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PRELIMINARY REPORT

OF

FINDINGS

ANALYSIS OF SCHOOL BUILDING COSTS

PREPARED FOR THE USE OF THE
SUB-COMMITTEE ON EDUCATION &
PUBLIC BUILDING

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PRELIMINARY REPORT OF FINDINGS

Analysis of School Building Costs Project

for

Subcommittee on Education and Public Building

Washington State Legislative Council

Olympia

July 14, 1949

TABLE OF CONTENTS

SCOPE AND OBJECTIVES

The project was instituted on the basis of information and opinion offered by Chas. W. Hodde, Chairman of the State Legislative Council, to the following affects:

1. The present distribution of state aid funds for school plant construction is unequal as between districts as conditioned by need, and those, rural in particular, which are unable to finance their own requirements are being neglected in existing programs of state aid to school plant construction.

2. The existing formulae for determination of state and local shares in building project costs is faulty and inequitable to the state and a contributing factor in the problem of distribution of state funds between districts.

a. Districts receiving state aid at present are receiving such assistance under a formula which allows expenditures for unnecessary construction at the expense, ultimately, of districts which could use these funds for necessary construction.

b. Present system of determining shares of construction cost encourages districts to contract for facilities far beyond their true needs or capacities to pay for, and encourages reliance upon state aid.

3. Too little is known of the factors which contribute toward evolution of an equitable formula for distribution of state aid and toward economy in school plant construction.

4. Responsibility for effecting economies in school plant construction is widely dispersed and insufficiently fixed.

The principal objective of the study, as outlined in preliminary discussions with the Chairman, is as follows:

1. The development of recommended legislation and its transmittal with supporting data to the next session of the legislature which, if enacted, would have the following affects:

a. Optimum distribution of state aid funds to local districts for school plant construction;

b. Determination of proper objects of state aid in school plant construction and development of formulae for sharing state and local responsibility for project costs and administration of planning and construction.

c. Greatest possible economy in utilization of state aid to school plant construction, i.e., making the money go as far as possible, consistent with the proper and safe construction and the needs of the communities affected.

Preliminary research has revealed other possible and related objectives of considerable worth and merit which it is recommended be included in this study. These are:

1. <u>The development of a basic code for school plant construction.</u>

During recent years, the development of a satisfactory code for school plant construction, to be embodied in the state laws, has become

an increasingly important and an increasingly thorny problem. The large majority of those states which do have and use school building codes have relied upon one which is general termed "regulatory", i.e., one which establishes minima and criteria in the interests of the public health and safety, rarely serving any other function, as opposed to the "informative" code. It is the contention of a many leading educators and educational writers, in addition to architectural and construction authorities, that the regulatory code has a profound tendency to encourage lack of vision and wastefulness in its interpreters and that, in many cases, minima established in such codes, invariably and automatically become optima - the standard in the minds of those who use the code. (See pages for a complete discussion of codes as applied to school plant construction.)

A brief survey of this state's statutes indicates that Washington has nothing in its laws which can reasonably be termed a building code for school plant construction. Scattered and brief references have been found to such matters as the requirement that doors on public buildings swing outward, and several relating to fire-proof construction and must, therefore, be considered unsatisfactory in many respects.

2. A study of current practices concerning architectural services and architects' fees.

Architectural services in school plant construction are commonly provided on a fee basis, by private architects. The most frequent basis for computing the fee is through agreement on a fixed percentage of the total cost, such percentage ranging usually from 4 to 8 percent.

It is quite apparent that this, an appreciable component of construction cost, is one of the first items toward which study, for economies sake, should be turned.

Quite apart from the high cost reflected in the percentage fee system, is the inestimable expense though avoidable resulting from inadequate architectural service. It is generally reported that architectural services are quite frequently secured without particular regard to the experience or training of the architect in the specialized principles of school - plant construction. Too often, the architect is imbued neither with understanding nor sympathy for the viewpoint of the educator as to educational requirements in this field.

It may be profitable to inquire into the various means by which architectural services are contracted for in this state, the fees paid, and the type of contracts drawn, and to undertake a study of the feasibility of other plans, such as a full time state architectural service.

3. A study of the present and future allocation of responsibility for administration of school building aid laws:

This appears to be a much larger question than might be indicated by present Washington statutes on the subject. It encompasses the whole matter of what assistance other than financial may be given the local districts by the state. It covers such subjects as overall planning for school - plant construction (i.e., detailed programming on a statewide basis), guidance by competent educators so that local school plant planning may benefit from the latest and most advanced thinking, technically and otherwise, and a multitude of other valuable considerations in addition to the basic business of making money available to local districts and

and controlling its distribution in a fair and equitable manner.

In this connection, the state legislature might give serious thought to the possibility of re-establishing the building facilities division in the office of the State Superintendent of Public Instruction, and increasing the scope and authority of its operations. Fully half of the states now maintain a comparable agency for the purpose of supervising state aid, or planning or coordinating planning and construction programs. Direct responsibility for the administration of state aid and overall state programming in school plant construction is lodged in several such units in several states. Care has been taken, however, to protect local autonomy and encourage local responsibility within the limits defined by the necessity for financial assistance from the state. It is recommended that the relationship between the state and the local authorities be clearly drawn in the law.

P A R T T W O

Research methods and nature of materials used

RESEARCH METHODS AND NATURE OF MATERIAL USED

The standard research methods of collection and survey of all available materials for the purpose of gaining understanding of background and basic principles was used.

Information on financing, volume of construction, unit costs, cost index trends, materials prices, labor costs, administration and procedure, laws and building codes, and trends in state controls was sought. Principal sources exploited were the technical periodicals and trade journals. Practically nothing has been published in book form.

It was immediately apparent that detailed and specific information and data on cost and construction trends in school plant construction is very scarce and incomplete. The most recently published compilation of unit costs for school plant construction among the forty-eight states, for example, furnishes conclusive data for only about half the states, no reply being received from the others.

All source materials were carefully classified, compared to eliminate duplications in information, and succinctly reproduced on working papers.

It must be noted that the majority of information derived from materials located in the research is of a type not easily amenable to tabulation or exactitude of presentation. Much of it can at best be only a matter of opinion. Though the opinion may be informed, still it is inevitably editorial to a large degree. In the interests of impartiallity an attempt has been made to present representative information only and to annotate all excerpts to show source.

PART THREE

Findings

FINDINGS

a. Costs

Indeces of building and construction costs. On a base year 1913 (Index 100) building costs in February 1949 stood at 352.9 or approximately three and a half times as high as in 1913. The index, on the same base, in 1929 was 210.0, in 1939, 196.2 and in 1945, at the height of was activity, was 237.7.

The index for material cost component in February 1949 was 190.0 or approximately 54% of the total building costs index. The skilled and other building labor cost component amounted to 46%.

The general construction cost index stood at 475.4 in February 1949, this figure including a much larger component of common labor than that of building costs.

These indices are quoted by "Engineering News Record" for March 17, 1949 (Survey and Construction Costs issue).

Detailed indices by type of structure were generally not obtainable for recent years. One local authority has evolved figures for brick construction indicating that the cost index for this type of building has risen steadily from 100.0 in 1926-9 to 213.8 in February 1949 on a nationwide basis. Other figures showing regional indices for Brick building (base year 1911-1914, are: 429 on the Atlantic Seaborad; 389 in the North Central states; 382 in South Central states; and 386 on the Pacific Coast. Indices for concrete building on the same base year were: 436 on the Atlantic Seaboard, 421 on North Central states, 411 in the South Central states and 416 on the Pacific coast. All these figures are indices as of February 1949.

In general, it appears that present day costs range from fifty to one-hundred percent higher than in pre-war years (1938-39) and that the sharpest increase has taken place in the common labor cost component. The first two months of 1949 exhibit a slight downward trend. Most sources are agreed, however, that this trend is not too significant. Monthly variations are becoming less varied and exhibit generally increasing stability. Both this and the slight down-trend may be attributed, possibly, to the easing of the labor and materials markets in availability and increasing supply.

Unit costs. A study recently conducted by the National Education Association exhibits a fair coverage of unit costs by locality and by type of construction, for 220 school systems in cities of 30,000 population or over throughout the United States, for the years 1947-48.

Costs are given per cubic foot and per square foot. The figures quoted exhibit marked differences as between regions (Eastern seaboard generally high and compared with the Pacific coast, for example) and as between types of construction. It is apparent, however, that many of the differences noted may be partially eliminated after equalization of quality and architectural type of construction. The rising trend from west to east may still exist but will not be so great.

Graphic distributions were prepared by the writer on the basis of this study, with the following results.

b. Factors affecting costs (1)

Types of plants. The design of the building is one of the most important factors influencing cost. Design can be mathematically measured by the relations of perimeter to ground area to cubic content. In an analysis of these relationships in school building programs in New York state it was found that the ratio of perimeter of cubic contents was twice as important as the relation of ground area to cubic contents in determining costs. Differences of as much as 10 cents per cubic foot were attributable to these factors. At the time of planning these buildings, important savings could have been made, or the building enlarged at no additional cost, had these factors been considered and the designs revised when it appeared that they were uneconomical.

The importance of these ratios is made clear by a very simple example. Consider a square eight feet on a side. The perimeter is 32 feet. The ground area is 64 square feet. Thus, $\frac{1}{2}$ foot of perimeter is required to enclose 1 square foot of ground area. Now, if this square is divided into two smaller equal squares which might correspond with the floors of a two story building, they would approximate 5.6 feet on a side with a ground area of 32 square feet each and a perimeter of 22.6 feet on each. Therefore, 45.2 feet of perimeter would be required to enclose 64 square feet of ground area, or .7 feet per square foot compared with .5 feet per square foot in the one story plan. From the point of view of the cost of exterior wall, it is obvious that the one-story building is cheaper than the two story building when the buildings are square. This type of analysis was carried out for 52 buildings in the previously mentioned study, and exact variations determined for 20 types of plans, together with formulae for estimating the costs from perimeter, ground area, and cubic content.

Types of structure. In New York state all available evidence indicates that steel skeleton frame buildings are cheaper than wall - bearing buildings. The difference in cost was found to be approximately 2 cents per cubic foot. A study conducted in St. Louis indicated even greater differences in favor of concrete skeleton frame buildings. Whether or not this is true for all sections of the country is of course open to question. But this type of analysis should possibly be carried out in every state to assure a maximum return for every school building dollar.

A study of types of roof construction in relation to cost favored slightly the wood-frame gable or hip roof over the steel frame concrete or gypsum slab roof, However, this saving can be avoided by the use of high gables or large attics which result in a large amount of nonhabitable cubic content.

Interior finishes. Variations in interior finishes may account for as much as 4 cents per cubic foot differences between buildings. However it is difficult to match this finding with economy in construction since there has been very little real research to date on the question of maintenance and depreciation of different types of finishes.

Functional distribution of space. The cost per cubic foot of a building may be low, but the total cost may be excessive because of the small amount of space devoted to educational purposes. It is claimed that no other phase of school-building design bears so much upon cost as allocation of space to secure a maximum percentage of the total cubic content for educational use.

In a recent study of costs in New York State, for example, it was found that the amount of non-habitable space ranged from 16.5 to 47.4 percent of the total cubic contents of buildings, with an average of

32.4 percent for all buildings. This indicates that in many cases more than one third of the total cubic contents is not usable and yet costs approximately 16 cents per cubic foot. On the average, only 41.5 percent of the total cubic contents was devoted to instructional and general educational units.

Much of the burden for the development of economy in this area is upon the architect, but the educational staff should certainly be prepared to check designs in order that there may be a minimum of waste.

Heating and ventilating. Heating and ventilating costs represented approximately 13 percent of the total cost of the four major contracts in New York schools which were studied. Of this amount, approximately 3 percent was chargeable to mechanical unit ventilators. It is frequently said that there is probably no other single part of a school building which has met with as much criticism as the ventilating system. Ventilating engineers and scientists who have studied ventilating requirements in schools are practically unanimous in suggesting the elimination of statewide uniform ventilating requirements. With the cost of providing 30 cubic feet of air per pupil per minute exceeding 3 percent of the total cost of the building, every effort should be made to erase this requirement from the laws and to establish ventilation needs in terms of local conditions.

Plumbing and electrical facilities. The major factor influencing costs in this class is equipment, but it is clear that no large economies can be found in these services, since the variation in price is so small. General construction costs vary so widely that real economy should be sought there before handicapping the plumbing and electrical services.

Waste. The usual procedure in planning a building is to set a price and give the architect a statement of the number and type of rooms desired. The architect then attempts to match costs and needs. Anplan is presented to be revised or accepted by the board. The architect chooses materials and designs which he believes are desirable. His choice may or may not be based on educational need. The school board accepts a design without realizing that the factors which largely influence the cost of the building are contained in these preliminary drawings. Comparisons are made on a cost per cubic foot basis without analysis of the utilization of space.

The result of this type of planning may be quite wastefull. Cheap materials which deteriorate rapidly may be used on the interior to offset the expense of an impressive exterior elevation, or unnecessarily expensive materials may be used merely because the community budget allows the architect to spend extravagently. The cubic foot cost may be brought to a rediculously low figure merely by increasing the attic space or using a particular formula for determining cubic contents. The allocation of space for corridors, stairs, administration, instructional units, or general units may be excellent, or very uneconomical, but in either case it may be largely a factor of choice rather than the result of deliberate planning for efficiency.

Comparisons of buildings on the basis of cost per cubic foot should be avoided by school-board members who are unfamiliar with the many factors which influence this unit of measure.

c. Financing. (2)

It is unfortunate that most school buildings have been erected during periods of inflation and paid for during periods of deflation. Financing plant programs by sinking-fund bonds has in most localities been discontinued in favor of twenty-year serial bond financing. Long term financing should be discouraged, because it tends to restrict future construction which may be as essential as immediate projects. If possible, school lent bonds should be limited to ten year serials with retirement payments commencing the first year after issue. Short term amortization will be even more essential if the apparent trend continues toward a less permanent type of a construction.

With the larger school administrative units, pay-as-you-go plant financing will become more feasible, and should be encouraged. If extensive school plant construction must be financed entirely from local funds, however, bonding will be necessary in most communities which have not accumulated building reserves.

During the past generation there has been a general trend toward greater state support of public education; but state funds, with rare exceptions, have been available only for current expenses. In some states, small allowances have been made for the construction of consolidated school houses, but only recently has there been a pronounced trend toward substantial state aid for capital outlay.

There is increasing sentiment throughout the nation for federal financial assistance for the construction of school facilities. Federal aid for the construction of school plants should be apportioned to states according to an objective formula based on need, ability, and effort. The flat-matching basis used in former public works programs is unfair to

communities in the lower economic brackets where the needs were the greatest. The principle of equalization should be applied to the distribution of state school plant aid to local school administrative units as well as to federal apportionment to states. Local units could plan their plant programs more specifically and intelligently if the federal and state governments would establish permanent policies regarding financial assistance for school plant construction.

d. Architectural services. (3)

The American Institute of Architects has established standard fees that architects may charge for design and construction services. Fees paid to architects ranged, in a study in New York State, from 4.5 to 8.5 percent of the total costs of projects included in the study. It is questionable whether it is possible to secure the right kind of architectural services by reducing payment to a point below six percent. It is also doubtful whether there is any justification for fees higher than six percent, since even the very best architects do not demand more than six percent on buildings costing as much as in school plant construction. Many architects utilizing similar plans for two or more projects charge the same fee for all buildings in the group. It does not seem reasonable to pay for designing when a design has been standardized. Architects utilizing standard plans should certainly be required to reduce their charges for architectural services. It is, however, even more questionable whether it is desirable to utilize standard plans. Certainly there can be no integration with community life when a building designed to meet the needs of one situation is superimposed upon a totally different environment.

Too much stress cannot be placed on the importance of the architect in the school plant program. It is he who must coordinate the services of all the special engineers and produce a total design incorporating the educational requirements in a pleasing structure conforming to state and local codes. All this he must do under the direction of the educational authorities and within the limits of a fixed budget. The successful performance of these functions calls for the highest degree of managerial ability, artistic talent, technical skill and professional integrity.

e. Overall school plant planning (Planning coordination.) (4)

There can be little doubt as to the desirability of local autonomy in school plant planning. This is a part of our democratic form of government and must be maintained. It is clear that under this form of local participation a certain amount of inefficiency is to be expected, but standardization and stagnation are prevented. Individual tastes are cultivated and allowed to express themselves, resulting in reasonable differences in plant design among communities which may be promoting similar educational programs. There has been little research however, by which lay participants can be guided in avoiding costly mistakes planning which fall outside the realm of mere differences in tastes or opinions. This is especially true in the field of school building costs. Architects are in general unable to give satisfactory answers to questions concerning the costs of many factors entering into design. School board members act blindly in many situations because past experience has not been made available to them.

Obviously then the achievement of a functional, durable, economical and beautiful school plant requires the cooperation of many specialists and the mutual adjustment of different interests.

Teachers, supervisors, administrators, and plant operation and maintenance personnel should be given opportunities to contribute ideas and suggestions when school plants are being planned. Suggestions should also be solicited from lay groups interested in the use of school plants for community services such as Parent Teachers' Association, Boy and Girl Scouts, Future Farmers of America, and Public recreation and forum groups.

Many of the larger school administrative units include on their professional staffs school plant specialists or educational housing consultants whose functions are to study educational plant needs and to coordinate the plant requirements of the different areas and departments into a total and continuous plant program. This type of permanent local service is very valuable and should be provided in administrative units contemplating extensive programs of school construction.

Unfortunately, the vast majority of school administrative units cannot support consultative services. In addition, where large amounts of state aid for capital outlays are contemplated, programs will suffer from lack of central coordination in expenditures. The development of state controls and supervision was a natural concomitant of the extension of state aid. It cannot be viewed soley as a necessary evil.

The twentieth century inaugurated state responsibility for the enforcement of state minimum standards for school buildings, requiring approval of plans and specifications and other kinds of state supervision. New York State passed its first law governing school building construction in 1902. In 1903 it provided a full time inspector of school buildings. The next year it strengthened its power by requiring certain definite standards for school buildings, requiring state approval of plans and

specifications, and creating a bureau of school buildings and grounds. By 1916, the Bureau had become a division in the State Department of Education.

Other states had been taking similar steps. As early as 1910, thirteen state departments of education and nine state boards of health were excercising some control over school building. State controls spread rapidly after 1910. Insofar as planning is concerned, twenty-two states had bureaus of school buildings and grounds, or analogous units, in their departments of education or related departments, by 1940. All were charged with a major degree of planning responsibility. Thirty-nine state departments reviewed plans and specifications for school buildings; twenty-five had legal provisions for enforcing standard provisions.

At the present time, over half of the state departments of education maintain school plant services to review locations and plants, to assure that state codes and regulations have been met, and to provide consultative services to local school administrators, Boards of education, and architects. Such services result in benefits to children, taxpayers, by promoting properly located and functionally planned buildings at reasonable costs. It has been urged, by leading educational authorities in this field, that all states maintain school plant services of this type, preferably in their departments of education. It has been contended that a rapidly growing demand for these services by local school officials and architects will require the expansion of such units and an increase in their personnel and finances. Washington state has maintained a unit such as this in the office of the Superintendent of Public Instruction for some time, on a take it or leave it basis. Its funds and personnel have been limited, and its proper function suffers from the lack of a

state code covering planning and standards in school plant construction.

Often times local school authorities require more specific and detailed school plant services than can be provided by state departments. If the local school plant program does not justify the full time services of a permanent educational plant adviser, it is advisable in many cases to call upon college and university staff members qualified in this field for school plant consultative services to supplement the services available by local personnel and from the state. All suggestions and recommendations from the foregoing sources should be channeled to the local superintendent who should prepare and approve the final recommendations to the local board of education covering over-all plant programs and the specific space allotments and educational requirements of individual projects.

f. Bidding and contracting.

Attempts have been made to determine the effect of competitive bidding on costs, but up to the present time, no clear-cut answers have been found. It appears that, in general, the more bidders on general construction, the better the chances of securing the lowest possible price. This, however, is apparently not true for service contracts.

There is considerable question of the desirability of awarding to the lowest bidder, since in many cases it is believed that the contractor has found a loophole in the specifications by which he may make substitutions.

The whole question of bidding should be made the object of intensive research. Undoubtedly, much can be learned and many undesirable practices eliminated by a complete understanding of the results of competitive bidding.

g. State codes for school building construction. (5)

ANALYST'S PREFACE: The following two excerpts from published articles concern themselves with a critical statement of the major problems in building legislation today. The pro's and con's for the regulatory code vs. the informative code are discussed and several points are brought out concerning the trend toward formalizing and standardizing the building code. Included is a rather valuable discussion of how the legislative body should go about the task of organizing and writing a satisfactory code.

"A New Pattern for Building Legislation"
Howard Vermilya, Architectural Record
March 1946. p. 68.

1. A positive concept of codes.

It is not enough merely to revise the details of the two thousand building codes in force throughout the country. We need a new pattern in the codes themselves, a broader conception of the objective of building legislation. Regulations as they stand today, are largely aggregations of restrictive measures adopted over the years as the evolving history of construction revealed potentialities for disaster and epidemic. They began in colonial times with the regulation of chimneys. Fresh impetus to additional restriction on construction was given as recently as the coconut grove holocaust. Codes have been considered, therefore, as negative prohibitions. As a result they tend to preserve the status quo in construction. They make it more profitable for the construction industry to adhere to more expensive, less economical methods. They have not been conceived as positive encouragement to experimentation, development and growth within the standards of safety and health which the community sets for itself.

It is possible to take a positive attitude toward the problem of building legislation. The basis for it lies in the reconsideration of

codes from the point of view of today's standards, and of the contribution which the construction industry could make to the community if it were not hampered by unintelligent restrictions. The building industry can be expected to make the same kind of progress as, for example, the aviation industry, when it is encouraged to embark in new directions. But like the aviation industry, it must have freedom to provide better products at lower costs while adhering to necessary standards. It will have such incentives only when regulation is conceived as permissive of all developments meeting standards.

For the public, such a conception of codes opens up the possibilities for:

1. The benefits of a scientific, rather than a political approach to the objective of better construction.

2. Flexibility leading to the development of more modern and more economic and speedier construction methods.

For the architect, this means:

1. Increased volume of construction.

2. Greater freedom of design.

3. Less energy consumed in determining what is permitted by building regulations.

For the manufacturer, it means;

1. Larger potential volume.

2. More normal marketing procedures and

3. Ability to estimate more readily the value of new developments.

Building legislation as now formulated tends to hamper production and increase construction costs principally in three ways:

1. By specifying requirements higher than necessary for health and safety, thereby requiring the use of more material, more expensive material

or costlier methods.

An example of this is the common requirement for ceiling heights, ranging from 8'6" to 9'0" as a minimum standard for habitable rooms. Assuming the recommended minimum of 7'6" of the American Standards Association to be sound, these requirements serve to raise construction costs unnecessarily. There are any number of cases where one city specifies standards 100 percent higher than others, although the problem in each case is similar. A study of 30 codes showed that minimum requirements for live loads for floors in dwelling units varied from 40 to 100 pounds per square foot.

II. By restrictive specifications which prohibit the use of adequate alternate materials and methods, thereby creating monopolistic conditions with attendant increases in cost.

The Chicago building code, for example, requires lath and plaster for all dwellings for fire resistence and for sanitation. Analysis of this requirement indicates that it is not only highly restrictive but actually ineffective in accomplishing the protection of health on which it is based.

III. As a deterrent to orderly development and marketing of materials and methods because of the difficulty of meeting the diverse requirements of 2000 building codes.

Every manufacturer has faced this problem in marketing a new product in the construction field. Since building codes tend to specify what has been done and these specifications differ from locality to locality, they actually inhibit development of national markets and serve to increase distribution costs. It would have been analogous in the development of the automobile if there had been two thousand municipal safety

officers writing requirements on the cars we use.

To the degree that building legislation produced these results by accident or intent, it is abusing the basic objectives of building regulation and serving special interests rather than the interests of the people. To accomplish the proper purpose of governmental regulation building regulation cannot prohibit the use of materials and methods of construction which are equivalent or even superior to specified materials and methods. Since building legislation affects the future growth of a community, regulations must be written and administered to permit sound construction at minimum costs.

2. The need for code changes.

In general, the standards in many codes, if not actually outdated, are questionable in light of present technical research. Many code provisions tend to freeze the use of traditional methods, and favor particular types of conventional construction.

For the industry to operate at optimum efficiency in the provision of lower costs and better construction, building regulation must be governed by three principles.

1. An adequate level of standards based on sound principles of safetly.

2. Regulations designed, not to increase cost of construction beyond its natural economic plane, but to permit the use of all materials and methods which meet standards:

3. A more uniform concept of standards, to give users the benefit of modern industrial processes applied to the mass production of construction materials.

REQUIREMENTS TOO LOW.

Building legislation has been criticized because its requirements are too low; therefore, society pays dearly through increased costs of police and fire protection and through loss of health and life because

of inadequate protection. Recent technical studies give cause for seriously questioning many of the fire protection practices generally accepted for the past twenty years. It is probable that this engineering research will result in the re-appraisal of all fire requirements on the basis of the combustible contents of the contemplated occupancy.

REQUIREMENTS TOO HIGH.

While some requirements of particular building codes may be criticized as being too low, other may be called too high, unnecessarily increasing the cost of construction in the community. In the ordinary dwelling, for example, increasing the thickness of the foundation wall from 8 to 12 inches adds 15 percent to the foundation cost; increasing floor design loads from 40 to 60 pounds per square foot adds 30 percent to the cost of floors; increasing ceiling heights by a foot adds approximately 11 percent to the cost of exterior walls.

Numerous examples of requirements which are too high or too low, often in the same code, can be found. In fact, it is obvious from the study of codes there is no common concept of the level of standards which is necessary to health and safety.

It is apparent that there must be much broader agreement on standards and requirements. The growth of the industry on regional and national rather than on a local basis, is discouraged by the diffuse patterns of regulation. Development and marketing of new materials and methods are inhibited by confusion of building legislation; use of methods and materials which have been tested during the was but which depart from traditional practice are hampered by obsolete regulation. At the very time when the construction industry might take its greatest steps forward in fulfilling the pent-up need with progressive methods, it finds itself hampered, rather than encouraged by legislation.

3. The problem of code preparation.

It is understandable that there is no uniform pattern in our codes; historically speaking, building regulation came about to answer the need for control of local conditions. It was only with the economic integration of our country that regulation became a matter of interest not only to individual communities but also to states and entire regions. Moreover, as suppliers of materials became national in scope, local code regulations began to have their influence on national economies. It is because building g legislation is now a national problem that we must have a sound understanding of the principles of regulation in order to arrive at a new pattern of control.

The basic objectives of building regulation (safety to life and the protection of health) are codified by establishing in legislation the requirements which control the construction, alteration, use and maintenance of buildings and the installation and maintenance of equipment. The determination of the level of the requirements to be established as an expression of the will of the community is the major legislative function. A parallel problem is the determination of the manner in which the requirements are to be formulated.

The second important function of the legislature is the establishment of the administrative agency or agencies and the grant of power to effectuate the aims, intent and purposes of the legislation. Here the framework within which the requirements are interprested and enforced is provided. Legislation in detail is inevitably prolix. In the field of building construction and maintenance, it is technical and in a large degree beyond the grasp of the layman. Many requirements are expressed as engineering formulae which are incomprehensible except to the technician.

obviously, a legislative body is incapable of preparing the legislation in detail itself. Naturally it must, therefore, request others to draft building requirements in the legislation which it finally enacts. Practice in drafting building legislation has varied. Sometimes it is drafted by the administrative agency which will enforce the legislation. Sometimes paid consultants are employed. Sometimes committees of private citizens, usually uncompensated, are established for this purpose. Often it is drafted by a commission appointed by the major (Governor) as a coordinating body representing the various interests in the field of building construction, alteration, and maintenance. The product thus derived receives legislative sanction by action of the state legislature.

In fact, this process is similar to a delegation of power on the part of the legislature. The legislature thereby becomes a court of review. The evidence presented at the hearings on the proposed legislation is relied on to develop the points at issue. To this extent, recognizing their lack of technical knowledge, members of the legislature protect the community and implement its policy concerning safetly, health, and welfare in building legislation.

The field of building regulation is becoming more and more borad. Today there are some thirteen major classifications under which building is regulated. These include, fire resistence and prevention; engineering design; general structural considerations; (including water supply and drainage systems) equipment; (including such devices as elevators, heating plants, etc.) heating; natural and artificial lighting; natural and mechanical ventilation; use; and planning and zoning.

In the past legislatures have been obliged, because of lack of data, to determine the level of standards prescribed by the requirements on the basis of opinion and judgment. Often prejudices and limited experience resulted in great discrepancies in the adequacy of the requirements, some being too high and others too low.

In building legislation as now generally drafted, the method of formulation of regulations is to describe the manner in which compliance is to be obtained. Some define the objective sought and include several descriptions of the ways in which this objective may be met. Others, failing to state the objective, describe only the assemblies of materials which are permitted.

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"School Building Codes", Nichols, John E., The American School and University, 16th Annual Edition, 1944, pp. 31-6.

There has been general apathy to actual planning of postwar construction, despite the urgings and warnings of interested groups. quite suddenly within the past few months this attitude has given way to pronounced concern and hustle. All about us postwar planning committees are springing up. So numerous are they becoming that they threaten to tangle each other up like the civil protection committees were doing by a year or so ago. In many municipalities they have gone so far as to arm themselves with actual working drawings and specifications for fire houses and town halls - and school buildings.

All of which reminds us of the situation prevailing during the PWA and WPA experiments in building when many localities were without any definite, thoughtfully worked out, long range school housing program. There were many cases where, although the over-all building program and the necessary facilities in each building had been well worked out, we were unable to indicate clearly and precisely the characteristics which would make those facilities most satisfactory. There is promise that we shall be better prepared for the building program now appearing on the horizon.

School men, with lots of assistance, are studying their communities educational needs. Very few, however, will be prepared to speak in anything but the most general terms of the relationships, locations, sizes, shapes, colors, materials, permanency and mobility of rooms and their equipment, of doors and windows, corridors and stairs, floors and walls.

Sources of help.

It must be borne in mind that most school buildings are planned by committees who have had no previous experience in their design and construction. Such groups must look outside their own membership for guidance if their handiwork is to hold promise of success. In many states they have no place to turn except to their superintendent of schools or to their architect - neither of whom is likely to be experienced in the intricacies of school planning. Most school administrators will freely agree that years of using school buildings will not alone make them competent school planners. The mere fact that an architect is clever in designing and an expert in materials ⊖ even though he may have in the past obtained a few school-house commissions is no assurance that he has a thorough grasp of the problems and aims of school design.

In some states there are school building specialists whose services are available to hard-pressed building committees. These services generally consist of occasional advice during the preparation of plans, with final review of them when completed. Valuable as this service is, it needs to be supplemented by reference material, readily available at all times, to give guidance and on the endless questions which must be answered as the work progresses; to give some advance indication of what approving authorities, if any exist, will require.

The regulatory code.

The instrument usually employed to give instruction concerning the requirements for approval is the school building code. In more cases than not it is neither used nor designed to present much more than those state regulations that standardize certain aspects of design and construction. This type of code can be designated, to distinguish it from other kinds,

as the "regulatory" code.

- It must be admitted from the very outset that regulations are a practical necessity. They are essential to furnish some degree of protection against ignorance, stupidity, and unscrupulousness. In most situations they are not needed. The vast majority of architects and building committeemen want to do a job which will reflect credit upon themselves. But regulations must be established for the few who are too lazy or too stupid to inform themselves on the problems they face, or who are willing to sell out for personal gain. In a very real sense they may be a sustaining wall at the back of the official who is charged with the responsibility for protecting the interests of the public and the children. On the other hand, specific regulations may well offer the public protection from the overzealousness of that same official when sometimes he loses perspective in the pursuit of his speciality.

Weaknesses and shortcoming.

Despite the necessity of the regulatory code, its weakness and shortcomings as a type are manifold indeed. To begin with, the whole philosophy or viewpoint of the regulatory code is backward looking, not forward looking. It is occupied with past mistakes in school design and with their elimination from the work at hand. This is as it must be perhaps. We may indeed learn from our mistakes. But it is not healthy, certainly in a school code to dwell upon them. When we do, we become so fascinated by the errors we have seen committed and which we cannot avoid in the future, that our approach to the task of planning becomes mechanical, cautious. Instead of fixing our gaze upon the horizon ahead and striking out boldly toward it, we advance by peering fearfully backward upon our tracks to see that we have not trod upon some fetish.

Again, our regulatory codes tend to actually freeze in these unsatisfactory practices which they attempt to limit. Few indeed are the school administrators or teachers who have a kind word to say for a basement or half basement room. They have been tolerated because somehow they were looked upon as extra space that could be had at little or no additional cost. So many abuses of basement spaces developed, however, that most school codes now place limitations upon them. But when an architect reads in a very code that must be his law and prophet that basement rooms used as classrooms must not be more than three feet below the ground level, unless he is immunized by strong personal convictions on the subject, the harm is done. He is presented with a picture of a school with basement rooms. The first thing we know we are presented with plans for a building with half of its floor area squashed into the ground - the very thing we had hoped to avoid.

It is a well known phenomenon among those who administer regulatory codes that an established minimum invariably and automatically becomes the optimum - the standard in the minds of those who use it. In regognition of the evils of crowding pupils in their schoolrooms, practically all states have codes of any kind establish a minimum number of square feet (or cubic feet) per child - 18 or 16 being the usual figure. The ludicrous aspect of these regulations is that they are established empirically on the basis of health requirements. So we go on and on building classrooms 23' x 28' as though those proportions had some inherent charm. Yet we know all the time that almost the universal plea among teachers who are not vegetables is for more room - room in which children can do something besides sit. The irony of the thing is that our codes are very largely to blame for this unhappy situation. That figure 18 square feet per pupil stands out like a beacon. It is not a point

of degradation below which the designer must not sink. It is that level which he is asked to attain - and reaching it, he prides himself on a job well done.

It is especially notable that slavish conformity to established minima cannot be laid at the doorstep of necessary economy. That claim is refuted by too many cases that have gone well beyond our piddling minima in items that really mattered, yet whose costs have not risen to particularly alarming heights. Usually we can attain many more of those things which are useful and needed if these that contribute principally to vanity are forgone.

Another dilemma of those who compile and administer codes is the practical impossibility of devising rules which can be applied with equal validity to a wide variety of situations. If regulations are to do what they are set out to do - regulate impartially and unequivocally - they must be subject to a minimum of interpretation. They must be wholly specific, free from those favorite crawling terms "adequate" and "sufficient", that mean so little. However, just as surely as a code becomes specific, it must embark upon a sea of definitions and exceptions which is endless - which becomes a morass of split hairs. The end product is so cumbersome as to be practically useless for those who must need help.

Finally, the great majority of the regulatory school building codes are not school building codes at all, but general building codes applied to schools. In other words they consist of regulations designed primarily to protect the public's physical welfare. Safety from fire and accident, the prevention of conditions which might spread disease or injure the health in other ways. Those considerations which are of vital importance from an educational standpoint - the location, interrelationships, and character-

istics of a multitude of educational facilities - these get short shrift. Every care is taken to put the child into a building where no harm can come to him. But for the reason for that building's very existence is blithly ignored.

The informative code.

That is the case against the regulatory code. What then is the alternative?

First, it is necessary that we realize that a code can pefform a function more valuable and significant than regulation. Briefly, that function is leadership. It should be designed primarily for the great majority of its users who need and desire information and guidance rather than for the minority that must be compelled.

If the designers of our schools and the committee members who are responsible for the buildings of them are to be lead to solutions and practices which are more acceptable to the educator, we must treat them like reasoning human beings.

It is to the layman, in the final analysis, that the code must be addressed. It is not to the educator. It is not even to the architect so much as to the banker, and the farmer who make up the building committee that hires the architect. These are the ones that must be reached. They must be given the reasons for every recommendation and every rule just as clearly and concisely as possible.

Besides the very practical advantage of fostering an understanding and willing cooperation, the informative code - to distinquish it from its distant cousin, the regulatory code - has another advantage which is equally important. It puts into practice the old adage that two heads are better than one. It opens the road to improvement.

This is not to condone the code which is so open-minded that it holds no convictions. On the contrary, a code can be most informative and most beneficial if it holds strong and definite convictions - and defends them with courage and vigor. But these convictions must be supported by reason. Not by compulsion except as a last resort. Such an approach goes far toward eliminating such wishy-washy terms as "adequate". When the controversy becomes great, there is all the more reason that the code openly sift the evidence pro and con, come to a conclusion, take a definite stand and advise accordingly.

The answer lies in the skillful use of emphasis. In every respect the regulatory element of our hybrid code must be subdued - made subordinate to the informative elements. To begin with, the regulations should be departmental rules with legal force which can be suspended by the department enforcing them when the suspension holds promise of benefiting the school. Under no condition should they be written into state law in a form that can be modified only by legislative action. Second, our regulations should be kept to that minimum which includes only the essentials. Otherwise, the teeth become too prominent. Third, our regulations should be placed where they must be searched out; distributed in among the more important informative material. Where segregated - even though they be placed at the end of the appendix in small type - their susceptibility to ready reference makes them much too tempting to the person who is more interested in getting ~~it~~ by than in doing a good job.

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