural Science Board Study Group No.3, "Dimensional standardisation," RIBAJ, April 1951, p.230.

2. J. Kay, "Modular co-ordination in Hertfordshire school design", AJ, 8 Dec. 1955, p.1785.

3. RIBA Study Group No.3, op.cit., pp. 203 - 233.

4. British Standards Institution, BS1708: 1951 Modular co-ordination, 1951.

5. Ministry of Education, Report of a technical working party on school construction (Cleary Report), 1948.

6. J. Kay, loc.cit.

7. Building Research Station, The use of modular co-ordination by the Hertfordshire County Council 1945-1954, Note no. C302, 1954. See also J. Kay, op.cit. for a description of this research programme.

8. AJ 23 Nov. 1950, p.428.

9. MOE, Cleary Report, op.cit.

10. BRS, op.cit., p.9.

11. HCC Memorandum, A: Requirements for a light steel frame (and) B: Suggestions for constructional system, 6/AW/DM/PH50, 19 Dec. 1949.

12. Ibid.

13. BRS, op.cit., p.10.

14. AJ, 23 Nov. 1950, p.421.

15. See J. Singer, Plastics in building, Architectural Press, 1952, pp.32-35.

16. Ibid., pp.81 - 89.

17. AJ, 23 Nov. 1950.p.429.

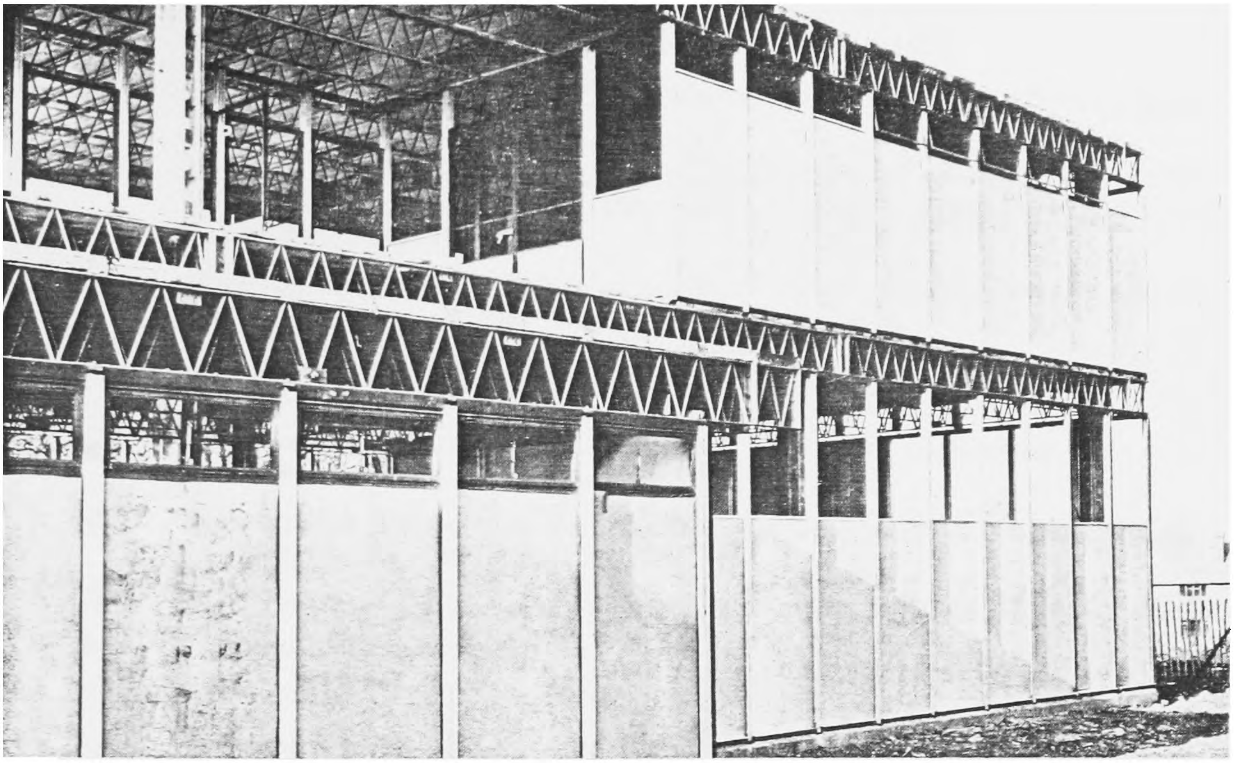
18. BRS, op.cit., p.12.

19. N. Pevsner, The buildings of England: Hertfordshire, 1953, pp.28 and 64.

20. Ian Nairn, Modern buildings in London, 1964, p.86.

21. BRS, op.cit., p.13.

22. MOE, The story of CLASP, Building bulletin no.19, 1961, pp. 8 - 10. See also (i) D.E.E. Gibson, "From Hertfordshire onwards", The Builder, 30 June 1961, pp.1243-4. (ii) G. Oddie, "The new English humanism: prefabrication in its social context," AR, Sept.1963, pp.180-182.



105.

Figures 105-129.

105. Oxhey, Clarendon SM School. View of Holoplast cladding being fixed to 3' 4" prototype steel frame. (Godfrey and Castle Cleary, School design and construction, p.322)

106. View of Clarendon School prototype under construction. (photo. Bruce Martin).

107. View of Clarendon School prototype from the south-west. (idem)

108. Ground floor plan of prototype block. (Architects Journal,23 Nov.1950, p.424)

109. First floor plan of prototype block. (ibid., p.425)

110. Borehamwood, Summerswood JM School, plan. (HCC drg. originally published in Architectural Design, Aug.1952, p.224)

111. Summerswood School, steel frame plan. Drawing adapted for clarity.

112. Summerswood School, range of panels for external and internal walling. (Architects Journal, 7 Aug.1952, pp.161-170)

113. Summerswood School, section through assembly hall and corridor. (Architectural Design, Aug.1952, p.228)

114. Summerswood School, detail of clerestory sill. (ibid.)

115. Summerswood School, detail of external walling at change of level. (ibid. p.229)

116. Summerswood School, detail of steel frame off-grid stanchion cap,

beam connections and foundation. (ibid., p.227)

117. Summerswood School, detail of Weatherfoil heater cabinet.(ibid., p.231)

118. Summerswood School, Holoplast panels range of standard connection conditions: sections, external walling. (Architects Journal, 7 Aug.1952, pp.161-170)

119. Summerswood School, Holoplast panels range of standard connection conditions: plans, external walling.(ibid.)

120. Summerswood School, Holoplast panel connection to floor, sill and ceiling. (ibid.)

121. Summerswood School, Holoplast panel junction conditions for internal walling. (ibid.)

122. Summerswood School, plan with wall colour coding. (Architectural Design, Aug. 1952, p.231)

123. Summerswood School, view of south end of building. (ibid.p.225)

124. Summerswood School, view of main entrance. (ibid.)

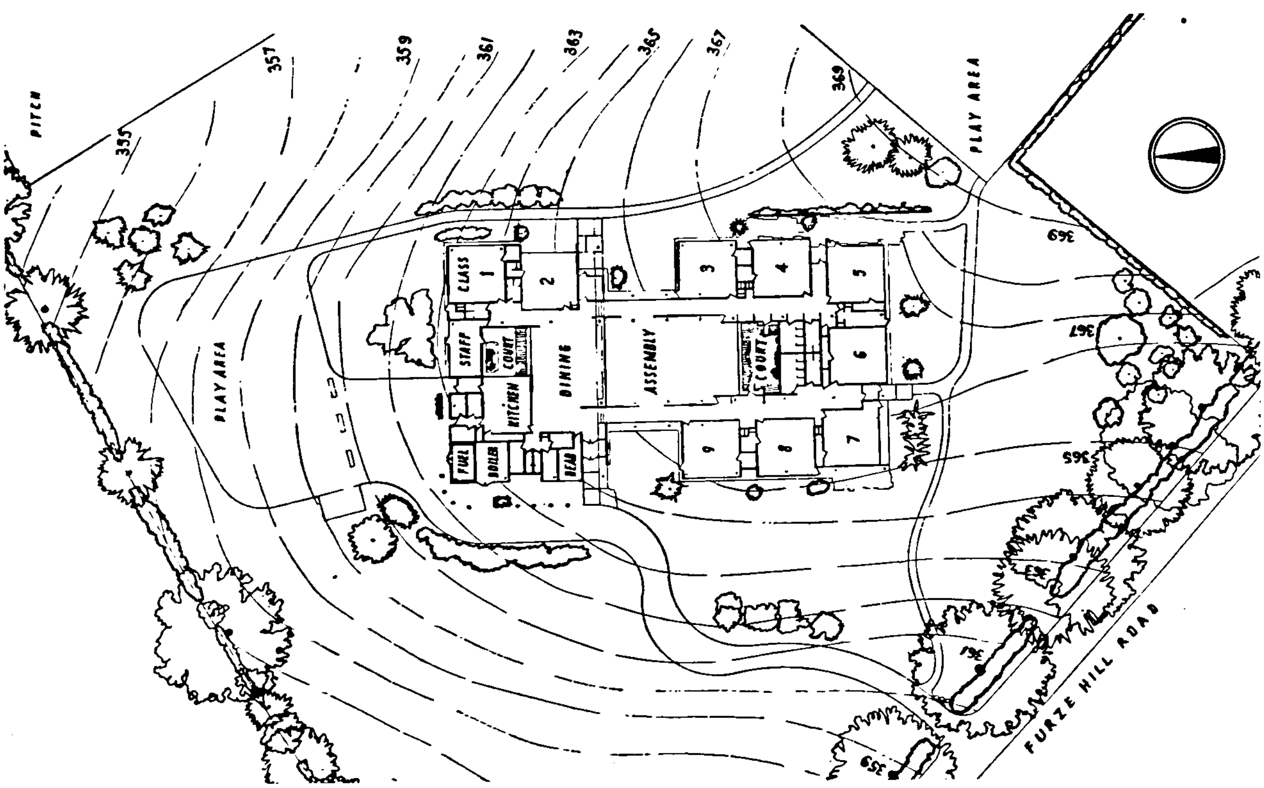
125. Summerswood School, view from south-west. (ibid., p.224)

126. Summerswood School, view of classroom interior. (ibid.p.233)

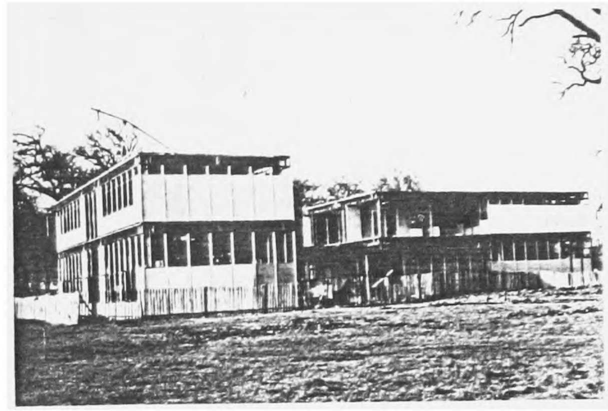
127. Oxhey, Clarendon School Ph.2, science and classroom block, section through external wall. (Architects Journal, working detail series, 30 July 1953)

128. Clarendon School Ph.2, plan of external walling. (ibid.)

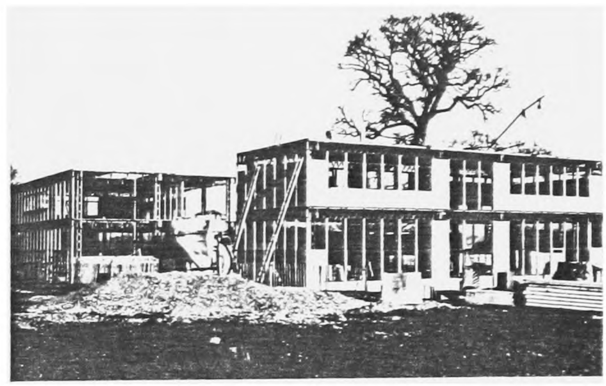
129. Clarendon School Ph.2, detail section through external wall, cf. fig.113 and 114. (ibid.)



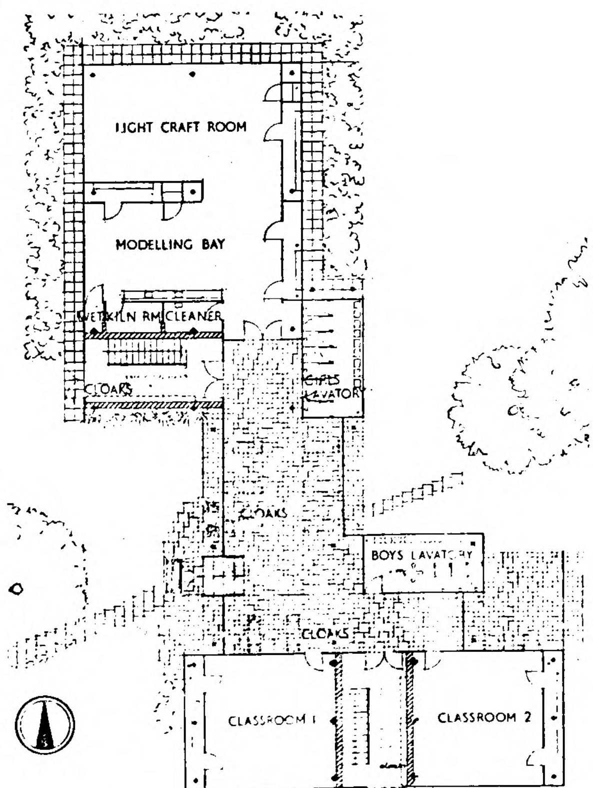
110.



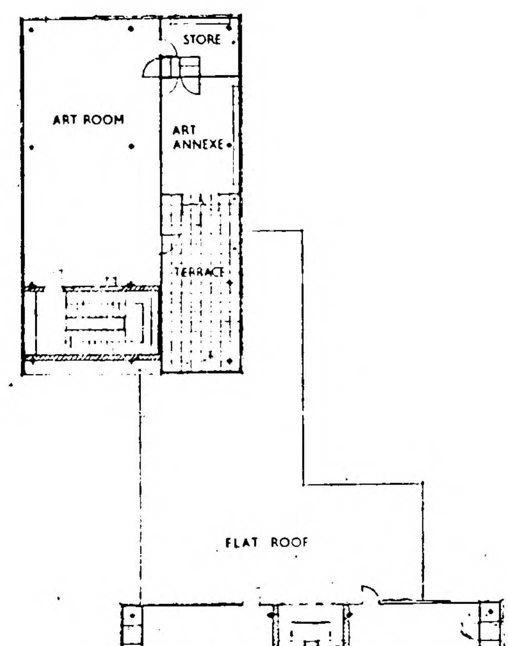
106.



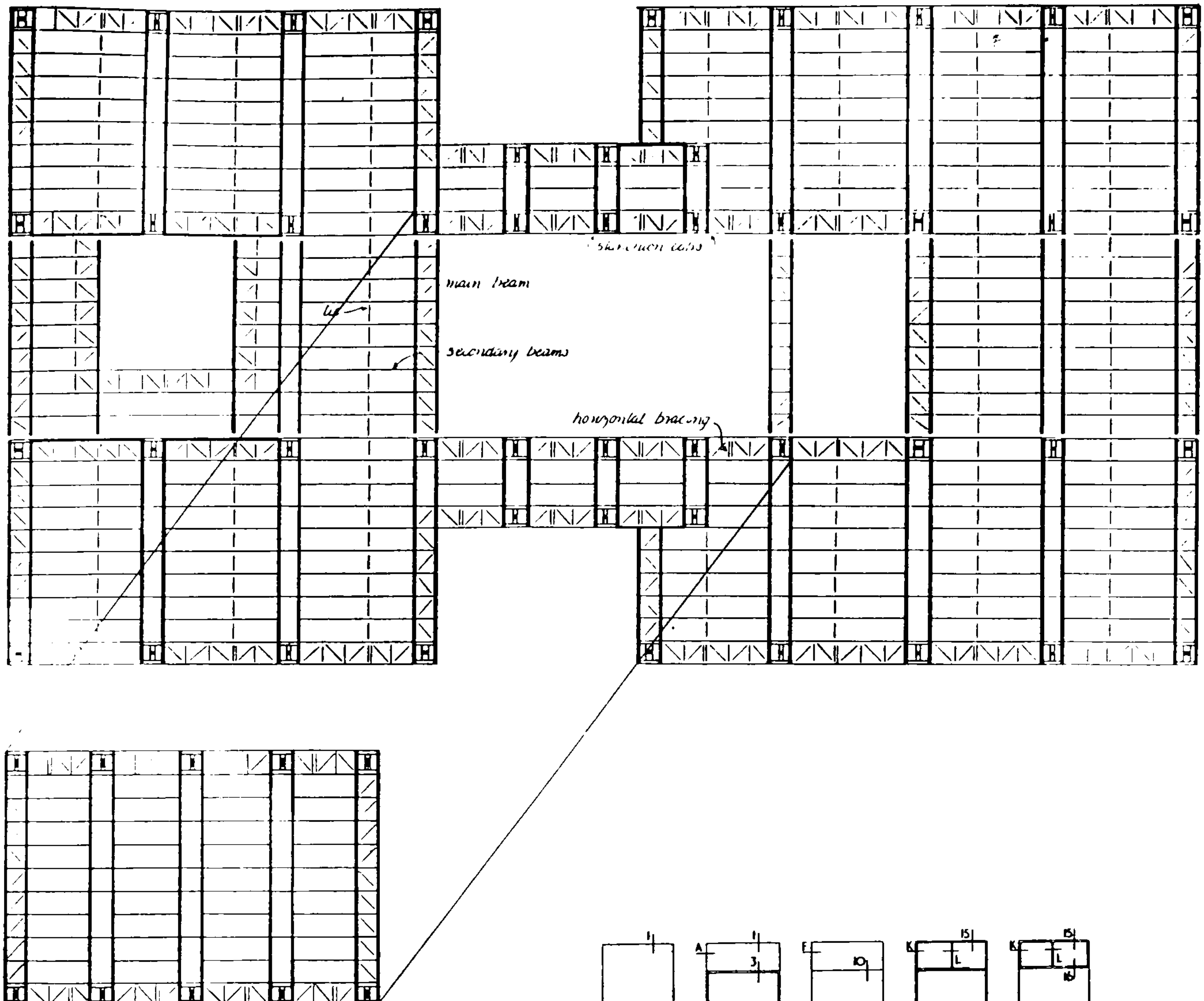
107.



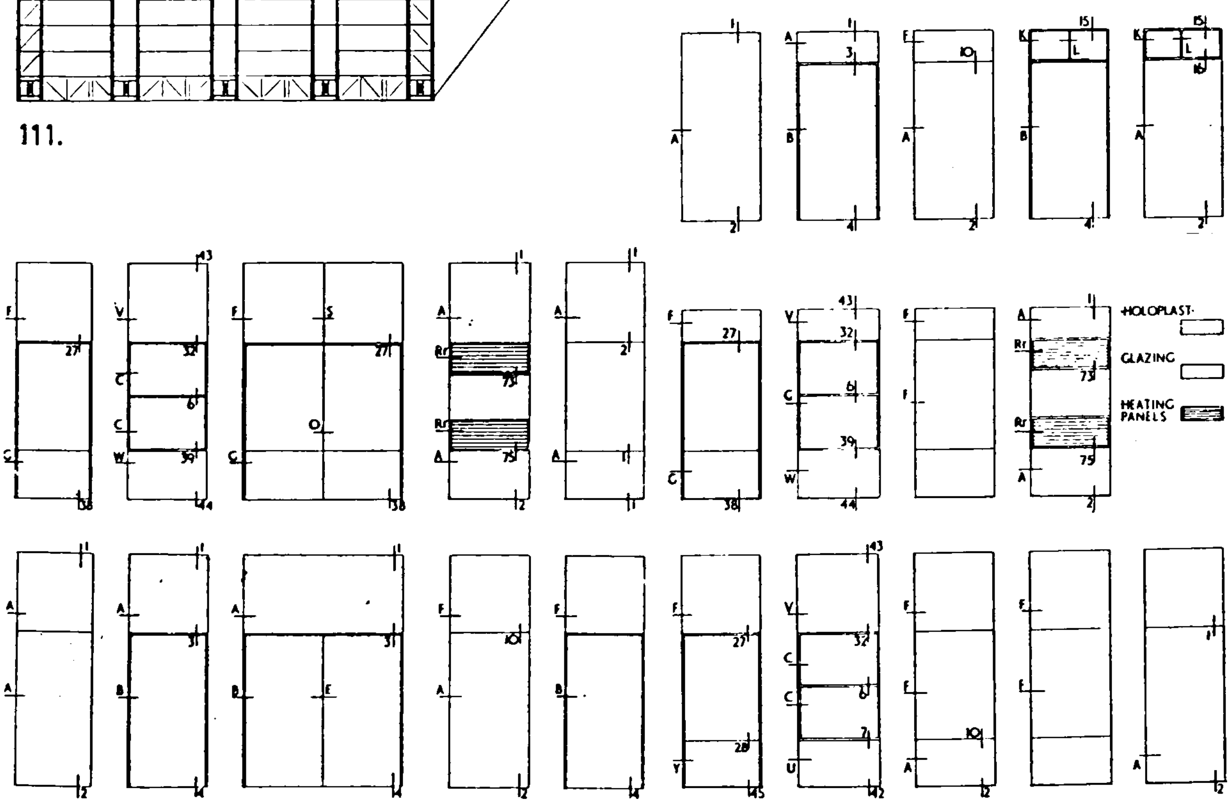
108.



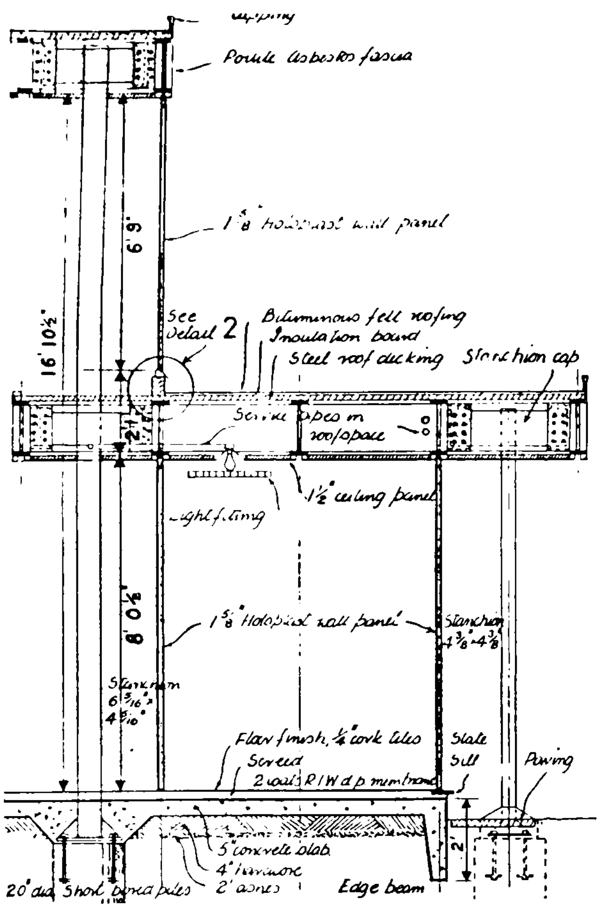
109.


main beam
secondary beams
horizontal bracing

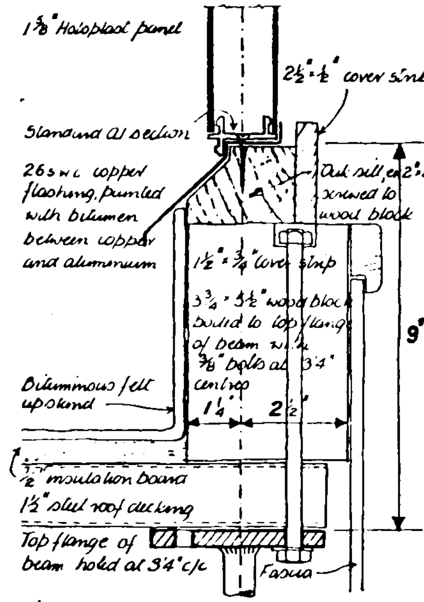
111.


HOLOPLAST
GLAZING
HEATING PANELS

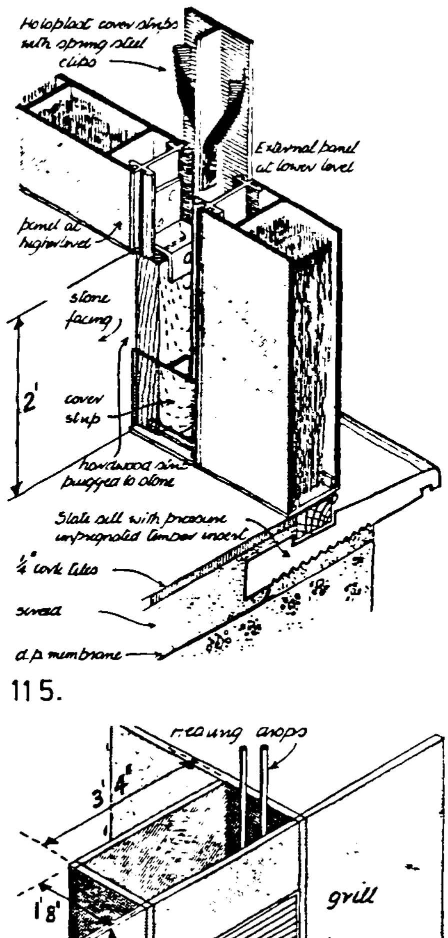
112.



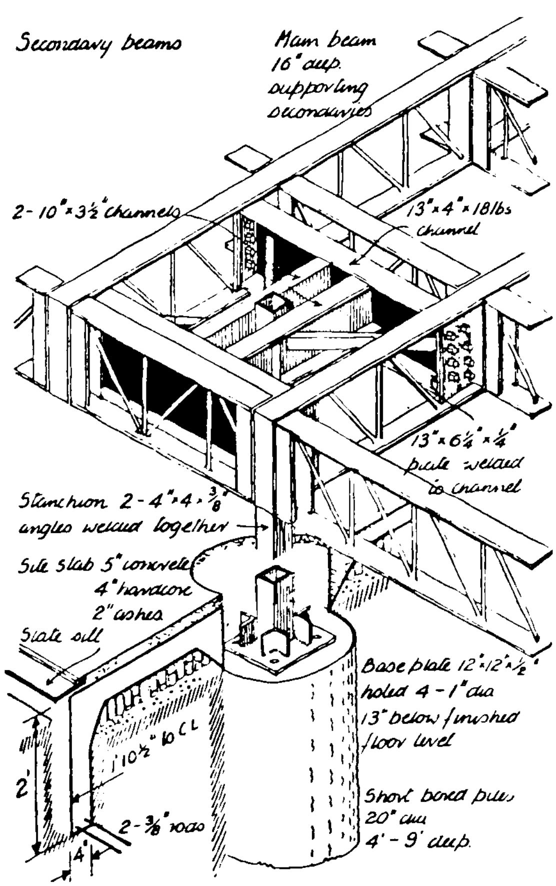
113.



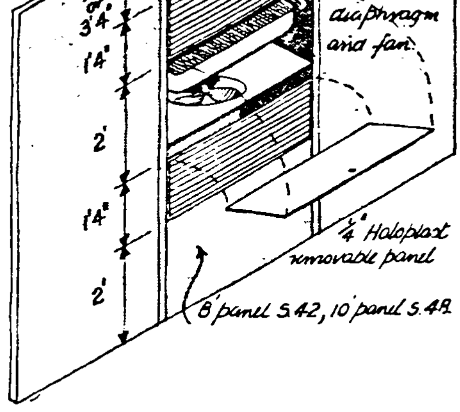
114.



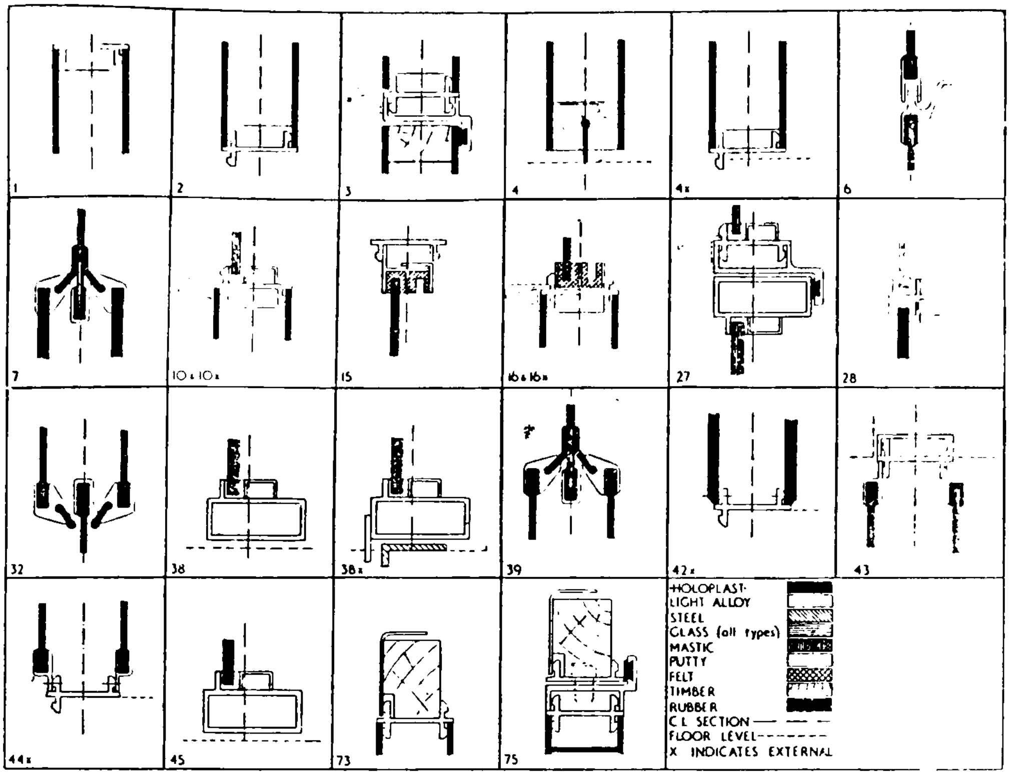
115.



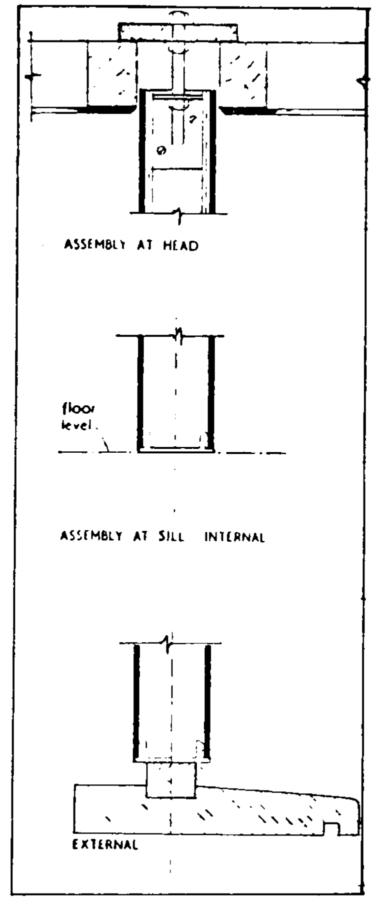
116.



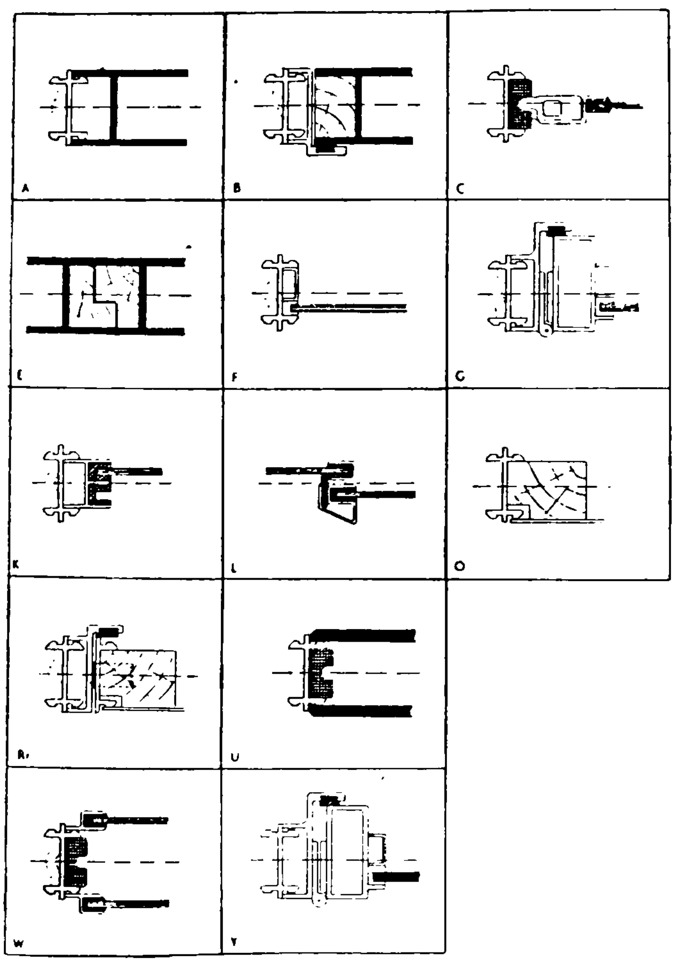
117.



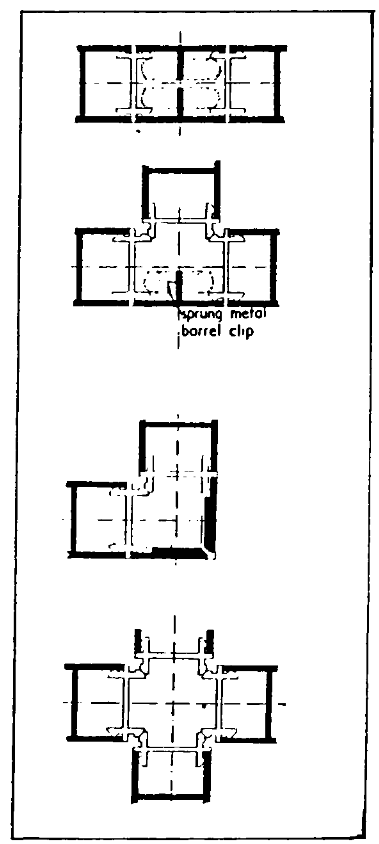
118.



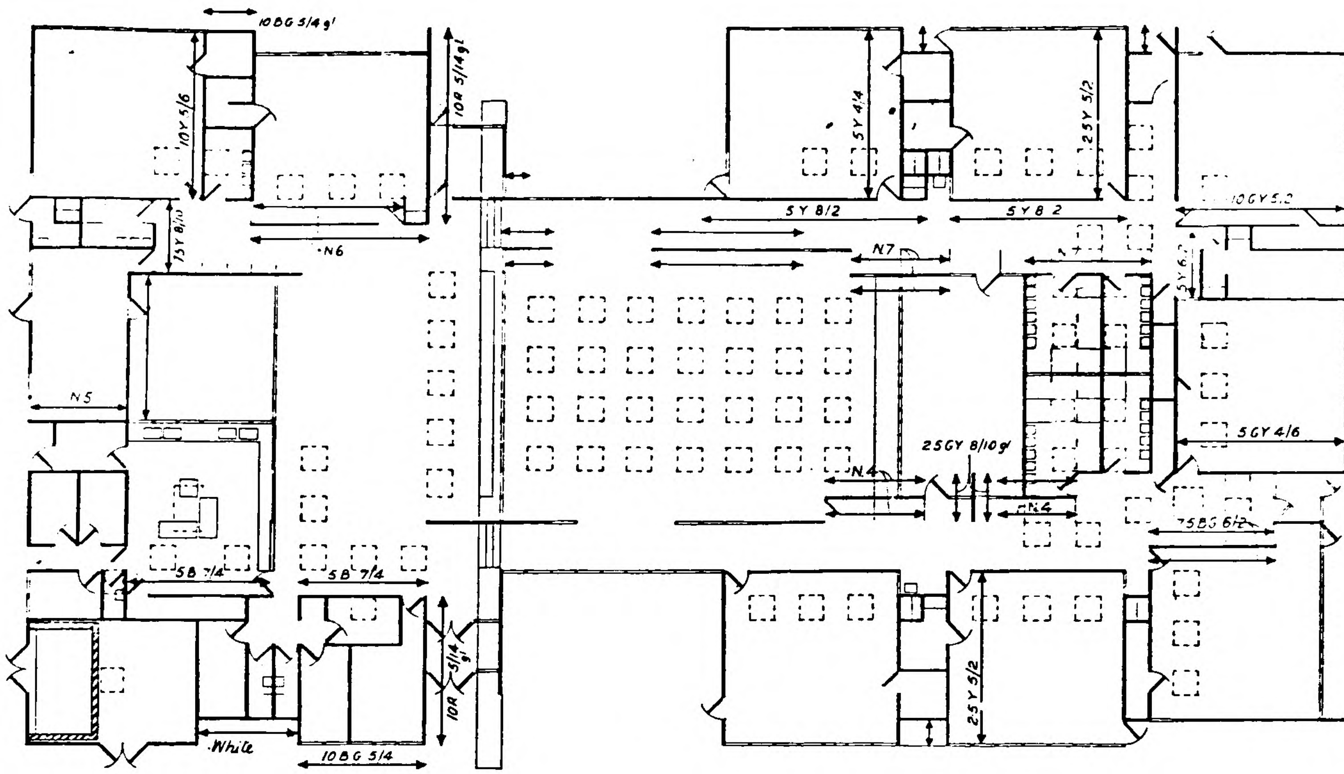
120.



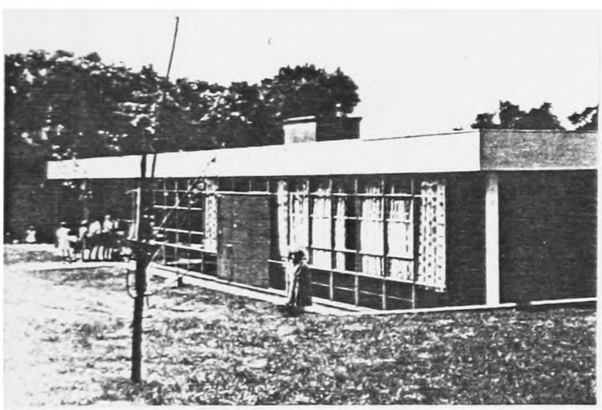
119.



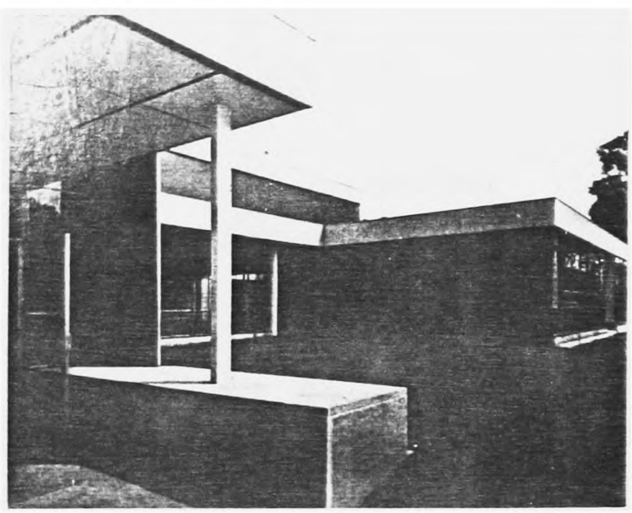
121.



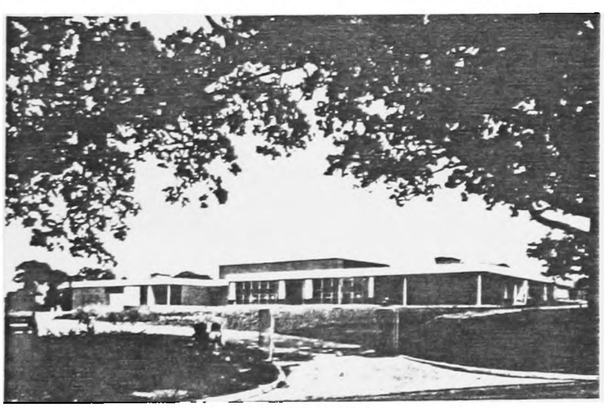
122.



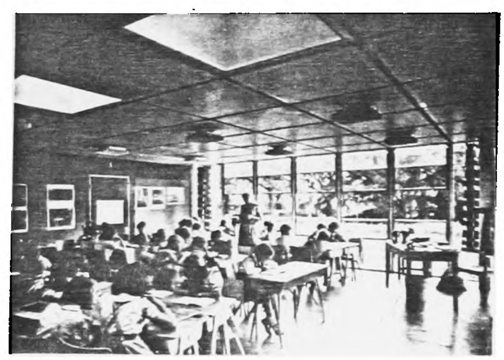
123.



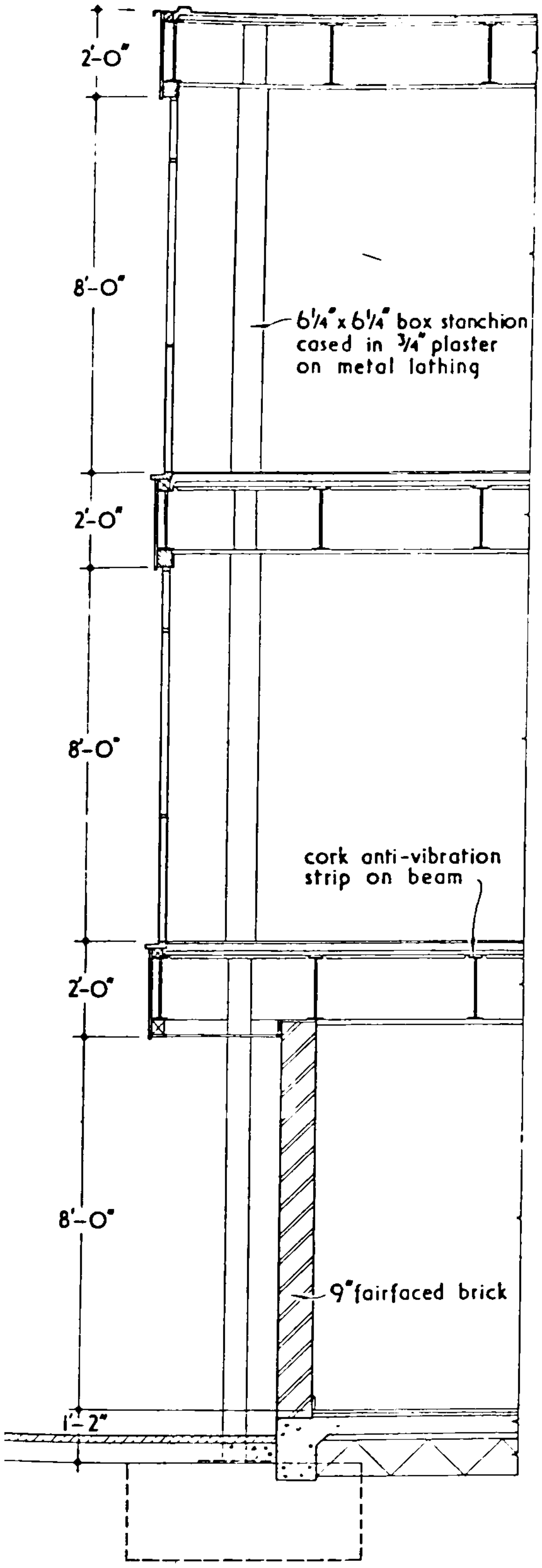
124.



125.

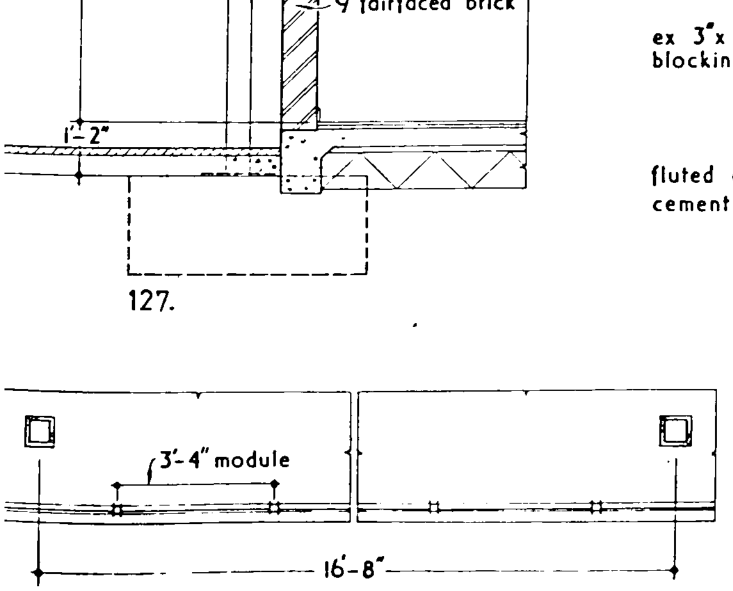


126.



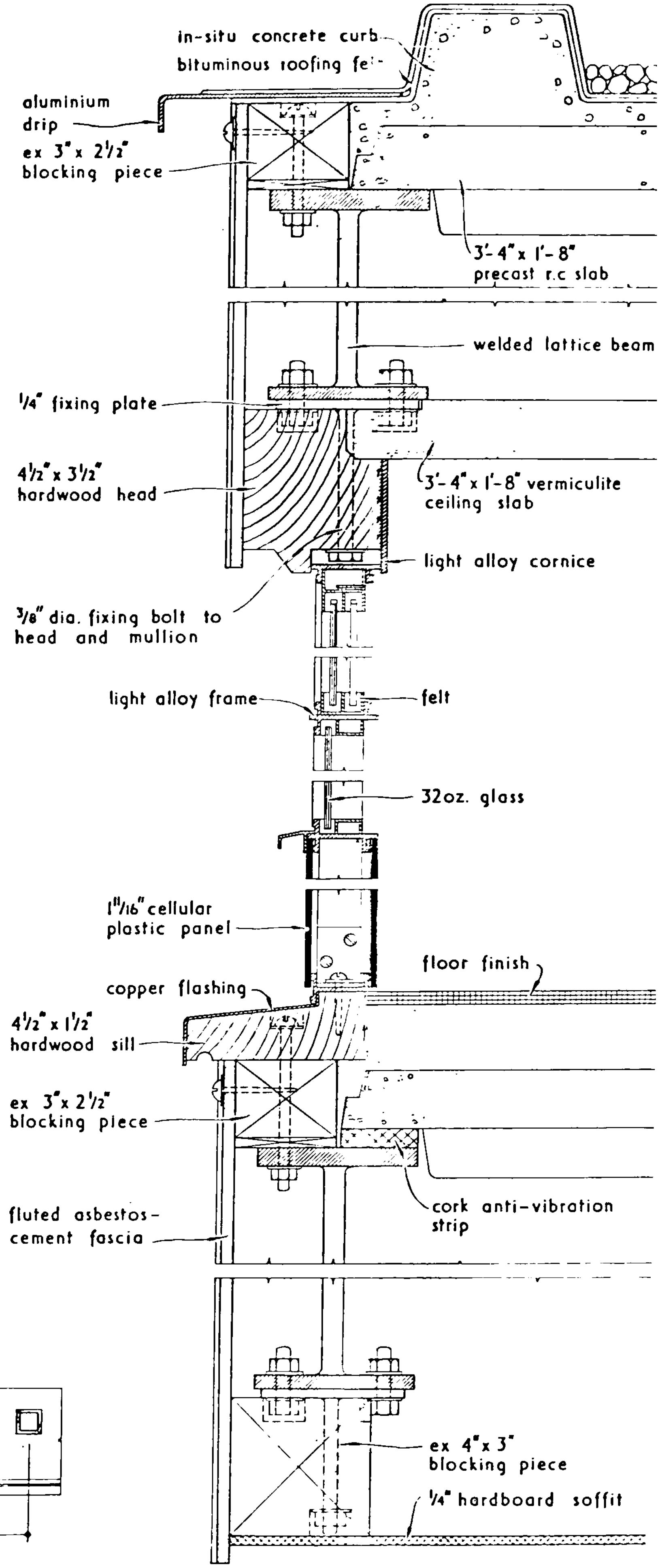
2'-0"
8'-0"
6¼"x6¼" box stanchion cased in ¾" plaster on metal lathing
2'-0"
8'-0"
cork anti-vibration strip on beam
2'-0"
8'-0"
9" fairfaced brick
1'-2"

127.



3'-4" module
16'-8"

128.



in-situ concrete curb
bituminous roofing felt
aluminium drip
ex 3"x 2½" blocking piece
3'-4"x 1'-8" precast r.c slab
welded lattice beam
¼" fixing plate
4½"x 3½" hardwood head
3'-4"x 1'-8" vermiculite ceiling slab
light alloy cornice
⅜" dia. fixing bolt to head and mullion
light alloy frame
felt
32oz. glass
1 11/16" cellular plastic panel
floor finish
copper flashing
4½"x 1½" hardwood sill
ex 3"x 2½" blocking piece
fluted asbestos-cement fascia
cork anti-vibration strip
ex 4"x 3" blocking piece
¼" hardboard soffit

129.

Chapter 18

THE FIRST SECONDARY SCHOOLS, 1950 - 51

Hertfordshire's first major Secondary Schools Programme was that of 1949-50. Approval was given by the Ministry of Education to four new secondary modern schools and two new grammar schools, one of which was subsequently transferred to the following year's programme. Before 1949, only two post-war secondary schools had been built in the county. The first was the Barclay School at Walkern Road, Stevenage, designed by the private firm of York, Rosenburg and Mardall in association with the County Architect; the second was the Hampden School at Oxhey which was designed within the department and on which construction commenced in April 1949. Neither of these schools was completed until 1951 so their value in terms of experience was limited.

As the Barclay School commenced only six months after the Cheshunt prototype began its relationship to the primary school programmes could not have been as remote as it might appear in the printed record. The early articles on the new schools published by the department made no mention of its existence and, equally surprising, the very detailed descriptive article which appeared in the RIBA Journal as early as October 1947 (construction commenced only the previous month) makes no mention of any collaboration with the County Architect.[1] Yet the school was for the same client and the steel-work and most of the other components were supplied by the same manufacturer as supplied Cheshunt.

It was the first application of the 8' 3" frame to both two-storey construction and secondary school design in the county. The RIBA Journal article gave a somewhat confusing account of the steel frame, used on both the Barclay and Hampden schools:

> The main construction will be in "Presweld" steel framework. This system employs galvanised components welded into lattice members for stanchions, floor joists and roof principals ...[2]

Ken Twist and John Redpath called it, more accurately a "two-storey empirical version of the Hills Presweld frame with r.s.j. stanchions."[3]

In the Barclay school the first attempts were made to interpret the provisions of the 1944 Education Act in Hertfordshire secondary schools. In the disposition of its elements, strung out to form semi-enclosed spaces, the plan bears a remarkable resemblance to Denis Clarke-Hall's pre-war school at Richmond, Yorkshire (figs. 131, 132). Its relationship to the "finger" plans of Stillman's West Sussex and Middlesex schools is equally evident.

Stylistically it bridged the gap between the work of the Middlesex and Hertfordshire County Architects Departments by the introduction of brick-faced flank walls, where no windows occurred; we shall see this device employed on occasions in the later Herts programmes. It would seem that neither the Barclay nor the Hampden schools, however, were considered to be sufficiently closely related to the primary schools development nor sufficiently far advanced, to be of significant value when work began on the 1949-50 Programme.

The background to the decision to investigate the 3' 4" module (in the Oxhey prototype) was discussed earlier. Oxhey Clarendon started on site six months after Barclay thus none of the three schools was very far advanced when it became apparent that large numbers of secondary schools would be required earlier than anticipated. The very rapid growth of the new towns and LCC housing estates made it impossible for the 3' 4" prototype work to be completed, fully assessed and the many new problems solved in the time available.

It was therefore decided to proceed immediately with an extension of the by now well-established 8' 3" system, building on the experience previously gained with the primary schools. Significantly, several of the architects starting on their first secondary school designs still had primary schools under construction, making them well equiped for the task. But the problem of translation was complicated by the sheer size of the secondary schools, making them impossible to design as single-storey structures. The development of a multi-storey frame was essential if they were to be contained within a reasonable coverage of the site.

New concepts of space, interdepartmental planning relationships, scale, ranges of specialised furniture and equipment combined with a new attitude to robustness, were among the essential aspects of design for the older age group of children. These factors would all need to be considered at the same time as the development of appropriate construction.[4] The problems from 1950 onwards were not, of course, restricted to the introduction of multi-storey components: further development in the design and construction of primary schools was considered to be of equal importance.

Hills were already working on an 8' 3" grid, two-storey frame to meet the requirements of other local authorities having urban sites which were restricted in area. This frame was agreed to be basically suitable for Hertfordshire's requirements, moreover the details of steelwork above first-floor level were effectively the same as those of the familiar single-storey construction.

Below first-floor level the stanchions required enlarging to 5½" x 6½" in all except corner and gable conditions, where the loadings were less. The increased height produced a greater overturning moment on the column which was consequently extended deeper into the foundations. A base with four holding-down bolts was provided, 16" below finished floor level. Since the building would be predominantly two-storey, the single-storey stanchions were also taken down to the same level for consistency.

Edge beam foundations were adopted at the perimeter of the building and overturning moments were taken up by reinforcing the site slab to a width of one 8' 3" bay in from the external wall. Although the concrete edge beams were of a width suitable for mechanical excavation, the contractors disappointingly failed to exploit this advantage.

The range of steel beams, which had been only three in number (a different beam for each of the three spans) was increased to include the constant depth beams. As with the 3' 4" prototype, these floor beams avoided changes in ceiling level and provided simple direct support for ceilings, obviating patent systems of suspension.

The top of the floor-bracing beam running between perimeter stanchions was lowered to a height of 8¾" above the top flange of the floor beam. This proved to be a considerable hindrance and made it necessary to build long lengths of wall-lining within the inner stanchion face, resulting in plaster cracks and loss of floor space.[5]

Once more, during the programme implementation the analysis continued and observations made became the development requirements for the following year's programme. For example, it became apparent that by redesigning the zed rail between the window head and the bracing beam, so that it could drain away any condensation, the lead cavity flashing could be dispensed with. Similarly, if a clamp system of window fixing could be devised much of the stanchion drilling would be unnecessary.[6] Too much was being bolted direct to the frame leading to manufacturing difficulties and complications; clearly the window system required rationalisation. Indeed if the eaves and gable ties were hidden within roof construction completely, the expensive and aesthetically heavy, pressed metal window surrounds could be dispensed with altogether.

The concrete cladding development followed the decision to revert to horizontal blocks on the primary schools described in Chapter 12.

There had been mixed views about the wide eaves of the 1948-49 primary schools.[7] Though the arguments for their deletion were production-based rather than aesthetic, and many had found them attractive "eyebrows", the Hertfordshire architects came to consider them:

> both aesthetically and structurally ... too heavy. It was felt that it was wrong to load necessarily heavy cantilevers with a concrete eaves block, so a pressed metal trough sectioned gutter of three different projections for different heights of building and with a pressed metal fascia was adopted...

however,

> three projections and the multiplicity of internal and external corner conditions produced a range of eaves components of fantastic proportions and for this reason and reason of aesthetics and cost it was agreed that the whole problem should be reconsidered.[8]

There was a strong feeling that on grounds of appearance the deep projection was inappropriate on a multi-storey building and that a fascia which did no more than master the external walling was desirable (figs. 139, 144). To make matters worse there were long delays in the delivery of pressed metal components, caused by the national steel shortage, reinforcing the eaves decision for future programmes.

In 1950 the Crittall Manufacturing Co. Ltd. were engaged for the windows and pressed metal trim. As was the case with Concrete Ltd. (floors and roof blocks) and Dow-Mac Ltd.(cladding blocks), once the firms were nominated on a programme basis it was possible to proceed with further development work prior to final standard component drawings being produced. Crittalls now provided a range which allowed glazing either of a "hole in the wall" type or the assembly of a window-panel composite unit, which could fill an 8' 3" wide bay for a full single or two-storey height. The panels in these composites were a sheet steel sandwich filled with "glass silk" insulation. However, when the cost of steel rose sharply early in the programme year many of the composite units were hastily replaced by windows and concrete cladding blocks. As designs progressed it was found that the window range required extending as the secondary schools needed more variety of types than had been anticipated.

At roof level the requirements of secondary schools differed from those of primary schools only in the need for a wider range of acoustic qualities for special rooms. Experience on primary schools had revealed that more positive methods for fixing ceilings should be sought, particularly where the heavier acoustic materials were employed. This need pointed to the desirability of a roofing block with a flush soffit.

Concrete Ltd. co-operated by reducing their standard block to $4\frac{1}{2}$" thickness in order to bring the load within the limits of the frame. The block's soffit provided for a variety of applied finishes: plaster, perforated plaster tiles with sound absorbent backing, and woodwool tiles or planks were all included (fig.141). Such a variety made it essential to select and prepare full ceiling layout drawings at an early stage in order to co-ordinate suitable light fitting positions and allow for the necessary fixing grounds to be cast into the soffits of the pre-cast roof blocks.[9]

As previously, the roof was finished with bituminous felt on a vermiculite screed, through which the electrical conduit ran. The structural floors used the same pre-cast block system as the roof, but thickened to 5". Sound reduction between floor levels was achieved by means of inserting glass silk between the blocks and the floor screed. This measure, however, did not solve the problem of sound passing through the slab joints, resulting in noise interference between teaching rooms.

The required half-hour fire resistance for the steel frame was to be provided by the suspended ceiling but tests made by the Fire Research Station revealed the method, developed with Union Ltd., was inadequate. It consisted of wood-wool tiles, cleat-fixed to pressed metal "top-hat" sections spanning between the bottom flanges of floor beams; the tiles were 2' $0\frac{3}{4}$" square, which related to the 8' 3" grid well enough but not the standard board sizes. Expert advice was sought:

> Discussion with the BRS led to the development of a classroom ceiling with a 4 ft. strip of perforated absorbent (perforated Gyproc with glass silk insulation) down the sides and the centre panel in plaster. The absorbent area was sufficient for classrooms and was disposed to prevent noise build-up in corners and to absorb external noise. The centre panel acted as a reflecting surface.[10]

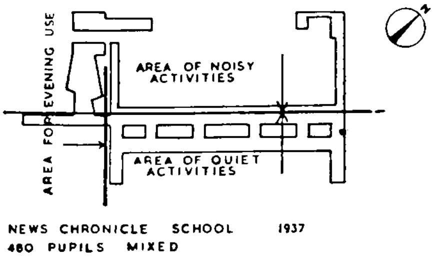
This method was used in the following year's programme.

In a manner which characterises the development process in system building, the discovery was soon made that the ceiling tiles required cutting to reduced sizes around the perimeter of rooms; similarly that light fittings could not be located in the centre of a grid square without drilling the pressed metal supports. The problems were both solved by offsetting the tiles from the planning grid by 1' 0$\frac{3}{8}$" in both directions and widening the fibrous plaster cornice to form a margin (fig. 141). This simple but ingenious device enabled all the tiles to be of a standard size; the cornice being pre-cast by the fibrous plaster sub-contractor.

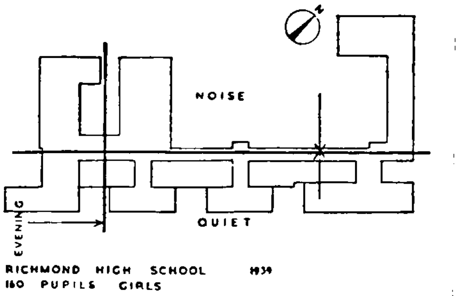
The problems of two-storey construction were beginning to be solved in the 1950-51 programme.

Notes to Chapter 18.

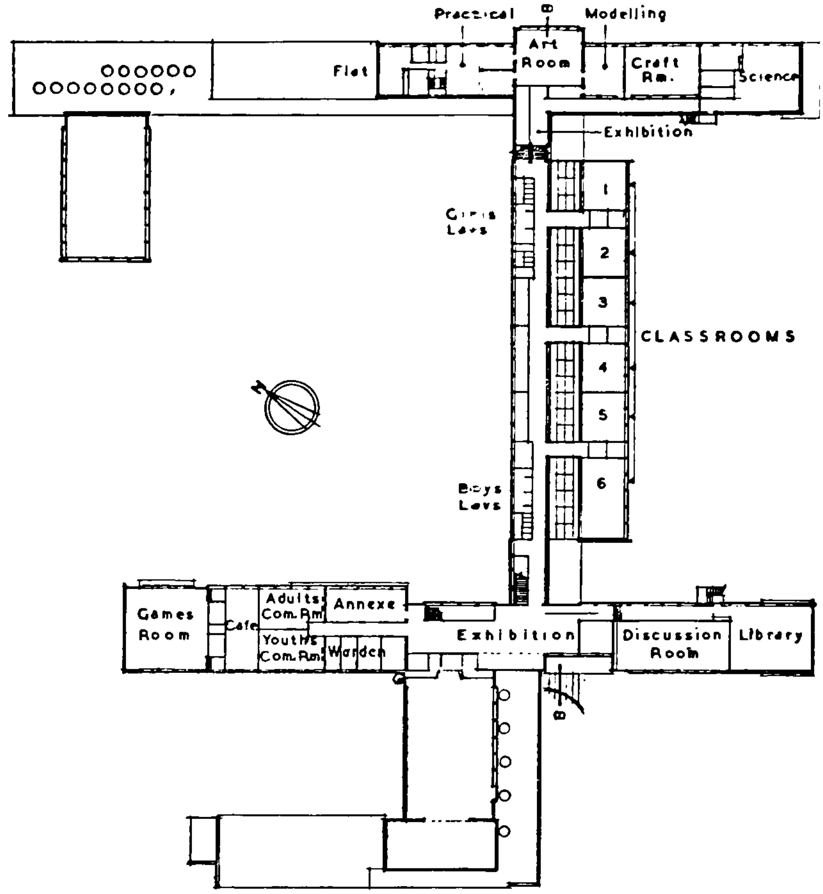
1. RIBAJ, "School at Walkern Rd., Stevenage", Oct.1947, pp.579-583.
2. Ibid., p.580.
3. K.C. Twist et al., "Hertfordshire schools development 5", AJ, 19 April 1956, p.379.
4. Ibid., p.381
5. Ibid., p.382.
6. Ibid.
7. R. Llewelyn Davies and J.Weeks, "The Hertfordshire achievement", AR, June 1952, p.372 et sec. See also K.C. Twist et al., "Hertfordshire schools development 6" AJ, 2 Aug.1956, p.156.
8. K.C. Twist et al., op.cit. (Herts development 5), p.383.
9. Ibid., p.384.
10. Ibid.



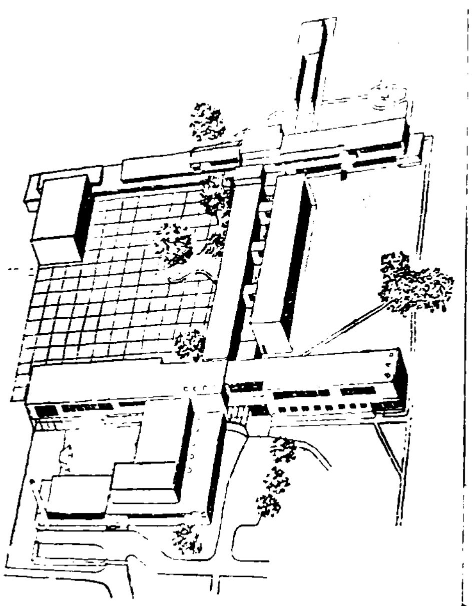
130.



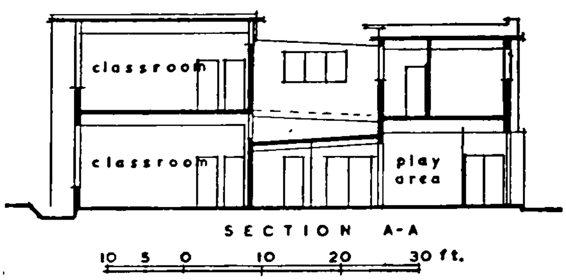
131.



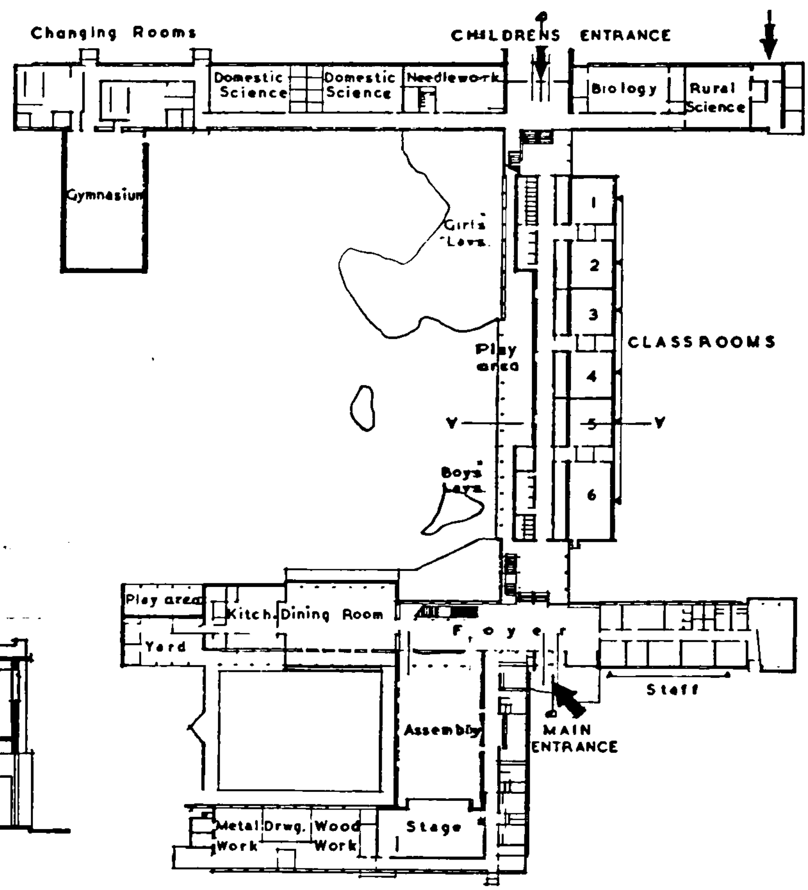
133. FIRST FLOOR PLAN.



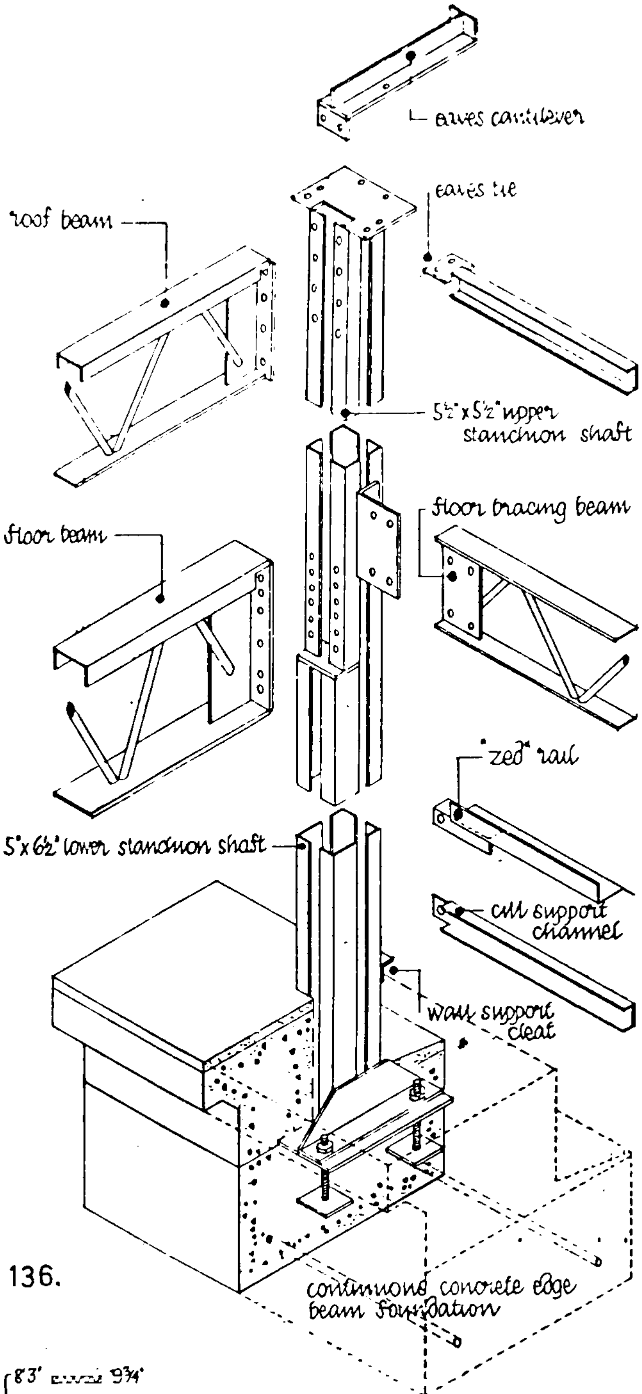
132.



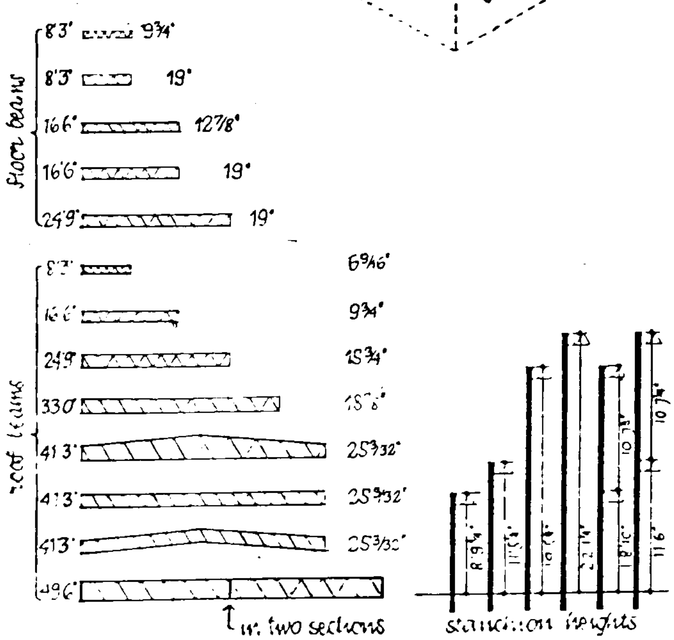
134.



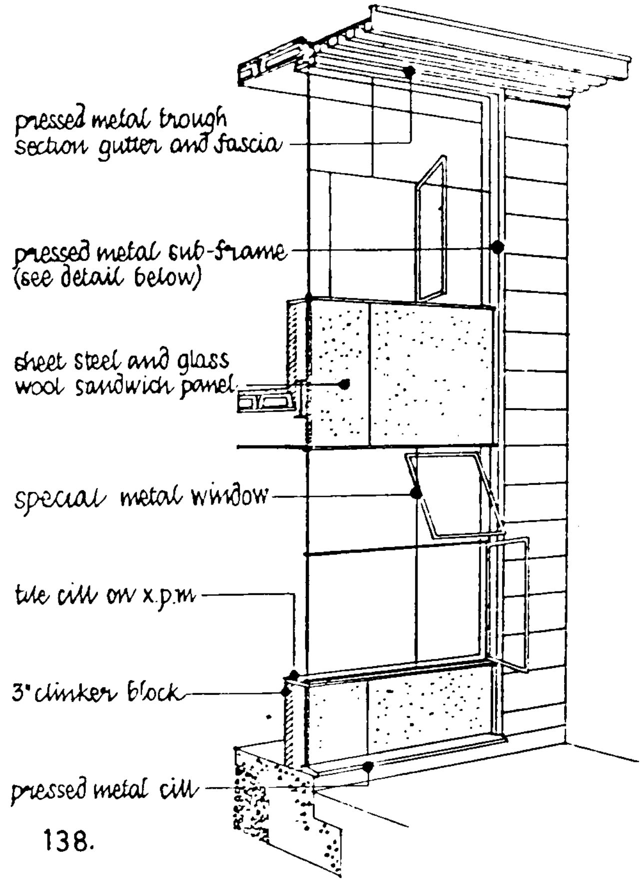
135.



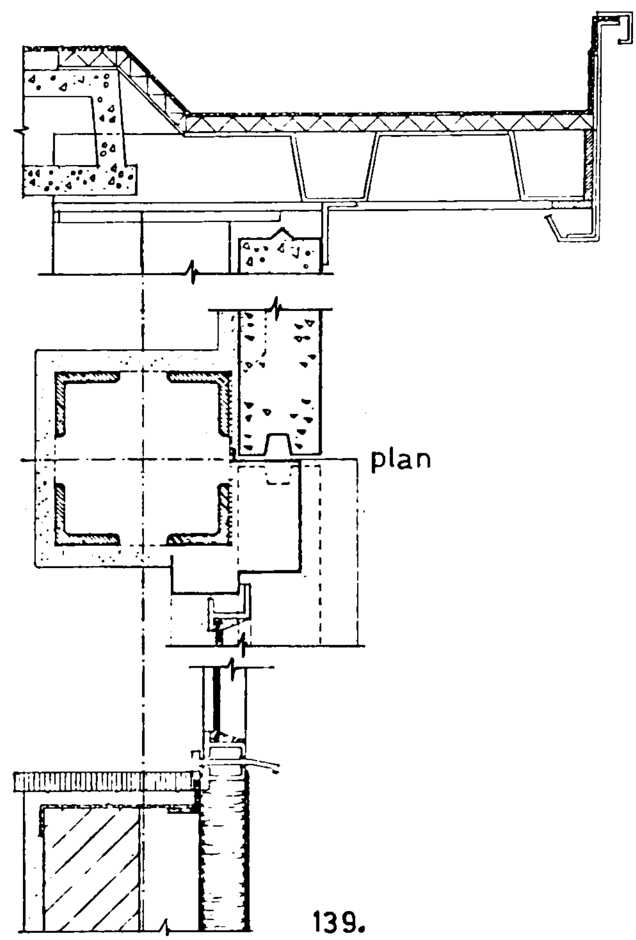
136.



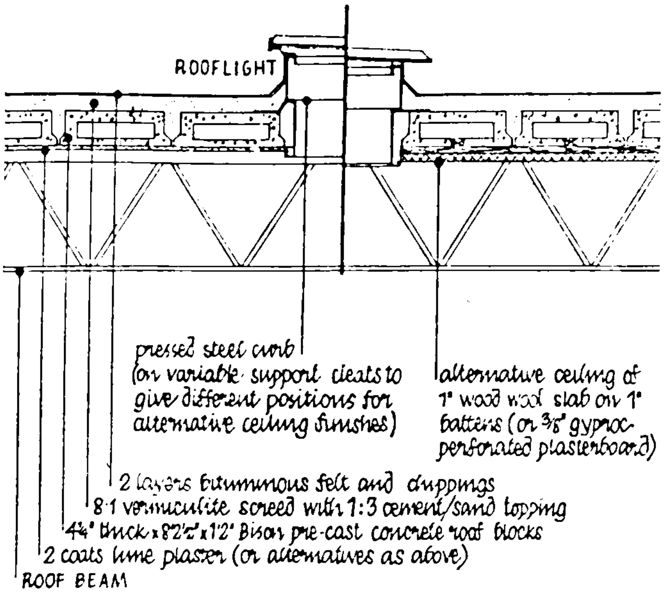
137.



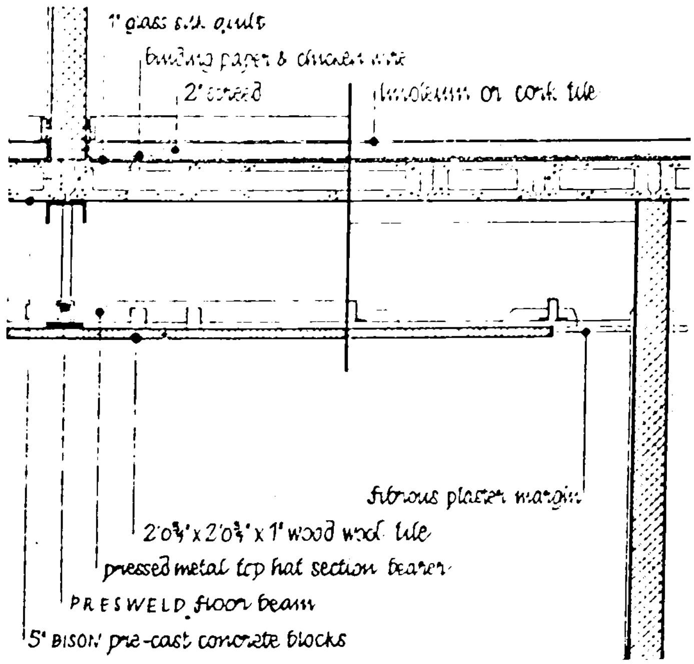
138.



139.



140.



141.

Figures 130-141.

130. Zoning schematic diagram of the News Chronicle school, 1937, cf. fig.8. (Architects Journal, 20 May, p.469)

131. Zoning schematic diagram of the Richmond High School, 1939, cf. fig.11. (ibid.)

132. Ariel perspective view of the Barclay School, Stevenage. (ibid., p.466)

133. Stevenage, Barclay SM School, first floor plan. (Godfrey and Castle Cleary, School design and construction, p.142)

134. Barclay School, section A-A. (ibid.)

135. Barclay School, ground floor plan. (ibid.)

136. Isometric diagram of steel frame components used in the 1950-51 Secondary Schools Programme. (Architects Journal, 19 April 1956, p.382)

137. 1950-51 Steel frame component range. (ibid.)

138. External walling component assembly. (ibid., p.383)

139. Section/plan through external wall at eaves and sill levels. (ibid.)

140. Roof and ceiling construction. (ibid., p.384)

141. Intermediate floor construction. (ibid.)

Chapter 19

8' 3" DEVELOPMENT FOR SECONDARY SCHOOLS, 1952-53

One of the main differences between working on secondary and primary schools was the longer time scale between design and building completion. Because they had come quickly into use the early primary schools had allowed relatively quick assessment of innovations to be made and the repetition of mistakes to be avoided.

In contrast, although the "user requirements" for secondary schools were becoming clearer with experience, it was still too early to assess the 1950 schools when design work for the 1952-53 programme began. However, work was sufficiently far advanced for some conclusions to be drawn.

The most important of these was that two-storey construction appeared to be relatively expensive and still necessitated too much site area being taken up with building. To date, development of the 3' 4" steel framed system had indicated an inherently higher frame cost and there were many other problems awaiting satisfactory solution.

Apart from the possibility that the steel shortage might worsen, there had been a general rise in prices of about seventeen per cent. To make matters worse the latter part of the 1950-51 programme had seen the MOE cost limit drop from £290 to £240 per place, though it rose again to £250 per place after the first school of the 1952-53 programme had been designed. The original target teaching area for the first (1950) secondary schools had been 90 sq.ft. per place.[1] After tenders for the initial scheme of the current programme were received it was clear that even 75 sq.ft. was too optimistic and later schools were designed down to 72 sq.ft. per place. Later, as costs continued to rise the target fell further to 70 sq.ft., despite the cost limit rising to £250 per place.[2]

Against this background of a steel shortage and economic difficulties it seemed distinctly unwise to commit a programme of at least nine secondary schools to the 3' 4" system. Thus, apart from the two schools which were designated development projects in timber framed construction as a hedge against the steel shortage (discussed in the next Chapter) it was decided to build the remainder in the 8'3" system, using the steel frame as economically as possible. Finding further economies would require some fresh approach to be made.

Although the County Education Officer was opposed to highly compact design solutions (nicknamed "magic boxes") on educational grounds, he now agreed that certain parts of schools could rise to three storeys.[3] Clearly this would enable considerable economies to be made. For example staircases could serve three instead of two floors and roofs could cover a greater volume of accommodation below.

On the frame therefore, the main new development effort was concentrated on its adaptation to three storeys. Hills had in fact, once more, just commenced design work on such a frame for commercial purposes when they were briefed on a new set of criteria by Hertfordshire.[4] The opportunity was taken to design a range of standard depth floor beams, including the bracing which was brought to the same depth and level as the other floor beams. It was fixed by bolting the web to cleats which had been welded to the stanchion shaft. The problem of four-way connections was ingeniously solved by means of "through bolting".[5]

The erection and manufacturing problems associated with elevational steelwork were tackled by replacing it, wherever possible, with a window-grid system manufactured by the window supplier. Except for the zed rails all members of the window system would be clamp-fixed to reduce still further the drilling of stanchions in the factory. The zed rail was redesigned in the form of a pressed steel weathering, welded to a continuous rolled steel, obtuse angled, member. One leg of the angle projected into the cavity to form the desired condensation drainage tray.

But the detailing was not entirely satisfactory: too light a guage was used for the pressed steel weathering and it tended to develop unsightly curves which were seen on elevation. After the third school in the programme it was replaced with a more substantial member.[6]

At roof level the eaves projection was reduced to a minimum; except in assembly halls and gymnasia all cantilever brackets were omitted (figs. 150, 151). The eaves and gable ties were now inverted so as to fix above the stanchion cap and within the roof space. As predicted, this improvement eliminated the need for pressed metal trim, reduced the fibrous plaster cornices, allowed more complete ceiling lighting and, above all, permitted the introduction of the modular window grid (or "window wall" as it became known).[7]

In order to facilitate an easier passage of services throughout the frame, the stanchion cap was provided with two holes. This successfully allowed conduit drops from the roof to be concealed within the stanchion but, because of floor beam connections and stanchion construction, difficulty was experienced in getting out of the back of ground floor stanchions without some site drilling.

As contractors had failed to take advantage of mechanical excavation the edge-beam foundations were abandoned in favour of column pads (fig.142). The single-storey stanchion bases were raised to 12" below finished floor level and pads were designed to take their own overturning moments.[8]

The floor blocks of the 1950-51 programme were continued with but the floating screed method of sound reduction was abandoned on grounds of cost. Instead, soft floor finishes were specified; generally cork tiles or studded rubber tiles. The floors themselves presented no problems but their associated ceilings required and received further attention. These ceilings clearly had physical and functional differences, contrasting with those beneath the roof and this distinction marks an important stage in the development of "elemental" sub-division. Thus the floor and its associated ceiling became classified for design and standard drawing purposes as "floor"; likewise the roof and its ceiling was classified simply as "roof". This recognition of functional, elemental, division was to have great significance in the development of new cost analysis and cost planning techniques which will be discussed in Chapter 23.

Two types of suspended ceiling were developed for the 1952-53 programme. The first was made up of 4' 0" square, perforated plasterboard panels, glued to battens and backed with the sound deadening material which had been investigated during the previous programme; the second was an 8' 3" x 2' 0¼" fibrous plaster panel, provided with acoustic slots and again backed with absorbent material. Both types were satisfactory acoustically and complied with the half-hour fire protection requirement. However, the 4' 0" square (Gyproc) panels rapidly ran off grid on account of their accumulative discrepancies and produced problems in irregularly shaped rooms. In these situations fibrous plaster cornices were required.[9]

Such cornices were unnecessary with the alternative, fibrous plaster ceiling. Here, extra width or reduced size panels could easily be made. The suspension consisted simply of light channel sections which were wadded onto the backs of the panels, making them self supporting between the bottom chords of adjacent floor beams (fig.146).

The roof blocks of the previous programme continued to be used but with changes in their surfacing. To reduce movement in the roof, blocks were grouted in 8' 3" squares, the grout being omitted over structural members. Expanded clay (Leca) screeds were introduced to reduce softness and for economy. The screeds were now laid flat for simplicity, except for 8' 3" square collecting dishes in which were positioned the rainwater sumps. These were drained by means of internal downpipes on account of the overhanging eaves being discontinued. The screed was covered with two layers of bituminous felt, as before, with granite chippings. No changes were made to the ceilings used in the 1951-52 programme.

Rooflights assumed a far greater importance with general disappearance of clerestory lighting. Opening types which could provide cross-ventilation without letting in the rain and which could be blacked out where necessary were required. The frequency of forming rooflight apertures in roof areas, often occurring adjacent to one another, involved a lot of extra work in trimming thereby slowing up progress during roof construction. Rooflight development included the introduction of a timber upstand and a pressed metal hood for weather protection, constituting a product (made by Crittalls) which was remarkably neat and efficient (fig. 147).

Towards the end of the programme an attempt was made to develop a "dry" form of roof construction which could be felted directly and which would have a soffit needing no further surface treatment. The material used was the "Leca" lightweight aggregate, as used in the roof screed, poured into a mould in which small-section strips of ordinary prestressed concrete were laid. The technique, developed by Concrete Ltd., appeared to provide such a roof and was used experimentally on a gymnasium later on in the 1953 programme.[10] It was judged to be most successful but the development ground to a halt when the manufacture of

Leca in this country stopped in 1954.

Certainly the most interesting and significant innovation in the programme was the development of a simple but effective curtain wall system. The architects described the exercise thus:

> Early discussions with Messrs Crittall were on rather conventional lines. The architects having prepared a theoretical scheme, went to the window experts and asked how the theory could most economically be put into practice. Thus the system was limited to the use of only standard-steel window sections and consisted of "Detroit" bars clamped to the outside faces of stanchions to which were fixed a series of frames in sash section sub-divided for glazing-in with glass or glazing-out with panels and coupled - where necessary - with standard sills and transomes.[11]

The frames were designed to cater for every vertical modular increment and thus provide the degree of flexibility that was being striven for. Into the frames went a range of screw-in vents, fabricated in either small or medium universal sections, and beaded-in Holoplast panels. The limiting size for medium universal section allowed the 8' 3" bay to be divided into four 2' 0" wide (nominal) casements. An alternative infill panel was designed consisting of a softwood frame faced externally with western red cedar vertical boarding and internally with stove-enamelled asbestos-cement sheet. The space between was filled with glass silk. Difficulties were experienced in obtaining suitable materials and, in general, the infill panel system was found to be expensive in comparison with the concrete cladding blocks.

By the end of the 1953 programme a fully glazed curtain wall system was developed: instead of "solid" infill panels, georgian-wired glass, backed with removable painted Asbestolux sheets were used. But these too proved expensive and further attempts were made to restore "a more clearly-articulated elevational treatment in which cladding blocks would not occur either above or below windows."[12]

On the first school to use the new Crittall wall system detailed costings indicated that despite the simplification of production, the increased number of window components and coupling bars made for far higher costs than had been expected. Considerable savings were subsequently made by limiting the maximum size of unit assembly to 8'3" x 6' 8", being the largest size suitable for Crittall's production line and galvanising tanks.[13]

Apart from accumulated inaccuracies on the faces of three storey stanchions, remedied by developing a clamp plate which would allow greater erection tolerances, few difficulties were encountered on site. Crittalls, in conjunction with the architects, had prepared an extremely comprehensive set of standard details. It was not until later in the programme when architects engaged on individual schemes attempted to introduce unexpected and largely unnecessary fenestration patterns that problems affecting production occurred.[14]

After 1953 the 8' 3" development process began to slow down and changes tended to be consolidatory rather than radical in nature.

A most important aspect of Hertfordshire's work was the method of combining standard drawings for the repetitive, detailed aspects of design with unique project drawings. It must be remembered that even though they were virtually all built from the same kit of parts no two schools were ever the same; although standardisation of the parts was central to the Hertfordshire method the system and the educational brief were constantly responding to fresh challenges. The means of communicating these evolutionary changes, i.e. the standard drawings and associated documents, needed to be continually under review.

Significant steps in the rationalisation and co-ordination of standard drawings and bills of quantities for the 8' 3" system were announced in an internal circular in December 1955. After reviewing the secondary schools standards, those printed on foolscap sheets of yellow paper, it was decided to make a two-phased revision of them.[15]

The first phase was routine, involving the correction of errors and amplification of content where either possible or necessary, along with an improvement of legibility. Phase two was to be more fundamental:

> Rationalisation of 8' 3" Secondary School system and 8' 3" Primary School system. Tie up with Bill Section numbering. Extension of application based on selected job details which are being used or can be used in more than one job.[16]

It was intended that the phase one amendments would apply only to the secondary schools of the 1955 programme and phase two, the bringing together of all 8' 3" standards into one system, would apply from the 1956 programme onwards.

A detailed draft programme was included in the circular breaking the task down into elements which conformed with the elemental structure of the bills of quantities, produced by the Quantity Surveying section of the County Architects Department. The circular commented:

> The extent to which the programme for phase 2 can be accomplished will depend on how many architects can be spared from teams between the completion of outstanding details for 1954 schools (on ground), outstanding and urgent work on drawings for 1955 programme and the commencement of design projects for 1956 programme. It should be remembered that although there may be only a few 8' 3" projects inside the group for 1956, the details apply to jobs for which private architects (working in collaboration with the County Architect) are responsible.[17]

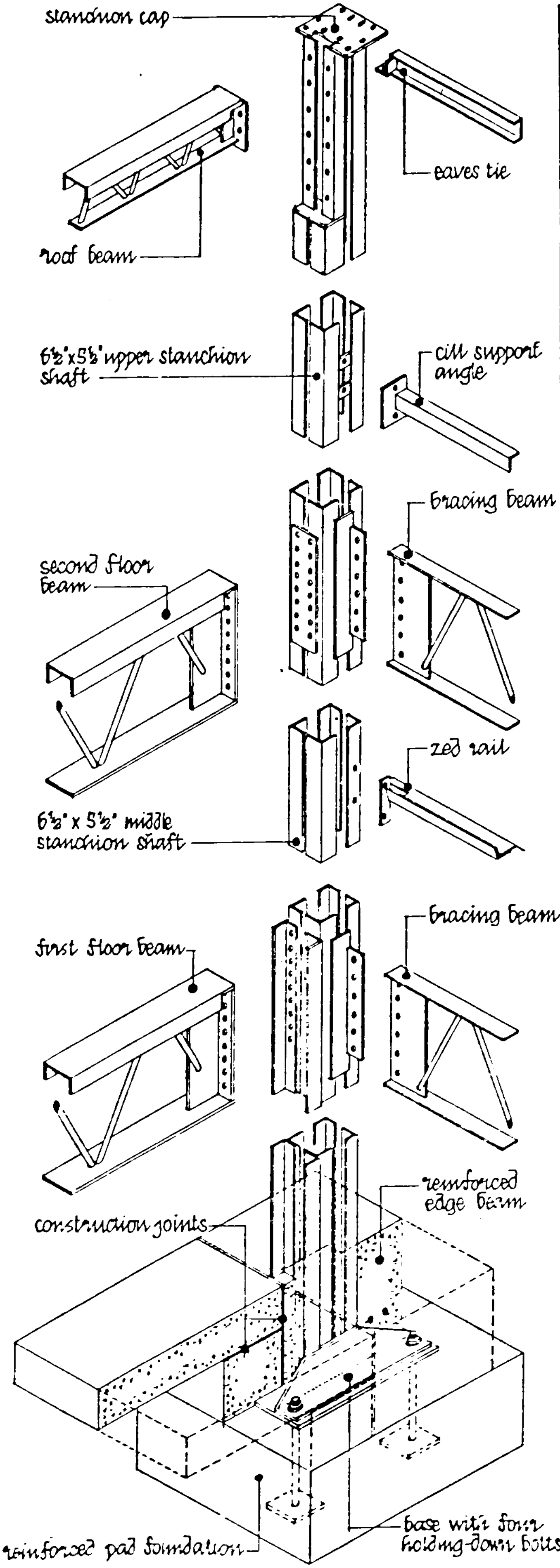
By May 1956 work on the new combined standards had progressed well enough for sets of drawings covering the main carcase of the building to be available to job architects. The new Blue Standards, so called because they were printed on blue dyeline paper, continued to be used with only relatively minor revision until the last 8' 3" project was completed in 1966.

The advantages of the merger were considerable. Inevitably the maintenance of two separate sets of standard drawings had meant both duplication and unnecessary variations of detail applying to the same "condition". When the idea of the amalgamation was presented to Ernest Hinchliffe of Hills "his immediate reaction was enthusiasm to simplify the steel frame and to supply Hertfordshire with one type of frame for all projects whether Primary, Secondary or F.E."[18] Before long he began to develop what he called his "834 Steel Frame". From Hills's point of view the step was simply a rationalisation of an inevitable kind.

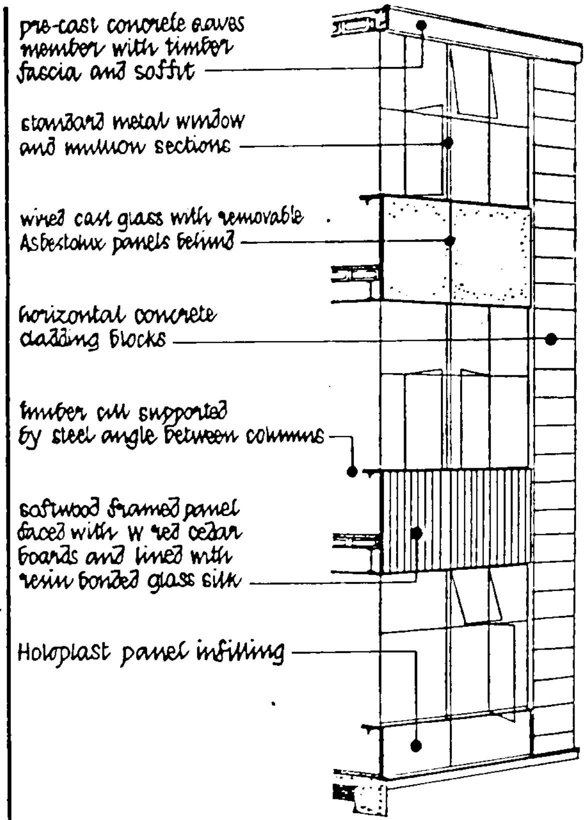
Hertfordshire, however, considered that "the time might be ripe for again thinking in terms of planning grids and their effect on flexibility, speed and economics."[19] Change was in the air and the Blue Standards exercise turned out to be a watershed in several ways. Most of its users had a great affection for the 8' 3" system which was not surprising as development work had always been spread across the department; small groups and individual architects being allotted specific tasks or being seconded to ad hoc groups. Most of the architects had therefore at some time or other had a share in its development and its fortunes. Nevertheless the mid fifties were a period of reflection on past achievements and future directions. We shall see in the next Chapter how certain established assumptions were being questioned in the Department at the very time when the final consolidation of 8' 3" was in progress. Market conditions with regard to the availability of labour and materials were changing and the ventures into 3' 4" alternatives were to instil a questioning habit in the minds of several architects in Hertford.

Notes to Chapter 19

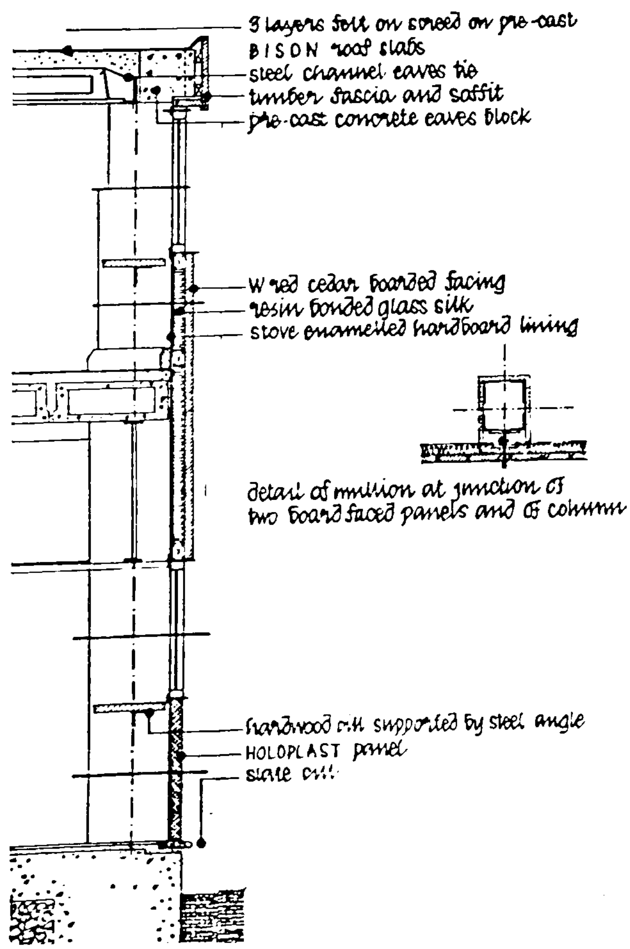
1. K.C. Twist, J.T. Redpath and K.C. Evans, "Hertfordshire Schools development 5," AJ, 19 April 1956, p.381. See also E650D. (49-52) 309.
2. K.C. Twist, J.T. Redpath and K.C. Evans, "Hertfordshire schools development 6," AJ, 2 Aug. 1956, p.157.
3. Ibid., p.156.
4. Ibid., p.158.
5. GEN 5A (52-54) 625.
6. AJ, 2 Aug. 1956, p.158.
7. E750T (51-53) 612.
8. AJ, 2 Aug. 1956, p.158, E750T (51-53) 612.
9. AJ, 2 Aug. 1956, p.161.
10. E750M (51-53) 612.
11. AJ, 2 Aug. 1956, p.159.
12. Ibid.
13. Ibid.
14. Ibid.
15. New schools group Circular no. 6, 13 Dec. 1955, GEN 77 (52-60) 931. See Appendix 2.
16. Ibid.
17. Ibid.
18. H.C.C. Report on the development of a new planning grid, 15 May 1957, GEN 5A.
19. Ibid.


stanchion cap
roof beam
eaves tie
6½"x5½" upper stanchion shaft
cill support angle
bracing beam
second floor beam
zed rail
6½" x 5½" middle stanchion shaft
first floor beam
bracing beam
reinforced edge beam
construction joints
reinforced pad foundation
base with four holding-down bolts

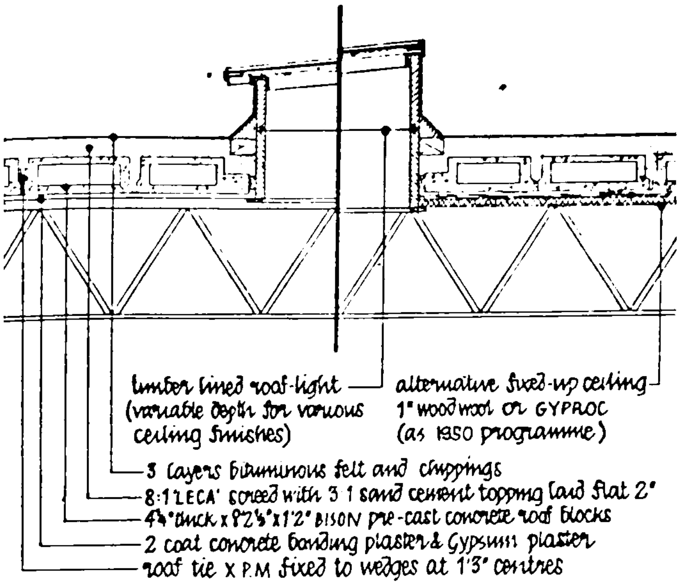
142.


pre-cast concrete eaves member with timber fascia and soffit
standard metal window and mullion sections
wired cast glass with removable Asbestolux panels behind
horizontal concrete cladding blocks
timber cill supported by steel angle between columns
softwood framed panel faced with W red cedar boards and lined with resin bonded glass silk
Holoplast panel infilling

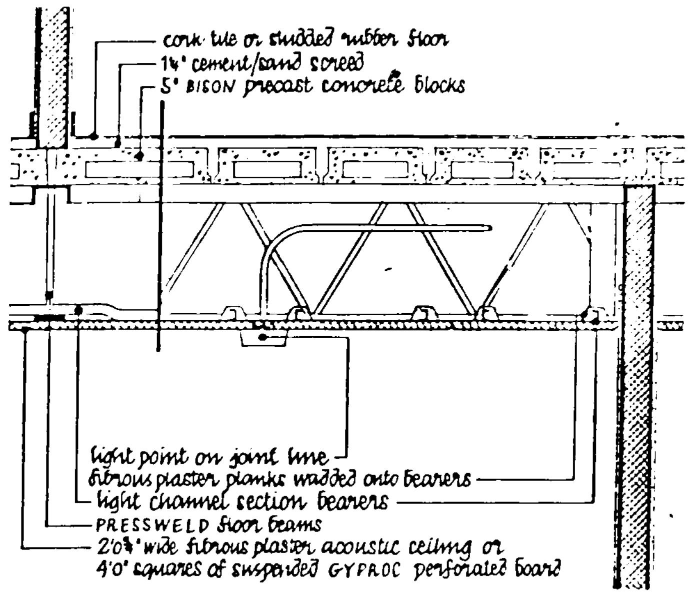
143.


3 layers felt on screed on pre-cast BISON roof slabs
steel channel eaves tie
timber fascia and soffit
pre-cast concrete eaves block
W red cedar boarded facing
resin bonded glass silk
stove enamelled hardboard lining
detail of mullion at junction of two board faced panels and of column
hardwood cill supported by steel angle
HOLOPLAST panel
slate cill

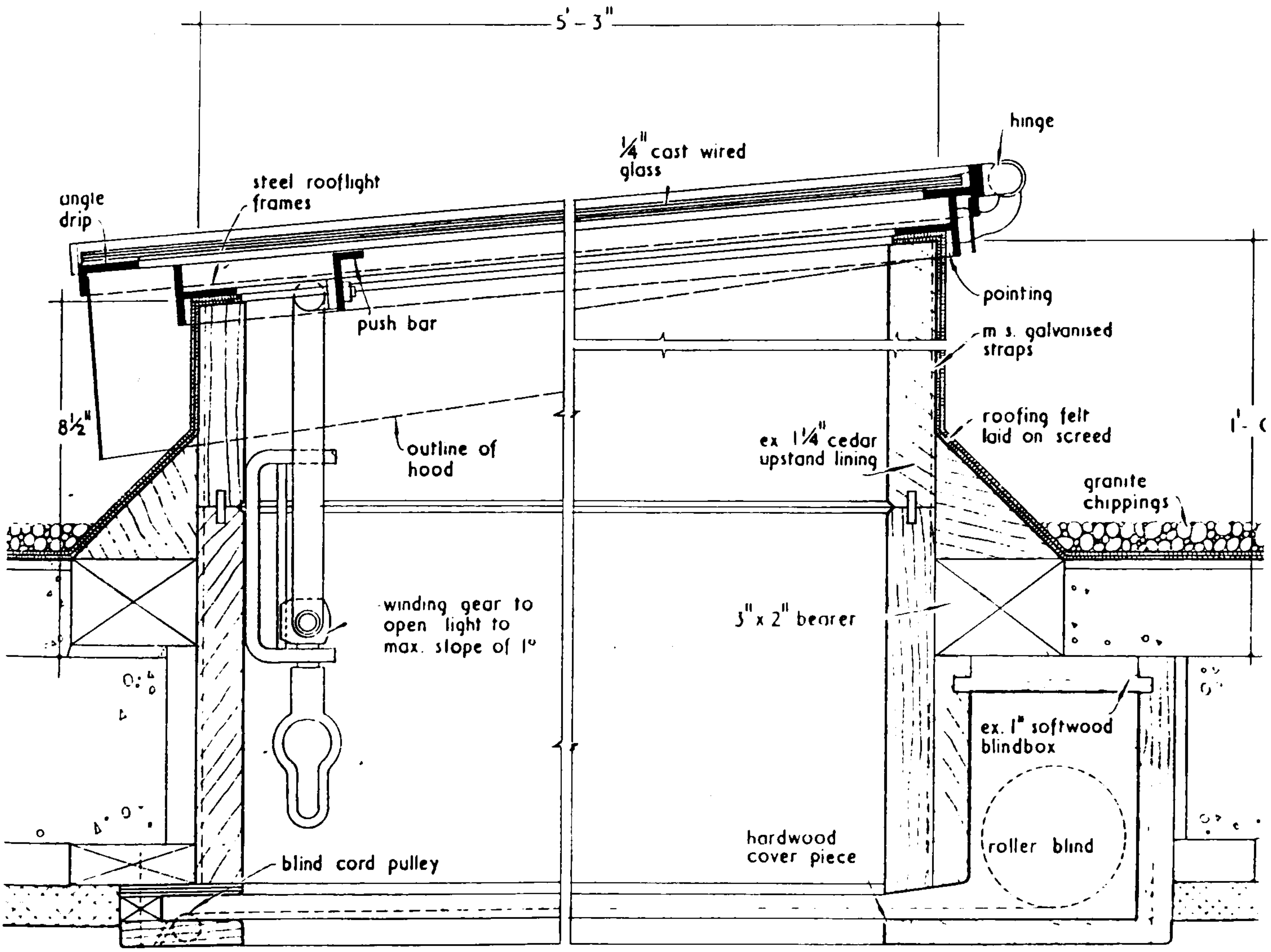
144.


timber lined roof-light (variable depth for various ceiling finishes)
alternative fixed-up ceiling 1" woodwool or GYPROC (as 1950 programme)
3 layers bituminous felt and chippings
8:1 'LECA' screed with 3:1 sand cement topping laid flat 2"
4¾" thick x 8'2½" x 1'2" BISON pre-cast concrete roof blocks
2 coat concrete bonding plaster & Gypsum plaster
roof tie X P.M fixed to wedges at 1'3" centres

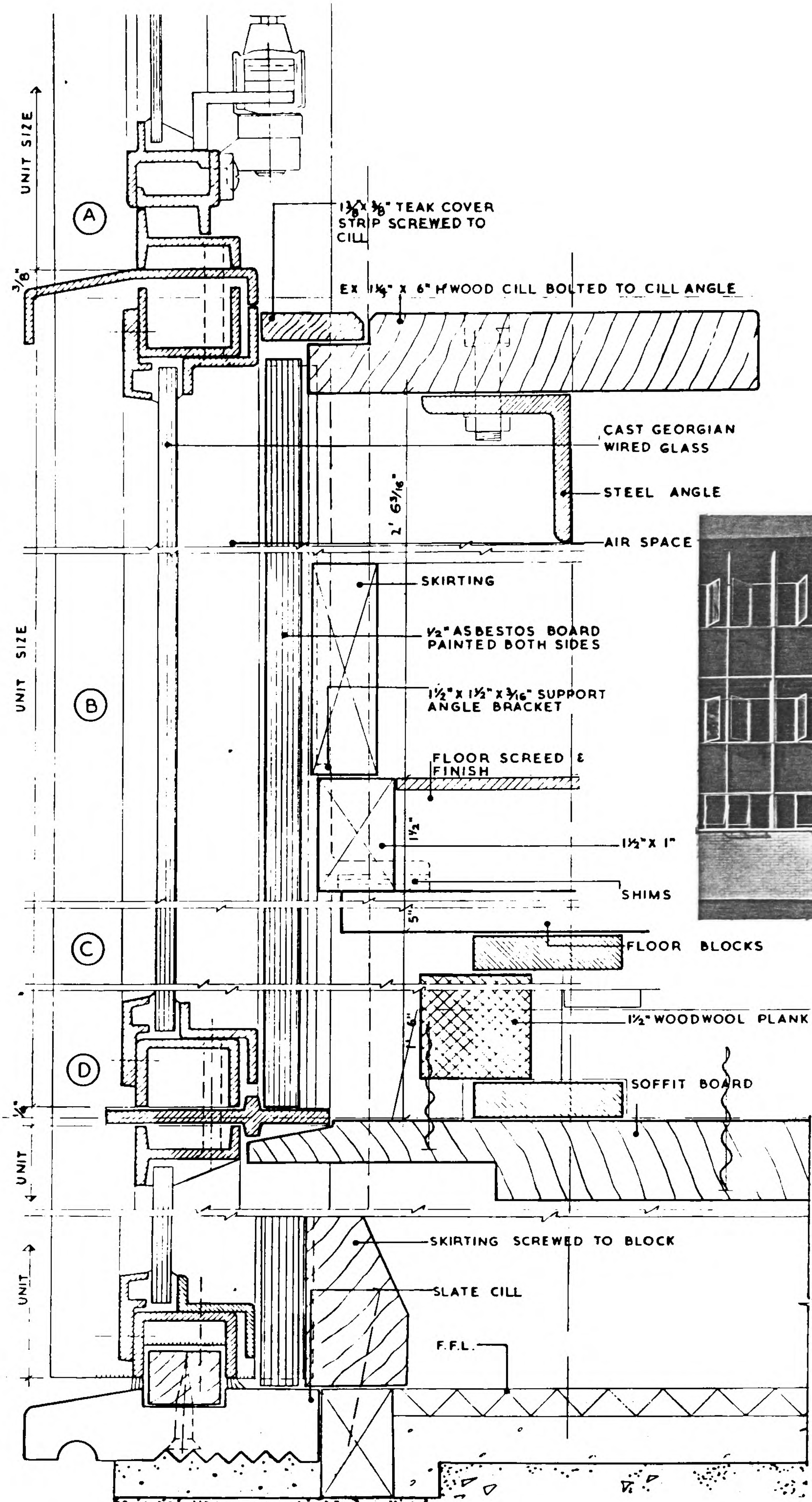
145.

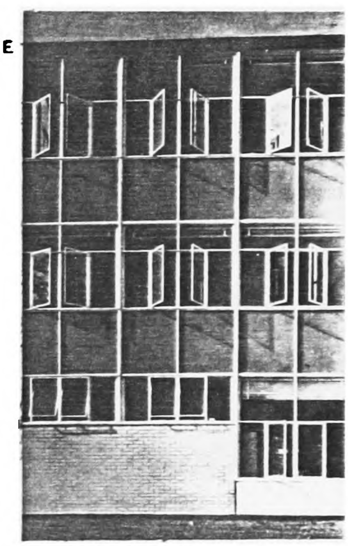

cork tile or studded rubber floor
1¼" cement/sand screed
5" BISON precast concrete blocks
light point on joint line
fibrous plaster planks wadded onto bearers
light channel section bearers
PRESSWELD floor beams
2'0¾" wide fibrous plaster acoustic ceiling or
4'0" squares of suspended GYPROC perforated board

146.


5' - 3"
hinge
¼" cast wired glass
steel rooflight frames
angle drip
pointing
push bar
m. s. galvanised straps
8½"
roofing felt laid on screed
outline of hood
ex 1¼" cedar upstand lining
granite chippings
winding gear to open light to max. slope of 1°
3" x 2" bearer
ex. 1" softwood blindbox
roller blind
hardwood cover piece
blind cord pulley

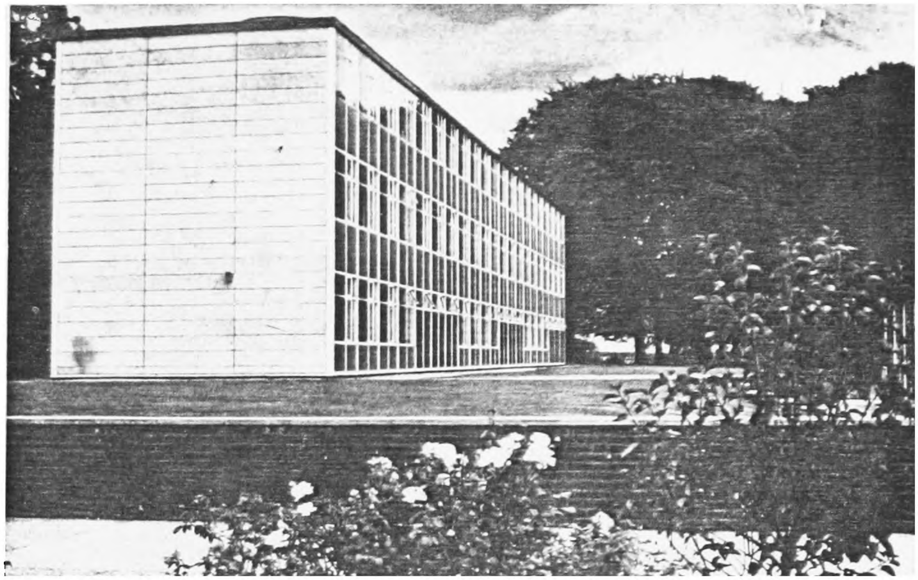
147.

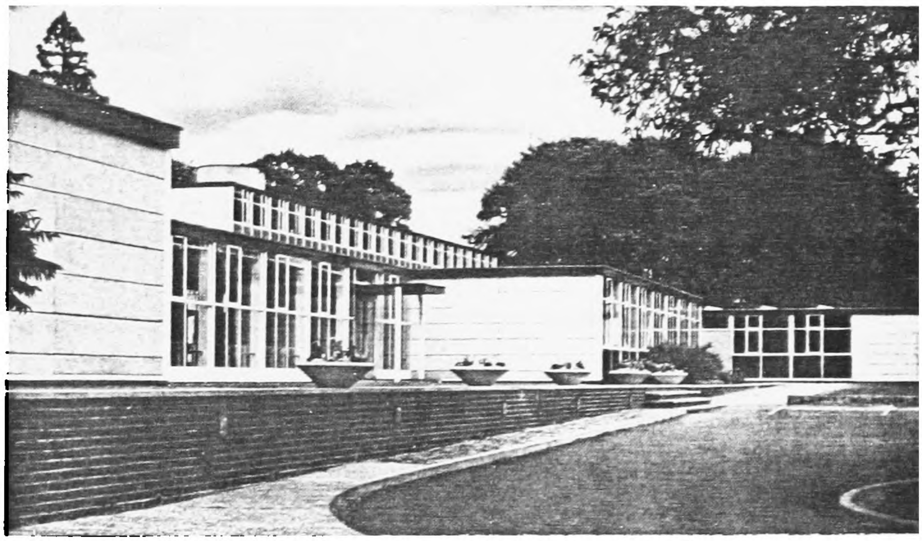

UNIT SIZE
A
3/8"
1⅜" X ⅜" TEAK COVER STRIP SCREWED TO CILL
EX 1¾" X 6" H'WOOD CILL BOLTED TO CILL ANGLE
CAST GEORGIAN WIRED GLASS
STEEL ANGLE
2' 6 3/16"
AIR SPACE
SKIRTING
UNIT SIZE
½" ASBESTOS BOARD PAINTED BOTH SIDES
B
1½" X 1½" X 3/16" SUPPORT ANGLE BRACKET
FLOOR SCREED & FINISH
1½"
1½" X 1"
SHIMS
5"
C
FLOOR BLOCKS
1½" WOODWOOL PLANK
D
SOFFIT BOARD
UNIT
SKIRTING SCREWED TO BLOCK
UNIT
SLATE CILL
F.F.L.



149.

148.

150. 

151. 

Figures 142-151.

142. Isometric diagram of steel frame components used in the 1952-53 Secondary Schools Programme. (Architects Journal, 2 Aug. 1956, p.158)

143. External walling component assembly, cf. fig.138. (ibid., p.159)

144. Section/ plan through external wall at spandrel level. (ibid.)

145. Roof and ceiling construction. cf. fig. 140. (ibid., p.162)

146. Intermediate floor construction. cf. fig.141. (ibid., p.161)

147. Detail section through standard rooflight construction. (Architects Journal working detail series, vol.3, p.73)

148. Langleybury School, 1954 Programme, detail section through external walling. (Edward D. Mills, ed. Architects' detail sheets, fourth series, p.126)

149. Langleybury School, view of external wall. (ibid., p.127)

150. Stevenage, Shephalbury SM School, view of classroom block. 1956 Programme. (HCC, Building for education 1948-61, p.19)

151. Shephalbury School, view of main entrance. (ibid.)

Chapter 20

ALTERNATIVE 3'4" FRAMES, TIMBER, CONCRETE AND ON-GRID STEEL, 1952-54

In Hertfordshire, as in other counties, the mounting economic pressures on school design brought by Ministerial cuts in cost limits, the national steel shortage and the continual rise of prices generally, stimulated an intensified search for alternative and cheaper methods of construction.

A decision was made in December 1951 to explore the possibilities of using timber for structural purposes. Discussions held with the Timber Development Association led to the firm of Samuel Elliott & Son being asked to collaborate in the development of a timber framed construction system. The basic requirement laid down was for a two-directional 24'0" span frame on a 3'4" module as a substitute for the 3'4" steel off-grid frame and capable of using its cladding components.[1]

Two primary and two secondary schools included in the 1952 programmes were selected for timber framed construction. This compared with eleven primary and two secondary schools which were to use the 8'3" steel frame in the same programme year. The translation from steel to timber was relatively quick and the team which did the development work at Oxhey and Summerswood were able to complete their investigations without any loss of impetus.

Briefly, the frame was of the portal type in which the columns were vee-shaped, laminated hardwood stanchions. Five different heights were determined and each timber stanchion was positioned to bear on a galvanised steel peg-shoe in the centre of a 3'4" square of the overall grid. It was therefore off-grid in the manner of the previous 3'4" steel frame.

The head of each stanchion was shaped so as to provide plywood slots, into which the main beams it supported were located. The main beams were of plywood box-section construction in five lengths, ranging from 16'8" to 40'0" and cantilevering 1'8" at each end in all cases. These main beams, in turn carried lattice timber secondary beams at 3'4" centres, positioned on the grid. All the beams had a constant depth of 2'0" (three times the vertical 8" module).[2]

Tolerance in positioning the stanchions and main beams was provided, firstly, by holding-down bolts which were not grouted until the stanchions had been aligned and plumbed and, secondly, by drilling the bolt holes in the secondary beams 1/16" oversize. The method allowed $\frac{1}{8}$" of tolerance on the centre line between beams. Both main and secondary beams were manufactured with an upward camber.[3]

Though not significantly cheaper than steel the frame was a novel use of timber in standardised modular construction. The only drawbacks it appeared to have were its essentially single-storey application and the fact that changes of level were very awkward to negotiate.

As a portal it lacked the four-way flexibility: changes of direction, where frames were at right angles to one another, were expensive and lacked the essential simplicity of the rectangular steel stanchions. A minor defect was that the cambers were not taken up, even when fully loaded, resulting in the wall panel connections being outside their limits of tolerance and ceiling panels failing to line up in the horizontal plane. The latter difficulty apart, the frame was smoothly and quickly erected.[4]

The cladding, to begin with, was similar in principle to the lightweight panels of the 3'4" steel frame, with all panel joints occurring on the grid lines. However, at the Theobald Street (Lyndhurst SM) School at Borehamwood, an interesting experiment was undertaken: instead of manufacturing or cutting the panels to fit a 3'4" module, "random" sizes were accepted. The dissociation of wall and structure had made it feasible for the manufacturers to be given the freedom to make panels of their own standard sizes. The sizes bore no relation to the module; both the panels and the lengths of the partitions themselves were of whatever size was convenient, even if this meant projection through the outer skin of the building, which surprisingly they did.[5]

The joints between the internal partition panels were tongue-and-groove or "spline" connections (figs.161-163). The external cladding was fitted to light alloy patent glazing droppers capable of accepting either a solid panel or glazing unit, the windows being horizontal sliders by Williams and Williams Ltd. (figs.164,165).

The experimental technique was adopted on the grounds that it avoided the expensive four-way connections that were characteristic of the Oxhey prototype. It avoided the cutting to waste that occurred when standard 4'0" panels were reduced to 3'4" (unless another use could be found for the off-cuts). The comment was made, too, that it avoided the monotony implicit in having a dropper at every modular position, making possible more varied and flexible design.[6]

On balance these advantages appear to have been offset by problems associated with the passage of the partitions through the external walling. This feature was not essential to the design approach and could well have been dispensed with had the line of development continued. As it was, the panels in some cases projected as much as 2'0", and the exposed top edges were poorly weathered. Furthermore the junction of external wall to the outward thrusting partitions optimistically relied on butt jointing and mastic for its weather resistance. The conjunction made replacement of broken panels a difficult operation and the relatively fragile Holoplast material was not sufficiently robust to be used in this manner, particularly in a secondary school.

As far as the relation of walls and structure to the grid was concerned, jointing the internal partition panels to the ceiling was complicated by the fact that they occurred, like the secondary beams, on the 3'4" grid.

Timber frames of this type were used only in the 1952 programmes. In the following two years, three primary school projects were built using the timber frame of Derwent Ltd., on a 6'4" module, but as they were complete technical packages without a Hertfordshire development contribution they are outside the terms of reference of the present study.[7]

Similarly, discussion of the 3'4" based concrete frames incorporated in a secondary school in each of the 1951,54 and 56 programmes has been excluded. These projects, although not without interest, fell very much outside the main lines of development and contributed little to the evolution of system building in Hertfordshire. The section detail and elevational view illustrated in figures 176 and 177, showing wood shingle cladding to a concrete structure, are included with the above remarks as a passing comment only. The eccentric combination of materials they display was not repeated. These and the Derwent schools, as with all "non-standard" schools, are however included in the statistical information presented in Appendix 5.

Concurrently with Hertfordshire's work on the 3'4" off-grid steel frame the Ministry of Education was collaborating with Hills in the development of another type of 3'4" steel frame; the Mk 1 version of this frame was used on the MOE development project at Wokingham in Berkshire.[8] The project attracted wide publicity and Hertfordshire felt obliged to try the frame as an alternative.

The two frames differed in a number of important ways, principal among these being the fact that the MOE frame was on-grid and therefore avoided the expensive mushroom caps. This meant, however, that the internal partitions, being set on the grid lines, "swallowed" the stanchions and thereby lost the advantages of disassociation discussed earlier. Hills's involvement at Wokingham went much further than the supply of a steel frame, indeed the company provided the full range of wall, floor and roof deck panels, together with a lightweight steel curtain-wall glazing system.[9]

But it was the frame alone that interested Hertfordshire. Briefly, it consisted of welded box stanchions, 5" x 5" and 8" x 5" at the perimeter, carrying main and secondary beams, all beams being bolted to cleats which were welded to the surface. All the floor and roof beams were 18" deep, which was three times Hills's vertical module of 6", in contrast with the Herts version. The depth limitation meant a maximum bay size of 13'4" x 26'8" was possible. Though simpler, lighter and in several minor details different from the mushroom-capped frame, it limited planning flexibility in similar ways: economic necessity made the maximum bay size become the standard. Corners and irregular plan shapes were relatively more expensive than in the 8'3" system and planning possibilities more restricted.[10]

Hertfordshire's prototype project for this frame was the Balls Park (Simon Balle) SM School at Hertford.
The layout was an elegantly planned group of three separate blocks in a parkland setting (fig.181) and a forerunner of the "pavilion" type of planning that was to become popular in the late 50s and 60s.[11] The "teaching block" was a three-storey slab closing a composition around

a central space, the other two blocks being single storey. One of these, the science and crafts block incorporated internal courtyards to light and ventilate an otherwise deep-plan arrangement (fig.180).

Working drawings were commenced in January 1954 but construction did not begin until April the following year, a reflection of the extensive study and analysis that went into its design. It was stated that the two main development objectives, apart from the use of the 3'4" frame, were:

> 1. An external walling system fixed at head and sill, and 2.Light and dry internal partitions.[12]

In fact the return on the investment turned out to be small as only two further Herts schools were to use a 3'4" frame.[13] Thus its greatest technical interest lay in its walling, both external and internal. Externally, the blend of cedar cladding and aluminium curtain walling was a pleasing combination which has stood the test of time well on several Herts schools. The novel but costly Seco partitioning system was limited to the upper floors of the three-storey block, plastered blockwork of varying thickness being used elsewhere. Despite the project's limited usefulness as a true prototype its approach to walling (figs.182-186) lay on a direct path to the 2'8" development which we shall examine in the following Chapter.

Finally, reference must be made to a 3'4" module system which was experimented with by the County Architects Department but not developed for the school building programme. This timber system or, more accurately, timber roofing system known as the "Punt" (after the shape of the roofing units) was used principally for the Gooseacre Health Centre in Welwyn Garden City.[14] Its details (figs.171-175) illustrate the ingenuity brought by the consulting engineers, Ove Arup and Partners, to the search for alternatives to steel. Like the Elliott vee-frame system it had the inherent disadvantage of being limited (as a system) to single-storey work; it was unlikely, therefore, to have proved a contender for serious development even if its manufacturers had continued production.

Notes to Chapter 20.

1. HCC, Timber development: report on the preliminary investigations. E750W (52-56) 724. See also E750Wa (53-55) 724.
2. BRS Note no. C302, Sept. 1954, p.13.

3. _Ibid._ 4. _Ibid._, p.14.

5. _Ibid._, p.13,14. See also "Theobalds SM school," _Municipal Journal_, 22 April 1955, pp. 1071-9.

6. BRS Note no. C302, p.14.

7. See Appendix 5: histograms, p.316.

8. MOE Building bulletin 8, 1952, _Development projects: Wokingham school_.

9. _Ibid._ See also Hills's brochure, _Presweld: Construction for schools_ (c.1954) for complete commercial system in its MK3 form.

10. BRS Note no. C302, p.15.

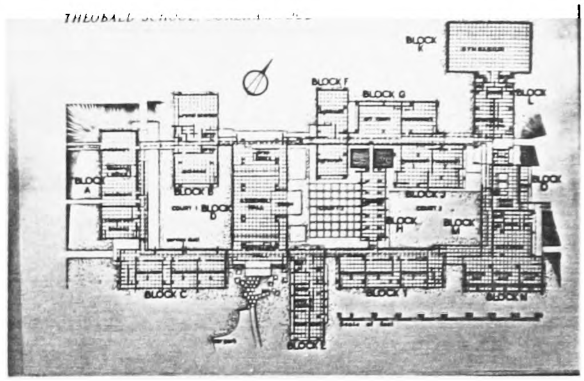
11. St. Albans College of Further Education is the classic example; others include Stevenage, Barnwell SM and East Barnet, John Hampden SM schools.

12. _AJ_, 24 April 1958, p.617.

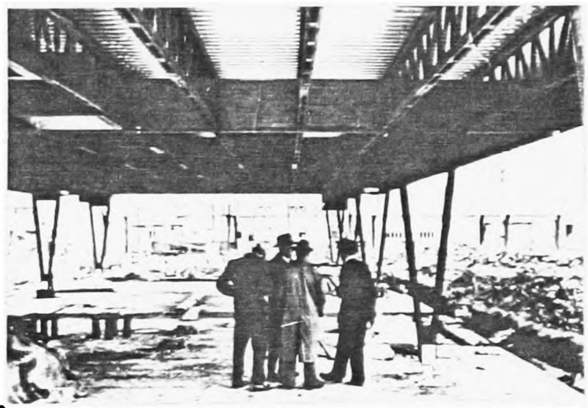
13. Appendix 5, p.316.

14. "Health Centre at Welwyn Garden City," _AR_, June 1956, pp.330-331.

152.

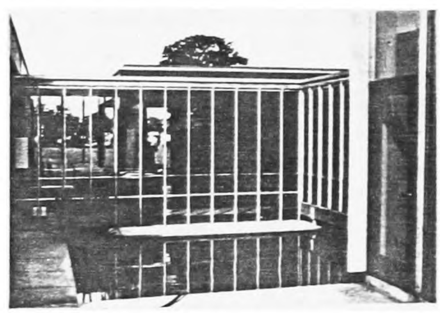


153.



154.

155.



156.

Figures 152-160.

152. Borehamwood, Lyndhurst SM School, view of timber vee stanchions and plywood fascia. (photo. Bruce Martin).

153. Lyndhurst School, plan. (Municipal Journal, 22 April 1955).

154. Lyndhurst School, view of main and secondary beams. (photo Bruce Martin).

155. Lyndhurst School, view of stanchions and beams. (ibid.)

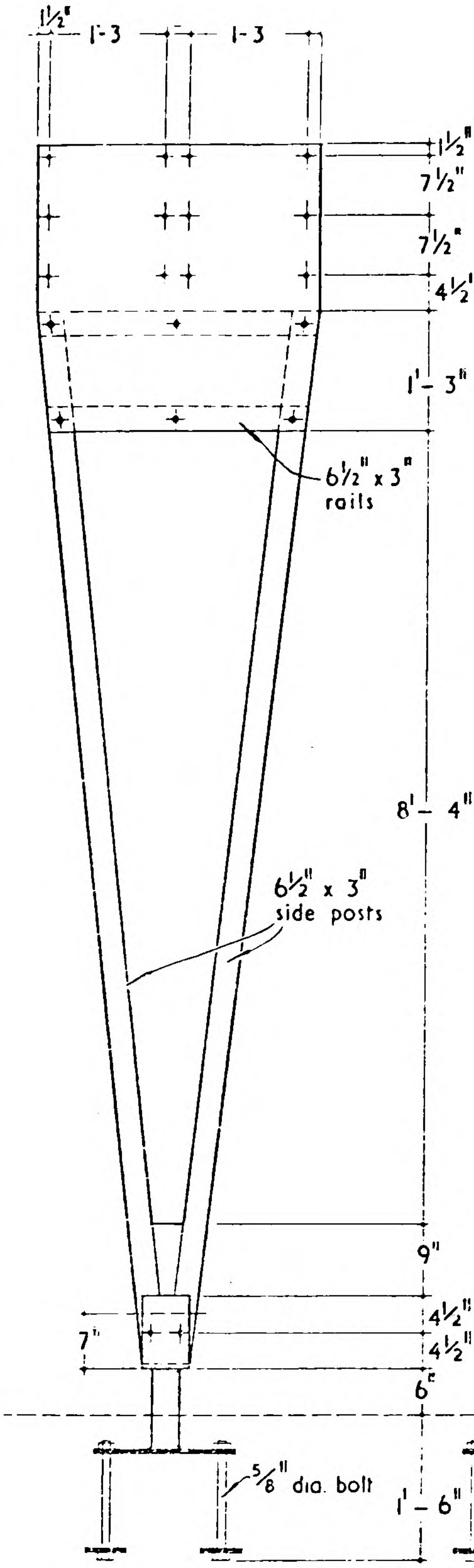
156. Lyndhurst School, view of internal courtyard. (ibid.)

157. Detail of vee stanchion construction. (Architects Journal, working detail series, 27 Jan. 1955).

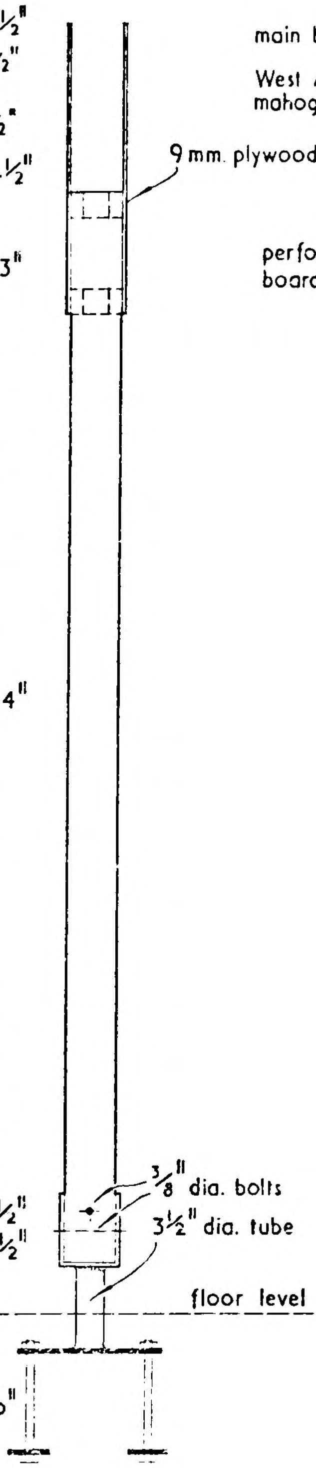
158. End elevation of stanchion, cf. fig. 157. (ibid.)

159. Detail section through external walling. (ibid.)

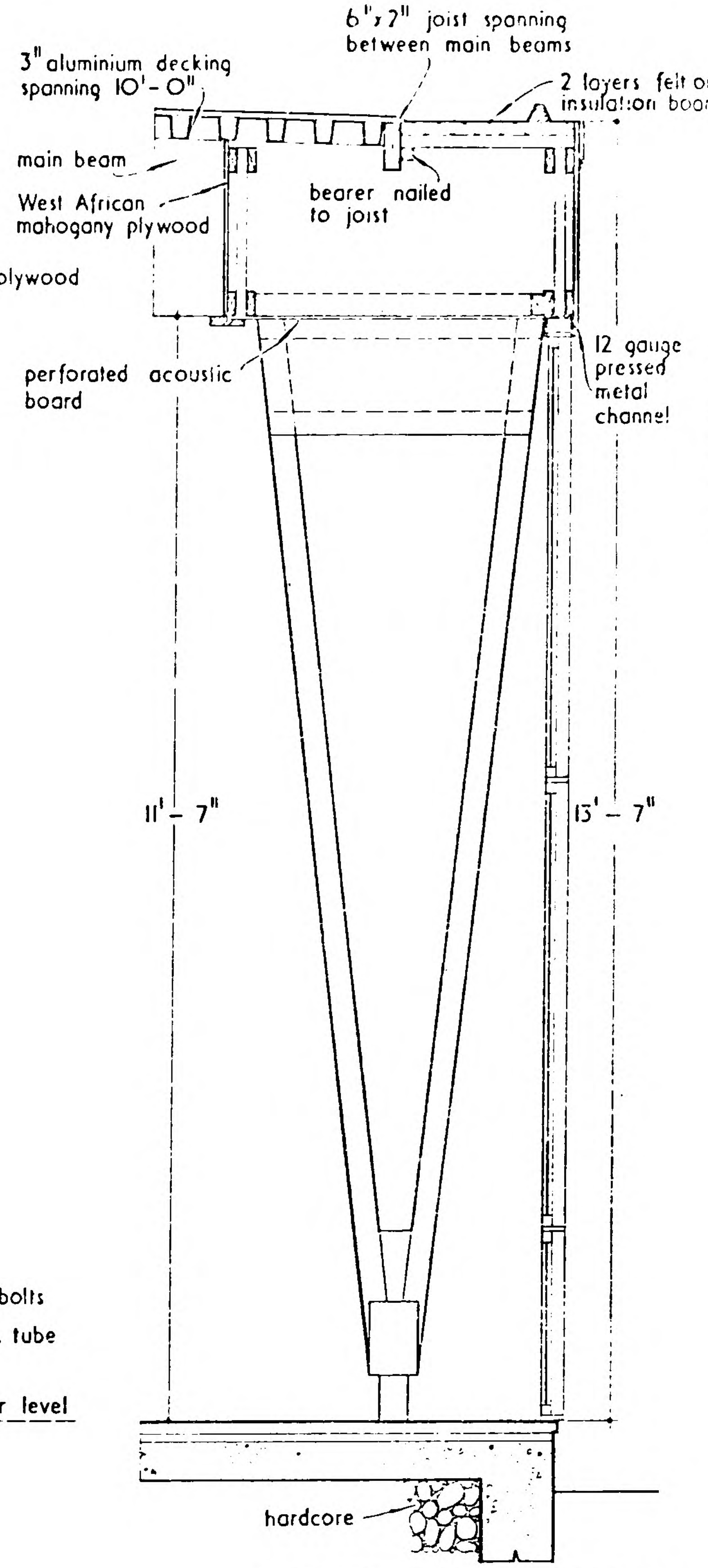
160. Stevenage, Roebuck Infants School, view of assembly hall interior. (ibid.)



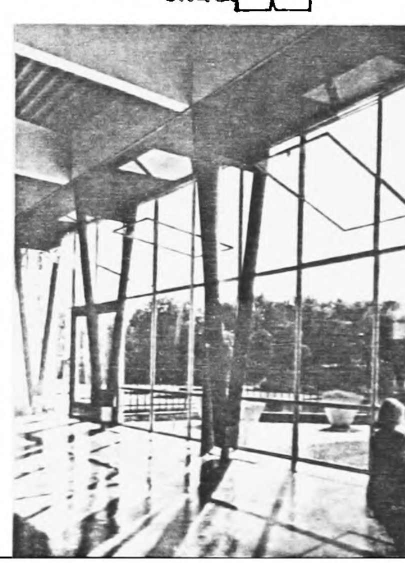
157.



158.



159.



160

Figures 161-177.

161. Detail plan of the Seco prefabricated partition (Municipal Journal, 22 April 1955)

162. Detail elevation of partition. (ibid.)

163. Detail section of partition showing junctions to floor and ceiling. (ibid.)

164. Detail plans of Holoplast panels used in the external walling. (ibid.)

165. Detail plans of Williams and Williams sliding window units in external walling. (ibid.)

166. Hatfield, Burleigh SM School, interior view. (Architectural Review, July 1955, p.28)

167. Burleigh School, detail elevation of a bay of timber framed external walling. (Architects Journal, working detail series, 7 Aug. 1954)

168. Burleigh School, plan of unit at fanlight level. (ibid.)

169. Burleigh School, plan of unit at sliding window level. (ibid.)

170. Burleigh School, detail section through external wall. (ibid.)

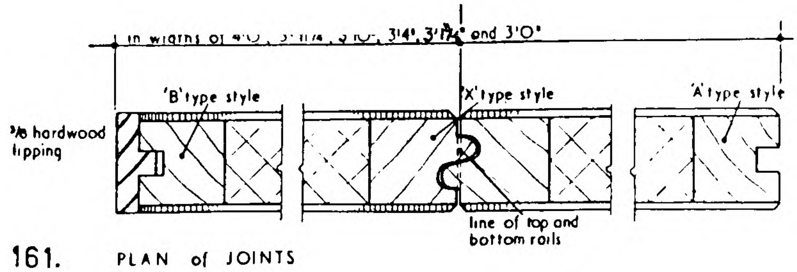
171. The Punt system, plan at roof level. (C.D. Productions Ltd. trade brochure, p.6. nd.)

172. The Punt system, section at A-A. (ibid., p.7)

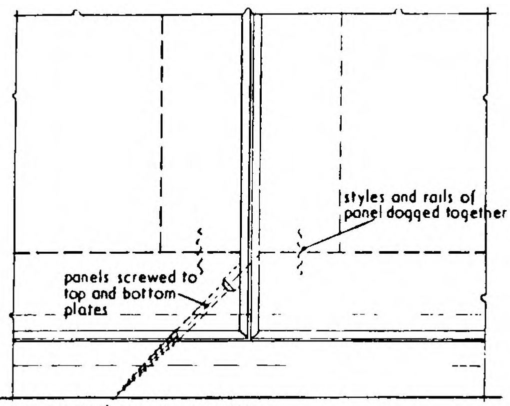
173. The Punt system, detail longitude 1 section and elevation of a "punt" prefabricated timber roofing unit. (ibid.)

174. The Punt system, detail plan of "punt". (ibid.)

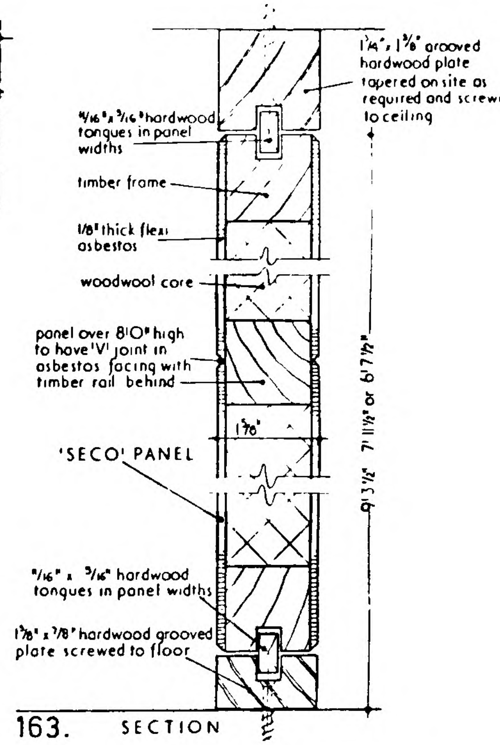
175. The Punt system, detail cross-section of "punt". (ibid.)



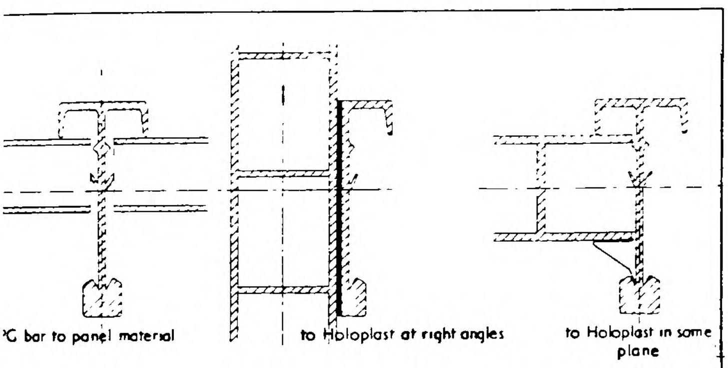
161. PLAN of JOINTS



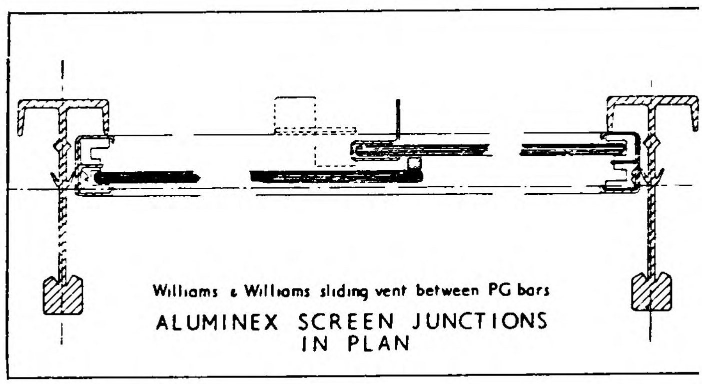
162. ELEVATION of JOINT



163. SECTION

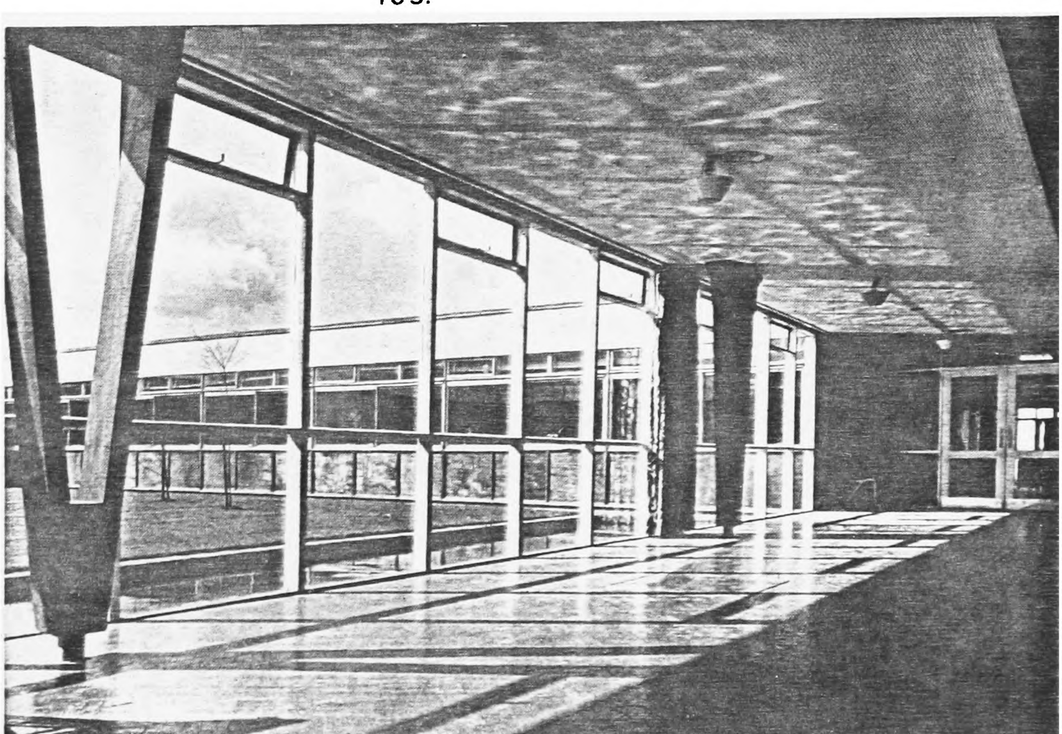


164.

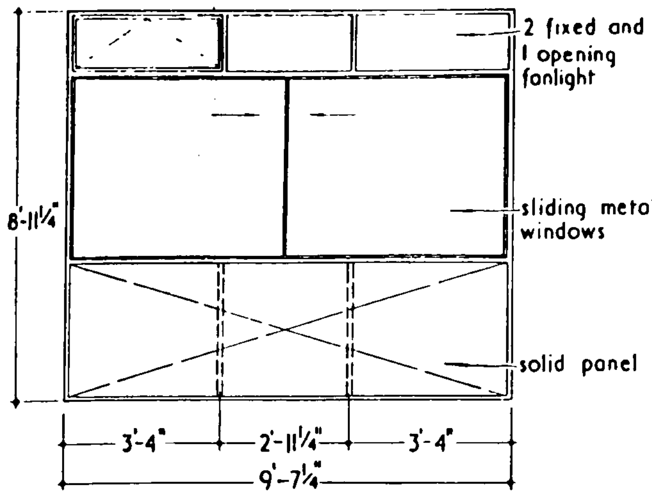


ALUMINEX SCREEN JUNCTIONS IN PLAN

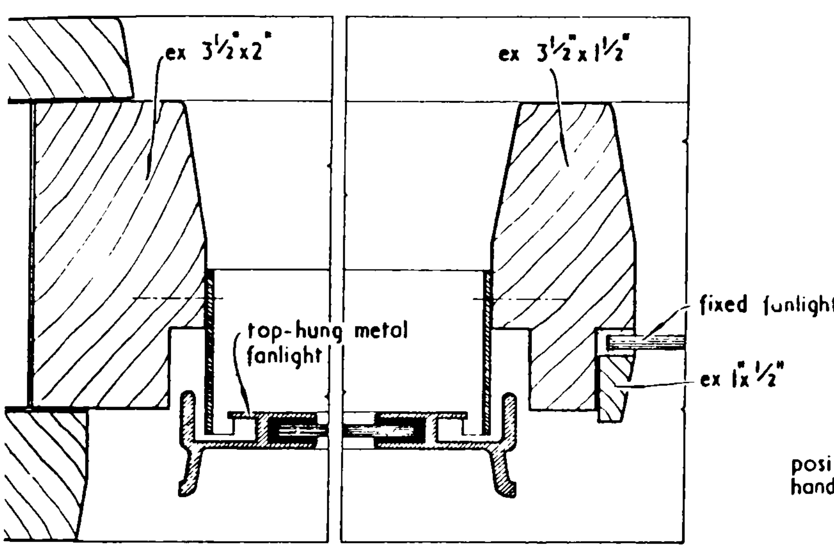
165.



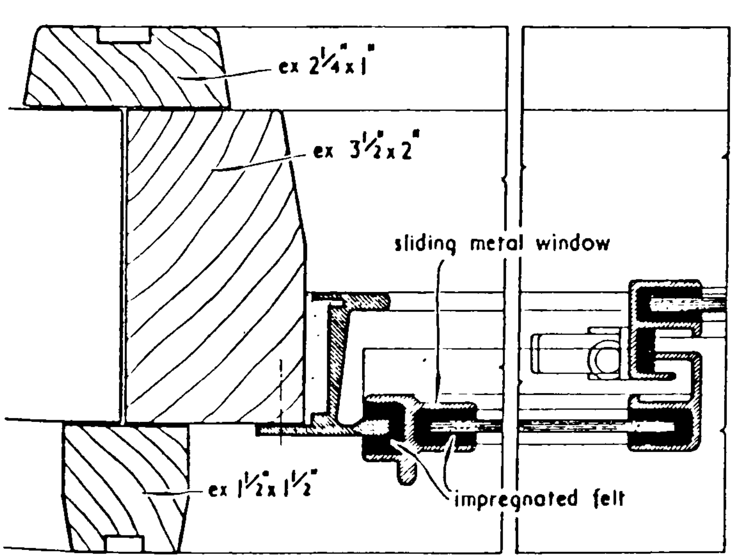
166.



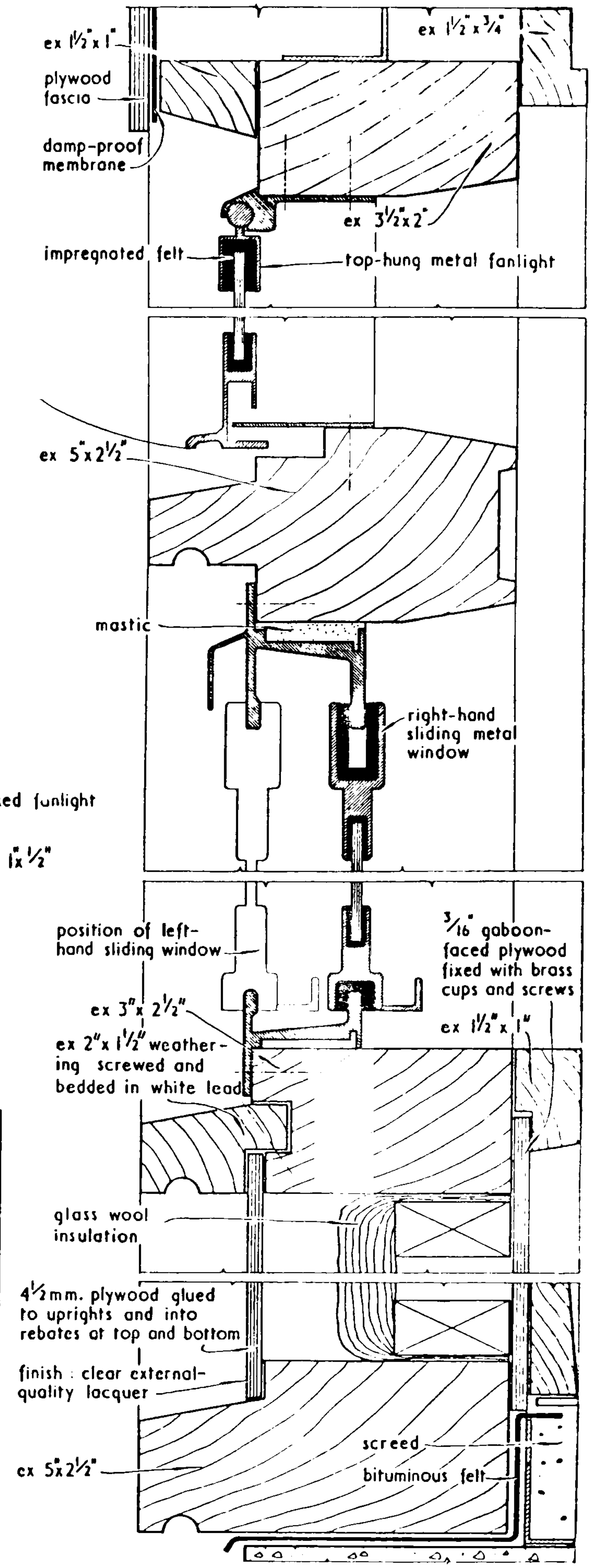
KEY ELEVATION
167.



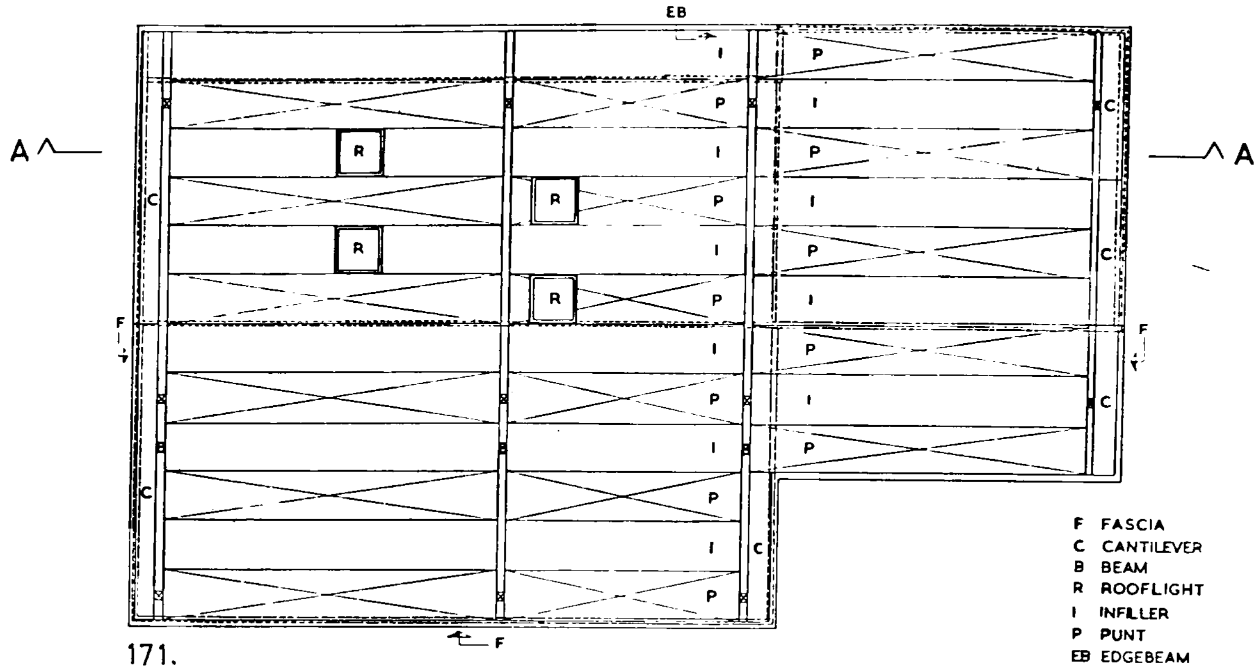
PLAN AT FANLIGHT LEVEL
168.



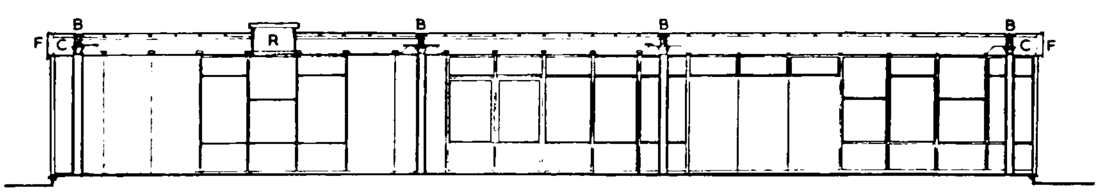
PLAN AT SLIDING WINDOW LEVEL
169.



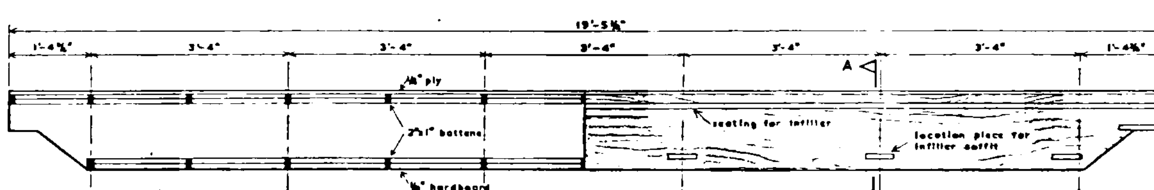
SECTION
170.



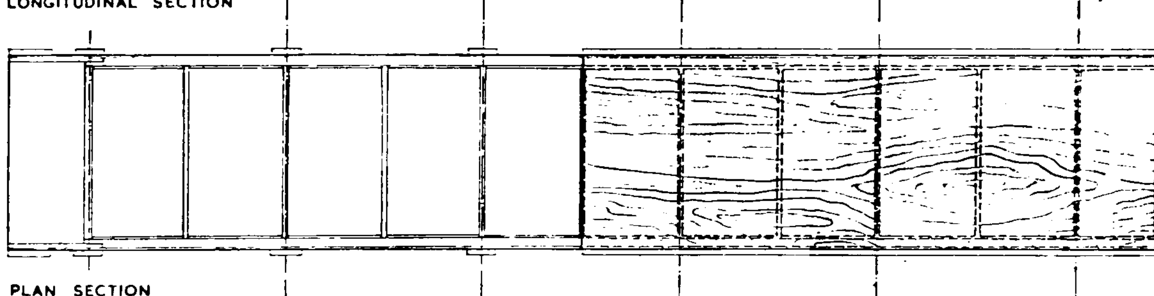
171.



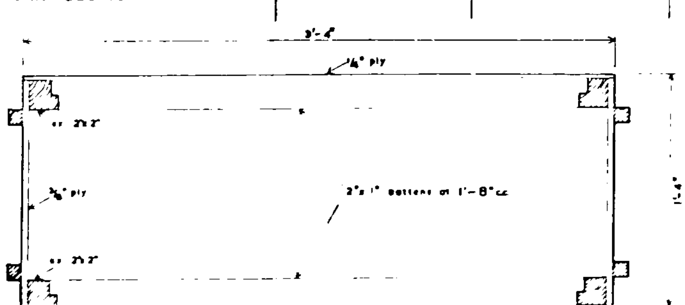
172. AA



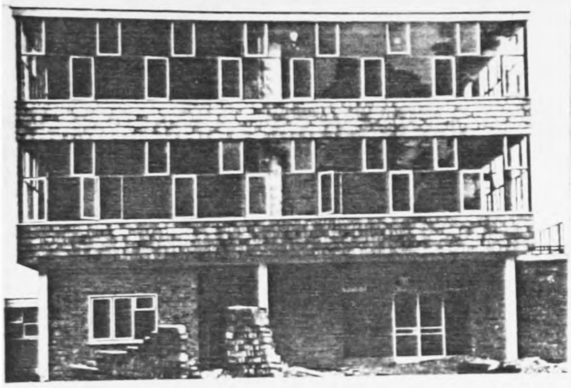
173. LONGITUDINAL SECTION ELEVATION



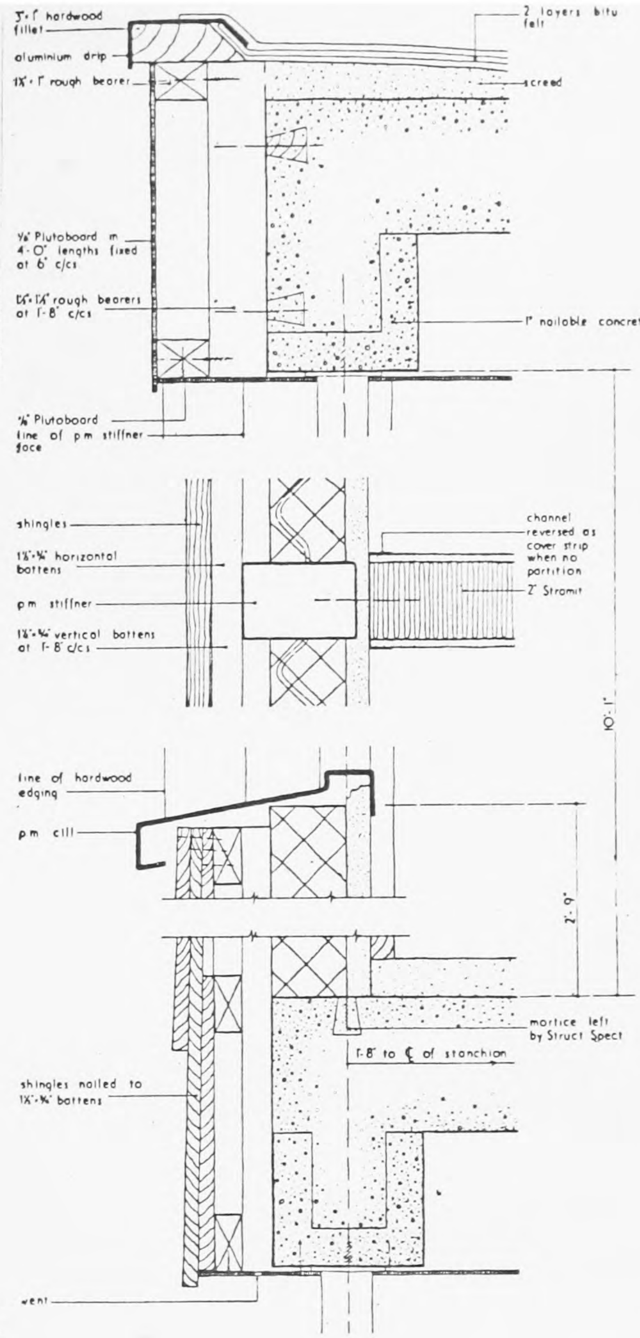
174. PLAN SECTION PLAN



175. CROSS SECTION A - A



176.

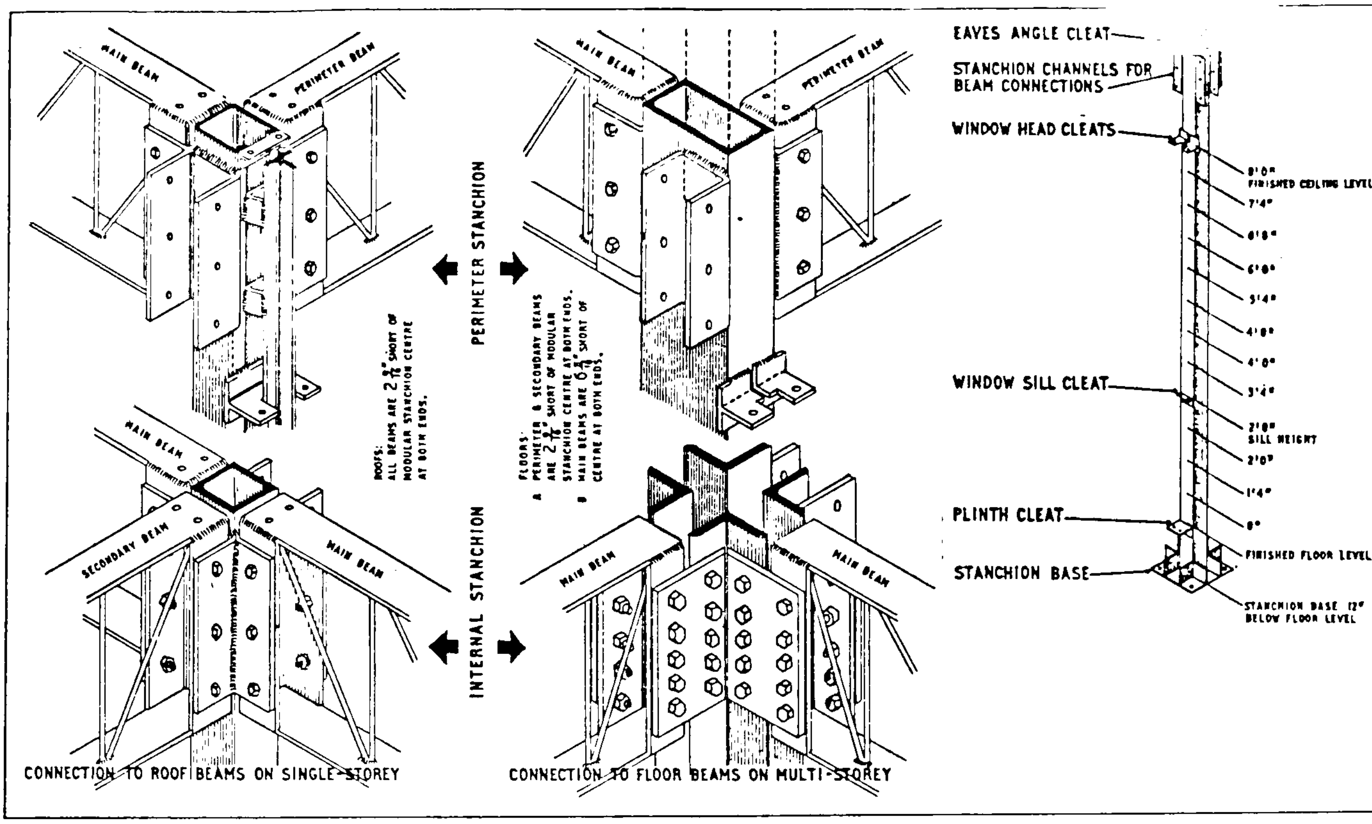


177.

Figures 176-177.

176. Watford, Francis Combe SM School, view of cedar shingle-clad external walling on brick ground floor walling. (Architectural Design, Nov.1954, p.337)

177. Francis Combe School, detail section showing cedar cladding applied to reinforced concrete structural frame. (ibid.)



178.

Figures 178-186.

178. Ministry of Education Development project: Wokingham SM School, for Berkshire County Council. 3'4" on-grid steel frame by Hills. Isometric diagrams of connections of beams to stanchions. (MOE, Building bulletin no.8, p.55)

179. Hertford, Simon Balle SM School, plans of ground, first and second floors of Block B, cf.fig.181. 3'4" on-grid frame and "pavilion" planning. (Architects Journal, 24 April 1958, p.620)

180. Simon Balle School, plan of craft block C. (ibid.)

181. Simon Balle School, site plan. (ibid., p.617)

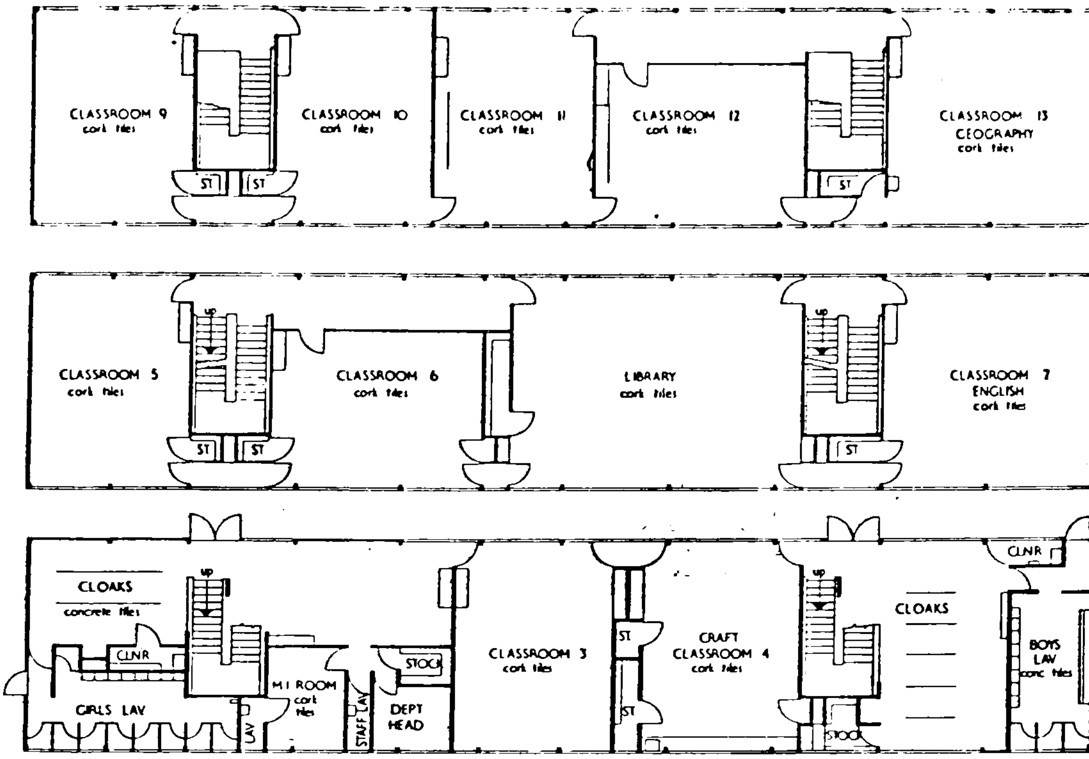
182. Simon Balle School, detail of external walling at salient corner; cedar boarding as cladding material. (ibid., p.619)

183. Simon Balle School, detail section of partition junction to floor and ceiling. (ibid., p.623)

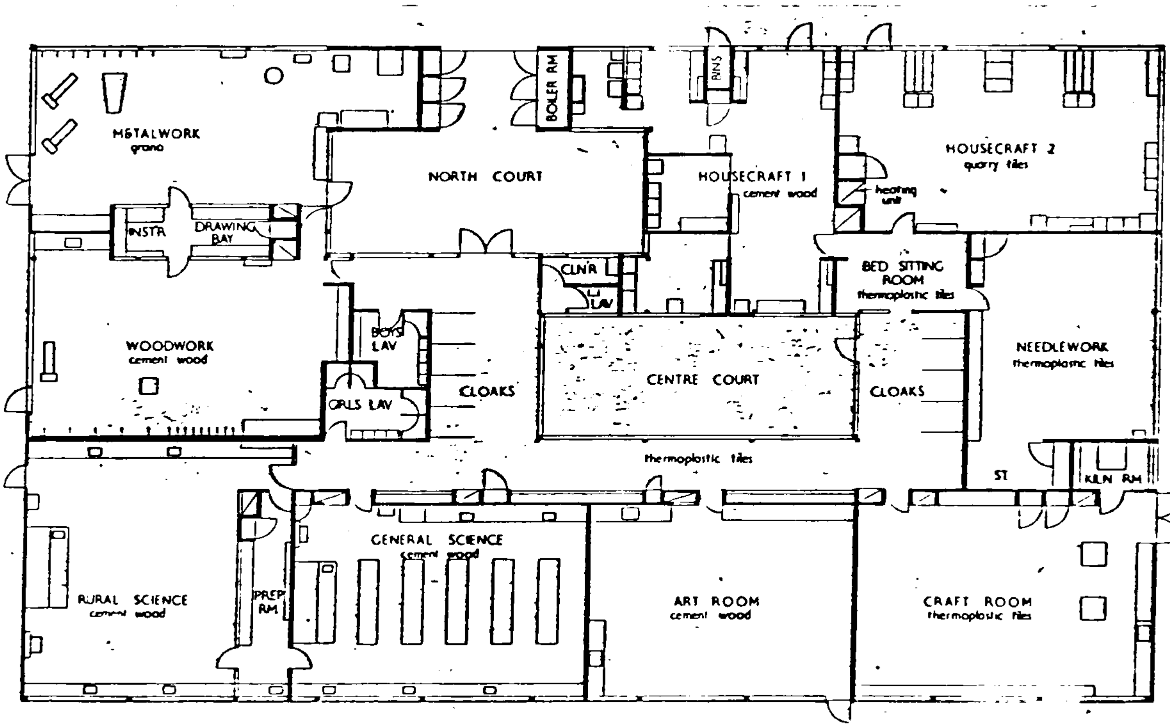
184. Simon Balle School, detail plan of partition junctions (ibid.)

185. Simon Balle School, sections through external walling. (ibid., p.169)

186. Simon Balle School, details of internal (re-entrant) corner condition. (ibid.)

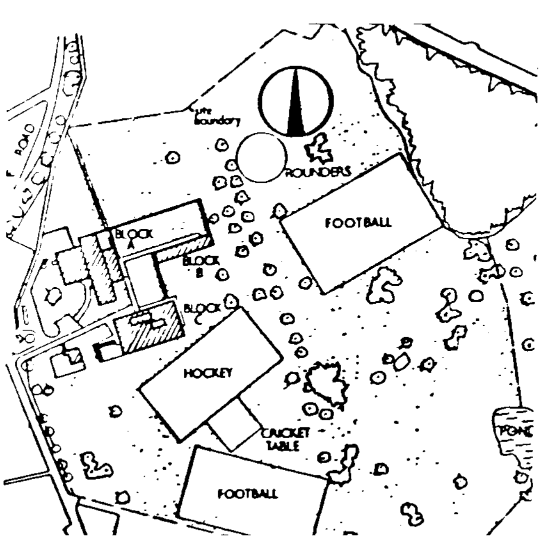

CLASSROOM 9
cork tiles
CLASSROOM 10
cork tiles
CLASSROOM 11
cork tiles
CLASSROOM 12
cork tiles
CLASSROOM 13
GEOGRAPHY
cork tiles
ST
CLASSROOM 5
cork tiles
CLASSROOM 6
cork tiles
LIBRARY
cork tiles
CLASSROOM 7
ENGLISH
cork tiles
up
CLOAKS
concrete tiles
CLNR
GIRLS LAV
LAV
M I ROOM
cork tiles
STAFF LAV
DEPT HEAD
STOCK
CLASSROOM 3
cork tiles
CRAFT CLASSROOM 4
cork tiles
BOYS LAV
conc tiles

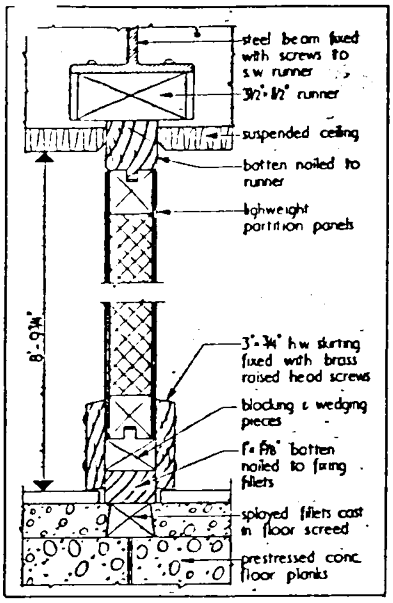
179.


METALWORK
grano
BOILER RM
NORTH COURT
HOUSECRAFT 1
cement wood
HOUSECRAFT 2
quarry tiles
heating unit
INSTR
DRAWING BAY
CLNR
LAV
BED SITTING ROOM
thermoplastic tiles
WOODWORK
cement wood
BOYS LAV
GIRLS LAV
CLOAKS
CENTRE COURT
CLOAKS
NEEDLEWORK
thermoplastic tiles
thermoplastic tiles
ST
KILN RM
RURAL SCIENCE
cement wood
PREP RM
GENERAL SCIENCE
cement wood
ART ROOM
cement wood
CRAFT ROOM
thermoplastic tiles

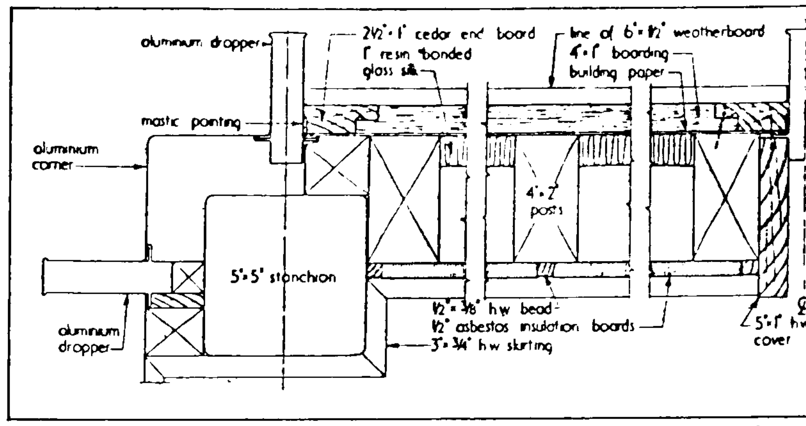
180.

181.

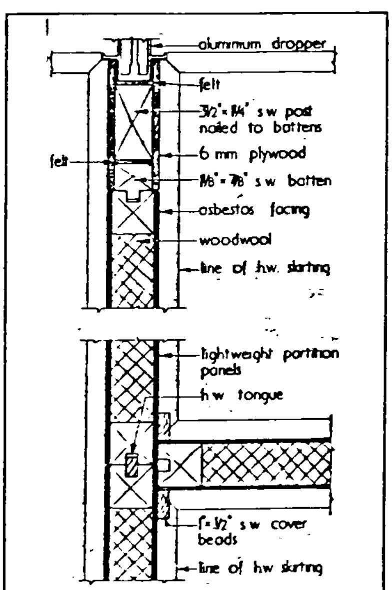

site boundary
ROUNDERS
FOOTBALL
BLOCK A
BLOCK B
BLOCK C
HOCKEY
CRICKET TABLE
FOOTBALL
POND



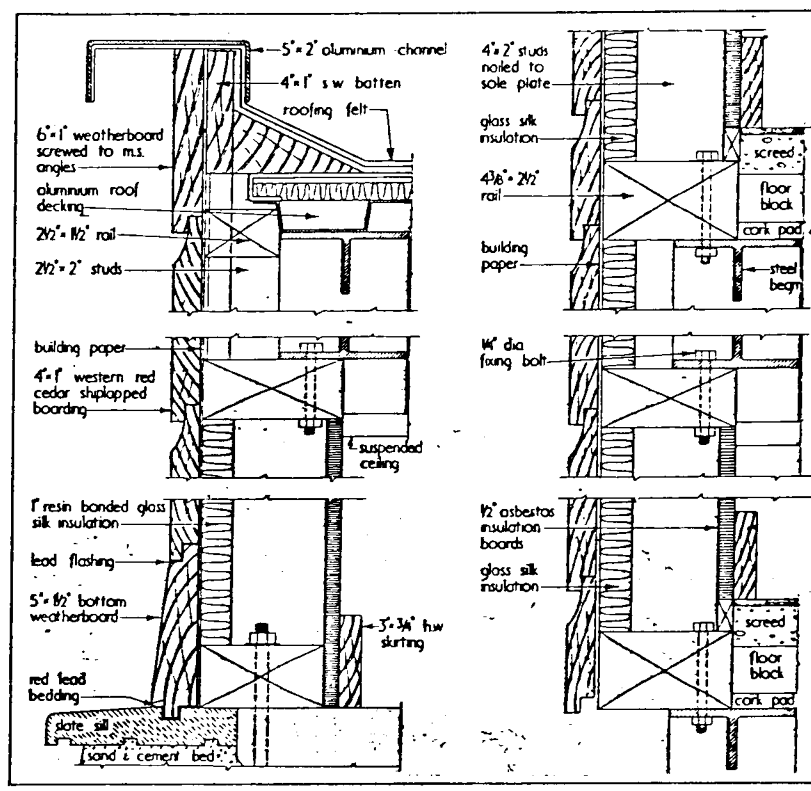
183.



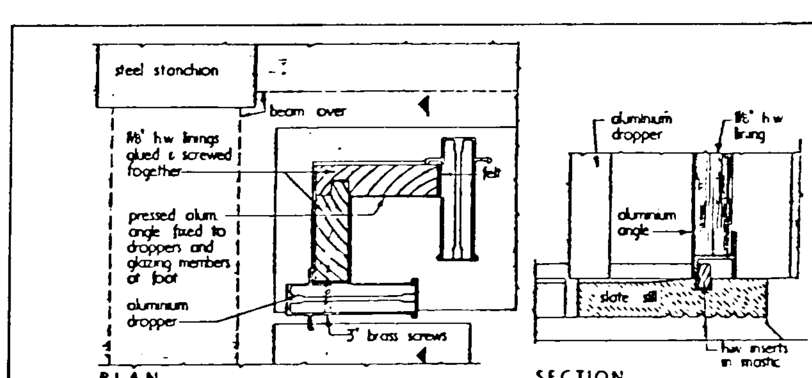
182.



184.



185.



186.

Chapter 21

A NEW PLANNING GRID: 2' 8" DEVELOPMENT 1957-64

The stimulus and opportunity to reconsider aspects of a system always occurs when a set of standard drawings requires redrawing or reorganisation. Such an opportunity had been created when the 8' 3" primary and 8' 3" secondary systems were consolidated and the Blue Standards were produced, a task completed by October 1956.[1] By then it was clear that none of the investigations into structural systems based on the 3' 4" module had yielded wholly satisfactory results. The drawbacks for school planning were, as we have seen, considerable; it was becoming obvious that the imminent Further Education (FE) programmes would highlight the shortcomings even more. Added to this, Hills were themselves reconsidering their steel frame: the climate was right for some completely fresh thinking on the matters of grid dimensions and frame types.

The first major FE project was the combined St. Albans College of Further Education and Hertfordshire College of Building. The design of this project for a single campus site in Hatfield Road began in June 1956. Between then and the following April the New Schools Group had been organised into six Teams[2] and enough done, centred on the St.Albans scheme, for a firm decision on a new grid dimension to be reached.

In May a report summarizing the investigations and their conclusions was put forward for internal discussion.[3] The report crystalised the Hertfordshire objectives more clearly and more concisely than any previous statement had done: "to produce a completely prefabricated light and dry system of construction for education buildings which would satisfy the Educational Terms of Reference within the cost limit at the time required by the user." Recounting the modular character of the frame, roof, external walling and ceilings which had been achieved it expressed a concern that partitioning still presented a problem area: the expense of the Holoplast walling was stressed, as was caution with regard to the subsequent Seco panels, "which, if the firm continues, may form the basis of a modular partition."[4] Two basic reasons for the lack of success were given: no manufacturer had produced a satisfactory partition giving the required sound transmission reduction within the cost limitation and, secondly, the limitations and complications of the 8' 3" frame made the development of such a panel economically unlikely. Furthermore, no immediate change was expected.

Despite this continuing drawback it was felt that an attempt should be made to "lay down a structural frame which could form the basis ... of the completely modular prefabricated light and dry building." Agreeing that all sizing should be in multiples of the international 4" basic module,[5] the report identified four essential conditions for such a frame. First, the walls would have to be freed from the stanchions completely; this was the main lesson learned from the 3' 4" experience and it meant that the steel-frame grid would have to be different from the planning grid, a "preferred dimension apart." Secondly, floor and ceiling partition fixings would demand a simple structural detail and would "merely require pickups to be arranged at agreed centres." The third condition was that of allowing partition panels to be of constant width and limited in incremental height allowances. Clearly for this to be so there would have to be a fixed relationship between the steel-frame grid and the partition, or planning, grid. Indeed the stanchions would have to be positioned on the half-module; in other words centred on the planning grid. Finally, to produce a level ceiling and standardise partition heights, constant-depth beams were essential.

Although these were in essence the characteristics of the 3' 4" frames which had proved to be both expensive and restrictive in design, there is an important distinction to be made. Whereas at the Summerswood school the off-grid frame had columns twenty inches from the grid, the beams and walling were <u>on</u> the grid lines. The new proposal was that the whole frame, i.e. both stanchions and beams, should be on one grid and all the walling should be on the planning grid, offset from the former by one half-module (fig.220). In this way the mushroom headed stanchions which had been responsible for much of the expense and complication could be avoided. It was precisely this principle which had been employed on the 3' 4" prototype at Oxhey with the Llewelyn Davies frame[6] and then abandoned in favour of the more complicated Summerswood frame. Curiously the report makes no mention of this fact and presents its proposal as if it were original.

Despite this anomaly, the reasons put forward in favour of the new module were superior to any which had gone before. Bearing in mind the Wood Report's reasons for 8'3" and the unconvincing arguments of the Ministry of Education in support of 3'4", Hertfordshire's basis for selecting 2'8" has a disarming simplicity and a clear rationality. To quote the report:

> In order to arrive at a steel grid Mr Hinchcliffe (sic) was approached to give maximum line stanchion spacings and gable spacings within the light Presweld construction. These were given as 11 ft. line stanchions and 29 ft. gable spacings. The dimensions were given on our requirement that all beams would be a constant depth of 1'6". Within the maximum spans an optimum grid has to be found. The module dimension must be suitable to cover the following conditions:
>
> 1. Dimension from back of stanchion to inside of cladding to be as small as possible. (This is a client requirement).
> 2. Side hung opening casement dimension.*
> 3. Door sizes.
> 4. Staircase openings.
> 5. Corridors and passages.
> 6. Handling sizes for components.
>
> No.1 above is the most important of the requirements to satisfy, and a half module of 16" was agreed best suited this condition and it also satisfies most of the other conditions referred to above. The working module was, therefore, decided upon at 2'8".[7]

But, surprisingly, the report failed to recognise an advantage in 2'8" of spectacular importance: its relationship to the standard size of 8'0" x 4'0" for virtually all building boards and sheet materials, together with the traditional stud spacing and nail or screw fixing centres of 1'4". Furthermore the potential was there to use brickwork, both internally as partitioning or externally as cladding, simply by "stretching" standard brick multiples from 2'7½" to 2'8" without causing any problems.

In June 1957 a meeting was held to allocate development tasks to teams and to ensure that "only one Team Leader was dealing with firms

---

* Casements in the 8'3" system were generally one-third bay size, i.e. very close to 2'8".

who were involved in the development of the components..."[8] As with the 8' 3" amalgamation, the method chosen was to distribute sections of the Elemental Bill[9] to the various groups. For example, section J (roofing) was designated the task of Team 7 which was "obtaining comparative costs of timber roof construction with falls, against asbestos roof construction ..."[10] The internal walling which had received so much emphasis in earlier reports went to Team 3.

A prototype in the form of a further phase of the Oxhey Clarendon School was designated but had limited usefulness per se on account of the St. Albans FE project being already in design. The prototype started on site in February 1958, just one month ahead of the huge St. Albans scheme.

It was decided that these two projects should lead the development of the "Glinex" partition, manufactured by Giksten Ltd, a product very similar to the "Seco" panels, consisting of a core of compressed flax-board faced on both sides with hardboard or sheet asbestos, lipped with softwood sections into which timber splines were housed.[11] The target cost of the internal walling element was comparability with 4½" lightweight concrete block walling, plastered both sides.

Stress was laid on detailing designed to overcome the problem of sound transmission at joints and corners, water penetration into the vulnerable core of the panels, tolerances and the accommodation of services in the walling. The last being solved by the introduction of "service panels" to the component range; positioned generally adjacent to door frames, they housed light switches and, on occasions, room thermostats. Experience had shown the material to be quite unsuitable for external walling, "similar conditions might arise to those at Bennetts End with the Jicwood (panels)."[12]

In due course a review of the completed building remarked that "the most serious defect in the building is to be found in insufficient sound insulation between some rooms ... caused by the use of dry partitioning."[13] In subsequent projects blockwork or brickwork was often used both to contain noisy areas such as staircases and in toilets where it contributed to solving the problems created by damp areas.

Most of the detailed characteristics of welding, types of members, cleating, holing and bolting were much as before, with the exception of the "castellated" main beams (figs. 218, 219), formed by flame-cutting flanged beams to increase their depth to weight ratio. With external walling positioned 16" from the peripheral stanchions and beams, "outrigger" or cantilever brackets for fixing walling components to the frame were devised. In detail, these 2'8" steel components had a crispness about them which all their predecessors had lacked; the unclad frame had an appearance both business-like and aesthetically appealing. The earlier schemes had their frames sheathed in a proprietary curtain wall system such as Quicktho or Warners but by 1960 Crittall's window-walling system, based on the earlier development, was the standard technique (figs.223-227).

The joining of partitions to the external walling (with its minimal mullions and disengaged columns) was achieved by means of timber "connectors" which enabled an extremely neat connection to be made but, unfortunately, produced additional sound transmission problems between rooms. As with the 3'4" off-grid systems, the only visible manifestation of the steel frame in the finished building was the free-standing column, except in gymnasia and workshops, where suspended ceilings were usually dispensed with.

The nuisance value of the columns was, however, reduced to 16"; from time to time the advantages and disadvantages of the off-grid frame were debated, generally with the conclusion that problems "could be reduced to acceptable limits ... (by a) minimum number of columns".[14] In November 1960 the suggestion was made that this reduction might be assisted by planning the steel frame on a 16" grid.[15] A study of the effects of such a measure was made by redrawing certain plans on that basis but the exercise was inconclusive and abandoned.

The 2'8", or 5'4", spacing of window mullions had an immediate effect on the proportions of both glass and solid panels, encouraging a fresh interest among architects in proportion and aesthetics. The combination of improved proportion and freeing the structure from the external wall gave the 2'8" system an inherent grace; the buildings which were designed on this module are among the most elegant of their genre. No other Authority employed the dimension and, despite the fortuitous nature of its aesthetic advantages, the system gave the Hertfordshire schools of the early 60s a distinctive character at a time when system builders in other parts of the Country were drifting into a duller monotony induced by the ubiquitous 3' 4" dimension.[16]

The St. Albans College was the second Herts school to win an RIBA Eastern Region medal. Like the Templewood JMI at Welwyn Garden City, which was the winner for the years 1948-50, St. Albans demonstrated that the system approach could, for all its emphasis on economy, speed and utility, produce buildings of publicly recognised aesthetic merit. The college layout at St. Albans epitomised the growing trend towards "pavilion planning," whereby teaching functions were clearly articulated into separate blocks. Ensuring simple construction, good light and ventilation, noise separation and zoning, it made good sense in the more specialised context of Further Education. However, it started a fashion which soon spread to other school types.

The trend had both educational advantages and disadvantages: grouping all workshop facilities into a block, or all laboratories into a science block, avoided problems of noise disturbance and reinforced departmental organisation and identity. On the other hand, pupils had to cross open spaces between class changes with all the inconvenience of gathering raincoats when the weather was bad. Enclosed and heated covered links were not usually possible for economic reasons and open-sided covered ways were useless in driving rain or in freezing conditions. Eventually the swing towards designing for interdisciplinary relationships, highlighted by the Newsom Report,[17] ruled out this approach to planning.

In the case of St. Albans it cannot be true that the engineering elegance of the new 2'8" frame had any influence on the architecture of the finished building; the timescale for design and construction made that impossible. It is however likely that design proceeded cautiously since the frame, except in fragmented drawn details, had never been seen until the works mock-up at Hills was available, and that this caution influenced the simple layout planning. In such a plan each part was a separate building having its own simple frame, avoiding the unknowns of block junctions or changes in floor and roof level.

The 2'8" system was in many ways the high point of technical development in Hertfordshire; the outcome of over ten years experience in steel-framed system building.

Unfortunately its days were numbered. During the Autumn of 1962 the firm of Hills of West Bromwich suddenly went into liquidation, bringing to an end one of the most fruitful partnerships between architects and manufacturers in building history. On this relationship had been founded the Development process and indeed the very concept of system building as we came to know it, first in Hertfordshire and then, encouraged by the MOE, in many other counties and consortia of local authorities or Government departments.

With Hills's disappearance, emergency arrangements were made with T.C. Jones Ltd to complete the schools in the current programme; the system to be renamed SEAC MK 1 on the formation of the South Eastern Architects Collaboration.

Notes to Chapter 21.

1. Team Leaders Meeting no.13 (26 Oct.1956) Gen.77.

2. Team Leaders Meeting no.10 (29 June 1956) Gen.77.

3. CA report on the development of a new planning grid, 16 May 1957.

4. *Ibid.*

5. *Ibid.*

6. BRE Note C302, p.10.

7. CA, 16 May 1957 *op.cit.*, p.3.

8. Meeting of 3 June 1957 on 2' 8" development, E840/5.

9. See Appendix 2.

10. Meeting 3 June 1957, p.2. A new team under V.H.Lee, who we shall see translate the timber roof into a new philosophy in the following Chapter.

11. *Ibid.*

12. *Ibid.*

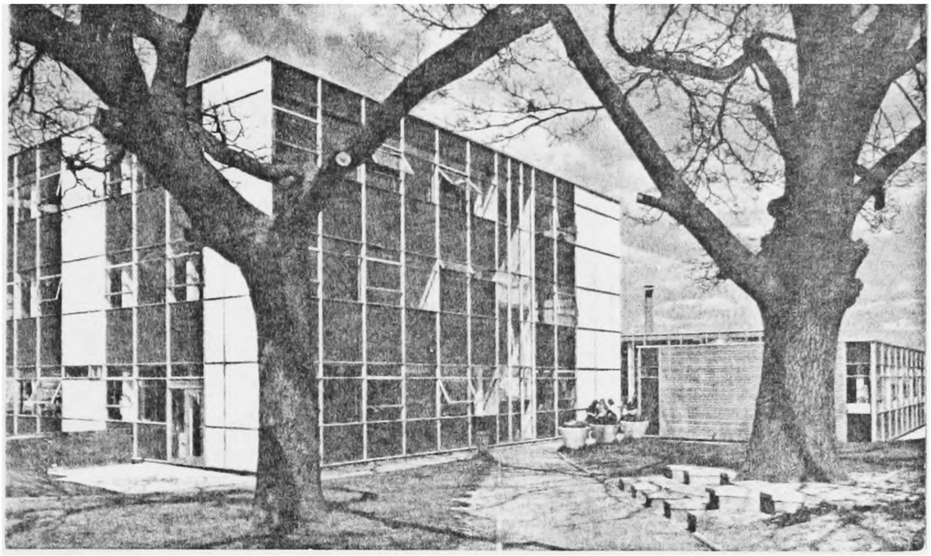
13. "College of further education." *AJ*,6 Dec.1961, p.1111.

14. Group Architects Meeting no.18 (16 Nov.1960) Gen.77.

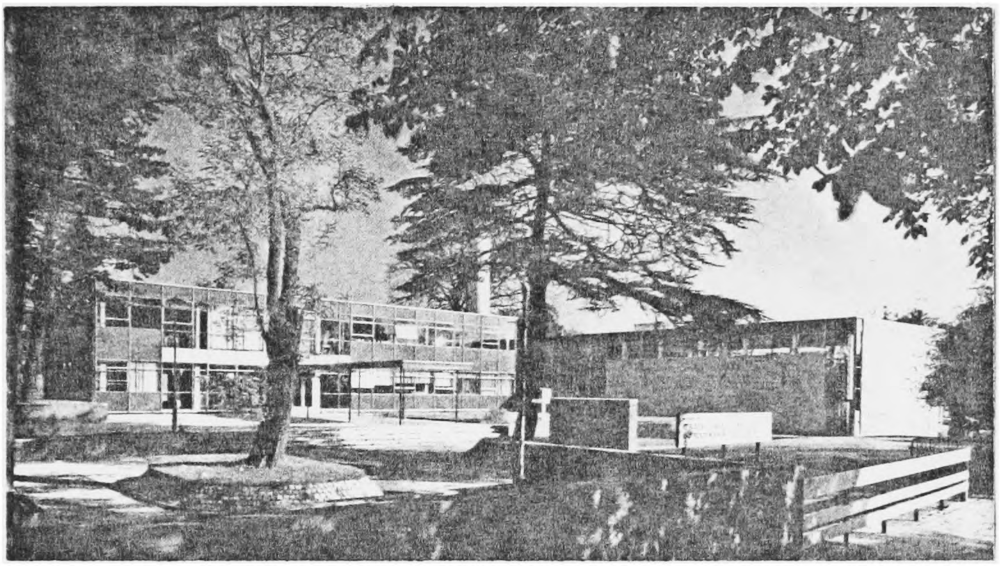
15. *Ibid.*

16. For schools, notably CLASP and SCOLA but other structural systems included Intergrid, Laingspan and Link. See *The comprehensive industrialised building systems annual 1965*.

17. DES, *Half our future*, 1963.



187.



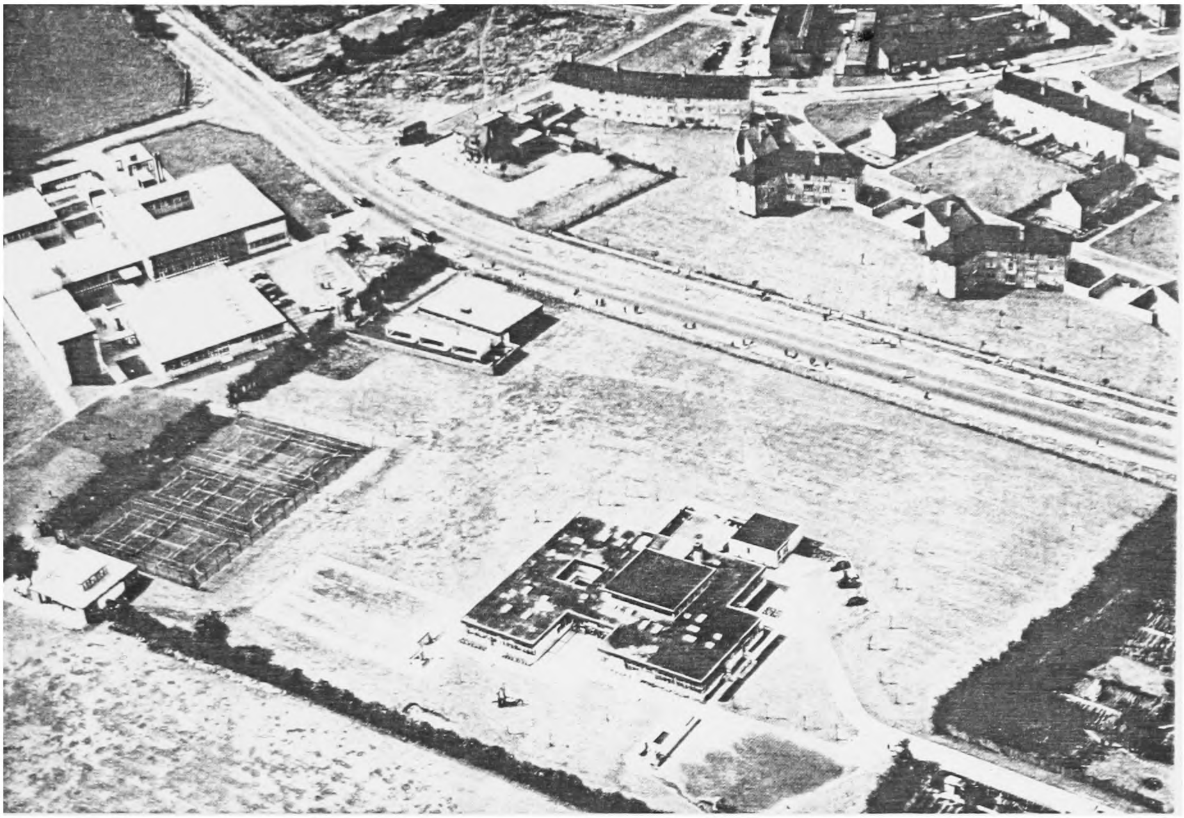
188.

Figures 187-189.

187. Oxhey, Clarendon SM School, view of 2'8" system prototype blocks. (HCC Building for education 1948-61, p.19)

188. St. Albans College of Further Education and Hertfordshire College of Building, view of main entrance. (ibid.p.9)

189. Ariel view of Hertford, Sele Farm Estate, showing the Sele SM School (top left) and Hollybush JMI School. (Plowden report, Children and their primary schools, plate 24)



189.

Figures 190-217.

190. St. Albans College of Further Education and Hertfordshire College of Building, site plan. (Architects Journal, 6 Dec.1961, p.1112)

191-212. These figures illustrate all floor plans in the combined college layout. The orientation of the plans accords with the site plan; ground floors may be distinguished from upper floors by the doors to the exterior. Fig.200 is a view of the junction of two-storey links connecting Administration and Assembly Hall blocks (illustrated in Architects Working Details series) (ibid., pp.1112-1123)

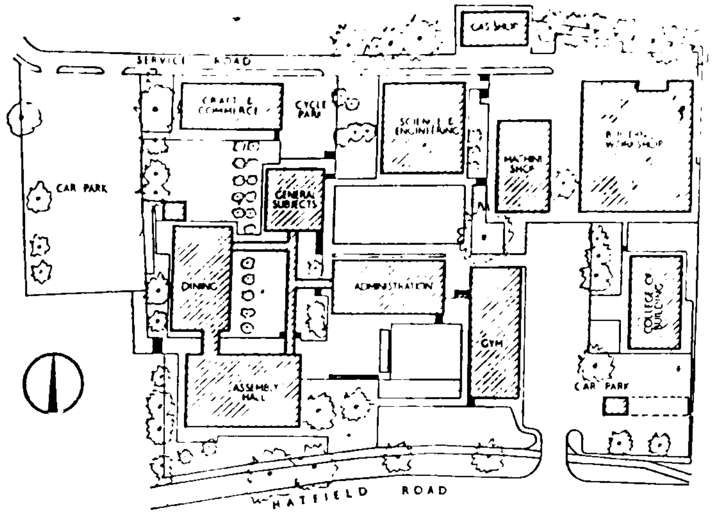
213. St. Albans College, details of internal door frame and screen connections. (ibid., p.1123)

214. St. Albans College, junction of four internal partitions. (ibid.)

215. St. Albans College, typical external (salient) corner. (ibid.)

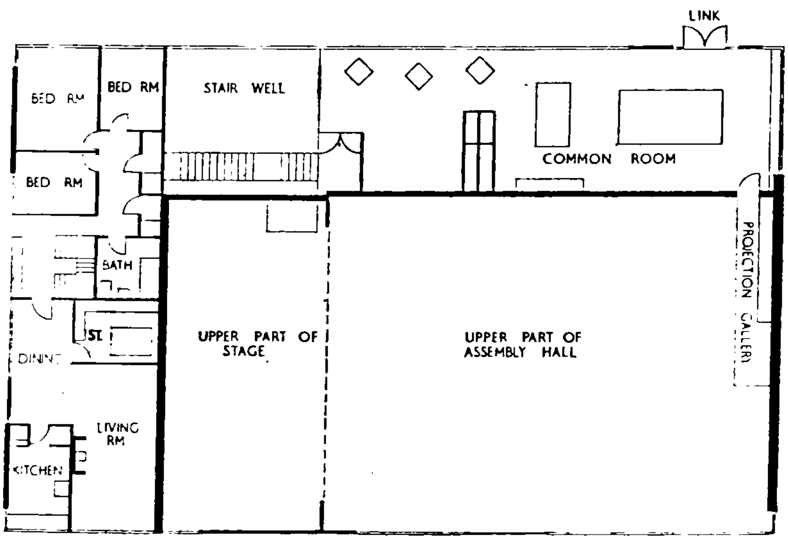
216. St. Albans College, detail plan of junction between cedar boarding and aluminium window-walling (ibid.)

217. St. Albans College, detail section of sill at ground level. (ibid.)

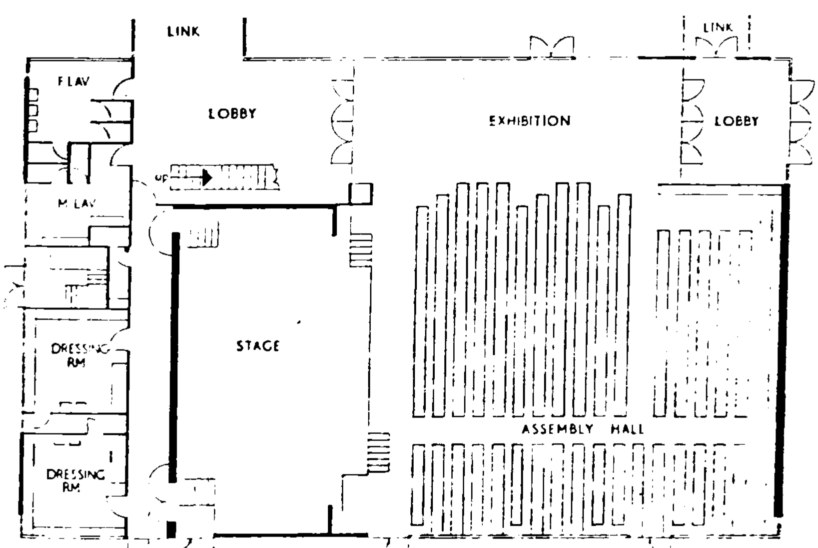


Site plan [Scale: 1/80" = 1' 0"]

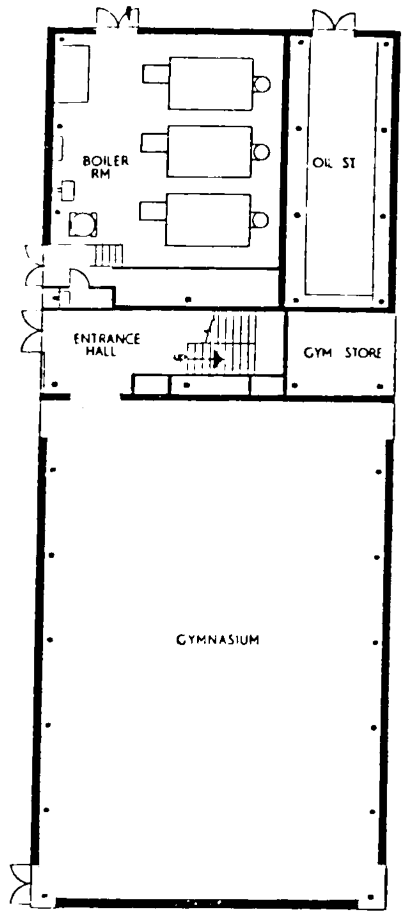
190.



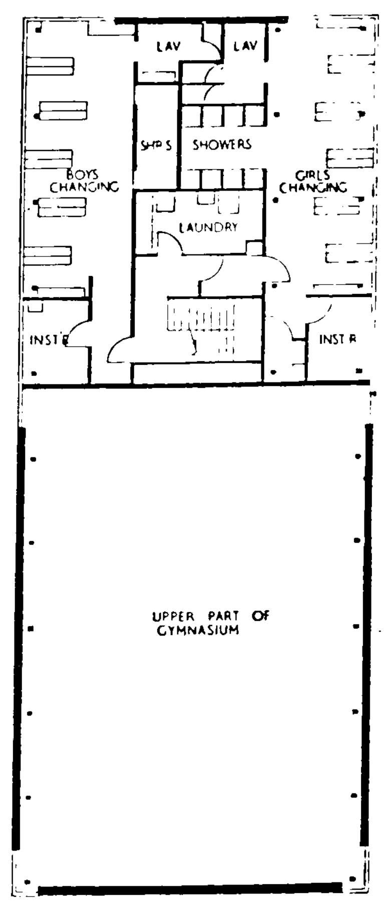
191.



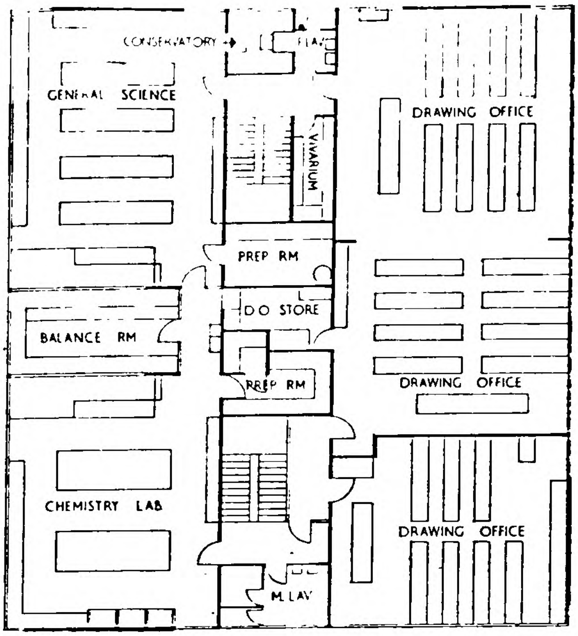
192.



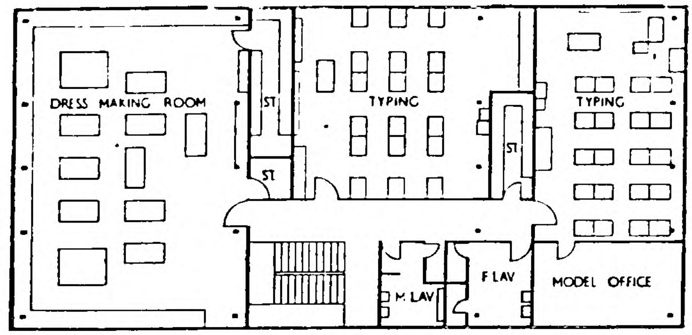
194.



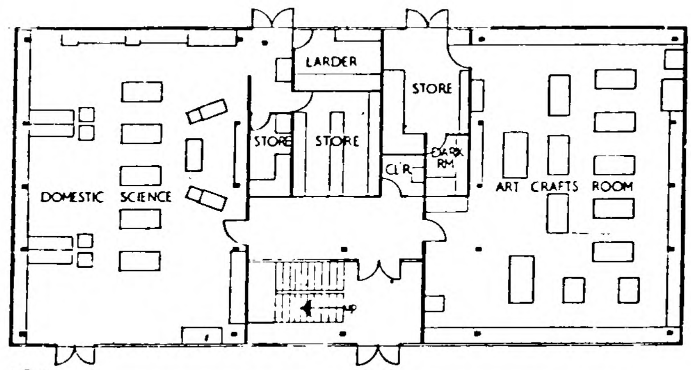
193.



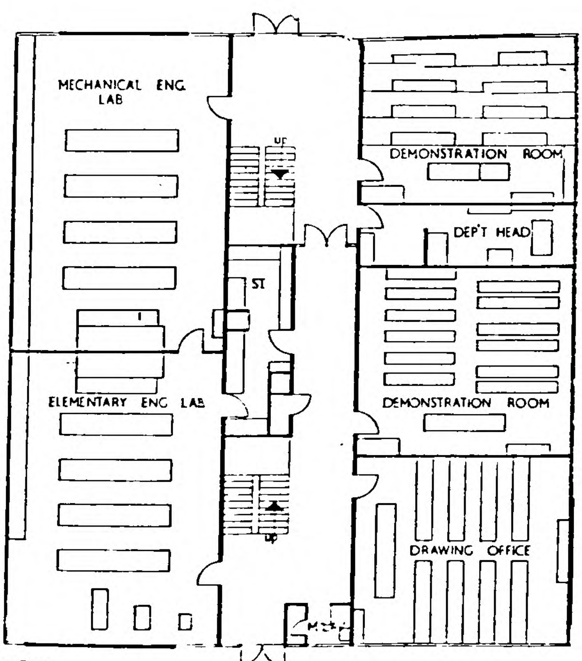
195.



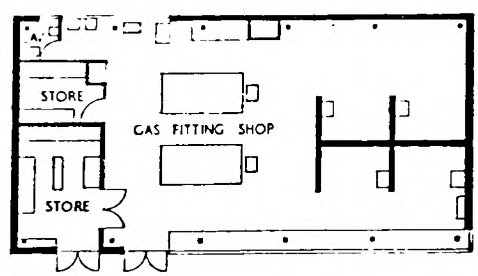
197.



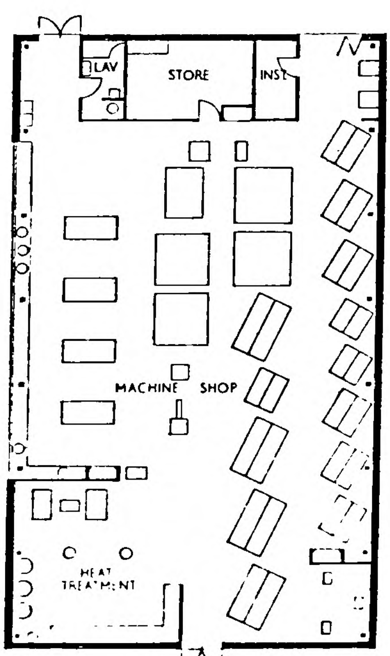
198.



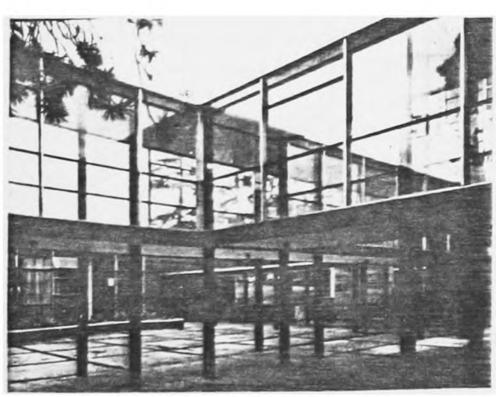
196.



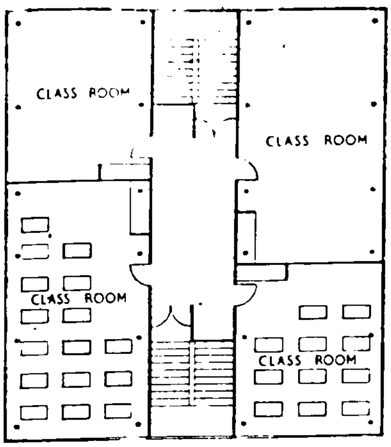
199.



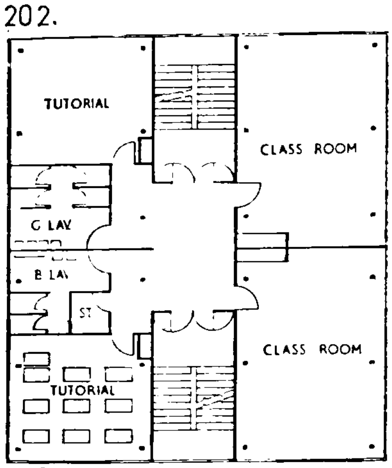
201.



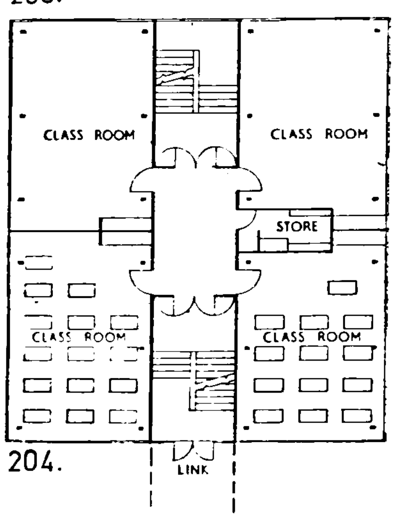
200.



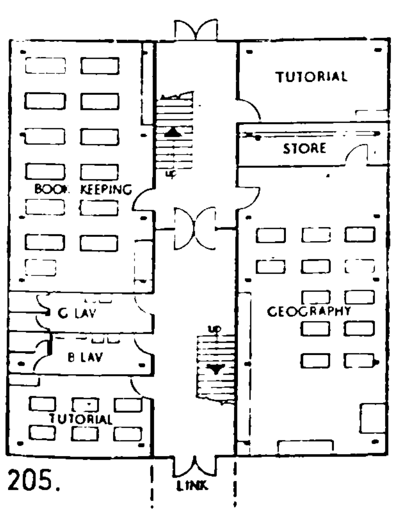
202.



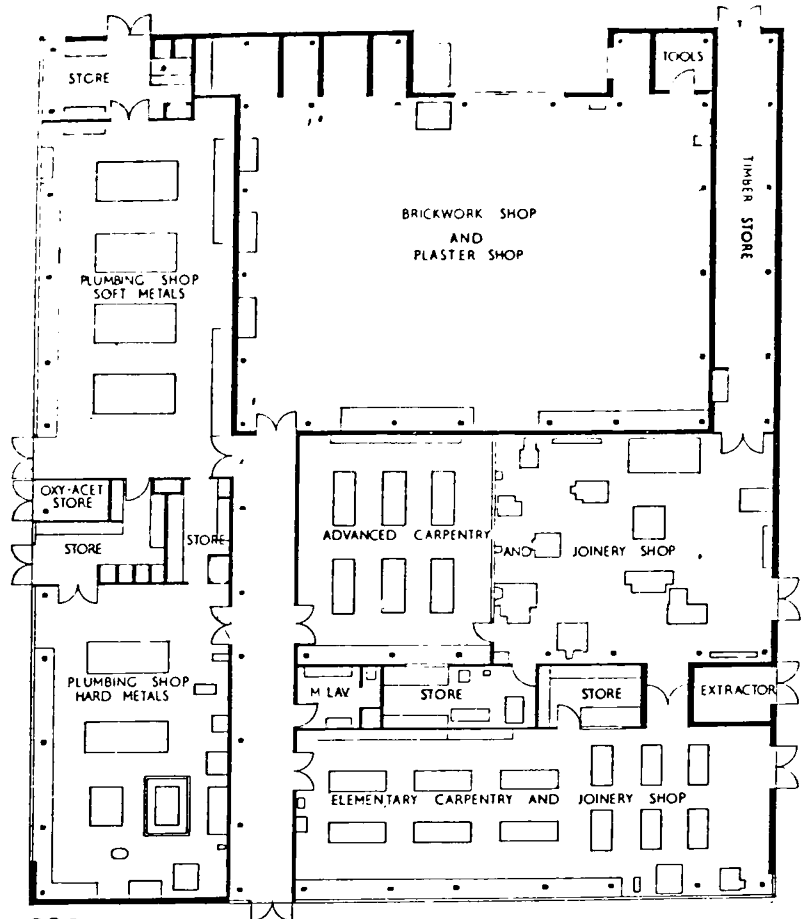
203.



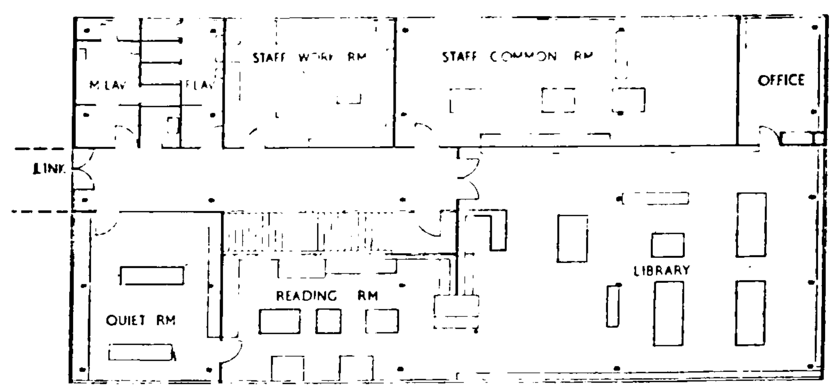
204.



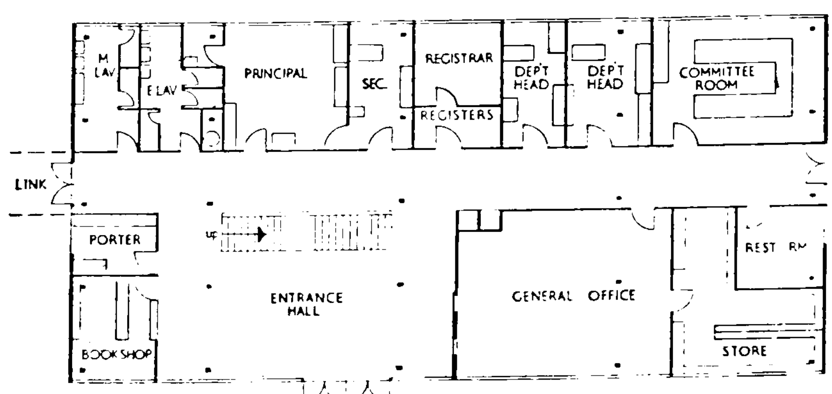
205.



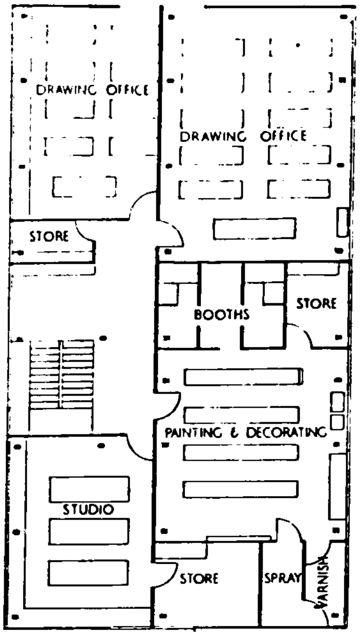
206.



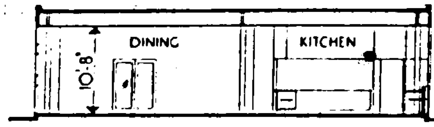
207.



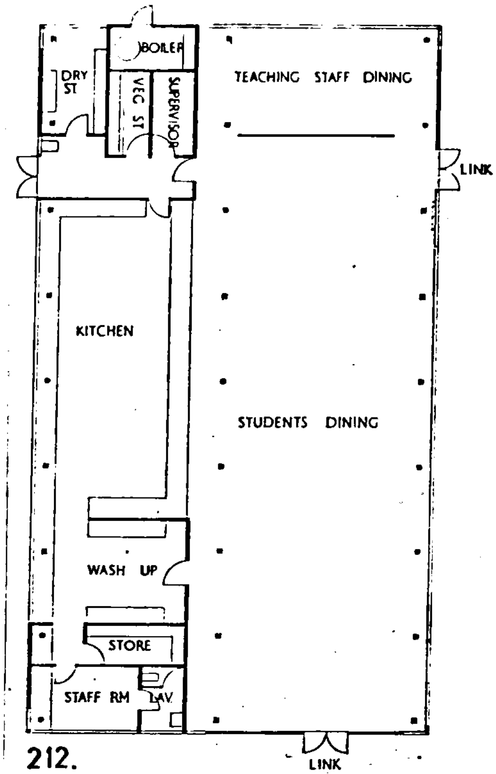
208.



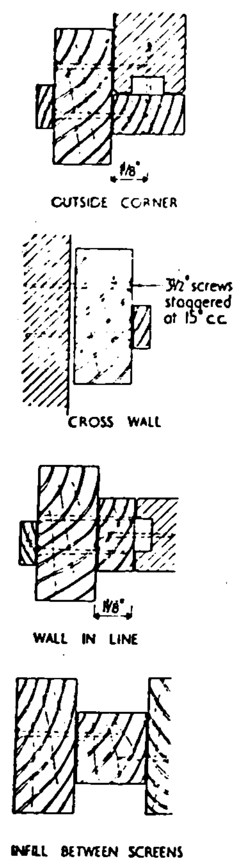
209.



211.

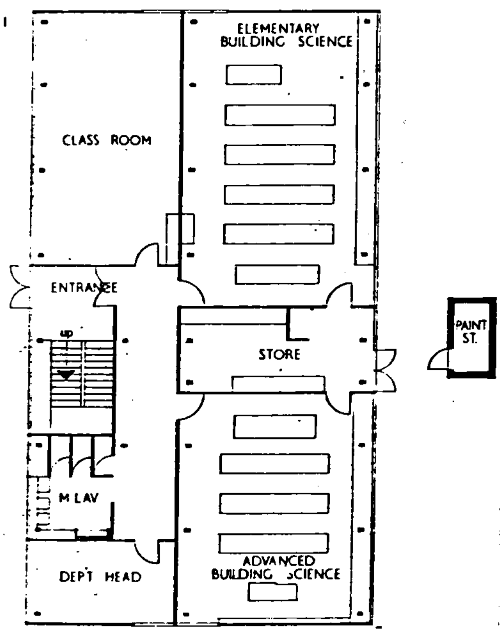


212.

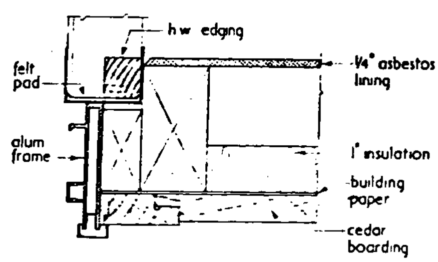


Typical door frame conditions
[Scale: 2" = 1' 0"]

213.

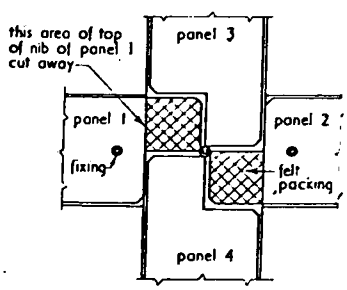


210.



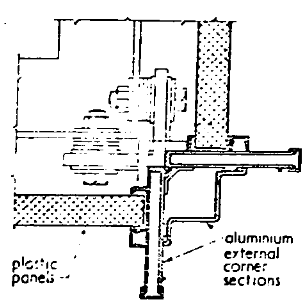
Plan of jamb of aluminium opening lights

216.



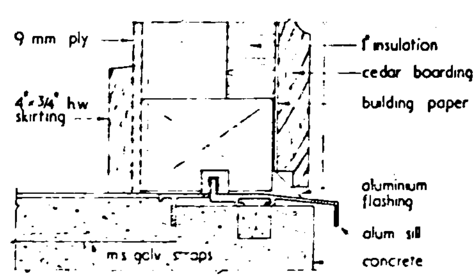
Junction of four internal partitions

214.



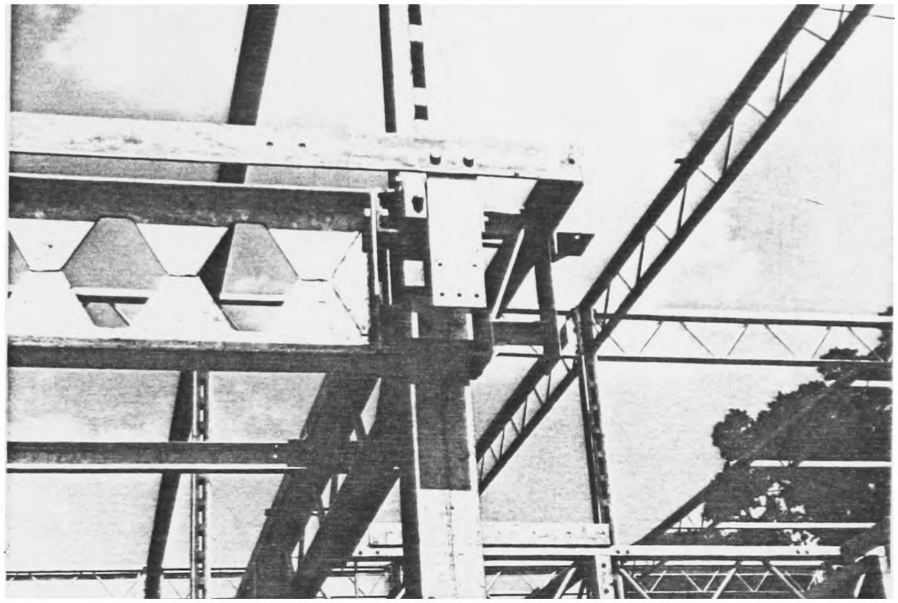
Typical external corner

215.

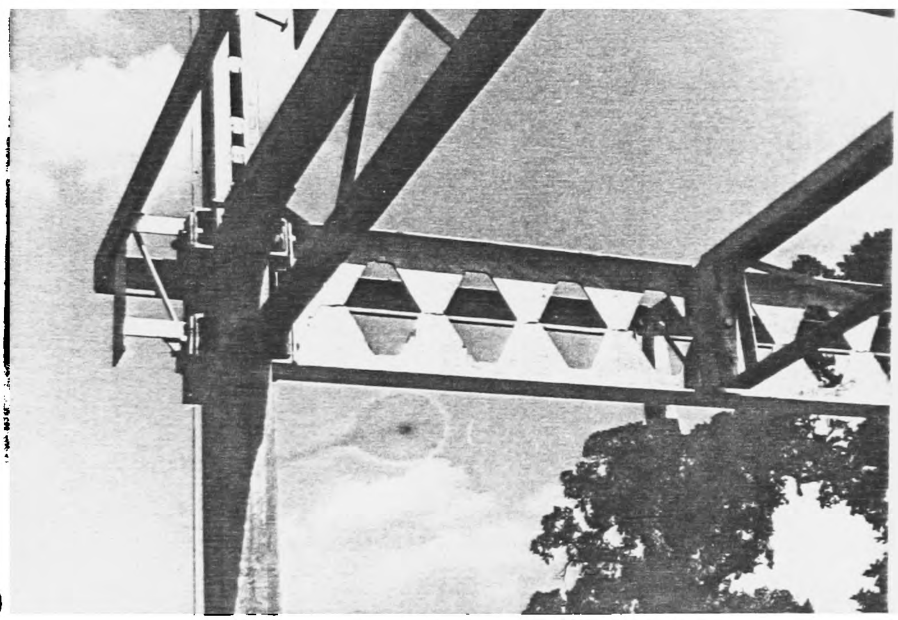


Sill at ground level

217.



218



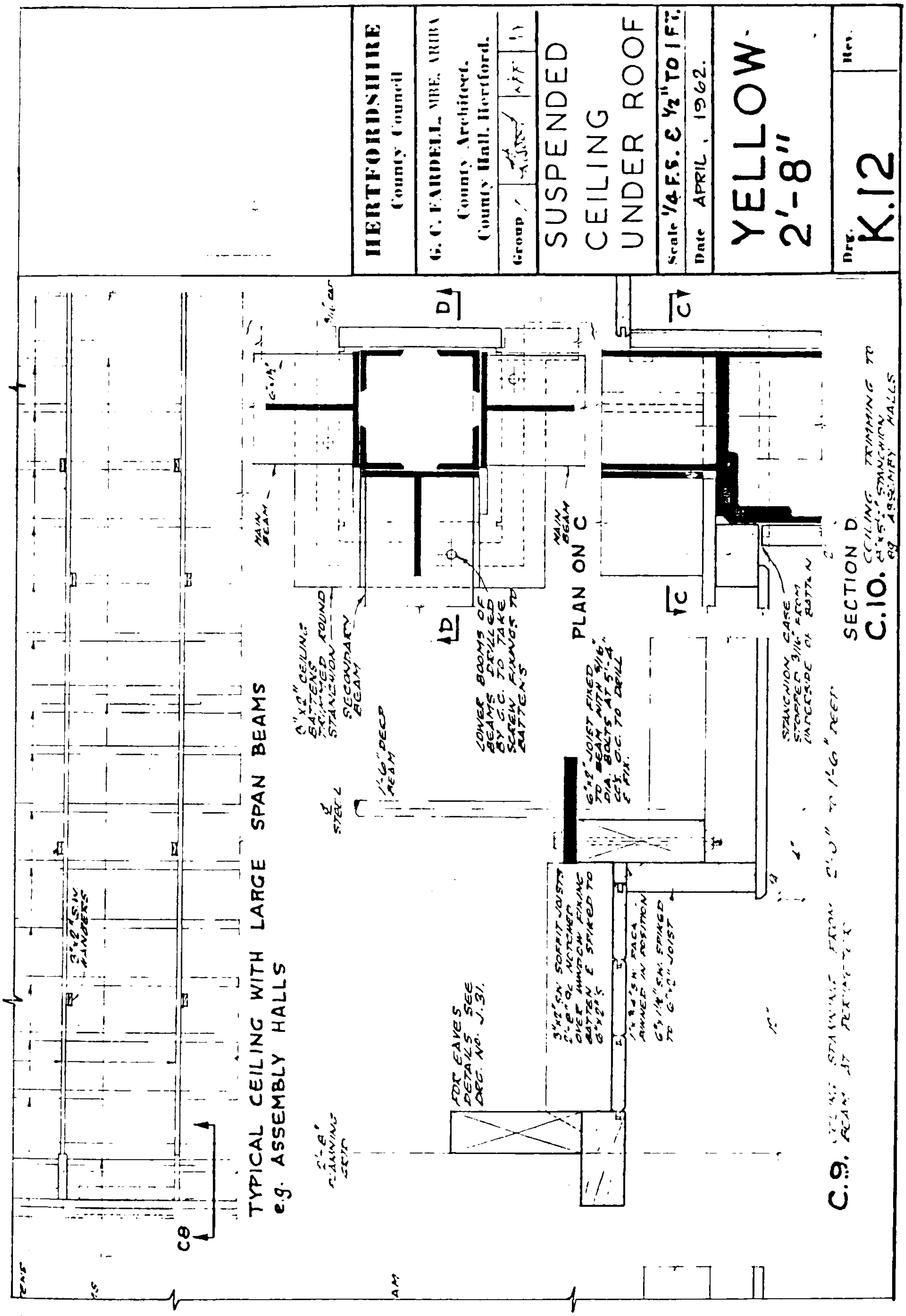
219

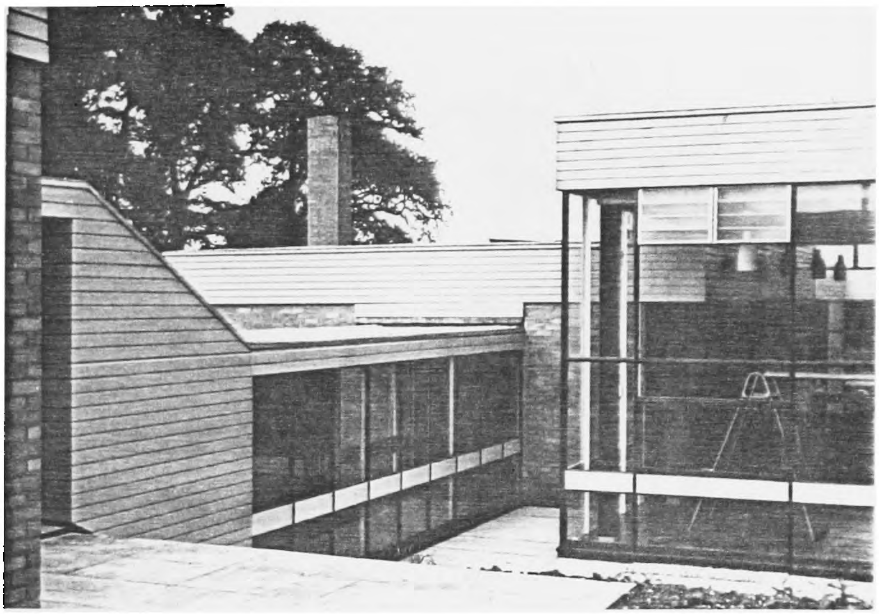
Figures 218-220.

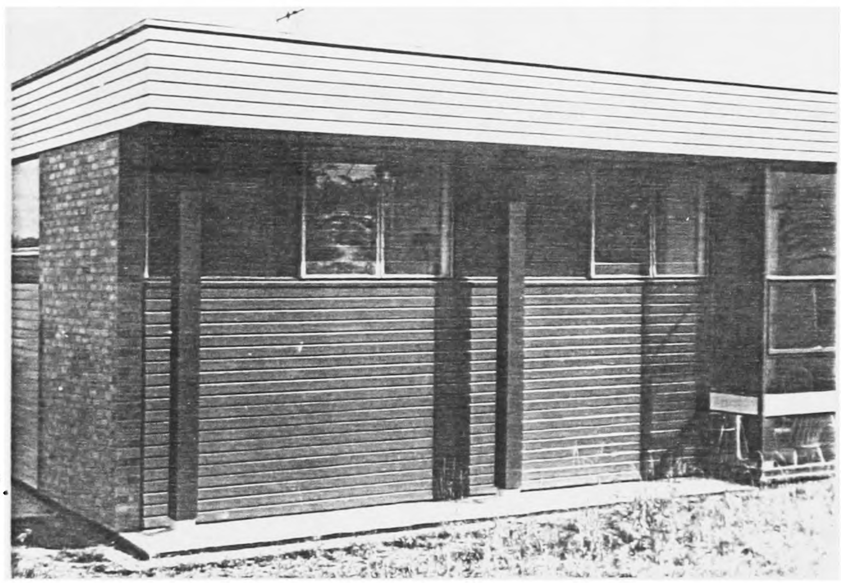
218. East Barnet, John Hampden SM School, close-up view of 2'8" steel frame showing castellated main beam, ground and first floor stanchions and cantilever brackets for fixing cladding components. This was the last steel frame to be made by Hills. (photo. M.P.K. Keath)

219. John Hampden School, reverse view of corner shown in fig.218. (idem)

220. The 2' 8" system, part of a Yellow Standard drawing. (HCC Yellow 2' 8" K12: Suspended ceiling under roof).


HERTFORDSHIRE
County Council
G. C. FARDELL, MBE, ARIBA
County Architect.
County Hall, Hertford.
Group
SUSPENDED
CEILING
UNDER ROOF
Scale 1/4 F.S. & 1/2" TO 1 FT.
Date APRIL, 1962.
YELLOW
2'-8"
Drg. K.12
Rev.
TYPICAL CEILING WITH LARGE SPAN BEAMS
e.g. ASSEMBLY HALLS
C8
3"x2" S.W. HANGERS
MAIN BEAM
SECONDARY BEAM
1'-6" DEEP BEAM
PLAN ON C
FOR EAVES DETAILS SEE DRG. NO. J.31.
SECTION D
C.10. CEILING TRIMMING TO 4"x5" STANCHION AS ASSEMBLY HALLS
C.9.

221. 

222. 

Figures 221 - 227.

221. Stevenage, Lodge Farm JM and Infants Schools, view of enclosed link and change of level between blocks. (photo M.P.K. Keath).

222. Lodge Farm Schools, view of recessed wall introduced in order to reconcile requirements of the steel frame with those of floor area. (idem)

223. Rickmansworth, Eastbury Farm JMI School, view of recessed corner similar to fig.222.

224. Eastbury Farm School, view of brick external walling used as non load bearing cladding to steel frame. (idem)

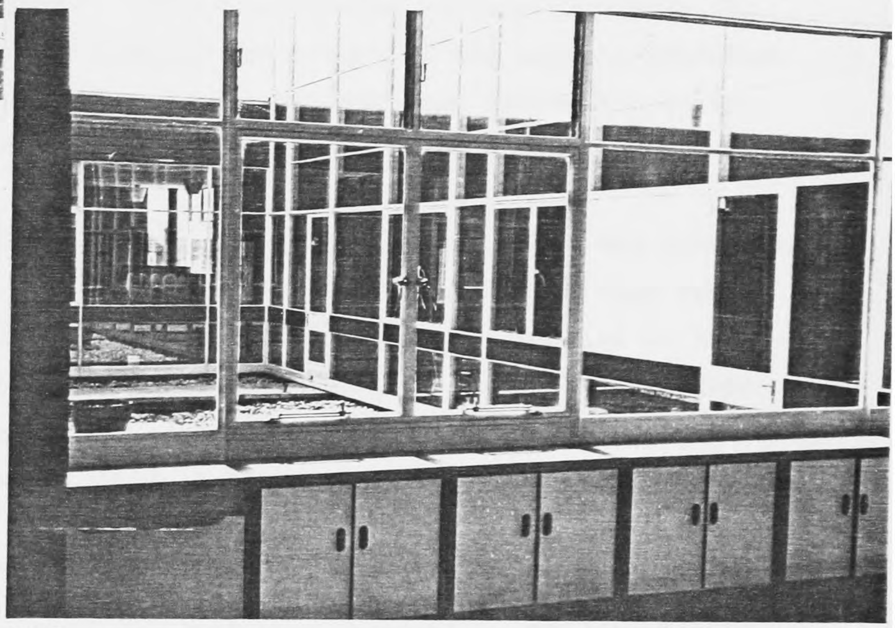
225. Eastbury Farm School, view of internal courtyard. (idem)

226. Stevenage, Chells SM School, view of external walling. (idem)

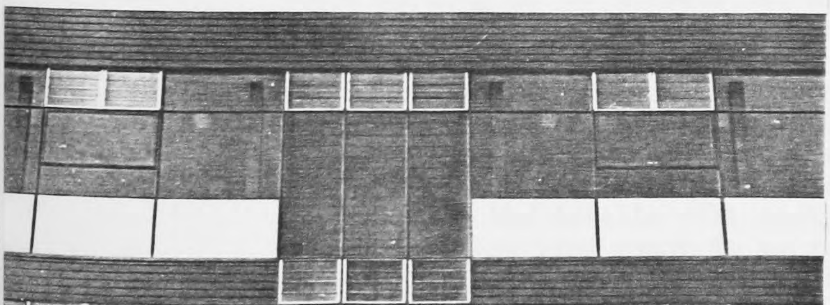
227. Chells School, view of three storey classroom block and link to single-storey administrative, assembly hall etc. block beyond. (idem)

223.

224.



225.



26.

252.

Chapter 22

TOWARDS A NEW DEVELOPMENT POLICY
STRUCTURAL CROSSWALL CONSTRUCTION
1958-64

At a Group Leaders meeting on 26 March 1956 it was confirmed that phase 2 of the St. Audrey's Secondary School in Travellers Lane, Hatfield, was to be the pilot scheme for the introduction of the Blue Standards. The importance of commencing on site in advance of the private-architect jobs, so that any problems arising from the standard details could be controlled, was emphasised. With this in mind certain proposals for the project which involved "special conditions of the wall-to-stanchion relationship" were called into question; after some discussion it was agreed that "this must be adjusted in accordance with the standard drawings."

Apparently some Group Leaders expressed surprise that the standards were meant to be applied as completely as possible; indeed they went so far as to suggest that "this restricted architects and led to lack of flexibility and possible stagnation in work of the office." Reading the minutes of the meeting[1] today one senses for the first time a note of discord; the basic creed is being questioned and requires defending:

> A discussion took place on this point and the policy of work in the Schools Group restated. This policy has been widely published and the results have received some approval. The standardisation of details is the essence of component prefabrication. The important point is that the limits are set and agreed by the architects working on the schools and not imposed from outside. With the present size of the Group it is obviously impossible for everyone to work on the details but ... each team has a representative in the Standards Team. There has been far too little interest taken in the work by the majority and very few suggestions made as to possible developments. The aim is to produce a sufficiently flexible range of alternatives to suit all reasonable requirements. Once settled the details will apply to all 8'3" jobs, subject only to any modifications found to be necessary ... this is the County Architect's policy for the production of the bulk of the work in new Schools and the proper course for anyone in disagreement with this is to see Mr. Aslin.

The remarkably frank minuting records that, after those reproving words, the meeting adjourned to examine the current drafts but on resumption the plea that "there is a serious danger of stagnation ... (and) new ideas are not encouraged" was voiced again.

Charles Cuthill, the Deputy, denied that this was the case or the intention and stated that new solutions and developments are encouraged "as always", but they must be based on the agreed "user requirement" brief and must always take into account previous experience and lessons. Cuthill then made a point which was difficult to argue against; at once bringing the matter to order and ensuring that unauthorised, one-off, development exercises were curbed:

> The schools which have tended to diminish the reputation of the office in the eyes of the Client Committees are those in which architects have, for various reasons, ignored the stated requirements. Several such schools have contained important technical and planning advances but have been condemned by the clients to such an extent that it is difficult for us to develop their virtues. The result has been a tendency for the Clients to become specific in their objections to certain lines of development. If these are considered sound by ourselves it is important that they should be put over in an organised way. A successful example quoted was the handling of the new type Primary School Classroom ...

The subject had aroused some strong feelings and Cuthill finally agreed that there was a case for fuller discussion involving the whole office. Two months later the subject was reopened in a discussion on current costs of school building. The suggestion was made that the "luxury of a frame" was no longer something that could be afforded; cross-wall and "rationalised traditional building" methods were cheaper and can be as speedy.[1] Alternatively, so the argument went, the office should develop load-bearing panel construction.

The minutes[2] of this discussion included a statement which although less admonishing in its tone is a vindication of the status quo and without concession:

> This would, of course, involve a radical departure from the principles consistently used in this office for building new schools and would require a complete change of policy.
> Although in some areas more traditional forms of construction are being used successfully to build schools more cheaply, it is not agreed that conditions in Hertfordshire have altered to the extent that we could safely abandon our own developed methods. It is also more than doubtful whether the average times for completion approach our own average. We are still one of the few authorities who have managed to keep up with the programme pace.
> It is also highly doubtful whether we should abandon what we still believe to be more advanced methods of construction to revert to

19th Century methods with their limitations on planning and with weather bound progress on site. The many advantages claimed and advocated by this office - and proved in practice with well over a hundred schools - of attempting to reduce site labour and produce methods more in line with 20th Century conditions are still valid. The methods are still working despite cost limits which have always been with us.

All true, but the statement concludes with a disingenuous apology:

> We have currently "invested" about 3,000 man hours (more than one Secondary School) in preparing new standard drawings. We cannot waste this time nor can we at this point spare the necessary time to commence the design and development work on a completely new approach. It is obviously essential if we are to progress that we should believe in what we are doing and that we should constantly review the situation.

And it was again proposed to discuss the subject more widely with all concerned and ascertain if there were any general trend of opinion in favour of a return to traditional methods "as a method of reducing costs, and if so what is happening to the general rate of building." Furthermore, it was proposed to concentrate on more factual cost information based on the analysis of recent schools; with the cost analyses completed to date it was becoming possible "to proceed to the next constructive phase of cost-planning." In effect the proposals appeared to be more conciliatory and objective; they were "felt to be the right answer rather than any panic stricken rush back to bricks and mortar."[3]

Although the episode hardly amounted to a crisis of confidence within the department, it was the first time that the steady development of steel-framed methods had been openly questioned and seriously debated; the timber-framed methods we discussed earlier were the results of cautiousness in the face of an impending crisis in steel availability. Now the assumptions about availability of traditional materials and skills were being questioned. But behind the ostensibly reasonable argument was there a deeper, subtler force at work?

The events had coincided with the first thoughts about developing a new steel frame based on the experience of 8'3" and 3'4" methods, but on an unprecedented 2'8" module. Thus, although in terms of dimensional co-ordination the new steel frame was a fresh departure, and seemed better suited to currently perceived needs than previous systems, it was not a <u>radical</u> departure. The office had become familiar with the role of pioneer and innovator; a tradition had been built up. Most of the original team which had got things going had, by now, left and a second generation of architects had inherited the mantle. Generally, those who had come more recently to Hertford were of two types: those who were attracted by the progressive image of the county and who tended to become conservative about its no longer radical, but still outstandingly successful, contribution to school building; secondly, a minority mainly of younger architects who were anxious to work in an atmosphere of continuing radicalism and reappraisal of previous assumptions.

Being of that cast of mind it would seem probable that they too would wish to make a fresh contribution, if not to carve a niche for themselves: they had not been involved personally in the development decisions of the late forties and early fifties. Perhaps they could not be blamed for refusing to believe that the end of the line had been reached, but in a sense it had.

The conditions of post-war Britain were changing, both in terms of materials and available technique and, more significantly, in terms of attitude and confidence. Moreover, it seemed that restlessness was growing in another, unexpected, quarter: questions had begun to be asked by the Elected Members.

In January 1958 a conference on the subject of secondary schools was held at Balls Park College in Hertford. The County Architect's contribution to the proceedings, which had spent a good deal of time discussing the construction and maintenance of flat roofs, was summed up in his recommendations to cover the forthcoming two or three years:

a. That the present method of building including the improved roof construction together with the modified contractual arrangements as described in the report should be continued for the year 1958/59; these arrangements will be amended as appropriate in the light of prevailing market conditions.

b. That if present trends continue, in the year 1959/60 at least one Primary School and one Secondary School should be designed as prototypes utilising an alternative form of construction and the minimum amount of nominated specialist work. The question of roof design will be a major consideration in this work.[4]

The County Architect gave an undertaking "to test the current market by building with more traditional materials."[5] It was against this background that Brookland Junior School in Cadmore Lane, Cheshunt (not far from the original 1946 steel frame prototype) came to be designed.

By the end of May 1958 a sketch plan had been approved in principle by the County Education Department and discussed in favourable terms with the Ministry of Education. The road was clear for the preparation of draft working drawings.[6] The construction was to be load bearing brick cross-walls carrying beams of the Elliott secondary-beam type and similar to those used in the Cawood Wharton construction which had been used by the Architects Co-Partnership at Park Lane, Waltham Cross. The beams, at 4'0" centres, could be penetrated by services in the same manner as lattice steel beams and proved to be cheaper than solid timber beams. They were preferable to Bison (concrete) slabs and steel beams, it was claimed, but there is nothing to suggest that the steel beams of the 2'8" frame would not have served equally well if not better. It is true that timber beams could be manufactured with sloping top chords, to provide the desired fall for rainwater run off, but this could also have been achieved with firring pieces on steel. That would have smacked of compromise with the steel system; it was not "traditional" enough.

In fact the timber beams worked well and were easily handled by the contractor without specialist skills. The Brookland school required only one 24'6" beam type to cover the majority of the school with a light 8'6" beam over the covered ways and a deep 40'0" double beam over the assembly areas (fig.228). The roof deck consisted of 8'0" x 4'0" standard grade 2" thick Stramit with a showerproof coating. BRS had produced a confidential report commenting favourably on its durability and resistance to rot.[7] This product eliminated the necessity for a wet screed and was cheaper and lighter than asbestos decking. In effect the roof was designed as a series of shallow, linked "butterfly" roofs, with internal gutters formed over classroom party walls, where the Stramit was omitted and the asphalt membrane dressed down onto a 6" wide strip of plywood. The advice of the BRS was sought with regard to draining each 40'0" x 50'0" catchment area of roof, by means of a sump discharging into a single downpipe, with the object of running both soil and surface water drains in a single trench to manholes outside the building.

The classroom window-wall was intended, somewhat unrealistically, to be "prefabricated in one piece 24' x 8'8" complete with blind boxes, thresholds etc. ... twenty of these will be delivered on low loaders..."

These "shop" windows, as they were curiously called, were to carry light loads and support the 8'0" span beams and the cantilevers where the roof was carried beyond the glazing line.

As far as the modular discipline was concerned the unit was to be "exactly the same as that used at Goffs Oak, namely 12", 24", 48" dictated by the size of the Stramit panel and ceiling boards." This meant that each classroom was to be 24'0" x 40'0" in the clear with a 12" neutral space between, occupied by the 11" cavity walling, which was covered with ½" thick pinboard on either side or, alternatively, by a 12" ceiling panel under a main beam.

At a Group Architects meeting on 12 November 1958, Geoffrey Fardell, who was to become County Architect on the retirement of Charles Aslin the following month, referred to Aslin's undertaking of nine months earlier to carry out investigations into traditional construction. The minutes[8] of the meeting, chaired by Fardell, declared:

> The practice of the office had always been to make the best use of what was available and to build in the most logical and rational way. V.H.L. showed how he had done this by using "load bearing" brickwork and light prefabricated timber beams adapted from the Elliott frame.
> T.B. showed how the sequence of operations had been worked out in collaboration with B.R.S. to introduce the maximum amount of repetition and orderly sequence of trades in line with H.C.C. practice for framed structures.

The questions raised at this volte-face, though pertinent, have a hint of a timid adherence to the old routine:

> Was the Cadmore system sufficiently adaptable? Would its adoption mean a departure from the use of standard drawings and group collaboration on a single basic way of building?
> Was it intended to throw away the skills of specialist sub-contractors?
> Would it be possible to get the roof on as quickly as possible with a framed structure?[9]

Construction commenced in April 1959 and the school was completed one year later.

When the school was reviewed in the AJ for 27 April 1961 the question asked was this, "Above all, is this building a denial of previous work at Herts?" The key point in this respect, the writer acknowledged, was that fifteen years previously there were very few bricks and no bricklayers, but now, limited quantities of both were available in the county. Because the project was to test out a rationalised version of conventional load bearing construction it was, therefore, "in line with previous thinking." The writer reported:

> Herts argue, for instance, that they have two advantages over most other counties with their schools building programme. One is this open-mindedness about the best solution of a given problem or group of problems. The other advantage comes from a combination of size and autonomy; in other words, they have a big enough programme to pursue experimental and other work without a direct need to set up a consortium to put it into effect. This pilot project therefore has its place as a field experiment within the context of the open-minded and flexible attitude of the county.[10]

Thus the arguments which had begun as an attack on the established method had been turned into apologia: the rebellious alternative was now clearly absorbed into the Herts approach. If it had not beaten the system it had simply joined it, and as far as the outside world was concerned it was a highly respectable arm of the county's technique.

Apart from the novelty of seeing such a school emerge from the Hertfordshire office the construction created wide interest in its own right. It was a puristic application of cross-wall construction in brick carried out with finesse resulting in a palpably delightful building. For the adherents to dimensional co-ordination theory, it was entirely compatible with the advanced thinking embodied in systems employing high degrees of prefabrication and standardisation.

The AJ declared its more important feature to be "the planning grid, which works like a Scotch plaid in one direction only."[11] In essence, 11" cavity walls (the traditional thickness), running north-south, carried a timber roof structure based on a 4'0" square grid; the structural wall "zone" thus occupied 12" in one direction only, each zone being separated by three 4'0" modules. The assembly hall and boiler house were free to be dimensioned outside this scheme because they lay outside the main plan area. In principle it was not unlike the alternative recommendation of the Wood Report we touched on in Chapter 4.

As had become the usual practice in primary schools in the county, the classrooms were arranged in pairs with adjoining cloak-hanging areas being used for circulation. The detailing was more consistent with the structural intent than was the decoration:

> For the most part... arises naturally out of the logical organisation of plan and structure, and quietly emphasises the way

> in which the various elements have been brought together. Examples of this are the stopped ends of the eleven-inch cavity walls and the junction between windows and fair-face brickwork. The solid angle eaves capping detail is also admirable. Slightly less successful are the short vertically boarded fascias and the panel decoration of the assembly hall ceiling. One cannot help observing that decoration, if it is to have its place in this type of "less is more" architecture, should attempt to emphasise the structural intention rather than obscure it.[12]

Perhaps the biggest surprise of all was the low cost of the school; that it had been "economically constructed despite a high standard of finishes and equipment, and it is highly successful from the point of view of the user." The cost had been contained within the MOE net cost limit of 64 shillings per square foot, but it was by no means a "cheap" school.

The external wall to floor ratio of 1:03 was relatively high and would normally have been symptomatic of an "expansive" structure; the finishes too were not cheap (figs. 97, 229, 230). That this had been achieved on the outer fringes of London and that it compared very favourably with other recently completed schools in traditional construction (such as the MOE development project village school at Finmere, Oxfordshire) seemed to be convincing evidence in favour of developing the method further.

At a meeting of the County Council held in February 1958 two Members, (Clrs. F.B. Austin and J. Aylmer) asked the chairman of the Education Committee to look into the possibility of using standard plans for new primary schools. In due course, and after further informal discussions, the two councillors were invited by the County Architect to visit the Architects Department to discuss the matter in detail and to hear about the methods of building employed. Discussion ranged about the use which had been made of standard components since 1947, the problems of applying standard plans to the sites of schools designed in recent programmes and the comparative costs of both buildings and professional services, using alternative methods.
It was shown that if a standard plan could be used, the saving in professional time might be worth approximately two per cent of the cost of a school but, on the other hand, a high degree of standardisation had been achieved already and the employment of very large standard units would have the effect of actually increasing the cost of site works in some cases.

Pointing out that his department was already committed to a number of development projects and that, as future programmes were unlikely to contain more than four or five schools in each year, the County Architect showed that it was not worth investing staff time, at that stage, in developing a standard plan.

The meeting, which took place in November, was one of C.H.Aslin's last expositions of his department's work: he retired the following month ten days before Christmas. It was also Geoffrey Fardell's first and the Department "had come out extremely well in the discussions ..."[13] The minutes of Fardell's first Group Architects meeting, held on 10 December 1958 reported him to have said "we were ahead of anything they had thought of." But a point had been made and accepted; the minutes confirmed "that in cases where requirements were absolutely similar we would attempt to use old schemes: this point must be borne in mind at all times." Whether or not any two sets of requirements and conditions matched sufficiently to justify reusing a plan is debatable. As it happened, no plans ever were repeated in this way.

The project designated to carry the development begun at Brookland a stage further was the St. Lukes ESN School at Colney Heath, St.Albans. The stated aim was to "overcome the problems in planning this type of job in achieving flexibility in both directions and in accommodating units such as assembly halls, which may require thicker brick walls."[14] The new system was developed during the summer of 1961 and became known by the acronym DISC, standing for Development In Structural Crosswall. By November draft standard drawings were virtually complete.[15]

The planning grid selected for DISC was 1'4" on account of its relationship with the current steel development on 2'8" and the desire to have as many components common to both systems as may be feasible. The basic principle was that all the load bearing crosswalls would be of cavity brick construction. In order to simplify the co-ordination of secondary components, such as windows and doors, and the dimensions of spaces between walls, the cavity walls were thickened to fill the full 16" zone (less the thickness of plaster). This posed a problem in regard to the Code of Practice for load bearing brickwork on account of the $4\frac{1}{2}$" cavities which resulted. The BRS advised that the code was shortly to be revised and that cavities, ranging between a minimum of two inches and a maximum of six inches were permissible, provided the number and length of wall ties was increased.[16] Slenderness ratios could not be altered and it would mean that walls in excess of 15'0" in height would have to be solid or have internal piers built into them at calculated centres.

The thicker walls helped to rationalise dimensions but they gave rise to criticism on account of their waste of space, particularly where they occurred within the shell of the building. To some extent the problem was alleviated by laying down a set of limitations which would permit the forming of recesses, within their thickness, to accommodate shelving, pinboard and general display purposes, without endangering stability.

Laminated timber beams made by Cawood Wharton and subsequently by Rainham Engineering were used for the roof (figs. 231, 232); windows were of conventional joinery and capable of being made up in any workshop. For the rest, the components followed the lead of the Brookland school but no DISC project ever seemed to achieve the freshness of character of its quasi prototype (figs. 233, 234).

DISC was the last Hertfordshire system to employ either timber roof beams or load bearing brick walls; on the formation of the SEAC consortium DISC was abandoned in favour of the work which Kent County Council had done on structural crosswall methods. This is touched on in the following Chapter.

Notes to Chapter 22

1. Team Leaders Meeting no.7 (26 March 1956) p.3. Gen.77.
2. Team Leaders Meeting no.9 (29 May 1956) pp. 2,3. Gen.77.
3. Ibid.
4. Extract from the conference notes appended to: Team Leaders meeting no.24 (28 Nov. 1957) Gen.77.
5. Ibid.
6. Minutes of meeting (13 May 1958): New primary school - Cadmore End, Cheshunt. E788.
7. Ibid.
8. Group Architects Meeting (12 Nov. 1958) Gen.77.
9. Ibid.
10. "Junior school at Cheshunt, Hertfordshire." AJ, 27 April 1961, p.610.
11. Ibid., p.611.
12. Ibid.

13. Group Architects Meeting no.1 (5 Jan. 1959) Gen. 77.
See also County Architects Report attached to agenda for proposed meeting on 10 Dec. 1958.

14. Circular: Development Policy, 8 Feb. 1961. Gen.77

15. Group Architects Meeting no.24 (14 Dec. 1961) Gen.77.

16. Ibid.

Figures 228-232.

228. Cheshunt, Brookland JM School, plan showing load-bearing brick cross-walls. (Architects Journal, 27 April 1961, p.610).

229. Brookland School, view of classroom interior showing practical area and lavatory and cloaks space. cf. figs. 95-97. (HCC Building for education 1948-61, p.11).

230. Brookland School, view from entrance hall into courtyard. (ibid.)

231. St.Albans, St.Lukes Day School, view of DISC prototype roof construction showing timber, plywood-webbed beams. (photo M.P.K. Keath).

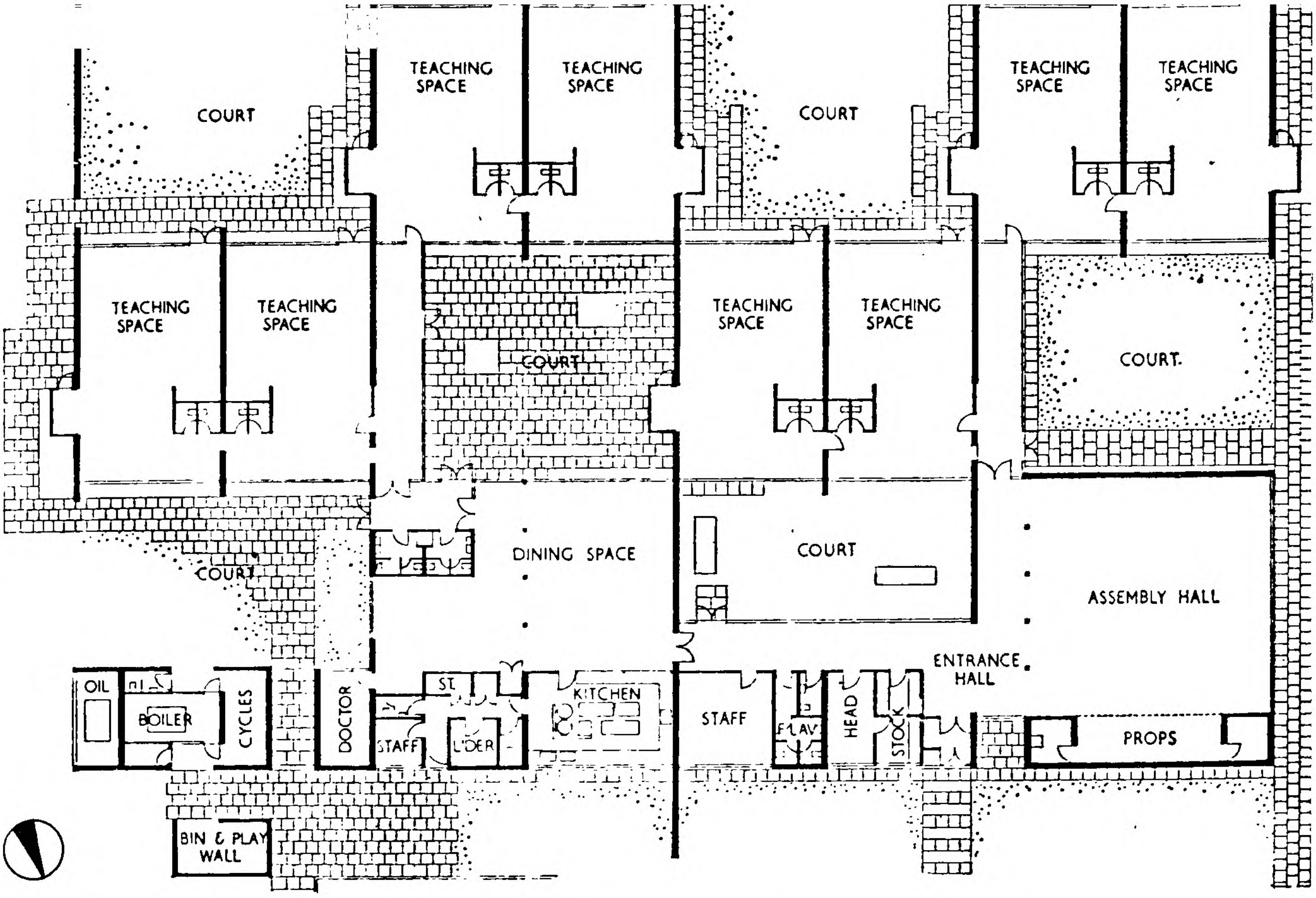
232. Croxley Green, County Branch Library and Old Peoples Club, DISC construction with laminated timber beams by Rainham Engineering Ltd. (idem)

233. St.Albans, St.Lukes Day School, view showing solid load-bearing walls and glazed non load-bearing "gable" walls. (photo M.P.K. Keath).

234. St.Lukes School, close-up view of adjacent wall types, cf. fig. 233. (idem)

235. DISC construction, typical Standard Drawing (Pink) for the 1'4" cross-wall system. (HCC drg.no. Pink DISC J25: Roof Details)

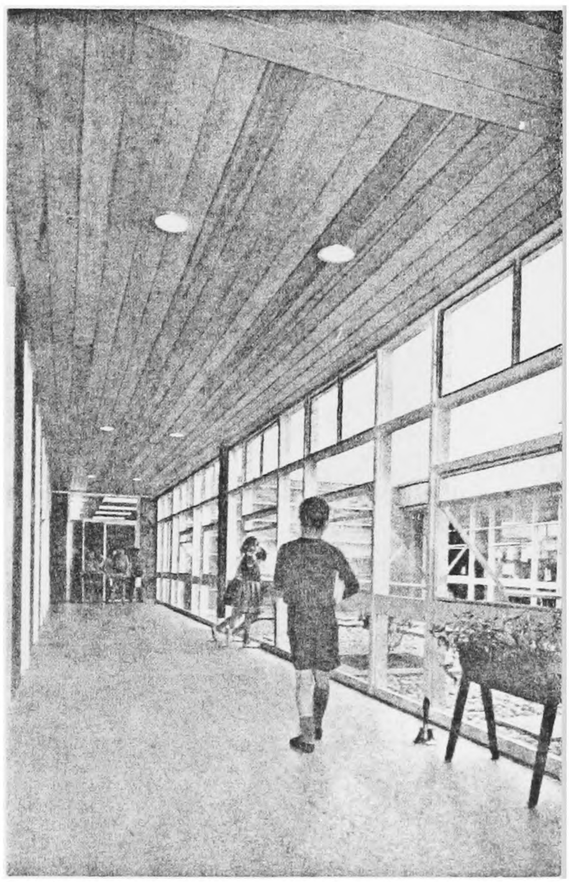
236. SEAC Mk 2a Brick construction, fragments of typical Standard Drawing illustrating external walling, timber window sections and plans, fascia plans. (HCC Drg.no. P(21)H1 : Brick Assembly)



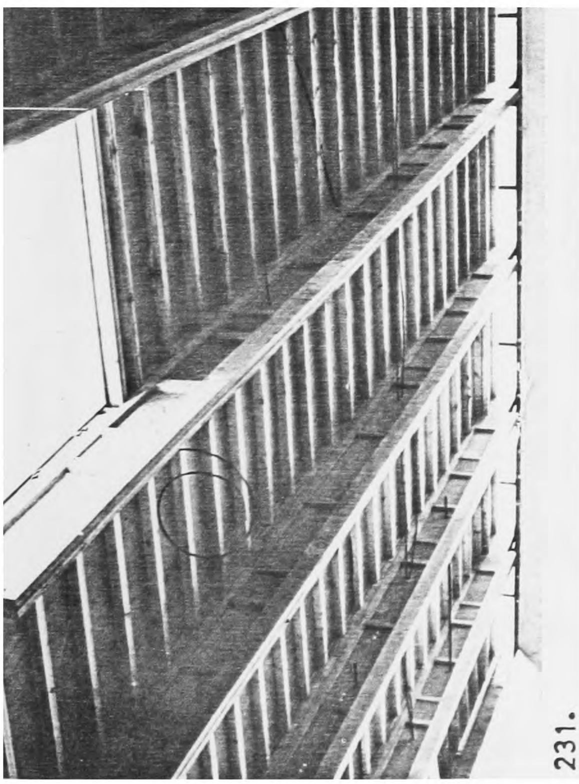
COURT
TEACHING SPACE
TEACHING SPACE
COURT
TEACHING SPACE
TEACHING SPACE
TEACHING SPACE
TEACHING SPACE
COURT
TEACHING SPACE
TEACHING SPACE
COURT.
COURT
DINING SPACE
COURT
ASSEMBLY HALL
ENTRANCE HALL
OIL
BOILER
CYCLES
DOCTOR
ST.
STAFF
L'DER
KITCHEN
STAFF
LAV
HEAD
STOCK
PROPS
BIN & PLAY WALL

228.

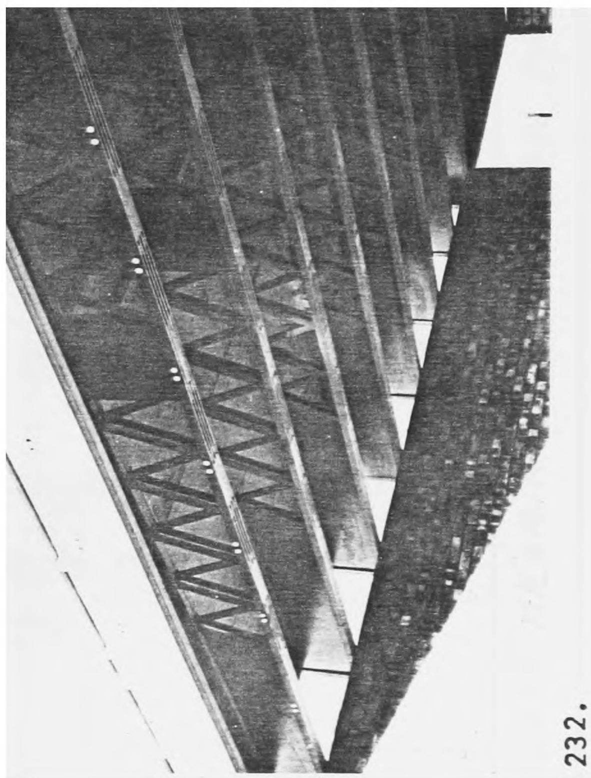
229.



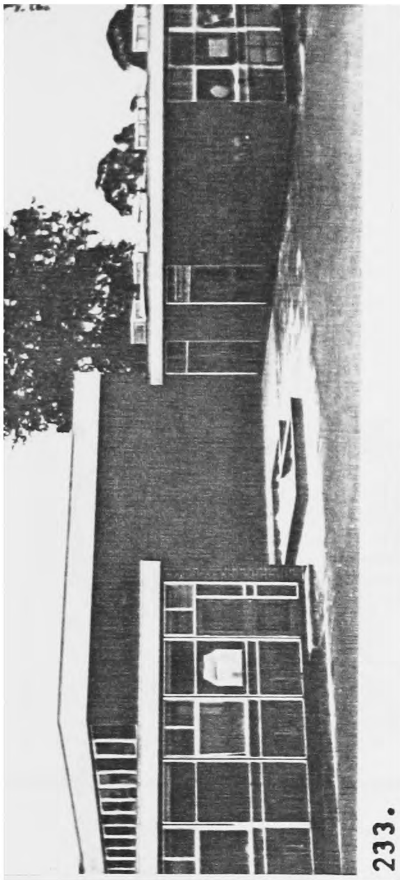
230.



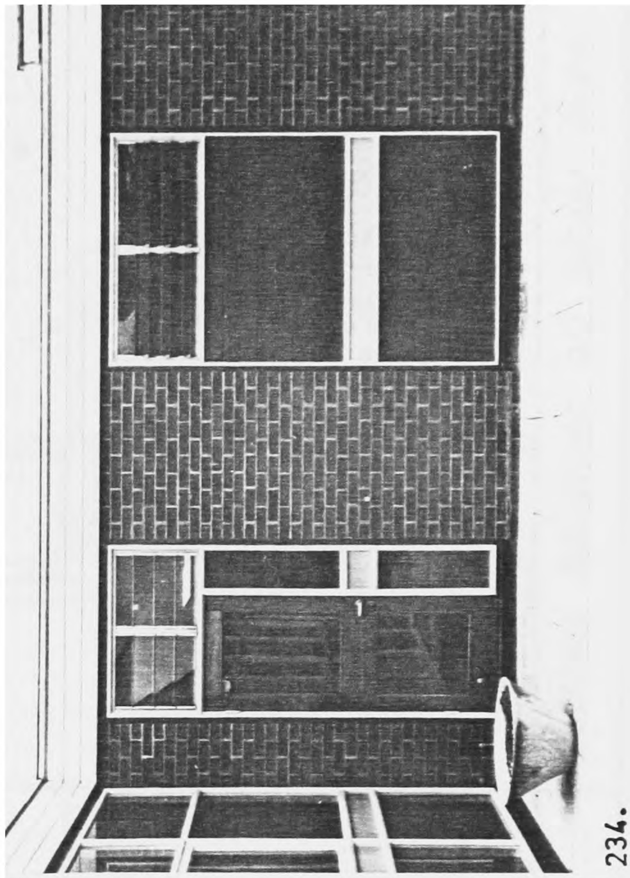
231.



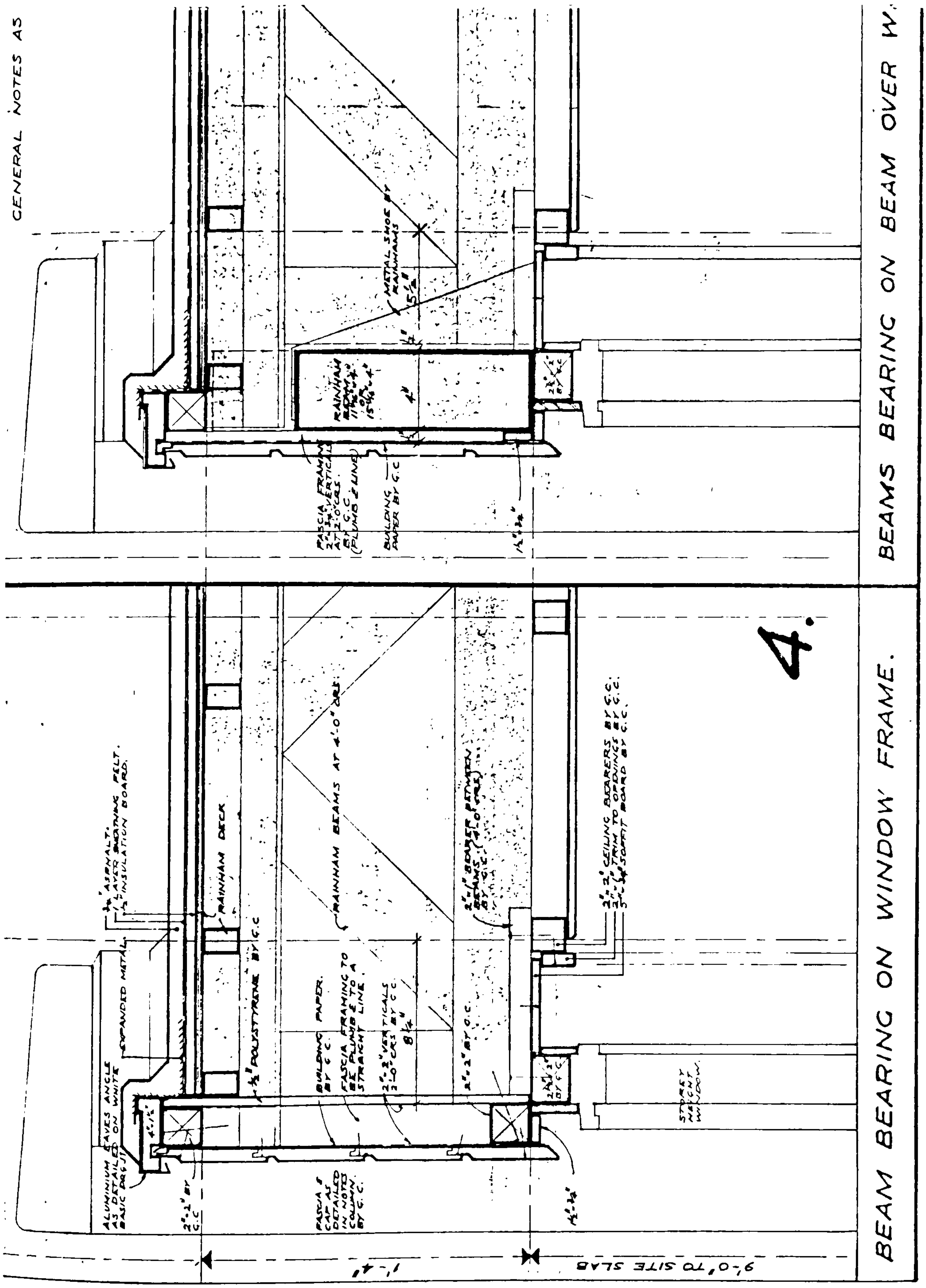
232.



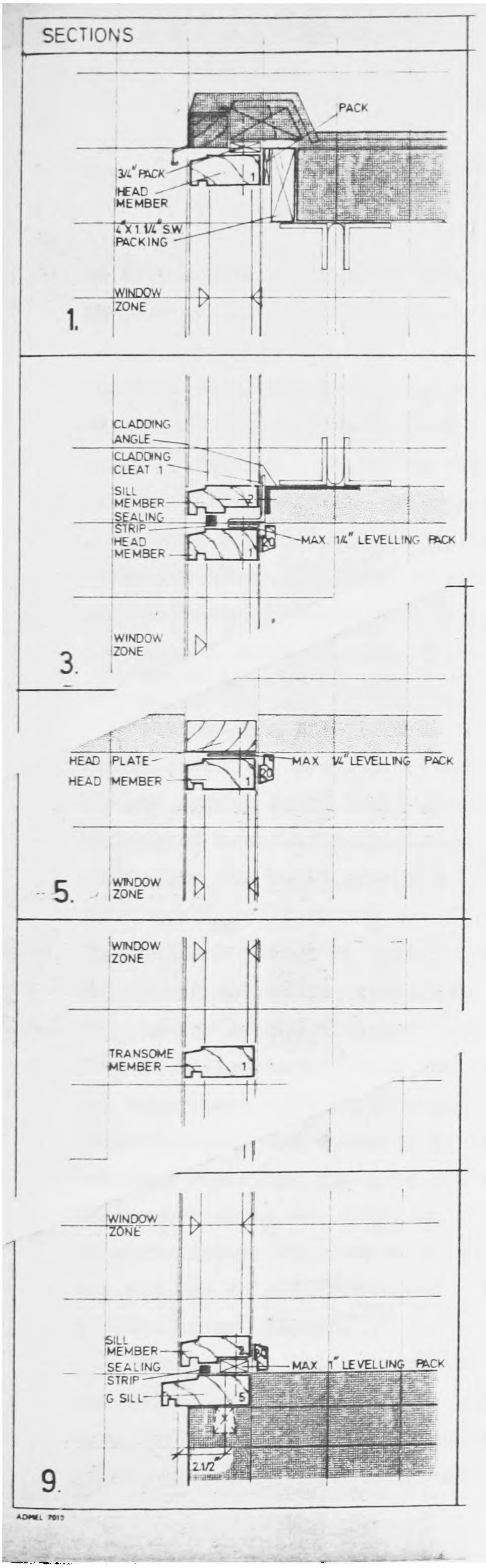
233.



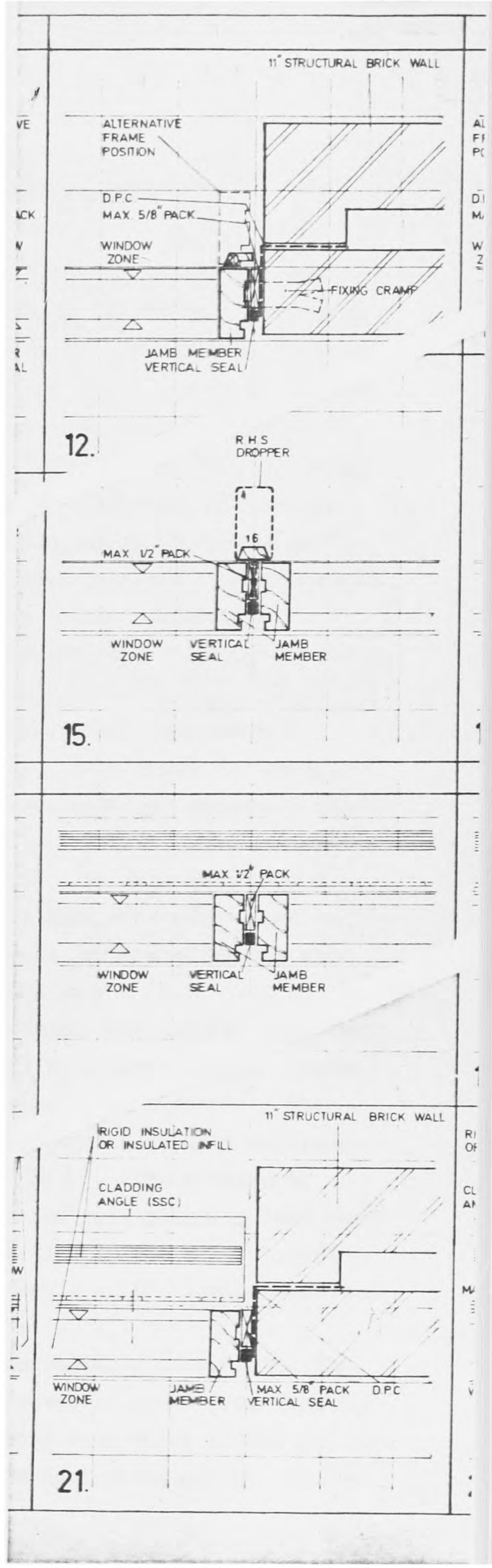
234.


GENERAL NOTES AS
BEAMS BEARING ON BEAM OVER W.
BEAM BEARING ON WINDOW FRAME.
4.
RAINHAM DECK
RAINHAM BEAMS AT 4'-0" CRS.
EXPANDED METAL
BUILDING PAPER BY G.C.
STOREY HEIGHT WINDOW.
9'-0" TO SITE SLAB
1'-4"

235


SECTIONS
PACK
3/4" PACK
HEAD MEMBER
4"X 1 1/4" S.W. PACKING
WINDOW ZONE
1.
CLADDING ANGLE
CLADDING CLEAT 1
SILL MEMBER
SEALING STRIP
HEAD MEMBER
MAX 1/4" LEVELLING PACK
WINDOW ZONE
3.
HEAD PLATE
HEAD MEMBER
MAX 1/4" LEVELLING PACK
WINDOW ZONE
5.
WINDOW ZONE
TRANSOME MEMBER
WINDOW ZONE
SILL MEMBER
SEALING STRIP
G. SILL
MAX 1" LEVELLING PACK
2 1/2"
9.
ADMEL 7013

236.


11" STRUCTURAL BRICK WALL
ALTERNATIVE FRAME POSITION
D.P.C
MAX 5/8" PACK
WINDOW ZONE
FIXING CRAMP
JAMB MEMBER
VERTICAL SEAL
12.
R.H.S DROPPER
MAX 1/2" PACK
WINDOW ZONE
VERTICAL SEAL
JAMB MEMBER
15.
MAX 1/2" PACK
WINDOW ZONE
VERTICAL SEAL
JAMB MEMBER
11" STRUCTURAL BRICK WALL
RIGID INSULATION OR INSULATED INFILL
CLADDING ANGLE (SSC)
WINDOW ZONE
JAMB MEMBER
MAX 5/8" PACK
VERTICAL SEAL
D.P.C
21.

Chapter 23

CONTROLLING COSTS
THE DEVELOPMENT OF COST PLANNING

No discussion of the Hertfordshire schools could be complete without a mention of the pioneering work done by the Quantity Surveying Section of the County Architects Department. The techniques of Cost Planning and Cost Analysis which were devised to assist cost control in the design of schools have a direct relationship with the development of system building. So successful were these methods that Cost Planning is now common practice throughout the quantity surveying profession.[1]

James Nisbet, who, at Johnson-Marshall's invitation joined Hertfordshire after six years of war service, found the existing systems of cost estimating (based on a figure per cubic foot) a handicap:

> when I asked how the figure was arrived at I was told not to worry about that as it came from experience, and it was this that put me on to the idea of analysing building costs. I started to collect and analyse the costs of similar buildings for comparison.[2]

Nisbet spent two important years in Hertford, years which he found, in his own words, to be "very interesting and stimulating, largely I think because of associating with the architects, a bunch of chaps full of enthusiasm for building a new kind of world." He then moved for a short spell to widen his experience with the firm of Gardiner and Theobald and thence to rejoin Johnson-Marshall, Medd and Crowley who had by now all moved to the Ministry of Education.

It was at the Ministry that Nisbet and Medd were able to test the idea of "elements as being the basis for making a comparison... (based on) experience with costing prefabricated schools in Herts."[3] The investigations led directly to the first publication on Cost Analysis and Cost Planning: Building Bulletin 4, in 1951.[4] The essence of BB4's philosophy was that, as cost analysis and cost planning "was based on post-mortems and wasn't making a contribution in the design sense... why not use this information... to build schools at the figure per place we were being allowed."[5]

The initial reaction of the quantity surveying profession to BB4 was unfavourable. It seemed that many believed it would give them more work for the same fee.[6] However, the Ministry work which Nisbet was engaged on soon advanced from cost analysis to cost planning and finally to the production of an elementally structured bill of quantities; Nisbet relates:

> in this we were much helped by Ivor Tomlin, an enthusiast from Howard Farrow and Clifford Nott, with whom I had worked at Herts and was now working there under Tatton Brown and on the same lines. He and I can never decide which of us produced the first elemental bill.[7]

The Elemental* Bill upset the surveying profession even more, being a complete change from conventional procedures; in Nisbet's view:

> they were certain that it would cost more money to produce. The RICS set up a special committee to kill the elemental bill. The battle I think was basically a private versus public service argument.[8]

In April 1954, J.G.Osborne read a paper to a General Meeting of the RICS.[9] In the discussion which followed, Nisbet "put his finger on the only real weakness in the storey enclosure approach to the problem. He asked whether (if the walls, floors and roofs were all going to be measured separately) it would not be simpler and more accurate to price each separately according to an assumed specification."[10]

This was the essence of the elemental approach to cost study. Briefly, the principle of cost analysis, the examination of the cost of projects already built, involves each item in the bills of quantities being distributed among one or more elements. After every item has been disposed of in this way, the sum of the elemental totals should equal the total tender figure. Ideally, the bills should be prepared with this eventual process in mind, thus making analysis much simpler by obviating the need to refer to abstracts or dimensions. Even the standard order of billing may be retained provided that the main elements are kept separate within each trade or section of trade. Cost planning, which uses the information gained from cost analysis to maintain control over costs on current projects, works in reverse: by dividing the building into its major components, or elements, measurement may be done from design plans. The elements are priced separately

---

* The latest edition of BB4 defines an element as "a part of a building with cost significance, which always substantially performs the same function or functions irrespective of the building's construction." For example, whatever the shape or form of a roof may be, and whether the construction is felt on timber or asphalt on concrete, the function remains <u>roof</u> and all items forming any part of a roof will always be analysed under the element of <u>roof</u>.

and the costs aggregated to total the estimate. Having arrived at a target price for each element, i.e. the Cost Plan, the working drawings may be checked element by element and a running cost check made instead of having to compare the whole building with a cost estimate.

The pure elemental bill, according to Ferry, "where each element is dealt with in turn irrespective of trade headings, is so unpopular with estimators that it is not really suitable as a tendering document under ordinary circumstances."[11] Aware of this problem, Hertfordshire pioneered an arrangement in which each trade, in each element, is printed on a separate sheet and coded so that the bill may be shuffled into either trade or elemental order at will. This simple but ingenious device enabled bills to be sent out in trade order for tendering and re-sorted into elemental order for subsequent analysis.

By 1954 several official departments had followed the initiative given by the MOE and Hertfordshire, notably the Works Directorate of the War Department, whose functions were later transferred to the Ministry of Public Buildings and Works.

Hertfordshire gave a further impetus to the new science of Cost Study when, in January 1955, C.M.Nott, the Chief Quantity Surveyor in the County Architects Department gave a paper to the Bedfordshire and Hertfordshire Branch of the RICS. Entitled A Method of Cost Analysis and Cost Planning,[12] Clifford Nott's paper described the development work in this field that had been done by Hertfordshire, based on the recognition that "a local library of cost information for either effective estimating or cost planning" was essential. Nott observed that "a few jobs carefully analysed are all that are needed". The paper illustrated the Hertfordshire method with two cost analyses of recent primary schools, using the Element Headings favoured by the county. The list is presented in Appendix 2 to the present study.

Nott attempted to forestall the criticism of his professional colleagues by remarking:

> Having accepted that cost planning is necessary, the cost of preparing bills of quantities in accordance with the new lay-outs should be compared with the total cost of preparing the normal bills by trades and then following up with the analysis by elements after tender stage. It has been found that the elemental bill will show a saving in cost in view of the reduction of abstracting time, and the better use of junior staff.

The essential relationship between the bills and the drawings which Hertfordshire had recognised was stressed:

> The new lay-out for bills of quantities undoubtedly has an effect upon the future of architects' drawings generally, as it seems logical to arrange the drawings in groups under similar headings to the bills of quantities with the usual plans, elevations and general arrangement drawings to ½-inch or similar scale, with the specification prepared in a parallel form. It would be advantageous if the drawings (and specification) are devoid of information irrelevant to that section, and the taker off can see clearly the extent of the particular work he is measuring. The architects... have already prepared drawings and specification in the suggested modified way for a programme of secondary and primary school buildings all of a similar form of construction, and a saving in time is also expected on this.

Nott concluded his paper with a plea for wide consideration to be given to grouping of information and standard specifications of building materials under some common headings, "and it may well be (such) headings will eventually be allied to the elements headings in bills of quantities for new works not only of schools designed on a modular part-prefabricated system, but of all works built by any method of construction."

Six months later the same Branch moved a resolution at the triennial conference of the RICS (Quantity Surveying Section) suggesting that the profession should "devise methods of examining analytically the cost of building and should prepare methods of applying such analyses to the control of cost at the design stage."[13] The resolution was supported by senior surveyors in public service but was carried by only a small majority. Nevertheless, the Chairman made a point of saying that the resolution, together with the views of those who had spoken on it, would be considered by the Quantity Surveyors' Committee.

Whilst the RICS published nothing, the RIBA gave its support, as did The Builder; but the Architects Journal gave the strongest lead of all. By introducing the weekly Building Studies, each of which was accompanied by a cost analysis, the magazine created a feature unique in architectural journalism. The first of such studies, that of a Hertfordshire secondary school, appeared on 24 February 1955,[14] and the first Cost Comment on the 4 August in the same year.

The AJ's pioneering study was developed with the help of the Hertfordshire County Architects Department and for the following seventeen years two Hertfordshire quantity surveyors, Ken Norman and Derek Stracey took it in turns to write Cost Comments each week.[15]

During 1956, following a report of a steering committee, the

Council of the RICS decided to set up a Cost Research Panel, thereby taking the first step in introducing the technique of elemental cost planning to the profession as a whole. Efforts to standardise cost analysis by means of a uniform set of rules were hampered by the difficulty of defining a fixed set of independent functional elements, indicating that standard cost analyses are inevitably a compromise between functional division and the ease of producing useful data.

Various authorities produced their own elemental breakdown according to the practical needs of the work they were mostly engaged on; some preferred to show Preliminaries as a separate item, others made a separate element of the frame. The policy of Hertfordshire differed from others most notably in the combination of the Finishes with the relevant functional element or structural item. The AJ, despite its Hertfordshire connection, grouped the cost of finishings to internal walling in other elements, but included the complete cost of self-finished partitioning in a "partitions" element, making elemental costs not strictly comparable. This difficulty did not arise with the Hertfordshire approach.

It was not until December 1969 that the first Standard Form of Cost Analysis was published by the Building Cost Information Service of the RICS. For comparative purposes the simple yardstick of cost, expressed per unit of floor area, has always been found to be satisfactory: "quantity factors" and the "elemental unit cost" are used to supplement the cost per unit of floor area information. Quantity factors for area of external walling and windows to floor areas are expressed as ratios, making possible comparisons with other buildings or alternative solutions. Elemental unit costs must be accompanied by specification notes indicating the standards obtained, which would not be apparent from the cost per unit of floor area.

We have seen in brief the early history of the Cost Study philosophy which was to inform the work of not only Hertfordshire, but the entire national schools programme during the period under review and since. It remains to examine the results of these efforts and to see how Hertfordshire's performance in this field compared with the national average.[16]

Graphs A and B (fig.237) show the rise of building costs, represented by the average hourly wage rate for building tradesmen, in relation to the rise in MOE/DES Cost Limits. Despite the impossibility of plotting the curves on strictly comparable scales, they indicate the disparity which effectively made the problem of keeping within cost limits progressively harder; the percentage increase over the whole period is given.

Graph C shows the dramatic drop in area per place which followed the introduction of the 1951 cost limits, but thereafter holding steady at 42-48 sq.ft. per place. This figure was constantly in excess of the MOE minimum and, indeed, the national average (fig.238).

Thus higher space standards were maintained despite rising costs and relatively diminishing allowances, making Hertfordshire's cost performance a double achievement. The factors which contributed to this containment of costs have been discussed in previous Chapters and may be summarised under the following headings:

1. Cost analysis, enabling the best value for money to be obtained.
2. The reduction of volume and plan area down to the levels of functional requirement, so avoiding wasted space.
3. The use of system, or industrialised building, techniques which though "not necessarily cheaper than traditional forms of construction (were) capable of quick erection undoubtedly saved time and money in those areas where traditional types of building labour, such as bricklayers, plasterers and carpenters are scarce."[17]
4. A scientific approach to fire safety: by planning and constructing schools to avoid expensive precautionary measures such as additional staircases and expensive fire resistance in the structure.
5. Constant research into cheaper and more efficient building services installations, avoiding expensive ducts by the use of floor and roof spaces.
6. Recognising that children require smaller fittings, sanitary fixtures and furniture, saving material costs over full-size items.
7. A design and construction approach that was almost entirely functional, every part of the building being designed, above all, to do its job without traditional ornament or whimsical architectural effect.

In the final Chapter an attempt will be made to evaluate the results achieved by this total approach to architecture in terms of the philosophy of the Modern Movement.

Notes to Chapter 23.

1. Douglas J.Ferry, Cost planning of buildings, 2nd.ed., 1970, p.12.
2. Gontran Goulden, "Quantity with quality". Building, vol.234, 10 February 1978, p.68.
3. Ibid.
4. Ministry of Education, Cost study, Building bulletin no.4. HMSO, 1951.
5. Goulden, op.cit.
6. Ibid.
7. Ibid.
8. Ibid.
9. J.G.Osborn, "A new approach to single price-rate approximate estimating". Journal of the Royal Institution of Chartered Surveyors, vol.33, April 1954, pp.810-824.
10. Ferry, op.cit., p.11.
11. Ibid., p.43.
12. C.M.Nott, "A method of cost analysis and cost planning", Journal of the Royal Institute of Chartered Surveyors, vol.34, May 1955, pp.919-928.
13. Ferry, op.cit., pp.11,12.
14. "Secondary school in Barnet Lane, Barnet," AJ, vol.121, 24 Feb.1955, pp.265-278 and 284.
15. "The Norman period," AJ, vol.155, 19 April 1972, p.827.
16. Ministry of Education, The story of post-war school building, Pamphlet no.33, HMSO, 1957, pp.59-64. (data up to June 1956)
17. Ibid., p.53.

Figures 237 and 238.

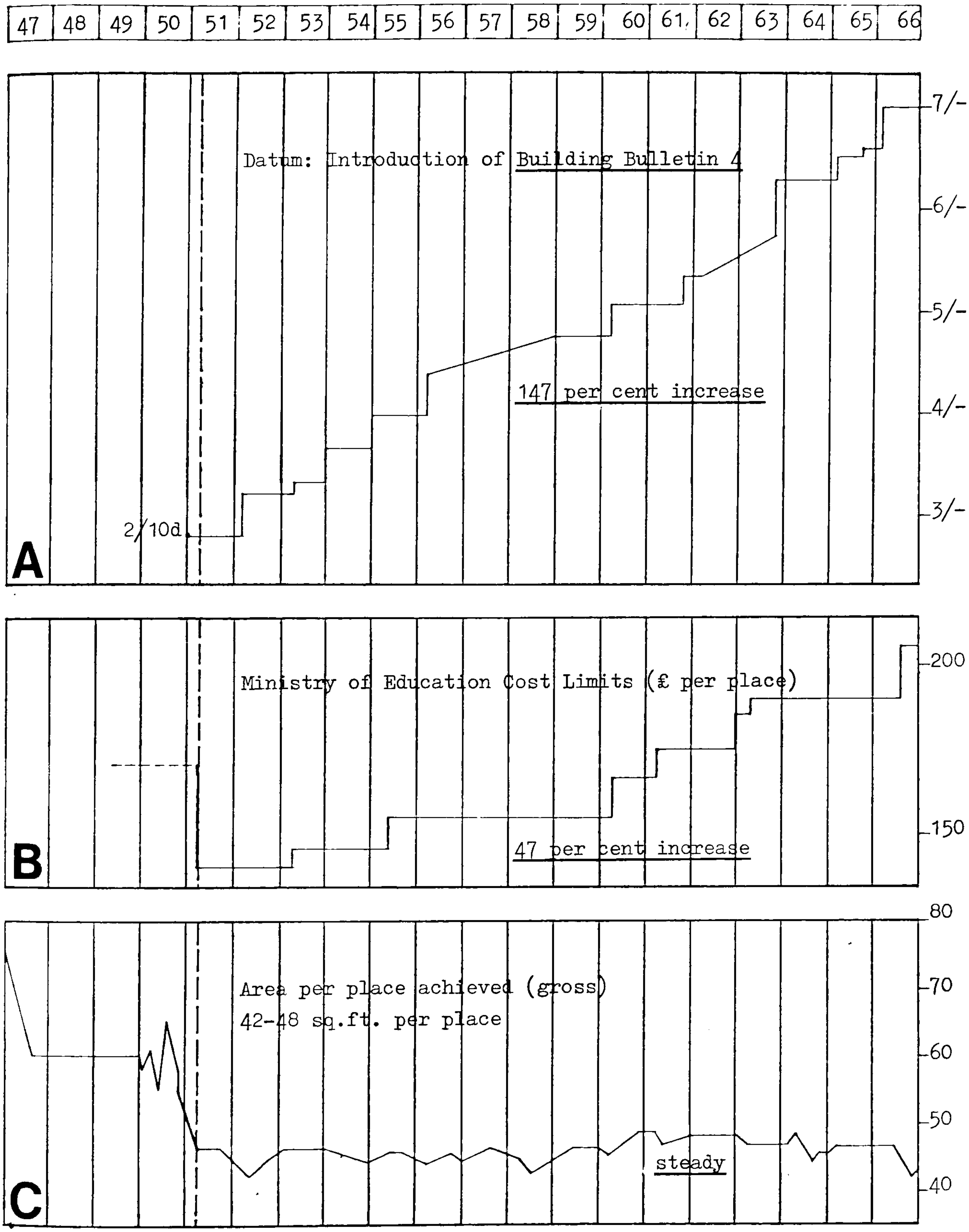
A. Wages increase: from 2s 10d to 7s per hour.

B. MOE/DES Cost limits: from £140 to 206 per place.

C. HCC Area per place achieved: 42-48 sq.ft. per place.

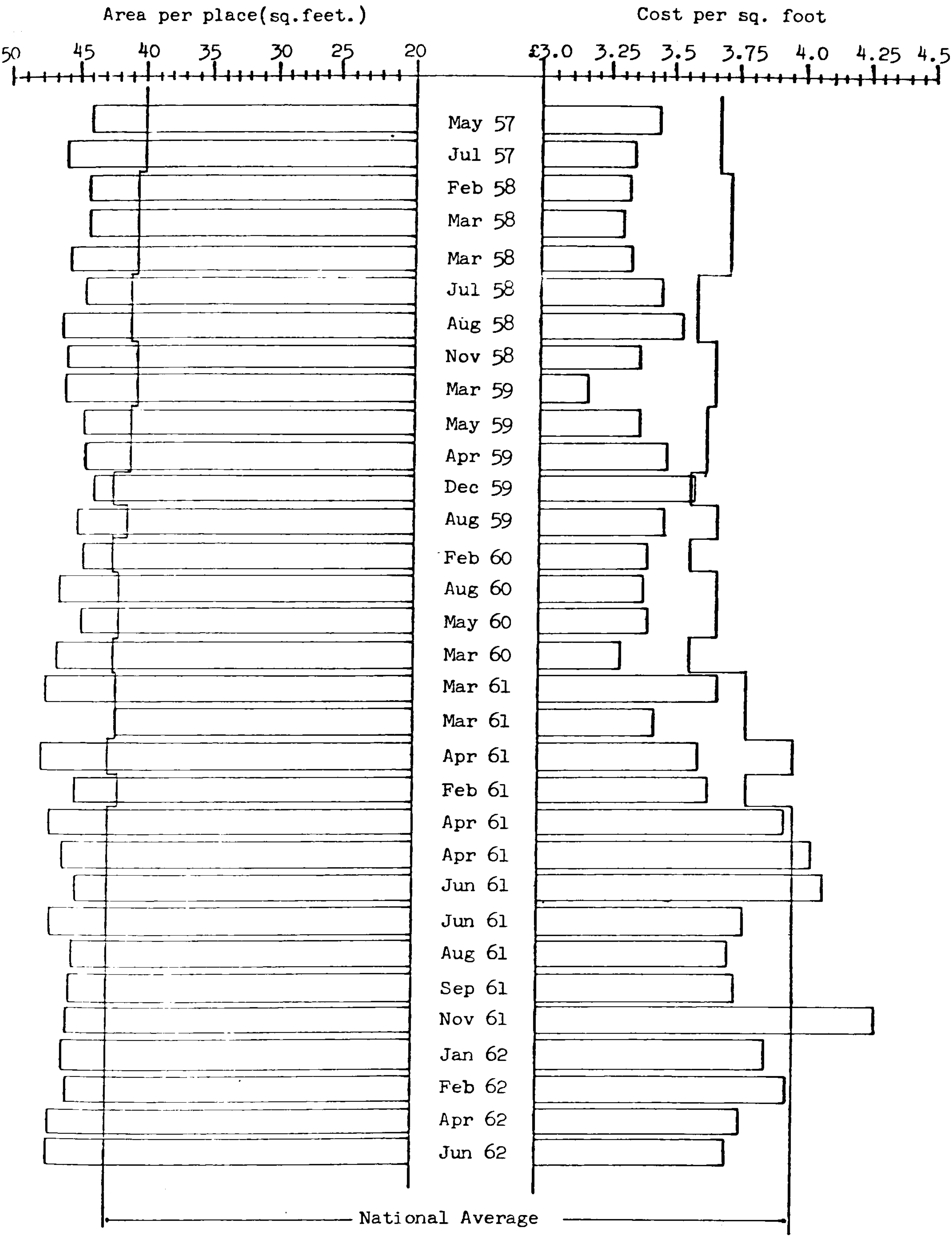
Data from HCC County Architects Department, Quantity Surveying Section (Graham Hayward, 1967).

238. HCC primary schools 1957-62: area per place and cost per sq.ft. compared with national average.



Hertfordshire County Council: Costs/ Allowances/ Area achieved. Fig. 237.

HCC PRIMARY SCHOOLS 1957 to 1962



238.

Chapter 24

THE DEVELOPMENT GROUP IDEA AND THE FORMATION OF THE SOUTH EASTERN ARCHITECTS COLLABORATION

In her study of local authority building, undertaken on behalf of the Royal Institute of Public Administration,[1] Elizabeth Layton included a remarkably comprehensive and perceptive account of the role of Research and Development in building. Outlining the growth of the Development Group idea, her conspectus gave prominence to the work of the MOE in the field of design and cost control of schools, work which had (in 1961): "been going on for ten years and has proved so successful that it is being extended to other government departments ... this pioneer work, starting first in the Hertfordshire County Council and moving thence into the Ministry of Education and then out again to local education authorities in general, has been of great importance."[2]

We have seen earlier how the development process in Hertford originated and much has been written about the work of the Ministry's Architects and Building Branch. Set up in 1949, the development group of the Branch was formed "to study changing educational requirements and their effects on school buildings, and to develop building techniques applicable to new schools in existing conditions."[3] Such terms of reference could not have applied more precisely to the aims of Hertfordshire. The development group's approach was similar to that of the County, indeed, the group "contained a number of those who had worked in Hertfordshire till 1948, and there has since been some interchange of staff between the group and the County Architect's Department."[4]

Commenting on the relationship between Educational and System development in 1975, the organisation for Economic Co-operation and Development (OECD) uses the Branch's work as a prime example and observes:

> Indeed, as a matter of interesting historical fact, the first initiatives for "educational development" ... were made not by educationists themselves, but by architects (of Hertfordshire County Council, England, in 1948-49) seeking to develop an industrialised alternative to bypass the labour shortages in conventional building and who found themselves unable to design an industrialised system without first finding out what kind of buildings education required it to produce.
>
> An educational development group is desirable, even when no system

development is needed. But satisfactory system development is inconceivable without the support of an educational development mechanism.[5]

By the early sixties similar development work was being carried out by groups in the Ministry of Works, the War Office, the University Grants Committee, the Ministry of Health and the Ministry of Housing and Local Government.[6] In addition, work of similar nature was going on in establishments such as the Building Research Station.

On the nature of development work it has been said that:

> the underlying motive power might be called constructive scepticism: scepticism because it seeks first to question all accepted assumptions; constructive because it believes that, by analysis and experiment, a better solution can often be found than the best current answer.[7]

It tries to tackle problems as a whole and not piecemeal. With controlled and finite objectives, there is no question of "going on" or "spending on" until a perfect or ideal solution is found: the constraints of cost and time make it necessary to organise resources to give optimum results within given terms of reference.[8]

And of the men and women engaged in such work:

> Developers are "naturals" and comparatively rare. They tend to be what they are by reason of temperament, rather than as a result of their education or professional training. Perhaps their most important characteristic, apart from professional skill is a sustained spirit of curiosity and enquiry, coupled with a strong desire to see their work produce practical results.[9]

The establishment of development groups was one of the most fruitful lines of progress in building design and cost control.[10] However, in none of them were local authorities directly involved, except as clients. Hertfordshire was an exception in this regard until 1957 when the organisation known as CLASP, the Consortium of Local Authorities' Special Programme, was formed. The initial contribution of CLASP was twofold: technical and organisational. The system of construction the consortium devised was not greatly different in principle from Hertfordshire's, except in its approach to foundations.[11] Faced with the difficulties of building schools in areas of mining subsidence, where the costs of special foundations were very heavy, a method nicknamed "rock and roll" foundations was initiated which, together with the use of a spring-braced steel frame provided a brilliant and economical solution.

More important was the way in which the group of local authorities pooled their resources, combined their orders and secured benefits in more intensive technical development, lower costs and better design. Interest in the system and in the organisation of the consortium was sufficient for a complete school to be erected in Milan as the United Kingdom exhibit at the twelfth Trienale in 1960. It achieved instant international recognition when it was awarded the gran premio con menzione speciale. European observers were astonished that the school "was not an isolated showpiece specially designed to an abnormally high standard for the purpose of winning awards."[12] That it was a straightforward production model, designed to normal Ministry cost limits and exhibited as "a typical example of the high standards now being widely achieved under Britain's school building programme"[13] honoured many more than its Nottinghamshire architects.

It was a tribute to all who had made the new approach possible; not least it was a belated honour to the pioneers in Hertfordshire. The Nottinghamshire County Architect was Donald Gibson when CLASP was formed. Gibson, who had been responsible for the replanning of Coventry, had a reputation sufficient to attract from Hertfordshire both Henry Swain and Alan Meikle, who together formed the nucleus of the CLASP development team. They were later joined by Dan Lacey, who had been co-designer of the Essendon JMI School in 1947. All three eventually rose to the top position in County offices; if their Hertfordshire connection was instrumental in their success then so be it. It is invidious to single out the personal contributions made by individual architects in the history of this subject, but what is certain is that the influence of the ex-Hertfordshire architects who made their way in other organisations has been profound. Henry Swain, the present Nottinghamshire County Architect said in retrospect:

> We like to think that we continued what the Hertfordshire Schools Group started under Stirrat Johnson-Marshall, David Medd, Mary Crowley, Anthony Cox, and others who really got the thing going in 1946-47. Most of the ideas have been with us since AA days with Arthur Korn, Walter Segal and Felix Samuely. I well remember a student visit to the Herts schools, and Arthur Korn pointing out the nearly finished Essendon School and saying (and you know he had the authority of the Bauhaus about him): "Take a look at that - that's the new architecture", and I've still got that vision of the light steel prefabricated building sitting lightly on the ground. My immediate ambition was to go and work in Herts ...[14]

The success of the CLASP organisation led to the formation of the Second Consortium of Local Authorities, SCOLA, in 1961. Inevitably the question of Hertfordshire's involvement in a consortium had to be seriously considered.

Thus in the Autumn of 1961 the Hertfordshire County Council formed a small panel of Members to investigate aspects of building, particully economic factors. A paper on Hertfordshire and CLASP was prepared by the Deputy County Architect and submitted to the panel and also sent to the Ministry "as representing Hertfordshire's views as to the desirability of entering into a consortium": the Ministry had recently expressed the wish that the county should enter into and lead a consortium. The paper concluded that since Hertfordshire's annual programme still exceeded that of the combined CLASP member programmes, there would be no financial advantage to the county.[15]

In January 1962 Donald Gibson, now Chief Architect to the War Department, invited the county's representatives to a discussion with those of CLASP, SCOLA, the MOE, the Ministry of Health and his own department, with regard to the possibility of an interchange of development information. Hertfordshire welcomed the idea though still resisted the pressure to join a consortium. It is probably true that the county had, at that time, more to offer than to gain from such a relationship. Within the Architects Department as a whole there was little enthusiasm for the idea: there had always been satisfaction in making personal contributions to group effort and the autonomy of the department was cherished by most architects. It had meant having the freedom to react quickly to circumstances with the minimum of unnecessary interference from outside; most realised what could be at stake if they were to become partners in a consortium which would inevitably be huge and cumbersome by comparison with the organisation they knew.

Kent County Council Architects Department, under E.T. Ashley-Smith, was known to have commenced building on modular lines, using the 3'4" grid, and a suggestion had been made that Kent should start a south-eastern consortium. Ashley-Smith described events thus:

> the most fruitful (advice) was the suggestion to team up with Hertfordshire. This seemed an excellent but unlikely proposition, since Hertfordshire had not then entered into any such collaboration, but at that very time it seems that War Office Eastern Command was pursuing the same idea and approaching Hertfordshire

> about a link-up. After deliberation, collaboration was formed between Hertfordshire, Kent and the War Office...[16]

And so Hertfordshire, almost reluctantly, assumed the leadership of SEAC.[17] As a starting point for this association, Hertfordshire made their full range of standard drawings and related documents available to the other two members. From this point on, system development was shared and standard drawings, ranges of components and other technical information for common use was produced jointly.[18] Towards the end of 1964 the scope of the association was widenened to include authorities, "whose building requirements were too small or sporadic for them to accept full membership conditions" to enable them to take advantage of consortium arrangements. Furthermore, conditions for Associate Membership were agreed and the Department of Education and Science (which had until recently been the Ministry of Education) joined to act as agent for local authorities outside the area of the three county members.

Inevitably the leading position which Hertfordshire had played in the organisation initially was reduced and, when a Central Development Group along CLASP lines was established with headquarters first in central London and then at Epping, development became divorced from production and the schools were no longer "Herts" in the true sense that the world had known.

Certainly fine education architecture continued to be built by the County Architects Department using the SEAC systems, but apart from the development of furniture and equipment, fittings and fixtures and various sundry items all standard drawings now came into the department from "outside".

There was undoubtedly a sense of loss and the feeling that an era had ended rather than that some exciting new enterprise had begun. Nineteen sixty-four brought with it a change of central government and change was in the air: all of a sudden the Ministry of Education became the Department of Education and Science (DES), the London County Council was reborn as the Greater London Council and many similar transformations occurred in the next six years or so.

Generally the changes and reforms reflected confidence in growth, technology and continuing prosperity. Many architects found the new methodologies of planning, industrialisation, information science, cybernetics, and even metrication, compelling; but increasing minorities were alarmed that the industrial society was rushing methodically towards total environmental disaster, irrespective of which political party held power.[19]

In the mid-sixties the national housing programme gathered momentum and system building took some new directions, many of which were to be bitterly regretted. Now, with hindsight we can observe a paradox: that system building made a notable contribution to producing first-rate schools, but, in the main, failed to produce satisfactory housing. And the question must be asked: why?

Perhaps part of the answer lies in the fact that the architect, through the Development Process, was able to control the standards and directions of school construction systems, ensuring that Education needs were never lost sight of. By contrast, in Housing it was the big contractors who, in the main, controlled the direction of system building. That the former was rooted in the needs of people, and the latter in the interests of large-scale production, goes some way to explain the disparity of satisfaction expressed today in these two great areas of British post-war building.

Notes to Chapter 24.

1. Elizabeth Layton, Building by local authorities, 1961.
2. Ibid., p.316, 317.
3. MOE Building Bulletin 19, The story of CLASP, 1961, p.8.
4. Ibid.
5. Guy Oddie, Industrialised building for schools, 1976, p.62.
6. E.Layton, op.cit., pp.314-357, passim.
7. Office of the Minister for Science, Report of the Committee on the Management and control of research and development, (Zuckerman Report), Appendix 5, p.123.
8. Ibid.
9. Ibid., p.124
10. E.Layton, op.cit., passim.
11. MOE Building Bulletin 19, 1961, p.26; See also "The CLASP system," AJ, 30 April, 1959, pp.645-65.
12. MOE Building Bulletin 19, p.3.
13. Ibid.
14. Gontran Goulden, "Practice made public." Building, 13 January, 1978, pp.57 and 59.

15. HCC Group Architects meeting no.23, 6 Oct. 1961, item 23/8(i).

16. E.T. Ashley-Smith, "The history of SEAC" RIBAJ, May 1961, p.199.

17. The collaboration formally began in April 1963.

18. SEAC: First report, published by the consortium in March 1966 contains full technical summaries (and elemental cost targets) of the Steel, Brick and Concrete methods, as well as those Basic Components which were interchangeable between the three. See also "SEAC: the first five years," Journal of the Society of Architectural and Associated Technicians, Sept. 1969, pp.3-8.

19. For the wider architectural and town planning scene see Lionel Esher, A broken wave: the rebuilding of England 1940-1980, 1981, pp.56-71. In similar vein, but with more substance, John Carter reflects on the years 1946-76 relating their architecture to political and literary events in a thirty-year chronological guide, "To endless years the same?" AJ, 6 October 1976, pp.627-61.

Chapter 25

HERTFORDSHIRE AND THE MODERN MOVEMENT, AN ASSESSMENT AND CONCLUSIONS

In the period under review, 1946-64, Hertfordshire County Architects Department designed and built over three hundred major education projects; a rate of one new school or major instalment of a school every twenty-three days.[1] No two plans were ever the same; moreover each year's agreed programme was built within the limits of both time and cost. The record is remarkable and the achievement demands evaluation as a whole, particularly in the light of present-day attitudes towards system building generally.[2] It could also be considered of significance to those parts of the world where social needs and available resources are considerably more divergent today than were those of Hertfordshire and Britain in 1945.

We need elaborate no further on the usefulness of a product which was highly regarded by educationists at the time,[3] however true it may be that latter-day requirements have changed and that priorities have shifted. Colin Ward has suggested that, "in the next decade of British schools, their susceptability to alteration, adaptation, transmutation ... may be the quality we admire most."[4]

On the whole the Hertfordshire schools have not so far shown themselves to be unresponsive to such alteration and there is no reason to suppose that they would fail if put to further tests. With their lightweight, framed construction the scope for moving internal walls about is almost limitless. Designed in an era of cheap fuel, it is perhaps more in the matter of energy conservation that they may be found wanting; even so, there are ways of increasing their thermal insulation value at reasonable expense.[5]

The time may come when population changes force some of the schools into redundancy, but this is a risk every building must take; it is up to the policy makers and the imagination of their advisers to find appropriate uses for such structures in the future. No building can be both *efficiently* designed within the economic limits of its time and be expected to be infinitely adaptable to undefined future needs.

The fact that Hertfordshire kept within Ministry cost limits and at the same time provided an area per place in excess of the norm, despite continually rising prices, places the cost efficiency of the system approach beyond question. That is, until maintenance is taken into account: for the delight of the educationists in the larger teaching areas should be measured against the ever vexing question of capital versus running costs. Colin Ward sums up the relationship succinctly:

> The continual search for ways of achieving quicker, cheaper means of construction and of reducing costs through the bulk purchase of standardised components has not necessarily been made at the expense of flexibility or quality of design. But the use of building systems in a regime of rigorous cost control is rather like the introduction of the potato as a staple diet in a peasant economy. It reduces the peasantry ... to a potato level of subsistence. Introduced to cope with particular situations - the need for school accommodation in Hertfordshire after the war ... inevitably they become the norm against which the initial cost of alternatives was judged. What do not enter into the initial calculations are the likely costs of maintenance over the years of the building's life.[6]

There is little purpose in making a detailed evaluation of the schools against criteria which have been directly or indirectly derived from Hertfordshire's own experience. For example, the OECD Programme on Education Building[7] has identified six benefits to be derived from the use of industrialised building which may be summarised thus:

a.) The extension of the building industry's potential.

b.) Cost advantages, depending on the system used.

c.) Savings in construction time.

d.) Savings in pre-contract time.

e.) Predictable quality and cost control.

f.) Facilitation of bulk purchasing for increased cost savings.

Thus if it is true that "the prime justification for the use of industrialised building systems is the inability of the building industry to meet demands without them"[8] then Hertfordshire's decisions in 1946 were fully justified; the other benefits can only be described as tautologous.

Interestingly enough the OECD paper identifies just one danger: "the pressure for industrialised building systems to replace alternative modes of building remain strong and possibly inexorable." We have seen how, just when the building industry in the mid-fifties was becoming capable of alternatives, the pressures for sticking to "light and dry" system construction indeed proved inexorable.

However, a further characteristic, which in the main acted as an advantage, can be postulated: that of design tutor. It is probably true that few designs qualify as individual architectural masterpieces but, by the same token, many must have been saved from indifference, if not disaster, by the qualities and limitations of the system in which they were built. The sort of democratic working methods we have seen could not guarantee consistent design ability. Thus, as a didactic tool, the system and its development methodology were invaluable: a raw young architect could, by implementing a standard detail prepared by a more experienced colleague, who had in turn drawn on the collective wisdom of the group, act with an assurance beyond his years.

This is not to say that details never failed; rather, that mistakes were seldom repeated and architects certainly did not each have to make similar mistakes in order to learn. Certain skills perhaps atrophied through being irrelevant to the development methods but others, in particular those of organisation and administration developed strongly. Many an ex-Hertfordshire architect has been grateful for the disciplines learned in the county office.[9]

The role of Development as a clearly identifiable design activity was, as we have seen, a fundamental aspect of the Hertfordshire approach. System Building as an ever changing response to an ever changing challenge is the child of Development, in the sense we discussed in the previous Chapter. Without Development Hertfordshire could only have had a stagnant system and without the system their objectives were unattainable.

It remains now to examine Hertfordshire's relationship with the Modern Movement and to make an interim assessment of their place in the history of architectural ideas.

As early as 1962 the Ministry of Education declared that Cheshunt is "in many ways one of the most important post-war British Buildings. Certainly its influence on the subsequent development of other systems of prefabricated school construction has been profound."[10] There seems to be no reason to change that view, only to emphasise it and observe that Cheshunt, in the company of several other schools, may be now worthy of consideration for statutory listing as a building of Special Architectural or Historic interest.

It should be axiomatic that a building of such seminal significance must have an important position in the history of modern architecture. One may ponder on why it is then that Cheshunt and the Hertfordshire Schools in general have not been given in recent writings on architecture the prominence which they appear to deserve.

Whilst it is true that the schools have often been mentioned in passing by historians and critics from Banham to Pevsner, more often than not they have been used to make points quite unconnected with the schools themselves. A good example of such an occurrence and one which sheds light on their nature can be found in David Watkin's controversial book Morality and Architecture where, in discussing an argument within an argument, we find the essence of Hertfordshire defined almost inadvertently. Quoting the celebrated RIBA lecture of 1957 wherein Sir John Summerson proposed that "the programme (acting) as the source of unity is, so far as I can see, the one new principle involved in modern architecture .... It is part of my case for a theory of modern architecture that it is the source."[11] Watkin then goes on to say:

> Significantly, the inadequacy of this view was exposed by a historian, Reyner Banham, and by an architect, Peter Smithson, in the discussion which followed Summerson's lecture. Banham pointed out that "when Gropius was thinking about the Bauhaus teaching programme he thought of it in terms of neat rectangular rooms or drew rectangles and circles connected by long straight lines, like the circulation diagram of a Hertfordshire school. Once you started to think about the programme of the building you were committed to a set of symbolic forms."

Watkin continues with the claim that:

> Smithson put the same fundamental point in a more general way: "To say that you can evolve a form from a social programme or from an analysis of the situation in terms of flow and so on is meaningless, because analysis without the formal content, the architects particular specialisation, has one factor missing from it."

and concludes:

> The comments of Banham and Smithson go some way to demolishing what we have called the morally insinuating and widely disseminated argument that modern architecture exercises some special unassailable claim over us since it is not a "style" which we are free to like or dislike as we choose, but it is the expression of some unchallengeable "need" or requirement inherent in the twentieth century with which we must conform.[12]

The core of Watkin's argument is that "modern" is just another style and has no inevitability rooted in twentieth century life. The use of the Hertfordshire schools in the argument is fascinating because of the series of apparent contradictions which surround it. On reflection it seems that Reyner Banham and Peter Smithson are not in fact making the same point: Banham was shedding light on Bauhaus methods, whereas Smithson was denying their efficacy.

What is of interest to us here is Banham's key phrase: "like a Hertfordshire school." Banham's acknowledgement of the Hertfordshire achievement is established elsewhere. Peter Smithson, on the other hand, was the architect (with his wife Alison) of the brutalist Hunstanton school, the most extreme example one might find to illustrate the antithesis of the Hertfordshire approach.[13] Just as Banham has to some extent, and perhaps unintentionally, defined the Modern Movement in terms of the Hertfordshire schools, so has Watkin contradicted his own thesis by enlisting Banham's remarks.

All of this tends to reduce the schools to mere ciphers in the word play of brilliant writers, but one is forced to wonder just how well the Hertfordshire methods were understood.

How then can one pinpoint the significance of the schools in the history and philosophy of architecture? The grounds on which Banham elsewhere faulted the Modern Movement most convincingly was its failure to "grasp the mind of technology, they produced a Machine Age architecture only in that its monuments were built in a Machine Age, and expressed an attitude to machinery ..."[14] Like a poetry of technology it had captured its spirit, if only superficially and somewhat self-indulgently. For facing the full brunt of functional demands and technology was not, and is still not easy: it is always tempting for the designer to fall back on "art" and take refuge in style. Christopher Alexander highlights the incipient danger of poetic attitudes towards machinery:

> In this atmosphere the designer's greatest gift, his intuitive ability to organise physical form is being reduced to nothing by the size of the tasks in front of him, and mocked by the efforts of the "artists". What is worse, in an era that badly needs designers with a synthetic grasp of the organisation of the physical world, the real work has to be done by less gifted engineers, because the designers hide their gift in irresponsible pretension to genius.[15]

As far as Hertfordshire is concerned, the mainsprings of their achievement lay not in any art-historical or philosophical context but in the organisation of activity directed, quite simply, towards providing school places for children. Only marginally was the group effort consciously influenced by any plastic theory of architectural form.

The writing on the schools by those who have at some time or another been directly concerned with them are noticeably short on architectural theory. "Architecture with a capital A" was the contemptuous phrase so often heard at County Hall, indicating the suspicion with which all architecture which placed style above user considerations was held. For the Hertfordshire team the architecture of the schools existed in itself and was not the by-product of, or the justification for, any generalised theory of design.

Whether or not Watkin intended the reference to the schools to support his contentions per se is of less importance than his discussion of architecture as an instrument of social policy, "employed to achieve supposedly 'moral' ends."[16] His interesting and largely successful efforts to demolish the notion of morality implicit in modern design are, for him, epitomised in his quotation of Sigfried Giedeon: "contemporary architecture takes its start in a moral problem ... (and where it) has been allowed to provide a new setting for contemporary life, this new setting has acted in turn upon the life from which it springs. The new atmosphere has led to change and development in the conceptions of the people who live in it."[17]

Few buildings of the Modern Movement have come, in their realisation, anywhere near the functional ideals of the Bauhaus or the pioneers. From the Fagus Works to Highpoint 2 the programme had at least got Smithson's "one factor" added to it, and often more. Sir Leslie Martin, recalling the events of the 1930s remarks that what had been achieved by 1939 was, above all, the idea that "designing a building was no longer a question of imposing an applied form. In every problem ... the appropriate form could be discovered in the problem itself."[18] Martin observes, too, "the possibility of applying these design ideas to the established social programme in housing and the developing educational work."[19] Which is just what, in Martin's view, a new generation in the late 1940s did.

We have seen that Hertfordshire's method of discovering the "appropriate form" was qualified by urgency. Starting as they did with an existing technique, the Hills frame, they modified it not in order to apply the design ideas of the pre-war period but because the programme demanded it. And so it was with every step in the development we have followed. The fundamental role of Hertfordshire was thus one of proselytiser: not component designer but component modifier, and the fundamental contribution to history was the organisation of the process with a capital "O".

The moral question for Hertfordshire consisted in producing <u>some</u> kind of schools but producing them in some way other than by resorting to the use of HORSA huts. Whatever form or style resulted was due to the manipulation of the technique within the strictest bounds of user-based rationality and without self-consciousness; any purely aesthetic morality was irrelevant to the development process. If then their work embodied the central philosophy of the Modern Movement it did so without any apparent conscious effort to do so, and what is more, it achieved it arguably as effectively as can be exhibited any buildings in modern times.

It is curious then that they have suffered comparative neglect from the history writers. Although the bibliography assembled for this study testifies to the enormous field of writing in which the Hertfordshire schools have featured, virtually all the items are either articles concerned with a single school, group of schools or phase of development, or a paragraph or two in a wider ranging work. The present study is the first attempt at a summary of the achievement. Compare this with the quantities of material that have been written on individual architects who have in many cases had but a fraction of the influence on events that Hertfordshire has had.

The explanation can only lie in the nature of the schools themselves, designed as they were by genuinely democratic teams and contributing to their own development process collectively. There are no displays of structural gymnastics and no glossy prestige edifices; they support no science-fiction visions of the future and have spawned no pamphleteering to outrage or inspire. In short, on the face of it there is little for critics to intellectualise about, save the simplicity of their intent and the thoroughness of their production. Ranging them alongside the output of the recognised pioneers and masters of the Modern Movement has either been inconvenient, or, has hitherto not seemed a fruitful subject for the writing of interesting architectural history: the present study rejects both these excuses.

Nevertheless, the national school building programme, led by Hertfordshire, came close to being an architecture of the people on a scale the like of which had not been seen since the parish church building of the fourteenth and fifthteenth centuries. During the 1970s this great offensive finally wound down, the battle won and a state of overkill reached: the country now has more school places than children to fill them. The levelling-off of the population curve and a growing disillusionment with growth coupled with changes in economic policies has caused a shift from an endeavour which was in any case destined to extinguish itself by means of its own efficiency.

Low impact technology, conservation both of energy and the inherited environment are the characteristic concerns of today. The philosophy of the Modern Movement is under attack from within and modern architecture is itself under attack from all sides, however unjustifiable that often may be. As architects struggle to regain their confidence they are becoming increasingly backward looking. Ironically, individualism has reasserted itself even in Public Service offices, to an extent that would have made the Hertfordshire achievement impossible had the mood prevailed thirty-five years ago.

Could it be then that what was witnessed in Hertfordshire in the period we have reviewed was, on the purest level of twentieth century idealism, the beginning and the end of Modern Architecture in its practical realisation ? It is not altogether a fanciful notion.

Notes to Chapter 25.

1. See Appendix 5.
2. Lionel Esher, A broken wave: The rebuilding of England 1940-1980, 1981, pp.285-6. See also Sutherland Lyall, The state of British Architecture, 1980, pp.45-49.
3. HCC Education Committee pamphlets, Hertfordshire Education 1870-1970 and Building for education 1948-61.
4. Colin Ward, British school buildings: designs and appraisals 1964-74, London, 1976, p.XlV.
5. In discussion with John Onslow, (Hertfordshire County Architect since 1978).
6. Colin Ward, op.cit., p.X.
7. Guy Oddie, Industrialised building for schools, Paris, 1975, p.70.
8. Ibid.

9. The present writer is a case in point having worked in the County Architects Department 1961-72. It is a subject frequently discussed when former Herts architects come together.

10. MOE Building bulletin 19, The story of CLASP, 1961, p.6.

11. My emphasis.

12. David Watkin, Morality and architecture, 1977, p.9.

13. Kenneth Bolton, "Hunstanton Secondary Modern School," ERA (Journal of RIBA Eastern Region), June 1968, pp.34-37.

14. Rayner Banham, Theory and design in the first machine age, London, Architectural Press, 1960, p.329.

15. Christopher Alexander, Notes on the synthesis of form, Harvard, 1964, p.11.

16. David Watkin, op.cit., p.4.

17. Ibid.

18. Sir Leslie Martin, "Notes on a developing architecture," A.R., July, 1978, p.16.

19. Ibid.

Appendices

Appendix 1

COUNTY ARCHITECTS DEPARTMENT NOTE

ON

WALL FINISHES: COLOUR

1. HISTORY

1946-8. Development by D.L.Medd of theory of colour application - "camouflage", the application and expression of structure (see earlier notes). Work in collaboration with Messrs.Gays, Dockers, Jenson and Nicholson, Manders. This work covered the prototypes and all schools in the 1947 Primary Programme. Colours were coded according to "Ostwald" and the colour samples for each school were mixed from pots of colour approximating to the Ostwald primaries by the site architect.

Together with this work these firms were asked to produce the Ostwald N.A. circle of 12 colours. The firms that produced these standards, however, produced colours of low hue intensity and complained that in order to match the Ostwald circle they had produced colours which were not mutually intermixable and were not all reducible with black or white.

1949. 1948/49 primary programme - first 7 schools. Messrs. Gays were given the contract for these schools and pots of pure Stainers were used for mixing the sample colours (crimson, scarlet, orange, yellow, lemon, prussian, ultramarine, vandyke, white and black). These Stainers represented the fullest hue content materials that were obtainable by the suppliers and were very much more brilliant than Ostwald N.A. samples previously obtained. Colours were coded numerically school by school and also coded with the initial letters of the basic Stainers used in obtaining the sample mix. This system was objected to by the manufacturers because of the large numbers of small quantities of special colours required (no repeat colours from school to school), and by the architects who objected to continual mixing from wet samples.

1950. 1948/49 primary programme - second 7 schools. Under advice from the Building Research Station (Mr.W.Gloag) and the Ministry of Education (Mr.D.L.Medd) the Munsell system of colour coding was adopted. Developed with Messrs.Dockers the system of 9 standard basic colours (crimson, red, orange, yellow, lemon, blue, umber, venetian, ochre, black and white) and 50 supplementary colours mixed from 6 basics (later a further 16 were added). The supplementaries were used in order to cut out the system of wet sampling by architects and to aid manufacturers by inviting repeats from school to school of the same colour, thus simplifying the supply of small quantities. A "loose chip" colour chart was produced. An analysis was made on the basics and supplementaries (separately) with Gays on the first 7 schools and was sent to the manufacturers.

The result of this was Messrs.Gays agreed to adopt this sytem, Vulcan Products agreed to adopt this system, Messrs.Jenson & Nicholson wished to withdraw. Dockers agreed to take their place in the third 7 schools of the 1948/49 primary programme.

In order to reduce the triplication of the range of supplementaries with different finishes (i.e. gloss, semi-gloss and flat oil) the standards of finish were agreed and laid down reducing the hue coverage in any one type (i.e. greys and whites, chiefly gloss, full hues, chiefly eggshell).

2. THE COLOUR SYSTEM

Munsell v.Ostwald. Since the Munsell system is less well known at present than the Ostwald system of colour coding a brief description of the principles of coding is given. The system consists of three sets of metrically sub-divisible co-ordinates as follows:

Value. Lightness or darkness: light reflectance with white at one end of the scale and black at the other.

Hue. Divided into 10 groups, red, yellow red, yellow, yellow green, green, green blue, purple blue, purple, purple red. Each group is sub-divisible into 10 again.

Chroma. Intensity of hue saturation with neutral grey at one end of the scale and full hue at the other.

Comparison between the two systems:

		Munsell	Ostwald
i.	Achromatic Scale	Divided up numerically (infinitely divisible) into stages, photo metrically equidistant, directly comparable with relectance value.	Divided by letters (not so easily sub-divisible) stages unrelated to scientific sub-divisions
ii.	Hue Circle	Divided up by letters and numbers (infinitely divisible).	Red, blue green, orange, yellow green, reduced in hue intensity.
		More yellow green and red than is Ostwald. Divided by numbers and	When compared with Munsell the range is wider in mauves and

. .	sub-divided by fractions which are unwieldy. Colours over emphasised blue green orange.	yellow greens and narrower in blues and greens.
iii. <u>Chroma Scale</u>	Possible to code infinitely brilliant hues; this admits development with pigments in getting and coding more brilliant basic hues.	Non-existent. A closed system which does not admit more brilliant than those shown on the P.A. circle.
iv. <u>General</u>	Hue is coded correctly according to the reflectance value of the particular colour. Possible to find coding for any colour.	Takes no account of reflectance value. Blank spots occur particularly amongst the brilliant hues and no system of numerical sub-division offers itself for coding colours falling between known points.
v. <u>Colour Cards</u>	Small and large colour books published in America only.	Pre-war German publications with perforated sample books quite good. First class American publication by Container Corporation of America using the "loose chip" system.

For the above reasons Munsell was felt to be a more scientific colour coding system than Ostwald and would probably supersede it in the end. That whatever system of colour application was adopted it would be in the interests if colour standardisation to familiarise suppliers with the Munsell coding system in practice now.

<u>Manufacturers Pigments - Standard basics</u>. Experience with manufacturers producing Ostwald N.A.circle showed that the colours produced suffered from the following defects:

i. The colours were not all mutually intermixable and those that were intermixable did not react to one another in the same way or with the same proportions of component hue as the Ostwald range itself which was based on intermixture of light and no pigment. For example blue reduced with white would veer towards blue green in reduction. This was due to the molecular structure of the different pigments which made the Ostwald or Munsell system impossible to transfer direct as a system of paint mixing.

ii. Matching Ostwald N.A. circle produced colours of infinitely less brilliant hue content than the standard pure pigments obtainable by any paint supplier. It was therefore decided to fix the range of standard pigments obtainable from the manufacturer which answered the following specifications.

a. As full a chroma as possible (disregarding maximum saturation shown on any chart).

b. All pigments mutually intermixable.

c. Capable of producing any colour by inter-mixture.

d. Pigments obtainable by all manufacturers.

e. No expensive pigments to be used.

The chosen scale of crimson (monolight dye stuff), red (monolight dye stuff), orange (monolight dye stuff), yellow (light chromate), lemon (Hansa yellow), blue (monastrial blue), umber (earth colour) ochre (earth colour) white (titania dye oxide), black (carbon black), answered all these points with the following exceptions: (See a - b above).

a. Blue and umber pigments low in chroma although chroma increased in reduction with white.

b. Red and blue not generally intermixable.

c. Mauves, purples and purple blues are omitted (these colours are not easily made light fast and are never intermixable with other colours).
This was not objected to greatly except in the case of purple blues for which reason the basic prussian blue may have to be introduced in the range. The basic green is omitted as the standard Brunswick green available to all manufacturers produces a bad range of greens, reminiscent of Railway Stations.

d. O.K.

e. Hansa yellow and monastrial blue are more expensive basic pigments than would normally be used by manufacturers in bulk except for special purposes.

Having agreed the range of basic colours it is now possible to consider the agreed supplementary range of colours which are mixed from these basics. The advantage to the manufacturer of the basics in obtaining the supplementary range is that he can give the mixing formula for each supplementary based on the volume or weight of each of the component basics used to obtain the shade. This may not be the most economic method for bulk orders but is economic where small quantities are required since milling is not necessary, and apart from final tinting, the procedure can be carried out by relatively unskilled labour. Experience with manufacturers of this system shows that there are certain firms already adopting a procedure something on these lines particularly those supplying celluloses to the coach work trade. A further value of obtaining a range from a set of basic standards is that the standard colours can be supplied to each site and used as tinters where the architect requires adjustments to be made. In order to enable the architect to have this freedom it is necessary for each manufacturer to state the properties and intermixing possibilities of each of the standard basics that he proposes to use. The manufacturer can then be called upon to guarantee his product even in site mixing so long as the instructions laid down by him concerning inter-mixing between different basics are adhered to by the site architect.

Supplementary Range. (This section is now out of date, but has been retained for general interest). This range was chosen in the light of experience in the 1947 primary schools programme and of the first seven schools of the 1948/49 programme but represents rather a random selection. Most of the colours contain some lemon or yellow and it is felt that this yellow content gives a general key to the range which is suitable for school use since it tends to give a warm friendly and hospitable tone to the colours used. The supplementary range, it is appreciated, is by no means perfect and was developed in a hurry in order to enable architects on the second seven schools of the programme to benefit from some system which gave them a richer range than the existing system on the market. It is intended in the light of further experience to extract those colours which are not called for and to insert new colours for which there is a demand. At the present stage the deficiencies which are complained of are warm browns and tints of all hues of value 9.5 and possibly higher. In practice it has been found that the possibility of using a colour outside the range of standards, where it is particularly required by the site architect, has answered a phychological resentment against the system for a means of expression which is basically decided emotionally. It has resulted in architects adhering to the system without the resentment which would have been felt had this possibility not existed. The architect is free to choose any colour he may mix from the standard basics, mixed under advice from the manufacturer regarding the inter-mixability of the basics, so long as he is prepared to take personal responsibility for pointing out the samples in the first place and supervising the mixing of the basics on the job to ensure that a fair match is obtained without doubling the quantity of paint required. The architect is therefore well advised to restrict such site mixing to small quantities only.

The supplementary range is required in order to help the manufacturers to stock up bulk supplies of popular colours and to help the architects to select from a limited range of colours, which then can be more usefully presented, than the commodious but indigestable way that they are presented in the existing Munsell books.

The loose-leaf system, that is to say painted samples detachable from the card backing, has been found to be a very effective aid to the architect in selecting his colours. A further standardisation of finishes is required in order to supply a range multiplying itself into high gloss, eggshell, flat oil, distempter and primer. So far it has been possible only to reduce the number of hues in each type of finish and to standardise the primers as suitable for use with a range of say 20 supplementary hues. Eggshell finish now remains to be coded scientifically according to the degree of gloss found most suitable.

The Munsell coding system seems to be the most scientific and objective system so far devised and Hertford have taken the first step to popularise the coding system amongst paint manufacturers. Colours are mixed from pigments which are common to all the paint manufacturers in the country, the supply of small quantities of paint selected from a wide range of hues is made possible by the wet mixsng by the manufacturers of standard basic colours. The standard basics enable the architect on his own responsibility to use colours outside the range.

3. COLOUR RANGE

The colour range now in operation was chosen in the light of the experience which had been gained on the 1948/49 programmes. The manufacturers were anxious to agree to a more comprehensive range than the 69 colours used on the previous programme which had proved administratively unwieldy and wasteful to manufacture.

The present range was therefore agreed by H.C.C. Ministry of Education and L.C.C. with the manufacturers as being a smaller and more balanced range for school design. It is based on the same group of basic pigments,as the previous range, although with the exception of Orange 10.R5/14, Red 7.5R 4/16, Crimson 5.0R2/12, black and white, actual basics have been omitted from the list of 49 colours and an adjacent colour on the Munsell system preferred.

If an architect designs, he therefore still has the opportunity to obtain from the manufacturer the wet basic pigments and by inter-mixing obtain a hue which is not on the range.

A consecutive numbering arrangement has been agreed as standard with manufacturers and it is necessary for architects in ordering to quote this only. It is hoped that this simplification will sort out some of the administrative bottlemecks.

At the series of meetings with the manufactuers, it was agreed that they and the Ministry of Education would try and interest other authorities in this range, in the hope that if it becomes widely adopted, manufacturers will be prepared to keep a stock as they do now with their standard products. (A Ministry of Education Bulletin is being prepared).

As a result of L.C.C. investigations a number of other manufacturers have now adopted the range. (The only firms at the earlier meetings were Dockers and Gays), and in the immediate future it is proposed to have a series of meetings with several additional manufacturers in an effort to widen the range of available firms.

4. COLOUR APPLICATION

a. <u>Expression of Structure</u>. The structural elements of beams and columns which are visibly expressed through the schools, provide a rhythmic framework which has been usefully emphasised by being painted a neutral colour or white and articulated from the wall panels between them. In general a neutral grey of value 7 or 8 has been used where walls are white but in certain schools where walls have been painted grey or light fawn rather than white, the stanchions themselves have been painted white in order to preserve the articulation. A point in favour of the grey is that the stanchion casings are inclined to receive more dirty finger marks than the wall areas and this is less noticeable on a grey background. As the vast majority of ceilings are painted white, grey has been used in order to pick out the beam from its background. The requirements in colour for this framework, which indicate a choice of a neutral grey, are that it should be a similar colour generally thoughout the school and act as a unifying framework within which the drama of colour can be enacted.

The use of colour on the walls themselves can help to express the system of construction which is basically light and which consists of a thin panel infilling to the frame.

Colour can be used also to articulate the internal from the external walls where they are adjacent and in this way to stress the logic of the structure. The use of different colours on walls at right angles to one another is another example of the intensification through colour of the formal conception of space and in many schools in the Assembly, Entrance and Dining Hall areas there occur wall spaces of considerable extent which can be seen from some distance which colour can make significant by emphasising the interpenetration of several areas by one particular plane or series of parallel planes.

b. Expression of Use - Hue. Colour is used in order to differentiate one area from another where the use differs, and to tie areas together which are isolated in space where the use is similar. Examples of the former can be found in schools where the Dining and Entrance areas are one space but in which one colour acts as a background to the Dining activity and makes this part of the general space more articulate. As an example of the latter, in the exterior paint of metal panels outside the Infants classrooms where these are isolated from one another, one can quote the use of a similar colour in order to express the fact that these independent areas have a similar purpose. The second example is the typing together of the classroom or cloak space area with its own lavatory by a similar colour scheme. Colour is also used for identification purposes in connection with use, particularly in lavatories and in the painting of the fibrous plaster coat supports. The intention has been to use the hues which reflect the type of activity which is to go on in the area in which it is used and to stimulate the emotions in a way that makes one receptive to the type of activity which takes place there. This idea has lead to the use of bright and dramatic hues of full chroma in Entrance and Assembly Halls. Slightly less dramatic tones for Dining Halls but considerably subdued and with definitely domestic character for the classrooms. In these areas sparkle has been provided by use of full chroma hues at low level only in painting doors to the cupboards which line the walls. In the staff rooms the most restful colours have been used.

c. Sympathy to Light - Value. Space can be made more readily appreciated if the natural light and shade conditions caused by the position of windows and roof lights are paralleled by the use of colour, the value of which is related to the quantity of light falling on the wall. In this way colour is used to intensify natural conditions of light and shade, and the colours which are adjacent to the windows will be lightest in tone and those further away from the windows the darkest. This use of colour must be related to the conditions considered in item (d) below however. The Munsell coding is useful when one is considering colour from this angle since the value number is expressed in every colour reference and by looking at the Munsell chart one can see if a high chroma is required together with a light colour the yellow range will answer the bill and where a high chroma with low value is required the blue range is indicated. This shows that it is possible to range from light to dark with either a high or low chroma as required but that the actual hue may in fact be partly indicated by the light conditions prevailing, as well as by the emotional conditions the colours are required to create.

d. Avoidance of Glare Contrast - Value. In order to prevent unpleasant glare conditions colours adjacent to large window areas have been kept white or over 9 in value. The fibrous plaster surrounds to windows and cases to stanchions are, as has been mentioned in (a) above, either white or grey so that this choice of colour for other reasons is also of use in reducing glare. Eaves soffits which are seen from inside the building silhouetted against the sky are also for this reason painted either white or very light grey. This factor is one which has to be borne in mind constantly when considering colour from the point of view of item (c) above.

e. Harmony - Pointillism and Synthesis. Where areas are large enough and colour is used in order to express any of the previous items considered there is a tendency towards a number of different colours being seen together at the same time. This suggests the use of different hues which will combine together to give a pleasant harmony but which in themselves may differ considerably. A parallel can be found in painting for this analytical kind of aesthetical expression in the work of the Pointillists.

Where a less dramatic contrast is required the articulation can still be achieved by reducing the degree of chroma generally throughout the scheme. It is, however, essential when considering such a use of colour in such an area to remember one can see all the colours used together. Where articulation in colour is not required or the number of walls visible are small, interest can be stimulated by the use of colours which are composed of a mixture of the different elements which might be used separately as above. These colours, of which a number are found in the supplementary range, are those light tints which reveal some of the component colours from which they are composed, particularly grey greens, yellow greens and blue greens.

5. DESIGN OF A COLOUR SCHEME - GENERAL NOTES

Use of "Loose Chip". When designing a colour it is necessary to have samples of the actual flooring materials available in order to complete the picture. The required colours can be extracted from the chart and compared with one another on the flat area and can be built up to form a box in which the reflection of one plane on to another area, from the floor to the walls, or from the ceiling to the walls, or floor can be studied. The differences between colours with the light falling on them and in darkened areas can also be seen. A general picture of the colour feeling can be obtained.

Perspective drawings. These are required:

i. In order to examine the actual relations in area of visible colour as seen on walking inside the school.

ii. To pick out the places which due to lighting conditions are those which should be stressed or coloured.

iii. In order to examine the shape of the wall area to be painted (to avoid expressing awkward wall shapes).

iv. To stimulate the imagination and crystalise ideas.

v. To express one's own conception and enable others to participate in discussion of them.

As a medium dye line prints (negatives in pencil) are suggested, coloured up with pastels (French type).

Pastels are first class in that colours can be superimposed, altered in hue in light and in shade cleanly and simply without any preparing being necessary. Subtle shading such as reflected light on to a ceiling adjacent to a window is easy by rubbing with a finger. It is a useful medium because with it you can feel your way towards a solution without having to commit yourself irrevocably in the first instance.

Discussion of Perspectives. In order to anticipate colours and to benefit from advice at an early stage it is useful to organise a discussion around the perspectives with one's fellow architects (mainly from the point of view of aesthetic expression, articulation of space, clear conditions etc.,) and with future users (from the point of view of use and suitability to environment to purpose). This discussion serves a further useful purpose in preparing the teachers for a new approach to the use of colour and enlisting their sympathy and support before the scheme is finally decided, rather than putting something over on them before they have had a chance to grasp some of the reasons behind this approach.

Further evidence shows that with the "prospective approach" it is almost impossible to appreciate all the conditions which arise since with the large glass areas, in external and internal walls views through from one area to another arise on the job which were not easily discernible on the drawing. A more thorough method of approach is therefore to use a simple "pins and cardboard" model of the Building or part of the Building and to colour the internal walls and floors with pastel. A set of loose chips for use in preparation of designs are available in Room 20.

Schedule of Colours for Standard Items. Colours which are standard throughout the school can be listed on a schedule. These are items such as beams and stanchion casings, window and door frames, railings, ceilings, skirtings, treatment of wood. In this connection it has been the principle to try and reveal as much wood graining both in furniture and equipment, doors, skirtings, seat units, handrails etc., as is possible in order to increase the sense of richness and warmth in tone inside the building.

Colour Plan. A marked plan has been found more useful to the paint contractor and supplier and simpler for the architect to prepare than schedules for the colours of wall areas.

The wall to be painted should be marked with an arrow marking the extent of the colours and the manufacturers's reference and number, e.g.24G. The type of paint to be used is given on the following painting schedule. Deviation from this causes complication in manufacture. The walls to be painted white can be left unmarked (generally well over 50% of the wall areas).

Schedule of Paint Finishes.

High Gloss

All external work, all lavatory partitions and mullions.
All walls to interiors of lavatories.
All walls to interiors of kitchens.
All exposed pipe runs.

Semi Gloss

All internal works except those mentioned above including all stanchion casings and fibrous plaster casts.
All galvanised or primed metal, work internally e.g. beams, door frames, window frames and screens, handrails etc., (except in kitchens and lavatories which will be high gloss).

Heat Resisting Paint

All heating pipes and radiators.

Distemper

Ceilings; and walls to stores.

Appendix 2

CONSOLIDATION OF 8'3" PRIMARY AND SECONDARY SCHOOL SYSTEMS
1955

Table showing Elemental breadown devised by Hertfordshire for the co-ordination of all drawings and bills of quantities.

Element prefix and Bill Section.		Objectives to be achieved in the Consolidation of 8'3" systems[2]
(A)	Preliminaries.	Check contract preliminaries. Check, amend and extend trade preambles and ensure "tie-up" with standard specifications. Revise drawing check lists.
(B)	Paved Playgrounds.	Details to tie up with standard specifications.
(C)	External Works.	Revise details for roads, paths, pavings external furniture, retaining walls etc.
(D)	Drainage.	Revise data sheets. Standard specifications. Consideration of extension of pitch fibre drainage system.
(E)	Foundations and Site Slab.	Review foundation methods. Extend application of bored pile foundations. Prepare foundation calculation data sheets and pro forma.
(F)	Frame.	Prepare simplified data sheets. Attempt to extend use of Primary School low block stanchions with 4" embedment (see Section 5). Review frame details.
(G)	External Walling.	Consider extension of dry joint walling technique to Secondary Schools. Review fenestration system. Detail full range of external doors porches etc. Revise and co-ordinate all D.P.C. details (existing section 7).
(H)	Internal walling.	Revise all data sheets. Detail comprehensive range of door frames and screen doors. Review fibrous plaster details and make serious attempt to extend protection techniques.
(I)	Stairs and Steps.	Collect a "library" of staircase drawings for information.
(J)	Floor construction.	Improve expansion joint detail.
(M)	Roof construction (and eaves).	Investigate possibilities of using

		Primary School roofing system (Universal Asbestos) on both Secondary and Primary Schools. Redesign eaves to suit dry roof. Design a foolproof rooflight that ventilates in all weathers, does not leak, looks well and doesn't cost too much ! Detail standard penetrations of roof. (Vents, pipes, extract fans etc).
(L)	Floor finishes.	Agreed list of approved flooring materials with cost limits.
(M)	Ceilings.	Revise "fixed up" ceilings for dry roof. Reconsider suspended ceilings. Review soffit conditions.
(N)	Furniture and Equipment.	Review and revise standard furniture. Design new library units. Extend range to include Handicraft units etc. Standardise kitchen servery hatch. Design kit storage locker. Revise and complete furniture. Redesign blackout blinds system so that ventilation is maintained when in use.
(O)	Heating.	Revise Weatherfoil cabinet details. Prepare standard data sheets for oil fired boiler houses, storage, flues, etc.
(P)	Plumbing.	Revise all sanitary fittings data sheets. Tie up with standard plumbing spec. Revise R.W.P. details.
(Q)	Electrics.	Prepare new data sheets.
(R)	Gas Services.	Data sheets.
(S)	Caretaker's Cottage.	Design standard cottage with suitable alternatives.

Notes to Appendix 2.

1. The elemental breakdown differs slightly from that given in C.M. Nott's paper (read at a meeting of the Bedfordshire and Hertfordshire Branch of the RICS at St.Albans on 21 January 1955, printed in RICS Journal for May 1955, pp.919-927)in the Element order, to which he assigns numbers instead of the alphabetical codes shown above. The alpha-code system was used to identify the element of all standard drawings and to co-ordinate them with the job drawings which were classified accordingly.

2. This table was issued as "Phase 2 Draft Programme" in Circular No. 6, 13 Dec. 1955, 3/KCE/DH/GEN.77.

Appendix 3

SCHOOL MAINTENANCE COSTS 1976-78

A high incidence of school maintenance-need and a relatively high cost of repair or replacement of components can be expected after some 18-25 years of use. This Appendix shows maintenance costs in Hertfordshire compared with the national average (table B) and with other buildings in the Council's ownership (table C). In table A the costs for 1½ years are shown distributed among the building elements, indicating the low percentage (apart from the roofing) attributable to the methods of construction. The data have been derived from a report by the County Architect to the Performance Review Sub-Committe, 5 January 1978.

A. SCHOOLS MAINTENANCE COST ANALYSIS.

Element	1976/77		First Half 1977/78	
	£	%	£	%
Heating	205,066	14.37	115,779	11.67
Roofing	159,846	11.20	105,253	10.62
External Walling	144,422	10.12	123,974	12.50
External Decoration	132,332	9.27	116,699	11.76
Internal Decoration	119,577	8.38	105,086	10.59
Electrical	101,182	7.09	87,119	8.78
Plumbing	87,134	6.10	57,464	5.79
Minor Improvements	83,745	5.87	42,836	4.32
External Works	65,278	4.57	39,544	3.99
Foundations	60,418	4.23	2,624	0.26
Playgrounds	56,072	3.93	39,125	3.94
Fencing	56,071	3.93	40,792	4.11
Internal Walling	43,083	3.02	32,679	3.29
Drainage	29,409	2.05	18,244	1.84
Furniture	28,994	2.03	14,886	1.50
Floor Finishes	17,277	1.21	16,808	1.69
Gas Installation	15,861	1.11	6,189	0.62
Ceiling	8,089	0.57	17,124	1.73
Floor Construction	7,298	0.51	3,471	0.35
Stairs	4,024	0.28	1,384	0.14
Ventilation	2,046	0.14	,573	0.06
Frame	99	-	4,504	0.45
Total	£1,427,323	100%	£992,157	100%

B. COMPARATIVE COSTS OF BUILDING MAINTENANCE* PER PUPIL.

	Primary 1967/77	Primary 1977/78	Secondary 1976/77	Secondary 1977/78
Average of English Counties	£13.11	£12.70	£18.04	£17.91
Hertfordshire	£10.44	£11.47	£19.04	£17.34
% variation	-20.36%	-9.7%	+5.5.%	-3.2%

* Including grounds maintenance.

C. 1977/78 BUDGET ESTIMATES: REPAIR, MAINTENANCE AND RUNNING COSTS COMPARED WITH INSURANCE VALUES BY MAJOR BUILDING TYPES.

Type	Insurance Value £M	Repairs & Maintenance Cost £,000	Repairs & Maintenance Insurance value%	Running Costs* Cost £,000	Running Costs* Insurance value%
Libraries	3	36	1.20	64	2.11
Schools	227	2015	0.89	3306	1.46
Colleges	48	260	0.54	815	1.69
Fire Stations	6	51	0.80	107	1.68
Police Stations	17	145	0.86	176	1.04
County Hall	10	42	0.41	103	1.01
Other Offices	6	54	0.97	117	2.11
Court Houses	3	7	0.28	21	0.79
Police Houses	-	103	-	Nil	Nil
Staff Housing	-	75	-	Nil	Nil
Day Care Centres	2	23	0.92	45	1.84
Residential Care - Children	4	50	1.29	133	3.46
Residential Care - Adults	11	103	0.92	343	3.04

* Running costs include fuel, light, cleaning materials and water; those shown as Nil are paid directly by the tenants.

Appendix 4

SEAC MK 2: SAMPLE DRAWINGS

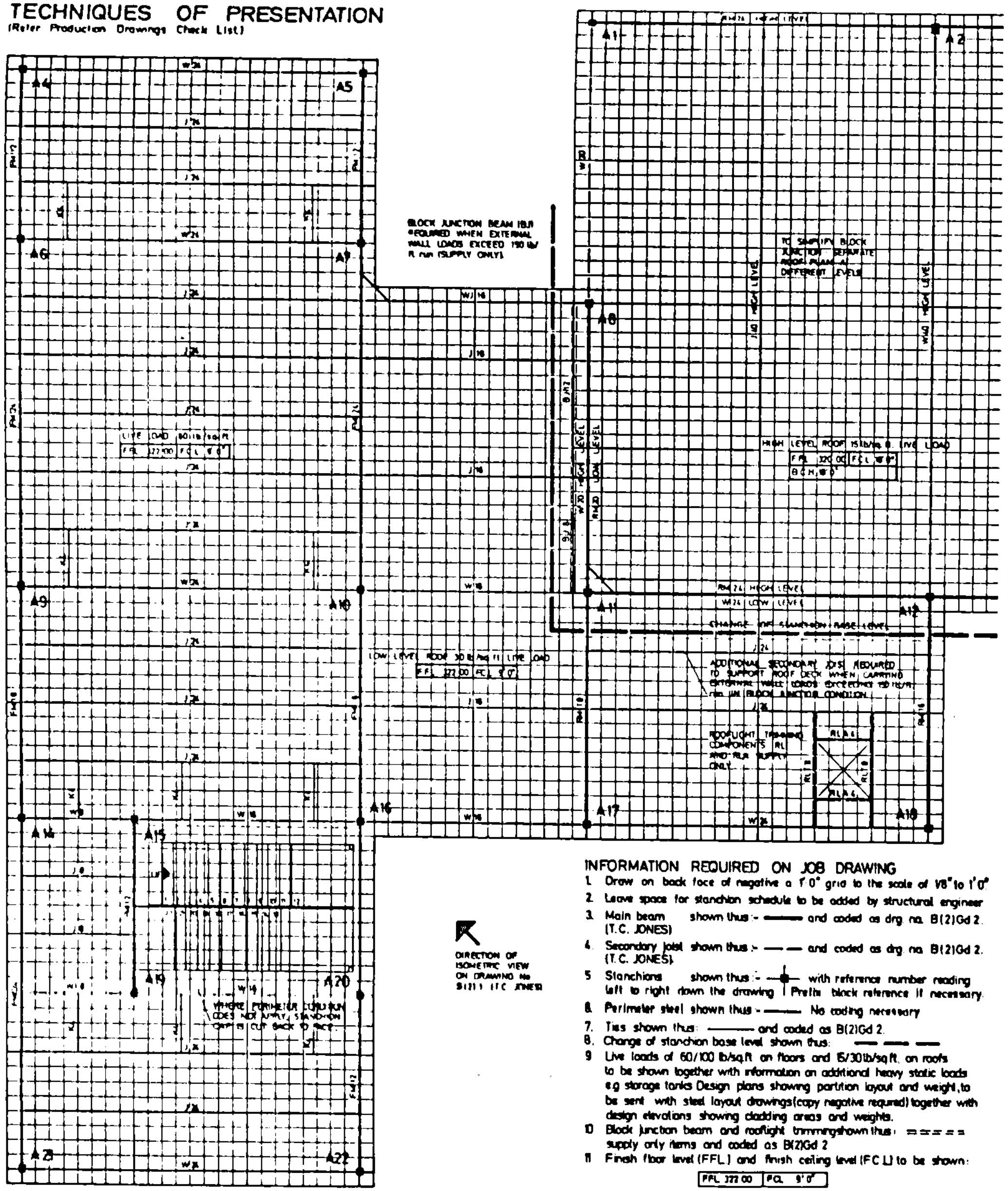
This Appendix illustrates what might be considered to be the final stage of steel frame development by Hertfordshire for the new schools programme. As described in Chapter 24, on the formation of SEAC the 2'8" system was re-named SEAC Mk 1 and development, still carried out by Herts on behalf of the Consortium, continued on the basis of a 1'0" general grid, but with 2'0" flexibility in the frame. After the lightweight cladding infill-panels of 2'8", heavy concrete wall units were reintroduced; a drawing illustrating these is included here.

The selected sample drawings have been reduced from the A3 format to which all Standards transferred from c.1965. They were originally drawn on A1 tracing paper, photo-reduced for offset lithographic reproduction on A3 size blue paper; the longer print runs required by the Consortium making this vastly improved method cost-effective. Elemental classification is now by SfB.

A.	SEAC Mk 2a Steel construction, Standard Drawing: — Steel Frame Limitations.	Drg.no.B(2)Gd1
B.	SEAC Mk 2a Steel construction, Standard Drawing: — Steel Frame Isometric Layout.	Drg.no. B(2)1
C.	SEAC Mk 2a Steel construction, Standard Drawing: — Steel Frame Isometric Details.	Drg.no. B(2)Gd3
D.	SEAC Mk 2a Steel construction, Standard Drawing: — Steel Frame Component Range.	Drg.no. B(2) Gd2
E.	SEAC Mk 2a Steel construction, Standard Drawing: Uf1—External Walling Heavy Cladding.	Drg.no. B(21)

TECHNIQUES OF PRESENTATION

(Refer Production Drawings Check List)



INFORMATION REQUIRED ON JOB DRAWING

1. Draw on back face of negative a 1'0" grid to the scale of 1/8" to 1'0"
2. Leave space for stanchion schedule to be added by structural engineer
3. Main beam shown thus :- ——— and coded as drg. no. B(2)Gd 2. (T.C. JONES)
4. Secondary joist shown thus :- — — and coded as drg. no. B(2)Gd 2. (T.C. JONES)
5. Stanchions shown thus :- —+— with reference number reading left to right down the drawing. Prefix block reference if necessary.
6. Perimeter steel shown thus :- ——— No coding necessary
7. Ties shown thus: ——— and coded as B(2)Gd 2.
8. Change of stanchion base level shown thus: —— —— ——
9. Live loads of 60/100 lb/sq.ft. on floors and 15/30 lb/sq.ft. on roofs to be shown together with information on additional heavy static loads e.g. storage tanks. Design plans showing partition layout and weight, to be sent with steel layout drawings (copy negative required) together with design elevations showing cladding areas and weights.
10. Block junction beam and rooflight trimming shown thus : = = = = = supply only items and coded as B(2)Gd 2
11. Finish floor level (FFL) and finish ceiling level (FCL) to be shown:

FFL 322.00	FCL 9'0"

12. Beam connection height (BCH) to be given in long span conditions.

FFL 322.00	FCL 14'0"
BCH 10'0"	

LIMITATIONS

The frame is designed for buildings up to four storeys high it is rigid and requires no vertical bracing. Dimensionally is based on a 1'0" vertical increment and 4'0" horizontal increment with limited 2'0" flexibility. Floors are supported by secondary joists at 4'0" centres and roofs by secondary joists at 8', 10 and 12'0" centres. The external wall is off-set 1'0" and supported by perimeter angles to main beams, secondary joists and stanchions via perimeter brackets or gable ties at 4', 6', 8', 10', or 12'0" centres.

Components controlling dimensions :-

Stanchions (dimensions given are from floor finish to ceiling finish)
Single storey 8', 9', 10', 12', 14', 16', 18', 20', or 22'0".
Multi-storey 8', or 9'0" and 10'0" ground floor only.
Floor and roof zones 2'0" except where long span secondary joist.
change of levels—Roof, 1'0" increment from 2'0" minimum.
Upper floor, not possible with standard stanchion. If required limit as roof

Main Beams (always connected to stanchions, supports secondary joists at 4'0" increment)
Lengths - 8', 10', 12', 16', 20' or 24'0".

Secondary joists. (connected to stanchion or main beam)
Lengths in floors - 4'0" to 28'0" in 2'0" increments.
Lengths in roofs - 4'0" to 44'0" in 2'0" increments.
Long span joists - 48'0" to 64'0" in 4'0" increments.

Roof. 15 lb/sq.ft. live load - secondary joists at 12'0" centres.
30 lb/sq.ft. live load - secondary joists at 8'0" centres.
Rope loads - 34'0" to 44'0" range joists at 10'0" centres.

Floor. 145 lb/sq.ft. max. superimposed load - secondary joists (heavy) 4'0" ctrs.
80 lb/sq.ft. max. superimposed load - secondary joists (light) 4'0" ctrs.

Perimeter Maximum cladding load in lb/ft. run on perimeters see table 1.
For stairs, brackets at 4'0" centres to give stability to balustrades.

Table 1.	Perimeter brackets & Gable tie centres.			
	4'0"	8'0"	10'0"	12'0"
Roof	Not applicable.	80 lb/ft.run.	* 60 lb/ft.run.	* 30 lb/ft.run.
Floor	● 500 lb/ft.run	165 lb/ft.run.	Not applicable.	Not applicable.

● 440 lb/ft.run plus nominal 60 lb/ft.run surplus on superimposed floor load.
* 80 lb/ft.run with stiffened top angle.

Wind load - to C.P. 3 1952. 72 m.p.h. exposure D., to withstand load frame limits on tables 2 & 3.

Table 2.	Minimum number of stanchions in row at max. centres for spans up to 28'0"									
Building type.	Single & 2 storey		3 storey			4 storey				
	ground	1st.	gnd	1st	2nd	gnd	1st.	2nd.	3rd.
SINGLE BAY	2 at 24'	2 at 24	3 at 12'	3 at 12	2 at 24'	—	—	—	—
DOUBLE BAY EXT	2 at 24	2 at 24	3 at 24	3 at 24'	2 at 24'	5 at 12'	5 at 12'	3 at 24'	2 at 24'
DOUBLE BAY INT	3 at 24	2 at 24'	5 at 12'	3 at 24'	2 at 24'	5 at 12'	5 at 12'	3 at 24'	2 at 24'
ALTERNATIVE INT	—	—	4 at 12	4 at 12'	3 at 24'	—	—	—	—

	single	double	single	double	single	double

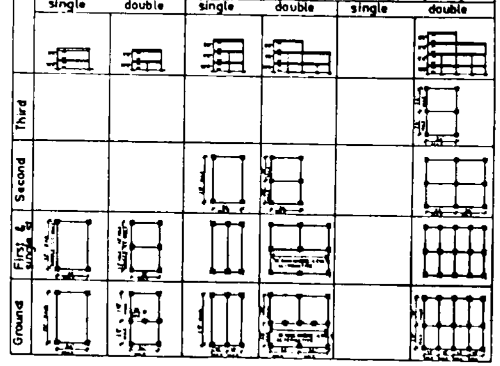


Table 3.	Minimum number of stanchions in row to long span secondary joists. (for single bay ignore internal stanchions)
34 38	[illegible]
38 40	[illegible]
42 44 48	[illegible]
52 56 60	[illegible]
64	[illegible]

1 SEAC 2a UPDATING BEAM RANGE REVISED MAR. '68 DAH

HERTFORDSHIRE County Council

G. C. FARDELL, MBE, FRIBA County Architect, County Hall, Hertford.

SEAC 2a

STEEL FRAME LIMITATIONS

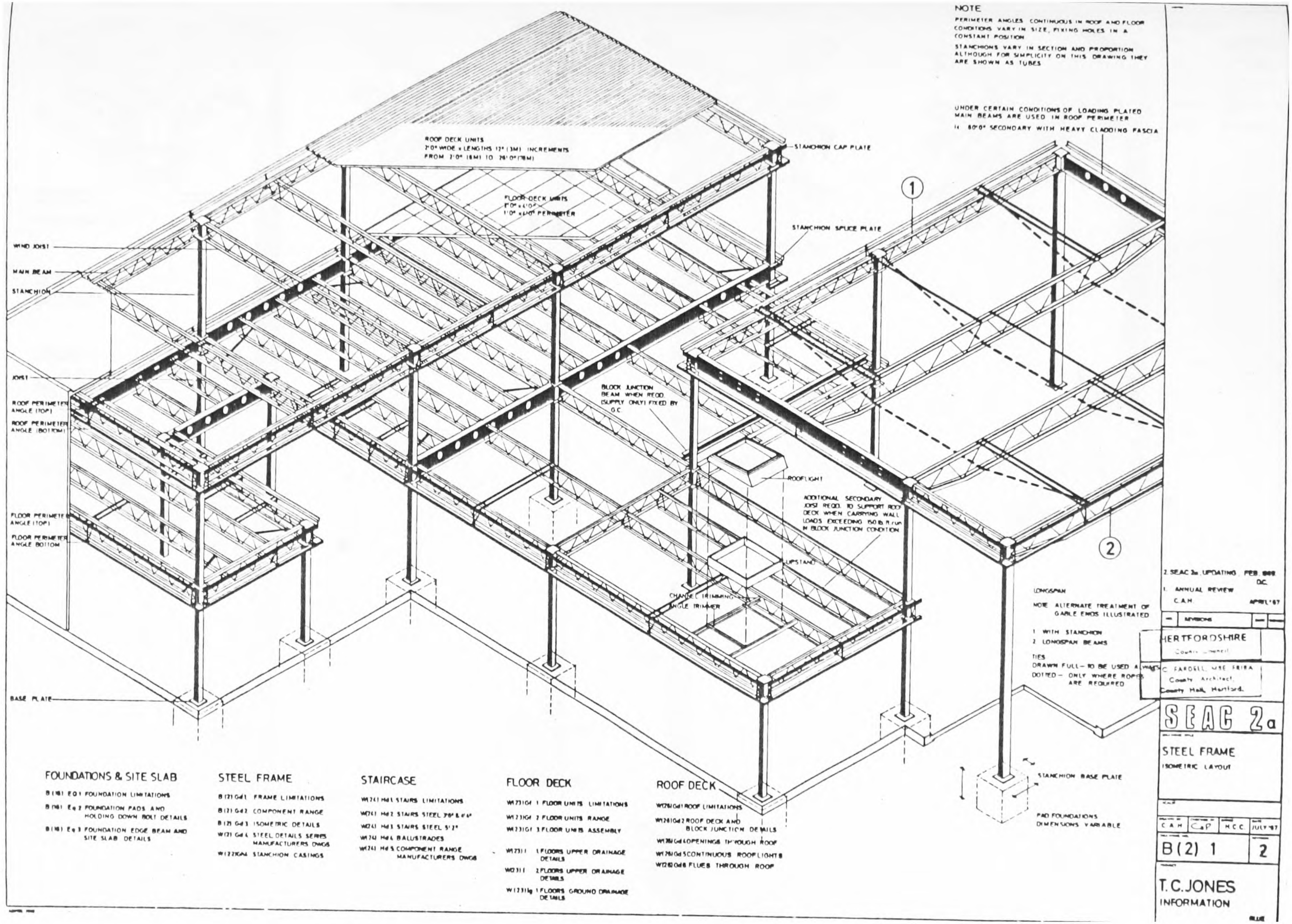
HCC JULY 67

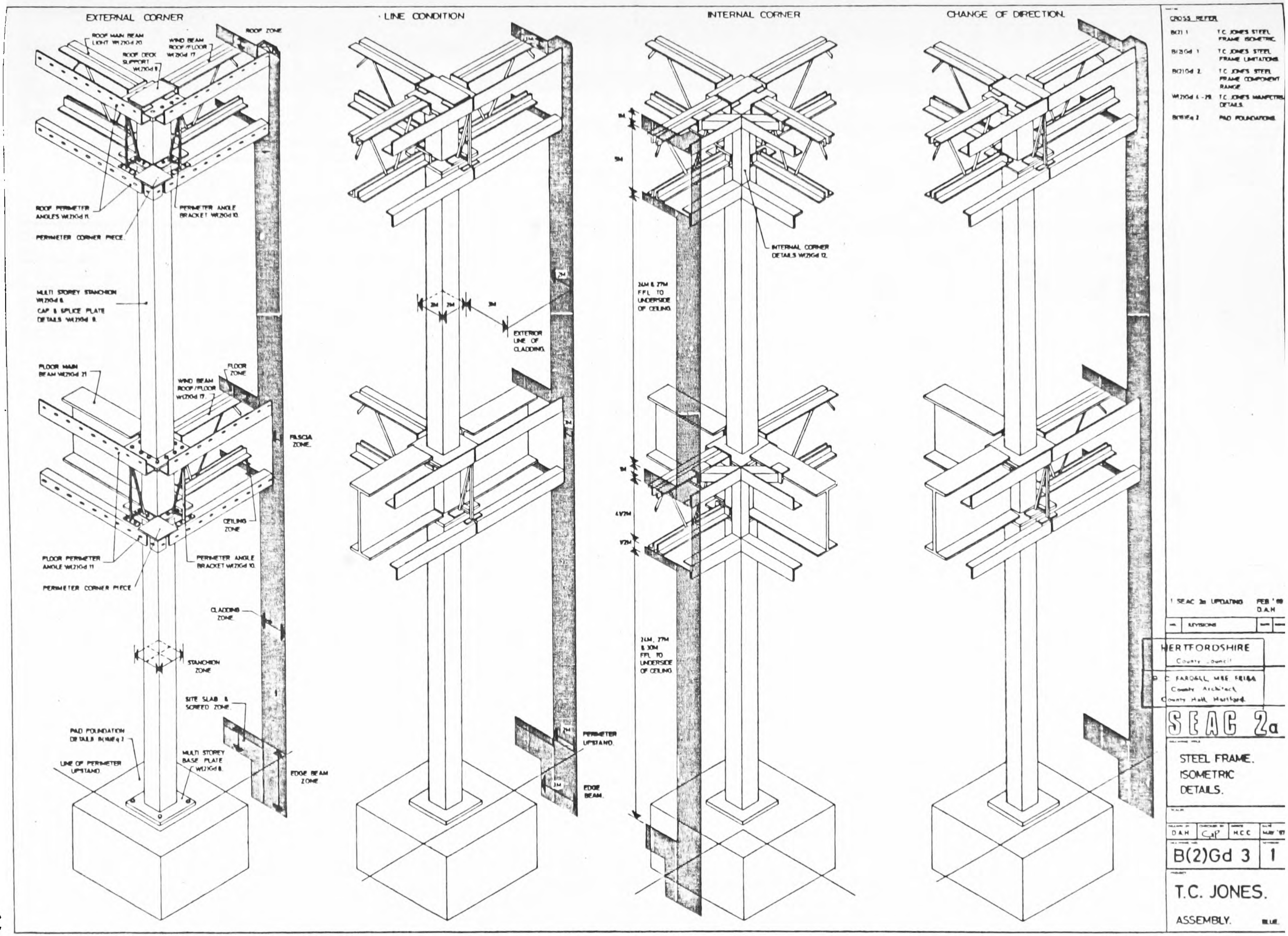
B(2)Gd1 1

T.C. JONES INFORMATION

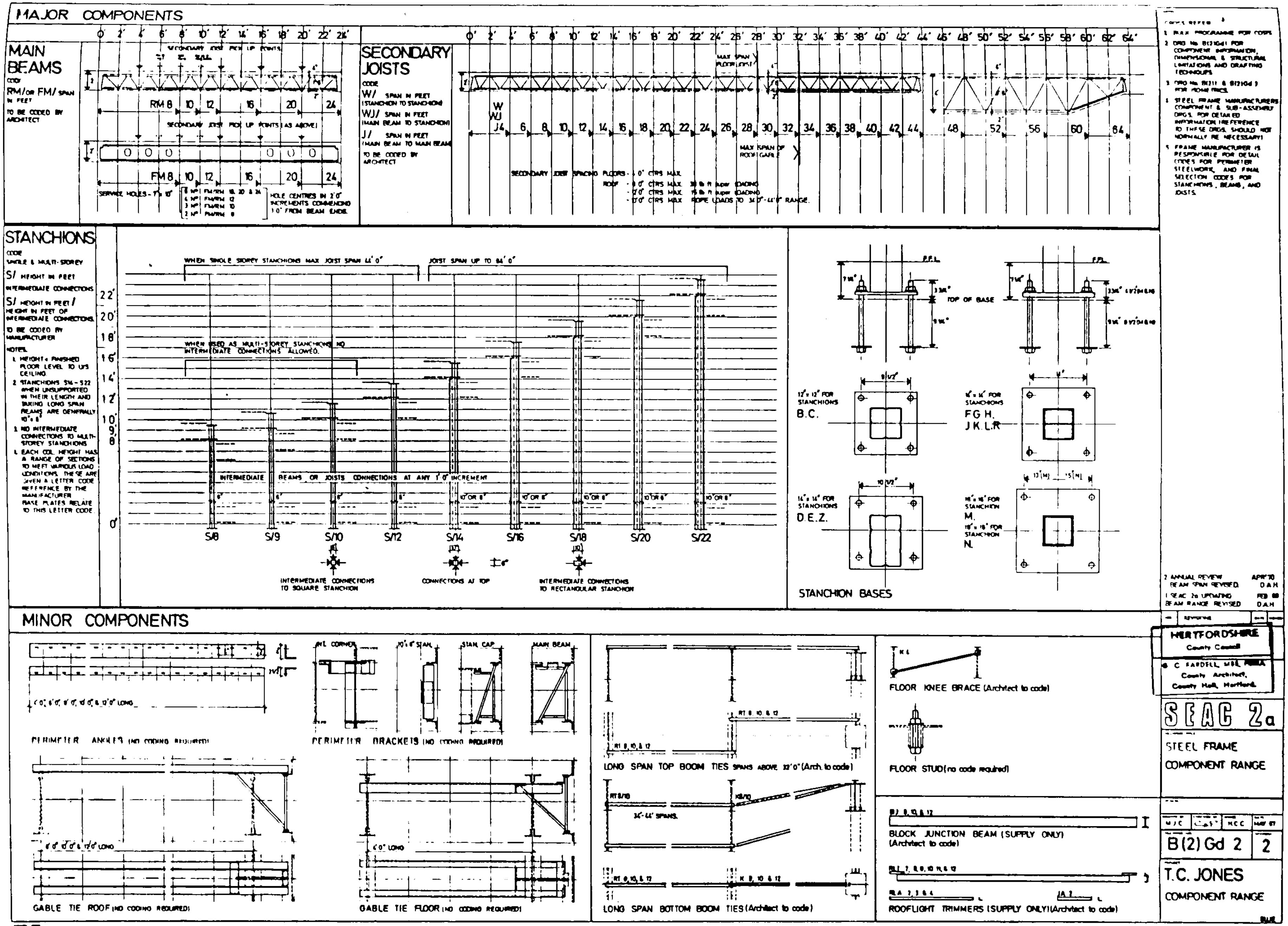
BLUE

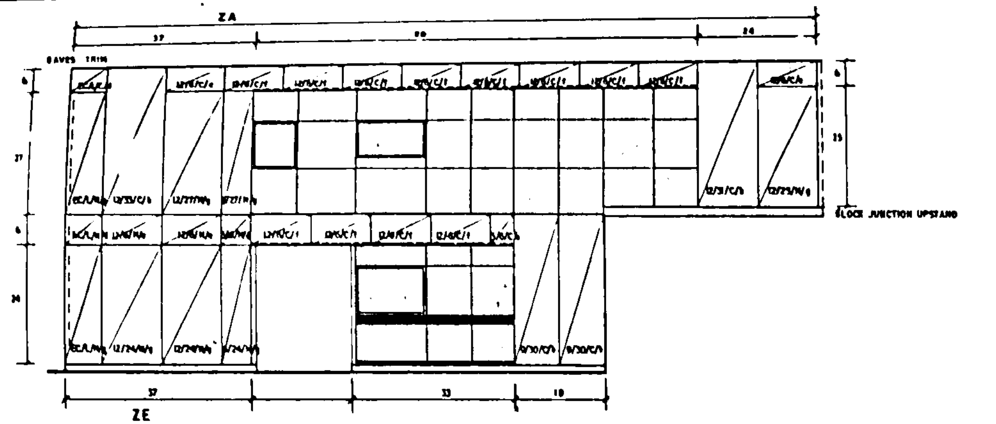
A

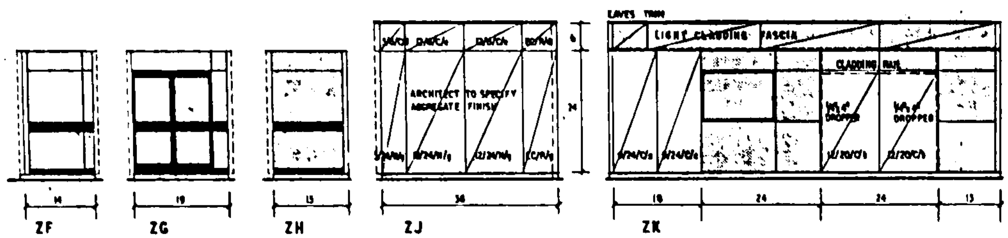

NOTE
PERIMETER ANGLES CONTINUOUS IN ROOF AND FLOOR CONDITIONS VARY IN SIZE, FIXING HOLES IN A CONSTANT POSITION
STANCHIONS VARY IN SECTION AND PROPORTION ALTHOUGH FOR SIMPLICITY ON THIS DRAWING THEY ARE SHOWN AS TUBES
UNDER CERTAIN CONDITIONS OF LOADING PLATED MAIN BEAMS ARE USED IN ROOF PERIMETER
ROOF DECK UNITS
2'0" WIDE x LENGTHS 12" (3M) INCREMENTS FROM 2'0" (6M) TO 26'0" (78M)
STANCHION CAP PLATE
FLOOR DECK UNITS
STANCHION SPLICE PLATE
WIND JOIST
MAIN BEAM
STANCHION
JOIST
ROOF PERIMETER ANGLE (TOP)
ROOF PERIMETER ANGLE (BOTTOM)
FLOOR PERIMETER ANGLE (TOP)
FLOOR PERIMETER ANGLE BOTTOM
BASE PLATE
BLOCK JUNCTION BEAM WHEN REQD. (SUPPLY ONLY) FIXED BY O.C.
ROOFLIGHT
ADDITIONAL SECONDARY JOIST REQD. TO SUPPORT ROOF DECK WHEN CARRYING WALL LOADS EXCEEDING 150 lb ft run IN BLOCK JUNCTION CONDITION
UPSTAND
CHANNEL TRIMMING
ANGLE TRIMMER
1
2
LONGSPAN
NOTE ALTERNATE TREATMENT OF GABLE ENDS ILLUSTRATED
1. WITH STANCHION
2. LONGSPAN BEAMS
TIES
DRAWN FULL — TO BE USED ALWAYS
DOTTED — ONLY WHERE ROPES ARE REQUIRED
STANCHION BASE PLATE
PAD FOUNDATIONS DIMENSIONS VARIABLE
FOUNDATIONS & SITE SLAB
B(16) Eq1 FOUNDATION LIMITATIONS
B(16) Eq2 FOUNDATION PADS AND HOLDING DOWN BOLT DETAILS
B(16) Eq3 FOUNDATION EDGE BEAM AND SITE SLAB DETAILS
STEEL FRAME
B(21)Gd1 FRAME LIMITATIONS
B(21)Gd2 COMPONENT RANGE
B(21)Gd3 ISOMETRIC DETAILS
W(21)Gd4 STEEL DETAILS SERIES MANUFACTURERS DWGS
W(22)Gd4 STANCHION CASINGS
STAIRCASE
W(24) Hd1 STAIRS LIMITATIONS
W(24) Hd2 STAIRS STEEL 7'8" & 6'4"
W(24) Hd3 STAIRS STEEL 5'2"
W(24) Hd4 BALUSTRADES
W(24) Hd5 COMPONENT RANGE MANUFACTURERS DWGS
FLOOR DECK
W(23)Gd1 1 FLOOR UNITS LIMITATIONS
W(23)Gd2 2 FLOOR UNITS RANGE
W(23)Gd3 3 FLOOR UNITS ASSEMBLY
W(23)1 1 FLOORS UPPER DRAINAGE DETAILS
W(23)1 2 FLOORS UPPER DRAINAGE DETAILS
W(23)1g 1 FLOORS GROUND DRAINAGE DETAILS
ROOF DECK
W(26)Gd1 ROOF LIMITATIONS
W(26)Gd2 ROOF DECK AND BLOCK JUNCTION DETAILS
W(26)Gd4 OPENINGS THROUGH ROOF
W(26)Gd5 CONTINUOUS ROOFLIGHTS
W(26)Gd6 FLUES THROUGH ROOF
2. SEAC 2a UPDATING FEB. 1968 D.C.
1. ANNUAL REVIEW C.A.H. APRIL '67
REVISIONS
HERTFORDSHIRE
County Council
C. FARDELL, MBE, FRIBA
County Architect
County Hall, Hertford.
SEAC 2a
STEEL FRAME
ISOMETRIC LAYOUT
C.A.H.
CaP
H.C.C.
JULY '67
B(2) 1
2
T.C.JONES
INFORMATION
B


EXTERNAL CORNER
LINE CONDITION
INTERNAL CORNER
CHANGE OF DIRECTION
ROOF MAIN BEAM LIGHT W(2)Gd 20
WIND BEAM ROOF/FLOOR W(2)Gd 17
ROOF DECK SUPPORT W(2)Gd 9
ROOF ZONE
ROOF PERIMETER ANGLES W(2)Gd 11
PERIMETER ANGLE BRACKET W(2)Gd 10
PERIMETER CORNER PIECE
MULTI STOREY STANCHION W(2)Gd 6
CAP & SPLICE PLATE DETAILS W(2)Gd 8
FLOOR MAIN BEAM W(2)Gd 21
FLOOR ZONE
WIND BEAM ROOF/FLOOR W(2)Gd 17
FASCIA ZONE
CEILING ZONE
FLOOR PERIMETER ANGLE W(2)Gd 11
PERIMETER ANGLE BRACKET W(2)Gd 10
PERIMETER CORNER PIECE
CLADDING ZONE
STANCHION ZONE
SITE SLAB & SCREED ZONE
PAD FOUNDATION DETAILS B(9)Ef g 2
MULTI STOREY BASE PLATE W(2)Gd 6
LINE OF PERIMETER UPSTAND
EDGE BEAM ZONE
EXTERIOR LINE OF CLADDING
PERIMETER UPSTAND
EDGE BEAM
INTERNAL CORNER DETAILS W(2)Gd 12
2.4M & 2.7M FFL TO UNDERSIDE OF CEILING
2.4M, 2.7M & 3.0M FFL TO UNDERSIDE OF CEILING
CROSS REFER
B(2) 1 T.C. JONES STEEL FRAME ISOMETRIC
B(2)Gd 1 T.C. JONES STEEL FRAME LIMITATIONS
B(2)Gd 2 T.C. JONES STEEL FRAME COMPONENT RANGE
W(2)Gd 1-21 T.C. JONES MANUFACTURING DETAILS
B(9)Ef g 2 PAD FOUNDATIONS
1 SEAC 2a UPDATING FEB '80 D.A.H
REVISIONS
HERTFORDSHIRE County Council
C. FARDELL MBE FRIBA County Architect County Hall, Hertford
SEAC 2a
STEEL FRAME. ISOMETRIC DETAILS.
D.A.H
H.C.C
B(2)Gd 3 1
T.C. JONES.
ASSEMBLY.
BLUE

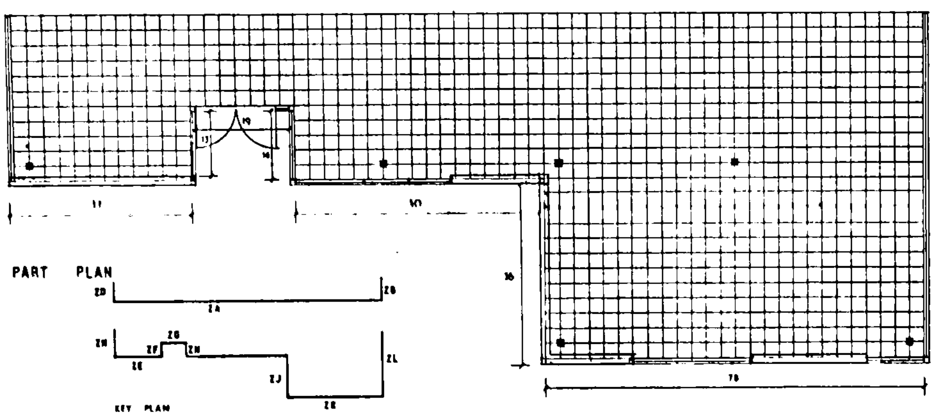
C


MAJOR COMPONENTS
MAIN BEAMS
CODE
RM/or FM/ SPAN IN FEET
TO BE CODED BY ARCHITECT
SECONDARY JOISTS
CODE
W/ SPAN IN FEET (STANCHION TO STANCHION)
WJ/ SPAN IN FEET (MAIN BEAM TO STANCHION)
J/ SPAN IN FEET (MAIN BEAM TO MAIN BEAM)
TO BE CODED BY ARCHITECT
STANCHIONS
STANCHION BASES
MINOR COMPONENTS
PERIMETER ANGLES (NO CODING REQUIRED)
PERIMETER BRACKETS (NO CODING REQUIRED)
GABLE TIE ROOF (NO CODING REQUIRED)
GABLE TIE FLOOR (NO CODING REQUIRED)
LONG SPAN TOP BOOM TIES
LONG SPAN BOTTOM BOOM TIES (Architect to code)
FLOOR KNEE BRACE (Architect to code)
FLOOR STUD (no code required)
BLOCK JUNCTION BEAM (SUPPLY ONLY) (Architect to code)
ROOFLIGHT TRIMMERS (SUPPLY ONLY) (Architect to code)
HERTFORDSHIRE County Council
SEAC 2a
STEEL FRAME COMPONENT RANGE
B(2) Gd 2
2
T.C. JONES
COMPONENT RANGE
D





ELEVATIONS



GENERAL SPECIFICATION

CLADDING UNITS — REINFORCED CONCRETE CLADDING PANELS WITH RANGE OF AGGREGATE FINISHES SUPPLIED COMPLETE WITH FIXING CLEATS, NUTS & BOLTS FOR FIXING BY GENERAL CONTRACTOR TO FLOOR SLAB & FLOOR & ROOF PERIMETER STEEL, OR TO CLADDING BAR WHERE PANEL IS LESS THEN FLOOR TO CEILING HEIGHT. SAMPLES OF PANEL & RANGE OF AGGREGATE FINISHES HELD IN EACH OFFICE

RANGES OF FINISH AVAILABLE

- 3/4" DURITE
- 3/4" DE LANK GRANITE
- 3/4" MOUNT SORRELL
- 3/4" CRIGGION GREEN
- 3/4" PERMWHITE
- 3/4" + 1/4" SHINGLE

NOTE: OTHER AGGREGATES MAY BE SPECIFIED IF AGREED WITH SUPPLIER & PRICE NEGOTIATED.

SPECIFICATION OF MATERIALS

- WEIGHT — APPROX 35 lb/SQ FT
- FIRE RESISTANCE — 1 HOUR (SUBJECT TO TEST)
- WIND RESISTANCE — IN ACCORDANCE WITH C.P.3. CHAPTER 5. EXPOSURE D

LIMITATIONS

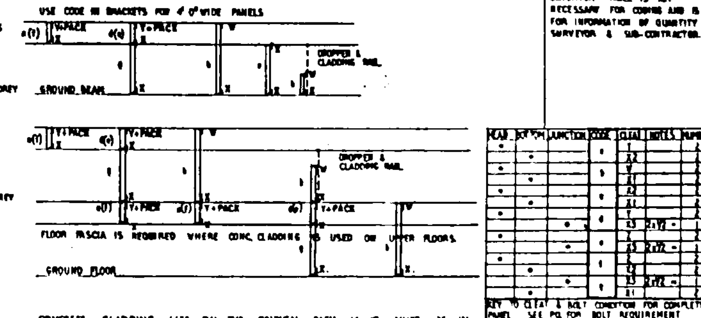
LOADING ON STEEL FRAME — (SEE MAX CLADDING LOADS ON PERIMETER STEEL ON DRWG B(2)H42 1)

SINGLE STOREY
1. ROOF STEEL IS DESIGNED TO TAKE FASCIA PANELS ONLY
2. MAX STANCHION SPACING WHEN FASCIA PANELS ARE USED IS 22' 0" NO LIMITATIONS WHERE LIGHT CLADDING FASCIAS OR FLOOR TO FLOOR PANELS ARE USED

MULTI STOREY
1. ROOF STEEL IS DESIGNED TO TAKE FASCIA PANELS ONLY
2. FLOOR STEEL IS DESIGNED TO TAKE A STOREY HEIGHT PANEL (MAX HEIGHT 11' 0") PLUS A FLOOR FASCIA PANEL
3. MAX STANCHION SPACING IS 18' 0"
4. MAX WEIGHT OF INNER LINING 5 lb/SQ FT

DESIGN LIMITATIONS
1. SEE CLADDING RANGE DRAWING W(21)UF2
2. EXTERNAL CORNER UNITS AVAILABLE IN 2' 4" WIDTHS ONLY
3. THE LOAD FROM UPPER FLOOR STOREY HEIGHT PANELS IS DESIGNED TO BE TAKEN DIRECT ONTO A FLOOR FASCIA PANEL BELOW THEREFORE ON MULTI STOREY JOBS FLOOR FASCIA PANELS MUST BE USED UNDER CONCRETE.

ASSEMBLY CONDITIONS — USE CODE IN BRACKETS FOR 4' 0" WIDE PANELS



ERECTION SEQUENCE — CONCRETE CLADDING LIES ON THE CRITICAL PATH AS IT MUST BE IN POSITION BEFORE THE ASPHALT ROOFING CAN BE COMPLETED OR THE WINDOWS FIXED. ERECTION SEQUENCES THAT MUST BE FOLLOWED ARE

SINGLE STOREY
1. FRAME.
2. FIXING CLEATS AT ROOF LEVEL.
3. ROOF DECK & ASPHALT ROOFING. (1 COAT AT EAVES)
4. CONC. PANELS OR FASCIA.
5. ASPHALT ROOFING EAVES (ADD FINISH & SPREAD CHIPPINGS)
6. WINDOWS.

MULTI STOREY
1. FRAME.
2. FLOOR BLOCKS.
3. FIXING CLEATS AT ROOF LEVEL.
4. ROOF DECK & ASPHALT ROOFING (1 COAT AT EAVES)
5. CONCRETE PANELS OR FASCIA.
6. ASPHALT ROOFING EAVES (ADD FINISH & SPREAD CHIPPINGS)
7. WINDOWS.

FIXING CLEATS — SEE DRG W(21)UF 6 & ASSEMBLY DRAWINGS.

TECHNIQUES OF PRESENTATION (REFER PRODUCTION DRAWING CHECK LIST & NOTES COLUMN THIS DRAWING)

SYMBOLS

- 12/6/C/N
- /N — PANEL NORMAL CONDITION USED ON CONCRETE TO CONCRETE HORIZONTAL JOINT CONDITIONS
- /C — PANEL CILL CONDITION USED ON CONCRETE PANELS WITH WINDOW OR LIGHT CLADDING OVER OR UNDER EAVES.
- EC/L — EXTERNAL CORNER PANEL, LEFT HAND
- EC/R — EXTERNAL CORNER PANEL, RIGHT HAND.
- a b c d e f g — CLEAT & BOLT CODE FOR COMPLETE PANEL.

SEPARATE DRAWINGS TO BE REFERRED TO FOR PRESENTATION TECHNIQUES FOR WINDOW WALLING B(21)H01, & FOR LIGHT CLADDING B(21)U 1.

REFER DRG. NO W(21)U3 FOR M.S. DROPPER SIZING & DETAILS.

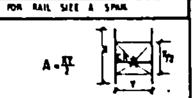
NOTE: ALL ELEVATIONS MUST BE DRAWN AS EXTENDED ELEVATIONS AS SHOWN. ALL ELEVATIONS ARE TO HAVE AN ALPHABETICAL CODE STARTING IN REVERSE ORDER E ZA/B/C ETC TO Z

CLERESTOREY
1. MAX. SPANS OF CLERESTOREY CLADDING RAIL BETWEEN M.S. DROPPERS, 8' 0" & 12' 0".
2. MAX. WIND LOAD TO BE APPLIED TO CLADDING RAIL IS THAT IMPOSED BY THE SUM OF HALF THE TOTAL WALL AREA ON EITHER SIDE OF THE RAIL, WITHIN THE DROPPERS. SEE TABLE BELOW
3. NO VERTICAL LOAD TO BE APPLIED.

MAXIMUM PERMISSABLE WALL AREA FOR RAIL SIZE & SPAN

DROPPER CENTRES	UP TO 8' 0"	OVER 8' 0" UP TO 12' 0"
3" x 3" x 3/8" RAIL	80 SQ FT	84 SQ FT
3½" x 3½" x 3/8" RAIL	NOT REQD	132 SQ FT

$A = \frac{XY}{2}$



NOTES

SEE PROGRAMME QUOTATION FOR SPECIFICATION & PROCEDURES.

THIS DRAWING TO BE READ IN CONJUNCTION WITH
- W(21)UF 2 COMPONENT RANGE
- W(21)UF 3, 4 & 5 COMPONENT DETAILS
- W(21)UF 6 FIXING ACCESSORIES
- B(21)G6 1 LINING
- W(20)U 4 CLADDING RAIL

ARCHITECT MUST CODE CONC PANELS ON PROJECT ELEVATIONS TO GIVE
1. SIZE & TYPE I.E. 6 (MODULES WIDE) /24 (MODULES HIGH) /N (NORMAL) OR C (CILL) CONDITION (SEE COMPONENT RANGE DRG W(21)UF 2
2. CLEAT ASSEMBLY CONDITION a b c d e f g. THE ASSEMBLY CONDITION DIAGRAMS SHOW TYPICAL PANEL ASSEMBLY CONDITIONS & THE APPROPRIATE CODE. WITH 4' 0" WIDE FASCIA & FLOOR FILLER PANELS, CLEAT Z IS USED IN PLACE OF CLEAT Y. CLEAT Z MUST HAVE 2 No FIXINGS TO STEEL. THE CODES e & f ARE USED ONLY FOR THIS CONDITION.

REFERENCES TO Y & Z ON DIAGRAMS ARE TO CLADDING CLEATS, SHOWN ONLY FOR INFORMATION. THE 'KEY TO CLEAT & BOLT CONDITION' TABLE IS NOT NECESSARY FOR CODING AND IS FOR INFORMATION OF QUANTITY SURVEYOR & SUB-CONTRACTOR.

3. ANNUAL REVIEW 1967
2. MINOR AMENDMENTS TO CLEAT CODING. CLERESTORY CONDITION ADDED.
1. ANNUAL REVIEW 1966

NO	REVISION	DATE	INITIALS

HERTFORDSHIRE County Council

G. C. FARDELL, MBE, FRIBA
County Architect,
County Hall, Hertford.

SEAC 2

DRAWING TITLE: EXTERNAL WALLING HEAVY CLADDING

SCALE

DRAWN BY	CHECKED BY	OFFICE	DATE
PL	DHM	HP BW	JAN 58

DRAWING NO: B (21)UF 1 — REVISION: 3

PROJECT: STEEL FRAME INFORMATION

E

Appendix 5

NEW SCHOOLS BUILDING PROGRAMME

COMPLETE LIST OF SCHOOLS

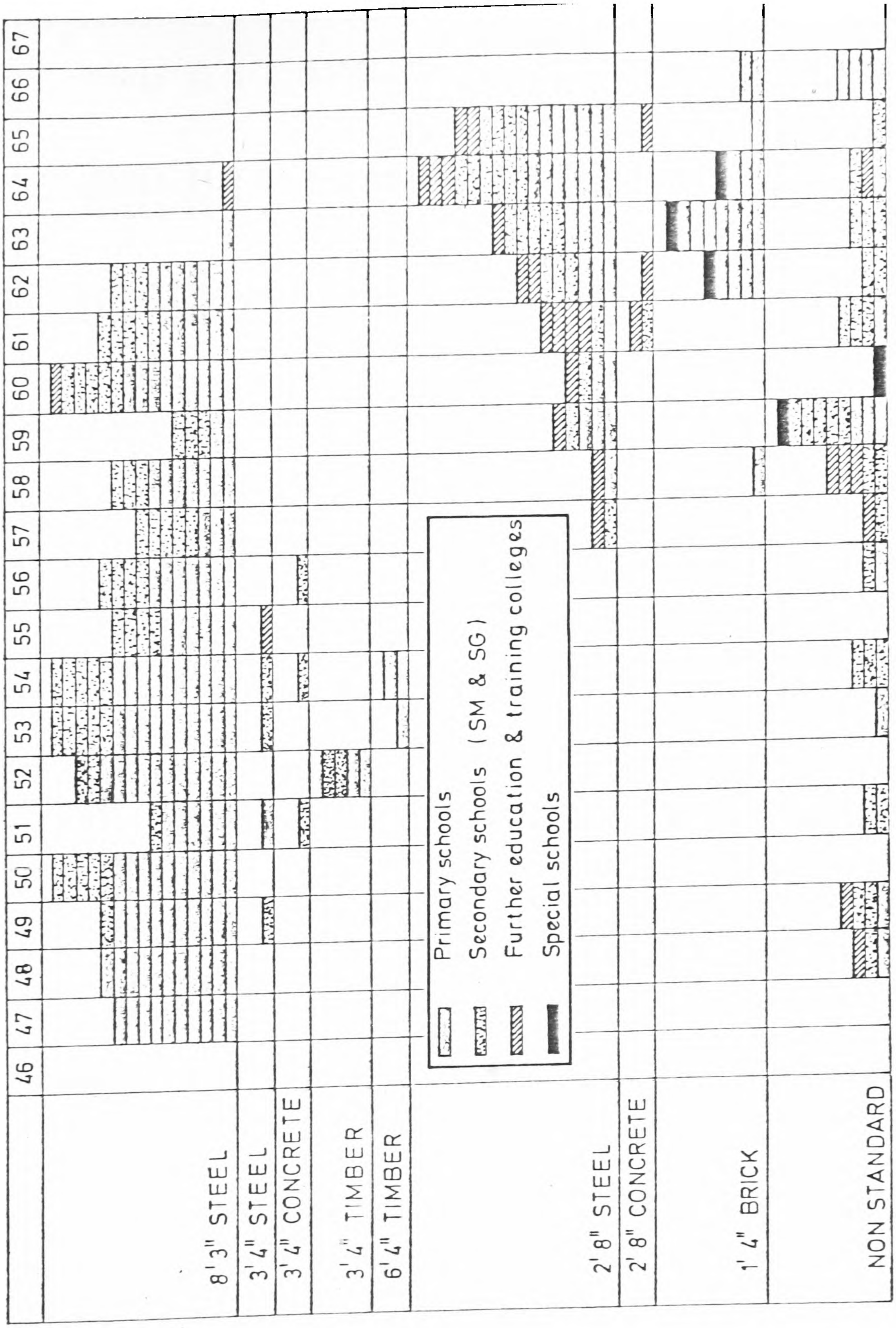
This Appendix lists every project, whether a complete new school or a major phase of a larger establishment, from the Cheshunt prototype to the last schools of the 2'8" system.

The list, which is extracted from the March 1970 edition of the New schools building programme produced by the County Architects Department, includes the original project names of all education building projects together with the names of the architects* and general contractors responsible, the commencement and completion dates of all contracts and the file reference numbers. The quantity surveyors and clerks of works concerned with each project are also listed.

The list is prefaced with a histogram summarising the output of schools of various types built annually in the successive Hertfordshire systems. Each block represents a project included in the list of schools. SEAC schools are not shown on the histogram.

---

* Projects carried out by private architects working independently are marked by an asterisk in column 1.


46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67
8'3" STEEL
3'4" STEEL
3'4" CONCRETE
3'4" TIMBER
6'4" TIMBER
2'8" STEEL
2'8" CONCRETE
1'4" BRICK
NON STANDARD
Primary schools
Secondary schools (SM & SG)
Further education & training colleges
Special schools

NO.	CTY. REF. NO.	SCHOOL	RE NAMED	TYPE	FILE	ARCHITECT(S)	GENERAL CONTRACTORS	QUANTITY SURVEYORS	CLERK OF WORKS	CONSTRUCTION	COMM.	COMP.
		NOTE: PROJECTS CARRIED OUT BY PRIVATE ARCHITECTS WORKING INDEPENDENTLY ARE MARKED BY AN ASTERISK IN COLUMN 1										
		1947 PRIMARY SCHOOLS PROGRAMME										
1	360	Cheshunt Blindman's Lane	Burleigh	JMI	444	B. Martin/D.L. Medd	Gee, Walker & Slater Ltd.	H.C.C.	Young	8'3" Steel	3.47	5.48
2	560	Essendon		JMI	456	W. Henderson/W.D. Lacy	Gee, Walker & Slater Ltd.	G. & T.	Pettifer	8'3" Steel	3.47	9.48
3	19	Letchworth Bedford Road	Wilbury	JMI	228	J.T. Redpath/D.L. Medd	Gee, Walker & Slater Ltd.	H.C.C.	West	8'3" Steel	6.47	4.49
4	40	Hitchin Strathmore Avenue		INF	563	J.T. Redpath/M. Crowley	M. & F.O. Foster & Co. Ltd.	H.C.C.	West	8'3" Steel	12.47	4.49
5	831	Hemel Hempstead Oliver Road	Belswains	J.M	558	J.T. Redpath/A. Cox	Gee, Walker & Slater Ltd.	H.C.C.	Beare	8'3" Steel	10.47	4.49
6	696	Croxley Green Little Green Lane		J.M.	90	W.D. Lacey	C. Miskin & Sons Ltd.	H.C.C.	Pettifer	8'3" Steel	7.47	5.49
7	697	Croxley Green Malvern Way		INF	449	W.D. Lacey	C. Miskin & Sons Ltd.	H.C.C.	Pettifer	8'3" Steel	7.47	4.49
8		Watford, Oxhey Site 4 (Orig. Infts.)	Colnbrook	S.S.	561	M. Crowley/B. Martin	Holland & Hannen & Cubitts Ltd.	H.C.C.	Reading	8'3" Steel	9.47	5.49
9	772	Watford, Oxhey Site 4 (Orig. J.M.)	Warren Dell	JMI	560	M. Crowley/B. Martin	Holland & Hannen & Cubitts Ltd.	H.C.C.	Reading	8'3" Steel	10.47	5.49
10	679	Bushey Millway	Highwood	JMI	442	A. Cox/B. Martin	C. Brightman & Son Ltd.	H.C.C.	Reading	8'3" Steel	9.47	4.49
		1948 & 1949 PRIMARY SCHOOLS PROGRAMME										
13	416	St. Albans Watson Avenue	Spencer	J.M	464	B. Martin/D. Middleton	C. Miskin & Sons Ltd.	H.C.C.	Beare	8'3" Steel	2.49	3.50
14	256	Hertford Morgans Walk		JMI	579	B. Martin/M. Smith	Ekins & Co. Ltd.	G. & T.	Pettifer	8'3" Steel	2.49	4.50
15	663	East Barnet Brookside	Monkfrith	INF	487	M. Crowley/O.J. Cox	Y.J. Lovell (Bucks) Ltd.	G. & T.	Howe	8'3" Steel	3.49	2.50
16	615	Borehamwood Cowley Hill		J.M	565	A.R. Garrod/M. Crowley	J. Laing & Son Ltd.	G. & T.	Reading	8'3" Steel	3.49	2.50
17	740	Watford Kingsway	Leavesden Green	J.M	397	E.C. Tory	Y.J. Lovell (Bucks) Ltd.	G. & T.	Reading	8'3" Steel	4.49	5.50
18	307	Ware Park Road	St. Mary's	INF	597	A.R. Garrod	Ekins & Co. Ltd.	G. & T.	Meek	8'3" Steel	4.49	7.50
19	524	Welwyn G.C. Pentley Park	Templewood	JMI	603	A.W.C. Barr	C. Miskin & Sons Ltd.	G. & T.	Meek	8'3" Steel	5.49	8.50
20	38	Hitchin Walsworth	Highover	JMI	623	W.D. Lacey	M. & F.O. Foster & Co. Ltd.	G. & T.	West	8'3" Steel	6.49	9.50
21	488	Harpenden Batford		JMI	598	B. Martin/F.C. Bowler	Y.J. Lovell (Bucks) Ltd.	G. & T.	Holden	8'3" Steel	6.49	9.50
22	575	Hatfield Birchwood Avenue	Gascoyne Cecil	J.M	144	D. Barron/C.E. Lovegrove	Gee, Walker & Slater Ltd.	G. & T.	Howe	8'3" Steel	7.49	9.50
23	423	St. Albans Aboyne Lodge		INF	325	D. Barron	Y.J. Lovell (Bucks) Ltd.	G. & T.	Holden	8'3" Steel	7.49	9.50
24	770	Watford, Oxhey Site 5	Oxhey Wood	J.M	639	Gollins & Melvin	Y.J. Lovell (Bucks) Ltd.	G. & T.	Curtis	8'3" Steel	8.49	9.50
25	771	Watford, Oxhey Site 5	Oxhey Wood	INF	640	Gollins & Melvin	Y.J. Lovell (Bucks) Ltd.	G. & T.	Curtis	8'3" Steel	8.49	12.50
26	741	Watford, Cassiobury		JMI	393	A.W.C. Barr/C.M. Cuthill	A. Fairhead & Sons Ltd.	G. & T.	Reading	8'3" Steel	9.49	12.50
27	834	Hemel Hempstead Adeyfield	Maylands	J.M	643	K.C. Twist/E. Twist	C. Miskin & Sons Ltd.	G. & T.	Beare	8'3" Steel	9.49	1.51
28	835	Hemel Hempstead Adeyfield	Maylands	INF	642	K.C. Twist/E. Twist	C. Miskin & Sons Ltd.	G. & T.	Beare	8'3" Steel	9.49	1.51
29	636	Barnet Whitings Hill		JMI	588	E.C. Tory/G.E. Webster	A. Fairhead & Sons Ltd.	G. & T.	Howe	8'3" Steel	10.49	10.50
30	833	Hemel Hempstead South Hill		JMI	541	Harrison & Seel	Universal Housing Co. Ltd.	G. & T.	Beare	8'3" Steel	10.49	12.50
31	429	St. Albans Tavistock	Mandeville	JMI	620	K.C. Evans/H.T. Swain	C. Miskin & Sons Ltd.	G. & T.	Potter	8'3" Steel	11.49	10.50
32	123	Stevenage Sish Lane	Fairlands	J.M	554	K.C. Evans	M. & F.O. Foster & Co. Ltd.	G. & T.	West	8'3" Steel	11.49	12.50
33	774	Watford Carpenders Park	St. Meryl	JMI	396	O.J. Cox/R.G. Lyon	Y.J. Lovell (Bucks) Ltd.	Thos. Barrett	Armitage	8'3" Steel	12.49	12.50
*	655	East Barnet, Church Hill (Orig. Infts.)		JMI	606	Dawe, Carter & Parts.	William King & Sons Ltd.	H.C.C.	Jones	Non-Standard	2.50	9.51
*	72	Wymondley		JMI	241	R. Sheppard & Partners	M. & F.O. Foster & Co. Ltd.	E.C. Harris	–	Non-Standard	8.50	10.51
		1948 & 1949 SECONDARY SCHOOLS PROGRAMME										
11	763	Watford, Oxhey Site 8	Hampden	S.M	562	W.A. Henderson/D.A. Forder	Gee, Walker & Slater Ltd.	G. & T.	Curtis	8'3" Steel	4.49	11.81
12	762	Watford, Oxhey Site 8	Clarendon	S.M	637	B. Martin/R. de Y-Bateson	Gee, Walker & Slater Ltd.	Thos. Barrett	Curtis	3'4" Steel (Prototype)	10.49	1.53
*	670	Bushey Aldenham Road	Bushey Grammar	GMR	387	Dawe Carter & Parts.	Y.J. Lovell (Bucks) Ltd.	H.C.C.	Hawkings	Non-Standard	5.49	10.51
*	106	Stevenage Walkern Road	Barclay	S.M	330	F.R.S. Yorke	Gilbert Ash Ltd.	Davies B. & E.	Curtis	Non-Standard	9.47	6.51
*241	343	Cheshunt Cambridge Road	Riversmead	S.M	445	Norman & Dawbarn	Y.J. Lovell (Bucks) Ltd.	Wm. C. Inman	Pollard	Non-Standard	8.50	4.53
		1949 FURTHER EDUCATION PROGRAMME										
*	986	Watford Technical College	College of Technology	C.T.	388	Lanchester & Lodge	Truett & Steel/ Y.J. Lovell (Bucks) Ltd.	G. & T.	–	Non-Standard	1938/46	1952
*154	976	Hatfield Technical College	College of Technology	C.T	451	Easton & Robertson	Gilbert Ash Ltd.	G. & T.	Pryor	Non-Standard	1949	1952

NO.	CTY. REF. NO.	SCHOOL	RE NAMED	TYPE	FILE	ARCHITECT(S)	GENERAL CONTRACTORS	QUANTITY SURVEYORS	CLERK OF WORKS	CONSTRUCTION	COMM	COMP
		1950 PRIMARY SCHOOLS PROGRAMME										
34	659	East Barnet Daneland	Oakland	INF	452	Architects' Co-Partnership	Catchpole & Co. Ltd	G. & T.	Potter	8'3" Steel	4.50	5.51
35	3	Baldock Weston Way	St. Mary's	INF	435	Harrison & Seel	M. & F.O. Foster & Co. Ltd.	Thos. Barrett	Nash	8'3" Steel	6.50	5.51
36	525	Welwyn G.C. Wheatley Road	Blackthorn	JMI	589	D. Middleton	Leightons Contractors Ltd	Thos. Barrett	Abrams	8'3" Steel	4.50	5.51
37	21	Letchworth Grange		J M	230	M J E. Middleton	Leightons Contractors Ltd.	Thos. Barrett	Nash	8'3" Steel	4.50	9.51
38	574	Hatfield Brookmans Park		JMI	599	C.M. Cuthill/A.R. Garrod	Ekins & Co. Ltd.	G. & T.	Holden	8'3" Steel	7.50	9.51
39	781	Abbotts Langley Popes Road	Hazelwood	INF	594	D. Middleton	C. Brightman & Son Ltd.	H C C	Reading	8'3" Steel	10.50	2.52
40	768	Watford, Oxhey Site 2 (Orig J M.)	Little Furze	JMI	647	Gollins & Melvin	Y.J. Lovell (Bucks) Ltd.	Thos. Barrett	Howe/Nash	8'3" Steel	11.50	11.52
41		Watford, Oxhey Site 2 (Orig. Infts.)	Hangers Wood	S.S	E647M	Gollins & Melvin	Y J. Lovell (Bucks) Ltd.	Thos. Barrett	Howe/Nash	8'3" Steel	11.50	11.52
42	453	London-Colney	Bowmansgreen	JMI	243	C.M. Cuthill/A.W.C. Barr	Ekins & Co. Ltd	G. & T.	Reading	8'3" Steel	12.50	4.52
43	692	Rickmansworth Shepherds Lane	Mill End (Now William Penn)	J.M S.M	527 510	M J.E. Middleton	Abbiss & Hale Ltd	Thos. Barrett	Hawkings	8'3" Steel	3.51	5.52
		1950 SECONDARY SCHOOLS PROGRAMME										
44	277	Hoddesdon Stanstead Road	John Warner	S.M	195	R S. Eve/S.V. Wyatt	A. Fairhead & Sons Ltd.	Thos. Barrett	Meek	8'3" Steel	11.50	1.53
45	409	St. Albans St. Julians (Girls)		S.M	301	Gollins & Melvin	C. Miskin & Sons Ltd.	Thos. Barrett	Pettifer	8'3" Steel	3.51	12.52
46	812	Hemel Hempstead Adeyfield		S.M	631	G. Fairweather	Circle Construction Co. Ltd.	Thos. Barrett	Howe/Pettifer	8'3" Steel	3.51	9.53
47	402	St. Albans Sandridgebury Lane (Girls)		GMR	303	K.C. Twist	Kirk & Kirk Ltd.	Thos. Barrett	Beare	8'3" Steel	4.51	12.52
48	513	Welwyn G.C. Hollybush Lane	Howard	S.M	410	K.C. Evans	Ekins & Co. Ltd.	Thos. Barrett	Dennis/Pearce	8'3" Steel	5.51	10.54
		1951 PRIMARY SCHOOLS PROGRAMME										
49	613	Borehamwood Furzehill Road	Summerswood	J.M	607	B. Martin	Hale Construction Co. Ltd.	Thos. Barrett	Abrams	3'4" Steel	11.50	1.53
50	773	Watford, Oxhey Site 9	Greenfields	JMI	648	H.T. Swain	Francis Jackson Contractors Ltd.	H.C.C.	Nash	8'3" Steel	8.51	9.52
51	617	Borehamwood Kenilworth Drive		JMI	113	R.I E Haynes/L. Hope	C. Miskin & Sons Ltd.	G. & T	Abrams	8'3" Steel	11.51	4.53
52	126	Stevenage Broom Barns		INF	692	V.H. Lee/M.J.E. Middleton	Francis Jackson Contractors Ltd.	H C.C.	West	8'3" Steel	4.52	4.53
53	576	Hatfield Birchwood Avenue	Cranborne	INF	719	M. Wollcki	Ekins & Co. Ltd	H.C.C.	Holden	8'3" Steel	4.52	4.53
54	618	Borehamwood Theobald Street	Brookfield	J.M	714	R.L. Brewerton	Francis Jackson Contractors Ltd.	Thos. Barrett	Reading	8'3" Steel	4.52	9.53
55	619	Borehamwood Theobald Street	Merydene	INF	714	R.L. Brewerton	Francis Jackson Contractors Ltd.	Thos. Barrett	Reading	8'3" Steel	4.52	9.53
		1951 SECONDARY SCHOOLS PROGRAMME										
56	690	Rickmansworth Scots Hill		GMR	280	Hening & Chitty	Universal Housing	Thos. Barrett	Hawkings	8'3" Steel	4.52	9.54
57	718	Watford Woodside	Francis Combe	S.M	592	W.A. Henderson/D.A. Forder	C. Brightman & Son Ltd	G. & T.	Pollard	3'4" Concrete/N.S.	6.52	9.52
*169	550	Hatfield Roe Green	Hatfield School	S.T	440	Easton & Robertson	Gilbert Ash Ltd	G. & T.	Pryor	Non Standard	8.51	9.53
*	80	Royston Garden Walk	Meridian	S.M	539	R. Sheppard & Partners	M. & F.O. Foster & Co. Ltd.	E.C. Harris	Bird	Non Standard	8.52	6.54
		1952 PRIMARY SCHOOLS PROGRAMME										
58	745	Watford, Garston Cow Lane	Lea Farm	J M	595	M.J.E. Middleton	C. Brightman & Son Ltd.	H C C.	Hall	8'3" Steel	7.52	12.53
59	353	Waltham Cross Park Lane	Hurst Drive	JMI	467	Hening & Chitty	A. Fairhead & Sons Ltd	G. & T.	Dennis	8'3" Steel	7.52	9.53
60	20	Letchworth Archers Way	Icknield	INF	748	Gollins, Melvin & Partners	Ekins & Co Ltd.	G. & T	Bird	8'3" Steel	8.52	12.53
61	210	Bishop's Stortford Havers Lane	Great Havers	JMI	625	A.H. Donnan	J.A. Elliott Ltd.	G. & T.	Ottea	8'3" Steel	9.52	9.53
62	666	East Barnet Bevan Estate	Livingstone	JMI	450	James Cubitt & Partners	Francis Jackson Contractors Ltd	H.C.C.	Nash	8'3" Steel	10.52	12.53
63	836	Hemel Hempstead Hobbs Hill		J M	746	H.T. Swain	Y.J. Lovell (Bucks) Ltd.	H.C.C.	Pettifer	8'3" Steel	3.53	9.54
64	837	Hemel Hempstead Hobbs Hill	Hobbs Hill Wood	INF	746	H.T. Swain	Y.J. Lovell (Bucks) Ltd.	H.C.C.	Pettifer	8'3" Steel	3.53	5.54
65	620	Borehamwood Saffron Green		JMI	718	R.I.E Haynes	C. Miskin & Sons Ltd.	H C C	Reading	8'3" Steel	3.53	5.54
66	744	Watford Woodside	Alban Wood	INF	593	R.C N. Paul	Kirk & Kirk Ltd.	G. & T.	Hall	3'4" Timber	3.53	5.54
67	129	Stevenage Roebuck		J.M	697	A.P. Tait	Ekins & Co. Ltd.	G. & T.	Dennis	3'4" Steel	3.53	9.54
68	768	Watford, Oxhey Site 7	Woodhall	J M	634	V.H. Lee	Francis Jackson Contractors Ltd.	H.C.C.	Dale	8'3" Steel	3.53	9.54
69	130	Stevenage Roebuck		INF	697	A.P. Tait	Ekins & Co. Ltd	G. & T.	Dennis	3'4" Timber	3.53	9.54
70	769	Watford, Oxhey Site 7	Woodhall	INF	634	V H Lee	Francis Jackson Contractors Ltd.	H.C C.	Dale	8'3" Steel	3.53	9.54
		1952 SECONDARY SCHOOLS PROGRAMME										
71	603	Borehamwood Theobalds	Lyndhurst	S.M	715	B. Martin/A.D.H. Embling	Francis Jackson Contractors Ltd.	G. & T.	Abrams	3'4" Timber	3.52	9.54
72	634	Barnet, Barnet Lane	Ravenscroft	S.M	431	K.C. Evans	Marples Ridgway Ltd.	Thos Barrett	Meek	8'3" Steel	10.52	6.54
73	555	Hatfield Wellfield Road	Burleigh	S.M	147	Architects' Co-Partnership	Welwyn Builders	G. & T.	Curtis	3'4" Timber	4.53	10.54
74	33	Hitchin Old Hale Way (Girls)	High School	S.M	751	R. Radford/H.T. Swain	J. Willmott & Sons Ltd	Thos. Barrett	Howe	8'3" Steel	4.53	11.54

NO.	CTY. REF. NO.	SCHOOL	RE NAMED	TYPE	FILE	ARCHITECT(S)	GENERAL CONTRACTORS	QUANTITY SURVEYORS	CLERK OF WORKS	CONSTRUCTION	COMM.	COMP.
		1953 PRIMARY SCHOOLS PROGRAMME										
75	431	St Albans New Green Farm (Orig. JMI)	Margaret Wix	J.M	646	Architects' Co-Partnership	C. Miskin & Sons Ltd.	G. & T.	Holden	8'3" Steel	7 53	9 54
76	832	Hemel Hempstead Belswains		INF	771	S. Morrison & Partners	Universal Housing	Gleeds	Reading	6'8" Timber	7 53	5 54
77	838	Hemel Hempstead Bennetts End	Chambersbury	JMI	745	M.J.E. Middleton	Universal Housing	H C C	Pettifer	8'3" Steel	9 53	1 55
78	839	Hemel Hempstead Chaulden		J.M	764	R Brewerton/M. Wolicki/ J. Platt	C Miskin & Sons Ltd.	H C C.	Hall	8'3" Steel	10.53	1 55
79	840	Hemel Hempstead Chaulden		INF	764	R. Brewerton/M. Wolicki/ J. Platt	C. Miskin & Sons Ltd.	H.C.C.	Hall	8'3" Steel	10 53	1.55
80	780	Abbotts Langley Hillside		J.M	549	M. Wolicki	Y.J. Lovell (Bucks) Ltd	G. & T	Pollard	8'3" Steel	11 53	9 54
81	127	Stevenage Bedwell		J M	693	Architects' Co-Partnership	A. Fairhead & Sons Ltd	G. & T.	James	8'3" Steel	12 53	4 55
82	128	Stevenage Bedwell		INF	693	Architects' Co-Partnership	A. Fairhead & Sons Ltd.	G. & T.	James	8'3" Steel	12.53	4 55
83	125	Stevenage Broom Barns		J.M	762	V.H. Lee	Francis Jackson Contractors Ltd.	H.C C.	James	8'3" Steel	1 54	1 55
84	615	Borehamwood Cowley Hill	Woodlands	INF	772	A H. Donnan	Y.J Lovell (Bucks) Ltd.	G & T.	Nash	8'3" Steel	3 54	2 55
85	526	Welwyn G.C. Blackthorn	Thumbswood	INF	773	R.C.N. Paul	C. Miskin & Sons Ltd	H.C.C.	Bird	8'3" Steel	3 54	3 55
•	361	Cheshunt Flamstead End		JMI	657	Hening & Chitty	C.P. Roberts & Co. Ltd.	G & T	Nash	Non-Standard	7.53	6 54
		1953 SECONDARY SCHOOLS PROGRAMME										
86	107	Stevenage West Shephall	Heathcote	S.M	703	K.C. Twist	M. & F.O. Foster & Co. Ltd.	Thos. Barrett	Pearce	8'3" Steel	7 53	9.55
87	813	Hemel Hempstead Bennetts End		S M	744	L.J. Clarke/A. Meikle	Leslie & Co. Ltd.	Thos. Barrett	Beare	8'3" Steel	11 53	5.56
88	802	Hemel Hempstead Road 333	Apsley Grammar	GMR	743	Johns & Slater	Leslie & Co. Ltd.	G. & T.	Beare	8'3" Steel	2 54	5 56
89	604	Borehamwood Leggatts Farm	Campions	S.M	687	S.V. Wyatt/G.V. Howes	Gee, Walker & Slater Ltd	Thos. Barrett	Abrams	8'3" Steel	3.54	3 56
90	601	Borehamwood Potters Lane		GMR	454	R. de Y-Bateson/ C.E. Lovegrove	Francis Jackson Contractors Ltd.	G. & T	Dale	8'3" Steel	5 54	5 56
91	514	Welwyn G C. Cole Green Lane	Heronswood	S.M	749	A.T. Williams/D.O. Sangster	Ekins & Co. Ltd.	G. & T.	Meek	3'4" Steel	5.54	2.57
		1954 PRIMARY SCHOOLS PROGRAMME										
92	841	Hemel Hempstead Adeyfield	Broadfield	J.M	649	J. Platt	Kirk & Kirk Ltd.	H C C	Reading	8 3" Steel	5 54	9 55
93	842	Hemel Hempstead Adeyfield	Broadfield	INF	649	J. Platt	Kirk & Kirk Ltd.	H.C.C.	Reading	8'3" Steel	5.54	9 55
94	131	Stevenage Peartree Spring		J M	700	S. Morrison & Partners	Ekins & Co. Ltd.	Gleeds	Dennis	6'8" Timber	3 54	12.55
95	132	Stevenage Peartree Spring		INF	700	S. Morrison & Partners	Ekins & Co. Ltd.	Gleeds	Dennis	6'8" Timber	3.54	12 55
96	578	Hatfield Redhall	Hazelgrove	JMI	731	Johns, Slater & Haward	Y.J. Lovell (Bucks) Ltd.	G. & T	Bird	8'3" Steel	6 54	9 55
97	490	Harpenden Roundwood		JMI	728	Architects' Co-Partnership	Francis Jackson Contractors Ltd.	G. & T.	Curtis	8'3" Steel	6 54	4 56
98	621	Borehamwood Leggatts Farm	Parkside	J M	761	H.T. Swain/J. Vaughan	Francis Jackson Contractors Ltd	G. & T.	Pettifer	8'3" Steel	1 55	9 56
99	622	Borehamwood Leggatts Farm	Greenacres	INF	761	H.T. Swain/J. Vaughan	Francis Jackson Contractors Ltd.	G. & T	Pettifer	8'3" Steel	1 55	9 56
100	133	Stevenage Long Meadow		J.M	698	A P. Tait/J. Ollis	Wm. Sindall Ltd.	H C.C.	Young	8'3" Steel	12 54	9 56
101	134	Stevenage Long Meadow		INF	698	A.P. Tait/J. Ollis	Wm. Sindall Ltd.	H C C	Young	8'3" Steel	12 54	9.56
102	529	Welwyn G.C. The Commons	Howlands	J.M	767	M.J.E. Middleton/R.B. Dixon	Y J. Lovell (Bucks) Ltd.	H C C.	Howe	8'3" Steel	3 55	10 56
103	530	Welwyn G.C. The Commons	Rolls Wood	INF	767	M.J.E. Middleton/R.B. Dixon	Y.J. Lovell (Bucks) Ltd.	H.C.C.	Howe	8'3" Steel	3.55	10 56
		1954 SECONDARY SCHOOLS PROGRAMME										
104	246	Hertford Balls Park	Simon Balle	S M	726	K.C. Twist/D.J. Weate	Crook Brothers	G. & T.	James	3'4" Steel	4 55	6 57
105	482	Harpenden Roundwood		S M	136	D C G. Davies	C. Miskin & Sons Ltd	G. & T.	Curtis	8'3" Steel	10 54	9 56
106	671	Watford Secondary Technical	Technical High	S.T	781	K.C. Evans/R.J. Whitley	Y J. Lovell (Bucks) Ltd.	G. & T.	Pearce	3'4" Concrete	5.55	1 58
107	556	Hatfield Travellers Lane	St. Audrey's	S M	729	G.F. Woodward/D.H. McCormick	Y J. Lovell (Bucks) Ltd	Thos. Barrett	Howe	8'3" Steel	3.55	9 57
108	764	Langleybury		S.M	725	J. Cubitt & Partners	Jesse Mead Ltd	Thos. Barrett	Reading	8'3" Steel	1.55	9 56
43	692	Rickmansworth Shepherd's Lane	William Penn	S M	E510	Architects' Co-Partnership	Abbiss & Hale Ltd.	Thos Barrett	Hall	8'3" Steel	3 55	11 56
110	342	Waltham Cross Park Lane	Queen Eleanor	S.M	802	Architects' Co-Partnership	A. Fairhead & Sons Ltd.	Thos. Barrett	Pollard	8'3" Steel	4 55	11.56
•	935	Tring Mortimer Hill		S M	801	Verner O. Rees	D. Lockhart Ltd.	Cameron & M.	Hickson	Non-Standard	5.55	3 57
•	203	Bishop's Stortford Thorley Hill	Boys' High School	S.M	437	H.V. Lobb & Partners	J A. Elliott Ltd	C E Ball	Bird	Non-Standard	3 55	2 57
•	101	Stevenage Alleyne's		GMR	329	Easton & Robertson	M. & F.O. Foster & Co. Ltd	G. & T.	Dennis	Non-Standard	4.55	8.57
		1955 PRIMARY SCHOOLS PROGRAMME										
111	124	Stevenage Pound Avenue 2 FE	Fairlands	INF	822	J. Cubitt & Partners	Ekins & Co. Ltd	H C.C.	Young	8'3" Steel	12.55	1 57
112	460	St. Albans West Avenue 1 FE	Killigrew	JMI	302	J Platt	C. Miskin & Sons Ltd.	H C.C	Hall	8 3" Steel	12 55	12.56
113	614	Borehamwood South 2 FE	Monksmead	INF	775	B L. Maciejowski	Francis Jackson Contractors Ltd.	G. & T.	Pettifer	8 3" Steel	2 56	5 57
114	435	St Albans The Camp 1 FE	Windermere Ave.	JMI	821	C. Culpin & Partners	Y.J Lovell (Bucks) Ltd.	G. & T.	Nash/Hall	8'3" Steel	4 56	4 57
115	409	Harpenden Batford 2 FE		INF	777	Architects' Co Partnership	H.C. James Ltd.	G. & T	Curtis	8'3" Steel	4 56	5 57
116	22	Letchworth The Grange 2 FE	Northfields	INF	230A	J. Ollis	J. Willmott & Sons Ltd.	H.C C.	Dennis	8'3" Steel	4 56	5 57

NO.	CTY. REF. NO.	SCHOOL	RE-NAMED	TYPE	FILE	ARCHITECT(S)	GENERAL CONTRACTORS	QUANTITY SURVEYORS	CLERK OF WORKS	CONSTRUCTION	COMM	COMP
		1955 SECONDARY SCHOOLS PROGRAMME										
117	672	Bushey Cold Harbour PH 1 3 FE	Bushey Meads	S.M	722	A.D.H. Embling/J.A. Bolton	C. Miskin & Sons Ltd	G. & T.	Reading	8'3" Steel	3 56	6 58
118	102	Stevenage Girls' Grammar 3 FE		GMR	707	C.L. Gotch	Ekins & Co. Ltd.	Thos. Barrett	Abrams	8'3" Steel	4 56	9 58
119	653	East Barnet Wilderness 4 FE	Ashmole	S.M	338	G.M. Whitley	A. Fairhead & Sons Ltd	G. & T.	Beare	8'3" Steel	4 56	7.58
120	511	Welwyn Garden (East) Grammar 3 FE	WGC High School (Now Sir Fredrick Osbourn)	GMR	468	K.C. Twist/G.R. Nettleton	Ekins & Co. Ltd.	Thos Barrett	Dale	8'3" Steel	4 56	9 58
		1955 FURTHER EDUCATION PROGRAMME										
121	950	Letchworth Technical College	College of Technology	C.T	624	W D Lacey/R.B. Walsh	J. Willmott & Sons Ltd.	G. & T.	Green	3'4" Steel	5 56	7 58
		1956 PRIMARY SCHOOLS PROGRAMME										
122	135	Stevenage Bandley Hill 2 FE		J.M	701	C. Culpin & Partners	Crook Bros.	H.C.C.	Young	8'3" Steel	5.57	8.59
123	136	Stevenage Bandley Hill 2 FE		INF	701	C. Culpin & Partners	Crook Bros.	H.C.C.	Young	8'3" Steel	5.57	8.59
124	531	Welwyn G.C. Creswick 1 FE		JMI	766	H.G. Cherry & Partners	C. Miskin & Sons Ltd.	G. & T.	Meek	8'3" Steel	11 56	9.57
125	784	Radlett Willow Way 2 FE	Fairfield	J.M	427	J. Cubitt & Partners	C. Miskin & Sons Ltd.	H.C.C.	Reading	8'3" Steel	9.56	9 57
126	121	Stevenage Weston Road 2 FE	Almond Hill	J.M	690	R.B. Dixon	A. Fairhead & Sons Ltd.	H C.C.	Young	8'3" Steel	10.56	10.57
127	434	St. Albans Oakwood Drive 1 FE		JMI	596	J. Vaughan	H.C. Janes Ltd.	H.C.C.	Hall	8'3" Steel	11.56	1.58
128	42	Hitchin Purwell Avenue 1 FE		JMI	534	D.G. Ashdown	J. Willmott & Sons Ltd.	H.C.C.	James	8'3" Steel	2.57	11 57
•	211	Bishop's Stortford Thorley Hill		JMI	429	H.V. Lobb & Partners	J.A Elliott Ltd.	C E. Ball	Bird	Non-Standard	1.56	1.57
		1956 SECONDARY SCHOOLS PROGRAMME										
129	278	Broxbourne Red House 2 FE	Baas Hill	S.M	453	R. Sheppard & Partners	Ekins & Co. Ltd.	D. Harwin	Bird	8'3" Steel	8 57	4 59
107	556	Hatfield Travellers Lane PH.2 4 FE	St. Audrey's	S.M	729	D.H. McCormick	Y.J. Lovell (Bucks) Ltd.	Thos. Barrett	Howe	8'3" Steel	2.57	7 58
130	10	Letchworth Grammar Extensions		GMR	227A	H Chetwynd Stapylton	J. Willmott & Sons Ltd.	H C C.	Green	Non-Standard	4.57	4 58
57	718	Watford Francis Combe PH.2 5 FE		S.M	592	D M W. Nicol/R Y. MacDonald	C. Brightman & Son Ltd.	V.B. Johnson	Pollard	3'4" Concrete	3 57	9.58
131	109	Stevenage Shephalbury 4 FE		S.M	699	J. Platt	H.C. Janes Ltd.	Thos. Barrett	Pettifer	8'3" Steel	5 57	12 58
•159	11	Letchworth, Norton S.M– Extensions		S.M	219	Woodroffe, Buchanan & Coulter	M & F.O. Foster & Co. Ltd	J. McBain	Pollard	8'3" Steel	4.58	1 60
		1957 PRIMARY SCHOOLS PROGRAMME										
132	363	Cheshunt Dark Lane 1 FE	Bonneygrove	J.M	768	B.L. Maciejowski	D. Chaston Ltd	H C C	Hall	8'3" Steel	8 57	9 58
133	844	Hemel H Warners End South 1 FE	Micklem	JMI	740	N H White/R S Watson	H.C. Janes Ltd.	H.C.C.	Reading	8'3" Steel	8 57	6 58
134	580	Hatfield Travellers Lane 2 FE	Broad Oaks	J.M	730	R B Dixon/F.M Marlow	Francis Jackson Contractors Ltd.	H.C.C.	Howe	8'3" Steel	2 58	5 59
		1957 SECONDARY SCHOOLS PROGRAMME										
117	672	Bushey Cold Harbour PH 2 4 FE	Bushey Meads	S.M	722	J A. Bolton	C. Miskin & Sons Ltd.	G. & T.	Reading	8'3" Steel	5 57	6 58
135	605	Borehamwood Thrift Farm 4 FE	Holmshill	S.M	785	Architects' Co-Partnership	Abbiss & Hale Ltd.	V.B. Johnson	Meek	8'3" Steel	8.57	5 59
12	762	Oxhey Clarendon Extensions	Sir James Altham	S.M	637	J H McMorrow	A. Fairhead & Sons Ltd.	H.C.C.	Abrams	2'8" Steel	2.58	9 59
136	814	Hemel H. Warners End 4 FE	John F. Kennedy R.C.	S.M	742	D.C.G. Davies	Jesse Mead Ltd.	V B. Johnson	Hickson	8'3" Steel	2.58	9 59
137	204	Bishop's Stortford Parsonage L. 3 FE	The Margaret Dane	S.M	571	J. Cubitt & Partners	J A Elliott Ltd	Thos. Barrett	Dennis	8'3" Steel	10.57	7.59
149	442	St. Albans Marshalswick 3 FE (Boys)		S.M	319	R.F. Freemantle	H.C. Janes Ltd.	G. & T.	Beare	8'3" Steel	5 58	2 60
158	245	Hertford Grammar School– Extensions	Richard Hale	GMR	155	R.E. McLardy	J. Willmott & Sons Ltd.	H C.C.	Jakeway	Non-Standard	5 58	10.59
		1957 FURTHER EDUCATION PROGRAMME										
138	970	St Albans College of F. Edn. & Herts College of Bldng.		CFE	804	R.J.A. Wakely	Wm. Sindall Ltd.	Thos. Barrett	Pearce	2'8" Steel	3 58	10 60
•160	978	Mid Herts College of F. Edn.		CFE	413	Louis de Soissons	C. Miskin & Sons Ltd.	Sydney A. Paine	Lord	Non-Standard	6 58	10 60

NO.	CTY. REF. NO.	SCHOOL	RE-NAMED	TYPE	FILE	ARCHITECT(S)	GENERAL CONTRACTORS	QUANTITY SURVEYORS	CLERK OF WORKS	CONSTRUCTION	COMM.	COMP.
		1958 PRIMARY SCHOOLS PROGRAMME										
139	581	Hatfield Travellers Lane 2 FE	Bishops Wood	INF	♦ 730	R.B. Dixon/F.M. Marlow	Francis Jackson Contractors Ltd.	H.C.C.	Howe	8'3" Steel	2 58	5 59
140	137	Stevenage Camps Hill 2 FE		J.M.	● 705	J. Cubitt & Partners	H.C. Janes Ltd.	H.C.C	Young	8'3" Steel	5 58	10.59
142	432	St. Albans Margaret Wix 2 FE		INF	646	J. Vaughan	J. Willmott & Sons Ltd.	H.C.C.	Hall	8'3" Steel	6 58	3 59
143	532	Welwyn G.C. Harwood Hill 2 FE	Harwood	J.M.	774	D.G. Ashdown/M.J. Kitchen	C. Miskin & Sons Ltd.	H.C.C.	Beare	8'3" Steel	8.58	9 59
144	845	Hemel H Warners End North 1 FE	Martindale	JMI	741	B.L. Maciejowski (Maciel)	Y.J. Lovell (Bucks) Ltd.	H.C.C.	Reading	8'3" Steel	10 58	9 59
145	450	Redbourn 2 FE		J.B	547	C. Culpin & Partners	C. Miskin & Sons Ltd.	V.B. Johnson	Hickson	8'3" Steel	3 59	1 60
146	846	Hemel H. Bennetts End 1 FE	The Reddings	JMI	733	R.B. Dixon/P.J. Hislop	H.C. Janes Ltd.	H.C.C.	Reading	8'3" Steel	2.59	1 60
147	365	Cheshunt Cadmore Lane 2 FE	Brookland	J.M	788	V.H. Lee	Townsend & Collins Ltd.	H.C.C.	Bird	1'4" Brick (Prototype)	4 59	4.60
148	462	St. Albans Skyswood 1 FE		JMI	574	J. Vaughan	T & B (St. Albans) Ltd.	Thos. Barrett	Hall	2'8" Steel	5 59	4.60
		1958 SECONDARY SCHOOLS PROGRAMME										
150	302	Ware 4 FE	(C.E.) The Trinity	S.M	644	P.M. Whitson	Ekins & Co. Ltd.	G. & T.	Pettifer	8'3" Steel	2.59	12.61
151	901	Kings Langley Love Lane 3 FE		S.M	203	H. Chetwynd Stapylton	A. Fairhead & Sons Ltd.	V.B. Johnson	Abrams	8'3" Steel	2.59	7 60
152	551	Hatfield Briars Lane 3 FE (Girls)	Girls Grammar	GMR	812	A.K.W. Morgan/J. Onslow	J. Willmott & Sons Ltd.	G. & T.	Howe	8'3" Steel	1.59	10.60
157	201	Bishop's Stortford Herts & Essex–Extensions		GMR	49	R.A.G. Kennett	J. Willmott & Sons Ltd.	H.C.C.	Dennis	Non-Standard	10.58	12.59
156	30	Hitchin Boys Grammar–Extensions		GMR	182	C.S. Russell	M. & F.O. Foster & Co. Ltd.	D. Harwin	Pollard	Non-Standard	1 59	8.60
		1958 FURTHER EDUCATION PROGRAMME										
*161	986	Watford Technical College–Extensions	College of Technology	C.T	388	Lanchester & Lodge	Francis Jackson Contractors Ltd.	G. & T.	Dale	Non-Standard	12.59	2.61
153	961	East Herts College of F.E.–PH I		CFE	787	H. Chetwynd Stapylton	Harry Neal Ltd.	Thos. Barrett	Pearce	2'8" Steel	3.61	4.63
*154	976	Hatfield Technical College–Extensions	College of Technology	C.T	451	Maxwell Gray	D. Chaston Ltd.	G. & T	Dale	Non-Standard	10.58	8.59
		1958 TRAINING COLLEGES										
155	–	Aldenham, Wall Hall–Adaptations		TTC	425D	G.M. Whitley	J.T. Bushell Ltd.	H.C.C.	Beare	Non-Standard	3 59	4 60
		1959 PRIMARY SCHOOLS PROGRAMME										
141	138	Stevenage Camps Hill 2 FE		INF	● 705	J. Cubitt & Partners	H.C. Janes Ltd	H.C.C.	Young	8'3" Steel	5 58	10.59
162	847	Hemel Hempstead Gadebridge North 2 FE	Rossgate	J.M	797	P.J. Hislop/R.L. Pye	H.C. Janes Ltd.	H.C.C.	Reading	2'8" Steel	5 59	11 60
163	848	Hemel Hempstead Gadebridge North 2 FE	Rossgate	INF	797	P.J. Hislop/R.L. Pye	H.C. Janes Ltd.	H.C.C.	Reading	2'8" Steel	5 59	11.60
164	566	North Mymms 1 FE	Bush Wood	INF	551	R.E. McLardy	G. Davies & Sons (Brox) Ltd.	H.C.C.	Pollard	Non-Standard	1 60	1 61
165	213	Bishop's Stortford Parsonage Farm 1 FE	Summercroft	JMI	610	R.A.G. Kennett	J.A. Elliott Ltd.	Thos. Barrett	Bird	Non-Standard	9 60	9 61
166	143	Stevenage Long Meadow 2 FE	Burydale	J.M	825	M.J. Kitchen	Cramb & Dean (Hatfield) Ltd	H.C.C.	Howe	8'3" Steel	2 60	1 61
167	144	Stevenage Loves Wood 2 FE	Shephall Green	INF	626	F.M. Marlow	A. Fairhead & Sons Ltd	V.B. Johnson	Young	2'8" Steel	10 59	9 60
*168	2	Baldock Weston Way–Extensions	St. Mary's	J.M	435	D. Dex Harrison	B.G. Cox Ltd.	C.E. Ball	James	Non-Standard	12 59	1.61
		1959 SECONDARY SCHOOLS PROGRAMME										
169	550	Hatfield School–Extensions		S.T	440	Maxwell Gray	D. Chaston Ltd	Cogan & Partners	Dale	Non-Standard	3 59	1 60
		(See project in 1967 Programme for this school to be taken over by Hatfield College of Technology)										
170	401	St. Albans Boys'–Extensions		GMR	318A	A.B. Thomson/R.H. Martin	C. Miskin & Sons Ltd.	V.B. Johnson	Hall	Non-Standard	8 59	11 61
171	108	Stevenage East Shephall 4 FE	Barnwell	S.M	704	R.J. Whitley/C.L. Edwards	A. Fairhead & Sons Ltd.	V.B. Johnson	Young	2'8" Steel	10 59	4.61
172	516	Welwyn Garden City 4 FE	Attimore Hall	S.M	811	G.R. Nettleton	A. Fairhead & Sons Ltd.	Thos. Barrett	Bird	8'3" Steel	6 59	1 61
173	803	Hemel Hempstead 4 FE	Cavendish	S.T	528	J.A. Murphy	Robert Marriott Ltd.	V B. Johnson	Beare	8'3" Steel	4 60	2.62
43	692	Rickmansworth Wm. Penn–Extensions		S M	510	C.J. McIntosh	Jesse Mead Ltd.	Thos. Barrett	Reading	Non-Standard	11 59	5 61
130	10	Letchworth Grammar–Extensions		GMR	227A	H. Chetwynd Stapylton	A.H. Burr & Co Ltd.	H.C.C.	Pollard	Non-Standard	9 59	9 60
174	275	Broxbourne 3 FE	Broxbourne School	GMR	660	R.B. Welsh/D.C.G. Davies	Townsend & Collins Ltd.	H.C.C.	Dennis	Non-Standard	4 60	2 62
110	342	Waltham Cross–Park Lane–Extensions	Queen Eleanor	S M	802	C.G. Clark	Townsend & Collins Ltd.	H.C.C.	Dennis	8'3" Steel	1 60	12 60

NO.	CTY. REF. NO.	SCHOOL	RE NAMED	TYPE	FILE	ARCHITECT(S)	GENERAL CONTRACTORS	QUANTITY SURVEYORS	CLERK OF WORKS	CONSTRUCTION	COMM.	COMP.
		1959 FURTHER EDUCATION PROGRAMME										
175	953	Stevenage College of Further Education—Phase I		CFE	898	N.H. White/J. Platt	C. Miskin & Sons Ltd	Thos Barrett	Meek	2'8" Steel	4 59	12 60
		1959 SPECIAL SCHOOLS										
176	–	Stevenage Day School	Whitney Wood	S.S	691	R.A. Hunt/C.A.W. Horne	Francis Jackson Contractors Ltd.	H.C.C.	Allam	Non Standard	10 60	2.62
		1960 PRIMARY SCHOOLS PROGRAMME										
177	145	Stevenage Shephall 2 FE	Ashtree	J.M	814	B.L. Macie	Francis Jackson Contractors Ltd.	H C C.	Young	8'3" Steel	3 60	1.62
177A	146	Stevenage Shephall 2 FE	Ashtree	INF	814	B.L. Macie	Francis Jackson Contractors Ltd	H.C.C.	Young	8'3" Steel	3 60	9 61
178	849	Hemel Hempstead, Warners End Farm 2 FE	Fields End	J M	834	B.L. Macie	Cawood Wharton & Co Ltd.	H C C.	Reading	8'3" Steel	9 60	9.62
178A	850	Hemel Hempstead, Warners End Farm 2 FE	Fields End	INF	834	B.L. Macie	Cawood Wharton & Co. Ltd.	H C C.	Reading	8'3" Steel	9 60	1.62
179	851	Hemel Hempstead, Highfield 2 FE		J.M	734	J. Vaughan/J. Onslow	T & B (St. Albans) Ltd.	H.C.C.	Hoar	8'3" Steel	6 60	7.61
180	456	St. Albans, Mount Pleasant Lane 2 FE	St. Stephen	INF	322	Maxwell Grey	J M Hill & Sons Ltd.	H C C.	Hall	8'3" Steel	11 60	8 61
181	533	Welwyn G.C. Harwood Hill 2 FE	Maran	INF	854	Clifford Culpin	G. Davies & Sons (Brox) Ltd	V B Johnson	Meek	8'3" Steel	6 61	9 62
182	141	Stevenage, Lodge Farm 2 FE		J.M	706	R.F. Freemantle	Ekins & Co Ltd	Thos Barrett	Young	2'8" Steel	6 61	7.63
182A	142	Stevenage, Lodge Farm 2 FE		INF	706	R F Freemantle	Ekins & Co Ltd.	Thos. Barrett	Young	2'8' Steel	6 61	7 63
183	534	Welwyn G.C. N.E. Area 1 FE	Rosedale	JMI	833	C H Paull	Cramb & Dean (Hatfield) Ltd.	V B Johnson	Howe	8'3" Steel	8 61	8.62
184	746	Watford, Meriden 2 FE		J.M	754	Maxwell Gray	Cawood Wharton & Co. Ltd.	H.C.C.	Franks	8'3" Steel	5 60	4.61
		1960 SECONDARY SCHOOLS PROGRAMME										
185	103	Stevenage, Pestcotts 4 FE	Nobel Grammar	S.T	709	A.W. Pearce	J Willmott & Sons Ltd.	V.B. Johnson	James	8'3" Steel	11.60	12 62
186	554	Hatfield, Old Rectory 4 FE	Onslow	S.M	808	D E. Saundery/J. Onslow	C. Miskin & Sons Ltd	G. & T.	Howe	8'3" Steel	7 60	5 62
187	345	Cheshunt, Mill Lane 5 FE	Turnford	S.M	789	F M. Marlow/G.R. Nettleton	D. Chaston Ltd	V.B. Johnson	Pettifer	2'8" Steel	4 62	9 64
188	716	Watford, Victoria Boys' 4 FE		S.M*	664	P O'Keefe/E. Wilkinson	Jesse Mead Ltd.	H C C.	Reading	8'3" Steel	6 61	1 63
189	12	Letchworth, Pixmore 4 FE	Willian	S M	661	J. Cubitt & Partners	J Willmott & Sons Ltd	V B Johnson	Clark	8'3" Steel	7.60	3 62
190	811	Hemel Hempstead, Corner Hall 4 FE		S M	757	H.G. Cherry & Partners	Cawood Wharton & Co. Ltd	G & T	Hailstone	8'3" Steel	2 61	5.63
		1960 FURTHER EDUCATION PROGRAMME										
191	991	Hemel Hempstead, West Herts College of Further Education	Dacorum College of Further Edn.	CFE	446	J.A. Bolton	Y J. Lovell (Bucks) Ltd	Thos. Barrett	Dale	2'8" Steel	2 61	2 63
		1960 TRAINING COLLEGES										
192	–	Hertford, Balls Park—Extensions		TTC	441A	G.M. Whitely	C. Miskin & Sons Ltd	V B. Johnson	Green	8'3" Steel (Mod.)	11 60	12.62
		1960 SPECIAL SCHOOLS										
193	–	Broxbournebury Special School—Extensions		S.S	439	Woodroffe, Buchanan & Coulter	F. Hitch & Co. Ltd.	J. McBain	Pearce	Non-Standard	9 61	12 62
		1961 PRIMARY SCHOOLS PROGRAMME										
194	703	Rickmansworth, Eastbury Farm 1 FE		JMI	543	G M. Whitley	E.S. Reid & Son (Builders) Ltd.	V B. Johnson	Hoar	2'8" Steel	7 61	12 62
195	853	Hemel Hempstead, Leverstock Green 1 FE	Westwick	JMI	816	R.L. Pye	T & B (St. Albans) Ltd.	V.B. Johnson	Beare	8'3" Steel	6 61	9 62
196	573	Hatfield, 2 FE	Briars Lane	INF	653	P.M. Whitson	L. Davies (Holloway) Ltd.	H.C.C.	Pettifer	8'3" Steel	6 61	9.62
197	436	St. Albans, Cunningham Hill 2 FE		J.M	851	C.J. Platten	C. Brightman & Son Ltd.	H.C.C.	Pollard	8'3" Steel	4 61	9 62
198	855	Hemel Hempstead, Gadebridge South 2 FE	Gade Valley	J.M	E737	Barron & Smith	C. Miskin & Sons Ltd.	V.B. Johnson	Hoar	8'3" Steel	11 61	8 63
198A	856	Hemel Hempstead, Gadebridge South 2 FE	Gade Valley	INF	737	Barron & Smith	C. Miskin & Sons Ltd.	V.B. Johnson	Hoar	8'3" Steel	11 61	1 63
199	535	Welwyn G.C. N.W. Area 1 FE	Homers Wood	JMI	795	Seligmann, Snow & de Saulles	Cramb & Dean (Hatfield) Ltd.	Thos. Barrett	Howe	8'3" Steel	7 62	7 63
200	254	Hertford, Sele Farm (Phase 2)	St. Andrews	JMI	784	C.G. Clark/R.E. McLardy	Ekins & Co. Ltd.	H C.C.	Green	Non-Standard	9 61	1 63

NO	CTY. REF. NO.	SCHOOL	RE-NAMED	TYPE	FILE	ARCHITECT(S)	GENERAL CONTRACTORS	QUANTITY SURVEYORS	CLERK OF WORKS	CONSTRUCTION	COMM.	COMP.
		1961 SECONDARY SCHOOLS PROGRAMME										
201	631	Barnet Q.E. Girls Grammar – Extensions		GMR	31/A	C.J. McIntosh	Cramb & Dean (Hatfield) Ltd.	G. & T.	Pearce	2'8" Concrete/N.S.	5 63	5 66
202	650	East Barnet Grammar – Extensions		GMR	106/F	Barron & Smith	C P Roberts/ L. Davis (Holloway) Ltd	V.B. Johnson	Shoosmith	Non-Standard	Handed to London Borough of Barnet	
203	815	Hemel Hempstead, Gadebridge 4 FE	Halsey	S.M	798	R. Matthew & J. Marshall	Y J Lovell (Bucks) Ltd.	Franklin & Andrews	Beare/Hailstone	8'3" Steel	2 62	11 63
108	764	Langleybury S M – Extensions		S.M	725	J. Cubitt & Partners	A. Fairhead & Sons Ltd.	Thos. Barrett	Abrams	8'3" Steel	1.61	9 62
204	443	Redbourn 3 FE		S M	609	J. Cubitt & Partners	C. Miskin & Sons Ltd	H.C.C.	Hall	8'3" Steel	3.61	10 62
205	403	St. Albans 3 FE	Francis Bacon	GMR	619	H.G. Cherry & Partners	C. Miskin & Sons Ltd.	Thos. Barrett	Thrush	Non Standard	2 62	5 64
206	111	Stevenage, Chells 4 FE		S.M	713	J. Platt	Cramb & Dean (Hatfield) Ltd	Thos. Barrett	Clark	2'8" Steel	9 61	12 63
207	301	Ware Girls' Grammar – Extensions	Presdales	GMR	353/A	C.J. McIntosh	Crook Bros.	G & T	Bird	8'3" Steel	2 63	6 65
208	510	Welwyn G.C. Grammar – Extensions	Stanborough	GMR	414/F	Maxwell Gray	M. & F O. Foster & Co Ltd.	H C.C.	Howe	Non Standard	3 62	1 64
209	717	Watford, Victoria Girls' 4 FE		S.M*	664	P. O'Keefe/E. Wilkinson	Jesse Mead Ltd	H C.C	Reading	8'3" Steel	6 61	10 63
		1961 FURTHER EDUCATION PROGRAMME										
191	991	Hemel Hempstead, West Herts College of Further Education – Phase II	Dacorum College of Further Education	CFE	446	J A. Bolton	Y J. Lovell (Bucks) Ltd	Thos. Barrett	Dale	2'8" Steel	2 61	2 63
210	981	Barnet, South Herts College of Further Education – Phase II		CFE	102/1	R.W. Sears	D. Chaston Ltd.	V.B. Johnson	Pearce	2'8" Steel	Handed to London Borough of Barnet	
211	988	Watford, South West Herts College of Further Education – Phase I	George Stephenson College of Further Education	CFE	828	A. Dickens	Y.J. Lovell (Bucks) Ltd.	H.C.C.	Dale	2'8" Concrete (Proto-Type Seac Mk 1)	3.63	3 65
212	982	Boreham Wood, South Herts College of Further Education – Phase II (Phase I of New College)		CFE	846	C.A.W. Horne	Headway Construction Co. Ltd.	V.B. Johnson	Shoosmith	2'8" Steel	12.62	3 64
		1961 TRAINING COLLEGES										
155	–	Aldenham, Wall Hall – Extensions – Phase I		TTC	425/1	R.L. Pye	C Miskin & Sons Ltd	H.C C.	Beare/Lord	2'8" Steel/1'0" Brick (Experimental) (+8'3" Gymnasium)	2 63	1 65
		1962 PRIMARY SCHOOLS PROGRAMME										
213	918	Berkhamsted Durrants Farm 1 FE	Westfield	JMI	613	J. Cubitt & Partners	Abbiss & Hale Ltd.	H.C.C.	Franks	8'3" Steel	11 61	12 62
214	680	Bushey, Cold Harbour 1 FE	Little Reddings	JMI	69	Wm. Crabtree	T.A. Bickerton & Son	G. & T	Franks/ Reading	8'3" Steel	2.62	3 63
184A	747	Watford, Meriden 2 FE		INF	754	Maxwell Gray	Cawood Wharton & Co. Ltd.	H.C C.	Franks	8'3" Steel	4 61	2.62
215	367	Cheshunt, Russells Ride 2 FE	Downfield	J M	838	K.C. Twist & R.J. Whitley	D. Chaston Ltd.	H.C.C.	Pettifer	1 4" Brick	10.62	1 64
216	583	Hatfield Woods Avenue 2 FE	Millwards	J.M	850	Barron & Smith	T & B (St. Albans) Ltd.	V.B. Johnson	Speary	8'3" Steel	4 62	8 63
216A	584	Hatfield Woods Avenue 2 FE	The Downs	INF	850	Barron & Smith	T & B (St Albans) Ltd.	V.B. Johnson	Speary	8'3" Steel	4 62	5 63
179A	852	Hemel Hempstead, Highfield 2FE		INF	858	L A. Wakeham	Y.J. Lovell (Bucks) Ltd	Thos Barrett	Hailstone	8'3" Steel	3.62	1 63
217	857	Hemel Hempstead, Chaulden 1 FE	Pixies Hill	JMI	864	G.I. Donaldson	Jesse Mead Ltd.	H C C.	Reading	1'4" Brick	7 62	8 63
218	858	Hemel Hempstead, Adeyfield 1 FE	Greenhills	JMI	852	E. Herrmann	Abbiss & Hale Ltd.	Thos Barrett	Hoar	1'4" Brick	9 62	12 63
219	147	Stevenage, Pin Green 2 FE		J.M	710	J.A. Murphy	G. Davies & Sons (Brox) Ltd.	V.B. Johnson	Clarke	2'8" Steel	11 62	4 64
219A	148	Stevenage, Pin Green 2 FE		INF	710	J.A. Murphy	G. Davies & Sons (Brox) Ltd.	V B. Johnson	Clarke	2'8" Steel	11 62	4 64
220	463	St. Albans, Marshalswick 2 FE	Wheatfields	J.M	577	M.W. Collins	Cramb & Dean (Hatfield) Ltd.	H.C.C.	Chuck	1'4" Brick	6 62	8.63
221	536	Welwyn Garden City, N.E. 2 FE	The Rowans	J M	831	K.C. Twist & R.J. Whitley	Y.J. Lovell (Bucks) Ltd.	Thos. Barrett	James	2'8" Steel	11.62	1 64
222	538	Welwyn Garden City, S.E. 1 FE	Burnside	JMI	861	Wm. Crabtree	T A. Bickerton & Son Ltd	G. & T.	Chuck	8'3" Steel	11 62	1 64
		1962 SECONDARY SCHOOLS PROGRAMME										
223	110	Stevenage, Sinks Spring 4 FE	Collenswood	S M	827	Stev. Development Corpn.	Francis Jackson Contractors Ltd	G. & T.	Froy	Non Standard	5 61	4 63
224	553	Hatfield, Brookmans Park 3 FE	Chancellor's	S M	600	Vine & Vine	C. Miskin & Sons Ltd	G. & T	Hall	8'3" Steel	2 63	9 64
225	816	Hemel Hempstead, Highfield 4 FE		S.M	732	J. Cubitt & Partners	C. Miskin & Sons Ltd	H.C.C.	Lord	8'3" Steel	12 61	9 63
226	652	East Barnet, John Hampden 3 FE		S.M	863	J A Wakeley/R.S. Gray	H. Neal Ltd	H C C.	Dennis	2'8" Steel	6 62	10 63
227	247	Hertford, Sele Farm 4 FE	The Sele	S M	683	B.L. Macie/P J Williams	Ekins & Co Ltd.	H C C.	Green	2'8" Steel	5 62	9 65

NO.	CTY. REF. NO.	SCHOOL	RE-NAMED	TYPE	FILE	ARCHITECT(S)	GENERAL CONTRACTORS	QUANTITY SURVEYORS	CLERK OF WORKS	CONSTRUCTION	COMM.	COMP
		1962 SECONDARY SCHOOLS PROGRAMME Continued										
228	112	Stevenage, Bedwell 4 FE		S M	860	C.J. Platten/G.I. Donaldson	Ekins & Co. Ltd.	V B Johnson	Clark	2'8" Steel	11.63	8 66
229	516	Welwyn Garden City, N.W. 4 FE	Monks Walk	S.M	779	Dunham Widdup & Harrison	Headway Construction Co. Ltd	V B Johnson	James	8'3" Steel	11 62	1.64
230	711	Watford Girls' Grammar–Extensions		GMR	361/F	Barron & Smith	Y.J. Lovell (Bucks) Ltd.	V B Johnson	Reading	Non Standard	7.64	11.68
		1962 FURTHER EDUCATION PROGRAMME										
175	953	Stevenage College of Further Education–Phase II		CFE	696	J. Platt/C.H. Paull	C. Miskin & Sons Ltd.	Thos. Barrett	Meek	2'8" Steel	3 61	2.62
153	961	East Herts College of Further Education–Phase II		CFE	787	H.P. Chetwynd Stapylton	Harry Neal Ltd.	Thos. Barrett	Pearce	2'8" Steel	3.61	5.63
231	952	Hitchin College of Further Education–Phase I		CFE	842	D.M.W. Nicol	M. & F.O. Foster & Co. Ltd.	H.C.C.	Allam	2'8" Concrete	7.63	9 64
		1962 SPECIAL SCHOOLS										
232	–	St Albans Day School	St. Luke's	S.S	818	E. Wilkinson	C. Miskin & Sons Ltd.	H.C.C.	Thrush	1'4" Brick	4.62	3.63
		1963 PRIMARY SCHOOLS PROGRAMME										
132A	384	Cheshunt, Dark Lane 2 FE	Bonneygrove	INF	768/1	L.A. Wakeham	Walker Symondson Ltd.	V.B. Johnson	Bird	1'4" Brick	6 63	12.64
233	491	Harpenden, Grove Road 2 FE	The Grove	J.M	458	Max Lock & Partners	Cramb & Dean (Hatfield) Ltd.	V.B. Johnson	Young	8'3" Steel	5 63	8 64
234	258	Hertford, Sele Farm 1 FE	Hollybush	JMI	682	J. Jenkins	C. Miskin & Sons Ltd.	H.C.C.	Smith	2'8" Steel	7.63	10 64
235	43	Hitchin, Oughtonhead 2 FE		J M	652	Martin Priestman	A.G. Baxter (Stotfold) Ltd	H.C.C.	Allam	1'4" Brick	8 64	4 65
236	288	Hoddesdon, Westfield 1 FE		JMI	538	A.W. Pearce/G. Sheffield	G. Davies & Sons (Brox) Ltd.	Thos. Barrett	Meek	2'8" Steel	12.62	1 64
237	788	Radlett, Gills Hill 2 FE (Inst)		INF	508	J. Sexton	E.S. Moss Ltd.	Thos. Barrett	Hall	1'4" Brick	11 63	9.64
238	706	Rickmansworth, Maple Cross 1 FE		JMI	107	Seligman, Snow & de Saulles	C. Brightman & Son Ltd.	V B. Johnson	Reading	1'4" Brick	5.63	5.64
112A	461	St Albans, Killigrew 2 FE		INF	302/F	Maxwell Gray & Partners	Cramb & Dean (Hatfield) Ltd.	Thos. Barrett	Chuck	1'4" Brick	5 63	4.64
220A	464	St. Albans, Marshalswick 2 FE	Wheatfields	INF	577/1	M.W. Collins	Cramb & Dean (Hatfield) Ltd	H C.C.	Chuck	1 4" Brick	9.63	9 64
239	150	Stevenage, Pin Green 2 FE	Moss Bury	J M	702	D.A. Joules	Headway Construction Co. Ltd.	Thos. Barrett	Clark	2'8" Steel (Seac Mk 1)	7 64	12 65
221A	537	Welwyn Garden City, N E. 2 FE	Nutfield	INF	831/1	K.C. Twist & R.J. Whitley	G. Mott & Son Ltd.	Thos. Barrett	James	2'8" Steel (Seac Mk 1)	10.63	8 64
240	750	Watford, Holywell (2 FE Completion)		INF	716/1	J Bott	C Brightman & Son Ltd.	H.C.C.	Lord	1'4" Brick	7 63	9 64
		1963 SECONDARY SCHOOLS PROGRAMME										
157	201	Bishop's Stortford Herts & Essex–Extensions		GMR	49/1	R.J.A. Wakeley	J A. Elliott Ltd.	H.C.C.	Dennis	2'8" Steel	8 64	9 66
241	343	Cheshunt, Cambridge Road–Extensions	Riversmead	S M	445/F	Norman & Dawbarn	F. Hitch & Co.	W C. Inman	Meek/Beare	Non-Standard	1 64	11.65
242	410	St. Albans, St. Julians 3 FE (Boys)		S M	301/F	Barron & Smith	Cramb & Dean (Hatfield) Ltd	V B. Johnson	Hall	2'8" Steel	6.64	3.65
243	673	Watford, Alexandra 4 FE		S M	871	K.C. Twist & R.J. Whitley	Cramb & Dean (Hatfield) Ltd.	Thos. Barrett	Beare	2'8" Steel	2 64	1.66
244	445	Wheathampstead 3 FE		S.M	469	Clifford Culpin	T. & E. Neville Ltd	H.C C	Young	Non-Standard	12 63	7.65
245	817	Hemel Hempstead, Chaulden 4 FE		S.M	865	C H. Paull	Headway Construction Co. Ltd.	H.C.C.	Hailstone	2'8" Steel (Seac Mk 1)	3.64	3.66
246	13	Letchworth, Highfield 4 FE		S M	753	L.S. Russell	D. Chaston Ltd.	H C.C.	James	2'8" Steel (Seac Mk 1)	5 64	9 66
106	671	Watford Technical High – Extensions		S.T	781/F	Ley, Colbeck & Partners	Wm. King & Son	V.B. Johnson	Abrams	Non-Standard	1 62	12 62
		1963 FURTHER EDUCATION PROGRAMME										
247	987	Watford, Second College of Further Education–Phase I (Replacement College)	Cassio	CFE	869	C.J. McIntosh	C Miskin & Sons Ltd	H.C.C.	Hills	2'8" Steel	7.66	8.68
		1963 SPECIAL SCHOOLS										
248	–	Hemel Hempstead Day School	The Collett	S S	881	I C. Taylor	Abbiss & Hale Ltd.	Thos. Barrett	Hailstone	1'4" Brick	8 63	10 64
		1964 PRIMARY SCHOOLS PROGRAMME										
147A	368	Cheshunt, Brookland 2 FE		INF	788/1	E. Wilkinson/J. Frisby	A A. Shaw & Co Ltd.	H.C.C.	Meek/Pettifer	1'4" Brick	4 64	6 65
249	493	Harpenden, West 1 FE	Wood End	JMI	872	Alex. Gordon & Parts.	Jarvis (Harpenden) Ltd.	V B Johnson	Chuck	2'8" Steel	9 64	9 65
14A	257	Hertford, Morgans Walk 2 FE	Chalk Dell	INF	879/1	P.M. Campbell	G. Davies (Brox.) Ltd.	H C C.	Pettifer	2'8" Steel	4 64	4 65
235A	44	Hitchin, Oughtonhead 2 FE		INF	862/F	Martin Priestman	A G Baxter (Stotfold) Ltd.	H.C.C.	Allam	1'4" Brick	6 64	8 65
251	506	Mardley Heath (6 Classrooms)	Oaklands	JMI	847	K.C. Twist & R.J. Whitley	E S. Moss Ltd.	Thos. Barrett	Farley	2'8" Steel	3 65	2 66
239A	151	Stevenage, Mobbsbury 2 FE	Moss Bury	INF	702/1	D.A. Joules	Headway Construction Co. Ltd.	Thos. Barrett	Clark	2'8" Steel	7 64	12 65

NO.	CTY. REF. NO.	SCHOOL	RE NAMED	TYPE	FILE	ARCHITECT(S)	GENERAL CONTRACTORS	QUANTITY SURVEYORS	CLERK OF WORKS	CONSTRUCTION	COMM	COMP
		1964 PRIMARY SCHOOLS PROGRAMME Continued										
252	939	Tring, Christchurch Road 2 FE	Goldfield	INF	791	Seligmann, Snow & de Saulles	Jesse Mead Ltd	V B Johnson	Dale	2'8" Steel	6 64	6 65
253	309	Ware, Tower Road 1 FE	Musley	JMI	643	G.R. Nettleton/D. Hosking	Ekins & Co. Ltd.	H.C C.	Bird	2'8" Steel	9 64	12 65
29A	637	Barnet, Whitings Hill (Completion) 2 FE		INF	588/F	Barron & Smith	T.A. Bickerton & Son	G. & T.	Pettifer	2'8" Steel	7 64	7.65
254	382	Cheshunt, Flamstead End (Completion) 2 FE		INF	657/F	Gerald Lacoste & Parts.	Botsford & Sons (Builders) Ltd	Thos. Barrett	Dennis	Non-Standard	9 64	9 65
185A	214	Bishop's Stortford, Summercroft 2 FE		INF	610/1	M. Tempest	J.A. Elliott Ltd.	V B Johnson	Dennis	1'4" Brick	6.64	7.65
		1964 SECONDARY SCHOOLS PROGRAMME										
255	804	Hemel Hempstead, Grove Hill		GMR	883	K.L. Begg	Jesse Mead Ltd.	H C C	Hailstone	2'8" Steel	5 65	10 67
256	220	Sawbridgeworth 3 FE	Leventhorpe	S M	614	K.C. Twist & R.J. Whitley	Headway Construction Co. Ltd.	H.C.C.	Bird	2'8" Steel	7 64	5 65
257	760	Watford, High Elms Lane 3 FE		GMR	887	C.J. McIntosh	C. Miskin & Sons Ltd.	H.C.C.	Hills	2'8" Steel	5 65	3.67
258	303	Ware, Park Road 3 FE	Fanshawe	S.M	866	P. Nellis	C. Miskin & Sons Ltd.	H C.C.	Young	2'8" Steel	7 65	3.67
129	278	Broxbourne, Bass Hill–Major Extensions		S M	453/F	Seligmann, Snow & de Saulles	Crook Bros.	G. & T.	Pettifer	2'8" Steel	7.65	1.67
259	341	Cheshunt, Dark Lane 3 FE	Goffs	GMR	886	J.A. Bolton/D.M.W. Nicol	Cramb & Dean (Hatfield) Ltd.	V.B. Johnson	Shoosmith	2'8" Steel	6.65	1.67
		1964 FURTHER EDUCATION										
160	978	Mid Herts College of F.E.– 2nd Instalment		CFE	413	Louis de Soissons	C. Miskin & Sons Ltd.	Sydney A. Paine	Gilham	Non-Standard	2.68	11.68
138	970	St. Albans College of F.E. (Refectory)		CFE	804	R.J.A. Wakeley	Holmes (Builders) Ltd.	H.C.C.	Pearce	2'8" Steel	7.65	10.66
138	970	Herts College of Building (New Building)		CFE	804	R.J.A. Wakeley	M. & F.O. Foster & Co. Ltd.	H.C.C	Pearce	2'8" Steel	2.66	12.68
250	960	Ware College of F.E.		CFE	895	D. Pummell	Ekins & Co. Ltd.	H.C.C.	Green	2'8" Steel	7.65	9.67
		1964 SPECIAL SCHOOLS										
260	–	Hoddesdon, Hailey Hall Senior Boarding		S.S	875	Dept. of Educ. & Sc.	G. Mott & Son Ltd.	Dept. of Educ. & Sc.	Dennis	1'4" Brick	7.65	12.66
261	–	Tewin Water–Major Extensions		S.S	636F	Seligmann, Snow & de Saulles	G. Mott & Son Ltd.	Thos. Barrett	Green	Non Standard	11.64	2 66
		1964 TRAINING COLLEGES										
192	–	Hertford, Balls Park		T.T.C.	441A	Twist & Whitley	Hosking & Son (Essex) Ltd.	V.B. Johnson	Green	8'3" Steel	6 65	11.66
		1965 PRIMARY SCHOOLS PROGRAMME										
262		Barnet, Totteridge 1 FE		JMI	336	Barron & Smith	Townsend & Collins Ltd.	V.B. Johnson	Contract Carried out by L.B. of Barnet			
263	153	Stevenage, Trotts Hill 2 FE		J.M	909	R. Matthew, Johnson–Marshall & Partners	J. Willmott & Sons Ltd.	Franklin & Andrews	Allam	2'8" Steel	5 66	
264	681	Bushey, Little Reddings 2 FE		INF	69F	Crabtree & Jarosz	Wm. King & Sons	G. & T.	Dale	2'8" Steel	5.65	7 66
215A	368	Cheshunt, Russells Ride 2 FE	Downfield	INF	838F	Twist & Whitley	G. Davies & Sons (Brox) Ltd	H C C.	Pettifer	1'4" Brick	8.65	10 66
265	82	Royston, Icknield Walk 2 FE		J M	829	Twist & Whitley	B.G. Cox Ltd.	T. Barrett	Froy	2'8" Steel	3 65	5 66
266	224	Sawbridgeworth (Bullfields) 2 F.E.	Reedings	J M	848	Twist & Whitley	Leyford Ltd.	T. Barrett	Smith	2'8" Steel	7 65	6 66
267	921	Berkhamsted, Greenway 2 FE		J.M	863	B.J Woodthorpe	D. Lockhart Ltd.	H.C.C.	Hoar	2'8" Steel	8 65	11 66
268	215	Bishop's Stortford, Thorn Grove 1 FE		JMI	505	B.J. Newman	J.A. Elliott Ltd.	H.C C.	Hemmings	2'8" Steel	8 65	9.66
269	290	Hoddesdon, Sheredes 2 FE		J M	897	R.W. Sears	G. Davies & Sons (Brox) Ltd.	T. Barrett	Shoosmith	2'8" Steel	8 65	11 66
270	24	Letchworth, Jackmans Estate	Radburn	J.M	888	D.R. Cardy	M. & F.O. Foster & Co. Ltd.	H.C.C.	Allam	Mk 2 Steel	12.65	10 66
197A	437	St. Albans, Cunningham Hill 2 FE		INF	851/1	F.W.J. Bedwell	J. Willmott & Sons Ltd.	H.C.C.	Hoar	Mk 2 Steel	3 66	3 67
271	306	Ware, Kings Hill 2 FE	St. Mary's	J.M	898	J. Bott	G. Davies & Sons (Brox) Ltd.	H.C.C.	Smith	Mk.2 Brick (Pilot)	9 65	12 66
		1965 SECONDARY SCHOOLS PROGRAMME										
272	227	Little Hadham, Hadham Hall–Major Extensions		S M	221/F	Gerald Lacoste & Partners	Leyford Ltd	T. Barrett	Dennis	Non-Standard	6 66	1 68
174A	275	Broxbourne, Grammar, Swimming Pool		GMR	660/F	Snow & de Saulles	Crook Bros	G. & T.	Pettifer	2'8" Steel	8 65	1 67
104A	246	Hertford, Balls Park–Major Extensions	Simon Balle	S.M	726	M.S. Tempest	G. Mott & Son Ltd.	V B Johnson	Pettifer	2'8" Steel	8 66	12 67
273	104	Stevenage, Fairlands 3 FE		GMR	889	Alex Gordon & Partners	J Willmott & Sons Ltd.	H C.C	Froy	2'8" Steel	9 66	6 68
274	512	Welwyn Garden City, Knightsfield 3 FE		GMR	912	P. Dunham, Widdup & Harrison	E S Gates Ltd.	V.B Johnson	Howe	2'8" Steel	4 66	4 68

NO.	CTY. REF. NO.	SCHOOL	RE-NAMED	TYPE	FILE	ARCHITECT(S)	GENERAL CONTRACTORS	QUANTITY SURVEYORS	CLERK OF WORKS	CONSTRUCTION	COMM	COMP
		1965 FURTHER EDUCATION PROGRAMME										
175A	953	Stevenage College of Further Education–Phase II		CFE	696/1	D.K. Pummell	M. & F.O. Foster & Co Ltd.	T. Barrett	James	2'8" Steel	11.66	8 68
211A	988	Watford, G. Stephenson–Print. Dept.		CFE	828	A. Dickens/G. Donaldson	Y J. Lovell (Bucks) Ltd.	H.C.C	Dale	2'8" Concrete (Mk 1)	10 64	8 65
191	991	Dacorum College of Further Education–Phase III		CFE	446/1	C.A.W. Horne/F.J. Bedwell	T. & B. (St. Albans) Ltd.	T. Barrett	Dale	Mk.2 Steel	12 66	8 68
		1965 TRAINING COLLEGES										
155A	–	Aldenham, Wall Hall–Extensions		T.T.C	425/1	R.L. Pye	C. Miskin & Sons Ltd.	H.C.C.	Reading	2'8" Steel	5.65	12.68
		1965 SPECIAL SCHOOLS										
275		Ware, Presdales	Pinewood	S.S	907	M.P.K. Keeth	C. Miskin & Sons Ltd.	H.C.C.	Smith	Mk 2 Brick (Mod.)	7.66	3.68
		1966 PRIMARY SCHOOLS PROGRAMME										
276	919	Berkhamsted, Swing Gate Lane 2 FE		INF	615	D. Armfield	Jesse Mead Ltd.	H.C.C.	Dale	Mk.2 Steel	1 67	10.67
277	369	Cheshunt, Windmill Lane 1 FE		JMI	913	Barron & Smith	E.S. Moss Ltd.	H.C.C.	Hemmings	Mk 2 Steel	8.66	8.67
233A	492	Harpenden, The Grove 2 FE		INF	458/F	Max Lock & Partners	B.G. Cox Ltd.	V.B. Johnson	Chuck	Mk 2 Steel	9 66	11.67
278	825	Hemel Hempstead, George St. 1 FE		JMI	885	R.W. Sears	C. Miskin & Sons Ltd.	H.C.C.	Hoar	Mk 2 Steel	12 66	12.67
279	910	Kings Langley, Havelock Road 2 FE		J.M	207	M.J.F. Pyle	E J. Waterhouse & Sons Ltd.	H.C.C.	Weaver	Mk.2 Steel	10.66	1 68
280	292	Hoddesdon, Forres Estate 2 FE		J.M	538	Snow & de Saulles	Cramb & Dean	H.C.C.	Bird	Mk.2 Steel	6.66	9.67
270A	25	Letchworth, Jackmans Estate	Radburn	INF	888/1	D.R. Cardy	M. & F.O. Foster & Co. Ltd.	H.C.C.	Allam	Mk 2 Steel	8 66	
145	450	Redbourn 2 FE		INF	956	J. Sexton	E.S. Moss Ltd.	H.C.C.	Hoar	Mk.2 Steel	10 66	9.67
281	155	Stevenage, Martins Wood 2 FE		J M	946	B.J. Newman/A.J. Pullen	G. Davies & Son (Brox) Ltd.	H.C.C.	James	Mk.2 Steel	4.67	9 68
281A	156	Stevenage, Martins Wood 2 FE		INF	946	B.J. Newman/A.J. Pullen	G. Davies & Son (Brox) Ltd.	H.C.C.	James	Mk.2 Steel	4 67	9.68
282	940	Tring, Dundale Road 2 FE		J.M	349	D. Hosking	D. Lockhart Ltd.	H.C.C.	Hailstone	Mk.2 Steel	10 66	12.67
283	478	Bushey Heath, Completion to 1 FE		JMI	70F	C. Culpin & Partners	Alec. A. Shaw & Co. Ltd.	G. & T.	Hall	Non-Standard	2 66	2.67
284	454	Colney Heath, Completion to 1 FE		JMI	448F	C. Culpin & Partners	G. Davies & Son (Brox) Ltd.	G. & T.	Hall	Non-Standard	9 67	10 68
285	251	Bengeo, Completion to 2 FE		J.M	459F	Twist & Whitley	G. Mott & Son Ltd.	H.C.C.	Smith	1'4" Brick	7.66	7 67
286	569	Northaw, Completion to 2 FE		INF	91	Snow & de Saulles	G. Mott & Son Ltd.	H.C.C.	Green	Non-Standard	1 66	8.67
287	281	Wormley, Completion to 1 FE		JMI	470F	G. Lacoste & Partners	G. Davies & Sons (Brox) Ltd	T. Barrett	Hemmings	Non-Standard	8.66	5 67
288	495	Harpenden, Crabtree Lane Completion to 2 FE	Crabtree	J.M	857F	Snow & de Saulles	Jarvis (Harpenden) Ltd.	T. Barrett	Young	1'4" Brick	11.65	11.66
308	206	Bishop's Stortford, Cricketfield Lane 1 FE–Completion	Northgate	JMI	906	M.J.F. Pyle	J.L. Glasscocks (Successors) Ltd.	H.C.C.	Hemmings	Mk 2 Steel	5.67	5.68
		1966 SECONDARY SCHOOLS PROGRAMME										
289	710	Watford Boys' Grammar–Extensions		GMR	363/F	Maxwell Gray	C. Miskin & Sons Ltd.	V.B. Johnson	Reading	Mk 2 Steel	9 66	4.68
290	691	Croxley Green, Durrants S.M.–Extensions		S.M	268/F	Snow & de Saulles	Y.J. Lovell (Bucks) Ltd.	H.C.C.	Hall	Mk.2 Steel	4 67	10.68
43	692	Rickmansworth Wm. Penn S.M.–Extensions		S M	510/F	Snow & de Saulles	Y.J. Lovell (Bucks) Ltd	H.C.C.	Hall	Mk.2 Steel	5 67	10.68
291	276	Hoddesdon, Sherades, 4 FE S.M.		S.M	942	Barron & Smith	Y.J. Lovell (Bucks) Ltd.	H.C.C.	Bird	Mk.2 Steel	4.67	4 69
292	406	St. Albans, Beaumont S.M.–Extensions		S.M	317/F	Barron & Smith	Cramb & Dean (Hatfield) Ltd.	H.C.C.	Thrush	Mk 2 Steel	7.67	12.68
170	401	St. Albans, Boys' Grammar–Extensions		GMR	318/F	Barron & Smith	Cramb & Dean (Hatfield) Ltd.	H C C	Thrush	Mk 2 Steel	7 67	3.69
*293	106	Stevenage, Barclay S.M.–Extensions		S M	330/F	Twist & Whitley	J. Willmott & Sons Ltd.	V.B. Johnson	Gilham	Mk 2 Steel	3.68	9 69
110	342	Waltham Cross S.M.–Extensions	Queen Eleanor	S.M	802/1	D. Harrison	Harpley Construction Co. Ltd.	H C C	Hemmings	Mk 2 Steel	10 67	1.70
46	812	Hemel Hempstead, Adeyfield S.M.–Extensions		S.M	631/1	G I. Donaldson	Jesse Mead Ltd.	H C C	Hailstone	Mk 2 Steel	6 67	12 68
245	817	Hemel Hempstead, Chaulden S.M.–Extensions	Bourne Valley	S.M	865/1	D R Cardy/P. Nellis	Jesse Mead Ltd	H.C.C.	Hailstone	Mk 2 Steel	6 67	11 68
205	403	St. Albans, Francis Bacon Grammar–Extensions		GMR	619/1	G. John	Cramb & Dean (Hatfield) Ltd.	H C C	Thrush	Mk 2 Steel	7 67	12 68
86	107	Stevenage, Heathcote S.M.–Extensions		S M	703/F	Twist & Whitley	J. Willmott & Sons Ltd.	V B Johnson	Gilham	Mk 2 Steel	3 68	9 69

Bibliography

Section A

MANUSCRIPT AND UNPUBLISHED SOURCES

1. COUNTY ARCHITECTS DEPARTMENT RECORDS

The files concerning the period 1945-64 have been deposited in the Hertfordshire Record Office (HRO) and are housed at the Record Centre in Tamworth Road, Hertford. They number nearly 5,000 and cover every aspect of the department's activities.

Generally the files contain correspondence, memoranda, some drawings (usually folded dye-line prints) and often some hand written notes. The material is contained in serially numbered storage boxes which are sub-divided into subject headings, each in a soft clip-folder which is identified by an alphabetical suffix to the file number. All the project file numbers are given in the List of Schools, Appendix 3 to this study.

Box numbers and file numbers have a random relationship and the List of files of the County Architects Department stored in the Record Centre must be referred to. All file references are given here in the following sequence:

Prefix and unique number - (subject and/years covered in brackets) - box number.

The following selected files are of particular relevance to this study.

(a) Annual New Schools Programme Series (in box no. sequence):

E555 (Steel supply 47) 178.
E555D (Steel 47-48) 181.
E473F (HORSA Huts 47-48) 197.
E473 (Gen. educ. corresp. 47-48) 203.
E6110 (Steel 48-49) 212.
E611B (Gen. Contrs. 48-49) 219.
E611 (Gen. 48-49) 219.
E611E (Heating and Vent. 48-49) 242.
E473 (Gen. corresp. re Educ. 49-50) 245.
E611G (Roof blocks 48-51) 256.
E651 (Visits to schools gen. 50-51) 259.
E555 (Gen. 47-51) 287.

E611D (Steel 49-51) 308.
E650D (Secondary schools prog. 49-52) 309.
E473A (Gen. 51-52) 428.
E555A (MOE 46-49) 436.
E555B (Gen. Contrs. 48-52) 436.
E555C (Contr. proced. 46-49) 436.
E555D (Steel 48-50) 436.
E555E (Heating 47-54) 436.
E555F (Int. walls 46-51) 436.
E555G (Cycle sheds 48) 436.
E555H (Flue 47-50) 437.
E555I (Roofing 47-49) 437.
E555J (Elec.47-51) 437.
E555K (Windows 47-49) 437.
E555L (Wall panels 47-51) 437.
E555N (Plumbing 47-48) 437.
E555O (San. fittings 47-49) 437.
E555P (Floors 47-50) 437.
E555Q (Furniture 48-51) 438.
E555R (Ironmongery 47-48) 438.
E555S (Doors 47-48) 438.
E555T (Paint 47-49) 438.
E555U (Blinds 47-51) 438.
E555V (Kitchen equip.47-49) 438.
E555X (Paving, landscape externals 48-50) 438.
E555Y (Manholes, drainage 46-48) 438.
E555Z (Publicity 47-50) 439.
E670 (New School Programme 1951-1958 49-52) 442.
E611A, E611B, E611C etc. (similar to the foregoing E555 series: the alphabetical suffixes refer to the same topics but relate to the 1948 New Schools Programme) 449-451.
E750Wa (New Timber; Schools prog. 1952-53) 455.
E650W (1950 Secondary schools, Murals and Sculpture 51-53) 505.
E630A etc. (E630 series relates to the 1950 Primary prog.) 511-513.
E650A etc. (E650 series relates to the 1950 Secondary prog.) 570 and 571.

E473L (Gen. Lavatories 47-52) 580.

E671A etc. (This series covers most of the subjects in E555 and relates to the 1951 programme) 586.

E750A etc. (1952 Secondary prog.) 611-613.

E518A (County Devel. Plan, Education Survey 1945) 638.

E770 etc. (1953/54 Programme) 717 and 750.

E780 etc. (1953/54 Secondary Prog.) 718.

E750W (New Timber schools 52-56) 724.

E750Wa (Devel. of timber frame 53-55) 724.

E750Wb (Devel. of external screens 52-53) 724.

E750Wd (Devel. of internal screens 52-53) 724.

E750QS (Quan. Surv.52-55) 724.

E800 etc. (1954/55 Programme) 735, 736 and 806.

E670A (Movable classrooms 54-57) 766.

E820 etc. (1955/56 Programme) 805 and 898.

E830 etc. (1955/56 Programme) 805 and 898.

E790 etc. (1954/55 Primary Programme) 812.

E656 (User requirements 51-57) 945.

E840H (Internal walling 55-61) 981

E840G (External walling 58-61) 991.

E840J (Roofing 60-62) 1043.

E840G (External walling 61-62) 1071.

E840M (Furniture 61-63) 1111.

E840G (External walling 62-63) 1114.

E840 (1956/57 Programme Gen. 56-63) 1124.

E840 (1956/57 Programme Stairs and Steps 58-64) 1166.

E840 (1956/57 Programme Roofing 62-64) 1166.

E840/1 (1956/57 Programme, Primary Gen. 55-64) 1219.

E840/1a (1956/57 Capital Projects 59-64) 1219.

E840M (1956/57 Programme, Furniture & Equip. 63-64) 1219.

E473J (Education Gen., Revenue Maintenance 47-64) 1221.

E840 (1956/57 Programme Gen. 63-64) 1243.

E473 (Education Gen.63-64) 1255.

E840H (1956/57 Programme, Internal walling 61-65) 1296.

E840/2 (1956/57 Programme, Major works 64-65) 1297.

E840/Dii (1956/57 Programme, Steel frames 63-65) 1297.

E840F (1956/57 Programme, Floor construction 56-65) 1297.
E630 (1950 Primary Programme Gen. 48-57) 1302.
E840/6G (SEAC Mk2 External walling 63-65) 1316.
E840/3 (1956/57 Further Education Programme 56-70) 1354.
E840/4 (Youth Wings 60-65) 1354.
E840/5 (Development Gen. 59-65) 1354.
E840/5b (Development 2' 8" Concrete frame 60-64) 1354.
E840/5c (Development Load-bearing brick 61-64) 1355.
E840/D1 (Structural frame 62-65) 1355.
E670 (1951/58 Programme Gen. 52-65) 1363.
E671 (1951 Programme Gen. 49-65) 1363.

(b) <u>General Subjects Series (in box no. sequence)</u>:

GEN 5A (Reports on 3' 4" frame constr. 49-50) 236.
GEN 1 (Gen. unclassified corresp. 46-51) 247.
GEN 61 (Heating installations 48-51) 277.
GEN 25 (Departmental Library 48-51) 279.
GEN 13 (Prefabrication 45-48) 290.
GEN 5A(Reports on methods of constr. 50-52) 408.
GEN 55 (Scientific BRS 47-52) 425.
GEN 44 (Fuel, gen. 41-54) 566.
GEN 75 (Modular Soc., gen. corresp. 52-54) 594.
GEN 61 (Heating Installations 53-54) 595.
GEN 75A (Modular Soc. Trans. 53) 621.
GEN 5A (Methods of constr. 52-54) 625.
GEN 42 (Publications 50-54) 637.
GEN 21 (Private Architects 51-55) 657.
GEN 75 (Modular Soc. gen. corresp. 54-56) 707.
GEN 5A (Methods of constr. 54-57) 776.
GEN 40 (Lighting 45-57) 783.
GEN 42 (Publications 54-58) 816.
GEN 75 (Modular Soc. 56-58) 830.
GEN 55 (Scientific BRS 52-59) 856.
GEN 70 (Holoplast, gen. 50-58) 872.
GEN 72 (Struct. design 57-) 872.
GEN 79 (Public rel., Lectures etc. 55-59) 917.
GEN 77 (Meetings Secondary and Primary Groups 52-60) 931.
GEN 1 (Gen. unclass, corresp. 56-61) 984.

GEN42 (Publications 58-61) 986.
GEN69 (Govt. publ. 53-61) 1021.
GEN42 (Publications 61-62) 1041.
GEN25 (Dept. library 51-63) 1117.
GEN95B (Herts, Kent, War Dep. 63-64) 1238.
GEN42 (Publications 62-63) 1255.
GEN56 (Officers Tech. Panel 51-65) 1315.
GEN4 (BSI 45-65) 1318.
GEN79 (Public rel., Lectures etc. 60-65) 1320.

(c) Job files of the principal projects discussed in the text:

The Job Files in the Hertfordshire Record Office unfortunately are not stored in consecutive groups. The following job files are therefore listed in standard subject-suffix sequence, irrespective of box order, for consistency and ease of retrieval:

Cheshunt, Burleigh JMI School.

E444 (41-48) 185; E444 (48-52) 424; E444A (46-48) 432; E444B (46-47) 173; E444B (Gen. Contr. 47-52) 432; E444C (46) 166; E444C (47) 173; E444C (Sub Contrs. 47-51) 432; E444D (Hills/Hilcon 46-47) 432; E444D (Hills/Hilcon 48-52) 432; E444E (Weatherfoil 46-51) 432; E444F (Dejongs 46-48) 432; E444G (Cl.Wks. 47-48) 432.

Essendon JMI School:

E456A (47-48) 411; E456B (Gen. Contr. 47-52) 411; E456C (Sub Contrs. gen. 47) 170; E456C (Sub Contrs. 48-52) 411; E456D (Hills/Hilcon 46-52) 411; E456G (Cl.Wks. 47-49) 261; E456QS (Gardiner & Theobald) 47-41) 411.

Borehamwood, Summerswood JMI School:

E607 (50-53) 490; E607B (Gen. Contr. 51-54) 540; E607C (50-51) 291; E607C (Sub Contrs. 50-51) 540; E607C (52-53) 540; E607D (Holoplast 50-53) 540; E607G (Cl.Wks. 51-53) 459; E607H (Hills steel 50-52) 540; E607QS (Quan.Surv. 51-54) 540.

Watford, Oxhey, Clarendon SM School:

E637 (48-53) 456; E637B (51) 266; E637C (50-51) 284; E637C (52-53) 559; E637D (Holoplast 50-55) 559; E637G (Cl.Wks.51-53) 560; E637H (Hills 50-52) 560; E637J (Quotations-struct.50-52) 560; E637K (Quotations-envelope 50) 560; E637L (Equip.50-53) 560;

E637W (Heating 50-55) 560; E637Q (Furn. 49-52) 560; E637QS (Quan. Surv. 51-55) 560; E638 (Gen 49-53) 558; E638A (MOE 49-52) 558; E638B (Gen. Contr. 51-53) 558; E638C (Sub Cóntrs. 49-54) 558; E638D (Holoplast 49-55) 559; E638E (Quotations 49-52) 559; E638H (Hills 49-52) 559.

Borehamwood, Theobalds, Lyndhurst SM School:

E715B (Gen. Contr. 53-54) 558; E715B (Gen. Contr. 54-56) 731; E715C (52-53) 476; E715C (53-54) 584; E715C (Sub Contrs. 54-56) 731; E715D (Timber frames 52-54) 702; E715F (Weatherfoils 52-55) 702; E715G (Cl.Wks. 53-55) 651; E715K (Non-accep. quotes 53-55) 702.

Cheshunt, Cadmore Lane, Brookland JM School:

E788B (55-60) 963; E788Ba (59) 964; E788Bb (Variation orders 59-60) 964; E788Bc (Issue of drgs.59) 964; E788C (Sub Contrs. 58-60) 964; E788D (Non-accep. quotes 59) 964; E788G (Cl.Wks. 59-60) 964.

St. Albans College of Further Education and Hertfordshire College of Building:

E804 (56-59) 849; E804 (60-61) 1029; E804B (57-62) 1118; E804Ba (Site minutes 58-65) 1038; E804Bc (Issue of drgs. 57-62) 1038; E804C (Sub Contrs. 56-59) 812; E804C (Sub Contrs. 59-61) 1029; E804C (Sub Contrs.62) 1038; E804D (Non-accep. quotes 59-66) 1038; E804E (Hills steel frame 56-61) 1038; E804QS (Quan.Surv.57-62 1038.

St. Albans, Colney Heath, St. Luke's Day School (Special):

E818 (59-65) 1292; E818B (Gen.Contr.61-65) 1325; E818Ba (Site minutes 62-63) 1325; E818Bb (Variation orders 62-63)1325; E818Bc (Issue of Drgs. 62) 1325; E818D (Non-accep.quotes 62) 1325; E818G (Cl.Wks.62-63) 1325.

Hertford, Balls park, Simon Balle SM School:

E726 (45-57) 792; E726B (55-56) 715; E726B (56-58) 818; E726C (54-55) 692; E726C (56-57) 780; E726 (56) 718; E726C (Sub Contrs. 57-58) 818; E726D (54-56) 772; E726G (55-56) 710; E726G (Clk.Wks. 55-57) 772; E726QS (Quan. Surv. 54-57) 772.

(d) County Architect's Meetings: Minutes.

The following were not evident in the HRO but "personal" copies which had been disposed of c.1966 were located and sets are now held by the present writer. These minutes record discussions and directives concerning policy, technical development and departmental management:

i. Team Leader Meetings, Nos. 1-30 (27 Oct. 1955- 28 Aug. 1958) series superseded by,

ii. Group Architects Meetings, Nos. 1-29 (5 Jan. 1959 - 11 Jan. 1963).

Appended to minutes in both of the above series are occasionally Office Instructions, Memoranda, Reports, Standing Orders etc., which were tabled for discussion.

iii. Development File, unnumbered (25 June 1962 - April 1963) containing standard Design Briefs, development and procedural notes, some minutes and memoranda.

(e) Miscellaneous Reports later than 1964.

Reports of theCounty Architect to the Performance Review Sub-Committee of the Finance and Resources Committee.

Building Maintenance Report No.1, 5 Jan, 1978.
Building Maintenance Report No.2, 15 June,1978.
Building Maintenance Report No.3, 5 October, 1978.

(f) County Architects Department Drawings.

All project drawings selected for retention after construction and Standard Drawings (originally printed in the colours below) are stored as microfilm in the County Architects Department at County Hall. Copies of specialist sub-contractor's drawings exist on most of the relevant project files.

Yellow	1952 Secondary schools.
Blue	8'3" steel frame.
White	"Basics" common to all systems.
Yellow	2'8" steel frame.
Pink	Brick structural crosswall; 1'4" DISC.
Green	2'8" concrete frame.

Few copies on the original coloured paper are extant; the present writer has retained a number of examples which became redundant in the 1960s.

2. OTHER UNPUBLISHED SOURCES

(a) Hertfordshire County Council Education Committee Minutes, in bound volumes, housed in the HRO, County Hall, Hertford.

(b) Photographic collections, particularly the County Architects Department technical library photograph and cuttings file; personal collections of Bruce Martin, Michael Keath.
Personal interviews and private papers, including diaries, job note books.

(c) Private sources, tape recorded personal interviews, and notes; diaries, job note books, sketches, local newspaper cuttings and miscellaneous memorabilia. See also Acknowledgements.

Section B

PUBLISHED SOURCES

The published works and papers in the Bibliography have all been handled during the course of research, although not all of them have been used in the preparation of this study. The list is not meant to be exhaustive but it is hoped sufficiently extensive to be of value to researchers in the history of school construction and system building generally.

Contemporary articles in technical journals written by members of the architect team, reporting developments with which the authors had been directly concerned may be regarded as primary sources. Such articles have been drawn on heavily for factual material, particularly in those sections dealing with 8'3" development; supplementary material has been drawn from the unpublished sources. Secondary source material has been used, in the main, only in support of interpretation.

The Bibliography has been structured to facilitate the retrieval of material with the greatest convenience, hence the section dealing with articles in technical journals is arranged alphabetically by journal, within which the articles are listed chronologically. Where the authors of such items are evident their names appear as the first entry.

1. BOOKS

ALEXANDER, C., Notes on the synthesis of form, Cambridge (Massachusets, Harvard University Press, 1964.

ALOI, G., Scuole (Schools), Hoepli, Milan, 1960.

BARHAM, H., The building industry: a criticism and a plan for the future, London, St. Botolph, 1947.

BAZAROV, K., "Aslin, Charles Herbert." In Contemporary architects, pp.46-48, London, edited by Muriel Emanuel, Macmillan, 1980.

BENTON, T., BENTON C. and SHARP D., Form and function: a source book for the history of architecture and design 1890-1939, London, Crosby Lockwood Staples, 1975.

COOK, P., Architecture: action and plan, London, Studio Vista, 1967.

DEESON, A.F.L., The comprehensive industrialised building systems manual, London, House Publications, 1964.

DE MARE, E., Editor, New ways of building, 2nd Ed., London, Architectural Press, 1951.

DENT, H.C., The educational system of England and Wales, 3rd Ed., London, University of London Press, 1966.

ESHER, L., A broken wave: the rebuilding of England 1940-1980, London, Architectural Press, 1981.

FERRY,D.J., Cost planning of buildings, 2nd Ed., London, Crosby Lockwood, 1970.

GODFREY, J.A. and CLEARY, R. CASTLE, School design and construction, London, Architectural Press, 1953.

GROPIUS, W., The new architecture and the Bauhaus, London, Faber and Faber, 1935. (reprinted 1965).

JACKSON, A., The politics of architecture: a history of modern architecture in Britain, London, Architectural Press, 1970.

JOEDICKE, J., A history of modern architecture, London, Architectural Press, 1959.

LANDAU, R., New directions in British architecture, London, Studio Vista, 1968.

LAYTON, E., Building by local authorities (Report of an inquiry by the Royal Institute of Public Administration), London, Allen and Unwin, 1961.

LEA, F.M., Science and building: a history of the building research station, London, HMSO, 1971.

MARTIN, B., School buildings 1945-1951, London, Crosby Lockwood, 1952.

MARTIN,B., The co-ordination of dimensions for building, London, RIBA Publications, 1965.

MARTIN, B., Standards and building, London, RIBA Publications, 1971.

MEEK, H., "Aslin", In Encyclopaedia of modern architecture, edited by Wolgang Pehnt, London, Thames and Hudson, 1963.

MYLES WRIGHT, H. and GARDNER-MEDWIN, R., The design of nursery and elementary schools, London, Architectural Press, 1938.

NAIRN, I., Modern buildings in London, London, London Transport, 1964.

NEWSOM, J.H., The child at school, Harmondsworth, Penguin Books, 1950.

OSBORN, F.J., Editor, Planning and reconstruction 1944-45, London, Todd, 1944.

PEVSNER, N., The buildings of England: Hertfordshire, Harmondsworth, Penguin Books, 1953.

RICHARDS, J.M., An introduction to modern architecture, 2nd Ed., London, Cassell, 1961.

RICHARDSON, H.W. and ALDCROFT, D.H., Building in the British economy between the wars, London, Allen and Unwin, 1968.

ROTH, A., The new school, Zurich, Girsberger, 1950.

RUSSELL, B., Building systems, industrialisation and architecture, London, Wiley, 1981.

SEABORNE, M., Primary school design, London, Routledge and Kegan Paul, 1981.

SEABORNE, M and LOWE, R., The English school: its architecture and organisation, vol.2 1870-1970, London, Routledge and Kegan Paul, 1977.

SINGER, J.B., Plastics in building, London, Architectural Press, 1952.

STILLMAN, C.G. and CLEARY, R. CASTLE, The modern school, London, Architectural Press, 1948.

TAYLOR, W., The secondary modern school, London, Faber and Faber, 1963.

KIDSON, P., MURRAY, P. and THOMPSON, P., A history of English architecture, Harmondsworth, Penguin Books, 1965.

TUBBS, R., The Englishman builds, Harmondsworth, Penguin Books, 1945.

WARD, C., Editor, British school buildings: designs and appraisals 1964-74, London, Architectural Press, 1976.

WATKIN, D., Morality and architecture, Oxford, 1977.

WEBB, M., Architecture in Britain today, London, Country Life, n.d., (c.1968).

WHITE, R.B., Prefabrication: a history of its development in Great Britain, London, HMSO, 1965. (see also Govt. publications).

WHITTICK, A., European architecture in the 20th Century, London, Leonard Hill, 1974.

2. MISCELLANEOUS PAPERS AND PAMPHLETS (in chronological order)

BUILDING INDUSTRIES' NATIONAL COUNCIL, Report on prefabrication. London, 1944.

ROYAL INSTITUTE OF BRITISH ARCHITECTS, Report of Committee on school design and construction. London, 1945.

ROYAL INSTITUTE OF BRITISH ARCHITECTS, Schools exhibition handbook. London, 1948.

BUILDING RESEARCH CONGRESS, S.A.W. Johnson-Marshall on schools construction (Division 3, p.165). London, 1951.

ARCHITECTS YEAR BOOK 4, J. Howe on new schools in Britain. pp.65-79, Elec, London, 1952.

HERTFORDSHIRE COUNTY COUNCIL, A hundred new schools: school building 1948-54. Hertford, 1954.

HERTFORDSHIRE COUNTY COUNCIL, Report of Education Committee on the secondary modern school. Hertford, 1955.

ARCHITECTS YEAR BOOK 7, School at Royston, Hertfordshire. pp.183-187, London, Elec, 1956.

THE ARTS COUNCIL, Introduction and notes to catalogue of exhibition: Ten Years of British Architecture '45 - '55. J. Summerson. London, 1956.

THE BRITISH COUNCIL, Britain's new schools, D.H. Morrell and A. Pott, Longmans Green, London, 1960.

ROYAL INSTITUTE OF BRITISH ARCHITECTS, Purpose and organisation of development groups. R. Walters, London, 1961.

HERTFORDSHIRE COUNTY COUNCIL, Building for education 1948-61. Hertford, 1962.

YOUNG FABIAN PAMPHLET, Architecture: art or social service ? Paul

Thompsom, London, 1963.
SOUTH EASTERN ARCHITECTS COLLABORATION, SEAC First report 1963-66. Hertford, 1966.
HERTFORDSHIRE COUNTY COUNCIL, 1870-1970 Hertfordshire education. Hertford, 1970.
ORGANISATION FOR EUROPEAN ECONOMIC COOPERATION, Industrialised building for schools. Guy Oddie, OECD, Paris, 1975.
ORGANISATION FOR EUROPEAN ECONOMIC COOPERATION, School building and educational change. Eric Pearson, OECD, Paris, 1975.

3. GOVERNMENT PUBLICATIONS (in chronological order)

BOARD OF EDUCATION, Suggestions for the planning of new buildings for secondary schools. Educational pamphlet no.86, London, 1931.
BOARD OF EDUCATION, Report of the Consultative Committee on the primary school. (Hadow Report), London, HMSO, 1931.
BOARD OF EDUCATION, Suggestions for the planning of buildings for public elementary schools. Educational pamphlet no. 107, London, 1936.
MINISTRY OF WORKS, Standard construction for schools. (Wood Report), Post-War Building Studies No. 2, London, HMSO, 1944.
MINISTRY OF EDUCATION, Regulations prescribing standards for school premises. London, HMSO, 1944.
MINISTRY OF EDUCATION, The Nation's schools. Pamphlet no.1, London, 1945.
MINISTRY OF WORKS, House construction second report. Post-War Building Studies No.23, London, HMSO, 1946.
MINISTRY OF WORKS, School furniture and equipment. Post-War Building Studies No.24, London, HMSO, 1946.
CENTRAL OFFICE OF INFORMATION, The battle for output 1947: full text of the white paper (CMD 7046), Economic Survey for 1947, London, HMSO, 1947.
BUILDING RESEARCH STATION, Library bibliography no. 138, Prefabrication. Garston, 1948.
MINISTRY OF EDUCATION, Report of a technical working party on School construction. (Cleary Report), London, HMSO, 1948.
MINISTRY OF WORKS, Heating and ventilating of schools. Post-War Building Studies No.27, London, HMSO, 1948.
MINISTRY OF EDUCATION, New Primary schools. Building bulletin no.1, London, HMSO, 1949.
MINISTRY OF EDUCATION, New secondary schools, Building bulletin no.2, London, HMSO, 1950.
MINISTRY OF EDUCATION, Cost study. Building bulletin no.4, London, HMSO, 1951.
MINISTRY OF EDUCATION, Memorandum on the use of steel in educational buildings. London, HMSO, 1951.
BRITISH STANDARDS INSTITUTION, BS 1708: 1951 Modular co-ordination. London, 1951.
MINISTRY OF EDUCATION, New colleges of further education. Building bulletin no. 5, London, HMSO, 1951.
MINISTRY OF EDUCATION, Development projects: Wokingham School. Building bulletin no. 8, London, HMSO, 1952.
MINISTRY OF EDUCATION, Colour in school buildings. Building bulletin no.9, London, HMSO, 1953.

BUILDING RESEARCH STATION, The use of modular co-ordination by the Hertfordshire County Council 1945-1954. Note no. C 302, Garston, 1954.
CENTRAL OFFICE OF INFORMATION, Education in Britain. Reference pamphlet no.7, London, HMSO, 1955.
MINISTRY OF EDUCATION, The story of post-war school building. Pamphlet no. 33, London, HMSO, 1957.
OFFICE OF MINISTER FOR SCIENCE, Report of the committee on the management and control of research and development. (Zuckerman Report), London, HMSO, 1961.
MINISTRY OF EDUCATION, Half our future. Report of the Central Advisory Council for Education (Newsom Report), London, HMSO, 1963.
MINISTRY OF TECHNOLOGY, Prefabrication, a history of its development in Great Britain. R.B. White, National Building Studies, special report no. 36, London, HMSO, 1965.
DEPARTMENT OF EDUCATION AND SCIENCE, Children and their primary schools. Report of the Central Advisory Council for Education (Plowden Report), London, HMSO, 1965.
BUILDING RESEARCH ESTABLISHMENT, Classroom temperature, clothing and thermal comfort - a study of secondary school children in summertime. (Three schools in Hemel Hempstead). Current paper 22/74, Garston, 1974.

4. ARTICLES IN TECHNICAL JOURNALS

The Architect:

1973 DERAMORE, A., Is system building architecture? 119 (Aug.) p.42.

Architect and Building News:

1936 Derby police courts and offices: borough architect, C.H. Aslin. 146 (May 15) pp. 195-196.
1945 GIBSON, D.E.E., Discussion on methods of construction, experimental building, research, etc. 184 (Nov.16) pp.111-115.
1947 HALL, D. CLARKE, Secondary schools. 191 (Oct. 31) pp.98-102.
1948 Planning the new schools, school planning in Hertfordshire. 193 (Jan.16) pp. 47-53.
1948 New schools exhibited, Editorial. 193 (June 4) pp.487-488.
1949 The Barclay secondary school Stevenage. 196 (Sept.16) pp.265-272.
1949 User requirements in school design, an account of an experiment in collaboration in Hertfordshire. 196 (Sept.30) pp.319-326.
1949 Two schools at the LCC Oxhey housing estate. 196 (Dec.2) pp.592-594.
1949 Two schools for the Hertfordshire County Council. 196 (Dec. 16) pp.635-637.
1950 ASLIN, C.H., Specialised developments in school construction. 198 (Nov.3) pp.494-496.
1950 Experiment in plastics, caption to illustration only. 198 (Dec.1) p.601.
1951 Southill school Hemel Hempstead. 200 (Sept.13) pp.201-284.
1952 Aboyne Lodge St. Albans, illustration, 201 (Jan.24) p.98.
1952 New police station Rickmansworth. 201 (April 24) pp.481-489.

1953 ASLIN, C.H., How the local authority works. 203 (June 11) pp.702-703.
1954 Little Furze primary school Oxhey. 205 (April 22) pp.261-264.
1954 Livingstone Primary school East Barnet. 206 (Oct.21) pp.462-464.
1955 New model service station Reading. 207 (June 16) pp.719-721.
1957 Langleybury secondary school. 211 (March28) pp.404-412.
1958 Waltham Cross secondary school, caretaker's cottage. 213.(Feb. 19) pp.243-244.

Architects Journal:

1942 STILLMAN, C.G., Schools. 96 (Nov. 26) pp.342-351.
1945 STILLMAN, C.G., School in standard bay units. 101 (June 7) pp.241-247.
1946 JORDAN, R.F., The equipment of schools. 103 (June 13) p.458.
1947 HERTS COUNTY COUNCIL ARCHITECTS DEPARTMENT, On the design of primary schools. 106 (Oct. 16) pp.339-347.
1948 ASLIN, C.H., Primary schools: the contemporary planning approach. 107 (May 20) pp.462-465.
1948 HALL, D. CLARK, Secondary schools: their planning problems analysed. 107 (May 20) pp.466-471.
1948 MEDD, D.L. and CROWLEY, M., School furniture and equipment. 107 (June 10) pp. 537-570.
1949 Schools in the Herts building programme. 110 (Oct. 20) pp.431-440.
1950 Prototype classrooms. 112 (Nov. 23), pp.420-430.
1952 Templewood JMI Pentley Park, Welwyn Garden City. 115 (March 27) pp.395-399.
1952 LACEY, W.D. and SWAIN, H.T., Primary schools in Hertfordshire: progress since 1949. 116 (April 3) pp.420-426.
1952 Primary school at Furze Hill, Boreham Wood. 116 (Aug. 7) pp.161-170.
1952 STILLMAN, J.C. and EASTWICK-FIELD, J.C., Ministry of Education development work: Wokingham school. In six parts.116 (Oct.16) pp.469-475; (Dec.4) pp.670-676.
(1953) 117 (Jan.8) pp.41-44; (March 12) pp.342-347;(May 28) pp.671-678. 118 (July 23) pp.111-118.
1953 Heating and ventilating (BRS research). 118(March 26) pp.407-409.
1953 Secondary school on the LCC estate at Oxhey. 118 (Aug. 20 pp.231-236.
1954 Secondary school in College Road Cheshunt. 119 (Feb. 18) pp.219-222.
1954 NOTT, C.M., Surveying and specification: cost analysis. 120 (Sept. 16) pp.353-6.
1955 Editorial, The Nation's cheap profession. 121 (Jan.27) p.119.
1955 Secondary school in Barnet Lane, Barnet. 121 (Feb.24) pp.265-278 and 284.
1955 LACEY, W.D. and SWAIN, H.T., Hertfordshire schools development (8'3" system). 121 (May 12) pp.643-651.
1955 LACEY, W.D. and SWAIN, H.T. Hertfordshire schools development 2 (8' 3" system). 121 (May 26) pp.717-725.
1955 LACEY, W.D. and SWAIN, H.T. Hertfordshire schools development 3 (Heating). 122 (Aug.11) pp.197-201.
1955 KAY, J., Modular co-ordination in Hertfordshire school design.

122 (Dec.8) pp.783-789.
1955 LACEY, W.D. and SWAIN, H.T., Hertfordshire schools development 4 (fittings and fixtures). 122 (Dec.22) pp.849-855.
1956 NISBET, J., Cost analysis and cost planning. 123 (May 10) pp.472 - 475.
1956 NOTT, C., NORMAN K. and STRACEY,D., Architectural economics: a new method of cost planning and cost analysis. 123 (May 24) pp.561-567.
1956 TWIST, K.C., REDPATH, J.T. and EVANS, K.C., Hertfordshire schools development 5 (secondary schools). 123 (April 19) pp.379-384.
1956 Assembly hall at Great Offley, Hitchin. 124 (July 6)
1956 TWIST, K.C., REDPATH, J.T. and EVANS, K.C., Hertfordshire schools development 6 (secondary schools). 124 Aug.2) pp.156-162.
1956 Primary school at Stevenage (Derwent system). 124 (April 24) pp.550-551.
1958 Secondary school at Balls Park, Hertford. 127 (April 24) pp.615-626.
1959 The CLASP system. 129 (April 30) pp.645-651.
1960 SWAIN, H.T., The mass production spirit. 131 (Jan. 31) pp.127-136.
1960 Primary school at Aboyne Lodge, St. Albans. 131 (May 12) pp.731-740.
1961 Hertfordshire development policy. 133 (Jan.19) p.112-113.
1961 Junior school at Cheshunt (Cadmore Lane). 133 (April 27) pp.609-622.
1961 IUA Congress special issue. 133 (June 29) pp.935-952.
1961 College of further education at St. Albans. 134 (Dec.6) pp.1110-1127.
1962 Herts C.C. 200 up.135 (Feb.14) p.344.
1962 Herts bridges for M1. 136 (Aug.15) p.410.
1962 Training college at Balls Park, Hertford. 136 (Sept. 5) pp.601-612.
1962 Working details revisited: 1, External non-load bearing walls. (Holoplast panels at Clarendon School, Oxhey) 136 (Nov.7) p.1088.
1962 Working details revisited:5, Metal windows. (Sliding window at Burleigh School, Hatfield) 136 (Dec.5) p.1292.
1963 WILLIS, M., Design for boys and birds. 137 (Jan.16) pp.150-161.
1963 Herts-Kent-War Office link up. 137 (March 27) p.651.
1965 MEDD, D.L. and KAY J., A new approach to primary school design. 141 (Feb. 17) pp.397-410.
1965 College at St. Albans revisited. 142 (July 7) pp.27-34.
1966 DIPROSE, A., SEAC: First report 1963-1966. 144 (July 6) p.17.
1972 The Norman period. 155 (April 19) p.827.
1976 CARTER, J., 1945-55 Decade of confidence. 164 (Oct.6) pp.630-641.

<u>Architects Journal Working Detail Series</u>:

1953 (30 July) Holoplast panels at Clarendon School, Oxhey.
1954 (15 June) Sliding windows at Burleigh School, Hatfield.
1955 (27 Jan.) Stanchion in assembly hall, School at Stevenage New Town.

1961 (18 May) Shoe lockers: school at Cheshunt, Herts.
1961 (1 June) Storage unit: school at Cheshunt, Herts.
1961 (5 July) Lavatory unit: school at Cheshunt, Herts.
1961 (19 July) Sink unit: school at Ware, Hertfordshire.
1961 (2 Aug.) Science bench: College in St. Albans, Hertfordshire.
1961 (2 Aug.) Glazed link: College in St. Albans, Hertfordshire.
1961 (16 Aug.) Projection balcony: College in St.Albans, Hertfordshire.
1961 (23 Aug.) Welding bench: College in St.Albans, Hertfordshire.
1961 (30 Aug.) Exhibition screens: College in St.Albans,Hertfordshire.
1961 (30 Aug.) Chemistry bench: College in St.Albans, Hertfordshire.
1961 (6 Sept.) Librarians desk: College in St.Albans, Hertfordshire.

Architectural Association Journal:

1946 Schools, a discussion. Report of an Ordinary General Meeting of the Architectural Association 61 (Feb.) pp.43-48. (Includes contributions by J. Newsom and C.H. Aslin).
1949 Architectural Association's visit to three Hertfordshire schools. 64 (March) pp.172-175.

Architectural Design:

1949 The use of standardisation in the school programme of Hertfordshire County Council. 19 (Sept.) pp.210-215.
1951 MILLS, E.D., Hampden secondary school, for the Hertfordshire County Council. 21 (Sept.) pp.266-275.
1952 Beechwood day nursery. 22 (March) pp.65-74.
1952 Summerswood school, Boreham Wood, Herts. 22 (Aug.) pp.224-233.
1954 The cladding of framed buildings, Chambersbury Lane School, Hertfordshire and Woodside Secondary Modern School. 24 (Nov.) pp.323 and 337.
1954 Burleigh county secondary school, Hatfield, Herts. 24 (Dec.) p.352.
1955 School at Royston, Hertfordshire. 25 (Feb.) pp.36-40.
1958 STIRLING, J., Young architects. 28 (June) pp.232-233.

Architectural Review:

1947 The Hertfordshire County Architects Department. 101 (Feb.) pp.63-66.
1949 TOWNSEND, R., Post-war schools in Britain. 106 (Sept.) pp.153-160.
1949 School at Essendon; Hitchin; Cheshunt; Stevenage. 106 (Sept.) pp.161-176.
1952 LLEWELYN DAVIES, R. and WEEKS, J., The Hertfordshire achievement. 111 (June) pp.366-387.
1952 Four schools in Hertfordshire. 111 (June) pp.373-376 (Aboyne Lodge), 376-380 (Pently Park), 380-382 (Croxley Green Junior), 383-384 (Garston day nursery).
1954 Preview. 115 (Jan.) p.12.
1954 WARD, N., Classroom furniture. 115 (May) pp.347-351.
1954 POST, R., Architect-manufacturer co-operation. 115 (May)pp.409-414.
1954 School at Cheshunt, Herts. 116 (July) p.43.
1955 School at Hatfield, 118 (July) pp.27-29.
1955 School at Garston, Watford. 118 (Aug.) pp.111-112.
1956 Health centre at Welwyn Garden City. 119 (June) pp.330-331.
1957 Walls off the peg - an analysis of British curtain wall systems,

(including "Quicktho" and "Holoplast") 122 (Sept.) pp.167-187.

1961 College of further education, St.Albans. 130 (Sept.) pp.199 - 200.

1962 BANHAM, R., Ill-met by clip-joint. 131 (May) pp.349-352.

1963 Industrialised building: system building - open or closed. 134 (Aug.) pp.138-146.

1963 ODDIE, G., The new English humanism. 134 (Sept.) pp.180-182.

1964 ODDIE, G., Letter to editor. 136 (Dec.) p.397.

1970 ROCK, T., et al, Manplan 4. 147 (Jan.) p.16.

1978 MARTIN, J.L., Notes on a developing architecture. 164 (July) pp.10-17.

1979 A.R. '30s, 166 (Nov.) pp.271-332.

Architectural Students Association Journal: PLAN

1949 Building, architecture, education. No.6 (Oct.)

Architecture and Building:

1959 St.Albans F.E. 4 (Nov.)

The Builder:

1947 The educational building programme: Ministry's plans for 1947. 172 (Jan.3) pp.15-17.

1949 Employment of new materials and methods of construction in post war schools: Lecture by S.H. Loweth. 176 (April 15) pp.450-453.

1955 Hitchen high school for girls. 188 (April 15) pp.625-631.

1957 Grammar school, Rickmansworth. 192 (Jan. 11) pp.44-46.

1961 GIBSON, D.E.E., From Herts onwards. 200 (June 30). pp.1242 - 1246.

1961 Stevenage College. 201 (Dec.8) pp.1082-1086.

Building (formerly The Builder, q.v.):

1975 Life as a government architect, (interview with J. Redpath). 228 (Jan. 24) pp.50-51.

1978 GOULDEN, G., Practice made public, (interview with H.Swain et al.) 234 (Jan.13.) pp.56-62.

1978 GOULDEN, G., Quantity with quality, (interview with J. Nisbet et al.) 234 (Feb.10) pp.68-72.

Building Digest:

1948 Schools, (special number). 8 (April) pp.117-149.

1948 New schools: problems of planning in conformity with provisions of 1944 Education Act analysed. 8 (July) pp.241-244.

Building Materials:

1965 BIRD, E., Adze and module: the man who started system building (C.H. Aslin). 25 (July) p.73.

Built Environment (formerly Official Architecture and Planning, q.v.):

1973 I.B. Now. Theme feature by Cleeve Barr, Bruce Martin, Louis Hellman et al. 2 (Jan.) pp.11-32.

Chartered Surveyor (formerly Journal of the Royal Institution of Chartered Surveyors.

1954 OSBORNE, J.G., A new approach to single price-rate approximate estimating. 33 (April) pp.810-824.

1955 NOTT, C.M., A Method of cost analysis and cost planning. 34 (May) pp.919-928.

1957 Cost analysis: a paper by the Cost Research Panel. 89 (April) pp.602-604.

Design:

1954 BERESFORD-EVANS, J., Towards better ceramic sanitary ware, (Adamsez). No.70 (Oct.) pp.20-25.

1974 Gropius and the making of Impington, (Gropius correspondence). No.302 (Feb.) pp.48-53.

1977 In praise of pace-makers, 25 year review 1952-1977. No.342 (June) pp.50-61.

Education:

1945 RIBA Committee on school design and construction report. (July 27) p.161.

1949 Formation of A & B Development group (confirmed through Circular 191). (April 29)

1951 ASLIN, C.H., School building in Hertfordshire. (April 27) pp.631-658.

1964 GIBBON, L.F., What happened in Herts. (Nov.27) pp.977-978.

1964 FARDELL, G.C., Industrialised building in Hertfordshire. (Aug.28)

ERA (Journal of Eastern Region, RIBA):

1963 BOLTON, K.J., Hunstanton secondary modern school. 1 (June) pp.34-37.

1968 FARDELL, G.C., Building for education in Hertfordshire. 1 (June) pp.16-23.

Industrialised Building Systems and Components:

1963 A welcome partnership. (June) p.5.

Institute of Heating and Ventilating Engineers Journal:

1953 WESTON, J.C., School heating research. 20 (March) pp.459-494.

1955 DICK, J.B., Experimental and field studies of school heating. 23 (June) pp.88-123.

Light and Lighting (Illuminating Engineering Society Journal):

1951 HOPKINSON, R.G., Lighting research at the B.R.S. and influence of recent research on school building. 44 pp.10 and 81.

1951 JOHNSON-MARSHALL, S.A.W. and SAMUEL, E.F. Recent trends in the design of schools as affected by lighting requirements. 44, p.138.

Modular Quarterly:

1960 Cadmore Lane School, Cheshunt. (Summer)

Municipal Journal:

1955 Theobalds S.M. School 63 (April 22) pp.1071-1079.
1957 Schools at Stevenage. 65 (May 10) pp. 1007-1012.

Official Architect:

1949 A prefabricated unit system for schools, (Arcon). 12 (July) pp.368-370.
1953 Colour in schools, (report on Illuminating Engineering Society paper on the use of colour in schools, by David Medd). 16 (April) p.199.
1954 New president of the Royal Institute. 17 (June) p.278.
1956 Peartree Spring schools and health clinic at Stevenage. 19 (June) pp.284-286.

Official Architecture and Planning (formerly Official Architect, q.v.):

1966 Schools issue. Editorial and articles by: MILLS, S., The developers (pp.1280-1285); WALLIS, M., Hertford: A system, yesterday, today and tomorrow (pp.1286-1289); Hertfordshire: Chells secondary school, Stevenage.(p.1328); DAVIDSON, C.H., A comprehensive view of industrialised building (pp.1397-1398). 29 (Sept.) pp.1280-1398.

Prefabrication:

1954 KITCHEN, J.H., Prefabrication and school buildings. 1 (June) pp.7-13.
1955 CUTHILL, C.M., Productivity in school Building. 2 (April) pp.257-262.

Royal Institute of British Architects Journal:

1945 School standards. 52 (Feb.) p.111.
1945 Report of the RIBA Committee on School Design and Construction. 52 (Aug.) pp.292-294.
1946 STILLMAN, C.G., School planning and construction. 53 (Jan.) pp.67-77.
1946 Ministry of Works standard hutting for schools. 53 (Feb.) pp.131-133.
1946 LOBB, H.V., The first post-war permanent schools. 53 (July) pp. 377-384.
1946 ALLEN, W.A. and BICKERDIKE, J.B., The daylighting of classrooms under the new regulations. 53 (Sept.) pp.492-495.
1947 SWARBRICK, J., The influence of daylight and sunlight on functional design of school buildings. 54 (Jan.) pp.183-190.
1947 WILSHERE, R.S., Modern school buildings. 54 (July) pp.459-464.
1947 School at Walkern Rd., Stevenage. 54 (Oct.) pp.579-583.
1947 FITZMAURICE, R., Use of materials. 55 (Dec.) pp.66-69.
1947 Some designs from the schools exhibition (part one). 55 (Dec.) pp.70-74.
1948 Some designs from the schools exhibition (part two). 55(Jan.) pp.115-119.
1948 New schools, RIBA Exhibition. 55 (May) pp.282-287.
1948 Nominations for the 1948 Council. 55 (May) p.302.
1948 Report of the Ministry of Education's technical working party

on school construction. 56 (Nov.) p.11.
1949 BIRD, E.L., The post-war schools of the Hertfordshire County Council. 56 (Sept.) pp.471-479.
1950 ASLIN, C.H., Specialised developments in school construction. 58 (Nov.) pp.9-14.
1951 Dimensional co-ordination. 58 (April) pp.230-234.
1953 JOHNSON-MARSHALL, S.A.W., The architect's contribution to value for money in school building and the role of the Ministry of Education. 60 (June). pp.310-313.
1953 SHEPPARD, R., Post-war development in school design. 60 (June) pp.313-319.
1953 ASLIN, C.H. How the local authority works. 60 (June) pp.319-320.
1955 Hertfordshire's hundredth new school, Editorial. 62 (Feb.)p.134.
1955 ALLEN, W.A., Modular co-ordination research: the evolving pattern. 62 (April) pp.246-250.
1969 ASHLEY-SMITH, E.T., The history of SEAC. 76 (May) pp.199-200.
1969 PLATT, J., The development of SEAC. 76 (May) pp.200-202.

<u>Royal Society of Arts Journal</u>:

1954 ASLIN, C.H., The design of new schools. 102 (Sept.) pp.804-816.

<u>Society of Architectural Technicians Journal:</u>

1969 SEAC - The first five years (interview with E.T. Ashley-Smith). 1 (Sept.) pp.3-8.

5. NEWSPAPERS AND PERIODICALS

1950 <u>Observer</u>, "Herts builds the 1950 school," Cyril Dunn, (April 16).
1950 <u>Financial Times</u>, "Architecture today: school buildings," A. Trystan Edwards, (May 23).
1952 <u>Sunday Times</u>, "Schools in Britain," (April 5) p.5.
1955 <u>Observer</u>, "Schools of today," R. Furneax Jordan, (Feb.20).
1960 <u>Times Literary Supplement</u> (special number). "The British imagination: a critical survey," includes essay: The architects ideas begin to take shape. (Republished by Cassell, London, with introduction by A. Crook, 1961).
1961 <u>Times</u>, Survey of the architect in Britain today. S. Johnson-Marshall. (July3).

6. BROCHURES (none of the following are dated; approx.date given).

Holoplast Technical Manual, Holoplast Ltd., c.1948.
Presweld Construction for Schools, Hills (West Bromwich) Ltd., c.1954.
Seco Permanent Construction, Seco Ltd., c.1946.
Steel window catalogue, Williams and Williams Ltd., c.1960.
The Punt System, C.D. Productions Ltd.
Bellrock Panels, Bellrock Gypsum Industries Ltd., c.1951.
"Tiling in post-war schools", Carter and Co., Poole and London, c.1950.