A PROPOSED SCHOOL BUILDING CODE FOR THE STATE OF ARIZONA

by

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CHAPTER I

INTRODUCTION

Importance of School Building Construction

School building construction is of basic importance from an educational and social standpoint, as well as a structural standpoint. The building program can be the lever by which school systems are reorganized along progressive lines. The changes in the conception of the function of the modern school have resulted in much experimentation and development of the present broad curriculum. The curriculum, in turn, has radically affected the planning of the modern school building. Buildings may no longer be judged merely on the basis of whether they meet certain standards of heating, lighting, ventilation, etc., nor can they be judged on the basis of former standards in classroom size, etc. The modern school building must now be appraised on the basis of effectiveness with which it has been planned and constructed to carry out the educational program of the school; also different educational programs will call for different types of school buildings.

These changes of the modern school curriculum are normal and encouraging. However, they have naturally led to much confusion among school authorities and architects. As the old standards and procedures in schoolhouse planning

and construction are outmoded and discarded, too often new methods and standards have not risen to take their place. School authorities often are not clear as to what they want and in many cases no mechanism for cooperative planning between the superintendent and architect has been set up. To quote Spain:

> "Forward looking communities are coming to realize that the new school program of specialized activities must be housed in a building which provides highly specialized rooms and facilities. To plan and erect buildings of this sort, having due regard for the needs of the curriculum, the demands of safety, the dictates of good architecture, and the financial resources of the community offers a challenge to the superintendent of schools and the architect, which they did not receive in earlier years. It also makes a demand upon their resources, which few of them are prepared to meet. The architect must scrap many of his old ideas and readjust his viewpoint, and the superintendent must equip himself with new data and a technique, which in the past he did not find necessary."[1]

We must recognize, then, that the problem of school building construction is a dynamic and changing challenge. As long as our ideals and methods of school curricula continue to change and develop, it is impossible for school building planning to remain static. But, having accepted the present situation as normal and desirable, it is expedient that we determine whether, within this process of change, there are developing fairly well-defined types of school building constructions.

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1. Spain, Charles L. "Economy and the Modern Curriculum." Detroit Educational Bulletin 16: Jan., Feb., 1933.

It may be well for us to turn the pages of time backwards a few years and view the various periods of school building construction. Roughly speaking, there are four general periods which may fall under the following headings: (1) Pre-World War period, (2) World War period, (3) Post-War period, (4) Depression period.[2]

The Pre-World War period of school building construction was characterized by lack of scientifically planned, unorganized building methods. The buildings constructed during that period are largely obsolete from an educational, social and constructional viewpoint.

During the World War period of 1914 to 1922, school building construction lagged far behind the needs of school enrollment. The average annual capital outlay was $116,934,873.00, or $5.71 per pupil.

The Post-War period, ranging from 1922 to 1928, saw an increase in school building construction to an average annual expenditure of $372,111,009.00, or $15.27 per pupil. Such increase in capital outlay for school buildings and equipment was largely made necessary by lack of construction during the World War period.

The Depression period saw school building allotments fall sharply from the post-war high. Average per pupil expenditures for 1930 were $14.44. Average per pupil

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2. Barrows, Alice. "The School Building Situation and Its Needs." Office of Education, Bulletin No. 35, 1937.

expenditures for 1932 fell to $8.03, and average per pupil expenditures in 1934 fell to the unheard of figure of $2.24.

However, the federal government took a hand in the financing of school building construction at this point with its Public Works Administration loans and grants. Starting in the year 1933 and running through 1936 Public Works Administration allocated funds for school building purposes to the average amount of $81,658,703.00 a year.[3]

In spite of the money allocated through Public Works Administration funds, a survey conducted by the Department of Education, Washington, D. C., indicated that in communities already building by Public Works Administration funds an additional $717,000,000.00 was needed for the completion of their school building programs.[4] Obviously, this does not mean that those communities not covered by the survey had no need for a school building program.

Since it has been estimated that our population will be static sometime after 1950, we might be tempted to question the need for this indicated building program. However, the reasons are self-evident if we should but pause to analyze them.

(1) School building construction is still in arrears as Public Works Administration grants did not bring the construction level up to pre-depression years, and pre-

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3. Barrows, Alice. op. cit.
4. Ibid.

depression years had, in turn, not completely caught up with the building shortage caused during the World War period.

(2) Enrollment has increased enormously during the depression. The enrollment increased from a yearly average of 20,484,325 during the years 1914 to 1920 to a yearly average of 26,129,216 for the years 1930 to 1934, which is an increase of 27.5 percent enrolled in our school systems. This increase came during the years when our annual capital outlay for school building construction had fallen to the ridiculous figure of $2.24 per pupil.

The larger part of this enrollment increase was in the high school, which showed the astounding jump of 168.6 per cent increase over the World War period enrollment. The present high school plants are definitely inadequate for this unprecedented increase.[5]

(3) Though a marked enrollment increase has not taken place in the elementary schools, modern times have made necessary modern curricula, which in turn have demanded modern school buildings. Since our modernization of school procedures has markedly changed the curriculum in the elementary schools, the need for elementary school building construction is just as vital as high school building needs.

Because of the lack of marked increase in enrollment in the elementary grades, school people should not be deceived into thinking a building program is not essential.

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5. Studebaker, John W. "Biennial Surveys of Education." Office of Education, 1934

The larger proportion of elementary school plants need modernization. Many elementary schools are of the one-room type. Naturally, some of these should be replaced by a centralized, modern plant. Many of our elementary schools of larger size do not come up to the modern standards in heating, ventilation, lighting, sanitation, accessibility, beauty, to say nothing of educational facilities.

Because of the complex and changing conditions of modern life, it is vitally important that the elementary school offer a richer and more varied program than formerly. It is admitted that elementary schools, as well as high schools, should offer opportunities for work in science, art, music, nature study, shop, libraries, and recreational activities.

(4) The modern school plant must make provisions for the education of the vast army of young boys and girls who have finished their formal schooling but have not been absorbed by industry.

(5) Furthermore, the schools must make provision for re-education of adults along lines indicated by industrial changes. These can be carried on only in a modern type of school building.

In the study undertaken by Barrows it was found that in 246 cities, which constructed school buildings with Public

Works Administration funds, a total of 722 buildings were constructed. Of this group 399, over 50 per cent of the buildings constructed, were elementary schools. Also, there were 82 junior high school buildings, 44 of which were new and 38 were additions. A total of 120 senior high school buildings were constructed, 69 being new, and 51 being additions. A total of 36 junior-senior high school buildings were constructed, 14 being new and 22 being additions. Combined elementary and high school building construction totaled 19 units, six being new and 13 being additions. Vocational and trade school construction totaled 18 buildings, 12 being new and six additions. A total of 16 new junior college buildings were constructed, one building being an addition. Furthermore, 31 buildings were constructed which were grouped under miscellaneous uses such as athletic plants, storehouses, administration buildings, band rooms, gymnasiums, home economics and industrial arts buildings, and buildings for handicapped children.[6]

In connection with the study, Barrows found that 39.3 per cent of the present elementary school buildings were 30 or more years old. As might be expected, the regions in which old buildings predominated were our older centers of population. The New England states led with

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6. Barrows, Alice. op. cit.

57.8 per cent of their elementary school buildings being 30 years or more in age. New York was second, with 49.6 per cent; the middle Atlantic states were third with 47.5 per cent; the north central states were next with 43 per cent; the central states followed with 14 per cent, and the Sierra Nevada states, which include Arizona, were last with 9.3 per cent. These facts uphold the previous contention that a school building program is of vital importance to the elementary grades.

It is apparent, then, that school building construction is of vital importance for several reasons:

(1) There are approximately 132,000 one-room schools in the United States, many of which do not offer a balanced educational program. If children are to be equipped to deal with conditions of modern life, it is necessary that the school provide facilities for modern curriculum. Such curriculum can best be undertaken in proper housing conditions. The average school, over 30 years of age, often does not meet these modern requirements.

(2) Schools must provide for those thousands of boys and girls between the ages of 18 and 21, who cannot attend regular sessions, but who are forced by technological changes in industry to remain idle during these formative years.

(3) The school must serve adults who wish to be re-educated along lines of work and leisure time activities.

(4) The lack of data available as to school building requirements indicates a need for exhaustive studies in this field.

And so it is obvious that school building construction is of vital importance from an educational and social, as well as a structural standpoint.

Problem of the Current Study

The problem of this paper is to make a study of the building codes in effect in various states, study the modern trends of school building planning and construction; then, in the light of these findings, draw up a school building code, which will be applicable to the state of Arizona.

It has often been said that school building codes both hamper and restrict free planning, on the one hand, and facilitate it on the other.[7] No doubt both statements are partially true. If all planners were expert enough, knew enough about all the phases of school building construction, were not financially restricted, had no pet theories, rode no hobbies, and were not concerned with any immediate profit to themselves, then we would probably get school building planning which is 100 per cent efficient without the use of codes or regulations. However, such individuals are as yet undiscovered.

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7. Schmidt, H. W. "Some Fundamentals of School Building Planning." American School Board Journal, June, 1936.

Even at best, codes only partially facilitate school building planning in the final analysis. They do not tell how to arrange spaces, what size rooms to use, how to best dispose of materials of construction, nor how to be economical in their uses, nor to estimate how much space must be devoted to this or that activity. But with all these limitations they are not useless by any means.

Codes are not developed overnight, nor are they formulated on the basis of "just because". Virtually all are the outgrowth of the vast amount of experience, result of knowledge based upon tried and proven methods, and with all, are the results of pooled knowledge of a great number of specialists.

Most school building codes are primarily concerned with matters of safety of life, limb and sanitation. They are collections of pertinent data and regulations, pertaining to guiding of the designer and bringing to his aid facts which he would otherwise have to dig out for himself, and which he would use anyway if he were conscientious and able. In this measure, then, a good code certainly facilitates the disposition of materials and also, as certainly, aids to a less degree in the design and construction of buildings.[8]

And so we find the use of school building codes, not

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8. Schmidt, H. W. Op. cit.

as an end, but as a means to an end, being restrictive enough to assure good fundamentals of planning and construction and elastic enough to permit the inclusion of new and approved developments.

Reviews of Related Studies

In the field of education, research and surveys have become widely accepted as indispensable in school administration and procedures. Meanwhile, such forms of furthering educational means have undergone considerable progress since the turn of the century. A comparison of some of the surveys published before 1920, with others published in the later twenties and in the present decade, shows a greater refinement in the techniques and methods. Attention should be called to the modern methods of furthering education and the long range planning of school building needs through:

(1) Issue of building permits over a period of years.

(2) Building saturation.

(3) Residential distribution of pupils.

(4) Zoning of districts.

(5) Location of homes.

(6) Location of industrial plants.

(7) Location of parks and play areas.

All of these have a definite and tangible bearing on the ultimate school building program.

The literature in the field of school building planning has increased rapidly since the middle twenties when school building construction was sharply increased. However, the most outstanding contributions have been limited to a few well-known authors. These men are George D. Strayer, Fred Engelhardt, and N. L. Engelhardt, who have individually or collectively published the most important and accepted thoughts along this line. There has been practically nothing of a modern nature written on the school building planning and construction in the state of Arizona. Such lack of thinking along this line prompted the State Administrators' Association to assign this topic to Dr. R. A. Holy, Superintendent of Schools of Casa Grande, who prepared and delivered a paper entitled, "A School Building Code for Arizona", at the annual meeting of the association in May, 1938. This being the only recent study on school building conditions in Arizona, it might be well for us to consider his findings.

"A School Building Code for Arizona", by R. A. Holy.

Dr. Holy contacted by mail 22 states to find the present status of state laws or regulations concerning school buildings and school building codes. Of the 22 states he found that seven actually had some form of school building code and 12 had no school building code. Three states did not answer. Of the 12 states which did not have school building codes, seven actually had school building

regulations of some form. Five had no regulations pertaining to school buildings, and apparently only had to conform to those building regulations of their particular locality.

He found that Arizona does not have a school building code. However, the Arizona state school law has several regulations applying to public buildings in general and to schoolhouses in particular. These regulations are of a general nature, dealing with the protection of life.

Dr. Holy did not actually propose a school building code for Arizona, but he made this suggestion, "It only seems wisdom that there should be some definite regulations concerning school building structures in this state, and that steps be taken to set up certain minimum requirements for the erection of all public school buildings in this state."

"The Spanish Style for a School of the Southwest", by Lyman and Place, Building Age, Volume No. 46, December 1924. An outstanding architectural firm of Arizona, which planned the Roosevelt School of Tucson, suggests the Spanish style for schoolhouse construction in the southwest. The building is to be very plain and severe without outside ornamentation except around the entrance, thus following the lines of the buildings erected by the early Spanish settlers. The severity of the lines and walls is broken by a red tile roof, with a simple cove set close under the eaves and the pierced pattern formed in the gables of the projecting

wings, which also act as ventilators for the roof space. The windows are equipped with iron grills, which add a rugged beauty to the protection they afford. The interior classrooms are connected by a central corridor from which five fire exits lead out directly upon the grounds.

This single-story Spanish type architecture has proven very practical and economical for the climatic conditions of the southwest.

"School Plant Requirements for Standardized Elementary and Accredited High Schools", by Haskell Pruett, George Peabody College for Teachers, Contribution to Education, Bulletin No. 128, 1934. This study was undertaken as a doctor's dissertation and attempted to analyze and answer the four following questions: (1) What are the school plant requirements for the standardization of rural and elementary schools, and the accrediting of high schools? (2) What are the relative values of these standards as determined by the accrediting agencies which made them? (3) What are the practices in administering these school plant requirements in standardizing the rural and elementary schools and accrediting the high schools? (4) What are the relationships of the accrediting agencies to other divisions of government machinery in the administration of standards of the school plant?

Taking these in the order of their procedure, Mr. Pruett found:

(1) There are 35 states having some form of written bulletins on the standardization of rural and elementary schools. There are 45 states having bulletins for accrediting high schools. Pruett abstracted and classified all standards pertaining to the school plant. He found for rural and elementary standards 3,486 items concerning school plant standards. By far the greatest emphasis of these items is placed upon substances for sustenance of life, air, light, water, heat, etc. More than half the standards are merely recommendations and are not necessary before the school can be rated as standard. There is a high degree of similarity as to the standardized items of the school plant mentioned by the standardizing agencies of the various states. In the standardization of high schools 3,182 items were noted by Pruett, the emphasis being placed on teacher equipment. Two-thirds of all such items were declared minimum requirements before accrediting could take place.

(2) Pruett discovered rural and elementary standards are in the form of weighted school check-cards in 25 states, while high school standards are weighted by 38 high school inspectors in 34 states, on a ten point scale. There seems to be little agreement among the accrediting agencies about the relative values of school plant standards.

(3) Pruett conducted a special study of the Oklahoma rural and elementary schools to determine which standards were most frequently observed in those schools which were accredited, and in those schools which were not accredited, and observation was made upon which standards were most frequently lacking. He checked to see if the wealth of the district was a factor in determining the absence of desirable standards. The correlation between district wealth and factors leading to non-standardization was found to be very low.

The high school practices were determined on a basis of case studies of involved problems of the school plant. The findings showed a wide variation of practices among the high school accrediting agencies in the items pertaining to standardization of the school plant.

(4) The following departments of the states are concerned with, or have jurisdiction over, some phases of the school plant:

a. State fire marshal

b. State health officer

c. State director of schoolhouse planning

d. State supervisor of physical and health education.

e. State supervisor of librarians and libraries

There was a considerable overlapping of work of these departments and often lack of cooperation among them.

Qualifications of the heads of these departments, on the basis of college training and experience, showed the best qualified to be the state health officer and the least qualified to be the state fire marshal, with qualifications for the others showing little difference in requirements with other members of the state departments. Inasmuch as this study shows conclusively that all standardizing and accrediting agencies are concerned with the school plant and that there is considerable overlapping and duplication of work of the state departments, the author has suggested a plan of organization to assign all of the functions of the school plant to one division of the State Department of Education, thereby eliminating the overlapping of duties and responsibilities with reference to the schoolhouses within the state.

"Standards for High School Buildings", by George D. Strayer and N. L. Engelhardt, Teachers College, Columbia University, 1924. This is a short pamphlet dealing with the standards for high school buildings, as outlined in the Strayer-Engelhardt score-card for high school buildings. These standards are to be used in analyzing the conditions and status of the existing school plant in any community, thereby affording a basis for the development of a school building program. The pamphlet includes a table which summarizes the scores given to buildings in several different high school building surveys made by the authors. Accord-

ing to their method of scoring any building which totals less than 500 points can seldom be considered as adequate.

The authors have divided their bulletin into the following headings: (1) The score-card of high school buildings, (2) The standards for high school buildings, (3) Bibliography of available literature covering the use of the Strayer-Engelhardt score-card for high school buildings, (4) An index of standards, and (5) Appendix of data on the organization and administration of high schools.

"Standards for Elementary School Buildings", by George D. Strayer and N. L. Engelhardt, Teachers College, Columbia University, 1923. This pamphlet is similar to the pamphlet on standards for high schools, simply making what changes are necessary for use in the elementary systems.

The book is divided into six main headings: (1) Field survey record sheets, (2) Score-cards for elementary school buildings, (3) Standards for elementary school buildings, (4) Explanation of the score-card method for evaluation of the school building, (5) Use of the score-card in a possible report on schoolhouse conditions, and (6) Bibliography of the available literature covering the Strayer-Engelhardt score-card for elementary school buildings.

The standards for school buildings as set forth by these two authors are the most authoritative and widely accepted aids to schoolhouse planning.

The previous reviewed literature on the various phases of the school building problems are related to the present problem of developing a school building code for Arizona.

Methods of Procedure

The author is vitally interested in the field of school building planning and construction, but realizes that he is far from an authority in that field. With this realization in mind, it becomes necessary to draw upon authoritative sources and modern approved methods related to school building planning and construction.

To this end, then, it will be necessary to study the existing state codes and regulations, to make a list of those features which, by common use, appear to be of fundamental importance in a school building code. However, since existing state codes may be largely outmoded, it will be necessary to supplement this information with the most modern and approved methods as advanced by authoritative sources. Therefore, a balance may be drawn between legislative provisions, on the one hand, and actual recommendations and practices, on the other hand. From these two sources of information it will be possible to select those points applicable to a building code for the state of Arizona, which will serve to unify state construction methods and yet will be elastic enough to permit the inclusion of modern improv- methods within the code.

CHAPTER II

ANALYSIS OF STATE SCHOOL BUILDING CODES

Origin of School Building Planning in the United States

School building surveying and planning, as we know it, did not come into being until the second decade of the twentieth century. Early reports of both state and city superintendents show a sensitiveness to many of the considerations taken into account in the present surveys and programs. These reports undoubtedly form the background and germ of present school surveys.[1]

The development of school plant planning has been in process for a long period of years. Alcott's prize essay on "The Construction of Schoolhouses",[2] was written in 1831 and may have been the beginning of the schoolhouse planning movement in this country. Many elements of a sound school building program were discussed in this essay. Considerable attention was given to the location of the schoolhouses, playground facilities, and construction of

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1. Holy, R. A. The Relationship of City Planning to School Plant Planning, Ph.D. dissertation, Teachers College, Columbia University, 1934. p. 24.
2. Alcott, William A. American Institute of Instruction, Discourses and Lectures, 1831. pp. 239-259.

the buildings.

An essay written by Horace Mann,[3] as early as 1838, submitted a report to the State Board of Education in Massachusetts on the number of schoolhouses in that state. Among the significant subjects discussed in this report is the location of schoolhouses and another section on yards and playgrounds. Mann emphasizes the need for sufficient enclosed space around a school building which can be utilized for playground. Numerous other reports written about this time discuss such problems as the amount of sickness among school children, the effect of poorly located schoolhouses on the health of pupils, the connection between schoolhouse appearance and cheerfulness and health of the pupils, hazards to school children because of schoolhouses being located on public highways, and many other reports of a similar nature.

One of the first volumes on school architecture was written by Henry Barnard in 1848.[4] In this volume conditions of schoolhouses in the various states, with a number of planning elements, such as location, size of site, and the architecture of the school buildings, were considered. The following paragraph shows that even in those days the progressive educators were beginning to consider

3. Mann, Horace. "Report of the Secretary of the Board of Education on the Supply of Schoolhouses."
4. Barnard, Henry. School Architecture; or Contributions to the Improvement of Schoolhouses in the U. S.

schoolhouse planning and construction:

> "In 1837 not one-third part of the public schoolhouses in Massachusetts would have been considered tenantable by any decent family, out of the poorhouse, or in it."[5]

By 1900 nearly all the states and territories in the north and west had enacted some form of compulsory attendance legislation, as a result new schoolhouses were needed. Another important factor which gave impetus to schoolhouse construction was the establishment and rapid growth of the high school about 1900.

Although compulsory attendance laws and the growth of the high school greatly increased schoolhouse construction, there seems to be little evidence of any effective planning during this period. Cities were small, vacant lots served as playgrounds, schools were built without play areas, and were usually constructed on the spur of the present moment.

Undesirable as were many features of the school plant perhaps the architectural and structural mis-planning was most noticeable. Johonnot expressed these conditions in the following terse statement:[6]

> "A traveler passing through a section of country can readily distinguish the schoolhouse by these distinctions. It is situated in a forlorn and lonely place. It exhibits every mark of neglect and dilapidation. It is entirely exposed to the depredations of stray cattle and unruly boys, by being situated on the street and not protected

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5. Barnard, Henry. op. cit. p. 16.
6. Johonnot, James. Schoolhouses. p. 15

> by a fence. It is unpainted and nearly half unglazed. Its style is non-descript, being too small for a barn, too deficient in the elements of just proportion for a dwelling, and too much neglected for the outbuildings of a farm - in short, too repulsive in all respects, exhibiting too many marks of parsimony to be anything but a schoolhouse."

A pioneer in school building construction was C. N. Kendall, who, as Commissioner of Education of New Jersey, prepared a school building survey for Boise, Idaho, in which he devotes an entire section on the construction of school buildings. As early as 1912 a survey of the school building situation was made for Harrisburg, Pennsylvania. Among other cities conducting school building surveys previous to 1920 were Great Neck, New York, Milwaukee, Wisconsin, Omaha, Nebraska, and St. Paul, Minnesota.[7]

The trend of thinking along the lines of better schoolhouse construction began to change from a qualitative nature, which spoke only of conditions as they existed, to a quantitative tone, which described conditions and made specific recommendations. Such form of thinking began to crystallize into specific recommendations and then legislative action regarding the various phases of schoolhouse construction. Thus evolved the present-day schoolhouse standards, with their current state codes.

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7. Holy, R. A. op. cit. pp. 36-37

An Analysis of Various Existing State School Building Codes and Regulations

The local district school building is the best equipped home that some children will ever know. The hours spent there will play a large part in moulding ideals, in setting up standards to be met in later life, and in leading pupils to desire the finer things in life after they leave school.

Properly constructed school buildings are more economical than those that are poorly constructed or are poorly arranged. Better and more work can be done in a well arranged building, with the same effort. A school building that is properly constructed makes possible a saving in time for the pupils; a saving in money expended by the local district; and a saving to the state. Thus, a well planned school building makes possible more efficient work at less expense.

The state and local district have a joint obligation in providing adequate buildings and accommodations to assist in the highest development of the school. Since children are required by law to attend school, the state and local district should be obligated to see that each child has an opportunity to attend school in a building that is arranged to protect his life and health, that is convenient and attractive, and that will serve to develop worthwhile ideals.[8]

8. Lee, Charles A. "Schoolhouse Planning and Construction." School Building Bulletin No. 3, State of Missouri. p. 3.

Since educational authorities agree that much of the value of the educational program depends upon adequate housing facilities, let us see what action the several states have taken in raising the standard of schoolhouse construction within their boundaries.

California: On March 10th, 1933 at 5:55 in the afternoon an initial earthquake shock occurred of sufficient intensity to shatter poorly constructed buildings in a densely populated district in the southern part of the state, and to seriously impair the stability of all but the better built building structures. Following this catastrophe the state legislature of California, then in session, promptly enacted a law, Chapter 59, Statutes of 1933, that vested the Division of Architecture of the State Department of Public Works with the authority and responsibility, under the police power of the state, to pass upon and approve or reject plans and specifications, also to supervise the construction of all public school buildings, except as specifically waived. This made mandatory preparation of adequate designs and specifications and the safe construction of such public school buildings within the state of California. This law went into effect on April 10th, 1933.

Connecticut: On June 2nd, 1937 the State Legislature adopted for one year's trial a school building code, as drawn up and compiled under the direction of the State

Board of Education. This code, with few modifications, has been retained.

It is the express policy and function of the Department of Education to extend the state code as a service, rather than a regulation. The Department welcomes the opportunity to work with local authorities in developing plans, and where this relationship holds throughout the development, final approval of building plans and programs is likely to be a mere matter of form.

Section 298-C, Cumulative Supplement to the General Statute requires that all plans and specifications for new school buildings within the state, and for all additions to existing school buildings, be filed with, and approved by, the State Board of Education before construction is started. It is further stated that the desirable aims and standards, and the minimum allowances expressed within the state code will serve for the evaluation of plans and specifications submitted for approval. The code will serve, also, as a basis for the appraisal of existing school buildings, except that minimum allowances may be subject to whatever modification and change the merits of individual cases may justify. Such exception to the minimum allowances may be granted in any particular case only if, after consideration of the request and the supporting evidence of need, such an exception is found to be reasonable and desirable.

The State Department also contends that since understanding of educational problems and methods of procedure are constantly developing, since kinds of materials, practices in construction, and contributing circumstances are subject to change, no decision by the State Board of Education is to be regarded as a binding precedent in subsequent considerations.

North Carolina: This state has not adopted a school building code. However, the State Legislature has passed a statute which requires that all plans for school buildings be approved by the Superintendent of Public Instruction. There is no other state law which applies specifically to school buildings, but school buildings naturally fall under rules and regulations pertaining to public buildings. The sanitary facilities must meet certain requirements of the State Board of Health and the fire safety features must conform to the regulations of the State Insurance Department. However, state school buildings do not conform to other provisions of the North Carolina Building Code, which limits the size of the building in certain types of construction.

Colorado: This state does not have a state school building code, nor is there special legislation governing school buildings. The local school boards have complete charge of school building matters and are subject only to the general state laws on buildings.

South Dakota: This state has a school building code which governs only the erection of one-story frame buildings. The school building code was prepared for the Department of Public Instruction by Kuehm and Walsh, Architectural Engineers. The code contains specifications of materials and workmanship required for the erection of one-story, frame school buildings, and states they are to be constructed in accordance with drawings and specifications prepared by the above-mentioned firm.

Illinois: This state does not have a school building code. School buildings constructed within the state are governed only by such laws as pertain to public buildings in general.

Iowa: The state of Iowa has no school building code and the only legal restrictions pertaining to school buildings that may be erected within the state is the requirement stated under Section 4370 of State School Laws, which states: "Before erecting a schoolhouse the Board of Directors shall consult with the County Superintendent as to the most approved plan for such building and secure his approval of the plans submitted."

Massachusetts: This state does not have a school building code. There are no specific laws pertaining to school building construction in the state, and school buildings erected fall under Chapter 143, General Laws of Massachusetts, Part II, Section VI, which states:

> "In buildings hereafter erected and in existing buildings, if so directed, windows shall have not less than one square foot of glass to each five square feet of floor area, and the top of the windows shall be not more than eight inches below the ceiling."

The Department of Public Safety exercises considerable control over school buildings, though it has no specified legislative power.

Mississippi: This state does not have a school building code and apparently has no legislation specifically covering school buildings. However, according to W. G. Eckles, Director of School Building Service, the state of Mississippi is governed by the Standards of the National Council on Schoolhouse Construction in planning and constructing their school buildings.

Missouri: The state of Missouri adopted a school building code in 1933. The code is contained in bulletin form of 116 pages entitled, "Schoolhouse Planning and Construction". The provisions and regulations contained in this code are not compulsory but are offered only as an aid in school building planning. This bulletin is very complete and should be an excellent aid to school building programs.

The State Department of Education recommends that no district undertake a building program until a carefully made survey has shown the need for new buildings and the ability of the district to pay for the program. The State Department will assist in determining the needs for build-

ing programs and in setting up educational specifications for each unit of the building. The State Director of School Building Service is to examine the preliminary drawings and suggest any needed changes to meet the needs of the particular school. After any corrections have been made, copies of final plans and specifications are to be sent to the State Department of Education for final approval before contracts are let.

New Jersey: This state adopted a school building code in 1925. The school building code has not been modified since that date. The code provides that no contract for the erection of any public school building or any part thereof shall be made until plans and specifications have been approved by the State Board of Education and a copy of such plans and specifications, as are approved, shall be filed with the State Board of Education. Also, a copy of the contracts for the erection of the whole, or any part, of the school building shall be filed with the State Board of Education within ten days after having been signed.

Nebraska: This state does not have a state school building code, and has no legislation pertaining specifically to school buildings. Schoolhouse construction follows under general building codes within the state.

New York: A tentative school building code was drawn up in 1934. However, at that time a great influx of Public

Works Administration money, to be used for school building purposes, led to the postponement of adoption of the code. Since that time the Board of Regents apparently has changed the policy of future state regulation of school building construction, because they have appointed an architect to head the committee in charge of completing this work.

At the present time the state law requires that the Commissioner of Education approve all plans and specifications on school building construction costing over $500, except in cities of 50,000 population or more.

Ohio: This state has embodied a school building code within the state school laws. Ohio requires that the Building Inspection Department of municipalities having a regularly organized department approve the plans for the erection of public school buildings. School buildings are to be regulated as to safety in case of fire, sanitation and numerous other regulations concerning construction of school buildings. Such regulations are to be under the direction of the State Department or the regular organized building inspection departments in those municipalities which have such departments.

Oregon: The state of Oregon does not have a school building code. However, it does have a manual on the construction and care of school buildings, which is available to all school boards or other interested parties.

This manual is drawn up in much the same manner as a school building code, however it does not carry the weight of legislative authority, being offered merely in the spirit of cooperation and aid.

Texas: This state has a school building code, which states that no public school building shall be constructed at an expense of more than $400 until the Board of School Trustees of the district shall first have secured a school building permit from the officer legally authorized to grant such permit. This permit will certify that the plans and specifications of the proposed building conform to the regulations prescribed in the school code. The school code deals wholly with such phases of construction as: lighting, heating (there are several clauses regulating the use of natural gas for heating in schoolhouses), ventilation, sanitation, and fire protection.

The state of Texas has vested power in the following offices for sole authority to grant permits for school construction. For county school buildings or a common school district within the county, the county superintendent of schools is the legal authority. For school buildings erected within a city or town, or otherwise independent school district, the superintendent of public schools in that district, city or town is authorized to grant building permits for school buildings. These officers are required to examine all plans and specifica-

tions for proposed school buildings costing over $400, to grant such permits only for those buildings as conform to the requirements of the state code. The county or city superintendent is also required to make a report to the state superintendent of all such permits granted by him, submitting plans and specifications for these buildings.

Utah: The state of Utah has a school building code, however, it is so old and outmoded that it no longer influences school building construction within the state. In fact, it has been several years since copies of the code have been printed.

West Virginia: This state has no school building code. The State Board of Education is empowered by law to establish rules and regulations governing construction of school buildings within the state.

The random selection of states whose school building legislation we have studied gives us a fair cross section from the entire country. Of the 18 states, not including Arizona, we have found legislation in seven of these in the form of a school building code. The remaining 11 states did not have school building codes. However, in several of these, school building legislation was similar to school building codes.

Only in two states, those of Connecticut and Missouri, was a complete school building code, embodying all information necessary for the planning and construction of modern

school buildings, offered. In both states the State Department of Education is empowered with the acceptance or the rejection of school building plans and specifications. The acceptance of plans and specifications is based upon conformity to the State Building codes.

In the other states, using school building codes, all have given some department or person within the state the authority to accept or reject plans and specifications. However, none of these states have drawn up complete school building codes, covering all phases of schoolhouse planning and construction. Such legislation fails in its intended usefulness because it uses the power to reject proposed construction without offering complete and acceptable requirements upon which construction may be planned. Utah, which boasts a school building code on the statute books, no longer attempts or considers using this code in actual practice.

Of those states which do not have school building codes we find legislation covering schoolhouse construction varying from specific and required laws pertaining to school buildings themselves, as in the cases of California, North Carolina, New York, and West Virginia, to those states which have no special legislation on this matter. Here again we find legislation which gives authority to some department or office to reject proposed school building plans and specifications without setting forth ideals upon

which a proposed building plan may be based.

In the opinion of the author there must be two phases of legislation pertaining to schoolhouse planning and construction. First, the setting up of a code of standards and second, some department or person to assist in carrying out these standards and to accept or reject them. It is foolish to expect good schoolhouse construction, based solely on the negative restriction of some authority being able to reject some proposed plans and accept others, without first giving school boards and architects a definite goal upon which to base proposed structures. In most states we find the sole authority on whether plans and specifications will be acceptable, vested in a source which may not be familiar with school building problems, thus making the general trend of legislation rather indefinite and of questionable value.

Thus far we have not considered legislation pertaining to schoolhouse construction in the state of Arizona. Chapter 59, Section 2606 of the Revised Code of Arizona, 1928, reads as follows:

> "The doors upon all schoolhouses, churches, theaters, public auditoriums and other public buildings shall be constructed that they may open outward; all screens, bars or other coverings of windows of such buildings, other than a place of legal imprisonment or confinement shall be so constructed that they may be easily and quickly opened from the inside. It shall be unlawful for any such building to be constructed, used or occupied unless

> the doors and windows upon such buildings are constructed in compliance herewith, and any person owning, using, or permitting the use of, any such building contrary to the terms hereof shall be guilty of a misdemeanor."

There are several other sections pertaining to public buildings in general, which apply to school buildings. These deal wholly with the selection, employment, compensation, and contracts pertaining to the hiring of architects by any officer of the state. Also, there are several sections of a similar nature on the contractors who build public buildings for any department of the state. These are very general in nature, dealing with hours of labor, pay, use of Arizona materials when possible, and other such recommendations. Of course, school buildings must conform to such local building ordinances as the city or county has concerning buildings in general. These pertain most often to fire hazards, sanitation and the like.

It is obvious, then, that the state of Arizona has practically no regulation of schoolhouse construction other than that pertaining to public buildings. In this regard, Arizona is definitely behind times. Obviously, the population of Arizona will continue to grow much more rapidly than in the nation as a whole. There are a good many contributing factors which point toward this influx of people. Suffice it to say, then, that Arizona may expect to build more schoolhouses and could afford to make definite legislative provisions governing schoolhouse construction.

CHAPTER III

GENERAL STANDARDS AND IDEALS OF SCHOOL BUILDING PLANNING AND CONSTRUCTION

Development and General Trends of School Building Planning

In observing current opinions of authorities on schoolhouse design and trends in existing state legislation, we see that school design has changed only less rapidly than the educational program itself. From an arrangement of cubicles of classrooms along a corridor, needed under past conceptions of education, to the provision of housing for a wide variety of experiences in living, is a far cry; yet, that is just the distance schoolhouse planning has moved in the past few years. Nor can we foresee the developments certain to come in response to the changes in the educational program. However, buildings planned today will be thwarting or aiding the educational program of the future. Steps must be taken to insure, not only safety, health and economy, but also flexibility as an essential part of any school building program.

Just as imagination and creative capacity are of fundamental importance in education itself, so are these qualities significant in school planning. Any regulations drawn up to govern and control schoolhouse construction

must be so drawn as to protect the state, the district, the pupil, and yet encourage creative thinking on the part of the school designer. Any code which standardizes school architecture may also tend towards stagnation. This will not hold true when standardization is applied on the basis of accepted educational practice.[1]

The primary function of a building code is that of service, rather than regulation, and should prove particularly useful in the numerous cases where communities have had little previous experience with the problems of school building construction.

Any proposed code for the state of Arizona must cover primarily those features which the school officials need to know when planning a building. No attempt should be made to include in a code those features which should be left to the school building architects. Rather, the contents of the code should assist local school officials in outlining for their architect what they want included in their school buildings, and as such, should help architects in planning suitable school buildings for the state.

Those divisions of schoolhouse planning and construction which should be regulated by a state code

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1. Donovan, John J. and Others. School Architecture. pp. 28-29.

come under the following units:

1. The School Building Architect.
2. Site of the School Buildings.
3. General Characteristics of the School Building.
4. The School Units.
5. Structural and Mechanical Features of the Building.
6. Details of the Buildings.

The above mentioned major headings, with such subdivisions as will naturally fall under them, should be considered from the standpoint of present acceptable educational ideals and practices before recommending any specific standards for a state code. These will be taken up and discussed in the order of their appearance in the recommended state code.

The School Building Architect

School design and construction constitutes a highly specialized branch of architecture. To give positive assurance of success the school architect must be thoroughly conversant with trends and recent developments in the philosophy and practice of education. He must realize fully the demands and significance of each school activity, its individual importance, and its relation to the whole program. The architect must possess the vision to interpret the aims of the educator and the ability to coordinate his architectural elements so they will best fulfill their

educational function. Beyond this, of course, the school designer must have the other qualifications of a good architect.

Selection of the Architect: The law provides that any agent of the state, upon the erection of a structure costing in excess of $500 shall employ the services of an architect. Such employment of the architect shall be made by direct selection or by public competition.[2]

Since not plans but architectural service is being sought, planned competitions are regarded by educators as an unsatisfactory means for selecting a school architect. Competitive drawings are usually based upon imagination rather than needs and employ pictorial attractiveness as a major influence. Obviously the most satisfactory basis for selecting the school architect is a review of professional qualifications and the excellence of past services.[3]

Compensation of the Architect: The law provides for compensation for the preliminary sketches and tentative design at the rate of one and one-half per cent of the proposed cost, this fee being deducted from subsequent commission. Compensation for complete working drawings

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2. Arizona State Law, Chapter 59, Section 2600, Revised Code, 1928, Public Buildings.
3. Donovan, John J. and Others. School Architecture. pp. 10-11

and specifications and details shall be a commission not to exceed four per cent of the actual or proposed cost. In case the architect acts as supervisor of construction, an additional commission not to exceed two per cent of the actual cost of the work shall be paid.

The law further provides that no compensation shall be paid by the agent, until in his judgment, a satisfactory set of plans and specifications have been submitted by the architect. In addition, it provides for the payment of the architect upon the above-named percentage in case the work is abandoned through no fault of the architect.[4]

Site of the School Building

The lack of scientific techniques for the selection of school building sites has frequently caused school authorities to locate buildings unsatisfactorily. When there is no objective basis for choosing building sites, pressure from especially interested groups or crowded conditions of a specified area are generally determining factors in the selection of the sites.[5]

There is no absolute basis for the selection of school building sites. However, it is possible to determine a somewhat reliable technique by considering these factors:

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4. Arizona State Law. op. cit. Section 2601.
5. Engelhardt, Fred. Selecting Sites for School Buildings. University of Minnesota. pp. 3-9

Distribution of School Population: School population is an element of the total population and bears a direct relationship to it. The total population of any given district with its resulting school population is determined largely by social and economic factors. Various sections, within a given area, will vary in potential school children population.[6]

The greatest difficulty in determining the number of children that an area will ultimately produce lies in the complex condition of a shifting population. Few districts are completely built up, some are slowly giving way to business and industrial encroachment, while still others are potentially capable of producing a large school population. Some technique is necessary, then, to measure the population distribution, as well as the present and possible ultimate saturation of known areas, if school buildings are to be properly located.[7]

The following are accepted methods for determining the present and possible future school population: The number of children per 100,000 square feet of area, used as a unit to measure density of school population; this unit applied in determining the extent of saturation of school areas. Maps showing the zoning plans as established for

6. Engelhardt, Fred. op. cit. pp. 3-8
7. Ibid. pp. 3-5

the city, including classification of industrial districts, business districts, residential districts, and possible future extension of city limits may be used. These maps of the entire area should show the extent of pupil saturation in the various zoning groups. Additional methods of gathering information on possible future school population should include population figures, including birth rates by age groups in the different sections of the community. Charts showing trends in building permits, issued within the various sections of the district will point toward possible new population centers. A school age population chart should be made periodically, thus keeping a continuous account of school population.

School Organization: Another basic factor in the selection of school sites is the administrative policy concerning the type of school organization. The school authorities must agree upon the type of organization, minimum and optimum size of the buildings, and the travel distance for children. School organization as determined by the school authorities must be extended into the future in order to take advantage of the building program.[8]

Size and Shape of the Land: The benefits that may be realized from outdoor school activities are in direct proportion to the amount of usable area available for these

8. Engelhardt, Fred. op. cit. pp. 3-9

activities. Over and above the play area the building itself, with possible future additions, will require sufficient space for proper distances from right of way and property lines, sufficient set-back from highways, landscaping of certain areas, parking spaces adjacent to auditorium or gymnasium, and sufficient space for buses to load and unload off the highway. The exact size of the space allotted to these various items and the total size of the site will naturally be determined by the ultimate number of children the school building is expected to house. However, regardless of the number of children enrolled a minimum space for outdoor activities will be:

Elementary schools - ten acres.[9]

Junior high schools - twelve acres.[10]

Senior high schools - fifteen acres.[11]

Aside from the gross area of the school site it is obvious that the total usability will depend primarily upon the shape of the site. The most desirable shape for a school site will be either square or rectangular and areas should not deviate markedly from this accepted ideal.[12]

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9. Strayer, George D. and Engelhardt, N. L. Standards for Elementary School Buildings. p. 10
10. Strayer, George D. and Engelhardt, N. L. Standards for Junior High School Buildings. pp. 9-10.
11. Strayer, George D. and Engelhardt, N. L. Standards for High School Buildings. pp. 9-14
12. Engelhardt, Fred. op. cit. p. 12.

Location for Environment: The activities within the school and on the grounds call for quiet surroundings, clean air, and abundant sunshine. In addition to these purely physical considerations, it is unquestionably true that wholesome moral surroundings and beauty and cheerfulness of adjacent buildings and grounds will reflect in countless ways in the attitudes and work of the pupils.[13]

School sites should be located at least one block from any busily traveled thoroughfare, bus, or carline. Furthermore, the school site should be well removed from industrial activities or other undesirable distractions. In this respect, existing conditions may be reckoned with much more readily than probable future developments. However, if the site is to prove of lasting merit, thorough consideration must be given to the course and nature of inevitable changes.[14]

Location for Accessibility: Although the convenient location of a school within its contributing area is desirable, it is best to sacrifice exact centrality in favor of superior size or environment. Only within a city, where the contributing area of a school is relatively static, can actual travel distances for the various schools be recommended. Recommended distances of travel for

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13. Engelhardt, Fred. op. cit. p. 20.
14. State of Connecticut, Department of Education. School Building Code. p. 22.

elementary school children shall not exceed three-fourths of a mile. Recommended distances of travel for junior high school children shall not exceed one and one-half miles. Recommended distances of travel for senior high school children shall not exceed two miles.[15]

The above recommendations regarding distances are nullified in many Arizona districts because of the lack of urbanization, the excessive size of school districts and the constantly shifting of migratory farm workers, causing the increasing utilization of school bus transportation facilities within the state. Safety and convenience of approach are of relative importance in the location of school building sites. Such approaches should not be along dangerous highways, should not lead over railways, cross busy thoroughfares, nor pass through undesirable business or industrial districts. Ideal conditions of access cannot be provided every pupil, but a balance should be sought whereby the greatest measure of safety is obtained for the greatest number of children.

Soil Factors: Where many states must consider soil factors from a drainage and seepage angle, the arid conditions in southern Arizona make such considerations relatively unimportant. The most ideal surface for a satisfactory schoolground is a form of sandy loam, which is

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15. State of Connecticut. op. cit. p. 24.

porous enough to permit rapid seepage, yet contains enough body to minimize dust and nourish grass and shrubbery. It is obvious that every school district within the state should strive to find suitable soil for a school site.

Location and Orientation of the Building: No school building should be located less than 100 feet from the street upon which it fronts, nor less than 50 feet between the building (including its future additions) and the property lines on either side. Because weather conditions are such that windows to schoolrooms may be open a good portion of the year, additions to the above mentioned distances will be advantageous to the pupil and teacher.

In general, classrooms should receive their maximum amount of direct sunlight before and after school hours. North exposures are dark, while south exposures suffer the glare and heat of direct sunlight. Only those exposures facing east or west are found entirely satisfactory for a majority of the rooms. This is a fundamental consideration in both the selection of a site and the orientation of the building upon it.

It is advisable to locate the building on an elevated part of the site, so placed that surface water will shed away from the foundations, leaving them dry. The building must interfere as little as possible with open playground and athletic field areas, thus leaving them unbroken and flexible.

The placing of the school building, with the above suggestions and limitations in mind, will enable the pupils to derive the greatest benefit from the plant as a unit number.[16]

Development of the Entire Site: The effort and care expended in designing a pleasing building will be largely wasted unless that same effort is used on the development of an attractive and useful setting. It should be an important adjunct to education to teach children that beauty and good taste are both essential and natural. In order to facilitate a happy and congenial spirit among the pupils, their everyday life should be associated with such surroundings.[17] It is advisable to secure the services of an experienced landscape architect. For small schools, or those which cannot afford such service, there are many departments in national and state governments or private associations which will give valuable aid in the development of the school site. The Arizona State Highway Department has offered this service in the past, and also valuable aid may be secured from the National Recreation Association, New York City.

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16. Wheelwright, E. M. School Architecture. pp. 1-17
17. Ibid. pp. 10-17

General Characteristics of the School Building

A few decades ago the educational program was a rudimentary one compared with the one found in the public schools of today. The little that was offered then was learned by reading and rote. The schoolhouse, a mere shelter in which these simple processes could be carried on, was a place of detention, as cheerless as the program it housed. With increasing enlightenment and growing complexity of civilization, there has come a correspondingly heavier demand on education. The three "R's" have given way to a great variety of learning activities designed to provide the necessary flexibility and diversity of learning that will better fit young people to find useful places in society.

These changes in the educational offering have necessitated far-reaching changes in the school buildings that house them. Not only do they now provide for a greater number of activities, but they encourage integrated programs. The learning process is not marked today by segregated areas of subject matter, and so the school building must be as varied in its resources as the life of the community it serves.[18]

Greater results are obtained from those activities which are done purposefully and willingly with a sense of

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18. Spain, Charles L. "Economy and the Modern Curriculum." Detroit Educational Bulletin No. 16, January, 1933.

achievement than from those that are pursued through compulsion. It is largely upon this premise that the trend of education is away from regimentation and formalization toward an attitude of self-motivating, informal cooperation. It is reasonable to expect, then, the architectural character of the school building to be in harmony with the activities it houses. As opposed to the severe formality and institutional factory-like appearance of many schools still in use, the building of today should be inviting and intimate in spirit, as homelike and attractive as possible.

This does not imply expenditure for non-essential ornamentation of exterior or interior, or the deleting of necessary educational facilities in any public school building. However, architectural excellence and simplicity, without barrenness can, and should be, secured through the application of sound principles of composition and proportion.[19]

Gross Structure: The general type plan most suitable to Arizona is the open or unit type construction as preferable to the block or compact type of construction. Against the block type's economy on roof, foundation, and exterior wall construction may be placed the lessened height of the open type with its corresponding savings in the

19. Donovan, John J. and Others. op. cit. p. 33.

reduced use of heavy building materials employed in construction. Aside from the purely financial considerations, the educational benefits of the open type plan are impressive. In reducing the height of buildings and spreading them over a larger ground area, vertical travel, always objectionable in schools, is replaced by horizontal travel. The lower and more open building offers greater exposure to sunlight and air, reduces to a minimum fire and panic hazards, is adaptable to the desirable segregation of certain activities, and withal is more flexible and more pleasing in architectural composition.[20]

Expansibility: The useful life of a well-planned and soundly constructed school may reach fifty years or more. During that time needs in space and educational facilities will change greatly. There is no way to foretell with any assurance of accuracy the exact nature of future needs. Therefore, the initial plan should anticipate additions and should permit as much latitude as possible in the nature of these additions. As a general rule, it is advisable to carry corridors through to the end of a wing, thereby not blocking its extension. In like manner, stairs should not be placed where additions to the building will necessitate their removal. Such expansibility is admirably suited to

20. Turner, R. Izer. The (American) Plan School Architecture Suitable for the Southwest. Unpublished Master's thesis, University of Arizona, 1929.

the open type of unit construction favored for southern Arizona.

Flexibility: Interior flexibility, like expansibility, is a necessary quality in schoolhouse construction. Often it is necessary to change the use to which a room is put, adapting it to specialized activities for which it was not originally designed. It may be necessary to create a large room by removing the partitions between two smaller ones, or to subdivide a room with additional partitions. This may lead even to the installation of new service connections. Therefore, it is necessary that partitions, as far as possible, should be non-bearing walls. Ventilation ducts and service lines should be run in the outside walls or corridor walls rather than in partitions.[21]

In short, if every possible future demand is considered beforehand, and those that are likely to occur are anticipated in the design of the building, changes may be made more readily and economically as the need arises.

Orientation: In general, most classrooms should have window exposure on the east or west. There are, however, certain exceptions to this rule. For kindergartens, where emphasis is on brightness and cheerfulness, and where visual effort is limited, a southern or southeastern exposure is quite satisfactory. Northern exposures are well

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21. Donovan, John J. and Others. op. cit. pp. 35-37

adapted to art and drafting rooms, where light intensities and qualities need to be as constant as possible. Direct sunshine is necessary for certain works in physics and biology, thereby making the southern exposures preferred. Orientation of the building to give the above mentioned exposures should be considered in any proposed plan.[22]

Circulation: A school's circulation facilities must be highly specialized if they are to serve the needs and demands of school conditions. Movement within the schools, instead of being evenly distributed throughout the day, tends to be concentrated into a series of peak loads. During these peak periods the entire school population moves at one time. This is not a simple flow, being two-directional and complicated by traffic from various passageways. Such circulation is especially noted in schools given over to the departmentalized plan of instruction. In junior and senior high schools corridors not only serve pupil traffic but usually their walls are lined with lockers, which are in use during the heaviest periods of circulation. Thoughtful planning can do much toward preventing congestion and confusion. Sufficient corridor width is necessary. Furthermore, corridor crossings where lines of traffic must cross should be eliminated. Perhaps the greatest single source of difficulty in this respect

22. Strayer, George D. and Engelhardt, N. L. Standards for High School Buildings. p. 14.

is the auditorium. When in use for general school assemblies its approaches must accommodate large numbers. Strategic location, therefore, so as to serve the student body by traffic routes which do not cross or converge, is necessary.

Even in the smallest schools it is essential that pupils may pass freely from any point in the building to any other point without distraction to other activities which may be going on. The same principle applies with respect to the public use of certain portions of the building, either during or outside school hours. School property may best be safeguarded and regular school activities protected from disturbances by arranging auditoriums, gymnasiums, shops, health units, and libraries so that they may be entered directly from the out-of-doors, without permitting access to the rest of the building.[23]

Elevations: It is the general rule that the fewer stories a school building contains the more readily it can be administered and the more flexible and convenient it is in use.[24] A common mistake in the design of schools has been the provisions of large basement areas that have nothing practical to commend them. The sinking of a room below ground level reduces its natural lighting and

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23. State of Connecticut. op. cit. p. 9.
24. Donovan, John J. and Others. op. cit. p. 42.

ventilation and has injurious psychological effect on the activities carried on there. It is generally assumed that a basement under the entire ground floor is necessary. However, developments in building design have demonstrated conclusively that this is not the case, and most architects are finding it less expensive to build above ground.[25]

It is the general principle of design that those rooms which are subject to concentrated occupancy, ie., assembly rooms, auditoriums, gymnasiums, cafeterias, etc., should be kept as near ground level as possible, thus alleviating some of the potential hazards that accompany the housing of concentrated groups, and also facilitating greater convenience in using and servicing these spaces.[26]

The School Units

The activities of a modern school, like those in the outside world for which the pupils are preparing, are extremely varied in character. Within the school each activity places its specific set of requirements upon the space that is to house it. Needless to say, the more fully and efficiently these demands are met by the design of the building, the more successful the activities become. For this reason, then, we should look upon the rooms within the school plant, not as classrooms, but as workshops, with

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26. State of Connecticut. op. cit. p. 11.

each having an individuality of design intended to aid in its usefulness.[27] Therefore, each individual school unit shall incorporate its own specific design requirements as a component part in connection with the design of the building as a whole.

Structural and Mechanical Features of the Building

The law provides that it may be optional for any state agent responsible for the erection of a public building to employ the building architect to supervise its construction.[28] Since supervision of construction is necessary, the architect who is responsible for the plans and specifications should be employed in the capacity of building inspector. Acting in this capacity it will be possible for him to see that the building is structurally and mechanically sound.

Details of the Building

Insofar as possible the plans and specifications shall call for details of construction coincident with good building practice and common sense. After building plans and specifications have been approved, details may not be changed without special consent of the architect and school authorities.

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27. State of Missouri. Schoolhouse Planning and Construction. p. 40

28. Arizona State Law. op. cit. Section 2600

CHAPTER IV

PROPOSED SCHOOL BUILDING CODE FOR ARIZONA

I. The Architect.

A. No school building, which is estimated to cost $500 or more, may be constructed, altered, or added to, without the previous hiring of an architect by the school board of trustees of the district involved.

B. Such architect shall be selected from a list of architects furnished by the State Department of Education, Division of Schoolhouse Planning. Selection shall be made directly by the board of education representing the school district involved.

C. The list of architects furnished by the State Department shall include only the names of those architects who are deemed experts in the division of school building design and construction.

D. Remuneration for any architect shall be on the rate as is provided by law.

E. Architects so employed shall be required to make at least two inspection trips through the completed school building. The first shall be not later than six months, and the second shall be not less than two years, nor more than three years after completion of the building.

F. The architect shall make a complete written report of his findings and recommendations after each inspection trip, submitting this report to the Board of Education of the interested district.

G. Failure on the part of the architect to comply with any and all regulations and duties pertaining to his employment shall cause the

the removal of his name or his firm's name from the state list of authorized architects.

II. Site of the School Building.

A. The site shall be selected upon the basis of good educational practice.

B. Possible population trends of the past, present, and future are to be considered in selecting the site. These tendencies are to be graphically indicated by the use of maps and charts of those factors such as:

1. A list of proposed city developments.
2. Contemplated extensions of city limits.
3. Average size of lots and new developments.
4. Maps showing extent of population saturation within the school district.
5. Graphs showing trends in building permits issued within various sections of the district.
6. Zone map of the district showing industrial, business and residential areas, with possible expansions of each.
7. Population figures by age groups in the different sections.

C. Under no circumstances shall any site be located in an undesirable environment such as proximity to railroad yards, industrial plants, busy highways and similar dangerous and distracting influences.

D. Adequate soil factors shall be of prime consideration in the selection of a building site.

E. Minimum sizes for school sites shall be as follows:

1. Elementary site - not less than ten acres.
2. Junior high school site - not less than twelve acres.
3. Senior high school site - not less than fifteen acres.

Since these are minimum sizes only additional space should be provided for schools of anticipated large enrollments and for possible future expansions.

F. The site shall be square or rectangular in shape to permit full utilization of the area.

III. General Characteristics of the School Building.

A. The orientation of buildings shall be such that the continuity of the area will not be broken.

B. Location of the building shall be such as will provide other than north exposure for main classrooms.

C. Provision for such landscaping as is in keeping with the size and cost of the building shall be figured as a part of the estimated cost.

D. The gross structure shall be so planned as to allow for future expansion and for interior flexibility.

E. No building shall provide for more than two floors above the ground floor. In no case shall other than heating plant, janitorial rooms, fuel storage, general storage, and similar services be provided for in the basement. School buildings in Arizona should be planned along unit rather than block lines of construction.

IV. School Units.

A. Administration unit.

1. Location shall be upon the ground floor, accessible from main centers of activity within the building, and fronting upon the main entrance of the building.

2. Divisions shall consist of principal's private office, general administrative office, an adjacent waiting room, which may be a part of the general office, separated by counter or partition, storage space, and toilet facilities, connected with the administrative unit. Such additional divisions should be provided as the size and complexity of the school would indicate.

3. Facilities shall include furniture, filing cases, cupboards, business machines, and such other items as the complexity of the unit would indicate.

B. Health unit.

1. Location shall be on the ground floor, convenient to either the administrative unit or athletic unit and shall be provided with an outside entrance.

2. Divisions shall consist of a main room, which must be at least twenty feet in length, storage space, and adjacent toilet facilities.

3. Facilities should include storage space, filing case, instrument cabinet, and such first aid and medical equipment as utilization would indicate.

C. Teachers' Rooms.

1. Location may be adjacent to the administrative unit or some other centrally located position.

2. Divisions shall consist of a separate room for men and women teachers.

3. Facilities shall include individual lockers, lounging, toilet, study and preparation accommodations.

D. Custodian's Unit.

1. Location shall be directly accessible from an outside entrance and from the rest of the building without passing through rooms used for instruction or study.

2. Divisions shall consist of heating plant, fuel storage, work space, supply and storage room.

3. Facilities shall include office or desk space, slop sink closets, work bench, tools, etc. Slop sink within closet space shall be provided on each floor as part of janitorial unit.

C. Classrooms.

1. Location - all classrooms shall communicate directly with a corridor which leads directly to two exits or stairways. No classroom shall be located in the basement.

2. Size - 15 to 18 square feet of floor area must be provided for each pupil with 200 to 250 cubic feet of air space per pupil. A classroom of 23 feet, by 26 feet, by 12 feet will seat 35 pupils.

3. Facilities shall consist of pupils' desks, teacher's desk and chair, bookshelves for both teacher and pupils, blackboards, tackboards, etc. (Specifications will be given under Details.)

D. Activity Space. (For elementary grades.)

1. Location shall be either included within or adjacent to each regular elementary classroom. Under no conditions shall the activity space be removed from the classroom.

2. Size shall consist of a minimum of from five to six square feet per pupil.

3. Equipment shall consist of work counters, storage space, and sink.

E. Storage Space.

1. Location is optional, but must be of convenient accessibility.

2. Size shall depend entirely upon the use and objects stored, together with size of school plant.

3. Facilities shall be conveniently arranged racks and shelves designed to accommodate articles stored.

F. Toilet Rooms.

1. Location shall be on each classroom floor, basement toilets only adjacent to special

activities. In no case shall students travel more than one floor to reach toilet facilities.

2. Size and divisions shall consist of toilets for each sex, which shall be located at opposite ends of the corridor. (Size will be given under Details.)

3. Facilities. (Will be given under Structural and Mechanical Features of the Building.)

G. Library.

1. Location must be convenient to study halls and classrooms. If intended for community use must be located on ground floor with outside entrance.

2. Size. (Will be given under Details.)

3. Facilities shall consist of main study room, book storage racks, librarian's room or desk adjacent to book racks, conference or study room for high schools.

H. Auditoriums.

1. Location shall be on the ground floor, accessible from classrooms and from the outside, and isolated against noise and interference.

2. Size - for schools anticipating an enrollment of less than 1000 the auditorium should be large enough to seat the entire student body. For schools with an enrollment greater than 1000, the auditorium shall be of sufficient size to seat at least one-half of the student body. For educational plans which use the auditorium only as a large classroom, such modification in size and construction as is indicated shall be provided.

3. Facilities shall consist of dressing rooms adjacent to the stage, provisions for moving properties on and off the stage, storage for scenery and direct access to toilets for both boys and girls. Stage walls and doors

shall be of fire-resistive materials. A motion picture booth or facilities shall be provided.

I. Gymnasium.

1. Location shall be on the ground floor and accessible from classrooms and outdoors. It shall be isolated against noise and interference.

2. Size. (Will be given under Details.)

3. Facilities shall include dressing rooms for boys and girls, accessible directly on to the gymnasium floor, and directly to outside athletic fields unless special athletic dressing rooms are provided. Routes to boys and girls dressing rooms shall be entirely separate. Shower, toilet and storage space shall be provided in connection with dressing rooms. Office room or space for instructors shall be provided, with proper record facilities. It is desirable to prevent crossing of playing floor by spectators upon entering or leaving the gymnasium. Combination auditorium and gymnasium recommended only for small schools of less than 200 enrollment.

J. Kindergarten.

1. Location shall be on ground floor, separate entrance, southeast exposure.

2. Size shall be 15 to 18 square feet per pupil for main room.

3. Facilities shall consist of activity room or outside play area for kindergarten use only. Toilet facilities, cloakroom, and storeroom shall be for kindergarten use only.

K. Homemaking Unit.

1. Location shall be on the top floor or otherwise isolated from general classrooms so that noise and smells will not permeate the entire building. In case the homemaking and art departments are integrated they should be located adjacent to each other.

2. Divisions.

a. Cooking space with unit kitchens and storage space.
b. Sewing space with general storage for this unit.
c. Domestic unit with divisions approximating those of the home. (Living room, dining room, bedroom.)
d. Child development unit.
e. General space for recitation and library facilities.

In small schools all activities may be successfully carried on in one room with movable partitions for the arrangement of project room.

L. Art Room.

1. Location on top floor with north exposure.

2. Size shall consist of approximately 35 square feet per pupil.

3. Facilities shall consist of drawing tables, individual storage, general storage, exhibition cases and shelves, tackboard and sink.

M. Industrial Arts unit.

1. Location shall be on ground floor with garage doors for outside entrance. In no case shall industrial arts unit be located below grade.

2. Divisions.

a. Drawing room. (Mechanical.)
b. Auto shop.
c. Electric shop.
d. Print shop.
e. Wood shop.
f. Metal shop.

In small schools all shop activities may be successfully carried on in one or two large rooms.

3. Facilities shall include such tool space, storage space, recitation space, drying and finish space, toilet and washroom space, and instructor's room or space, all depending upon the size and complexity of the shop.

N. Science Unit.

1. Location shall be on top floor or otherwise isolated to prevent odors and fumes from permeating the building. The location should provide for sunlight during some part of the day.

2. Divisions are to accommodate the following laboratory sciences:

a. General science.
b. Biology.
c. Physics.
d. Chemistry.

In smaller schools all of these activities may be carried on in the same laboratory.

3. Facilities shall consist of classroom space, necessary laboratory equipment, including approved sinks, plumbing, ventilation and such storage space and supply rooms as the size and complexity of the unit would indicate.

V. Structural and Mechanical Features of the Building.

A. Construction types.

1. Fire resistive - shall be a building of incombustible construction throughout, but with combustible doors, sash, trim, floor and ceiling finishes. Floor, wall, and ceilings shall be properly backed with bearing walls of approved fire-resistive materials, and with other structural members having fire ratings as follows:

a. Four hour resistance - bearing walls, fire walls, piers, columns and walls supporting girders.

b. Three hour resistance - walls and girders other than already specified, beams, floors, ceilings, and roof.

c. Two hour resistance - fire partitions.

2. Fire-Safe - shall be a building in which the exterior and/or bearing walls are of approved fire-resistive materials. Other structural elements are wholly or partly unprotected as required for fire-safe construction. Corridors, stairways and heating plant rooms are entirely fire-resistive as under type (1).

3. Ordinary - buildings in which the construction is like that of type (2), except that corridors and stairways are not of fireproof construction.

4. Frame - buildings in which the exterior and/or bearing walls are wholly or partly of inflammable material.

a. Types (3) and (4) structures under no conditions shall be more than one story in height.

B. Limitations of Height.

1. Buildings with more than two stories above the basement in any part shall be of type (1) construction throughout.

2. Types (3) and (4) structures under no conditions shall be more than one story in height.

3. Buildings with two stories above the basement shall be of type (1) or (2) construction.

4. The basement shall consist of a story whose ceiling, at the perimeter, averages not more than six feet above outside grade at the building line, and in no case exceeds grade line by 12½ feet. Any story which does not come within these limits will be classed as a first story.

C. Construction.

1. Foundations and footings.

a. Wall and column loads shall be evenly distributed on reinforced concrete footings, properly sized in accordance with the load bearing qualities of the soil.

b. Foundations shall be of concrete, well bedded stone or hard-burned brick laid in cement mortar. As a precaution against leakage, foundation walls enclosing a basement shall be poured concrete adequately treated with water-proofing.

2. Walls.

a. Walls shall be of a material consistent with construction type, properly flashed to prevent seepage of water.

3. Floors.

a. Floors shall be of material consistent with construction type.

4. Roofs.

a. Roofs shall be of material consistent with construction type. However, flat roofs should be put on with a minimum service guarantee of twenty years, skylights shall be of non-corrosive material with glazed wire-glass, watertight in construction.

b. There must be a ventilated and accessible air space between the ceiling joists and the underside of roof rafters except that over small areas insulation may be used in lieu of such air space.

5. Live-load capacities shall be measured in pounds per square foot uniformly distributed:

Auditoriums, galleries, stages	100
Classrooms	60
Corridors	90

Cafeteria 80
Gymnasium 120
Laboratories and libraries 60
Library stack and bookrooms 120
Roofs pitched less than 15 degrees 50
Roofs pitched more than 15 degrees 40
Shops (according to use) 80-250
Stairs 90

D. Electrical.

1. General.

a. Materials used in electrical installation shall bear the label of the National Board of Fire Underwriters in all cases where such materials are available.

b. Artificial illumination shall be capable of providing required illumination independent of natural sources.

c. The following is the recommended artificial illumination:

1) Recommended 15 foot candles - minimum 10 foot candles at work level for:

a) Study rooms
b) Libraries
c) Sewing rooms
d) Art rooms
e) Drafting rooms
f) Metal working shops and all rooms where fine work is done.

2) Recommended 12 foot candles - minimum eight foot candles at work level for:

a) Classrooms
b) Laboratories
c) Gymnasiums
d) Other shops

3) Recommended five foot candles - minimum three foot candles at work level, or floor level for:

a) Corridors
b) Lobbies
c) Stairs
d) Locker rooms
e) Toilets

d. Certain rooms, such as shop, sewing rooms, laboratories, etc., may require individual light to supplement the general illumination.

e. The surface brilliancy of any lighting unit used for general illumination shall not exceed three candles per square inch for the brightest square inch. This requirement necessitates the use of semi-indirect or indirect illumination.

f. Switches.

1) Switches shall be on the knob side of all entries.

2) Corridors and stairways shall be controlled by three-way switches located at each end of these spaces.

3) Remote control switches of gymnasium, auditorium, etc., shall have pilot light protection.

4) It is advisable to have classroom illumination controlled by two switches so those lights away from the windows may be used independently of the lights on the window side.

g. Intercommunication systems.

1) It is advisable for all larger schools to be provided with complete local two-way intercommunication systems or provisions for future installation.

h. Clocks.

1) School systems operating on a departmentalized basis shall be provided with a master clock system which shall call for buzzer and bells independent of fire alarm facilities.

E. Heating and Ventilation.

1. Heating.

a. Normal boiler capacity should be sufficient to heat the building to a temperature of 70 degrees without forcing. Provisions should be made for anticipated future loads.

b. All heating shall be of the central unit type employing steam or hot water radiators.

1) One-room or small schools shall be provided with circulating heaters.

c. Radiators shall be placed beneath windows insofar as possible and the wall-hung type is recommended. Screens should be provided to protect nearby occupants from excessive heat.

2. Ventilation.

a. The following number of outside air-changes per hour are required:

1) Six changes per hour, by fan if necessary for:

a) Toilet rooms
b) Locker rooms
c) Dressing rooms
d) Cafeteria
e) Cooking rooms

2) Four changes per hour, by gravity or fan for:

a) Classrooms
b) Study rooms
c) Libraries
d) Laboratories
e) Shops (exclusive of fume hoods)
f) Auditoriums
g) Gymnasiums

b. Exhaust ducts or flues should be of fireproof construction and continuous from room grills to points of exhausts outside of building.

c. Exhaust fan switches should be located and controlled by pilot light switches located in janitor's room, principal's office, or both.

d. Attic space under flat roofs shall be provided with openings sufficient to permit free circulation of the air.

F. Plumbing.

1. Installation.

a. In accordance with local plumbing codes, or where such do not exist installation shall conform with commonly accepted good practice.

2. Number of Fixtures.

a. Elementary school.

1) Boys - ratio of urinals to water closets is two to one. Two urinals for each 30 boys is considered adequate.

2) One water closet for each 20 girls is considered adequate.

b. Junior and Senior high schools.

1) Boys - ratio of urinals to water closets is five to three. Two urinals for each 45 boys is considered adequate.

2) Girls - one water closet for each 30 girls is adequate.

c. The ratio of lavatories to total toilet fixtures shall be one to two for all schools.

d. Drinking fountains shall be located on each floor and convenient to gymnasium and playground.

1) One drinking fountain for each 50 to 75 pupils.

2) Under no conditions shall drinking fountains be located in toilet rooms, nor shall blubber heads be attached to lavatories.

G. Gas.

1. A master valve shall be provided in each room where there are several gas outlets. This valve shall be furnished with a locking device and located so that it may be conveniently closed when the gas is not in use.

VI. Details of the Building.

A. Stairways.

1. Number.

a. In every case stairways shall be sufficient in number to empty the building in three minutes.

b. There shall be at least two stairways accessible from the corridor which serves the classrooms.

2. Location.

a. No open stairwell shall be located so that a pupil must pass it to reach a second stairway.

b. All stairways shall be located adjoining outside walls and shall open directly upon the outdoors, or upon vestibules which open outdoors.

3. Width.

a. A unit of stairway width shall be 28 inches and one unit shall be required for each 60 pupils on floors above the first. (In case it cannot be determined how many pupils a floor will handle, one pupil per 40 square feet of floor area is an accurate estimate.)

b. No stairway shall contain less than two units of width and such other units of width as are necessary to service floors above them.

c. Stairs shall be of constant width throughout their length.

d. Stairs eight feet or more in width shall provide center hand rails.

4. Runs.

a. No stairway shall have a height of more than eight feet between landings.

b. Ramps shall be substituted for runs of fewer than four risers.

5. Risers and treads.

a. The sum of two risers and a tread, exclusive of the nosing, shall be not less than 24 inches nor more than 25 inches. No riser shall be more than seven and one-eighth inch in height and no tread shall be less than 10 inches, exclusive of the nosing, in width.

b. There shall be no variation in the width of treads and height of risers in any flight.

c. Variations in height of risers in different flights shall not exceed three-sixteenths of an inch.

d. Edges of treads and landings shall have non-slip nosings set flush with treads and landings and of a color as will show the edge of each step by contrast.

6. Landings.

a. Landings shall maintain a width and depth of not less than the width and depth of the stairs they serve.

b. No door shall open immediately upon a run of stairs, but shall open upon a landing at least the width of the door.

c. Doors, during their swing, must not reduce the effective width of landings and shall not interfere with use of stairs when open.

7. Hand rails and balustrades.

   a. Hand rails shall not encroach upon the required width of stairs.

   b. Hand rails shall be provided on both sides of every stair for pupil use. Stairways ten feet or greater in width shall be provided with center handrail.

   c. Hand rails which do not continue around landings shall terminate by being returned against the wall.

   d. The vertical length from the nosing to the top of the balustrade shall be not less than 36 inches.

   e. Hand rails shall be attached to all balustrades and shall vary in height from two feet, six inches, to three feet, depending upon the age of the pupils to be accommodated.

8. Enclosures.

   a. All stairways that serve more than two stories shall be of type (1) construction and enclosed in fire-resistive, smoke-proof towers.

   b. Doors serving stair towers shall be of non-combustible materials with clear wire-glass panels as approved by the Board of Fire Underwriters.

B. Exits and Entrances.

1. Number.

   a. There shall be at least two means of egress remote from each other for every floor of the school building.

   b. Exits shall be provided to serve independently of each other the following:

      1) Stairways from stories above
      2) The first or entrance story

3) The basement
4) The auditorium
5) The gymnasium

2. Location.

a. At least one exit shall be within 100 feet of the corridor door of every room used by the pupils.

b. Exits shall be so located so that there will be no dead ends in which children could be trapped.

c. Exits should be provided convenient to playgrounds, auditoriums and gymnasiums.

3. Width.

a. A unit of exit for doors shall be 28 inches except that 40 inches may be rated as two units.

b. The number of units of exit-door widths from first floor shall be as follows:

1) One unit for each required unit of stairway width from upper floors.

2) One additional unit for each required unit of stairway width from the basement.

3) One additional unit for each one hundred occupants or each 4000 square feet of gross floor area for the first story.

4) One additional unit for each 600 square feet of the floor area of the auditorium.

4. Height.

a. Exit doors shall not be less than seven feet in height and shall swing outward with exit travel.

5. Additional Provisions.

a. Exit doors shall be provided with approved anti-panic hardware.

b. Steps outside exits and entrances are highly objectionable and shall be reduced to a minimum.

C. Corridors.

1. Construction.

a. All corridors of more than one story buildings shall follow building types as previously indicated.

b. Floors should be of such materials as will give resilience and quietness to pupil traffic.

2. Width.

a. Corridor passageways, clear of all obstructions, shall be of the following minimum width:

1) In small elementary schools of six rooms or less - eight feet wide.

2) In larger elementary schools and small high schools - ten feet wide.

3) In larger junior and senior high schools the width shall be increased in proportion to the length of the corridor, number of rooms served, and likelihood of increased loads, but in no case shall the width be less than 12 feet.

3. Additional Provisions.

a. Projections such as drinking fountains, supporting columns, etc., shall not extend more than eight inches out from the wall.

b. Steps shall not project into corridor passageways.

c. Corridors shall have no dead ends or pockets, but shall provide direct passage.

d. Corridor ceilings shall be acoustically treated to prevent transmission of noises.

e. Service lines shall not be run exposed in corridors.

D. Toilet Rooms.

1. Size.

a. Toilet rooms shall be of sufficient size to accommodate the number of fixtures as are required by previously determined ratio. (See Plumbing under Structural and and Mechanical Features of the Building.)

2. Fixtures.

a. All fixtures shall be of a size and height designed to accommodate the age level of the pupils.

b. The soap and towel dispensers shall be provided convenient to the lavatories.

c. Lavatories shall be located nearest the doorways and shall be equipped with mirrors.

d. Sanitary napkin dispensers shall be provided in the girls' toilets of junior and senior high schools and in teacher's (women) rooms.

e. Screens shall be provided so that a direct line of vision from the corridor into the toilet room will be impossible.

E. Windows.

1. Location.

a. All rooms used for study or instruction, with the exception of those noted below, shall have unilateral lighting with windows placed in the wall parallel to the long axis of the room.

1) Multilateral lighting is permissable in the following:

a) Kindergartens
b) Industrial arts shops
c) Home economics department
d) Science laboratories
e) Gymnasiums
f) Auditoriums
g) Cafeterias

2) In science laboratories, or wherever movable furniture is used, bilateral lighting is permissable. However, the windows should be placed on the left and rear of the room.

2. Dimensions.

a. Windows in rooms used for study and recitation, physical training, shop, or laboratory shall provide a net glass area of not less than 20 per cent of the floor area.

b. Rooms using north exposure shall have not less than 25 per cent net glass area.

c. The top wall glass shall be as near as possible to the finished ceiling. In no case shall the distance from the floor to the top of the glass be less than one-half of the width of the room.

3. Window shades.

a. Shades shall be of translucent materials and so hung that any portion of the window may be shaded independently of any other portion.

F. Interior Doors.

1. Number.

a. Rooms designed to accommodate more than forty pupils shall have two means of egress.

2. Size.

a. Schoolroom to corridor doors shall be not less than three feet by six feet, ten inches, by one and three-quarters inches.

3. Additional Provisions.

a. Classroom and toilet room doors shall be glazed with glass panels if borrowed light is necessary to properly light corridors.

b. Toilet room doors shall have door closers and kick plates.

c. Doors shall be locked only from the exterior, opening from the interior whether locked or not.

d. Fire doors shall be provided wherever type of building construction indicates.

G. Sizes and Capacities of Rooms.

1. Width.

a. The width of rooms used for instruction or study shall not be greater than twice the distance from the floor to the top of the glass in windows.

b. In rooms having windows on opposite walls the width may be equal to the sum of the width allowed by each bank of windows.

2. Height.

a. The clear height of rooms used for instruction or study shall be not less than 12 feet.

b. The clear height of playrooms, auditoriums, cafeterias, etc., shall be increased above 12 feet in relation to the size, occupancy and use.

c. The minimum clear height for spaces of pupil use other than the above mentioned shall be not less than nine feet, six inches.

d. Gymnasium height shall be 21 feet from floor to lowest horizontal roof member.

3. Length.

a. The standard unit of classroom length is generally taken as 30 feet. Variations shall be according to need and use.

4. Area.

a. The standard classroom size is 12 feet by 22 feet by 30 feet.

b. In no case shall rooms used for study or instruction be greater than five times the net glass area of the windows.

5. Capacities.

a. Classrooms shall provide a minimum of 200 cubic feet for each pupil station.

b. The following table of areas per occupant may be used as a standard:

Auditorium and assembly rooms - 6-7 sq. ft.
Cafeterias, exclusive of serving space.....9-10 sq. ft.
Study halls, recreation rooms...16 sq. ft.
Elementary classrooms.....18 sq. ft.
Kindergartens, libraries, art, typing rooms ..... 20-30 sq. ft.
Science laboratories and homemaking units ..... 30-40 sq. ft.
Shops ..... 40-60 sq. ft.

H. Floor Coverings.

1. Types.

a. Floor coverings shall have smooth, dust resisting surfaces, and in rooms used for instruction or study shall be quiet and resilient.

b. The following is a list of recommended coverings for the different rooms

1) Administration - linoleum or asphalt tile.
2) Art and drawing rooms - same.
3) Auditorium and assembly room - same.
4) Boiler room - hardened cement.
5) Cafeteria - linoleum or rubber tile.
6) Classroom and activity rooms - linoleum or asphalt tile, cork, rubber tile.
7) Conference rooms - same.
8) Music rooms - asphalt tile and linoleum.
9) Corridors and foyers - asphalt, rubber, ceramic tile, linoleum, composition and terrazzo.
10) Domestic science - asphalt, rubber, ceramic, tile, linoleum, terrazzo.
11) Gymnasium - wood.
12) Health room - linoleum.
13) Kindergarten - linoleum, rubber, asphalt, tile.
14) Laboratories - asphalt, rubber tile, linoleum, cork.
15) Locker and shower rooms - terrazzo or ceramic tile.
16) Shops - wood, hardened cement, properly prepared dirt.
17) Toilets and washrooms - terrazzo or ceramic tile.
18) Libraries - linoleum, rubber, asphalt tile, cork.

I. Acoustical Treatment.

1. Location.

a. All spaces used for instruction or study, all corridors and unclosed stairwells shall be acoustically treated against excessive reverberation or transmission of sound.

b. The auditorium and gymnasium shall be free from reverberation and echoes by design and acoustical treatment.

J. Lockers and Wardrobes.

1. In junior and senior high schools it is advisable to recess lockers along corridor walls. However, in no case, shall lockers encroach upon minimum standards of corridor

width.

2. Individual lockers shall be provided in all rooms using the activity space.

3. Wardrobes shall be provided for all elementary grades in connection with each classroom.

4. Such special units as athletic department, home economics department, industrial arts department, etc., shall be provided with ample locker and wardrobe facilities.

K. Finish and Color.

1. All rooms and corridors finished in hard plaster shall be painted with washable colors of appropriate harmony.

2. Interior finish of wood trim shall be painted in harmony with the walls and ceilings.

3. In no case shall wood floors or wood trim be finished with an oil or wax treatment.

L. Blackboards and Tackboards.

1. The following list of heights may be used as standard for blackboards, tackboards and counters:

Grade	Floor to Bottom of Board or Top of Counter	Width of Board
Kindergarten	1'-10"	3'-6" to 4'
1st	1'-10" to 2'	3'-6" to 4'
2nd	2'-2"	3'-6" to 4'
3rd	2'-2" to 2'-4"	3' to 3'-6"
4th	2'-4" to 2'-6"	3' to 3'-6"
5th	2'-4" to 2'-8"	3' to 3'-6"
6th	2'-6" to 2'-9"	3' to 3'-6"
7th,8th	2'-10" to 3'	3' to 3'-6"
9th,10th,11th,12th	3'-0"	3' to 3'-6"

M. Built-in Equipment.

1. Such built-in equipment as is necessary for pupil storage, book storage, material

storage, work and display counters, closets, bulletin boards, trophy cases, etc., shall be carefully estimated and provided for in the original plans.

N. Fire Escapes.

1. Since building sizes are limited in conformance with construction types it shall be unnecessary to provide fire escapes outside the building walls.

2. Stairways, halls, and corridors when built in conformance with construction types will serve as fire escapes.

O. Fire Alarm Systems.

1. Every school of more than six rooms shall be provided with fire alarm system which is entirely separate from any bell and buzzer system.

2. At least one alarm box shall be conveniently located on each floor and such special units as the heating room, projection booth, and stage shall be equipped so that an alarm will go off automatically in the presence of excess temperatures.

3. In larger cities the school alarm system shall be connected so as to automatically sound an alarm at the nearest fire station.

CHAPTER V

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

The principal purpose of this study has been to develop a school building code for the State of Arizona. To justify such an undertaking it was necessary to ascertain the needs of the country, as a whole, for the building and improvement of schoolhouses, and to realize that Arizona, being the last frontier, may naturally expect to be school building conscious for some time.

Since Arizona has practically no regulation of school building construction, a study of legislation pertaining to school building construction in 22 states was undertaken to determine what regulation, control, encouragement and help various other states have offered their local authorities in solving their building problems. An analysis of the better existing state building codes, coupled with authoritative information on the most modern trends in school building construction, served in the development of a state school building code for Arizona.

The results of this study show that in spite of the reduced birth rate, tending to produce fewer and fewer children of school age each year, continued expansion of school building construction is necessary. We find this

situation due to several reasons:

First, it was found by Barrows that approximately 40 per cent of our existing elementary school buildings are over 30 years old. These buildings are obsolete from an educational and structural standpoint. The changing conception in the aims of education in the elementary grades has brought about marked change in the curriculum, which in turn has produced demands upon the school buildings themselves which our older structures were not designed to cope with.

Second, because the high school has become the people's finishing school, and because boys and girls of high school age are not readily absorbed by industry, the high schools throughout the country have shown an increase of 168 per cent since 1930. It is obvious such an increase has placed a demand upon existing high school structures which is beyond their normal capacity.

Third, there are approximately 132,000 one-room schools throughout the United States, many of which should be consolidated. This would necessitate the erection of well-planned consolidated schools at strategic locations. Arizona is one of the worst offenders in this respect. In fact, our state school law tends to encourage continuance of these out-moded one-room units.

Fourth, due to technological changes in industry many

boys and girls of school age are unable to find a place in industry. The modern school must take care of the continued education of these youths through part-time, vocational and night instruction.

Fifth, in a similar manner the schools must be fitted to re-educate adults along leisure and work activities.

Sixth, the lack of available data on school building requirements indicates a need for exhaustive studies along this line. In Arizona it is especially essential that some recognition of the importance of school building construction be taken due to the indicated increase in our population.

In spite of the importance of school building construction from an educational and structural standpoint, in only two of the 22 states studied did the author find complete legislation covering this subject, and in only 20 of the 48 states is a department of school building planning and construction within the state department of education. Two states, namely Connecticut and Missouri, provided for a department within the state department of education to handle this problem. These departments have final authority on the erection of any public school building within the state. In both states, besides legislative control, the state department offered complete and up-to-date building codes which local authorities could use as a guide in drawing up plans and specifications for school buildings.

Of the other states studied, several had school building codes but either lacked legislative control, or provided only for control and did not offer a code as a guide for planners of school buildings. From the above-mentioned provisions showing the recognition of the importance of school building construction, we find varying degrees of control, down to no legislative control, or no mention of school building construction other than of public buildings in general.

Since Arizona falls into the latter class, having no legislative control other than that pertaining to public buildings in general, it would seem that the development of a school building code for Arizona should be a worthwhile undertaking. The code is not the answer to all school building problems but should serve as a guide in helping local authorities.

The code has been broken up into the six following main headings, which will be briefly summarized here.

First - The School Building Architect: Since the Arizona law provides for the selection, employment, and remuneration of architects employed on public buildings in general, the code proposes the same procedure be applied as is already provided for in the present Arizona law.

Second - The Site of the Building: This is broken into the following eight parts, each of which will be summarized briefly:

1. Distribution of population. Obviously it would be a great waste of the taxpayers money if buildings are not located so that they may serve the greatest number. The location of school buildings involves, not only the present school population, which is, in turn, a part of the total population, but also must recognize future trends. The most accepted method of determining school population is finding the number of children per 100,000 square feet of area, using this as a unit of measure. Then determining by observation of city ordinance probable future location of residential areas.
2. Type of School Organization: This, in turn, is determined by the educational plan. The most significant phase of this is determination beforehand of the minimum and maximum size of the school plant, which, of course, has a direct bearing on the size and location of the school site.
3. Size and Shape of the Land: Any benefits which are to be derived by proper location of the school site must be augmented by the selection of a site which is both usable from the standpoint of shape, and adequate from the standpoint of size. In general, elementary schools should provide for a minimum of ten to twelve acres for playground space. Junior high schools should have a minimum area of not

less than ten acres, with additional space to provide for additional construction. Senior high schools usually require at least a site of 15 to 20 acres. The shape of the land is not particularly important, however such shape as obviously does not lend itself to complete utilization must not be considered.

4. Location for Environment: In addition to the physical characteristics of the school site, it is unquestionably true that wholesome moral surroundings will reflect in the attitude of the pupils.

5. Location for Accessibility: Though a convenient location of a school within its contributing area is desirable, the prevailing policy of transporting pupils by bus in Arizona somewhat offsets this necessity. It has, however, been advocated that elementary school children should not walk more than three-fourths of a mile to school; junior high school children should not walk over a mile and one-half, and senior high school children not over two miles.

6. Soil Factors: Except in the mountainous mining regions of Arizona soil factors should be the least significant of all factors pertaining to the school site. Any section of Arizona should provide a school site of proper soil and drainage facilities.

7. Location and Orientation of the Building upon the Site: It is advisable that consideration be given to window exposures, as have been outlined in the code itself. In addition, it is advisable to locate the building as advantageously as possible from every standpoint.
8. Development of the Entire Site: In Arizona, where the climate throughout most of the state lends itself admirably to the cultivation of the flora, the beautification of the landscape should be an integral part of the completed school site.

Third - The General Characteristics of the School Building. Since the schoolhouse is the finest home many of the children will ever know, it is desirable that the general architectural scheme should indicate a pleasing, wholesome, practical type of school structure. The general type of school architecture most suitable to the greater part of Arizona is the open or unit type construction. It lends itself admirably to the isolation of noisy and odorous units. It is the most practical from the standpoint of future expansion. It is the most flexible, in that units may be adapted to the activities which they house. It is the most economical type of construction, and, in short, offers every possible feature necessary in schoolhouse construction.

Fourth - The School Units. Within the school various activities place different requirements upon the space which they occupy. For this reason, then, we look upon the units within the school as workshops, each having its individuality of design. The school units have been broken down into the following, and specifications and requirements for each have been embodied in the school building code:

1. Administrative unit.
2. Health unit.
3. Teachers' rooms.
4. Custodian's unit.
5. Classrooms.
6. Activity Spaces.
7. Storage Spaces.
8. Toilet rooms.
9. Library.
10. Auditorium.
11. Gymnasium.
12. Kindergarten.
13. Homemaking unit.
14. Art room.
15. Industrial Arts unit.
16. Science unit.

Fifth - Structural and Mechanical Features of the Building: This unit deals with those aspects of a general nature which go to make up the shell of the school plant. This section deals with the different types of construction. These are classed as "Fireproof", "Firesafe", "Ordinary", and "Frame". The limitations in height and floor area of the above-mentioned types are as recommended by the National Board of Fire Underwriters. The general characteristics of foundations, footings, walls, floors and roofs, with their live-load capacities, are treated in a general manner. Lighting intensities, both electrical and artificial, for the various school units are recommended in foot candle intensity. Heating and ventilation of the school structure are not major problems in Arizona. The simple and direct window gravity system, supplemented when necessary by fan exhaust, should afford ample ventilation, with wall-hung radiators of the steam or hot water type furnishing heating facilities.

Sixth - Details of the Building: Insofar as possible, the details of the building have been offered in a sense of general recommendation which is coincident with good practice. General details are recommended for the following:

1. Stairways
2. Exits and Entrances
3. Corridors

4. Toilet rooms
5. Windows
6. Interior doors
7. Size and Capacities of the rooms
8. Floor coverings
9. Acoustical treatment
10. Lockers and Wardrobes
11. Blackboards and Tack boards
12. Finish and Color
13. Built-in equipment
14. Fire escapes
15. Fire alarm systems

It is obvious that any attempt towards regulation of school building practices will prove of little value without some adminstrative unit designed to help local authorities in their attempts to follow such a code. To this end, then, it is recommended that Arizona State Legislature create a Department of School Building Service, within the State Department of Education. The director of this department shall be elected by the State Board of Education and shall have such qualifications as his position would indicate. He will be the final authority in all matters pertaining to plans and specifications, and no school building construction, alteration, or additions will be undertaken without his approval.

In conclusion, we recognize that the activities of a modern school, like those in the outside world for which pupils are preparing, are extremely varied in character. Each activity places its specific set of requirements on the space that is to house it. The more fully and efficiently those requirements are met in the functional design of the space, the more successfully the activities may be followed. To this end, then, may the proposed code be used to guide school officials and architects in their functional planning of new school units.

BIBLIOGRAPHY

A. Books

1. Alcott, William A.
   Prize Essay on the Construction of Schoolhouses.
   Discourses and Lectures, American Institute of Instruction. 1881.

2. Barnard, Henry.
   School Architecture or Contributions to the Improvement of Schoolhouses in the United States.
   A. S. Barnes and Company, New York, 1848.

3. Donovan, John J. and Others.
   School Architecture.
   Macmillan and Company, New York, 1921.

4. Guerin, Chief.
   Making Schools Safe From Fire.
   Pyrene Manufacturing Company, New York, 1917.

5. Holy, R. A.
   The Relationship of City Planning to School Plant Planning.
   Ph.D. Dissertation, Teachers College, Columbia University, 1934.

6. Johonnot, James.
   Schoolhouses.
   J. W. Schermerhorn and Company, New York, 1871.

7. Mann, Horace.
   Report of the Secretary of the Board of Education on the Supply of Schoolhouses.
   Dutton and Wentworth, Boston, 1838.

8. Schweickhard, Dean M.
   Industrial Arts in Education.
   Manual Arts Press, Peoria, Illinois, 1929.

9. Wheelwright, E. M.
   School Architecture.
   Rogers and Manson, n.p., 1901.

10. Wood, Thomas, D.
Health Supervision and Medical Inspection of Schools. W. B. Saunders Company, New York, 1927.

B. Periodical Articles

11. Lyman and Place.
"The Spanish Style for a School of the Southwest". Building Age, (December, 1924)

12. Schmidt, H. W.
"Some Fundamentals of School Building Planning". American School Board Journal, (June, 1936.)

13. Barrows, Alice.
"The School Building Situation and its Needs". Department of Education Bulletin No. 35. (1937.)

14. Engelhardt, Fred; Hegel, Newton, and Womrath, George.
"Selecting Sites for School Buildings". University of Minnesota Bulletin, (1928.)

15. Lee, Charles A.
"Schoolhouse Planning and Construction." School Building Series, Bulletin 3, State of Missouri, (1933.)

16. Pruett, Haskell.
"School Plant Requirements for Standardized Elementary and Accredited High Schools." George Peabody College for Teachers, Contribution for Education. Bulletin 128, (1934.)

17. Spain, Charles L.
"Economy and the Modern Curriculum." Detroit Educational Bulletin 16:2, (January, February, 1933.)

18. Strayer, George D., and Engelhardt, N. L.
"Standards for High School Buildings." Teachers College, Columbia University, (1924)

19. Strayer, George D., and Engelhardt, N. L.
"Standards for Elementary School Buildings." Teachers College, Columbia University, (1923.)

20. Strayer, George D., and Engelhardt, N. L.
"Standards for Junior High School Buildings."
Teachers College, Columbia University, (1923.)

21. Studebaker, John W.
"Biennial Surveys of Education."
Department of Education, Bulletins, (1906-1934)

22. Thomas, Minor Wine.
"Public School Plumbing Equipment."
Teachers College, Columbia University, Bulletin 282, (1928.)

23. New York State.
"Report of Committee on Ventilation."
E. P. Dutton and Company, New York, 1923.

24. University of North Carolina.
"The High School Library."
Extension Bulletin, Vol. 14:2, (June, 1923.)

25. State of Connecticut.
"School Building Code."
Department of Education, (June 2, 1937.)

26. State of Missouri.
"Schoolhouse Planning and Construction."
School Bulletin Series, Department of Education, (1933.)

C. Unpublished Materials

27. Turner, R. Izer.
"The (American) Plan School Architecture Suitable for the Southwest."
Unpublished Master's thesis, University of Arizona, (1929.)