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AIA SCHOOL PLANT STUDIES. A SELECTION 1952-1962.

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A COLLECTION OF 40 ARTICLES DISCUSSES VARIOUS ASPECTS OF SCHOOL PLANNING PROBLEMS. THOSE ON PRELIMINARY PHASES REVIEW--(1) ARCHITECT SELECTION, (2) DEVELOPMENT OF EDUCATIONAL PROGRAMS, AND (3) SCHOOL COSTS. ARCHITECTURALLY-ORIENTED ARTICLES COVER--(1) CONSTRUCTION AND STRUCTURAL TYPES, (2) STANDARD SCHOOL PLANS, (3) FLEXIBILITY, (4) PREFABRICATION, (5) SAFETY, AND (6) MAINTENANCE. SPECIFIC SCHOOL TYPES DISCUSSED ARE--(1) SMALL SCHOOLS, (2) PRESCHOOL BUILDINGS, AND (3) URBAN SCHOOLS. ENVIRONMENTAL CONTROL IS REVIEWED IN TERMS OF--(1) ORIENTATION, (2) NATURAL VENTILATION, (3) LIGHTING, (4) COLOR, (5) VISUAL ENVIRONMENT, AND (6) ACOUSTICS. CONCEPTUAL ARTICLES COVER TOPICS OF NEW IDEAS AND QUALITY, WHILE TOPICS SUCH AS CASEWORK, TEACHING EQUIPMENT, KITCHENS, AND AUDITORIUMS ARE REVIEWED IN MORE SPECIFIC TERMS. (MH)

AIA School Plant Studies

A SELECTION 1952-1962

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1735 New York Avenue, NW, Washington 6, DC

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Eric Pawley, AIA, editor

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Foreword

The idea of this series of brief papers on school planning problems came from discussions of the AIA Committee on School Buildings in 1951 under the chairmanship of William W Caudill, AIA. As we have many times found true since then, in ten years of working with this and other Institute committees, the members of these select groups feel a serious responsibility to the membership as a whole for *communication*. The question always recurs—"How can we get to the architects of the country some of this information we receive from our contacts and experiences as committee members?"

One method which appealed to this committee was this series of short papers appearing several times a year, first in the *AIA Bulletin* then, with the end of that ten-year-old publication (1947-1957), in the *AIA Journal*.

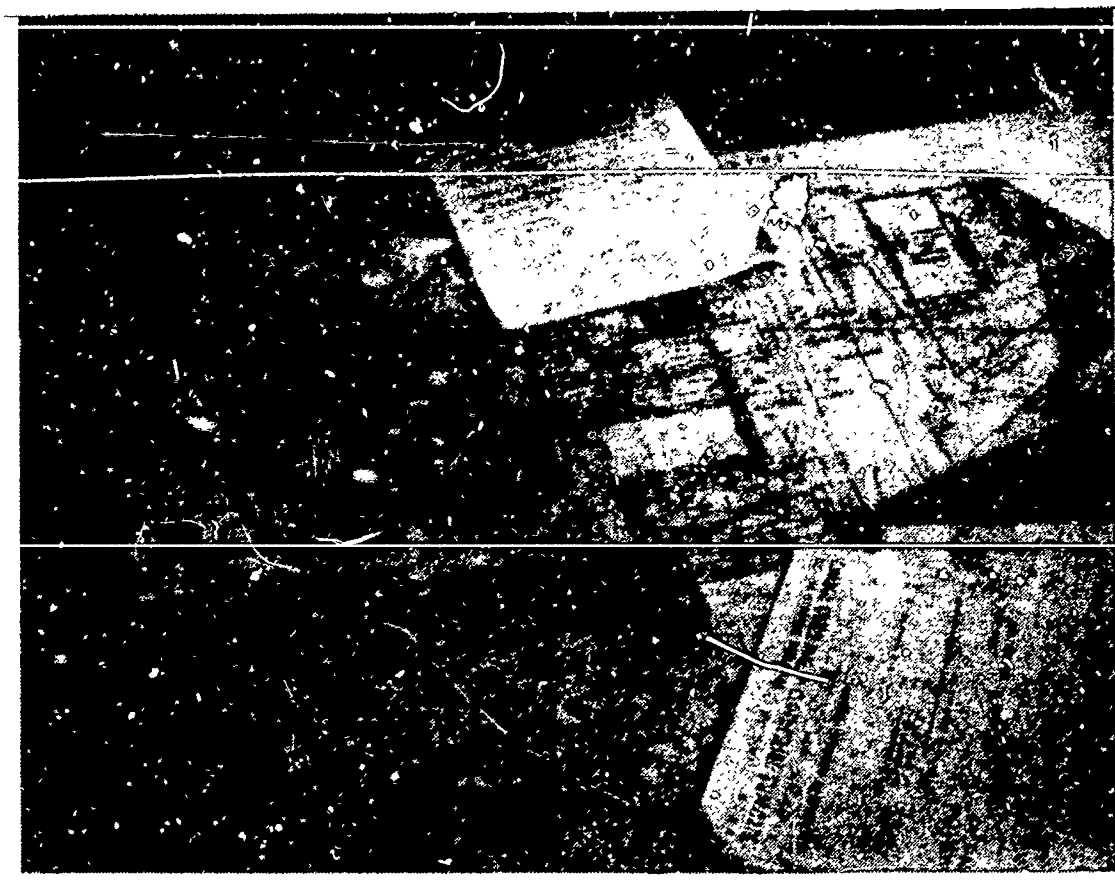
From the beginning, an effort was made to prepare this material so that it would also help laymen: architects' clients among school administrators, school board members, state education officials and professors of education training future administrators. To this end, these brief articles, going to all our members in the AIA publications, have been reprinted (about 8200 copies of each issue) for several kinds of distribution, for the most part free. Several thousand copies go to the American Association of School Administrators, our long-time collaborators in many projects, and through them to their mailing lists, including all county school superintendents (some 3000). Several hundred go to the members of the National Council on Schoolhouse Construction, another organization our committee has worked with on technical projects, whose members include state education department officials and consultants. We sell 1200 copies of reprints of each issue to the Ontario Association of Architects. Several AIA members buy small quantities for distribution to their clients—a fine way to let them know you are continuing to think of solutions for some of your mutual problems. Finally, the SPS reprints seem appreciated by US and foreign visitors to the Octagon seeking special information. A rough estimate indicates we have distributed nearly 400,000 copies of these SPS reprints in ten years. A few have been reprinted a second time, but many are out-of-print although frequently requested. It has seemed better to make this selection from the ten years' series in booklet form for sale at cost.

Cost? When we realize that all the papers have been contributed without pay by busy people, that original preparation involved a lot of correspondence, seeking and preparation of illustrations, editing, proofreading, circulation of draft texts in many cases for review by committee members (also busy people)—we realize that the true cost would be large. This modest series is really a major contribution to better school architecture.

Our authors have included members of the committee, other AIA members, educators, technical specialists and spokesmen for other organizations. Certain papers were based on talks or prepared for special occasions. Those on school lighting pertain in this way to the nine-year project of the joint task committee of the AIA, the Illuminating Engineering Society and the National Council on Schoolhouse Construction. Those on educational theatres resulted from our collaboration with the Theatre Architecture Project of the American Educational Theatre Association. The two on small schools were written by staff to indicate to our colleagues in the International Union of Architects Working Commission on School Buildings that the United States also had a concern for this building type and to prepare for some recognition of our architects in the current international efforts to provide educational facilities for the developing countries.

It has been my personal good fortune to work more than these ten years with the exceptional men of successive AIA Committees on School Buildings and Educational Facilities as their staff executive. As such, and as AIA Technical Editor, it has fallen to me to edit this series. This particular compilation in book form has been accomplished in record time by my most capable aide, Margaret Phillips, Assistant to the Technical Editor, *AIA Journal,* and by Marilyn Housell, Assistant Art Director. Its several merits are due to them, any defects go back to the original.

Eric Pawley, AIA
Editor AIA School Plant Studies



Selecting an Architect for School Building Construction

by the Joint Architectural Advisory Committee*

Potomac Valley and Washington-Metropolitan Chapters AIA

From a report prepared for the Board of Education of Montgomery County, Maryland

Boards of education and superintendents have a serious obligation, not only to themselves, but to many generations of school children, in selecting architects for their school building programs. While it is true that the success of a school building project rests with many people, it is the architect who determines whether the completed structure will be "just another building" or truly an "environment for learning." It is understandable that there are times when the superintendent and board members feel the need for a set of criteria by which they might evaluate the qualifications of people who engage in the practice of a profession as complex as architecture.

Selection Methods

There are any number of ways in which a board of education may select an architect, although basically, these can be grouped into three general categories, namely:

- direct selection
- comparative selection
- design competition selection

In the *direct selection* method the board may select its architect on the basis of his reputation, demonstrated ability and the recommendations of others for whom the architect has rendered service. This method is commonly used where the board has a continuing building program and is therefore able, by means of constant review, to evaluate the individual performance of those architects already serving the board. The list of architects can be expanded, reduced or revised as the board sees fit, and as the magnitude of the building program dictates.

The *comparative selection method* calls for selection from a group of architects who are given opportunity to present evidence of their qualifications, either by means of a written application or personal appearance before the board or, as is most often the case, by both written application and personal appearance. This method of selection is most generally used by school boards who are embarking upon their first school building program and have no background of experience upon which to base their selection. In this case the architects are invited or have made application for consideration.

In the *design competition selection method* the architect is selected by means of an architectural competition. This method of selecting an architect, while not common in the school field, is time-honored among architects and has produced some of the world's great building designs. Because of abuses which have arisen, architects have prescribed certain rules governing the conduct of such competitions. These rules require, among other stipulations, that the selection of the winning designs be placed in the hands of a competent jury, and that certain remunerations be set aside for the competitors and winners.

Thus, while there is no question that competitions invariably produce stimulating results and provide opportunities for young architects which they might not otherwise obtain, the additional expense and time involved have made this method of selection somewhat difficult, particularly in situations where expense or time is a governing factor. (Information on the competition selection method is contained in AIA Document B-451)**

Use of Standard Questionnaire

In order that the board of education, as well as the superintendent and his staff, may have available at all times sufficient information concerning the architects already employed and those who may have requested consideration, it would be well to use a questionnaire form. This form could be one specially prepared by the school staff to suit its own purposes, or one of several nationally recognized standard forms. Such a document has been prepared by the National Council on Schoolhouse Construction and the AIA (AIA Document B-431). This standard form of questionnaire is probably the simplest of any available, and yet gives sufficient information for preliminary purposes. It also allows the architect to supplement the form with his own brochure, photographs or other evidence of his qualifications.

The use of such a questionnaire provides the superintendent and his staff with uniform references for any number of architectural firms. Further, by the use of such a form, applications may be accepted at any time during the year, with a complete roster of interested firms readily available for consideration. This may serve to offset last-minute pressures on the staff and board members and yet assure each architect of a careful evaluation of his qualifications.

It is suggested that selection of an architect be based not solely on a written form. After consideration of the information contained in the questionnaire the superintendent, and perhaps the board of education, will want to interview those architects whose qualifications appear to satisfy best the board's requirements. Much information which cannot be spelled out in a written application is brought forth in a personal interview and serves to supplement the superintendent's knowledge, upon which he can then make his recommendations to the board.

General Considerations

In considering the many factors bearing upon selection of an architect, there are a number of basic questions which give serious concern to board members.

LOCALE

One of these is the problem of whether or not to consider only architects located within a restricted area —such as a county or state. The architectural profession has never, within its ranks, recognized jurisdictions, except as these are governed by the licensing laws of the various states. Many architectural firms practice in several states. Generally speaking, the fact that a local architect has a knowledge of local conditions, is available at a moment's notice and has a deep concern for local problems give him a distinct advantage.

Along these same lines, boards are often confronted with demands from architects based on the premise that residence in a community carries with it the right to receive a commission for a school building. Members of the architectural profession, generally, are ever conscious that the serving of a client is a privilege and never a right. An architect is entitled to consideration only when his professional qualifications, measured in terms of experience, competence and integrity satisfy the standards set by the job to be done.

EXPERIENCE

Another question which so often arises in the minds of board members is one regarding consideration of the architect with little or no experience in school planning. This is usually the younger practitioner who may have a number of other building types to his credit. It might be unwise to assign to this architect a large and complex project, both on the basis of lack of experience and size of organization. Conversely, it would be unfair to rule out of consideration altogether the person who has not yet designed a school, particularly if he has proved himself to be competent and imaginative in other fields. Architects, like doctors and lawyers, are professional men licensed by a state after a long and arduous period of education and training—but there are individual differences in talent and experience. A talented young architect may be able to take the educational concepts and principles set forth by the educators and produce a school building which will make a real contribution to education and architecture. Experience alone does not guarantee a good building.

There are no infallible guide-posts in this matter and a board must make its decision on the basis of its public responsibilities, keeping in mind the need for creative thinking and, at the same time, realizing that there is no substitute for experience.

ROUND-ROBIN APPROACH

The "round-robin" or "spread the work" approach is sometimes recommended to a board of education. This provides for the assignment of projects to architects one after the other; in other words, each architect can be sure of a job as his turn comes around. This takes care of everybody and selection is not required. While this method is simple, it is foreign to our whole private enterprise way of life. Any selection which does not take into account merit or achievement is bound to produce school buildings of uniform mediocrity. Advances in any field come only from the stipulation of competition in its finer sense—the generating of new ideas, new techniques and new accomplishments.

Architect's Qualifications

Having discussed various methods by which an architect is chosen, it might be well to discuss some of the factors which the superintendent or board members might wish to consider in evaluating an individual architect's qualifications. Unfortunately, there are no standard procedures or criteria which will serve for a particular job. Each board must consider its own peculiar needs and devise its own ways of approaching the problem.

There have been published lists of questions which can provide a fairly good basis for evaluating an architect's abilities and attitudes. One such list was compiled by Dr. W. W. Theisen, former Assistant Superintendent of Schools, Milwaukee, Wisconsin, and covers those points which he considers of paramount importance in evaluating an architect:

"His Abilities"

1 Does he know his business? Has he had adequate experience in the field of school architecture? Is he thoroughly competent and qualified to give services which only an architect can give? Is he a leader in his profession?

2 Does h have designing ability? Does he have special ability in designing the type of building desired?

3 Does he combine with the qualifications of an architect, the abilities of an engineer? Will he plan a building which is sound and enduring in every particular? Are the buildings which he has erected highly satisfactory from the standpoint of safety, sanitation, heating, ventilating and

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lighting? If he is not himself a trained engineer, has he associates who can render first-class engineering service, who will determine foundation requirements accurately, who will compute stresses and strains correctly and prescribe requirements as to structure and materials for carrying maximal loads, who will design adequate systems of heating, ventilating and lighting in all of their details and who will prescribe plumbing and sanitary requirements which will prove satisfactory?

4 Does he possess a sense of the esthetic and the artistic to a high degree? Do the buildings he has designed reveal beauty, beauty both in their external and internal features?

5 Has he had good sense of economy? Does he know where to economize? Does he appreciate the fact that utility is the first consideration and economy second? Has he the ability to prepare designs calling for material which will require the least outlay for maintenance? Is he economical, but not to the point that durability is sacrificed or that resulting maintenance costs are made unusually high?

6 Is he a specification writer of the highest rank? Are his specifications clear and free from ambiguity? Is every unit of construction and installation so carefully detailed as to prevent loopholes resulting in controversies? Will they reduce to a minimum the possibilities of careless and of inferior workmanship, unmatched colors, substitutions of inferior material or equipment, and omissions, and protect the board against the payment of large bills for extras? Will the penalties exacted of contractors act as an effective deterrent to the "cutting of corners"? Are the architect's specifications open, or are they closed to all but manufacturers and suppliers who sell a particular brand of product or manufactured articles, thus narrowing the field of potential bidders?

7 Is he a highly competent executive who will protect the board's interest at all times? Is he competent to advise the board on the responsibility of bidders? Does he insist on a rigid enforcement of contract provisions before approving payments for work done? Does he have the capacity to make administrative decisions when necessary? Has he a capacity for dealing with contractors in such a way as to get work done properly?

8 Is he equipped to supervise construction? Will he provide competent and fearless inspection at all times, regardless of the number of workmen engaged on the job, in order that there shall be no use of inferior materials, improper mixtures, omissions, substitutions and careless workmanship? Will he provide, in addition to general inspection, specialists competent to pass upon heating, ventilating, electrical and other installations when necessary?

"His Attitudes"

1 Are his honesty and integrity above question? Is he financially honest and not connected with any producer or contractor? Are his claims for consideration marked by thoroughness of understanding and sincerity of purpose, or does he attempt to sell his services through political pull or through pretty pictures of proposed buildings?

2 Will he have the confidence of the board? Will he cooperate with the board and the superintendent? Has he given evidence in his previous school building work of his ability to work harmoniously with the superintendent and members of the board? Is he abreast of the times and informed concerning the growth problems of school architecture? Has he a scientific attitude?

3 Is he relatively free from bias or prejudice in favor of certain types of design or does he tend to have set notions in such matters as the external treatment of the building, the distribution of windows, the type of heating and ventilating equipment, the spaciousness of corridors and foyers, or the use of specialized types of equipment, which are likely not only to add many extra dollars to the cost but seriously interfere with the educational efficiency of the building? Is he concerned primarily with the use rather than appearances? Do the buildings which he has designed show originality in architectural thinking or do they reveal a deadly monotony in style? If asked to plan an addition does he show regard for the work of previous architects in such a way as to preserve some semblance of harmony in external treatments?

4 Is he open-minded? Is he willing to study school problems? Is he sufficiently willing to make changes with a view to greater utility, improved appearance, or lower cost when necessary?"

* * *

So we see that there are a great many things to be considered in selecting an architect. Technical competence alone is not qualification enough in the design of a school building. Architects, educators and board members must concern themselves with the educational facilities and be aware of the influence that the classroom environment has upon children during the formative period of their development as good citizens. It is important, therefore, that a school building be thoughtfully and patiently designed, and that men of the highest integrity, judgment, business capacity, aristic and technical ability be chosen to provide the architectural skills necessary to accomplish these ends.

Construction of a school building involves a great many groups and individuals, all having differing degrees of responsibility for the final result. The relationship of these, one with the other, can have a decisive influence, not only upon the building, but upon the success or failure of the educational program to be housed within its walls. In an effort to clarify relationships as well as responsibilities of the various participants in a school plant program, the National Council on Schoolhouse Construction together with the AIA prepared a pamphlet entitled "Responsibilities and Relationships in Planning, Designing and Building a School Plant" (AIA Document M-501).*

Functions of Architect

1 Review with the educational staff the educational program and proposed schedule of facilities preparatory to making sketches.

2 Assist in site selection.

3 Prepare preliminary studies including site utilization plans and make revisions.

4 Be responsible for compliance with the applicable building codes.

5 Determine structural methods and materials.

6 Provide educational officials with cost estimates and assist in preparing project budgets.

7 Prepare final working drawings and specifications, advertisements and bid forms, assist in securing bids, prepare tabulation of bids; recommend contractors and provide information for the preparation of construction contracts and bonds.

8 Direct the supervision of construction, provide large-scale drawings, check shop drawings, make color selections, interpret drawings and specifications to the contractor, check progress of work, issue payment certificates, and recommend final acceptance.

9 Provide educational authorities with final set of prints including on-job changes and corrections.

10 Plan and specify equipment in cooperation with the school authorities.

Educational Programming

Before the architect can start development of even the most preliminary sketches, he must understand thoroughly the purposes and requirements of the proposed structure. He must know the client's needs, budget and other factors which will affect the final design. Consideration should be given, not only to present needs, but also to future expansion in terms of site utilization, orientation and topography. These factors are related, although subordinate, to the main consideration which is the designing of a proper environment for learning — spatially adequate, architecturally significant and economically feasible.

Preliminary Drawings

After carefully reviewing the educational program with the school staff members directly concerned, and with his own staff and engineering consultants, the architect develops preliminary sketches of the proposed structure. These sketches provide a basis for discussion and evaluation of broad concepts of design, size and arrangement of spaces and establish basic determinations which will govern preparation of working drawings. The sketches are examined by the school staff and board, revised and refined until a solution is reached which satisfies every aspect of the program, and has the approval of various individuals and agencies (state and local) concerned.

Working Drawings and Specifications

When it has been agreed that the preliminary drawings have satisfied all of the client's requirements, the architect begins the working drawings and specifications. The working drawings show, by means of plans, elevations, sections and details, the total scope of the project — space arrangements, kinds of materials and methods of assembly. Drawings are also made of plumbing, heating, ventilation, electrical installations and all structural work. The specifications, which complement and are coordinated with the drawings, establish quality and kinds of material to be used in construction of the building, from foundation concrete to finishing hardware. They also establish standards of workmanship which the contractor will be expected to provide. In essence then, the drawings will show *where* and *what* work is to be done, and the specifications will describe *how* it is to be done.

The working drawings and specifications serve a three-fold purpose:

- express in tangible form the owner's requirements and the architect's solution
- serve as bidding documents for determining cost
- serve as legal instruments governing the construction contract.

It is apparent that final working drawings and specifications are not a mass-produced product suitable for over-the-counter merchandising. The much-used phrase "buying blueprints" is no more a true measure of the hours spent on sketches, discussions with client and public officials, collaboration with consultants, and coordination of the efforts of dozens of highly trained specialists, than is that small piece of paper, called a "prescription," any measure of the medical doctor's service to his patient.

Estimates of Cost

Quite often the architect must decide, on the basis of the most preliminary of sketches, whether or not his design can be built within the amount of money appropriated for the project. He must make this decision often as far as a year ahead of the time actual bids can be taken. He must analyze and evaluate a whole series of variables which are commonly known to affect bidding, some of which are as follows:

- availability of materials or equipment

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- condition of local construction market at time of bidding
- changes in costs of material or labor
- season when construction might start
- number of bidders
- unusual conditions inherent in project

A slight change in one of these factors can affect cost of a given project to a significant degree. If the architect has had considerable experience in the school building field, his preliminary estimates are apt to be reasonably accurate, simply because his wealth of experience has provided him with fairly exact unit costs for similar building types. By adjusting these unit costs to meet conditions which are expected to exist at the time of bidding, he is able to predict the cost with a reasonable degree of exactness. Even so, there are many factors present at the preliminary sketch stage that cannot be resolved until detailed investigations of site conditions, structural systems, utility requirements and characteristics of various materials have been made and evaluated. Sometimes a professional quantity surveyor is retained to make an estimate. Here again, since he will be dealing with early sketches and brief outline specifications, his estimate is often inconclusive and cannot be guaranteed. Therefore, preliminary estimates should be viewed, not as a firm commitment by the architect, but as a measure of the estimated cost, prepared for the guidance of those concerned, and representing the best information and judgment available at the particular time.

While working drawings and specifications are in progress, the architect should maintain a running check of market conditions, material costs and constantly evaluate problems in the planning and engineering aspects of the project. If it becomes apparent that some unfavorable condition will have an adverse effect on the project cost, the architect should so advise the board. Subsequent decisions will then be made in the light of the best judgments of all persons involved. To indulge in wishful thinking that somehow or other the price will be right is neither prudent nor in the best interests of the architect, the board of education or the general public.

Supervision

A troublesome problem in the architect-client relationship is the matter of supervision of construction, because questions often arise from differing interpretations of what constitutes the architect's nominal supervision. Actually, the word "supervision" is a misnomer, when used to refer to that part of the architect's services which begins with the signing of the construction contract. "Administration" is a better word, because architects' office records show that as much time is spent in the office, checking shop drawings, reviewing and approving materials submitted by the various subcontractors and material suppliers, reviewing contractor's requisitions for payment, writing letters, answering telephone inquiries, preparing detail drawings, etc, as is spent in the field overseeing actual construction operations.

Many school people and board members overlook the office administration part of the architect's service because it is a [illegible] of the building operation which generally concerns the contractor and the architect and with which the client is only remotely connected. Shop drawings are an excellent example of architect-contractor relationship.

These drawings are prepared by the manufacturer or supplier for fabricating specific items needed in construction. They are based primarily on information contained in the architect's working drawings and specifications, but cover only the specific and detailed application of the manufacturer's product. It is from the shop drawings that the manufacturer will build his product, whether the product be a coat hanger or a tremendous steel girder. Size, weight, finish and method of assembly must be checked and coordinated with the other parts. Not only does this checking procedure require time for detailed review, but it also requires close collaboration between the architect and his engineers and discussions with the contractor and manufacturer. The architect is the principal factor in this part of the building operation, since he alone is in the key position to coordinate and interpret the entire project which, at times, involves as many as a hundred different trades. Shop drawings for a school project may number into the hundreds, and for a large project may even exceed a thousand, but they are rarely seen by the board or school staff.

In field supervision, the confusion generally arises from differing interpretations of the words "adequate supervision." To establish this in terms of visits or hours spent on the job does not take into consideration the cyclical nature of a construction operation. At certain vital stages, the architect and his structural and mechanical engineers may have to spend several hours at the site—at other times the clerk-of-works' daily inspection may be adequate. Yet even a client familiar with construction practices would have difficulty in deciding whether better supervision would result if the architect were to visit the job for half-an-hour each day, or whether it would be better to spend an entire morning there one day a week. These are the reasons why it has never been feasible to set a precise schedule of inspections. Just as a patient relies on his dentist to determine the number of visits and length of time needed to correct a specific dental deficiency, so too must the client depend on the architect's judgment to provide adequate supervision. It is really a matter of professional responsibility and personal integrity.

Another aspect of supervision which can cause confusion is the relationship between the architect's nominal supervision of the work and the clerk-of-works continuing day-to-day inspections. While this relationship is not governed by any hard and fast rules, and may change in various parts of the country, some generally accepted principles can be set down.

For example, the State of California has had to cope with the problem of earthquakes for a great many years, and in consequence, has passed some fairly stringent laws regarding school construction practices. They have defined in the statute, as precisely as any we have found, the differing responsibilities of the architect and of the inspector.

"The Architect (or registered engineer) shall maintain *such personal contact* with the project as is necessary to assure himself of full compliance with the approved plans and specifications . . .".

"The Inspector (or clerk-of-works) must have *actual personal knowledge obtained by his personal and continuous observation* of the construction in all stages of its progress that the requirements of the plans and specifications are being exactly and completely executed. Continuous inspection means complete inspection of every part of the work . . .".

While the foregoing quotations may not apply in every instance, or in every locality, they do express the differing degrees of responsibility usually found in the coordinated supervisory functions of architect and inspector. The architect should be completely familiar with the job site activities and be satisfied in his own mind that the client is getting the quality of construction called for in the plans and specifications. The inspector, on the other hand, should have a reasonably accurate knowledge, by virtue of actual observation and record keeping, that the general contractor and his sub-contractors *have*, in fact, faithfully complied with the terms of the construction contract.

Apart from the actual site work and related office administration, there are other factors, over which the architect has little or no control, which can adversely affect a project. For example, by the very nature of public bidding, an architect has no choice in regard to selection of the contractor who will construct his building. In certain instances, the caliber and experience of the contractor, his financial status, his business methods, the subcontractors he employs, etc., can cause an increase in the architect's administrative and supervisory workload to the point where the architect suffers serious financial loss, particularly when the contractor finds himself in financial difficulties while the project is underway. Material shortages, labor disputes, national emergencies, and even the weather may prolong the construction period by several months to a year, thus increasing the architect's administrative costs. The architectural profession accepts these problems as part of the risk of doing business but architects are ever concerned with the strain these outside influences can place upon the architect-client relationship.

Extra Costs

There is probably no more bothersome problem to a board of education than the payment of extra costs beyond the contract amount. In spite of the architect's utmost care there are bound to occur some conditions on any job which require the payment of extras.

In order to take care of this, some owners set up a contingency item in the project budget, ranging from one to three per cent of the contract amount. There are others who feel that, in setting aside a contingency fund, there is a tendency for the contractor to seek extras, knowing that money is available.

It is prudent to assume that, since absolute perfection never can exist, some provision should be made for a reasonable amount of extra costs in any construction contract.

There are any number of ways errors and omissions can occur. Generally they fall into three categories:

- unforeseen conditions
- changes by the owner
- errors and omissions by the architect

Sometimes a little more care in the review of plans and specifications by the school staff and the architect can prevent errors but in many cases they are caused by factors beyond anyone's control.

Usually the most expensive extras occur from conditions which were either unknown or unforeseen. For example, if rock or water are encountered during excavation, a change in foundations is necessary, test borings and soil analyses. Though accurate, may have been misleading. It is not usually economically feasible to make more than a few dozen test borings which on a large site cannot give more than a bare outline of underground conditions.

In some cases errors occur from the architect's misinterpretation of the client's requirements. For example, chalk boards are indicated when the client may have wanted display board. It is sometimes difficult for the architect in dealing with lay people to be really sure that he is understood. Architects have found that some persons have had a limited amount of experience in visualizing in three dimensions that which is indicated on the drawings. They express an opinion without really understanding the effect such a decision can have on the whole planning process. Most school systems have a trained staff, some members of which serve as liaison with the architect, interpret the educational needs, and furnish information in a useful and understandable manner. Consequently, errors in this category are usually small in cost, but an accumulation of small items can mean a sizable addition to the contract.

Errors which are most distressing to the architect, and most irritating of all to the school board, are those which are just plain "mistakes." These occur as conflicts between the plans and specifications, or when, inadvertently, an essential item is left out. Architects, being human, can and do make mistakes. Sometimes an inexperienced draftsman will make a simple error, or, insufficient time is allowed for the final painstaking review or coordination of the architectural, structural, mechanical and electrical work. Given enough time to check and recheck, this type of error could almost be eliminated. Unfortunately, everyone—the school board, the staff, the architect and his consultants—is generally under constant pressure to get the building built. Such errors will continue to plague both school officials and architects.

Summary

From the foregoing discussions, which cover only a few of a wide range of professional obligations, it is obvious that all architectural services cannot be performed by a single individual. An architect must necessarily call upon the resources of others: the engineers—structural, mechanical, electrical, acoustical and civil—the landscape architect and a host of special consultants—kitchen, hardware, equipment, lighting, library, laboratory —to name only a few. Except in a few unusual cases, the architect pays for these services out of his own fee.

Although he shares his work with many, the architect carries by far the greatest responsibility. As the recognized leader of the group, it is his obligation to see that the joint endeavors of all have but a single purpose — service to the client.

SELECTING AN ARCHITECT

by Eberle M. Smith, AIA, member national AIA committee on school buildings*

As demand for new school facilities increases, more & more school boards are confronted with problem of selecting school architects. School facilities are an important part of community life as they house our children during a very formative stage. It is important to design them well. A good share of responsibility for well-designed school facilities falls on school architects. So, selection of architect should be carefully considered. Few individuals ever go thru process of selecting an architect. Unless one has a business of some kind involving plant expansion, opportunity to know what an architect does & what his status is rarely comes to average individuals.

So, what should one look for in selection of an architect? How should he be guided? What problems are involved? Just what is expected of an architect? What is his function? What is his place in the building program?

To begin with, architect's position is midway between that of school board or planning committee (party who wants building) & that of contractor or builder (party who contracts to construct building).

Architect takes concepts & principles that owner (school board) wishes to have incorporated into building & develops these concepts & principles into designs — expressed in blueprints of working drawings & specifications — that can form a basis for an actual contract with a contractor or builder to construct a very special building. Architect then goes further & supervises construction to see that owner is actually obtaining exactly what he contracts & pays for.

* *AIA subcommittee:*
Eberle M Smith, AIA, chairman
Clarke E Harris, AIA
Lauren V Pohlman, AIA

Architect does many other things along the way that assist owner — such as advising him on costs of buildings, site selection, taking bids, advising on selection of contractors, material selections, keeping of accounts & paying of contractors.

Architect's function & status is complex & today's technological developments multiply technical problems inherent in construction.

So, what does one look for in an architect? It is obvious that experience is important — certainly on large projects it is quite vital. But experience by itself is not the answer. An architect may have had many years of experience doing same thing over and over again. Repetition by itself does not make for right. A young or new architect may be able to seize upon concepts & principles expressed by owner, & with originality born of youth, design & plan a building which will be a real contribution to education & architecture.

An owner might well think in terms of how well an architect may give personal service. An architect whose office is situated so that he may be within easy reach for consultation, board meetings, etc, may be better able to serve than one at some distance away.

How well does architect get along with his clients, contractors & fellow architects? An architect must work with many people & quality of his human relations is a matter of real import. What is architect's reputation on previous jobs? Has he stayed within his budget? Does he cooperate & try to give owner what he wants? Does he have patience & desire to respect opinions of others? Do his buildings have character, atmosphere & warmth, or are they cold, institutional, imposing or inept?

Does architect have proper technical forces in his office or is he affiliated with accredited professional technicians that allow him to give proper service or engineering services compatible with scale of project in mind? These might include structural engineers, plumbing & heating engineers, electrical engineers, site engineers, landscape architects, etc.

Does architect supervise construction properly & see that payments are made correctly to contractors in order to protect owner's financial interests?

There are a great many things to look for in selection of an architect & it is no small task to do it with credit.

To assist owners in process of selection of an architect, the Committee on School Buildings of the American Institute of Architects & the National Council on School House Construction have collaborated in a joint effort to produce a questionnaire which should prove helpful in this regard. In developing this questionnaire, every effort was made not to be partial to any one group of architects or discredit another, yet to bring out significant, essential & adequate information which will materially assist owner. This systematic & specific comparison of vital information on available architectural firms should aid in making a logical choice. It should be entirely adequate in itself for preliminary screening & thereby save time & expense for many architects & school boards over old-fashioned, elaborate questionnaires often still being used today. It is reproduced in full on following two pages.

NCSHC subcommittee:
Wilfred F Clapp, chairman
Paul W Seagers
W W Theisen

DATE SUBMITTED

ARCHITECT CANDIDATE

PROJECT NAME

STANDARD FORM OF QUESTIONNAIRE FOR SELECTION OF ARCHITECTS FOR SCHOOL BUILDING PROJECTS

(Approved by the National Council on Schoolhouse Construction & The American Institute of Architects Available from AIA, 1735 New York Avenue, N.W., Washington 6, D.C.)

A INFORMATION BY THE SCHOOL SYSTEM TO THE ARCHITECT:

1 Name of school system ______

______

2 Name of superintendent or other person to whom questionnaire should be returned

______

3 Size of system (pupil enrollment) ______

4 General description of proposed projects:

______

______

______

______

5 Approximate timetable for planning & construction period:

______

______

______

B ARCHITECT'S QUESTIONNAIRE:

1 Name ______

2 Business address ______

3 Telephone number ______

4 Type of organization (check one)

☐ Individual ______

☐ Partnership ______

☐ Corporation ______

(over)

A.I.A. DOCUMENT NO. B-431
(Formerly B-481) 1958 Edition

5 Names of principals, professional history, professional affiliation, key personnel, staff organization; (attach information if you prefer)

---

6 Attach list of completed buildings your firm has designed during recent years. If you have recently established your own practice, indicate prior responsible affiliation with other projects, underline those which you feel are examples of your work appropriate to our problem & which you would like to have visited.

Include cost of building, type of building, location & dates of construction. (use separate sheet)

7 Give names of persons to whom the board of education may write. These persons should have knowledge of your firm & your work:

---

8 Attach any other material which might help the board of education in giving you proper consideration. In questions 7 & 8, the board is interested in finding out about your:

- integrity
- thoroughness
- creativeness
- adequacy of supervision
- business procedures & record keeping on the job
- financial responsibility

9 If you are called in for an interview, you will be asked to furnish information indicating:

- that your organization is adequate to do the job
- that previous commitments will not prevent expeditious planning of this project
- that you are willing to devote time to carry out cooperative educational planning with designated school staff members or committees
- completeness of contract documents (plans & specifications)

PRIVATE OR STAFF ARCHITECTS FOR LARGE SCHOOL SYSTEMS?

WESTERN UNION

(ADDRESS)

1. **DOES YOUR SCHOOL EMPLOY STAFF ARCHITECT OR PRIVATE ARCHITECTS FOR SCHOOL CONSTRUCTION?**

2. **IF STAFF ARCHITECT, DOES HE PREPARE PLANS AND SPECIFICATIONS ? FOR NEW WORK OR MAINTENANCE ONLY ? OR DOES HE COORDINATE WORK OF PRIVATE ARCHITECTS ?**

3. **IF YOU HAVE CHANGED, IN PAST 8 YEARS, FROM STAFF TO PRIVATE, OR VICE VERSA, GIVE REASONS BRIEFLY.**

4. **WHICH METHOD IS THE MOST SATISFACTORY ?**

ANSWER COLLECT WIRE AND MORE DETAIL BY LETTER IF NECESSARY.

AMERICAN INSTITUTE OF ARCHITECTS
DEPARTMENT OF EDUCATION & RESEARCH
WASHINGTON DC

In response to numerous requests for information pertaining to current practices of large city school systems in regard to employment of architects for school construction, the American Institute of Architects, thru its Committee on School Buildings (May 1953), undertook a survey of 53 cities in the US with population of 200,000 or over to determine extent to which these cities use:

- **private architects**
- **staff architects in public employ**

technique:

The American Association of School Administrators furnished a list of members of its sub-group: **Superintendents of schools in cities with population over 200,000.** This list included 53 US cities given in adjacent table. With minor exceptions near 200,000 mark they correspond with those given in 1953 edition of **World Almanac,** quoted from 1950 census. Telegrams identical with that shown above were dispatched to superintendent of schools for each city, with exception of Washington, DC, whose present practice is known.

results:

From total of [illegible] telegrams sent, 49 answers were received & form basis for following tabulations.

In analyzing & classifying results it was found that answers to question no. 1 fell into four categories indicated below rather than two groups outlined in the question.

QUESTION No. 1:

does your school system employ staff architect or private architects for school construction?

group 1:

18 school systems using private architects exclusively

birmingham alabama
cincinnati ohio
dallas texas
dayton ohio
grand rapids michigan
houston texas
long beach california
louisville kentucky
memphis tennessee
norfolk virginia
omaha nebraska
portland oregon
providence rhode island
san antonio texas
san francisco california
seattle washington
worcester massachusetts
youngstown ohio

group 2:

23 school systems using private architects & also having staff architect (or engineer) who co-ordinates work of private architects &/or performs maintenance & minor repairs

akron ohio
atlanta georgia
baltimore maryland
boston massachusetts
buffalo new york
detroit michigan
denver colorado
fort worth texas

53 US CITIES OVER 200,000 POPULATION

akron ohio
atlanta georgia
baltimore maryland
birmingham alabama
boston massachusetts
buffalo new york
chicago illinois
cincinnati ohio
cleveland ohio
columbus ohio
dallas texas
dayton ohio
denver colorado
detroit michigan
fort worth texas
grand rapids michigan
houston texas
indianapolis indiana
jersey city new jersey
kansas city missouri
long beach california
los angeles california
louisville kentucky
memphis tennessee
miami florida
milwaukee wisconsin
minneapolis minnesota
newark new jersey
new orleans louisiana
new york new york
norfolk virginia
oakland california
omaha nebraska
philadelphia pennsylvania
pittsburgh pennsylvania
portland oregon
providence rhode island
richmond virginia
rochester new york
st louis missouri
st paul minnesota
san antonio texas
san diego california
san francisco california
seattle washington
syracuse new york
toledo ohio
tulsa oklahoma
wichita kansas
worcester massachusetts
youngstown ohio
washington dc

indianapolis indiana
kansas city missouri
miami florida
minneapolis minnesota
newark new jersey
new orleans louisiana
oakland california
oklahoma city oklahoma
philadelphia pennsylvania
richmond virginia
san diego california
st paul minnesota
toledo ohio
tulsa oklahoma
wichita kansas

group 3:

4 school systems using private architects & also having staff architect who prepares plans for some projects

columbus ohio
los angeles california
new york new york
rochester new york

group 4:

5 school systems using staff architect exclusively

chicago illinois (late reply not tabulated below)
cleveland ohio
st louis missouri
syracuse new york
washington dc

3 of these (chicago, syracuse, washington) use municipal architectural department for staff purposes

summary of question no. 1:

41 use private architects for major school construction (groups 1 & 2)

4 use private & staff architects for major school construction (group 3)

5 use staff architect for major school construction (group 4)

QUESTION No. 2:

if staff architect, does he prepare plans & specifications? for new work or maintenance only? or does he coordinate work of private architects?

(answers to this question are, of necessity, included under question no. 1)

QUESTION No. 3:

if you have changed, in past 8 yrs, from staff to private or vice-versa give reasons

Only 4 cities indicated change in procedure in past 8 yrs (post-war). Following excerpts from replies indicate changes:

portland oregon:
". . . until recently have employed staff architect who prepared plans for maintenance & small projects. In future plan to have all architectural work performed by private architects. Believe this method is more satisfactory & creates better public relations."

philadelphia pennsylvania:
". . . since 1945 has employed private architects for school construction. Until 1937 the Board employed several architects for new construction. As we did no building until 1945 our staff of architects was dropped."

fort worth texas:
". . . we added staff architect (for coordination mainly) 5 years ago because we felt our professional staff not technically trained to work with private architects. However, we do assign responsibility for general coordination of planning to Assistant Superintendent."

st paul minnesota:
". . . staff consulting architect hired for first time in 1951."

new york new york:
". . . private architects employed because our own staff architects could not handle volume of work entailed in present building program."

Almost all answers indicated that most school systems had been operating under their present procedure for many years.

QUESTION No. 4:

which method is the most satisfactory?

Answers from 49 cities indicated that:

29 school systems are satisfied with their present practices

2 school system might wish to change

18 school systems made no comment on this question

Several noteworthy comments covering both points of view are excerpted below:

new york new york:
". . . will probably continue present arrangement. Private architects serve as measuring stick against own staff & vice-versa."

baltimore maryland:
". . . consider employment of private architectural firms more satisfactory & efficient. Contributes advancement in design, presents diversity of skills & enables more rapid progress on broad front."

richmond virginia:
". . . where private architects are used we feel it is quite essential to have staff assistance in coordinating their work."

miami florida:
". . . Board of Public Instruction finds staff more satisfactory because of continuing growth & coordination & consistency of planning."

(ed. note: since private architects are also presently employed, it is not clear whether above refers to advisory or planning capacity)

kansas city missouri:
". . . in an extensive building program I prefer private architects."

minneapolis minnesota:
". . . would be impossible to employ necessary staff to prepare plans & specifications for all necessary work & retain such staff for a period of time."

oklahoma city oklahoma:
". . . we would like to employ school architects to do work of present engineering staff in making preliminary studies & evaluating plans & specifications of private architects."

syracuse new york:
". . . cooperation with city government has worked out satisfactorily."

OTHER CONSIDERATIONS

Although data gathered covered cities with population of 200,000-&-over it is possible by making use of same information to compare practices of cities of 500,000-&-over.

cities 500,000-&-over:

Using **World Almanac** 1950 census population figures it appears that there are 18 cities in 500,000-&-over category. Of these 18 cities answers were received in this survey from 16, & are distributed in following manner:

10 use private architects for major school construction (groups 1 & 2)

2 use private & staff architects for major school construction (group 3)

4 use staff architect for major school construction (group 4)

CONCLUSIONS

It is clearly evident from information gathered by this survey that in most large school systems in the US it is most common practice to use services of private architects for major school construction, supplementing this service by employment of a staff architect for performance of maintenance & minor repair work or to coordinate work of private architects.

john w mcleod, chairman (1953-54)
aia committee on school buildings

GROUP I
TELEGRAMS FROM CITIES EMPLOYING PRIVATE ARCHITECTS

Has always been policy in Omaha to employ private architect.

omaha nebraska

Our school district has always employed local private architectural firms.

seattle washington

Our Board of Education employs private architects for school construction.

youngstown ohio

Memphis schools have always used private architect.

memphis tennessee

Dayton schools employ private architects no change in policy.

dayton ohio

City of Worcester Massachusetts employs private architects for school system always has been policy.

worcester massachusetts

Gentlemen, our school system employs only private architects. We have never had staff architects.

norfolk virginia

San Antonio employs private architect to supervise all school construction. In effect for 20 or 30 years.

san antonio texas

Dallas schools employ private architects also a consulting architect who coordinates work of private architects. No change in last 8 years.

dallas texas

Providence schools employ private architects for school construction. Change occurred more than 8 years ago. Present method satisfactory.

providence rhode island

1: Private architects selected from panel chosen by Evaluation Committee. 2: Maintenance plan not too major—city architect. 3: Have not changed. 4: Prefer private architects.

san francisco california

The B'ham public school have employed since 1928 Warren, Knight & Davis architects of B'ham, Ala. for preparation of plans & specifications for new work. Also plans for maintenance of force accounts as necessary.

birmingham alabama

Long Beach Board of Education has employed private architects for over $40 million construction projects during last 6 years. No change in policy pertaining to architectural serivec in past 8 years. Our Board favors current policy. No change anticipated, so present practice satisfactory.

long beach california

1: Our school system does not employ a staff architect (salaried) as such. However, we engage services of a private architect who coordinates all architectural services. Compensation is on a percentage basis: namely 1%. Project architects are employed on the basis of 5%, compensation rate being based on fact that supervising architect prepares & provides for project architects (a) basic requirements for each project, & (b) schematic & preliminary drawings. 2: Coordinating architect prepares plans & specifications for new work only. However, as stated above, he serves as coordinator of all architectural services. 3: We have made no marked changes in this practice for the past 8 years. 4: Our present method is, in our opinion, most satisfactory.

houston texas

The school system employs private architect for school construction. Until recently have employed staff architect who prepared plans for maintenance & small projects. In future plan to have all architectural work performed by private architects. Believe this method more satisfactory & creates better public relations.

portland oregon

Grand Rapids, Mich. answers as follows: 1. system does not employ staff architect but uses private architects for construction. 2: No staff architects. 3: No change in past 8 years. 4: we use 7 architects with one designated as coordinator. The architects pay the coordinator's fee. At present we have assigned 14 buildings to the 7 architects.

grand rapids michigan

We do not now employ a staff architect & never have. We employ local architects with some experience in school construction & control them with a detailed contract & a comprehensive architects manual. Competent engineers on the school staff work with the architects in the preparation of specifications. We are well satisfied with our procedures.

cincinnati ohio

1: Louisville retains private architect & private engineer. 2: architect prepares plans & specifications for maintenance but not new work. No coordination of work of other architects. Engineer prepares plans & specifications for maintenance & new work. 3: No policy change in recent years. 4: We have had same architect & same engineer more than 20 years. I like present plan.

louisville kentucky

GROUP II
FROM CITIES EMPLOYING PRIVATE ARCHITECTS & STAFF COORDINATORS

School system employs staff architect for repairs & maintenance. Employs private architects for new construction.

buffalo new york

We maintain staff architectural engineering department, main function to prepare standards & coordinate work of private architect No recent change in policy.

oakland california

Regarding telegram of May 13 we commission private architects. Have staff engineering department under assistant superintendent for business services which coordinate this work.

denver colorado

San Diego city school employs one staff architect. Chief responsibilities plan checking, also design for maintenance & minor remodeling jobs. All new buildings by private architects. No change in last 8 years.

san diego california

1: Use several firms of private architects. 2: Employ young staff architect for coordination & checking plans. 3. This is second year for staff man because of heavy building program. 4: We like present arrangement.

wichita kansas

Indianapolis school system employs private architect school construction. Have staff architect who works closely with private architect. Have not changed plans in past 8 years. Feel present plan very satisfactory.

indianapolis indiana

Our school system employs staff architects & also private architects for school construction. Staff architects prepare plans & specifications mainly for maintenance only but sometimes if job not too big for new work. They coordinate work of private architects.

atlanta georgia

1: Private architects employed. 2. Staff construction engineer coordinates work with private architect & prepares plans & specifications for small new work as well as maintenance work. 3: Building program began in 1950. 4: We prefer our method.

toledo ohio

In reply to your wire: 1: Board of Education Planning Department prepares preliminary layout for private architects & private engineers. 2: Staff architect also prepares plans & specifications for all maintenance work. 3: No. 4: As stated above.

detroit, michigan

1: Department of School Buildings has an architectural division. 2: This division prepares plans & specifications for minor alteration work. Major work let out to private architects & Dept. cooperates. 3: No change. 4: Present method satisfactory.

boston massachusetts

School retains chief engineer who is an architect for smaller jobs & employs private architects for major additions & new buildings. Staff architect prepares plans & specifications for smaller jobs. In an extensive building program I prefer private architects.

kansas city missouri

Our school system employs private architects for school construction. Staff architect prepares plans for maintenance only. Where private architects are used we feel it is quite essential to have staff assistance in coordinating their work.

richmond virginia

1: Staff architect. 2: Coordinates work of private architects on large job. Prepares plans & specifications on alteration work & major maintenance. 3: Has been staff architect. 4: Dade County Board of Public Instruction finds staff more satisfactory because of continuing growth & coordination & consistency of planning.

miami florida

Following reply is submitted to your telegram of May 13, 1953 Paragraph 1: Private architect for new construction & for major alterations. 2: Business superintendent coordinates work of private architect, staff architect prepares plans for small alterations. 3: No. 4: No comment.

newark new jersey

1: Akron has a staff architect & also uses outside architectural services for school construction. 2: Staff architect prepares plans for maintenance & small building changes. He does have responsibility of coordinating work of private architects. 3: We have made no changes in our architectural service for at least 15 years.

akron ohio

1: Our school district employs an architect on part time basis. 2: His chief assignment is to coordinate work of private architects on new projects. He is available for plans & specifications on additions or modernization which is done by our own maintenance department. 3: Present plan has been in effect for the past several years. 4: No action.

tulsa oklahoma

The School District of Philadelphia since 1945 has employed private architects for school construction. A staff architect prepares plans & specifications for maintenance work. Until 1937 the Board employed several architects for new construction. As we did no building until 1945 our staff or architects were dropped. Use of private architects has been satisfactory.

philadelphia pennsylvania

1: We employ a staff architect for liaison between educational staff & private architects & contractors. 2: Staff architect provides plans & specifications for minor rehabilitation work. Major rehabilitation & new buildings done by private architects. 3: Staff consulting architect hired for first time in St. Paul in 1951. 4: Present system has been very satisfactory & is popular with staff & local Chapters AIA.

st paul minnesota

GROUP II (continued below)	GROUP III	GROUP IV
In response to your telegram Division of School Facilities, Department of education, Baltimore, does not employ staff architect for capital improvement school construction. Staff architect maintained only for development internal changes & modifications existing buildings. Facilities Division staff of architects & engineers coordinate work of private architects & attend progress meetings during construction. Currently working with 21 different firms of architects. Policy regarding employment private architects for new building plans has not changed past two decades or more. Consider employment of private architectural firms most satisfactory & efficient. Contributes advancement in design, presents diversity of skills & enables more rapid progress on broad front.	**school systems employing private & staff architects** (see below)	**school systems employing staff architects exclusively** (see below)
baltimore maryland	Responding to your telegram as follows: 1: Both. 2: Both. 3: No change in past 8 years. 4: Combination of both for city as large as Los Angeles. **los angeles california**	uses staff architect exclusively **washington dc**
Answering your questions: 1: We employ both staff architect & private architects. 2: Staff architect prepares plans & specifications for new work only in exceptional cases. Usually for maintenance work only. His main responsibility is coordination of work of private architects. 3: We added staff architect 5 years ago because we felt our professional staff not technically trained to work with private architects, however, we do assign responsibility for general cordination of planning to assistant superintendent. 4: Our present system is most satisfactory. **fort worth texas**	Answering telegram concerning architectural services. 1: We employ staff architect. 2. He prepares plans & specifications for new work & maintenonce, also coordinates work of private architects. 3: Architect no longer manages maintenance. 4. We believe our method is satisfactory. Letter follows. **columbus ohio**	Syracuse school system is fiscally dependent city engineering department provides architect & constructs school building. No change has been made in recent years. Cooperation with city government has worked satisfactory. **syracuse new york**
Minneapolis public school system employs private architects for school construction but has one architect on school staff who coordinates work of private architects. No change in past 8 years from present practice. With present building program, would be impossible to employ necessary staff to prepare plans & specifications for all necessary work & retain such staff for a period of time. School architect has 3 draftsmen & prepares plans & specifications for part of maintenance work. Present plan is satisfactory. **minneapolis minnesota**	Answer your telegram May 13th categorically. 1: Employs both staff architect & private architects. 2: Staff architect prepares plans for some projects & for all maintenance & coordinates work with private architects on remaining projects. 3. Have had staff architect since 1921. 4: Hold our arrangement to be very satisfactory. **rochester new york**	1: Employs staff architect. 2: Prepares plans & specifications for new & maintenance work. Does not coordinate work of private architects. 3: No change. 4: Since there has been no change, we have no basis for comparison. **st louis missouri**
1: Oklahoma City schools employ private architect for school construction. 2: School engineering staff makes preliminary studies & evaluates plans & specifications. Minor maintenance work is planned by engineering staff & performed by school maintenance forces. Major maintenance work is planned by private architect & placed on contract. 3. No changes in past 8 years except expansion of engineering staff. 4. We would like to employ school architects to do work of present engineering staff in making preliminary studies/& evaluating plans & specifications of private architects. **oklahomo city oklahoma**	1: System employs combination staff architect. 2: Staff architect prepares plans & specifications for new work & for modernization project. Also coordinates work of private architects. 3: Private architects employed because our own staff architect could not handle volume of work entailed in present building program. 4. Will probably continue present arrangement. Private architects serve as measuring stick against own staff & vice versa. More detailed reply will follow in letter. **new york new york**	1: Cleveland Board of Education employs staff architect. 2: Staff architect prepares plans for new work & Maintenance. 3: This procedure in effect since 1938. 4: Staff architect most satisfactory. More detailed information by letter. **cleveland ohio**

SCHOOL PLANT PROGRAMMING

by Charles R. Colbert, AIA *

Creative thought necessary in architectural programming is as great as in architectural design — actually we are talking about same thing! Creativity is result of method of approach & capacity for work. All thoughtfully conceived buildings which contribute to evolution of architecture are result of careful progression of design analyses. The architectural program is an integral part of this creative process.

Following simple procedure will clarify our thinking:

- **justify the whole (even though society that supports it be illogical!)**
- **justify the part**
- **reconcile part to whole**

source of programs:

Writing of an architectural program is based upon same principles & requires same verve as process resulting in creative design of which it is part. A cold listing of contents & dimensions of facilities to be housed is not a program. Neither is the philosophical hog-wash of educational generalities which ignore economics & facts of 20th century.

An architectural program for a school has as its ultimate purpose creation of environment for learning & teaching for many years in future. Anticipation & extrapolation of valid architectural & educational concepts & principles must be placed in competent hands. Fiction of letting "staff" fix criteria of design is wholly unworkable. Limited & biased experiences, distorted personal values & obsolete attitudes invalidate the concept. Except to placate militant staff members & serve as frosting for public opinion the role of acceptance of teacher recommendations is anarchy. While minute personal understanding of their needs is imperative, it must be agreed that our school buildings outlive our teachers by generations. Our structures must be designed to house unborn children of yet uneducated parents who will receive educational training not yet determined!

Far too common practice of using assistant superintendent in charge of planning & construction as a stepping-stone to the superintendency brings about vacillation & petty internal politics only equaled by board appointments of architectural jobbers & brokers. Common professional goal of creative & contributive educational buildings is seldom possible thru compromise & transient responsibility.

Educator, architect, or team appointed to develop school plant architectural program should be selected on basis of ability for creative & cooperative endeavor. If their efforts cannot be confluent, frictions & frustrations of cross-authority & dual responsibility will negate large expenditures.

Program should assume mutual faith & respect between architects & school authorities. Too often architectural program is considered a legal document for holding both parties in line. It should be used as a tool of understanding whereby all parties to endeavor may pool collective knowledge for common purpose.

Educators who pose as building experts & architects who pose as educational specialists should be looked upon with equal question. While both parties must work for better understanding of each other's problems & feel free to suggest & recommend, fundamental authority based upon experience & training certainly should be accepted.

program studies:

You must by now be wondering just who should write architectural programs. In my opinion prime responsibility should be that of one person. Selection of that person is dependent upon location & type of particular structure, organization of system & size of over-all building program.

If construction is limited to one building, I believe architect should write program as his first submission to his client. A meeting of minds between architect & client is essential at earliest possible time, & program can serve as an instrument to correct misconceptions between architect & school official in initial phases. There is no better implement for understanding than a complete word picture of proposed structure & its reason for being. Preparation of complete program without question is an economy for both parties &, when approved, establishes sound basis for operation.

Architectural program for an individual school must be founded on preceding studies. Social analysis of community's needs & objectives, inventory of its financial assets, & finally an educational program are basic design factors of outstanding educational plants.

Planning is the process of relating these studies to time & specific action. A plan implies analysis of existing conditions, anticipation of future change, & establishment of logical methods for control of these conditions. From this it is evident that systemwide planning should precede school plant program.

A major function of architectural program is to relate individual structures to whole. A system is made up of related parts. Full understanding of philosophy & objectives underlying whole system is necessary in creative design of individual structures.

In building programs consisting of several schools, it is natural that basic policies are affected. Therefore, I believe that creation by school board of a temporary planning & programming office directly responsible to board is necessary & justifiable. The many studies & inventories precedent to architectural program may be made & evaluated by this office. These studies should establish:

- **community objectives after an inventory of community assets — includes contributions by political leadership civic groups, sociologists, financial analysts**
- **desirable educational philosophies & administrative arrangements to carry them out — this study is responsibility of board, superintendent of education & his staff**
- **systemwide architectural concepts thru study of physical practicality — responsibility of supervising architect & city planner**

- **administrative procedures for expeditiously carrying out building program — by supervising architect & business manager & must include reconciling of individual building budgets with community's over-all school plant needs**
- **individual architectural programs**

In this case architectural program may be written either by system's supervising architect, their architectural consultant for entire program, or by individual architects selected for separate buildings. If last method is used (& in my opinion it is superior except in largest school systems), sections dealing with standardized units & procedures must be furnished.

definitions:

In usual school system architect should serve as administrative extension of superintendent of schools. In this relationship it is important that his duties & responsibilities be defined. To assure full coordination & complete harmony between school officials & architect, following procedures & responsibilities should be carefully set forth in architectural program:

- **scope of architectural services**
- **services available from architect & from school system**
- **required date of building completion**
- **legal limitations of school board**
- **method of submitting & reasonable content of preliminary drawings**
- **method of supervising construction & approving change orders**
- **requirements for payments**
- **procedures for appealing decisions & reconciling differences of opinion**
- **handling of news-releases**
- **methods of selecting equipment & furniture**
- **procedures for putting plant into operation**

trilateral balance:

Architectural program must also concern itself with cold implications of cost. Relationship of educator & architect is nowhere closer or more involved than in preparation of building budget. There is said to be trilateral balance between size, cost & quality of construction. Either the architect or educator may control 2 of these — neither can control all 3. This extremely simple concept is seldom recognized. Far too often, relation between architect & educator is set in an environment of common mistrust & skepticism: educator establishes commandment of a 22'-9" room-width & architect hides his art work in masonry specifications.

In addition to balance of area, budget & finish, there is also a relationship between capital expenditures & maintenance cost — & these are transferable. Question of building permanence is not only functional but financial. We can build pyramids of stone or canvas (& house same amount of space). Only theoretical differential is maintenance cost. We have a choice of concentrating human effort in cutting stone or spreading it over a longer period in lesser quantity by constructing tents. This example by exaggeration is applicable to our school building. If we are to design & program wisely, we must determine life span of our schools & tolerable operating budgets & maintenance costs.

Budget & contents of buildings are prerogatives of educator while arrangement & finish are natural & necessary functions of architect. For outstanding structures it is of course necessary that entire relationship be one of collaboration, but this fundamental division of prime authority is essential & should be recognized at outset.

standardization:

Most architects & many educators unfortunately have grown to believe that standardization implies stock plans & repetitive construction of identical structures. This concept is highly erroneous & is vulnerable to valid argument that neighborhoods have needs peculiar to themselves. Second greatest of false economies would be to attempt to fit an army into a uniform of one size. Greatest false economy would be to let each man design & fit his own dress to his peculiar pleasure.

Relation of school to school system is similar to individual & army — taxi cab & cab fleet. Can you imagine a cab fleet ranging from Cadillac Fleetwoods to Crosley Roadsters? Maintenance, inventory surpluses, administrative costs & operating procedures would make idea ridiculous — yet our school systems, for lack of systemwide planning & coordinated programming, are in midst of such an expansion program.

As an architect you need not fear that I recommend prototype schools

PROGRAM GENESIS

- **conceptual or dream period:**

  cosmos to specific geographic point
  time to social conditions
  custom to technics surrounding it
  economics to living standards
  purpose to means

- **research on what has already been done & WHY:**

  analytical criticism
  extracting good, not condemning bad

- **study of economy of means & contents:**

  operating windows vs power ventilation
  land cost vs structural system
  education finances
  toilets vs classrooms
  environment vs cubage

- **factual statement of immediate needs:**

  the program

or pernicious stock plans. They are another great evil. I do recommend standardization of parts in some cases & of procedures just as we accept modular coordination. I am also convinced that proper school plant standardization starts in highest political & administrative echelons.

There are 4 levels of standardization which if adopted would allow all reasonable range to architectural & educational creativity & yet assure great economic savings of operating & capital expenditure budgets:

- **reasonable standardization of political objective, educational method & sociological thought at policy-making level:**

  fiscal matters
  personnel assignment
  attendance districting

  social responsibility can be standardized without freezing future progress

  relationship of health clinics
  libraries
  playgrounds &
  other facilities

  should be fixed between
  municipality
  school system
  health departments

  School uses at night add greatly to cost of building. Certainly we may not continue to expand community responsibility of education without revision of tax structure.

- **standardization of architectural concepts at philosophical level:**

  steel vs concrete
  modular coordination
  organic
  regional
  rational

- **standardization of administrative mechanics:**

  reporting systems
  operational procedures (incinerator, custodians, etc)
  class sizes
  student-teacher ratios

- **standardization of services, supplies & replacements:**

  maintenance of parts inventories
  service mechanics
  purchasing procedures

Standardization within prescribed & flexible limits is mandatory for maximum economy & long productive life. Form & extent of standards is relative to size & other factors peculiar to each community. In a system of 100 school buildings principles of standardization for 5 or 6 new schools may not be excessive while in a system of 10 related structures 2 could be unreasonable.

codes:

Most municipal & state building codes are obsolete before they become effective. This is usually because codes deal with specifics rather than principles. It is argued that specifics are due to necessity of legal administration & usual caliber of public officials. It does not consider dangerous ease of formulating codes & difficulty of revising them.

Municipal & school officials should assist in constantly reviewing building codes affecting their structures. Thru architectural program, need for change can be justified & unreasonable requirements altered by fact & reason.

Millions of dollars are wasted each year on school buildings because of adherence to obsolete & ill-advised building codes. I will cite two examples:

- **in New Orleans we are required by the Sewerage & Water Board to furnish 1 toilet/20 pupils. I am sure that this ratio of 125% more toilets than required by New York will not help the South to rise again!**
- **in Kansas ceiling ht must be ½ room width (?)**

As it is natural to reevaluate educational standards & operating procedures during programming of a new building, so it is reasonable to reevaluate standards of construction.

First principles rather than dogmatic rules are basis of outstanding educational systems as well as buildings. Peculiar position-politic of chief school administrator makes him fearful of changes & therefore of ideas. Often economic justification is not enough to overcome this factor. In New Orleans for instance we found that gang showers for girls would reduce renovation cost of high schools by $15,000-$20,000. Price of modesty here alone has been at least $100,000 in last few years. Public mores resting on a false sense of Victorian modesty are as slow to change as cycle of learning, but in interest of better education we should overcome fears of architects for educators, educators of boards, boards of parents, parents of children & children of teachers.

In the foregoing I hope I have had some success in raising question in your minds of validity of several generally accepted school plant planning concepts — which I like to refer to as "architectural myths." American College Dictionary defines myth as "collective belief built up in response to wishes of group instead of analysis of what it pertains to." Those collective beliefs of architects which I would particularly like to discount are following:

- **that an architectural program is limited to definitive listing of finite truths & is natural consequence of architectural contract — it is rather implement for achieving greater harmony between client & architect & must exert creative force in realization of better buildings**
- **that programming & planning are same thing — actually architectural program must follow & build upon systemwide plans for economic & social development (including population distribution), educational objective & reasonable standardization**
- **that systemwide standardization is expensive, impractical & stultifying — in reality standardization occurs at several levels & is essential to reasonable & economical operation**
- **that educational specialists should write architectural programs**
- **that everyone in school system should be consulted in determining building requirements & contents**
- **that school boards should select architects — prefer that superintendent do so)**

Schools are institutions for inculcating ideas & ideals. How then can we reconcile far too common, trite, archaically conservative, odorous boxes that we call schools?

I am convinced that preparation of architectural program is integral part of creative design process, that it is instrumental in development of major economies, that it expedites work of all concerned & that it assures harmony between collaborating parties.

Bilateral lighting, single-loaded corridors, adequate play yards, raised classrooms, & entire administrative concept of autonomous classroom have come thru public understanding & studied, rational research approach. The architectural program is inevitably dedicated to justifying better public understanding of school needs.

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* *member AIA Committee on School Buildings this paper condensed from presentation at AIA Gulf States Regional Conference, September 1954*

EDUCATIONAL SPECIFICATIONS

by Russell E Wilson * (abridged by permission from series of articles in Nation's Schools)

EACH new school plant should be built three times. First "building" is by educators, in form of written educational specifications which describe educational program — second is by architect, in form of architectural specifications & working drawings which interpret educational programs needs, & third is by skilled craftsmen, in form of completed building constructed according to instructions of architect.

Greatest waste in school construction in recent years results from lack of sufficient attention to first step — educational planning. Even where educational planning is considered important, it is not usually carried to point of preparing detailed description of educational program to be housed.

This description is often called the educational specifications. They include detailed description of groups of pupils to be housed — kinds of educational activities to be carried on in each separate room, & kinds & amounts of equipment, supplies & furniture to be installed or stored in each part of building, including consideration of future expansion.

To date, greatest efforts by educators to obtain economies in construction have been thru their architects. Efforts of educators & architects to produce modern, functional, clean, simple structures have produced major economies apparent to anyone who makes even superficial comparison of school buildings constructed in the 20s with those erected since world war II. While economies have been substantial, they have been essentially face lifting or cleaning-up & simplification of building materials & methods.

Gothic towers & Roman columns are now considered expensive & unnecessary. We can list such physical improvements as better lighting, controlled thermal environment, effective use of color & new decorating schemes. Much of this good work is due to initiative & imagination of school architects.

While school architects will continue to make further economies in school building construction, it seems likely that they have already made their greatest contribution by changing from ornate, historical structures to modern, functional architecture with more space per dollar expended. Next major improvement (& resultant economy) in school buildings lies with educator & amount & kind of educational planning he does for each school.

A few years ago there was great objection among architects to building new schools from prewar blueprints. Now educators are beginning to think about a similar problem — mistake of building new schools to house prewar educational programs.

We are recognizing that greatest waste in school building construction in 1954-55 was brought about because many educators failed to give architects a well-thought-out description of their educational program. In fact, many school architects report that they were not given a written description of any school program, old or new. Only information they obtained from school officials before they started to work were two small bits: approx number of children to be housed & approx amount of money available.

This lack of information results in buildings that do not fit today's best educational concepts. For example, 1000s of high school auditoriums continue to be built from plans developed many years ago to accommodate orators of William Jennings Bryan era. These auditoriums are complete with stage & all trappings & paraphernalia of legitimate stages of two decades ago.

Whether a large spectator type of auditorium is desirable in a high school depends upon wishes of local community leaders & educators. However, since an auditorium of this type represents a major portion of cost of a high school building & since it probably is most unused area within the building, it is desirable to reexamine basic educational concepts behind such a unit.

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* *Former Assistant to the Superintendent & Director of School Building Planning, Public Schools, Dearborn, Michigan.*

Certainly, modern arts of communication — radio, public address systems, television, filmstrips & motion pictures — have caused the passing of great orators. Modern techniques of stage scenery & lighting have outmoded tremendous backstage areas & machinery of old legitimate theaters. Modern audio-visual techniques & equipment have pervaded up-to-date daily classroom instruction.

Other concepts have emerged, such as effectiveness of group work as compared to old lecture-audience situation & direct participation in physical & mental recreation rather than crowds of spectators observing a few star performers. These concepts raise grave doubts about constructing an auditorium — a most prominent & perhaps expensive part of high school building — frequently, however, determined upon for community uses rather than educational. Another case requiring new diagnosis is the school library.

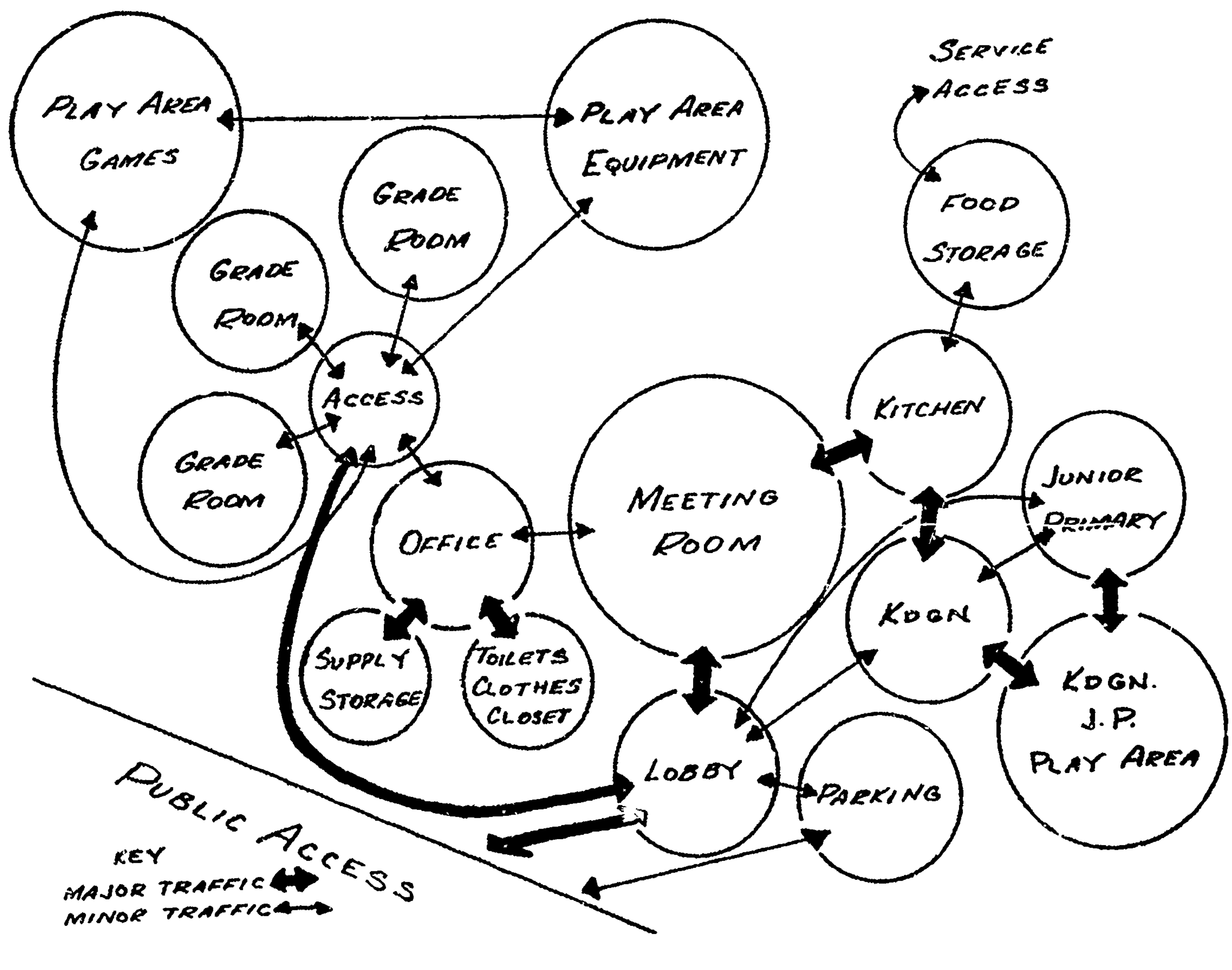
In past, & unfortunately many times in present, school libraries appeared to be cathedrals for learning but, in reality, were mausoleums for books. Trappings & decorum characteristic of high school libraries would gladden heart of a funeral director. To many this is complete antithesis of library's purpose, for books are made to awaken minds of children & to let imagination take flight.

Auditorium & library are only two examples of rethinking that must go on, & is going on, before a building can be designed to fit the educational program.

no trespassing on architect:

Much so-called educational planning contributed by educators in postwar building period is invasion of proper planning field of architects. Without recognizing that they are trespassing, school officials tell architect that they would like to have bricks used here, tile used there, rooms of particular size for this common situation, a certain number of prescribed stories, & a specific brand of heating or ventilating system. In extreme instances, even blueprints have been prepared by educators & solemnly handed to architects.

Educational spatial relationships for a K-3 primary school



While playing architect, educators often overlook their real role in building schools — that is, to give architect best description possible of how building will be used & characteristics of users. (ed: suggested space requirements for some special educational uses may be helpful — others may be governed by codes).

This lack of proper communication between architects & educators has been a major cause for construction of many educationally unsound & financially un-economical buildings. In history of school building planning, there is no long-established tradition & practice for educators to tell with fairness & specificity their educational desires. Now, it is believed that by adopting medium of educational specifications, educators can be placed in direct communication with school architects.

saves time & money:

By having at his disposal a clear statement of a desired educational program which has official approval of a board of education, an architect can then proceed to his planning directly. In many cases, this will eliminate a long & trying period in which architect presents preliminary plans over & over again to school officials & board of education.

Since most educators & architects have never actually prepared or seen a set of educational specifications, these specifications can best be described by comparing them to architectural specifications. Both are necessary for a well-planned, well-built school building. Architectural specifications describe a school building in terms of physical materials, dimension & shapes. In many instances they describe precisely even processes to be used in construction.

Educational specifications describe educational program in terms of processes & activities to be carried on by various groups that use building. More precisely, while architectural specifications describe physical materials & measurements for schoolrooms, educational specifications describe people & what they will do within classrooms.

facilities listed:

For example, while architectural specifications might say that a particular classroom is to have walls of masonry & floor covering of asphalt tile & is to be 30′ long & 26′ wide, educational specifications intended to describe same situation might say:

This room is to be used by various groups of pupils, with max number of 30. Pupils will occupy room thruout normal school day & will engage in reading, individual seat work, informal games & dramatics. They will use items listed. (Here is given specific number of chairs, tables & desks, listed by size & shape). Further, in carrying out various activities, pupils will need to have available within this space hot & cold running water, electrical outlets & other conveniences to be named. In order to execute program efficiently, there should be available to pupils & stored within this space various items of movable instructional equipment, including record player, stated amounts of paper, books, paint & like.

Architectural specifications normally start out with statement of general conditions of contract. Educational specifications should begin with statement of general philosophy of educational program. As next step, architectural specifications describe various standards of workmanship & various processes to be used in construction. This offers direct parallel to description of methods & educational goals that should appear in educational specifications. Then, as third step, architectural specifications frequently become specific & list in great detail all special materials & all special building techniques to be used in a particular part of the building.

Again, there is a parallel — educational specifications should list teaching materials & room equipment room by room.

Essential differences between educational specifications & architectural specifications are that educational specifications are written description of an environment in which an educational system is to operate & architectural specifications are written description of how a plant is to be constructed, to operate & to look.

For ins[illegible], educators, in describing surroundings they consider desir[illegible]e for students, would say that they believe classroom should have homelike atmosphere, which will create in student a feeling of well-being & mental poise & which will stimulate him to mental activity.

Educator might even go further & say that classroom should produce maximum of physical comfort, such as might be achieved by good ventilation, good lighting & comfortable chairs & tables.

This understanding reserves for architect the responsibility for designating kind & source of light, colors in classrooms, & type of heating & ventilating system.

a different vocabulary:

Architect, in turn, after considering educational specifications, should be free to use an entirely different vocabulary. His description of same classroom might say that to produce conditions desired by educators in this classroom the room should be X' long & X' wide, with ceiling height of X'X" — wall surfaces should be of this specific building material & that specific building material — & wall colors should be as indicated on his color chart, & room trimmings, such as doors, windows, wainscots & curtains, should be of particular design, color & texture, as specified. Further, to create kind of physical conditions appropriate to carrying on educational activities prescribed by educator, a particular kind of lighting, heating & ventilating system is required.

If educators responsible for planning of school buildings can develop better methods of communicating their thoughts on educational programs to school architects, there seem to be real possibilities of accomplishing great gains in educational efficiency of future school buildings. In recent years a sufficient number of educators have prepared educational specifications for new buildings so that some significant recommendations can be made now, based on their experience.

Recommended Content for Educational Specifications

General Considerations

BRIEF DESCRIPTION OF EDUCATIONAL PLAN

- Program considerations
  - General statement of philosophy
  - General characteristics of the community
  - General characteristics of the student body
  - General characteristics of the curriculum
  - General relationships of this school to the school system
- Administrative considerations
  - Description of attendance area
  - Description of grades and groups to be accommodated
  - Anticipated enrollments by (1) grades, (2) years, and (3) courses
  - Personnel requirements

BRIEF DESCRIPTION OF PHYSICAL PLAN

- General character of the building
  - Architectural style
  - General type of construction
  - General atmosphere to be created by the building
  - Major sections or units of the building
  - Preferred number of stories
- General facilities required in the building: instructional, noninstructional and community use areas
- General characteristics of the site: location, size and dimensions, physical description (topography, soil, and so forth), and available public utilities

Detailed Statements of Desired Spaces and Educational Program

INSTRUCTIONAL SPACES

- Required numbers and kinds of rooms
- Descriptions of the program, functions and facilities for each room
  - Sizes and kinds of groups to be accommodated
  - Teaching methods
  - Types of class activities
  - Location and relationship to other facilities
  - Physical arrangements and features
  - Descriptions and lists of the equipment, furniture and materials

NONINSTRUCTIONAL SPACES

- Required numbers and kinds of rooms
- Descriptions of the functions and facilities for each room
  - Sizes and kinds of groups to be accommodated
  - Types of activities to be provided for
  - Location and relationship to other facilities
  - Physical arrangements and features
  - Descriptions and lists of the equipment, furniture and materials

Detailed Statements of Desired Site Arrangements and Development

INSTRUCTION AND RECREATION FACILITIES: outdoor class areas, free play areas, organized game areas, and equipment requirements

ARRANGEMENTS FOR SERVICE FACILITIES AND BEAUTIFICATIONS: landscaping requirements, service drives, parking requirements, sidewalks and approaches, and pupil transportation requirements

Detailed Statements Regarding Physical Details of Building

STRUCTURAL DETAILS: lighting, acoustical, hardware and lock systems, floor, and wall surface

MECHANICAL SYSTEMS: ventilation, plumbing and heating

UTILITY SERVICES: electrical power systems, fire alarm systems, gas service, sewage systems, communication systems, clock and program systems, and water supply

Detailed Statements Regarding Financial Plan for Project

FUND RAISING PROGRAM

ALLOCATIONS OF MONIES

- Professional fees and services
- Site acquisition and development
- Furniture, equipment, and materials
- Construction contracts

Nation's Schools

planning content for educational specifications

Use of improved education planning procedures will affect external & internal appearance of future buildings more than has the architectural revolution in school building design. Educational specifications, describing in detail a desired education program & as bulky as a padded master's thesis, have been painstakingly prepared by educators across the nation — Scarsdale, NY — Plainfield, NJ — Dearborn, Mich — Janesville, Wis — Grand Island, Neb — & San Mateo, Calif.

More educationally-efficient schools resulting from efforts of educators in these & other school districts deserve consideration of all educators concerned with school building planning.

School districts that have enthusiastically reported on use of educational specifications cause prediction that practice of preparing them for each new school building will become as common in future as present practice of preparing general school building surveys.

Materials & information in a set of educational specifications constitute a substantial document comparable in size & form to general architectural specifications. In actual practice, information included by various school districts to date has taken many forms Much information can be presented as straightforward written composition. Statements of philosophy & descriptions of various teaching situations & teaching methods adapt to this form. Enrollment statistics can be presented in tabular form or in charts & graphs. Other information, such as required or desired spatial relationships between various instructional units, can be shown diagrammatically.

Style of writing is important. Major task for planning committee is to present a word picture of projected school program. These words should describe such things as:

- **various aspects of classroom activities & procedures — kinds & frequencies**
- **groups — sizes & time schedules**
- **materials, such as books, supplies, equipment & furniture — kinds & amounts**

To be of most value, educational specifications should be written so that they can be read & comprehended by noneducational or nonprofessional groups such as might be found in various community organizations & by architects & their staff members.

Considerations affecting style should be vocabulary readily comprehended by laymen & architects & descriptions of educational program that will allow architect freedom to use his creative design ability. As educators approach task of preparing a set of educational specifications they should be primarily & professionally educators. They are not expected to be master plumbers, draftsmen or brick masons, &, definitely not architects.

Recommended contents for educational specifications can be summarized in three major areas:

- **philosophy & curriculum**
- **administration organization**
- **noninstructional service requirements**

Development of these 3 major areas can be approached in a variety of ways. For example, a recent school planning guide issued by the state of Michigan listed 25 leading questions for a local school building planning group to answer. This list includes such questions as how will groups using building be organized? What curriculums or programs will be housed? What special activities will require specially designed facilities?

Another approach to educational specifications is illustrated — a recommended contents outline derived from study of educational specifications prepared by local school officials & from review of various recommendations made by school plant authorities

Even in such a listing as this one effect is to place undue emphasis on many mechanical & architectural aspects of building. Description of educational program & how it is intended to operate are most important. These considerations should make up major bulk of information included in a set of educational specifications. They should not be overshadowed by descriptions of how building is to be constructed & to look, for this is architect's province.

This new vehicle for educators to use in communicating educational information will help to make submission of educational information to architects a normal procedure in school building planning. There is no excuse now for submission of educational data to school architects to be left to accident or to whims of a particular educator. Instead, as a regular procedure, educators under all circumstances of building a new project should submit, as a matter of course & as a matter of record, a good, lengthy statement of their educational program in form of educational specifications to architect assigned to project. Conversely, architects should expect such statements to be readily available from their educational clients.

Benefits from preparing educational specifications, as reported by educators who have had experience with this school building planning technique, are of 3 kinds:

- **benefits to school system in improving its regular activities, such as curriculum development**
- **benefits of direct value in planning a specific new school, such as forecasting precise personnel requirements**
- **benefits in facilitating work of school architect, such as providing tangible basis for estimating cost of proposed project**

procedures for preparing educational specifications:

Procedures for preparing a set of educational specifications become a framework for discovering wishes & needs of teachers, pupils & others who use building.

These procedures are different from traditional school planning techniques. Effect on proposed school, as well as school district & community, is almost as important as final document — primarily because of staff & community participation.

Analysis of techniques & procedures used by more than 60 school districts that have prepared educational specifications resulted in following general recommendations.

Only general recommendations can be given, because procedure followed by each school district, must fit local administrative organization.

Preparation of educational specifications calls for committee type of organization. This committee, or committees, should be under direction of superintendent of schools & should involve various staff & community groups, including both parents & students.

One comprehensive committee formed for a fairly large school district included teacher-representatives of all grade or subject areas, a building engineer, a school nurse, parents & students. Administrative staff members, such as director of school plant planning, director of child accounting, assistant superintendent in charge of curriculum, & superintendent, served as ex-officio members. This meant they attended & participated in all meetings but had no vote. Curriculum-coordinators were included as permanent resource persons.

To define educational program for a new school, committee will need to meet over rather long period. Some committees have taken a year. Others have concentrated studies & have finished job in 3 months.

Amount of work to be done & original research required have caused some districts to arrange released time from regular duties for committee members so that they may attend meetings.

One district discovered that it took less time to prepare a second round of educational specifications after first building for a particular grade level had been built, because committee could study what had been done previously & use much basic research & mechanics determined by first group. Individual educational specifications were still necessary, however, because of continuous improvement of curriculum & building ideas in any well-organized school system.

Some school officials provided committees with general contents-outline around which to build final educational specifications. Others prepared questions to be answered, arranged field trips to new schools built in other cities & provided consultants (at committees' request). Architect is on call during planning meetings & attends frequently.

Administrative studies should be made of projected enrollments for proposed buildings, of different kinds of age & grade-groups to be accommodated & similar problems. Such data should be incorporated in final educational specifications.

place of superintendent:

In this concept of school building planning as a cooperative venture, superintendent becomes a dominant factor — not as mechanical administrator but as creative educator. This is contrary to some older practices in which a standing committee of board of education is dominant or such matters are left to business manager.

consultants:

Concept also implies that if educational consultants are retained they should be responsible to superintendents & planning committees. They are no longer allowed to go off in their corner to prepare educational specifications independently of local efforts.

approvals:

Before any planning steps are taken, school board should endorse officially the kind of planning organization & procedures to be used. Before finished educational specifications are turned over to architects they should be submitted to board for careful reading & approval.

Board approval gives educator official endorsement of his proposed educational program. It gives architect reasonable expectation that if he draws his plans in accordance with educational specifications they will be accepted by board.

less effective data:

Although educational specifications, as such, are a new planning technique, educators & architects have been concerned with subject matter of educational specifications for a long time. In many instances written materials have been given by school officials to architects to define scope of work. Sometimes architects have had to take initiative & have had to pester school officials with questions & information blanks

Reports of planning committees often have been submitted to architects. Occasionally, there have been official statements of educational policies issued by boards of education. Seldom, however, is job done with thoroughness & smoothness resulting from preparation of educational specifications.

questions, answers & democracy:

Let us look first at general problem of curriculum improvement. Occasion of building a new school offers greatest opportunity to review, examine & reappraise school programs.

Many questions must be answered, such as: "Shall we have a swimming pool in the new high school?" or "What kind of health program & health services shall we include in the ne elementary school?" Answers such questions form contents of a set of educational specifications.

Community has a right to know answers to such questions for its town & for a particular school building.

Citizens have a right to know how their local school officials & board members stand on such questions. In recent years so-called democratic or group processes have become common in many school administrations. Perhaps greatest benefit claimed for this increase in democratic action is fact it is good for staff members to participate more directly in operation & direction of their school system. Few people seriously question premise that participatory behavior is fundamentally more satisfying than spectator behavior. Herein, also, lies basic claim that preparation of educational specifications thru committee efforts within a school system will improve staff morale. Term "staff" is meant to include all kinds of people involved in a school system— not just teachers but also engineers & members of clerical staff & school nursing group. Staff morale can be harmed rather than improved if final educational specifications are not used in good faith. It has been learned from bitter experience that once an idea of an individual has been incorporated into a set of educational specifications that particular individual, be it teacher, board member, or interested parent, is most likely to expect to have that same idea demonstrably evident in finished school building.

cost estimates:

Often in a school building program architects are asked to make preliminary cost estimates for each school building project. Batting averages in this situation tend to be disappointing because of lack of precise information. Frequently, major criteria applied by community members & school boards in measuring value of a particular group of school buildings is that of how closely actual construction coincides with estimates given by architects & school officials. Educational specifications can help architects & school officials improve accuracy of their estimates for a particular school building because they include precise description of every space to be included within building & precise description of every function that will be carried on within each room. In addition, educational specifications will include specific lists of equipment, both built-in & movable, which is to be placed in each room. This body of information offers only practical basis for preparing financial estimates.

operational efficiency:

Educational specifications also assure more efficient use of new school building by involving in the planning people who will use building. It should be evident that teachers who help plan classrooms will be able to make better use of these rooms. Similarly, if engineers & custodians help plan heating plant, they will be able to operate it more efficiently.

typical time schedule:

Many benefits of educational specifications can be inferred from following hypothetical time schedule for building of a school:

- **project begins when school officials begin to think about need for new school — may be several years before actual new school will be occupied — this is time for school administrator to start file of ideas on new educational programs & thoughts about new building**
- **perhaps months later, committees will be formed to begin actual planning. — each committee may be given written charge or responsibility which might well be to produce a particular section of educational specifications — such committees will then have a recognizable & definable goal**
- **meanwhile, usual staff curriculum committees will be working on curriculum revision & improvement — these committees should gain added impetus from knowledge that their efforts will be implemented in a new building — findings & recommendations of curriculum committees will fit naturally into contents of final educational specifications**
- **board of education meetings, public assemblies & finance committees will consider problems caused by contemplated new building — educational specification data being accumulated can be used as basis for discussions & publications centered on new building**
- **teachers will be scheduled to examine new buildings & to appraise promising new educational programs — expanding file of data for educational specifications becomes logical place to record observations, suggestions & acceptable ideas for new school**
- **architect selected to plan new building will be asked for preliminary cost estimates — developing educational specifications can be of use to him as basis for estimates (ed: but architect must have sole responsibility for budget — he cannot add desirable features urged by educational consultant or others without regard to budget)**
- **at some time official board action must be taken, establishing scope of school building to be built — educational specifications can be adopted as official description of projected educational program & building**
- **preliminary building plans must be drawn & architectural specifications must be written — educational specifications, by now in hands of architect, can supply body of working knowledge stating needs of client & defining planning task**
- **architect will be asked to present preliminary plans & specifications for official board of education approval — later, after several meetings & plan revisions, process will be repeated in approval of final plans & specifications — educational specifications can be used as reference points to check & appraise work of architect**
- **state agencies will want to review & appraise proposed plans & specifications — educational specifications can be submitted along with architect's documents, for they will help interpret blueprints**
- **during construction of new building, it can be expected that both lay people & staff members will raise questions about details — information taken from educational specifications will in many instances be more understandable to interested parties than would be impressions gained thru inspection of blueprints or of building when it has been partially completed**
- **other related problems will arise — personnel will have to be hired, furniture & equipment purchased, & supplies ordered — information needed to perform these tasks can be taken directly from educational specifications**
- **when building is finally occupied, new staff will have to learn how to use this most expensive item of instructional equipment — building itself — new building & un-indoctrinated teachers are a bad combination — educational specifications can be used as inservice training manual on purposes & operation of new building but should be supplemented by personal attention of those who prepared educational specifications**

General Considerations for a Junior High School

(Excerpts from educational specifications for O. L. Smith Junior High School, Dearborn, Mich.)

PHILOSOPHY

It is the responsibility of the school to recognize: (1) that we are living in a rapidly changing social pattern; (2) that in our more specialized urban society there is less opportunity for the individual to live a full, meaningful life.

1. Keep our curriculum flexible in order that the child may be equipped to meet the changes in his environment.
2. Provide real-life experiences to take the place of the learning the child once gained in a more open society.
3. To use the cultural, historic, industrial, natural and geographic resources of the community to enrich the curriculum and at the same time to encourage understanding between the school and the community.

It is the responsibility of the school to give the best education possible to each child, regardless of his capabilities.

1. Meet individual differences.
2. Recognize different kinds of intelligence—social, mechanical, artistic and intellectual.
3. Discover for each child his particular aptitude, give opportunities for him to achieve in his field, and stimulate his further development.
4. Mastery of academic and social skills necessary for the child to feel adequate.
5. Provide opportunities for and encourage creative learning in all phases of the curriculum.
6. Meet the physical and emotional needs of the child.
7. Provide opportunities that will develop an understanding and appreciation of his cultural and historical background.
8. Develop the scientific method of thinking in all types of situations.

It is the responsibility of the schools to develop lasting desirable character traits that will enable the child to meet the demands of a democratic society.

1. Provide for a gradually expanding freedom as the child shows his capacity to handle it and grows more practiced in self-discipline.
2. Freedom for the child to make choices and to assume the responsibility that democracy imposes on the individual.
3. Practice in group planning, living and evaluation of his learning experiences.
4. Develop the emotional and spiritual values of the child that he may act toward others with intelligent understanding and sympathy.
5. Create an atmosphere in which each child has a feeling of security and importance.

It is the responsibility of the school to be of service to the community.

1. Understand the particular interests of the community.
2. Discover what the community has to offer the school in the way of services—group and individual.
3. Provide for a variety of services and facilities for children and adults.
4. Provide a recreational, learning and cultural center for the community.

CHARACTER OF BUILDING

Plan a one-story building, style to be simple, modern, functional. Provide for future expansion of building.

SITE

1. Location. The school site is bounded by Notre Dame, Syracuse, Yale and Telegraph Road business frontage. All of the property is not included in this site. See map next page.
   City owned property immediately adjacent to the east will be used jointly by the city and the school as a playfield.
2. Size. The various parcels of land consolidated by the school district total 8.3 acres.
3. General Description. The school site is an L shaped plot. The site is near grade level, with sandy top soil and clay base. The site is now heavily wooded.
   Public access will be on Yale and Notre Dame.

• • •

ADMINISTRATIVE ORGANIZATION

Instructional Organization

1. The school will serve children of junior high age for the attendance area bounded by Michigan Avenue, Gulley Road, Dartmouth, Monroe and Outer Drive, subject to such variation as conditions may require.
2. The school will be organized as Grades 7 through 9 and will accommodate pupils of these grades from the following elementary schools: Long, Nowlin, Oxford and some from Whitmore Bolles.

Personnel Requirements

1. The following requirements are based on census figures for the included area, plus an estimated increase based on present building in this part of the city. Figures for teachers are based on the present junior high school course of study, with a basic class load not to exceed 30.
2. All units of the building, including classrooms, shop, homemaking, arts, cafeteria, physical education, health, administration, pool and library, are to be planned for maximum of 900.

• • •

FACULTY:

English	6 3/5
Social Studies	6
Mathematics	6
Science	3
Remedial and Activities	2 2/5
Vocal and Music Appreciation	2
Instrumental Music	1
Health	4
Shop and Homemaking	4
Art	2
Typing and Business Training	1
Counselors	2
Librarian	1
Principal	1
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CLERKS:

Clerk 3	1
Clerk 2	1
	2

NURSE: 3/5

MAINTENANCE:

Engineer	1
Fireman	1
Custodian	3
Matron for Pool	1
Janitress	1
	7

CAFETERIA:

Manager	1
Helpers	5
	6

EQUIPMENT, FURNITURE AND SUPPLIES FOR MATHEMATICS CLASSROOM

(Excerpts from educational specifications for O. L. Smith Junior High School, Dearborn, Mich.)

Movable Equipment
- Thirty student tables
  - Table desk type
  - Open front for book storage
  - Not less than 20 by 26 inch top
  - Variation in heights to accommodate students
- Thirty chairs fitted for above tables
- Teacher's desk with composition top
- Teacher's chair, swivel type, with arms
- Steel cabinet file
  - Thirty inches high or height of teacher's desk
  - Have lock
  - Suggested two drawers
  - Also suggested to have a card file, that is, two drawers and two card-file drawers, 3 by 5 inches
- Two worktables for back of room for project work
  - About 30 by 30 by 60 inches
  - One type of drafting table. Purpose is to provide working space for project work
- Four folding chairs—nonrubber feet

Storage Space
- 4 to 8 feet of closed bookcases
- Two drawer cabinets of the T-3 type
- One teacher's wardrobe closet of the T-2 type
- Bookcart for keeping books under window
- Storage for transit

Other Items
- Blackboards
  - Some permanent and some reversible in front
  - One section of front blackboard of the reversible type should be either scratched or painted for graphing
  - Blackboards at side reversible with bulletin boards
  - Narrow corkboard above blackboards
- Map rails for hanging charts

Workroom for This Area
- Duplicating machine and worktable
- Storage space for paper and duplicating supplies; cupboards
- Worktable or desk with chair
- Typewriter with desk. Typewriter to be equipped with mathematic keys
- Sink
- Two steel letter files—four drawer
- Calculator

Supplies
- 1 demonstration slide rule
- 10 to 12 yardsticks
- 2 metal capped meter sticks
- 12 blackboard compasses, good quality
- 12 blackboard protractors, good quality
- 1 set of geometric figures, large size
- 1 steel tape 50 feet long
- 1 abacus
- 36 foot rulers
- 36 student compasses
- 26 student protractors
- 6 steel rules 6 inches long
- 1 micrometer
- 1 parallel ruler
- 1 stop watch
- 1 stapler
- 1 graph chart for use with crayons
- 1 set of forms for volumetric measurement
- 1 model of cubic inch and 1 model of cubic foot
- Colored chalk
- Plastic clay
- 30 drawing boards 16 by 24 inches
- Equipment listed is for each room, except workroom.

PHILOSOPHY AND FUNCTION OF AUDITORIUM, LIBRARY AND GUIDANCE AREA

(Excerpts from educational specifications for Clara Bryant Junior High School, Dearborn, Mich.)

AUDITORIUM

This unit should be planned to accommodate:
1. Student assemblies, student productions (dramatic, musical, discussion), motion pictures, and other programs
2. Class groups needing large stage facilities for activities growing out of classroom work
3. Community meetings

The auditorium should be easily accessible to instrumental and vocal music groups and be capable of filling and emptying rapidly. The corridor outside the auditorium should be large enough to accommodate groups of this size. There should be a built-in public address system with facilities for suspended microphones, microphones on stands, or recording units. Adequate space should be provided for storage of scenery and costumes. Provide plenty of electric outlets for equipment detailed later. Provide theater type seats, covering material to be short pile mohair or equal. Seats to be spring-equipped. Provide darkening by traverse draperies. Stage curtain should function in the usual manner. Provide flexible side partitions so that stage can be completely opened if needed. Material of stage curtain to be velours or equal, color to be chosen.

• • •

GENERAL LIBRARY

The library facilities are conceived as a resource for projects and activities growing out of classroom work. Ordinarily, individuals or committees will come to the library for research projects under the direction of the classroom teacher. The function of the librarian will be to assist teachers and pupils in the carrying out of classroom projects. Recreational reading during activity periods, noon hour, and after school will be encouraged.

Library conference rooms will be used for reading or discussion by small groups of pupils, for listening to educational recordings by pupils or teachers, for filmstrip and slide previews by teachers. Provide electrical outlets accordingly.

Facilities should include conference rooms, circulation and reading center, storage and work rooms, and office library.

• • •

GUIDANCE AREA, including conference rooms

The purpose of the guidance program is to assist the individual through guidance or counsel to make wise choices, adjustments and interpretations in connection with critical situations in life (family, career, health, finance) in such a way as to ensure continual growth for *self-direction.*

Plan a guidance unit with three conference rooms, one testing room, and a reception room. Reception room should be large enough for a few easy chairs and lamps. There should be direct access to the records room. Entrance to guidance unit should be from arts corridor, not main corridor.

EQUIPMENT, FURNITURE AND SUPPLIES FOR GUIDANCE SUITE

(Excerpts from educational specifications for Clara Bryant Junior High School, Dearborn, Mich.)

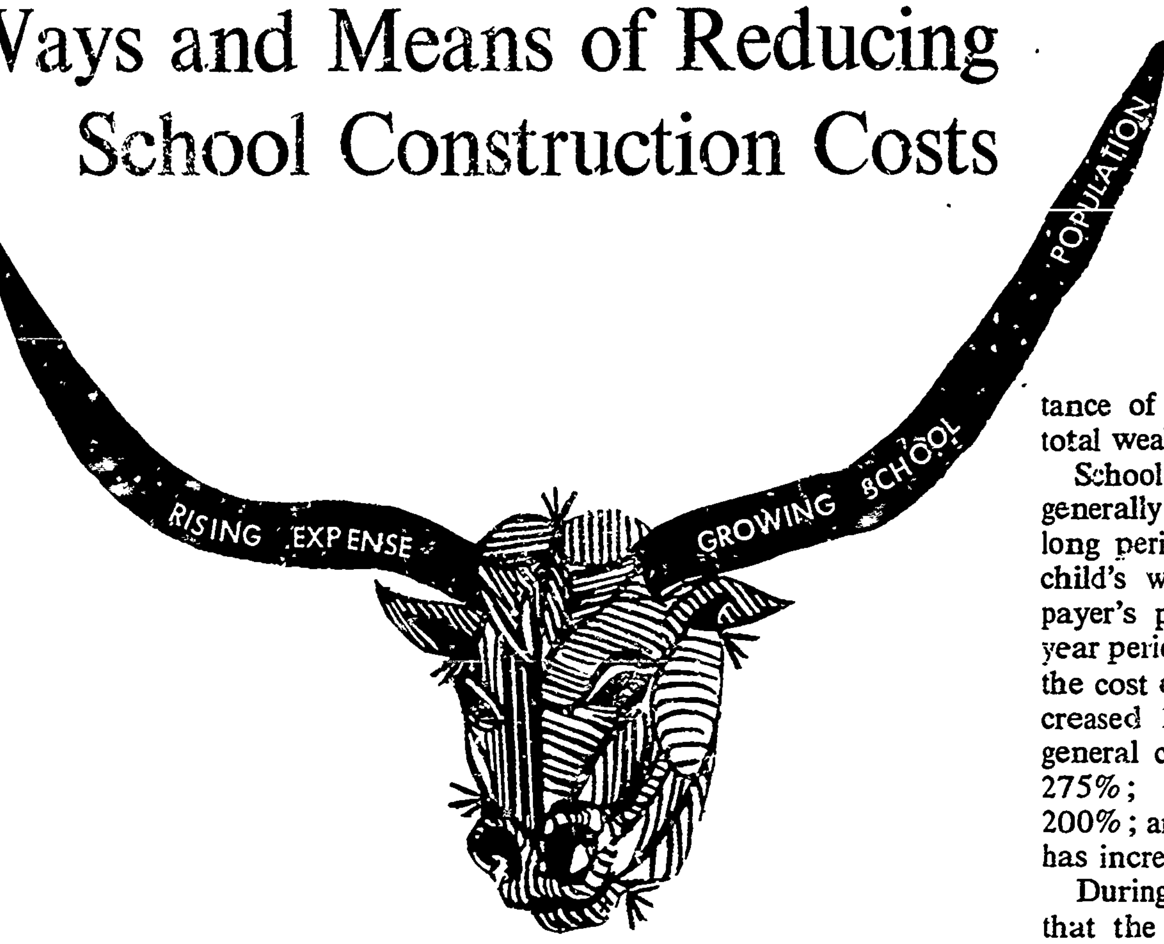
Equipment for three conference rooms
- Three regulation office or teachers' desks
- Three swivel desk chairs—leather seats
- Three regulation steel files—four-drawer
- Six lounge or occasional chairs
- Three standard size chairs
- Three office desk lamps
- Three hall trees
- Three wastebaskets

Equipment for record room
- Six steel letter files—four-drawer
- One table—steel base, light wood top, 29 inches high, 36 inches wide, 70 inches long
- Six chairs, steel base, blond wood top to match table
- One wastebasket
- One typewriter and stand with casters
- One swivel chair to match typewriter stand

Equipment for testing room
- Two tables, steel base, light wood top, 29 inches high, 36 inches wide, 70 inches long
- Six chairs, steel base, blond wood top to match table
- One wastebasket

Equipment for waiting room
- Two magazine racks—medium size
- Eight chairs—four lounge, four occasional
- Three bookcases
- One oblong table
- One wastebasket
- One floor rug
- One small davenport
- One bulletin board
- Four suitable pictures

Ways and Means of Reducing School Construction Costs



by **John L. Cameron**

Chief, School Housing Section, Office of Education US Department of Health, Education & Welfare

From a paper delivered at the August 1960 conference of the National Association of County Officials, Miami Beach, Florida

Conservative estimates by the US Office of Education indicate that during the decade 1959-60 through 1968-69, an additional 607,600 classrooms will be needed to adequately house the public elementary and secondary school children of this country. During the five years 1959-60 through 1963-64, construction of 416,600 classrooms is needed to take care of normal needs and to eliminate the accumulated backlog. These data do not include facilities other than classrooms which are needed to make up a complete school plant. Many communities are finding it difficult to finance their needed school construction. This situation results from five simple facts; namely, [illegible] enrollments, population [illegible], aging buildings, shrinking dollars, and the decreasing importance of land as a portion of the total wealth of the nation.

School officials and architects generally have had in mind, for a long period of time, not only the child's welfare, but also the taxpayer's purse. During the twenty year period between 1947 and 1957 the cost of school buildings has increased 150%, while the cost of general construction has increased 275%; highway construction, 200%; and the cost of automobiles has increased 200%.

During the twenty year period that the cost of school buildings increased 150%, cost of steel increased 215%, face brick 200%, common labor 330%, and skilled labor 220%.

The economy in school buildings can be attributed to the careful planning of school board members, school officials at both the State and local levels, architects, engineers, and in many cases to local fiscal authorities. Realizing that the present and future needs for school buildings are enormous, they have planned together by looking carefully at the kind of space and equipment needed for effective teaching and learning. This cooperative planning has resulted, for the most part, in buildings constructed at reasonable costs which meet the essential needs of the educational program.

The question now is—how can we get *even more* for the school building dollar; or, as I would like to rephrase it—how can we get *more per dollar* out of *more* school building dollars? It should be pointed out also that we are not merely concerned with what it costs to construct a school building, but we are also concerned with its life span and what it costs to maintain and operate it throughout its useful life. And, it is not only what we *put into* a building that counts, but it is also what we *get out of it*. No matter how low the cost of a school building, if it does not serve its educational purpose as a functional facility, its cost will be excessive.

School administrators are seeking ways to reduce school plant costs, and some of them feel that substantial savings may be made by reducing the *cost of construction.* It is desirable to build school plants in an economical manner. However, all of the economy cannot come in construction. Many construction economies have been effected, and we may be approaching a minimum construction standard consistent with safety, function, and long-range economy. Studies of construction economies should be continued; but, at the same time, studies should be made of other factors in school plant costs. It is with these other factors that county commissioners, in their official capacities and as leaders in the community, have the greatest opportunities to contribute to substantial savings in the costs of providing school facilities.

The following methods of effecting school building economies are suggested:

1 *Reduce the number of school districts*

Even though we have reduced the number of school districts in this country from approximately 63,000 in 1953-54 to about 40,000 now, we still have many small school districts. The Committee for Economic Development, in its publication *Paying for Better Schools,* recommends a further reduction to approximately 10,000.

During the school year 1956-57 more than 90% of the public school systems in the United States enrolled fewer than 1,200 pupils, and approximately 58% enrolled fewer than fifty students.

In any combining of districts, officials should make sure that all schools are brought up to a level equal to that of the best schools, or even higher. Merger of school districts cannot be justified on the basis of a leveling-out process that improves the quality of education for some children and impairs it for others.

The merging of school districts should result in the following benefits:

- improved educational opportunities for a large part of the student population
- a broader and more nearly equalized base for financial support
- reduced administrative costs in many districts. *Note:* very likely, costs will not be reduced by combining large districts as the administrative staff required after merging will probably be as large as the total of the districts before they were merged
- simplified long-range planning—particularly along the fringe areas of a growing city
- improved plant maintenance. Since fewer maintenance men will be needed for a large school than for several small schools, the combining of schools will make money available to employ men skilled in plumbing, heating, electrical, painting, and other trades
- simplified and economical transportation of pupils. In numerous districts the school bus passes by a school in one district as it takes pupils to a school in another district, the one in which they live. This is costly not only in money but in time
- reduced cost of providing new school facilities
- reduced costs of operating school buildings.

2 *Reduce the number of small schools*

All recent significant studies have indicated that large schools can offer better educational programs at a more reasonable cost than small ones. This is particularly true of secondary schools.

The greatest value to be gained from carrying out this suggestion is the improved educational opportunities to boys and girls. Even though the small high school has a greater cost per pupil than the larger one, it is pretty much limited to offering college preparatory work, whereas the large high school has the potential of doing a better job of college preparatory and of preparing the large percentage of the high school graduates who do not go to college. A secondary value, but an important one, is the savings in capital outlay and in operating costs.

In consolidating schools, officials must exercise mature judgment to keep such mergers within practical limits. If geographical or other conditions make it necessary to maintain a small school, district officials should make a determined effort to enable it to offer the best possible opportunities to the pupils who attend it. Such a situation illustrates again the importance of having a broad base for financial support of the schools.

3 *Plan the organization of the schools and the building program to provide for future needs*

An outstanding educational consultant recently said, "The time to do a survey is when you think you don't need it." His statement illustrates the importance of having a definite plan prepared before you are confronted with the necessity of taking action.

Long-range plans should be reviewed frequently and modified to take into account changes in conditions which were not foreseen in the original planning. Buildings should not be constructed that will not be needed when the long-range plans have been realized. More money has probably been spent on buildings that should not have been constructed or were built larger than necessary than on so-called frills.

4 *Secure sites in areas of predicted population growth well in advance of the actual need for the building*

Selection of proper sites will be possible if an adequate job of long-range planning is done. After an area has developed, school sites are expensive and often difficult to secure without going through condemnation proceedings.

5 *Make the school part of a correlated community plan in order to get maximum usage from such facilities as auditoriums, libraries, gymnasiums, playgrounds, and shops*

Careful advance planning should be done by all interested parties in order that the scheduling of non-school activities will not interfere with school functions and in order to determine what portion of the total cost should be charged to the school.

6 *Avoid the use of stock plans*

The planning of each school building project is a different problem. Orientations are different; site topographies and shapes are different; access roads and streets are different; the availability and location of utilities are different. Most important, a school building should be designed to accommodate the educational program a particular community has determined it needs and wants. The building should also be a source of pride to the community.

The use of stock plans makes it next to impossible to properly utilize newly developed building materials and techniques. Adequate inspection of a building while it is under construction is of vital importance, and it should be inspected by the individual or firm who was responsible for its design. This would be impractical if stock plans were used.

7 *Choose professional help with care*

This applies to educational consultants, architects, engineers, and legal counsel. Complete plans and specifications which are easily understood usually result in more favorable bids. Adequate and thorough contract documents will reduce the inevitable change orders and extras.

8 *Seek standardization of component parts*

Savings can be realized from modular designs of recurring units. Avoid the necessity insofar as possible of having special fabrication work done in the field.

9 *Use materials obtainable near the project*

When practical, plan for the use of materials obtainable near the location of the project. The availability of craftsmen experienced in the installation of selected materials will have a bearing on the cost.

10 *Keep mechanical equipment in line with needs*

It appears that this is an area in which more money than necessary has been spent on school buildings during the past several years. Elaborate control systems are costly in the initial stage and expensive to maintain.

11 *Construct buildings of such quality that insurance, maintenance, operation, and replacement costs will be low*

A building of poor quality will be expensive to insure and to maintain, and the useful life of the building will be decreased. If it does not adequately accommodate the instructional program the cost of instruction will be increased, and the quality of the educational program will be diminished.

12 *Develop an adequate maintenance program*

Students can learn better and teachers can do a better job of teaching in an attractive, well-maintained environment. Good maintenance helps keep a healthful and pleasant environment for more productive learning and saves money in extending the time before major repairs or replacements must be made. It is foolish to build a million-dollar building and give it five-and ten-cent care.

A maintenance program, adequately staffed and equipped, should be developed and the jobs to be done regularly scheduled. Ample allowance should be made for emergency maintenance.

13 *Take bids at a favorable time*

The most favorable time to take bids depends upon several things. The location of the school, the number and size of competing projects, seasonal factors, and the general economic conditions all have their effects on costs. Timing of bid requests may be responsible for as great savings as any other economy measure.

14 *Schedule for full utilization of the building*

Colleges and universities in particular have been subject to recent criticism because it has been reported that their facilities were not fully utilized. Perhaps to a lesser extent, the same might be said of some of our secondary plants. Full utilization may mean rescheduling to the end that each teaching space is used throughout the school day. It may mean an extended school year which many of our secondary schools already have in the form of summer sessions. In any event, the extent to which our present facilities and those being planned are and will be utilized should be carefully studied. This is an area in which there could well be some carefully planned experimentation.

15 *Finance, within means, on a pay-as-you-go basis*

A long-range plan of financing needed school facilities should be developed. It may be necessary, particularly to take care of the backlog of school building needs, to receive the funds required through the sale of bonds. It would seem wise to finance school building needs resulting from population growth from annual capital outlay levies.

In counties of low valuation, a capital outlay levy at a reasonable rate would not produce sufficient funds in any one year to construct a building of any size. In such cases, a capital reserve fund, which could not be used for other purposes, should be accumulated until it is of sufficient size to do an adequate job of constructing a needed school facility.

16 *Watch the bond market for a favorable time to sell bonds*

Selling bonds at a reduction in rate of even one-half percent will make a very substantial difference in the total cost over the period of time for which the bonds are issued.

17 *Whenever possible, have school facilities ready when they are needed*

Increase in the cost of construction has averaged from 2 to 3% per year over the past several years.

Conclusion:

Rapid advances in the development of new building materials and techniques and in improved design during the next few years will enable us to get better school plants for the money we invest. It is doubtful, however, that we can make any substantial savings in the cost of constructing a school building. Improvements will be made in teaching techniques and in instructional aids, but it is unlikely that we can reduce the cost of instruction. There is one thing we can do with better facilities and better techniques: We can improve the quality of education.

Charles F Carroll, State Superintendent of Public Instruction in North Carolina, has very appropriately said: "The heaviest and most burdensome tax we can pay is the tax on ignorance." We cannot afford ignorance. We *can* afford education.

SCHOOL BUILDING COSTS

From a talk given at the Spring 1957 meeting of the Ohio School Business Officials Association by E. W. Dykes, AIA*

We are all aware that unprecedented sums are now being spent for school building construction. Since almost all such buildings are financed from public money, it is inevitable that controversy over construction costs will arise. Mountains of misinformation are available on the subject. I think I can show the error of some of this talk by throwing certain items of controversy into their proper perspective.

First, let's look at some of the most popular methods of measuring school building construction costs:

- **cost per student**
- **cost per classroom**
- **cost per cubic foot**
- **cost per square foot**

UNITS OF MEASURE

The *cost per student* unit reflects not only structural costs but educational program costs as well. Its usefulness is restricted, however, because the layman is generally unaware of these distinctions. Used in conjunction with cost per square foot, the per student unit indicates rather clearly differences in program. Cost per student can be used only for complete buildings, as additions rarely include a complete complement of all necessary rooms.

The *cost per classroom* unit is the most widely misunderstood of all the units. It is confusing because the other three are used in connection with actual costs per unit of measurement while the classroom cost reflects also the costs of corridors, boiler rooms, cafeterias and other rooms essential for a complete educational program. Obviously, the unit means absolutely nothing unless one knows what the other rooms are in a particular building under discussion.

I have seen a simple classroom addition compared with the national average on classrooms. This simple addition did not include the costs of other rooms so the figures were favorable. An interested taxpayer upon reading these statistics would rush to excoriate his own school board who then turns to the architect and so on down the line until the thing is settled. Since it is not feasible to include an explanation each time the classroom unit of measure is used, this measure is next to meaningless.

Cost per cubic foot has long been one of the popular units of measure in building costs. It is far enough off the mark that I suggest its use be limited to a controlled body. For example, if the height of an 8′ high room were increased to 10′, 20% would be added to the cubage but perhaps less than 5% to the cost. Unless the use of the room demanded the increased height, very little would be added to the usefulness. Total construction bill would be up but cubage cost would be down. An architect who sticks close to minimum heights in order to cut costs comes up with higher costs per cubic foot than an architect who pays no particular attention to the lower ceilings. To compare costs on a cubage basis would be unfair.

The *cost per square foot of usable space* method gives a good indication of the size of a building, whereas cubage does not. However, it does have serious shortcomings. A room 20′ x 30′ containing 600 square feet costs so much per square foot to build. If this room were divided into two rooms by a wall down the middle, the square area is the same but the cost goes up. Divide it again —again the cost rises without changing the area.

A few years ago in our office we had a building in which the square foot cost was quite high. It baffled us until closer examination showed a very high ratio of wall areas to total areas. We devised another form of estimating which we have found to be more accurate—*the cubic foot of wall* method. We squeeze all the air out of the building and get a unit price for the unit volume of material in it. This method is unworthy of widespread use because it would require a lot of explaining to get everyone to measure in just the same way.

This business of measuring, incidentally, also causes difficulty in comparing jobs measured by different people.

I do not place a lot of faith in any method of measurement. Yet we all must have one to guide us as we design our buildings. In our office we have settled on cost per

WE'VE LICKED WINTER CONSTRUCTION.

Cartoons by Thomas Hutchens. Mr. Hutchens was also the cartoonist for the AIA film "A School for Johnny."

* Mr. Dykes is a partner in the firm of Lawrence, Dykes and Associates of Canton, Ohio.

square foot method and use cubic foot of wall method as a check. From this discussion we can conclude that unless you really know what is being measured in a building, the unit methods of comparing cost are unreliable.

OUTSIDE INFLUENCES

Comparisons of building costs from different areas are of little real value, since local competition, taxes and labor conditions affect prices greatly.

Competition may increase costs as much as 10%. When there are more contractors than construction, contractors sometimes take a building at just a little bit over cost to hold their crew together and to cover regular overhead costs.

Also, since winter is a poor time for building, many contractors cut costs so they can get a job at the start of the new season. Some builders introduce innovations in material handling and cut their office overhead, so they can afford to be the successful bidder.

Although school administrators are interested in the lowest school costs possible, they should also be interested in the contractor making a profit on the job. Then they can be more particular about finishes and correction of little defects in the building than if the contractor is working on a very close margin.

High local taxation is likely to affect bids. Federal taxes account for about 25% of school costs, but they are uniform throughout the country.

Restrictive labor practices can have a strong affect on costs. The superintendent of a New York suburban school told me about having movable partitions put up in his office. The workmen, who lived in the metropolitan area, arrived on the job about 10 or 10:30 and put their tools away at 2:30. They charged a full day's work on the basis of portal-to-portal pay! To some extent such practices happen in all organized areas throughout the country. It is a situation which is difficult to alleviate; nevertheless, it must be dealt with.

METHODS OF SAVING

In Ohio, school buildings represent about 10 cents of the educational dollar; the balance is used for the educational program. So if we cut building costs 10% and in doing so add nothing to maintenance and operation, we gain nothing but a few more headaches and an unsatisfactory building. I'm not one to sneer at a 10% saving if it is real saving, but let's look at the various methods and see whether so-called savings are real savings after all. Some fall into the class of half-truth and the whole truth casts a different light.

The first money saving item to consider is a *master plan* for building construction. This means purchasing building sites well in advance of the time they will be needed, and preferably large enough to take care of expansion.

The *building levy* is a most remarkable way of saving money and should be considered by every area which has sufficient taxable property to make it feasible. Interest represents over 3% of the educational dollar. Why not eliminate it?

The *educational program* itself can cut costs. I would venture to say that 95% of the educational program can be carried on in the self-contained classrooms because classrooms are the heart of the program. I do not know what would happen if only the classrooms and a minimum of other facilities were built, but the tremendous difference in building costs cannot be overlooked. I do not necessarily recommend such a thing but I think it should be a matter of serious study for a community which finds itself underhoused and with low taxable values.

If the *size of rooms* were kept to a minimum, a definite saving would result. However, increase in cost is not directly proportional to increase in area. Some studies I have made indicate that a 20% increase in area using the same number of rooms results in an overall increase of 5% to 10%. Since education is the end result desired, the ratio of dollar per "ounce" of learning is better.

Complete plans and specifications are good insurance since they result in the lowest possible bids. If documents are complete and show all items to be constructed or included without weasel phrasing, the bidders will put in the figures exactly as they see them and adequate inspection will insure that the owner get precisely the building for which he is paying. This minimizes changes which cost more than if included originally.

Pre-planning of additions is another way of saving. It might even be well to pay the architect for the preliminary planning of a complete building although working drawings are ordered only for the part to be built immediately. The first structure will be somewhat more expensive because of heating plant and other facilities sized for the future building, but thousands of dollars will be saved when the addition is made. This is not only a saving but results in better planned school buildings.

Insurance rates may soon eat up whatever savings are made in construction. For example, exposed steel may increase the insurance premium. The architect should be instructed to check on any items which require more insurance and to figure how long it would take for the extra cost of insurance to overbalance the savings.

We claim there is little difference in cost between *one- and two-story buildings*. In our office two-story schools have average 3.2% less than one-story ones. My feeling is that the one-story buildings are educationally superior, and, as a taxpayer, I am willing to advocate their use despite the slightly higher cost. Stairways, which cost more than other space, are eliminated, and also the maintenance problem of washing second-story windows.

The *use of standard plans* is another way of saving that many school boards suggest. On identical sites and at the same period of time, use of a stock plan possibly would result in some savings. But an attempt to adapt a standard plan even slightly, often results in more cost than the architect's fee. Also, advances in school building design cease when such a plan is used.

"Shaving" materials is another

TABLE 1

Variations in School Building Construction Costs Resulting from Use of Materials of Different Quality

	Contract price	Cost per sq ft	Difference per sq ft $	Difference per sq ft %
Using best materials for good maintenance without regard to cost	$304,180	$13.46		
Actual cost	285,800	12.58	.88	6.5
Using lowest limit maintenance items	277,400	12.22	1.24	9.2
Using lowest limit maintenance items & omitting certain program items	259,488	11.42	2.04	15.2

popular method of saving. But some things must not be compromised. We believe that heating and ventilating systems must be of top design. Good seeing conditions are absolutely essential although the fixtures themselves may vary in quality. The walls, windows and roof must be able to withstand the elements. A bonded roof will sometimes leak long before the bond runs out!

Using the Charles M. Watson School in Massillon, Ohio, as a case study we see what savings can be made by downgrading materials and omitting certain program items. (tables 1 and 2) However, the desirability of these savings begins to fade when one considers the probable increase in maintenance cost and headaches, and the lack of proper teaching facilities.

It has been our experience over the years that no one specific item will save a great deal on building cost. It is the intelligent savings in a number of places and the pre-planning of buildings that save expense. Small savings in materials can result in higher maintenance operation and a limited educational program. Don't be penny wise and square-foot foolish.

TABLE 2

Decrease in Construction Costs Resulting from Substituting Materials and Omitting Certain Program Facilities

Proposed change	*Actual cost*	*Decrease in cost per square foot of building*	*Decrease in cost per square foot of material or unit*
Replace galvanized windows with painted steel	$ 450	$ .121	$.019
Omit painting of boiler room piping	75	.0036	——
Omit silicon waterproofing	450	.0685	.019
Omit Durowal reinforcing	650	——	.028
Use asphalt tile instead of terrazzo corridors	2,800	.80	.124
Use vinyl title instead of terrazzo corridors	650	.186	.028
Omit vacuum cleaning system for chalk trays	3,023	——	.133
Omit glazed tile in corridors	800	.70	.035
Omit glazing angles (76 lights)	152	2.00 (each)	.006
Omit 10 corridor tackboards	1,650	1.85	.073
Omit all wardrobes, teachers storage & sink cabinets	5,300	180.00 (each)	.232
Omit side coiling partition between cafeteria & gym	4,700	——	.207
Omit acoustic in classroom	250	.10	.011
Omit skydomes	3,000	300.00 (each)	.132
Omit metal shelving cabinets	3,000	300.00 (each)	.132
Omit painted window vents	112	2.80 (each)	.005

ECONOMY IN SCHOOL BUILDINGS

by Donald W Edmundson, AIA*

BILL CAUDILL in one talk on school building design, used as an illustration a camera tripod. One leg represented educational requirements & as various features of program were added, this leg was extended until finally it reached its full length. Next leg was quality of building. As various quality features were added, this leg was extended until it was all the way out. Third leg was cost. All too many times its extension is stopped by budget limitation, with result that leg is so short that tripod cannot stand. When this occurs, it is necessary either to find some means of extending budget leg or of reducing other two.

Problem of meeting budget is a very serious one & one which must be faced by architects & educators early in any planning program. Population increases are descending upon us like flood waters from a broken dam. Need for added classrooms & teachers almost staggers our understanding.

Little red school houses will do no longer. A bit of blackboard behind teacher's platform & tin cup hanging over water bucket have been replaced in modern classrooms by cabinets for storage of multitudinous supplies & corkboard for display of pupils' work has almost crowded out chalkboard. Running water, sinks, drinking fountains, floods of daylight, artificial light, controls, gadgets & more gadgets to control gadgets. Architect goes crazy trying to specify or invent them & custodian has nervous prostration trying to maintain them.

Nevertheless, all these things are upon us & appear to be necessary — at least to a degree. Together with rising costs of labor & material, they flow together to make a rising tide until they meet immovable barrier of limited budget. This budget is, in turn backed up by legal limitations as to bonded indebtedness & sometimes voters' unwillingness to add to already over-heavy tax burden.

If our needs are to be met, then, economy must dominate in all planning & building. This need for economy extends into every community from smallest & poorest district in back corner of state to largest cities. While I have not heard of any other districts pressed to frugality of one New Mexico district that is trying to find ways to make dirt floors usable, economy is watched very carefully even in cities where use of more expensive materials is often rightly justified by reduced maintenance costs during life of building.

We should distinguish between economy & cheapness. Webster defines *economy* as "thrifty" administration — often from retrenchment in expenditures — "strict husbanding of resources." Another meaning more pointed toward our problem is "management or ordering of parts, functions, etc, in an organic & organized system."

Cheapness, on other hand, refers to low cost &, many times, low worth or value. Since we are considering buildings that are designed for 40- or 50-year life & which will in many cases, no doubt, be used for much longer than this, we dare not lose sight of costs over long haul as well as initial expenditure.

Research & publications committee of National Council on School House Construction has published a study on *Principles of economy in school plant planning & construction.* Two definitions are quoted which I should like to requote. First is from New York State Commission on School Buildings, as follows: "Economy, as applied to school house construction implies wise & carefully managed expenditure of school funds in providing facilities which are adequate in terms of needs of educational program at most reasonable cost." A word of caution is added in NCSHC booklet about low initial costs & it is pointed out that cheapest possible first cost is not always true indication of economy. They also note that "any curtailment that handicaps educational program or reduces efficiency should be classed as false economy."

Other quotation is from American Association of School Administrators — from their book *American School Buildings* — as follows: "True economy is a complex relationship between original cost, educational utility, efficiency, maintenance & operation expense."

programming:

Design of educational program is not within scope of this presentation — we would simply like to emphasize that program must be realistic. Architect is not a magician & contractor is not a philanthropist — at least not by intention. If major leg-shortening is necessary to make tripod stand, some of excess may have to be sawed off program leg as well as quality leg.

Educator knows how many children he will have to educate, he knows courses that must be taught, number of teachers that will be required & general character of program that will be carried on. Together with architect he can determine type of environment desired for students. Social & economic status of community must also be taken into consideration.

* *member AIA national Committee on School Buildings representing NW region*

It is not intended to draw a hard line of distinction at this point, but rather an indication of responsibilities. A wise architect can be of great assistance in many phases of programming.

concealed costs of bad timing:

It is generally possible to forecast school plant needs for several years in advance. Budget needs too can be, generally, forecast with reasonable accuracy. Yet, many times, reluctance to face realities or hesitancy to present them to voters all too often delays prog ıs until there is insufficient time for proper study & planning processes.

By limiting his time, you may prevent architect from giving problem adequate study, you may make it impossible for him to produce most economical plan, he may be prevented from preparing complete & carefully detailed drawings that enable contractor to give lowest possible bid. Lack of time may mean that old details & plans may be warmed over & accommodated to your site & program, possibly at a saving to architect but with decrease in efficiency of finished plant. On other hand, increase in bids caused by enforced lack of completeness, increases architect's fee. Don't expect him to do it for less when working under forced draft, because wear & tear can be terrific & overtime & its accompanying inefficiencies may far offset any gain. Main point is that it costs you money whether it goes in pocket of architect, draftsmen, or builder or suppliers & craftsmen on job.

As to desirability of results & savings from longer & more careful planning there can be no question.

time of bidding:

Another matter of timing which may be more intangible but nevertheless has important bearing on costs, is time of bidding. Best time is when there is no other work being bid, no work going on & everyone is anxiously looking for a job. Obviously such a time cannot always be found. In fact, such an idealistic time can seldom be found.

For more realistic answer, analysis of work under construction should be made & if possible a season of year should be selected in which contractors & subcontractors are finishing up work at hand & are becoming interested in the next job.

During early months of year (in NW) major construction is more likely to be in finishing stages & members of building industry are anxious to line up work for coming season. On other hand, we have had good results in fall bidding where contractors are anxious to find work to keep key personnel busy during winter months. Even though weather may not permit maximum productivity they are better off to have key personnel producing at half speed than to carry them on non-productive payroll or run risk of losing them.

Even if it is impossible to set date ahead careful consideration of actual day of bidding may have effect on cost of building. If several large jobs are being bid about same time, it behooves architect to check with fellow practitioners to avoid several major jobs being bid at same day or even, as sometimes has happened, two at same hour. Many times a contractor may wish to bid both jobs but conflict makes it extremely difficult if not impossible for him to assemble his figures. Last few hours in a contractor's office before time of bid opening are apt to be very hectic. Phones are ringing constantly with subs trying to get figures in & estimator is taxed to utmost to compile his figures with lowest bid on each item & totals properly made.

If two jobs are bid at approximately same time contractor will often be forced to choose between them because it is physically impossible for him to bid both. This, of course, means less bidders on both jobs & man who does not bid might have been low bidder. Thus, if days for bidding can be reasonably scattered, often appreciable savings can be realized.

Sufficient time should be allowed contractor for compiling of bid — from 3 to 4 weeks depending on size & complexity of jobs.

time of completion:

Time allowed for construction process can also have its bearing on cost if a job must be unduly rushed or if completion schedule forces contractor to carry on during bad weather with inevitable lowering of efficiency — which must be given consideration in bid. A wise contractor will, of course, push a job to completion as rapidly as possible & thus cut down on overhead, investment in equipment & interest lost on retainer-fees. I have actually known of contractors that added several thousand dollars to their figures because they felt time schedule was unrealistic &, being backed by a liquidated damage clause, it might add to their cost.

Because these matters of timing can add up to many thousands of dollars & yet cost school district nothing in quality or adequacy of facilities it seems strange that more consideration has not been given to their importance.

multi-use of space:

Another phase of planning from which economies may stem is in multiple use of space. This again ties in very closely with programming & it is not for architect to have final say as to what uses may be overlapped into what spaces. There are many combinations (with which we are all familiar) which have been tried with varied degrees of success. Use of one space for more than one purpose immediately implies compromise & compromises are seldom completely satisfactory.

Again quoting from New York State Commission on School Building *Economy handbook* — rooms should be designed for multiple use ". . . when functions to be served (1) will not cause serious conflict in scheduling of needed facilities, (2) will allow adequate time for each function in school & (3) require physical facilities somewhat similar in dimensions & nature."

Any contrivance that makes for utilization for all parts of school-day is a step toward economy. Corridors, often ¼ area of entire school plant, may be completely unused for many hours. It is true that corridors are necessary for circulation, & most high schools have for many years used corridor areas for lockers, but there are still many hours when there is no use made of them.

Perkins & Will in their highschool at Keokuk, Iowa, & when associated with Caudill, Rowlett & Scott in Norman Oklahoma highschool, have progressed toward making these areas valuable as social space.

A new junior high school at Bryan Texas by Caudill, Rowlett & Scott reduces separation between classrooms & corridors in such manner as to make corridor-space act as part of classroom.

area planning:

• **shape:** Another consideration which can have definite effect on cost of building is general planning & arrangement. This is not intended to be an argument in favor of single- or double-loaded corridors, finger plans, cluster plans or compact plans, but will merely attempt to indicate that some of these things affect cost.

Another axiom for planners might be stated — "if you want to cut corners on cost eliminate corners on plans." Outside wall costs more than inside partitions. Stairways cost more than corridor. There is saving in area & outside wall by compact plan arrangement. Savings may be offset by additional cost of getting adequate light to inside portions of classroom.

• **height:** AIA Committee on School Buildings has recently published a *school plant study* on lower classroom ceilings. This leaflet indicates that ceilings as low as 7′ 8″ have been used successfully. Ceilings of 12′ & 14′ were designed primarily to permit light (falling at its legally-ordained angle of 45°!) to penetrate inner reaches of 24′ rooms & secondly to provide a large volume above pupils' heads for storage of contaminated air! With today's techniques for getting natural light & artificial light into every part of room & with forced ventilation systems — reduction in old-fashioned concept of high ceilings is certainly worthy of consideration. Saving in wall height & volume of air to be heated will certainly contribute saving in building & operating costs.

• **flexibility:** To make a plan as flexible as possible may or may not create savings in initial cost. In any event it should provide an overall economy. Use of movable storage cabinets & space-dividers may create very real economy in space utilization.

Again quoting from NCSHC treatise on economy: "a school house that is so designed & constructed that it is next to impossible to alter or rearrange classroom space shackles educational program. This is false economy regardless of how low initial cost of building may have been."

design technique:

So much for planning process — now let us consider design techniques that affect economy of school buildings. How are we going to enclose our space? What materials are we going to use for floors, walls, ceilings & roofs? What will be our system of support for these materials? Is there any economy in a multi-story building over a 1-story structure or does economy lie in direction of a spread-out campus plan?

There are many factors with bearing upon answers to these questions. Availability of materials in an area & proximity of craftsmen experienced in their installation may produce many different answers to same question. Local weather conditions may have bearing not only on durability & acceptance of some material & types of construction but may affect installation of materials.

In Portland Oregon area plaster is one of cheapest materials we can use for interior wall finish & it can be applied any time during year.

Cost of artificial heating & drying is relatively small. On other hand in a remote area, hundreds of miles from nearest plasterer, cost of transportation & subsistence will make cost of plaster much greater. Areas with freezing nights in July necessitate operation of heating plants — which again runs up cost.

Type of construction & combustibility of materials has direct bearing on insurance rate of a building & again is a phase of planning that sometimes becomes very mysterious & has often been ignored. Insurance rates are set by rating bureaus which observe rules — which sometimes seem to be fearfully & wonderfully made. Sometimes changing material in an outside wall or fireproofing of apparently unimportant lintels will make considerable difference in insurance cost of entire structure.

A small frame addition to a fire-resistant structure will have detrimental effect on insurance rating of entire building.

floors:

If ground is level & reasonably dry, cheapest floor construction is probably a concrete slab poured directly on ground & covered with asphalt tile. An irregular piece of ground or moisture conditions may necessitate slab being reinforced & supported above ground — perhaps, use of wood-joist construction may be indicated.

While slab-on-ground may appear to be very simple, many times required pipe trenches for heat pipes & ducts add costs which rob design of economy. In recent years materials have been developed whereby heat pipes can be carried in insulated sheaths outside of building area to avoid some cost of trenching. However, if frost-line is 30" or more down, widening of foundation wall excavation may make construction of pipe-trench a simple matter, Here again, locality & weather conditions have a bearing even on cost of floors.

walls:

Our office recently made comparative cost analysis of several types of exterior wall construction. These were analyzed on basis of initial cost, probable maintenance costs & cost of fuel to offset heat loss. Final analysis compared all walls on their costs over a 20-year period. Result indicated that some walls with low initial cost lost some of their economy when costs of repeated maintenance & cost of pumping heat thru them were taken into account.

partitions:

Most usual construction of wood partitions is frame with dry wall or plaster finish. In Portland area we are finding that steel studs with gypsum lath & plaster are in about same bracket as wood frame wall. I am told that an elementary school addition with tilt-up concrete walls between each classroom has worked out quite economically. These walls should certainly provide good sound barriers between rooms & should be acme of indestructibility. They do, however, seem to be inflexible in case changes should be desired.

In last year's issue of *American School & University*, Bill Caudill had a report on what he calls *space-dividers*. He has made wide use of panels of chalkboard, corkboard, pegboard & plywood extending from floor to rather low ceiling. These serve not only as dividers but are useful for display. Movable cabinets have been widely used as space-dividers. These devices all would appear to have commendable features.

Our own cost analyses have always indicated that where low cost is mandatory, a straight framed partition, which a carpenter understands, is still cheapest. Chalkboards & tackboards may then be mounted in more limited areas & at less cost than full-height materials proposed for space-dividers.

windows:

Comparative costs of wood sash vs steel sash vs aluminum should be weighed very carefully. In some cases glass can be stopped into rabbets in structural members & windows constructed very simply. On other hand if number one workmanship is required this may make millwork out of what otherwise would be framing.

There are many designs of aluminum windows that can be installed for not too much more than wood or metal sash. This eliminates painting but if sash section is too light or window too large other problems may be introduced which again bring costs up.

Everyone is now becoming window-wall or curtain-wall conscious. Practically every manufacturer of sash is coming out with a window-wall. This generally consists of sash extending from floor to ceiling glazed with glass where light is desired & with some sort of opaque & heat-resistant material up to window-sill height. This material may be structural glass with baked-on enamel finish or it may be a porcelain enamel metal or anodized aluminum. This may be backed with varying combinations of insulating & fireproofing materials. Integral mullions may even be strong enough to carry roof loads.

At present time most of these window-wall systems are no cheaper than more conventional types of construction. However, race has just begun. It certainly seems it should be cheaper to manufacture a panel such as this in a factory & assemble it in one piece than to construct a wall of concrete, face it with brick & set sash in an opening.

roof framing:

Oregon is a lumber-producing country & roof framing systems making use of this readily available material have always been popular & inexpensive. Sometimes our "pond-dried" materials create shrinkage problems but on whole we have learned to get along very well with lumber.

In days of 24' classroom, heavy joists could be made to span this distance.

By time we had this type of construction refined, educators began clamoring for larger & more nearly square classrooms. We than had to put our stock roof plans back on shelf & begin searching for new & economical ways of supporting roofs over these longer spans. Steel trusses, glu-lam beams, steel joists, long-span joists are all being used & new systems are appearing every day. Pre-stressed concrete beams for instance have been found to be competitive with glu-lam wood construction.

In south, where lumber is more expensive, 1-story school buildings have been economically built in reinforced concrete with roof slabs erected on steel columns by lift-slab method. Lift-slab design has an important application in multi-story construction. In northwest we have not found any way to make it competitive with wood framing for 1-story buildings.

Rigid-frame steel bents are popular in places where lumber is not too plentiful. In this system posts & roof frames are welded together in integral units that support horizontal & earthquake stresses as well as vertical loads. These bents are erected to form a self-supporting frame, roof is built on top & walls & partitions are set under roof between structural bents.

multi-story vs 1-story:

While most of us are convinced that elementary schools should be limited to maximum of 500 pupils & built on one floor, there are cases where a multi-story building should be considered for secondary schools. This would be true where site is limited, where very large student body must be accommodated & it might be appropriate where site is of such irregularity that it does not lend itself to a spread-out building. There are many such factors, perhaps more educational than architectural. In a multi-story building there will be added costs for stairways & corridors to give access to stairs, & in all probability multi-story building must be of fire-proofed construction. Savings are realized thru reduced roof area & some savings in heat-loss because of more compact building. If school is large there may be considerable savings in distances traveled by students & administration.

mechanical equipment:

In rural schools of not too long ago, entire mechanical system consisted of shielded stove in one corner & pump on porch. Urban schools had inside plumbing & central heating. Heating controls consisted of teacher sending a note to janitor which sometimes resulted in janitor putting more wood on fire, or was sometimes simply ignored with a few mumbled remarks not intended to be carried back to teacher.

An extravagance forced upon us by regulation is excessive number of plumbing fixtures required by state departments.

We now find plumbing & heating costs accounting for 16-24% of total cost of construction with electrical contracts running from 5-10%. These mechanical devices, without which our schools would not be considered modern, are comprising from 1/4 to 1/3 of total cost of our buildings.

While some of this no doubt adds to comfort & health of our school children, it all has added to cost of our school buildings.

I am told that a school was recently constructed where a limited budget forced architect to employ very novel & almost unheard-of device of hand-controlled valves for regulation of heat in each room & where teachers open windows for ventilation. Custodian has to turn on oil burner in morning. We are told that system is working quite admirably with only minor complaints about added work & responsibility. While it might be quite dreadful to contemplate, we may find such expedients with increasing regularity.

site:

A growing school district with any kind of population forecast would do well to buy & hold sites in a developing area. Not only will it be possible to select them with greater degree of freedom, but property will probably cost less than after development has started. In selecting a site it is important to consider availability of utilities. In determing cost of a school site cost of development should also be considered. Low initial outlay may be overshadowed by necessity of extensive roadway, water system or sewage disposal system. Soil conditions that make good farm or pasture lands may create foundation & drainage problems. Contours & their effect on building & development of playgrounds should also be considered.

conclusion:

There are no known ways of making huge savings in construction. Real economies can be realized only by careful consideration of all possibilities — by chipping here a little, there a little, juggling, compacting areas & facilities, overlapping here & there, mixing imagination with good judgment.

With best effort this still may not be enough & something must then be done to one of other legs of tripod.

Many of you will probably remember, during early days of automobile there were innumerable gas-saving devices offered to car owners. One motorist had so many devices, each guaranteed to save 20% of his gasoline, that he had to stop every 25 miles & drain excess of his gasoline tank. If anyone should find any way of accomplishing this in school construction I would certainly appreciate it if you would let me know how you're doing it.

ONE MORE ROUND IN THE SCHOOL COST BATTLE

by Landis Gores, AIA

EVEN back in pre-satellite days, educational costs in the US were a subject that bubbled and frothed like a seething caldron; and a series of forays into the field last summer by some very popular journalists for pages of possibly too popular publications can only be agreed to have occasioned some thoroughly noisy explosions which were curiously devoid of significance. Certainly the serious and reasonable rebuttals which appeared in our major architectural magazines are to be welcomed for returning the discussion to facts and figures and chapters and verses—and among other things to pointing out the minuscule role of the architect in causation of school costs. And yet to this one interested spectator—no participant, being an architect who has yet to be commissioned with the five schools it is necessary to show to one's credit before he can hope to be entrusted with his first one, yet not really an 'educator' either, having not once been within the gates of a normal school or teachers' college—to this one the temptation is irresistible to say that we have been thus far fencing around with what may well be the really central issue in the question of educational building costs. And so, like a fool, he rushes in where experts fear to tread—although, be it said to their credit, they do not deny the need. School Consulant Nickolaus L Engelhardt, Jr, in *Architectural Forum,* November 1957, says one "all-important item still escapes these simple end-figures . . . the *quality* of the educational program."

A VALUE CRITERION

Here, at last, is the subject which should enlist, if it has not already, the attention of every citizen—we are all in it together. The late John Knox Shear touched on this aspect also in *Architectural Record,* October 1957: "At the outset, the very value placed on education differs widely. Where books are revered, libraries will be bigger, and where basketball, gymnasiums." It is a matter which has long fascinated this critic, has impelled him through countless publications and investigations in search of such a quality, or value, criterion. Having found none ready-made, he has therefore constructed, and proposes here to set down, his own suggested tabulations for assessing school building programs in terms of educational quality. These figures are certainly not correct, for they are inescapably subjective but so are all value judgments. If they can only serve as whipping posts, that others may stand up and express differing value judgments in opposition to them, they will have served a signal purpose in redirecting attention for the lion's share of cost responsibility from the architect to the essential owner, the board of education and the taxpayer-voter.

How are educational costs assessed, in terms of educational values? There is, in fact, a sort of Basic Field Manual on the subject, the *Biennial Survey of Education in the US,* issued by the US Office of Education, eg 1948-50, ed 1953—unfortunately its accounting breakdown, while classical for bookkeepers, will have nothing to do with volatile conceptions like educational values. The categories are:

administration
instruction
operation
maintenance
auxiliary services
fixed charges

The briefest of study establishes that items 2 and 3 both include costs connected with every conceivable feature of the educational program and, without any further attempt at distinction, clearly some more incisive, more significant, more subjective criteria are required for value judgments.

The field, from here on, is open. It is vast, only slightly contoured. But it is not entirely without signposts—Mr. Shear's quoted sentence points us a way. Other arrows in same direction are to be seen day after day, in editorial pages in news and opinion magazines, in reports of words and thinking of many serious men. Arthur Bestor, Professor of History at the University of Illinois, suggests the following series of educational priorities:

1. standard instruction in basic intellectual disciplines
2. special programs for superior students
3. remedial programs
4. intramural athletic & physical fitness programs
5. vocational training in special skills
6. extracurricular activities
7. scholarship funds for able students in need
8. custodial and life-adjustment programs
9. interscholastic athletics

Once priorities have been proposed in the race for the educational dollar, explanations are clearly in order, especially for those categories at the bottom of any man's list. Assuming 1-4 to be self-explanatory, one must limit 5 to technical vocational training, machine tool and metal fabricating, carpenter and cabinetwork training, etc, in urban areas, agriculture and livestock in rural areas, to avoid confusion with 8. Category 6 includes such formative but ancillary activities as student publications, student government, student clubs with various worthy interests, prom, student welcome and other broadly social committees. Category 7 involves recognition of need for educational funds, in default of more normal sources, for very gifted students of depressed economic background who require more than tuition aid to keep them in school past the statutory minimum age. Category 8 is the great grab-basket—not only cooking and sewing and 'general business,' but a multitude of mundane activities which already have been seen to demand a greater share of the edu-

"The Restoration of Learning," NY 1955

cational dollar, both school plant and instructional, then all of 1-3:

consumer education: how to shop smartly
how to make a family budget
how to look at movies, or TV, or whatever
how to be popular at parties and dances
baby care and training
child psychology
elementary sociology and civics
elementary hygiene
sex education
driver training

Meanwhile, 9 includes not only actual athletic contests, but allied spectacularity such as band and chorus (not to be confused with the serious study of music), cheerleading, drum majoretting, etc . . . . Against anguished protests, let it be remembered none of these categories is of itself stigmatized. But since they all compete for the educational dollar, there must be priorities.

It will not be possible, in any case, to apply this scale of priorities for the general educational dollar directly to school building co... But, adapted very respectfully from that scale, a new scale of priorities for a school building program emerges in outline, with alphabetic tabs this time and a numerical value rating:

A.	standard instruction in basic disciplines	10
B.	superior and remedial program facilities	9
C.	fine arts, etc, instruction and practice	7
D.	intramural athletics and physical fitness programs	5
E.	vocational training in special skills	4
F.	extra-curricular activities	3
G.	custodial and life-adjustment programs	2
H.	interscholastic athletics	1
J.	administration and basic functional spaces	3

A few explanations are in order again. Categories 2 and 3 have been combined into B since physical plant required is virtually indistinguishable. C (visual arts, architecture, music, drama, etc) is a new departure, a quirk of this observer's values, the product of his conviction that esthetic education is a very important component of the educational process. Categories D, E, and F are conceived as unchanged from 4-5-6. Category 7 drops out as inapplicable in a study of physical building programs. Categories 8 and 9 remain as G and H. But the addition of a new category seems also necessary: the inevitable functional elements which bear no more, it seems, on one facet of the educational program than on another, but which still must be housed, as efficiently as possible, yet at some cost —administration, cafeteria, walks, drives and parking, also health suites, hall lockers and storerooms. All these and more of this order are included in Category J. Finally, these tabulated priorities suggest a diversion already indicated in the table.

classrooms	80% A	10% B	10% G		91
kindergartens	80% A	10% B	10% G		91
science labs	90% A	10% B			99
general business & typing	100% G				20
home economics	100% G				20
art rooms	60% C	20% B	20% G		64
shop & farm buildings	60% E	40% G			32
band & chorus rooms	70% H	30% F			16
gymnasia	50% D	50% H			30
pool	70% D	30% H			38
study halls	80% A	20% G			84
general education labs	70% G	20% B	10% J		35
auditorium	40% G	30% C	20% F	10% B	44
music rooms	70% C	20% G	10% B		62
cafeteria	100% J				30
library	90% A	10% B			99
shower & locker rooms	60% D	40% H			34
administration & health suite	60% J	20% D	20% G		32
guidance & conference rooms	100% B				90
student organizations	100% F				30
teachers' lounges & offices	100% A				100
undifferentiated administration	(see comment bottom 2nd column p. 40)				40
paved & landscaped playspace	70% D	30% G			41
paved parking & roads	80% J	20% H			26
athletic fields	70% D	30% H			38
stadium, grandstands, rink	10% D	90% H			14
stage equipment	40% C	30% F	30% G		43
science equipment	80% A	20% B			98
cabinets & lockers	50% J	40% G	10% A		33
kitchen equipment	70% J	30% G			27

To resist ascribing point values in strict reverse order and to give a little extra weight where weight is due. Thus A and B stand slightly apart at the top of the list with 10 and 9—C with 7 is still quite a cut, and quite rightly, above the great group of activities neither intellectual nor academic which obtain valuations between 5 and 1. Meanwhile J is too basic to deserve banishment below the level of interscholastic "athletic" spectacles. After due consideration it is accorded a weight of 3, not so much because of any doubt of its necessity as because of a familiarity with its tendency to proliferate in classic conformity with Parkinson's Law.

The application of these thus established priorities to given physical spaces is speeded up by the examples of N. L. Engelhardt, Jr, in his excellent technical cost analysis in the *Forum* article cited earlier: his comprehensive lists of components, especially lists No. 1 and No. 5 may be transcribed almost directly to provide the bulk of the entries on the next tabulation. (See bottom p. 257) Once again a subjective judgment looms: Very few of the listed spaces are devoted to one and only one of the 9 categories of this last tabulation. And so each space must be considered separately, with probable extent of its allocation to one or more of the 9 fields of activity accounted for. It seems only fair to limit such an imprecise apportionment to 10%, among other reasons because it is thus possible to develop a total value index of all physical elements between 1 and 100 instead of one of 10 times that range. For example, an art room would tend to be used about 60% of the day for serious esthetic study, appreciation and practice by the general range of students, about 20% for special work either of a remedial nature for slow or difficult students or of an advanced nature for specially qualified students, and about 20% for socio-psychological adjustment projects in self-expression through permissive finger or spatter or wiggle-painting, cutting paper-and-paste abstractions or general 2- or 3- dimensional goldbricking. Arithmetically, 6C (tithing percentages allotted) plus 2 B plus 2 G equals 6 x 7 + 2 x 9 + 2 x 2 equals index 64 for art rooms. Meanwhile a science laboratory, which still presumably lends itself to nothing (may God preserve us) except serious study by every member for 90% of its day plus an extra 10% of double duty with advanced students, receives an index of 9 A plus 1 B equals 9 x 10 + 1 x 9 equals 99, or just about as close to occupational perfection as can be desired. [*Ed: these calculations presuppose highest possible utilization but may perhaps be applied to any general average utilization*]

Another's list, every other list, will differ from this one. But that is as it should be: only let every school board member or school building committee member sit down for the time required to place his own honest best evaluations on these tables, and this paper will have more than served its purpose. To return to a few more hotly disputable items of the last table—various athletic elements are apportioned between D and H from estimates of extent to which their size or equipment cost has been inflated for benefit of paying spectators rather than of participating students. In the hope that the auditorium may occasionally witness convocations of most all the student body for exposure to a truly outstanding person or institution, it has been accorded a minimal (10%) B component as acknowledgment of its superior program potentialities. As to the radical divergence of index values between study halls and general education laboratories, these result from an assumption that the pedagogic policy of the institution concerned is implicit in the terminology used: in a study hall one studies, in a general education laboratory one does apparently almost anything except study. Finally, in the table above there has been added to the basic Engelhardt breakdown a classification of undifferentiated administration, in view of frequent impossibility of determining, from plans under comparison, exact uses to which various component sub-areas of 'administration' are put—certain minor but high priority activities may also be involved, such as a clinical psychological guidance suite for determining needs of exceptional individuals or a teachers' retreat with privacy enough to justify the name. For the rest, no explanations, no apologies.

With this table complete, there remains only application to specific, to actual schools. While Engelhardt's breakdown clearly proposes, as does this paper, to be valid for primary as well as for secondary schools, markedly sharper divergences are sure to manifest themselves in studies of highschools where the galaxy of non-classroom spaces is so far more extensive. Accordingly, the next project at hand is to analyze, by these criteria, 4 of the 5 new highschools presented in detail in the *Architectural Record,* October 1957. The 5th school therein considered involves such a high proportion of future construction as to render it unsuitable to this study. At the start, be it noted that for speed and simplification all classrooms have been assumed at 750 sf (according to Engelhardt, no classroom no matter how large should hold more than 27 pupils—if a top limit is set on the number of pupils, a maximum room size would appear in order also, and comparison is made more apt in both particulars). All other construction areas are measured to include wall thickness where scale is sufficiently large. Areas developed but not built on are measured, then discounted, as follows: walks, landscaped courts and play areas, roads and paved parking areas divided by 30 on the assumption their cost will approximate $0.50 psf where building costs average $15 psf. Athletic fields are divided by 50 on a similar assumption. Laboratory, kitchen, stage equipment, etc, are likewise translated on a basis of 1 sf construction equivalence per $15 of equipment cost. To each area equivalent is applied the relevant index figure from the table—totals are then calculated, of basic area and of evaluated educational use area—resulting ratio is the index of the quality of the educational program embodied in building examined—QED.

classrooms	13,500 sf	91	1,225,000
science labs	5,600	99	554,400
commercial education	1,680	20	33,600
home economics	1,920	20	36,400
art rooms	1,920	64	122,700
shop	3,200	32	102,600
band room	1,200	16	19,200
gymnasia	7,500	30	225,000
auditorium	7,400	44	326,000
music rooms	750	62	46,500
cafeteria	4,400	30	132,000
library	3,600	99	356,400
showers & lockers	6,100	34	207,400
administration—undiff	4,200	40	168,000
paved & landscaped play	600 equiv	41	24,600
parking & roads	2,500 equiv	26	65,000
athletic fields	3,800 equiv	38	142,000
stage equipment	470 equiv	43	20,000
science equipment	1,300 equiv	98	127,000
cabinets & lockers	6,200 equiv	33	204,600
kitchen equipment	1,560 equiv	27	41,300
totals	79,400		4,176,700
EDUCATIONAL QUALITY INDICES:			
John Jay High School, Cross River, NY		4,176,700/79,400	52.6
Washington High School, Phoenix, Ariz		5,399,000/109,800	49.2
Horace Mann High School, Little Rock, Ark		3,835,100/66,845	57.5
Westwood High School, Westwood, Mass		3,604,200/66,950	53.9

AN EXAMPLE

One school suffices to demonstrate breakdown and calculations involved: the first of the 4 proposed, John Jay High School, in Cross River, NY, is at same time most fully documented in the *Record* article, and accordingly follows herewith:

It is to be noted that in each case above, completed form and maximum enrollment of school is considered, since several projects, in departure from their current operation, envisage substantial increases in numbers of classrooms while one plans no increase in classrooms but several substantial non-academic additions. To analyze from existing conditions would thus be clearly unfair. Also note that data on equipment costs are furnished in original text in unequal patches if at all. Such items are as a whole relatively small and not markedly below eventual final indices but in fairness to the school most completely tabulated (John Jay High School), its quality index will rise from 52.6 to 54.1 if its equipment costs be eliminated from consideration as is the case with most others. Finally, note that lowest-rated school of the 4 considered presents somewhat of a special case—it is only the heavy investment in vocational training areas, shop and farm both, far beyond that of any other school and presumably in response to a district plan or some such local pressure, that brings the index in this one case fractionally below 50.

The greatest interest, to this observer, lies in the relatively small divergence among the 4 widely separated schools studied. It would seem to indicate a considerable uniformity of opinion among superintendents, school boards or taxpayers, across the nation, about the type of educational facilities they wish to purchase with their building dollars. The fact that all 4 schools rate only in lower and middle 50s by the criteria is equally significant, though in a slightly different way. So long as the community has an undisputed sufficiency of dollars, surely it is free to expend them on all facets of the educational program whether they have a value rating of 1 to 10 in the table, provided only that funds are budgeted for higher value activities in advance of ones of lower priority. But in communities where school building funds are limited, or where intention is to secure as nearly as possible maximum educational value from the building dollar, it would be surprising if somehow a higher educational quality index could not be secured.

Two unidentified schools cited by N L Englehardt, Jr, in the *Forum*, November 1957, provide a case in point. Application of the space indices to these schools results in an educational quality index for School A, the austerity school, of 58 6—for School B, the luxury school, of 53.2 Here, for all its economy, School A, with only half the square footage of School B, both total and per pupil, receives an index only 1.1 above the highest of the 4 identified *Record*

classrooms (24)	18,000 sf	91	1,638,000
science labs	6,000	99	594,000
art rooms	2,000	64	128,000
shop	2,000	32	64,000
gymnasia	6,500	30	195,000
showers & lockers	2,500	34	87,500
auditorium	6,000	44	264,000
music rooms	2,000	62	124,000
cafeteria	4,000	30	120,000
library	2,500	99	247,500
study halls	2,000	84	168,000
administration—undiff	1,500	40	60,000
totals	55,000		3,690,000
educational quality index:		3,690,000/55,000	67.1

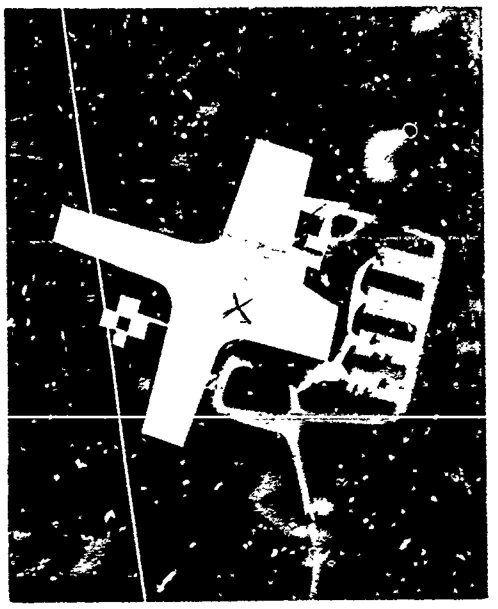
schools rated earlier. Many amenities of program have been sacrificed, and more than a few essentials of education have been seriously cramped or slighted. A smaller and cheaper school has been built, to be sure, but at a very real educational cost. And yet the cost, the sacrificing and slighting, are not inevitable. Some belt-tightening, perhaps, but not real cramping, if only the low-priority non-educational proclivities are closely watched and trimmed or excised wherever possible. A new, modest but well-rounded highschool can be formulated for the same 900 students as Schools A and B, with an increase in net area over the former of only 15%, but with restoration of all the really crucial features of the luxury version which were lacking in the economy model —auditorium separate from cafeteria, study halls separate from library, more and larger classrooms and science, art and music rooms, as in the breakdown above.

To raise quality index substantially above this 67.1 would appear to be a formidable work, entailing general revision of curriculum and of teaching emphasis sufficient to justify a revaluation of our space indices. This must be a consummation devoutly to be wished, in some quarters at least, with the withering away of the two lowest-priority elements —namely interscholastic athletic spectacles and permissive life-adjustment programs, almost every instructional space would rise in dignity, resulting in the altering of certain of the indices to read as follows:

classroom	98
art rooms	74
shops	40
gymnasia	40
study halls	93
auditorium	66
music rooms	74
showers and lockers	40

And as a consequence, the same physical spaces which were accorded a quality index of 67.1, would in this new school attain a quality index of 76.2.

If this be but a numbers game, let each man make the best of it. Of course these figures have been in many instances subjective, and vulnerable—the professional school planning expert is not so foolhardy as to risk his specialty on such will-o'-the-wisps and he, like Mr. Engelhardt, appraises with laudable lucidity site costs and administrative costs, construction costs and fees, correction factors for year and time of year and region and type of community, gross area and net area, character of structure and character of materials. And not for a moment is the importance of any of these hard factors to be denied or minimized. But there still remains that elusive, quintessential question of the real value of the educational program each building embodies—and so here is one tentative suggestion of how to go about the answer.



Budget for School Site Development

by **Robert F. White,** ASLA, Landscape Research Consultant

Texas Engineering Experiment Station

High School, Oscoda, Michigan. Architects: Eberle M. Smith, Associates. Intriguing model for a senior high school with a capacity of 1,320 students located on an eighty-acre site. Note ingenious use of simple materials defining site and facilities.

The atmosphere for learning is not confined to buildings alone. The relationships of buildings to their sites and of the sites to the community are vital for stimulation of a sense of belonging to an ordered society. This means a society in which learning is important not only for self preservation from man's destructiveness, but in which nature and her processes are to be contemplated for their life-giving attributes —to be made a part of education.

Since it is not possible to locate each school site in a pristine wilderness or, as a matter of fact to bring the pristine wilderness to the school building, what might be considered an intelligent approach to school site landscape development under present circumstances?

It is not the intent here to describe the process of site or planting design nor to suggest methods of planting or plant types, but rather to suggest the real values resulting from these and to indicate their costs. Professional services for these details are available to those interested. Because of the nature of the work involved, most landscape architects prefer to quote their fee schedule on a particular job, however, to generalize, it may be stated that school site and landscape development plans are usually available on a sliding fee schedule depending on the construction cost —a project costing $5,000, for instance, would call for a 15% fee for full service while a $50,000 project would require a 10% fee, etc. The cost of planning service, in most instances, will be made up in a brief period by the elimination of costly errors resulting from the lack of forethought.

In spite of the fact that man has made great scientific advances and the development of synthetics of all types are now big business, he is still completely dependent upon plants for his existence. Since this is true it would appear that education at all levels should consider vegetation and vegetative processes of inestimable value for learning for all ages.

A Part of Education

The school site is seldom considered in its true character—it is a potential laboratory for learning.

The areas of learning are the purely utilitarian aspects and the esthetic values. A separation of these does not mean to imply a greater importance for either—rather does it emphasize the importance of both.

With the rising population and the growing tendency toward corporative farming, and consequent elimination of the small farm, it becomes increasingly apparent that fewer and fewer children will have an opportunity to witness the miracle of seed germination and to gain the realization that most human food is directly or indirectly connected with the soil. Since this is true, a significantly-sized garden plot should be available to all grades on each school site. The gardening should be done seriously and in sections of the country where planting may be accomplished only during spring and summer months, the gardening may be carried over as a very worthwhile summer activity. Such a school garden would not necessarily be limited to the cultivation of vegetables only, both annual and perennial flowers could be included as part of the study. In any case, a well-cared-for garden, be it vegetable or combination of vegetable and flower garden, can be a source of real pleasure.

The garden, under most circumstances, would be a minor portion of the school site. The remaining portion of the site not covered by buildings and parking areas—and of the latter much study is needed—should have some vegetative cover. The cover has very practical aspects, which fortunately have simultaneous esthetic values. It eliminates soil erosion by wind and/or rain and further enhances the site by elimination of dust and mud, which in turn reduces building maintenance costs and produces a more healthful atmosphere.

Anti-Vandalism Aid

At this point it may be well to suggest the importance of stimulating inte[illegible] what appears to be a neglect[illegible]a of our education process—namely, preservation and protection of public property.

Somehow, we Americans have the erroneous impression that public properties are the responsibility of anyone other than ourselves. We see everywhere the results of an attitude that since an area is public it may be abused. Consequently, tax dollars which might have been

Novato High School, Marin County, California. Reid Rockwell Banwell and Tarics, Architects. A senior high school with a capacity of 850 pupils located on a 43-acre rolling site in the San Francisco Bay area. This site in a small valley with wooded hills on three sides is generously sprinkled with splendid oak trees. Since the housing developments near-by were destroying the trees, the board of education of the school district made it a special point to try to preserve the trees on the site. For this reason the building has been developed among the trees and the play areas have been located on portions of the site that were not wooded

spent to purchase added benefits for all must be used to maintain and police the limited spaces available.

With our rapid increase in population this situation is bound to become more acute unless we can make people see that public property is a trust to all and that it behooves each of us to protect his own interest by caring for it. To flount authority is apparently a human characteristic. If at an early age we could be made to realize that such action really means that we are working against ourselves, the situation might improve. What better place than the school site to introduce the true values of respect for public properties? This can be done only with public properties which have been developed and are maintained in a manner which warrants such respect.

Area and Duplication

Although some far-sighted school administrators have been successful in acquiring reasonably-sized sites for school development, in many areas inadequate sites continue to be bought. To be sure added acreage means added initial and development costs and, not to be overlooked, added maintenance costs.

It is apparent that school authorities may have difficulty in justifying site development costs in relation to total budget. It is hoped that this paper will help bring the *educational* potential of all aspects of school site development into proper focus, so that its immense value will be realized by all, and consequently be given its proper weight in school development budgets.

Many cities have recognized the duplication involved in neighborhood recreation facilities and school sites and have provided for the former by continued use of school facilities beyond the regular school hours. To be sure such use would add the burden of policing but this would be greatly offset by elimination of duplicate public facilities. The idea has much appeal to most tax-payers.

The practicability of combining park, recreation, and school sites is a matter of local concern. Regardless of how it is to be accomplished, if the school site is to yield its full potential and become a laboratory for learning, it is bound to require more area.

Maintenance Essential

If the school authorities are not willing to accept the responsibility for adequate development and maintenance of this type of school site which will serve to educate young people and at the same time prove an asset to the community in which it is located, they might seriously consider multistory structures rising out of very limited hard - surfaced area surrounding them.

Whatever the size, all free land area surrounding school buildings must be maintained. Since this is true, all persons responsible for school site planning must budget for adequate site development and in addition be realistic about budgeting for site maintenance. The new school building will be limited in real value to students and community if it stands alternately on a dusty desert or in a sea of mud depending on the weather.

Budget

Although no single set of figures could possibly be applicable to all sections of the country, the following criteria may serve as a guide to suggest a reasonable basis for a

Annual Maintenance—an example

total acreage included	546 acres
tractor mowing only	185 A @ $ 55.00 per acre
tractor plus small mowers	58 A @ $ 61.76 per acre
lawns and shrubs without permanent irrigation	222.8 A @ $163.58 per acre
lawns and shrubs with permanent irrigation	12 A @ $211.58 per acre
complete maintenance—highly developed areas	68.2 A @ $512.52 per acre
average acre maintenance cost	$165.77 per acre

*Costs may vary in other regions of the US. Figures given apply to the southwest (Texas)

budget for school site and landscape development. Any site and landscape treatment serves its function and looks well in direct relation to the quality of the maintenance it receives. The janitor cannot be expected to maintain the grounds only when he has nothing else to do. Competent grounds maintenance personnel is mandatory, even if it has to serve on a part-time basis.

The following price data on school site development and maintenance costs present a reasonable base for budgeting purposes:

Earth Work

Excavation may range from $1.50 to $15.00 per cubic yard, depending on quantity, nature of material (sand or bedrock) to be moved.

Porous fill $2.60 to $4.00 per cubic yard, again depending on quantity and nature of material.

Lawn Areas

Fine grading, fertilizing, seeding or sprigging may range in cost from $0.35 to $1.00 per square yard, depending on soil preparation, type of grass used, and manner of propagation.

Planting

Groundcover areas may range in cost from $0.25 to $2.00 or more per square foot depending on soil preparation and plant material used. Shrubs used in mass planting or hedge rows may range from $1.50 to $4.00 each planted, depending on variety, size and planting methods. Specimen shrubs and small flowering trees — shrubs or trees used singly to emphasize characteristics of species — may range from $10.00 to $50.00 each planted, depending on variety, size and planting methods.

Shade Trees

In most instances, size of tree, rather than species, is the determinant of tree prices. Although quite large trees may be transplanted successfully, a 5 or 6-inch caliper trunk would probably be largest practicable size to use in school site development. Very often small trees of 2 to 3-inch caliper trunks, well planted and properly maintained will reach the size of the initially planted larger tree in two or three years time. Tree prices might range from $35.00 to $250.00 each, depending on size.

Irrigation

In many areas of the country lawn and planting irrigation systems are necessary to preserve plant materials during periods of drought. They are insurance on the investment. In larger open areas quick-coupling outlets designed to cover approximately 5,500 square feet may be installed for prices ranging from $85.00 to $100.00 per outlet. Pop-up-heads for watering areas where spray control is an important factor cover approximately 175 square feet per head and range in price from $16.00 to $20.00, depending on kind of pipe used. Initial installation costs are soon offset by reduced maintenance and use of less water.

Fences and Screens

Whether or not fences or screens are used on the school site depends on many factors. In most instances they are considered for utilitarian value only and add little esthetic quality. This need not be so and if used, they should become an integrated part of a pleasing composition. They may cost as much as $25.00 per lineal foot for a six-foot, 8" thick masonry wall or as little as $1.00 per lineal foot for a four-foot chain-link fence.

Walks and Paved Areas

Under most circumstances walks and paved areas are a part of general contract. In any case, they should be generous in width and functional in line and direction. They must be durable and safe. Although walk and paved area materials need not be confined to concrete or asphaltic products alone, these are most widely used. Depending on material and construction details, such as exposed aggregate, color, etc., such surfaces may cost from $0.25 to $1.00 per square foot.

Lighting of school site is another item of site development for which funds should be budgeted.

The foregoing cost information cannot be adjusted to a formula to be applied to all school sites. It is itemized only to emphasize the fact that all site improvements cost money and that such improvements should be considered in developing budgets for school building programs that are not to lose this educational potential.

Any school site will look and function well in proportion to the quality of maintenance it receives and should have a site maintenance budget. Again, it is not feasible to suggest any uniformity. Each site will have its own characteristics and consequently require individual consideration.

Maintenance Illustrations

The above table reports on actual annual maintenance cost picture for a college campus.*

A thirty-acre campus type high-school site originally planted at a cost of approximately $10,000.00, the planting operation having been done by school board personnel, is now being maintained at an annual cost of $7,700.00—or an average of $256.66 per acre.

Conclusion

Each school site needs consideration as a pleasing community asset, functional in every detail. Its teaching potential should be exploited fully and programmed adequately. A professionally-trained landscape architect can help you toward these objectives. Funds must be budgeted not only for initial development but for continued maintenance operations.

WHAT IS GOOD SCHOOL ARCHITECTURE?

y Eric P[illegible], AIA*
[illegible] AIA panel presentation
AASA convention
tlantic City, NJ
ebruary 195[illegible]

John Lyon Reid, FAIA — *Roger Sturtevant photo*

human values: psychologically sheltering effect of roof-like ceiling — sun control by overhang, sky glare cleverly avoided by hillside — nature near at hand. Oak Manor School, Fairfax, California

IN A PLAY by Jean Giraudoux one general tersely & completely explains another general's failure by the comment—"He had a bad definition of war."

What is architecture anyway?—our ideas have changed a lot since I started studying the subject in 1926. There were a lot of catch-expressions then—& now—about architecture being "organic" (Whatever that means), needing a "total unified effect," requiring "balance," either thru symmetry (which was easy) or asymmetry (which was hard to get away with until senior year). We also were instructed to seek good "scale," good "relationship to adjacent buildings" & we were given the limited choice between "monumentality" & "delightful informality."

Apparently the teachers of architecture of our time had forgotten one of the most important statements of architectural theory — that of the Chinese philosopher Lao-tsze 2500 years ago:

"The reality of a room is not in the four walls but in the space enclosed."

In 1926 they didn't teach us much of anything about architecture as we think of it today—as space, conditioned for use & amenity. Architecture is a fabric of useful & experiential space. That is space that you can sense as an esthetic experience. If you wish to understand architecture better, try to develop in yourself this ability to experience space. Static space as you stand in it—or dynamic space as you walk thru it & it flows around you in changing volumes of enclosure. Even outdoors when walking thru the woods & coming to a clearing or when climbing around in hilly country or when among large rocks you can enjoy participation in space when this sense of it is awakened. In fact you enjoy these experiences now without understanding them.

Good architecture—is design in space (but not cold, sterile, abstract space). It is space which is conditioned by (& which conditions) light, color, form, texture, sound, air, body-furniture & thing-furniture, storage, water & power supply & waste-disposal. Good architecture works with its region & climate. It encourages safety & is fire-safe—not a combustible trap! It is designed to be easier to take care of & to maintain in good condition. This is the true meaning of the revolution in contemporary architecture—that these dynamic forces & elements should shape the building, & thru coordinated expression in it become an esthetic experience.

building life-expectancy:

How long does a school building last? 30 years? 50 years?

Is it possible that there will be some

* staff executive,
AIA Committee on School Buildings and Educational Facilities

Perkins & Will, AIA *Bill Hedrich, Hedrich-Blessing photo*

flexible groupings — multi-lateral lighting — intimate relation to natural setting — warmth of natural wood ceiling. Heathcote School, Westchester County, New York

school buildings built according to today's ideas still in use 30 or 50 years from now? Yes, it is possible — & we hope that they may even be paid for!

Can you see now how important it is that a school building be flexible for improvements & alterations of function & have an adequate site & plan for additions?

What are the values of extreme permanency of construction? Should schools, on the other hand, as one bright observer puts it, be disposable teaching cartons? This is no special pleading for repeat-business for architects but a question of economics. Communities change. Bring a Roosevelt to Washington — take industry out of New England & put it in the South — find oil in Mississippi — bring the aircraft industry to Los Angeles — bring a war-marriage birth rate to a whole nation — & you begin to have what we've got! You have heard the details of class room needs, etc, & I don't want to load you with more dangerous national average statistics — the curse of every building project — but what is this?

A one-dollar bill. A friend of mine calls it the most restful shade of green in the whole world — if you keep a large enough area of it in the field of view!

building dollar:

Actually, so far as construction is concerned & compared with 1926-29 costs it is 45 to 36¢ — depending on whether you build in Atlanta or New York. That's all it's worth compared with building costs of 25 years ago. Let's spend the education dollar wisely. As architects — & talking about architecture — we are not interested in spending one cent of school money extravagantly. We are convinced that we can design a proper environment for teaching & learning without extra expense. It does not take money primarily, it takes professional ability.

true values:

The intangible aspects of this national asset — architecture for true education — include all the cultural benefits of first steps toward lasting satisfactions & experiences of beauty & understanding of life & of the world around us. They include social adjustment to our times &, we can hope & pray, more intelligent decisions of citizenship, vocations & personal life.

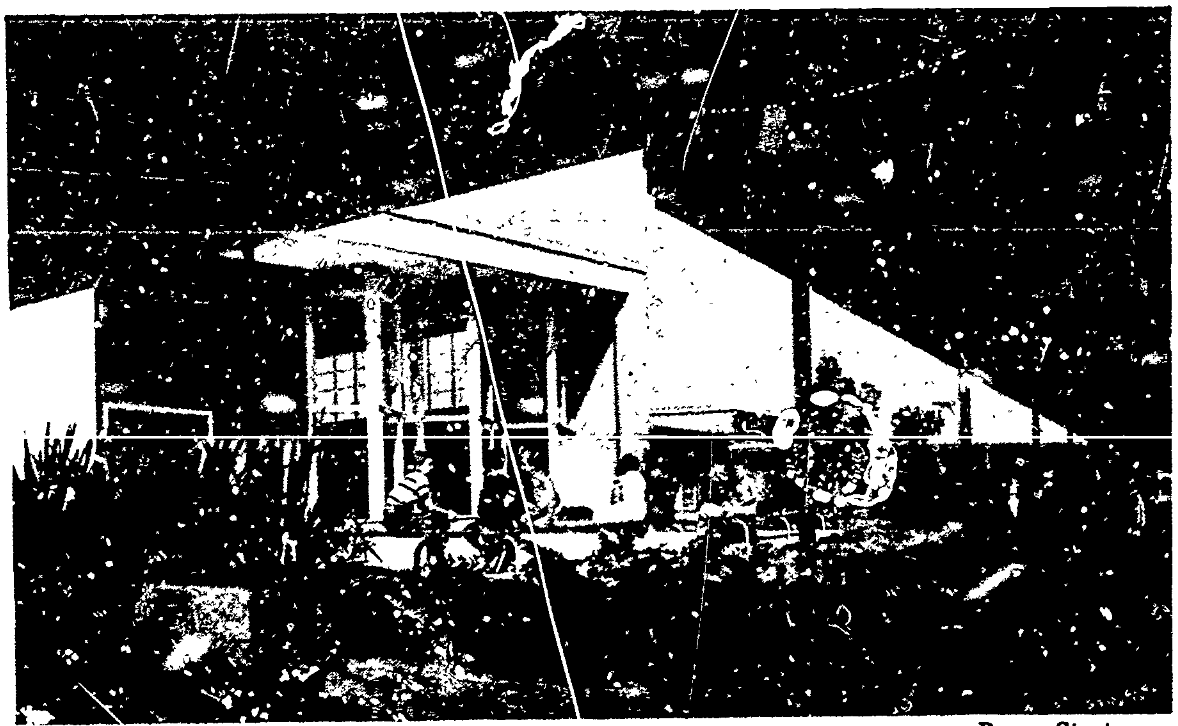
Manual skills are not menial. Ideally there should be continuous cross-stimulations between the cultural & vocational. Unless our children learn early that this boundary is not a hard-&-fast line they stand to lose the values of many natural & normal life experiences. The special rooms for any school plant are by no means pedagogical decoration. They are part of the total function of education. Almost all of us tend to specialize & narrow our lives to a few interests but the world needs more people with broad vision & understanding. This early school experience is a first step.

It goes on in a sequence of experiences in which good school architecture has an essential place &, because of that, "just-any-cottage" is never going to be a proper school.

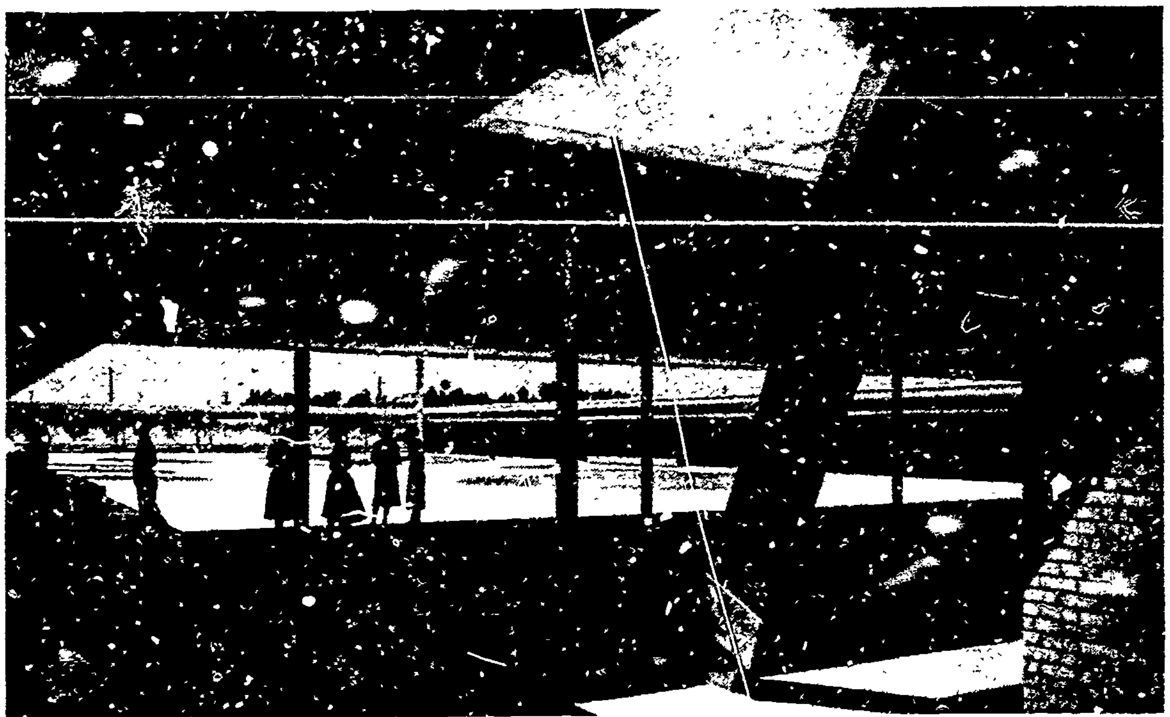
just-any-cottage:

Should we throw away all the educational & technical progress in classroom design of the last 30 years? Residences have notoriously bad illumination — the worst of any building type. What about the record of home accidents? What about the long-span classroom for flexibility & freedom of educational programs? What about established regulations for ventilation? Some of the cost comparisons used in advocating the combustible cottage are also out of line. It would seem hardly fair to compare them, as some printed stories have, with $40,000 average classroom costs of fire-resistive school construction (which costs came from the highest bracket in an inadequate sample). I'm not talking against the poorly named "little-house" concept, the true cluster or campus plan — I think they hold great promise of economy, improved function & intellectual stimulation. I am talking against the use of "just-any-cottage" in a speculative housing development — put up by the 'whole hoi-polloi of the building trades" as one advocate put it — that's not my phrase. Why should we sell our children's birthright for a "mess of cottage!" — with or without re-sale value!

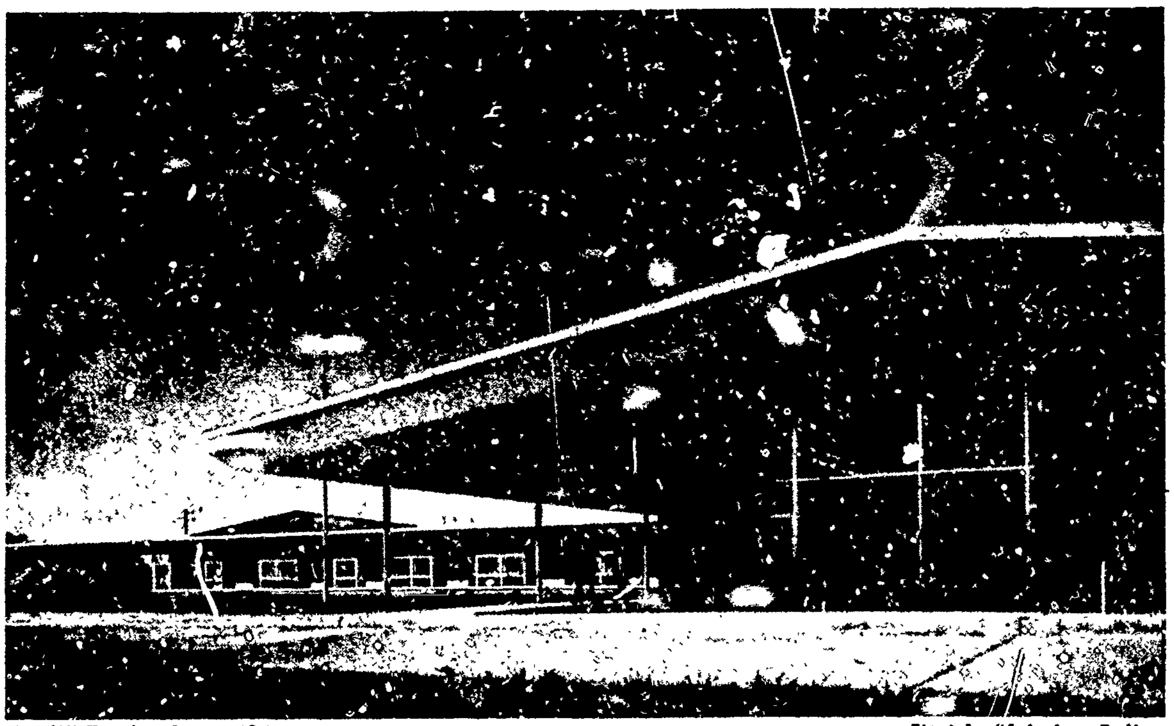
On this question of ultimate replacement — would a stingy community vote to pay the local tax money to remove & replace the bungalow abortions any quicker than our generous Congress has voted to pay money to remove & replace the temporary buildings on the Washington Mall, which date from World War I & were added to during World War II? Apparently what the proponents of these ideas believe is that we should have cheaper schools — for priceless children!



John Lyon Reid, FAIA *Roger Sturtevant.*
the site is part of architecture — John Muir School, Martinez, California



Caudill-Rowlett-Scott, AIA *Ulrich Meisel — Dallas*
mighty shady goings on — Junior High School, Laredo, Texas



Caudill-Rowlett-Scott, AIA *Ulrich Meisel — Dallas*
a wide-open welcome — Sam Houston Elementary School, Port Arthur, Texas

Bill Hedrich, Hedrich-Blessing

nature field trip — just outdoors — Heathcote School, Westchester, New York

Bill Hedrich, Hedrich-Blessing

child-scale buildings, nicely related — Heathcote

Hedrich-Blessing

a cluster of classrooms in the landscape — Heathcote

In the midst of the current high standard of living in America in which $1.4 billion can be spent annually on television & other billions on entertainment & appetites I get fed up with the constant squeak of "cheap!" The civilization & culture to which we pretend would demand something else as a worthy expression of our time.

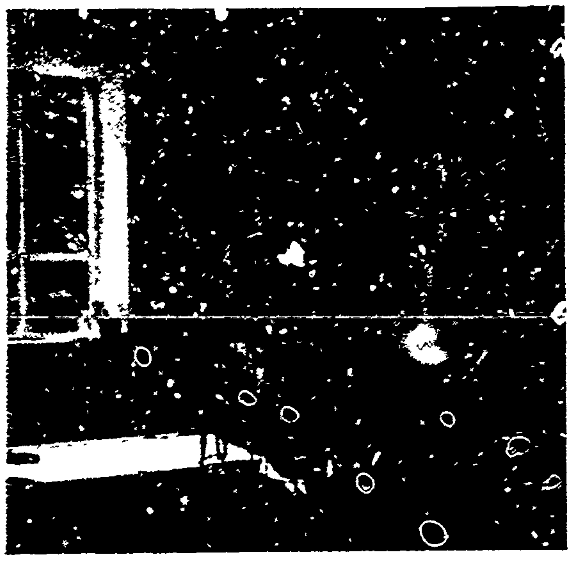
human values:

In the other direction entirely — it has been my great pleasure & benefit on several occasions to hear my old classmate, John Lyon Reid, talk on human values in school architecture. Here I should like to add another vector to the complex of forces whose resultant is good school architecture — a vector which is aimed like an arrow at every normal human being. I speak of humor — sadly lacking for lo these many years in most architecture. In Germany, last summer we saw several examples of this element of school design — & it can be an effective educational asset. I remember several fine fairy-tale-legend mural paintings. In one elementary school, each classroom (in a finger-plan school, no less!) was identified by a different & quite charming geometrical metal cut-out. In our country I might mention the very clever & amusing copper sign made up of caricatured schoolboy faces at (again my classmate) Ralph Burkhard's Southgate Elementary School in Seattle. In Germany, it was exciting to learn that in every public building 1% of the construction cost must, by an excellent law, go for art incorporated in or on or about the building — mural paintings, relief sculpture or free-standing sculpture, etc. Ralph's amusing sign cost all of $150.

This may, to immature critics, seem an extravagance — pay good money to perpetuate a joke! Well, why neglect one of the most powerful human motives in making our buildings attractive & in recurrently creating a receptive frame of mind towards school? For obvious reasons the funny story, the light touch, persists in finding its way into the presentations of our best speakers. One

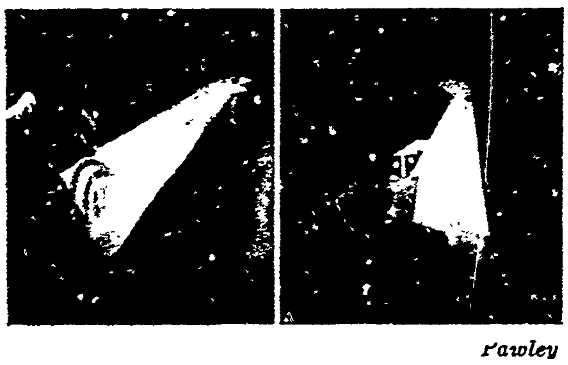
Pawley

copper sign — funny faces
Southgate Elementary School, Seattle



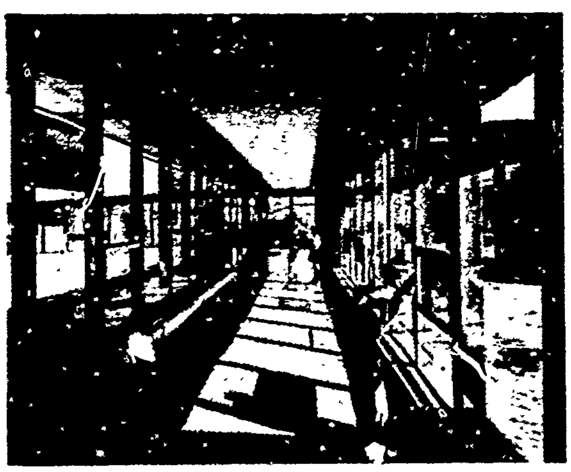
Pawley

school stairhall mural
Garmisch-Partenkirchen, West Germany



Pawley

triangle symbols (metal cut-outs) to identify primary classrooms in one wing
Hohewaltschule, Stuttgart, West Germany



Bill Hedrich, Hedrich-Blessing

small sash are of brightly colored glass — kaleidoscopic & a strange world
Heathcote School, Westchester, NY

of Margaret Mead's famous anthropological studies — that of the Arapesh people of North Borneo — shows the socially desirable effect of a good-humored, fun-loving environment on the up-bringing of children.

education by architecture:

Along with pictorial or graphic humor goes the intelligent use of gay & cheerful color & interesting texture & form. Architecture is a total teaching medium itself, you know. A noted architect has told me of his boyhood in Salem, Mass., & of — years before he knew what the word architecture meant — how he delighted in running his fingers over the exquisite colonial woodwork carved by Samuel McIntyre — one of the best who ever curled a shaving. Let's have more total education of the individual.

stock plans:

A word about stock plans & prefabrication. The AIA Committee on School Buildings has determined by national survey that stock plans for repetitive use for school buildings have been rejected by 3[illegible] states. Of the 10 states which make them available almost all are for 1- or 2-room buildings or other minor work. This is not the place to argue about them. They just do not fill the needs of today's educational standards & programs. As a matter of policy they prevent intelligent development & progress in studying a school board's needs.

prefabrication:

I worked in this field for more than four years. Systems & house designs we developed were used in thousands of dwellings.

I am convinced that the only logical & practicable application to school buildings is in the design & production of certain standard unit construction & equipment elements, rather than complete classrooms or buildings. The analogy of this right use of prefabrication with language is rather elegant, as mathematicians say. The designer & manufacturer of prefab or standard elements & systems is concerned with parts (vocabulary) — & how parts go together (which is grammar). Composition is the skilled task of the architect. This explains the great error of publishing any assembly of classroom elements as an ideal classroom. Proper relationships must be arrived at by an architect thru solution of what might be thought of as "simultaneous equations" of the many design terms for each special case — which go far beyond classroom walls.

"solutions?"

I have, I hope, disposed of the bungalow abortions, of stockplans & prefabrication — for the present — we can certainly reject double or triple sessions as a solution. How about architects' fees? Isn't there a possible saving there? That, friends, is where you can save money but not in the way you think. You must provide an adequate fee & time for study of any architectural project, particularly at preliminary stages when the most important & expensive decisions must be made. Here is where improved & money-saving concepts develop. Here is where the architect earns his professional fee & in this, as in everything else, you can get only what you pay for. In California, the state has established a fee of 8% for school work — mainly because of multiplied tasks it, & earthquakes, place on the architect but isn't it significant that California has some of the most remarkably fine & low-cost schools in the world?

No, the place to look for real savings is in these new concepts, as well as in such areas as revision of obsolete building & school code & financing requirements, excessive insurance regulations & in working with the climate instead of against it, to reduce the overload of expensive mechanical equipment in our buildings.

This, I believe, will start us toward good & economical school architecture — good space for teaching & good room for learning — a primary educational asset.

STRUCTURAL TYPES IN SCHOOL CONSTRUCTION

by EBERLE M. SMITH, AIA*

FRAMEWORK

THE STRUCTURAL system of a school building is the framework on which enclosing envelope is draped. The building itself takes on shape, size & mass of this framework. No building can be better than limitation set up by controls of this framework. A well designed school interprets this framework & an architect can tell almost from a glance at exterior of school just what framework consists of. This leaflet will help you understand this basic & important feature of school building.

THREE ELEMENTS

In analyzing any structural system, we find that it is composed of three basic parts:

- vertical supporting members
- horizontal supporting members
- deck material.

Many combinations of materials & systems can go to make up these parts. Sometimes vertical & horizontal supports merge into one, as in rigid frame type of construction. In general, however, the three parts that go to make up any system can be properly identified, & if we think of these separate parts, it is simpler to understand & analyze the type.

Often structural material or system is part of finished surfaces of rooms. This is case with masonry bearing-walls with exposed structural columns & beams. Precast roofing deck, & often joists, are left exposed to form finished ceiling. Then structural system does double duty.

In general, vertical supports fall into two major classifications. wall-bearing or column. Wall-bearing is oldest & often most economical type of construction, but it may waste space & result in an inflexible plan. Steel, concrete & fabricated timber have led to use of much smaller vertical column supports & wall-bearing construction has been eliminated to a large extent. This is especially true of multi-story buildings. In those areas where resistance to earthquakes & violent winds is a major requirement, column supports are most frequently used in one-story construction as well, since they can be braced easily by horizontal structural elements to resist horizontal forces. Masonry wall-bearing construction, on other hand, must depend upon its weight or cross bracing from partitions to resist high winds.

Recently, perhaps due to high costs & scarcity of steel, there has developed a novel type of wall-bearing, one-story school construction. It is very well adapted to open planning where repetition of several typical rooms occurs. It consists simply of a bearing wall between each classroom on which the roof (either flat or sloped) is supported. This allows use of continuous windows on both sides of classroom & is adaptable to any type of section as well as to corridors with classrooms on one or both sides.

Another method of saving steel & still producing a rigid masonry building is to reinforce the masonry with steel rods in the masonry joints, or to provide for them by special masonry units. This construction is economical & is popular in earthquake regions.

Column-type construction allows great freedom in exterior wall treatment & design of building form because structure or frame can be independent of enclosing materials: For example, columns may be placed within enveloping wall, free-standing inside of wall, or free-standing outside the wall.

Horizontal supports may be joist, beam, or truss, or any combination of these three. A very popular type is steel joist (spaced 16"-36" on center) supported by either wall-bearing or beam construction. Beam construction in steel often supports steel joist construction or concrete slabs, wood or insulation plank or panel type decking. When it is combined with steel columns, it can be fabricated into rigid bents to resist horizontal forces. Concrete beam construction is often used on multi-floor projects. It is almost always combined with concrete deck & concrete column construction. The truss has always been widely used as a horizontal supporting member for long-span construction, such as auditorium & gymnasium. Lately, it has been used quite extensively in classroom design.

Deck construction consists of material placed over joists or small horizontal supporting members. Over steel joists, poured-in-place gypsum or precast light-weight concrete decking is widely used. Wood planking is most widely used over wood construction. Recently a precast decking combination of wood shaving, Portland cement & reinforcing steel has been used on spans up to eight feet. It forms an insulated structural deck & sound-absorbing finish ceiling. Steel panel decking is available in long spans which form a finish ceiling with built-in acoustical material. Care must be used in any precast finish decking material to see that space provision is made for electrical conduits. In concrete structures, concrete itself very simply becomes deck material.

Combination of these three component parts (vertical support, horizontal support, & decking) into the building forms the structural system. It can be seen that there is almost an unlimited number of combinations of types that can be assembled from material available.

MATERIALS

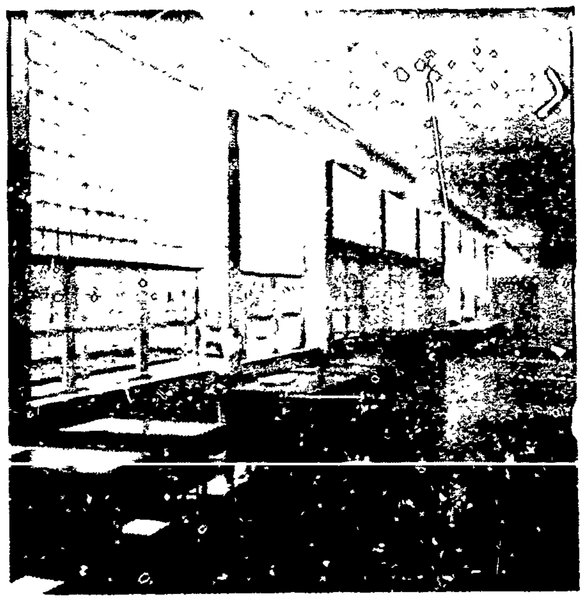
In any structural system, basic materials used are concrete, steel, & wood. **Concrete** has advantage of being, in itself, fire resistant &, because it is a plastic material, it is easily adapted to unusual shapes. Its disadvantage is characteristic heavy weight. Consideration should be given to this material both as cast-in-place & as precast units. **Steel** is readily fabricated from structural shapes, lightweight bars & sheets into structural members that will meet almost any condition. In itself, it is **not** a fire-resisting material. It does produce construction that is light in appearance. **Wood** is simplest material to handle in a great many respects & is perhaps easiest to fabricate. Use of high-grade, waterproof glues with laminated construction & use of modern metal connectors to increase strength of joints has given wood construction new possibilities. Of course, it has disadvantage of being a combustible material.

1. RIGID STEEL FRAME

designed for demountability
acoustical ceiling

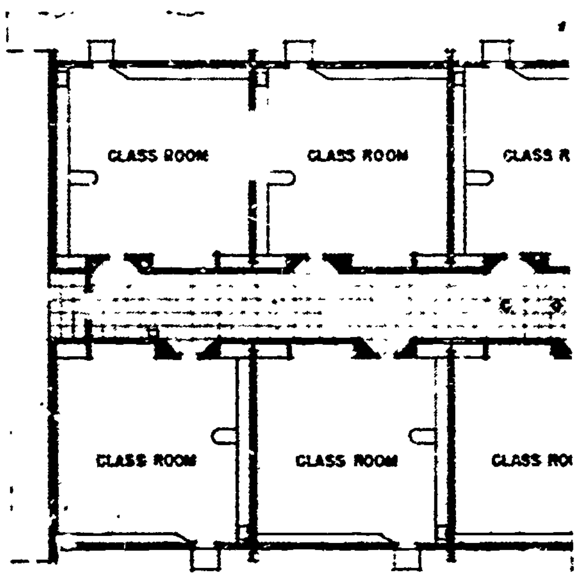
2. EXPOSED FRAME

steel beam on masonry wall supporting steel purlins & lightweight roof deck



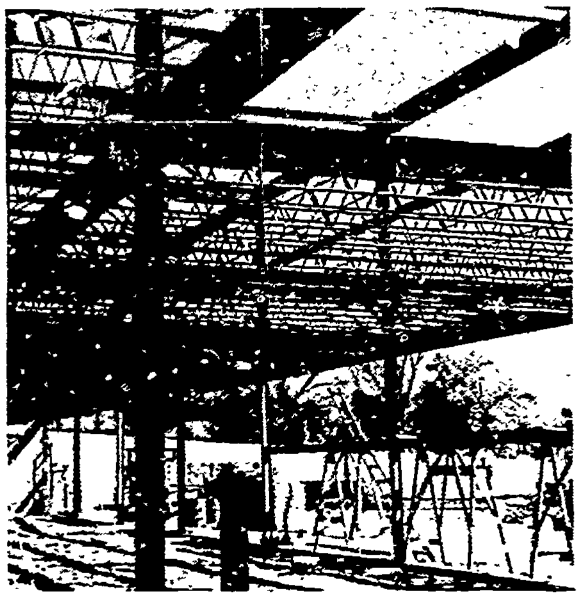
3. CONCRETE BENT FRAME

beams & columns integrated in semi-rigid bents—concrete slab above acoustical tile



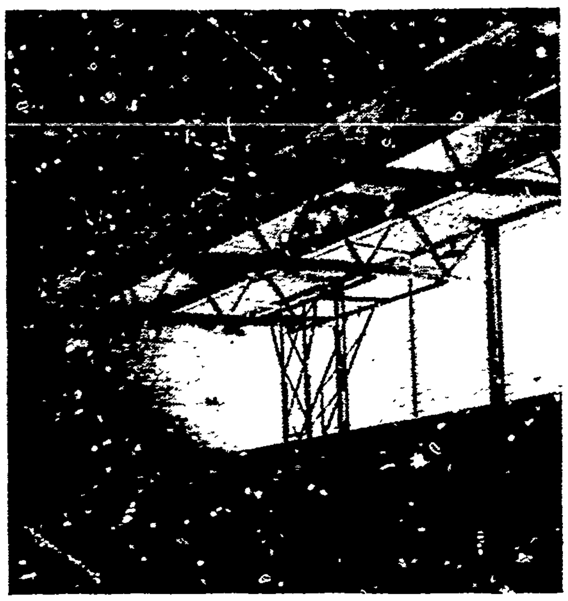
4. WALL-BEARING PLAN

masonry walls between columns support longitudinal joists permit continuous windows—Nichols, Butterfield & Segerberg, Arch



5. STEEL JOISTS

for floor structure supported on steel frame —note reinforcement of ends for bearing
Earle A. Deits, Architect



6. STEEL TRUSSES

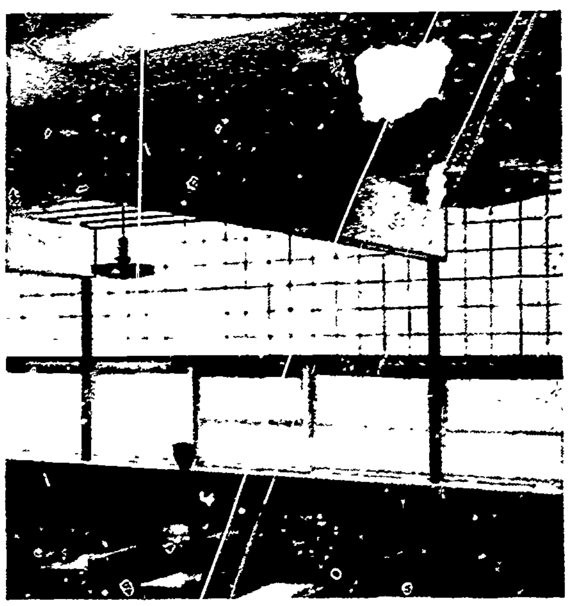
on steel columns & supporting steel purlins —lightweight plank roof deck—note windows to deck height (transverse trusses)

7. PLANK AS CEILING FINISH

lightweight deck on steel purlins—steel beams & columns

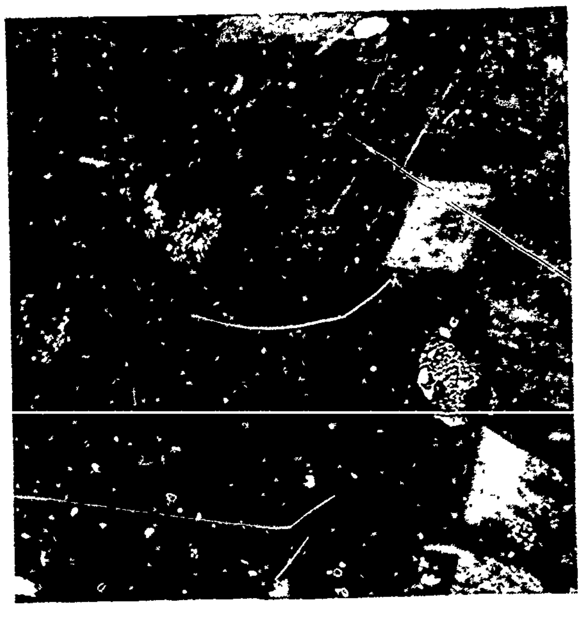
8. STEEL ROOF DECK

acoustical panel type with fireproofed steel beams & columns (masonry block)



9. LAMINATED WOOD BEAMS

on steel pipe columns—wood plank roof & ceiling—William Arild Johnson, Architect



10. REINFORCED BRICK MASONRY

bond-beam of brick & special clay units to hold steel rod reinforcing
Structural Clay Products Institute

11. CORRIDOR EXPANSION JOINT

providing for movement in long structures
Rhees Evans Burket, AIA

12. SUNSHADE CANOPY

protecting windows from sunlight
McLeod & Ferrara, AIA

LATERAL & THERMAL STRESS

In any type of construction, adequate precaution must be taken to insure proper resistance to lateral stress from wind, or, if need be, earthquake. Frame construction can be readily reinforced to take care of this lateral stress. By designing columns & beams as rigid bents or with knee-braces or equivalent, such stress can be taken care of. In masonry wall-bearing construction, walls which brace each other are used to resist these stresses. To some extent, the weight of masonry construction takes care of these stresses.

Expansion & contraction of building materials due to exposure to heat or cold is an item too often neglected or misunderstood. Any structure will expand & contract during changes in temperature. Soft materials, wood, do not present much of a problem in this respect. Rigid materials such as steel, concrete, or masonry do present problems, & allowances should be made for them. Particularly, thought should be given to this item when a combination of masonry walls & reinforced concrete or steel is used.

LOCAL CONDITIONS

Structural types now being used throughout the United States vary in detail, but, to a large extent, there is a surprising conformity in generalities. This conformity as to generalities is probably due to widespread dissemination of photographs of current schools in architectural & educational magazines, school exhibits & conferences. Rapid expansion of school plants since the war has made school architects & school boards very conscious of better buildings being built in their own & surrounding areas.

Details of structural system are usually influenced by local conditions of available material & particulars of shelter. In West & Northwest, abundant supply of timber has resulted in very free use of wood construction. Concrete is widely used throughout the whole country, as well as masonry bearing-walls of concrete or brick units. Steel is also widely used. At present time, architects are trying to find ways to eliminate at least the heavier sections of steel in their designs because of national shortage of this basic material.

Shelter from the elements in the West means shelter from sun, rains, & earthquakes. Western structural systems must first of all be resistant to earthquake. For this reason codes prohibit use of unreinforced masonry. To a large extent, one-story buildings are built of braced-timber or steel frame construction. Projecting canopies are built into structural system to protect windows from direct sunlight. Open covered passages serve as connecting corridors. Cross-ventilation is provided in most rooms, resulting in natural air conditions. Thus, protection from elements in the West has led to development of one-story, open type of plan & framed structure.

This type of structure has influenced, to a large extent, buildings throughout the country. In the North & East, where protection from cold weather is paramount, projecting canopies are decreased; natural ventilation is supplanted by mechanical ventilation; & connecting corridors are built in, but open type planning prevails. Structural framing need not be as rigidly braced to withstand lateral stress, & there is frequent use of wall-bearing supports.

THE FUTURE

It is an architect's duty to use his imagination & ingenuity constantly to explore new combinations of old materials & to examine new materials with a critical eye. In today's market of increasing costs & scarcity of skilled tradesmen, it is necessary to eliminate as much field work as possible. If use can be made of factory-fabricated materials in larger units, there should be decreased costs in the field. Precast decks in longer spans certainly should be explored to the limit. Precast concrete, lightweight concrete units & laminated wood all have possibilities.

Whether column & beams are exposed on inside or exterior or whether exterior materials (such as supporting brick walls) are brought inside the building, the structural system, if it is honestly thought out & clearly expressed, will help produce good design.

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* Mr. Smith is a member of AIA Committee on School Buildings. Illustrations not otherwise credited are work of Eberle M. Smith Associates. Photos by Astleford.

PREFABRICATED SCHOOLS

by Alonzo J. Harriman, AIA *

Prefabricated schools & schoolhouse construction are a new development of potentially great importance to architects & educators. Having its current impetus in Europe, particularly in England, this development is being studied in this country also, & techniques & methods for school buildings are now evolving with potential of great savings of time & mone

Prefabrication, in this sense, is halfway between minimum prefabrication including standardization (common to usual building methods, such as steel sash, masonry sizes, etc) & complete buildings of a rigid design, incapable of variation except by complete classroom units.

These systems utilize a small number of differing parts so dimensioned & designed as to give great freedom of arrangement & building design, with architect still designing building to suit educational & functional program, site, etc.

In England the pressing drive toward prefabrication was critical lack of wood &, to lesser extent steel, as well as field labor, coupled with great need for schools & speed of construction. Added to this, surplus factory space & manufacturing labor made such a development almost obligatory.

A similar lack of field labor was one incentive for the particular American system noted later, at least for its original development. But in this country primary advantage, perhaps, of prefabricated schools is almost 100% salvage & reuse. With this type of school, schoolhouse population can keep pace with changes of city, & more important, area population thru "downs" as well as "ups," as this population shifts with economic & other trends. We are a footloose nation & our communities are in continual change in parts of a city as well as between cities.

* *member of AIA Committee on School Buildings*

No system at present studied can be termed complete. A goal of complete standardization & prefabrication would have to include coordinated prefabricated tack & chalkboard units, casework, wardrobes & all fittings of a complete school. Many, if not most, of these items are manufactured now but are not dimensionally compatible with each other & with a prefabricated building shell.

many materials available:

Most school work has been done with light-steel sections, precision concrete & other cement mixtures. In other building fields, wood, & plywood & glue (as well as other types of building boards & materials) have been developed into various systems.

Prefabrication is a manufacturing rather than a building process, & is based on manufacturing concept of interchangeable parts. For such a use, raw materials, aside from basic suitability to ultimate use, must possess manufacturing suitability of uniformity of properties & dimensional stability after forming.

size ranges:

Prefabrication & standardization systems have been developed, with more or less completeness, in a wide range of sizes of units. One extreme might be World War II Liberty Ships, with tremendous sub-assemblies. Other extreme might be small ceramic tile units.

In the field of prefabricated schools, most recent systems have tended to be based on a so-called "2-man" load, capable of being lifted & positioned by two men. This has seemed best compromise between large units saving still more building time, but needing cranes, etc, & smaller one-man loads, which must be considerably smaller for accurate positioning.

This matter of size of unit is bound up with that of module-spacing * but is not quite the same since module-spacing refers to a design & dimension grid to which sizes of actual units are related.

costs:

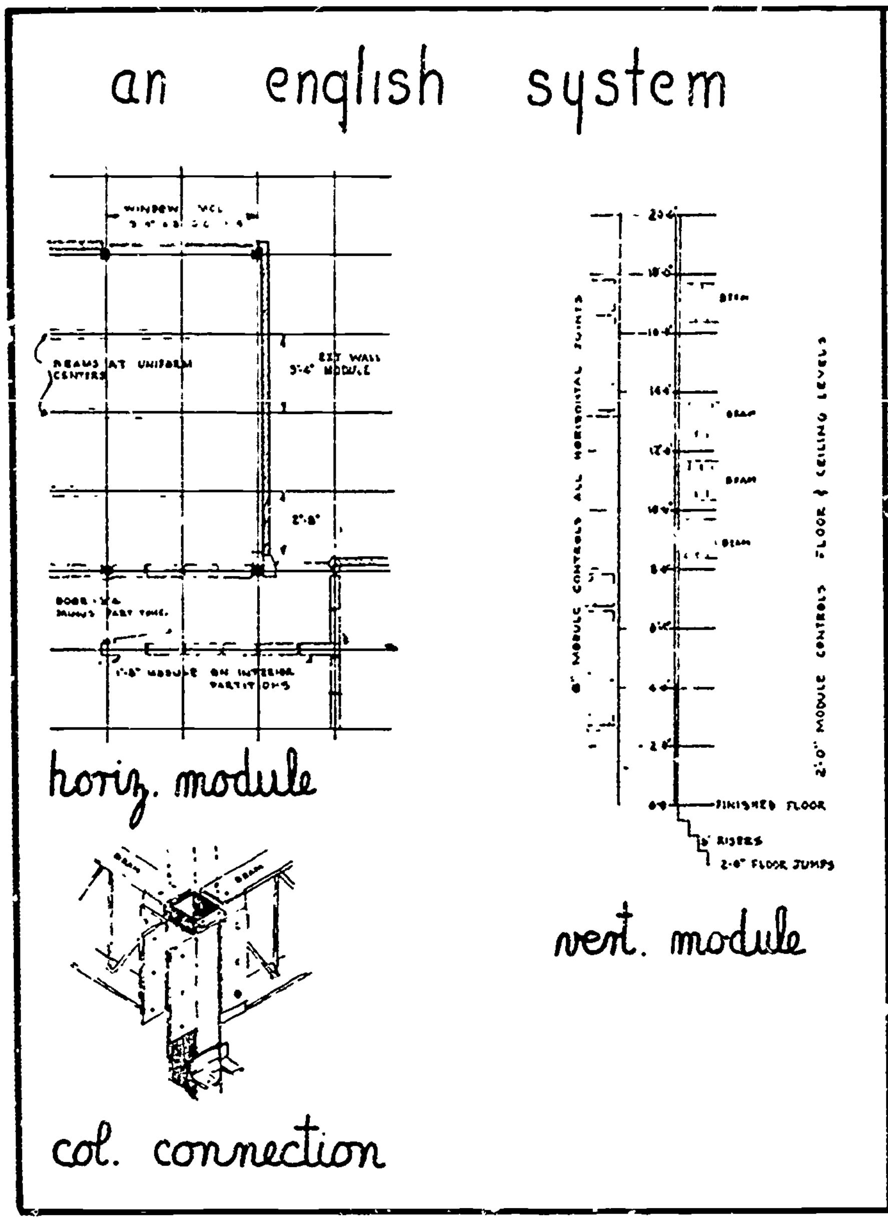
Cost of these prefabricated schoolhouse systems is at least competitive with familiar building methods & often is much more economical. Extent to which it is economical will depend on such factors as speed of construction necessary (prefabricated school buildings in England have averaged 50% faster completion) scarcity of (or high wage-rates of) skilled construction workers, local material supply or lack of suitable building material in which case freight spent for prefabricated units is far more effective than freight spent for raw building materials, & similar factors. Tremendous savings & economies accompany a large volume of manufactured units, as witness automobiles, appliances, TV sets, etc. It is only the manufacturing process based on special machines & tremendous volume that brings them within financial reach of anyone.

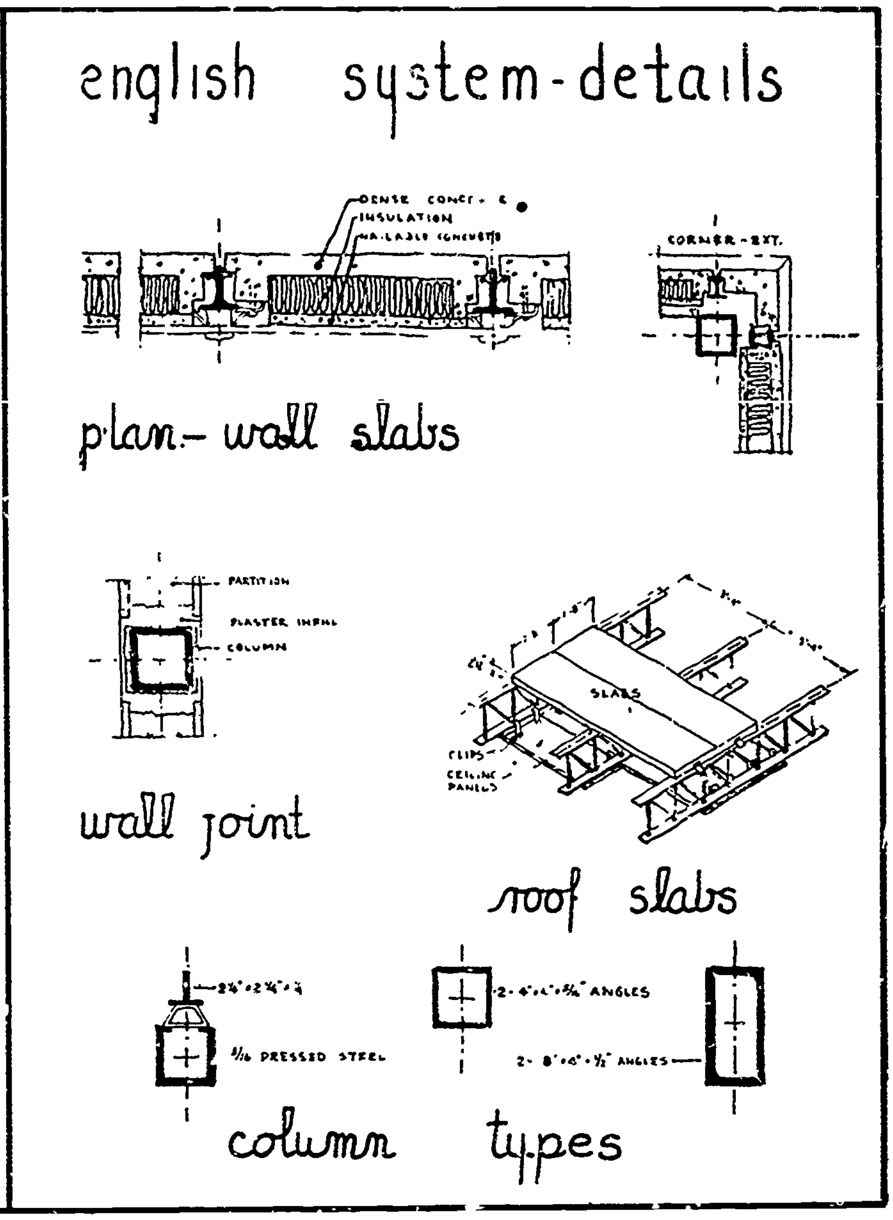
That same type of cost reduction with increasing volume will come with prefabrication of school buildings goes without saying. Basically it is substitution of electrical energy for human energy & all prefabrication simply exchanges kilowatt-hours for man-hours.

systems:

A description of two systems, one English & one American, will indicate two different approaches & material-uses leading to prefabricated school buildings & thus perhaps point up basic concepts & approach needed in any prefabrication system.

* *module — a unit of measurement used in repetition in building design, like regularly spaced columns, partitions or windows.*





english system:

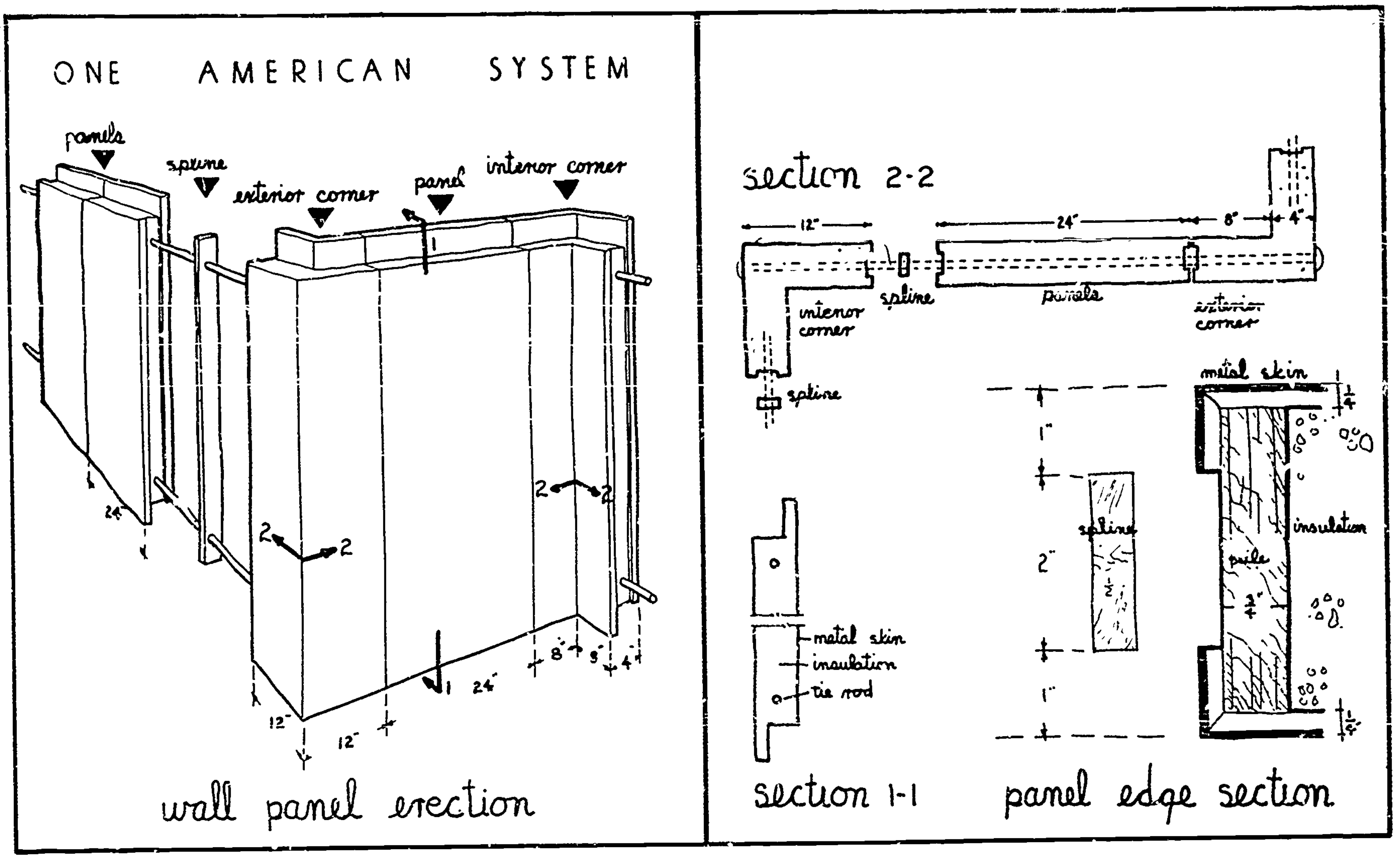
This, briefly, is one of hollow square steel columns & bar-joist type beams to which panels, usually of pre-cast concrete, are clipped or bolted. This is one of several systems in use there — others using more conventional steel sections for framing or pre-cast & pre-stressed concrete members.

The module or dimensional standard used in this system is 3′-4″ (incidentally this approximates one meter & may help export to metric system countries). Earlier English prefabricated schools had used a module of 8′-3″ but it was felt that more exact architectural planning would result from a smaller, more flexible spacing. A vertical module of 2′ was likewise used throughout.

The series of steel columns, some of which are shown in the illustration, originally consisted of 6 different sections, later reduced to 4. These are either of pressed-steel or 2 rolled steel angles or channels welded together to form various strength columns — but with constant thickness of 4¼″. Open-web joists or beams are similar to our bar-joists but are of a constant depth of 1′-4″, which with ceiling & floor construction gives ceiling-to-floor-height of 2′. Wiring, etc, is run in open network of bean.s. These beams, in one weight or another, run on module spacing 3′-4″ to columns or header beams. Perimeter beams also run around outside at floor height. Standard end-connections to attach beams to columns & standard bracing details have also been developed.

This framing system has been designed for buildings of up to 4 stories height, being primarily developed for secondary schools. Although a steel frame could have been designed to be more economical of steel & money it would not have been standardized & fitted to module which results in other economies. Upon this steel frame, floor, ceiling & exterior wall panels are bo.:ed or clipped. These panels are generally 3′-4″ wide, of sandwich type — of vibrated, reinforced-concrete, cement & wood shavings or hard cement with finish stone chips densely embedded, etc. Each type of panel usually has some type of insulation & is of pre-cast cement type. Interior partitions are of hollow pre-cast plaster thick enough to cover interior columns. Interior side of exterior walls is finished with plasterboard site-nailed to nailable interior face of exterior wall panels. Partition panels run full height of room & are 1′-8″ wide.

Many details of fastening, light-fixture design, sash & door openings & framing are omitted here but they & many more details are all keyed into this modular system for prefabricated buildings.



american system:

In contrast to this post-&-lintel type of construction one American system utilizes a load-bearing panel that is its own support, weather-cover & insulating filler.

Based on a 24″ module these panels are built of plywood faces, with necessary strength developed by interior bracing & edges — forming an air-tight box filled with fluff insulation. A metal skin (usually aluminum) is bonded to faces of box forming an impervious vapor-barrier & weather protection as well as permitting excellent maintenance. Thickness of these panels is 4″ & projecting lips at each end provide attachment to floor & roof construction. Height of these wall panels is 8′-10′-12′, but various special conditions of thickness, types of insulation & metal skins can be easily designed for. Its efficiency of course comes from the "stressed-skin" type of structure it is.

Edges of these panels are interlocked with a spline strip & whole wall pulled together with tie-rods of pipe running thru top & bottom of all panels thus making a remarkably rigid structure.

Similar roof panels are used bearing on laminated wood beams or other walls. This panel system is notable in that there is perhaps more flexibility of planning with it than with most, as well as a great possible variation in types of panel & hence walls for special conditions.

conclusion:

These brief descriptions of two systems ignore many problems & complications of prefabrication but indicate approach. There can be many types of prefabrication systems but all will perhaps entail uneconomic structural design in some parts as compared to conventional construction — whether this over-design be based on strength of steel required or other factors. This over-design has been a small price, however, for the many advantages of a flexible plan with interchangeable units.

Development of a nearly complete prefabricated school, as in England, where both building structure & finishing are included, requires a great deal of over-all control, research & development money which in that country has come in large part from central government. This need of centralized coordination is perhaps greatest barrier to completely prefabricated schools in this country for, as has been noted, most components of a school are or can be manufactured. Remaining factor is over-all coordination of sizes & connections to form a uniform compatible system.

It is of greatest interest that most of these systems are based on usual architectural services for design of buildings to suit site, program, etc. They are in no sense a ready-made school of standard model classrooms. Significant flexibility of design is essentially as great as ever.

STOCK PLANS FOR SCHOOL BUILDINGS A NATIONAL SURVEY

by the AIA COMMITTEE ON SCHOOL BUILDINGS*

Data presented herein were collected in November 1951 by telegraphic survey of all 48 State Departments of Education. The information has been circulated to some extent in untabulated form but it was felt that this more complete report would be of value to those communities in which the question might arise & might provide helpful information for administrators, educators, school board members & citizens.

This is a factual report of the survey with no attempt to discuss use of stock plans which the great majority of these offices disapproved. Another SCHOOL PLANT STUDY now being prepared by a recognized authority will go into more detailed study of the stock plan problem.

It is interesting to note that the response to the survey was very prompt, 46 of the 48 replies being received within a few days—some the same day—& that they were in a number of cases followed by vigorously-worded airmail letters.

10 states have limited stock plans available:

west virginia	1-room
california	
minnesota	2-room
kentucky	4-room
maine	
arkansas	$10,000
mississippi	$15,000
oklahoma	"small construction"
virginia	4-6-room
	7-10-room
north carolina	special units

23 states do not use & never have used stock plans for school buildings:

arizona	montana
colorado	nevada
delaware	new hampshire
idaho	new jersey
illinois	new mexico
indiana	north dakota
iowa	ohio
kansas	oregon
louisiana	rhode island
maryland	utah
massachusetts	washington
	wyoming

15 states do not use but formerly used stock plans & have now abandoned them:

alabama	new york
connecticut	pennsylvania
florida	south carolina
georgia	south dakota
michigan	tennessee
missouri	texas
nebraska	vermont
	wisconsin

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STOCK PLANS FOR SCHOOL BUILDINGS—A NATIONAL SURVEY

(● yes X no)

state	available	extent	statute	ever	reasons for discontinuing & comments
alabama	X	a) additions to old const. b) 2 classrooms	X	● in past	discontinued when stock plans became obsolete & did not have personnel to draw new plans. (O. P. Richardson)
arizona	X		X	X	schoolhouses done on a local district basis. (Myron R. Holbert)
arkansas	●	impoverished districts only max $10,000	X		practice discouraged, nature & services of architect emphasized. However needs of impoverished districts probably demand continued limited use of stock plans. (J. W. Handy)
california	●	1-room	X		education code based upon school district employment of private architect. Support of this concept is firm policy of state department of education. (Charles Bursch)
colorado	X		X		(J. Burton Vasche)
connecticut	X		X	● 35 years ago	1 & 2-room school plans prepared 35 yrs ago, only about two buildings erected. Definite consideration in a few localities of employing an architect on a salary basis to set up necessary organization for about 5 yrs. (N. S. Light)
delaware	X		X	X	(George R. Miller, Jr)
florida	X		X	● in past*	* formerly plans for special shops. All stock plans discontinued because of different site conditions, enrollment & curricula, & because stock plans impede development of changing techniques of instruction. (Forrest M. Kelley, Jr)
georgia	X		X	● til now	virtually discontinued & discouraged because existing stock plans antiquated, personnel insufficient to revise old or develop new plans & because of unsatisfactory results due to local officials not constructing building properly. (L. Miles Sheffer)
idaho	X		X		for over 25 yrs state department of education has had a part-time architect available as consultant on plans for school buildings. Law requires employment of a licensed architect for original planning of schools. (Alton B. Jones)
illinois	X		X		rather obsolete & very elementary bulletin shows suggested plans for 1-2, 6-8 room schools. Future bulletins will not go even this far. (C. C. Byerly)
indiana	X		X	X	(H. L. Smith)
iowa	X		X	X	each community should solve its building problems individually in light of local needs. For that reason no plans to furnish stock plans to local communities. (Gerald W. Boicourt)
kansas	X		X	X	(W. C. Kampschroeder)
kentucky	●	1-2-3-4 room bldgs & assist in plans for shops, lunch rms etc. additions			projects usually so isolated & scattered that satisfactory architectural service not available. This plan seems to be in interest of board as well as of architects. (Gordie Young)
louisiana	X		X	X	(C. E. Holly
maine	● Auth.	up to 4 classroom bldgs	● (1944)		some adoption of stock plans, prepared by an architect (law), have been used in many of the smaller communities. (William O. Bailey)
maryland	X		X		(James L. Reid
massachusetts	X		X	X	(John J. Desmond)
michigan	X		X	● before 1932*	* prior to 1932 1-room school stock plans. Discontinued when school code of that time was repealed & because law requires an architect to prepare plans for any building costing $15,000 or more. Board would oppose law requiring stock plans, feels that it is inadvisable. (Wilfred Clapp)
minnesota	●* Auth.	rural schools up to 2 classrooms	●		practice unsound & has been practically *inoperative for past 10 yrs. (I. O. Friswold)
mississippi	●	rural schools up to $15,000	X		no law either for stock plans to be furnished or architects to be employed. Stock plans furnished to districts with very little funds, (costing less than $15,000). Larger jobs done by architects. (T. H. Naylor)
missouri	X		X	● some years ago	a few stock plans for small buildings. Discontinued because plans not complete enough to get good comparative bidding, idea of all schools in state looking alike not appealing, & buildings should be designed to fit particular community's needs & style in architecture. (George D. Englehart)
montana	X		X	X	(C. R. Anderson)
nebraska	X		X	● about 1925*	* recommended floor plans included in annual reports. Discontinued to allow local initiative. Consultive services offered based on extensive surveys conducted by qualified staff or professional volunteers. (Floyd G. Barker)

(● yes X no)

state	available	extent	statute	ever	reasons for discontinuing & comments
nevada	X		X	X	sole function of state department of education is to approve plans. (Dwight F. Dilts)
new hampshire	X		X		(Paul E. Farnum)
new jersey	X		X	X	(John H. Bosshart)
new mexico	X		X	X	law requiring approval of small buildings & additions token only. (Tom D. Riddle)
new york	X		X	● years ago*	* plans & specifications for 1 or 2 teacher schools which became outmoded & under district reorganization no demand for them. Larger districts are more able to furnish architectural services. Plans for these occasional units should be adapted to individual district needs & desires. (Don L. Essex)
north carolina	●	special units & features to be incorporated in plans	X		standard state stock plan occasionally developed largely for sake of illustrating certain economies & available to schools upon request. These were often bases for plans done by architects. Present service of developing specialized units & features to be used in total planning welcome by architects & school authorities. (Clyde A. Erwin)
north dakota	X		X		department approves plans before construction. (M. F. Peterson)
ohio	X		X	X	(E. J. Arnold)
oklahoma	●	small construction	X		use of stock plans limited. (Phil Gruber)
oregon	X		X	X	department suggests plans which meet needs of individual schools. Plans must be worked out with regard to site, type of program, etc. (A. L. Beck)
pennsylvania	X		●*	●	* statute requires that stock plans for schools up to 4 rooms but these have not been issued for yrs due to their obsoleteness. (Harry W. Stone)
rhode island	X		X	X	department's approval of all school plans required. Requirements should be kept flexible. (Michael F. Walsh)
south carolina	X		X	● to 1948	discontinued because of utter lack of adaptability to sites, needs & different programs, lack of economy because original architect not at hand to supervise & prevent errors. State educational finance commission feels that public funds are best safeguarded by having work done by registered architects. (W. B. Southerlin)
south dakota	X		X	●	at one time rural school plans furnished. State standard school aid was discontinued as were the plans.
tennessee	X		X	● 15 years ago	practice discontinued because each school building should be tailored to house local educational program. Law provides that all school buildings costing $10,000 or more be planned by a registered architect. Department agrees, wants to avoid lack of originality. (J. B. Calhoun)
texas	X		● 1909*	● ?-1950	statute provides for buildings for small rural districts, but this has not been practiced for some yrs because stock plans could not adequately meet needs of various communities. (Joe R. Humphrey)
utah	X		X	X	(Vaughn L. Hall)
vermont	X		X	●	for number of years plans for 1 or 2-teacher schools furnished but discontinued as this size not in demand due to consolidation. (Carl A. Batchelder)
virginia	●	a) 4-6 classroom b) 7-10 classroom	●		stock plans furnished many yrs ago discontinued, found impracticable. New stock plans (1952) for 2 types of schools each with alternate additions of classrooms & auditorium. Architect needed for supervision & general adaption to particular site & community. (Arthur E. Chapman)
washington	X		X	X	district officials select architect. (George R. Pasnick)
west virginia	●	1-teacher school	X		plans furnished to county boards for optional use. (W. W. Trent)
wisconsin	X		X	● 1926-1951	for yrs very active service in furnishing stock plans for 1-2-3 room schools & additions. Result unsatisfactory because of limited borrowing power, difference in site & terrain, different community needs, lack of professional supervision. Discontinued for these reasons after agreement that registered architects would accept that type of work (small schools, additions, etc) at regular fees. Department will support any legislature requiring that all school construction be done by a registered architect. Present law provides that construction exceeding 50,000 cf be done by an architect. (A. L. Buechner)
wyoming			X	X	(Edna B. Stolt)

STOCK PLANS FOR SCHOOLS—SUBSTANCE OR SHADOW?

by Dr Charles W Bursch

THAT STOCK PLANS for school construction have not worked satisfactorily, where tried throughout the nation over the years, is well-documented in AIA School Plant Study for Jan-Feb 1953. But advocacy of such plans for schools continues in many quarters.

Such advocacy comes, among other sources, from legislators, staff members of taxpayers associations, representatives of Grange & Farm Bureau Federation, school board members, educators, interested school patrons & taxpayers. On numerous recent occasions, stock plans have been proposed seriously & vigorously as a means of saving time & money in capital outlay programs for schools.

These proposals have, with equal vigor & seriousness, been opposed by those who place high value on problem-solving type of planning for school construction, & the right, & even obligation of a school system to use each new construction project as an opportunity to improve school design & construction.

a true evaluation:

It is our purpose here to explore merits of this controversy. Upon what basis should such proposals & opposition to them be evaluated?

Most obvious & important differences between using or not using stock plans for schools, is in time taken to prepare plans & specifications — in timing of professional attention to layout design & specifications — & in functional appropriateness & economy of layout & design of a specific construction project at a specific time at a specific location. It appears, therefore, that proper & valid basis for decision would be clear & comprehensive understanding of function & importance of planning school buildings.

What values, both educational & financial, are expected to accrue to a school project from thorough, competent planning, done immediately prior to construction? In brief, what is function of planning?

why do we plan?

Function of planning may be expected to differ from project to project but in general, planning is done for following purposes:

- **to prepare plans & specifications to reflect best current thinking in educational requirements & in educational trends obtained from school district staff members, educational & school plant consultants**
- **to prepare plans & specifications for a project that incorporates best current knowledge of school building design & specifications, & best construction procedures & practices obtained from architects & engineers**
- **to give adequate attention in design & specifications to local conditions such as temperature, rainfall, direction & velocity of prevailing & storm winds, snow load, earthquakes, available fuels, neighborhood noises, access roads, utility connections, load-bearing value, workability & fertility of soil, contours, drainage, & presence of safety hazards**
- **to coordinate conflicting desires for floor space & construction quality in order to establish priorities so that funds available for project can be most wisely expended to accomplish best specific purposes for which project is intended**
- **to relate present construction needs & financial ability of school district to its estimated future needs & financial ability — in short, to relate present project in terms of quality level of construction & services supplied to carefully worked-out master plan for total site utilization at some future date**
- **to determine point at which urgency of need for building dictates that further planning should cease & construction proceed**
- **to meet local & state school construction code requirements with least cost & least interference with educational service of building**
- **to make it possible for construction bidders to be really competitive because of directness, clarity & completeness of plans & specifications**

who plans? who makes stock plans?

Whoever plans a school building exercises considerable control upon type & cost of educational program to take place in proposed building. Education in this country is a state responsibility but task of providing & managing educational enterprise has been assigned to local agencies — school districts. As an important part of that assignment, school district officials are responsible for planning school buildings. It would follow then, that local school officials may properly decide whether or not to use stock plans for a given project. These decisions, however, should be based upon thorough knowledge of implications of using such plans.

In first place, when stock plans are used, many crucially important planning decisions are made by persons not responsible to the school district concerned.

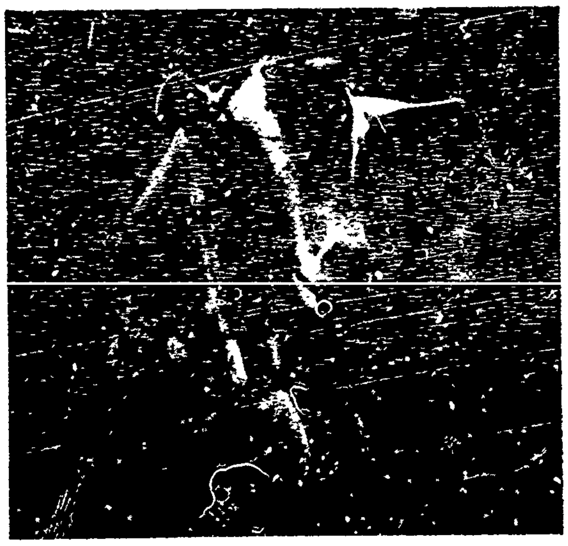
Stock plan proposals usually provide that they be prepared & made available by the state. State agency having this responsibility would of course, include only such plans as it chose. It would follow therefore that their use by local school districts would be tantamount to increasing state control of education at expense of local decision & control.

Another inescapable implication of use of stock plans is that genuine functional planning suffers. For example, when plans for a project are being developed on an individual problem-solving basis, inclusion of a recommended feature is easy & a natural part of planning procedure. However, if recommended feature is not found in the stock plans, it becomes necessary to determine if its incorporation will, because of plan changes required, nullify cost & time-saving intended when decision was made to use stock plans.

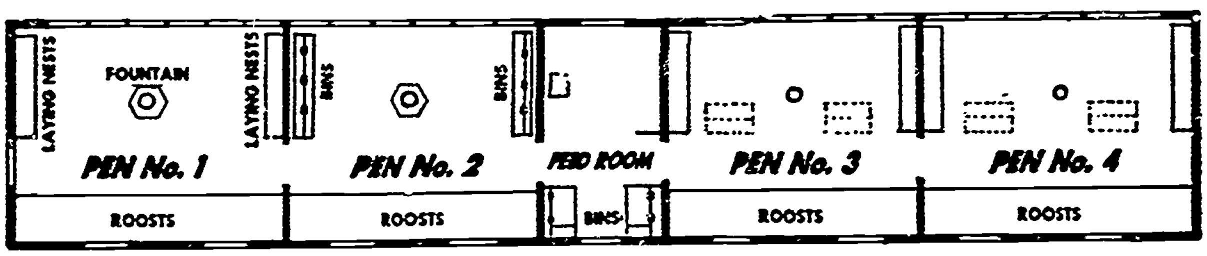
how much planning?

Since degree of thoroughness & completeness of planning is one of principal issues in deciding whether or not stock plans should be used, it becomes necessary to explore question "just how much planning

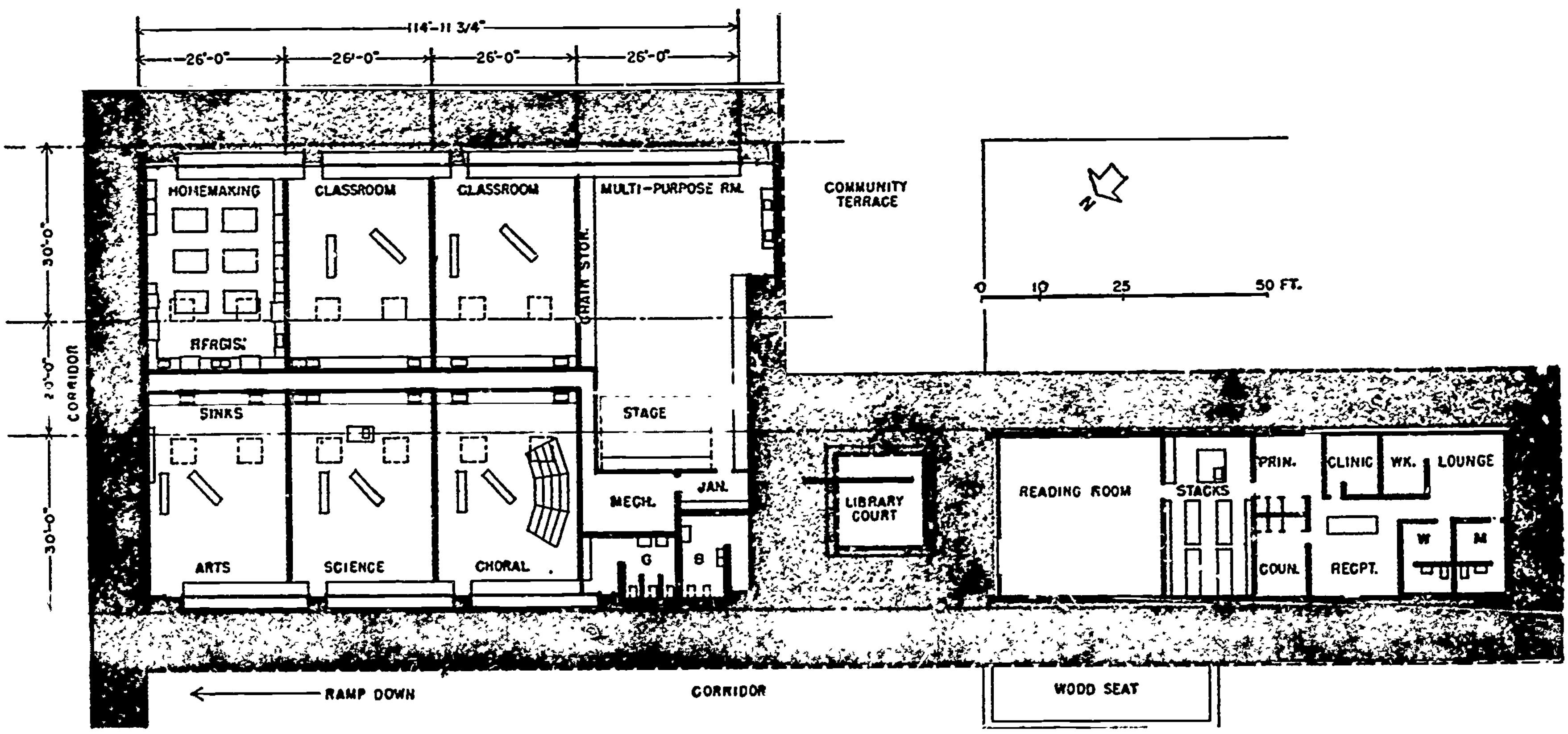
"We don't need a bell anymore at school — teacher just whams on the wall to call us in from recess . . ."



". . . if stock plans are good enough for MY KIDS — they're good enough for YOURS!"



free stock plans from government agencies for livestock have confused rural legislators — this laying house sure looks like a school, hey? it's easy to forget that today's school may be only 50% classrooms



HS Tyler Texas — Caudill, Rowlett, Scott & Associates, AIA *Architectural Record*

one wing of a remarkably fine (& economical) school — the difference is professional educational & architectural planning ability (not extra expense)

does a school construction project deserve?" In general, amount of planning justified for any type of construction is related to:

- **importance of enterprise — it is important to society to have a school building that does best possible job for education**
- **magnitude of construction program — total national need for school construction is so large that improvement in efficiency & lowered unit costs when applied promptly to entire program, constitutes significant total — conversely, if improvements are not incorporated in plans & specifications promptly, there is a very great loss**
- **cost of plant as related to cost of educational program housed therein — since big money (approx 90%) is spent on personnel, services & supplies, it is imperative that every reasonable precaution be taken to plan plant-expenditure (only 10%) so that it will make greatest possible contribution to effective use of the 90%**

More specifically, each school construction project deserves a quality & amount of planning sufficient to:

- **make sure that spaces & equipment provided make maximum contribution to efficient operation of personnel in accomplishing purposes of school — personnel involved would include pupils, custodians, clerks, adults who use school as civic center or night school, as well as teachers, administrators & other professionals**
- **fit building to site for economy of construction & maximum utilization of total site area**
- **select & integrate construction materials for lowest first cost, at that location, consistent with use-requirement & low maintenance & replacement costs, & to specify construction procedures appropriate to materials, labor & services available locally at time of construction**
- **produce plans, specifications & other contract documents that are sufficiently direct, clear & complete — to permit construction bidders to make accurate cost estimates**
- **produce drawings & specifications & to select equipment that guarantees a building having greatest possibility for inexpensive future adjustments to changing needs of education — this highly important quality of flexibility is well-defined by William W Caudill, AIA, as combination of fluidity, versatility, convertibility & expansibility**

From foregoing, it is clear that a mediocre or lower quality of architectural service would be inadequate for planning tasks that are necessary & desirable on a school construction project. If those services are not rendered by highly competent architects, there is not much point in devoting planning time to them.

ways to lose money:

Time & place are of crucial importance in rendering planning services. Outstanding plans & specifications for one location at some past time may be woefully inadequate & inappropriate at another place or time. Unless architect incorporates latest appropriate construction features & procedures, & unless he is entirely free to use plans, materials & specifications appropriate to place where project is to be constructed, owner well may lose, in unnecessary construction, maintenance & operation costs, many times over, the saving in planning cost made by using a ready-made plan designed for another place at another time, or a plan designed to solve a hypothetical problem which in fact does not exist anywhere!

plan values:

When confronted with need for a school construction project & for a decision between ready-made plans & a problem-solving approach, school building officials should weigh values listed below:

- **is careful, complete, timely & competent planning of sufficient importance to justify following an individual project problem-solving planning procedure?**
- **is there a sufficient variety of available & cataloged stock plans to justify hope that one can be found that substantially fits requirements of needed project?**
- **does planning time that may be saved by using stock plans, represent prudent offset to threat of impaired usefulness of building which represents large outlay & which would probably continue in use for 30 to 50 years — even though functionally inadequate when constructed?**
- **are advantages expected from use of stock plans sufficient to justify local school district in surrendering part of its prerogatives & obligations to agency furnishing stock plans? — when stock plans are used, district loses control of who does planning, when & where it is done & to what degree of completeness plans are to be developed**

saving time & money?

Pressures for using stock plans are pressures for saving planning time & for saving money on total project. It should be emphasized that planning time can be saved only in situations where educational usefulness of building, completeness of plans & specifications for really competitive bidding are not rated very highly & where sufficient variety of stock plans is available to permit selection that fits the specific site. Similarly, cost of project can be reduced by use of stock plans only when school is willing to settle for inadequate & incomplete planning, & therefore willing to settle for less than most appropriate functional provisions in building.

In brief, use of stock plans for schools, whether authorized by school district or used without such authorization, constitutes repudiation of validity & importance of planning process & abandonment of responsibility for attempting to make improvements. Such repudiation & such abandonment of responsibility are untenable in any important aspect of public education in a democracy.

". . . to draw up a permanent standard you have to be smarter than anybody!"

NEW IDEAS IN SCHOOL CONSTRUCTION

by John W McLeod, AIA*

IN THINKING about new ideas in school construction it becomes evident that two separate influences are constantly at work, changing & refining our attitudes & approaches to school planning. Stated simply, these influencing factors are:

- **changing concepts in education**
- **technological advances in design & materials**

While it is impossible to measure relative importance of these two major influences on school planning, it is my opinion, based on a lifetime spent in design of school buildings, that architecture has & always should, serve as the handmaiden of education. In other words, new techniques we have learned in regard to structure, & new & improved materials which are becoming available, should serve one purpose, & one purpose alone — & that is, to provide an environment which will permit education to develop to its fullest extent, without any crippling restraint imposed by the building envelope with which we surround it.

significant new work:

Let's examine some changes taking place in education, at least insofar as these changes are influencing design of school buildings. We can fairly well agree that, in postwar years, we have expended our best efforts in design of elementary schools, mainly because greatest pressures have occurred at elementary level. Vitality of our educational resources in lower grades is evidenced by exciting, colorful buildings found in every state of the union. It has been my privilege, in serving as vice-chairman of the AIA National Committee on School Buildings, to have visited hundreds of school plants from Maine to California. I am constantly impressed by fact that a great many, if not most, really significant school buildings are to be found, not in large cities, but in smaller communities of say, Texas, or Maine, or Michigan, & yes, even in my own state of Maryland. This I attribute, almost without exception, to sincere efforts of a dedicated educator, who like the country doctor, wants nothing but the best for his own community, & inspires those around him, including his architect, with an overwhelming desire to provide it. This is why, I believe, that significant strides have been made in elementary school planning & building. Different though the educational approaches may have been, end result is a vigorous, enthusiastic elementary program complete with school buildings to match.

some specifics include:

- **access outdoors from classrooms**
- **corridorless schools**
- **self-contained classrooms**
- **attractive courtyards**
- **lower ceilings**
- **improved furniture, movable casework, better finishes**

secondary schools lagging:

Can the same be said for our secondary schools & their buildings? With few exceptions, I think not. We have, of course, seen any number of excellent highschools designed & built in past few years, but basically, insofar as educational program is concerned, the same guiding principles have been used as were in effect some 10 or 15 years ago. It is true, of course, that a great many physical changes have taken place in our present-day high schools. We have reduced number of stories & spread out the building, we have decentralized some into campus-style arrangements, & so on, taken altogether, these buildings have been eminently successful in terms of today's educational program — but what of tomorrow?

As an architect engaged in design of school buildings, I should know better than launch into a discussion of educational programing. However, because I will touch upon some aspects of education which, if generally accepted, may significantly affect secondary school planning, I shall proceed to discuss these points, secure in my cloak of ignorance. As one thought-provoking approach to secondary education, I am sure some of you have heard or read about the hypothetical concept of total educational experience developed by Archie Shaw, Superintendent of Schools in Scarsdale, NY, & widely publicized. This concept envisions the school itself providing only a portion of the students' experience.

"Random Falls:"

By means of "work contracts" student is enabled to draw upon all community resources to further his education. He may work for a time in the county courthouse or again in the local manufacturing plant, each time returning to school for further study in "common learnings." Even within school itself the need for accommodating constantly shifting class groupings has stimulating implications for planning the educational center. In this connection, School Executive Magazine commissioned John Lyon Reid, FAIA, one of the country's leading school architects, to design a plant to house this unique program. Examination of these designs will indeed point up the fact that the educational program surely dictates the planning approach.

You may say that since this whole concept is hypothetical anyway, we can dismiss it as an interesting mental exercise. Surprisingly enough though, editors point out that almost every so-called innovation outlined in this concept is presently in use in one or another school system across the country.

the little school idea:

Another interesting but somewhat different educational approach which may well affect secondary school planning is to be found in the "little school" idea. This development has its roots in the often expressed concern which many educators have for the large highschool which by its very size tends to become overpowering & institutional.

The "little school" concept then, seeks to break down the very large highschool into several smaller unit schools of 300 or 400 pupils each.

**vice-chairman AIA Committee on School Buildings — from a talk at New Jersey School Board Association workshop program — November 1956*

The idea is, of course, that closer pupil-teacher relationship of smaller schools can be retained, without losing advantages of extensive facilities which only a large school can offer. Also, it is said, a student has a sense of "belonging" in his relation a "little school" which he can never quite achieve when thrown in with a thousand other pupils.

an actual example:

Rather than attempt to discuss all planning implications inherent in the "little school" idea, perhaps, by describing for you an actual school plant based on these principles, I can better add to your understanding of this fairly unique educational & architectural approach.

North Hagerstown High School, which will house 1600-1800 students, is to be located in Hagerstown, Maryland, & was designed by our firm for the Washington County (Maryland) Board of Education. Contract cost for this project is slightly over $3,000,000 & construction will start soon. Decision to design this school plant in terms of 4 small unit schools, was made after some small beginnings of the "little school" idea had been incorporated into design of another highschool in the same county, completed & occupied in September 1956. From these small, somewhat timid approaches, all of us concerned, board, superintendent, educational consultant, & particularly our own firm as architects, felt that we had gained enough knowledge to launch into a full-fledged design project embracing all of the "little school" principles.

Basically, North Hagerstown High School, is physically sub-divided into 4 small school units of 400 pupils each. Each school will have its own administrative & guidance counseling facilities. Each school will have its own assembly area & grouped around this will be general & specialized classrooms & laboratories for each group. All 4 "little schools" are arranged around & related to library unit, & this library then, becomes focal point of instructional areas of all 4 schools.

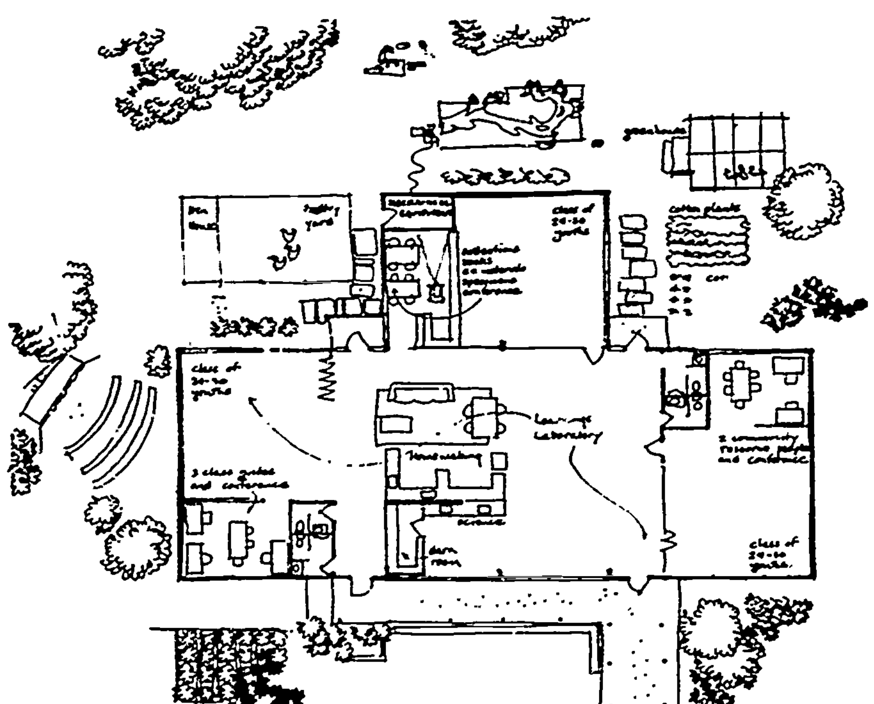
There are, to be sure, certain building elements in the total school plan which will be used by all of student body. A 1500-seat auditorium will also serve as community auditorium. A large gymnasium, however, will be arranged somewhat differently than in a typical highschool. A series of smaller locker & dressing rooms are provided, since it is expected that with 4-school arrangement, intramural sports will take on new meaning.

In matter of food service & dining facilities, we have brought forth some interesting innovations. This problem of mass-feeding for 100s of students has always been of some concern to educators, & difficult for architects to solve. Solution here has been to provide a food service & dining area for each 2 schools. A 3rd dining room is provided in the public area of the school for use of teachers, visitors, & students who may not happen to be working in the "little schools" at the time. A central kitchen will prepare meals & transport them in insulated food carts to the 3 serving-kitchens. Even though we have a single dining area serving 2 little schools, it is possible by use of folding doors to serve one or other of the 2 schools independently.

While we have provided specialized shop areas for vocational & home arts training, we have also provided areas for generalized training in these subjects adjacent to the little schools, so that these activities can be more closely related to classroom work programs.

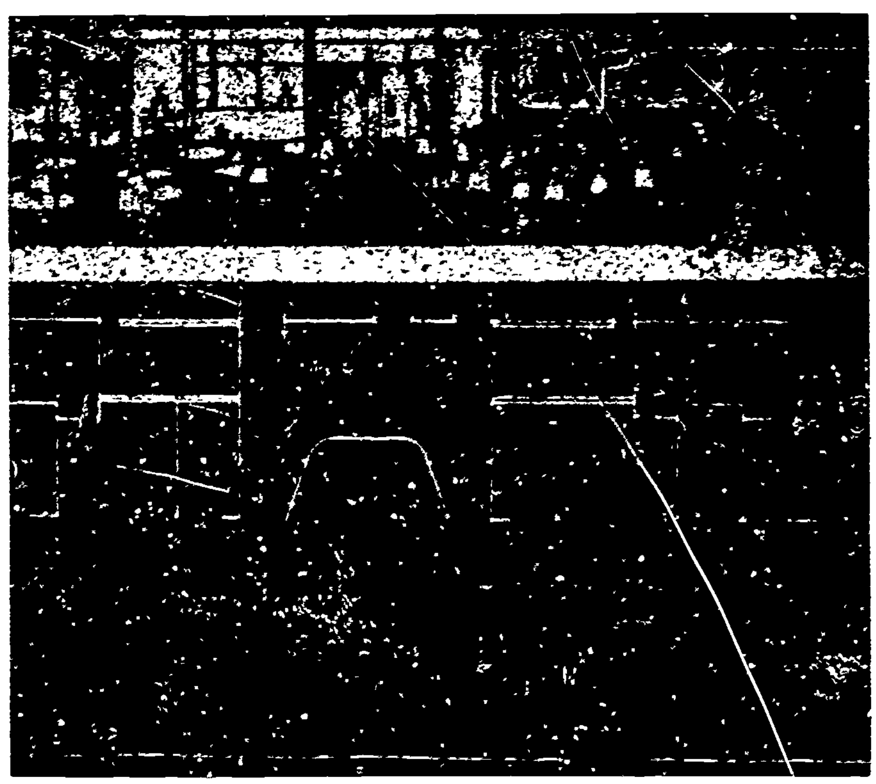
educational television:

Provisions have been made in North Hagerstown High School for a radio & TV workshop. This matter of educational TV brings me to another potent force which can change our planning concepts for schools, both elementary & secondary. About 6 months ago, the Fund for Advancement of Education, working jointly with the Radio, Electronic Television Manufacturers Association, chose Washington County, Maryland, to



School Executive

Random Falls: typical learning laboratory



North Hagerstown HS: general education lab

be recipient of a grant to inaugurate a 5-year county-wide closed circuit educational TV program. This, I believe, is the first such large scale experiment of its kind, with ultimate objective of having all 48 schools in the county participating in the program.

It is not my purpose to enter into a lengthy discourse here on pros & cons of educational TV, but to sketch for you, briefly, some implications which TV may well have for design of our future schools. Since the 2 highschools which we have designed for this board of education are expected to play an important role in the TV experiment, we have had to work quite closely with technical experts in providing necessary facilities for both receiving & transmitting. Further, since this is a continuing experiment, we have had to work out our structural elements in such a way to permit running of TV cables to every possible location. This has required a great deal more flexibility & accessibility than would be required under normal circumstances.

After observing the TV program in action, it seems to me, if we are going to use this medium in our schools, that some theories as to daylighting classrooms may have to change, & indeed, some thinking about desirable size of classrooms itself, may have to be reappraised. Certainly, if educational television becomes a vital teaching force & not just another supplemental teaching aid, then implications, with respect to both elementary & secondary school building planning, may be far-reaching indeed.

junior colleges:

One other area in which I can see possibility for future change is in respect to the junior college, or community college, as some prefer to call it. Already we can see in California the beginnings of a tremendous acceleration in construction of junior colleges. I understand that 100s of school districts there are constructing these facilities or preparing for them. Regardless of whether or not we see these junior colleges as separate entities or merely as an extra layer on the highschool, we are surely faced with some new requirements which, in turn, will require new & different solutions in school planning. As an example, in one of our Hagerstown highschools, we have built a separate junior college administration & commons building. Highschool facilities will serve, for present, to house instructional activities but a part of the 88-acre site is being reserved for future junior college development.

I have outlined just a few significant developments known to me which are taking place in education today. There are, of course, a great many others of equal significance. Some of these ideas will fall by the wayside, others again, will bear fruit & take their place in the expanding educational scheme of things. All will leave their mark on the planning of school facilities.

technological advances:

A 2nd factor which may influence school planning is technological advance in design & materials. The building industry is now ready to supply us with an array of new materials—materials which need not require us to discard completely the tried & true products but should permit us new flexibility to adjust our buildings to changing demands.

Specifics include:

- **new daylighting control methods**
- **new electrical lighting methods**
- **packaged heating & air conditioning**
- **precast structural systems & roofing panels**

component prefabrication:

Great interest has developed in past few years in many new metal curtain-wall treatments. Large units of window & wall panel are available in steel & aluminum, so insulated that a 2" thickness of panel wall can do the work of a 12" masonry wall. This is just one example of a type of component prefabrication.

A great many laymen have supposed that the architectural profession is opposed to prefabrication. I can assure you that this is not so — the AIA for years has been chief proponent of modular coordination, which is, of course, forerunner of all forms of prefabrication. What the architectural profession is opposed to, however, is over-the-counter sale of packaged prefabricated classroom space.

I have described for you some interesting experiments in education which have been going on in many cities, towns & villages across the country. I have worked with school boards, faculty committees & citizens' advisory groups, discussing, analyzing & evaluating needs & wishes of a great many communities in relation to their school building programs. With this as a background, I cannot convince myself that we are ready to set these things aside & accept one or another manufacturer's idea of what a school room should be. I realize that a great many school board members, superintendents, & yes, even architects, become "battle-weary" from constantly fighting rising costs, rising enrollments, etc, but surely, achievements we have made in this country, thru education at local level, are not to be exchanged lightly for some mail-order panacea for all of our school-building ills.

What I would propose to industry is this — concentrate on producing more & more complete assemblies of component parts of structures & accessories, so that advantages of mass-production, in terms of reduced costs & accelerated delivery schedules, would be of material benefit to all, & not alone to some particular manufacturer. Advantages are obvious — wide range of selection among products, retention of traditional practices of competitive pricing & public bidding, & most important of all, freedom to plan a school building, using these standard components, but in such a way that it will function for betterment of educational processes, rather than to strangle them.

Finally I would say — encourage your superintendent & his staff to explore new and better ways of teaching & then further, encourage your architect to use some of the new & exciting materials which are becoming available, so that benefits of our American productive know-how will be returned to us in reduced costs & better school buildings. Mistakes may be made but these mistakes should not be used as excuses to divest ourselves of our responsibility to provide our children with the best possible education & in best possible buildings we are able to provide.

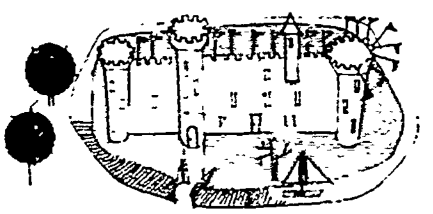
Flexibility in School Building Design

or

the ancient KING and his 3 WISE architects

BY C. HERBERT PASEUR*

Once upon a time, long, long ago—back in the real dark ages of education—schooling was carried on in a very different manner. Only the royal family had the opportunity for a formal education, and the serfs were saddled with the responsibility of paying for their schooling. With education strictly limited to the royalty, the schools were conducted right in the palace. Now, we aren't positive, but this could very well be the derivation of a term we still hear today—SCHOOL PALACES.



School Palaces....

In one particular province of this ancient country, a firm of three architects was commissioned by the king. They had a countrywide reputation for being school palace specialists. They attended school conventions, did research scrolls and displayed their beautifully hand-chiseled school plans on solid stone tablets. They did a tremendous volume of building, and it was general knowledge that they had chiseled more schools than anyone else before or since.

They also had a reputation for low cost school palaces—one even went as low as 243.5 serf labor days per square foot (about $11 by today's standards). These square foot cost figures were compiled by the architects because one of their many responsibilities of that day was to step off the square footage (barefooted) in the palaces after they were completed. Of course, the popular assumption that the foot was a standard unit of measurement proved to be wrong because many years later, it was discovered that these architects had 8" feet which accounted for the apparent low square foot cost of their buildings. It was decided then that the square foot method of determining whether a building was economical or not was rather crude and a resolution was passed to try to find a more logical method.

Even with this team of prominent architects in charge of its building program, this province had extremely bad luck in building school palaces. The king had many queens, and no sooner would he get one palace completed than his family would outgrow it and he would have to build another palace.

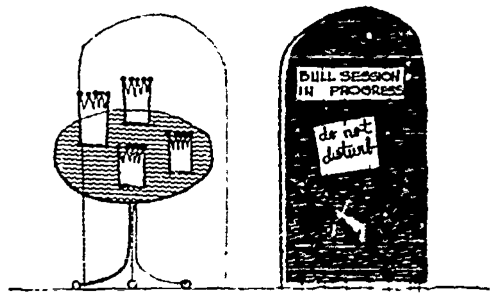
This didn't set too well with the local serfs who had to build the palaces. Besides, every time this happened, they were asked to pass another twenty-year bondage issue. These serfs would never get their freedom if this continued.

The king decided to attend a regional meeting to find some way to combat this rising opposition to slavery. In shooting the bull with three other kings, he found out that they had solved their problems by incorporating "flexibility" into their palace plans. Now he didn't know what this meant but, rather than show his ignorance, he nodded his head up and down understandingly and rushed back to his kingdom.

He immediately called in his three wise architects. "If the new palace plans don't have flexibility," he screamed, "I'm going to the next province to hire architects!" Now, the very thought of this shook the three architects from top to bottom. The king ordered each to visit one of the three provinces that had flexibility and report back what they found.

About a month later, the architects returned and had an audience with the king. The king asked each of the wise architects the meaning of flexibility, and each related his visit.

The first wise architect had visited the north province and this was his answer. "Sire, I found that flexibility meant planning for future growth. Additions and annexes are planned for because the king knows his family is going to grow. This way, he doesn't have to build a new palace every few years. I don't believe the word 'flexibility' is correct. What we really mean is *expansibility*.



The second wise architect had visited the south province, and gave his answer. "Sire, I found that flexibility meant efficient use of space. For instance, since the great dining hall is used for eating at night only, the king has turned this room into a student center during the day. By using each area more efficiently, he doesn't have to build a new school palace so often. I don't believe the word 'flexibility' is correct. What we really mean is *versatility*."

The third wise architect had visited the east province and gave this answer. "Sire, I found that flexibility meant planning for interior change. In the palace I visited, instead of three-foot stone walls, there is a system of stone columns that support the roof. All of the walls are independent of the structure and constructed of wood so they can be moved as different space needs arise. Instead of building a new castle at every stage of family growth, he converts nurseries into bedrooms, bedrooms into apartments, etc. I don't believe the word 'flexibility' is correct. What we really mean is *convertibility*."

Of course, the king, being a wise old man himself, immediately saw

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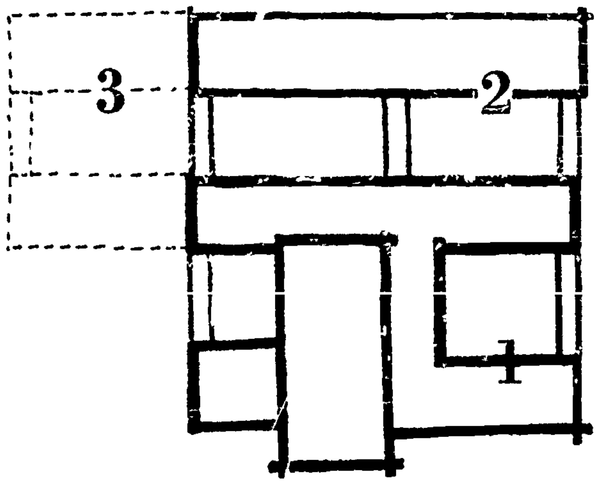
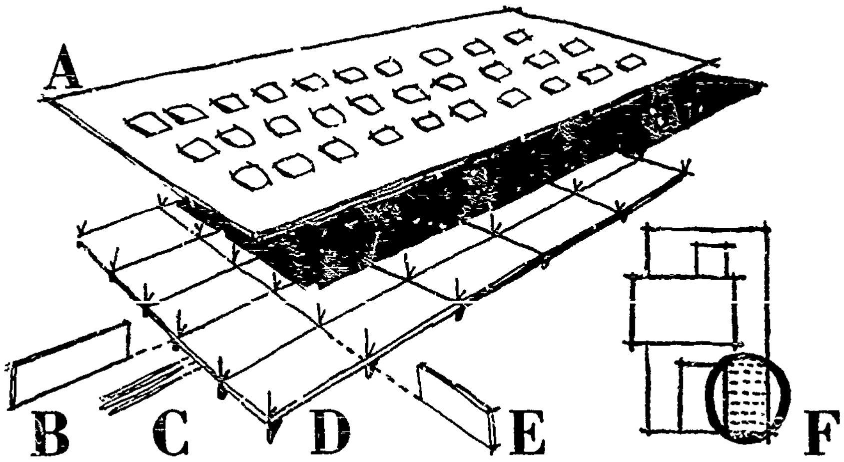
EXPANSIBILITY



FLEXIBILITY



A Top Lighted Umbrella Roof
B Movable Partitions
C Utilities Under Slab
D Pre-cast Joist Floor System
E Movable Partitions
F Structural Column Spacing

that flexibility meant all of these things—

- expansibility for exterior changes
- versatility for multi-function
- convertibility for interior changes

—each of the architects was correct!

In the last category, convertibility for interior changes, there are varying degrees of change—summer, overnight and instant.

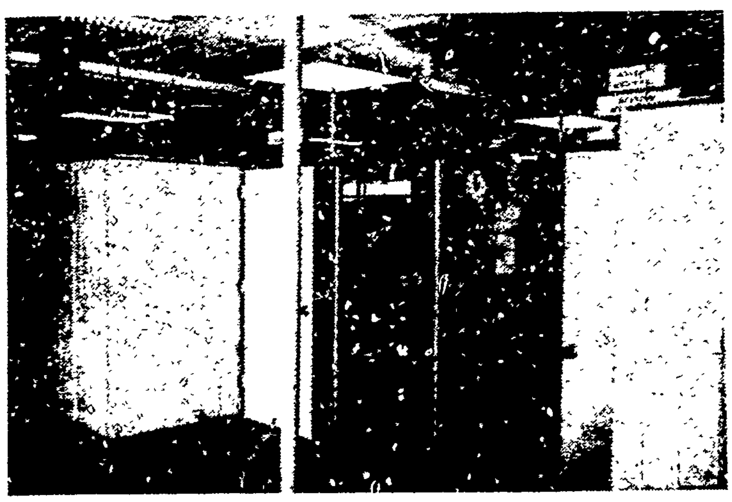
Convertibility

There are three major items in school buildings that affect convertibility:

- structure — how the roof is supported
- utilities — how plumbing and electricity are provided
- partitions — how space is divided

The Norman High School at Norman, Oklahoma, is a good illustration of the use of convertibility. The planning module in the illustration shows these major requirements:

- umbrella roof — supported on columns and completely independent of walls for support
- provision for utilities — floor of building is raised 2′ above outside grade, resulting in a crawl space under entire school which gives complete freedom for running pipes and conduit and allows stub-ups to be made anywhere in building
- partitions — built-in right on job by contractor — similar to a residential partition, constructed of 2″ x 6″ studs and ¾″ wood paneling. To relocate, are demounted by removing paneling and taking studs apart and reassembled — a simple operation, requiring time, but not skilled labor



Norman High School, Norman, Oklahoma

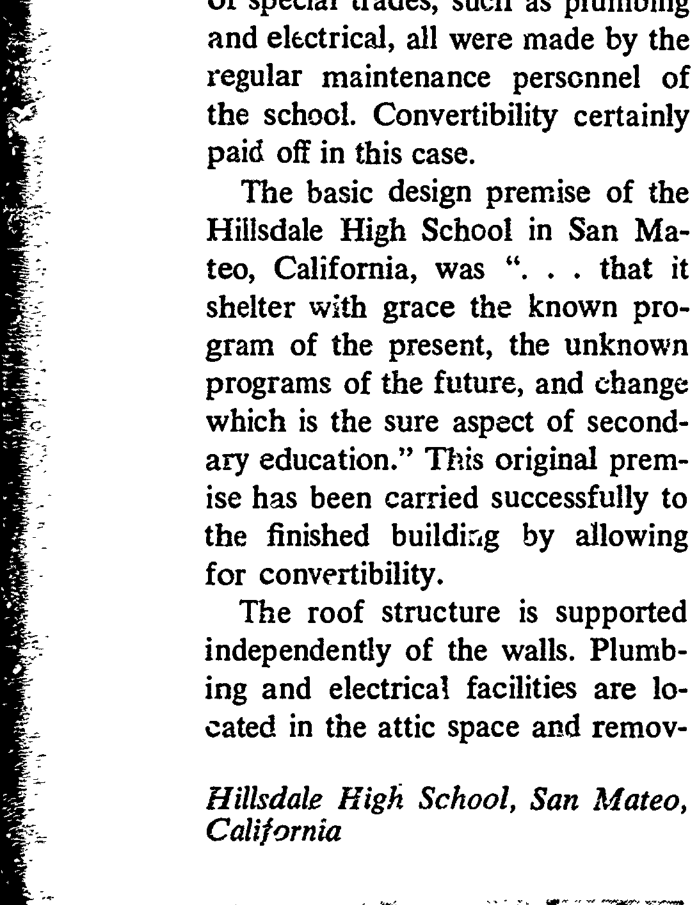
If there is anything that makes you believe in convertibility, it is to have a secondary school with which you are associated double the size of its student body. That's what happened at Norman. In a period of about five years, enrollment increased from original 600 students to 1,100 students. Expansion of the physical plant was carried out in two stages.

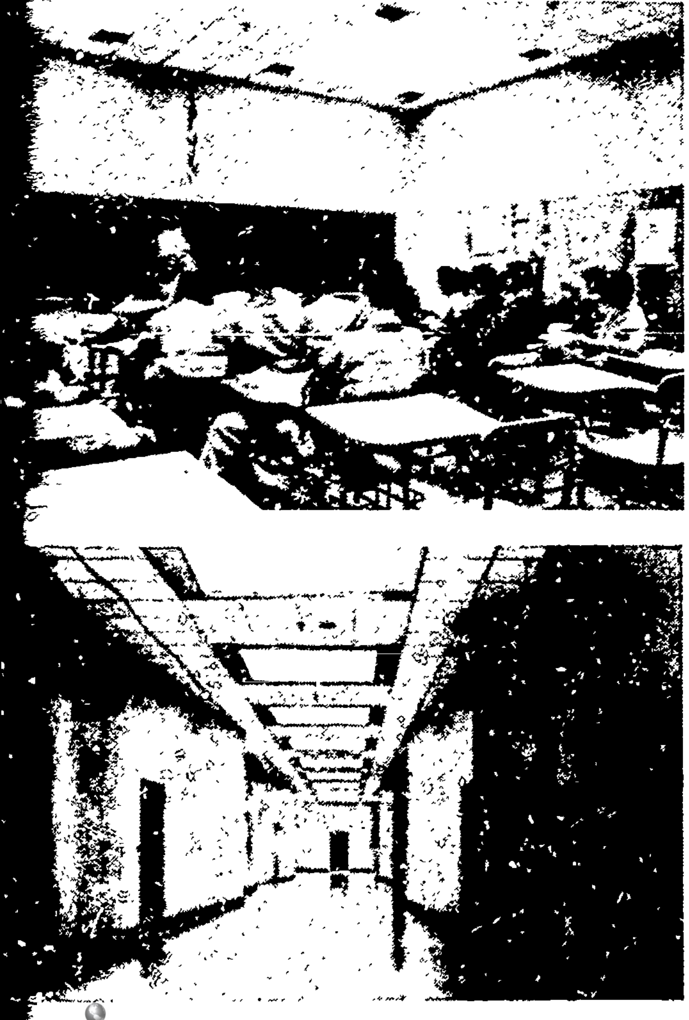
First stage was the addition of a new 24-classroom unit. Next was the conversion of all special academic areas in the original school to expanded departments. This conversion affected every department in the school — home economics, science, cafeteria, kitchen, library—all doubled in size. The departments of business administration, speech and choral singing were moved to new locations. The original planning module containing the elements of convertibility allowed these changes to be made during the summer vacation. Changes were so simplified that with the exception of special trades, such as plumbing and electrical, all were made by the regular maintenance personnel of the school. Convertibility certainly paid off in this case.

The basic design premise of the Hillsdale High School in San Mateo, California, was ". . . that it shelter with grace the known program of the present, the unknown programs of the future, and change which is the sure aspect of secondary education." This original premise has been carried successfully to the finished building by allowing for convertibility.

The roof structure is supported independently of the walls. Plumbing and electrical facilities are located in the attic space and removable sections of the ceiling allow connections to be made any place in the school. The skylight becomes the real core of this system. Around the perimeter of the skylight are located the artificial lights and at the four corners are grilles for heating and ventilation—a very compact solution.

Hillsdale High School, San Mateo, California





Partitions allow interior changes to be made overnight or on weekends. These partitions are a manufactured piece of equipment, constructed of metal with a baked-enamel finish. The manufactured joints and connections allow the partitions to be moved in large sections in a relatively short time.

Effect of Partitions

So we see that to a large extent the degree of convertibility depends upon the partitions. If we examine a conventional partition in school design, we find it has two basic functions—privacy from sight and privacy from sound. However, with today's construction methods, using prefabricated light-weight materials, we find in a lot of cases we really don't get privacy from sound. This problem is further compounded by today's requirements of convertibility, which means for our partitions to be movable, they must have many joints and connections, all of which leak sound. Take away the function of sound control and use partitions for privacy from sight only—and see the freedom we now have. The sight screens do not have to go to the ceiling or floor. We can eliminate doors. We can use drapes, portable folding screens, rolling cabinets, sliding panels, etc., to divide the space.

This concept of space division would adapt most readily to any future educational concept. Each week, or each day for that matter, the school could be completely rearranged to accomplish the next unit of work.

But what about sound privacy? There is no cut-and-dried solution right now. But if the demand for instant convertibility is great enough, we can muster the necessary resources for research to solve any problems of sound. We do have

some methods of sound control that can be applied to open plans today. One theory being explored is called "sound masking." By putting speakers at close intervals in the ceiling, we gain a certain amount of privacy through controlled background "noise" — solved in large office spaces today with Muzak. This, again, isn't a cure-all, but it is a step in the right direction.

As I see it, there are two reasons why schools today are not incorporating instant convertibility.

- Disadvantages of instant convertibility still outweigh the advantages. This balance could easily be reversed in the future.
- Our present educational program does not require this extreme concept of convertible space.

The true value of instant convertibility however, lies in anticipating future needs rather than in just satisfying the needs of today.

What are these future needs? We don't know, but we do know that tomorrow's needs will differ from today's. In a recent issue of *School Executive,* Dr. Walter Cocking says: "As I see it, it is inevitable that deep and vastly important changes will occur in America's educational system during the next ten to fifteen years. The character of these changes and the direction they will take will have vast significance. The issues to be decided are many . . ."

To accommodate these educational changes referred to by Dr. Cocking, the design of the physical plant will also have to undergo deep and vastly important changes—and this is the disturbing thing — the school plants being built today will be required to house this new program. This, to us, places a note of urgency on achieving instant convertibility now.

PRE-SCHOOL BUILDINGS

by Heinrich H. Waechter, AIA *

educator-architect relationship:

Nursery school & kindergarten planning requires intimate understanding between teacher & architect. Architect must observe & try to understand the great variety in activities of the very young child & educator needs architect's imaginative & technical skill in order to find 3-dimensional expression of his teaching ideas. The more precise the educator's formulation of teaching needs are, the better will be the architect's stimulation to find answers in terms of building. (Note: another architect points out that this is most true for 2-6, for older children a general formulation of teaching needs may lead to a better answer in terms of building design.)

It is not enough to provide for health thru good lighting, ventilation & sufficient space. It is not enough to choose types of construction & materials to provide for requested amounts of space & to stay within budget limitations. The main question will always be how to provide environment & building facilities in which a certain type of education can take place in best possible way. A well designed building for such educational purposes results from integration of educational & architectural thought.

planning requirements:

Pre-school buildings are essentially part of the housing situation & therefore should be located as near to family homes as possible. Most ideal situation lets child walk safely from home to school thru a greenbelt, a continuous landscaped area undisturbed by traffic (see illustration—but youngest children need transportation or escort). In built-up city areas with multi-story apartment houses it is difficult to find enough out-door playground space & children often meet dangerous traffic on their way to & from school. Some very large modern apartment houses have pre-school facilities for the youngest children right in the block. Pre-school education is usually separated from public schooling & most nursery schools are privately owned. Only 5- to 6-year olds go to public kindergartens connected with public schools. Trend to consolidate school districts & build many large-sized schools causes a problem in planning of pre-school facilities. A small number of pre-school children living near such consolidated schools can still be housed on the site. If a more typical number of pre-school children are transported daily with the other children, the bus system has to be enlarged & becomes complicated—with little ones squeezed in between older children. Under these circumstances the small child becomes unnecessarily detached from home environment, particularly if the community has good houses in well-designed residential site planning.

various types:

Although pre-school education for the young child from 2-6 has a history of more than 200 years preschool training has not been generally accepted. Much progress has been made &, with varying educational & social approaches, following major types have evolved:

- **nursery schools located in residential neighborhoods, including housing developments**
- **kindergartens as part of public school system or, if sponsored by PTAs, in classrooms furnished by school district**
- **pre-school facilities in settlement houses & other philanthropic institutions**
- **pre-school laboratories in colleges or high schools with curricula related to educational, psychological or child-care training**

We are not considering child-care centers & nurseries which relieve mothers while they work or go shopping but which do not maintain a regular educational program.

schedules:

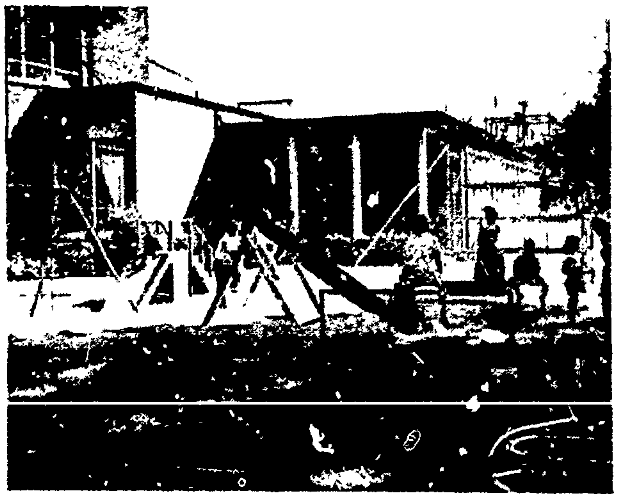
Educational & child-care standards in schools for the very young are generally very high & demand more variety in facilities than we find in other school types. Such a program may be illustrated by a typical schedule which includes different play periods & takes care of routine activities, like eating, sleeping, toileting, etc. Such schedules should be flexible & will require more time divisions for the youngest than for the older groups, depending on need for physical care & length of time children can pay attention. Day schools need to be more elaborate as to facilities for eating & sleeping than schools which operate only on a 3-4 hr basis.

play activities:

Generally accepted principle of "learning by doing" is basic in preschool curricula. Free-play periods, in which children go about separate activities, alternate with group activities in which all participate. Brief health inspections to detect any sign of contagious disease are given before the child joins the group in the morning. Furthering mental & bodily health is a major part of the educational program.

A child can, at any time, join others in social play or retire to a quiet corner & busy himself with something of his own interest. He may work at a table, on the floor or in the garden. Activities of 2-3 year olds will be much simpler than those of older children. Following tables indicate appropriate materials & activities:

open cabinets & shelves: (child proportions)	**crayons pegs balls puzzles**	**blocks picture books various toys**
play equipment: (sometimes child-built)	**doll houses stage store post office**	
large low sink or pool: outdoor pool:	**waterplay floating animals toys or boats**	
flower shelves:	**pots vases tools**	
terrarium:	**small animals plants**	
aquarium:	**aquatic life**	
art experience:	**easel painting finger painting paper pasting clay modeling**	
audio-visual:	**slide & strip-film projector screen room darkening**	
music:	**phonograph-records piano simple instruments drums bells—triangles pot-covers, etc.**	
wheel toys:	**wagons, tricycles pushtoys**	
outdoor equipment: (indoor in some larger installations)	**swings jungle gyms slides pet care spray pool gardens**	

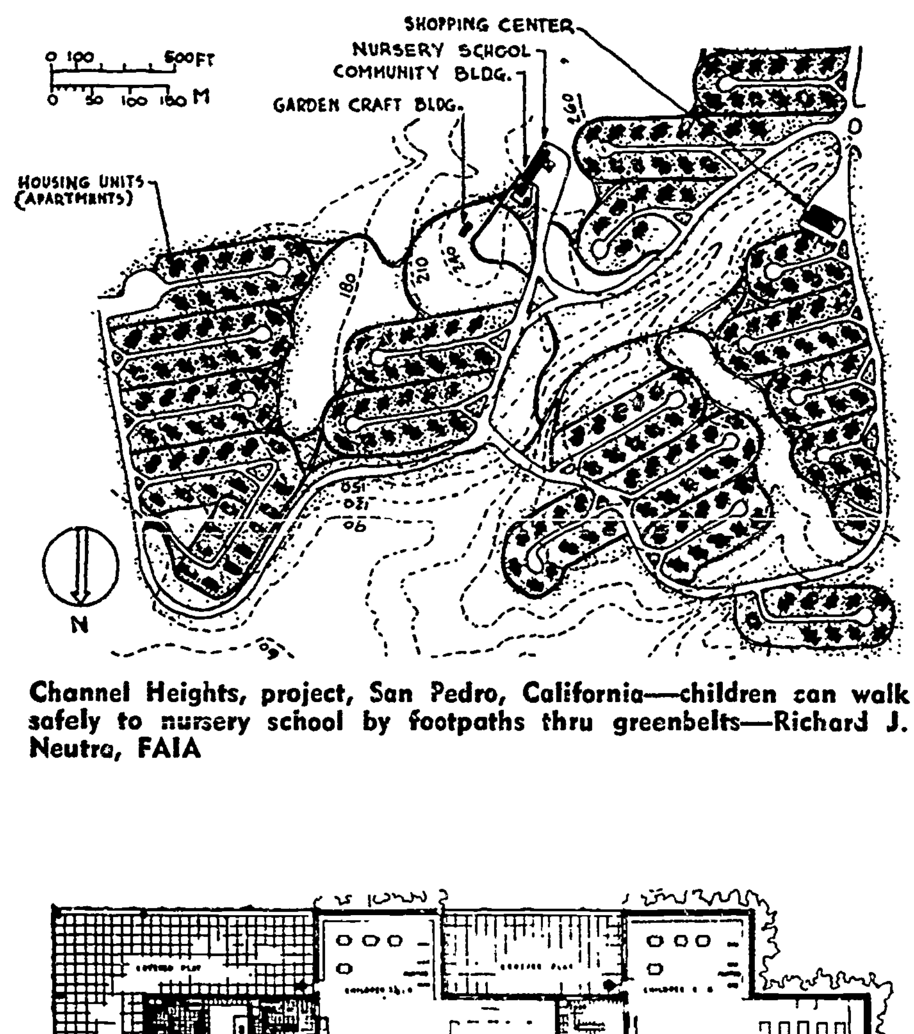


Waechter

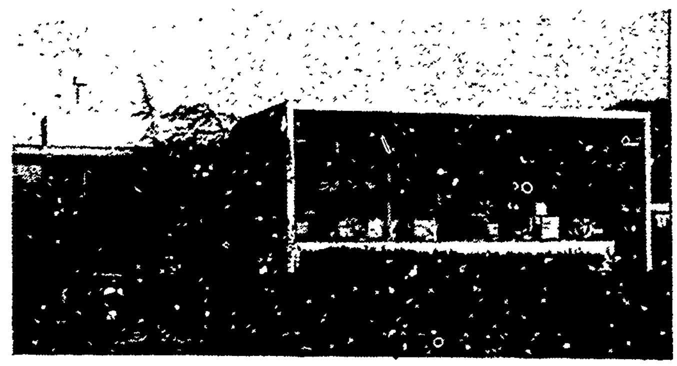
where turf can be maintained it provides best playground surface—State School for the Blind, Salem, Oregon—Wolff & Phillips, AIA

Hedrich-Blessing Studio

Clyde L. Lyon School, Glenview, Illinois, has a very friendly & homelike kindergarten room—Perkins & Will, FAIA



Channel Heights, project, San Pedro, California—children can walk safely to nursery school by footpaths thru greenbelts—Richard J. Neutra, FAIA



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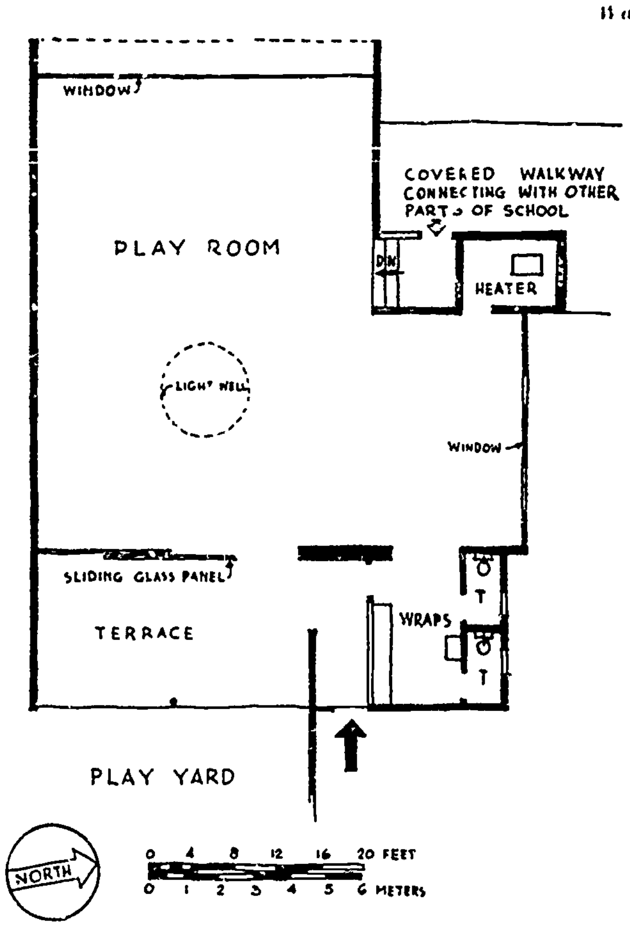
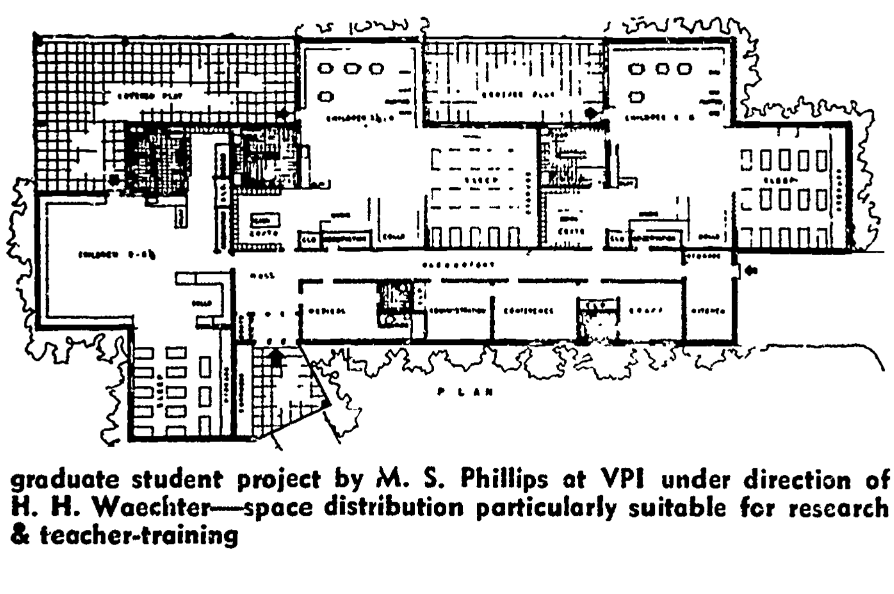


Meiner's Oaks School, Ojai, California, has completely detached Kindergarten unit—L-shape favors diversified use—Maynard Lyndon, FAIA



graduate student project by M. S. Phillips at VPI under direction of H. H. Waechter—space distribution particularly suitable for research & teacher-training

space requirements:

Number & size of rooms required will depend on whether school is a day school or half-day school. Some functions of one kind of room may be combined with those of other rooms particularly for smaller installations—depending on program or available space. Following types of rooms are needed for a self-contained school for very young children:

play or group room	**isolation room**
sleeping room	**conference room**
dining room	**office**
toilets & lavatories	**teacher's room**
children's lockers	**caretaker's suite**
observation room	**utility room**
kitchen	**storage**
laundry	**entrance hall & other traffic areas**

Individual groups vary in size from 14 to 25 children according to age. Although minimum space requirements have been given as from 35-70 sf/child, above description of play activities indicates that optimum space requirements must be determined by individual study of each project. In each case you must decide whether the great variety in activities should be taken care of by designing multi-shaped rooms with many special areas & nooks for various activities or whether a simple room would be better—if it is large enough to set up space-dividing movable furniture, low screens, play house, free-standing sinks, etc. Careful consideration of the many possible activities—which may take place while sitting on the floor, sitting or standing at tables, running in open areas or lying on cots—will lead to conclusion that it would be wrong to give these children just another standard class room in an elementary school, even if separate entrance & toilet facilities are provided.

room arrangements:

While there are innumerable types of pre-school buildings, a few room arrangements have proven practical in almost every case. Entry hall with lockers for wraps is the strategic point from which playroom(s), isolation room, office & toilets are to be reached. Since toilets have to be accessible from outside playground & possibly should be supervised by teacher in the playroom thru a window, a definite relationship will develop between entrance areas, lockers, isolation room, playroom & toilets. How these elements will fit together depends also on orientation possibilities & topography. In temperate areas southern orientation with controlled sunlight is perhaps most favorable. Sleeping areas should be free from sunshine while in use. Good principles of lighting & ventilating the contemporary school & house, generally speaking, find application in pre-school buildings. Main modification would be that small children change activity & position frequently according to the limited time during which they can pay attention. Therefore, there is no limited level or rigid desk location of task as in ordinary school rooms. Although good brightness-balance of lighted surfaces in the field of view is most valuable some variance in light is natural. Activities should be adjusted to face away from excessive contrasts of bright & dark areas. Good planning results in a balanced scheme where the many & sometimes conflicting requirements are reconciled. One-sided emphasis on construction, lighting or other engineering aspects may lead to neglect of circulation & usability of space. It is the especial quality of the architect's vision to see these varying requirements together & to coordinate them.

materials & construction:

Pre-school buildings are by virtue of their function comparatively small, one-storied structures—in **scale** with small children. Therefore, all types of structures used in residential & small school construction are applicable—wood-frame, steel-frame, concrete or masonry. Type of structure should favor ideas expressed in planning the school, including relation of indoors & outdoors. Materials should be simple but able to stand good hard use. Finishing materials & exposed structural materials should be in harmony with color scheme & part of the design. Floors should be warm & resilient. Safety considerations are same as in any other type of school.

playground:

Outdoor facilities are practically of same importance as those within the building. Landscaping is a most urgent part of any pre-school planning, influencing climate around building & making possible all outdoor activities. Trees & shrubs which give shade to the building perform also the function of screening outdoor activities or improving larger outdoor play areas. A covered play area should be nearest to building, as an extension of playroom. Children should have access from it to paths for wheel toys & to areas with equipment such as:

jungle gym	**sandbox**
swing	**play-sculptures**
traveling rings	**pet house**
slides	**treehouse**
	spray or wading pool, etc.

Small children like to work garden plots & to wander about exploring the grounds. Ground surfaces should be turf wherever possible. Paved areas should be asphalt rather than concrete. Where turf cannot be maintained under equipment, use sand, tanbark or similar resilient material. Taking care of pets, from rabbits & cats to ponies, is very popular & wholesome, but grounds should be sufficiently large to house animals properly & supervision should be available.

* *permission was granted by F. W. Dodge Corporation to use material from the Architectural Record book "Schools for the Very Young" by Heinrich H. Waechter, AIA, & Elisabeth Waechter.*

Small Schools-I

(1 TO 3 CLASSROOMS)

by **Eric Pawley, AIA,** *Staff Executive,*
AIA Committee on School Buildings and Educational Facilities

Few of us realize the continuing relevance and importance of small schools today—not only for countries where public education is beginning new development but in populous, already industrialized places. The one to three-classroom school still has obvious pertinence for rural education, in sparsely settled areas.

". . . *But surely not in metropolitan regions?*" We can hear this assumed-self-answering question. The facts supporting the need for small urban and suburban schools are based partly upon our lethal traffic-ways and murderous intensity of traffic, and partly perhaps upon educational values, of which more later.

Traffic

A strange and savage form of urban surgery has been inflicted upon our cities in the name of "modern transportation." Massive programs of federal, state and municipal limited-access highways, freeways, parkways and interchanges have carved neighborhoods and school districts into islands adrift in a rough sea filled with finny traffic as deadly as the sharks, barracudas and piranhas it so much resembles. It is difficult to see a valid need for the 300-hp, 120-mph personal automobile, but Madison Avenue would have us all believe that this is our birthright and an essential part of our economy. There are many such pressures upon us for highway programs, which are beyond the scope of this brief paper, but it is encouraging to note that our one major city which everyone agrees has the most charm and individuality, San Francisco, also had the strength of civic character to say NO! to plans for six cross-city freeways.

One eastern county school superintendent, noting that a new 10-mile stretch of highway nearby was posted for a construction cost of $1,000,000 per mile exclaimed "We could have built our whole school system for the cost of that ten miles of road!"

Buses

Provision of school buses (a large and influential pressure in itself) adds a particularly cumbersome vehicle to the traffic and occasionally has been a convenient, modern, packaged way of getting rid of loads of children all at once. With all the lip-service to planning we have had in the intervening thirty-five years, few have followed the excellent thinking (Clarence S. Stein, FAIA, and Henry Wright Sr) behind the classic Radburn residential concept of separate pedestrian walks without crossings at grade. There must be something about it the real-estate developer and "merchant-builder" (who now have almost complete responsibility for our suburbs) find unacceptable.

There have also been more and more caustic comments about the changing concepts of walking as something people do, and the elaboration of facilities for physical education and the viewing thereof.

Nearness—a Value

All of this points up the idea of primary schools within safe walking distance of homes. One-to-three classrooms means a pupil-load of twenty to 100 children. In some urban areas of this traffic island or enclave type this may well be all the primary children. Certainly there are values in the smaller scale unit for younger children.

Temporaries

Another type of need for small units results from temporary fluctuations of population. Alert superintendents and school boards can be forewarned of these and some have met them with temporary, mobile or demountable units. An architectural wag has called them *"disposable teaching cartons"* but if the situation is truly temporary and such units are not permitted to become permanent (not easy) it is one solution. They also may meet the need of some remote districts where construction on site is difficult and expensive. An expansible scheme has been used and others may employ several trailer-width units sealed together at the site. With such minimal facilities good design is of the utmost importance. They cannot be single trailer-size shoeboxes. A recent School Plant Study* on orientation for solar heat control pointed out proper design methods for alleviating some of the discomfort in such small shelters in hot climates.

In Housing Developments

From time to time proposals are made that one or more typical dwelling units in housing developments be allocated for primary school use. The argument is again to meet a temporary need and that the units can later be completed as dwellings and sold.

There seem to be several objections. Usually there are radical violations of school safety and fire laws—in materials, construction, details and planning. Also, usual residential finish materials and hardware just will not take the beating of school-use. Instead of perhaps three pairs of stampers, door-bangers and sticky hands there will be more than twenty pairs. Maintenance is multiplied. Illumination also will be below par in daylighting with usual residential fenestration, and in electric lighting unless there are special installations.

Why not do it right in the first place? Architects of some larger-scale housing have done this—notably the pioneering example (1947) of Affonso Eduardo Reidy in the five-classroom elementary school within the great Pedregulho housing development in Rio de Janeiro. Some New York City housing has also included school facilities.

The Teacherage

In remote areas there may be need for a "teacherage" or living-quarters for the teacher related to a small school. This may be the only solution. A 1958 survey indicated that nearly six percent of teachers of one-teacher schools lived in them, an additional two percent in trailers.

AIA Journal, Aug 1960: 69-72 BT 1-40. Holmes & Chance, "School Building Orientation"

A combination of this kind is basic in the remarkable rural education program of Mexico developed under the leadership of Jaime Torres Bodet, Federal Minister of Public Education, and his most capable architectural chiefs: Pedro Ramírez Vázquez and Enrique Vergara. This system is of such interest that we shall devote a separate study to it in the near future. The teacherage is also found in Europe.

Educational Values

The small school, particularly the one-teacher school, makes strong demands on the teacher. It may involve mixing age-levels and suitable instruction for six to eight grades. The old tradition of using older pupils as assistants is doubtless frowned upon by the profession as an invasion of hard-won certification. It may even have been made illegal but every capable teacher must recognize two of its specific values: delegation of the teachers' work-load under guidance, and a definite educational value for the young assistant even if not aimed toward a career in teaching. The experimental work with legitimized teachers' aides in Michigan several years ago seems to have died out—we wonder why. . . . It seems to have turned into full-union-card team-teaching. Perhaps such unofficial methods are best left informal, spontaneous and undiscussed?

Anyone who has observed or has been a part of the multi-age classroom must have been impressed with certain educational values which no other situation gives. The young child is strongly motivated to emulate anything it admires—in fact this is education. Perhaps this is stronger in the upward direction (emulation of elders) at first—but teenagers must abjectly conform to their own age. Artificial segregation of age-levels removes opportunities for understanding and even tolerance, in the downward direction. A curious thing happens, however, when a bright younger pupil can outshine an older pupil (we'll leave the teacher out of this!). Instruction which permits this is possibly salutary for all ages. So much for the sacred cow of "readiness!"

Paul Woodring notes ". . . the one-room school of the 19th and early 20th centuries changed us from a predominantly illiterate nation of frontiersmen to one in which each child, rural as well as urban, had a chance to get an education. . . ."* That 1958 survey** (latest accurate figures) again shows that from nearly 200,000 such one-teacher schools in 1918 the total has decreased to about 24,000—but 400,000 children still attend schools with one teacher teaching six to eight grade levels. Eleven of our states each still have more than 1,000, four states each have more than 2,000. Pupil access figures are also interesting for such schools:

40% in automobiles
20% in school buses
31% walk
balance: bikes, even horses

Consolidation

A great effort has been made to abandon small schools and to consolidate their populations and offerings in larger centralized facilities, even if it means forty-mile bus rides. We hear much educationese about this and bags of foundation money have been spilled for studies, research, reports and dissemination. It is true that much of this effort has been directed toward elimination of marginal high-schools which may have persisted through local pride alone in spite of decreasing numbers of graduates. It would seem wise to re-examine any extension of the idea to elementary and primary schools. Some state education officials are inclined to view smaller schools as administrative nuisances and, in support of consolidation, go so far as to claim that certain new small schools were built by localities "to block consolidation."

In some cases the pendulum of largeness has boomeranged. The 2,000- or 3,000-pupil school has had to be subdivided into four or more "little schools" or "schools within a school"—to offer "better educational opportunities" of several sorts. Largeness may also reflect a certain amount of ambitious administrative empire-building and other values not related to education. We are told, rather inconsistently, that below a certain size a school "cannot offer adequate educational opportunities. . . ." Surely this is a mistaken concept which equates education with equipment rather than teaching. It smells so much of commercial pressure that it reminds us of the zeal for audio-visual instruction *über alles*, the prime example of the holy crusade for fringe commercial benefits.

At a recent meeting of the AIA Committee on School Buildings and Educational Facilities our member from the AIA Western Mountain Region remarked that he had gone back to Wyoming from the last meeting determined to apply in the work of his own office some of the things he had heard discussed. "You know," he said, "some of the ideas you fellows talk about are very exciting, but we found it pretty hard to apply those 'school-within-a-school' and team-teaching concepts in a one-classroom job!"

Growth

All schools, small and large, must face the possibility of needing to be larger. Design for growth is not a new idea. It requires forethought in site acquisition and building placement, in building plan and utilities. Plans are best developed with the ultimate in mind, then adjusted for early needs. It takes skilful design to make all stages look well.

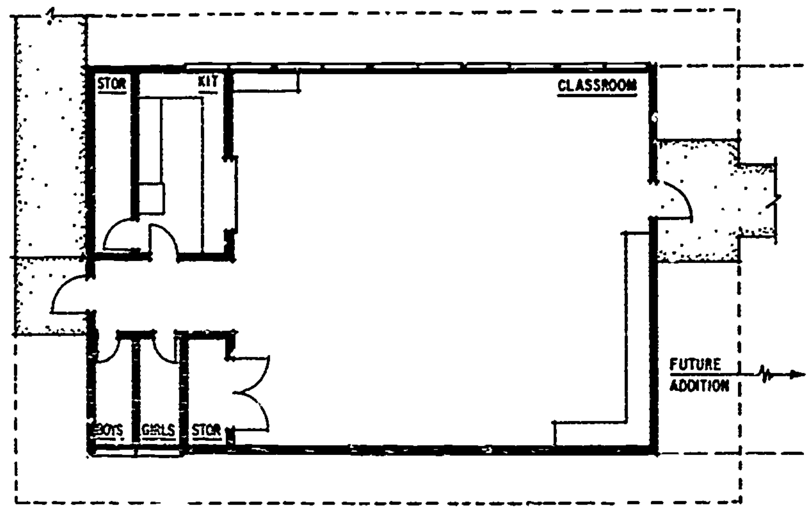
Esthetics and Education

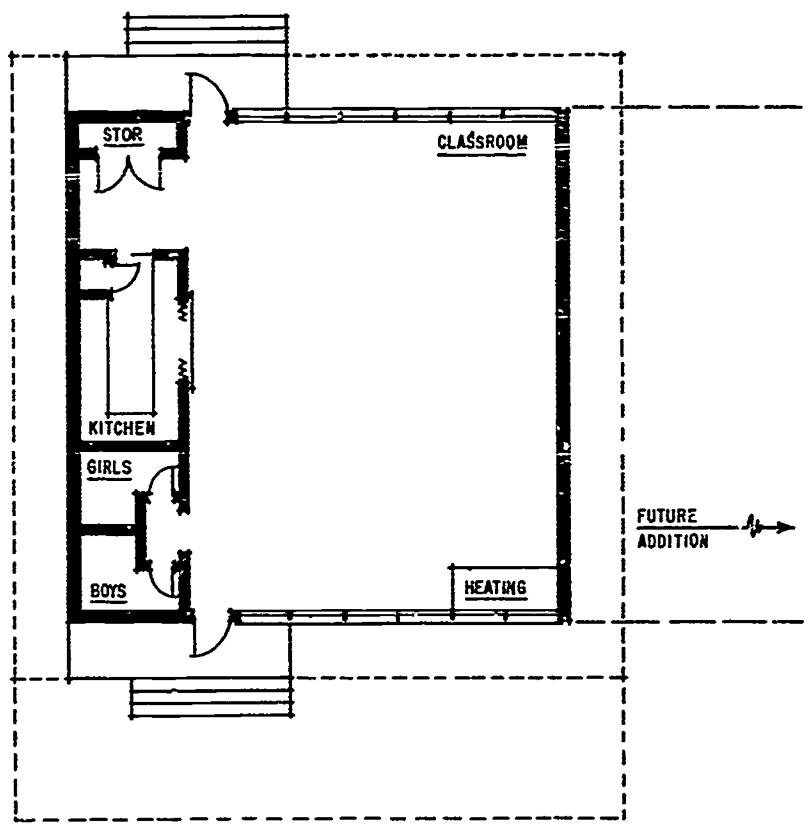
The time should long ago have passed when education is thought of as something within books and other media, useful tools for a teacher, or that the teacher (and the school) are the only avenues of education. The child's total environment teaches. Good architecture teaches and in a school can be conducive to an improved teaching-learning situation. Our best school architects have done far more for contemporary education than they get credit for. This does not mean that using Smearallover Paint and Blastotherm Heating or Dazzleouch Lighting will help Johnny learn to read faster (if ever). It does mean that a carefully-designed interior which approaches an integration of all elements of design: space, light, color, acoustic, thermal, etc, can be, as required, a relaxing, pleasant experience or a stimulating one. Spaces can be designed specifically to facilitate certain school tasks. Exteriors can be orderly, well-proportioned, in good scale with their surroundings and suggest a building you would like to enter—instead of a forbidding or monotonous place in which children must spend so many hours each day. It does not take great expense to accomplish this—it takes good professional service.

Saturday Review, 18 Feb 61 p 62
**"One-teacher Schools Today" NEA Research Monograph 1960—M1 75pp paper $1.25

One-Teacher Elementary School
Forks of Salmon, California
Smart and Clabaugh, Architects

Note expansion—daylighting unilateral (N)
roof construction: 2 x 6 truss framing over
4 x 18 glulam beams; separate generator
shed to reduce noise and vibration



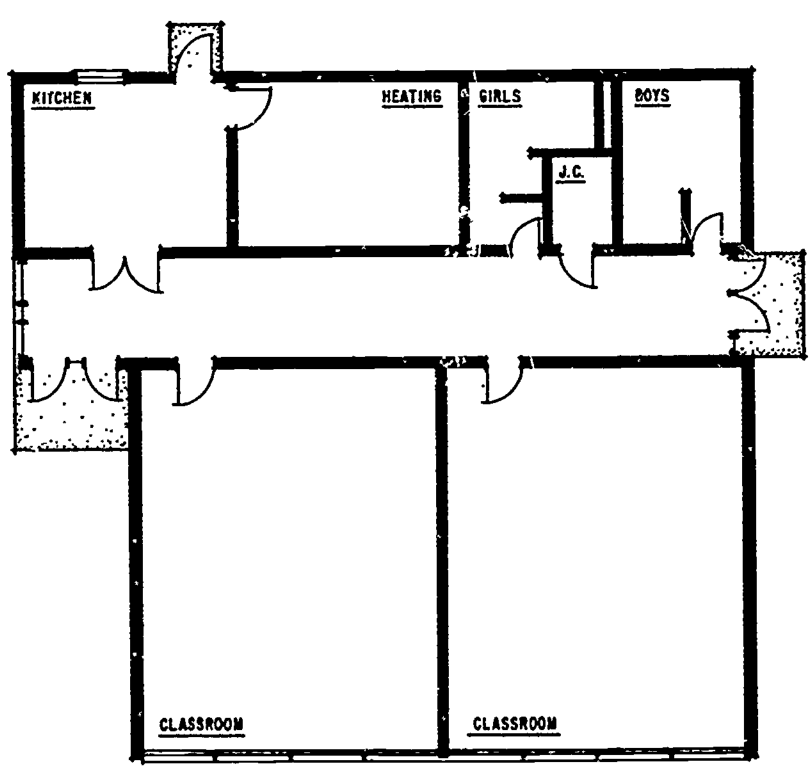


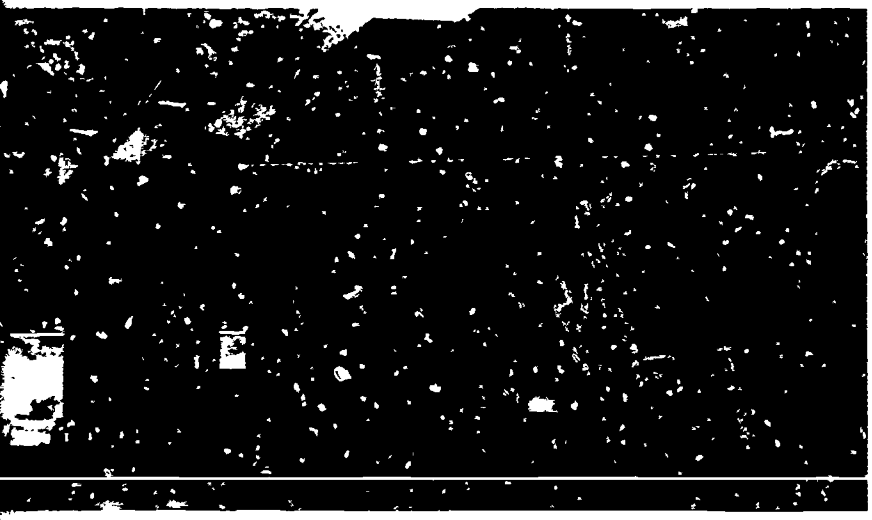
One-Teacher Elementary School
Coffee Creek, California (1960)
Smart and Clabaugh, Architects

Bilateral daylighting (E+W) with broad
overhang on west; separate cottage for
teacher's residence (at local expense)

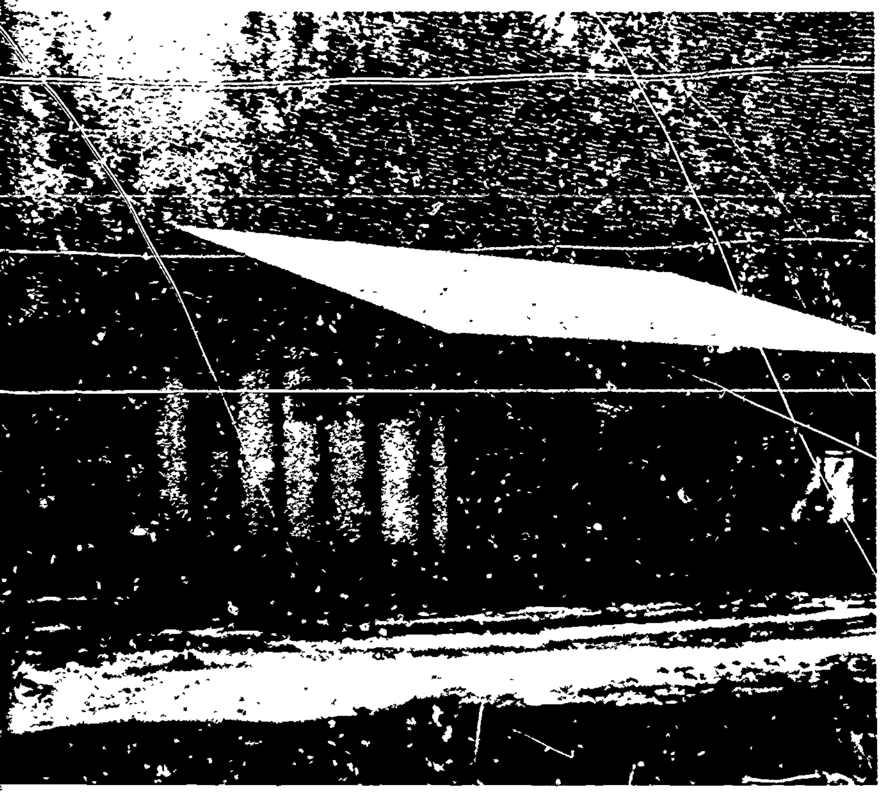
Two Classrooms and Kitchen
Dixon Elementary School
Lone Rock, Wisconsin (1959)
Weiler and Strang and Associates,
Architects

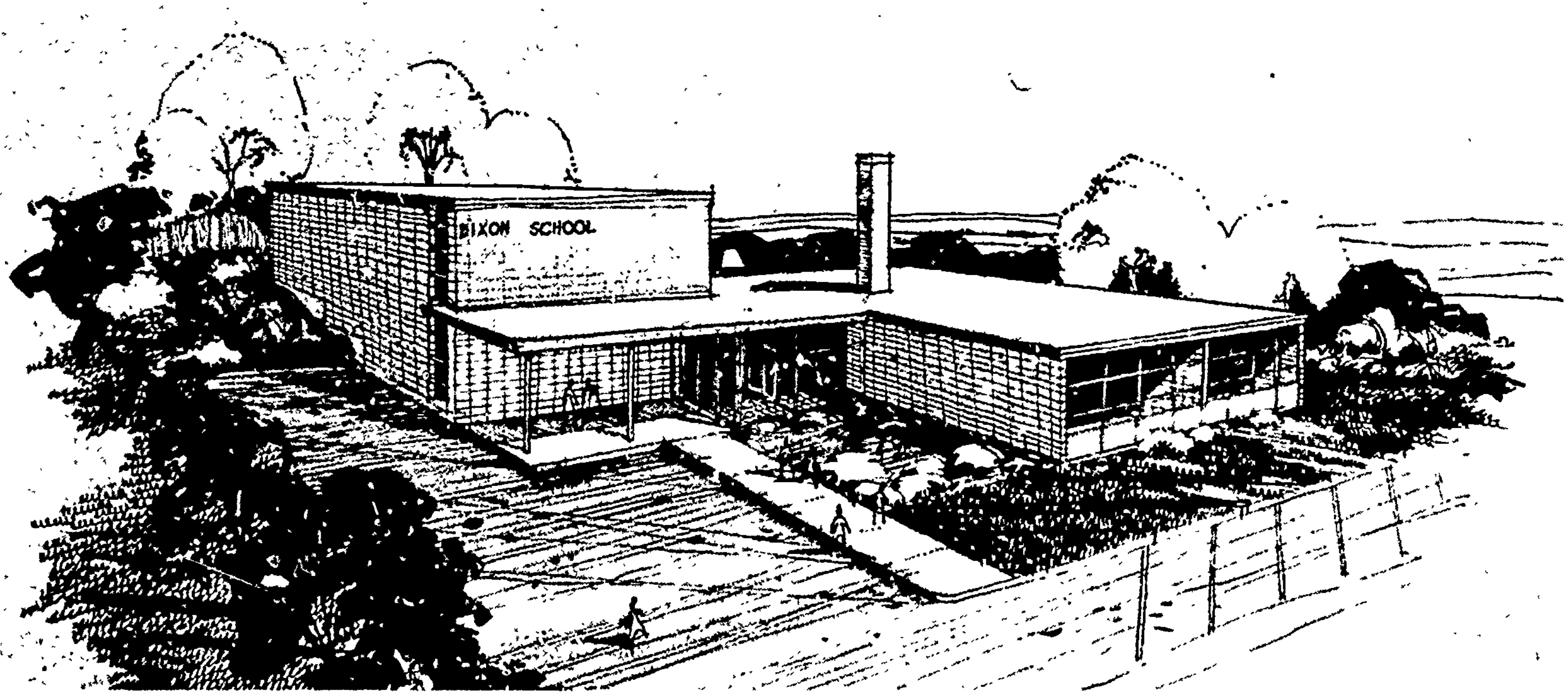
Unilateral daylighting facing east;
plan permits easy expansion

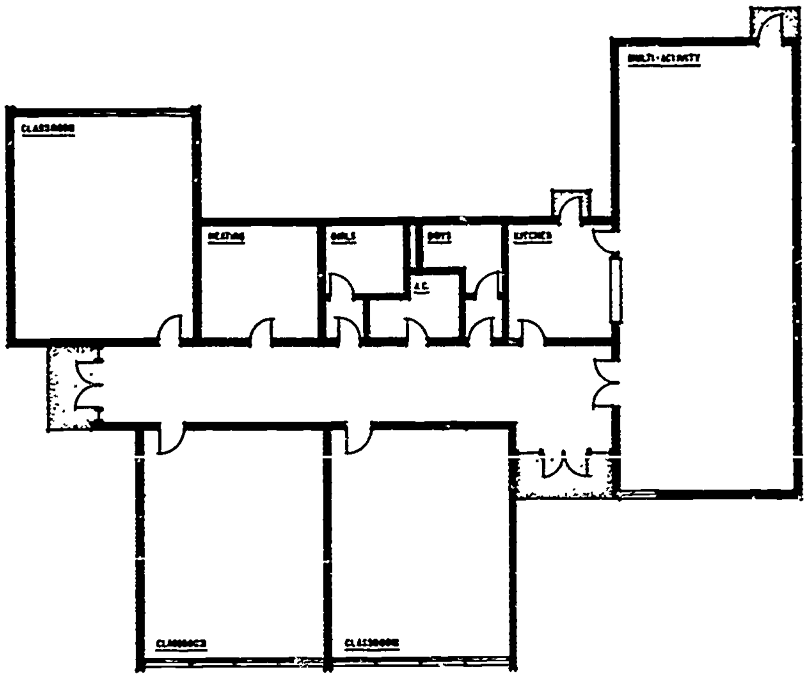




William Wollin





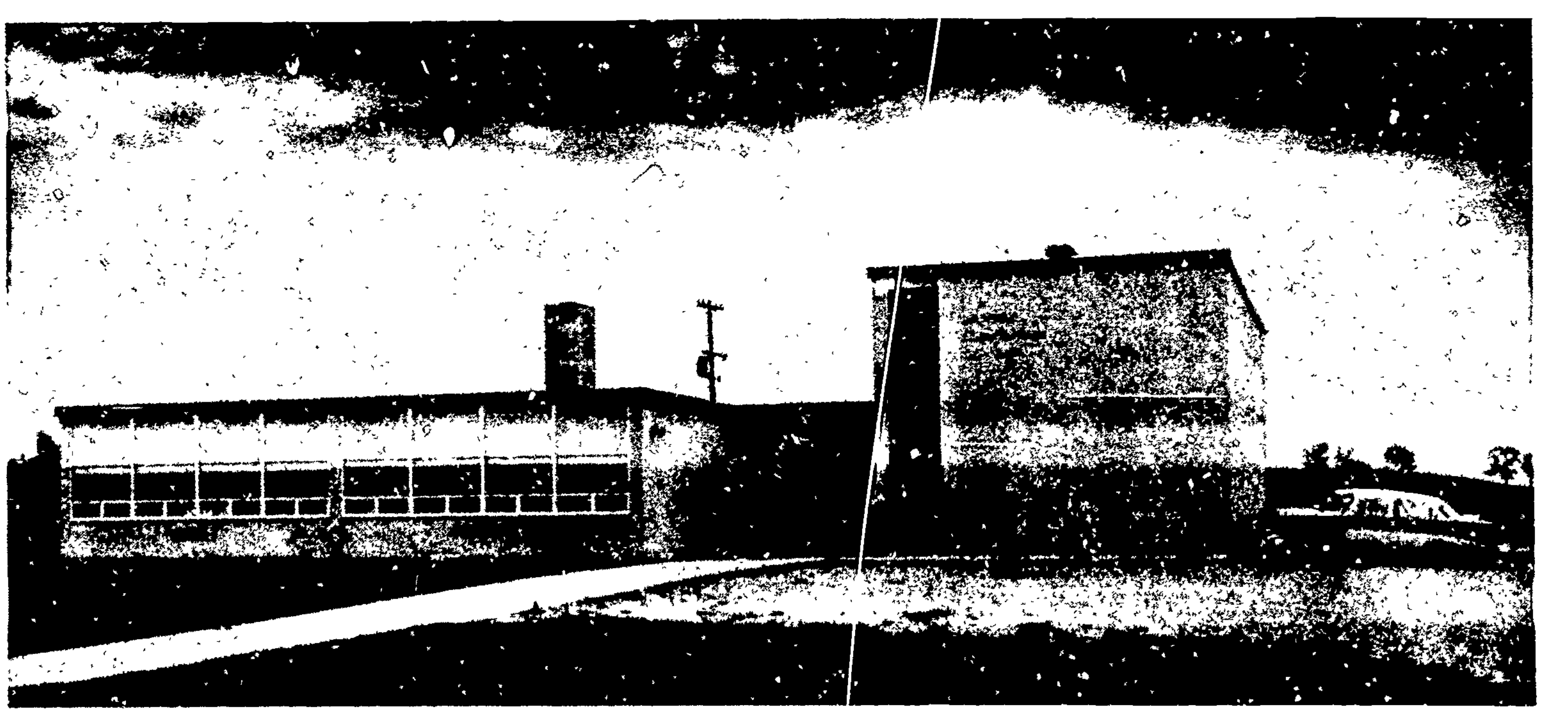


Three-Classroom Plus Multi-activity Room and Kitchen

Badger Elementary School (1957)
Dane County, Wisconsin (near Madison)
Weiler and Strang and Associates, Architects

Acoustical tile ceiling; unilateral daylighting; roll-shades; sandwich panels above glazing

William Wollin



Small Schools-II

(4 CLASSROOMS)

by **Eric Pawley, AIA,** *Staff Executive,*

AIA Committee on School Buildings and Educational Facilities

A curious phenomenon of some of our suburban development has been its almost complete lack of local government. The new residents come from cities where they personally had no part in government except their votes. Planning, zoning and building in the new area may be under minimal regulation. This situation grew so bad in one metropolitan region that permits for construction of several hundred houses were held up until proper school facilities were assured. Some subdivisions have been planned with a completely callous neglect (omission) of school sites. Others have allotted only such areas for schools as could not be used for houses.

Sites

While such sites present a "challenge" to the architect, with skilful planning in which the picturesque qualities and changes in levels are taken advantage of they may result in most attractive and functional school properties. No one could claim for them the simplicity of treatment which leads to sure economy. A method has been found, however, and numerous examples exist of a practical and pleasant way of handling such rough sites by what has come to be known as *campus planning.* To avoid the difficulties and expense of changing levels within a larger building the elements are subdivided into appropriate small units connected by walkways which may or may not be covered, and/or enclosed, depending upon climate. Changes of level are much less expensive outdoors. This scheme also lends itself to pleasing groups of small-scale structures, preservation of trees, a real identity for each school subdivision, possibly better natural light and ventilation, easier access, exit and fire protection, and simplified additions to existing school plants.

We believe that by far the most popular examples of such campus units have been designed with four-classrooms and their appropriate local services. Illustrations for this School Plant Study are a sampling of several varieties of these "quads" from different parts of the US. In some of the actual school plants these may be initial or the only buildings—in others they are multiplied or related to other units such as the two kindergartens in the Bristol Primary School. There is nothing magical about four classrooms; one excellent school has three classrooms plus a larger common activity room in such a unit plan.

Covered Walks—Landscape

The variety of covered walks is so great that we may devote a separate School Plant Study to them. They offer many opportunities for design. Such campus sites also provide a better relationship of school to landscape and in the most highly developed examples of this sort (Heathcote and Wilbert Snow) a delightful natural environment becomes, as it emphatically should be, part of education. It should be realized also that this is not an accident or due to well-meaning gifts of plant material, cast-stone benches, or decorative bird baths by local nurseries or garden clubs. Significant landscape design is a professional service and well worth whatever budget can be set aside for a competent landscape architect *even if it must be limited to a design for future treatment* (future planting). Then with a good plan as a basis, community generosity can be explored. A notable school planned by an association of two well-known architectural firms was made ridiculous in appearance by a gift of what one of the architects calls "green chicken croquettes."

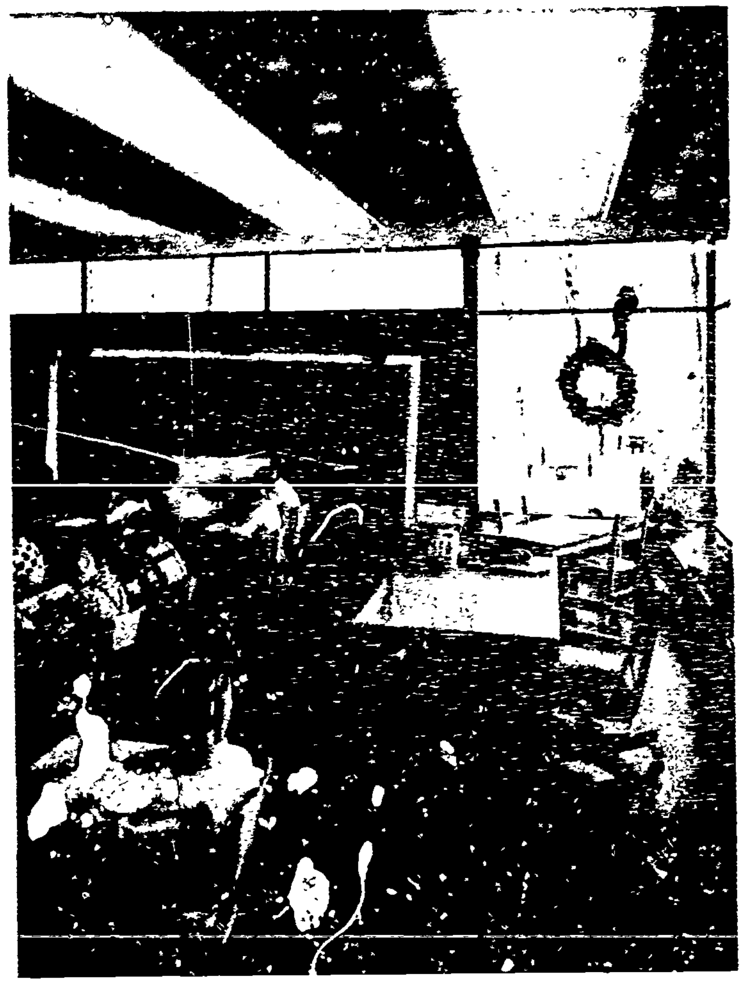
Effective landscape design will also aid visual conditions within the school. A view out into leafy foliage screening sky-glare removes the Enemy Number One of a desirable balance of brightness contrasts. Most interesting studies have been made with wind-tunnel models at Texas Engineering Experiment Station of the effects of different landscape treatments on natural ventilation of school buildings. Design does not stop at the wall and we must agree—*good design does not cost, it pays.*

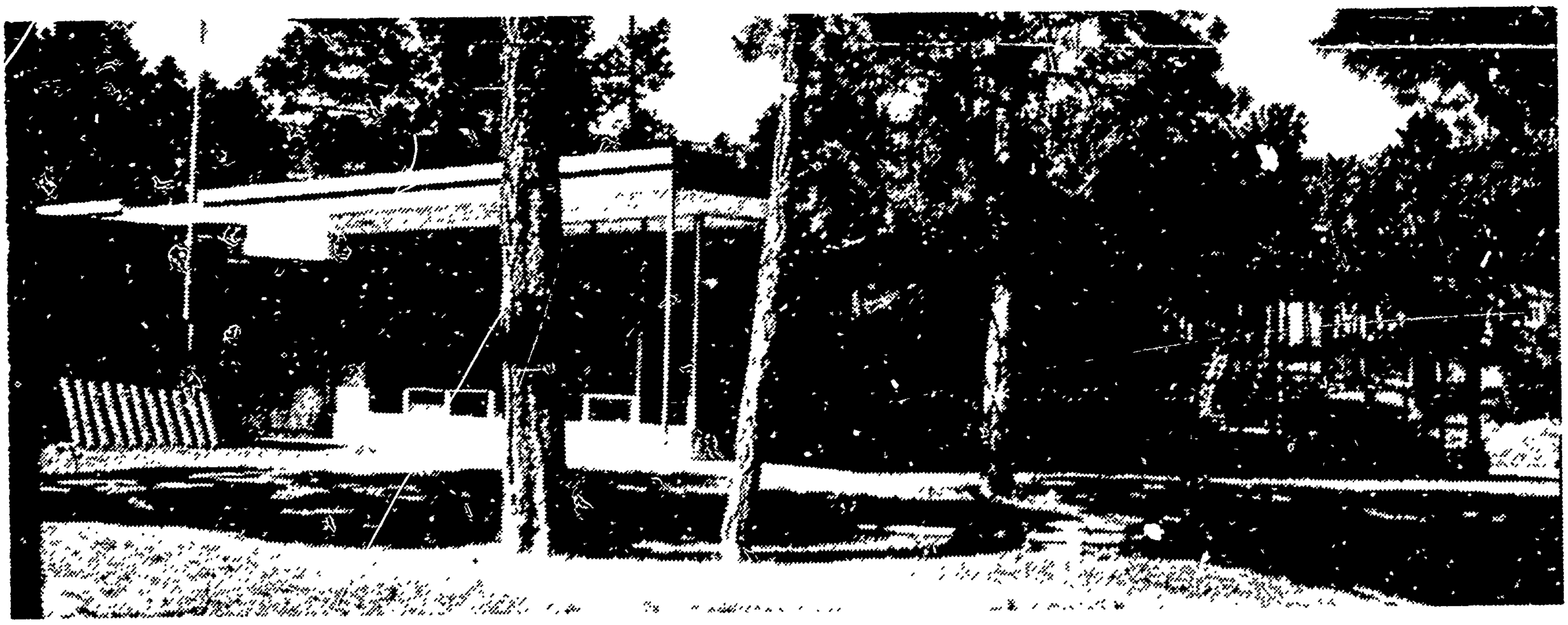
Down with Multi-purpose

The school may well be the first focus or fulcrum for community action, and the school board members the first local officials. The school is also a center of local pride and organized athletics or entertainments with their demand for a community or parental audience. These facts explain the early demand for a larger-than-necessary school auditorium—which is really a town hall—and for a gym overloaded with spectator-seating, neither of which should be part of the cost of the schools. These spaces are rarely effective for teaching—a little theatre of a few hundred seats is far better and is becoming an extremely popular element—by no means a frill but an important educational space if well-designed.

Such a feature in the lay mind pre-supposes seating capacity equal to school population but as a matter of fact it might be part of a quite small school which is expected to grow. The activity of the Children's Theatre Conference (a part of the American Educational Theatre Association) is evidence of a strong development of the idea that such experience is not extra-curricular but an important part of general education.

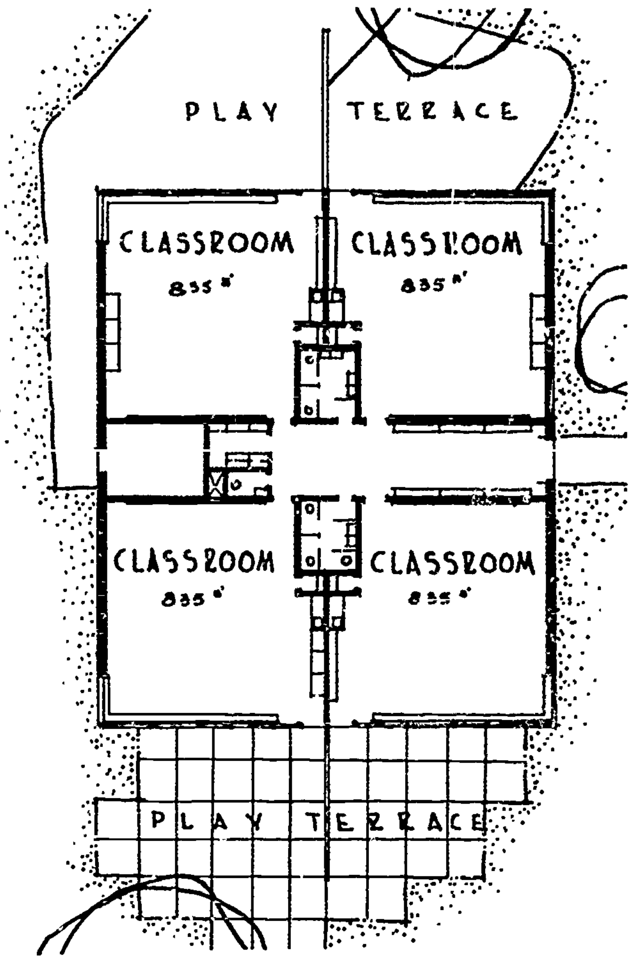
Smaller schools usually settle for "multi-purpose" rooms which end up being no-purpose if conversion from one use to another is awkward. These hybrids: cafetoriums, gymnaterias, audinasiums may appeal to some but there is little educational benefit from stacking folding chairs, pulling tables up or down, etc, or from waiting for it to be done by help being paid from education budgets. Over the life of the building these losses are only too real. Solution? Minimize multi-purpose—permit continuous scheduling of these spaces. Multi-purpose space is the foe of utilization and compromises every function.





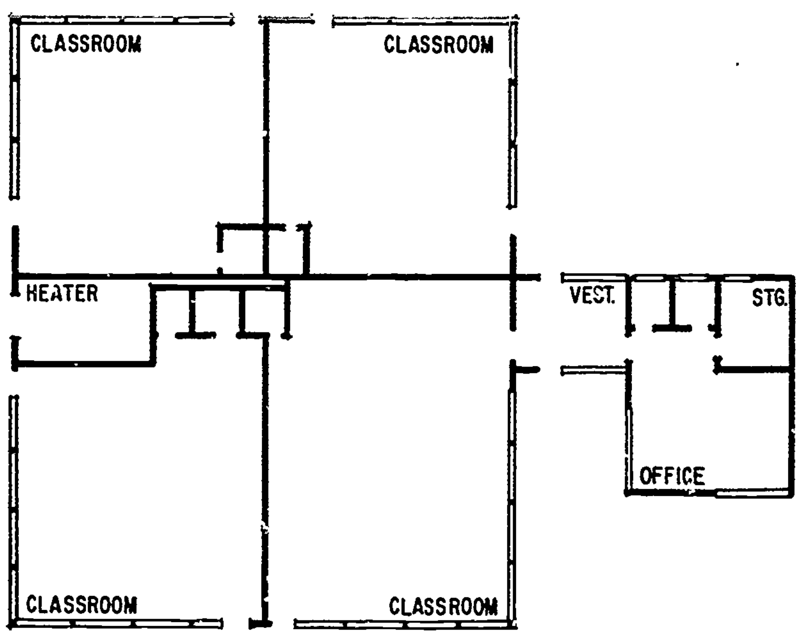
Four-Classroom Unit (1 of 5)
Wilbert Snow Elementary School,
Middletown, Connecticut (ca 1955)
Warren H. Ashley, AIA
Photos: Joseph W. Molitor

Bilateral daylighting: 1 bay and transom on side, lift-slab concrete construction; informal hardtop play areas



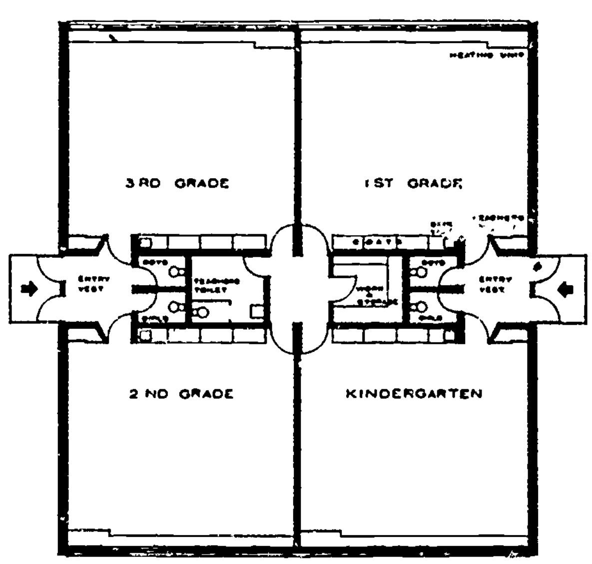
Four-Classroom School
Valley School, Los Alamos,
New Mexico (1951)
Flatow and Moore,
Architects

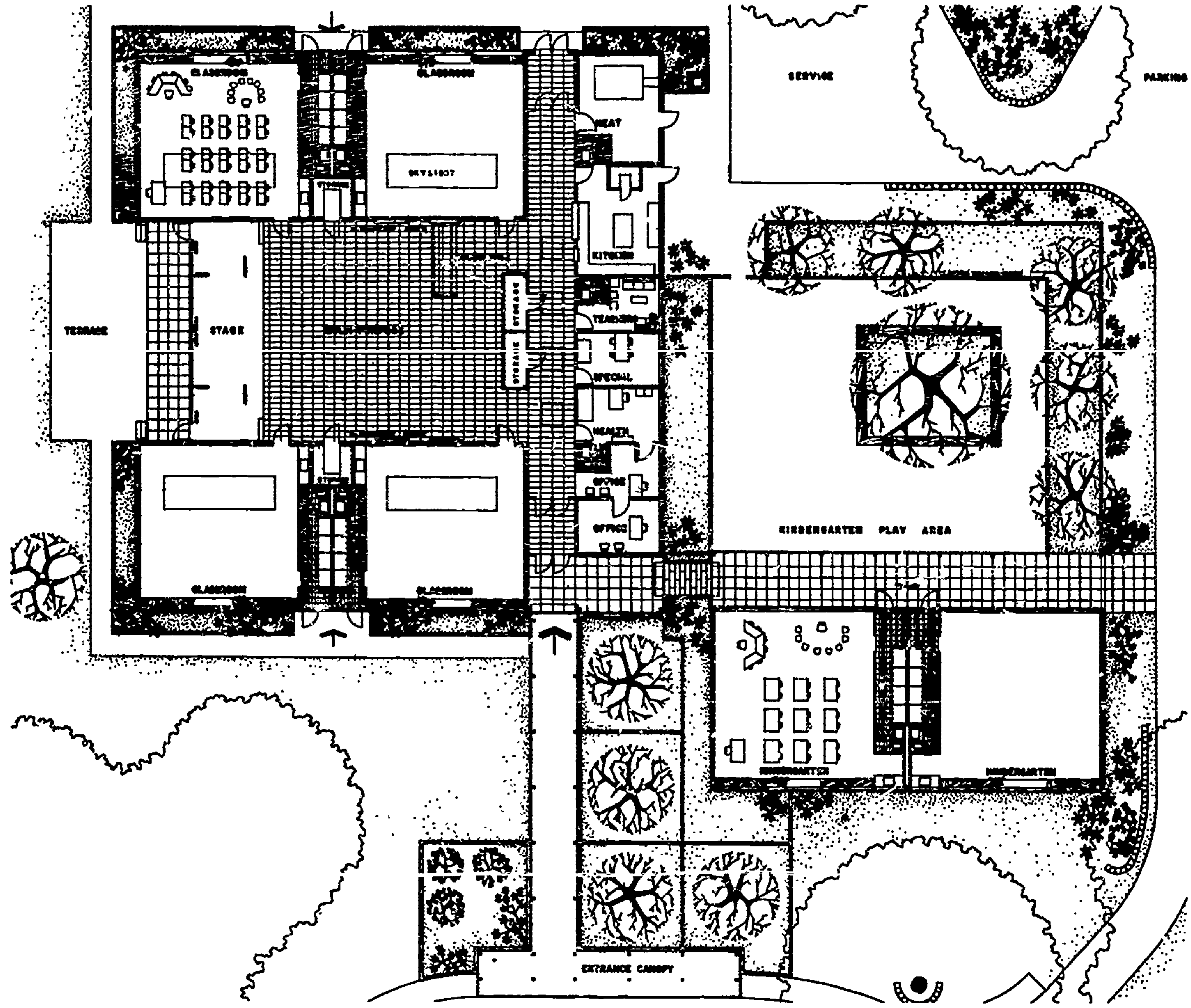
Kindergarten, 2 primary, 1 elementary centralized services; bilateral daylight



K-3 Four-Classroom Unit
Merrill Primary School,
Merrill, Iowa (1958)
Harold Spitznagel & Associates,
Architects

Unilateral daylighting; neatly-planned quad





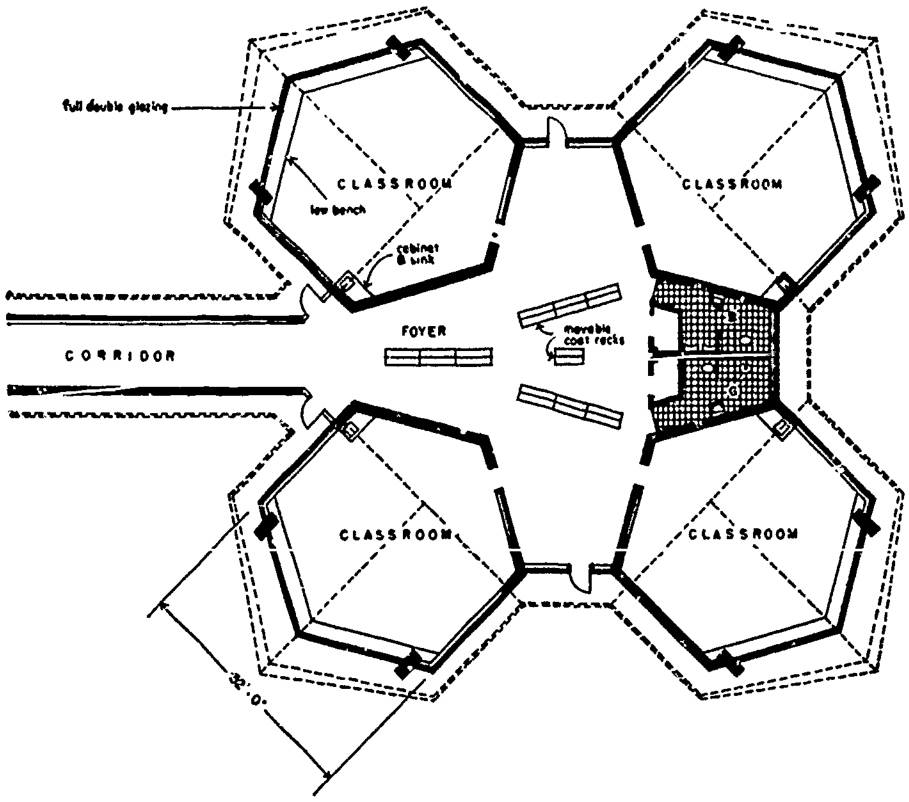
MacMazuki

Four Classrooms, Two Kindergartens, Multi-purpose Room, Kitchen
Bristol Primary School,
Webster Groves, Missouri (ca 1955)
Hellmuth, Obata & Kassabaum, Architects
Self-contained classrooms;
daylighting: bilateral in KG (NS),
unilateral for classrooms plus
toplight; heating: hot-water radiant
in KG floor, individual controls in C.R.

MacMazuki

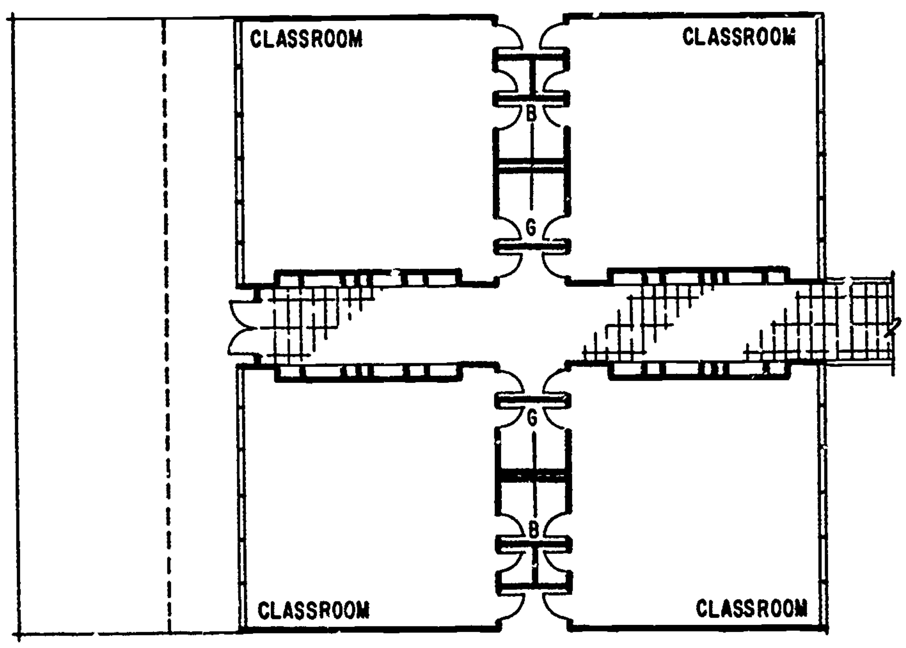
Four-Classroom Unit (1 of 3-5)
Heathcote Elementary School,
Scarsdale, New York (ca 1954)
Perkins & Will, Architects
Plan: "Architectural Forum"

Elaborate auxiliary facilities in campus plan; glazed corridors a specially attractive feature; daylighting: 4 sides of hexagon—landscaping



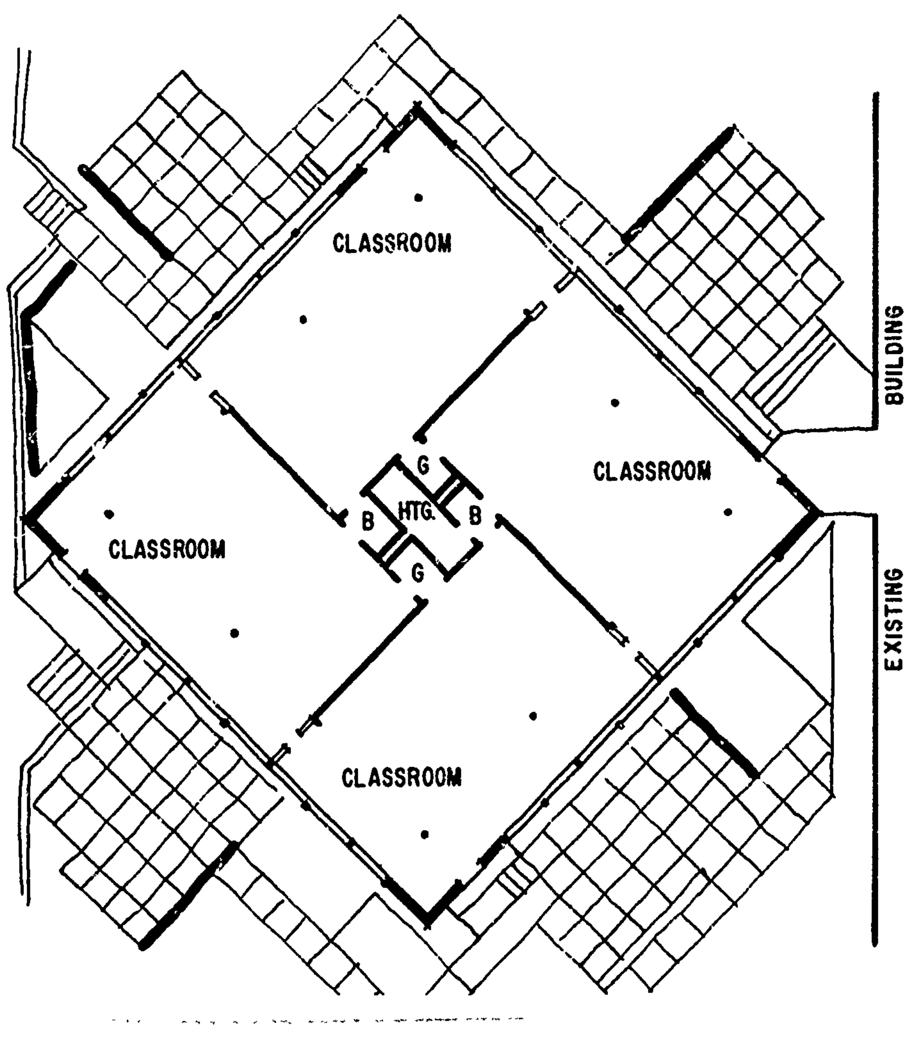
Four-Classroom Unit (1 of 6)
Valley Woods Elementary School (K-6)
Birmingham, Michigan (ca 1957)
Eberle M. Smith Assoc;
Architects

Quads preserve excellent site quality in large campus plan school because northern climate units are connected by glass-enclosed passages



Four-Classroom Addition
Jane Phillips Elementary School
Bartlesville, Oklahoma (ca 1955)
Caudill-Rowlett-Scott, Architects

Free-plan, lift-slab construction; daylighting bilateral plus toplight



URBAN SCHOOLS

by Cyril G. Sargent

IN 1912 after disastrous fire of 1908, the city of Chelsea in metropolitan Boston built what was at that time largest elementary school in the country — 70-classroom Williams school. In 1954 (peak enrollment year) only 27 classrooms were needed. In 1954 also 70% of community had given serious thought to leaving & 33% were actually planning to move out within 2 years or as soon as possible. Tax rate was $71/1000 — highest in state — city was resorting to borrowing from capital funds for what little maintenance was being done on schools & no new school, except one addition, had been built since 1918. Chelsea is a city of 39,000 population.

Are following conditions peculiar to old cities such as Chelsea & Boston:

- **decline of population at core of metropolitan city**
- **stagnation of school plant development**
- **blight in education thru sterile adaptation to obsolete environments?**

What does typical school in Boston look like? In 1954 its 221 school buildings were inventoried & a "profile" drawn.[1] "This typical but mythical school is located on a site which is between 1/2 & 9/10 of an acre. (Only 18 have more than 2 acres.) Building is located in area which has adjacent combination of residential & industrial structures. It was built between 1900 & 1920. (Only 22 have been constructed since 1920, whereas 75 were built before 1900.) It will be between 2½ & 3½ stories & odds are that it will have more than 3½ stories, rather than less than 2½. (Only 4 buildings in city are 1-story structures.)

"Our typical but mythical school will have between 10 & 14 rooms. (16 buildings in Boston have less than 5.) It will be steam-heated, using coal, shoveled by hand. (Less than 1/5 buildings have any type of automatically-fired heating systems.)

"Classrooms, with exception of kindergartens, have fixed furniture throughout. Classrooms are poorly lighted (probably less than 20 foot candles) & there are excessive brightness contrasts present because of dark woodwork, unshielded light sources, natural or artificial. Toilets are located in poorly ventilated basement. Most handwashing facilities are located in same sink as drinking fountains.

"Outdoor recreation on less than 1-acre site previously mentioned, will of necessity be extremely limited. Chances are about 1:10 that softball may be played, but only 1:40 that baseball will be possible. Only 2 schools have provisions for track & 3 for tennis."

Between 1950 & 1955 state census, Boston city proper dropped in population from 801,000 to 723,000 & of a school-age-population (7-16) of 93,500 only 60,000 attended public schools. In 1954 21 elementary & secondary schools were closed, bringing total to 25 closed since war. Only 2 new schools had been built by 1952 although plans presented to School Board called for 30 new buildings or additions by 1965. In old sectors of industrial cities & metropolitan areas across the land, how much renewal of schools has taken place during last 3 decades?

Not all cities, of course, exhibit these same conditions. Some, like San Francisco, have enough school sites available for an estimated 20 years, while still others, like New York are, in spite of major building programs, operating on double sessions in parts of city.

Each urban area presents its own unique features & combinations of growth, development, blight or decay. But amid all variations are certain more or less common features, which in composite can be said to represent urban problem of America. Among some more significant conditions are certain sociological, economic & political trends.

(1) "Look to the Schoolhouses . . ." report of study made at request of Boston School Committee by Center for Field Studies, Harvard Graduate School of Education, Cambridge, Mass, 1953

population shifts:

Although metropolitan communities continue to grow more rapidly than country as a whole, shift in population from central urban area has, in recent years, begun to reverse itself & central city is giving way to growth of suburbs. These migrations are not affecting all age groups equally & there appears in some cases to be outmigration of married couples of childbearing age at same time as immigration of older persons is taking place. This net shift outwards is accompanied by large internal migrations resulting from development of large-scale housing projects, expressways & more recently, urban redevelopment programs. Population of city is in flux.

government cost — taxes:

Cities have become saddled with increasing costs of government for services frequently required by suburban commuter who spends his work-day in city & his money (including taxes) in suburbs. As vehicle traffic overcrowds streets more police are needed; as property ages more fire protection is required, yet as this same property ages, ability of city to produce revenue which keeps pace with these costs is lessened. Problem lies with tax source traditionally available to localities — this property tax-base is notoriously inelastic, regressive & outmoded. A recent study in New York State commented[2] "New York State is not unlike many other states in its pattern of property tax trends. Study of property valuations since 1939 (using that year as a base index) shows that during this period while:

- **national income advanced over 275%**
- **income from business advanced over 350%**
- **corporation profits after taxes advanced over 350%**
- **property valuations (for New York) advanced only 11%**

(2) "A Valley & a Decision" Corning New York Study, Center for Field Studies, Harvard Graduate School of Education, Cambridge, Mass, 1954

"Can any more striking proof be needed of inadequacy of local property tax base to continue to support local government service -- unless major re-evaluation takes place or unless people accept necessary increases in tax rate for fiction they are & translate them into more nearly 'true' rates?"

For the city problem is particularly acute. Not only are more services demanded of it, but costs of these services are consistently higher than in towns & suburbs. To this must be added higher cost of land, condemnation & construction. It is certainly cheaper (in dollars) to build on vacant suburban land than to take by eminent domain, tear down & reconstruct in city when reconstruction conforms to better standards of space, reduction in densities & stringent & frequently outmoded codes. Moreover as city grows older, depreciation of property values is reflected on assessment rolls so that at times marginal property actually is assessed at more than market value.

politico-legal problems:

In political area plight of city is similarly accentuated by outmoded legal machinery & structure. Creatures of legislature, established by charter 50 to 100 years ago, they are restricted in almost daily action by laws no longer conforming to social realities of today. Attempts to enlarge corporate boundaries, annex new territory, establish a metropolitan political unit, meet with little success in legislatures traditionally dominated & controlled by non-city vote. Resulting intricate overlays of districts, authorities, commissions & independent school districts becomes a maze seemingly requiring herculean efforts for even relatively "easy" problems. Bureaucratic controls, contracts awarded on basis of patronage or campaign donations, dull & deadening hand of public servants playing it safe (whereby safe is meant doing what there has been such ample precedent for that he need never fear being called to account for his actions), these add political deterrents to effective action.

Moreover, this same movement to suburbs has deprived central city of some of its best potential leadership. Not voting in elections, voice & influence of many leaders in business, industry & professions are lost to development of public policy.

a complex task:

Within this intricate political, social & economic organization, new schools must be built & old ones modernized or abandoned. Problem is at once ecological, financial, political, & above all, one of *values* which American society holds about human beings & their individual needs.

Urban school problems can be solved only within framework of larger issue of what we want our cities to become. Until we can find some agreement on this question & some operational programs as to how to implement these policies, urban schools can be expected in many cases to continue to be wrong kind of schools in wrong locations.

good signs:

Is situation altogether hopeless? Fortunately no. There are many promising developments: those of Chicago, Milwaukee, Baltimore & Philadelphia, to mention 4. Growth of city & regional planning movements has been rapid in recent years.

Most striking is emphasis on human element in planning. People are less thought of as abstractions or statistics from census than as human beings seeking a full life. Attitudes, expectancies & needs of people are being more thoughtfully studied & reflected in plans being developed. Earlier concepts of static master plans are giving way to those of continuous renewal & development in a dynamic planning process. *And people themselves are participating in planning.*

Role of technical person is being redefined with result that planner increasingly is becoming a member of a team of people. Philadelphia's 3 designs of organizing for study & action provide interesting case studies in this process.

research needed:

One major weakness in much work being done on city renewal is our lack of findings & research on relation of densities of population to efficiency, with efficiency defined in terms of total economic & social costs rather than solely in terms of monetary returns to cost of land. It would appear that if we could begin to establish some of these relationships more systematically we might have an important added key to planning of cities & schools.

Although adequate solution to problem of urban schools will be met only thru relating education to total process of re-building cities, certain assumptions which may seem reasonable can be suggested & certain specific questions can be somewhat isolated for examination. Here are 4 assumptions:

assumption I:

Decentralization of cities will continue, perhaps with some acceleration due to new & awesome reality of hydrogen bomb. Density of population within given urban land areas will similarly decrease.

inference:

Where schools were formerly built on assumption of stable & growing population new schools must be planned for central city in terms of rapidly shifting conditions. Where we have talked of flexibility within buildings we must think in terms of flexibility among buildings. Logical conclusion of this approach is not at all necessarily "portable" or "demountable." It is suggested that continuous renewal & movement of people demand approach to design which implies shorter life-span & perhaps smaller units. This decentralization should make it possible to open up space for "islands of living" in our urban centers. It will be necessary to accomplish by social sight-raising what it accomplished in suburbs by necessity. This social sight-raising must revolve around idea of remaking city as well as rebuilding schools.

assumption II:

That there will be increasing attention devoted to social-psychological city. Problem stems from what is sometimes referred to as psychological isolation, feeling that there is less & less to live for in common life of community. This factor of isolation seems to some observers to be one cause of political apathy, cynicism & social prejudice.

inference:

There will be more considered approach to city planning in terms of informal organization membership, membership in work & other functional units & neighborhood concepts — neighborhood not defined in terms of town neighborhood of 50 years ago but in terms of conditions of urban life. School can be one institution around which such neighborhoods are developed. We have in past frequently asked question how large should a school be for economical operation. Perhaps we should better ask how large should a school be in a city if it is to be a neighborhood school. Then we can develop administrative solutions for operational needs. Perhaps more schools of 200-400 pupils & fewer 1,000-1,500 pupil schools would help relate school to neighborhood &, most important, make available to city child kind of environment which his suburban cousin has, to take place of large impersonal institutional structure of 20s & 30s.

assumption III:

That social reality of interdependence is making legal fiction of independence obsolete.

inference:

That as units of government grow larger & more complex in attempts to encompass problems of social & economic interdependence there will be other problems made more difficult of solution. Among these are those commonly associated with development of bureaucracy & bureaucratic controls.

In field of school plant planning & building, problem can be stated in terms of conformity, standardization & lack of invention. *How can variation & invention be provided for within centralization?* A number of cities now have either their own architectural staffs designing schools or a staff architect to check on work of other architects. Studies seem to show that many recent city schools simply do not measure up in terms of design, materials or construction methods to produce savings in cost or to reflect concern for human values involved in good school architecture. Easy approach of "3rd drawer down" for next required plan is all too prevalent. Not that this method is exclusive province of staff architects! Is revolution in school architecture to bypass city? This is a revolution to date primarily in suburbs.

Solution would seem to lie in engaging best private architects to design individual schools or a series of smaller repetitive units. Newest in materials, methods & cost would emerge from competition among individual architectural firms so employed. Chicago has recently modified function of its architectural division to permit this to happen. But even this approach will not yield better city school buildings unless certain other deterrents are overcome.

One of these is problem of *how far it is necessary for technical person to check technical person.* Here there seems to be divided opinion — but there would seem to be less risk in placing confidence in first quality professional firms than in over-reliance on "plan checkers" in a local bureaucracy. If there is such a person his function might better be that of working toward modernizing codes & building restrictions in light of new materials & construction techniques to make it less difficult for architect to "design around them."

assumption IV:

That, despite urban redevelopment possibilities & practices, problem of large site acquisition will be difficult to solve.' This may hamper & restrict both location & design of school buildings, particularly on secondary level, *unless*:

inference:

We take a much needed & long overdue look at secondary education. If we do we may modify radically our thinking & planning of these schools. We might find that what we need in secondary education can be facilitated by a school plant, elements of which are located at numerous places for a variety of educational purposes throughout city. Bill Caudill's "classroom in a courthouse" is but one of many possibilities if we go at task of breaking down 4 walls of school building & breaking out of isolation of classroom from realities of life of community. We have tended to avoid this look into past by hiding behind term flexibility. This is an insufficient answer. We need some positive statements about goals, programs & methods for a secondary educational desirable at once for our kind of society in second half of 20th century & incorporating best we know about growth, development & learning. Usual list of generalities is not enough. They must be developed in detail & with recognition of specific local community needs if they are to be of significant influence in modernizing educational program & secondary school plants.

Secondary education in many ways today is concerned with learning abstractions about other people's abstractions about someone else's experience!

conclusion:

Perhaps we need to take fresh look both at adolescent's world & adult world around him. Might we not find that much of what passes for education in our high schools today is of little meaning? Educator now has important & difficult task of helping reformulate a secondary education program which is adequate to task today. Architect cannot do this for him (although some architects seem to be more concerned with educational problems & have real insight into them). Until these programs begin to emerge & take form the architect must seek to build around most restrictive building code of all — that of antiquated educational thought & plans.

From *Geometrie et Horlogiographie*, Jean Bullant, Architect, published in Paris, 1608. From the Richard Morris Hunt Collection, AIA Library

School Building Orientation

by **James R. Holmes** and **Clayton W. Chance**

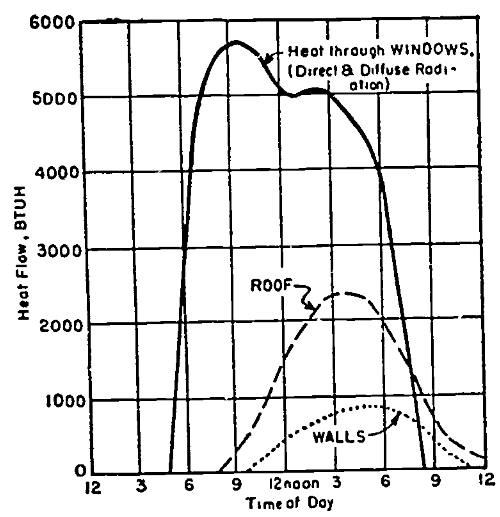
Since the tremendous cost of educating our children directly affects everyone's pocketbook, taxpayers want to know if they (we) are getting our money's worth. The need to improve our educational techniques is recognized by our educational leaders. Some universities are demanding that many courses usually offered in the first year of college be taken in highschool. If highschool work is to be more rigorous, the effects will be felt all down the line.

Thus, a need to insure the best possible teaching and study conditions at all levels demands that school officials and school architects provide the "most for the money." Teaching must become swifter and easier—learning must be cheaper and more effective. The school building costs only about 10¢ of the total education dollar but many school boards and other parties concerned do not realize the impact of the sun on building and operating costs.

Importance of Suncontrol

Those who plan a school building and determine its position on the site must give special consideration to its compass orientation and relation to the moving sun. This solar relationship directly and importantly affects the school environment, teaching efficiency and learning capacity of our young scholars. Therefore, this paper provides guidance for planners who must fix the permanent orientation of school buildings. It presents information on a technique for checking the shielding of glass windows from unwanted sunshine.

FIGURE 1 *Comparison of heat flow through glass, walls and roof on a low cost frame house developed under Industry-Engineered Homes Program in 1948, where windows were flush with wall. (Appendix Report No. 6 — Application of Climatic Data to House Design.* HHFA.)



If all school buildings could be airconditioned, study of shading and orientation would still be important. Although comfort may be obtained for any building by use of airconditioning units of adequate capacity, proper shading of glass is necessary to keep down cooling costs.

A prominent architect commented that while it is unlikely that any architect would design an insurance, bank or similar building without providing airconditioning, he would have few opportunities to plan airconditioned schools, especially for lower grades. School children rarely have a choice of schools. They attend the school of their district whether it is comfortable or not. If they must spend the afternoon in a room uncomfortably warm from sun heat, we, the taxpayers, are in the long run financially affected.

Still affected more or less by regional climate, the need for cooler buildings is increasing as more and more heat-producing machines, such as electric typewriters, movie and slide projectors, computers and more and more shop equipment are introduced. When it is proven that airconditioned schools can pay their way, more schools may be airconditioned, particularly in hot-humid and hot-dry climates or districts where schools begin to be used year-round. The cost of airconditioning is an item easily blue-penciled, if the estimated cost of a new building exceeds the budget. At least, the building may be planned for future airconditioning. With or without it, the school building should have the best possible orientation and sun protection. In itself this will save money.

Building orientation has received inadequate attention in current publications. William W. Caudill, AIA, one of the architects for the well-shaded San Angelo High School, has recognized this in insisting, "The sun must be kept off the glass." Rather sensational statistics developed by the Structural Clay Products Institute, Washington, DC, show that in Houston, Texas, airconditioning costs attributable to one square foot of frame wall and one square foot of glass could be $0.79 and $21.52, respectively. Unshaded windows invite large quantity of heat, thereby raising temperatures, producing discomfort and increasing costs.

Methods

Most extensive work in the field of sun-shading has been done by Victor and Aladar Olgyay*, research architects and teachers. They compare the large amount of heat entering a building through unshaded glass with smaller amounts entering through other surfaces (Fig. 1).

They also determined that if glass is shaded at all times, the amount of diffuse heat transmitted through glass is small and varies little with orientation.

The Olgyays have provided a method of evaluating effectiveness of devices for shading glass from direct and diffuse heat. For comparing effectiveness of different shading devices at the same orientation or for comparing effectiveness of same overhang, awning, etc., at different orientations, their method can be simplified and reduced to easy graphical solutions. Thus an overhang may be designed for its esthetic appearance and then evaluated. This overhang may be

* *Application of Climatic Data to House Design*, HHFA January 1954, Superintendent of Documents, US Government Printing Office, Washington DC

varied in dimensions and evaluated to determine its best length.

If design is set and length of overhang fixed, evaluations may be made for various orientations to determine highest efficiency rating. Best orientation should be chosen near compass direction showing highest rating, with due consideration for local factors including directions of prevailing breezes, sites, view, and relationship with adjacent buildings.

True shadows may be cast for various times of day to determine areas of glass irradiated by rays of the moving sun. Using these areas and the angle relation between sun-ray and glass, amount of sun-heat actually transmitted through glass may be closely approximated.

The Olgyay method calls for graphic projection of a drawing of the shading-device, such as awnings, walls, trees, etc, upon a diagram of the sky vault or celestial sphere. This masked area, as it is called on the surface of the sky, outlines sun positions from which glass is shaded. The mask may be superimposed on a map of the sun's hourly position for the year, on which are also plotted areas of time when shading is needed (when outside dry-bulb temperatures exceed 70°F). On this same map, curves can be plotted to indicate amounts of sun heat striking glass from all sun positions.

Thus for any glass area facing a given direction, the amount of heat prevented from reaching the glass by an overhang may be computed and compared with total amount that would reach a similar but unshaded window. Procedure for obtaining such comparisons requires data obtained from several devices which are separately illustrated in Fig. 2. Combined they form a calculator (Fig. 3) from which data may be replotted on a rectilinear chart to simplify calculations.

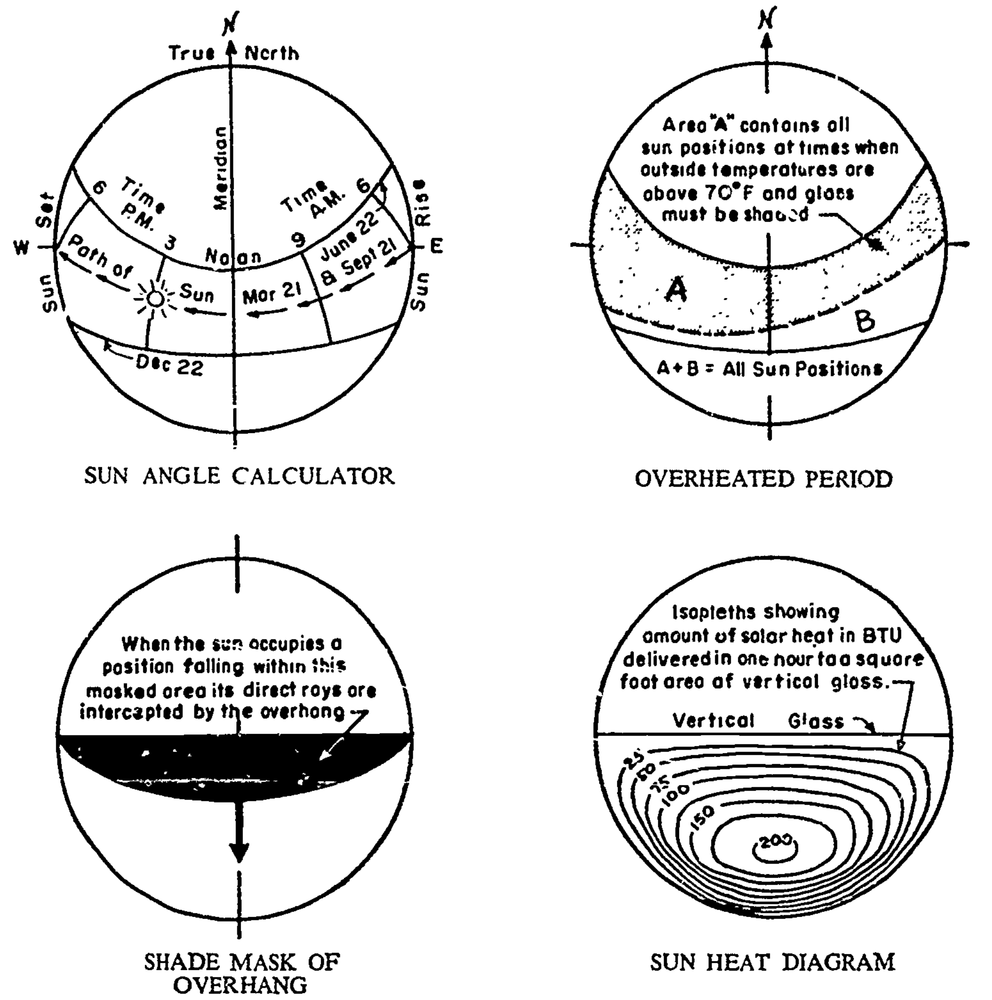


FIGURE 2 *Component parts of radiation calculator*

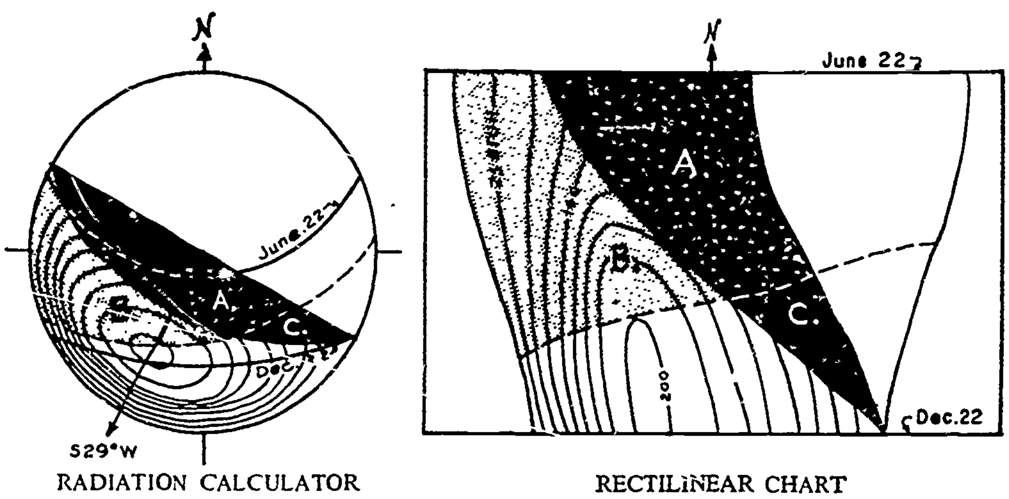


FIGURE 3 *Devices for determination of shading performance of an overhang. (Areas A, B and C replotted on rectilinear chart, are converted to amounts of time by use of a planimeter. Total amount of solar heat is found for each area by summing up time spent by sun in each radiation zone. Ratio of solar heat A to solar heat A and B is the summer shading performance of the overhang.)*

Evaluation of Design

If architects study proposed buildings for such efficiency ratings, decisions on solar orientation can be made on a firm basis. Some embarassing mistakes may be prevented. An overhang design may be based correctly on sun-angle data, but the designer remember that the "sun moves."

The designer must know how to locate the sun at all times, and be able to trace its path as it moves across the sky. He must know how to find the angle between sun-rays and surfaces in all positions. Also he should know how to cast shadows of the "moving sun." With this knowledge, he can create effective shading designs and check his results.

If a school board wants to change the orientation of his proposed building, the architect should restudy his sun-shading devices and check their effectiveness for the new orientation.

When the school building is carefully oriented, good ventilation, lighting and sun-shading may be expected. If a school building is poorly oriented, these features are often adversely affected to the extent that effectiveness of teaching may be jeopardized.

Poor orientation should not be dictated by someone's desire to keep walls parallel or perpendicular

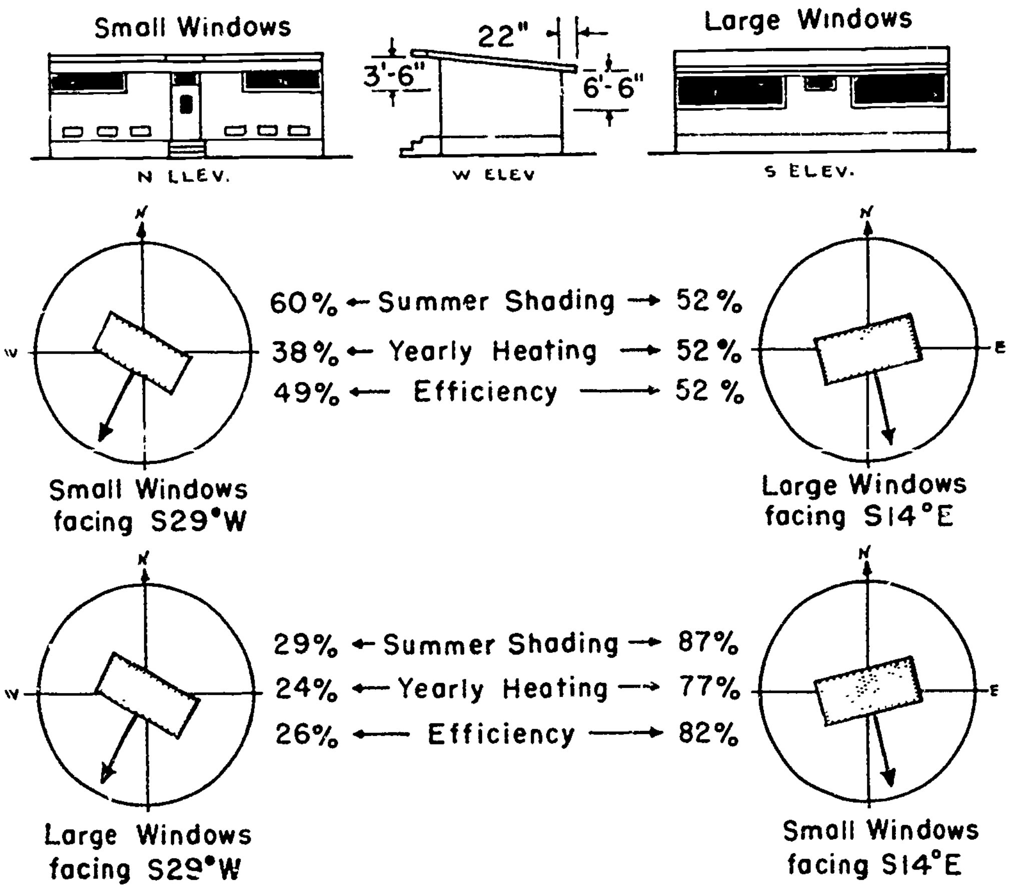


FIGURE 4 *Shading efficiency of 22" overhang for large and small windows at orientations of S 29° W and S 14° E*

to sidewalks or to other buildings. Neither should good ventilation and lighting be sacrificed for a view, especially when students pay the penalty in the form of discomfort from sun-heat and eye fatigue due to glare. Orientation, however, must be skillfully evaluated in the total design. In the hands of a less-talented practitioner these considerations may not in themselves yield pleasing appearance.

Example of Application

Using the Olgyay method, simplified for this purpose, the authors made a study of some temporary school buildings designed by a school board in a Texas city (Fig. 4). There are about 50 of these buildings facing all points of the compass. They have only a 22" overhang which is neither effective in reducing glare nor adequate for proper sun-shading for varied orientations.

Air motion is very important in this part of the country because cooling is needed most of the year rather than heating. The north wall contains ventilators, opening outward at floor level, and also has small high windows under the overhang. Facing the prevailing breeze, the ventilators permit it to enter low, sweep across the floor and thence upward to the higher windows on the opposite wall. (If the breeze enters through high windows, it crosses the room at ceiling level.

When these buildings face true south, the sun cannot reach the glass from high altitude angles. However, when they face southeast or southwest, the overhang does not fully shade glass at all times. When they face southwest, the sun begins to shine on glass about the time outside temperatures are reaching a maximum and children are beginning to tire from the day's work. It is mandatory that glass areas be shaded in the afternoon. Even if the building were airconditioned, the glass would need shading because 89% of direct sun-heat striking this glass would be transmitted into the classroom.

In this survey made at several different school sites, various orientations were studied and shading efficiency ratings were computed as described below.

SHADING EFFICIENCY RATING (by Olgyay Method): Effectiveness is computed in three ways:

- SUMMER SHADING PERFORMANCE: amount of solar heat intercepted by shading device during overheated period compared with amount delivered to unshaded window at same period
- YEARLY HEATING EFFECT: loss of winter sun effect because of glass shaded at times when heat is needed (below 70°F)
- TOTAL SHADING EFFECT RATIO: final evaluation of shading device for the year—average of summer shading performance and yearly heating effect

Summer shading performance is of more significance in the Austin, Texas, area than in more northern areas of the state such as Amarillo, where winters are very cold and yearly heating effect is more important. Also, solar and earth geometry cause 30°N latitude to receive the greatest amount of summer heat—Austin latitude is 30° 16′.

In this report, comparisons are presented for only two orientations; one very poor, and one very good. Results presented in Fig. 4 show that by selecting proper orientation for this temporary building, school officials can obtain the efficient rating of 87%, (S 14°E) in place of the poor rating of 29% (S 29°W). The difference in these ratings represents a large saving from unwanted heat. There is a direct correlation between good orientation and lowered temperatures. In a preliminary study of this building under similar conditions except for orientation, the authors have reported temperature differences up to 13°F.

This increased amount of heat, due largely to unshaded glass at the poor orientation, should be of concern to school officials interested in a building's cost in terms of its contribution to educational processes.

Proper climate conditions within school buildings provide greater comfort to teachers and students. Just as there is a strong correlation between comfort and profit in industry, as indicated by the large number of airconditioned industrial and office buildings, there is a corresponding relation between comfort and effectiveness in teaching and learning. (Industrial airconditioning designers have long used the rule-of-thumb that for each 1°F above 70°F, human efficiency and productivity decreases approximately 1%). Much more research is needed.

With temperatures lowered, due in part to proper building orientation, a better environment is provided, discipline problems are reduced and study conditions are improved. Thus, by providing the best possible orientation and sun-shading for their buildings, school officials and architects have the opportunity to make another important contribution to economical and effective education.

CLASSROOM COMFORT THRU NATURAL VENTILATION

by WILLIAM W. CAUDILL, AIA, & BOB H. REED*

THE WIND—COMFORT PROVIDER

The wind, when properly used, can provide comfort in classrooms. During hot school months brisk air movement caused by wind within living zone of a classroom is quite capable of producing a cooling effect upon the children by accelerating conduction of heat from their bodies & by increasing opportunity for evaporation of perspiration. Everyone knows that comfort in the classroom aids health & learning. But very few people know the simple facts about how wind can be utilized to provide this comfort. (See photo opposite)

HOW AIR MOVES

When wind blows against a schoolhouse, it envelopes the building & sets up zones of relatively high & low pressures. High pressure zones are generally in region of building wall which faces wind. Wind hitting wall of building exerts pressure on that surface. Low pressure zones, sometimes called wind shadows, occur in region of opposite wall & sides. Airflow thru schoolbuilding is caused by air being forced thru openings adjacent to high pressure & being pulled out thru openings adjacent to low pressure zones. Like the wind itself, air within building will flow from high pressure to low pressure. In fact, when these relatively high pressure & low pressure zones are set up they create "little winds" within & around the building. It is these little winds that make classroom comfort possible thru natural ventilation.

Air movement is also caused by temperature differences. In tall buildings thermal currents are quite pronounced, but in low school buildings these currents are very hard to feel & are insignificant as far as comfort is concerned. The slightest breeze will overpower them. It is important to remember that air movement needed for comfort in a classroom is caused by pressure differences, not temperature differences. If there are openings on only one side of a classroom & classroom faces the wind, there cannot possibly be any effective air movement in room because wall opposite windows simply dams up air & creates a high pressure zone within classroom. If classroom were on leeward side of building, then it would be a low pressure zone.

A classroom, in order to have proper airflow, must be planned so that it creates both a high pressure zone and a low pressure zone adjacent to it, but still more important it must have openings in the high pressure zone to let air in & openings in low pressure zones to let it out. (See drawing opposite)

OPENINGS—HOW LARGE?

Greatest fault in present-day classrooms is that they lack sufficient outlet openings. In order for air to flow into a classroom it must be allowed to flow out. In other words, to get effective air movement, cross-ventilation is needed. Most classrooms have ample inlet openings in window wall but lack outlet openings in opposite wall. Of course, the corridor door, when open, helps some, but not enough to produce airflow of sufficient speed for comfort. In order to acquire necessary air movement for hot month comfort, there must be relatively large outlet openings opposite the window wall. In fact, greatest air speed through classroom is obtained when **outlets are larger than inlets.** It is like water flowing over a spillway in a dam. There is much greater speed of flow in spillway than in reservoir. Accordingly, it is better to dam up air on outside of classroom than it is to dam it up on inside. Most efficient way of producing greatest number of air changes within a classroom per square foot of total opening is to have inlet openings equal to outlet openings. To produce greatest number of air changes have both inlets & outlets as large as possible. Air changes are important for eliminating odorous conditions (not a great problem in typical classroom), but mean very little in hot weather comfort. It is air movement—around the bodies of students—that counts. To get necessary air movement there must be openings, ample ones, to let air in, & openings, still larger if possible, to let air out.

AIRFLOW PATTERN

It has been said that air must flow around children in order for them to experience sensation of cooling. Sometimes it is very difficult to control airflow pattern so that main air stream flows where it is wanted, particularly if wrong kinds of windows are used. Some types of windows shoot breezes tantalizingly over heads of perspiring students. Often window sun hoods, too, cause air to flow near ceiling instead of floor. Upward airflow is fine in cold months because it allows cold, fresh air to mix with hot air at ceiling before drifting down on students, but during hot school months cool breezes should be directed on students for comfort. Airflow in living zone is ever important.

Airflow pattern is determined chiefly by inlet opening. The inlet is very sensitive & acts like a nozzle on a water hose. It can cause upward flow, downward flow, or even shoot air to right or to left & air will flow across classroom in same direction as it enters regardless of location of outlet. In other words, if characteristics of inlet are such that air is directed to ceiling, the airflow pattern will be along ceiling even if

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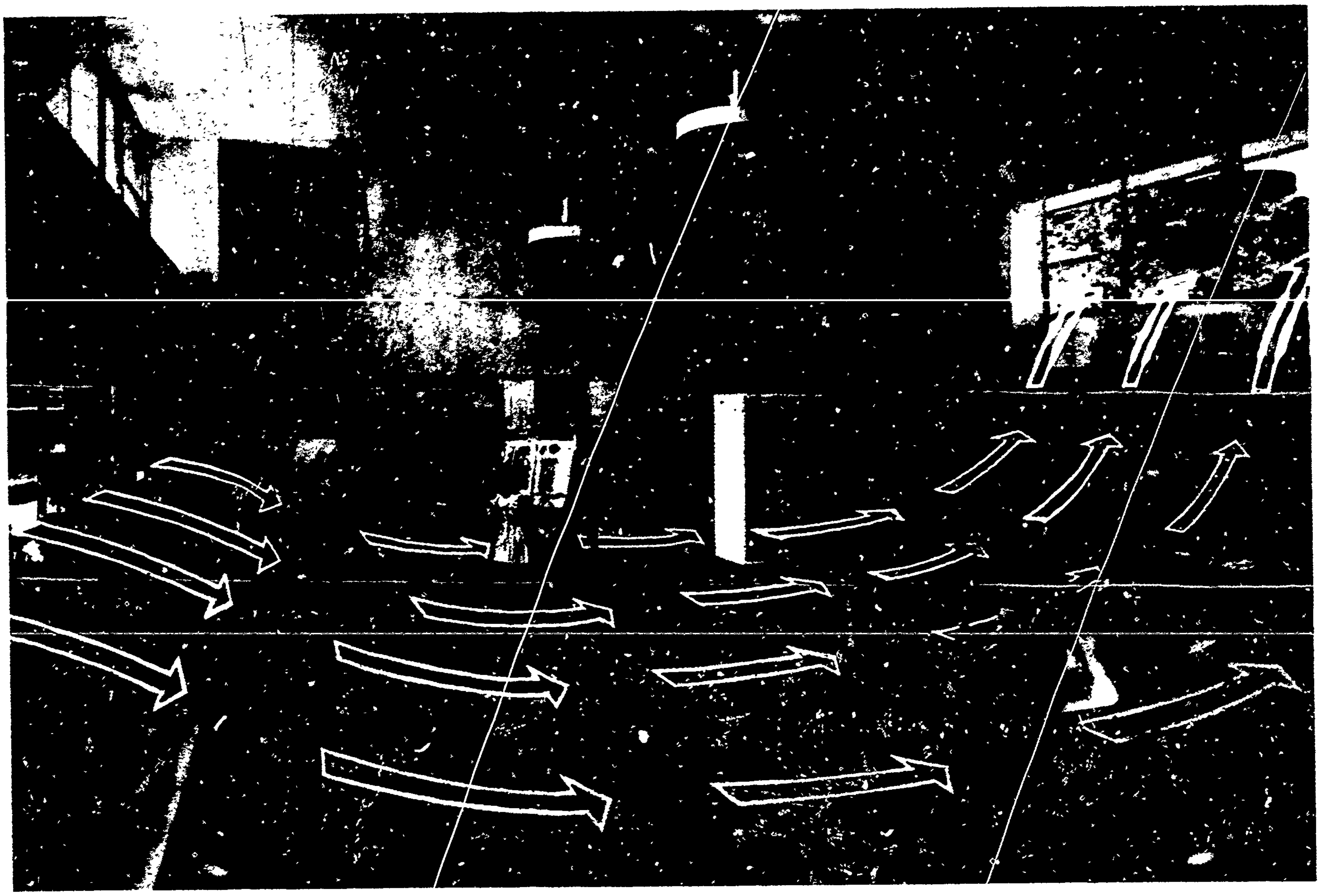
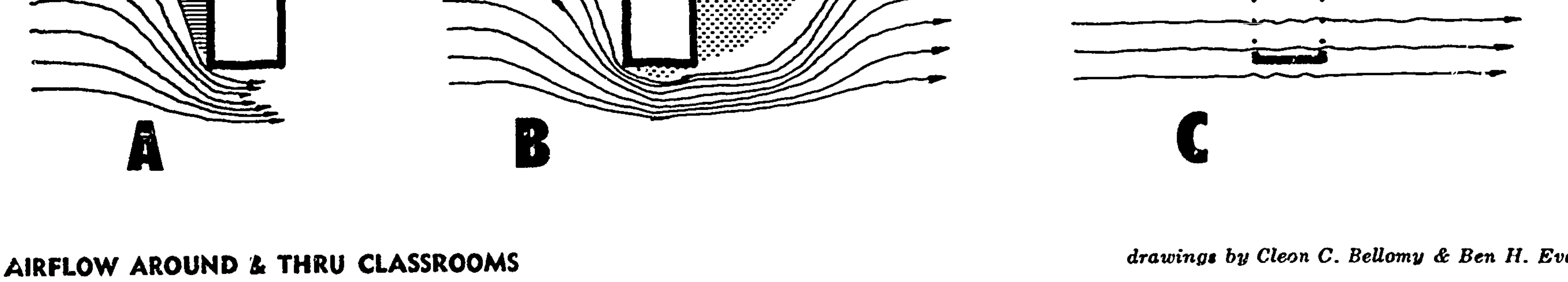
Bob H. Reed is Research Assistant, in Charge of Model Testing Project, Texas Engineering Experiment Station.



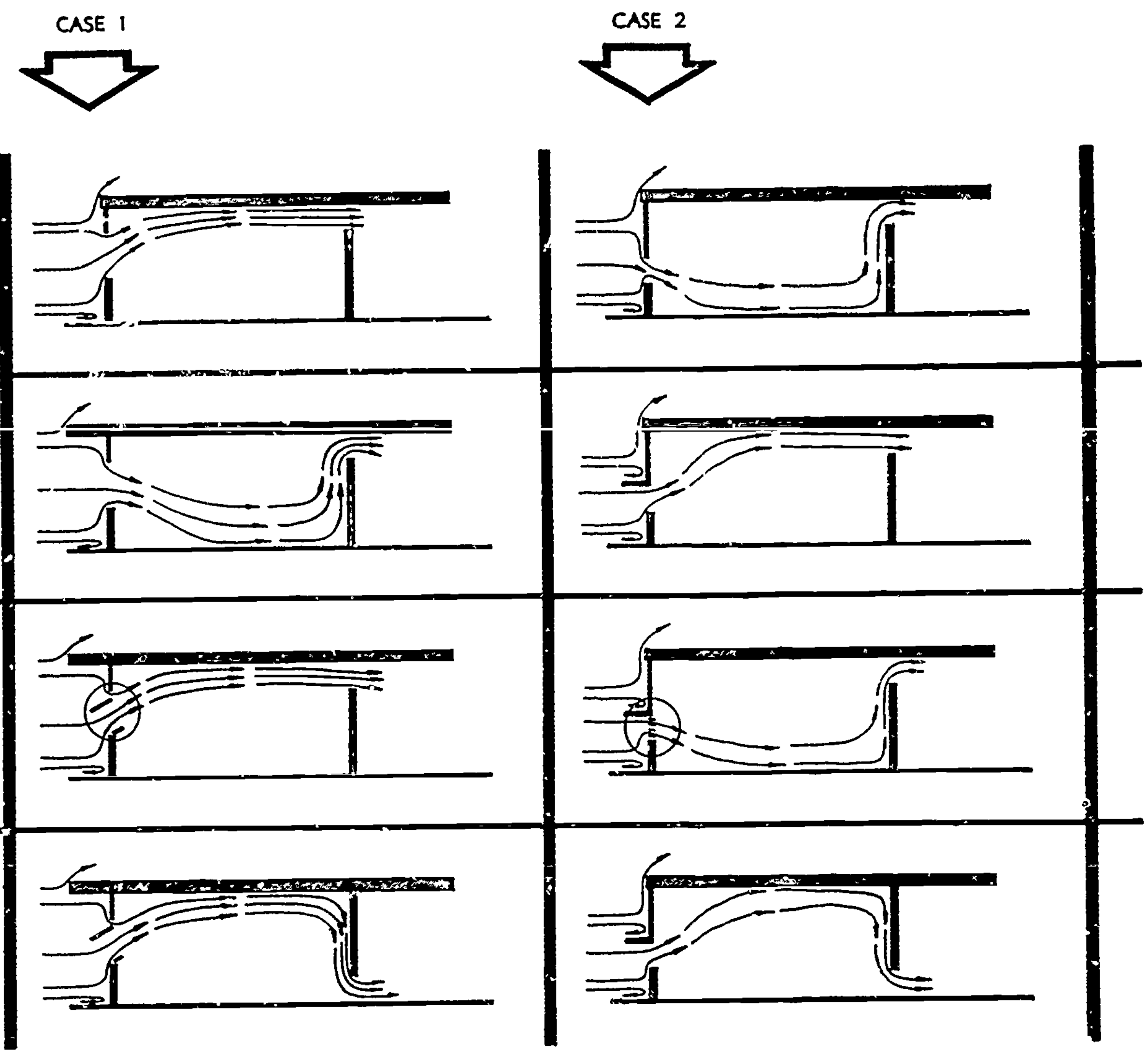
Fairfax school, Fairfax, California—Bamberger & Reid, AIA *Photo: Roger Sturtevant*

In many regions of US comfort in classrooms may be achieved by making proper use of breezes which occur during hot school months. When breeze is directed into living zone of classroom & around bodies of school children, this movement of air helps to produce a cooling sensation by increasing rate at which perspiration evaporates & by accelerating conduction of heat from body.



AIRFLOW AROUND & THRU CLASSROOMS *drawings by Cleon C. Bellomy & Ben H. Evans*

When wind blows against a wing of classrooms it envelopes the building & sets up zones of relatively high & low pressure. High pressure generally occurs near side of building facing wind. The building dams flow of air (see A) & sets up a high pressure zone. Air flowing around or hopping over building creates low pressure zones (see B), sometimes called wind shadows. Since air flows from high pressure to low, flow of air in classrooms may be achieved if openings are placed in walls adjacent to high pressure zones to let air in & in walls adjacent to low pressure zones to pull air out (see C).



1. Some wall treatments, by virtue of ratio of solid areas to open areas, will tend to cause incoming air to flow in a certain direction. Case 1 shows a wall which causes an upward airflow pattern along ceiling, Case 2 shows a wall which causes a downward airflow pattern along floor.

2. Other architectural elements may also influence direction of incoming air. These drawings show how addition of an overhang to Case 1 changes original upward airflow pattern to downward pattern, & how another kind of overhang added to Case 2 changes its original downward airflow pattern to an upward pattern.

3. Vane-type windows have definite directional effect on airflow. Some windows are designed to direct airflow upward, others are designed to direct it downward. Only a few can be operated to do either. These drawings show how, regardless of effects of overhangs, addition of a combination projected-hopper window to Case 1 changes downward pattern back to an upward pattern, & how addition of a jalousie type window to Case 2 can change upward airflow pattern back to a downward pattern.

4. Direction of movement of air into, & consequently across a classroom is determined at inlet openings, not at outlet openings. These drawings show that relocating outlet openings does not materially change airflow pattern in classroom

outlets are located near floor on opposite wall. Tests show that in such a case air will actually flow down opposite wall without a short circuit across room. So location of outlets is relatively unimportant. But location & type of inlets bear primary consideration in classroom design. Diagrams on this page illustrate these facts.

6 POINTS TO REMEMBER

Classrooms can be comfortable during hot school months if full use is made of wind—at no cost to taxpayer—provided that in design of classrooms, attention is given to these simple facts:

- air will flow from a high pressure zone to a relatively low pressure zone making it possible to set up little winds within a classroom
- for proper air movement there must be openings in classroom to let air out as well as openings to let it in
- larger the outlet greater the air speed
- for hot month comfort air should flow along living zone
- airflow pattern is not affected materially by location of outlets
- location & type of inlet openings control airflow pattern across classroom.

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LANDSCAPING THE SCHOOL SITE

by a committee of the American Society of Landscape Architects, Meade Palmer, chairman

THE PROFESSIONAL landscape architect's concept of adequate facilities for public schools has basically changed. Schools have become community focal points. They serve not only basic educational needs but recreational & social aspects of community life as well. Reading, writing & arithmetic have been supplemented by passive & active recreation for student & neighborhood groups — concerts & night schools bring new advances & techniques to the community. The old school (in some instances a dingy, forbidding pile of stone or brick) is fast disappearing along with its small, unattractive, unusable, fenced-in playgrounds. Parents & teachers have demanded progress & the public's interest in how tax dollar is spent has done the trick. Technical collaboration between architects & landscape architects is bringing better & better solutions to problems of shelter & site.

Great strides have been made in developing new criteria for school building design but solutions for related problem of site development have evolved more slowly. This seems strange in view of fact that school costs can be cut considerably by good site selection & good site planning.

site selection:

Site planner should work in close contact with city planner & architect in initial site selection — before final acquisition of property. Often, two or more sites would serve equally well as far as school board is concerned. Choice should then be resolved on its merits from points of view of city planner, landscape architect & architect. There is no question but that many thousands of dollars can be saved by proper choice of site — transportation costs can be substantially reduced — location, vegetative cover, topography, drainage, type of soil, size & shape of plot are all questions that can be converted into dollars-&-cents.

Once site has been selected, close collaboration between 3 professions can result in finding site's full potential. Properly handled, an irregular, "difficult" site can be made more attractive & interesting — with perhaps even more positive educational values than a flat "easy" site.

With today's greater emphasis on physical education & extracurricular interest in sports, with ever-pressing need for parking space for use during & after school hours, school grounds must be larger & more intensively developed to secure fullest benefit from well-planned buildings & to insure that public receives maximum benefit from money spent.

larger problems:

City or community planning should precede site selection & studies for site development should proceed simultaneously with development of building plans. Questions of building location & orientation can have profound effects upon usefulness & appearance of remainder of site.

Orientation must be considered in its architectural-functional aspects at an early stage by architect. A building properly located can facilitate organization of play areas & substantially reduce problem of supervision. In sites that are restricted in size, a properly located building can save valuable space for much needed play areas.

In same way that techniques of lighting, ventilation & temperature control have advanced to point where architect can accomplish almost anything desired, informed & skilful considerations of local climatological conditions & orientation of playfield can increase usefulness of outdoor classrooms & play spaces.

Topographic studies in plan, section & model can reveal many possibilities for use of irregular sites. Extensive leveling of a site is neither economical nor attractive. Differences of grade should be accepted as opportunities to segregate areas for various age groups & uses. Skillfully handled, a play of levels can add interest, may improve appearance &, in addition, materially reduce grading costs.

survey & grading:

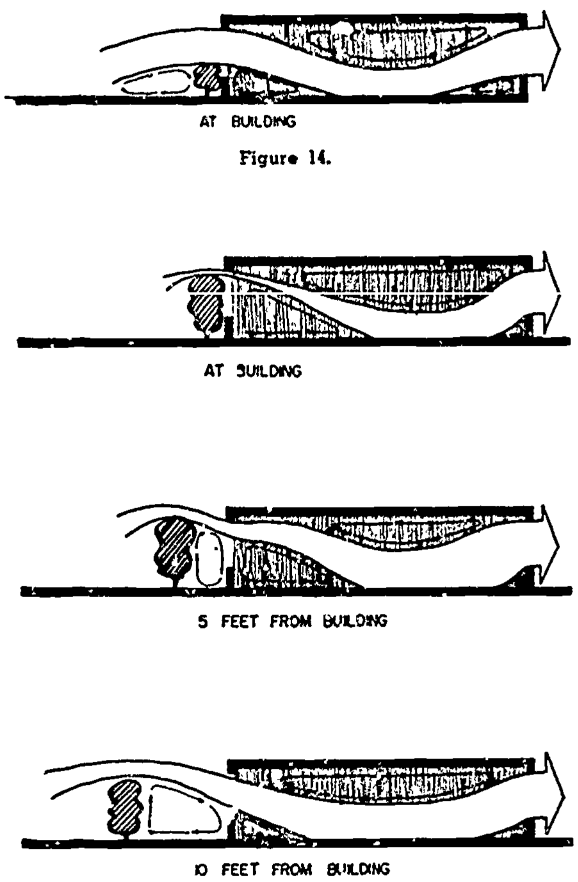
Accurate topographic survey of site, including elevations of existing or proposed streets & drainage areas adjoining site, is absolutely essential to intelligent study. A grading plan, based on this topographic information should be prepared for entire site. Such a plan, well conceived, will save future grading costs when contemplated expansions are added — by anticipating future needs & providing for them. Success or failure of a school's development can often hinge upon correct determination of first floor grade, itself a result of consideration of a number of factors — including topography, street grades, drainage & size & shape of building or buildings.

traffic patterns:

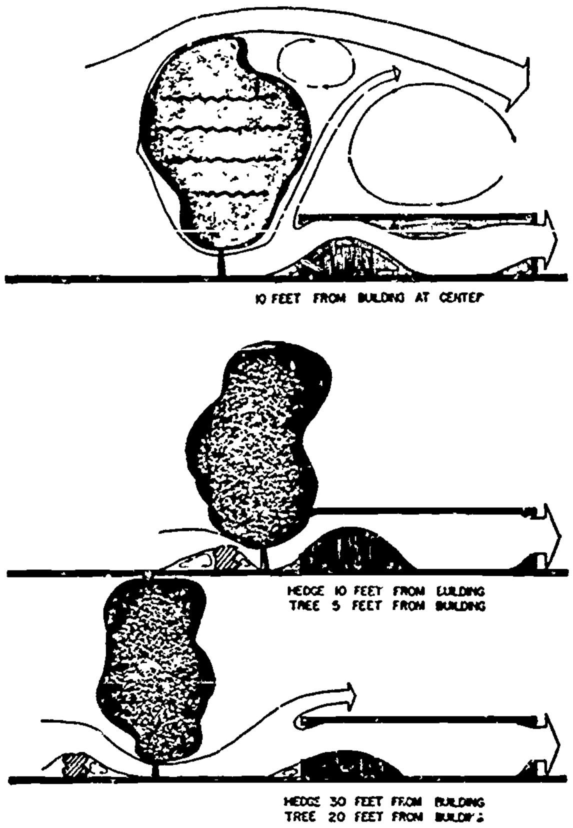
Children, left to their own devices will soon prove the axiom that shortest distance between two points is a straight line — demonstration, unfortunately, that is not materially altered by shrubbery or grass. Thorough study of basic traffic generators which determine circulation patterns should be part of site plan. Walks & drives should be designed to fit this pattern & to discourage deviations therefrom. Surrounding school building with a grass area & letting daily use determine circulation pattern is not good planning.

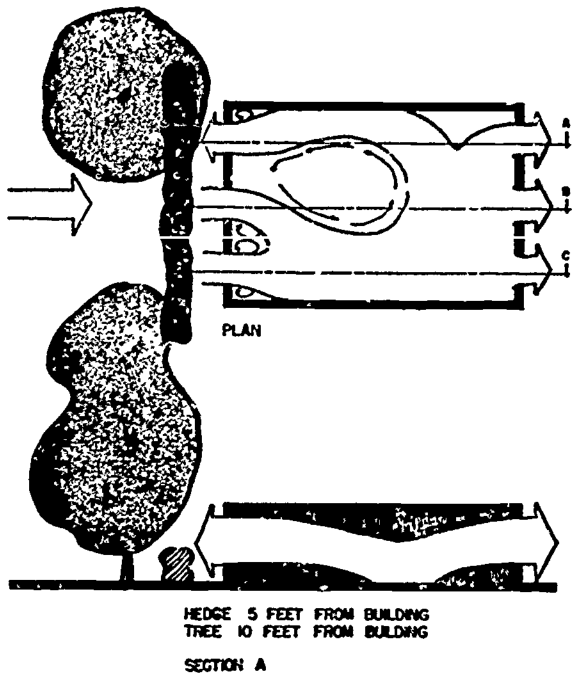
Drives & parking areas must be ample but should be located apart from play areas. Parking areas, especially, should be closely associated with public streets — transition from street to school yard can often be successfully accomplished by means of parking space & accompanying planting strip.

Associated with walk pattern are paved play areas for all-season use. In most cases, these paved areas should be for multiple use — form part of circulation system & at same time afford space for games & use by smaller children. These areas should be large enough to accomodate majority of children likely to use them & should, preferably, be divided between shade & sunlight. Ample sitting space of rigid construction will add to usefulness of areas.

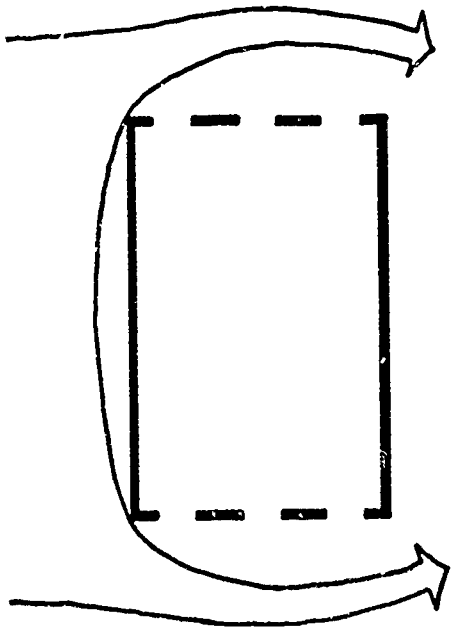


medium & high shrubs in various locations related to building sections

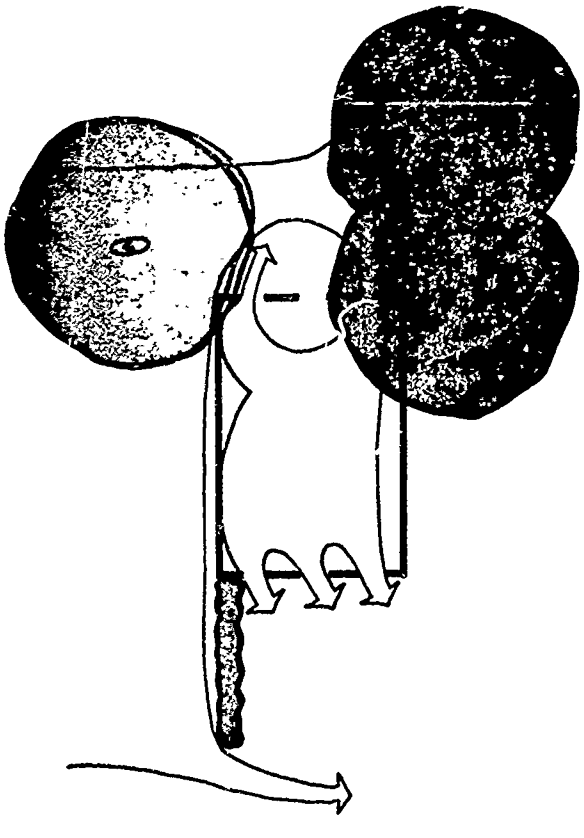




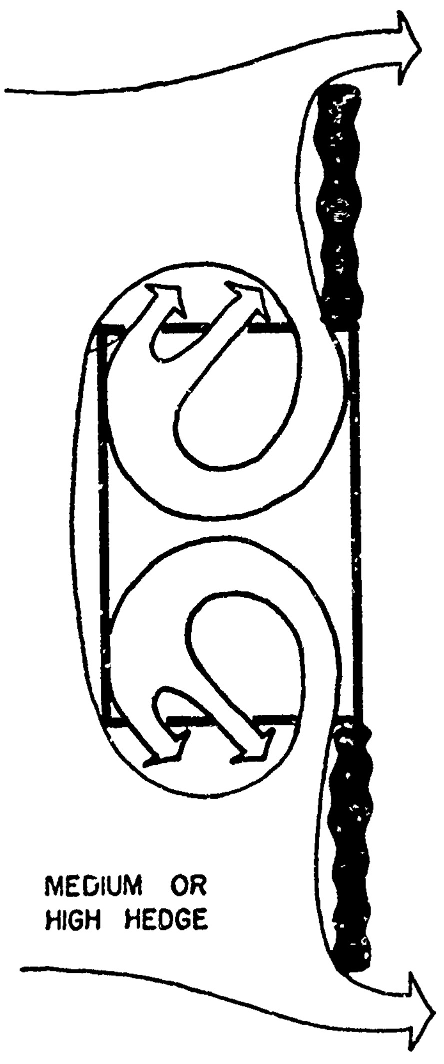
trees, with & without hedges, at various distances from buildings



BUILDING TURNED 90° INTO THE BREEZE WITH NO PLANTING



tree-hedge-building combination



illustrations used by permission from "Effects of landscape development on natural ventilation of buildings & their adjacent areas" by Robert F White (Research report 45 Texas Engineering Experiment Station, March 1954)

Roland Chatham, Bryan, Texas

test procedure: smoke patterns in wind tunnel (from White report)

drainage:

In any area as intensively used as a school playground, drainage is an important problem. Types of soil, amount of vegetative cover planned, location of natural drainage courses & grades of adjacent developed areas are important considerations. Considerable economy lies in avoidance of underground drainage structures whenever possible. Use of certain types of ground-cover will prevent costly erosion & reduce maintenance cost on steep slopes.

It should be emphasized that site design must take into account proper elevation of buildings with respect to sanitary drainage system.

landscape material:

When possible, every consideration should be given to the preservation of existing trees & shrub growth. On perimeter of property, trees & shrubs afford valuable visual & acoustical screen for adjacent properties. Even one tree saved in play spaces is worth hundreds of dollars for its shade. Under certain conditions expense of welling or walling around certain trees might be justified. Wooded areas not usable as playground space, because of excessive grades or for other reasons, can become desirable neighborhood picnicking spots with addition of tables & grills.

No school plan can be considered adequate without an accompanying planting plan. Plants are a part of good architecture — they also serve as inexpensive, yet effective, air-conditioners, screens for noise & unsightly views & wind breaks. Shade from a few well-chosen & advantageously placed trees adds immeasurably to comfort of children in classroom or on play lot. Trees & hillsides are very useful means of glare control if properly placed in relation to classrooms.

Choice of plants is necessarily limited to those varieties of trees & shrubs that require minimum maintenance. Plants requiring frequent clipping or spraying are, of course, ruled out. Except under certain conditions, shrubs should be of varieties that can take considerable wear-&-tear & that that can tolerate normal amounts of dry weather. Most school budgets can provide for only limited maintenance.

Design must consider visual integration of varied planting with mass of buildings from all points-of-view. One 30" high fir at each corner (beloved solution of countless lay friends of schools) is hardly fair to building or children or community. Extensive areas of "front lawn" are not only expensive to maintain but often occupy space better devoted to play areas or parking. To reduce maintenance problems, slopes & other areas can be planted with ground-covers, preferably of a sort discouraging trespassers.

Question of whether to sod or seed is best determined by comparative local costs. Seeding has advantage of affording opportunity of establishing a mixture of grasses to suit particular area & soil. Sodding is useful in getting an immediate cover in seasons when it is not possible to seed.

miscellaneous:

Correctly located fences, of sufficient height & substantial construction, aid in prevention of trespass, protect adjoining properties & reduce supervision. Effect of a boarded-up "Keep Out" property should be scrupulously avoided but use of adequate chain-link fences — especially on perimeter of athletic fields — will often prevent a flood of complaints from property-owners. It is a safety "must" along heavily travelled streets.

Raised or enclosed planting beds designed as part of architecture should be carefully studied before acceptance. Such devices often create conditions which will not support plant life.

Needless to say, all site-work should be covered by ample specifications written by one experienced with local conditions.

Design of school projects is complex, demanding combined talents of a number of qualified experts in various professional fields. More & more schools are becoming focal points, centers of community activity. As such, they should set a standard for excellence in design, in architecture & in landscaping. When one considers the tremendous inherent responsibility — educating & molding character of future generations — no effort is too great to expend to see that the job is accomplished.

SCHOOL LIGHTING—20 YEAR PROGRESS REPORT

by Charles Dana Gibson *

Let us begin our review of school lighting history with installation of bare lamps in classrooms. Some places I know never got past that initial stage. Some have been past it & are now back to it. Whole story at first was getting "some" electric light into schoolrooms. Emphasis was on raising lighting levels to 10-15 footcandles.

As that trend continued, electric lighting installations were evaluated in terms of amount of light they produced at desk-level.

"Quality lighting" for most part then was a laboratory term. Theorists kept on writing about it & industry kept right on selling footcandles. Finally, however, a good indirect incandescent lighting system became more & more respectable until, with few exceptions, electrical industry was including concept of quality along with quantity.

Then came fluorescent! From the gaudy midway of a World's Fair this infant son of Gaseous-out-of-Discharge made his diaper-clad appearance. There have been few occasions indeed when any segment of industry has staged such an intensive propaganda campaign for a product. Fluorescent became "the modern light source" & commonly exchanged fixture for fixture when relighting "old" incandescent jobs. Practically overnight hot & cold running cathodes & magical phosphors were creating & transforming ultraviolet energy into the Light of the World.

What happened to the "quality" school lighting story the literature had loudly proclaimed? The quality story was forgotten. From same pens & same pages the quantity story took over again. We had made full circle & were back singing "Bring-outdoors-indoors." Lessons & progress of preceding years were traded-even for a light source which by nature of its poor application broke nearly all established rules for quality lighting.

Fortunately for cause of good school lighting, World War II put an end to this mad rush. Its result was the critical materials tie-up, plus continued research on & refinement of fluorescent sources during war years. Remainder of last 10-yr period has witnessed continuing trend toward quality-with-fluorescent until again respectable school lighting solutions include element of quality with both incandescent & fluorescent sources.

daylighting:

Now let's review briefly history of daylighting. Since it was the original, & in many cases only school lighting source, daylight has been classified by most people as the prime source for school lighting. Electric lighting has been classified as a "supplemental" light source. However, currently this concept is being challenged in some situations.

At first any daylighting technique went unchallenged. Sun exposures with unshielded glass were common for classrooms. Old fallacy of "flushing the room with sunlight" created intolerable visual conditions for 1000s of pupils & teachers. Out of that primitive era we emerged into a controlled orientation approach to school-housing design. Since north-light offered best around-clock-daytime light source with fewest glare-control problems, the now internationally famous "finger-plan" for school plants developed. Dr Charles Bursch,* the Paul Bunyan of school planning progress, created this finger-plan approach. He thus began a series of developments which already have caused international re-appraisal of school plant design techniques & which will continue, by constant refinement, to increase educational usefulness of school buildings.

new possibilities in design:

Again World War II made significant contribution to school design — this time in construction materials & techniques. Development of laminated wood & light steel structural members during that crisis made possible economical construction of wide-span structures. Freeing of school design from shackles of 24' classroom spans & introduction of relatively inexpensive structural materials & construction techniques in form of rigid-frame design, opened new architectural vistas. Bi-lateral & tri-lateral daylighting design became common. With multi-source daylighting came sun-control problems which eventually developed into concern for sky-brightness controls. (see diagrams)

false emphasis on quantity:

Twenty years ago we talked with naive ignorance about importance of school lighting. Fallacious emphasis on quantity led people to believe that more light we had the better we could see & learn. Literature reeked with reports of so-called research which proved that pupils learned more in rooms with X footcandles than they did in classrooms with -X footcandles. (And even recently one lamp manufacturer issued a leaflet addressed to school administrators recommending that they make an easy check of their schools with a light-meter to see if they needed relighting!)

This misguided emphasis shows ignorance of the learning process. If time permitted we could review at length reasons given by electrical industry for wanting to provide schools with more electric lighting equipment & more electrical power.

visual comfort & efficiency:

Today we talk in terms of brightness-balance & conservation of human resources. De-emphasis on quantity has not discarded footcandle as major lighting measurement unit, it merely has placed it in its proper relationship to other lighting factors. We do say, however, that after we have produced 20 footcandles at task level, other quality factors making for reasonable brightness-balance take over.

We make no claims that poorly lighted schoolrooms "ruin the eyes" or produce ignorant pupils. We do say, however, that any school design which does not provide the best we know for visual comfort & efficiency is costing pupils & teachers unwarranted amounts of physical energy.

To perform critical seeing tasks in a properly conditioned visual environment requires expenditures of large amounts of our energy resources. As any environment becomes less & less adequate in terms of visual comfort & efficiency, energy cost for critical seeing becomes greater & greater. This fact has physical, emotional & educational growth & development implications for pupils which are far more important to school administrators, teachers, pupils, parents & electrical industry than any bread-&-butter arguments for good school lighting advanced in past.

getting together:

Most significant activity of people now interested in school lighting design is constructive communication. By this I mean that groups with varying interests in the same field get together & rationally present their point-of-view & then, with a cooperative mind-set, listen to other fellow's point-of-view.

In October 1952, the writer, acting as liaison officer from the National Council on Schoolhouse Construction, had a half-day conference in New York City with C. L. Crouch, Technical Director of the Illuminating Engineering Society. Points of difference were put on the table & need for better cooperative effort by both organizations was agreed upon.

In December 1952, entirely independently, the American Institute of Architects requested that IES hold a joint committee meeting with them to discuss possible revision of the document "American Standard Practice for School Lighting (1948)." Because of current heavy agenda this meeting was not held until October 1953 (Nela Park, Cleveland, Ohio), at which time the AIA suggested that NCSHC be invited to work with IES & AIA in event it was decided to revise the document.

In meantime entire June 1953 issue of "Illuminating Engineering" was devoted to school lighting with members of NCSHC contributing major articles. Official liaison reports to NCSHC for 1952 & 1953 included materials prepared by Mr. Crouch which reviewed activities of IES committees in field of school lighting or related areas.

(Committees from the 3 national groups mentioned have now held 2 more meetings & revision of the obsolete standard document has begun.)

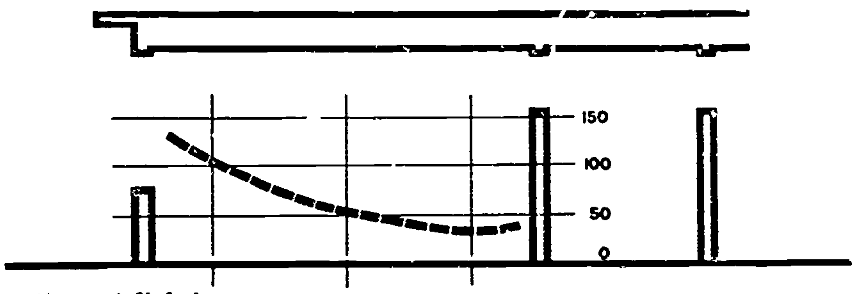
Fact that official IES publications on recommended practice continue to disagree on points of common concern best evidence of confusion within electrical industry. There is, however, a desire for constructive communication & IES is making sincere efforts to clear up controversial points by research. Independent studies conducted in major universities are now beginning to provide much more stable basis for effective lighting design than we have had in past. Last year another major group within electrical industry began a research program. Pacific Coast Electrical Association has appointed a school lighting committee to set up & supervise a program — half of which is underway:

■ project no 1: establishment of a "Service to Industry" contract with University of California at Berkeley for library research & evaluation:

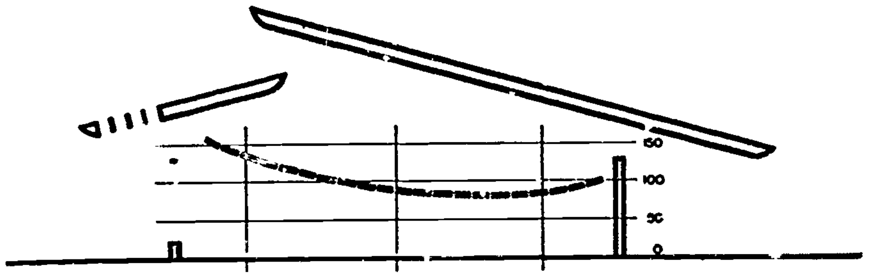
- **review school lighting literature to determine kinds & amounts of past research in field of school lighting**
- **evaluate probable validity**
- **determine areas already adequately investigated**
- **outline areas needing research before reliable data will be available**

The university has accepted this contract with understanding that results would be made available to schools thru California State Department of Education & that university has right to publish any findings with or without sanction of PCEA.

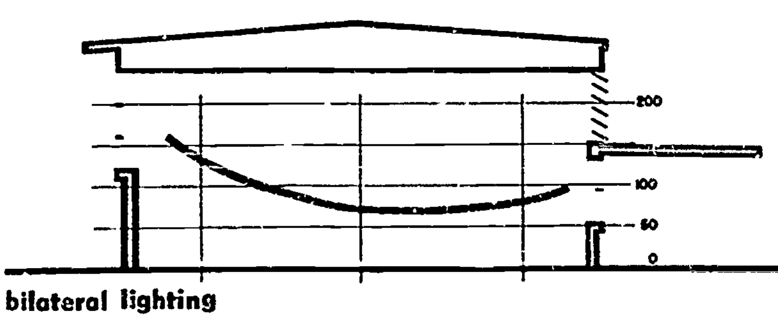
■ project no 2: study of brightness conditions in schools & rating them in terms of visual comfort. PCEA committee is exploring possibilities



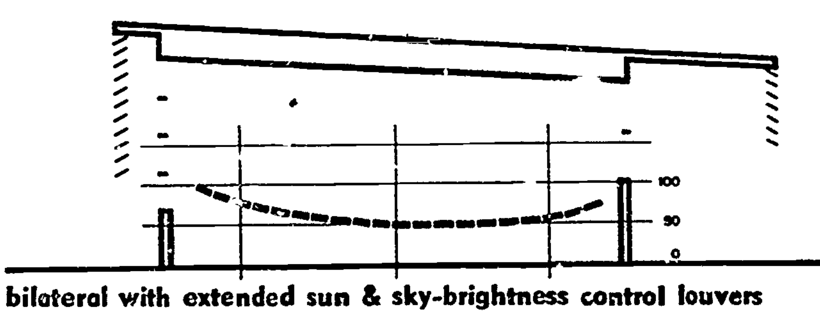
unilateral lighting



tri-lateral lighting



bilateral lighting



bilateral with extended sun & sky-brightness control louvers

all cuts from Texas Engineering Experiment Station booklet: "geometry of classrooms . . ." (Caudill & Reed 1952)

of this project in terms of the new direct-reading brightness meter & intends to provide latest lighting recorders & other instruments to facilitate work. Committee is now supervising 24-hr/day light & brightness recording experiment in actual classroom situation.

Big job for project 2, however, is setting up format for brightness study. Before main project is defined in detail, best advice available in fields of ophthalmology & general medicine will be obtained. Actual brightness research will be conducted by UCLA & we hope can be tied in with IES studies.

lighting goals:

Objectives established by NCSHC are listed because they reflect frame-of-reference, they are realistic in terms of visual comfort & efficiency & follow closely general recommendations of Quality & Quantity Committee of IES:

- footlambert brightness of any surface viewed from any normal standing or sitting position in schoolroom should not exceed 10X footlambert brightness of poorest-lighted task in room.
- footlambert brightness of any surface viewed from any normal standing or sitting position in schoolroom should not be less than 1/3 footlambert brightness of poorest-lighted task in room
- footlambert brightness of any surface immediately adjacent to task should not exceed 3X task brightness.
- brightness difference between adjacent surfaces should be reduced to minimum.
- brightness goals stated above assume lighting system that provides from 20-40 footcandles on poorest-lighted task. As footcandle levels are increased, sources of high brightnesses should be controlled to more nearly approach brightness of task.

Extent of area of surface producing brightness has measurable effect upon visual comfort. Small areas of either extremes of brightness generally are less noticeable than large areas of same brightness.

Term "task," as used in above definitions of goals, is interpreted to include any visual task which may be encountered in a schoolroom:

book on desk
symbols on chalkboard
(perhaps most difficult)
lab apparatus
artwork on easel
exhibits on tackboard
~~**motion pictures**~~
lantern slides

On basis of this concept it is apparent that tasks may be in either horizontal or vertical plane & may require student to face in any direction. Visual tasks in schoolrooms range in brightness-differences from reading black symbols on white paper to sewing with black thread on black cloth. Other factors remaining constant, visual comfort & efficiency increase with increase in brightness-difference within task.

conclusions:

- **daylight & electric light will be considered a complementary team of energy sources working toward same goals. Instead of being designed as separate problems, they will be coordinated in basic design pattern. Adequate controls for all daylight & electric light sources will be considered a prime part of design problem & not as appendages, alternates or afterthoughts**
- **lighting systems that meet brightness-balance goals advanced in this paper will be considered an integral part of school building. They will not be considered expendable in order to provide funds for less necessory educational & architectural features**
- **further design experimentation will continue but will be based on defensible & objective goals to be accomplished rather than on impelling urge to be different or use of propagandized equipment, materials or techniques**
- **we will begin our design thinking in terms of our best results to date & then, by using progress we already have made, we will further refine known good solutions to take them farther toward planned & accepted goals.**

FRAME-OF-REFERENCE:

- **brightness-balance instead of high footcandle levels is prime consideration in establishing acceptable visual environment for critical seeing tasks**
- **visual comfort & efficiency depends upon establishing & maintaining max & min brightness-differences between task & areas of high brightness & between task & areas of low brightness in 360° visual field**
- **no inhibitions should be placed upon seating or other work-station arrangements within room in effort to establish visual comfort**
- **high levels of illumination without brightness control do not mean better visual environment**
- **sky brightness & ground brightness are 2 major daylight sources & both must be controlled in order to produce positive visual environment for critical seeing tasks**
- **use of ground brightness as an effective daylight source can be part of planned design of building**
- **function of electric lighting is to supplement or replace daylighting**
- **both general light sources should be subjected to same brightness limitations & design of both sources should be coordinated to provide acceptable performance from both in completed structure**
- **maintenance problems created by lighting design must be held to minimum**
- **progress in daylight design depends not only upon development of more effective classroom sections but also upon planned & intelligent integration of all buildings in a school plant into patterns which guarantee daylight sources as well as sky brightness control**
- **orientation of buildings alone will not solve problems of brightness-balancing**
- **building design develops from correlation of interior & exterior elements which, in combination, produce comfortable & efficient visual environment**

Director, Office of School Planning, California State Department of Education

SCHOOL LIGHTING — FROM AN ARCHITECT'S VIEWPOINT

by Eric Pawley, AIA, Research Secretary AIA, Staff executive AIA Committee on School Buildings from a seminar 21 March 58 at University of Michigan short course on Light & Vision 19-21 March 58

AS WE HAVE listened to the fine presentations of this conference and our other meetings here several facts stand out. We are learning more about each other and our individual and mutual problems—perhaps becoming, in this process, less of a problem to each other. The anthropologist Ashley Montagu once said —"you must decide, in a controversial matter, whether you are going to be a part of the problem or a part of the answer!"

NORMAJEANISM

One scene evoked by the past week's meetings, however, in at least one architect's mind, could be described as follows: I see that twiggy-wristed Scotch-Canadian moppet, Norma Jean, struggling thru a sea of obsolete illumination nomenclature (footcandle, candlepower etc), over the coral reef of Dr. Blackwell's painful accumulation of data and into a formidably viscous—if not elastic—morass of fudge factors (1) —aided only by her trusty No. 2 hard percil. To those of you who do not know Norma Jean (2)— you will!

But this is very serious. Normajeanism, in education or in lighting, will call for American communities both sides of that unfortified border to spend millions of dollars they do not have. (Hmm! *unfortified*, eh?) Our temporizing but obvious decision is that we must find out more about school children and their activities. Thanks to Bill Clapp and the National Council on Schoolhouse Construction we shall make a start on this. Quite possibly, that child's faint hard pencil writing is not *the* realistic criterion of such multiplications of cost.

A BETTER CRITERION

In a school there are more than 100 visual tasks—of a wide range of ease and difficulty. I must make clear that what follows is intended to be in no way derogatory to Blackwell's method, data or immediate findings. I would be incompetent to argue with them. I do find myself constrained to warn against possible ignorant applications.

It is my opinion that we must recognize that some tasks are more difficult than others and that any attempt—*in installations,* please note that qualification—any attempt to make school tasks "equivalent in ease of seeing" or "equivalent in visibility" may be fallacious and undoubtedly will be expensive. The human being needs variety, is trained and educated by and thrives on meeting varied conditions. We may not welcome them but I believe this is so. *This does not mean variations within a specific task which interrupt our normal span of attention.* Extreme example: If we ride in a train and the sun beats the shadows of a row of telephone poles across our newspaper we soon stop trying to read it. An entirely new seeing problem is that of bother-some reflections on the convex surface of classroom TV sets.

EDUCATION

Most important aspect of school lighting is its educational value— how it assists pupil and teacher in the educational process. Educators, lighting engineers and architects know very little about this—but we know more than we know about some of the other elements of the learning environment.

As Bill Clapp has told you, and as John Chorlton will detail, the AIA has been working with the NCSHC and the IES for the last 5 years toward a statement of the principles of good school lighting. We are grateful for the characters of the men selected by the other two organizations. They have been patient [illegible] our ignorance and our, er . . . quiet modesty! (which is harder to take). We have been patient with the slow sweep of the 1 APS alpha rhythms of their brains when it comes to matters of esthetics. We like the guys and they're real hard to wear down.

QUALITY OF LIGHTING

Experience makes us believe in a balance of brightnesses in school lighting—decrease of strong contrasts of light in any field of view today's school child may have. Experience and the Chorlton-Davidson-Finch research have made us aware of the loss of seeing efficiency due to reflected glare from task or immediate surround. We are rather disturbed about how serious this is in terms of compensating light. Good practice—notably in California—has opened our eyes to what can be done with daylight control if you can get a school to buy it.

The architect aware of these elements of lighting design is more and more convinced of the validity —the urgency—of the "quality story"—that there is far more to the specification and design of good school lighting than a table of foot candle intensities for various rooms —or tasks—that room surface finishes, fenestration location, areas and glazing are involved as well as fixtures and lamp specification and maintenance. Vision research largely discounts color in a way no architect can do with his other responsibilities for total design.

TOTAL ENVIRONMENT

Furthermore, some of us are convinced that the total environment is part of the lighting quality story— that thermal and humidity conditions, acoustical conditions, perhaps even such unknowns as atmospheric quality, including electro-charge, may be important. Some of these sense impressions aid or cancel out each other. As I mentioned, in a talk on this campus Tuesday, a small boy is reported to have said "you can't taste peanuts on a roller-

(1) *fudge factors—empirical adjustment coefficients*
(2) *Norma Jean is the name of the little girl whose faint pencil handwriting was selected as a critical seeing task in current research on school lighting*

coaster!" The integration and coordination of all of these factors is the architect's job and in a school this must be done in a manner that yields the utmost of educational and esthetic value.

This total concept of the architectural environment has an educational value which is just beginning to be recognized. Thru its varied appeals to the senses (the true meaning of *esthetics*) it enriches experience. Just the experience of well-proportioned space is important.

This total concept of environmental factors is the architect's coordinating province. This was hinted in a lady's question yesterday—couldn't the architect take more responsibility for the continuing good functioning of his buildings? We could and should and some do. I have even seen an *owner's manual* produced by one office. There are problems. It may often be politically inexpedient for a school administration to maintain a continuous relationship with an architect, desirable as that might be for both. Then too, school business managers, superintendents and particularly assistant-superintendents-in-charge-of-construction know all there is to know about details. Teachers College teaches 'em how often to wax and mop and what to use—but the choice of wax may be based on its nonskid quality rather than lack of specularity—and man! doesn't it look clean when it's shiny?

And lighting fixture maintenance—OK, we'll have luminous-indirect. Oh yes, the troughs will have to be cleaned periodically of spitballs, paper airplanes, rubberbands, assorted suicidal bugs, cutout letters saying BEAT CENTRAL HIGH—in addition to mere dust! How many times should ventilating system filters be changed? Have the Ed Docs ever noticed a correlation (goody!) between dirty filters and dirty lighting equipment? How about throwing these cleaning jobs off-phase to smooth out loss and gain of light?

Is this ARCHITECTURE?

No!—but the total effect is—*the building is not an environment until you include the conditions within it, and nearby.*

Sally Carrighar, a naturalist and a fine writer, wrote me from Alaska about sensory environments— ". . . perhaps the landscaping around a house should be done with scents in mind—and have you ever listened to the sound of the wind in different kinds of trees . . . ?"

These, too, are parts of architecture.

UNIVERSAL EXPERIENCES

The pendulum swings—certain architects, feeling securely contemporary, have refused to put fireplaces in houses—"inefficient heating," they say, "creates drafts—dirty—puts airconditioning out of balance—fireplaces are sentimental and vestigial in the modern house!"

It is curious to note that the electric light was the first divorce of man-made light from odor (and the need for combustion air). Wood and coal fires, oil, candle, gas, all have their characteristic (and sometimes foul) smells. All have heat output and characteristic color temperatures.

There is something very basic in us that takes a true pleasure in bayberry or beeswax candles or a good hickory fire (which also crackles). Now, for heaven's sake, don't go home and design some sputtering lamps (we have 'em already in some fluorescent installations). This is the trouble with most lighting engineers' attempts at "mobile" color lighting. This kind of thing is very subtle and must be done with finesse (I don't mean pale colors) but a design sense—or it is terribly corny.

ARCHITECTURE THAT COUNTS

Several people, yesterday morning, denied possibility of putting figures on the elements of architecture and repeated the old misconception of the architect's reliance on *intuition*. There is nothing mysterious about this. Intuition is principally drawn from a summation of individual experience— but there *is* something that happens in the creative act, and in the understanding and appreciative use of a creative piece of architecture, which eludes quantification. There are just too many terms in the equation. This is the reason why the US Office of Education, for instance, will never be able to compile enough statistics to be able to tell a good school plan from a bad one. It is the reason scorecard evaluations of school buildings do not work. It is also an explanation of the failure of some building designs which overemphasize one-shot and limited expressions—just all texture, or "lineyness" or acute colorosis.

What can be done to bring in some order? Money, and the intellectual and cultural limitations of clients, aside—technologically we can do anything. I believe we can learn to analyze the different elements of our sensory environment and put enough figuration upon them to understand them and to be able to reproduce them as design elements. What are the dimensions of these nets by which we are attempting to catch these minnowy sense impressions so that we may examine and measure them and recognize their size and quality when we want to find them again?

Let's leave this analogy before it begins to smell fishy—but we need systems of measure for all our experience in order to bring it into focus for architecture or environmental design. Selection and integration of design elements is still the creative task.

* * *

There is too little poetry today—it is the best way of saying things if you will listen to it and I wish to close with a poem entitled:

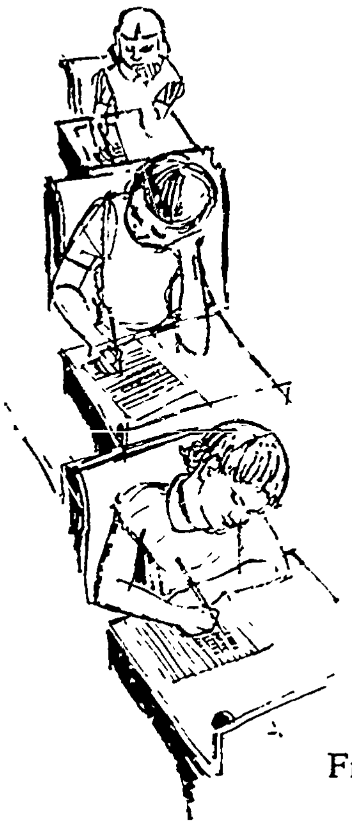
PHILOSOPHY

sometimes the world seems narrow
a place of short horizons
at the ends of streets

within—
there are indeed
broad avenues of the mind
lined with blossoming trees
with serene traffic of thought

with monuments
or an arch of triumph
closing the vista

but when we gain that circle—
there are more avenues.



Effects of Teaching Equipment and Supplies on Visual Environment

by **Foster K. Sampson, IES***

From a paper delivered at the AASA convention, Atlantic City, NJ, February 1960

An Important Breakthrough

Problems of classroom lighting are a major concern of architects, engineers and school administrators responsible for specification and design of illumination systems. Many "Recommendations," "Codes," and "Practices" have been proposed by technical and non-technical groups. Axes have been ground (and swung) and basic principles expounded. Fortunately research is now sufficiently advanced to allow reasonably adequate statement of engineering requirements for efficiency and comfort in several basic areas of such design. With requirements determined, relative success or failure of any design project is dependent solely upon ingenuity of architect and engineer and attitude of administrator responsible for basic program.

One team has been doing pure research on vision for a decade and results of this work are useful for lighting common visual tasks. Kirk M. Reid (former President of the Illuminating Engineering Society) stated that this work had done more to advance the understanding of illumination requirements than all previous research in this field. This was high praise for Dr Blackwell, director of this research, who has since gained acceptance of his research methods and findings from local, national, and international authorities.

Dr Blackwell's work has recorded data from standard laboratory test objects and related them to visual tasks commonly found in the classroom. The data indicated that illumination values required for efficient seeing varied over a much greater range than had previously been suspected.

Brightness versus contrast

Dr Blackwell, using young adult observers with normal or normally corrected vision, recorded visibility of a standard test object, a luminous disc, of varying size and contrast as seen against a background of varying brightness, all carried out in a large uniformly bright control cubicle. The measurements covered sizes ranging from an extremely tiny spot to large detail. The time interval varied from 1/1000 second to 1 second and the brightness of the background changed from .001 to 800 footlamberts.

Having determined how the eye sees a standard test object, it was necessary to relate laboratory data to field conditions of "moving" eyes and differing details of various school tasks. The "moving" eye factor was determined by observing detail on a large moving wheel passing at different speeds in front of the observer.

Relation of various school tasks to the standard luminous disc was estimated by varying contrast of the luminous disc until it was equally visible through an optical instrument (contrast threshold meter) to the given school task. Once "equivalency" was established, laboratory data, with "moving eye" factor included, could be used to determine illumination necessary to see the task at a given rate of performance. Rate of performance was based upon a complete degree of accuracy and an eye-pause of 1/5 second—found to be the average pause of the eye in reading and scanning.

Measurements of actual tasks indicated that tasks having good contrast required low levels of illumination, those having poor contrast needed much more than a proportional increase in illumination. For tasks of the same size, a decrease in contrast of 1% required an increase of illumination of 15% to make the task with low contrast "equal in visibility" to the task of higher contrast.

A classroom task usually having high contrast is the reading of six to twelve-point printing type on good book paper. Measurements of many samples of this kind of

* Mr Sampson is associated with Kistner, Wright & Wright, Architect-Engineers, and consultant to the AIA subcommittee on school lighting

task established that levels of *one to 3 footcandles* would be adequate on the basis of visual performance data. Examples of classroom tasks having lower contrast than this printed material included reading pencil handwriting, and fairly good duplicated material. Poor duplicated material from several different processes had poor contrast and blurred detail.

Samples of handwriting with #2 pencil on white, lined paper were tested revealing that the lighting level required, for equal ease of seeing, varied from plus or minus one footcandle to 105 footcandles. The twelve samples (40% of a 31-member sixth grade class) having the poorest contrast required an average of sixty-three footcandles.

Tasks with poor contrast required much higher levels of illumination for equal visibility. Shorthand notes taken with a #3 pencil required seventy-six footcandles. Many duplicated samples, made by different processes, needed from 200 to 600 footcandles and in some extreme cases 2000 footcandles.

An original page typed with a good ribbon needed only 0.97 footcandles. The fifth carbon copy required 133 footcandles for equal ease of seeing.

These findings provide a basis for determining proper levels of illumination for classrooms. It is essential that the classroom and its lighting system be designed to provide an environment which is conducive to good seeing and a pleasant place in which to learn. Thermal comfort, noise level and esthetic feeling of the space must be given due consideration. The problem faced by the school administrator and the architect is how to evaluate these essential requirements and integrate the design components into a pleasant spatial environment.

We must provide the foundation for evaluating a comfortable, pleasing and efficient seeing environment. The publications of the National Council on Schoolhouse Construction make us aware of the "Principles" or "Goals" first stated in 1946 and modified in more recent printings. These goals were based wholly on experience. A paper was presented to the Illuminating Engineering Research Institute (March 1960 in Washington, DC) which reported findings of research on comfort and glare evaluation from large area sources. The preliminary results, we believe, begin to confirm the recommendations of the National Council "Goals" and indicate good reason for even more restrictive brightness ratios.

The concept of environment conditioning, as set forth in the "Goals," restricts the brightness relationships of the many elements in the visual field. When the eye fixes upon a visual task or any significant area of brightness, an adaptation level is established which is a function of the brightness of the area and its surroundings. This adaptation will result from the contribution of the many brightnesses, integrated with respect to size, brightness, and to the angles by which their positions are displaced from the line of sight. The eye shifts from one brightness to another, re-adapting to the new brightness condition. If there is a considerable difference between the two levels of brightness, time is required for the eye to adapt itself. One of the important requirements for a satisfactory visual environment is that brightness to which the eye must adapt should be kept within desirable limits.

Basic Principles

Taking many points into consideration, the "Principles" for providing a comfortable and efficient visual environment are generally accepted to be as follows:

- Under ideal conditions for visual comfort and efficiency, brightness of task should be equal to or slightly greater than brightnesses within the visual environment
- In a classroom, the brightness of any surface viewed from any normal standing or sitting position should not differ excessively from brightness of the visual task. As higher or lower brightnesses of surfaces in the visual field approach brightness of task, visual comfort and efficiency increase. Research indicates that for best lighting with a thirty footcandle level, the highest acceptable brightness of any surface in the visual field should not be greater than ten times brightness of task. Above thirty footcandles, brightness ratio should be decreased as footcandles increase. The exact relationship is as yet indefinite but some data available indicate that maximum brightness is best limited to approximately 250 footlamberts. Lowest acceptable brightness of any surface in the visual field should not be less than one-third brightness of task.
- Brightness of surfaces immediately adjacent to the visual task is more critical than that of more remote surfaces in the visual surroundings. Adjacent surfaces have lower acceptable brightness limits than surfaces further removed from task. Research indicates that surfaces immediately adjacent to visual task should not exceed brightness of task.
- Brightness-difference between adjacent surfaces in the visual surrounding should be reduced to an acceptable minimum (and should be at most one-third task brightness).
- Direct and reflected glare should be avoided in any lighting system.
- Daylight and electric light systems should conform to same brightness and brightness-difference principles. Both systems should be coordinated in design to assure effective contribution of each.
- Lighting systems should be designed in such a manner that they will contribute to a cheerful, and esthetically pleasing classroom environment.

To determine brightness relationships in a classroom, the visual task is a suitable reference point. There are many visual tasks in schoolrooms, variously located in the room. For design purposes the task is assumed to have a 70% reflection factor and a surface which will produce a brightness 0.7 times the footcandle level on the task. Brightnesses in the classroom are referred to this reference brightness and in the "Principles" of school lighting the brightness of the visual task is meant to be the reference task brightness.

Techniques

So far nothing has been said about how the lighting should be achieved. A few simple rules, if properly followed, help to determine number of lamps which must be used in any specific lighting system to provide a predetermined level of illumination in any particular space. There are many other important decisions which must be made, however, to assure a satisfactory result.

Acceptable lighting solutions must provide an adequate level of illumination uniformly distributed over the classroom work area. Points to be considered here are those which directly affect the visual environment, and consequently comfort of the observer, and those qualities of the system which affect seeing the task itself. These are two separate and distinct considerations. Many lighting systems may be satisfactory in one respect, but quite unacceptable in the other.

As established in the second "Principle" above, no surface within the students' view, either horizontally or vertically, should exceed a brightness of 250 footlamberts under lighting levels of thirty-six footcandles or more. With less than thirty-six footcandles, the brightest surface should not exceed ten times that of the task itself. This is generally accepted as a desirable limitation—however, if reasonable levels of illumination are to be provided, this limitation may be achieved only with systems in which lamps are completely shielded from view and ultimate source of illumination is large, as in an indirect system or a luminous ceiling. With systems of this character there is a minimum of reflected glare when compared with other commonly used systems which provide equal flexibility in seating arrangements.

There are many people who, although they recognize the superiority of low-brightness systems, do not wish to rule out completely those installations which exceed this desirable minimum. For this reason a rather complex set of limitations has been set up by the Illuminating Engineering Society. Restrictions for direct glare are specific for viewing angles from the horizontal up to 45° above the horizontal, but there is no attempt to limit or specify brightness above this angle.

Lighting systems and the problem of glare

There are five classifications of interior lighting systems all of which have advantages and disadvantages:

- *Indirect systems* direct from 90% to 100% of light output to ceiling and upper side walls. If well planned, both direct and reflected glare are minimized.
- *Semi-indirect systems* emit 60% to 90% of luminaire output upward with possible control of direct and reflected glare.
- *Direct-Indirect* has about equal components upward and downward. Luminaires for this system must be suspended to be effective. Because of higher downward component, shadows and reflected glare will be more of a problem.
- *Semi-Direct* directs from 60% to 90% of light downward. Luminaire is usually mounted on ceiling. Upward component helps to light ceiling but in most cases ceiling is relatively dark and unless luminaire is quite large, shadows and reflected glare will be objectionable.
- *Direct* produces 90% to 100% of its light downward and depending upon relative areas of light-producing surfaces, the system may be among the best or the poorest. Large areas of six to eight feet square, or larger, can produce shadow-free, and glare-free light, while individual sources of smaller area must concentrate a high percentage of light downward to avoid direct glare. This concentration of light has the serious drawbacks of causing deep shadows and bad specular reflections.

For years reflected glare has been known to be a serious problem—to be avoided if possible. John Chorlton, IES, has actually measured and reported losses due to reflected glare under several different systems of lighting. Percentages of contrast-loss caused by these different systems were known but the full impact of these losses were not recognized until Dr Blackwell determined that it took an increase of 15% in illumination to overcome a 1% loss in contrast.

The report by Finch, Chorlton, and Davidson, presented before the international congress on illumination in Brussels last summer, reported methods and results of research on effects of specular reflections on visibility. Contrary to previously accepted ideas, the brightness of light source in the 0° to 45° zone is not directly the major cause of reflected glare. Several examples of printing and handwriting tested, showed that losses due to reflected glare were proportional to concentration of total light flux within the glare zone. This means that if all the light falling on the task came from outside the glare zone, the reflected glare would be at a minimum. The worst condition is that in which all the light comes from the glare zone. Students in a classroom may be seated at tables, facing in all directions, so that the lighting system must provide for flexibility. The most satisfactory system is that in which there is least concentration of light in any one area. Light will then fall upon the task from the largest number of directions and there will be least concentration of light in the glare zone.

Not all classroom tasks are glossy, and matte samples tested show relatively small losses due to reflected glare, regardless of lighting system.

Fundamentals

- We now have research on vision and evaluation of light-levels necessary for a particular accuracy of seeing, for a wide variety of tasks. Architects, engineers, and administrators must now decide how to apply this knowledge to selection of lighting levels for classrooms.
- There is a continually increasing appreciation of the value of environmental conditioning. The "Principles" repeated in this paper, establish goals which will be a challenge to any progressive architect.
- We now have valid information as to losses due to reflected glare —most important to understanding and evaluation of lighting systems.
- Tasks found in the classroom point out the need for considerable improvement in quality of reproduced material.
- If pencils are soft, and kept sharp and paper white rather than colored, better visibility results.
- Printed material is better produced with dull ink on matte paper. Only where it is necessary for fine detail should semi-gloss or glossy paper be used.
- Chalk boards with not more than 30% reflection factor, large characters and supplementary lighting are recommended.
- Difficult tasks are best done under the best light in the room. In some cases this may require supplementary lighting.

COLOR FOR SCHOOLS

John Lyon Reid, AIA*

In most modern school buildings, & especially in those that are thoughtfully & skillfully designed, color often makes strongest impact on first-time visitor of any physical parts of the building. An appealing scheme of colors has much to do with community acceptance of a new school building. An appealing scheme of quickly appreciated by both adults & children.

Intent of this report is to treat a complex subject briefly — it is addressed both to educators & architects & it is my hope that a reading of this will encourage deeper & more detailed study of this important subject.

Color can do two important things for a building:

- **enchance function & use**
- **increase architectural stature of building thru esthetic values**

It is difficult or impossible when designing a building to think of these two apart from the building.

Modern design shows great concern in matters of function & utility & it is only natural that our treatment of color partake of this same concern. Color, when any serious thought at all is given to it by those who aren't color specialists or architects, is usually regarded only as a matter of preference & prejudice — how about that? — more later. First, let's get to things that we **know** about color, as distinguished from intuitive & imaginative things (these latter things are important, too!).

We **know** that we can use color to:

- **improve seeing conditions**
- **increase orderliness**
- **reduce maintenance**
- **improve safety**
- **identify materials & objects**
- **improve morale, well-being & working efficiency**

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*member AIA Committee on School Buildings

We **know** also that rooms & areas, differentiated according to use they are given, each invites or demands different contributions from color. Classrooms generally, (this includes shops, laboratories, libraries) & traffic areas, eating spaces, & assembly rooms have different color requirements, because of differing uses as well as time & condition of occupancy.

color has 3 factors:

How do we go about accomplishing these **known** uses of color? First, let us examine facts of color. Color has 3 main characteristics:

- **hue is that attribute of color wherein blue is distinguished from yellow, & yellow from green**
- **value is measure of relative darkness of color ranging from theoretical white as a light value to black as a dark value (thus a pure yellow is lighter in value than blue or green)**
- **chroma is degree of saturation of a color — where color is intense & clear chroma is high & where color is grayed chroma is low — color of low chroma may have either high or low value**

Another consideration which is important, especially in school buildings, is light-reflectance of color, which is another aspect of value. White reflects approximately 85% of light falling on it while black reflects practically no light in amounts which can be used for seeing tasks. When we think of color we usually think of paint — it is often used to protect building materials such as plaster, wood, metal, & sometimes acoustical tile, cork & other materials. But every building material has its own color & texture such as brick, aluminum, stone — some offer choices as do linoleum, floor tile & ceramic tile.

How do we use colors of paint & native colors of building materials so that we can avail ourselves of the **functions** that color can perform? Here are suggestions only, not rules, & they provide a brief summary of things that color can do:

to improve seeing conditions:

Light is provided by windows, toplights, monitors & electrical sources & is reflected, diffused & distributed throut space by reflectance of surface colors & textures, to become available as illumination on task.

Good seeing conditions are strongly affected by color design. Strong brightness contrasts are both tiring & distracting, & color can be used to reduce them to tolerable levels. Sources of light are brightest areas in a room & surfaces adjacent to light sources should be as light in value as possible to reduce brightness contrasts. Thus window mullions & walls in which windows occur should be as high in value as practicable. Ceilings should likewise be high in value, & where suspended electrical fixtures provide indirect lighting, upper parts of walls should be treated so that reflectance will be at least 70%. Chalkboards & pinning boards are much lower in reflectance than this & color of surfaces immediately adjacent to them should have a value between their reflectance factor & higher reflectances of surrounding surfaces to serve as transition. Floor covering should be as light as possible, consistent with good maintenance, to reflect & diffuse light & to reduce brightness contrast with visual task on desk & desk-top itself.

This is especially true when light is received from overhead sources. Most furniture now available is finished in colors of high value, so that problems of brightness contrasts are more manageable. Colors of other parts of building, visible thru windows, should be chosen to eliminate distracting sources of high brightness — this becomes a problem when a sunny wall dominates view from classroom windows. Although glossy surfaces are easier to maintain in a clean condition, care should be exercised to avoid distracting specular, (mirror-like) reflections.

to increase orderliness:

Function occasionally imposes on a room a disorderly pattern of doors, cabinets & units of mechanical equipment. Where hue & value of such items are different from surrounding areas, resulting untidy pattern can be distracting. By judicious use of color, designer may paint out offending arrangements & create order.

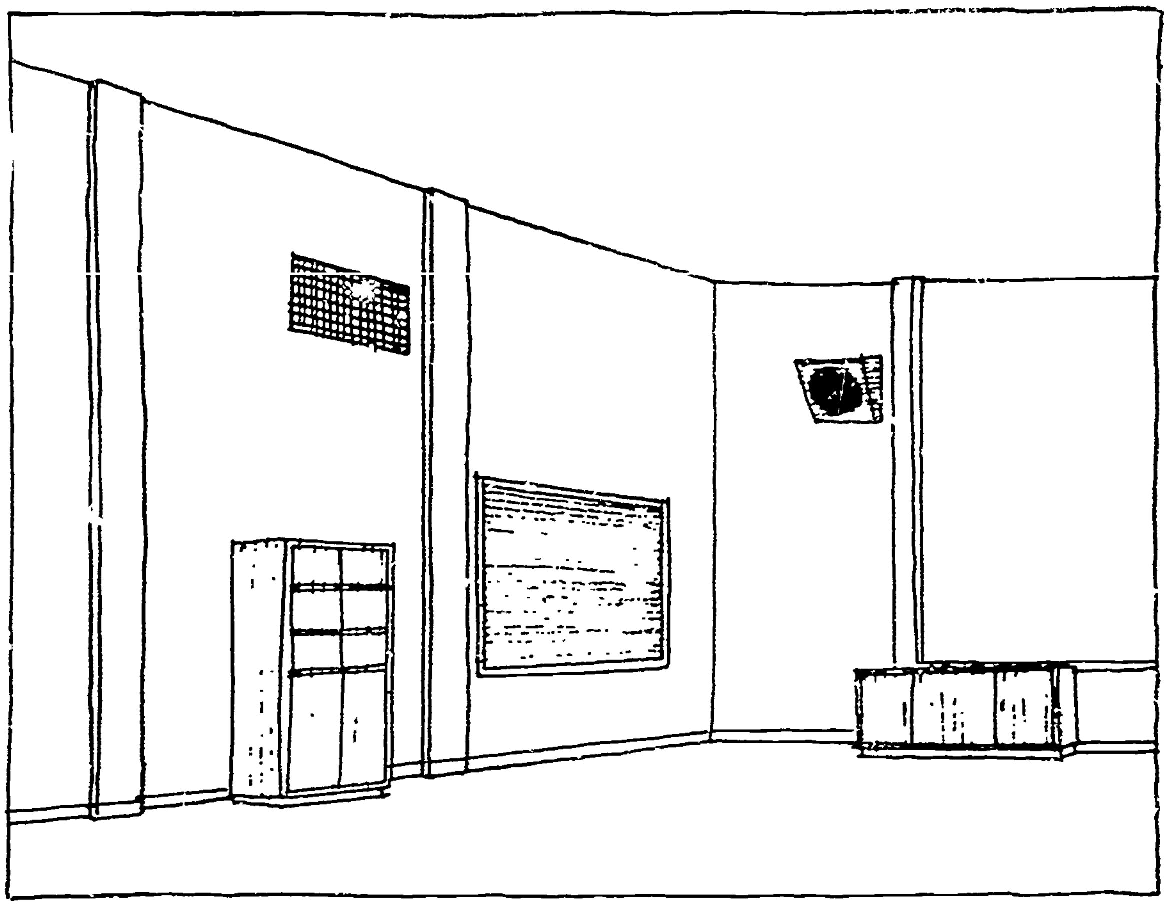
to reduce maintenance:

Certain colors seem to take delight in magnifying finger & scuff-marks, & in making psychos out of custodians. Areas subject to defacement (it happens occasionally) & marks of use should be treated with colors that minimize these troubles. That does not mean a return to schoolroom brown — it has taken years to get away from it. There is no excuse for painting rooms the color of dirt so dirt won't show. You can do only so much with color — rooms can be kept clean much more effectively if teacher will help children respect & care for their school building.

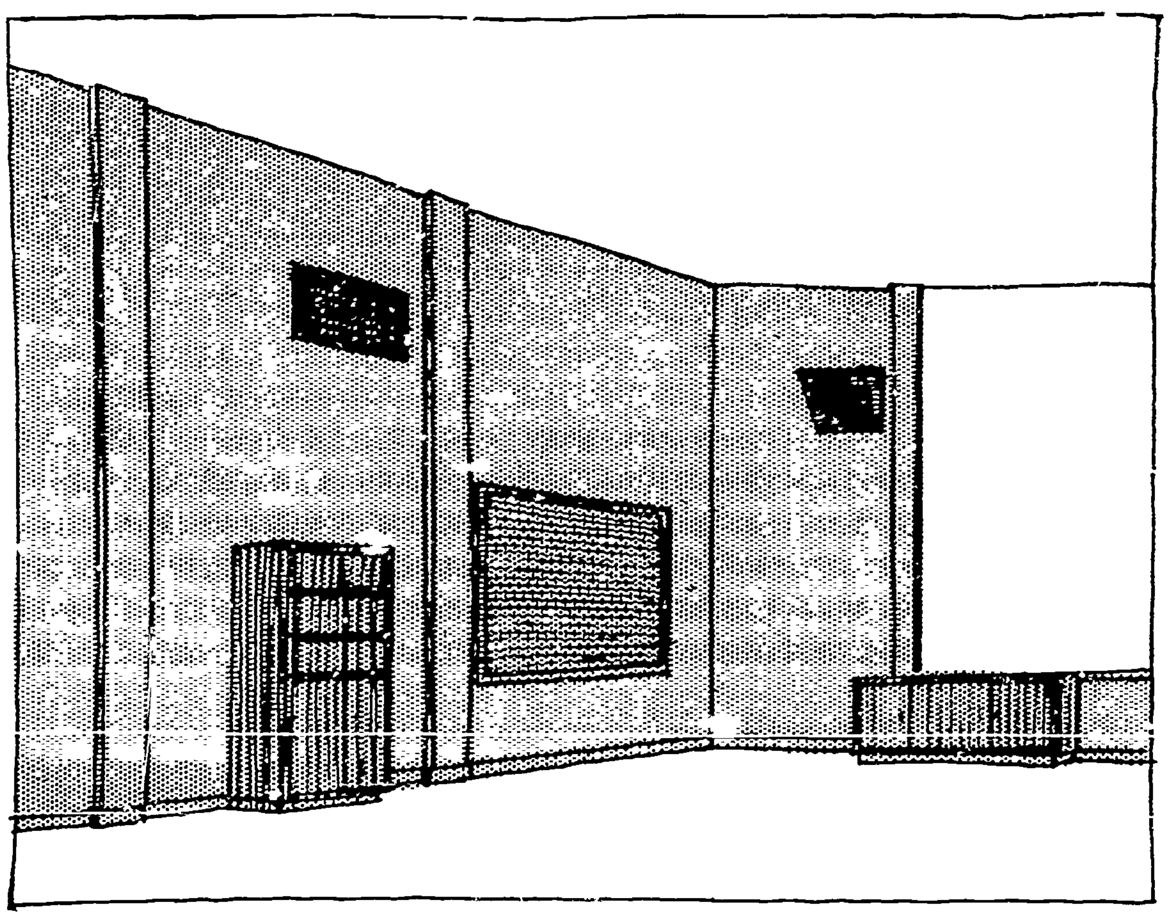
However, washable paints & easily-renewable wood-stain colors will earn the architect custodial benediction. Architect should always provide school staff with color numbers & tradenames of paints when building is completed — sometimes extra cans of wet paint are useful for touch-up work.

to improve safety:

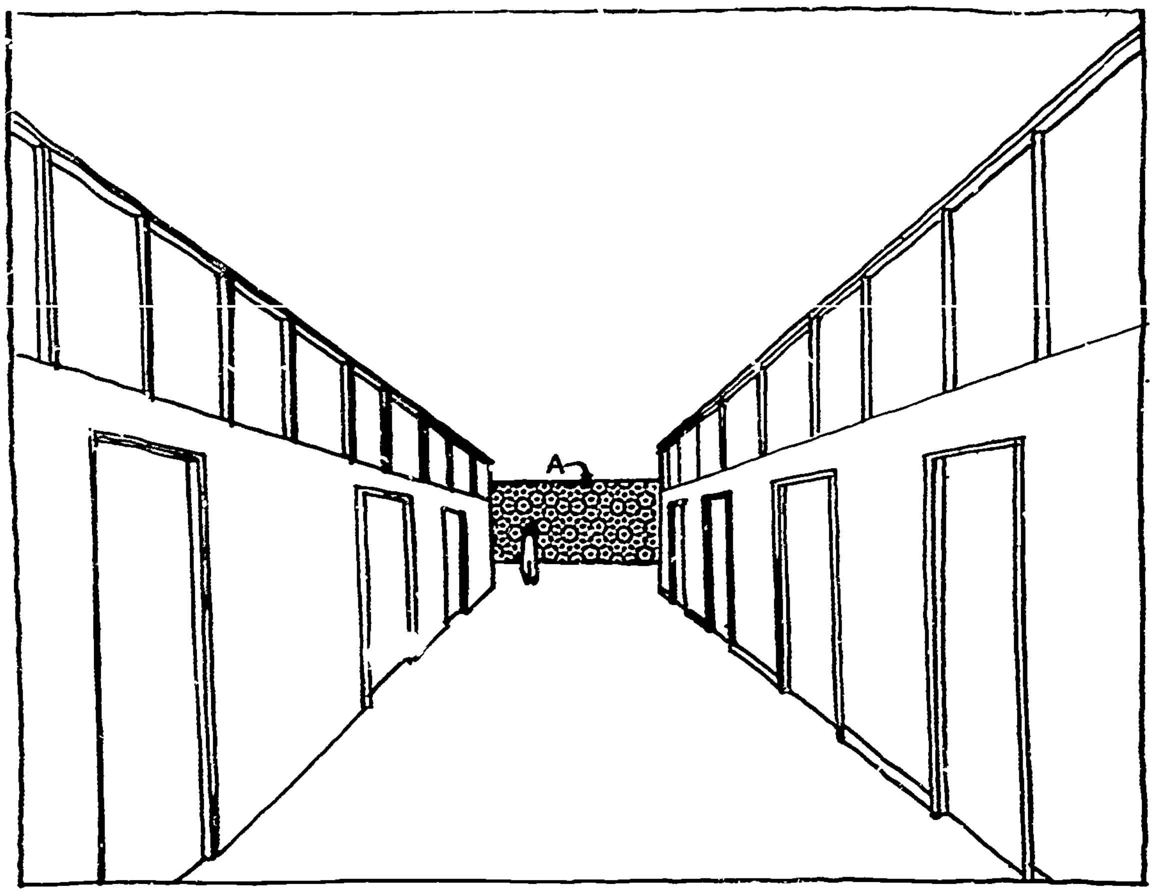
There are several systems of safety color available which are used by industry. One of these should be used in shop areas & mechanical rooms. In addition to this more obvious use of color for industrial & mechanical



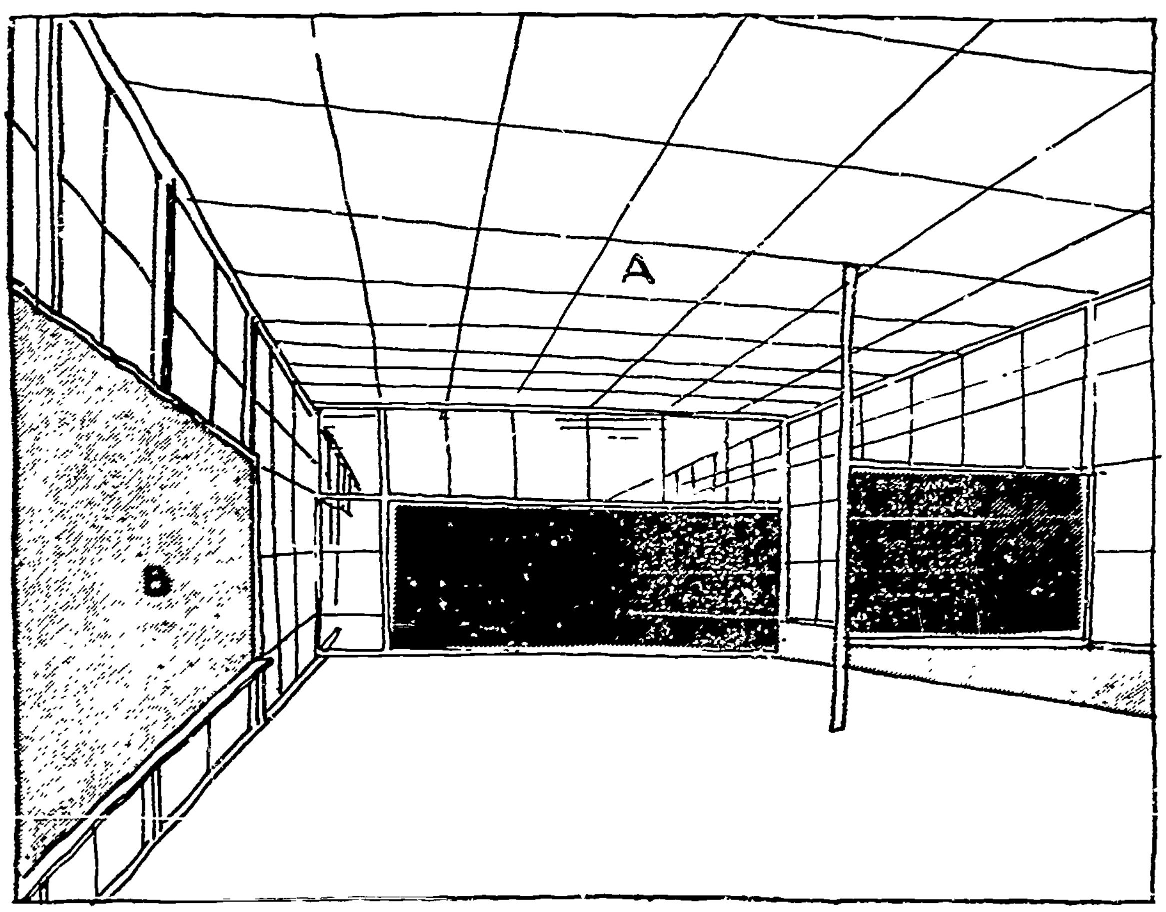
disorderly pattern of elements . . .



. . . may be improved by color



use advancing color of strong chroma to reduce apparent length of corridor



ceiling A should be highest reflectance

walls B in plane of windows should be high reflectance to reduce brightness contrast

walls C, in parallel planes, can be same color to intensify space relationships

equipment, other danger points such as sudden or unexpected changes in floor level, emergency shower heads for chemistry rooms, & other obstructions can be flagged by color.

to identify materials & objects:
Color can be used to assist very young children to identify such important things as doors to toilet rooms, cabinets & drawers for storage of different instructional materials, & block & clay bins. Rooms also may be given identification by different colors on doors or by floor patterns in corridor opposite room entrances. In primary schools, even entire buildings may be identified by color. These same principles may be applied with profit in rooms & equipment used by older children, who do not rely on colors for identification as much as younger ones, but who may experience both convenience & pleasure from such color uses.

to improve morale, well being & working efficiency:
We know that rooms with north exposure can often be more pleasant & warm when treated with warm colors, & that rooms receiving large amounts of sun for long periods are generally better treated in cool colors. Color literature cites case of female office-workers who were warm, comfortable & happy in a room with pale yellow walls who donned sweaters & complained about cold when rooms were painted in a cool blue scheme, although thermometer recorded same temperature regardless of paint. Workers grumbled about weight of black cases that were being handled & found same cases much lighter in weight when painted in yellow. Red is stimulating & even exciting when used carefully but may be irritating when it is not balanced with other colors. Blue may be soothing or depressing; green, refreshing & relaxing; yellow may be exhilirating. Young children are said to enjoy strong primary colors when judiciously used, but not

nearly as much as old architects who use these child-preferences as an excuse for their own enjoyment of primary colors. The very fact that color is used, & especially when used well, results in improved attitudes —in contrast, a glum schoolroom-brown environment can't make anyone happy. So far, these considerations are mechanical aspects of color which invite methodical approach.

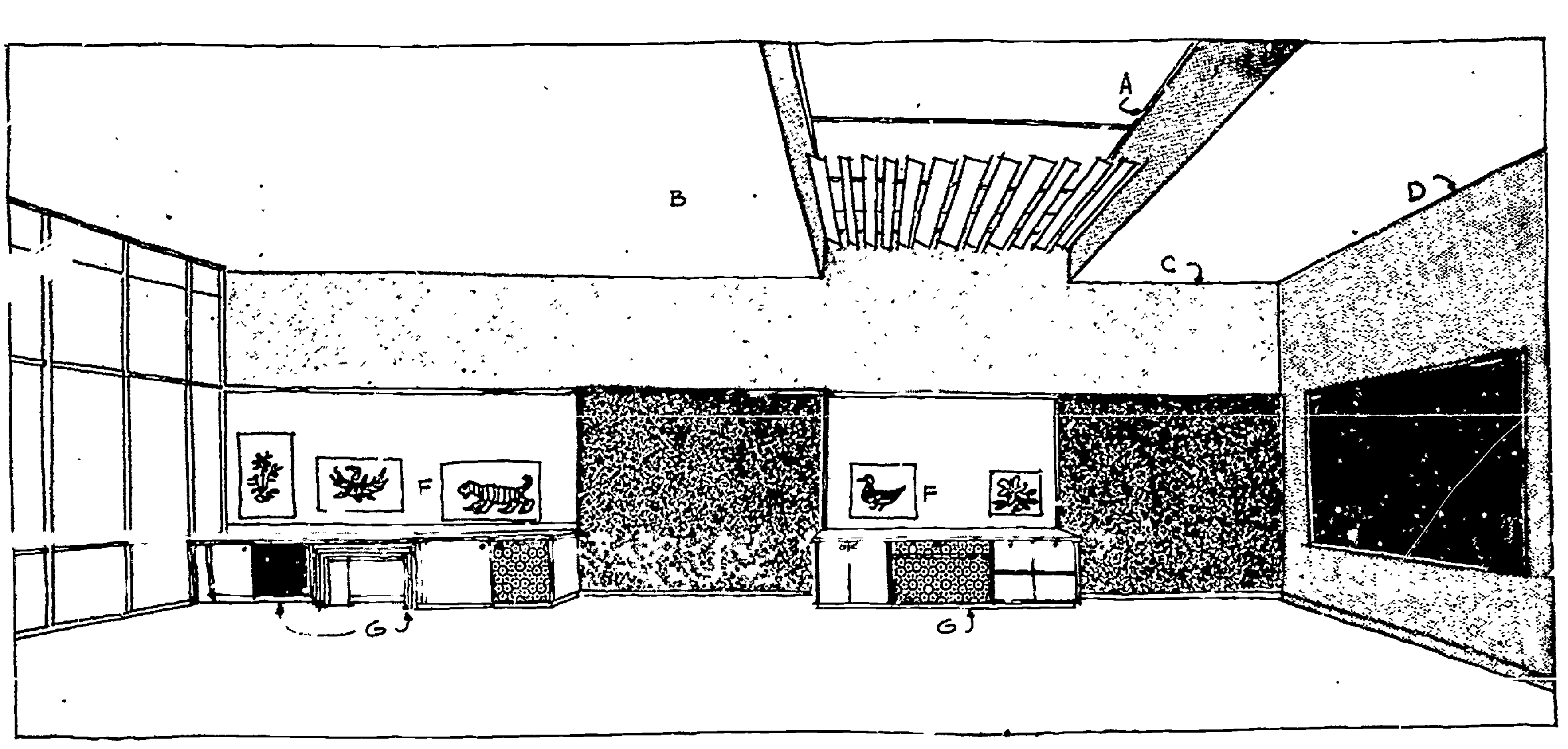
To continue this methodical approach even further, we now examine use of room & time & nature of occupancy. Color treatments will differ according to concentration, stimulation, gaiety or repose appropriate to different spaces.

classrooms:

By this classification I mean elementary school classrooms, "academic" (for want of better term) rooms of the secondary school, laboratories, libraries & all other instructional spaces of the school plant in which concentration & work are order of day & in which term of occupancy may be long, varying from 45 minutes to full school day. Students themselves & work they produce, strike dominant color notes. Obvious conclusion for a color scheme is to make it predominately neutral & quiet. Accents of high-chroma colors should be reserved for small areas & located so as not to conflict with exhibition areas for completed work projects — color of which is often an important feature. If these accent colors are applied to movable cabinets, or to sliding cabinet doors which are designed to be removed & relocated, then color design of room can be altered to a minor extent by students, who may change position of these color accents & their distribution in room.

Hues for these color accents should be few in any one room, generally one or two in number, & certainly not more than three. Large color areas of room should also make use of few hues, generally not more than one or two, of which one should predominate in area, & in any event should be low in chroma or neutral as recommended above. If there is a dominate hue to views outdoors from the interior, which does not change greatly with seasons, dominant hue for color scheme of room may be chosen as after-image of outside color, to afford visual relief.

Neutra, in his excellent book "Survival Through Design" Chapter 24, calls our attention to hopelessly static quality of painted interiors, especially strong color schemes. Such interiors are greatly different from constantly changing colors found in nature. He recommends our recognition of part that nature may be allowed to play in providing variation of interior colors, in changing light of morning & afternoon, cloudy & sunny days, & seasonal changes in coloration. These are subtle & cannot cope with a scheme of strong interior colors. When choosing a color scheme for a classroom, do not underestimate effect of color during long-term occupancy for hours, days, or months.



vertical walls A of overhead light-wells should be lower in value & reflectance than ceiling B to reduce contrasts — walls C should be lower in reflectance than ceiling B — wall D is lowered in value to form value transition for chalkboard E — pattern on wall F should be kept low at child scale — different hue at G to identify equipment

traffic areas:

These areas offer opportunity for strong, stimulating colors, high in chroma & with a wide range of values. Such a color scheme can provide a lift, sparkle & excitement for brief time students are in transit from one location to another, after a long period of concentration in a classroom. Long corridors can be shortened by a strong advancing hue at end of a corridor vista.

eating areas:

These should be cheerful & gay & colors should be chosen to make foods appetizing, & to create an atmosphere for pleasant dining & conversation. If dining area is used for other purposes, suitable color compromises are inevitably in order.

gymnasia:

Here there is need to see fast moving objects & same criteria for brightness contrasts & good vision that apply to classrooms, likewise apply here.

assembly rooms:

Since these areas are generally provided with a platform or stage & are designed to serve as a setting for speakers, a play with dramatic stage sets, or a concert, color scheme could well be spacious & dignified; it should not be so strong in color as to defeat the work of stage-set designer. These rooms are often seen under darkened conditions or under artifical light which should be recognized in designing color scheme.

color design as an art:

All the above, dealing with **known** facts of color leaves more unsaid than said. Talented & skillful designers may be able to deny many things that have been said & still come up with distinguished color. These rules & suggestions may help in avoidance of mistakes but good color design is infinitely more than avoiding mistakes — it is an art.

The architect, when designing a building, thinks of mass, space & volume as well as function, convenience & maintenance — color plays a part in his thinking in creation of building form. He can interpret & organize form, pattern & texture thru use of color. This requires mind & spirit of an artist — his skill & temperament are developed by training & experience.

Color cannot be separated from architecture. It is not presumed in this study to deal with any aspect of esthetics, except one — its importance. Good architecture, in the sense that it is a fine art, is vitally important to school buildings. As good architecture, school buildings add depth to growth & learning experience of children. Most unfortunately, precious little attention is paid in teaching programs to learning opportunities inherent in esthetic values of a building.

cooperative planning:

Principle of democratic planning procedures, where school staff & teacher planning committees participate in building planning with architect, is responsible for growing excellence of our schools. Why is it that cooperative planning techniques involving educator & architect can work so well in making school housing effective educationally, & yet these same techniques of cooperation usually fail to produce distinguished color? Basic reason is possibly this: in cooperative planning efforts educator uses his experience & skill in teaching to establish standards of function, & architect uses his experience & skill in planning & construction to meet these standards. This cooperative effort of complementary skills is fruitful.

When color committees of teachers are formed to select colors, as they often are, the teacher then aspires to do a job of design which requires experience & skill she does not have — she has stepped out of her job of educator. Color design requires skill & experience similar to that needed to design a structural steel frame & yet few teachers presume to undertake this job. Typical qualifications of color committees are an understandable eagerness to have a hand in construction of the building, & to be able to say "I chose that color — it is **my** contribution to this building"; plus liking for some colors & violent dislike of others, (color **does** have emotional overtones) & plus a summer credential in art.

We have been told by several experienced & sincere educators that teachers have a right to choose colors of buildings in which they will spend long hours, that they have their color preferences which they are entitled to enjoy, & that they even have a right to make their own mistakes. If mistakes are their own, they will not be likely to complain, we are told — but bad color is too high a price to pay for this future silence. What of the children? Any weaknesses of procedure or concept, in joint work of educator & architect, that may lead us to something less than the best, should not be accepted merely because it is a democratic planning procedure.

But what about these teachers & their interest in color & their liking for color? Is there a place for the color committee in planning procedure? Should architect ignore teacher in order to achieve a distinguished color design? Answer is obvious that there **is** a place for a color committee & that teacher preferences in color **should** be recognized.

suggestions:

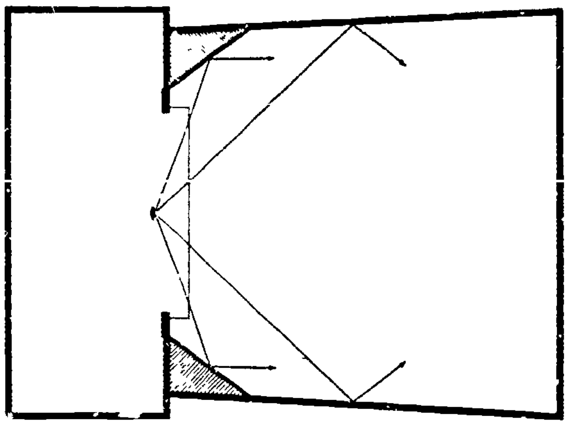
Here are a few suggestions for color committees.

- **tell your architect how you will use color in teaching — do you want cabinets & work counters color-coded to help children use them?**
- **what work will children do which involves color? how & where will it be displayed? what spirit do you want in the color around you? quiet & neutral? lively? cool? warm?**
- **if you desire, choose one or two major colors of the scheme & indicate these as preferences to your architect — please permit your architect, however, to choose other colors which will develop theme you have chosen. Good color is a relationship — final choice of hue, chroma, value, & reflectance should rest in one skilled hand —that of architect**

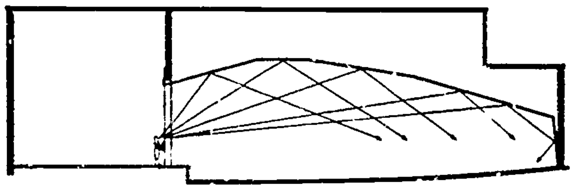
Good architecture has a deep significance as a mark of our culture. Good architecture in schools is an indispensable necessity because of learning & development opportunities it provides for children. Recognition of these values of good architecture is growing, though slowly. Good architecture & good color are inseparable.

ACOUSTICS OF SCHOOL BUILDINGS

by BENJAMIN OLNEY*



- splayed sidewalls reflect sound into side seats
- non-parallel walls prevent "flutter" echoes
- plane, rather than curved, rear wall prevents undesirable sound concentrations & echoes



- splayed ceiling reflects sound to rear where most needed
- low ceiling height conserves sound & acoustical material
- tilted rear wall reflects sound usefully to rear seats rather than to stage or front seats as an echo

plan & longitudinal section of auditorium illustrating acoustically functional design

SITE & LAYOUT

Site should preferably be in a quiet residential neighborhood. Rooms in which quiet is important should be kept at least 300 feet from busy highways or railroads. Strategically located earth embankments & dense trees or shrubbery planting are helpful as screens against traffic noise. In designing a school building, keep essentially noisy rooms well separated from those requiring quiet. Auditorium should either be located in separate wing or separated from classroom areas by corridors, storerooms or similar spaces. If band rehearsal room must be located adjacent to auditorium & simultaneous use is intended, partitions should provide superior insulation (50 decibels or more—see below) & special sound-retarding doors should be used. Cafeteria & kitchen should be in a separate wing & their open windows should not face those of quiet rooms across a court. In multistory buildings, isolated construction such as floors "floated" on soft material & ceilings suspended on insulated hangers is usually required to give satisfactory insulation against impact sounds such as footfalls, hammering & certain machinery noises.

THE ACOUSTICALLY COMFORTABLE ROOM

Acoustics of a room should be comfortable. One should be able to understand speech without effort. Well-performed music should sound natural & pleasing if individual taste is satisfied. To achieve this comfortable environment, sounds reaching a listener must be sufficiently loud to be heard without effort. They must not be unduly prolonged by echoes & by reverberation. The latter phenomena cause confusion of speech by exposing listeners simultaneously to syllables being uttered at the instant & a composite of others uttered at instants just past. Neither should successive notes of music appear to overlap objectionably. Last, but equally important, noise must not be present in a disturbing amount.

CONSERVING SOUND

Adequate loudness is achieved by consideration of the following, applying particularly to auditoriums but generally to any type of audience room:

- design seating space to keep average distance from performer to auditor short as possible
- keep ceiling height low as possible & shape walls & ceiling so that sounds are reinforced by reflection from these surfaces with little loss & inappreciable delay
- slope floor sufficiently to insure sound reaching any auditor without passing closely over intervening—& highly sound-absorptive—audience
- use min amount of added sound-absorptive material necessary to control reverberation
- use public address system if required by size of room

CONTROL OF REVERBERATION

Excessive reverberation is caused by too slow dying away of sound energy. It can be controlled by application of sound-absorptive material to room surfaces, but always at expense of loudness. "Optimum reverberation time" strikes a balance between these conflicting factors & permits best results to be obtained with min acoustic treatment for rooms of any size used for **speech, music,** or **reproduced sound.** Optimum is somewhat different for each of these uses. Such acoustic treatment also reduces noise level.

Listeners describe rooms having excessively long reverberation times by such terms as "echoey," "boomy," "noisy," "everything sounds mixed up"; & rooms with too short reverberation times as "dead," "depressing," "sound seems swallowed up."

auditorium:

A school auditorium must accommodate a large variety of acoustic activities ranging from recitation by small children to band or orchestra concerts. This necessitates a compromise value of reverberation time & demands careful attention to room shape & other acoustic factors. Drawings on page 18 show an auditorium shaped for good acoustics.

Amount of sound absorption necessary to achieve given reverberation time is directly proportional to volume of room. An audience provides "free" absorption with one high school pupil being equivalent to about 4 square feet of typical acoustic tile. It is economical, therefore, to adjust volume where feasible so that an audience of typical size provides practically all absorption required. It is customary to design auditoriums so that optimum reverberation time occurs with 2/3 full audience. With use of fully or partially upholstered chairs, it is possible to achieve optimum reverberation time in properly shaped auditoriums finished with conventional materials such as wood, hard plaster or cement block without use of added sound-absorptive material. Upholstered chairs are valuable in preventing acoustics from varying widely with size of audience, as a seated person effectively substitutes his own absorption for that of his chair. By keeping volume, & consequently absorption, to min & making effective use of walls & ceiling as reflectors, max conservation of sound is accomplished.

An auditorium shaped for optimum acoustics will be attractive in appearance as well as acoustically comfortable. (see photograph of Joseph Sears school auditorium)

classrooms:

Classrooms should be designed to provide optimum hearing of **speech.** Because of comparatively large volume/occupant, some added absorption is usually necessary. Common practice of applying acoustic material to the ceiling only does not provide optimum hearing conditions. With this treatment reflections between opposite walls are not subdued & harsh, rattling effects are produced. It is good practice to treat all space above chalkboards on at least two adjacent walls & place remaining required absorptive material around edges of ceiling. Lower classroom ceilings reduce absorptive area required.

Kindergartens require comparatively heavy treatment because of large volume/pupil together with lower absorption & higher noise output of small children.

Music rehearsal rooms:

Acoustics of band & orchestra rooms should duplicate insofar as possible acoustics of auditorium & other large rooms where public performances occur to avoid disconcerting change in acoustic environment. This requires not only a suitable reverberation time but also greater diffuseness than afforded by usual rectangular rooms & conventional treatment. Diffuseness is promoted by non-parallel walls, large convex or triangular wall corrugations & arrangement of acoustic material in strips & patches. Latter can be neatly accomplished by completely covering field of treatment with perforated facing & installing acoustic material behind only where needed. (see drawing)

audio-visual rooms:

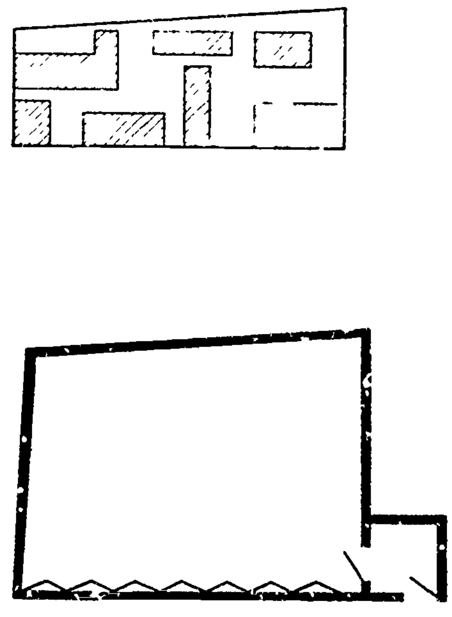
Reverberation time should follow motion-picture theatre practice with special attention given to shape & treatment of wall facing loudspeakers.

gymnasium:

Unless intended to be used frequently for speech & music programs, acoustic treatment is not critical & is aimed chiefly at noise reduction. It is economical here to take advantage of acoustic properties of certain building materials. Concrete blocks made with cinder & other light-weight aggregates have considerable but uncontrolled absorption. Advantage may also be taken of high absorption afforded by certain types of mineral fiber roof insulation by arrangements that provide effective acoustic exposure of under surface to interior of room.

Perkins & Will, AIA — *Krantzen Studio*

school auditorium—Kenilworth, Ill.



elevation & plan

- sloping ceiling
- entire wall covered with perforated facing
- sound-absorptive blanket installed in shaded areas only
- non-parallel walls
- heavily treated vestibule acting as "sound lock"
- plywood splays on one wall

band rehearsal room

miscellaneous rooms:

Corridors should be heavily treated with absorptive material of high efficiency. Otherwise corridors act as effective noise conduits. Treated corridors contribute very substantially to general quiet.

Cafeteria, kitchen, offices, library, etc, usually receive conventional noise reduction treatment. Character & type of absorptive treatment varies with use of each space.

SOUND INSULATION & CONTROL OF NOISE

walls & partitions:

Unit used in rating sound transmission is the decibel (db). A partition affording insulation of 30db permits only 1/1000 of sound energy striking it to pass thru, yet moderately loud speech can be distinctly understood thru the partition. A 40 db partition passes only 1/10,000 of incident energy permitting loud speech to be barely understood but reducing normal speech to an unintelligible murmur. Contrary to popular belief, application of sound-absorptive material to a wall surface has little effect on transmission **thru** wall.

Transmission thru airtight walls & floors occurs entirely via mechanical vibration & diaphragmatic action. Therefore, transmission is dependent only upon **structural characteristics** of building. Massive, stiff structures are essentially sound-retardant while light, flimsy, vibratile structures readily transmit sound. Homogeneous walls are usually poorer insulators than composite walls of equal mass having soft or springy materials, or dead air spaces interposed between dense, massive members.

Comparative data on some typical partitions are shown in the drawings. It should be understood that there are many other types of masonry & frame partitions that afford equivalent insulation.

Plastering one or both sides of lightweight, porous concrete blocks is essential. If plastering is omitted on partition shown at bottom of drawing insulation will drop to about 11db. This is inadequate for any situation in a school building.

doors & windows:

These are weak spots in sound insulation. They must be essentially air tight to be fully effective. Possible insulation afforded by a heavy door can be reduced by cracks around edges to the insulation afforded by a much lighter but well-sealed door. Special heavy doors with gasketed stops & automatic threshold closers are justified for use in music practice rooms having highly insulative, dividing & enclosing partitions.

Heavily treated vestibules can be made to serve as "sound locks" & effectively double insulation provided by a single door. (see drawing of rehearsal room)

ventilating system:

Motors & fans should be mounted on correctly designed vibration isolating supports & should be chosen for low noise. **Loose** fabric or rubber sleeves should be used to isolate fans from ductwork. Airflow noise at grilles is usually negligible for air velocities below 1000 feet/minute. Lining ducts with sound-absorptive material reduces transmitted noise & crosstalk between rooms.

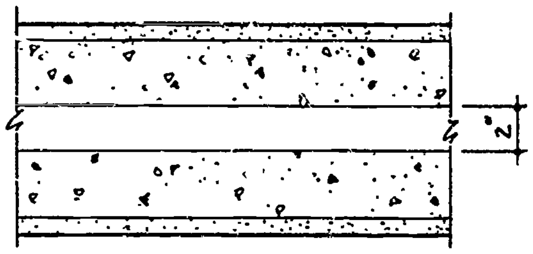
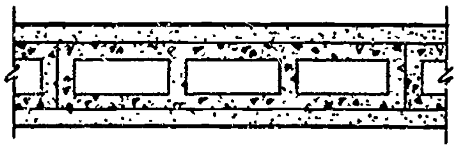
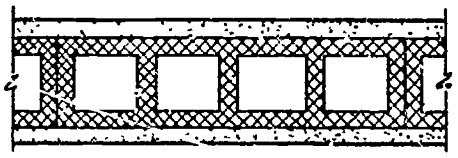
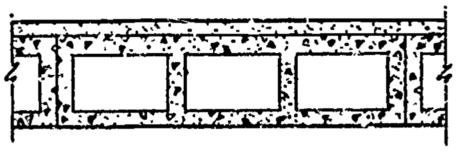
heating plant:

Certain types of oil burners produce high noise levels. This should be considered in locating boiler room & designing its walls.

public address systems:

Many school auditoriums are so large that, in spite of most advanced acoustic design, unaided juvenile speaking voices cannot be satisfactorily heard in all seats. Some authorities recommend a public address system in any school auditorium exceeding 50,000 cubic feet in volume.

It is best to use only a single group of loudspeakers located over center of proscenium opening with individual loudspeakers sufficient in number & so aimed to cover audience area adequately. Suitable accessible space for loudspeakers should be provided in original building plans. In auditoriums like those illustrated loudspeakers may often be concealed in a cove located behind center of front ceiling splay, with opening in splay covered with acoustically transparent fabric.

typical use & description	partition section	sound transmission loss
band rehearsal rooms 3" cinder concrete slabs plastered outer faces no ties		**51 db**
individual music practice rooms 3" cinder block plastered both sides		**45 db**
classrooms—forced ventilation, closed windows 4" hollow clay tile plastered both sides		**40 db**
classrooms—ventilated thru open windows 4" pumice cement block plastered one side		**35 db**

some partition details—other constructions in masonry or frame may give equivalent insulation values

* Mr. Olney is senior partner in the firm of Olney & Anderson, consultants in acoustics

THE CASE FOR CASEWORK

a well-designed school provides for storage of materials for doing & the work of the doers—but it should never be a storage place for doers

by LAWRENCE B. PERKINS, FAIA*

"Mr. Architect, please give us plenty of storage space!"

From every homemaker, from every nurse, from every secretary, from every teacher in the land this battle cry rises. As teachers & architects work together in pre-design conferences, one sets forth precise solutions. But comes "we want storage," & precision ends.

Mere quantity is no solution. Proper storage is as important an element in school design as proper light, proper ventilation & proper teaching. There is no one right answer to storage problems. It varies with educational methods used, with school program & with age group using it. This is main reason we have found it less difficult to design storage units than to buy them. While it is dangerous to oversimplify, let's break requirements into what has to be stored:

- **clothing:** coats, gym shoes, hats, roller skates, mittens, rugs, galoshes, blankets, painting smocks
- **books:** textbooks, storybooks, reference books, magazines, sheet music
- **paper:** big sheets—little sheets, colored paper for cutting, plain soft paper for painting, plain hard paper for drawing, lined paper for writing, test paper
- **other supplies:** scissors, paste, pencils, paints, crayons, brushes, clay, water jars, blocks, cardboard, toys
- **accomplishments:** finished painting, drawings, modelling work
- **special items:** wood- & metal-working tools, lumber, looms, nails, scenery, screws, folding chairs

CLOTHING

A wet snowsuit *smells.* It drips. It dampens dry things. It is bulky & won't conform to hooks or ordinary coat hangers.

For these reasons a locker is far less good as a solution to storing clothing than some open arrangement in a corridor. We have tried many variations of open closets for clothes & like the setup in Westwood School, Woodstock, Illinois, as well as any. Its good points are a knee-high shelf where children can sit to put on or take off overshoes & can set things down. Rubbers & boots are tucked away just below the bench, on a grillwork shelf that lets air circulate for quicker drying. Coats & hats hang on wood pegs deep enough to hold them firmly. Bad points of these open lockers include not enough pegs for separate hanging of extra clothing in extreme weather & use of each locker by more than one child. A compartment shared by two is responsibility of neither & is always in disorder—fault of the one not present. At Blythe Park School, gym shoes are stored below hinged seats of benches lining opposite walls. More often, though, gym shoes are kept with painting smocks & nap rugs in classrooms, where they are ready for immediate use. Here again ventilation is important & a series of square bins works well.

BOOKS

Books still belong on shelves. As long as those shelves are not so deep that books retreat out of children's reach they will suffice. We believe, however, that only texts, where any copy is like any other copy, should be subject to regimentation & barracking of shelves. Picture books, books for thumbing & browsing through, should be on counters or ledges where they can be plainly seen & easily reached, looked at & put back.

PAPER

Because of its properties, paper is most unwieldy item school architects have to contend with. There are small sheets & large sheets & shapeless scraps. Any one kind of paper may serve half a dozen different purposes. Because paper has no rigidity it must be stored flat. Because it is heavy (in quantity) it can't be piled to any depth. Because individual sheets are light it should be stored in something with sides so it won't slide easily from grasp of new fingers & spill.

This would indicate that a series of shallow drawers, each holding a different kind of paper, is best answer. Possibly most practical solution is a tier of trays about 1" deep with only a slight lip on front. Then children can see into trays without opening them to make sure they are getting the right paper. They can open tray by gripping leading edge, thus avoiding protruding handles that could cause injury. Each tray should be large enough to hold max sized paper used. (We make ours for 24 x 36 paper, an allowance not provided for in manufactured units.) Then it will file small pieces of paper equally well as large ones.

OTHER SUPPLIES

Storing materials for creation is more important that storing what has been created. Pencils, erasers & art supplies in general should be studied for quantitative needs & provided for near where they will be used.

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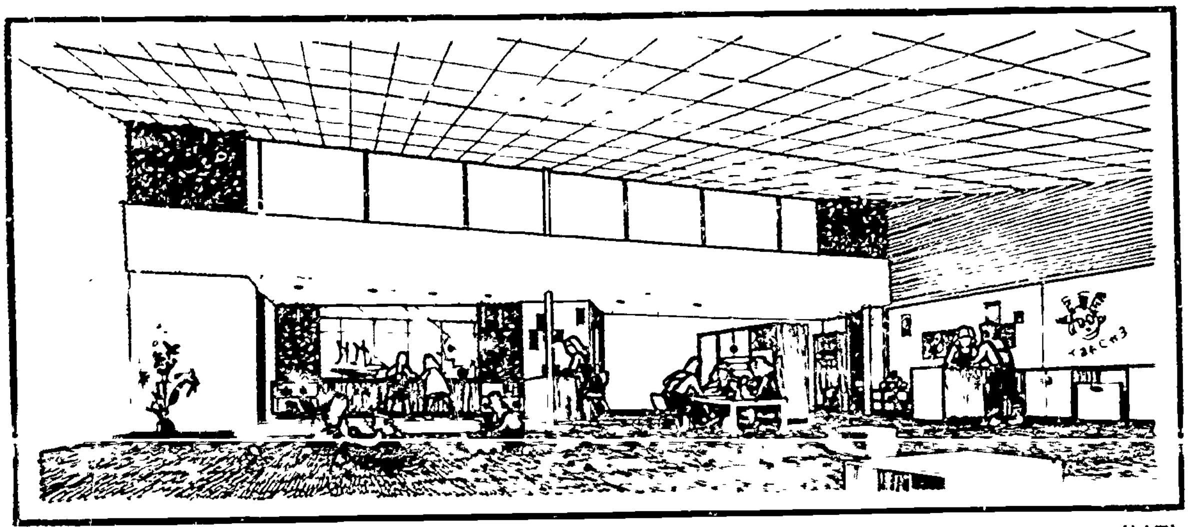
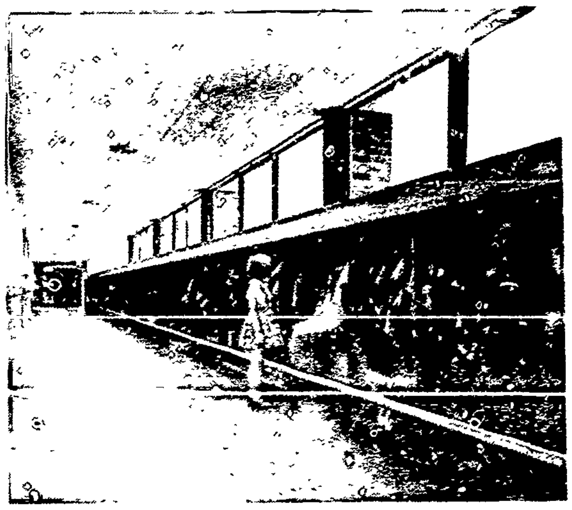
*Senior partner Perkins & Will, architects-engineers

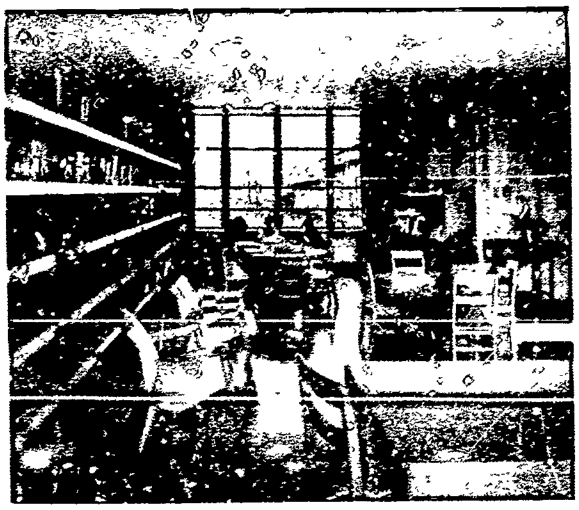


elementary classroom Hagerstown, Md—note teacher's desk (MF)

same from corridor offset (MF-M)
note paper drawers & corridor glazing

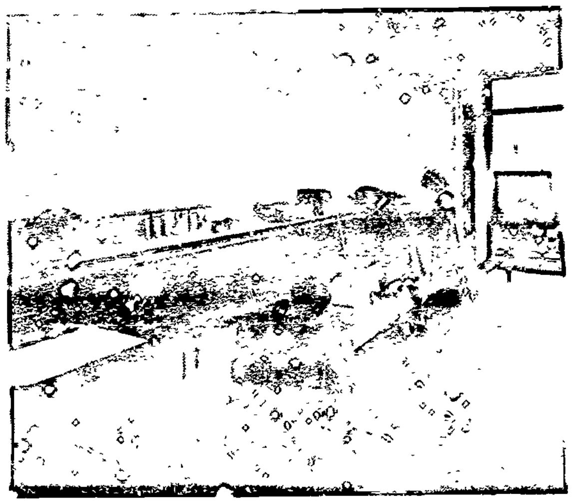


open lockers Westwood School, Woodstock, Ill. angled wood pegs (PW-HB)



library Westwood School
wood shelves brick wall (PW-HB)

Clyde School, Glenview, Ill.
paper drawers—open smock bins (PW-HB)



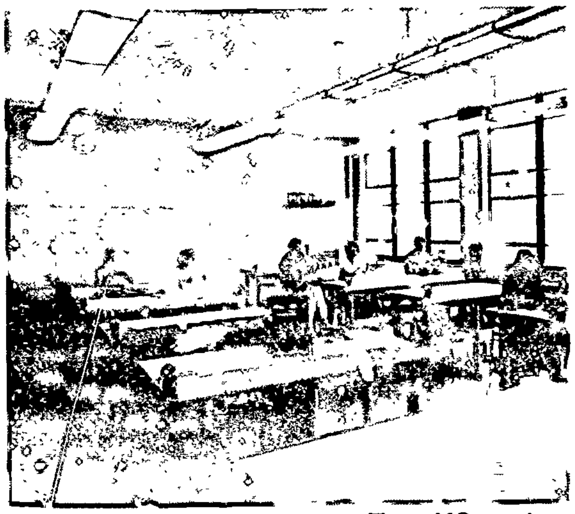
Deerfield, Ill. p. ary school—sink & cabinet storage, shelv (PW-HB)

art room Willard School, River Forest, Ill.
cabinets, storage & display shelving (PW-K)

corridor displays Westbrook school—note rail at bottom of locker (PW-K)

kindergarten art area Blythe Park School, Riverside, Ill—shelves for blocks (PW-HB)

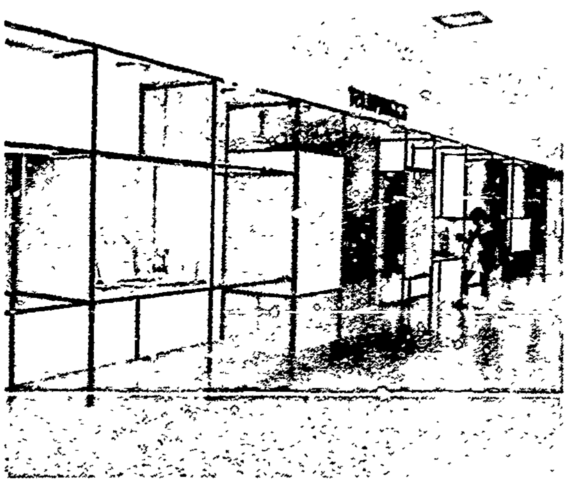
shop Roosevelt JHS, River Forest, Ill. storage below benches, tools roll (PW-K)



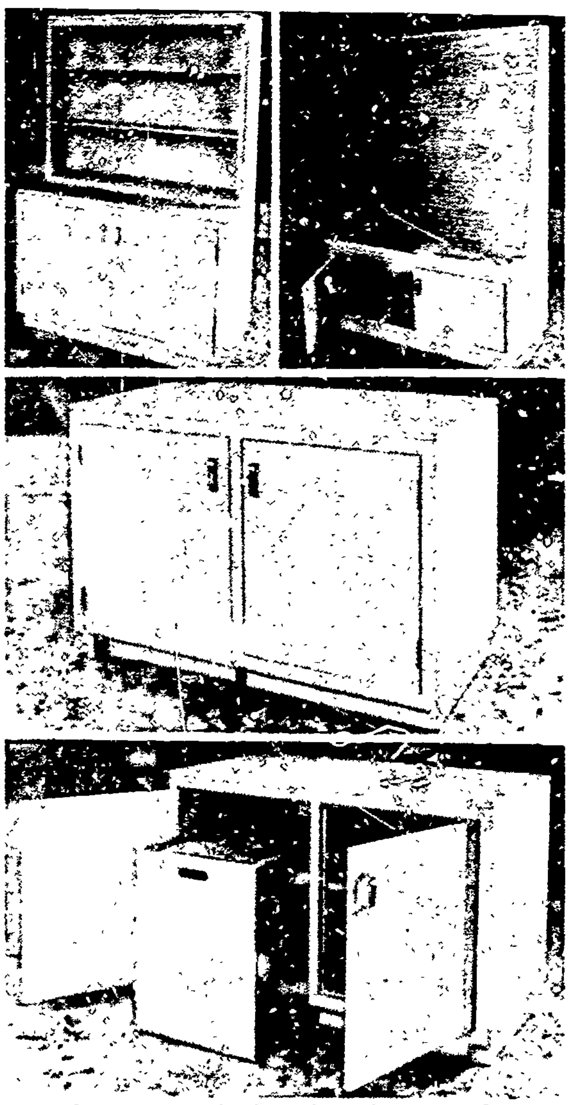
arts & crafts lab, Evanston Twp HS project cupboards in rear (PW-HB)

Key: (MF-M) McLeod & Ferrara, AIA— *photo: Maroon* (PW-HB) Perkins & Will, AIA— *photo: Hedrich-Blessing* (PW-K) Perkins & Will, AIA— *photo: Kranzien*

storagewall Hillendale, Md, interlocks with next room (MF-L)



flexible corridor display units (MF-M)



movable casework, Los Angeles area Schools —Kistner, Wright & Wright, AIA

Key: (MF-L) McLeod & Ferrara—
photo: Robert C. Laytman

A strong case can be made for moving storage cabinets within classrooms. Besides serving function of concealing contents, these cabinets cut down clutter & confusion by simplifying distribution & collection of supplies. Even more important, they can be used to subdivide an otherwise monotonous room in relationship to program teacher wants to put on. This is especially important when project is watercoloring. Mobile cabinets can be fitted with racks that hold water jars tight against spillage & hold brushes firmly to prevent damage & accelerate drying. Our standard classroom assembly frequently includes a little handtruck with a clay jar in it. These trucks serve as additional display space & fit under counters when not in use.

ACCOMPLISHMENTS

Completed work must be both stored & displayed—display being merely a psychologically pleasant means of storing. Display should be of short duration, since fresh experience contributes more to education than raking over embers of past achievements.

Tacking strips in profusion competently handle display of 2-dimensional work in classrooms. A shallow shelf above work counters puts 3-dimensional paper & clay figures at child's eye level. For more public display we like pine panels in corridors & lobbies, or glass display cases beside door to each classroom. Between display at school & display at home, we prefer achievement files consisting of big, flat pieces of plywood on which several watercolors can be laid on top of each other. These & other storage shelves fit under counters on which work is done.

SPECIAL ITEMS

Individual treatment. Metal-& wood-working tools used in junior & senior high schools, for example, we put in vertical tool boxes on casters which can be moved to point of need. In schools which have a combination auditorium-playroom we use dollies that fit under stage for storing & moving folding chairs.

As a general rule we plan one sink cabinet, one work bench, one paper storage unit & one book cabinet per classroom. All other cabinets are fitted with adjustable shelves for general storage. Shelves serve better than drawers which not only limit size & shape of items to be stored, but can pinch fingers. Storage should have a definite though general purpose. It should never be used merely to defer a decision.

A friend of ours—a teacher—told us an interesting story not long ago. She had taught for 10 years & had organized files of excellent material. It was valuable. It was available. But that summer the school house burned & all her stored resource material went with it.

"My next year of teaching was much the best," she related. "I knew well enough what I wanted. Each project for the children had to be organized afresh, started over with a sort of make-do technique. What had been routine became a new & vigorous experience all over again for me."

* * *

In spite of this experience periodic fires should not be counted on—which suggests that opening line of this article should be modified to insure against old-fashioned attic type of storage in modern dress.

SCHOOL SAFETY

by D. Kenneth Sargent, AIA

SAFETY IN SCHOOL buildings is everyone's business! Building codes can require it, architects can plan for it, builders can observe it during construction & in workmanship, school administrators can maintain it by policy, observation & timely action, teachers & parents can encourage it, children can be taught it.

Every hazardous condition arises because someone didn't think a problem thru. Safety engineers are the only pessimistic prophets that we cannot afford to discount. While building codes have helped to reduce accidents in buildings they cannot control all areas of planning & prevent all accidents.

School authorities & architects must provide safe structures & facilities for our youth. Acknowledging such responsibility, it is difficult to understand hazards which persist in plans for these structures & for their site development.

incidence, frequency & locations of accidents:

General tendencies indicated by statistical reports such as those of the National Safety Council, demonstrate that designers must consider more than code requirements. Typical statistics indicate that more accidents occur to senior & junior HS students than to those in elementary schools—almost 9/100,000 student-days occurring to senior HS students alone. Surprisingly, lowest rate is shown for children in kindergarten-to-3rd-grade group.

Approximately 3x more accidents occurred to senior & junior HS students within buildings than occurred upon the grounds. Accidents happening on school grounds were far more numerous during months of September & October than other periods of academic year.
For elementary children, yearly average is about 1½x more accidents occurring on grounds than within buildings. As reported monthly, accident rate on grounds exceeds building rate for each month reported.

From such averages, it would appear that more care should be exercised in site planning, especially for elementary schools.

sites & play areas:

Relationship between a school building & its site development is inseparable & it is most desirable that architects control it & thus correlate planning of site to building layout. Careful planning & design of sites to avoid hazards will remove many conditions contributory to accidents.

Obvious hazards due to bad site utilization continue to appear in site plans. Service & other drives all too frequently bisect school property, separating school building from playfield. Schools served by bus transportation frequently are designed without off-street unloading platforms. Occasionally such loading platforms are so located as to require pupil to cross bus driveway. Designs for bus unloading areas too often disregard necessity of segregation of age groups immediately upon discharge from vehicle.

Play areas should also be so planned as to separate age groups into preferably four units, namely: kindergarten & primary, 4th-6th grades, junior HS & senior HS. In larger schools, where separate instructors are provided for each sex, some of these areas should be further divided. Screening, such as natural barriers or planting, is desirable to separate them. Divisional screening is especially necessary where hazard areas such as outfields of ball diamonds are adjacent to other playfields. Where playgrounds border streets provide adequate protection by fences, planting or both.

Isolation of different age groups, necessary because of varying play habits & preferences, can be voluntarily affected by proper distribution of play equipment. Swings, chutes & such play equipment should be placed at some distance from hazards resulting from normal games of other age groups. Since young elementary school students are attracted by such equipment, the group will normally occupy only that general area. Isolated play areas, in other words, must provide facilities to cater to normal preferences of specific age groups.

Sites of adequate area will always prove safer than an overcrowded location upon which, because of traffic, it is impossible to maintain suitable turf.

SITE STANDARDS (NY State Education Dept)

elementary:	5 acres minimum for 200 pupils.
	1 acre additional for each 100 additional pupils
secondary:	10 acres minimum for 250 pupils
	2 acres additional for each 100 additional pupils

That these figures are minimum, is demonstrated by size of sites purchased in central NY. Elementary schools, enrollment of which approximates 500 children, usually take 12-15 acres. For secondary schools, average site area is from 30-50 acres.

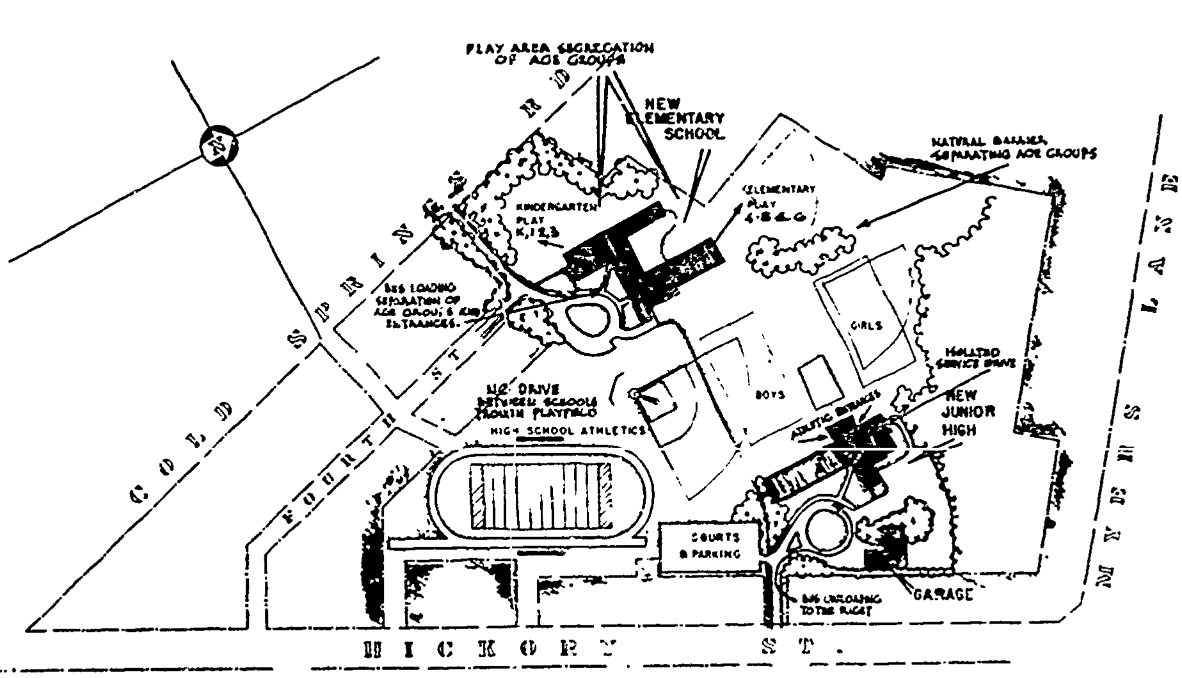
There is no substitute for turf as a safe ground cover, except for parking & organized game areas, such as courts. Too often districts, faced with continued maintenance cost of grass, have turned to paving or gravel or bare ground which are worse. We who design should impress upon building owners long term advantage of maintaining grass on play areas

Many casualties might be avoided if proper setting of play equipment is required. It seems unnecessary to observe that concrete paving is improper for such equipment as merry-go-rounds, yet such fundamentals are all too frequently overlooked.

Tanbark or rubber-based resilient paving are ideally suited to play surfaces subject to concentrated & continuous wear. Turf is best suited for all-round ground cover for most play fields.

Plan of sites & building should be such as to make easy supervision of play areas [illegible] should provide easy access f[illegible]e in charge of each subdivisi[illegible]r site. Note that office windows of principal, physical education instructor or teachers facing playgrounds will not result in proper field supervision. Easy access to play fields will insure presence of supervisors to a greater degree than will windows.

Where sites are hilly & uneven too many designers resort to high retaining walls. Use of walls for change of grades should be discouraged. Such steep slopes may be held against erosion by ground cover & planting. Cost of maintenance of such areas is far less than cost of accidental falls. Rails & parapets for such walls or areas fail to provide safety but rather are an invitation to climb. For the older groups, most accidents occur inside buildings. Building interiors should receive careful consideration to insure planning for safety.

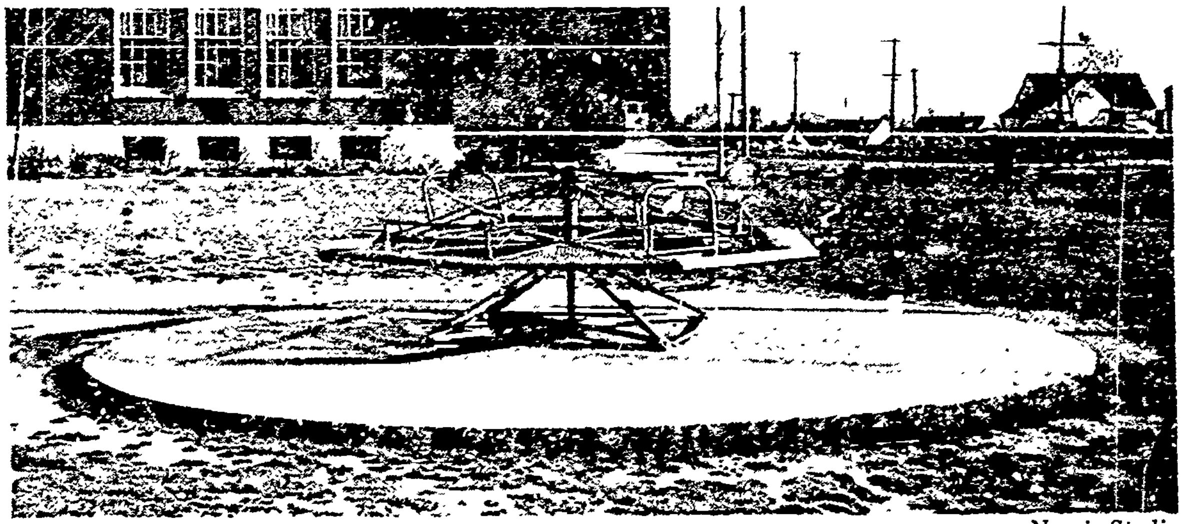


Sargent, Webster, Crenshaw & Folley, AIA architects

siteplan—Liverpool central school—functional areas

stairs:

Regardless of code requirements, many serious accidents occur on stairs. Direct cause in many cases is student carelessness or roughness. Nevertheless we should attempt design which will prevent secondary causes of these accidents such as omission of rails, too long runs & other defects. Ramps are no safer than stairs. Elimination of stairs by construction of one-story structures is to be desired & certainly a must for elementary schools.

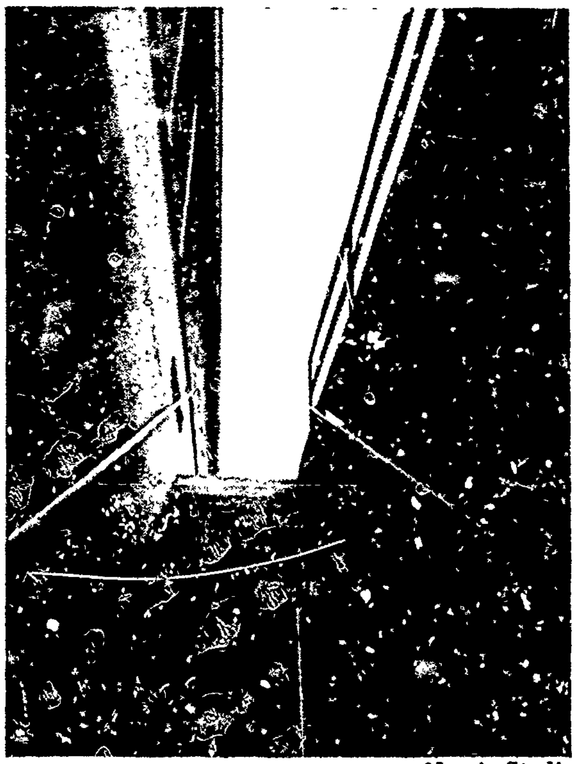


Norris Studio

improper & hazardous concrete paving for play equipment

Difficulties of one-story construction in large secondary schools, due to uneven or small sites, may dictate multistory structures. Complete elimination of stairs from such school buildings is practically impossible but great care should be exercised in design. No stair should be designed with risers in excess of 6½" for secondary pupils or 6" for elementary children. No straight runs should be allowed. Intermediate landings should provide change in direction. Provide handrails easy to grasp, on each side of the stair at 30" above nosing. For open stairs use a guard rail 45" high. Construction of a wire barrier or stockade over this height does not appear to be justified.

In general, stairs should be designed for double files of students. To increase width of stairs for triple lines of students is not as desirable as more stairs—not to mention safety resulting from less congested corridor intersections. Although such design is more expensive, its merits justify cost.



Norris Studio

invitation to climb

Norris Studio

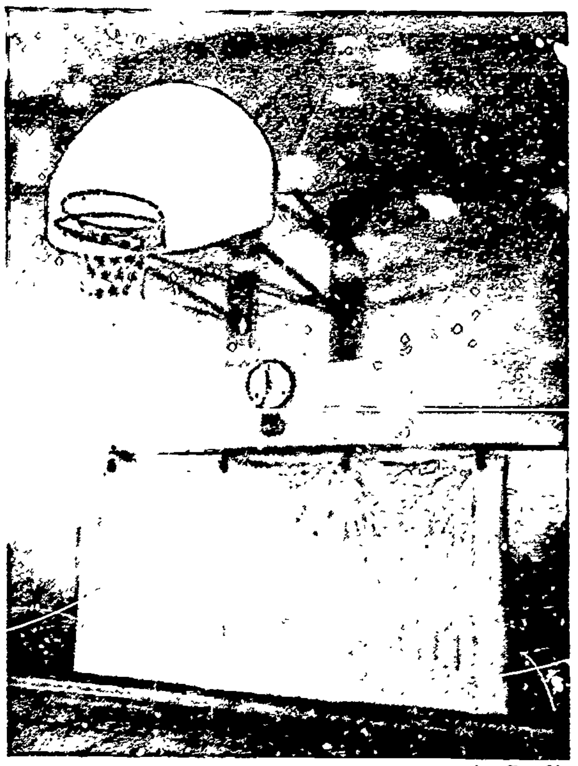
short stair runs, rails both sides

be so distributed as to place uniform use on all stairways without undue congestion of any one stair. Consideration should be given to total peak-use at end of each class period. A detailed study of stair capacity in which administrator assigns rooms & studies travel distance & frequency of student use of each element will result in better & safer planning of these circulation elements & exits

Well-located stairs will also result in adequate exits. All such exit stairs should land directly at ground level with exterior doors immediately accessible. Avoid too distant or circuitous travel from stair to exits. Dead-end corridors projecting beyond exits are not desirable & are prohibited by most codes.

Ralph Trumbull

cork wainscot in contact areas



Norris Studio

smooth wood wainscot on strong blocking for equipment attachment

fire-safety:

Protection from fire is a big subject & within scope of this paper only salient observations can be made. Most victims of fire lose their lives as a result of carbon monoxide rather than actual burns. Thus, stair locations should prevent any direct physical connection with basement, heating plants, storage areas, or other hazardous locations. When doors from such danger zones open into stair halls, such doors should open against traffic & should be equipped with automatic closing devices. Doors between such areas & stair halls should, of course, be elsewhere located where possible. It is assumed that all stair halls are constructed of non-combustible materials.

One most logical fire prevention method is construction of fire-resistant buildings designed to encourage "good housekeeping" in hazard areas. In non-fire-resistive buildings such rooms as boiler, electric distribution, storage & fan rooms should be of fire-retarding construction with insulating light-weight plaster ceilings & walls & openings provided with fire doors.

If such adequate storage rooms are provided, there will be less tendency to misuse plenum chambers & fan rooms for dead storage, a very bad condition too frequently found in school buildings.

Because of great fire hazard of basement areas, such space should be separated from occupied portions of building by fire partitions & doors.

gymnasiums:

The gymnasium is also an area of high accident frequency. As in most other accidents, nature of activities in the gym has much to do with the accident rate. Such reasoning should not be an excuse, however, for construction & detail detrimental to safety of occupants.

Too many gymnasiums are wainscotted with brick or other masonry. Such material has a very hard surface & sharp edges at joints are likely to cause skin burns & lacerations. Flush surfaces, such as wood panels when smooth-finished & waxed, have proved much more satisfactory. When properly backed with solid wood furring an adequate anchorage for equipment also results. Inadequate or improper anchorage of gymnasium equipment to masonry walls has been a common cause of serious mishaps.

Slippery floors, especially gymnasium floors, may be avoided. Although no specific recommendation can be made, the surface of any floor material can become most dangerous when maintained with wax— as is almost universal procedure in school buildings. Samples of several waxes should be tried from time to time & tested for slipperiness as well as wear & cleanliness. Surfaces resulting from different waxes vary so much as to change considerably the degree of hazard within an area.

shops:

As indicated by statistics, a great many school accidents originate in shops. Most accidents that occur in these spaces are due to improper guarding of machinery or use of power tools. The architect can control safety of such areas to some degree by observing fundamental safety principles.

- **by allocating adequate space for each machine to be installed, with sufficient work area around equipment to allow proper use of tool** (US Office of Education hopes to supplement its study of body dimensions with shop clearances, etc.)
- **by adequately lighting machine & bench areas to illumination levels suggested for operations involved**
- **by selecting non-slip type floor for all machine & bench areas**

Ample, well-lighted storage areas will avoid danger of improperly stored material & equipment. School shop design & plans can copy details of industrial construction which have increased safety of worker to a point where he is safer at work than at home.

color:

Current industrial practice includes careful safety planning of colors of backgrounds, equipment, moving parts & controls. Several paint manufacturers have published recommendations for such color aids to safety.

SCHOOL PLANTS IN EMERGENCY AND DISASTER

by Walter Rein AIA

EVEN SUPERFICIAL INVESTIGATION of a modern school plant indicates easy conversion into an efficient disaster emergency reception center or hospital. Those features which are not identical or similar, or which a hospital would require but not a school, are readily adaptable from facilities usually available in school plants. This approximation could be made even closer *if we would but plan new schools for emergency service from the start.*

As a rule, a school plant consists of groups of buildings arranged according to use—central, peripheral, or in a finger plan. At least classrooms proper are connected with one another, as the local climate requires, by covered or enclosed walls or corridors, usually between 6′—10′ wide.

The different facilities could be transformed easily to serve emergency needs if a few specific requirements were incorporated in school plans.

WHY SHOULD ARCHITECTS LOOK INTO THIS PROBLEM?

Architects have a contribution to make to civil defense and effective preparedness for emergencies of all sorts. Civil defense information sheets issued by FCDA and the US Office of Education recommend consultation with school engineers (who service heating plants) and with school nurses on planning of school shelters and emergency hospital facilities. Architects would be equally well, if not better qualified to help. The AIA Hurricane Committee is already working on programs of operation for disaster relief rendered by our schools whenever disaster strikes, in flood, earthquake, tornado, hurricane, explosion, or fire. It seems obvious that scope of this committee should be extended to include civil defense.

THE DANGER

In 1955, when bombs were far less destructive than those of today, when neither sputniks nor ICBMs were a reality yet, a number of official information sheets were issued emphasizing necessity of preparing for mass exodus of urban populations in case of an attack warning. At that time it was reported that a test bomb explosion had made a crater 175′ deep and that at a distance of 15 miles from ground zero people would require fallout-proof, shelters in order to survive.

Only a few months ago, many of our citizens would still have discarded as far-fetched the view that we are exposed to nuclear attack—not any longer. All of us are now aware of powerful technical possibilities in the hands of our adversaries.

According to FCDA, an attack releasing just under 400 megatons (400 million tons) of energy would result in an estimated 40 million casualties, with 16 million killed the first day. 2,500 megatons would kill an estimated 104 million people. Clearly, planned mass exodus would be a futile undertaking. The new situation calls for new analysis.

Researchers at the large Naval Radiological Defense Laboratory point to the fact that there is no way to "run and hide," that shelters and rehabilitation facilities are the only answer—without alternative. This was again emphasized recently by Dr Edward Teller and Dr Vannevar Bush who spoke before the Senate Preparedness subcommittee. Dr Teller used the expression "passive defense" when he stressed need for shelters and for preparatory steps to restore the country physically and economically after a nuclear attack.

It is clear that these serious warnings mean that we have to get ready for the worst and should not expect that an enemy would waste his efforts with anything but his most destructive weapons. This is the view also of the Naval Radiological Defense Laboratory and civil defense administrators share it.

Shelters designed to save people under nuclear attack are quite different from bomb shelters which some of us may have seen or used during the two world wars. They now have to afford protection against possible injury from blast, heat, light, initial radiation, and radioactive fallout.

Modern bombs, according to Air Force Secretary Quarles, destroy everything within a 12 mile radius, cause serious damage for 40 miles, mass casualties from radiation for 90 miles and dangerous radiation for 175 miles around. There is no fleeing from these effects anymore. It would seem to be a wise precaution and an excellent investment if our new schools as well as other public and semi-public buildings were equipped with adequate shelters.

It is assumed that such an initial attack would take such proportions as are thought to be required to knock out our country in one big swoop. Schools in those areas which were spared would be commandeered and would become centers and gathering places for survivors from stricken areas. Therefore, schools ought to be prepared to care for everyone possible.

Oceans have ceased to be barriers against destructive attacks by an enemy equipped with ICBMs, U-boats, supersonic planes, and H-bombs. We are now more open to enemy attack than, say, Belgium was to German attacks. It is one of the most unpopular task of community leaders to keep unpleasant realities before the eyes of the public and to promote measures of precaution and preparation *before* any type of disaster strikes. Working for precautionary measures is, however, not without rewards. It is gratifying to restore in our fellow man some feeling of security by creating visible and tangible manifestations of readiness and preparedness, thereby directly improving his health and well-being. Architects can make important contributions in this extension of their public professional service.

The problem of preserving human lives and reducing human suffering under H-bomb attack has been approached from various angles. Plans for evacuating entire urban populations upon alarm or warning must be discarded as unrealistic. Neither means of transportation nor roads populations would have to travel over are available for a mass flight—nor would there be time to flee far enough, since radius of destructive force has increased with size and kind of bombs. Actually, loss of life might be increased many times by the fact that the masses of people on clogged roads—within a diameter of 350 miles from explosion—would be entirely unprotected and exposed to radiation. The old recommendation to duck into a ditch must be termed almost naive in the face of radiation and fallout dangers. The whole evacuation concept has been shattered by Senator Dirksen's recent revelation that our elaborate Distant Early Warning Radar System (DEW line), just completed at tremendous expense, will not detect missiles in time.

The idea of defending a city has also been abandoned as hopeless in the face of modern means of destruction. Our forces will attempt to intercept projectiles on their way, before they reach their targets. Beyond that, we must try to protect human lives by shelters, and to restore some semblance of bearable living conditions after destruction of accustomed environment. To this end, our schools should logically be enlisted and prepared.

While totalitarian countries can enforce construction of ample shelters as a condition of building permits, we prefer to rely upon voluntary cooperation. To stimulate such cooperation is one of our pressing tasks—leadership is needed. If we do not provide for disaster relief ahead of the disaster, there will be no relief.

In a community located within the effective radius of an atomic explosion, merely saving lives would not do. When the time comes that the fires have been extinguished, the radiation has sufficiently abated, and the survivors could venture to dig themselves out from their shelters, they would all be in need of care. Many would be sick or injured, and the whole population would be indigent, helpless, destitute, by destruction or poisoning of water supply, food, clothes, and shelter. Decontamination would top the list of their immediate wants. Radiological contamination of large areas would reduce availability of local resources and facilities. Recovery, testing, rehabilitation, and decontamination will become an immediate and paramount problem.

At that moment, disaster centers, ready and equipped to furnish water, clothes, food, and shelter would be true blessings. Hospitals, *empty* hospitals, to minister to sick and injured, would be invaluable. There would not be one person among all who had been able in that extremity to save their skin, who would hesitate to give any of his earthly possessions for a ready-made receiving center open to him.

Existing hospitals, insufficient in peacetime, could not meet sudden emergency needs of mass casualties. To add to this dilemma, it must be assumed that hospitals situated in an attack area would be obliterated along with all other structures. H-bombs are non-selective.

Our school boards could well seize the initiative by insisting that their schools incorporate at least a minimum of preparatory measures which would make schools suitable emergency hospitals and receiving centers in times of disaster. Architects, when studying plans, would find that a large number of preparations listed below could be incorporated without curtailing requirements of school construction program proper. Such incorporation of facilities for the school's second duty will not lead to record low cost figures per square foot of school plant, or per student, but the well-being of the community as a whole should be a paramount responsibility—achievement of some record low cost figure a secondary consideration.

Measures preparing the school for service as a disaster relief center would make the school still more important to the community, would further more intimate relations between school and community. Community organizations should be invited to visit the school plant, to inspect its facilities and preparatory measures, with the aim that members of the community should become thoroughly familiar with them in order to be able, if necessary, to take over certain emergency functions.

HOSPITALS AT A MOMENT'S NOTICE

Modern school plants should be prepared to provide:

- shelter and cover with filtered ventilation
- capabilities for feeding, housing and care of hungry and homeless
- casualty care, first-aid station
- emergency hospital care
- medical supplies, water, blankets, clothing
- health and sanitation requirements
- fire protection
- decontamination
- family rehabilitation, counsel, referral

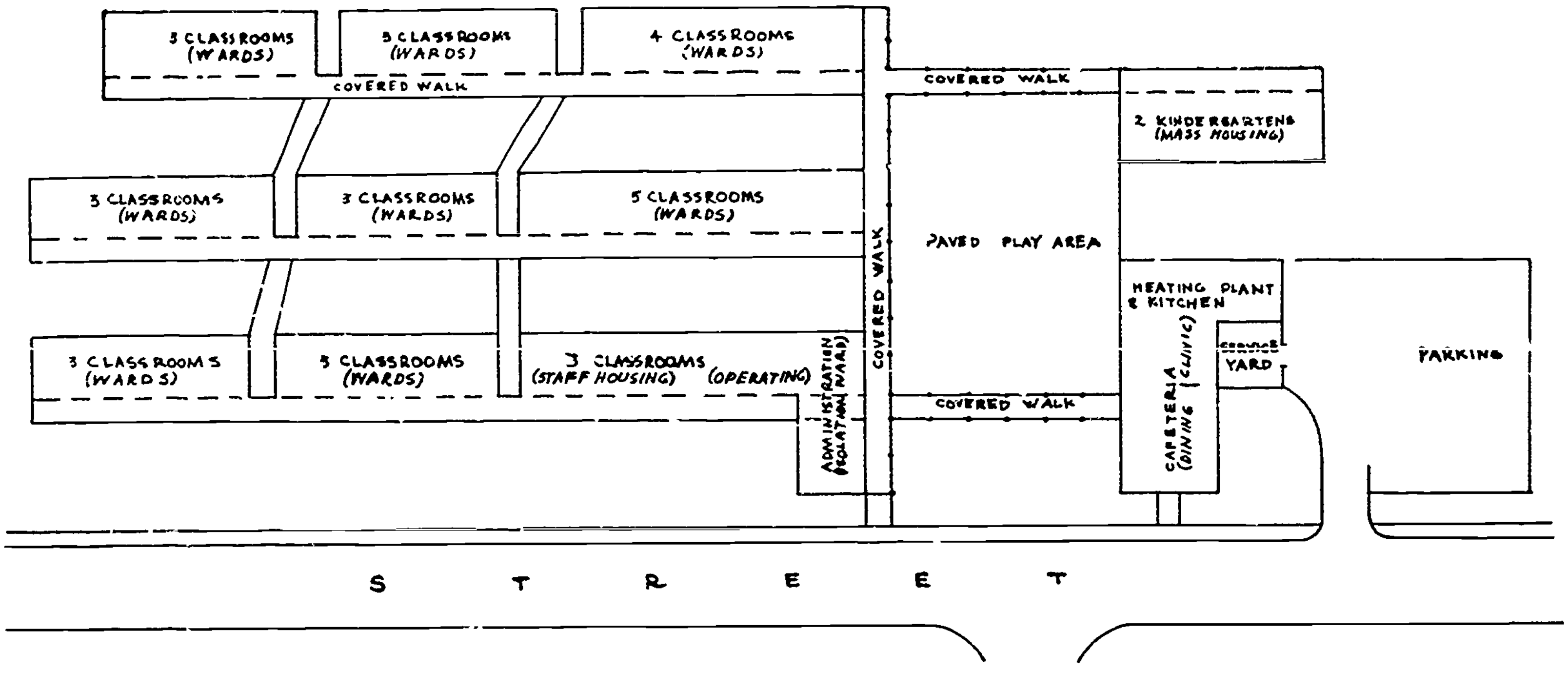
Far more than mere shelter is ready at hand in our school plants, if we will but recognize potentialities.

CLASSROOMS

Obviously, academic classrooms would make most comfortable *wards*. Heating, ventilation and lighting are efficient, floors and walls are hygienic, acoustical treatment reduces noises, colors are restful and pleasing, there are often drinking fountains in the classrooms or nearby, and ample toilet facilities. Many classrooms are even equipped with blackout curtains, now used during periods of audio-visual education. Stretcher bearers could well negotiate normal 36" wide classroom doors—for wheeling beds in and out of wards, a door width of at least 40" would be preferable.

TEACHERS' WORKROOMS

Some school plans show teachers' workrooms or offices between classrooms. From these rooms, teachers can watch adjoining classrooms through glass panels. These rooms are often equipped with a sink and counters with cabinets underneath. Naturally, these workrooms would become ideal *nurses stations*. In the cabinets, blankets, linen, pillows, sterilizers, drugs, splints, and many other items which a nurse must have



E L E M E N T A R Y S C H O O L
(CONVERTED INTO EMERGENCY HOSPITAL)

at hand could be stored. If room has telephone or speaker connection with administration area, as they often do, so much the better.

Where school structures of more than one story in height are considered for auxiliary use as wards, there should be an elevator of sufficient size to allow for a stretcher or bed with two attendants. *Service elevators,* often planned for such buildings, could be dimensioned and located accordingly—which may make them more efficient for either task.

COVERED PASSAGES

Covered passages between buildings obviously facilitate conversion. Walks could be used, of course, to move patients from one building to another, for instance, between ward and operating suite. Walks would also enable doctors, nurses, stretcher bearers, and ambulant patients to get around in any weather without exposure, as well as facilitate distribution of food by carts.

HEALTH CENTER

Most schools have a health center, either in a separate building or in a wing, often near administration. In larger schools, such a health center often consists of a reception room, a nurses' room, restrooms with cots for boys and girls, toilet rooms, and at least one treatment room with good-size storage. Sometimes, there are additional doctor's and dentist's rooms. Restrooms are usually arranged in such a manner that nurse can watch both rooms from her desk through glass panels. Those rooms would make *isolation wards* providing real safety from cross infections or spread of contagion.

Other rooms of health centers will be found suitable for conversion into *operating suites*—size and general layout permitting. These rooms, too, should be planned from the start for both purposes and should be equipped with proper utility connections. It will be found that installations required for possible limited operating suites will be just as usable for health center's normal functions

ADMINISTRATIVE OFFICES

Administrative offices would probably continue to be used for their original purpose, or at least some of them, to accommodate reception center or *hospital management*—their built-in facilities would be just right for either purpose.

CAFETERIA, MULTI-PURPOSE ROOM

All persons housed at reception center need food in addition to clothing and shelter. It will be a tremendous load on cafeteria and the homemaking kitchens to prepare and distribute this food. Cafeteria must be expected to work around the clock and should be planned accordingly, especially storage areas.

MEETING ROOMS

In some schools, there are rooms for parent-teacher meetings, lounges for teaching staff and other accessory rooms, usually with lavatories, toilet facilities and conveniences for preparing snacks. These suites could be used to house *medical staff.*

SCIENCE CLASSROOMS

For an emergency hospital to function properly, a *pharmacy, laboratory, pathological examination room,* and *morgue* would be desirable. With some planning, these facilities can be satisfactorily contrived in our high schools from biology, physics and chemistry classrooms without too many extra installations that would not be required for classroom use proper.

SHOP BUILDINGS

Wood, metal, auto, and radio shops of the school are vital for a disaster center and hospital. Importance of metal and woodworking shops for maintenance and repair work is obvious. It would be up to auto shop to keep ambulances in good repair, while radio shop would keep radio communications open. A 2-way radio station would be found a great blessing—since the flood disaster they are now standard in New England hospitals—and they have obvious educational possibilities.

An auxiliary power plant or an emergency generator, available in many schools, would be essential, as the normal power supply cannot be expected to be available in such an emergency as we are preparing for.

SHOWER ROOMS

These large showers, usually near gymnasium, will prove to be of highest value for decontamination of multitudes of people who were exposed to nuclear facilities.

HOMEMAKING CLASSROOMS

These classrooms contain housekeeping, sewing and cooking equipment and can serve well as diet kitchens, nurseries, even maternity wards, laundries, and manufacturing shops for clothes and bed linen.

AUDITORIUM, GYMNASIUM, MUSIC OR DRAMATIC ARTS BUILDINGS, SPORTS FIELDS

If such facilities are available, they will in all likelihood be used to augment other facilities to house those multitudes of refugees from disaster areas who, after having been decontaminated and provided with clean clothes, may not be in immediate need of medical attention but are destitute and homeless.

Probably, tents or barracks will have to be erected on sports fields and play grounds to house those who have no place to go.

WAREHOUSE

Storage is one of the biggest problems. The school warehouse, if there is one, will as a rule prove too small. Sufficient storage facilities are one of the critical items which would have to be planned just for the second—emergency—duty of the plant, unless a centralized warehouse is maintained by the school district somewhere nearby.

INCINERATOR

School incinerator would safely dispose of all combustible waste not emanating dangerous radiation.

WATER WELL

A very critical item in any disaster will be water supply. Water is vital for survival, but normal supply will, in all likelihood, not function or water may be poisoned by flood, fallout or chemical warfare. For this reason, every school plant should have its own, independent water well and pump system to provide at least one source of potable water in the area. Such installations pay for themselves, even though the emergency for which we are preparing may never occur. In the New England floods, hospitals were served with fresh water by tank trucks—but no means of connecting truck to plumbing was available—this would be an easy provision to install in a school.

DRIVEWAYS, PARKING

Driveways planned to carry school buses or supply trucks, are fully adequate to carry ambulances. Storage of spare parts and automotive fuel is one of the problems for which a solution must be found.

PLANNING AT LOCAL LEVEL

By necessity, foregoing suggested uses of existing school facilities for emergency hospitals and receiving centers can be only an outline and do not present a complete program. Neither is this the place to go beyond such generalized suggestions, nor would wide variation in school plants and their physical makeup permit statement of rules which could be followed by the majority.

We hope to have shown, however, that school plants can readily be made into self-sustained islands of assistance and service. There may be more buildings or fewer—they may serve different purposes or may be combined and laid out in various ways suggesting quite different solutions for emergency use. For this reason, a recipe for conversion planning would be of little value.

Such planning can only be done at local level. If possible, the architect who planned the school in the first place, if he has experience in hospital requirements, should be entrusted with conversion planning.

If the school is still on the drafting boards, the archite[illegible] charge will know best whether his experience in hospital planning is sufficient or whether he should call in a hospital expert. It would be folly, indeed, if we should fail to make these relatively few and simple preparations. The wisdom of designing our new schools with their emergency function in mind can hardly be overemphasized. Double function design should be made mandatory for all new schools.

WHO PAYS?

Funds might be spent, in numerous ways, were they available, for our children's education. Those districts which can still finance their schools by bond issues, may find it easier to convince the electorate of the desirability of the school if the plan provides for tangible disaster relief and protection for the population in addition to teaching facilities for their children. If the people can be made to understand that their money will pay off doubly, will serve two different purposes, will buy two commodities at almost the price of one, that the buildings erected with the funds will serve double duty, they may be more inclined to vote in favor of a school bond issue.

The states; hard pressed to finance school buildings in districts which have exhausted bonding capacity, have so far been unable to finance anything but traditional essentials.

Federal aid for school construction, if it had been adopted by Congress, might have been another way to finance a conversion program because financing disaster aid is a federal responsibility:

- Public Law 875 provides for continuing means of assistance by the federal government to states and local governments to alleviate sufferings and damage resulting from major disasters
- Public Law [illegible]34 provides for donation or loan of surplus federal equipment and supplies to states for use or distribution by them under Public Law 875.
- Public Law 107 authorizes federal assistance in providing temporary housing or other emergency shelter for disaster sufferers.
- Public Law 480 provides for making maximum efficient use of surplus agricultural commodities
- Executive Order 10427 of 16 Jan 1953, provides that the Federal Civil Defense Administration, acting on behalf of the President

shall direct federal agencies to provide assistance in major disaster.

CD Information Sheet 31 * lists among the duties of CD wardens to "help set up improvised camps, assist in emergency feeding, lodging, registration, first aid, decontamination, and caring for dependent persons and children at assembly and reception areas or other encampments."

Therefore, to get federal funds allotted for the purpose of preparing our schools for emergency hospital and reception center duty should be possible under existing legislation since a comparatively small expenditure would bring a large return, not only in progress in a sadly lacking development, but also in the great emotional value of restoring a certain feeling of security, a reassurance that our government is doing something effective to protect us from the residual and perhaps worse consequences of an enemy attack.

So far, civilian protection is wanting to an alarming degree. The President is said to have now under consideration a civilian shelter program costing $22 billion over a 10 year period. Here seems to be a step in the right direction. Part of this money, once available, should be coupled with a program as outlined above to mobilize and prepare our schools for their second duty as emergency hospitals and support centers.

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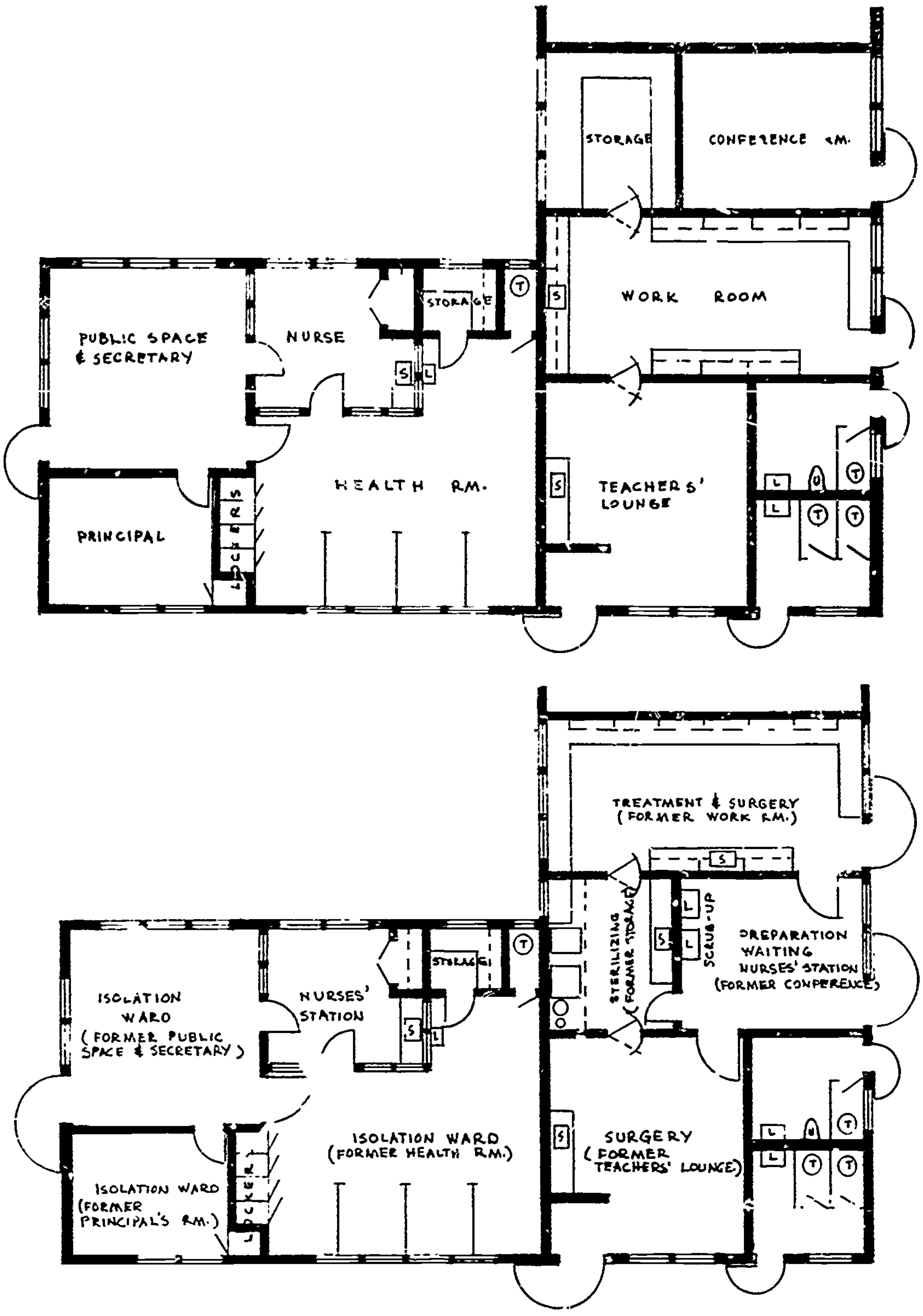
* *The role of the warden in the H-bomb area*. 1955. (Supt of Documents, US Government Printing Office, Washington 25, DC 5c)



SCHOOL PLANT CONVERTED FOR DISASTER USE

PLANNING A SCHOOL MAINTENANCE & REPAIR PROGRAM

by James Neil Morris*

SOUND MAINTENANCE of school plant facilities is application of people, tools & materials to protect capital investment, to increase efficient utilization & to reduce cost.

This type of maintenance is a workable — & positive thing. It doesn't just prevent something — it produces. It does not mean added cost — it means substantial savings thru judicious use of public funds to produce maximum & efficient utilization of existing facilities. What's more, it is practical, realistic & attainable.

Within less than 10 years, industry will double its maintenance expenditures to about $22 billion annually as result of automation & necessity of answering riddle of more production with less labor. Similar increases will be reflected in school building maintenance by reason of new construction, obsolescence & changed conditions of use. It has been estimated that our present public, elementary & secondary school plant facilities are valued at approximately $27.2 billion — & includes approximately 2.5 billion sf of gross floor area. It is conservatively estimated that annual cost of housekeeping, recurring repairs, replacements & improvements to this group of buildings is approx. $1.5 billion on year-to-year basis. In spite of this substantial cost, over-all quality of school plant maintenance at national level leaves much to be desired.

Ultimate aim of all good maintenance programs is to reduce unit cost of goods sold or services rendered.

Planned maintenance helps industry do this by getting maximum use from facilities & equipment & by providing reminder to perform recurring repairs & replacements on planned rather than hit-or-miss basis. Same thinking should apply to school plant maintenance.

* Consulting maintenance engineer, Washington DC

When we talk about school maintenance, oddly enough we are also talking about people — people in organized effort with specific responsibilities to their work & to each other. It is not purpose of this article to outline methods to be followed in organizing a maintenance crew, how to assign responsibilities or how to handle employee-relations — but to present a few comments & suggestions that may be of assistance to school administrators.

survey:

In giving consideration to a sound maintenance & repair program, it is essential to establish & maintain a complete & accurate record system.

First step toward this end is thorough survey & inspection of all existing facilities & equipment. Obviously, school management must know what it has & where it is before plant may be maintained properly. While need for such detailed survey & inspection may seem self-evident to most school administrators, it is surprising how many maintenance people don't know what they have or where it is located.

Professional architectural & engineering personnel should be used for survey & inspection of school building facilities & all related equipment. Ideal arrangement would be to use architectural services initially employed in design & construction of facilities as these professional services should be projected into operation & maintenance of physical plant. In any event, survey & inspection should cover all portions of building structure from foundations thru roof, including all mechanical & electrical installations.

evaluation & report:

Next step is professional evaluation of survey data to determine maintenance & repair procedures. A detailed, comprehensive report should be presented to management for study & implementation. This narrative report should list every routine housekeeping operation & outline procedures to be followed on daily, weekly, monthly, quarterly & annual basis. Cleaning & sanitation procedures should be clearly & concisely described for each individual surface &/or material incorporated in structure. Personnel requirements should be established & work schedules outlined so as to assure maximum utilization of manpower & materials. Professional evaluation of these data will permit establishment of realistic budget for general housekeeping & sanitation in accordance with accepted standards.

As general rule, school administrator is not enthusiastic about spending money for maintenance & repairs. What he wants is to avoid breakdowns & expensive repair bills.

We accept fact that breakdowns & repairs can be caused by too little maintenance, but there is also such a thing as too much maintenance.

We should stress importance of properly evaluating maintenance for each individual building structure. It is necessary to know what surfaces & equipment must have constant & careful attention to guard against breakdowns & to promote sound housekeeping & sanitation practices. It is also important to know what portions of building & equipment may be safely neglected without serious penalty until a planned periodic maintenance is accomplished.

prevention:

A sound preventive maintenance program must be designed & applied to vital components of building structure & its equipment where breakdowns would interrupt essential services, cause expenditure of large sums of money for repairs, or endanger health or safety of personnel. Reasonable sequence of work should be established & receive conscientious followup in form of regular inspections on part of school management. Consideration should also be given to fact that there is a normal life to all structures & equipment. It is not good judgment to squeeze last operating dollar out of expensive finishes & vital equipment It is best to make regular & peri c inspections so as to discover incipient repairs before they develop into major replacements.

personnel:

It is of utmost importance that management re-appraise criteria now being followed in many areas when selecting maintenance personnel who will be responsible for maintenance & protection of facilities representing large capital outlay or continuous expenditure of substantial public funds. Jack-of-all-trades who, with toolkit in one hand & oilcan in other, has been made fully responsible for all phases of maintenance is no longer the solution.

Even in average elementary school, maintenance operations should be departmentalized & elevated to same professional status now assigned to other related duties in administrative & teaching fields. Term "school janitor" should be discarded immediately & replaced by more realistic "superintendent of maintenance" or other similar title. Good housekeeping & general sanitation practices have their effect upon impressionable minds of children & qualified professional maintenance personnel must provide clean & well-maintained buildings if school health program is to be effective.

procedures:

Value of time & motion studies in performance of most simple maintenance operation cannot be overly emphasized. There is right way & wrong way to sweep, dust, mop & to do a' other routine duties that make up a goo housekeeping program.

A simple little procedure like having each mopper place a small steel wool pad under the ball of each foot lets him knock off chewing-gum & heel-marks without bending over.

A few minutes here & there will soon save daily manhours. A realistic training program for all maintenance personnel will produce dividends as it keeps them current with latest techniques & developments. A most successful school maintenance program conducts regular training programs for students & teachers alike — in tactful recognition that each member of entire school family is an active participant on their over-all maintenance team.

costs:

Cost of school housekeeping programs will vary, of course, with each individual building & local conditions of use. Experience has demonstrated that a well-planned program of housekeeping for a modern high-school plant should cost approx 25c to 30c/sf/yr on a recurring basis.

While some school systems point with pride to fact that their housekeeping costs may be as low as 15c/sf, inspection of these facilities will immediately reveal quality of work well below normally accepted standards

There is a rapidly growing trend throughout industry toward use of contract custodial services for all housekeeping. It offers many advantages to schools in areas where such service is now available thru qualified & experienced contractors.

Data developed during recent survey of 4500 publicly-owned buildings throughout US has focused particular attention on annual cost of recurring repairs, replacements & improvements required to update these facilities to provide efficient utilization of space &/or to replace outmoded buildings with new structures. Each of these categories were broken down into 20 line-items of work during evaluation of field data for analysis. Average age of buildings surveyed was 27.2 years. Total gross floor area of approximately 113 million sf was involved. Each building was inspected by qualified & experienced construction management engineer or architect.

Approximately 4% of total buildings surveyed were found to be obsolete to point where expenditure of additional funds for maintenance was not considered prudent. Structures considered suitable for continued economical usage were evaluated on basis of thorough updating during next 5 years, including installation of adequate lightin r conditioning, as well as expa on & remodeling to meet needs of occupying agencies & rapidly expanding workload.

Applying these field data to national group as a whole, it developed that a reasonable budget could be established for repairs as follows:

recurring repairs	**16c/sf/yr**
replacements	**7c**
improvements	**8c**

Following table breaks down repair-dollar into %s of total cost so as to flag significant line-items of work for close attention & remedial action:

line-item of work	recurring repairs	replacements	improvements
landscaping	3.0%	2.2%	0.3%
sidewalks & drives	6.4	4.9	1.2
electrical work	4.0	2.1	5.5
lighting	1.5	4.1	9.4
heating	5.3	8.5	1.4
air conditioning	1.8		48.2
ventilating	1.6	4.3	3.2
plumbing	4.1	12.2	0.4
roof work	4.6	22.0	0.3
remodeling	3.3	5.1	20.1
floors	4.1	14.1	1.0
structural	3.1	11.4	2.3
painting	40.5	2.6	0.7
other	16.7	6.5	6.0

With appropriate variations to suit local conditions, these cost factors may be used as yardstick for over-all problem of repairs to school buildings. At national level, it develops a program of recurring repairs to heating & plumbing systems, as an example, valued at approx $37.5 million. Along with a recurring painting program valued at approx $162.5 million, this points out need for closer look by all professional groups concerned with design, construction & maintenance of school building facilities.

typical problem — dampness:

Water moisture problems are perhaps root of more evil in building maintenance than any other factors. While it is entirely possible in theory to produce masonry walls that will not leak, workmen become careless in use of brick, stone & mortar. End result is damage to interior finishes & unexpected repair costs

In damp & humid areas, it is good practice to use a proper waterproofing & toxic additive to oil paints to combat fungus & decay. One manufacturer combines 3 concentrated phenols with his waterproofing compound to produce toxic effect of full-strength creosote without staining. It is immediately apparent that a prime coat of this type of material will kill suction in surface to be painted, extend paint-coverage & add life to painted surface. This same type of material is also used to advantage as spray coat over masonry surfaces painted with cement water paints — all without color or texture of painted surface.

Within past few years, significant developments have taken place in development of painting materials. Key to most paint failures is improper selection of materials, faulty workmanship & failure to prepare properly surface to be painted. One cannot expect to apply paint over accumulated dirt & grease & get a perfect job.

leaking roofs:

Widespread use of pea gravel cinders & other similar materials as fill for built-up composition roofs is questionable from standpoint of maintenance. Leaks are practically impossible to find. In addition to added weight, this type of fill develops & holds heat & re-roofing becomes a problem. Development of mineral hydrocarbon polymers & use over past 15 years indicates that spray applications of liquid aluminum foil (in lieu of conventional fill over built-up composition roof surfaces may be partial answer to these maintenance problems.

cleaning:

Development of chemical detergents permits school management to select one material to do entire cleaning job Use of deodorant blocks & so-called disinfectants in toilet areas serves no useful purpose & is a good indication that careless cleaning habits are being followed. Clean fixtures & surfaces have no odor & it is not necessary to purchase nor use materials of this type.

Careful & professional attention should be given to selection & use of cleaning equipment, tools & materials. Floor waxes, in particular, should be selected on basis of quality performance for specific floor surfaces to be treated. General trend is toward use of excessive amounts of waxes & frequency of application that is wasteful & not necessary.

Properly selected machine equipment is a must in any well-planned school maintenance program.

budget:

A well-controlled budget is essential to a successful maintenance program. Need for funds can never be predicted with 100% accuracy. Flexibility is necessary. Major breakdowns will cause overspending. In these cases, only alternative is to reduce amounts allocated to other activities.

By putting over-all requirements & benefits of good maintenance before school management in clear, concise & graphic manner, your chance for approval of funding requests has a better chance. In this manner, management is placed in position of accepting your recommendations or assuming part of responsibility for future breakdowns.

Management will support maintenance only when it can gage performance. Reports covering maintenance are difficult to present as the better the job is done in preventing trouble, less there is to report. Only thing that can be done is to report activity & let complete absence of major repairs determine efficiency of overall maintenance operation.

MAINTENANCE CONSIDERATIONS IN SCHOOL BUILDING DESIGN

by Howard Dwight Smith, FAIA, Ohio State University
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Albert F. Gallistel, AIA, University of Wisconsin
Paul H. Elleman, CE, Ohio State University

SCHOOL ADMINISTRATOR, architect & taxpayer, all interested in design for adequate & convenient facilities for the total school program, also seek plans which are not costly in operation & maintenance. Adequate time for architectural study of these factors will prove that practical & esthetic considerations are not mutually exclusive.

In the shared responsibilities of architect & administrator, consideration of maintenance problems should begin in early stages of research & programming & extend thru working drawings & specifications. This will affect selection of materials & equipment, choice of standard or stock elements such as windows, requiring a balance between initial cost, appearance, rate of deterioration, cost of painting & cleaning, etc.

The architect must himself balance his best professional judgment with the administrator's experience & special local conditions. The administrator likewise should avoid rulings which may be based on isolated examples of unsatisfactory experience.

The more nearly the architect may be able to put himself in place of user & the more closely he may be in contact with completed building over long periods of use, the more sympathetic will be his approach to study of effects of maintenance on design.

design maintenance criteria:

- **choice of materials based on:**
  - **durability or longevity**
  - **ease of cleaning or renovation**
  - **facility of replacement**
- **choice of apparatus & equipment based on: proven worth & reputation**
- **consideration of first cost versus upkeep —"True economy is a complex relationship among original cost, educational utility & operation expense." (13)**

PRINCIPLES

Maintenance economy must not be carried to point of educational detriment or embarrassment. Use of cheap materials which cut life span of a structure generally builds up maintenance costs. This is true whether

- **life span of structure is deliberately set low to avoid throttling future educational program with obsolescent physical plant, or**
- **structure is a stop-gap to provide temporary housing to meet crowded conditions Pumping life blood, in form of dollars, into so-called "temporaries" has proven an expensive operation to many educational agencies in recent years.**

Discrimination must be exercised in appraising esthetic & structural values in terms of local conditions such as hurricane hazards in Florida & Gulf States, earthquake hazards &, in general, use of designs or details for one climate not suitable for another region.

Planning & construction elements listed below serve to illustrate principle that good design need not be sacrificed by considerations of economy of maintenance & convenience of operation. Such considerations may prove the spur to distinctive architectural achievement.

BASIC PLANNING PROBLEMS

■ adaptability:

Most buildings sooner or later are subject to alterations & additions. Original plans should include open-end corridors & provisions for extension of all utilities.

■ ceiling heights:

Reasonably low ceiling heights reduce cubage & costs of construction, cleaning & painting, also heating both in initial equipment & fuel. Somewhat higher ceilings in semi-tropical areas are justified only if they contribute to natural ventilation thru openings properly proportioned & placed.

■ janitorial & maintenance services:

In large buildings plan divisions in service units, vertically or horizontally:

- **one office for head custodian**
- **at least one janitor supply & operation station on each floor.**

■ extra-curricular control:

By proper location of interior gates or doors & stairs with reference to entrances, vestibules & lobbies so that portions of structure, when not in use, may be fully isolated.

■ expansion & contraction of materials:

Design must include properly predetermined expansion joints at major structural division points of large buildings.

EXTERIOR DESIGN

■ water:

Source of many serious maintenance problems in nearly all parts of country—design to avoid leaks:

exterior walls:

use non-porous materials or materials with non-porous surface treatment

add waterproofing on **outside,** not **inside,** of foundation walls

window sills, copings & all horizontal masonry surfaces should be water-repellent material &/or placed over thru-wall flashing.

in masonry, use full waterproof & tooled or weather-struck joints, & parge backs of exterior 4" of face-brick walls

in metals (corrosion-resistant) use fully over-lapped joints, caulked & with full provision for expansion

in wood or other similar surface materials, use fully over-lapped joints, caulked & surface treated.

roofs, parapets & flashing:

For effective water-shedding on flat roofs, do not depend upon theoretical drainage expected of a flat plane. In practice, no roof surface may be depended upon to be free from irregularities which may cause indefinite retention of water at undetermined or undesirable points.

When properly controlled, spraying of flat roofs is a valuable cooling device at some times of year in certain climates. For this use, roof & its connections & flashings must be constructed as a tight waterproof envelope.

For sloping roofs send water beyond exterior walls by means of eaves & gutters. For metal, seams & joints necessary for expansion

& contraction should be located by designer rather than left to devices of roofer.

parapets safely used only when:

- **both sides of parapet wall are treated as fully watertight exterior walls**
- **coping is as fully watertight as any roof should be**
- **intersection with adjoining roof, either flat or sloping, is fully watertight**
- **scuppers or openings thru parapet provided at high points of its intersection with roof, for emergency overflow before water rises above safe flashing levels.**

flashing & counterflashing exposed at exterior intersection of roof & wall often forms a prominent pattern which should be determined by designer & not left to mason & roofer.

skylights:

Maintenance personnel are generally strongly opposed to skylights because many of them leak. Where needed for light &/or ventilation they can be designed & constructed to be watertight.

downspouts:

Rainwater drainage, except in southern parts of country, is best provided by interior downspouts or leaders, which should be located away from exterior walls, preferably exposed or accessible in chases or pipe-shafts for ease of maintenance & repair. Exterior downspouts should have leaf- or debris-catchers & a substantial boot or shoe for proper protection at bottom of conductor.

■ other exterior problems:

entrances:

Keep dirt & water out of building by proper overhead weather protection & by foot-cleaning devices prominently & conveniently located.

Avoid open exterior entries which require policing.

Use only most durable materials for steps to withstand long, hard usage. For safety, no step should be used at door threshold & steps adjacent to any entrance should be flights of not less than 3 steps.

refuse storage:

will be needed, sooner or later, near service entrance. Provide in original design either by construction or landscape camouflage, do not leave to become an eyesore.

smoke stacks, flues or chimneys:

(for heating & incinerators)

Designer should recognize their inevitable prominence & inevitable discoloration, & anticipate by selection of materials, texture & colors which will not emphasize discoloration.

windows:

Large areas usually desirable or required by code—select in terms of:

- **readily replaceable stock patterns**
- **non-corrosive material**
  - **for longevity**
  - **effect on exterior color scheme**
- **ease of maintenance**
- **weather-tightness**
- **interior condensation drainage**

architectural concrete:

is a poured plastic material which reaches its physical & chemical "set" rapidly after placing—which should determine its final form & finish.

Surface textures should be modified only by **taking away** & **never** by adding material after initial set. Where there is absolutely no danger of frost action, application of color & texture by use of reputable concrete paint is effective. Otherwise, paint should not be applied over architectural concrete. Concrete which requires "cosmetic" curing should be rejected as structurally unacceptable.

INTERIOR PROBLEMS

Greatest area of common concern between architect & administrator. Selection of colors & finishes usually a compromise between ideal colors & surfaces & considerations of initial cost & maintenance costs.

■ color:

of great importance in emotional impact in addition to appearance—select in terms of:

soil-proofness
cleaning
renewal—matching

■ floors:

minimum of interior angle intersections, coved where possible

color by means other than **applying** paint or pigments

entries, corridors, shops & labs:

hard durable materials:
terrazzo
ceramics or masonry, in small renewable units
hardwood in carpenter shop

offices, classrooms, general spaces:

hardwood
linoleum
asphalt or mastic tile

■ walls:

smooth plaster preferable to rough or textured for cleaning & painting

ceramic tile—higher initial cost offset by

permanence of color
impervious surfaces
low maintenance cost

porous, unplastered masonry block —lower initial cost & slight acoustical benefit offset by cost of repainting

wainscots:

especially in corridors & stairwells

if painted on plaster use tough gloss or semigloss paint

color determined in original design, not left to undiscriminating custodian

intersections of wall surfaces:

rounded or coved regardless of rigidity of corner beads & other protective measures.

■ ceilings:

white or near white for light reflection must be kept clean—therefore easily cleaned surface desirable

acoustical materials—selection of porous surface vs perforated-porous vs perforated pan-type, balanced against long-range cleaning or repainting costs.

■ woodwork:

stained & varnished easier to maintain than painted

rehabilitation of antiquated golden oak by sprightly colors is effective & popular.

HEATING — PLUMBING — ELECTRICAL

Collaboration between architect & mechanical engineer should begin at preliminary stage. Ever-increasing amount of piping, conduit & fixtures used in modern educational buildings emphasizes desirability of orderly arrangement of such equipment & accessories, exposed, or at least accessible in tunnels or pipe-shafts for ease of maintenance, repair & replacement. A designer cannot ignore such features in large numbers, often in conspicuous places. They become as important in architectural design as are doors, windows, stairs, cabinets, blackboards.

■ heating & ventilating:

Simplest type of equipment in small buildings to minimize skilled operation & maintenance labor

- **wall-hung** radiators or units facilitate floor & wall cleaning, dirt minimized by wall shields
- exact location of **vertical supply & return** heating lines, in conspicuous locations, specially where they flank windows, must be predetermined by architect, not left to engineer, contractor or craftsman. Similarly "swing-joint" & other exposed elements
- modern **"packaged"** heating & ventilating units require careful pre-planning in terms of both engineering principles & practical considerations of accessibility, cleanability & replacement.
- **ventilation registers** & exposed duct openings should be designed for cleaning & repair access as well as orderly architectural pattern
- **exterior coal or ash-handling devices:**

  locate & design as definite part of architectural composition

  locate to produce min need for & to facilitate cleaning of resulting dust & dirt
- **fresh air intakes:**

  design & location for min or zero dirt intake which is

  harmful to system
  adds to cleaning & maintenance even with filters
  avoid ground-level intakes
- **underground utility lines:**

  should be properly founded or flexibly supported at ingress points to avoid damage due to settling fill.

■ plumbing:

toilet rooms:

impervious material—floors & walls (at least wainscot)

wall-hung fixtures—complete floor clearance

individual valves

piping, valves, accessories, fully accessible if not completely exposed

"abuse-proof" fixtures & accessories

janitor slop-sinks:

some, if not all, at floor level

drinking fountains:

surrounding protective floor & wall areas—moisture proof & easily cleaned

■ electrical:

artificial lighting:

standard fixtures & parts (except at points of very special architectural distinction)

ready supply
accessible for replacement

electrical system:

safety power sub-stations

all main conduits in tunnels, shafts or closets

all accessories exposed or easily accessible.

SITE PROBLEMS

■ surface drainage:

(natural or designed topography)

prevent or minimize erosion

play area drainage
rapid & complete without erosion

gutters, drains, retaining walls
in original design, not left to expediency forced by experience.

■ seeded areas—new projects:

ample sodded edges (18" to 24")
complete sodding on slopes

■ planting beds—massed vegetation:

simple in form
located for convenient care

■ vines on buildings:

bronze hooks to support main stems

network or trellis for demounting of clinging vegetation.

■ flag poles (on building or site):

located for easy access & maintenance of halyards, etc.

■ roads & walks:

pattern easily followed by snow-plow

traffic signs & painted curbs anticipated by architect & landscape architect with reference to other features & color scheme.

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CENTRAL KITCHENS—THE ANSWER?

by Richard Flambert*

DURING THE PAST ten years many school districts have introduced central kitchens into their food service operations in an attempt to solve the problem of sharp increases in food and labor costs. This trend is especially marked in the West. Central kitchens are areas where food is prepared not only to be served in a dining room in the same building, but to be transported to another school or schools for service there. Or, they might be in a separate building where all food is prepared for service elsewhere.

PLANNING A CENTRAL KITCHEN

The establishment of a central kitchen requires thorough planning. The maximum requirements must be forecasted from the standpoint of number of schools, size of student bodies, and percentage of participation.

The central kitchen should be conveniently located. In some areas it is better to have a separate building in the center of the district. In others it is better to build it in conjunction with a proposed secondary school. In some districts one central kitchen might do for the entire school system, while in others where a large territory is covered it might be better to build two or even more central kitchens.

The method to be used in getting the food from the central kitchen to the receiving schools is an important factor in planning. At present four main methods are used:

Vacuum Cans: Food is taken directly from the ranges, ovens, and refrigerators and placed in pans which go into vacuum containers. In the receiving schools the food is transferred to hot and cold sections of the serving tables. Main advantages of this system are:

- **food is kept hot or cold**
- **food carts are unnecessary**

Disadvantages are:

- **amount of time used in transferring food from one type of container to another**
- **necessity for a serving table**

Districts using the vacuum can method are generally satisfied with it.

Containers with tight fitting lids: Food is put into boxes, pans, or pots and transported to the schools, where the containers are placed on the serving table. This method works for short hauls, but too often food has to be reheated in the receiving schools.

Carts with hot and cold compartments: One section holds approximately 20 trays on which cold food is placed in the central kitchen. Another section contains pans of hot food. At the school the compartmented trays are removed from the cold section and the hot food is added to them. This method is costly because of the number of carts needed.

Electrically heated and cooled carts: Pans containing hot and cold foods are placed in separate sections of the cart. The cart is transported to a school, rolled off the truck and wheeled into position at the serving counter. Electric connections are reestablished and food is served directly from the cart. There is very little temperature change during transportation. Everything is included in the cart but milk, which is generally delivered directly to the school. This method is the one most generally used, and is the most successful.

These last two methods require the design and purchase of trucks (with hydraulic tail gates) which hold approximately 6 carts each.

Serving areas in the receiving schools must be set up. Required facilities are generally a three-compartment sink, a 30-cubic-foot reach-in refrigerator, an employees' locker room, a two-burner hot plate, a small storeroom, a work table, an ice cream cabinet, and a modified serving counter. It must be decided whether dishes, pans, silver, etc, will be washed and sanitized at the schools or returned to the central kitchen. There is a difference of opinion regarding this. Some think that a central kitchen should handle everything but the actual serving of food, and others think this puts too much of a load on the central kitchen.

The central kitchen must be designed and equipped with all modern labor saving equipment. The menu pattern determines what equipment should be used for food preparation and service, and where it should be placed. Necessary equipment will equal the amount used by a large highschool kitchen if there are five to seven schools to be served. If more, large scale production equipment is necessary.

ADVANTAGES AND DISADVANTAGES

In theory, central kitchens are able to reduce costs by savings in purchasing, accounting, storing, quantity food preparation, and serving. However, this has not always worked out in practice. The kitchens have been successful in districts where a complete study of the situation was undertaken by school officials and their qualified consultants. The known advantages are:

- **one person can be responsible for all phases of purchasing, receiving, storing, preparation, and transportation of food**
- **quality and uniformity of products can be assured.**
- **organizing and training one staff is more efficient than doing so for individual staffs**
- **it costs less to produce in large quantities**
- **better facilities and more time are available to plan new dishes and take advantage of modern technological changes**
- **receiving schools require a minimum amount of equipment and less space**
- **payroll expense is less since fewer man hours are required**

Among the disadvantages mentioned by educators are:

- **all food is the same—no choice possible. There should be sufficient variety in the menus to provide children with the food they like. However, it is difficult to allow free choice with a 25-30¢ plate lunch and still meet food and payroll costs.**

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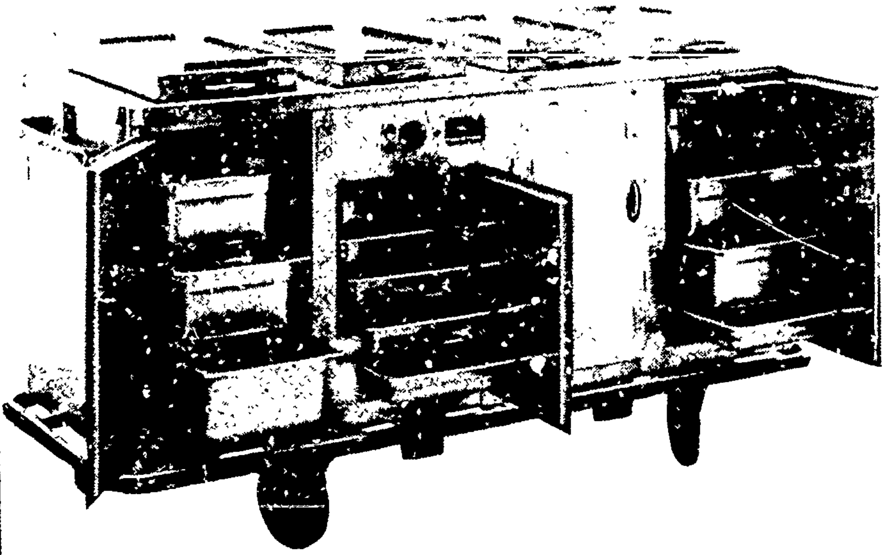
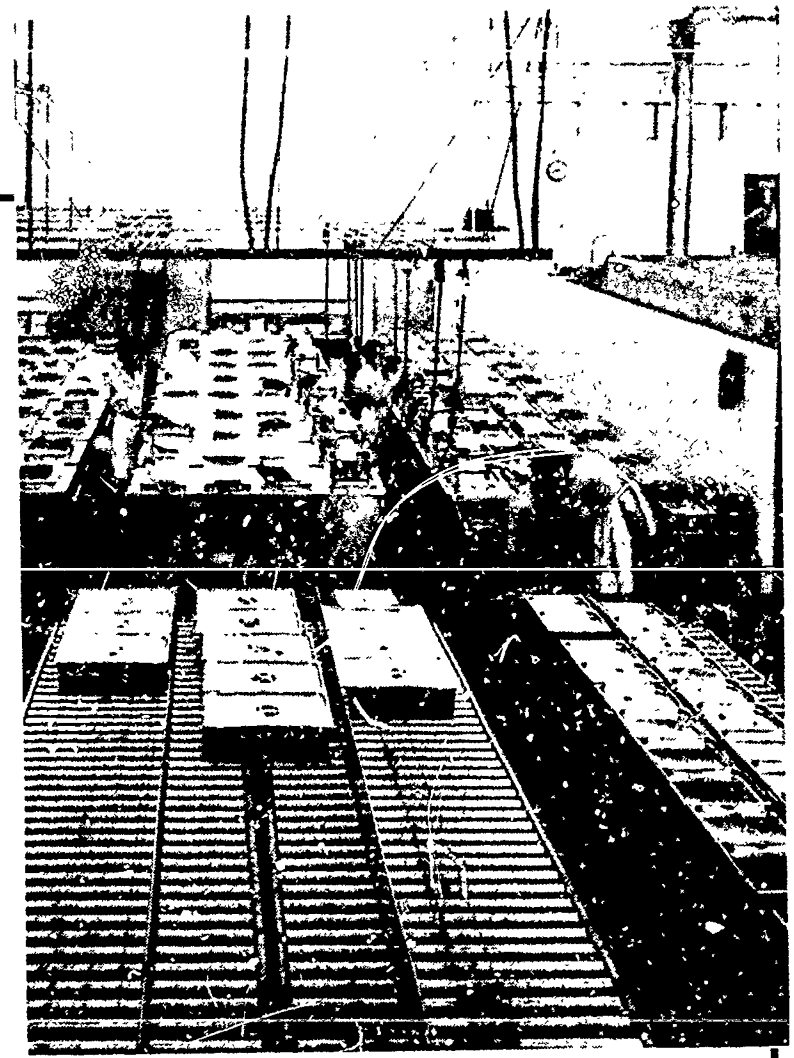
DETAIL PHOTO OF FOOD CART. TWO RIGHT COMPARTMENTS FOR SALADS AND DESSERTS (NOTE COLD CARTRIDGE PARTIALLY EXTENDED AT TOP RIGHT). TWO LEFT COMPARTMENTS FOR HOT FOODS. TOP LIDS HOLD CONTAINERS OF BREAD, ETC. THREE HUNDRED MEAL CAPACITY.



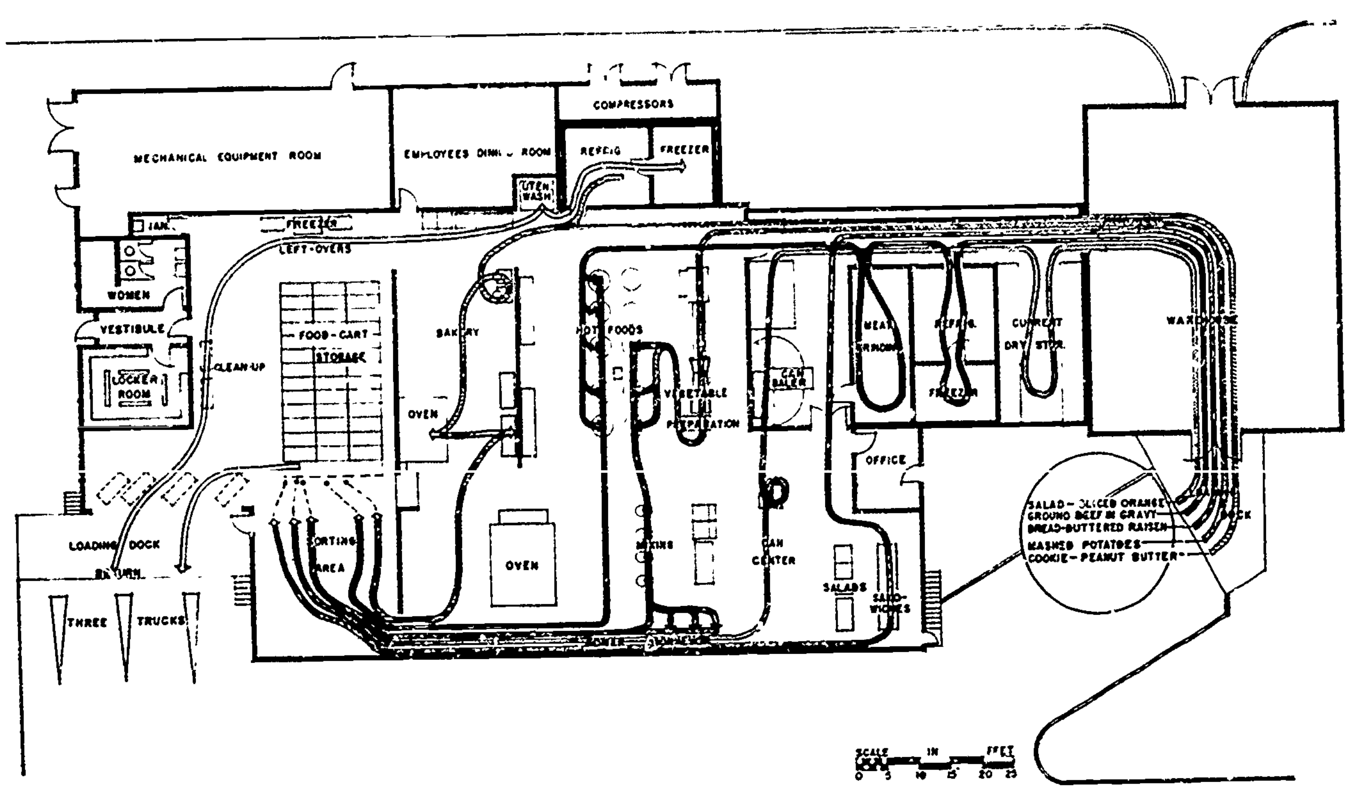


THE LOADING AREA. CARTS ARE HEATED FROM OVERHEAD ELECTRIC CABLES AND CHILLED BY DOLE PLATES.

A CART BEING LOADED ONTO A TRUCK FOR TRANSPORTATION TO AN INDIVIDUAL SCHOOL.

FOOD PUMP USED FOR TRANSFERRING HOT FOOD, SUCH AS SPAGHETTI WITH SAUCE, CHILI AND BEANS, BEEF STEW, ETC., FROM KETTLES TO SERVING PANS.

All photos are of the Central Kitchen of the Norwalk, Calif. School District. It is designed for the production of 10-12,000 lunches per day.



- no special dishes can be prepared for the teachers. But it must be remembered that the school lunch program is for the children and not for the faculty. The nutritious food is just as good for adults, who can get larger portions for a slightly higher price.
- many receiving schools have the same amount of equipment as regular kitchens. This fault lies in the planning.
- food is slopped in transportation. This has been remedied—carts are held rigidly in the trucks—items such as soup are no longer served
- children are unable to experience the appetizing odors of food and friendly attention of the individual school cafeteria. This is not exactly true, since these experiences occur at serving time under any circumstances.
- receiving schools over-order and left-over food is served as seconds or thrown out. This is a matter of planning. There is no justification for waste at any time.
- it is impossible to mass produce food and have it taste homemade. It is the duty of kitchen planners to avail themselves of all information regarding technological changes made in methods of production and in equipment. With proper supervision and care given to food production methods, the criticism given mass produced foods is not valid. It must be remembered that no two cooks or managers get the same results, and many children are penalized because of inferior cooking, which a central kitchen corrects.

OTHER METHODS

Are there any economical methods of cafeteria service other than central kitchens? In a large school district in California, *minimum marginal elementary school kitchens* were set up. In areas of approximately 800 square feet, the kitchen, storeroom, dish room, and serving line are included. 150 to 200 lunches are served daily, using the pre-assembled tray rack. This is simply a portable rack that is used just before meal time. Cold food, such as salad, dessert, juice, buttered bread, etc., is placed on each 10″ x 14″ compartmented plastic tray, together with silverware wrapped in a napkin. These trays are placed in the rack (48 in each rack) and wheeled to the serving counter. At meal time the hot entrée is placed on the counter. As each child passes the counter the attendant takes a tray from the rack with her left hand, dishes out the hot food with her right hand and passes the tray to the child, who picks up his carton of milk.

We have found that children can be served about as quickly as they can walk by the counter. When a double serving counter is used, we have clocked over 200 meals served in less than 5 minutes. This has proven to be so successful that other districts are using the same system. However, more supervision is required and managers are needed for each school.

In secondary schools the growing popularity of the *"square" or "scramble" system* has solved the problem of serving large numbers of children regularly. Students enter a square area, pick up their trays and silver from a table in the center of the space and serve themselves at their own leisure. Hot foods are served by cafeteria personnel—usually not more than 2 people. The square space is planned to accommodate 20 to 30 people and there are at least 4 cashiers. This permits rapid service and eliminates the long line of students waiting for others to make up their minds. The more cashiers, the faster the service. The area usually has 2 means of entrance controlled by turnstiles with electric push-buttons. There is, of course, a need for control at the peak periods of serving. There are a number of these installations, in the East, Northwest, and in Southern California, which have proved very satisfactory.

It should be pointed out that where a central kitchen is part of a secondary school, the scramble system is possible and completely satisfactory.

ECONOMY

The cost of building and equipping schools is increasing rapidly, with no end in sight. It is imperative that school officials demand full value for the expenditure of taxpayers' money. Many, if not most, school cafeterias are too elaborately built and over-equipped. Considering the fact that cafeterias are generally used for only one meal, the use of space and equipment must be justified. This can be done through the use of central kitchens, minimum sized kitchens with pre-assembled tray racks, "squares" in serving in secondary schools, or a possible combination of any of the three systems.

EDUCATIONAL THEATRE ARCHITECTURE*

By Eric Pawley, Research Secretary, American Institute of Architects

A MATTER OF DEFINITION

LIKE THE ARMY CHIEF OF STAFF referred to in Giraudoux's play *Siegfried* we cannot afford to have a wrong definition. He was a failure because he had a wrong definition of war—a pretty basic defect in his profession.

What is the definition or purpose of the educational theatre?

Those who believe they perceive a high mission for it can answer this question in many ways. There are some who look on the theatre first as a synthesis of arts and techniques of expression and communication. Others, with a psychiatric orientation, can see great benefit to troubled individuals who go thru the experience of role-playing. Those with a traditional educational bent realize the theatre's mission of transmitting to our age the rich treasures of the humanities thru study, performance, hearing and seeing of works of the past. Some few, with torches flaring against a dark and troubled background, look for individual contemporary messages and interpretations of and for our own times. Still others think of the educational theatre as vocational schooling—training for performance, production or writing for radio, television, motion pictures or stage. Perhaps too few see a long-range purpose in the creation of intelligent, receptive audiences of the future—a cultural tradition possibly best illustrated in history by the significance of the *Comedie Francaise* to the French—again possibly to too few French, today.

The methods and purposes of the theatre are delightfully presented in Giraudoux's one-act play *L'Impromptu de Paris* which takes place in Louis Jouvet's theatre with his own acting company as the cast explains—to a government official who crashes a rehearsal with news of a national theatre subsidy—just what the theatre is all about.

Jouvet himself left a thick notebook of agonizing attempts to communicate his deepest thoughts about his *metier*—sentences and paragraphs often written in early morning hours after performances in his own theatre in Paris, or on tour with his players in the provinces or during the war, in South America.

Both these examples deal primarily with the task of the actor—which others as well have tried to express and explain. We are concerned here specifically with the educational theatre—the purpose of which must be admitted to be bewilderingly protean. Like the sorcerer in many a folk and fairy tale—when grasped, it changes from repulsive old man to fluttering bird to squirming snake to flowing water to blazing fire to beautiful woman. The idea is to keep a firm hold—especially when it is a beautiful woman!

THE ARCHITECTURAL PROGRAM

A firm grasp on the idea of architecture for the theatre implies knowing the *program* for the building. These purposes, discussed above, are essentially program ideas and the first step toward a successful educational theatre facility—before any drawings are made—is a word-description of exactly what will be done in it—what your hopes are for your specific theatre in terms of staff and students, kinds of activities on stage and back-stage, seating capacity or demand, facilities for music, projection, lighting, scenery handling and/or production, acoustic demands, control spaces required, costumes, library, rehearsals, recording—the endless number of disciplines that interweave to produce theatre and make it such a fascinating fabric.

Before preparing this word-picture of working areas there are larger basic decisions to be made and stated in your program or educational specifications. Is a traditional proscenium stage going to fill your future needs and keep the interested student population high—high in numbers as well as high in inspiration? Will there be any work in the round? Will you need radio, television and/or motion picture studio facilities?

THEATRE & LANGUAGE STUDY

A most interesting possibility lies in combination of theatre with the language laboratory and the new approaches to high fidelity sound reproduction and visual analysis of speech and dialects—such as the research of the Haskins Laboratories supported by the Carnegie Corporation of New York.

Visible speech analysis has shown how we differentiate between and recognize words—how we tell "bat" from "pat" and "that." Patterns on sound-track have been studied and "hand-written" copies or simplifications played back to give speech and sounds without an audible human source. A report of this work notes that "By altering the pattern in slight and subtle ways, quality and accent can be changed in predictable fashion. Thus, the word *Alabama* can be given the characteristic drawl of a Southerner, or the (stressless) accent of a Frenchman. It is possible to work with any language, analyzing its characteristic modes of pronunciation and its dialects, and to compare with a new order of precision the various languages of the world." (1)

Equipment of laboratory quality for this research costs several thousand dollars—but undoubtedly simplified facilities of less precision could be developed for student use.

Such a combination of theatre and language-study has tremendous educational value for today because the first step in understanding other people is understanding their language well enough to realize that translations are imperfect. The classic example was the almost-fracas in the United Nations when a mild request, phrased in conventional French as *"nous demandons"* was clumsily interpreted as a most undiplomatic "we demand!"

**a paper presented before a sectional meeting of the American Educational Theatre Association convention Boston 28 August 1957 (revised)*

Such rewarding study will require language-laboratory facilities, with tape-recorders, listening-recording booths and library, perhaps storage for portable equipment for supplementary classroom use and by all means mirrors for study of gesture—the American's weakest expression.

MULTI-PURPOSE

The current fanaticism for low costs in school buildings—make 'em cheap but our children are priceless—has loaded us with multi-purpose rooms. Some of these cafetoriums, gymnassemblies, auditerias and audinasiums are the kind of illegitimate offspring you might expect—others are adequate—but they are always design compromises. Our question should be: Can we afford *them?*

This is by no means a new problem as some younger teachers might believe if they are familiar only with current publications. In 1938 Alice Barrows of the US Office of Education wrote an article entitled *"The combined auditorium-gymnasium: The Dr. Jekyll and Mr. Hyde of the school building."* (2) With the technical help of Lee Simonson she also wrote a constructive and pioneering 50 page pamphlet on the subject—now out-of-print—with (in 1939) natural emphasis on proscenium theatre planning. (3)

Another, much neglected aspect is pointed out by R. N. Lane, acoustical consultant, as follows:

> ". . . The *cafetorium* has recently come into general use in modern schools. From an architectural acoustics standpoint this is a very regrettable marriage between a cafeteria and an auditorium; experience has shown that the design of this particular type of room is usually based more upon cafeteria requirements than upon auditorium requirements and that, consequently, the rooms should be treated from the noise control rather than the architectural standpoint. It is recommended, therefore, that as much absorptive material be used in a cafetorium as possible so that the clatter of the dishes will be somewhat reduced and the conversation of 600 to 1000 students will not become acoustically overpowering. Since cafetoriums invariably have low ceilings and improper layout for a good auditorium, it is impossible to treat them for excellent hearing. Therefore, the acoustical treatment affording the maximum noise control is recommended, along with a good public-address system to enable people to hear at meetings held there." (4)

Hardly good conditions for theatre use.

COSTS

Incidentally, on the matter of costs. it was illuminating to hear a school superintendent report recently that a 14-room elementary school cost about the same as *one-half-mile* of highway and that for the cost of 10 miles of road he could build his whole school system! Apparently all we need is the same pressure for adequate schools that we've had for roads . . . and we'd better generate it or there may be more stop-signs—and they may read "NYET!"

SLOPING FLOORS

It may be doubted that our generation will see, in average secondary schools, general construction of sloping-floor theatres. 22 years ago I wrote a brief plea for them and for special visual education rooms for optimum projection quality—seating about 125. (5) The VE people now prefer to take it to the classroom and fuss about getting the room dark enough.

There are serious visual obstructions for an audience on a flat floor and considerable data has been published on this problem of vertical sight-lines and the correlative one of horizontal sight-lines. (6) I suppose we could theorize about comparative values of individual empathy at a performance contrasted with feeling the one-of-the-group insistence imposed by seeing everything with other heads in the way! You know—togetherness!—let's leave it at that.

Perhaps we need to rethink the whole idea of theatre form and seating—the concept of the window-stage—and become multi dimensional. There seems no reason why (except for basketball practice—if that has priority in your educational system) no reason why a gymnasium cannot be arranged for arena or multi-form staging. (7) (I know, I just blasted away at multi-purpose.) Is the proscenium stage obsolete—with or without adequate wings and stage-tower? I should not be surprised if we soon find it so.

I should like to see some arena-stage-lighting studies directed toward development of a simple, safe, frame which could be flown like a flat cloud in any space of adequate ceiling height and do the job of lighting an acting area.

What seems not to be generally recognized is that the proscenium automatically trails along with it a host of fire and building regulations embedded in hard-to-change codes, some of which go back to candle-footlights and explosive scenery.

There should also be study of movable seating and riser platforms to develop a non-creaking design.

THREE OR MORE DIMENSIONS

From an anthropological point of view it may be regression to go from the abstraction of two dimensions of the window-stage back to three—but moving on to four dimensions (or more) with space-time considerations and others, we enrich experience—but make completely satisfying esthetic results *very* difficult! It's a dilemma with really sharp horns but students and audiences composed of parents are possibly less critical of some of these values.

THE LARGER TEACHING FACILITY

Still another trend related to the multi-purpose idea (but an improvement) is the introduction of a larger unit in a teaching facility, variously called "Room A," "General Education Laboratory" or "Learnings Laboratory." (8) These are rooms perhaps three times the size of an ordinary classroom in which many individual and group projects go on simultaneously. Such rooms often include a platform for oral and dramatic presentation. One example of this type I have seen is part of a 5-year experiment in educational television—supported by the Fund for the Advancement of Education and by industry thru RETMA (Radio, Electronics and Television Manufacturers Association).

Elementary classrooms also

have made provision for oral and visual presentation by a low platform, as in Salem Avenue Elementary, Hagerstown, Md. (McLeod & Ferrara, AIA). Foster Senior High School in Seattle (Ralph Burkhard, AIA) has small curtains on diagonal ceiling tracks to create detached areas in the classroom.

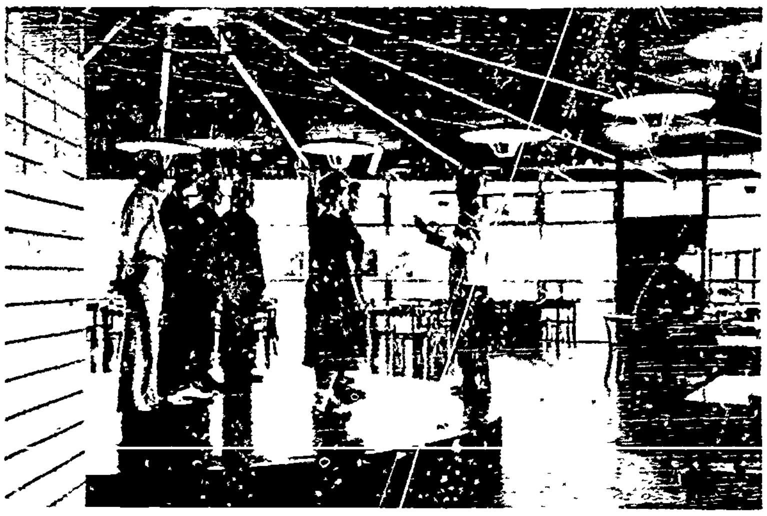
SPECIAL FORMS

Architects and engineers have been designing roof shapes of multi-folded plate and curving shell construction which are of great formal and structural interest. The recent Danish competition-winner for an Australian opera house is a particularly exciting example. (9)

A logical development of these for warm climates or summer use is the play-shed. We have illustrated two Texas schools by Caudill, Rowlett & Scott Associates which suggest this type of structure. One problem of the school play-shed is that the central area should be used for focus or acting area in daytime rather than an open end to avoid working against the light.

THE ARCHITECT'S CONTRIBUTION

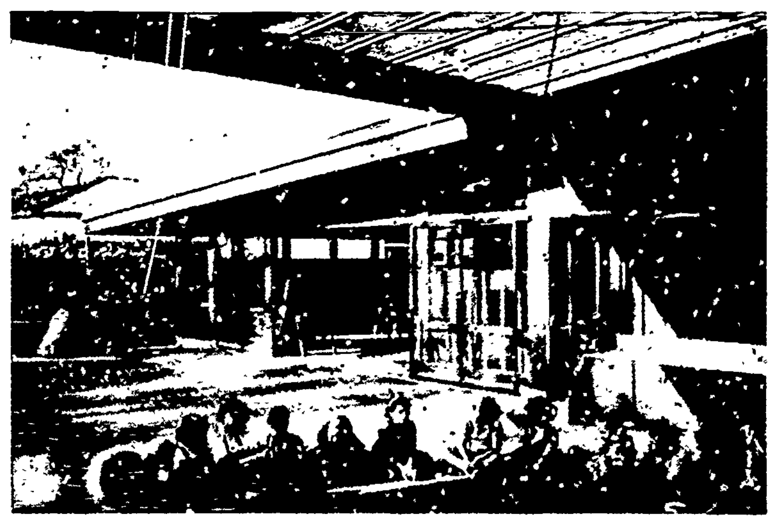
Years ago among the early productions of Bauhaus design pioneering in Germany the architect Walter Gropius proposed what he called a *Totaltheater*, an elaborately mechanized multi-form space which was never built. About 1900 several great German theatres were built to designs by the architect Max Littmann which technically have rarely been surpassed. (by *technically* I mean in adequacy of stage and production areas and in audience sightlines.) There are architects today who knew this field and others who can do an excellent job of translating a good program into a specialized building without former experience with that particular building type. There are perhaps a few whose work has been a challenge and stimulus to the best thinking education has been able to muster. There is no question but that the best architects have always made major contributions to education in their work and a few educators are beginning to see the educational importance of architectural values.



WILSON JHS MECKLENBURG CITY NC — CAFETERIA
A. G. ODELL JR, FAIA

SO HAGERSTOWN HS MD — GENERAL EDUCATION LAB
MCLEOD & FERRARA, AIA

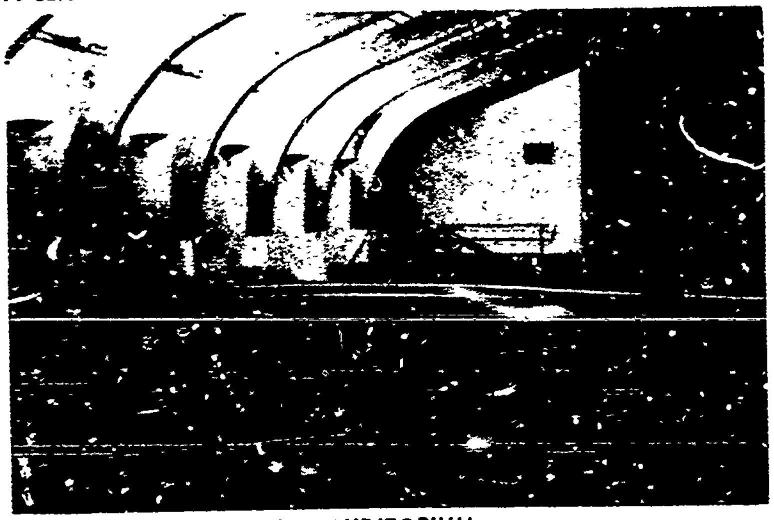
WHITE OAKS ELEMENTARY
IDEAL INDOOR-OUTDOOR PRESENTATION SPACES



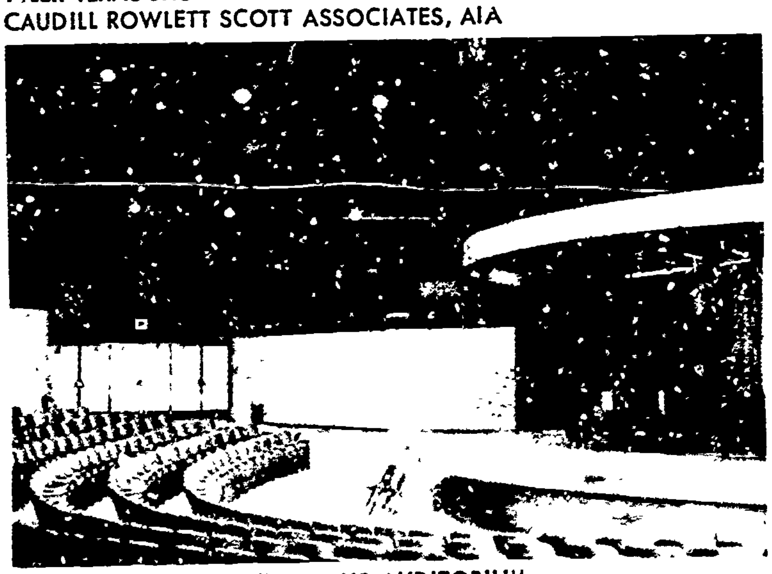
WHITE OAKS ELEMENTARY
JOHN WARNECKE, AIA

Photos this page supplied by architects

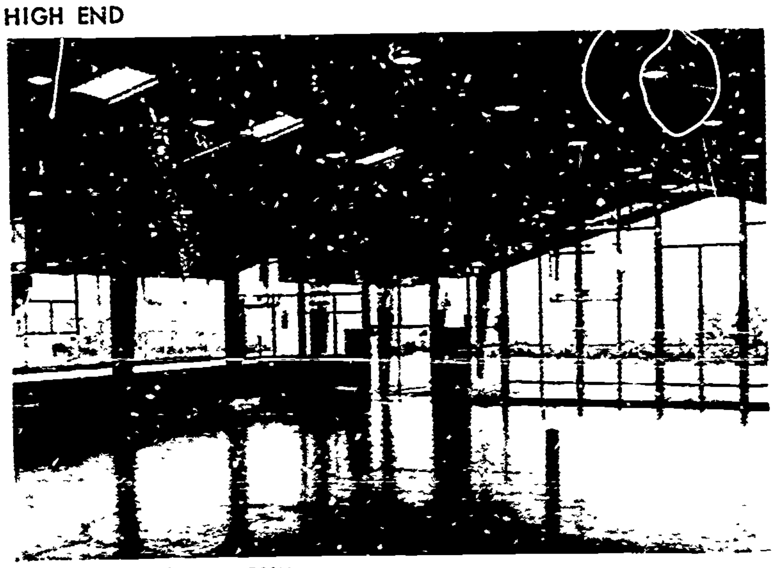

SO SAN FRANCISCO HS — AUDITORIUM
A SEPARATE STRUCTURE

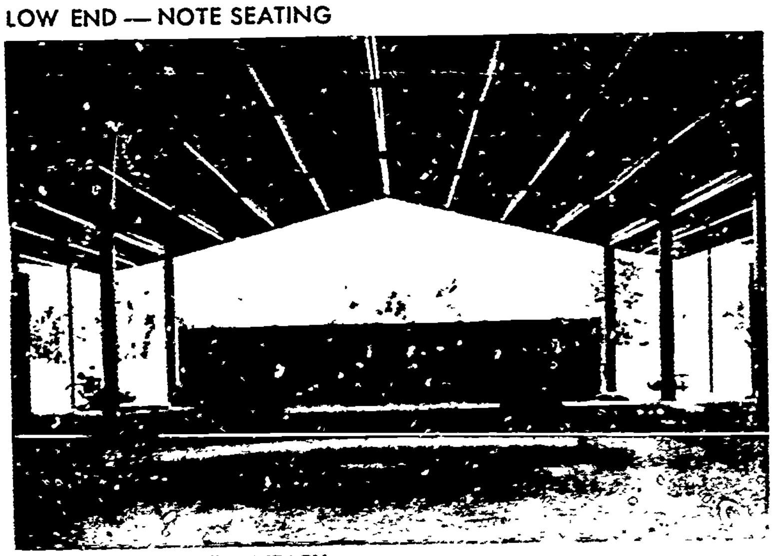

SO SAN FRANCISCO HS — AUDITORIUM
JOHN LYON REID PARTNERS, FAIA

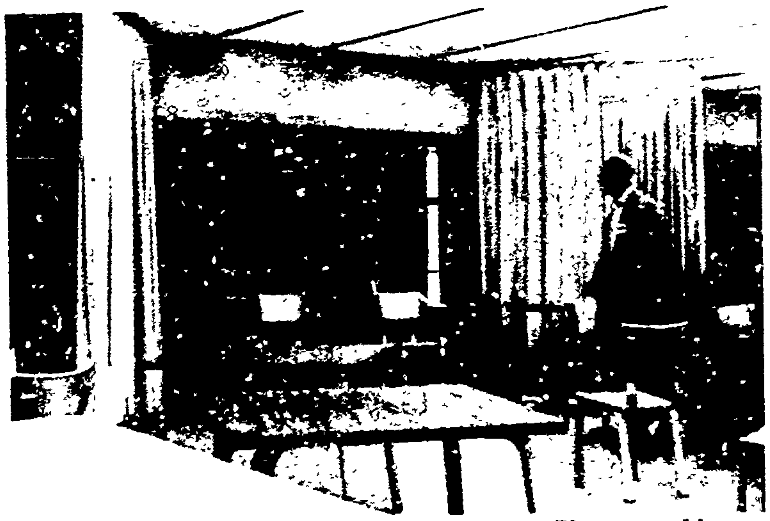

TYLER TEXAS JHS — GYM
CAUDILL ROWLETT SCOTT ASSOCIATES, AIA


COLLEGE STATION TEXAS — HS AUDITORIUM
CAUDILL ROWLETT SCOTT ASSOCIATES, AIA


TYLER TEXAS JHS — GYM
HIGH END


TYLER TEXAS JHS — GYM
LOW END — NOTE SEATING


LIBERTY TEXAS ELEMENTARY
CAUDILL ROWLETT SCOTT ASSOCIATES, AIA


FOSTER JHS CLASSROOM CURTAINS
RALPH BURKHARD, AIA

Photos on this page by Eric Pawley

More often the dramatics teacher concerned about a new school building project finds himself isolated from building program preparation and frustrated by indifference of administrators, school board, parents or legislators who view educational theatre as beyond the call of duty in education "in these times when schools cost so much . . ." Experience has proved otherwise and a good small theatre (not a cafetorium or a monster auditorium!) has been found one of the most useful and most-in-demand spaces in a school.

PROJECTION

Proper sight-lines for viewing screen projection have been an enormous influence on theatre shape. Persons interested in immediacy of dramatic effects and rapport between actor and viewer can talk all they want to about 180° or 200° seating surrounding the presentation area. For optimum projection-viewing, seats should never lie beyond diagonals drawn from opposite sides of screen at 50°. This results in approximately 80° seating and is, and should be, a major determinant of seating plan in any space for viewing projection. The question is whether a window is for both air and vision. Progressive architectural design often prefers a fixed window. Perhaps school people will some day realize that this multi-purpose combination is as wrong (for full audience) as the others.

SIZE OF AUDIENCE

The question of size is very important. It is commonly held that optimum audience for dramatic presentation is considerably less than 600. Literally, it's a far cry from the great-voice-tradition which is about to atrophy under electronic pampering anyway . . . But *must* the space be used for full student-body assemblies and a full graduation class on stage?

The use of the school theatre facility by the community is often advanced as justification but we find Frank Lopez, AIA, a former senior editor of the *Architectural Record*, distinguished for his thoughtful comment on school building problems, writing:

". . . another reason our school buildings lack the ultimate in stature may lie in our insistence on . . . premises which time may prove false . . . almost all our schools are so consciously oriented toward the community as a whole that the most important occupant, the child, finds his building compromised in some respect . . .

". . . In tying the school to the community so closely what have we gained for what we've lost? For we have lost in the process; the gymnasium built primarily to satisfy a community's lust for basketball costs enough to raise more than a suspicion that something somewhere else in the school was sacrificed to make the gym possible. An auditorium as a teaching instrument is one thing; as a 'little' theatre for adult use it is quite another, and apt to be just as expensive as the gymnasium, to raise just the same suspicion.

"Not that we advocate abolishing such school elements! However, when construction costs so much is it not wise to examine every item in the program with a jaundiced eye? Perhaps—and we know of several instances—the gym, the swimming pool, the community theater can be secured through the cooperation of another civic department, a private agency, a fund raised for the specific purpose. All these methods have been used. Sometimes the special-purpose structure is integrated with the school, sometimes the two are divorced." (10)

THE LITTLE SCHOOL IDEA

The General Education Laboratory idea mentioned has another corollary—rather poorly termed the "little school" concept—which should be of great importance to teachers of the educational theatre. This idea effectively breaks down the monster 2000-pupil school into 4 little schools of 500 each, sharing certain common facilities but with opportunities for 4 groups instead of one major team for sports and one cast for plays. Instead of a favored few being able to star in leading parts—four times as many can have this important achievement of a worthy objective. How much promising material has been rather blighted by the early discouraging experience of never getting a major part. Just think—four Juliets—four Mercutios! A dramatics teacher might prefer four different plays, of course, but the way statistics on juvenile delinquency are going, you'll probably end up with four squeaking Lady Macbeths!

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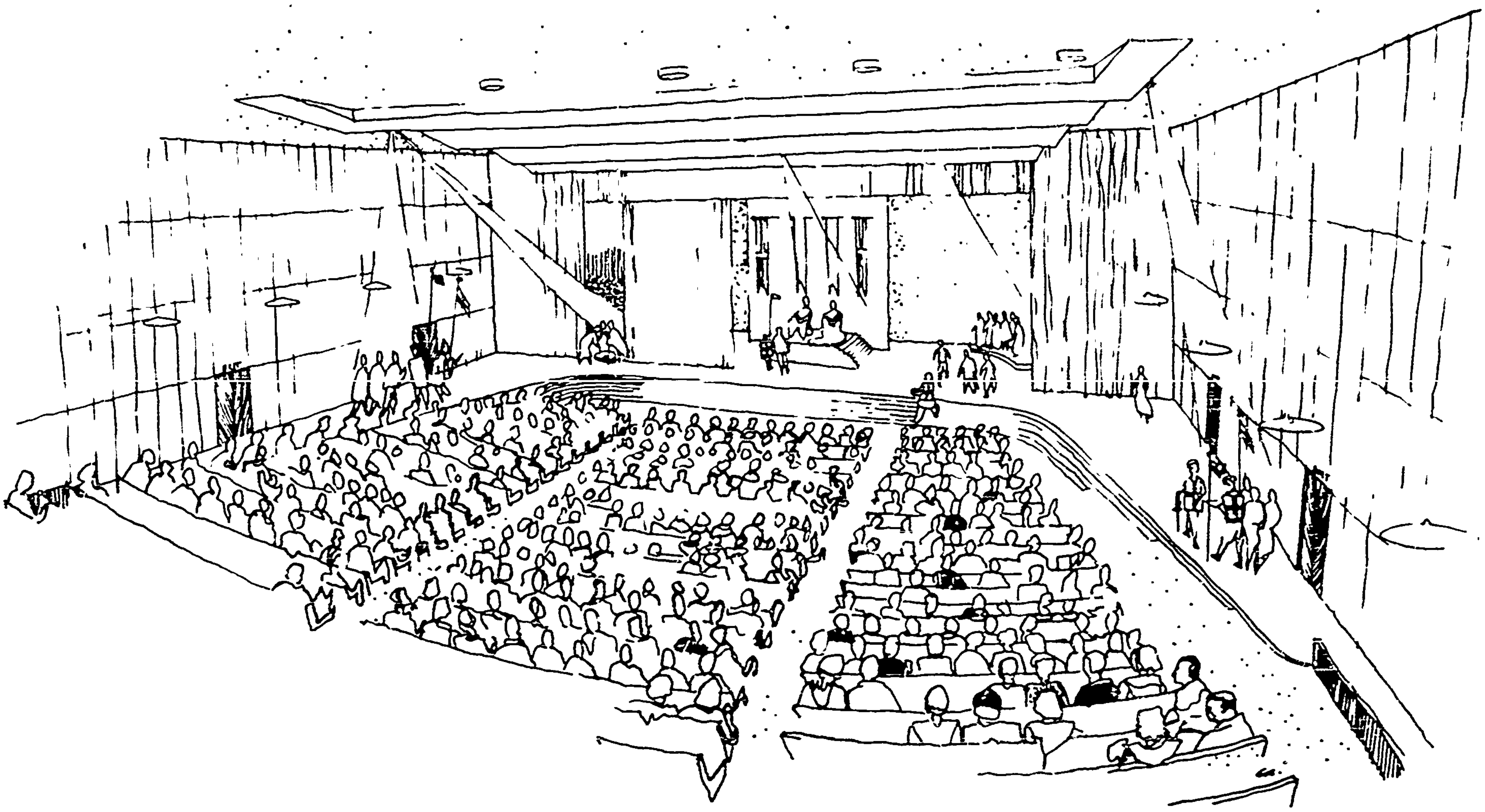


DESIGN SKETCH FOR AUDITORIUM (1000 SEATS) SHOWING FLEXIBLE SIDE-STAGES FROM *HIGH SCHOOLS TODAY AND TOMORROW*, BY CHARLES W. BURSCH AND JOHN LYON REID, FAIA (REINHOLD 1957), AN EXCELLENT NEW BOOK.

A HAT IN THE RING

by William M. Davis, American Educational Theatre Association (AETA)

This is first of a new series of School Plant Studies to be devoted to the educational theater, contributed to us by members of AETA. It is a general introduction to school theatre planning to be followed by other studies of special areas and features. This welcome collaboration is typical of work being done for the Institute by the AIA Committee on School Buildings and Educational Facilities in its liaison program with other organizations.

Mr. Davis, after several years work with an arena stage (which, with the tone of his comments, suggested the title of this paper), is now back with a traditional proscenium theatre.

IN NOVEMBER OF 1933 I began to work on a play for college production. Now as I write this it is 25 years and about 200 productions later. *Not once* in all that time has an architect ever asked for my advice or opinions on how a theatre might be planned so that it would function efficiently, economically, and put on technically excellent productions. I mention this because it is not the exception but the general experience of members of AETA, teachers in this field.

The *owners* may have told you they were satisfied—you have to please them. But why are most theatres in America so poorly planned? So difficult to work in? So wasteful of money, time and effort? Technical directors, scene-designers, light designers, costume-designers, carpenters, electricians, seamstresses have to work in cramped quarters. They throw away scenery because there is no place to store it. They vote against fine plays because they require more than two sets and there is not enough off-stage space to stack furniture and scenery. (Ed: Actors are different—in school at least they are so hopped up, starry-eyed and full of lines that little else matters!)

FUNCTIONALISM

In planning a house who would place a bedroom between dining room and kitchen? It isn't functional—which is to say, it *will* work, but how awkwardly! We have plenty of theatres planned this way. Would you plan a bedroom or dressing room in a house without closets? There are literally hundreds of theatres in this country (mostly high-school) with no space whatever for storage of costumes. This means that costumes must be rented, which costs money. How many of you have ever talked with someone who has designed or made costumes for plays? I mean the people who know the areas and dimensions required—know them because they work there because they turn out costumes in these rooms. Your answer most probably applies to all the other practical workers in the theatre: the stage crews in dungarees who must cope with conditions imposed on them by their buildings.

THREE PROBLEMS

Let me list those things which are out of the control of everyone: architects and technicians alike. 1st—not enough money. 2nd—a poor plot of land to build on. 3rd—a board of trustees, or similar group, who labor under the impression that if the theatre is imposing on the outside, it is obviously excellent backstage. (None of these people has ever been backstage.) One or more of these three things have spoiled hundreds of theatres, but I believe that only the second reason (poor site) is beyond any hope.

Not enough money: Here things can be improved over a long term by making sure that what money is available goes into construction, not equipment, and *especially not into interior decoration.* To change the plan of a building after it is up can be pretty expensive, so it is much better to build it right in the first place. Buy the wood paneling later.

The *site* may be chosen before the architect enters the picture—if this should not be the case, even the general outlines of the proposed building will indicate what sort of plot is needed.

An ignorant *donor or board* of overseers: This is really tough. I have in mind a university which was left a large sum to be applied toward construction of a new theatre—with one string attached. It must have a gold dome. Now, there is no doubt that this will certainly be a glittering shrine of the drama—but *domes* —all this glisten will NOT be gold in the mind of the electrician who must worm his way on his stomach, across 2x4 scaffolding above the auditorium ceiling under that stupid dome framing, pulling a spotlight with him to attach to the front lighting set-up—and then go back and make the same trip again with cable to hook it up to an outlet. This sort of thing can take as much as half an hour instead of ten minutes. This is a 200% increase in work time and when multiplied thruout the building, it is easy to see why all the available time is used up just accomplishing basic tasks. The building was not planned with the realization that such work was going to be done.

PEOPLE WHO KNOW

Everyone who has not had to cope with tiny offstage spaces or obsolete lighting setups believes that form (in the esthetic sense) is more important. If function does enter their minds it refers to the size of the lobby (and its decorations), rugs in the aisles, wall hangings, and of course, wood-paneled offices. There will be several bronze plaques imbedded in the lobby—too bad the money ran out before we could get all the lighting instruments you said you wanted but why is it so dark on stage?

If the front offices are Elizabethan for some reason it follows that the scene construction crews will be able to build excellent sets (wherever they do that sort of thing). In the rare cases where someone does remember that a crew exists and does ask them—their suggestions are scrapped because they just don't rate an Elizabethan office and besides there's paint on their jeans. Just the same, loud and critical static is heard when the crew cannot do as well as expected after they have been handed this brand new building. A solid gold Cadillac is a splendid looking item—but it won't run. No one remembered to ask the mechanic what his years of work on motors told him about the suitability of gold piston rings. I suggest that more grimy workers be consulted. The trustees may still want this area omitted or that one changed but at least they should meet people who can say, "Look, I've actually done this kind of work, I've budgeted and spent management money on it, and I know your suggestion will slow down production. You can incorporate it if you wish, you certainly will get poorer players and poorer educational results."

How can we m... the front-office people in a university or highschool understand that there are teachers back-stage endeavoring to produce *educational* theatre and inculcate in students good habits of thought and practice? There are several ways:

- **you can say so**
- **you can consult these people—when suggestions are made that appear to be to their detriment you can point out that they say they require something else**
- **you can request that designers and technicians attend meetings at which plans are discussed**
- **you can suggest that a theatre consultant be retained**
- **you can retain him yourself**
- **you can look at some good and bad examples of theatre architecture in your region**

Let me say a word or two about these examples. Unless you worked in dramatics in college you will not know a good backstage layout from a bad one. The solution is simple. Ask the people that you find *working* back there. Don't ask the school or building superintendent—ask the harassed English teacher. He'll tell you—plenty, I expect. Explain who you are and what you want and I'll guarantee he'll give you all the time you want, all the help you want, free. The advice you need is close by, as near as the nearest college or civic theatre—and in many highschools as well. We must have good facilities to teach well.

BASIC REQUIREMENTS

These are not necessarily in order of importance but they are items that will help to produce economical and effective plays. They will allow for teaching theatre as well as the college says it is taught!

Storage space: Scenery, costumes, furniture and hand properties, lighting and sound equipment all have to be kept somewhere. The stage IS NOT A STORAGE SPACE. That area is used for performances. Some other place must be provided and this storage space is needed in order to save time and to save money. You do not have to lay out cash for materials to build a flat if the flat already exists. You do not have to take several hours to build and cover a flat if the flat already exists. Economy, plain and simple. And it follows that you then have free time and money to produce better shows, to spend for educational values.

This storage space must be in the *same building* as the shop and stage. By chance as I write this, it is raining outside. Providentially I have not scheduled crew trips across the college campus where I work to the dormitory basement where our furniture is kept. Upholstered furniture and newly painted scenery do not go out in the rain. It takes longer to make these trips than to move from one room to another. Economy of time again. If a truck is hired—more money is spent and trucks are not available at any time of the night or day, seven days a week. (This indicates that technicians work seven days a week: they certainly do—they have to overcome limitations of their theatre!) The same situation occurs when the play is over and various items are being returned to storage.

The storage areas must be of the *right shape*. Most important item to note here is that for costumes, properties, and lighting equipment, the ceiling does not have to be higher than 8′—you cannot lift items higher than that. For scenery—and please note my change in wording—there does not need to be more than 12′ of *clear space*. 10′ is often quite satisfactory. Be sure that doors are large enough and in right places so that items which are supposed to be stored can be brought in and taken out. Even foam rubber sofas have too many bones to bend around sharp corners.

Storage areas of the *right size*. The size of furniture and hand property storage can be dismissed in a word: infinite. Provide as much as you can. Lighting and sound equipment storage can be quite small because most instruments are left in place on the stage. Equipment and accessories are put in the light-storage room.

Costumes have a basic section module of 6′x6′. This provides for the width of a row of costumes, plus a wide aisle, sufficient to move down with your arms full, and it is high enough so that long costumes will not drag on the floor. In addition to the racks, there must be plenty of rooms for accessory storage: belts, stockings, feather boas, and usable scraps of all kinds.

There is usually a maximum size desired for *scenery* storage, but it depends on the theatre program and the preferences of the scene technician so that it is not practical here to give comparative sizes. In any case, it probably won't be large enough; it never is.

Accommodations for those *people* who work on a play—*actors*, for one group: A dressing room is not just a small room. It is specially planned for the special operations that happen in it. It has specific dimensions, depending on how many people will use it. It has a sink, to help wash off makeup. It has ventilation, and this is important, for acting in makeup is a sticky, sweaty business. Dressing rooms should either have windows opening to the outside or mechanical ventilation. Ask *any* actor.

Crew members, for another group—they need lockers to keep their street clothes in while they are working. They need showers to wash off the dirt they acquire. They need a room in which to change their clothes. In addition, in colleges and universities, they need a room to study in during the long periods of waiting in the evenings. There will be classes tomorrow.

Adequate *access* to the theatre for trucks and materials. This is particularly important if touring companies go out, or if outside groups come in. Can a tractor-trailer full of scenery, lights, and costume trunks back up to the stage door and unload at a proper dock? Remember, this operation must be scheduled weeks in advance and cannot be postponed because of poor weather. Can 16′ lumber be brought directly to the shop without going thru the auditorium? Can rubbish be removed from the shop without rolling or trucking cans thru a classroom?

Be sure the plans for the *shop* show plenty of clear wall space. A good shop should have an aggregate of 50′ of blank wall—it can be in several sections. This is needed to lean scenery against, and a scene-unit can be 20′ long. Also, a power saw requires, for the most efficient operation, a clear wall space of 24′. This will enable it to handle lumber up to 16′ long.

When planning various hanging positions for *lighting instruments*, be sure you have also planned so that electrician can get to them, and once there can adjust them. Final focusing must be done with instrument in place and it is nearly impossible to train Brazilian snakes to do this job. I have several times put on plays in a highschool theatre where only access to auditorium lights was by scaling a ventilating tunnel, walking across a small beam and finally going head first thru a small hole not more than 12″ x 18″. A New England college that I know of has an access shaft to the beam lights so small that the larger students cannot go up. Once arrived at a lighting position, workers must be positioned securely enough so that they can use both hands to work instruments.

MULTI-PURPOSE AUDITORIUMS

Be careful with auditoriums which, "of course" will have provision for movies (or TV). Multipurpose auditoriums may be an economic necessity but the purchasers of such edifices are not getting two-for-the-price-of-one. They are getting about one and two-thirds. And it is always the theatre which is the two-thirds. Movie projection is a precision operation: projector and screen both must be located in fixed spots and kept there. Theatre operations have to work around them. Extra work is involved in taking down sets and putting them back up so that movies can be given. I think that no-one ever cancelled a movie because there was a set on stage. Down it comes. Roughly speaking, I would estimate that when a movie set-up is included in plans for a theatre, about one play less per year can be produced because of time lost in working around the movies. Backstage facilities are also cut down. None of this can be avoided in this pernicious combination but it is important that school committees realize it. Two different types of entertainment cannot occupy the same place at the same time.

REHEARSAL ROOM — ORCHESTRA PIT

A new college theatre often means an upturn in theatrical activities. Often two shows will be working at the same time. The second will be working in a *rehearsal room*—a definite need. Dimensions are obvious and standard: 4′ larger than acting area of stage. This is so actors can be offstage, so to speak, and so that director will not be encroaching on areas that actors must move thru. Since there is often shouting in a play, the rehearsal room should be some distance away from the stage.

If an *orchestra pit* is planned, the number of musicians that it will hold must be made quite clear to the board of trustees. And there must be access to it. I know, I know, *of course*, there will be access! Fine—have you remembered that a piano must be moved in and out of the pit? Did you know that double-bass viols cost up to $5000, so that they are not casually bumped along behind the player? How many of you have ever handled that most awkward of all instrument cases—a harp case?

THE IMPORTANT DIMENSION

Preliminary planning of the theatre includes a decision on how many people the auditorium will accommodate. This figure is arrived at by estimating the number that will come to all performances of one production, and then dividing by the number of performances. Auditorium capacity and depth available for seating are two determinants of the width of the proscenium. Now here is the important item: This width, this distance, is the first concrete dimension that can be put on paper. It is the first cause, to borrow a phrase from philosophy. The rest of the entire building devolves from this dimension.

So help me, if you do not start with this particular dimension, you're just wasting your time. Sooner or later you will arrive at that point, of course, and then you will find that much of what you have already done is thrown out of whack, and you have to do it all over again. Begin at the beginning: the proscenium. It affects the entire structure.

Backstage Isn't Backstage Anymore

by **Edward C. Cole** *Yale School of Drama*

Adapted from a paper delivered at AETA Convention, December 1959

The process of designing a theatre often starts with a plot of ground, an over-all budget figure, and a vague notion that there should be a stage, an auditorium and a lobby. Sometimes there is a program of required rooms and equipment. Even when the bill of particulars is pretty thoroughly drawn there is often no real comprehension of the variations which are possible in stage and auditorium and in relationships between the two.

Sometimes, even, the school or college theatre is designed without bringing the theatre worker (the director of drama, or the department head) into the councils and the planning sessions. Sometimes, in state or municipal buildings, there is a complex hierarchial chain of command which keeps the architect at much more than hailing distance from the persons who are going to use the theatre. Sometimes existing theatres are used as prototypes and copied without adequate investigation of their good and bad features.

Sometimes architects are given, or must compile, bills of requirements drawn from reference manuals that are either incomplete or archaic.

All too often the design of the exterior of the building dominates interior shape and arrangement with the result that operation of the building as a theatre is either difficult or impossible.

Architecture or sculpture?

There seems to be current among "name" architects a compulsion to create forms which are startling. Witness the church in the shape of a fish in Stamford, Connecticut, the hockey rink in the form of a brontosaurus in New Haven, and the auditorium in the shape of an eighth-sphere in Cambridge. One cannot dispute motives without knowledge of the situation; one can and must, charitably and in fairness, recognize the right and duty of the architect honestly to arrive at the appropriate form for the buildings which he designs. If the accomplishment of a particular external expression in a building derives from careful consideration of the uses of the building and at least does not interfere with the uses of the building there can be no complaint; but when, as has been the case in more than one instance, the predetermined external shape has cramped, compressed, distorted and hindered the operations within the building, there is basis for objection.

Sophistication

A theatre is a complex building. It has several component spaces which are organically related one to another and the relationships are surrounded with a set of variable values which by their variability in different situations make impossible the establishment of a set of fixed specifications as to size, shape and arrangement. The final sizes, shapes and arrangements must be evolved by the adjustment of the fundamental relationships in consideration of the factors in each particular situation. A thorough knowledge of theatre practices is necessary, but other knowledge is also necessary; the status of theatre in a particular community must be evaluated, the stage of development of those who will operate the theatre both presently and in the future, their "theatre-readiness," must be appraised, their readiness to progress from one level of production to a higher, more sophisticated level. It avails little to place at the disposal of a producing group a highly experimental theatre form when their, and their audiences', theatre sophistication is not capable of using or appreciating it. This reasoning extends also to elaboration of staging equipment, lighting equipment and other facilities.

The Origin

The place where the design of a theatre starts is where the audience and the performance confront each other. The design works outward from that point in all directions, logically and methodically, according to requirements, until the outside walls and roof are reached and positioned.

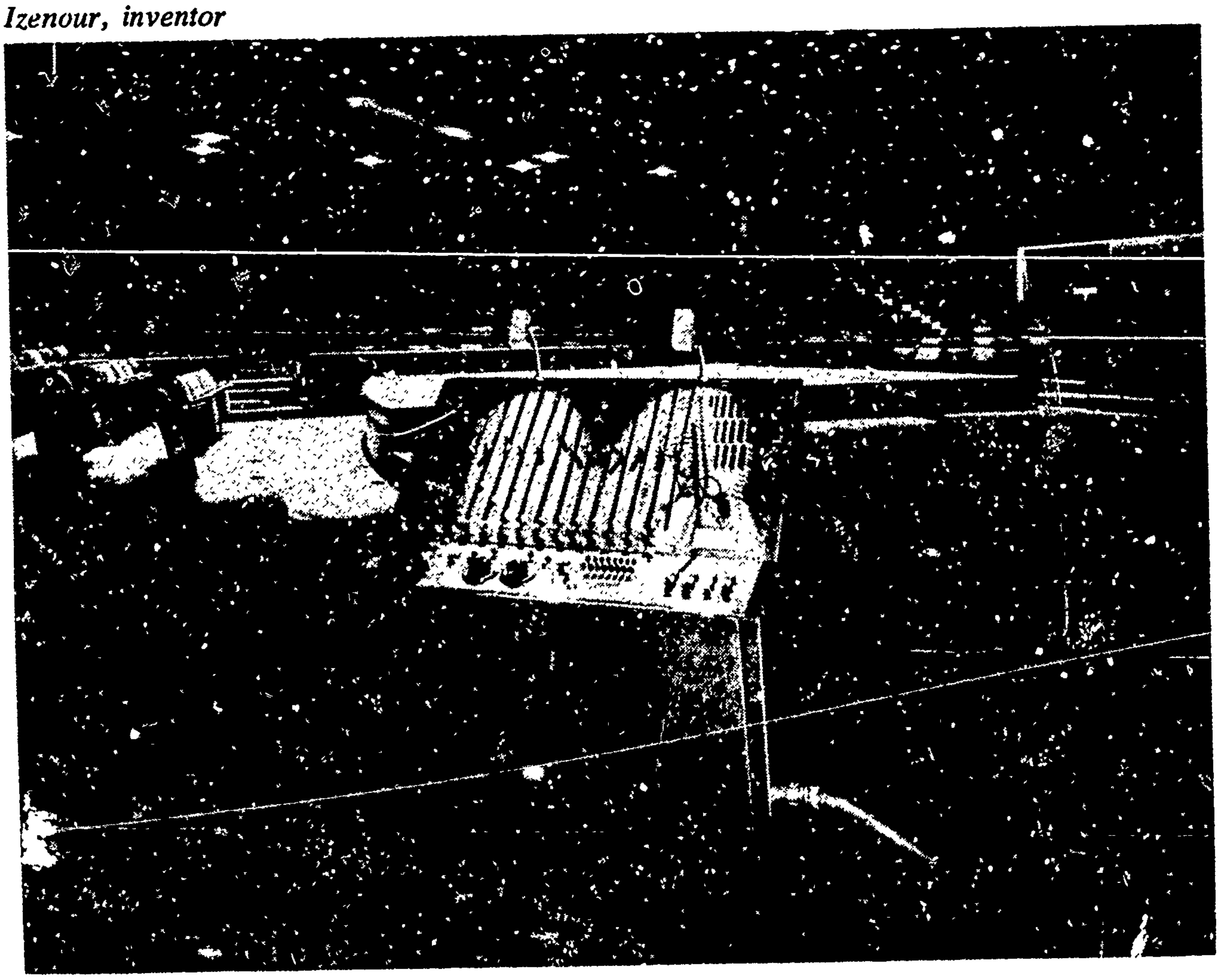
Viewpoints

The fundamental decision is the one regarding the audience-performance relationship. It must be decided whether the audience shall be seated all on one side of the performance and look in one direction at the performance, or whether the performance shall surround or partially surround the audience, or indeed whether these various arrangements shall exist in varying degrees at different times.

Backstage isn't backstage anymore

The rigid separation of audience from performance which has existed in the theatre until recently is breaking down in various ways. The performance elements, the

Photo at left: Console-controlled electric motors across rear wall of stage above gridiron. Below: SceneControl console in Loeb Drama Center—Hugh Stubbins & Associates, Inc, Architects. (Clancy's SceneControl), J. R. Clancy Inc—U. S. Patent #2,942,879. George C. Izenour, inventor



backstage elements, are not staying backstage. Most obviously the action is bursting thru the proscenium onto side stages or forestages, and denying the proscenium entirely in the arena form. In one amusing production of a farce an actor stuck his head through the ceiling lighting slot and uttered some lines. It was that kind of play and the action was effective. Actors have entered from orchestra pits, down aisles, even through tunnels under the seating banks.

Now as the actor departs from the area within the proscenium, he leaves behind him a number of devices which traditionally have aided him in his performance: Act curtain, scenery and scenery-handling devices, wings for entrances, trapped stage floor, adjustable levels and a variety of lighting positions. The purposes of backstage equipment are to set up, to operate, and to change production aids which the playwright and director call for, which the designer supplies and which the actor uses—the changing productional environment of the actor. When the actor leaves this changeable and changing environment of backstage and goes into the spaces in, or around, the audience, he enters an environment which to date has been changeable only within narrow limits and with difficulty. In an unchanging environment the actor is not only not helped in the execution of his art, he is hindered by the very sameness of the fixed forms. Monotony may set in and with it boredom, the anathema of theatre art.

Why the new forms?

It is in part boredom with the fixed form of the proscenium theatre, despite flexible backstage facilities, which has motivated the revolt against it. But in executing this revolt the revolutionaries have not added positive values to balance those lost productional values which reside in the abandoned backstage area. Not yet, that is. And here lies the challenge: Here lies in fact the 20th century contribution to the form of the theatre: To retain the positive productional values of the proscenium theatre's backstage area and to provide for the actor a changeable environment in the other areas into which advanced production styles are taking him: The forestage, the side stages, the arena stage. The changeability of the backstage area must be made to extend to these other areas.

The challenge

Even if the performance is in an *avant garde* style which denies the validity of representational scenery, the forms which surround the actor and upon which he moves must be variable to be most effective. The very differences in the moods between and within plays, the scales of the action, the styles of performance, the emotional tonality of the subject matter, demand differences in forms: From light to heavy, from massive to delicate, from horizontal to vertical to angular, from ordered to jumbled, from symmetrical to irregular.

The answer to the challenge seems to lie in the movement of parts of the theatre itself; adjustable forestages, sidestages, arena stages, wall panels, ceiling panels. This is not a new idea. Gropius' *Total-Theater* is only one of many projects which have attained respectable positions in theatre history. What is new, and this is the third point, is that technological developments, mostly outside the theatre, have been placed at our disposal; the devices to make these changes possible. Until now we have not had devices with sufficient subtlety, or "sophistication" as the engineers say, to perform the movements silently and with infinite variability accompanied by precision and dependability, and controllable remotely thru analogs, telemeters and amplifiers, so that minute movements by an operator may guide the movements of large heavy objects with speed changes and precise positioning as desired. If we want to raise and lower sections of floor we may do so; if we wish to change the position of a wall, it is possible; if we wish to fly objects onto or off an arena stage, we may.

We now have remotely controlled flying systems which have no counterweights and hence are independent of the theatre's walls. We have platforming systems capable of instantaneous adjustment and total recall of previous configurations. And we have a device for automatically moving whole sections of seats, so that in a matter of minutes the theatre may assume the form for proscenium production, for arena production or for open stage production.

If the demand resulting from a number of motives — theatrical need, the urge to adventure, the view for the future, or any other motive—is expressed and backed by sufficient funds, these devices can and will be built into future theatres.

Theatre engineering

These devices are electro-mechanical and they must be understood, operated and maintained by human beings, probably technical directors who must possess the knowledge and skills to perform these tasks. The educational theatre must train them. What kind of training should they have? What kind of skills should they acquire? Certainly greater knowledge in math and science than most technical directors have today. Certainly some skills in metal and electrical crafts and in electronics.

As a start in the preparation of persons for these jobs, we at Yale are asking candidates for the Technical-Design-Lighting major either to have had math thru trigonometry and physics thru basic electronics and statics, or to get these subjects in the Yale Engineering School, or at least to take a minimal course, in Math and Physics for Technicians, which we have introduced as a stopgap into the School of Drama curriculum. And we are selecting from our "T-D-L" students those with qualifications, interest and aptitudes in this direction to work as "apprentices" (or lab assistants if you wish) in George Izenour's electro-mechanical laboratory, for about a quarter-year each, to learn bench skills and circuitry, and to find out if the sample justifies the full course dinner. And we hope that enough candidates will like the diet to enable us to satisfy an already existing, though small, demand for men qualified in this work.*

Backstage isn't backstage anymore. It is all over the theatre. And soon stagecraft won't be stagecraft anymore. It will be Theatre Engineering.

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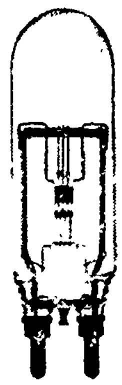
* In March 1960, a Rockefeller Foundation grant was made to Yale by which Dr Izenour may select research fellows to work in this laboratory on yearly appointments.



The General Auditorium

by **James Hull Miller**

Theatre Design Consultant; Director, Arts Laboratory, Shreveport, Louisiana

Auditorium Trends

There is, in theatre architecture, a marked trend towards an actor-audience relationship which encourages the single-chamber design concept and necessitates re-appraisal of architectural space and applied stagecraft. The open stage is one of the descriptive phrases indicating this form of theatre arrangement. A most dynamic example of the form in its purest sense can be found in Ontario, Canada, in the stage for the Stratford Shakespearean Festival. Most examples in the United States are more conservative, representing various phases of melting away or redesign of the proscenium frame to a degree which allows the traditionally separate chambers of auditorium and stagehouse to flow together.

Bringing auditorium and stage into a single architectural envelope diminishes or eliminates the concept of a working loft stagehouse. Either auditorium ceiling planes will extend over acting area, or, conversely, acting area will flow out of the window stage, abandoning the service of vertical rigging. Architecturally speaking, the void above stage is plugged.

Contributing Factors

It will require the theatre historian and the research student to invent a logical chain of development for these phenomena; for our purpose it will be sufficient to expose some aspects and results of the changing arrangements. Many things appear to be happening simultaneously, seemingly unrelated, but of tremendous interest to the planning of a school presentational center.

One factor contributing to retirement of the proscenium arch has been the determination to devise a bett-- seating arrangement stimulated perhaps by the ultimate comfort of television viewing. Widening of the seating arc, with resulting decrease in spectator distance, has been inevitable. The pictorial dimension of the window stage has been usurped by the TV picture tube, proponents of the open stage argue, leaving the unique sculptural dimension of the living stage to the theatre. Removal of stage mask destroys traditional organization of stagecraft along strictly pictorial lines and permits absolute freedom in audience arrangement.

A second contributing factor has been the desire to eliminate a stage space which must be serviced scene-by-scene in a sequential fashion, replacing it with one which can be arranged more arbitrarily in multiple fashion, scenically or architecturally, or by a blend of both. Success of such stages at present lies in the hands of skillful and imaginative designers, for most textbooks and similar aids to a tradition have not yet overtaken these developments. Again, proponents of the multiple stage point out that bringing a scene to the frame compares unfavorably with moving the frame to the scene as is the practice with the camera. They argue for a technique of theatre which is in its own way as fluid, and not dependent on cumbersome mechanics.

Audience Viewpoint

It is obvious that the spectator will view a larger stage space. This does not mean, necessarily, that the overall stage floor will be greater, but that more present floor area will be exposed to view by removal of the proscenium frame. Since the method of stagecraft by which stage space is invested with illusion changes, the need for conventional wing-spaces equal to playing area is largely eliminated. Freed from the discipline of the frame which implies complete pictorial settings, stagecraft is reorganized into complexes of set-pieces, reducing the number of set changes as well as representing greater economy of actual space occupied.

A third factor has been acoustical. The human ear has become sensitive to high fidelity, and at the same time the luxury of volume control has been placed within reach of the individual listener. Thus one comes to the theatre disciplined to an excellence of sound of a degree unnecessary to the stage a generation ago. When a theatre is designed from an acoustical standpoint, inevitably the forward ceiling planes find their way across the major acting area and the single-chamber concept is fulfilled. When one considers deployment of stagecraft to serve a production in multiple rather than sequential fashion, there is no great loss from retirement of the stage loft. Multiple stagecraft is developed from floor-based islands of set-pieces, not from suspended units whose terminal lines aloft require the masking of a frame.

Acoustics Affect Design

Designers have been quick to realize that the extension of the auditorium ceiling planes over the acting area creates an entirely new esthetic discipline, one of rather dynamic intimacy. Ease and effectiveness of lighting is encouraged through employment of many catwalks and associated lighting slots. Curtains on lateral tracks may be developed through ceiling slots. Absence of rigging and nuisance-masking cloths permits effective background projection and eliminates need for painted drops.

A fourth factor helping to bring about an abandonment of the two chamber concept of stage and auditorium has been development of economical single-span structures of overall envelope type. In stores, schools, office buildings and libraries alike the tendency has been to wrap up the overall volume of space with one structural thrust and then to partition in a manner reminiscent of traditional Japanese screen devices. Inevitably new space divisions are suggested to the theatre architect.

A contingency to the fourth factor has been the desire to retain a manner of permanent control over the initial freedom of space division which accompanies overall structural envelopes. Never before in the history of theatre has division of space been freer nor demand for multiple-use zoning greater, especially in school and community facilities.

Fifth, and last, contributing factor to breakdown of traditional lines of demarcation between stage and audience structures seems related to stagecraft itself, including provision of many types of acting areas.

Few theatres are built today for specialized programs. Hence, if opera and drama are to share the same roof, the decision for a wide or for a narrow proscenium must be avoided, and a stage devised that will satisfy requirements of both.

Actually, the open stage does just this by permitting scenic occupation of open space rather than filling a framed space of predetermined size. If forum and drama are to share a stage, a forward-thrust platform, serviced by a properly designed ceiling, will go further towards solving particular needs than a stage withdrawn beyond a portal with or without apron. If the theatre is to develop any degree of fluidity in scenic transitions and at same time feature its intrinsic sculptural dimensionality, its stagecraft must tend towards easily deployable units, or stationary set-piece complexes, both of which are part and parcel of the platform-type stage. More fabulous stage machinery is not the ultimate answer here. A great amount of such machinery has been designed to service the sequential area of the frame. Most of this equipment lies beyond the budget of the college and community theatre. For living theatre to survive as a grass-roots institution, the answer to the mechanics of stagecraft will be found in creative design—with guidance, not beyond the schoolchild.

Special School Needs: Flexibility

Let us consider now demands made upon average school auditoriums. These run a gamut from forum and concert to operetta and drama. Forums are best conducted from a forward projecting platform. Concerts are best held on a stage within the acoustical chamber of the audience. Operetta demands a large stage area, drama, a smaller area. The traditional picture frame stage offers no advantage to concert or forum. Between operetta and drama the dimension of the picture frame becomes a controversial factor. In addition, all frames, including the screen, dictate a narrow but deep audience arrangement.

An older and rather unsatisfactory solution was the combination of apron and contained stage. Spacewise, necessary playing area existed; esthetically, its proper use was denied, because stagecraft for open stage and that for window stage are categorically opposed. Also, the main curtain, at the proscenium, becomes, in effect, a secondary or intermediate divider of total stage space, in conflict with the idea of a curtain as a temporary mask of the stage area. Furthermore, lighting systems are forced to straddle a single space, architecturally divided.

It would appear from a study of the total program to be serviced by a school auditorium that strictly theatrical phases are in a minority position. The fact that discussion of provisions for dramatic art plays a major role in auditorium planning lies in the technical complexity of stage requirements. It is my belief, after experience in production designing and theatre planning for over twenty years, that the solution of school auditorium design lies in increase of technical facilities which can be incorporated into architectural elements of a ceiling common to stage and seating areas, and abandonment of separate stagehouse.

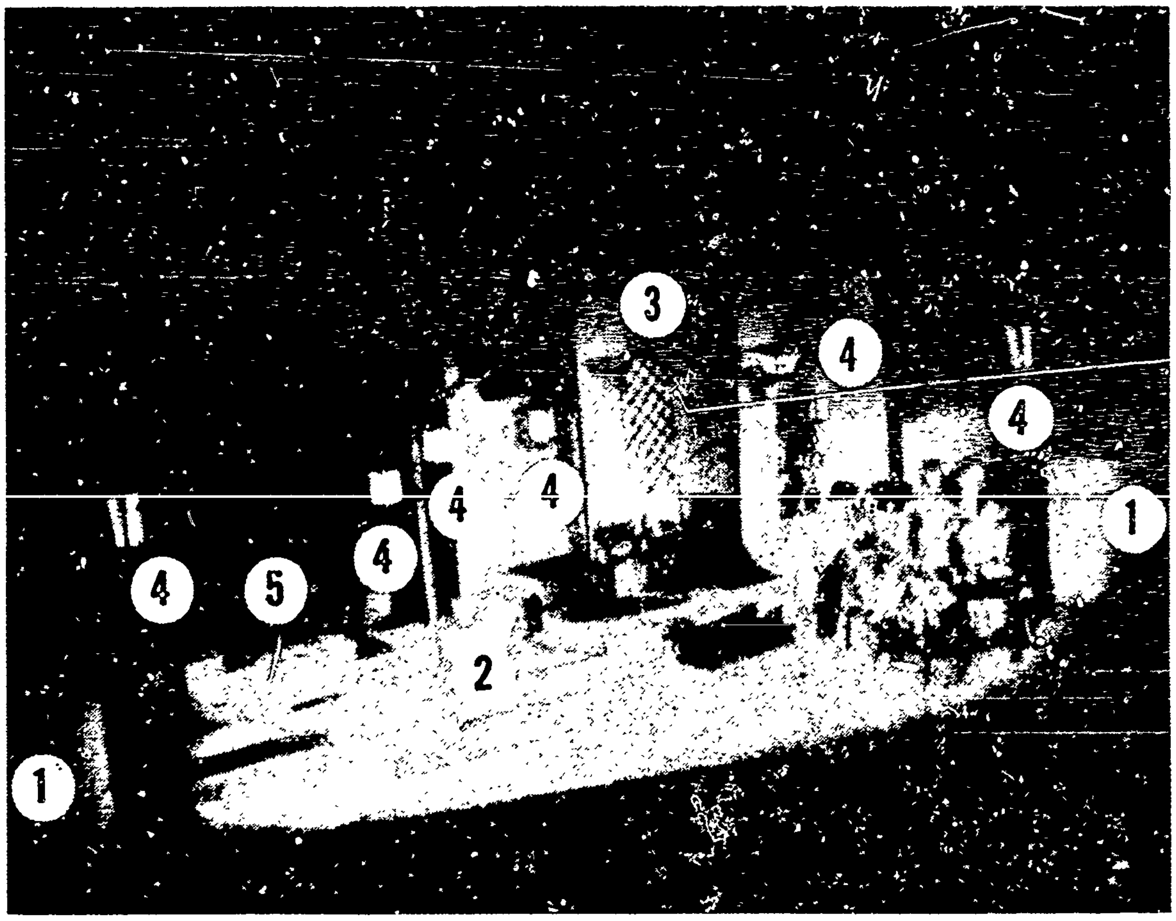
A Modest Proposal

This proposal is not as drastic as it may seem when theatre production for schools is reviewed objectively. First, a properly developed ceiling will immediately separate the function of general illumination from that of stage illumination. Architectural downlighting may be developed in efficient patterns at reasonable heights. These units may be controlled by raise-lower dimmer switches on motor-driven circuits, controls being placed at locations strategic to those using the chamber for general programming. Dramatic lighting by spotlights distributed along various catwalk-and-slot positions in the ceiling is placed under central control in an observation booth accessible to specialists. Economy of current as well as equipment preservation results. Now it is possible to design a theatrical lighting system to specifications of and for use by trained theatrical personnel, without present watering-down of equipment to combine with general purpose use. With efficient spotlights, readily accessible to theatre workers, specified areas of the large stage can be highlighted and zoning of a particular scene defined. Material factors of stagecraft in schools have always been a problem. Theatrical shop and storage spaces found in commercial and university plants are too large in area for school plants. Open stage, however, is less demanding than proscenium stage in amount of settings required, for, in open stage technique, a set more often than not dominates the center of the acting area, already defined by light, rather than surrounding it, or depending upon the presence of a proscenium frame for its termination. Regardless of other contributing factors, open stage would appear to favor a more practical type of stagecraft.

Acoustically, all programs receive equal advantages in sound projection, and extension of auditorium ceiling planes over major stage area eliminates many sound problems now corrected by expensive public address systems, especially in elementary schools. The void over the contained stage is an acoustical handicap, and this space is further deadened by insertion of cloth masking-pieces. In most school construction, these adjuncts are added to a stage by scenic supply houses and have little relation to original school plans.

Dramatic Lighting

Reference to the illustration on background projection will show how a very simple projection method can be developed for the open stage. Actually a drastic revision of the old Linnebach idea,



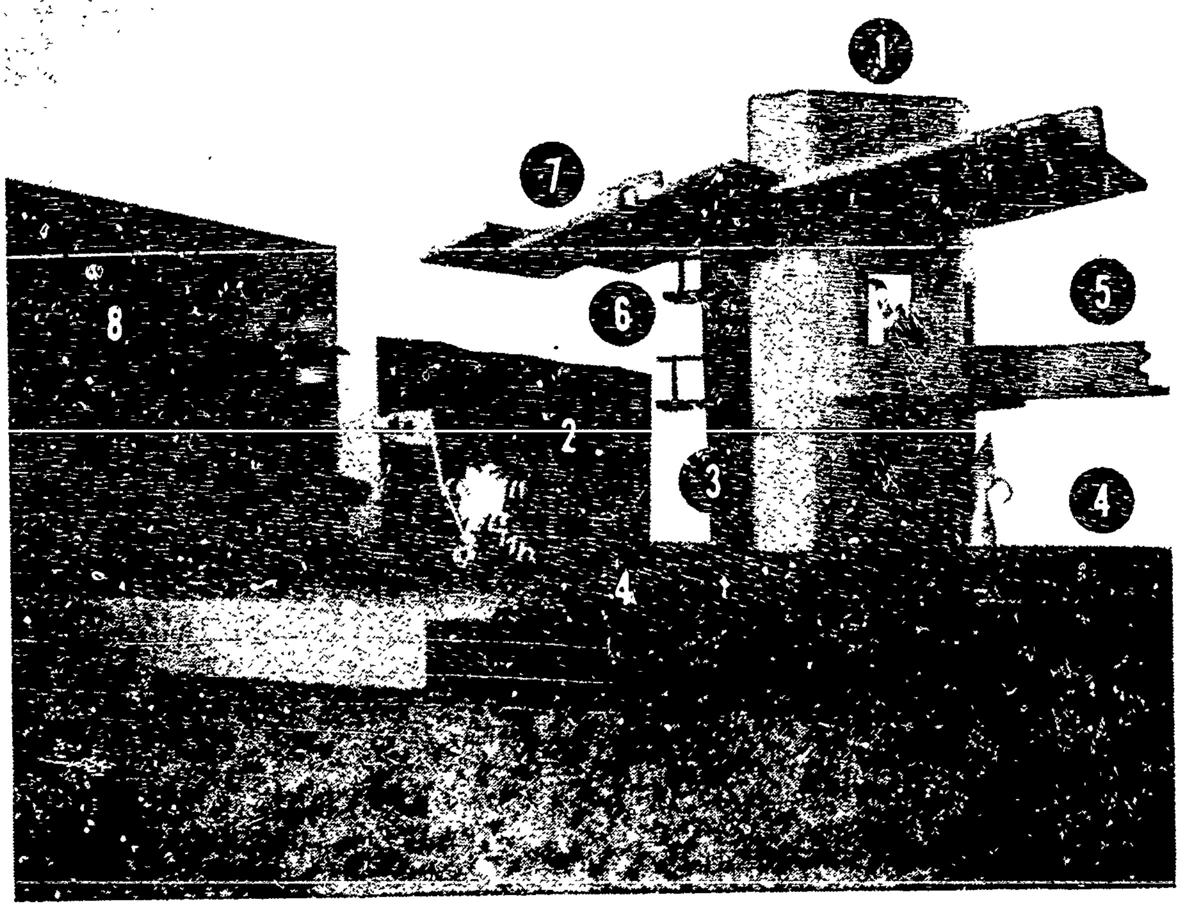
Example of true open staging for a scene from Act II of Carmen, *the tavern of Lilias Pastia, as produced by the Shreveport Symphony Society and designed by Miller. Zonal limits established by light, concept of the tavern has become that of an island in space. Essential features of the set are diagrammed above.* 1 *Signature screens in this case used as flexible elements in area zoning of scene. Actually, they represent exteriors, past which the tavern is disclosed.* 2 *Platform complex used throughout* Carmen, *from which many setpieces derived support. Also served to mask floods at base of background screens* 5. 3 *The "island" screen complex representing the tavern—flats covered with flamingo-colored Indian Head cloth. Only fabric, no paint, was employed on all screens for this production.* 4 *Note manner by which environment of tavern is extended beyond the three screens by lanterns in space. Note also glow in windows, adding luminosity.* 5 *Background consisted of 5' x 14' screens, set at 60° to one another, and covered with charcoal-gray burlap. "Illusion" of traditional cyclorama, being artificial in concept, would be destroyed by such illusion-shattering factors as "spill," although the other screen units were nearby and shadows were present. There is no other way to explain illusion of space created in the spectator's mind*

the present system owes its creation to Thomas Wilfred, in my mind, the most advanced pioneer in the art of pure light that we have in this country today. Wilfred's Direct Beam system capitalizes on finer lamp filaments available in recent years. It introduces a greater lamp-to-image distance for clarity, and eliminates necessity of using heat-resistant materials for construction of images. The system cannot be mounted efficiently in a working loft stagehouse but can be inserted easily in open stage design. It is attractive for school use because complex background imagery can be fashioned directly from such materials as cardboard, wrapping paper, gelatines, lacquer dyes or lamp dips on acetate or plastic sheets, or even silhouettes of real objects such as potted plants and random foliage.

Study of the illustrations will reveal the necessity of accurate theatrical consultation in development of the ceiling planes, such as the distance from one lighting slot to another and their overall height from stage floor, angles of illumination, location of slots for curtain tracks and relationship of the projection system to plaster-wall background. No open stage design should be considered unless a proper auditorium ceiling is to be furnished.

Some examples from experience

Rethinking of traditional theatre planning came about almost helter-skelter, not so much as an ordered development within the theatre as an interaction between domestic and industrial developments and the theatre world. Considerations such as seating, multiple space use, acoustics, structural envelopes and stagecraft, were influenced by pressures from without the theatre proper. I myself ventured into common ceiling plane design by degree, through challenging problems in remodelling as early as 1953. At first these planes were scenic structures lashed to service catwalks in situations where fly lofts were discarded either for structural or financial reasons. Next, the proscenium frame, now disengaged from overhead service, was well-upstaged, playing the role of wing



Model of stage-left portion of an open stage theatre, showing organization of space within this discipline of design. Stage vestibule **1** *is all that remains of old side proscenium treatment, reduced to 11' in plan for the 100' wide total building span. Wing space for sequential staging is recovered at will by folding screens* **2** *or by curtain* **3**. *"Plateau-type" stage* **4** *flows elliptically into audience area, providing additional acting area or valuable circulation in general purpose programming. Vestibule itself* **1** *is terminal point for gallery* **5** *with its lighting and acting possibilities and also for light catwalks* **6**, *as well as providing access to catwalks above ceiling planes* **7** *for adjustment of stage-lighting instruments. These ceiling planes in plated fashion are common both to audience and stage areas for acoustical as well as visual reasons and are slotted for curtains and offset for lighting ports. They also contain architectural downlighting fixtures for general purpose illumination. Plaster background* **8**, *finished in pale slate gray, completes architectural envelope of theatre.*

Access to storage, shop and dressing areas to rear is by vomitoria around ends of background. With development of open stage design we are able to employ a building structure rectangular in plan and with a low, common roof line

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facades as in the case of the Midland Theatre Center in Texas. Here the open stage concept replaced that of the proscenium to satisfy a program which often included over twelve hours of continuous and varied activities per day.

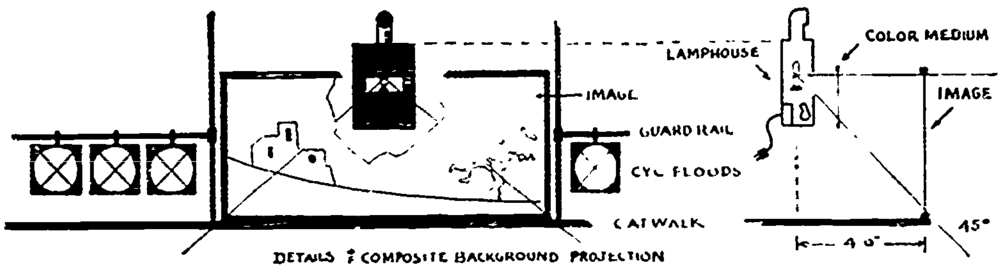
Until I remodeled the auditorium at Lamar State College of Technology in Beaumont, Texas in 1958, I had not realized the full acoustical implication of continuation of ceiling planes of the auditorium over the major portion of the stage area. Nor was I prepared for the amazing esthetics of these planes which seemed to float the stage forward towards the audience. I have heard this identical observation from many who have witnessed productions in this theatre. A barn-like audience chamber had become intimate.

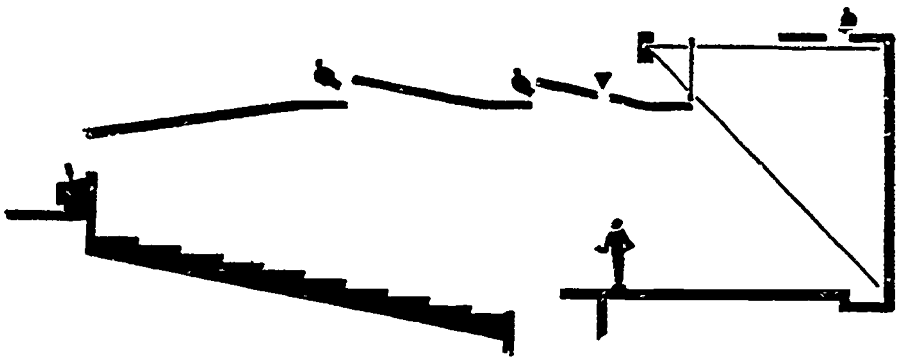
During the last few years I have become fascinated with the adjustment of theatre craft to its own presentational competitors, movies and television, and to contemporary influences beyond the theatre proper. There are two fields however, where little progress has been made, one being the multiple-purpose school auditorium, the other, low cost but efficient theatre housing for the small college and community. Obviously none of the more elaborate mechanical solutions associated with million dollar theatres are appropriate here. At the same time stagecraft itself should be simplified and made more fluid. These two fields are complimentary to one another. Solution through design rather than through machinery and sound systems was sought.

An Arts Laboratory

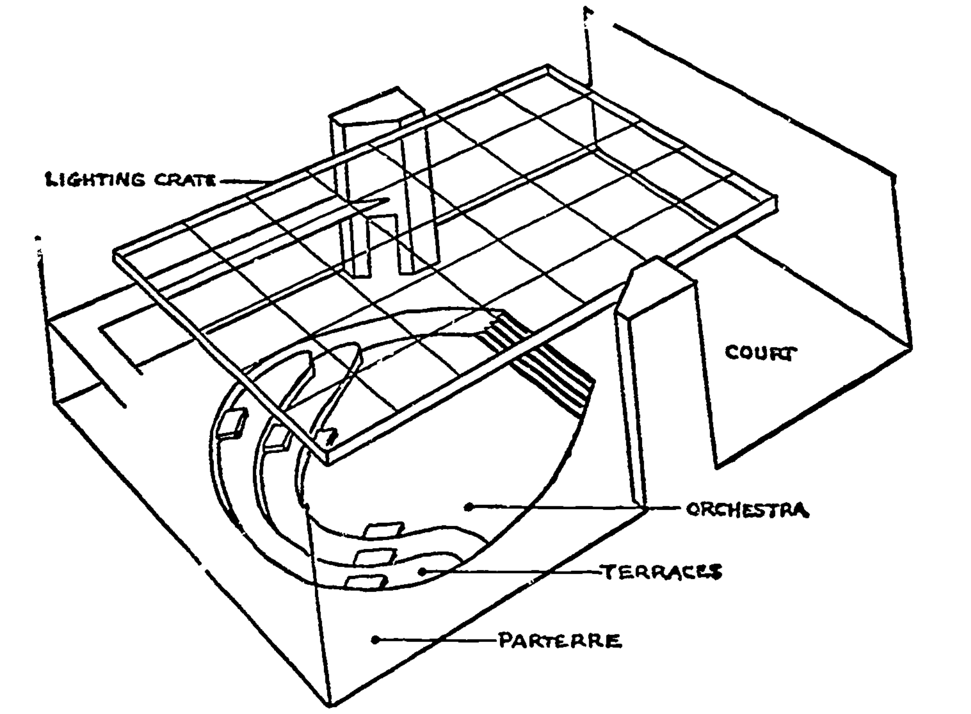
Towards these ends I set up in Shreveport, with the help of friends, an institution known as the Arts Laboratory, for study and development of space stagecraft and further experimentation with equipment for my projection systems. Materials for the work come through contracts for sets for regional productions. Only those seeking new solutions or with exceptional problems are attracted to the Laboratory.

Objective experimentation applied to stagecraft has brought some amazing and largely unanticipated results. By dissociating living the-





Section of an open stage community theatre seating four hundred. No spectator more than forty feet from stage. Acoustically excellent space-envelope for set-piece stagecraft, multiple staging and full background projection. Variation of same profile can be used in proscenium theatres where space-staging replaces framed sets and expensive loft structure



Waco Civic Theatre, Waco, Texas, 1958. Designer: James Hull Miller. Core: 50' x 80' overall. Seats: 150 canvas folding chairs. Note adaptability to various types of performance: proscenium, open, arena or classical staging

atre stagecraft from a surface pictorialism, elements of a scenic shorthand to the mind's eye begins to emerge. We have discovered tremendous latitude between the object which stimulates the mind and recollection of the experience. We think that it is not necessary for *stage* scenery to satisfy the eye of the camera in order to be a successful communicator of an environment. I do not imply absence of scenery, nor excessive stripping down, the style of selective realism, nor even symbolism in the 1930 American sense. I do mean those processes whereby a play is analyzed for essential meaning and a legitimate abstract pattern set up to which visual elements necessary to realism of the piece are anchored. We address the spectator in terms of his own process of imagery, the eye, a roving reporter, the mind, a calculator of values from collected scraps of reality.

All this is not as drastic as it might appear. This approach is closer to producing the fragmentary than to the continuous setting, but this is precisely what we require for the space stage. To build a stage as wide as the building, to be able to recover all the stage for the spectator when we desire, and to invest this total space with variously devised environments in whole or in part, simultaneously or sequentially, these are our practices. When all this is accomplished properly on one stage, we have reached our goal, that of the true general purpose auditorium.

By de-emphasizing the proscenium and by creating a complete architectural envelope with ceiling and floor planes passing through the old conventional line of demarcation, it is possible to employ space staging in new complexes, both multiple and simultaneous, especially avoiding costly implication that a scene must extend from one side of a stage mask or proscenium to other.

Of all elements shown, those representing ceiling planes are possibly the most important esthetically and acoustically. Relationship of upstage ceiling plane to background projection techniques is illustrated in diagrams but this whole technique requires expert geometrical analysis.

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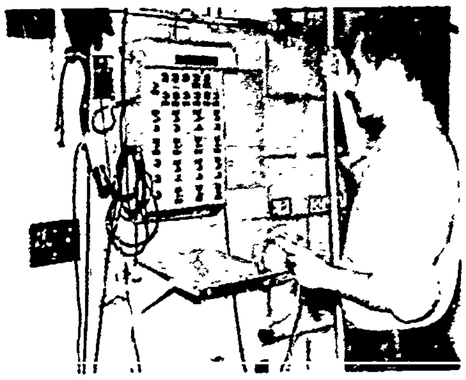


Stage manager's control panel

Tonight at Eight Twenty-Nine

by **William M. Davis, AETA***

The American Educational Theatre Association—one of the largest organizations of persons interested in the theatre—meets annually for a three-day convention. The work of the association is carried on by various projects devoted to different aspects of theatre arts: new plays, graduate research work, curricula, summer theatre activities; technical disciplines are covered by two projects: "Scene Design Technical Developments Project," and "Theatre Architecture Project." TAP, one of the larger groups within the association, devotes itself to the study of research and development in the field of theatre construction and equipment. Various current investigations include: collection, study and publication of data on new theatres constructed in the US and Canada; a study to determine the best type of space for teaching dramatics in the American highschool. TAP maintains close liaison with the US Office of Education, various state offices, professional societies and school administrators. The work of the various projects is reported in AETA's "The Educational Theatre Journal." TAP is associated with and assisted in the formation of the American Center for AITT, and has been instrumental in the recent founding of the broader US Institute for Theatre Technology (not limited to educational theatre). Many AETA members belong to both. Inquiries concerning the work of the association or the Theatre Architecture Project can be addressed to the Executive Secretary of the association, Professor John Walker, Michigan State University, East Lansing, Michigan.

"Magic Time" is the expression often used to describe the short period of time in the theatre when the house lights are dimming and a sense of anticipation grows in the audience. This article will deal with a "magic moment"; the instant before a performance actually gets under way. In front of the curtain the audience is waiting; in back of it everything has been checked, everybody is in place, the Stage Manager has received the phone call from the House Manager at the box office assuring him that everyone has arrived, and the director has said goodbye and left the stage. The Stage Manager now looks around, takes a deep breath and raises his hand to signal—and right here we are going to immobilize, as it were, everyone in the building. Thus stopped in their tracks, we will move around the theatre, take a look at some thirty-seven of the sixty-odd people required for the performance, and discover why each is where he is, and how the design of the building is planned so that they all can perform to the best of their ability.

The play is *MacBeth*, by William Shakespeare. It is going to be a big show, vivid and exciting; a lot of labor has gone into getting it to the moment at which we freeze all movement.

Shakespeare's first scene, a very short one with the three witches, has been cut, and the play will start with the scene of the camp near Forres. The change from scene to scene during the play will be done with lights for the most part; they will dim out, there will be a quick change, and they will come up. For some scenes this will not be necessary; instead the action will shift to or from a side stage.

Since seven o'clock the students working on the show have been arriving backstage: The actors to make up, and the technicians, for the most part, to make a quick check (everything was gotten ready during the afternoon) and then to study for tomorrow's classes until curtain time. By eight-twenty-five the Stage Manager had his word from the House Manager that he would be able to begin on time. He called "Places for act one" and waited till eight-twenty-eight: Then made a personal or telephonic check that every person who was involved in the first two scenes was on stage and was ready. The first intimation that the audience will have of the start of the performance will be music swelling from the auditorium speakers. Sixty seconds of this and then the house lights will start down, while the music gets louder. Now the Stage Manager leans forward to buzz the Sound Man, we put them into suspended animation, take a look at the diagram, and discuss each one.

The numbers on the diagram are counter-clockwise. Those in bold are technicians; those in italic are actors.

1 Light Controlboard Operator
2 His Assistant:

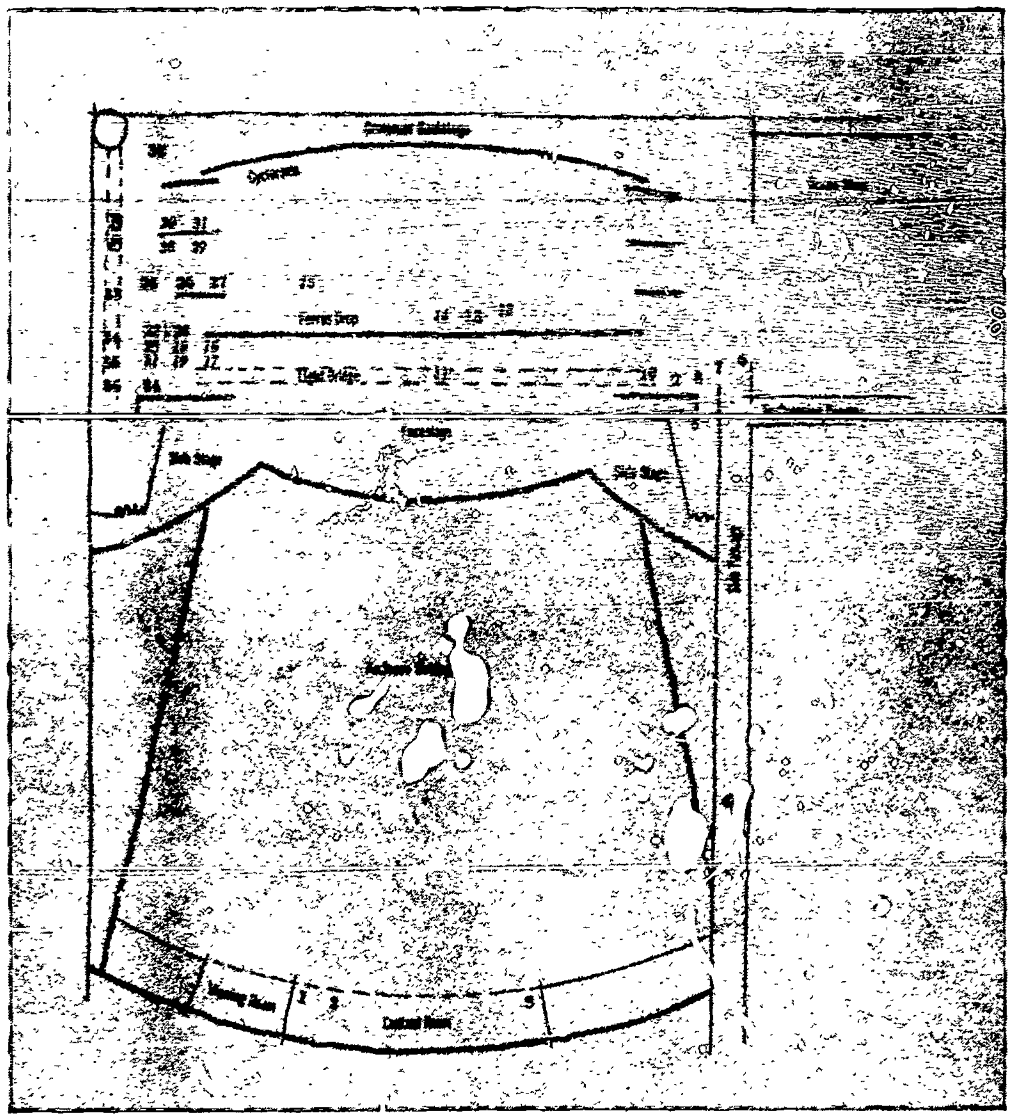
Their architectural requirement is a soundproof, ventilated control room, located in a position that will allow them to watch the show from approximately the same point of view as the audience. Thus situated, they can coordinate their routines precisely with the action on the stage, instead of working blindly, by ear alone. They hear the play through a PA system, which also is piping the lines elsewhere: Dressing rooms, Green Room, and director's office. The operators view the play thru a soundproof window. They are in touch with the Stage Manager via intercom telephone. A second architectural requirement is that the control room be accessible to the backstage area without the need of passing thru the auditorium.

3 The Sound Operator:

He has the same requirements as the light controlboard operators, and for the same reasons. Where the electricians must coordinate exactly with an actor who ostensibly switches on a lamp, the Sound Man must match exactly the movements of an actress who turns on a hi-fi set. He needs enough room in front of his window for a bench large enough to hold a tape deck, a three-speed turntable, an amplifier, a record rack, and his cue sheets. In addition there may be a pre-amplifier, and a set of controls for various speakers backstage.

* American Educational Theatre Association

Note: This [illegible] as a block diagram [illegible] the areas and positions [illegible] used in the [illegible] It represents [illegible] the requirements of actors and technicians in any theatre performing any play



4 The Director:

His work is finished: a moment ago he turned over responsibility for the running of the performance to the Stage Manager and is now on his way out to the rear of the auditorium to watch and make notes on the performance. He is going along a small passageway which connects the backstage area with the lobby. This passage is NOT a public way. Its function is to allow unobstructed indoor traffic from the stage to the lobby. Once the performance begins it is not possible for anyone to pass through the auditorium. The Director, the Scene Designer may want to drop back to check something. The crew chiefs backstage will want to take a look at the actual performance to see how it is going. But most important, actors in costume may need to use it. There are times when actors enter or leave the stage *(Our Town* and *Waiting for Lefty* come to mind) through the auditorium. They could go around outside *if* the weather permitted. But only if, because they must not damage their costumes. Since there can be no way of knowing the weather a month in advance, when the play first begins rehearsal, the protected route is necessary. Without it, such special pieces of action are either omitted or are made awkward; hiding in the cloakroom, for instance.

5 An Actor, playing a wounded sergeant. It is probably not correct to speak of an actor's architectural requirements for a stage. In the sense we mean, it is the director's requirement. This actor is where he has been told to be. He is just inside the entrance to the right-hand side stage. As Duncan and his entourage enter the stage from the left-hand wings, this actor will limp into sight from his position. He cannot, from where he is, see the entrance of the other actors. But on the wall in front of him is a small green lamp: When it goes on, he will get ready, and when it goes out, he will enter. This is a cue light, for silent signals. It is operated from the Stage Manager's control panel, and there are nine more of them in various positions around the stage, including one in the lobby to signal actors waiting there. The Director is using the side stage for this first entrance because he wants to bring the play as close to the audience as possible for a moment, thus briefly giving them the idea that this is going to be a colorful, exciting drama. As the performance goes on, these side stages will be used more and more. When Lady MacBeth is somnambulant in the great shadowy hall of the castle, the Doctor and Nurse will be "concealing" themselves on one of these stages. The final battle will be fought all over them, as well as the main stage.

6 The Technical Director:

He is a faculty member, and the only adult remaining backstage during the performance. Except in an emergency he will do nothing all evening long (except drink coffee). He keeps himself as insurance against any mishap, including a missing crew member —but *not* a missing actor! Thus he stays well out of the way. There must be plenty of off-stage space for him to keep clear of the actors and crew members, tho it is a little far-fetched to say that this is an architectural requirement for him at this point.

7 An Assistant Stage Manager:

There is always at least one ASM for every play, and their primary job is to be an understudy for the Stage Manager. As a rule, of course, he is never called on to take over the running of the show. His other duties include checking on actors and scene shifts and reporting this to the Stage Manager. Right now he, too, is keeping out of the way.

8 The Stage Manager:

The most important person in the entire production. He has the ultimate responsibility and therefore he has ultimate authority. He starts the show, he sees that it continues, in all its aspects and in order, and he ends the show. When he says, "No more curtain calls—house-lights up," that's that. To accomplish all this he has one or more assistants, and he himself

Control room, color wheel

All photos by William M. Davis

is located in the most advantageous position backstage. This is almost invariably in the same place: Next to the curtain ropes. It can be on either side of the stage. By placing the Stage Manager and the Curtain Man side by side there is instant, and *quiet*, communication between them. There can be no misunderstanding of the command "Curtain!" with that juxtaposition, and there have been countless missed cues when these two people were located on opposite sides of the stage. Indeed, if a whisper is too loud, a tap or gesture will do. This is particularly important during curtain calls, since their number is almost never pre-determined, yet the curtain goes up and down rapidly. There is split-second thinking here, and the final curtain is not known till it's over.

The Stage Manager has the Master prompt book, in which is marked every cue, and the warning for every cue, every entrance, and the point at which each actor should be on stage to be able to make that entrance. He needs a small shelf to hold this book, usually a looseleaf notebook. For his communications he needs an intercom phone (a master), and perhaps a mike for backstage PA. There ought to be a clock, because all acts are timed. And there needs be a panel for the cue light switches, mentioned in connection with the wounded soldier previously. Sometimes there are some light switches there as well, for lights controlling the backstage areas. All this requires a section of wall against the front of the stage, the proscenium wall, a width of about three feet is plenty. This position must be about eight feet away from the stage, in order that actors and scenery will not be blocked as they go on and off stage. The downstage position is also the one where, in nine shows out of ten, the Stage Manager can get a pretty good view onstage. His intercom cable should be long enough so that he can move some eight feet from his station if necessary. A companion requirement to this clear wall space for his control station is the placement of the door to the dressing rooms near by: Thus he can see actors come (and go) without stirring from his stool. And keeping track of actors is his most vital and most difficult duty; they tend to be very casual at times, particularly undergraduate actors, who are not always amenable to the discipline required during a performance.

9 The Curtain Man:

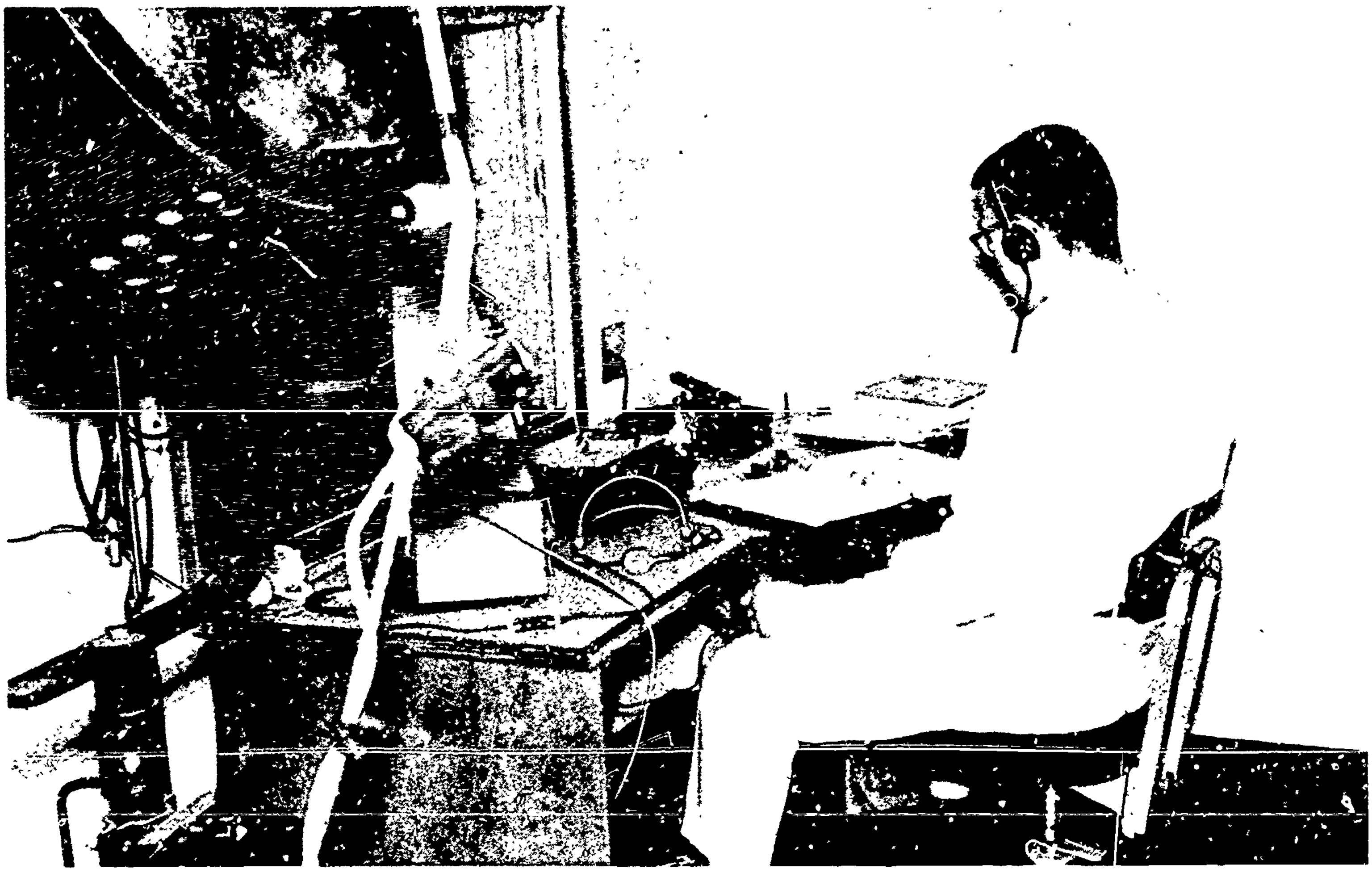
His position and the reason for such position are given in the previous section on the Stage Manager. An alternative position often found for the curtain lines is against the side wall, where they are the first set of rigging lines.

10 The Prompter:

She sits just out of sight of the audience, hidden from them by a semi-permanent piece of scenery called the *Tormentor*. While her preferred position is always near the Stage Manager for the sake of communication, it is always governed by the plan of the scenery, and because of this she may even shift her position from act to act as the settings are changed. She places herself where she can get the best view of the stage, yet not be seen herself. Because of this, she is the exception to the rest of the persons mentioned in the article: She has no architectural requirements. The prompter is always related to the scenery and nothing else. She has a small-wattage lamp to see by; it is plugged into a house-type outlet under the Stage Manager's panel.

11 Electrician:

This crewman is not on stage, but is standing on a metal catwalk running the length of the proscenium opening, and hanging just above it. It is called the *light bridge* and usually serves as an inner proscenium — the front and underside of the walk being covered with dark velour. Architec-



Control room, studying before show

turally this is a requirement of the lighting designer rather than of this particular electrician. It is primarily a mounting position for many lighting instruments having pipes and electrical outlets for this purpose. The electrician is on it as a matter of economics. During the Witch Scene, coming up, three spotlights will be used from here, all with green color media. They will not be needed again until Act IV. So as soon as the scene is over, the electrician will remove these green media and substitute light blue ones for the many castle interiors that are due. This means that fewer instruments need be purchased for use, and fewer circuits need be incorporated in the controlboard. When necessary, special follow-spotlights can be operated from this position.

12 **An Actress,** playing the First Witch. She is in position behind the Forres drop, ready before the performance begins, in order that there will be as little delay as possible between the first and second scenes. It [illegible] straining a point to say that architecturally what she needs is acting area space; space to move around in without seeming cramped.

13 A Property Girl:

She is standing by the witches' cauldron. All good cauldrons must steam a little from the evil broth inside and this one will be no exception. The girl has been stopped in the act of putting a container of dry ice into the pot. She needs a place to keep this ice before the play begins; that place is an icechest in the room where all current properties—articles used on stage— are kept. Such a room is not shown on the diagram.

14 and *15* **Actresses;** the Second and Third Witches. Same as the First Witch. The Stage Manager knows they are there because the Assistant Stage Managers have told him so.

16 17 18 19 **Actors,** playing Duncan, Donaldbain, Malcolm and Lennox. They stand in the wings, ready to enter as the lights come up. They need space. All have swords hung at their sides and they must keep far enough apart so as to clear each other's armament. And they must be far enough apart so that they will enter as a king and his retainers, not like a group of commuters coming out of the Times Square Shuttle.

20 and *21* **Actors;** Standard Bearers. Duncan is the King of Scotland. The Scottish colors and his own personal standards follow him. Thus these two actors have eight-foot poles which they carry *upright.* They need space, too, not only off-stage floor space, but overhead clear space.

22 and *23* **Actors:**

Men-at-arms. They are guards; they carry heavy spears. More space needed.

24 Assistant Stage Manager:

This is a large, complex production, with many scene changes and a large cast. Therefore there is an Assistant Stage Manager stationed permanently on this side of the stage to check all actors and scene changes in this area. He stays in contact with the Stage Manager by intercom phone; the outlet is located on the wall by the entrance to the side stage. No scenery can be stored right here; it must be kept somewhere else.

25 A Floor Electrician:

At the end of the Witch Scene, when the lights are out, he will go onstage, pick up the "fire" under the cauldron and continue *in the same direction* off the other side. Since the fire is actually electrical in nature, it is supplied by a cable which will be invisible during the dark scene. He will pull it off after him. He needs space: Space to wait offstage as he is doing now, and space on the other side of the stage to move into quickly without fear of tripping over a piece of scenery in the dark.

Pin rail crew ready

26 and **27** Two more **Property Girls:**

For them the same as the electrician just mentioned. One will take the cauldron off, the other the tripod that it stands upon. Space. They will store these items in the property room until Act IV.

28 and *29* **Actors;** MacBeth and Banquo. They wait offstage to enter in the second scene.

30 and *31* **Actors;** Angus and Ross. They, too, enter in the second scene. There must be enough clear space offstage for them to stand in.

32 A Property Girl:

She is in charge of all the properties on that side of the stage. Thus she has just given out the two standards and the two lances to the men-at-arms. And when they come offstage she will take them back; if this is not done they will be laid almost anywhere, since actors cannot be trusted to put things back where they should go. All the area back of her is for property storage during the performance. At the moment she is just standing.

33 34 35 Flymen:

They are on a side gallery some twenty-two feet off the floor and it is their job to raise and lower all the scenery hung on the pipes over the stage. These pipes are for the most part counterweighted, although a few have sandbags. Only No. 34 will work during the first shift—Forres to Heath—since all that is required is to pull up the Forres Drop and the Heath with the Witches will be seen when the lights come up. There is a cue light up here but he will not use it this time, but take his cue from the lights blacking out.

36 The Chief Flyman:

He works along with the others, but is the one responsible. On the wall by his position is an intercom outlet and a green cue light. No intercom will be needed tonight, but the cue light will be used in some of the succeeding shifts. When it goes on the fly crew gets ready; when it goes off, they work. By raising their working position so far off the floor, that much space is freed from the movement of scenery and actors. The crew are leaning against the rail now, watching the show begin.

This is everybody in position on the stage. Before the evening is over many more will be involved; some six scene shifters, and nearly twenty actors. When Birnam Wood moves on Dunsinane, it's going to take a good bit of offstage area, clear of scenery, for all that greenery to assemble before its entrance. And it takes up a lot of space in the property room between performances, too. Nor have we mentioned the makeup and costume crews, who work elsewhere in the building.

A stage is like a physics laboratory: The best results can be produced with the best equipment. A good worker can do wonders with poor equipment, but that is no reason to saddle him with it. Backstage one of the most important features of the planning and design is *enough room:* Room to store the scenery and furniture that is used in the second act, and still leave room for a group of actors to go off without jamming up in the exit. Limitations of the budget can cut down the cubage, but such cutting down should be done with the knowledge that to a greater or less extent, the productions will suffer. Beyond a certain point, some plays simply cannot be done.

This paper has shown what space and design features are needed, and *why* they are needed. A theatre building serves its inhabitants so that they may serve the audience. It is the hope of the author that by this postulating of a perfectly possible play in a not-too-idealized theatre (indeed, it follows an existing one quite closely) some of the technical requirements will be clearer in the readers' minds.

many schools, would be essential, as the normal power supply cannot be expected to be available in such an emergency as we are preparing for.

SHOWER ROOMS

These large showers, usually near gymnasium, will prove to be of highest value for decontamination of multitudes of people who were exposed to nuclear facilities.

HOMEMAKING CLASSROOMS

These classrooms contain housekeeping, sewing and cooking equipment and can serve well as diet kitchens, nurseries, even maternity wards, laundries, and manufacturing shops for clothes and bed linen.

AUDITORIUM, GYMNASIUM, MUSIC OR DRAMATIC ARTS BUILDINGS, SPORTS FIELDS

If such facilities are available, they will in all likelihood be used to augment other facilities to house those multitudes of refugees from disaster areas who, after having been decontaminated and provided with clean clothes, may not be in immediate need of medical attention but are destitute and homeless.

Probably, tents or barracks will have to be erected on sports fields and play grounds to house those who have no place to go.

WAREHOUSE

Storage is one of the biggest problems. The school warehouse, if there is one, will as a rule prove too small. Sufficient storage facilities are one of the critical items which would have to be planned just for the second—emergency—duty of the plant, unless a centralized warehouse is maintained by the school district somewhere nearby.

INCINERATOR

School incinerator would safely dispose of all combustible waste not emanating dangerous radiation.

WATER WELL

A very critical item in any disaster will be water supply. Water is vital for survival, but normal supply will, in all likelihood, not function or water may be poisoned by flood, fallout or chemical warfare. For this reason, every school plant should have its own, independent water well and pump system to provide at least one source of potable water in the area. Such installations pay for themselves, even though the emergency for which we are preparing may never occur. In the New England floods, hospitals were served with fresh water by tank trucks—but no means of connecting truck to plumbing was available—this would be an easy provision to install in a school.

DRIVEWAYS, PARKING

Driveways planned to carry school buses or supply trucks, are fully adequate to carry ambulances. Storage of spare parts and automotive fuel is one of the problems for which a solution must be found.

PLANNING AT LOCAL LEVEL

By necessity, foregoing suggested uses of existing school facilities for emergency hospitals and receiving centers can be only an outline and do not present a complete program. Neither is this the place to go beyond such generalized suggestions, nor would wide variation in school plants and their physical makeup permit statement of rules which could be followed by the majority.

We hope to have shown, however, that school plants can readily be made into self-sustained islands of assistance and service. There may be more buildings or fewer—they may serve different purposes or may be combined and laid out in various ways suggesting quite different solutions for emergency use. For this reason, a recipe for conversion planning would be of little value.

Such planning can only be done at local level. If possible, the architect who planned the school in the first place, if he has experience in hospital requirements, should be entrusted with conversion planning.

If the school is still on the drafting boards, the architect in charge will know best whether his experience in hospital planning is sufficient or whether he should call in a hospital expert. It would be folly, indeed, if we should fail to make these relatively few and simple preparations. The wisdom of designing our new schools with their emergency function in mind can hardly be overemphasized. Double function design should be made mandatory for all new schools.

WHO PAYS?

Funds might be spent, in numerous ways, were they available, for our children's education. Those districts which can still finance their schools by bond issues, may find it easier to convince the electorate of the desirability of the school if the plan provides for tangible disaster relief and protection for the population in addition to teaching facilities for their children. If the people can be made to understand that their money will pay off doubly, will serve two different purposes, will buy two commodities at almost the price of one, that the buildings erected with the funds will serve double duty, they may be more inclined to vote in favor of a school bond issue.

The states; hard pressed to finance school buildings in districts which have exhausted bonding capacity, have so far been unable to finance anything but traditional essentials.

Federal aid for school construction, if it had been adopted by Congress, might have been another way to finance a conversion program because financing disaster aid is a federal responsibility:

- Public Law 875 provides for continuing means of assistance by the federal government to states and local governments to alleviate sufferings and damage resulting from major disasters
- Public Law 134 provides for donation or loan of surplus federal equipment and supplies to states for use or distribution by them under Public Law 875.
- Public Law 107 authorizes federal assistance in providing temporary housing or other emergency shelter for disaster sufferers.
- Public Law 480 provides for making maximum efficient use of surplus agricultural commodities
- Executive Order 10427 of 16 Jan 1953, provides that the Federal Civil Defense Administration, acting on behalf of the President