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AUTHOR Lindsay, Noel
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ABSTRACT

Despite the diversity of national circumstances, all countries have the common aim of providing the right kind of school buildings in the right place, at the right time, and at the right cost. The objective of the present study is to establish the best institutional means for achieving this aim and, insofar as there are common patterns between countries for such institutional arrangements, to try to identify them. The institutional arrangements for school building relate essentially to the total period from the initiation of a project (that is, as soon as the need for a school and its type and size have been determined) through completion of the building and its subsequent maintenance and evaluation. The processes involved in this must, moreover, be viewed at all times in the wider context of forward planning of school building programs if implementation is to be effective and resources properly used. Indeed, the framing of school networks and of forward capital programs to meet educational needs are key factors in the whole matter. (Author/IRI)

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INSTITUTIONAL ARRANGEMENTS

FOR SCHOOL BUILDING

BY NOEL LINDSAY

EA 007 500

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT
PARIS JULY 1975

The Organisation for Economic Co-operation and Development (OECD) was set up under a Convention signed in Paris on 14th December, 1960, which provides that the OECD shall promote policies designed:

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- to contribute to sound economic expansion in Member as well as non-member countries in the process of economic development;

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The Programme on Educational Building (PEB) was established by the Council of the Organisation for Economic Co-operation and Development as from January 1972. Its present mandate expires at the end of 1976.

The main objectives of the Programme are:

- to facilitate the exchange of information and experience on aspects of educational building judged to be important by participating Member countries;

- to promote co-operation between such Member countries regarding the technical bases for improving the quality, speed and cost effectiveness of school construction.

The Programme functions within the Directorate for Social Affairs, Manpower and Education of the Organisation in accordance with the decisions of the Council of the Organisation, under the authority of the Secretary-General. It is directed by a Steering Committee of senior government officials, and financed by participating governments.

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P R E F A C E

From the beginning of its work, the Steering Committee for Educational Building paid attention to problems of institutional arrangements. Indeed, all issues studied under the Programme invariably touched upon these problems and it was felt therefore that they needed to be treated separately.

The study on Institutional Arrangements for School Building was entrusted to Mr. Noël Lindsay, at the time representative of Ireland to the Steering Committee, today consultant to the World Bank. His experience as Principal Administrator to the Building Unit of the Irish Department of Education made him particularly qualified for this task.

The study developed on the basis of information collected during visits to a number of countries selected to cover as wide a range as possible of different situations. Mr. Lindsay was assisted in his task by a sub-group of four members of the Committee, who helped in drawing relevant conclusions from the material assembled. Their contributions were particularly valuable at the stage of finalising the report as were the comments made by the Committee itself.

Since the theme of institutional arrangements underlies all issues in the field of school building and thus constitutes a sort of common denominator, there were clear difficulties in treating it in as brief a document as this without giving the impression of relative dispersion, further reinforced by the diversity of the situations referred to in the study. Institutional arrangements are in fact closely linked to the geographical and economic characteristics of various countries as well as to historic traditions behind their administrative systems but it is nevertheless through these differences that the common features of the problems facing them all emerge.

This is why the report refers to other studies carried out under the Programme which all emphasise the important role played by institutional arrangements in the solution of the problems they examine. This is particularly the case of the recent publication "School Building and Educational Change", a report on the international Symposium held in Buxton, England, late in 1973. The themes discussed, especially those concerning social and economic pressures, briefing and design, methods of building, and research and development brought into play numerous problems related to institutional arrangements. Likewise, other publications, already issued or to appear shortly, deal with the same problems but from specific angles : "Building Implications of the Multi-Option School", "Industrialised Building for Educational Purposes" and "Providing for Future Change: Adaptability and Flexibility in School Building".

The unity of the present study is formed by two major considerations which are treated in themselves and are also subjacent throughout the entire analysis. The first aims at determining as precisely as possible the distribution of responsibilities, be it in the way these can be exercised at different levels of the administrative structure or in the sharing out of responsibilities between the various parties involved in the briefing, design and building process. The second consideration consists in seeking the best ways and means of reconciling the rigour of proceedings with the continuous renewal of solutions and procedures which have to adapt to changing needs. It will be seen for example that the proposals made concerning the formulation of norms and the introduction of cost control techniques or of implementation planning become meaningful only in relation to the analysis of research and development activity.

GENERAL CONSIDERATIONS

1. Any investigation covering a number of countries must have constant regard to the individual peculiarities of each, especially their size, their traditions, their problems and their resources. In the field of school building there is diversity in institutional arrangements, ranging from very centralised systems to those that are totally decentralised. National circumstances also differ: in some countries the need for new school buildings is relatively marginal in comparison with what exists already; in others the demand is overwhelming as a result of extensions of the compulsory school leaving age, major migration trends and/or fundamental changes in educational structures. In the latter case the problem may also be compounded by a concomitant shortage of technical manpower and of capital resources.

2. Despite this diversity of circumstance, however, all countries have the common aim of providing the right kind of school building, in the right place, at the right time and at the right cost. The objective of the present study is to endeavour to establish the best institutional means for achieving this aim and, insofar as there are common patterns between countries for such institutional arrangements, to try to identify them.

3. The institutional arrangements for school building relate essentially to the total period from the initiation of a project (that is, as soon as the need for a school and its type and size have been determined) through completion of the building and its subsequent maintenance and evaluation. The processes involved in this must, moreover, be viewed at all times in the wider context of forward planning of school building programmes if implementation is to be effective and resources properly used. Indeed, the framing of school networks and of forward capital programmes to meet educational needs are key factors in this whole matter.

4. At the present time, when many countries are experiencing scarcities in the supply of materials, it is opportune to recall that effective resource utilisation is the central and over-riding issue to which all activities covered by the OECD Programme on Educational Building are directed. Some countries have tended to see resources in terms of their financial capacity to produce them internally or to acquire them on an international market. All are now becoming uncomfortably aware, however, that the resources of such materials have their limits - even globally - and that there is an urgent and worldwide need to conserve them. In such a situation, the effective utilisation of resources acquires a new dimension that may well prompt national authorities to ensure that they are used more sparingly and economically, whatever their country's financial capacity may be to buy at home or abroad.

5. Another circumstance that makes it timely to repeat the necessity of relating all new school building to a forward national programme is the increasing tendency for local interests to become involved in the matter with the consequent danger of the national context being overlooked. In some countries the devolution of responsibility to the local authority is already a reality, in others it has not yet taken concrete form. The pace is likely to accelerate, however, as means are found of reconciling local initiative and control with national interests. Additionally, there is a complementary trend in the planning of school buildings towards consultation with a wider public which includes parents, teachers, students and industry and may involve their participation in the planning process locally.

6. Increasingly, then, the question is no longer whether there should be local involvement and local participation in decision-making, but rather what the respective roles of the various levels of responsibility in school building should be according to the problems treated. Some processes may fall comfortably within local competence, others may transcend local boundaries in the degree of expertise and co-ordination of activity called for. The size of country has a major bearing on the solution. Tradition and political evolution (as, for instance, in Switzerland) may well be over-riding considerations. Thus, the issue becomes one of how best to co-ordinate local or regional aspirations and initiatives in the light of a national perspective.

LEVELS OF RESPONSIBILITY IN SCHOOL BUILDING

7. In some countries a three-tiered system has been adopted for the control and management of school building, the various functions being apportioned between the central, regional and local authorities. In others, regional authorities do not exist and responsibilities for school building are then shared between the central and local authorities. The precise connotation of these levels and their respective roles may thus differ considerably from one country to the next. For example, in some places a municipality may constitute the local authority while in others there may be no authority below the level of the region. In England, for example, the so-called Local Education Authorities at county level are in fact regional authorities. Similarly, in France the regional authority known as the "Académie" may well perform many of the functions discharged elsewhere by the central authority. Variations such as these relate, of course, to a country's size, traditions and general administrative structure.

8. In view of this diversity of nomenclature and structure it seems best in reviewing the functions that have to be performed in implementing a school building programme, not to class them with respect to any named level of authority but to arrange them in groups that correspond with 'levels' only in a relative sense. The important thing is to recognise which of these functions need to be grouped to be carried out effectively and which can be performed individually or locally. At what precise level of authority the various responsibilities are placed is a matter for each country to decide for itself. Thus, the essential functions in planning and implementation are here grouped in three categories: Central, Regional and Local.

(a) Functions at Central Level

9. The role of the central authority is seen as one of overall control (by direction, advice or restraint) to ensure effective resource use as well as satisfactory educational input. It may work through the following mechanisms, whose functions would be closely inter-related.

(i) A Central Research and Development Unit to carry out investigations on the basis of which norms and guidelines can be formulated. (As yet, few countries have such a unit).

(ii) A Central Planning Unit to co-ordinate and formulate proposals on educational structures, school networks and forward school building programmes. (Most OECD countries have such a unit).

(iii) A Central Design Unit to comment and advise on design proposals for building projects. A number of countries have such units. In some the function is delegated to the regional authorities if they sustain appropriate expertise.

(iv) A Central Administrative Unit to recommend procedures, handle legal arrangements, formulate norms applicable to school building and exercise control. Most countries have such a unit; sometimes it coincides with the Research and Development Unit; in other cases it may form part of the general legal and administrative services of the ministry or government agency concerned.

(b) Functions at Regional Level

10. The regions are likely to play an increasing role in school building since many aspects of the process require a level of expertise unlikely to be available to the local authority often too small to sustain such expertise. It is necessary to repeat here, however, that in a number of countries where regional authorities do not exist most of the responsibilities exercised elsewhere by the regions are discharged by the local authorities while some remain the prerogative of the central authority. The principal point to be made here is that there appears to be a growing need for an authority (however it may be designated) at one remove from central government and yet sufficiently large to initiate and co-ordinate the processes required to implement national policy. In very broad terms, this includes the following (often manifold) functions:

- compiling all statistical data relevant to future planning in the region;
- proposing a regional school network and developing forward building programmes for government approval;
- arranging for the acquisition of sites and the planning, design, erection and maintenance of schools, if and when the regional authority has responsibility for school building and/or advising the local authority if and when the latter is responsible for school building;
- controlling costs in accordance with centrally determined norms and compiling cost data;
- reviewing progress and evaluating implementation.

11. To apply norms and guidelines effectively and to perform functions over a field as wide as this requires, as already indicated, the availability of considerable expertise, constant liaison with other levels in the system and consultation with outside bodies. To the extent that any of these functions are not performed, or performed without adequate expertise, resources will be used less effectively. The aim should therefore be to create regions of sufficient population size to warrant employment of the necessary spread of technical specialists. Such regional units can be established either within an existing regional authority or through the creation of consortia of local authorities. If for any special reason such a solution cannot be adopted, it will be necessary to arrange for further assistance to be provided by the central units, in particular the Research and Development Unit and the Central Design Unit.

(c) Functions at Local Level

12. The involvement of teachers, parents, students and industry is likely to be most effectively harnessed in their own immediate areas. To take advantage of this, it is felt that local authorities (or whatever the appropriate term happens to be for the lowest level in the system) should be enabled to play a significant role in school building. Such a role normally relates to the provision of primary and pre-primary schools, but increasingly extends to secondary schools. It would include the following functions:

- submitting proposals to the regional and/or central authority on size and location of schools;
- acquiring school sites;

- preparing proposals for briefs in consultation with local interests but within the framework of existing norms and constraints for submission to the regional authority and/or arranging for the planning, design, erection, handover and maintenance of schools with the advice of the regional or central authority;
- controlling costs with the assistance of higher authority;
- providing the regional and/or central authority with data on all projects undertaken.

13. The nature of the issues that arise in school building may be administrative, financial, educational, architectural or technical. These cannot be seen as disparate functions; the structure of the mechanisms responsible for school building should, therefore, reflect their inter-relationship. The need for multi-disciplinary teams on the staffs of such bodies is elaborated in paragraph 38 but notice should be taken in the present context of the grave responsibility that lies upon the architect - particularly as concerns the safety of his building. Administrative and educational considerations should not be allowed to over-ride legitimate design considerations.

14. A division of responsibility for school building as between the Ministry of Education and the Ministry of Public Works remains an issue in some countries. There are advantages in concentrating technical expertise in all areas of building in one department (e.g. Public Works) and particularly so where there is a shortage of technical manpower. Arrangements for school building on this basis, however, have frequently led to an undesirable split in responsibilities at the policy formulation and planning stages between the educational and the technical authorities. To avoid this dichotomy and to ensure that the educational requirements remain the prime objective, many countries have vested total responsibility for school building in the Ministry of Education. Wherever such responsibility lies, it is important that educational and technical planning considerations should not be separated. Educationists, together with architects, engineers and other interested parties should therefore form part of any central units with responsibilities for school building whether such units are located in the Ministry of Education or in the Ministry of Public Works. The increasing need for co-ordination, shared and joint use of school and community facilities may eventually lead to reviewing existing patterns of responsibility. In the meantime arrangements are increasingly being made at regional level for a better utilisation of available technical expertise across the boundaries of ministerial departments.

PLANNING AND BUILDING PROCESSES

15. The flow chart presented on pages 8 and 9 illustrates how the total process of planning and building schools consists of a series of inter-related activities. The purpose of this Report is to elucidate the significance of the main processes as outlined in this chart and to discuss their most appropriate places in an institutional system for school building.

Framing a School Network

16. A priority in the school building process is the determination of a school network and it is from such a base that all proposals and programmes for school building need to proceed. Such a network will be in accord with national decisions on school structures and will be dependent on adequate data being available on enrolment forecasts and on the existing stock of schools. The preparation of a school network, if only in preliminary form, should never be deferred due to lack of precise data and forecasts on demographic trends and population movements. It should proceed, under a system of rolling review, using whatever data is available.

17. The establishment of a school network is an example of a function which in the first instance ought to be performed at regional level in close collaboration with local authorities. Central government is often too remote from local realities to undertake the preparation of such a network. On the other hand, the majority of local authorities are too small for efficient co-ordination to take place and also often lack the necessary expertise. The elaboration of regional school networks is therefore an essential first step in programme planning. Whatever the authority responsible, it will consult with authorities below it in the hierarchy, where they exist, or otherwise with interests at the local level and obtain proposals with support data regarding siting and sizes of schools. There can be no doubting the value of local involvement in the determination of a school network. The injection of local statistical data and knowledge of topography, traditional attitudes, and the like adds much to the realism of any decisions taken. Equally, it makes such decisions more acceptable locally.

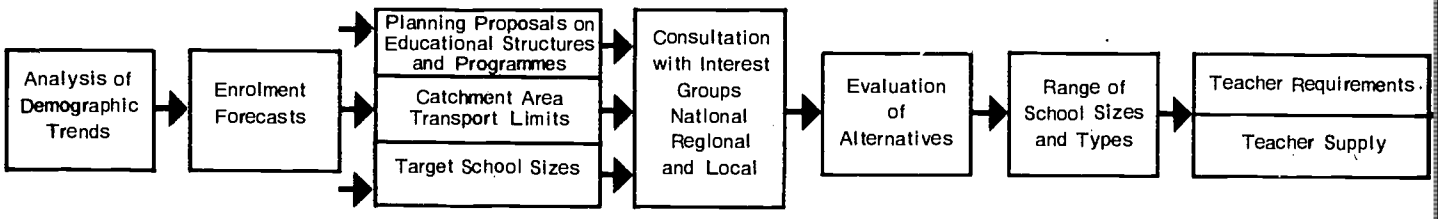
18. National decisions on educational structures and on optimum sizes of schools in accordance with such structures will provide the framework within which regional network planning will proceed. A central co-ordinating agency must also provide projected statistical trends and patterns of population growth with migration trends for each region clearly defined. Such a function could most properly be performed by a Central Planning Unit which, in addition to providing national guidelines for regional network planning, would co-ordinate the totality of proposals and adjudicate where catchment areas for school centres should rationally overlap regional boundaries or seek co-ordination between two regions. In the light of the experience gained from analysis of a number of possible solutions, it would advise the regional planners, where necessary, on modifications to proposals. While it may be seen as proper to retain a power of veto at central level, it is likely that such power would be exercised only in extreme cases.

19. Decisions taken at the central level should not restrict unduly, however, the variety of solutions that may prove necessary in special population situations. In more sparsely populated areas it is frequently necessary to examine the matter, not so much in the context of given educational structures covering specified age spans, but of the ages of the children to be accommodated in terms of travelling distance and time, of the type of curriculum to be provided within economic constraints and of the rational use of teachers. In such circumstances three-year age spans - 6 to 9, 9 to 12, 12 to 15 and 15 to 18 - or similar types of division may be an appropriate basis for considering the extent to which some or all of these would form one school unit.

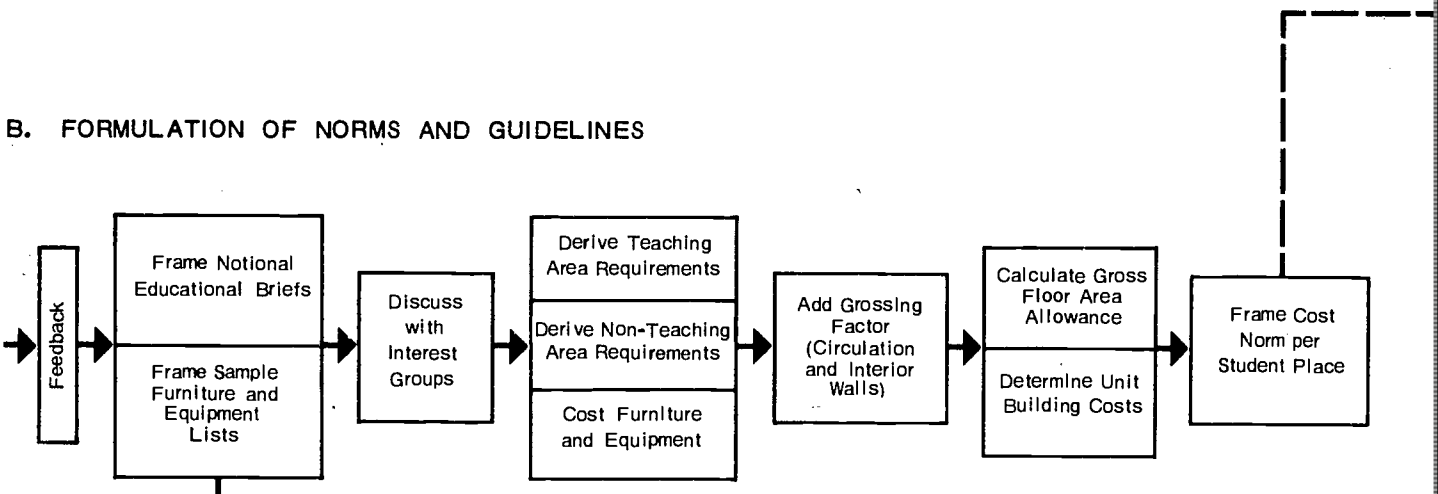
20. Framing the school network and decision-taking as to the types and sizes of buildings should be on-going processes during which alternatives are continuously and thoroughly evaluated. Such evaluation should have the widest possible purview. It should serve as a point of reflection on the uncertainties of the future, the need for energy conservation and adaptability in buildings, questions of land use and the very nature of school buildings as separately identifiable institutions. A central Planning Unit in collaboration with a Research Unit would be one source of initiation of such evaluation, but the decision-making process itself should comprehend a stage of reflection on the wider issues.

21. Any framing of a school network and of a sequential forward building programme should be preceded by an analysis of the existing stock of schools. The scale of such a task is regional but obviously requires local involvement. Such an analysis should indicate the age and condition of the buildings and any needs for educational or physical up-dating. Provision for such up-dating should feature in the forward programmes. The analysis will also have regard to any spare capacity of existing buildings. Irrespective of the authorities involved, the institutional arrangements must allow surplus accommodation at any level of education to be used for whatever other purposes - educational

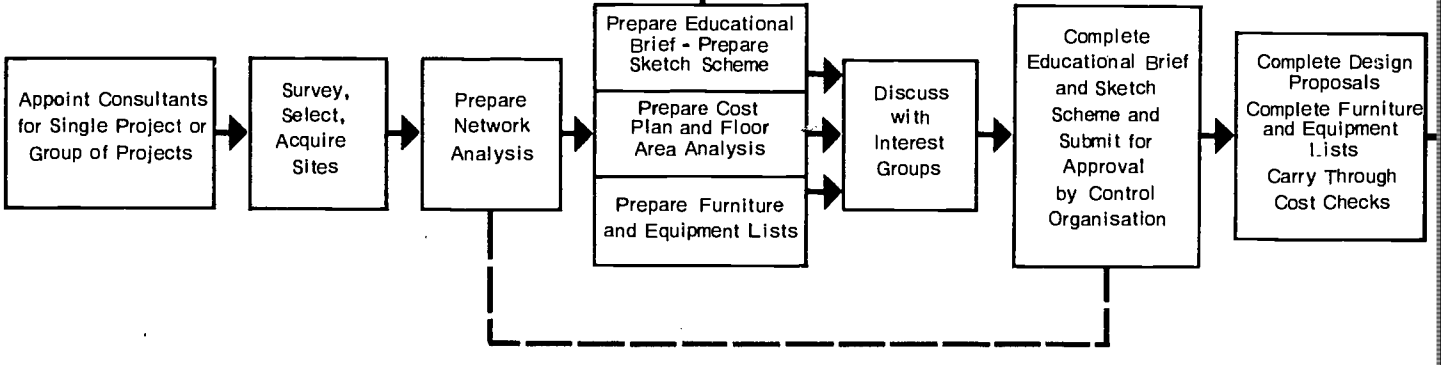
A. PROGRAMME PLANNING



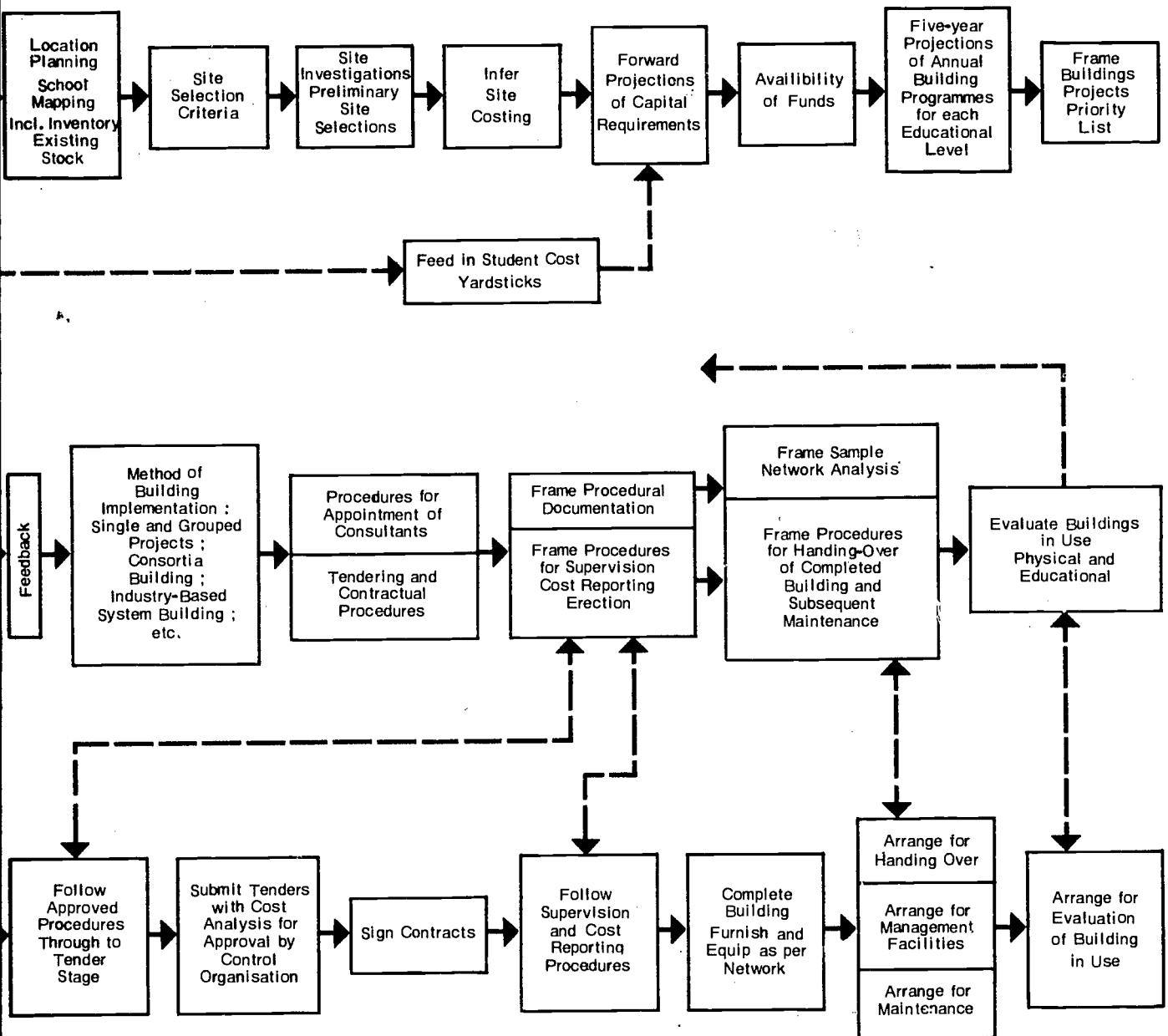
B. FORMULATION OF NORMS AND GUIDELINES



C. PROJECT PLANNING AND EXECUTION



PLANNING AND BUILDING PROCESSES



or community - may be considered appropriate. Such changes in the functions of school buildings, or of part of them, may become increasingly important in the future if efficient use is to be made of available resources.

22. Another factor that affects the finalisation of the school network is site availability. The problem of sites is likely to be particularly vexed in urban growth areas where the demand for land for all purposes is at its highest. Site acquisition is greatly facilitated where needs are determined well in advance of need, and it is now generally accepted that urban planning should include provision for school sites; but it will be increasingly difficult to press all the claims of schools against other competing interests. For example, the assignment of large areas for intermittent use by schools for sports and games is unlikely to be sustained in the future. In short, urban planners should be apprised as early as possible of the desirable criteria for school sites, it being realised, of course, that all of these cannot ultimately be entirely met.

23. The actual acquisition of a school site should, where feasible, be carried out by the authority responsible for the building. Local authorities should, and generally do, have the power of expropriation of sites for schools but, since this normally takes place at a stage when costs have escalated and is often a slow and tedious process, it is not a procedure to be relied on other than exceptionally. As already suggested, a formal link between educational authorities and urban planners seems the only satisfactory answer to this problem. Such a link requires to be forged at two levels: at local or regional level for the purposes outlined in the preceding paragraph, and at the central level where research is required into school site requirements in the wider context of urban planning generally. Such a function might fall on a Central Planning Unit working closely with town planners.

24. The preplanning stages of a school network and building programme include consideration of a number of other important factors which lie outside the confines of the present study. The more notable are those that refer to what actually goes on in the school - curricular matters, educational technology and, of course, all that relates to teachers. A school network must have regard, for example, to teacher supply - both short-term and long-term where the two are significantly different. In addition, decisions on teacher-pupil ratios are not only relevant to the determination of optimum school sizes but also fundamentally affect the planning of school buildings. At central and regional levels, therefore, those responsible for the planning of school building programmes need to be in close liaison with those responsible for teacher supply.

Forward Programming of Building and Capital Requirements

25. Forward planning of national investment is now an established pattern in most deveveloped and developing countries and often takes the form of a 5-year plan up-dated annually. As part of this process there is generally an obligation on central government to ensure that local investment is in conformity with available national resources. In some instances this obligation is fulfilled only fitfully with no set mechanism of reporting and accountability; clearly, however, it should be part of a wider accountability from local to central level. In school building, such a mechanism requires the preparation and costing of forward programmes at regional level in consultation with local authorities, or at local level where no regional level exists, the co-ordination of these programmes at central level and their examination in the context of national resources. This is a minimum requirement and is a procedure that is in operation in many countries. Whether the examination at central level should be carried further into an analysis in detail of local programmes will depend on national circumstances - particularly the effectiveness of national guidelines and the expertise available at regional and/or local level.

26. Forward planning in detailed terms is unlikely to extend beyond five years ahead. A three-stage implementation process, of which the English model is an example, constitutes an excellent base for such planning. This process entails the preparation of:

(a) a 'preliminary list' of projects for the completion of which a need is reasonably foreseeable within the next five years, but which can at this stage only be arranged in a provisional date order;

(b) a 'design list' of projects drawn from the preliminary list, on which detailed planning and design work is taking place and which can be expected to start in a specified year;

(c) a 'starts programme' of fully planned and costed projects to be started in the specified year.

Whether such planning should be done at central level or at regional level with co-ordination by central government is a matter for countries themselves to decide. But whoever does it should also prepare a building priority list in case available capital proves inadequate to fund the total programme within the five-year period.

27. Forward planning establishes for each level of authority the nature of the school building programme to be tackled in terms of financial and manpower resources required and the extent of the demand on the building industry from the educational sector. It provides the opportunity for devising systematic implementation schedules and an orderly flow of work. It assists in ensuring an equitable distribution of available funds between regions as distinct from funds being allocated as demand occurs without due regard to the relative urgency or importance of the proposed projects. It is in forward programmes that the possibility lies of achieving economies of scale - whether by the use of standardised plans (or preferably standardised components), by bulk purchasing or serial tendering - and of drawing on the resources of industry to obtain better and more economical buildings. It also helps to reduce the need for emergency building programmes and enables projects to be planned and implemented in stages.

28. Factors that militate against forward planning should be closely examined. In some countries it would appear that budgetary arrangements artificially restrict the time available for planning and building of schools in that the list of projects, on which acquisition of sites and planning may proceed, may only be determined a short while before the budgetary year in which funds will be allocated to them.

The Need for Norms and Guidelines

29. The trend towards devolution of authority from central level imposes an added responsibility on national authorities to provide guidance and expertise to the regional and/or local authorities to ensure effective implementation and to safeguard interests other than the purely local. Experience generally indicates that the absence of norms for school building results in an uneven pattern of provision in terms of unit costs, floor area and educational provision and invariably in costs far in excess of those which could be achieved.

30. Norms can be defined generally as regulations and/or guidelines about the standards it is intended school building should meet. They may relate to such things as: the the areas and volumes necessary per pupil; detailed descriptions of equipment required, environmental questions concerning lighting, heating, ventilation and aural characteristics; the appropriate wall, floor or ceiling finishes needed; safety precautions; the services demanded for teaching purposes; methods of controlling costs and permissible expenditure.

31. The ways in which quantitative and qualitative norms are expressed, like the objectives they are intended to meet, differ from country to country but can be grouped as follows:

- those that describe what must be done by prescribing the means to be employed to reach certain standards of area and/or quality without necessarily specifying their aims in terms of performance (e.g. so many 150 W tungsten light fittings in a room of specified size and shape); these may, even so, be implicit;
- those that prescribe the ends sought but not the way in which to achieve them - sometimes thought of as 'performance standards';
- those that merely demand that the aspect dealt with should be 'suitable', 'appropriate' or 'adequate' without prescribing either means or ends though they may be backed-up by examples of the kind of solution which is regarded as satisfactory.

These three ways of expressing norms, whether mandatory and/or indicative, are by no means mutually exclusive and, in many countries, can be seen to co-exist in the set of norms and/or guidelines that govern school building practice. However, the most interesting trends would today appear to be those most conducive to the latter two types of norms and which channel research and development work accordingly.

32. A further aspect covered by norms, quantitative in nature but meriting separate consideration, is expenditure. When norms limit expenditure some people may resent the constraint they impose. But the fact that they exist is often, quite naturally, confused with the actual level of the limit at a given moment. When these two aspects are distinguished, the existence of such expenditure norms may in fact prove to be a stimulus in the work involved in briefing and design insofar as it requires the desirable to be considered in the light of the possible, therefore compelling the making of choices. In addition to this, expenditure norms have the further positive role of promoting the fairest possible distribution of resources and, indeed, provide the key for this distribution enabling the available means to be rationally shared among various regions, localities or projects.

33. It is important to distinguish between norms that are essential and those that are unnecessary. The need has also to be recognised for a continuous or 'rolling' reformulation of norms in the light of technological, educational and other advances. Norms can inhibit development unless framed in such a way as to state minimum requirements (educationally and technically) and maximum permissible provision in the light of available resources - with freedom for individual design between these two poles. These poles have to be set realistically so that real choices are left to designers of individual schools.

34. As a follow-up to the present report the OECD has initiated a special study (Activity 8 in the Programme on Educational Buidding) on this particular topic. Its objectives are: to identify the major problems involved in formulating or reformulating norms and the means of solving them; to provide for discussion and examination of methodological alternatives in the determination of critical norms; and to provide broad quantitative data that will enable each country to make a ready comparison of its own standards with those of others.

35. In advance of this study, however, the present position can at least be summarised in general terms. The process of school building is conditioned by three factors: mandatory regulations, a body of advice given by central, regional or local authorities and an area of freedom to design a school which meets the special needs of the neighbourhood it is to serve. The relative weight of these factors varies from one country to another. Too many precise regulations inhibit imaginative design, while advice, particularly that given by a central authority, is often interpreted as mandatory. The design team (architects, engineers, administrators and educationists) require a sufficient measure of freedom to seek innovatory design solutions to the changing needs of education.

Establishing Norms and Guidelines: the Role of Research and Development Units

36. Any practicable set of norms must have the backing of research and they must be subject to rolling review. This presupposes the existence of a body competent to ensure that these conditions are fulfilled, and brings us back to the Research and Development Unit already suggested as one of the mechanisms of the Central Authority. As well as being responsible for carrying out the necessary investigations on the basis of which norms and guidelines can be formulated, such a unit would harness and co-ordinate research and development work being carried out at regional or local level, disseminate the results of such work and establish mechanisms of feedback.

37. This matter was discussed at length during the OECD Symposium on School Building and Educational Change at Buxton, England, in October 1973*. There the question was posed of whether such a unit should be located within a central government agency or established as an autonomous or semi-autonomous institute. At the start, one may distinguish between pure research, which might be carried out by a specialised research institute, and applied research and development. Insofar as applied research and development is concerned, it seems essential that it should not be divorced from the realities of overall national financial constraints and the practicalities of building implementation. The work of the Unit should be seen as the mechanism by which norms and/or guidelines are formulated and revised and new design solutions sought. It is highly unlikely that the results of its work will have an immediate impact unless the Research and Development Unit is linked institutionally with a central government agency.

38. It cannot be too strongly emphasised that the work of a Research and Development Unit requires the interaction of a variety of disciplines and skills - educationists, architects, engineers, educational administrators and cost experts - and there is a growing need to include sociologists in such a team. It is further essential that no one skill should assume or be given a special status in the team: each member has to feel that he is contributing on an equal basis to common solutions. Such a relationship is also a reflection of the type of structure that is essential to any mechanism with responsibility for school building. It should exist at central level if, as proposed, the Design Unit is located there; but it should also be reflected at the lower levels that have direct responsibility for school building projects or for advising subordinate authorities.

39. A Research and Development Unit should itself at intervals complete the design of a school as a development project, or act in association with an appointed design team. Without direct development work any Research and Development Unit would soon lose its effectiveness and the interest and enthusiasm of its members. Such work is also a major feature of the on-going process of review of norms and guidelines. It makes them credible and acceptable, and sets parameters within which experimentation and change not only can take place but are actively encouraged.

40. There are different views as to whether or not development projects should be required to conform to existing norms. Certainly there should be no initial assumption that the norms will not apply. Equally, however, if development projects are to serve as a means of reviewing norms and guidelines, then, where work indicates a need to modify them, this should be carried through on the project itself, the guidelines being up-dated accordingly It is necessary to distinguish here between overall floor area requirements and unit building costs; the factors of change arising from new educational objectives are much greater for the former than for the latter and what may influence the one should not too readily be assumed to affect the other.

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* Eric Pearson: School Building and Educational Change, OECD, Paris, 1975.

41. As already observed, it is to be hoped that research and development would also be carried out at the level immediately below the central level, be it regional or local. Such work on the part of, say, a regional authority is likely to be particularly rewarding where forward planning allows the development of a building programme of sufficient size to warrant in-depth studies that are simply not feasible for one-off projects. Examples of such arrangements are the development groups associated with consortia building in England and Wales (Clasp, Seac, and the like) and the work of Samskap in Sweden. The Central Research and Development Unit should lend support and encouragement to the development of such programmes and the studies associated with them - or initiate them itself where the country is small - and assist in collating and disseminating the results. Finally, the results of experimentation at local or regional level - whether in the building of new schools, the adaptation of old or the changing use of space - need to be reported 'up the line' to the Central Research and Development Unit, with which in any case the subordinate authorities would have strong links.

42. In stressing the need for research and development work it must be made clear that such work can only be successful if based on adequate data and information. The Research and Development Unit should ideally have at its disposal the following data:

(i) floor area analyses, showing teaching areas, circulation areas and ancillary areas for all schools designed within say, the previous five years;

(ii) cost analyses of building contracts for the same period;

(iii) time-scales from initiation of projects to completion;

(iv) data showing volume of work (in money terms) executed for each building contract on a month-by-month basis;

(v) work-load on professional staff and on labour during the contract;

(vi) supply-flow of materials.

Briefing and Design Criteria

43. One of the key factors in the briefing and design process is the determination of the brief. This interprets the wishes of interested parties and potential users within whatever constraints, financial or otherwise, may be found necessary. Accordingly, it is desirable that proposals for the brief should emanate from the local level. Whether limitations of time and the exigencies of the building programme or the curriculum will hamper local initiation of the brief is, of course, a separate issue which can only be decided in the individual circumstances. There is the further factor that the development of a modern educational brief is a complex operation demanding a level of expertise that may not always be available at local level. Be this as it may, it seems of primary importance that all parties concerned at the local level be encouraged to express their views and needs. Stimulating such local interest and participation and interpreting what is expressed could well be among the tasks of experts at regional or central level.

44. The brief may be seen as having two parts:

(i) Statement of objectives: the social and pastoral needs within the school, the learning and teaching activities stemming from the proposed curriculum and aims of community use, with their spatial implications;

(ii) The means of attaining the objectives: the physical and technical criteria for the school building at the relevant educational level, related particularly to the thermal, acoustic and visual environment, with appropriate reference to fire, health, etc., regulations.

It seems neither desirable nor feasible to develop criteria under (ii) on an individual school basis. Such criteria having general application might best be developed at central level - based on the work of the Research and Development Unit - with provision for regular review. It is in (i) that the essence of the brief for an individual project lies and it is here and in the design solution, which will form part of the final brief, that local wishes may be expressed. If the function of developing a brief is to be performed adequately at local level, norms and guidelines are necessary that will not only express the constraints (floor area, cost, etc.) within which the brief must be developed but also provide guidance as to the format of the brief, and the issues to be covered by it. It is likely that the constraints will be those applying nationally. The Central Research and Development Unit could also usefully postulate the format of the brief which could then be developed by the regional and/or local authority into a notional brief for its own use and as a guide to those directly involved in the preparation of briefs for individual projects. A further type of guidance that has much to commend it is exemplified by the Building Bulletins of the Department of Education and Science for England and Wales, which provide detailed expositions of possible design solutions to specific types of areas, such as Arts and Crafts, Languages, Science and so on.

45. A primary requirement in the establishment of briefing and design criteria is the development of floor area indicators, related to a minimum teaching area and, desirably, a gross floor area. It is in this matter that the greatest scope arises for saving without detriment to educational needs. Excessive floor area provision is likely to result from inadequate analysis of teaching area requirements and space usage and from inadequate criteria for assessing non-teaching space needs. As to the latter, studies carried out in some countries have led to a reduction by half in the proportion of non-teaching area to teaching area. There is a variety of techniques for assessing teaching area needs. The recently published Lancashire Education Authority's Secondary Education Brief demonstrates one method. Several other methods have been described and analysed in another report recently published under the Programme on Educational Building*. The form in Annex 1 is yet another example illustrating how teaching area needs and teacher needs may be determined in the context of the curriculum and teaching arrangements for an individual school and of room usage factors. Such studies, where not already carried out, would fall to the Research and Development Unit as a basis for stipulating or recommending a minimum teaching area and a gross floor area; these studies would then be made available to local or regional authorities together with model analyses.

Furniture and Equipment

46. Many people have expressed reservations about guidelines emanating from central sources that specify educational needs in terms of specific teaching areas, area layouts, furniture and equipment on the grounds that solutions tend to become locked within the guidelines. This is a danger, but nonetheless if such guidelines are formulated to serve as illustrations they can provide the necessary guidance without constraining. Studies at central level on layouts and resultant furniture and equipment needs should desirably relate to alternative solutions and wherever possible should be based on development projects with which the Central Research and Development Unit is involved as well as reflecting experimentation carried out locally.

47. Such studies should extend to collating data on costs of furniture and equipment so that cost norms for furnishing and equipping schools at the various levels of education can also be determined. Furniture and equipment are integral parts of the school building and total cost proposals should include adequate provision for them. Cost norms

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* Jean Ader: Building Implications of the Multi-Option School, OECD, Paris, 1975.

will provide guidance as to economic cost levels and will help to emphasise that choices may have to be made between competing claims on available resources. They will also clarify the extent of the investment in furniture and equipment required and this will strengthen the hand of those who have to find the necessary finance. It is not uncommon to have the provision of furniture and equipment falling on a different agency, or a different unit within the one agency, from that providing the school building. Yet it would seem most important that those determining the form and layout of the building should also determine its furniture and equipment content, whatever the means of procurement.

48. The architect and educationists involved in the school design should be afforded an opportunity of specifying their furniture preferences. Some degree of compromise may have to be accepted in arriving at arrangements that will save costs by bulk-purchasing furniture or using off-the-shelf items, but the matter requires to be approached with caution. An appraisal of items that might be bought in bulk should be carried out by qualified educational interests and any choice of furniture available under such a scheme should be subject to continual review. It is in the continuing use of an item of furniture that has long outlived its suitability that the real danger of bulk-purchasing lies. Procurement of furniture by this means must, therefore, lie in the hands of educational authorities on the basis of specifications and lists that reflect current educational needs and hence require frequent up-dating with changing needs and evolving markets.

49. School equipment certainly lends itself to bulk-purchasing with worthwhile cost savings. Where, however, strict procedures of public tendering on a competitive basis are enforced, difficulties sometimes arise in framing general specifications that will accommodate the two objectives of lowest cost and satisfactory standard. It is essential that the evaluation of equipment tenders should encompass more than questions of cost; other factors that have to be considered are, for instance, time of delivery of supplies on site, time of completion of contract, the extent to which the supplies are suitable for their purposes and are otherwise acceptable as to performance, warranty and after-sales service. Evaluation under such conditions by educationists in conjunction with the appropriate administrators will generally ensure the provision of school equipment to a satisfactory standard.

Cost Control

50. The development of cost norms is an important feature in any effective system of cost control. The yardstick may be a maximum cost per student place accompanied by the requirement of a minimum teaching area. In particular where there is major cost inflation, however, it would seem preferable to consider gross floor area and unit building costs as separate elements within the cost norm, the former to be subject to review on a continuing basis in relation to changing teaching patterns and new curriculum needs and the latter to be up-dated with increases in labour and material costs. It is essential that a building cost norm be realistic and subject to constant up-dating at reasonably close intervals.

51. National practices differ in the extent to which norms determined at central level are mandatory or voluntary. Where all or most of the finance comes from central sources, the general practice is to tie the level of funding to such norms as have been determined centrally and, in many instances, to make adherence to these a positive condition of financial support. Where there is a substantial local funding, the position is more complex and local authorities may have the power to expend whatever they may wish over and above a pre-determined central subvention. Care in avoiding undue expenditure is equally necessary under such an arrangement, particularly in a climate of scarce resources. Local funds, whatever their source ought to be seen as part of total national resources to be spent as fruitfully, effectively and economically as possible. Additional expenditure

from local funds may also contribute to an inequality of school building provision as between one district and another. Where, therefore, it is not considered desirable to tie a central subvention to cost norms, an alternative might be to reduce the central subvention by the amount of any excess over and above the cost norm that is paid out locally.

52. As already suggested, the bases for determining cost norms should desirably be developed by the Central Research and Development Unit. In themselves, however, such norms can have only a limited effect unless accompanied by guidelines and procedures indicating how they can be attained. Certain essential steps emerge. First, the essential constituent elements of the building (foundations, floors, roof, etc.) have to be classified and listed in a standardised form. An example of an internationally recognised classification is that of the SfB system described briefly in Annex 2. Given such classification, cost information is required on the various elements as a basis for framing a cost plan for the building. To this end a cost data bank needs to be built up based on analyses of tender costs with adjustments for material and labour cost increases. The tenders submitted by contractors therefore need to be in a form in which the costs for the various elements can be extracted and a tender cost analysis made. The information thus available will enable a cost plan to be developed for a building at an early sketch-plan stage and this will serve as a framework throughout the development of the design with adjustments and checks on individual elements being carried out on a continuing basis. An example of such a cost plan is contained in Annex 3. In any such cost planning system there are two main objectives: to ensure, firstly, that planning takes place within the parameters of the cost norms and, secondly, that the total cost is spread over the elements as effectively as possible. Except in circumstances of extreme inflation, cost planning on the basis referred to normally ensures that tenders when received will be on target. Should savings be required at tender stage, however, the form in which the cost information is available will facilitate obtaining such savings without unduly lowering standards for a particular element.

53. Cost reporting during building is a further stage in the control system to ensure that the cost target remains valid up to completion of building. In many countries contracts include a price variation clause for increases in labour and material costs during building. There seems little hope in the present inflationary context that this will be dispensed with. It is possible, however, to make allowance for this factor, without dispensing with cost control mechanisms during building.

54. It would be idle to pretend that a sophisticated system of cost control could be operated without the necessary skills of cost expertise being available. In some countries these skills seem to be available only to a very limited degree. In such circumstances it should be a task for the Central Research and Development Unit, or some other agency appointed for the purpose, to persuade authorities to operate the necessary control and to assist in the local implementation of the required procedures. Simplified forms of cost control should be introduced where more elaborate forms could only be operated ineffectively. The essential factor is that cost control should become an accepted feature of the planning and building process to be refined and developed as experience grows and expertise improves. Cost control of individual building projects should be seen also in the wider context of capital expenditure on a national scale and as an essential element in forward capital programming.

Building Procedures

55. It should be emphasised that countries seeking economies in school building costs, and which do not already systematically analyse floor area needs, would do well to do so before seeking savings through improved implementation procedures. Savings in unit costs can at best only partly redress excessive costs resulting from excessive floor area provision.

56. In determining what building procedures to adopt, building authorities must first decide whether to proceed on the basis of a one-off project or whether the building should be included as part of a programme for which advantages of bulk-purchasing, etc. would be sought. In taking such a decision, an authority should, of course, consider the various alternatives open to it. The Central Research and Development Unit could be of help in this and one of its tasks should be to monitor different procurement methods and assess their respective advantages and disadvantages in given circumstances. The alternatives are, perhaps, most conveniently viewed in two classes - those applicable to Individual Projects, and those employed when Projects are Grouped. For each the main alternatives open are summarised below.

(a) Procedures for Individual Projects

57. Traditional Tendering Procedures. Tenders are sought by open competition between contractors who have been short-listed on the basis of previous work performed, managerial and financial capacity, etc., either through a pre-qualifying stage or in accordance with a national classification of contractors. In order to ensure that evaluation of tenders is on the basis of 'like-with-like' and for the purposes of cost control during construction, it is essential that the building be fully pre-planned and tender documentation fully detailed before tenders are sought. Adequate time must be allowed for such pre-planning. Contractors' tender prices should be itemised in a prescribed form that is standard throughout the country for all types of building. Such a breakdown of tender prices makes it possible to assess how realistic a tender is, to determine the cost of any unforeseen variations during construction and to improve the crossflow of information necessary for any system of cost planning. It is recommended that countries which at present operate on the basis of an all inclusive tender price should extend their requirements to include a standardised cost breakdown, preferably taking into account international developments in this field.

58. The 'Turn-key' Procedure is that in which tenders are sought on the basis of 'design and build', the tender documentation consisting of a schedule of accommodation accompanied by a statement of educational objectives and by outline specifications. The reason usually advanced for adopting this procedure is saving in time. In most cases, however, the procedure has the great disadvantage of inhibiting, if not eliminating, consultation (particularly between educationist and architect) during the briefing and design stages, and also of reducing the element of competition since relatively few contractors are likely to be in a position to tender. So while the standard of construction may be high enough, educational requirements are rarely satisfactorily met and cost advantages seldom obtained.

59. Industrialised System Building. Here, tenders are sought from system builders on the basis of a sketch-scheme, with or without outline specifications. Such a procedure may be acceptable where systems of satisfactory standard are available and appropriate to educational needs, where public open tendering is not an absolute requirement, and where comparative evaluation of tenders is feasible. Apparent savings in cost must be viewed with caution. It is only in highly industrialised countries, and there often only in conditions of shortage of skilled labour, that proprietary system building may compete successfully with traditional methods.

60. Performance Specifications. This procedure, which can be combined with other procedures provides an opportunity for industry to offer building solutions through public open tendering on the basis of a sketch-scheme and performance specifications. Industrialised system builders often claim that if this procedure was used more generally the real savings from industrialisation would begin to emerge. The elaboration of performance specifications good enough to ensure a satisfactory solution is, however, a most demanding undertaking and the process of evaluation even more exacting.

61. Negotiated Contracts. In this procedure the advantage lies in the fact that the traditional practice of keeping the expertise of the contractors apart from that of the designers is abolished. A contractor is selected on the grounds of his previous performance and is involved in the design process right up to the point of a contract price being agreed. By associating the contractor in the architect/educationist dialogue at an early stage it is believed that the potential contribution of industry to design development can be more effectively realised. This is, however, not a procedure to be followed generally since it departs from normal competitive tendering without evidence of cost benefits accruing. Nevertheless, it merits being tried out experimentally provided effective control can be exercised. It is reported to have had positive results in the Netherlands but in all cases the contractor selected was willing and competent to operate with open budgets (including overheads, risks and profits) and the building authority had cost and management experts on the design team. Furthermore, until the end of the design stage the contractor acted as a consultant and the actual building contract was subsequently signed only if and when agreement was reached on prices and constructional details.

(b) Procedures for Grouped Projects

62. The report on Industrial Building Methods for Educational Purposes to be published in the autumn of 1975 as part of the OECD Programme on Educational Building will deal at some length with grouped projects. Therefore only a brief summary of the main procedures applicable to such projects will be made in the present report.

63. School building projects may be grouped together to save on time, cost and/or manpower or to achieve a higher standard. An element of standardisation is inherent in such grouping whether in the form of standard plans (with or without the possibility of variations) or in terms of standardisation of components within a variety of design solutions.

64. Standard Plans (with or without variations). Here tenders are sought from general contractors by open competition on the basis of serial tendering. Tenders may be submitted for one project or any combination of projects within the programme. Tenders are also sought on a serial basis from sub-contractors for components which lend themselves to fabrication off-site or are available off-the-shelf. These may account for 50 per cent or more of the total building cost. The use of standard plans reduces technical manpower requirements and the time required for design, and hence the outlay in fees. More research is possible than for an individual design and a more satisfactory educational solution is to be expected. Cost savings are likely to be made as contractors become familiar with the processes involved and through bulk purchase of components. The major objections to the use of standard plans for a programme of schools concern the dislike of repetitive buildings with no or few possibilities of local variations including adaptation to site, the risk of a bad solution being repeated in a whole series of schools, the danger of reduced experimentation and, at worst, of stagnation. These risks are very real and it must be borne in mind that this procedure should never be used exclusively, nor should a given standard plan be used for more than a limited series of schools, say maximum twenty. Furthermore, each series must form the object of evaluation with a view to improving subsequent series.

65. The Component System. Tenders are here sought from general contractors on the basis of individual designs for each project but with a commitment as to the use of standardised components, arrangements for the price and availability of which being the responsibility of a specially appointed co-ordinating group. Some systems have been developed where only some elements are standardised and form the object of bulk ordering such as floor and ceiling finishes, light fittings. These influence design only marginally. More normally, however, such elements as structure, roof, wall-cladding and possibly services are

part of component systems with consequent repercussions on design (e.g. Clasp, S.C.S.D.). Systems may be 'closed' or 'open' (i.e. low or high degree of interchangeability of parts). While problems of interfacing remain, there is a general tendency to develop more 'open' systems as a result of growing sophistication in application, increasing modular co-ordination and greater availability of dimensionally and functionally compatible components.

66. The application of a fully developed component system requires a high degree of expertise and adequate technical manpower for co-ordination and implementation, and a sufficiently developed supply industry. It also necessitates a sufficiently large building programme to allow cost savings in the supply of a variety of standardised components. Its principal advantage over the standard plan is that it can achieve much the same savings in cost without the limitations of the standard plan. But, to warrant the development of a component system and to achieve the full cost benefits of bulk-purchasing, it will normally be necessary for a number of authorities to 'pool' their building projects, for example through the creation of a consortium. A team of specialists must then be appointed to develop the system, to co-ordinate implementation and to assume research and development on a continuing basis. International experience in this field may provide helpful guidance but needs to be supplemented by work undertaken by a country's own Central Research and Development Unit.

67. Performance Specifications. This procedure has already been referred to among those applicable to individual projects (see paragraph 60 above). The possibility of harnessing the technical expertise of industry is clearly far greater for a programme of grouped projects than for a single project as is the adoption of a more systematic approach to assessment of tender proposals. It must however be for each country to decide whether industry has the necessary expertise to offer and if so whether the use of performance specifications is the most suitable way of harnessing it. This would be a (not inconsiderable) task for the Central Research and Development Unit.

68. Industrialised System Building. This procedure implies serial tendering on the basis of a sketch-scheme. Tenders are sought only from industrialised system builders with known standards of performance. The advantages of this procedure are not as convincing as may first appear except in circumstances of extreme labour shortage and where time is of the essence. Normally, system building should be required to prove itself in open competition.

69. Following this review of building procedures some general conclusions can be drawn. There seems little doubt that the building industry needs to avail itself more fully of modern technology and industrialisation if its efficiency and productivity are to be improved. Rationalised traditional building is already today an amalgam of industrial production and traditional building skills, with increasing use of factory-made components and industrialised methods. Traditional procedures and processes require continuous analysis in terms of time and cost savings both at the stage of planning and that of construction; on-the-job management in particular offers considerable scope for improvements in many countries. Such analysis should proceed parallel to any evaluation of systems, or experimentation in their use, as possible alternatives to traditional buildings.

70. The factors affecting decisions on building procedures are complex and frequently intertwined. They relate to required time-scales, technical manpower availability, state of the building industry, considerations of educational and aesthetic suitability of the finished product. In view of the national interests involved, there is a need for central involvement in such decisions, if only in an advisory capacity.

Emergency Building Programmes

71. Recourse to temporary prefabricated buildings to provide urgently needed accommodation is a worldwide phenomenon due mainly to the post-World War Two bulge in demand for school places. They are today used in a variety of situations, for example where certain needs arise that will no longer exist after some years, or in growth areas where accommodation cannot be provided sufficiently quickly. The question whether such temporary accommodation provides the best solution possible in all or any of these situations merits a detailed study in itself. It is frequently charged that it represents a wasteful diversion of resources from permanent accommodation, that it offers a poor return on money invested, that it does not meet education needs and that in many cases it continues to be used indefinitely simply because it is there. Its extensive application, however, lends some support to its usefulness in given situations. Temporary buildings will continue to be required to meet temporary needs and indeed, relocatable temporary buildings can be a means of supplementing permanent facilities to meet peak needs. Yet there is a clear danger of their over-prolonged use and of their being too readily seized upon as a solution in cases where the existence of a school network and adequate pre-planning would have allowed of a more satisfactory resolution of an accommodation problem.

72. In order not to be overtaken by events if and when the need for emergency programmes do arise, it would be desirable to plan them in advance so that a variety of developed and costed building plans of satisfactory physical and educational standard would be ready to hand each with a pre-determined time-scale of erection and each applicable to a variety of site conditions.

Appointment of Design Teams

73. It cannot be too strongly emphasised that a satisfactory educational brief is dependent on a continuing dialogue between client and design team from inception of the project to completion of the design process. It follows that the team should be appointed at a very early stage. Indeed its role even at the stage of investigating site suitability needs to be strengthened.

74. Where consultants, and more specifically architects, are appointed from the private sector it may be by direct selection on the basis of previously known work, by means of a selection board or by some form of architectural competition. Direct selection is quick and may work satisfactorily but it may not ensure, uniformly, the best appointment possible. Appointment by selection board is more objective but slower. Competition using an independent board of assessors to evaluate entries is more objective still but entails disadvantages. A competition seriously inhibits the dialogue between client and architect which is the very essence of briefing and design. In addition, if applied to schools on a one-off basis, competitions could prove cumbersome and time-consuming, particularly when the total school building programme is large. A more effective use can be made of competitions when the successful designs are intended to relate to a series of schools. In these circumstances, submissions need not take the form of fully developed designs for any specific school.

75. The practice in some countries is to appoint one architect for the design of a building while the implementation is assigned to another. The closest liaison is required in these circumstances to ensure, firstly, that implementation relates fully to design intentions and that the design can be modified in accordance with any special factors emerging during implementation and, secondly, that the process of feedback from implementation to design is not impaired. It seems preferable, however, that the design architect should continue to be associated with the project up to its completion.

76. For countries where the design of school buildings is entrusted to private architects, it has been suggested that it might be worthwhile considering the creation of some sort of College of School Building Architects or, at least, the holding of specialised courses. School building is becoming an increasingly complex field requiring specialised knowledge and experience and such measures, or again the introduction into the design teams of a 'briefing consultant' as exemplified by recent Dutch developments, might well improve the quality of output.

Use of Critical Path Analysis in Project Planning

77. The purpose of critical path analysis in school building is to identify for each project or group of projects the stages of implementation from initiation of the project until completion, the time required for each stage, the action-dates for each activity, and more particularly the critical dates and activities. It should be available to all those responsible for building implementation and should be kept relatively simple to avoid undue complications in up-dating. The Central Research and Development Unit could provide sample analyses for guidance both as to format, methods of operation and achievable time-scales. An example of such a critical path analysis applied to a group of projects is shown in Annex 4. It should, however, be emphasised that the use of critical path analysis can only be fully effective provided certain requirements are complied with - for instance the willingness and ability of the various parties concerned to submit to the discipline of such project planning.

Time-scale for Planning and Building

78. Enquiries have shown that the period from initiation of a project to commencement of building may be anything from one to five years (or considerably more in some cases) as against one to two years normally for the period of actual building. Where savings in time are required they should be sought in the first instance, therefore, in the pre-building period. A critical path analysis may help in determining where such savings can be made and where activities can overlap without inconvenience. For example, activities concerned with site acquisition and with the formulation of the brief, as well as design work where the site is known but not acquired, can be carried out simultaneously. Realistic time-limits are required for the process of consultation. Pre-planning should, if feasible, be carried out in the framework of an overall analysis dating back from the time when the school building is required.

79. It is difficult to provide any indications as regards time-scales for planning and building respectively. In some countries about 18 months are required for each of these stages, and there are examples of even shorter periods. Further investigations would be required to find out how this is made possible. Certainly it appears that more time should be allowed for briefing and design than is the case in many countries at present. As mentioned earlier, the use of industrialised system building is one way, but not the only way, of rationalising the building process. Improving traditional building methods, while making use of industrialisation wherever feasible, is likely to prove more satisfactory in achieving time and cost savings, at least within the foreseeable future.

Processes of Consultation

80. Consultation is normally necessary at several levels. Centrally, of course, it arises in connection with policy issues concerning educational structures, school sizes and suchlike. The Central Planning and Research and Development Units will initiate a constant dialogue with the level next in line - be it regional or local - which itself will consult with the central authority on proposals for school networks and forward programmes. At the level of project planning, consultation on the brief and on design

proposals, which will increasingly involve teachers, parents, students and local business interests, will take place at local or regional level - or both, as appropriate to the country's educational administrative structure. Such processes of consultation may lead to considerable delays, if they are not begun early enough and if time limits are not set. In Denmark, where there is considerable experience in this matter, it was recently proposed that a set procedure should be established whereby a brief and preliminary sketch scheme would be prepared by specialists - design team including educationists - for discussion at a meeting open to all concerned. After this a further two weeks would be allowed for the submission in writing of views and suggestions. It is assumed that the preparation of proposals by the specialists would include a formal process of consultation with local teachers. Such a procedure commends itself as providing a realistic limit to the consultation period.

Evaluation of Buildings in Use

81. The evaluation of buildings in use (from both the physical and the educational viewpoint) - together with the results of experimentation, research and development work - are key factors in a rolling review of norms and guidelines. Most countries have informal reporting of experimentation, and reactions to buildings in use will frequently find some expression in the design of subsequent buildings. What appears to be called for, however, is a wider dissemination of results of experimentation and a more systematic evaluation of buildings in use, with reporting of such evaluation. Technical aspects can probably be evaluated within the first year of use of a school whereas educational aspects cannot adequately be assessed until the building has been in use for at least two or three years. Nevertheless if evaluation, however limited, cannot be made relatively rapidly it will have little feed back value.

82. Some of the evaluation criteria will be quantifiable, others will depend on subjective judgement. To enable comparison from one evaluation to another some kind of rating system will have to be established for both. The quantifiable criteria will include the extent to which the required number of spaces of the required size were made available; the level of the services available in each space; the degree of flexibility and adaptability provided; the acoustic, thermal and lighting levels; the movement patterns measured in terms of time required, the level of performance of the building fabric; the initial costs of the building and subsequent maintenance and recurrent cost. The criteria requiring subjective judgement will include the overall reactions of users, visual and environmental considerations, the extent to which innovation is encouraged and facilitated by the design and the level of satisfaction of users with the performance of individual spaces, and with the inter-relationship of spaces.

83. It would seem appropriate that all new school buildings should be the subject of an evaluation as regards both technical and educational aspects. Such an evaluation could be carried out by the building authority using the services of architects, engineers and educationists. It should involve the study of the building in use and the recording of the reactions of the users and the evaluation team. A copy of the resulting report should be forwarded to the Central Research and Development Unit for information. To facilitate such evaluations this Unit could suggest appropriate methods and criteria.

84. In addition to this form of evaluation, there is need for more systematic appraisals of a limited number of projects which could be selected on the basis of the evaluation reports referred to above. These appraisals should be carried out by a multi-disciplinary team (educationists, architects and educational psychologists) sponsored by the Central Research and Development Unit. The results are likely to be of particular value for subsequent development projects but would also serve more generally as guidance to all building authorities.

Maintenance of School Buildings

85. This is a responsibility which should, and normally does, lie with the local or regional authority, depending on the level at which the project was initiated. A major difficulty sometimes arises where the authority responsible for building is not responsible for maintenance. In these cases it is unlikely that there will be the same degree of involvement in the performance of the building (of which adequate maintenance is an integral part) or in ensuring the finance for maintenance. It is necessary to emphasise that maintenance is a positive activity which must take place on a regular and systematic basis and requires adequate funds and adequate staff to see that it is carried out.

86. The use of materials that will reduce the degree of maintenance required is now appreciated (though this is sometimes used as a justification for excessively high costs); nevertheless the need for maintenance in some degree will continue to arise. To help to meet this need, consultants should be required to furnish a maintenance manual when arranging for the handover of buildings. Such a manual might form the basis for attempting to estimate annual maintenance costs.

87. Ideally, for any major element of the building, the contract with the supplier should include a provision for maintenance. This was a feature of the S.C.S.D. system in California. But only trial and error will determine if, in a particular national circumstance, suppliers would be willing to quote on such a basis and if the additional costs involved in the bid would be acceptable.

Building Regulations

88. Many countries have general buildings regulations, most of the requirements in which relate to considerations of fire, health and structural stability. These regulations are of general application and it would be a matter for the Central Research and Development Unit to seek to have them modified where there is evidence that they unnecessarily restrict educational building. Some local authorities also have building bye-laws which may prove restrictive in some cases, though this did not emerge as an issue in any of the investigations made in the course of this study. Generally negotiation should resolve any problem since there is normally provision for waiver of bye-laws where circumstances warrant it. The greatest difficulty is likely to arise on account of lack of unfiromity in fire requirements where, as in many countries, fire officers can establish their own rules. A national body with on-going responsibility for fire regulations is seen as a necessity.

Co-ordination of School and Community Facilities

89. This matter will be the subject of a separate investigation in the Programme on Educational Building (Activity 7: Co-ordination of School and Community Facilities) and only brief comment is called for here. Use of school facilities by the local community and use of community facilities by the school are now accepted in principle in most countries although the level of use varies widely and many issues such as those concerning insurance, responsibility, management and so on continue to arise. An increasing number of projects designed for such joint or shared use are emerging. Capital financing is not a problem where it is a matter of making school facilities available for community use without additional capital expenditure being involved. Regrettably, however, it is not always easy to achieve joint funding by two or more authorities - the one responsible for education and the others for community provision - despite the fact that injection of additional funds over and above the educational outlay would greatly improve the suitability of the school buildings for community use. In any national context a policy decision on joint provision is required if real progress is to be made with this issue.

ANNEXES

ANNEX 1. An Irish Example of How to Determine the Number of Teaching Spaces Required

This educational worksheet can be used for programming new school buildings or extensions to existing schools. It permits the calculation of the number of teaching spaces required once the number and distribution of pupils by age group and type of classes and the educational organisation of the school have been defined.

The example represented here is that of an Irish comprehensive school of 510 pupils comprising:

- Junior Cycle: 360 pupils (years 1, 2 and 3) with 110 pupils in each year plus 30 pupils in need of remedial education;
- Senior Cycle: 150 pupils (years 4 and 5) with 75 pupils in each year.

The following organisation has been adopted as regards the basic grouping of pupils (class groups):

- In the Junior Cycle, each year-group of 110 pupils is divided into four class groups with a maximum of 30 pupils in each for most of the subjects; for certain subjects, however, half-year groups are used, each in turn divided into three groups with up to 20 pupils in each.
- In the Senior Cycle, one year-group comprises three class groups with a maximum of 30 pupils in each (in principle 25). In certain subjects the year-groups are divided into 4 groups of up to 20 pupils in each.

On this organisational basis, and thanks to the inter-relationship established between the various teaching spaces, the possibility remains open to form smaller or larger groups than those indicated, depending on the needs arising from teaching practice.

The method of calculation is simple:

- The left-hand part of the worksheet is used to determine the total number of weekly class periods by subject according to group size and number of periods by subject and year.
- The right-hand part of the worksheet is used to determine the number of areas required according to type of teaching space. The total number of class periods obtained in the left part are here shared out amongst the various teaching spaces; however, there is no pre-set rule as to how to do so, and the actual breakdown results from the educational organisation and teaching methods proposed for the school. Lastly, the number of spaces required is also governed by the time during which the school's facilities are or will be available (in this case: 40 periods per week).

The number of teachers required is shown in the last column. There is a slight difference between the total number of weekly class periods (column 17) and the total number of weekly periods representing the load on the teachers (column 34). This enables certain teachers with specific responsibilities (in this case seven) to include three non-teaching periods in their weekly teaching load.

The worksheet also enables the pupil/teacher ratio and the use factor of each of the proposed spaces to be checked. Should any of these fall well below the accepted mean for the region or the country as a whole, the educational organisation and/or the breakdown of class periods per type of teaching space must consequently be reviewed.

CYCLES

Secondary	Comprehensive	LOWER		UPPER		40	5	8	45	Fixed/Rotating
Level of School	Type of School	Theory	Practical	Theory	Practical	Weekly School Periods (WP)	School Days/Wk.	Daily School Periods	Minutes/Period	Classroom Organisation
		30	20(1)	30	20(1)					

Standard Class Size

CLASS PERIODS BY SUBJECT

	SUBJECTS	GROUP SIZE	CYCLE	Junior Cycle (Years 1, 2, 3)						Senior Cycle (Years 4, 5)						
			GRADE	Each Year						Each Year						
			MODE	M&F	F	M	M&F			M&F	M&F	F	M	M&F		M
			NO. CLASSES	4	3	3	Total			3	2	2	2	Total		1
			ENROLMENT				3 years							2 years		
				1	2	3	4	5		6	7	8	9	10	11	1
1	Irish	30		4 16			48			4 12				24		2
2	English	30		4 16			48			4 12				24		7
3	Mathematics	30		4 16			48			5 15				30		5
4	Social Studies	30		8 32			96			9 27				54		8
5	Music	30		1 4			12			1 3				6		1
6	Physical Education	30		2 8			24			1 3				6		2
7	Foreign Languages	30		4 16			48			4 12				24		-
8	Science Subjects	30		4 16			48				4 8			16		3
9	Art & Crafts	30		2 8			24				4 8			16		4
10	Home Economics	20			4 12		36					4 8		16		
11	Commerce Subjects	20			3 9		27					4 8		16		
12	Industrial Arts	20				7 21	63						8 16	32		
13																
14																
15																
16																
17																
18																
19																
20																
21																
22																
23																
24																
25																
	TOTAL (Class Periods)			132	21	21	522			84	16	16	16	264		

CALCULATIONS

STEP 1.

STEP 2.

STEP 3.

STEP 4.

STEP 5.

NOTE :

DEFINITIONS:

MODE: MALE (M), FEMALE (F), ARTS (A), SCIENCE (S), OTHER –
SHADED BOXES: WEEKLY ALLOCATION OF PERIODS PER SUBJECT
PERIOD: A DIVISION OF THE SCHOOL DAY IN MINUTES
CLASS: A BASIC ORGANISATIONAL DIVISION OF THE PUPILS
CLASS PERIODS: TOTAL NO. PERIODS/WK. (= NO. PERIODS PER CLASS X NO. CLASSES)
WEEKLY TEACHER LOAD: NO. INSTRUCTION PERIODS PER WEEK PER TEACHER (COL. 34)
GROUP SIZE: THIS MAY VARY ACCORDING TO NATURE OF ACTIVITY
USE FACTOR: EXPECTED NO. PERIODS OF USE AS A % OF MAXIMUM
WP: WEEKLY SCHOOL PERIODS
N: NO. TEACHING SPACES REQUIRED
TCP: TOTAL CLASS PERIODS
COLUMN (17) = SUM OF PERIODS IN COLS. 1-16 = SUM OF PERIODS IN COLS. 18-33
COLUMN (35) = COL. 17 ÷ COL. 34
R = TEACHER FOR REMEDIAL EDUCATION

EDUCATIONAL WORKSHEET

SCHEDULE OF ACCOMMODATION

5 | Fixed/Rotating | …/Period | Classroom Organisation

ENROLMENTS

CYCLES	Lower	Upper	Total
Male			50%
Female			50%
Total	360	150	510

1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year
110	110	110	75	75	

M F Both — Sex of Teachers

Periods	Hours
33	24 3/4

Teachers' Weekly Work Loads

CLASS PERIODS PER TYPE OF TEACHING

4, 5)		Remedial Education — 2 Classes from Junior Cycle (15x2)					TOTAL Weekly Class Periods	General Classroom	Lecture Room	Language Laboratory	Mathematics Room	Music/Drama Room	Science Laboratory	Demonstration Room	Art/Crafts Workshop	Industrial Arts Workshop	Mechanical Drawing Room	Home Economics Room
M&F Total 2 Years		M&F 1	F 1/2+1/2	M 1/2+1/2	M&F Total 2 classes			PUPILS PER SPACE 30	45	30	30	30	30	60	30	20	20	2…
10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
24		2 2			4		76	62		8		6						
24		7 7			14		86	71		8		7						
30		5 5			10		88	12			33							
54		8 8			16		166	10	70					23				
6		1 1			2		20					20						
6		2 2			4		34											
24		- -			-		72	55		17								
16		3 3			6		70						60	10				
16		4 4			8		48								48			
16			8 8		8		60											60
16			- -		-		43											
32				8 8	8		103								12	61	30	
264							866	210	70	33	33	33	60	33	60	61	30	60
…ATIONS	STEP 1. Total Class Periods (TCP) / Weekly School Periods (WP) = 100% USE							5.2	1.7	0.8	0.8	0.8	1.5	0.8	1.5	1.5	0.7	1.5
	STEP 2. SPACES REQUIRED = N (A WHOLE NUMBER)							6	2	1	1	1	2	1	2	2	1	2
	STEP 3. USE FACTOR = TCP x 100 / N x WP (%) (100% = WP)							87.5	87.5	82.5	82.5	82.5	75.0	82.5	75.0	76.2	75.0	75.0
	STEP 4. ENTER: No. EXISTING SPACES																	
	STEP 5. NET SPACES REQUIRED = STEP 2 — STEP 4																	

NOTE: (1) Groups of 20 pupils for subjects in which individual supervision is a…

Both / chers	Periods	Hours	Prin.	V. Prin.	Counsellors	Others	A	B
	33	24 3/4	1	1	1			
	Teachers' Weekly Work Loads		No. Teachers Ex-Quota				No. Posts of Responsibility	

NAME AND LOCATION OF SCHOOL

ASS PERIODS PER TYPE OF TEACHING SPACE

0	30	60	30	20	20	20	20	30	30+30	30		Teachers	
Science Laboratory	Demonstration Room	Art/Craft Workshop	Industrial Arts Workshop	Mechanical Drawing Room	Home Economics Room	Commerce Room	Social Studies Room	Gymnasium	Library			WKLY LOAD (PRDS.)	No. Req'd.
23	24	25	26	27	28	29	30	31	32	33		34	35
												165	4+1R
						43						99	3
	23						33		30			165	3+2R
												33	1
								34				33	1
												99	3
0	10											66	2
		48										33	1
					60							66	2
						43						33	1
		12	61	30								99	3
0	33	60	61	30	60	86	33	34	30			891	24+3
5	0.8	1.5	1.5	0.7	1.5	2.1	0.8	0.8	0.7				510
2	1	2	2	1	2	3	1	1	1				18.9
.0	82.5	75.0	76.2	75.0	75.0	71.7	82.5	85.0	75.0				

TOTAL
ENROLMENT
PUPILS PER TEACHER (average)

COMMENTS

Note on Remedial Education and its Organisation: 65 Junior Cycle pupils (18%) will need remedial education: 35 will be in mixed-ability groups (with special work in small groups of 5 for a period each day), 30 in 2 special classes of 15 pupils each [32 periods with remedial teachers, 8 periods with specialist teachers in Home Economics (F) or Industrial Arts (M)]

Note on Pastoral Organisation:

2 Remedial Classes = 2 Groups
330 Pupils Junior Cycle = 11 Groups of 30 each
150 Pupils Senior Cycle = 5 Groups of 30 each
Total: 18 tutors + 3 House-masters with responsibility for 6 tutors each.

Note on Social Organisation:

Other Comments:

Total weekly load on the teachers (periods) 891
Total weekly class periods 866
Difference 25
3 House-masters, 4 Heads of Departments — Total 7 with 3 non-teaching periods each

Compiled by: _____

Date: _____

idual supervision is a priority.

ANNEX 2. DESCRIPTION OF THE SfB SYSTEM

The SfB System, recommended by the International Council for Building Research Studies and Documentation CIB(1), was developed as a classification system both for project information (defined as information particular to a building project and available only to those engaged on the project) and for related general information (defined as information not particular to a building project but applicable to any project and available to everybody). The first international version was published in 1966; the elements which follow have been drawn from the 1973 international version(2), on which the national versions are based.

The main purpose behind developing this system is to provide an instrument for communication; its objective is to promote the generation, exchange and use of building information by rendering more coherent the classification categories and the terminology employed nationally by the various parties(3) involved in the process of building, as well as internationally by building specialists. It provides a method for collecting, storing and processing building information. Consequently it has become widely used and SfB is successfully applied today for a great variety of forms of documentation, including product catalogues and data sheets, design guides, technical articles, feedback reports, briefing notes, drawings, workmanship and performance specifications, bills of quantities, cost plans and analyses, networks, budgets, notes of meetings, labour constants, variation orders, building regulations, codes of practice and standards.

The system consists in using strictly defined codes in the form of three 'basic tables'. The terms used in these tables have been chosen for their unchanging import and so as to preclude anything except concrete realities. The three-faceted approach allows different combinations when designating complex realities; neither ambiguities nor overlap can therefore be tolerated in the tables.

Figure 1 illustrates the simple principle of 'building'. Activities transform selected resources into results. The result of a building activity is a part of the building in question.

The basic feature of the SfB system is its specific approach to the breaking down of any building project into parts in such a way that each part is significant to all those involved in the building process. The design team's basic interest is in the functioning of the part for which the client pays. The constructor's basic interest is in the cost he incurs for his resources and the price he gets paid for constructing the past.

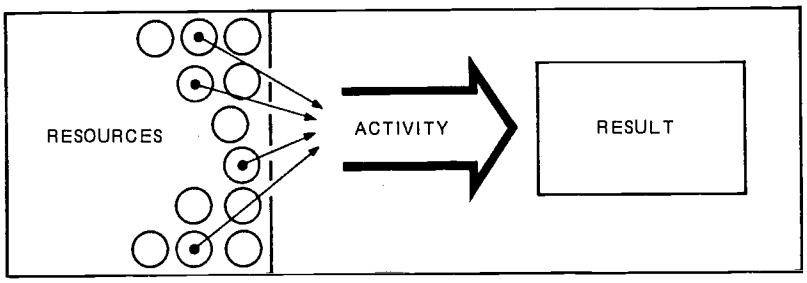


Figure 1 : SfB basic consideration of a construction activity

(1) CIB, Postbox 20704, Weena 704, Rotterdam, The Netherlands.
(2) Sources:
(a) CIB Report N° 22, The SfB System - Authorised Building Classification System for Use in Project Information and Related General Information, CIB, Rotterdam, 1973.
(b) SfB Applications Guide. Draft (to be published in November 1975 by the Irish SfB Agency for CIB-SfB Development Group).
(3) Designers, contractors, promotors, manufacturers, administrators and users.

The right-hand section of the diagram refers to a part as defined by SfB; the left-hand section represents all the resources (materials and others) used in the construction of this part. These are the two major facets distinguished by the SfB system.

Parts are characterised in two different ways, namely:

- by their function. In this case they are termed elements (e.g. walls, floors, windows, etc.); they answer the question "What is the part from the user's point of view?"

- by the type of activity by which the part is constructed. Construction is a part defined by the way it is made; this is a reply to the question "How is this part made (or how will it be made)?".

Resources form the input into the construction process, in the main 'Materials' (including all kinds of manufactured products) but also other resources such as 'Administration' (or 'General'), 'Plant', and 'Labour'.

All the terms necessary to analyse everything in the building process can therefore be classified and encoded using the three basic tables:

Basic Table 1, listing the elements. Classes of elements are coded by two-digit numbers in brackets, e.g.:
(23) Floors
(43) Floor finishes
(56) Space heating services

Basic Table 2, listing the constructions. Classes of constructions are coded by capital letters, e.g.:
E Cast in situ work
I Pipe work
S Rigid Tile work

Basic Table 3, listing the materials and other resources, the code used being small letters for main groups, followed by figures for specific materials, e.g.:
b Plant, tools
c Labour
f Precast materials
f3 terrazzo (precast)
u Protective, Process/Property Modifying Agents
u4 Flame retardants

The SfB system uses combinations of the codes contained in its three basic tables as needed for different purposes. In a collection of trade catalogues, for instance, the class "terrazzo floor tiles" is coded (43) Sf3 because the product is made for floor finishes (the element class (43)), it is a tile (made for the construction class S) and it is terrazzo (resource class f3). Since there are only a limited number of codes they may be easily learned and remembered when used in practice. The same kind of classification, which the natural language applies by using the three key words floor - tile - terrazzo is expressed by the codes (43) - S - f3. The coding, however, allows for a more precise definition, which may be understood internationally and by which information can be systematically arranged in all kinds of project documents as well as in collections of related general information.

The SfB system can be put into operation at various levels of complexity. Its use at elementary level proves effective and cheap without the need to go on to the more complex forms. On the other hand, the SfB system is used successfully for automated processing too. National application tables adapt the international classification to the conditions peculiar to various countries. (The 'reserved' items in the tables may be used, more facets may be added and broad classes may be further sub-divided).

For further details concerning the SfB system the reader should consult the member institutions of the SfB Development Group of CIB/W52. The following list gives the SfB Agencies in OECD Member countries:

Belgium	Université Catholique de Louvain (SfB Agency) Mr. J.F. Mabardi Faculté des Sciences Appliquées Centre de Recherches en Architecture Château d'Arenberg Kardinaal Mercierlaan HEVERLEE
Denmark	Byggecentrum (SfB Agency) Mr. G. Boni-Jensen Gyldenløvesgade 19 DK-1600 KØPENHAVN V
Finland	Bygginformationsstiftelsen (SfB Agency) Mr. Martti Tiula Bulevarden 1 HELSINKI 10
France	Le Centre d'Information et de Documentation du Bâtiment (SI/SfB) (SfB Agency) Mr. R. Florentin 100 rue du Cherche-Midi 75006 - PARIS
Germany	Universität Stuttgart (BRD/SfB) (SfB Agency) Dipl. Ing. Klaus Büchin Institut für Baukonstruktionen Keplerstrasse 11 D-7 STUTTGART
Iceland	The Building Research Institute (Rb/SfB) (SfB Agency) Mr. Gunnlaugur Palsson Keldnaholt REYKJAVIK
Ireland	The National Institute for Physical Planning and Construction Research (Tf/SfB) (SfB Agency) Mr. Finbarr Shanley St. Martin's House Waterloo Road DUBLIN 4
Japan	Building Centre of Japan, Inc. (SfB Agency) 14-23, 1-chome Harumi Chuo-ku TOKYO
Netherlands	Bouwcentrum (SfB Agency) Mr. Anne Volbeda Weena 700 Postbus 299 ROTTERDAM
Norway	Norwegian Building Research Institute (SfB Agency) Mr. Hans Petter Sundh Postboks 322 Blindern OSLO 3
Sweden	Svensk Byggtjänst (SfB Bureau) Mr. Ingvar Karlén, Co-ordinator Box 1403 S-111 84 STOCKHOLM
United Kingdom	Royal Institute of British Architects (CI/SfB) (SfB Agency) Mr. Alan Ray-Jones 66 Portland Place LONDON WIN 4AD

ANNEX 3. An Example of a Cost Plan

The partial cost plan presented in this Annex and supplied by the Building Unit of the Irish Department of Education is only an example to illustrate what can be done on the basis of the suggestions contained in paragraphs 50 to 54. It follows the SfB classification system described in Annex 2 and in order to understand the value of using it in this way it should be noted that:

- in this application of the SfB system, only Basic Table N° 1 is used; it serves as a standard list of building elements classified and referenced in accordance with the wish expressed in paragraph 52;
- the codes of this table should be supplemented as follows (the SfB tables all include reserved, or free, items which can be defined for a specific use):

(99) total cost of building (summary building)
(0-) indirect costs of project (summary project indirect) *
(9-) direct costs of project (summary project direct)*
(--) total cost of project (summary project total)

Given that (90) represents site cost, then: (--) = (0-) + (9-) = (0-) + (90) + (99)

The table below enables a complete inventory to be made of the various items involved in determining the costs. It also provides a practical means of analysing or foreseeing their breakdown by item; in other words, this type of instrument is sufficiently precise to serve both as a basis for decisions and control.

Application of SfB System to Cost Analysis

(00)	(10) Prepared Site	(20) Site Structures	(30) Site Enclosures	(40) Roads, Paths, Pavings	(50) Site Services (piped and ducted)	(60) Site Services (electrical)	(70) Site Fittings	(80) Landscape, Play Areas	(90) Summary Site	(—0)
(01)	(11) Ground, Earth Shapes	(21) Walls, External Walls	(31) External Walls' Completions	(41) Wall Finishes Externally	(51) Services Centre	(61) Electrical Centre	(71) Display, Circulation Fittings	(81)	(91)	(—1)
(02)	(12)	(22) Internal Walls, Partitions	(32) Internal Walls' Completions	(42) Wall Finishes Internally	(52) Drainage, Refuse Disposal	(62) Power Distribution Services	(72) Rest, Work, Play Fittings	(82)	(92)	(—2)
(03)	(13) Floor Beds	(23) Floors, Galleries	(33) Floors', Galleries' Completions	(43) Floor Finishes	(53) Liquids Supply Services	(63) Lighting Services	(73) Culinary, Eating, Drinking Fittings	(83)	(93)	(—3)
(04)	(14)	(24) Stairs, Ramps	(34) Stairs', Ramps' Completions	(44) Stair, Ramp Finishes	(54) Gases Supply Services	(64) Communication Services	(74) Sanitary, Hygiene Fittings	(84)	(94)	(—4)
(05)	(15)	(25)	(35) Suspended Ceilings	(45) Ceiling Finishes	(55) Space Cooling Services	(65)	(75) Cleaning, Maintenance Fittings	(85)	(95)	(—5)
(06)	(16) Foundations	(26)	(36)	(46)	(56) Space Heating Services	(66) Transport Services	(76) Storage, Screening Fittings	(86)	(96)	(—6)
(07)	(17) Pile Foundations	(27) Roofs	(37) Roofs' Completions	(47) Roof Finishes	(57) Ventilation and Air Conditioning Services	(67)	(77)	(87)	(97)	(—7)
(08)	(18)	(28)	(38)	(48)	(58)	(68)	(78)	(88)	(98)	(—8)
(09)	(19) Summary Ground Substructure (Building)	(29) Summary Structure (Building)	(39) Summary Completions (Building)	(49) Summary Finishes (Building)	(59) Summary Services (piped and ducted,) (Building)	(69) Summary Services (electrical) (Building)	(79) Summary Fittings (Building)	(89)	(99) Summary Building	(—9)
(0—) Summary Project Indirect	(1—)	(2—)	(3—)	(4—)	(5—)	(6—)	(7—)	(8—)	(9—) Summary Project Direct	(——) Summary Project Total

Note: Sub-totals can be arrived at by column or sometimes also by line.

* Definition: indirect costs - costs that cannot be allocated to particular constructions
direct costs - materials and labour

To avoid overburdening the presentation of the illustrative cost plan provided, only the following parts are shown here:

- the identification of the project;
- the recapitulative summary;
- one partial list giving the detail of certain items in this summary.

This list can readily be related to the columns of the preceding table (Application of SfB to cost analysis).

COST PLAN - IDENTIFICATION OF PROJECT

NAME OF PROJECT Community School

DESCRIPTION OF PROJECT 810 Pupil School

CLIENT Department of Education DESIGN TEAM

TOTAL FLOOR AREA ..4972..... m2

Enclosing Walls / Floor Area = ...45%.....

Usable Area .....3821..... m2 (76% of total)
Circulation Area 660.. m2 (14% of total)
Ancillary Area ..368.. m2 (8% of total)
Internal Division 123. m2 (2% of total)

FUNCTIONAL UNITS ....810.....

FUNCTIONAL UNIT AREA ..6.14 sq. m.

TOTAL COST PLAN £ .....337,965.92.....

TOTAL COST PER m2 FLOOR AREA £ .....67.97.....

FUNCTIONAL UNIT COST £ .....417.33.....

DATE OF COST PLAN ..1st.May,.1974

NOTES: The cost plan is in accordance with the standard cost plan (for submission to clients - April, 1973) of the National Building Elements Committee.

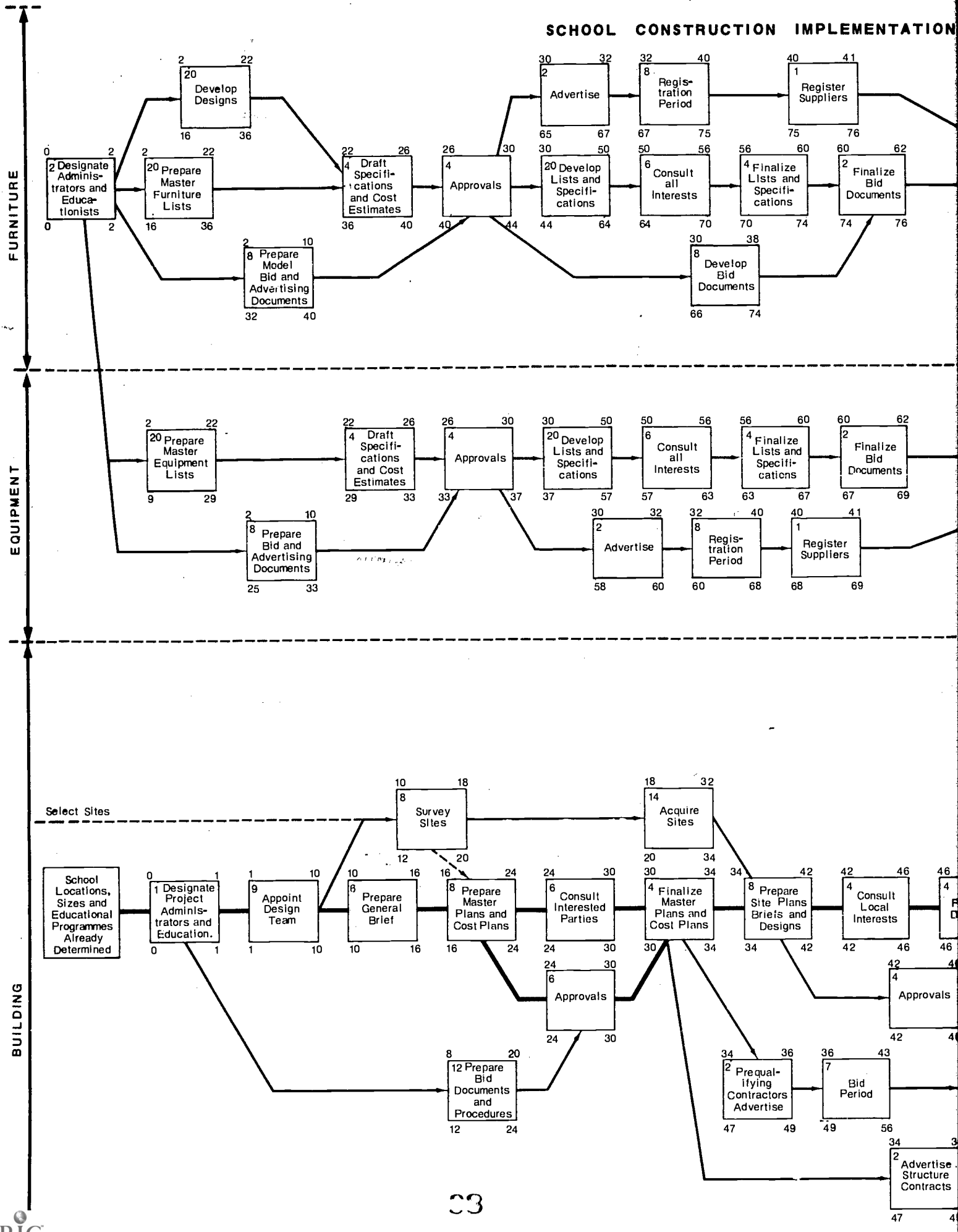
The cost plan is based on costs applicable at the date stated in the cost plan and does not allow for increases that may occur after this date.

COST PLAN SUMMARY

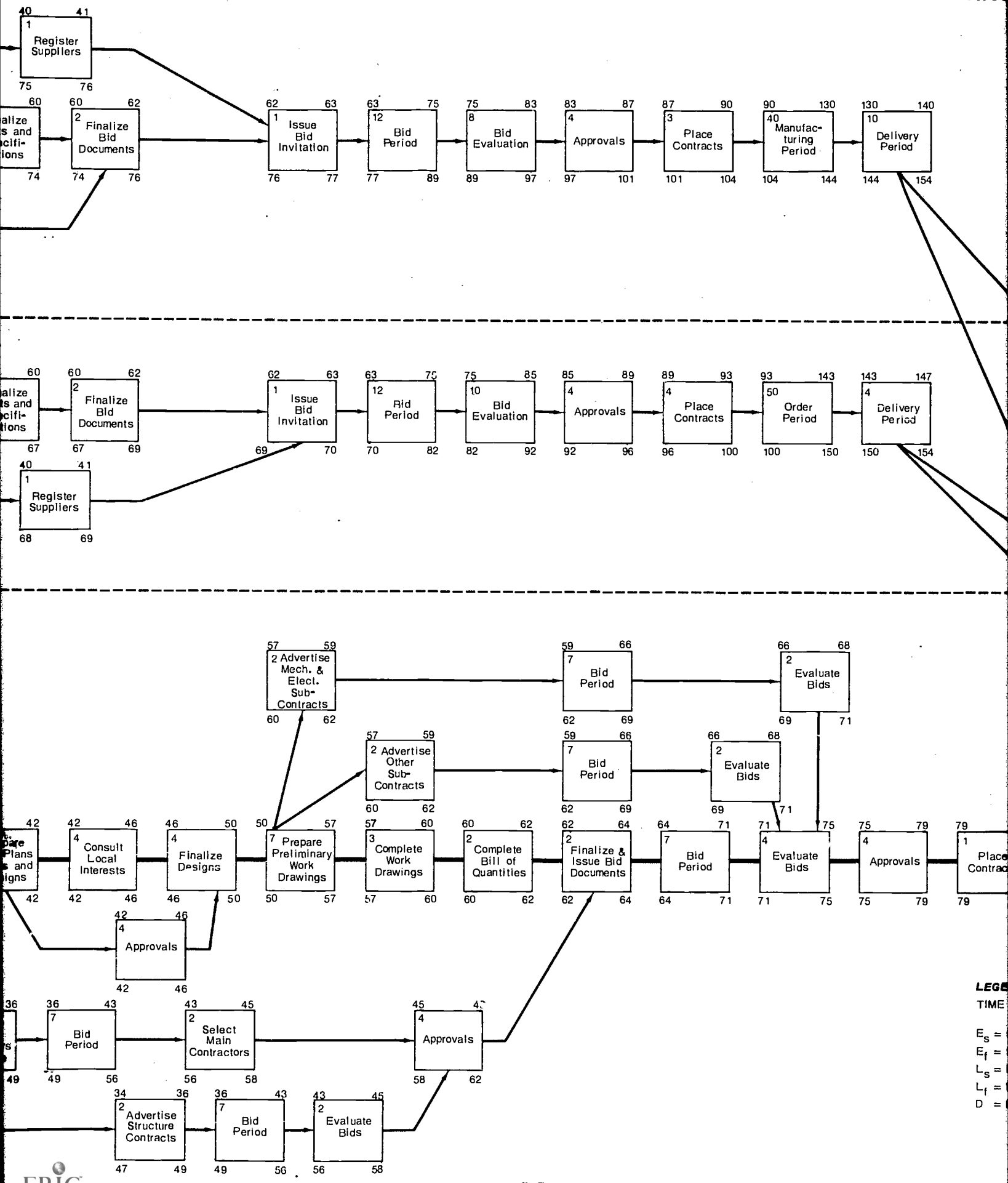
Element Groups		Element Group Cost £	Element Group Cost per m2 of floor area £	Comments
(19) Building Substructure		34,953.16	7.03	
(29) Building Structure		106,773.70	21.47½	
(39) Building Structure Completion		45,195.48	9.09	
(49) Building Finishes		35,450.36	7.13	
(59) Building Services (Piped & Ducted)		54,592.56	10.98	
(69) Building Services (Mainly Electrical)		26,600.20	5.35	
(79) Building Fittings		2,063.38	0.41½	
(90) Siteworks		-	-	
(0-) Project - indirect costs (preliminaries, insurances, etc.)		22,374.00	4.50	
	£	328,002.84	65.97	
Add for VAT	£	9,963.08	2.00	
(--) Total Project Target Cost (exlcuding fees, interest charges, etc.)	£	337,965.92	67.97	

COST PLAN DETAILS

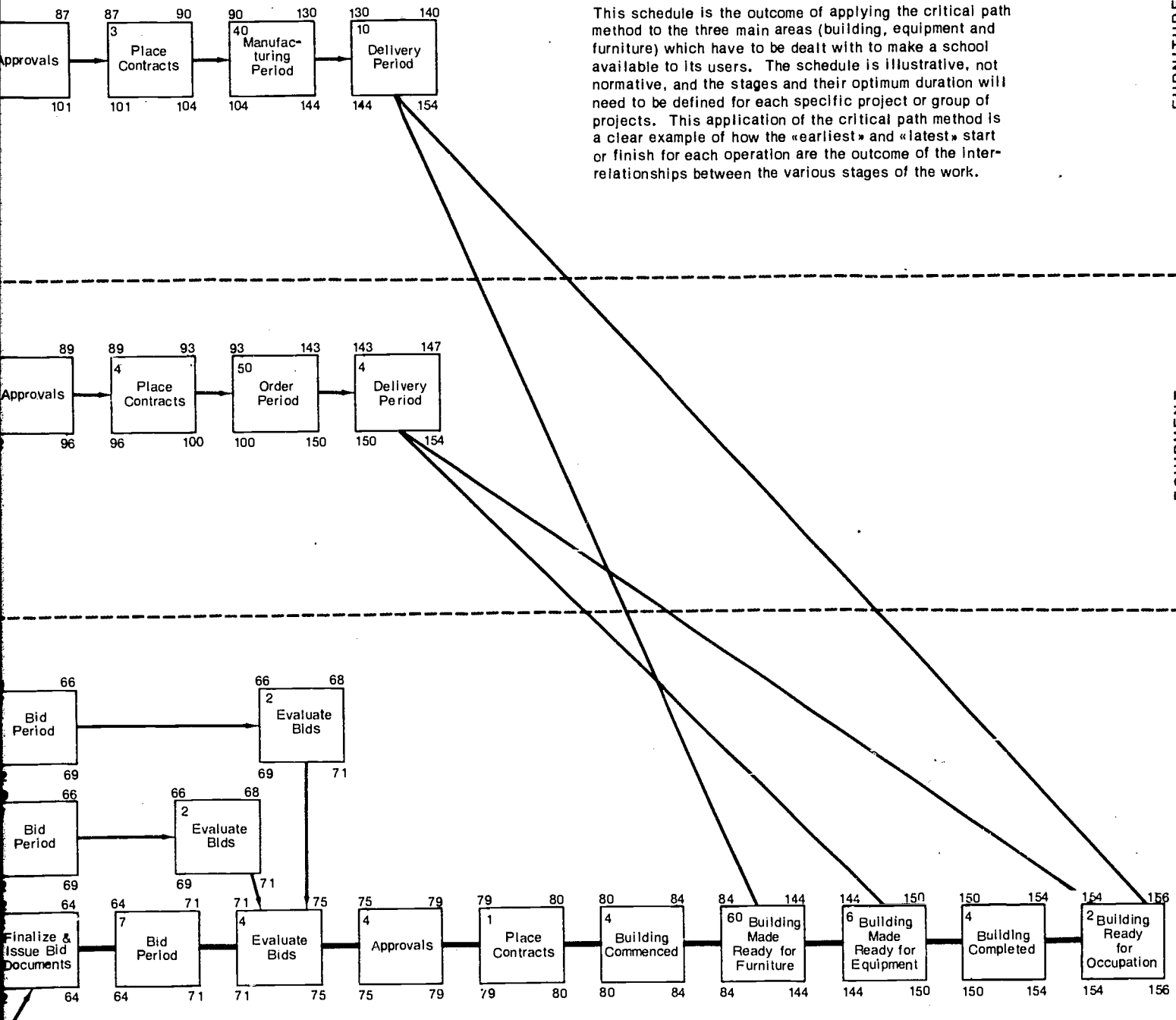
Element	Element Cost £	Cost per m2 Floor Area	Brief Specification
Building Substructure			
(19) Building Substructure	34,953.16	7.03	Pads and strip foundations. Concrete floor with thickness-ing under partitions.
Building Structure			
(21) External walls	7,308.84	1.47	Cavity construction. Brick outer. Concrete blockwork inner.
(22) Internal walls, partitions	18,098.08	3.64	100 mm concrete blockwork.
(23) Floors, galleries	-	-	
(24) Stairs, ramps	-	-	
(25) Reserved	-	-	
(26) Reserved	-	-	
(27) Roofs	55,562.10	11.17½	Precast concrete, insulation and asphalt-high level. Me-tal deck, insulation and asphalt-low level.
(28) Frames	25,804.68	5.19	Precast concrete 'H' frames.
Building Structure Completion			
(31) External walls: completion	35,649.24	7.17	Softwood doors and patent glazing.
(32) Internal walls: completion	9,049.04	1.82	Flush doors, softwood frames.
(33) Floors, galleries: completion	-	-	
(34) Stairs, ramps: completion	-	-	
(35) Suspended ceilings	-	-	
(37) Roof: completion	497.20	0.10	Rooflights.
Building Finishes			
(41) Wall finishes externally	incl.	incl.	
(42) Wall finishes internally	5,817.24	1.17	Fair faced blockwork.
(43) Floor finishes	16,407.60	3.30	Carpet and PVC.
(44) Stair, ramp finishes	-	-	
(45) Ceiling finishes	13,225.52	2.66	300 x 300 Woodfibre tiles on patent suspension system.
(47) Roof finishes	incl.	incl.	
	£ 222,372.70	44.72½	


SCHOOL CONSTRUCTION IMPLEMENTATION
FURNITURE
EQUIPMENT
BUILDING
2 Designate Administrators and Educationists
20 Develop Designs
20 Prepare Master Furniture Lists
8 Prepare Model Bid and Advertising Documents
4 Draft Specifications and Cost Estimates
4 Approvals
2 Advertise
8 Registration Period
1 Register Suppliers
20 Develop Lists and Specifications
6 Consult all Interests
4 Finalize Lists and Specifications
2 Finalize Bid Documents
8 Develop Bid Documents
20 Prepare Master Equipment Lists
8 Prepare Bid and Advertising Documents
4 Draft Specifications and Cost Estimates
4 Approvals
20 Develop Lists and Specifications
6 Consult all Interests
4 Finalize Lists and Specifications
2 Finalize Bid Documents
2 Advertise
8 Registration Period
1 Register Suppliers
Select Sites
School Locations, Sizes and Educational Programmes Already Determined
1 Designate Project Administrators and Education.
9 Appoint Design Team
8 Survey Sites
6 Prepare General Brief
8 Prepare Master Plans and Cost Plans
6 Approvals
12 Prepare Bid Documents and Procedures
14 Acquire Sites
6 Consult Interested Parties
4 Finalize Master Plans and Cost Plans
8 Prepare Site Plans Briefs and Designs
4 Consult Local Interests
4 Approvals
2 Prequalifying Contractors Advertise
7 Bid Period
2 Advertise Structure Contracts

N IMPLEMENTATION SCHEDULE FOR A GROUP OF PROJECTS USING THE CRITICAL PATH METHO



ECTS USING THE CRITICAL PATH METHOD



This schedule is the outcome of applying the critical path method to the three main areas (building, equipment and furniture) which have to be dealt with to make a school available to its users. The schedule is illustrative, not normative, and the stages and their optimum duration will need to be defined for each specific project or group of projects. This application of the critical path method is a clear example of how the «earliest» and «latest» start or finish for each operation are the outcome of the inter-relationships between the various stages of the work.

FURNITURE

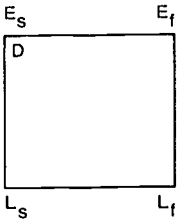
EQUIPMENT

BUILDING

LEGEND

TIME IN WEEKS

E_s = Earliest Start
E_f = Earliest Finish
L_s = Latest Start
L_f = Latest Finish
D = Duration



PEB INFORMATION LEAFLETS

Issued by the OECD Programme on Educational Building (PEB), the leaflets aim at disseminating information on themes related to the activities of the Programme and on interesting examples of innovatory school buildings. They are particularly directed at administrators, local politicians, architects and educationists working in this field and it is hoped they will stimulate them in their search for new solutions to new problems. Leaflets available to date (English ard French versions) are:

1. School Building Today and Tomorrow
2. Maiden Erlegh : an English Secondary School Development Projet
3. C.R.O.C.S. : a Swiss Industrialised School Building System
4. ff5 : a Canadian "casework", or furniture and equipment system for schools
5. Industrialised Building Systems, Educational Objectives and the Problem of Change
6. Institutional Arrangements for School Building .

To ensure that future leaflets are related as closely as possible to the interests and preoccupations of the readers, the Secretariat would welcome comments and suggestions for further topics. These, and also requests for additional copies of available leaflets, should be addressed directly to the PEB Secretariat, or alternatively, if from a participating country, to the national representative or correspondent to the Programme.

NATIONAL REPRESENTATIVES AND/OR CORRESPONDENTS TO PEB

AUSTRALIA : Mr. R.A. FOSKETT
Department of Education
P.O. Box 826
WODEN, A.C.T. 2606

AUSTRIA : M. M. HINUM
Bundesministerium für
Unterricht und Kunst
Minoritenplatz 1
1014 VIENNA

BELGIUM : Mr. A. van BOGAERT
Fonds des Bâtiments scolaires de l'Etat, des Provinces et des Communes
Ministère de l'Education nationale
28 rue J. Lalaing
BRUSSELS B - 1040

DENMARK : Mr. H. KJEMS (Chairman)
Ministry of Education
21 Frederiksholms Kanal
COPENHAGUE K

FINLAND : Mr. O. LAPPO
Helsinki Institute of Technology
OTANIEMI

FRANCE : Mr. G. LE MEUR (Vice-Chairman)
Direction des Equipements
Ministère de l'Education nationale
142 rue du Bac
75357 - PARIS

GREECE : Mrs. I. PANAYOTOPOULOS
Division for School
Construction Programmes
Ministry of Education
15 Mitropoleos Street
ATHENS

IRELAND : Mr. S. O'MAHONEY
Building Unit
Department of Education
Marlborough Street
DUBLIN 1

ITALY : Mr. C. CICCONCELLI (Vice-Chairman)
Centro di Studi per l'Edilizia Scolastica
Ministero della Pubblica Istruzione
Piazza Marconi 25 - EUR
00144 ROME

NETHERLANDS : Mr. M.H.C. FAKKERT
School Building Department
Ministry of Education and Sciences
Riouwstraat 178
THE HAGUE

NORWAY : Mr. E. GRYLLING
Building and Teaching Aids Division
Ministry of Church and Education
OSLO-Dep.

PORTUGAL : Mr. A.M. GONCALVES
Direcção-Geral das Construções Escolares
Praça da Alvalade N° 11-2°
LISBON 5

SPAIN : Mr. J.I. URIOL
Junta de Construcciones Instalaciones y Equipo Escolar
Ministèrio de Educación y Ciencia
Alfonso XII, 3 y 5
MADRID

SWEDEN : Mr. A. FALTHEIM
Board of Education
Karlavägen 108
S-106 42 STOCKHOLM

SWITZERLAND : Mr. B. von SEGESSER
Kantonsbaumeister
Hirschengraben 43
6000 LUCERNE

TURKEY : Mr. A. OKAN
Yapi Arastirma Enstitüsu
Atatürk Bulvari 243
Kavaklidere
ANKARA

UNITED KINGDOM : Mr. D.M. FORRESTER
Architects and Building Branch
Department of Education and and Science
Elizabeth House
39 York Road
LONDON SE1 7PH

PEB SECRETARIAT

Miss L. GIBSON : Principal Administrator
Mr. J. ADER : Professional Staff Member
Mrs. F. FRANCESCHI : Assistant responsible for documentation
Mrs. J. BARNOUX : Secretary

Mr. G. ODDIE : Senior Adviser

2, rue André Pascal
75775 PARIS CEXEX 16
Tel : 524 9260