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A REVIEW OF STUDIES OF ECONOMIES IN SCHOOLHOUSE CONSTRUCTION.

BY- DOHERTY, LEO D. WHEATLEY, ARTRELLE
STATE UNIV. OF N.Y., ALBANY
NEW YORK STATE EDUCATION DEPT., ALBANY

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ECONOMIES IN PLANNING AND DESIGNING BEGIN WITH THE WISE CHOICE OF AN ARCHITECT. COMPLETE INFORMATION ON BUILDING NEEDS, ENROLLMENT PROJECTIONS, AND PROGRAM MUST BE AVAILABLE. INCLUSION OF MULTIPLE-USE ROOMS, MINIMAL PERIMETER WALLS, LOWERED CEILINGS, MINIMAL WASTE SPACE, MINIMAL USE OF GLASS, AND USE OF STOCK PLANS ARE CONCEPTS WHICH CAN EFFECT ECONOMIES. FURTHER ECONOMIES CAN BE EFFECTED BY CAREFUL SITE SELECTION, DEVELOPMENT, AND UTILIZATION. PREFABRICATED SCHOOLS AND MODULAR DESIGN ARE NEWER CONCEPTS SUGGESTED AS EFFICIENT USES OF MATERIALS. LOW COST MAINTENANCE CONSTRUCTION CAN SAVE MUCH MONEY. USE OF TEMPORARY BUILDINGS SHOULD BE AVOIDED. CAREFUL FINANCING OF BUILDING PROJECTS WILL HELP REDUCE COSTS ESPECIALLY IF PROPER TIMING IS INCORPORATED. TIMING IS ESSENTIAL TO THE ENTIRE CONSTRUCTION PROGRAM. A BIBLIOGRAPHY IS INCLUDED. (RH)

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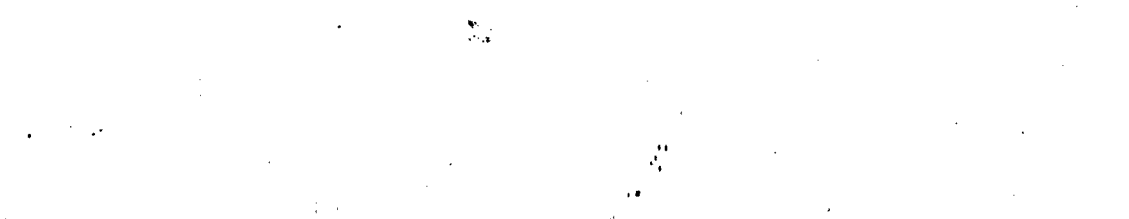

The University of the State of New York
The State Education Department
Division of Research
May 1960

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A Review of Studies of Economies in Schoolhouse Construction

Leo D. Doherty
Associate in Education Research

and

Artrelle Wheatley
Research Aide

May 1960

FOREWORD

One-third of the school buildings in use in New York State in 1958 had been built in the preceding eight years. The need for new buildings stretches on into the future to house the increasing number of pupils, to replace obsolescent buildings and to adjust to shifts in population.

Economy in school construction will help to make more adequate facilities available and release resources for providing educational programs of higher quality. The present review of the literature, summarizing studies of economies in school construction, offers a background for continuing study.

Lorne H. Woollatt
Assistant Commissioner
for Research

May 1960

Introduction

Recent studies of schoolroom need indicate that nearly 100,000 additional classrooms will be needed in New York State by the end of the school year 1964-65.[1] This increased need for schools is accompanied by an increase in school building costs. These factors have created an ever-increasing demand for economy in school construction.

Defining economy is the first step in the consideration of various proposals for low cost construction. The New York State Commission on School Building states "economy as applied to schoolhouse construction implies a wise and carefully managed expenditure of school funds in providing facilities which are adequate in terms of the needs of the educational program at the most reasonable cost."[2]

A great many articles and reports have been published on the subject of building economies.[3] This report will examine some of the economy measures that have been advanced for school construction from the aspect of the primary responsibility of the school. Many proposals have been directed solely at the costs of building construction. The necessity of building schools at the most reasonable cost is of great importance but not at the price of building inadequate schools.

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[1] Doherty, L.D. An Estimate of School Building Needs in New York State Through the School Year 1964-65. New York State Research Offices, May 1959.

[2] New York State Commission on School Buildings. Economy Handbook. Economies from A to Z. Albany. The Commision. 1953.

[3] See Bibliography.

Economy measures in educational planning and architectural design, site selection and development, materials and methods of construction, maintenance considerations, financial planning, and timing considerations will be examined.

Present Day Economy

Despite the many articles in popular magazines which complain of the "costly palaces" which are being built, the evidence indicates that school building costs have shown a lower rate of increase than other construction costs. In the twenty years from 1937 to 1957, the cost of school buildings increased 150 percent. At the same time the cost of all buildings increased 210 percent; general construction increased 275 percent.[4] The American Association of School Administrators attributes this economy to careful planning. "School board members, administrators, teachers, architects and lay citizens have approached school building planning by taking a good look at the kind of space and equipment teachers and pupils need and can use to best advantage in teaching and learning and have designed buildings that will meet these essentials. Everything else has been trimmed off."[5]

Planning and Design

Economies in design may be attained through careful educational planning and creative designing. The New York Commission on School Buildings considers the wise choice of an

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[4]The American Association of School Administrators. Stretching the School Dollar. Washington. The Association. 1957.

[5]Ibid.

architect one of the major economies in planning and building schools.[6] The Commission recommends that the architect be employed as early as possible and be provided with all pertinent information.

Educational planning requires complete information on such factors as "(1) purpose of the building (2) present and future enrollment (3) sizes of the groups with which teachers will work, or the teacher-pupil ratio (4) educational experiences that are to be provided (5) summer and after-school use of the building (6) age group or age levels of the children to be housed (7) scope of curriculum content."[7]

Within this framework basic economy measures have evolved. The elimination of features that contribute nothing to the usefulness of a building, gables, cupolas, gingerbread decorations, is an educationally economical practice.

Economical design obtains the maximum usable space with a minimum of excess cubage. The New York State Commission on School Buildings recommends "design with little waste space in attics and basements, simple roof lines, no parapets, classrooms with 9 foot ceilings, and efficient combinations of big cubage spaces like auditorium, gymnasium and cafeteria. It also

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[6]New York State Commission on School Buildings. Op. cit. p. 6.

[7]National Council on Schoolhouse Construction. 13 Principles of Economy in School Plant Planning and Construction. Nashville. The Council. 1954. p. 9.

requires straight outside walls with a minimum of jogs and corners to achieve short perimeters."[8]

Multiple-purpose Rooms

Multiple-purpose rooms are often proposed as an economy measure. Combinations, to be educationally effective, must be made on the basis of schedule demand and environmental considerations.

The popular auditorium-gymnasium combination has been criticized on both these counts. Scheduling difficulties quite often arise. Shaw, in analyzing this combination found that the difference in environmental requirements such as the amount of light, the type of sound conditioning, the type of flooring desirable for gymnasium and auditorium activities far outweighed the similar requirements for large amounts of space.[9]

Some schools have found a library-eating room combination a satisfactory compromise, by separating food preparation and serving space and book shelf space from the central area.[10]

Perimeter Walls

One undebatable source of economy is the reduction of perimeter walls. Outside walls are necessarily more expensive than inside partitions because they are heavier, more insulated and must be built to withstand the weather. A study prepared by Rensselaer Polytechnic Institute for the State Education

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[8]New York State Commission on School Buildings. Op. cit. p. 18.

[9]Shaw, Archibald. "Trends in Multi-purpose Rooms." American School and University. 1952-53. pp. 279-84.

[10]Ibid.

Department shows that a 10,000 square foot area enclosed in a square would result in cost savings of $21,000 for exterior walls as compared with the cost of a design with many jogs.[11]

Ceiling Heights

The reduction of volume by lowering ceiling heights means savings in construction costs. Theisen found that while savings are not in direct proportion to reduction in cubic-foot content, a reduction of two to four feet from the once standard twelve foot ceiling effects savings not only in construction costs, but also in heating and maintenance costs. Educators report a favorable effect on children and teachers from the more home-like atmosphere and improved acoustics.[12]

Waste Space

The National Council on Schoolhouse Construction recommends that basements be eliminated or held to a minimum. Savings are realized from not having to excavate, and more economical floor construction is facilitated.[13]

Flat roofs contribute to economy through reduction or elimination of waste attic space. In some cases the roof deck may also serve as the ceiling, reducing material costs.

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[11]Hauf, Harold, et. al. Potential Economies in School Building Construction. Albany. The University of the State of New York. p. 13.

[12]Theisen, W.W. Lower Classroom Ceilings. AIA School Plant Studies. September 1954.

[13]National Council on Schoolhouse Construction. Op. cit. pp. 27-28.

The Use of Glass

The use of large amounts of glass area to permit maximum use of natural light has been questioned on the grounds of economy. Studies have shown that costs may be cut by reduction of the amount of glass. The initial cost of glass area per square foot is nearly always greater than that of blank walls; minimum use of glass can reduce initial building costs by as much as 15 percent.[14] The use of natural light as a primary light source has been questioned because in New York State the sky is overcast during a large percentage of the time school is in use, large window areas require the use of sun control devices, and artificial light is in constant use regardless of the supply of natural light.[15]

Stock Plans

The Stock Plan is often urged on school boards. The layman often feels that there must be a good standard design for school buildings and that a considerable saving could result from the use of such a plan. In a survey conducted by the American Institute of Architects in 1953, it was found that twenty-three states have never used stock plans, fifteen states formerly used them but have abandoned the use, and the ten states that have limited stock plans only provide them for small

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[14] Hauf, Harold, et. al. Op. cit. p. 11. National Council on Schoolhouse Construction. Op. cit. p. 15.

[15] Caudill, William. Toward Better School Design. New York. F. W. Dodge Corp. 1954. p. 64.

schools.[16] The Legislative Research Council of the State of Massachusetts found that in 1957 uniform school plans were used only in the six states of Arkansas, California, Maine, Mississippi, Oklahoma and West Virginia. In all cases the plans are for schools of four classrooms or less.[17]

The Report prepared for the Massachusetts Legislature summarizes the arguments of the proponents of stock plans as follows:

> "Many school buildings must be built. It is better to build more standardized schools, even though they may not be ideal, rather than slow down the school building construction program and thereby crowd educational facilities.
>
> "Communities that are called upon to assume heavy tax burdens because of increases in enrollment may not find themselves in a position to be idealistic. These communities, it is argued, should be given the assistance afforded by standard school plans.
>
> "If a community is willing to pay the additional costs for the ideal school, uniform plans do not stop it from doing so. In fact, its knowledge may be so assisted by standard plans as to require a better individually designed school structure."[18]

To summarize the views of opponents of uniform plans the same report says:

> "Uniform school plans can promise savings only in one direction,--that of time. On the other hand, unfortunate results frequently flow from the hasty planning which are /sic/ promoted by their use. Reliance on uniform plans repudiates the importance of the local planning process and abandons

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[16] Stock Plans for School Buildings: A National Survey. AIA School Plant Studies. January, February 1953.

[17] Commonwealth of Massachusetts. Legislative Research Council. Report Relative to School Construction Methods and Costs and Uniform Architectural Plans. Boston. Wright & Potter Printing Co. Legislative Printers. 1958. p. 111.

[18] Ibid. pp. 119-120.

> responsibility for attempting to make improvements continuously in our schools--which are two important elements of providing good public education in a democracy."[19]

A list of potential economies to be used by Massachusetts localities in the planning and design of new schools contains the recommendation "Avoid Stock Plans."[20]

Other

Many suggestions for potential economy show no clear-cut advantages and must be analyzed on the basis of specific situations. Among these plans are single-story vs. multi-story buildings and the campus plan vs. the compact plan.

Sites and Site Development

Economy in school sites must be considered from three points of view: selection, development and utilization of the property. Featherstone points out that "logical location of school sites requires a study of the past, present and future to determine trends in community growth, enrollments and the educational community-service programs. More effective overall planning is done when there is cooperative effort by the school board, school officials and other community leaders."[21]

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[19] Ibid. p. 124-125.

[20] A report by the committee to study school construction costs to Governor Christian A. Herter quoted in Massachusetts Legislative Research Council, op. cit. p. 132.

[21] Taylor, James. School Sites: Selection, Development and Utilization. Washington. U.S. Department of Health, Education and Welfare. 1958. p. 3.

"Immediate and long term economies resulting from wise site selection may mean savings amounting to tens of thousands of dollars in the cost of site preparation, building construction, provision for utility services, fire protection and the like."[22]

The initial price of the land must be weighed against many other factors. Herrick states that "unless the price is exorbitant, suitability of location, adequacy of size and other factors related to the effectiveness of the school program should be given far more weight than the dollar cost."[23]

In the interest of economy the board should have the advice of an architect or engineer in site selection. An architect or engineer can determine if a site would require special draining, excessive grading, or a costly type of construction due to soil conditions.

Suggested procedures for economy in sites have been summarized in the criteria offered by the National Council on Schoolhouse Construction. These recommendations are:

1. The site should be selected in terms of the type and size of the school to be accommodated and of the nature of the school's educational program.

2. The site should be centrally located with reference to the children who will attend the school.

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[22]New York State Commission on School Buildings. Op. cit. p. 10.

[23]Herrick, McLeary, et. al. From School Plant to School Program. New York. Henry Holt. 1956. p. 74.

3. The site should be large enough not only to accommodate adequately the necessary building or buildings but also to provide ample space for outdoor instruction and recreation, for parking, and for future expansion of buildings and play area.

4. The site should be located so as to be reasonably well removed from objectionable features such as distracting noises, unpleasant odors and excessive heat.

5. The site should be readily accessible not only to the children who will attend the school but also to the general public for community use, educationally or recreationally.

6. The site should be located so as to safeguard the children against the hazards of main streets, arterial highways, and railroads.

7. The site should be so located that water, sewers, electricity and other utilities can be provided at reasonable costs.

8. The site should have an elevation and contour which will insure good drainage and a type of subsoil which provides a good base for building footings and foundations.

9. The site should be selected with due regard to its proximity to public recreational, educational, and cultural facilities such as parks, libraries and museums.

10. The site should be one which lends itself readily to landscaping and provides a pleasing and beautiful natural environment.

11. The site should be purchased before the need becomes critical.[24]

Material and Methods

In the period between 1937 and 1957, the cost of common labor increased 330 percent; the cost of materials and

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[24]National Council on Schoolhouse Construction. Op. cit. pp. 6-7.

components for construction increased 200 percent.[25] Many suggestions for economies in these areas have been made. Not all of these proposals represent true economy.

Prefabrication

Prefabricated schools have been offered as a means of cutting costs. Studies have shown that while a prefabricated school can, in general, be built for less money than a comparable conventionally built school, prices go up the moment that modifications are made in the design. No two schools are exactly alike; therefore, compromise of either the school program or the prefab design is inevitable. Architectural Forum cites the case of a school design in Westport, Connecticut, which was rejected because of a total cost of $1.14 million. The prefabricated design that was substituted cost more than one million dollars because design changes had to be made.[26]

Modular Design

While prefabricated buildings have not proved economical, the use of modular design and repetitive planning have been found to result in lower costs. The standardization of building components based on a four inch module has made savings possible, both in reduction of labor costs and in reduction of wasted materials. At the same time this technique allows latitude in establishing a design to meet the needs of a particular

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[25] The American Association of School Administrators. Stretching the School Dollar.

[26] "Prefabrications Changing Role." Reprinted from Architectural Forum. November 1957.

educational program. Caudill[27] cites as an example the fact that a crew of workmen can put up 100 similar steel columns and beam frames in a much shorter unit of time for each frame than it would take if there were only five frames to erect. Not only does the use of repetitive units cut costs at the site, but material costs may be cut also. It is cheaper to cut 100 beams all of the same size than to cut 100 beams of different dimensions.

Educational Facilities Laboratories found that no particular structural system is generally most economical.[28] Clark, in listing contributions the architect and engineer can make toward economical school construction, stressed the use of materials produced locally.[29] He found that in many cases transporting materials to the site costs from 20 to 50 percent of the selling price. He also recommends the utilization of materials and methods familiar to local labor, as labor efficiency drops rapidly without familiarity. A 10 percent drop in efficiency will increase building cost approximately 6 percent.

In choice of materials and methods of construction, many of the considerations for economy must be made on the basis of the particular situation.

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[27]Caudill, William. Op. cit. p. 103.

[28]"New Ways to Cut Costs." Architectural Forum. 111 (November 1959) p. 123.

[29]Clark, Bradford. "Economy in School Construction." American School Board Journal. 120 (April 1958) pp. 3-7.

Maintenance

Initial construction costs have generally received most of the attention when costs are considered. The fact that the cost of maintaining school buildings is almost as much as the cost of acquiring the buildings is quite often overlooked. In New York State 11.9 percent of school costs are due to purchase of original plant, while 9.7 percent are due to use of plant, for operation and maintenance charges.[30] Economy, therefore, requires a combination of low first costs and low maintenance costs. According to Clark "in the final analysis, the low maintenance cost requirement is undoubtedly the more important, for maintenance starts the day the building passes from the responsibility of the builder to the owner and continues thereafter until the building is razed."[31]

Many studies have shown the inadvisability of choosing materials solely on the basis of low initial cost. Some schools have used asphalt tile in student bathrooms instead of ceramic tile. Many of these schools have had to rip out the asphalt tile later to replace it with the impervious ceramic materials.[32]

Another school left off the asphalt specified to cover the concrete slab. It was later discovered that the savings in

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[30]Hauf, Harold, et. al. Op. cit. p. 3.

[31]Clark, loc. cit.

[32]"Bargain-basement Education is No Bargain." Reprinted from Coronet. October 1958.

wax, which soaked into the concrete, would have paid for the tile in only three and one-half years.[33]

In many cases additional initial costs have resulted in substantial long range savings. The Hauf study indicates that provision of adequate thermal insulation may result in savings of as much as 6 percent in total annual operating and maintenance costs.[34]

In addition to higher initial cost, overuse of glass can result in much higher maintenance costs. Upkeep costs on the windows for cleaning and repair may become costly. In New York City the cost of replacing windows in 1958 was $401,307. In one school opened in February 1959, 589 windows were replaced by November 1959, at a cost of $2,680.[35] The addition of bars, screens, etc. to the windows to prevent vandalism is a source of added cost, as is the provision of shades, blinds and other sun screening devices.

Heat loss through glass surfaces can result in additional heating charges. A study of operating costs for classrooms with minimum and maximum window areas indicates an annual cost of additional fuel of $61.50 for the room with maximum window area as against $19.80 for the minimum window classroom. Although the cost of lighting the minimum window room was twice as much

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[33] National Council on Schoolhouse Construction. Op. cit. p. 13.

[34] Hauf, Harold, et. al. Op. cit. p. 16.

[35] Board of Education figures in an editorial. The New York Times. November 20, 1959.

as lighting the other, there was a substantial saving in operating costs for the room with minimum glass area.[36]

The use of wood for roofing, structural framing, floors, is often suggested, but any initial cost advantage may be wiped out by higher fire insurance rates. In New York State a better than eight-fold penalty is imposed for the use of wood.[37]

Temporary Buildings

The advocates of temporary buildings feel that they serve a critical need and can be built quickly and cheaply, then replaced in a few years. In most cases these temporary buildings have proved to be an expensive economy.

Hicksville, New York, constructed eight temporary buildings. They were erected at a cost of $15.00 a square foot instead of $18.00 for permanent buildings. The fire insurance rates, however, are eight times as high as the rates for fire resistant buildings.[38]

If temporary buildings are replaced in a few years the cost per year is apt to be quite high. If the building is used for a long period (some "temporary" buildings erected shortly after World War I are still in use)[39] additional costs for operation and maintenance must be included.

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[36]A Study by Louis Drakas for the State of Connecticut, reported in Potential Economies in School Building Construction. p. 12.

[37]Hauf, et. al. Op. cit. p. 16.

[38]"Bargain-basement Education is No Bargain." Reprinted from Coronet. October 1958.

[39]Herrick, et. al. Op. cit. p. 466.

Financing

There are four basic ways to pay for a new school: pay for it out of current revenue, accumulate a reserve fund to pay for it, short-term borrowing, and long-term borrowing.

The first two methods are cheaper, but only the larger and wealthier districts have sufficient wealth to provide adequate funds on a pay-as-you-go basis. In general, at least three out of four districts in New York State must borrow funds to meet the cost of construction.[40]

Concern over interest rates has caused many districts to examine critically the traditional method of borrowing money through long-term bonds.

Short-term financing, to which some school districts resort, is cheaper initially as interest rates are usually lower for shorter term than for long-term bonds. Since short-term issues must be smaller and for shorter terms, they require repetitive refunding more frequently. Often these measures cost the district more in interest than one long-term issue would have cost.[41]

Leaseback mechanisms have been suggested as a means of financing schools. Some states have set up authorities which build schools with limited obligation bonds and lease these schools to the district. These arrangements have been found to cost taxpayers more in the long run. Investment bankers estimate

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[40] Hauf, et. al. Op. cit. p. 22.

[41] "Money for Schools." Reprinted from Architectural Forum. November 1957.

that limited obligation bonds must carry one-fourth of one percent more in higher interest rates because the full taxing power of the locality is not behind the bonds.[42]

The necessity for long-term borrowing requires that economies be sought in the area of interest charges. A major factor in the interest rate charged is, according to the American Association of School Administrators, the credit rating of the school.[43] "Critical yardsticks" in determining credit rating, according to one report, are:[44] "the ratio of total debt to assessed valuation of property; total debt to full market value; per capita debt; the debt calendar itself, that is, how the debt is spread over the future, how much state aid a locality gets; the tax collection record."

Cost savings by good timing of borrowing have been shown.[45] Herrick states that "low interest rates are achieved by offering the bonds for sale when market conditions are right, by selling the bonds in attractive denominations, by securing competition in bidding, and by meeting fully all technical requirements that affect the safety of the purchaser's money."[46]

Savings in interest costs may be effected by planning payments for early reduction of principal. A sinking fund plan, in

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[42]"Money for Schools."

[43]American Association of School Administrators. American School Buildings. Washington. The Association. 1949. p. 30.

[44]"Money for Schools."

[45]Hauf, et. al. Op. cit. p. 22.

[46]Herrick, McLeary, et. al. Op. cit. p. 468.

which principal payment is deferred to one maturity date, may result in twice the interest costs of an equal annual total payment plan which consists of an equal principal-decreasing interest schedule.[47]

Significant savings result from scheduling repayment over as short a term as possible, or by substituting a twenty year bond program for a thirty year repayment plan. The Hauf report estimates that economical financing programs can result in savings of up to 15 percent of the total building costs.[48]

State school financing authorities have been proposed as an instrument for effecting economies in school building finance. Such an authority would have two main functions: (1) to advise and assist a local school district in the preparation of a bond issue for sale and (2) to buy bonds of the district and, in turn, to issue its own tax exempt bonds for sale. Proponents of this plan hold that the bonds issued by the authority should command a higher rating than those of individual districts, with resulting lower interest costs, that the advisory service would improve the market for those districts choosing to sell their own bonds, and that the number of small issues coming to the market would be reduced.[49]

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[47] Viles, N.E. Local School Construction Programs. Washington. U.S. Department of Health, Education and Welfare. 1957. p. 56.

[48] Hauf, et. al. Op. cit. p. 22.

[49] Governor's Committee on the Marketing of School Bonds. Schools for New York. Albany. The Committee. 1957.

Timing

Considerable savings may be realized as a result of proper timing. Studies have shown several areas of economy that are affected by time consideration.

When site acquisition is planned for several years in advance of actual needs, options may be secured on or purchases made of desirable parcels of land before prices rise.

Cost advantages that result from allowing sufficient time to the architect for planning have been mentioned.[50] In discussing the costs of allowing insufficient time for the architect to complete his work Edmundson says, "by limiting his time you may prevent (the) architect from giving problems adequate study, you may make it impossible for him to produce (the) most economical plan, he may be prevented from preparing complete and carefully detailed drawings that enable (the) contractor to give the lowest possible bid. Lack of time may mean that old details and plans may be warmed over and accommodated to your site and program, possibly at a saving to the architect but with a decrease in (the) efficiency of the finished plant. On the other hand, increase in bids caused by enforced lack of completeness increases the architect's fee.[51]

The Hauf study estimates that the cost savings that might be realized from permitting adequate time for the architect's preparation can amount to 5 percent of the original cost.

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[50]Hauf, et. al. Op. cit. p. 22. Edmundson, Donald. Economy in School Building. AIA School Plant Studies. May-June 1956.

[51]Edmundson, op. cit.

Many studies have shown that savings result from proper timing in advertising for bids. The New York State Commission on School Buildings recommends:[52]

1. Advertise for bids, if practicable, when building activity is at a low ebb and building contractors are eager for work.

2. Advertise for bids, if practicable, in late fall or early spring when many contractors are out of work.

3. Advertise for a sufficient time to enable builders to obtain dependable bids from sub-contractors and supplies, ordinarily not less than three or four weeks.

4. Advertise for bids to be opened at a time when bids are not being received from other important projects.

Silverthorn points out an appreciable saving that resulted from rejecting all bids made in October and resubmitting the project for bids the following February.[53]

The time allowed for construction can affect the cost. Lower bids are likely to be received if a reasonable amount of time is allowed for the completion of the project. Edmundson states that some contractors have added several thousand dollars to their figures because they felt that the time schedules were unrealistic and, when backed by a liquidated damage clause, might add to their cost.[54]

The time factor in relation to financing has been mentioned previously.

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[52] New York State Commission on School Buildings. Op. cit. p. 43.

[53] Silverthorn, Harold. "Factors that Produce Economies in School-house Construction." Nation's Schools. 53 (May 1954) p. 74.

[54] Edmundson. Op. cit.

The Hauf study voices the opinion that timing may be responsible for greater savings than any other economy measures.[55]

Summary and Conclusions

While many articles are written on the topic of school building economy, much of the material is of limited or questionable value. Many proposals are offered which promise economy, but few studies offer supporting evidence for the proposals.

The study of the literature concerning school building economies leads to two main conclusions:

1. There is no magic formula that will guarantee a low cost schoolhouse. The low cost school can be obtained only as a result of the accumulation of savings in all aspects of the building program.

2. Economies in construction are the result of careful planning. Good educational planning leads to the use of funds for facilities that are necessary for a good educational program, without waste of space or materials, to the use of materials for long-term economy in maintenance, to good timing consideration.

While in each area of the building program there are some basic economical measures, in most cases comparisons must be made on the basis of the specific conditions and requirements that apply in each case.

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[55]Hauf, et. al. Op. cit. p. 24.

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