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ABSTRACT

This report details a method by which the cost of school building construction in Massachusetts could be substantially reduced. A special study committee concluded that a systems approach to school building would cut costs and produce buildings of better quality and greater flexibility. It recommended the creation of a Statewide corporation to oversee and finance school construction throughout the State while insuring continued local participation in planning and design. A related document is EA 004 073. (RA)

## ERRATUM

Two steps were inadvertantly omitted from the list of Recommended Procedures for Constructing a School on Page 15

Following Step 15:

Dept. Ed. Approves preliminary plans.

Following Step 27:

Dept. Ed. Approves working drawings.

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*Cover: Sixteenth century  
systems construction: The  
Orders of Vignola (Courtesy of  
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SUMMARY REPORT

11-36

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# A systems approach for Massachusetts schools

A STUDY OF SCHOOL BUILDING COSTS FOR  
THE MASSACHUSETTS ADVISORY COUNCIL ON EDUCATION

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EDUCATION & WELFARE  
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by Campbell, Aldrich and Nulty, Boston

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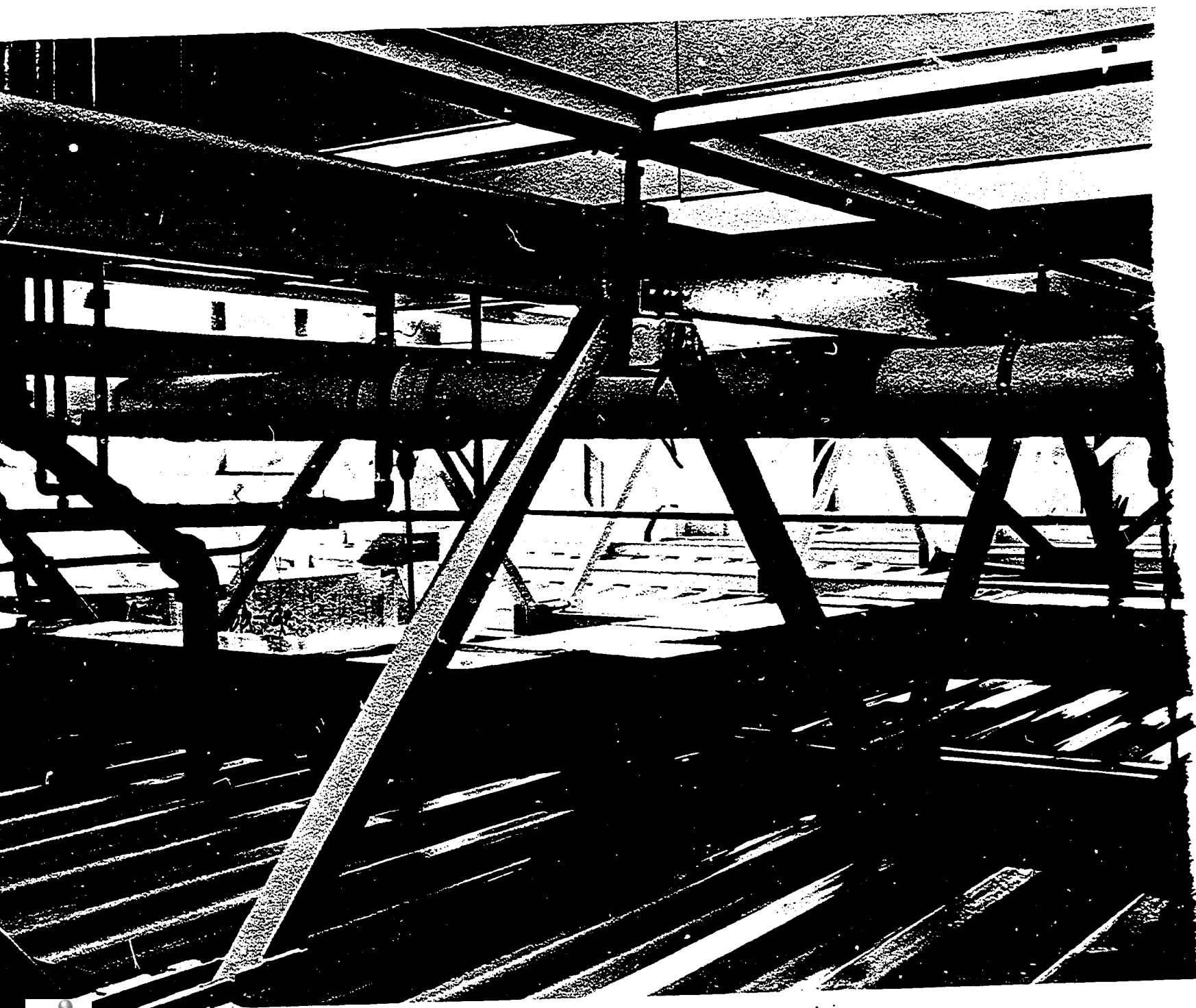
Summary Report prepared by Intelligence for Education, Inc. Paul Abramson, Editor

November, 1971











## FOREWORD

Growth in population, modern technology and inflation have raised the economic costs of servicing and governing our complex society to an almost unbearable load. The leisurely, relatively simple, decentralized practices of the past do not respond to the opportunities of modern technology, and they are wasteful in responding to increasing demands and costs. Our public schools, spending \$1.2 billion a year, are the State's biggest business—public or private. Providing housing for 1.1 million school students constitutes the State's largest single construction business, \$150 million in 1971. On the conviction that people in Massachusetts and their leaders need to know what possibilities are available to them, and informed by the study of the Business Task Force for School Management that modern management practices and application of modern buildings systems could appreciably reduce the cost of our school buildings, the Advisory Council commissioned the study summarized in this volume. It engaged the noted architectural firm of Campbell, Aldrich and Nulty to assemble a team of experts in

finance, law, architecture and engineering. They gathered extensive data, analyzed most of the factors, developed recommendations, and those costs are reflected at meetings and in the result of these studies. The State fund appears in this volume. An examination of the recommendations and agenda to which they should give careful attention. The Advisory Council created it and appointed it, and significant studies and consideration require.

Heating, ventilating and air conditioning system



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## WORD

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finance, law, management of technology, architecture and education. This team has gathered extensive information, appraised most of the factors affecting school building costs, developed a series of steps to reduce those costs and presented them for discussion at meetings across the Commonwealth. The result of these efforts, funded by \$135,000 of the State funds and \$10,000 of Federal funds, appears in this summary.

An examination of the analyses and recommendations of this study suggests an agenda to which the people and their leaders should give careful attention. On behalf of the Advisory Council and the Legislature which created it and funded it and the Governor who appointed it, we present this extensive and significant study and urge that it be given the consideration the dimensions of its subject require.

*William C. Gaige  
Director of Research*

g, ventilating and air conditioning system

### **The study team**

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## **Introduction**

School construction is an expensive business. Millions of dollars are spent each year on direct building costs of new elementary and secondary schools and on additions, major remodeling and modernization. In Massachusetts, the cost of school building now approaches \$36 per square foot as compared to \$19 per square foot just 10 years ago. The cost of land, fees and equipment is additional. (This is not unlike the experience of other states.) The total spent on new school construction alone exceeded \$150 million in 1970 and reports indicate that vastly more space will be required in the next five years.

This report details a manner in which the cost of school construction in Massachusetts can be substantially reduced—perhaps by as much as 40%—while the quality of construction is increased and local planning and participation strengthened. Considering the current need for school construction, the desire of citizens to hold the line on taxes and the necessity to provide equal educational opportunity for children throughout the Commonwealth, the program presented here is one that demands immediate consideration and early action.

### **Formation of a study group**

In June 1970, the Massachusetts Advisory Council on Education (MACE) commissioned the Boston architectural firm of Campbell, Aldrich and Nulty to assemble an interdisciplinary team to examine the school construction process in Massachusetts with an eye toward possible reductions in cost and increased efficiency. A particular emphasis of this study was to be the applicability of systems building—already being used in other

parts of the United States and the Commonwealth of Massachusetts.

A team of experts was assembled to its charge, to provide a picture of the current state of building construction planning and contract procedures, a thorough investigation of the schoolhouse industry, and recommendations for improvement.

This booklet summarizes the team's findings, explains the supportive materials, and presents a full 300-page report. It is available to all libraries throughout the Commonwealth. The study team that assembled it is the Commonwealth's first for citizen discussion and action.

*\*For the names of the study group and the firms involved, see the list on the left.*

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parts of the United States and Canada—to the problems of the Commonwealth.

A team of experts representing a wide range of activities was assembled for the year long study.\* In response to its charge, the study team put together a detailed picture of the existing school delivery process in the Commonwealth. Basic data was compiled on all school construction projects begun since mid-1965. The existing planning and approval process, building codes, state of building technology, labor markets, bidding and contract procedures and means of finance were all thoroughly investigated. The result was a comprehensive view of the present mechanisms by which a schoolhouse is built and a platform from which recommendations for change might be formulated.

This booklet summarizes the basic findings of the study team, explains its recommendations and presents the supportive material for the recommended steps. (The full 300-page report is available at college and university libraries throughout the State.) It is the hope of the study team that it will receive wide readership throughout the Commonwealth, and that it will become the basis for citizen discussion and executive and legislative action.

*\*For the names of the members of the study committee and the firms and activities they represent, see column at left.*

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## The need

During the next five years, school districts in Massachusetts will need more new classrooms than in any similar period in history. Contributing factors for this huge demand include presently overcrowded classrooms; current use of outmoded, below standard space; demands for new space caused by the creation of kindergarten programs in all districts; and shifting of students from non-public to public schools. An important additional factor is the inability of local municipalities and districts to keep up with expanding needs over the last few years. In large measure this has been due to taxpayer resistance to increases in an already overburdened property tax. Massachusetts has one of the highest property tax rates in the United States. Educational programs are largely dependent on this revenue.

Altogether, it is estimated that by 1975, 30 to 40 million square feet of instructional space will be needed, at a total cost exceeding \$1.5 billion. When the cost of borrowing money is added, the total tax bill for Massachusetts would exceed \$2.2 billion.

*A great need for more classrooms*

As the table on page seven shows, 10,700 instructional rooms must be provided by 1975. This does not include space for such activities as physical education, libraries, auditoriums and administrative needs. This sum was estimated by superintendents to be needed just to accommodate new students and overcrowding. In addition, up to 3,140 classrooms may be needed to accommodate transfers from non-public schools; and at least 1,500 to replace sub-par rooms, the majority of them in combustible buildings. As the table shows, the need is not confined to any one area of the Commonwealth. Nor is it needed later, rather than sooner. The greatest demand is indicated for the next three years.

This is not the first time that Massachusetts has faced an immense school building task. In the post-war period, the School Building Authority, a pioneering state agency, was created. What was then seen as a temporary commission, SBAC was renewed five times over the years until, in 1966, it was merged into the Department as the School Building Authority. Given the limits—including a very low budget—upon its activities, the SBAC and SBAB have been yeoman service for more than two decades. It has certainly been largely responsible for the building of schools built in the Commonwealth during this period. It is the belief of the study that new mechanisms must be provided to meet the new situation of the 1970's.

Estimating the needs of school construction is relatively easy. Finding the resources to meet these needs is far more difficult. In the construction program in the Commonwealth, five major obstacles stand out.

### OBSTACLE 1.

#### **The tax base and voter resistance**

Taxpayer resistance to new school construction has reached a state of revolt. Over the years, a majority of the school bond referenda to the electorate have been turned down. This is two-fold: Many children go through inadequate, overcrowded buildings until a building is finally approved, children get less building for more money.

The burden of financing schools is

Generally, the TAs indicated high job satisfaction but expressed some personal concerns and recommendations for change. This information was then relayed to the Curriculum Associates by the DS Coordinators. Several changes are occurring and different results appear to be emerging during the second year of the experimental phase. A copy of the actual log sheets used is found in Appendix B.

Reactions from other staff members at Parker and Spring Creek about the role and performance of the TA have been mixed. Staff members feel most positive about the assistance that TAs provide to individuals and small groups of students, the working relationship between TAs and other staff members, and the willingness with which the TAs have performed the tasks requested of them. On the other hand, staff members have been concerned with the difficulty in trying to develop a new role for the district, with identifying when a TA can and cannot work with students on his own, and in overcoming the feelings that the TA is another clerical aide.

Some district personnel (not directly teaching or working in the DS schools) have expressed concern about the future impact of the TA program as it relates to protecting educators. The most usual question from those connected to the professional teaching associations is, "If you can hire three Teaching Assistants for the same amount as one teacher, what is to prevent boards and administrators from replacing some teachers with Teaching Assistants?" The response of the DS Coordinators has been that of recognizing that a potential problem exists and that a solution will have to be found. We do not have the answer ready this instant, but we do feel that the answer is not to abolish the TA position. One of the recommendations in the

following section relates to this issue.

The other major issue, primarily among those involved in personnel practices in the district, is the question of how much time should the TA work directly with students, and what kinds of activities should the TA be allowed to conduct with them. The development of the TA position to date indicates to the DS Coordinators a strong need to produce a clear and concise description of the TA role, with specific guidelines for time allotments for the TAs activities with students. This is necessary to prevent the use of TAs as substitutes for absent teachers, and insure that TAs will not be expected to plan lessons, conduct the activities, and evaluate students. Planning lessons, conducting activities, and evaluating students are aspects of the role of the certificated teacher. Only the second of these, that of conducting activities, should properly be included in the TA role; indeed, it is the basic function of the TA. A second recommendation of the next section is offered as part of the response for those concerns.

In summary, the data so far indicate that Teaching Assistants are generally performing the tasks originally expected of them in the position. Further, there has been no emerging effort on the part of the Spring Creek and Parker staffs to seek more Teaching Assistants by releasing some of their certified teachers. Finally, neither staff has demonstrated a willfull intent to misuse the Teaching Assistants in any way. In fact, there has been a concerted effort in both schools to be extremely careful that the TAs are not misused and that they are asked to perform only their expected role.



RECOMMENDATIONS

The following recommendations are proposed by the DS Coordinators after studying the data gathered to date and after much deliberation and consultation with the Personnel Director, Area Directors, principals and teachers in the DS schools, and the Teaching Assistants themselves. They are presented as ideas for the beginning of further discussion and negotiation about the role of the TA and its potential for the Eugene School District.

The first recommendation addresses itself to the issue raised by many professional educators, namely, that the Teaching Assistant program is a major potential threat to teachers because approximately three Teaching Assistants can be employed for one average teaching salary. The recommendation has the following four components:

- 1) We propose that the district board and administration consider a major change in the budget allotments for the staffing of schools. It is suggested that an allotment be established, as is presently the case, for the provision of a necessary number of professional and clerical staff.
- 2) A basic change we propose is that the district in addition establish a flexible allotment for staffing each school. There would be no restrictions on the use of this allotment for either professional or non-certified staff. However, each school staff would be required to show evidence to the administration of having evaluated its needs for staff, to indicate to the administration the intended utilization of personnel acquired from the flexible allotment, and to provide a plan of

action for evaluating the results of that staff performance.

The flexible allotment would allow each staff to decide whether the needs of the program would best be met by the use of TAs or of other specialists.

- 3) It is proposed that a school with a well-designed plan for staffing and evaluation of its program at a designated time could request the addition of Teaching Assistants from the monies allotted for certificated or non-certificated staff. It is suggested at this time, however, that a limit be set upon the amount of money that could be used from either allotment.
- 4) Finally, it is suggested that the EEA TEPS committee, the District Personnel Director, and the area directors work jointly with the DS Coordinators and the TAs to develop final guidelines for the previous three sections of this recommendation. These guidelines would be completed by June, 1972.

The second recommendation relates directly to the role of the Teaching Assistant, and proposes the acceptance of the position in the district's staffing pattern as an alternative way of providing education for students. The recommendation is as follows:

We propose that the Teaching Assistant position be accepted as a regular position in the staffing pattern of the Eugene School District. Acceptance of this proposal would not necessarily provide each school in the district to have an equal number of TAs. It would mean that the position is available for schools that determine that Teaching Assistants could help them to improve the program



in that school. We mean that the district will have a set of guidelines for selecting Teaching Assistants, a description of the actual roles that the TA can perform, and a policy stating who is responsible for supervision and evaluation of the TA. It is suggested that these guidelines be developed by the same group formed in recommendation number 1.

A final recommendation is that the five elementary schools presently participating in the DS Project be provided monies to continue the Teaching Assistant Program. This provision would cover the transitional period until the studies are completed regarding the methods of budgeting in schools, the final rate of pay, and the TA role description. It is proposed that an increase in salary be granted to those TAs who have worked for one or two years in the project's experimental phase. It is further recommended that the monies needed for this recommendation be drawn from the present budget allotment for the experimental phase of the DS Project.

#### A FINAL REMARK

In summary, we strongly recommend that the Teaching Assistant position be established in the district as another alternative way to organize staffs for instruction. The data indicate very positive outcomes from the program to date. Recognizing the various concerns and problems also indicated by the data, the DS Coordinators will continue through the rest of this year to make the adjustments necessary to overcome the concerns.

We are convinced that the recommendations proposed in this report are realistic for the district in terms of how the district can finance such a program, how guidelines should be established for further development of the Teaching Assistant role, and what requirements must be placed upon school staffs that decide to utilize the services of the TA.

## Appendix A

### EUGENE PUBLIC SCHOOLS

#### Differentiated Staffing Project May, 1970

#### PARAPROFESSIONAL ROLE ANALYSIS

##### Description

The paraprofessional shall provide instructional assistance to the certified staff. The main responsibility will be to serve as teaching technician, performing a number of teaching tasks with students.

##### Specific Functions

- 1) Provide individual research help for students seeking assistance.
- 2) Serve as listener and helper to small reading groups.
- 3) Serve as a discussion leader for large or small groups.
- 4) Seek out information and materials for instruction by self or other unit staff members.
- 5) Provide assistance to teachers in analyzing individual student progress.
- 6) Assist teachers in the creation of learning packages or programs.
- 7) Operate audio-visual aids for groups of students.
- 8) Salary and contract hours are presently being considered.

##### Personal Qualities Desired

- 1) Demonstrates positive attitude toward children.
- 2) Demonstrates awareness of educational goals and objectives.
- 3) Possesses ability to relate positively with other adults.
- 4) Demonstrates ability to follow instructions and carry out necessary tasks.
- 5) Demonstrates desire to improve self skills and instructional skills necessary to the position.

# Appendix B

## EUGENE PUBLIC SCHOOLS Differentiated Staffing Project Instructional Assistants Log - 1970-71

NAME \_\_\_\_\_

DATE \_\_\_\_\_

SCHOOL \_\_\_\_\_

DAY \_\_\_\_\_

LOGGED \_\_\_\_\_

A. Estimate the time in minutes spent on each task.

TASK		NO. OF MINUTES				
		Mon	Tues	Wed	Thurs	Fri
1.	Working with Total Class of Students					
	a. Discussion					
	b. Reading to class					
	c. Hearing pupils read					
	d. Operating audio-visual aids					
	e. Adminstrating assignments & monitoring tests					
2.	Working with Small Student Groups					
	a. Discussion					
	b. Skill reinforcement - Conducting drill exercises					
	c. Hearing pupils read					
	d. Assisting with student research					
3.	Working with Individual Students					
	a. Reinforcement of skills					
	b. Assisting with student research					
	c. Desk to desk individual help					
	d. Reading to a student					
	e. Hearing a student read					
4.	Working with Staff					
	a. Seeking out materials					
	b. Attending meetings					
	c. Assisting with Evaluation of Students					

	Mon	Tues	Wed	Thurs	Fri
5. Clerical Duties					
a. Reproducing test, worksheets, transparencies					
b. Constructing materials (bulletin boards, games, etc.)					
c. Correcting papers and tests					
d. Housekeeping					
e. Hearing a student read					
6. Supervision Duties					
a. Recess supervision					
b. Noon duty					
c. Halls supervision					
d. Field trips					
7. Working Alone					
a. Planning					
b. Research					

B. List difficulties or problems encountered during the week. How were they resolved?

C. List any tasks performed that do not fit the categories in section A. How much time did the tasks take?

NAME \_\_\_\_\_

SCHOOL \_\_\_\_\_

DATE \_\_\_\_\_

- 1) From whom do you receive most of your supervision?
- 2) With whom do you spend most of your time planning for what you do?
- 3) Discuss any general thoughts or feelings about the position of Teaching Assistant (paraprofessional) that you might have at this time.
- 4) Are there any particular kinds of training programs that you think would be beneficial at this time in assisting you in fulfilling your responsibilities better?

school districts in Massachusetts have more classrooms than in any other state. Contributing factors for this are: the present overcrowding of classrooms; outmoded, below standard buildings; the creation of new schools in all districts; and shifting of students to public schools. An immediate inability of local municipalities to keep up with expanding needs is one measure this has been taken. Increases in an already high tax rate in Massachusetts has one of the highest in the United States. This is largely dependent on this

that by 1975, 30 to 40 million square feet of space will be needed, at an estimated cost of \$2 billion. When the cost of the total tax bill for Massachusetts is \$2 billion.

Table 1 shows, 10,700 instructional spaces by 1975. This does not include physical education, administrative needs. This requires superintendents to be needed for students and overcrowding. Classrooms may be needed from non-public schools; sub-par rooms, the majority of buildings. As the table shows, any one area of the Commonwealth is later, rather than sooner. Indicated for the next three

This is not the first time that Massachusetts has faced an immense school building task. In 1948, during the post-war period, the School Building Assistance Commission, a pioneering state agency, was formed to meet what was then seen as a temporary crisis. The life of SBAC was renewed five times over the next 18 years until, in 1966, it was merged into the State Education Department as the School Building Assistance Bureau. Given the limits—including a very low budget—placed upon its activities, the SBAC and SBAB have performed yeoman service for more than two decades. It has certainly been largely responsible for the high quality of schools built in the Commonwealth during that period. It is the belief of the study group, however, that new mechanisms must be provided to meet the new situation of the 1970's.

Estimating the needs of school construction is comparatively easy. Finding the resources and procedures to meet these needs is far more difficult. As the school construction program in the Commonwealth is now constituted, five major obstacles stand in the way:

#### OBSTACLE 1.

##### **The tax base and voter resistance**

Taxpayer resistance to new school construction is reaching a state of revolt. Over the past few years, a majority of the school bond referendums submitted to the electorate have been turned down. The effect is two-fold: Many children go through their full careers in inadequate, overcrowded buildings; and, when the building is finally approved, children and taxpayers get less building for more money.

The burden of financing schools is not felt equally

#### *Role of SBAB since 1948*

*Resistance to building leaves children in overcrowded schools*

## 6 THE NEED

*Local tax base leads  
in inequality*

throughout the State. The ability of local property owners to pay for new school facilities varies widely, frequently in inverse ratio to the need. Equality of educational facilities for all residents of the Commonwealth is simply not feasible when the major impact of school construction costs falls on an individual community. State construction aid provides some assistance, ranging between 40% and 65% of the cost of construction fees and equipment (but not land or interest payments), but inequality of local programs remains a fact of life. There is a need for a means of financing new school construction which will not put further strains on the unequal and inadequate local property tax.

### OBSTACLE 2.

**State laws and procedures that create delay and potential confusion and that lead to uneconomical building practices.**

All new schools must be approved by the State Department of Education and other interested State agencies. (There are 13 different State departments, agencies, boards or divisions in Massachusetts issuing building regulations.) The State planning and approval process is cumbersome. Coupled with a lack of written standards, procedural handbooks or information service on facilities and comprehensive local and State requirements, it is no wonder that in meetings throughout the State several hundred persons told members of the study team that the building process is too long and should be shortened. (Altogether, the study team identified as many as 141 actions and procedures that districts could be required to go through in the process of bringing a building from recognition of need to opening. A few might reduce this number to 110 or 120, but too many must repeat the important initial steps.)

*Approval practices  
create extra problems*

While the procedures necessary to gain approval of a school building can at times be long, tedious and frustrating, other aspects of current State practice can also create problems. For example, the approval practices of the Department of Education and the Depart-

ment of Public Safety result in per-pupil grants that are often larger than those found in other States. Efficient buildings are not encouraged. The Commonwealth places no limit on the maximum per-pupil cost which can qualify for financial aid. At some schools in Massachusetts have as little as 25% usable (or educational) space compared to the State size. The median is 75%. Compact, well-planned schools with upwards of 85% educational space are reimbursed at the same rate as less economical

School building regulations are written by the Department of Schoolhouse Structural Standards but are interpreted by the Department of Public Safety, whose members may have different interpretations of the regulations from those intended. Within the Department of Public Safety, different persons approve plans from different districts. This inspection work in progress. Again differences in interpretation are likely to occur. These multiple jurisdictions result in loss of time, frustration and increased cost.

From the foregoing it is clear that if school construction in Massachusetts is to become less expensive and more efficient, steps must be taken to codify State building standards, to bring them into line with modern technology, to give them flexibility to change with the times, and to bring them together in such a way that they rather than hinder, local school districts.

### OBSTACLE 3.

**The state of the school construction industry**

Although construction contracting is one of the major industries in the United States—and education construction is the industry's dominant business in Massachusetts—it is largely composed of small contractors. The multiplicity of subcontractors and suppliers involved in a typical school project serves to diffuse responsibility and to encourage buck passing. The result is time-loss, disputes over jobs and frequent change orders and other procedures that add cost and delay completion. (Two-thirds



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### **ures that create delay n and that lead to g practices.**

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er interested State agencies.  
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ssachusetts issuing building  
nning and approval process  
with a lack of written stan-  
oks or information service on  
sive local and State require-  
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From the foregoing it is clear that if school construction  
in Massachusetts is to become less expensive and more  
efficient, steps must be taken to codify State proce-  
dures, to bring them into line with modern techniques,  
to give them flexibility to change with the times and  
to bring them together in such a way that they aid,  
rather than hinder, local school districts.

### **OBSTACLE 3.**

#### **The state of the school construction industry**

Although construction contracting is one of the largest  
industries in the United States—and education con-  
struction is the industry's dominant business in Mas-  
sachusetts—it is largely composed of small companies.  
The multiplicity of subcontractors and suppliers in-  
volved in a typical school project serves to diffuse  
responsibility and to encourage buck passing. The  
result is time-loss, disputes over jobs and quality,  
frequent change orders and other procedures that  
add cost and delay completion. (Two-thirds of the

*Procedural changes are  
needed for efficiency*

study's sample of recent schools were not completed on time, with the average delay running 35% to 40% of the agreed-upon time.)

*Best contractor effort  
not being rewarded*

Adding to the problem, there is nothing in the State bidding process to encourage extra effort on the part of the contractor. The selection of the contractor is dependent in effect on price alone and there is no feasible way to award superior performance. Thus a contractor who meets all of his schedules must compete on the basis of cost alone against contractors whose work is habitually long delayed.

School construction, as a process, is characterized by high costs, fragmentation of responsibility, inadequate cost and time control, wide fluctuations in the amount of work in progress, and seasonality. Clearly, for the sake of economy alone, some process must be implemented to overcome these shortcomings.

#### OBSTACLE 4.

#### **The isolation of school districts and their lack of expertise in building**

In Massachusetts, as in other states, the design and construction of public schools is a function of local municipalities and regional districts, which with consultants, plan and design each new facility, contract for construction, raise the basic funds to pay for it and operate it for the duration of its useful life. This local involvement is certainly a desirable procedure.

*Long range planning  
too often neglected*

But due in part to the press of more urgent matters and lack of funds, inadequate attention is given to long range planning and forecasting at the local level. As a result, the need for new school facilities is frequently allowed to become critical before the planning and design process is initiated. The result is that new buildings are not occupied until long after the need has become critical.

Beyond that, few communities maintain permanent

#### **Estimate of Need for Additional Reported by Superintendents**

	1971	1972
<b>Metro</b>	103	216
Elementary	56	5
Middle	24	107
Secondary	18	104
Occupational	5	—
<b>Suburban</b>	245	192
Elementary	48	77
Middle	13	10
Secondary	174	95
Occupational	10	10
<b>Mid-east</b>	316	443
Elementary	125	117
Middle	126	89
Secondary	39	198
Occupational	26	39
<b>Northeast</b>	319	349
Elementary	85	96
Middle	84	77
Secondary	119	155
Occupational	31	21
<b>Southeast</b>	575	453
Elementary	129	150
Middle	159	178
Secondary	272	103
Occupational	15	22
<b>Western</b>	575	360
Elementary	224	148
Middle	179	139
Secondary	163	58
Occupational	9	15
<b>TOTAL</b>	<b>2133</b>	<b>2013</b>

recent schools were not completed average delay running 35% to 40% in time.)

problem, there is nothing in the State to encourage extra effort on the part of the contractor. The selection of the contractor is based on price alone and there is no incentive for superior performance. Thus a contractor who meets all of his schedules must compete on the basis of cost alone against contractors who are usually long delayed.

Construction, as a process, is characterized by delegation of responsibility, inadequate control, wide fluctuations in the amount of work, and seasonality. Clearly, for the construction process alone, some process must be implemented to overcome these shortcomings.

#### of school districts and their lack of building

As in other states, the design and construction of public schools is a function of local school districts, which with consultant design each new facility, contract for construction, use the basic funds to pay for it and determine the duration of its useful life. This local approach is certainly a desirable procedure.

Due to the press of more urgent matters, inadequate attention is given to long range planning and forecasting at the local level. As a result, the need for new school facilities is frequently not recognized until long after the planning and construction has been initiated. The result is that new buildings are occupied until long after the need has

new communities maintain permanent

#### Estimate of Need for Additional Instructional Rooms as Reported by Superintendents of Schools, 1971 — 1975

	1971	1972	1973	1974	1975	Total
<b>Metro</b>	103	216	930	202	178	1629
Elementary	56	5	254	202	178	695
Middle	24	107	236	—	—	367
Secondary	18	104	230	—	—	352
Occupational	5	—	210	—	—	215
<b>Suburban</b>	245	192	228	132	69	866
Elementary	48	77	86	48	26	285
Middle	13	10	66	27	11	127
Secondary	174	95	66	47	17	399
Occupational	10	10	10	10	15	55
<b>Mid-east</b>	316	443	739	320	299	2117
Elementary	125	117	247	96	75	660
Middle	126	89	154	23	94	486
Secondary	39	198	266	189	120	812
Occupational	26	39	72	12	10	159
<b>Northeast</b>	319	349	595	284	75	1622
Elementary	85	96	219	83	22	505
Middle	84	77	129	33	6	329
Secondary	119	155	206	139	34	653
Occupational	31	21	41	29	13	135
<b>Southeast</b>	575	453	768	303	405	2504
Elementary	129	150	230	110	176	795
Middle	159	178	185	86	137	745
Secondary	272	103	218	42	75	710
Occupational	15	22	135	65	17	254
<b>Western</b>	575	360	442	294	288	1959
Elementary	224	148	129	73	175	749
Middle	179	139	146	125	71	660
Secondary	163	58	125	59	34	439
Occupational	9	15	42	37	8	111
<b>TOTAL</b>	<b>2133</b>	<b>2013</b>	<b>3702</b>	<b>1535</b>	<b>1314</b>	<b>10,697</b>

## 8 THE NEED

### *Support needed for local planning effort*

building committees. As a result, there is little carry-over of experience from one project to the next. Each building committee must learn its role anew—must rediscover the wheel—for each school building. It is apparent that some provisions must be made to establish and support permanent local building committees if local districts are going to be able to maintain direction of school construction planning to meet the needs of their students.

#### **OBSTACLE 5. The additional cost of interest payments and inflation**

Interest payments can add as much as 60% to the cost of a new school over a 20-year period. So long as bonds are floated on a local basis, these costs will remain high. A system under which bonds could be supported by the State would reduce the cost of bonds by giving them a higher rating, by attracting large syndicates interested in purchasing them, and by making it possible to float bonds at times when the market is most favorable. This single change in current school building procedures would save millions of dollars for the citizens of the State.

### *Building costs doubling*

Inflation is a more difficult cost to pinpoint, in that while costs rise, the tax dollar also becomes cheaper. Nevertheless, construction costs have been rising at an annual rate of approximately 12% (doubling in six years). Although there are indications of an imminent lessening to 7% (doubling in 10 years), it is obvious that any delay in the construction of a school not only deprives children but also is costly in purely monetary terms. Since most of the delays are procedural in nature (ranging from doing the necessary planning and passing the bond vote to gaining State approvals) it is apparent that steps can be taken to simplify the procedures and thus cut down on the time and dollar loss.

As can be seen, five major obstacles impede school

construction practices in Massachusetts. It is clearly recognized, however, that none of these obstacles is insurmountable. As a matter of fact, each can be overcome through the use of systems and procedures already in effect in many school construction programs across the nation.

The study team's survey of the state of school construction in the Commonwealth led to four conclusions:

1. *That there is an immediate need for school construction.*
2. *That present procedures for school construction are lengthy, difficult, sometimes inefficient and drive the cost of construction up.*
3. *That fragmentation of both local projects and the construction industry creates a number of problems including delay in building completion.*
4. *That there are steps that can be logically taken to meet the State's building needs in a more efficient manner.*

The next task was to outline those steps and procedures that would meet current needs and establish a mechanism that would make them work.

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dures that would meet current needs and to suggest  
a mechanism that would make them work.

*Problems are obvious;  
solutions are possible*

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## A systems approach to building

Part of the charge to the study team was to investigate the applicability of systems building to the problems of Massachusetts.

In its essence, the systems approach to building is simply a working method which, instead of attempting to solve a complex problem piecemeal, approaches it in an orderly way by defining goals, analyzing means of achieving them and then carefully organizing the actual progress to a solution. As applied over the past decade to the construction of schools in California, metropolitan Toronto and elsewhere, the systems approach has yielded new ways of organizing the school delivery process which have resulted in systems construction: a series of components which may be assembled, rapidly and without cutting or fitting, into attractive, economical and flexible school buildings which are a better buy than conventionally constructed structures.

*Increased quality,  
decreased cost*

Systems building is not guaranteed to produce less expensive schools, although its use in many instances has resulted in lower construction costs than for conventional buildings. Systems construction produces buildings which incorporate more needed facilities and more flexible space for the same dollar. And because systems construction is much faster than traditional building, it allows new schools to be completed and to begin their use earlier at considerable savings in total project and peripheral costs.

As presently known in North America school building systems grew out of a single highly successful program known as School Construction Systems Development (SCSD), which was active in the early 1960's in California. About a dozen school districts agreed to cooperate, creating an "aggregated market" for building compo-

nents. The market was sufficiently large to attract manufacturers in developing new products and modifying existing ones for use by local architects in individual schools. Performance specifications established what was expected of the components, leaving open the means by which the performance was achieved. This was the first time in the construction industry in this country that groups of manufacturers came together to develop compatible components to that extent.

Since the completion of the SCSD program there have been a number of successful systems building programs throughout the United States and Canada, both developed new components and took advantage of existing ones—often called "off-shelf" components. Many other schools throughout the United States have made use of systems components. Readily available, coordinated building components now include structure; heating, ventilating and air conditioning; integrated ceilings; electrical and electronic distribution equipment; and interior partitions. Together, these components can account for 40 to 50 percent of the construction cost of a new school. Further systems development could encompass as much as 75 percent of the school construction cost.

In effect, the use of systems components extends the standardization already used in screw threads, gauges, light bulbs and so on, to the school building itself. The quality of designs possible with systems components is, as with conventional building, a function of the architect and his client.

The systems process should not be confused with stock plans. Stock plans standardize complete building systems. Building systems standardize only the components.



## Approach to building

Study team was to investigate building to the problems

This approach to building is which, instead of attempting piecemeal, approaches it by setting goals, analyzing means and carefully organizing the system. As applied over the past ten years in schools in California, and elsewhere, the systems approach of organizing the school building has resulted in systems components which may be assembled without cutting or fitting, into a flexible school building design, as opposed to conventionally constructed

guaranteed to produce less cost through its use in many instances. Systems construction produces more needed facilities and more for the same dollar. And because it is much faster than traditional building, schools to be completed and at considerable savings in total costs.

North America school building has the highly successful program of the Systems Development in the early 1960's in California. Districts agreed to cooperate, creating a "market" for building compo-

nents. The market was sufficiently large to interest manufacturers in developing new products and modifying existing ones for use by local architects in designing individual schools. Performance specifications established what was expected of the components while leaving open the means by which the performance was achieved. This was the first time in the construction industry in this country that groups of manufacturers came together to develop compatible components to that extent.

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*Systems building,  
not stock plans*

## 10 A SYSTEMS APPROACH

pieces. These components may be utilized to create any plan that is needed to meet the needs of a particular school.

The most recent and best publicized attempt to use stock plans as a way to cut the cost of school buildings occurred in neighboring New York State. The plan proved unworkable and for all intents and purposes has been abandoned.

New York's stock plans were acceptable but uninspired designs. Architects were still faced with many design decisions. The plans could not respond sensitively to site conditions and precise student needs. There is a built-in tendency to obsolescence of techniques, materials and ideas, that, probably more than any other factor, prevents the widespread or successful use of stock plans. The systems approach does not suffer from this problem.

Systems components are no more or less inhibiting to a designer than standard door sizes, floor tiles or lighting fixtures. Since the architect is relieved of the necessity of forcing a collection of unrelated parts into some sort of a fit, he can devote more of his time and effort to apportioning space and creating an esthetically attractive environment for education.

### *Successful systems projects*

Since SCSD, other systems projects have been undertaken successfully. The School Systems Project (SSP) of Florida simply took the SCSD components and utilized them on a mass scale in Florida. The result (see chart) has been a considerable reduction in school costs as well as a 45% saving in the time needed to design and construct a school building.

The Study of Educational Facilities (SEF) program in Toronto, Canada, was a major step forward. It went far beyond SCSD in many respects, generating a wide range of coordinated building products that will become available for general use on small projects as well as large ones. Among the systems components developed

by the SEF project are spring/ceiling, interior space heating, plumbing, electric-electronic equipment and casework. From Toronto to Massachusetts, the Toronto and Montreal—are particularly with climatic conditions in the Commonwealth.

Another project of significance taking place in British Columbia. The British Columbia Building Authority has been creating efforts of 80 independent contractors to make available to them construction. The British Columbia Building Authority has a large enough number of systems bidders. At the time of the school boards informed of when a project is contemplated have to start from scratch. The Columbia plan is voluntary and is based on their costs used.

Systems building brings the present school construction in savings in time in the design of a school project. It results in lower costs. It results, too, in high flexibility enough to meet educational needs. This is a point that must not be overlooked.

One key to the development has been the use of performance specifications leading to important modifications. For example, it is not enough to specify heating and air conditioning systems in the building of a school. The specification of heating or cooling. Performance specifications in this case would also design so that it puts no strain on the building. The design of a building may be successful.



TEMS APPROACH

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by the SEF project are structure, atmosphere, light- ing/ceiling, interior space division, vertical skin, plumbing, electric-electronic distribution, roofing, car- pet and casework. From the point of view of applicability to Massachusetts, the Toronto project—and another in Montreal—are particularly significant since they deal with climatic conditions more closely akin to those in the Commonwealth.

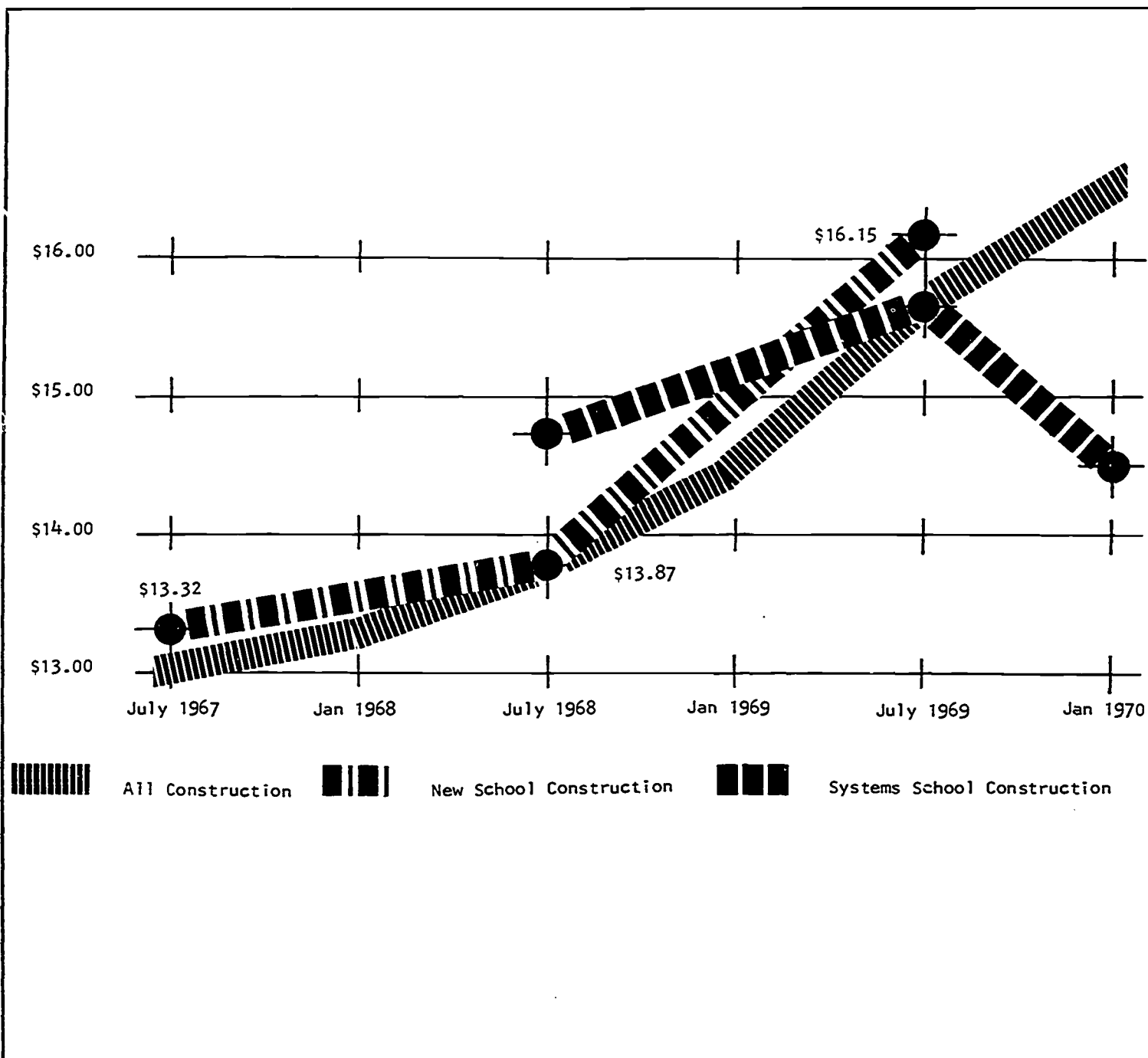
Another project of significance to Massachusetts is taking place in British Columbia where a School Build- ing Authority has been created to coordinate the build- ing efforts of 80 independent school districts and to make available to them the advantages of systems construction. The British Columbia plan will develop a large enough number of school projects to attract systems bidders. At the same time it will keep local school boards informed on new developments, so that when a project is contemplated, the board does not have to start from scratch. Participation in the British Columbia plan is voluntary but payment to local districts is based on their costs using the systems approach.

Systems building brings order to the near chaos of the present school construction process. It results in savings in time in the design and construction phases of a school project. It results in savings in construction costs. It results, too, in higher quality school buildings flexible enough to meet educational program changes. This is a point that must not be overlooked.

One key to the development of systems building has been the use of performance specifications. This has led to important modifications in many components. For example, it is not enough for a heating, ventilating and air conditioning system to be compatible with other systems in the building or to provide a given amount of heating or cooling. Performance specifications in this case would also demand that the system be de- signed so that it puts no limitation on how the interior of a building may be sub-divided. This performance

*Savings in time and construction costs*

*Importance of performance specifications*



## 12 A SYSTEMS APPROACH

specification gives schools considerable extra flexibility and increases their long term usability. By the same token, since the specifications don't tell the manufacturer the methods or materials he must use, he has more flexibility in finding economical solutions to the performance demanded. Performance specification is a tool for achieving higher quality in school buildings.

The existence of a number of schools using systems components clearly establishes that it is possible, feasible and economical to use systems building to construct schools in Massachusetts. These schools, however, although they use systems components, have been bid and contracted for in a conventional manner and not without considerable legal question surrounding such practice. In order to secure the full advantages of a systems approach to school construction on a statewide basis, various modifications must be made to the existing bidding system.

For example, the present bidding law of the Commonwealth makes difficult the specifying of components by the performance required of them rather than by the materials and methods to be used. The statutory categories of filed sub-bids are not well-suited to systems components. (Some recent projects by temporary exception to the law have been successfully bid using, for instance, a single sub-bid for "integrated ceiling," rather than splitting that component, as required by law, into its electrical, acoustical tile, heating and other parts.)

Prequalification of bidders, felt to be an indispensable part of developmental systems building programs, presently is illegal in Massachusetts. Staged bidding, either in the form of component pre-bidding or "fast-tracking," is cumbersome, although legal.

Building codes, while conservative and outdated in a few instances, present no major obstacle to the introduction of systems building, but the procedures involved in getting approvals defeat many of the advantages of systems construction.

There are other areas of current Statute that would have to be modified or modified to make the advantages of systems building off for the people of the Commonwealth. The most important step the State must take is to "aggregate a market" in order to make school construction in Massachusetts more attractive to component developers.

The concept of aggregating a market is a new one. If an individual school district has a program worth \$3 million or even \$10 million, the national demand it has limited purchasing power. A group of school districts can be put together to agree to purchase systems components. An "aggregated market" of several million dollars can be created. The challenge is to create a mechanism that will allow the State to take full advantage of the market in order to take full advantage of the construction, without encroaching on the autonomy of school districts to make local decisions on school curriculums and school construction. To be truly effective, such a mechanism must have to in some manner speed the construction process and relieve the pressure that the current situation now puts on the local real estate market.

*Modifications needed  
in present laws*

*Pre-qualifying bidders*

## SYSTEMS APPROACH

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The experience of a number of schools using systems building clearly establishes that it is possible, feasible and economical to use systems building to control school construction in Massachusetts. These schools, however, though they use systems components, have not contracted for in a conventional manner without considerable legal question surrounding the practice. In order to secure the full advantages of the systems approach to school construction on a statewide basis, various modifications must be made to the present bidding system.

First, the present bidding law of the Commonwealth makes difficult the specifying of components by performance required of them rather than by the methods and materials to be used. The statutory cap on the number of sub-bids are not well suited to systems building. (Some recent projects by temporary exception to the law have been successfully bid using, instead, a single sub-bid for "integrated ceiling," "splitting that component, as required by the law, into electrical, acoustical tile, heating and other

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There are other areas of current State law and practice that would have to be modified or changed in order to make the advantages of systems building truly pay off for the people of the Commonwealth. But perhaps the most important step the State must take is to "aggregate a market" in order to make school construction in Massachusetts more attractive to potential systems component developers.

The concept of aggregating a market is a rather simple one. If an individual school district has a building program worth \$3 million or even \$10 million, in terms of national demand it has limited purchasing power. If a group of school districts can be put together and can agree to purchase systems components cooperatively, an "aggregated market" of several hundred million dollars can be created. The challenge is to develop a mechanism that will allow the State to aggregate a market in order to take full advantage of systems construction, without encroaching on the ability of local school districts to make local decisions about their own school curriculums and school construction projects. To be truly effective, such a mechanism would also have to in some manner speed the construction processes and relieve the pressure that school construction now puts on the local real estate tax.

## Aggregating a market

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# Establishing a Massachusetts School Construction Corporation

The recommendations of the study committee were developed with several goals in mind. Among them:

- ☐ To provide equal educational opportunity for every child and teacher throughout the Commonwealth.
- ☐ To provide for the construction of school buildings at less than the current prevailing costs.
- ☐ To close the gap between the time when a new school is needed and when it is available for use.
- ☐ To accomplish those two goals with buildings of a quality which is equal or superior to schools currently being constructed.
- ☐ To provide a degree of relief to the property taxpayer by removing school construction costs and financing from dependence on the property tax.
- ☐ To accomplish that goal while insuring local participation in school planning and design.
- ☐ To encourage continuing improvement in the quality, economy and delivery time of new schools.
- ☐ To achieve all of these goals as rapidly as possible.

## *Two possible courses of action*

The results of this study indicate that there are two courses of action by which these goals might be achieved. The first would essentially retain the existing administrative relationships but would revamp procedures through a process of legislation, administrative regulations and changes in daily practice. The second course of action would radically transform the school delivery process by transferring the active responsibility for constructing schools to the State through the creation of a Massachusetts School Construction Corporation (MSCC) which could take advantage of systems building and other cost and time savers. *The*

*second course of action will achieve the same goals and is the recommendation of the study committee.*

The establishment of a Massachusetts School Construction Corporation would automate the school construction market in the Commonwealth. It would place the entire fiscal structure of school construction and financing under State control. It would permit the State Department of Education to concentrate on educational objectives and the State Department of Finance to provide for planning and apportionment at the State level. In short, the MSCC would manage the school construction process throughout the Commonwealth, insuring that their local school construction needs are met with quality buildings, at lower cost.

While the other possible course of action would involve changes in present procedures and retaining the basic school construction process, the reality suggests that such a road is fraught with too many unrelated pieces of legislation, too many vested interests, however well intentioned, may be perceived by some, would be a radical departure from present practices would have to be a complete overhaul. The likelihood is that such an attempt would fail and would either die or would be so slow that it would not be ready when needed. The changes could not be implemented until a well defined need for school housing between

The fundamental responsibility for the school construction in Massachusetts rests by Constitutional

## Establishing a Massachusetts School Construction Corporation

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1. Equal educational opportunity for every child throughout the Commonwealth.

2. The construction of school buildings at current prevailing costs.

3. The time between the time when a new school building is available for use.

4. The construction of buildings of a quality equal or superior to schools currently in use.

5. A measure of relief to the property taxpayer from school construction costs and financing on the property tax.

6. The attainment of that goal while insuring local participation in planning and design.

7. The continuing improvement in the quality of school buildings every time of new schools.

8. The attainment of these goals as rapidly as possible.

The study indicates that there are two courses of action by which these goals might be achieved. The first would essentially retain the existing relationships but would revamp the process of legislation, administrative changes in daily practice. The second would radically transform the school construction by transferring the active responsibility for school construction to the State through the creation of a Massachusetts School Construction Corporation which could take advantage of systems and other cost and time savers. The

second course of action will achieve the necessary goals and is the recommendation of this study.

The establishment of a Massachusetts School Construction Corporation would automatically aggregate a school construction market in the Commonwealth. It would place the entire fiscal structure of the State behind construction bonds. It would remove the burden of school construction and financing from local tax roles. It would permit the State Department of Education to concentrate on educational objectives. Finally it would provide for planning and approval at the local level. In short, the MSCC would make it possible for school districts throughout the Commonwealth to meet their local school construction needs faster, with better quality buildings, at lower cost.

While the other possible course of action (wholesale changes in present procedures and relationships, but retaining the basic school construction structure) might eventually accomplish some of the objectives, political reality suggests that such a road is not feasible. Too many unrelated pieces of legislation would be needed, too many vested interests, however legitimately they may be perceived by some, would be involved, too many present practices would have to be changed. The likelihood is that such an attempt would get bogged down and would either die or would be so long in development that it would not be ready when needed. Certainly such changes could not be implemented to meet the identified need for school housing between now and 1975.

The fundamental responsibility for public education in Massachusetts rests by Constitutional provision with

*Advantages of  
school construction corporation*

*Better buildings at  
lower cost*



## 14 ESTABLISHING MSCC

the State government. In truth, however, the provision of public education has been carried out at the local level with the State playing a supportive and largely reactive role. The strain which this has placed upon local resources is evidenced by the increasing reluctance of citizens to tax themselves for needed school construction.

### *Obligation to provide equal educational opportunity*

The study group's recommendation for a Massachusetts School Construction Corporation rests in the belief that the Commonwealth has a direct legal obligation to provide equal educational opportunity for every child of school age in the Commonwealth and that this obligation can only be met by shifting the responsibility for financing school construction from the local property tax to general State revenues. It must be emphasized that this shift is not intended to reduce meaningful participation by the local school authorities in the planning and operation of their schools but it is fair to say that under the construction corporation, the State's role as a reactive or passive partner would end.

### **Operation of MSCC**

### *Working with local officials*

The Massachusetts School Construction Corporation would be responsible for all public school construction within the Commonwealth. It would receive projections of five-year needs from local districts and use these to determine how much building it would finance and where. Local officials would select architects and would determine the curriculum and approve the design of the building in cooperation with the State Board of Education.

The MSCC would aggregate a market large enough to attract many potential suppliers of building components. In addition, it would have the resources to conduct its own research and development program relating to construction techniques, building materials, planning and cost data analysis. The MSCC would administer a new system of competitive bidding and would be responsible for the construction of school

facilities and the purchase of component construction.

It is proposed that legislation be adopted to create the Massachusetts School Construction Corporation as a State agency within one of the executive offices under the present cabinet system. A recommendation is made as to the particular department in which this corporation should be placed.

All financing of school building projects would be handled by the MSCC. The financial powers of the new Corporation would enable it to obtain the approval of the Governor and the Legislature for the issuance of new notes and bonds backed by the full faith and credit of the Commonwealth. Bond issues could be made large to attract nationwide syndicates. The Corporation to obtain the lowest interest rate available at any given time and to minimize the expense resulting from the cumulative effect of issuing multiple bonds. (It is estimated that this will reduce current interest payments on State bonds.) The State would provide the initial approval of the Corporation's plans. Thereafter, money that is required for the operation of MSCC (probably 2% to 3% of the total cost of the funding of projects) would be derived from the construction cost savings in the form of payments of principal and interest on the bonds to be made from the State's general revenue.

*\*Under legislation establishing the Corporation, authority exists during the next two years to be exercised through Executive Orders or by further legislation. The ultimate placing of specific agency responsibilities which should be weighed in the following: (1) the planning function would seem to appear to make it suitable for the Executive Office of Communities and the construction responsibilities would seem to be more appropriate within the Transportation and Construction; (2) the subject matter with which it deals results in its being given to its placement within the Department of Educational Affairs.*

In truth, however, the provision has been carried out at the local level, placing a supportive and largely positive burden which this has placed upon the State, evidenced by the increasing reluctance of local school authorities to take themselves for needed school

A commendation for a Massachusetts School Construction Corporation rests in the belief that the State has a direct legal obligation to provide an educational opportunity for every child in the Commonwealth and that this obligation can be met by shifting the responsibility for school construction from the local property tax to State revenues. It must be emphasized that this is not intended to reduce meaningful participation of local school authorities in the planning of their schools but it is fair to say that if a school construction corporation, the State's role as a partner would end.

The Massachusetts School Construction Corporation would be responsible for all public school construction in the Commonwealth. It would receive projections of construction needs from local districts and use these to plan construction. Each building it would finance and construct it would select architects and would review and approve the design of construction in cooperation with the State Board of Education.

The Corporation would aggregate a market large enough to attract potential suppliers of building components. It would have the resources to conduct research and development program relating to construction techniques, building materials, and cost data analysis. The MSCC would administer a system of competitive bidding and would be responsible for the construction of school

facilities and the purchase of components for school construction.

It is proposed that legislation be adopted establishing the Massachusetts School Construction Corporation as a State agency within one of the existing executive offices under the present cabinet system. No recommendation is made as to the particular cabinet secretariat in which this corporation should be placed.\*

All financing of school building projects would be done by the MSCC. The financial powers to be granted the new Corporation would enable it to issue, subject to the approval of the Governor and the General Court, notes and bonds backed by the full faith and credit of the Commonwealth. Bond issues could be sufficiently large to attract nationwide syndicates, thereby enabling the Corporation to obtain the lowest possible rate of interest available at any given time and would eliminate the expense resulting from the current practice of issuing multiple bonds. (It is estimated that this alone will reduce current interest payments by 10%.) The State would provide the initial appropriation for startup costs. Thereafter, money that is required for the operation of MSCC (probably 2% to 3% of expenditures) and the funding of projects would be derived from a portion of the construction cost savings made. Annual payments of principal and interest on these bonds would be made from the State's general revenues.

*Reducing interest costs*

*\*Under legislation establishing the Governor's cabinet, authority exists during the next two years for decisions through Executive Orders or by further legislation as to the ultimate placing of specific agencies. Among the considerations which should be weighed in this decision are the following: (1) the planning function of the corporation would seem to appear to make it suited for inclusion within the Executive Office of Communities and Development; (2) the construction responsibilities would indicate the appropriateness of its placement within the Executive Office of Transportation and Construction; (3) the educational subject matter with which it deals results in some consideration being given to its placement within the Executive Office of Educational Affairs.*



The local role

Under this plan local school districts retain jurisdiction over site selection, educational program, space requirements (consistent with State-established standards)\* selection of an architect, approval of preliminary plans and working drawings. Thereafter the design, construction and funding of each school facility would be carried out by the Corporation. (See above for steps involved in an MSCC school building project.)

*\*Local districts will be permitted to exceed these standards and to pay for this increase from locally voted taxes or bond obligations.*

Each district would be required to establish a standing school building committee, made up of five members with overlapping three-year terms. This committee would have the following responsibilities:

- To survey existing school facilities, prepare project

Local building committees

Recommended Procedures for Constructing a School  
Massachusetts School Construction Corporation

- |           |   |           |  |
|-----------|---|-----------|--|
| MSCC      | 1. notifies cities and towns to appoint School Building Committee (SBC)                                     | Arch.     | 14. prepares detailed preliminary plans (space requirements, exterior appearance, and site development). |
|           | 2. notifies communities to:   | SBC       | 15. approves preliminary plans.  |
|           | a. develop a comprehensive plan of existing school building facilities;                                     |           | 16. submits preliminary plans to MSCC.   |
|           | b. project school building needs;   | MSCC      | 17. reviews preliminary plans.   |
|           | c. develop a school land-use plan.  | SBC       | 18. attends meeting with MSCC.   |
| SBC       | 3. consults with Corporation, arranges for completion of surveys and obtains funding and contract approval. | MSCC      | 19. approves preliminary plans.  |
|           | 4. submits surveys and plans to MSCC.   |           | 20. aggregates market of schools.  |
| MSCC      | 5. approves comprehensive plan, survey and school land-use.   |           | 21. prepares performance specifications for product purchase.  |
|           | 6. establishes priorities for construction based upon reports of needs.                                     |           | 22. bids performance specifications.   |
|           | 7. selects, within appropriation from General Court the number of schools for construction.                 |           | 23. accepts bids.  |
| SBC       | 8. obtains educational program and specifications.  | Arch.     | 24. approves bids from manufacturers.  |
|           | 9. selects and approves architect from prequalified list.   |           | 25. prepares working drawings and specifications.  |
|           | 10. provides site.  |           | 26. submits working drawings to MSCC.  |
| MSCC      | 11. approves site.  | MSCC      | 27. approves working drawings.   |
|           | 12. establishes preliminary budgets for construction projects.  |           | 28. advertises for construction.   |
| Dept. Ed. | 13. approves educational specifications.  |           | 29. accepts bids.  |
|           |   |           | 30. awards contracts for construction.   |
|           |   |           | 31. approves contractor's payments recommended by the architect.   |
|           |   | SBC/Arch. | 32. conducts field inspection.   |
|           |   |           | 33. orients staff to new school.   |
|           |   |           | 34. presents school facilities to School Committee.  |

## 16 ESTABLISHING MSCC

*Local committees  
play key role*

tions of school building needs, and to oversee the preparation of a comprehensive school land use plan. The costs of such planning would be funded by the corporation.

- ☐ To provide necessary sites.
- ☐ To obtain an educational program and space requirements for each specific school project.
- ☐ To select an architect.
- ☐ To approve preliminary plans and working drawings.
- ☐ To accept the completed school building on behalf of the local district.

### Structure of MSCC

In order to provide an organization which is representative of, and responsive to, the educational interests of the State as a whole, the corporation's board of directors would be appointed by the Governor and be drawn from a variety of cities and towns from all parts of the State, with balanced representation of the major political parties and interest groups. The 15 members of the board would include members from the following categories:

*Wide representation*

- I. *Cities*
  - One from a city over 500,000 in population;
  - One from a city between 100,000 and 500,000 in population;
  - One from a city less than 100,000 in population, none of whom would be from the same county.
- II. *Towns*
  - One from a town within the metropolitan Boston area;
  - One from a town under 5,000 in population;
  - Two from other towns, none of whom would be from the same county.
- III. *Professional members*
  - A superintendent of schools.
  - An educator.

An architect.

A person experienced in industrial management.

A person experienced in municipal finance.

IV. Two members from the public sector, one of whom would be from the same county.

V. The chairman of the State Board of Education.

In order to insure that the functions of the corporation be carried out free from political considerations, more than eight members would be from outside the party.

The members would serve without salary, with reimbursement of expense. The chairman be designated from the Governor's office, in order to maintain the independence of the office of the Governor for the state. Other officers and members of the board in accordance with the rules established by them.

The board of directors would appoint professional staff and personnel and for the achievement of the objectives of the corporation would not be subject to the Civil Service laws. The tasks of this agency require the highest competence, and they necessitate competitive salaries commensurate with the comparable skills in the private sector.

The corporation would be subject to the State Auditor.

### Role of the State Department of Education

The State Department of Education would present functions relating to the

## ESTABLISHING MSCC

to determine the needs of school building needs, and to oversee the preparation of a comprehensive school land use plan. The costs of such planning would be funded by the corporation.

To provide necessary sites.

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#### I. Cities

- One from a city over 500,000 in population;
- One from a city between 100,000 and 500,000 in population;
- One from a city less than 100,000 in population, none of whom would be from the same county.

#### I. Towns

- One from a town within the metropolitan Boston area;
- One from a town under 5,000 in population;
- Two from other towns, none of whom would be from the same county.

#### I. Professional members

- A superintendent of schools.
- An educator.

An architect.

A person experienced in industrial or construction management.

A person experienced in municipal and state finance.

IV. Two members from the public at large neither of whom would be from the same county

V. The chairman of the State Board of Education

In order to insure that the functions of this board would be carried out free from political interests, not more than eight members would be of the same political party.

The members would serve without compensation but with reimbursement of expenses. It is proposed that the chairman be designated from time to time by the Governor, in order to maintain accountability in the office of the Governor for the standard of performance of the corporation. Other officers would be elected by members of the board in accordance with by-laws established by them.

The board of directors would appoint requisite professional staff and personnel and would be responsible for the achievement of the objectives of MSCC. The corporation would not be subject to the provisions of the Civil Service laws. The tasks to be performed by this agency require the highest degree of flexibility and competence, and they necessitate the offering of competitive salaries commensurate with those paid for comparable skills in the private sector.

*Quality of staff*

The corporation would be subject to audit by the State Auditor.

### Role of the State Department of Education

The State Department of Education would retain its present functions relating to the establishment of mini-

### Comparison of potential cost saving on school construction under different courses of action

(Note that figures in calculations are not what would be obtained from simply adding the savings, because successive savings must be calculated as a percent of a percent.)

	Savings through changes within existing framework		Savings thru Mass. School Construction Corporation		
	Probable	Maximum	Initially Probable	Initially Maximum	6-10 yrs. in future
<b>Savings on construction cost per square foot</b>					
Net savings through the Systems Construction Process:					
Systems Components & Installation	5%	9%	13%	16%	20%
Performance Specifications					
Prequalification of Bidders					
Project Management					
Phased Construction					
Less: Deduction for Administration of Program (2-3%)					
Volume Purchasing	1	3	6	6	6
Net Savings	6%	12%	18%	21%	25%
<b>Savings from reduction of floor area</b>					
Increased Planning Efficiency (reduction of gross: net ratio)	8%	10%	8%	10%	10%
Reduce Programmed Space Requirements	8	10	8	10	10
	15%	19%	15%	19%	19%
<b>Combined savings of reduced cost per square foot and reduced floor area</b>					
Cost per sq. ft. savings (from Table 1)	6%	12%	18%	21%	25%
Floor Area savings (from Table 2)	15	19	15	19	19
Combined savings on general contract	20%	29%	30%	36%	40%

**Comparison of costs of three schools for the same number of students and the same educational requirements** *Identification of need assumed to be in January 1971*

	Conventional school	Systems School built by 1971	Estimated potential savings
Number of Pupils	750	750	
General Contract			
Cost per square foot (based on prices bid in 1971 for completion in 1973)	\$36/s.f.	\$30/s.f.	\$
Floor Area	100,000 s.f.	85,000 s.f.	\$
Contract Price (for 1973 completion)	\$3.6 million	\$2.5 million	\$
Delay of completion beyond 1973	2 years	—0—	
Escalated Contract Cost	\$4.2 million	\$2.5 million	\$
Project Cost (i.e. includes land, equipment, fees, etc.)	\$5.1 million	\$3.4 million	\$
Interest Rate on Bonds	6%	5.5%	
Cumulative Total Debt Service Over 20 years	\$8.3 million	\$5.4 million	\$

minimum standards for all public school buildings. It is proposed that the department be required to establish and promulgate minimum standards as binding regulations by mid-1972.

### Role of other State departments

The Department of Public Safety would be allowed to disapprove the minimum standards promulgated by the Department of Education as they relate to areas within its jurisdiction. Any dispute between the two departments would be resolved by a special public hearing before a Board of School Building Standards, to be established as a part of the Department of Public Safety.

### Public health

The Department of Public Health would retain its present powers and duties relating to the approval of

health and sanitary requirements for all public schools by local communities.

In sum, then, MSCC would be a State responsible for the construction of public schools in the Commonwealth. Local officials would be responsible for planning, for acquiring sites and for development and building design. The State would be responsible for funding schools, for aggregating a market, for bidding, for construction management. It would also be responsible for conducting research to further the economies in school construction, to determine the economies of all the economies this approach would provide. The chart on the preceding page indicates the economies that could be provided by comparing school construction practices.

**Comparison of costs of three schools for the same number of students and the same educational requirements** *Identification of need assumed to be in January 1971*

	Conventional school	Systems School built by the MSCC Estimated potential savings	Maximum estimate of savings
Number of Pupils	750	750	750
General Contract			
Cost per square foot (based on prices bid in 1971 for completion in 1973)	\$36/s.f.	\$30/s.f.	\$27/s.f.
Floor Area	100,000 s.f.	85,000 s.f.	81,000 s.f.
Contract Price (for 1973 completion)	\$3.6 million	\$2.5 million	\$2.2 million
Delay of completion beyond 1973	2 years	—0—	—0—
Escalated Contract Cost	\$4.2 million	\$2.5 million	\$2.2 million
Project Cost (i.e. includes land, equipment, fees, etc.)	\$5.1 million	\$3.4 million	\$3.0 million
Interest Rate on Bonds	6%	5.5%	5.25%
Cumulative Total Debt Service Over 20 years	\$8.3 million	\$5.4 million	\$4.6 million

num standards for all public school buildings. It is proposed that the department be required to establish and promulgate minimum standards as binding regulations by mid-1972.

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The Department of Public Safety would be allowed to disapprove the minimum standards promulgated by the Department of Education as they relate to areas within its jurisdiction. Any dispute between the two departments would be resolved by a special public hearing before a Board of School Building Standards, to be established as a part of the Department of Public Safety.

The Department of Public Health would retain its present powers and duties relating to the approval of

health and sanitary requirements for site selection for public schools by local communities.

In sum, then, MSCC would be a State corporation responsible for the construction of public schools in the Commonwealth. Local officials would be responsible for planning, for acquiring sites and for curriculum development and building design. The corporation would be responsible for funding school construction, for aggregating a market, for bidding procedures and for construction management. It would encourage—and would conduct research to further—the use of systems components in school construction, taking advantage of all the economies this approach represents. The chart on the preceding page indicates the sum of the economies that could be provided by MSCC as compared to any attempt to overhaul, piecemeal, current school construction practices.

*A total approach to school construction*

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## Conclusion

### *The charge*

This study committee was formed for the purpose of examining the school construction process in Massachusetts, with particular emphasis on systems building. The objective was to find ways to reduce costs, increase efficiency and at the same time to guarantee high quality buildings. A fundamental premise of the entire study was the belief that the State must assume direct responsibility for providing equal educational opportunity for all children of the Commonwealth.

In essence, the study committee found the systems approach to school building applicable to Massachusetts. Moreover, it found that using such an approach could cut costs and result in buildings of better quality and greater flexibility.

The study committee also found that there is a great need for school construction in the Commonwealth, but that local taxpayers are reluctant to add to the inflexible property tax in order to pay for them. In addition, it found that many current State procedures, laws, local ordinances and customs serve to slow building projects and to drive costs up.

It was these factors—plus the need to aggregate a market in order to take full advantage of the systems construction process—that led the study group to examine the advantages inherent in a Statewide corporation that would oversee and finance school construction throughout the State while insuring continued local participation in planning and design.

### *The need*

### *The conclusion*



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