

PROTOTYPE SCHOOL DESIGNS:

Can Prototypes Be Used Successfully?

A CEFPI Research Publication

The Authors:

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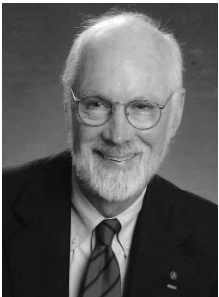
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Biographies



Laura A. Wernick, AIA, REFP, is a Principal of HMFH Architects, Inc. She is extremely active in the national dialogue on architecture and education, and has organized and spoken at CEFPI conferences, both regionally and nationally, as well as the AIA's Committee on Architecture for Education. Her projects include the nationally recognized Thompson Middle School in Newport, RI,

an urban facility that goes beyond classroom education and links students and families to a variety of social services. In addition, she has been responsible for the design of public and private elementary, middle and high school facilities, as well as unusual, technically complex renovations, such as the Electro-Acoustic Music Studio at Harvard University's Paine Hall. Ms. Wernick is a member of the Boston Society of Architects Ethics Committee, CEFPI, the UMASS Lowell Graduate School of Education Advisory Board, and President of the Child Care Resource Center. She holds a B. Arch. from Cornell University.



John F. Miller, FAIA, is a founding principal of HMFH Architects, Inc. in Cambridge, MA. He has been at the forefront of architecture in the public realm throughout his career, leading the firm's involvement in the design of many award-winning school facilities, including the Golden Hill and Silver Hill Schools in Haverhill, MA which received the William Caudill Citation from AS&U and

the Butler Middle School in Lowell, MA and The Charlestown High School in Charlestown MA both of which received the Walter Taylor Award from AASA/AIA. As a founding member and current chair of the Boston Society of Architects' Educational Facilities Committee, Mr. Miller has been instrumental in the development of a historical database of school construction costs in Massachusetts. He is also involved with professional registration and practice issues on both the national and local levels, having served as Director and on various committees of the National Council of Architectural Registration Boards, as well as Vice Chair for the Massachusetts Board of Registration of Architects. Mr. Miller is also a Fellow of the American Institute of Architects, and Board President of the Cambridge Neighborhood Apartment Housing Service. He holds a BA from Williams College and MArch from Graduate School of Design, Harvard University.

Introduction

Across the country school districts are faced with unprecedented growth. As student populations increase, existing schools are overcrowded and falling in to disrepair. Communities and school districts are searching for an efficient, cost effective way to build new schools that are tailored to their students' needs, and can provide adequate resources as their student population continues to expand. Many communities have looked to prototype, or stock designs, as a way to fulfill their needs.

The purpose of this report is to determine under what circumstances the use of prototype school designs are appropriate, what measurable benefits are realized, and if any disadvantages result from their use.

Methodology

A search of reports, studies, papers and articles related to the use of prototype school designs was conducted. The search resulted in numerous studies prepared by Departments of Education including Arkansas, California, Georgia, North Carolina, Virginia and Washington and position papers prepared by the American Institute of Architects (AIA) and state components. They spanned a period from 1964 to 2005 and included AIA components from California, Illinois, New Jersey, North Carolina, Pennsylvania, Texas and Utah.

We reviewed articles written by Architects, Educational Planners and Educators. We also reviewed newsletters and articles. We identified school districts that are currently using prototype school designs and communicated with them by email and telephone.

An email inquiry was sent to American Institute of Architects' State Government Network members to identify architects who have or are designing prototype schools and to identify school districts that have used prototype school designs. A preliminary questionnaire was developed based on issues identified by research and outreach efforts. While we received some useful data, the response to that effort was disappointing.

What is a Prototype?

In the literature we reviewed prototypes are often referred to as: Stock Plans, Standard Plans, Clone Plans, Duplicate Plans, Plan Reuse and Model School Design Plans. For the purpose of this report we will use the following definition:

Prototype School Plans are construction documents that have been used to construct more than one school with minor modifications required for the second and subsequent schools.

Current Trends in School Design

Current trends in school design theory support a planning process that is often at odds with the development of prototype school designs. In the Report from the National Summit on School Design, convened by the American Architectural Foundation and Knowledge Works Foundation, in Washington on October 6-8, 2005 the following eight (8) recommendations for School Design Excellence were stated:

1. Design Schools to Support a Variety of Learning Styles
2. Enhance Learning by Integrating Technology
3. Foster a "Small School" Culture
4. Support Neighborhood Schools
5. Create Schools as Centers of Community
6. Engage the Public in the Planning Process
7. Make Healthy, Comfortable, and Flexible Learning Spaces
8. Consider Non-Traditional Options for School Facilities and Classrooms

Ronald Bogle, President and CEO of the American Architectural Foundation said in the Report on the National Summit on School Design, that "we have moved beyond the one-size fits all approach to school design to an age of greater innovation and flexibility tailored to meet the needs of individual students, schools and communities." He further stated, "The successful schools of the future need to apply the research on how students learn and how the quality of our educational facilities affects student performance, health, safety, self esteem and well being" (2006).

Prior Studies by State Departments of Education

We reviewed and have summarized the findings of the following studies prepared by State Departments of Education:

1. "Stock Plans Program, Experience of Two School Districts," Washington, 1960
The use of stock plans may have contributed to the higher costs in school construction. The school building program can best be served by the continued encouragement of original design and use of new and varied materials.
2. "Stock Plans for Schools: Chimera or Panacea," California, 1970
History indicates that achieving modern school facilities at less cost through the use of stock plans is an unrealized dream....the idea of stock plans has been extensively explored and the preponderance of available facts and opinions has prompted us to reject stock plan proposals as neither sound nor economical.
3. "Standard Architectural Drawings for School Buildings," California, 1972
Use of prototype school designs...was impractical due to variations in soil conditions, weather conditions, site access, orientation, accessibility of utilities, educational program policies and class size.

4. "Recommendations Regarding the Development and Use of Stock Plans," Georgia, 1991
The feasibility of using this approach as a means of reducing costs or shortening the time required for design and construction of new schools does not appear to be practical nor economical.
5. "School Design," Oregon, 2000
Prototype designs make sense within a local system when building multiple buildings of the same type in a short time frame.
6. "School Design," Virginia, 2002
The economy of multiple uses of architectural plans is doubtful at best, and the most would be a fraction of the total cost of a school building. The perceived savings with model school design plans are actually nothing more than shifting costs from the local school division to the Commonwealth.
7. "Prototypical Building Designs: Recommendations," Arkansas, 2004
The feasibility of using this approach does not appear economical and/or practical to meet the educational facilities needs of the State of Arkansas.

Other Case Studies:

The American Institute of Architects' Position Regarding Prototype School Design

The American Institute of Architects opposes state implemented prototypical school designs because they believe that they compromise both the children's learning experience, and the architectural integrity of the designs.

"The AIA believes school facilities should be designed and built to fit the environment, the location and the specific needs of children and teachers using those schools." And that "Standardized, or stock, plans fail to incorporate individual communities' specific educational needs." (AIA, 2005).

Although using prototype designs may result in some initial savings, the cost of revising the plans and adapting them to specific sites usually negates them. The AIA found that of the 25 states that have used standard designs all 25 have stopped using them, because they were not beneficial.

Systems Approach

In the 1960s, California, Toronto and Boston utilized a systems approach to school construction. Standard criteria were established for mechanical and electrical systems. Modular ceiling and partitions components were developed, designed to be efficient, and to provide the same facilities and resources across the district. These components could be assembled into modules that were adaptable to different sites. Although they proved easy to build, they were not as flexible

as originally envisioned, and public bid laws provided obstacles to cost effective purchasing. Eventually all three programs were discontinued.

Clearinghouse of Prototype School Designs

California, North Carolina, Florida and Pennsylvania have created web sites that feature prototype school designs. The underlying goal of a library of school designs is to make designs available to school districts to reduce the time it takes to design a school from scratch and to reduce the fees paid to architects and engineers. There are, however, corollary benefits. Clearinghouse web sites provide easy access to successful designs that can educate architects, educators and the public on current trends in school architecture, best practices in school design and examples of sustainable design.

New York City Prototype Schools

In the mid-90s, the New York City school system was faced with both the disrepair of their existing schools, and a constantly increasing population. To address the need for more space, and better quality schools the city developed a Prototype School Program. The City hired four architects to create a series of modular designs that could be adapted to different site conditions. These schools provided solid facilities and could be built quickly and relatively inexpensively. These designs were considered a success at the time because they alleviated the desperate need for space, and provided a quality-learning environment. The projects were criticized for limiting community involvement and their lack of individuality. Approximately 20 schools were constructed before the program was discontinued.

Philadelphia School District "Little School House" Program

Like New York, Philadelphia was faced with a rapidly increasing student population, and a lack of space. In 1997 the city, along with the architecture firm VITETTA developed the "Little School House" design, a common core of administrative and recreational spaces that could be combined with classroom wings. They were designed to be both flexible, and predictable. In 1999, the "Little School House" facilities were awarded the Facility of the Month Award by School Construction Magazine. (Richard Sherman, personal communication, December 12, 2003)

Clark County School District, Nevada

Clark County has one of the fastest growing enrollment rates in the country. Because of this they also have one of the largest construction programs. The district has been using prototypes since the 1960's and they have constantly seen major savings. They have constructed 68 schools since 1998 and had 10 additional schools under construction at the time of this study. The use of prototypes has resulted in a 2-3 % savings on design and a 3-8% savings on construction. Change orders are less than 1/2 of a percent. Up to a year is saved in the overall process. The district uses the architect who designs a

given prototype each time that given prototype is constructed to avoid legal issues and to make the process more predictable. They are also constantly making minor changes and refinements to the prototypes. Clark County considers their prototype program a success, partially due to their long range planning which identifies community needs and appropriate sites well in advance, and the experienced staff that oversees each project.

Loudoun County Public Schools, Virginia, and Orange County, Florida

Both Loudoun County and Orange County have a high growth rate, and are building lots of schools quickly. In Orange County, in 5 years they have built 27 elementary schools and they will build an additional 24 within the next 4 years. Both counties have found prototypes to be cost effective and time efficient. The use of prototypical plans has reduced construction costs and design fees, as well as change orders. Internal staff is constantly reviewing and updating the plans. The reported disadvantage of the programs is that the schools lack individual character and do not always reflect specific community needs.

Brockton, Massachusetts

Because Massachusetts tends to have smaller school districts, with more community involvement, and constant change to building codes, prototypes are illogical, even in districts with rapid growth. The Brockton, Mass school district built 5 new schools in 7 years, but found that using prototypes was neither time, nor cost efficient. Due to funding delays and program changes the initial designs had to be revised and redesigned, which extended the time frame, and increased costs

Haverhill, Massachusetts

Haverhill, Mass is one of the few smaller school districts that considers the use of prototypes a success. The city built four nearly identical elementary schools over a period of 5 years. Community involvement in the design process impacted the design but all schools incorporated the same basic facilities. Haverhill considers the prototype program a great success in part because the concept of a prototype was instrumental in gaining public support for the funding of the project. Due to site specific adaptations required, the anticipated cost savings were not achieved, but the schools were awarded the 1994 William W. Caudill Citation by *American School & University*. That this important award was given to a prototype school disproves the notion that prototype designs cannot be worthy of architectural recognition.

Findings

State Controlled Prototype School Design Programs

Our research concluded that a state-run program to provide prototype school designs for its school districts was not practical and would not result in cost savings. Not one of the states we looked at recommended using prototypes. According to the American Institute of Architects' 2006 stock plans issues brief, twenty-five (25) states have used prototype school designs and all twenty-five (25) have abandoned the use when the school districts realized they were losing money and receiving an inferior product.

Large, Rapidly Growing School Districts

These school districts have shown the advantages of using prototype designs. When building many of the same type of school it can be cost effective and quicker to use the same plan repeatedly. The communities that have shown the most success with this have continually revised their plans, and have a full time staff dedicated to the upkeep of prototypes.

Smaller School Districts

Smaller school districts confronted with a short-term enrollment bulge often opt for a prototype school design plan. The benefits enjoyed by larger school districts are rarely realized by smaller school districts that are building two (2) or three (3) schools at one time. The anticipated cost savings may not be realized if the selected prototype needs to be adapted to neighborhood requirements or specific site constraints.

Kit of Parts

In several rapidly-growing school districts the Kit of Parts, or Module system of building schools, has been an answer to the need for quality learning spaces to be built quickly. This approach allows flexibility to adapt to differing sites and school sizes. Although they lack in individuality they are often less rigid than a set prototype design. However, even a kit of parts approach requires continual updating.

Clearinghouse of Prototype Designs

Statewide websites or clearinghouses have shown benefit, not only as a library of plans, but also as a resource for architects, and school districts on new technology, and previous successes. Although plans may not necessarily be reused, they are a valuable learning tool.

Systems Approach to School Buildings

In the 1960s, California, Toronto and Boston developed and used a system approach to school design and construction. The expectation of savings from standardizing building systems and materials while providing interior flexibility were not realized and all three programs were ultimately abandoned.

Conclusion

Research has shown that there is a strong correlation between the design of a school and the performance of its students. When we looked at Prototype School Designs as an answer to the need for high quality quickly built schools we found the following:

- State-run Prototype School Design Programs are not practical and will not result in cost savings.
- Prototype School Design Programs in large school districts where there are ample resources can ultimately result in significant savings in time and cost when a large number of school buildings are being built within a short time frame.
- There is a lack of documentation on actual cost savings achieved when a school district reuses a prototype design that requires modification for site adaptation, educational program changes, or code changes.
- Web-based clearinghouses of prototype school designs are a valuable resource. However, there is a lack of research that documents cost savings from the reuse of these plans as well.
- A Kit of Parts approach to prototype school design has been used successfully when a large number of school buildings are being built within a short time frame. This variation of a prototype design addresses a number of the disadvantages of the one-size-fits-all approach.

Educators believe that schools should be designed to meet the needs of the individual student. Architects and educational planners advocate for schools to be designed that take advantage of, and respond to site-specific and community specific characteristics. Under the right conditions, the decision to use a prototype design can save time and money. The decision of whether to build a prototype versus a site-specific design is usually a trade off and should only be made after a careful analysis of the benefits and disadvantages.

Full Report

Acknowledgements

This report was funded through the generous contributions of the Council of Educational Facility Planners International and the American Institute of Architects.

Introduction

School districts across the country are faced with unprecedented enrollment growth. In the 1999 report *The Baby Boom Echo: No End in Sight*, the U.S. Department of Education reported that U.S. public school enrollments have achieved record highs for 14 straight years, with no end in sight.

The fastest growing school districts include New York City (NY), Dade County (Miami, FL), Los Angeles (CA), Clark County (Las Vegas, NV), Broward County (Fort Lauderdale, FL), Chicago (IL), West Palm Beach (FL), Orange County (Orlando, FL), Greensboro (NC), and Lawrenceville (GA). Clark County's enrollment growth rate is among the highest in the United States. According to the Clark County School District Facilities Division website, the school district's enrollment has grown by 10,000 students each year since 1994 and by more than 13,000 students each year for the last two years.

The combination of immigration, demographic shifts and deterioration of existing school facilities has put significant pressures on many communities to build new, or renovate existing schools in order to appropriately house their students. For communities that are planning on building multiple schools, the dream of a prototype school plan, one that can be designed one time and be inexpensively built over and over again, persists.

Clark County and many other school districts across the United States have turned to Prototype Schools to meet the demand for new classrooms. Prototype school buildings have been used by states and school districts for years with the expressed goal of cost savings.

In 2003, Massachusetts Inspector General Gregory Sullivan urged the Department of Education to create prototype designs that cities and towns can use. He suggested that tens of millions of dollars could be saved each year by the use of prototype school designs. He said prototypes would lower design costs, reduce the occurrence of inadequately or overly designed schools, lead to quicker review and approval by the Department of Education and ensure that new school buildings would meet state standards and technology requirements. (Tench, 2003)

State legislators have made similar proposals across the United States for years. Some states have legislated prototype school programs while others have initiated studies to determine the feasibility of a prototype school design program.

Typically, in response to initiatives for prototype school design programs, architects represented by the American Institute of Architects oppose the use of prototypes and articulate why their use is inappropriate and will not result in anticipated savings. Legislators have debated the use of prototypes, and their associated advantages and disadvantages, across the United States and in many school districts.

The purpose of this report is to determine under what circumstances the use of prototype school designs are appropriate, and what measurable benefits are realized and what disadvantages result.

Methodology

A search of reports, studies, papers and articles related to the use of prototype school designs was conducted. The search resulted in numerous studies prepared by Departments of Education including Arkansas, California, Georgia, North Carolina, Virginia and Washington.

The search also revealed position papers prepared by the American Institute of Architects (AIA) and state components. They spanned a period from 1964 to 2005 and included AIA components from California, Illinois, New Jersey, North Carolina, Pennsylvania, Texas and Utah.

We reviewed articles written by Architects, Educational Planners and Educators. We also reviewed newsletters, newspaper articles and magazine pieces.

We identified school districts that are currently using prototype school designs and communicated with them by email and telephone.

An email inquiry was sent to American Institute of Architects' State Government Network members to identify architects who have or are designing prototype schools and to identify school districts that have used prototype school designs in the past and or are currently using prototype school designs. A preliminary questionnaire was developed based on issues identified by research and outreach efforts. While we received some useful data, the response was disappointing.

Emerging Trends in School Design

The American Schoolhouse is becoming something new and different at the beginning of the 21st Century. After 15 years of furiously building and renovating schools to meet the demands of the baby boom echo the American Schoolhouse is

evolving into something new as educators and technology transform the very nature of learning.

These statements are from the Report from the National Summit on School Design, convened by the American Architectural Foundation and Knowledge Works Foundation, in Washington on October 6-8, 2005.

The Report includes eight (8) recommendations for School Design Excellence:

1. Design Schools to Support a Variety of Learning Styles
2. Enhance Learning by Integrating Technology
3. Foster a “Small School” Culture
4. Support Neighborhood Schools
5. Create Schools as Centers of Community
6. Engage the Public in the Planning Process
7. Make Healthy, Comfortable, and Flexible Learning Spaces
8. Consider Non-Traditional Options for School Facilities and Classrooms

Ronald Bogle, President and CEO of the American Architectural Foundation said in the Report on National Summit on School Design, that “we have moved beyond the one-size fits all approach to school design to an age of greater innovation and flexibility tailored to meet the needs of individual students, schools and communities.” He further stated, “The successful schools of the future need to apply the research on how students learn and how the quality of our educational facilities affects student performance, health, safety, self esteem and well being” (2006).

In Learning by Design 2001, William Day asserts that current education reforms demand that we rethink the architecture that houses our children to accommodate new teaching styles such as interdisciplinary and team teaching.

At the same time that many educators advocate school buildings that should be designed to meet the needs of the individual student, a growing trend in school construction is the use of prototype school buildings. Prototypes hold out the promise of providing better facilities at reduced costs for new construction. “Experience has shown, however, that prototype designs often do not offer the economy of scale for renovations or additions that they do for new construction.” (Day, 2001)

In *School Ways, the Planning and Design of American Schools* by Ben E. Graves, Chapter 4 titled, The Future, includes a discussion on Prototype Schools. Some communities have

explored the use of prototypes to reduce the time consuming and expensive process of planning, design and construction; “if the design works, why not save money and energy by using it again”. When considering the use of prototypes, educators and architects must address some key issues.

- Will the design be compromised by differing site conditions?
- Are spaces compromised to fit the prototype system?
- Can prototype designs respond to different neighborhood characteristics?
- Will savings result?
- Will prototype schools be more or less responsive to changes in educational philosophy?
- Does the prototype process restrict design creativity resulting in cookie cutter schools? (Graves, 1993).

The challenge facing architects and educators who attempt to design prototype schools will be to accommodate the eight recommendations put forth at the National Summit on School Design while achieving significant cost and time savings.

What is a Prototype?

In the literature we reviewed prototypes are often referred to as: Stock Plans, Standard Plans, Clone Plans, Duplicate Plans, Plan Reuse and Model School Design Plans. For the purpose of this report we will use the following definition:

Prototype School Plans are construction documents that have been used to construct more than one school with minor modifications required for the second and subsequent schools.

California and North Carolina use a clearinghouse of prototype school designs intended to provide time and cost savings. Kit of Parts is another variation where prototype designs of key spaces are used to design a school. In the 1960s, California, Boston and Toronto implemented programs that used standard systems and components to design schools. All of the above are variations of prototype school designs.

Prior Studies by State Departments of Education

We reviewed and have summarized the following studies prepared by the State Departments of Education in Arkansas, California, Georgia, North Carolina, Virginia and Washington.

1. “Stock Plans Program, Experience of Two School Districts”, Washington, 1960
2. “Stock Plans for Schools: Chimera or Panacea”, California, 1970
3. “Standard Architectural Drawings for School Buildings”, California, 1972

4. "Recommendations Regarding the Development and Use of Stock Plans", Georgia, 1991
5. "School Design", Oregon, 2000
6. "School Design", Virginia, 2002
7. "Prototypical Building Designs: Recommendations", Arkansas, 2004

1. "Stock Plans Program, Experience of Two School Districts" Washington State Board of Education, 1960

The study referenced a 1958 survey of 47 states that resulted in 42 responses. Of these responses only two (2) large school districts were using prototype school plans to a degree that would be useful in analyzing the cost saving benefits. After the survey was made, New York initiated a stock plan program. The study analyzed the costs to construct schools in the two districts and compared them with the cost of construction in Washington. The conclusion of the study states that "the use of stock plans may have contributed to the higher costs in school construction". The report further concludes:

It is evident that the interest of the school building program in the State of Washington can best be served by the continued encouragement of original design and use of new and varied materials. Such an approach to school planning has served well in the past and proves again the American tradition of competitive and free enterprise. (State of Washington, Board of Education, 1960)

2. "Stock Plans for Schools—Chimera or Panacea" California State Department of Education, Bureau of School Planning, 1970

This report begins with three statements:

- Schools built from stock plans represent yesterday's buildings at today's prices.
- The schoolhouse has not been built so excellent that it is worth building twice.
- School districts have an obligation to use each new construction project as an opportunity to improve school facility design.

The report states that history indicates that achieving modern school facilities at less cost through the use of stock plans is an unrealized dream. The report concludes that stock plans have been used where a district has: the same space requirements and educational program; the sites are flat; the district is happy with the original design and few modifications are required; and the schools are built within the same time period so the original plans are not obsolete.

The report includes a statement from a 1952 report: Because of the huge building program in California the Legislature has studied various possible economics in construction. The idea of stock plans has been extensively explored and the preponderance of available facts and opinions has prompted us to reject stock plan proposals as neither sound nor economical. (Gibson & Eatough, 1970).

3. "Standard Architectural Drawings for School Buildings" California State Department of Education, Bureau of School Planning, 1972.

This report includes a historical review of existing statutes related to the use of prototype school plans and the extent that these laws have been implemented. The goal of the report was to determine if prototype plans had been used and if the use of prototype plans will result in lower costs while providing educational space that will meet the needs of changing educational programs.

In 1956 the Bureau of School Planning conducted a survey to determine if there was interest in using state developed prototypes. Due to lack of interest, funds to develop prototype school designs were not approved.

In 1961, a report entitled "Cost Analysis for Preparing Plans, Specifications, and Brochure to Establish a Pool of Duplicate Plans for School Buildings" was prepared. The Study assumed eleven plans for each school level. Due to the "extreme costs for a state service of this type, questionable savings and utilization by school districts", the budget request was deleted (State of California, Bureau of School Planning, 1972).

The Bureau determined that the use of prototype school designs in California was impractical due to variations in soil conditions, weather conditions, site access orientation, accessibility of utilities, educational program policies and class size. However, rapid growing school districts have reused plans at a reduced architectural fee when more than one plan of grade level is built within a year and the same site conditions prevail. When there is a time lag of one year or more the use of duplicate plans is uneconomical due to new legislation, new educational programs, new building materials and equipment, and changing construction methods.

In the 1960s, California initiated the School Construction System Development Project. From 1960 to 1960, thirteen (13) school districts participated in the program.

As a result of a nationwide survey, 79% of the states reported they had discontinued the use of prototype school plans. The reasons stated include:

- Plans become obsolete
- Stock plans impeded development of changing teaching methods

- Different site conditions
- Each community should solve its building problems in light of local needs
- Practice was found to be impractical (Calvert, 1972)

A supplement to the report included an estimate of the cost if the state employed architects and engineers to develop a given number of standard plans. Thirty-two (32) plans would be required to respond to varying terrain, climate conditions with respect to temperature, winds, snow loads and soil conditions, architectural appearance for geographical area (Mountain, Desert, Coastal), school size and age group (K-8 and 9-12). (Askin & Calvert, 1972)

4. "Recommendations Regarding the Development and Use of Stock Plans" Georgia State Department of Education, 1991

A survey of 50 State Departments of Education and 184 school superintendents in Georgia was conducted to determine if any states or school districts in Georgia had ever used or were currently using standard or stock plans. Of the forty-one (41) responses received, four (4) states responded that stock plans had been used and no state indicated it was currently using standard plans. The four (4) states were Colorado, Maine, New York and Colorado. Colorado's use consisted of portable, two classroom structures.

The Report's recommendation is:

Based on the research and documentation of past experience regarding the use of standard or stock plans and specifications for construction of new public school facilities, the feasibility of using this approach as a means of reducing costs or shortening the time required for design and construction of new schools does not appear to be practical nor economical over a period of time. Therefore, it is recommended that the proposal to develop and use standard (or stock) plans and specifications for new school construction be rejected. (Georgia Department of Education, 1991)

5. "School Design" Governor of Georgia's Education Reform Study Commission, Education Facilities Committee, 2000

This study explores the pros and cons of the State's role in the following areas of school planning and design: Education Specifications, Design Standards, Prototype Designs, Value Engineering, and Selection of a Qualified Architect.

In Georgia the local school district is responsible for all of the above. Currently many school districts use prototype designs. The ten (10) largest school systems account for nearly two thirds of all new school construction and most of these

districts have found greater economy and control of the design process by reusing plans.

Life cycle cost is discussed. Balancing "the initial cost against serviceability and continuing operational cost for maintenance and energy is necessary". Design standards developed by the State could require high performance schools, which would improve environmental quality and energy performance.

The pros in using prototypes are:

- Reduces architectural fees and time
- Creates comparable facilities across the State
- If regularly updated would facilitate learning from mistakes

The cons are:

- Requires updating plans regularly
- Requires design for specific site location
- Requires more State oversight
- Reduces local system input to the design and construction planning process
- Could cause a loss of identity for local systems

The study discusses the use of a Library of Plans as a means to reduce design time. The potential cost savings result from a reduction in the architectural fee of 1-2%. These savings evaporate if the design requires extensive site adaptation or other changes.

The findings of the report are "prototype designs make sense within a local system when building multiple buildings of the same type in a short time frame."

A list of alternatives are presented to drive further discussion on school design and include:

- Provide incentives for life cycle costing
- Conduct a benchmark study of state design standards from an environmental standpoint
- Adopt a Kit of Parts prototype for school design
- Encourage the reuse of existing constructed school plans to reduce design costs and time
- Develop a web-based library of plans
- Conduct a contest for best school design
- Consolidate bids for construction of several schools
- Recommend or require value engineering standards for local school systems (Governor's Education Reform Study Commission, 2000).

6. "A Feasibility Study for Model School Design Plans" Virginia Department of Education, 2002

Dr. Glen Earthman, professor emeritus at Virginia Polytechnic Institute & State University, prepared this study. The purpose of the study was to determine whether or not the idea of model design plans for schools would be a viable means of reducing the total cost of providing safe and modern schools buildings. The study findings are based on a survey of superintendents of schools, architects and educational planners.

Research of other states' experience with State Standardized Plans was conducted. The findings were similar to those of the previous reports discussed above.

The conclusions reached are as follows:

- The economy of multiple uses of architectural plans is doubtful at best, and at the most would be a fraction of the total cost of a school building. If the state developed sixteen (16) different plans to accommodate local requirements, the chance of an overall savings would be minimal. Costs to update and maintain model school design plans would further diminish the opportunity to realize any savings.
- Prototype plans could quickly become obsolete as a result of changing educational needs, availability of vendors to supply specified goods and materials over time, and changing building codes. Changes and redesign would be required to keep them up to date.
- Prototypes would have to address different grade configuration, size.
- How would prototype plans address local educational needs?
- Community participation in the planning process could be limited.
- There are liability and architect registration issues, which would have to be resolved.

The final conclusion reached reads:

The evidence points to the finding that such plans would not be used or accepted because they would not meet the needs of the local education program. In addition, there are some major problems associated with the use of such plans that would more than likely negate any possible savings that would be realized. In fact, the perceived savings with model school design plans are actually nothing more than shifting costs from the local school division to the Commonwealth. Even at that, the transfer of economies would be in the architectural fees, which is a small percentage of the total cost of a building, but again, the preponderance of evidence would indicate there would not be any overall savings realized. (Virginia Department of Education, 2002)

7. "Prototypical Building Designs, Recommendations Regarding the Development and Implementation of Prototypical Building Designs for the Construction of New K-12 Educational Facilities" Arkansas, Public Relations Committee, 2004

On its face, the potential of reducing engineering and design costs by developing a series of standard prototypical building plans and specifications for educational facilities seems so intuitive that it is difficult for lay people to understand why we have not considered this solution before. (Arkansas Public Relations Committee, p 4, 2004)

Since the greatest school facilities' needs across the United States are in the area of maintenance, remodeling, renovation and the expansion of current facilities, there will be limited benefit from a prototype design strategy. Other issues that may be limitations are:

- If prototype plans are developed at the state level a large staff of architects and engineers would be required to continually update and modify prototype plans to keep them current.
- A large number of designs would be necessary.
- Prototype plans eliminate open competition of proprietary materials and systems.
- Prototype plans would become obsolete without constant updating.

The report looked at previous state reports and based many of its findings on the 1991 Georgia survey. The conclusion in this report states "the feasibility of using this approach does not appear economical and/or practical to meet the educational facilities needs of the State of Arkansas." (Arkansas Public Relations Committee, 2004)

With the exception of the 2000 study by the Georgia Governor's Education Reform Study Commission, six (6) of the studies reviewed came to a common conclusion. The Georgia study provides pros and cons of prototype school designs and suggests further study.

The studies cite major problems with a state-run prototype school design program. In order for prototypes to work effectively according to the studies, they must be able to respond to the following design and planning issues:

- Orientation for optimum energy efficiency
- Appropriate orientation to site design, roads, sidewalks, parking, playing fields
- Different site topography
- Climatic differences
- Efficient relationship to utilities
- Structural systems which respond to differing wind zones, seismic zones and soil conditions
- Availability and cost of materials
- New materials

- Differing zoning regulations
- School size
- Grade configurations
- Modifications to correct design errors
- Changing and differing educational philosophy
- Changing and differing educational programs
- Flexible designs which do not stifle creativity
- Respond to issues of architect liability and architectural regulations
- Community process
- Loss of identity and individuality
- Context
- Mandatory or voluntary participation
- Diversity of design

2005, American Institute of Architects, “Stock Plans: Bad for Schools”

The American Institute of Architects’ position papers over the years have contributed to the debate over the use of prototype school designs. The key points have been quoted in many of the state sponsored studies, which have recommended that prototype school design initiatives be rejected.

The 2005 American Institute of Architects’ Issue Brief regarding stock plans, states the position that:

The AIA believes school facilities should be designed and built to fit the environment, the location and the specific needs of children and teachers using those schools. Economical school construction is possible by designing school buildings that are strategically adapted to specific locations and needs. Architects can minimize costs by determining in advance the size and equipment needs of classrooms based on the academic priorities and teaching techniques of the school. Standardized, or stock, plans, fail to incorporate individual communities’ specific educational needs. Cookie-cutter design of schools is a risky approach that may undermine the effectiveness of the learning environment.

Twenty-five (25) states have used standardized plans for school buildings. All twenty-five (25) states abandoned the idea of using standardized plans when the school districts realized they were not reducing costs, and in some cases they were losing money and receiving an inferior product.

The American Institute of Architects maintains that it is essential for state and local governments to invest in well-designed schools that meet specific requirements of the school site and curriculum and increase student achievement. The short-term savings of using a prototype school plan are often negated by the cost of adapting the project to the unique conditions of the site. A project designed specifically for a site can lower construction costs and can lower maintenance and energy costs and a well-designed school can enhance the learning experience. Plans drawn by one architect and modified by another architect create liability issues and may be in conflict with registration regulations.

Systems Approach to School Building

In the 1960s, California, Toronto and Boston utilized a systems approach to school construction. One of the goals was to incorporate flexibility into the designs so that interior space could be easily reconfigured to accommodate changing needs.

Standard criteria were developed for the structural system, heating, ventilating, and air conditioning systems, demountable partitions, ceiling and lighting. The initial goal

The American Institute of Architects’ Position Regarding Prototype School Design

The American Institute of Architects and its state chapters have opposed most initiatives by state legislators to adopt state prototype school design programs. This effort is chronicled by the following position papers released during the last forty (40) years:

1964, American Institute of Architects, “Why Standard Plans Don’t Work”

1987, Utah Society of American Institute of Architects, “Legislative Alert”

1989, American Institute of Architects, California Council, “Conflict of State Laws”

1992, American Institute of Architects, North Carolina Council, “Why Stock Plans for Public Schools Don’t Work”

1993, American Institute of Architects, California Council, “Why Stock Plans for Public Schools Don’t Work”

1993, American Institute of Architects, “Why Stock Plans for Public Schools Don’t Work”

1993, American Institute of Architects, Illinois Council, “Plan Stamping is Illegal”

1996, American Institute of Architects, North Carolina Council, “The Case Against Stock Plans”

1999, American Institute of Architects, Pennsylvania Chapter, “The Preapproved School Design Act”

1999, American Institute of Architects, New Jersey Chapter, “AIA New Jersey Opposes the Administration’s School Construction Proposal”

2003, Boston Society of Architects, “Letter to Governor Mitt Romney in Opposition to the Inspector General’s Proposal for Prototype School Designs”

was to buy these systems in bulk or to commit to purchase an agreed upon quantity.

California developed the School Construction Systems Development (SCSD) program that focused on the efficiency of mass production while avoiding standardized plans or monotonous repetition of plans and appearance. Designs were different but were all built with identical systems or components (Rydeen, 2002). From 1966 to 1971, School Construction Systems Development components spread into more than 1300 U.S. schools. One of the program's successes was the use of affordable, moveable partitions to create space flexibility. (Rydeen, 2002)

An evaluation of the School Construction Systems Development system in 1967 by James Benet, published by the Educational Facilities Laboratories, concludes, "Society needs both higher quality and larger quantities of school building to meet the complex learning facility requirements of the present and future." (Educational Resources Information Center, 1967)

Toronto's building system was called the Study of Educational Facilities (SEF) and was similar to School Construction Systems Development. Twenty-two (22) open plan schools were built using the system.

Boston's building system was called BOSTCO and was used during the 60s and 70s to build new inner city schools. A case study of BOSTCO Track 1 includes "In this system the most efficient and appropriate technology was applied to the development and assembly of building components." (Educational Resources Information Center, 1972)

The BOSTCO system included standard structural, mechanical and electrical systems. The interior ceiling consisted of a five (5) foot coffered grid system incorporating lighting and supply diffusers. Demountable partitions were located on the grid. Wiring was fed overhead into the partitions. Due to public bid laws, many of the expected cost savings from standardized specifications were not realized. The high level of flexibility was not utilized to the extent anticipated. (J. Miller, personal communication, July 2006)

All of these systems eventually fell out of favor and were discontinued.

Clearinghouse of Prototype School Designs

The underlying goal of a library of school designs is to make designs available to school districts to reduce the time it takes to design a school from scratch and to reduce the fees paid to architects and engineers. There are, however, corollary benefits. Clearinghouse web sites provide easy access to successful designs that can educate architects, educators and the public on current trends in school architecture, best practices in school design and examples of sustainable design.

California, North Carolina, Florida and Pennsylvania have created web sites that feature prototype school designs.

California

The State Allocation Board and the Office of Public School Construction established the Prototype School Designs web site as a comprehensive source of school planning and design information. The following information is provided for each project: plan abstracts, site plans, floor plans, photographs, program data, construction data and architects' contract. The database is searchable by location, size, cost and grade level.

One of the goals was to assist school districts in reducing the time and costs of designing new facilities by promoting the reuse of plans. The sharing of information on school designs would allow school districts, facility managers, and business managers to be aware of the latest school designs, design solutions, products and building options. (Office of Public School Construction, 2003)

The website (www.planupload.dgs.ca.gov/CASchoolsHome.asp) includes examples of elementary, middle and high schools. The design must be for a new school, where plans have been approved by the California Department of the State Architect and the California Department of Education within the last four years. Recommendations regarding the use of prototypes are included in the Public School Construction Cost Reduction Guidelines (April 26, 2000) and include the following items.

Allow time to develop a prototype: Developing a good prototype takes additional time than required for a non-prototype school. Districts with construction oriented facilities staff are better prepared to develop prototypes. Additional time is required to properly develop educational specifications, solicit community input, and refine district standards and to do the design.

Design prototype to facilitate educational changes: The design is effected by, and must respond to changing educational programs. It must be timeless and flexible. The best practice is to develop a wide variety of prototype components so that the district can mix and match. The key is to allow the district maximum flexibility to respond to changing needs while maintaining the cost effectiveness of the prototype design. This is best accomplished by:

- Incorporating the latest educational specifications from all schools that will use the prototype;
- Incorporating each school's community in the design process; and
- Designing the prototype as a series of sub parts or components that can be configured to match each of the various specifications.

Ensure site compatibility: Adaptation of prototypes to various sites requires design flexibility. Site issues lean toward the development of prototypical components and subsystems that can be selected and assembled into complete buildings, thus allowing proper design response to site issues, including soil conditions, which may require structural modifications of the prototype design. Other site issues are environmental and site configuration. The prototype should be designed to allow exterior modifications, without reducing the cost savings, to respond to the need to meet neighborhood design standards.

Design consulting issues: There are potential design liability issues that must be resolved in using the prototype approach. The recommendation is to use the original architect for the reuse of the original contract documents.

Consider product versus service: The difference between buying a product and buying a service raises liability issues. The recommendation is for a district to seek legal advice.

Consider the fee issue: Consider selecting the designer based on the availability and qualifications of the prototype. The designer of record may agree to a reduced fee assuming there is little or no change to the prototype.

The above recommendations support designs that are flexible and can adapt to different site conditions and changing educational needs, as well as a design process which includes the community and results in a design which reflects community needs and values.

The Office of Public School Construction conducted a survey of school districts to learn what processes they utilized resulted in efficiencies. The survey was mailed to ninety-seven (97) school districts and county superintendents. Of the 37% that responded (36 responses), 69% used prototype plans for multiple projects (25 responses).

- 92% saved time on the application process (23 responses)
- 60% saved time in the construction process (15 responses)
- 48% saved money in the construction process (12 responses) (OPSC, 2003)

The Office of Public School Construction and the Division of the State Architect collaboratively issue a joint newsletter, *The Breaking Ground*, that provides school districts, architects, design professionals and consultants with valuable information on current topics which impact school construction including energy conservation, sustainability, universal design and historic preservation. Each issue also showcases a new K-12 school design. The newsletters serve as a resource for school districts for the latest school facility planning ideas and design solutions. (OPSC, 2003)

The Division of the State Architect maintains a Sustainable School website (www.sustainableschools.dgs.ca.gov/sustainableschools) that is intended to help schools create high performance educational facilities that will ensure the optimal health and productivity of students and faculty. The website provides a diverse collection of sustainable building resources including guidelines, programs, case studies, publications, funding options and incentives.

The California Division of the State Architect has produced a “Collaborative for High Performance Schools Video Series” (www.chpsvideos.com). The series covers the topics of School Siting, Energy Performance, Daylighting, Water Resources, Environmental Quality, and Building Performance and Measurement, and states in the introduction: “Never before has the need to build resource-efficient, healthy, daylit schools been more important as local communities embark to construct or renovate tens of billions of dollars worth of K-12 educational facilities over the next 10 to 15 years”.

The Office of Public School Construction issued a Best Practices Report in March 2003, which contained examples of reuse of prototype plans. The benefits of reuse of plans are listed and include:

- Reduction in planning/coordination process
- Decrease in time and expense in construction drawing preparation
- Streamlined application and approval process through the Division of State Architect and the Office of Public School Construction
- Enables District to project more accurate construction costs

The State of California supports and promotes good school design through a wide array of resources that are available to school districts, architects, educators and the public.

North Carolina

The 1996 North Carolina General Assembly directed the State Board of Education to establish a central clearinghouse of prototype school designs for access by local boards of education that may want to use a prototype design in the construction of school facilities. This system is expected to result in cost and time savings on school design, provide broader access to architects that specialize in school design, and increase awareness of current trends in school design.

The website (www.schoolclearinghouse.org) is maintained by the School Planning section of the North Carolina Department of Public Instruction which “assists school districts, architects and designers in the planning and design of high quality school facilities that enhance education and provide lasting value to the children and citizens of the state.”

As of August 2006, the website included twenty-eight (28) elementary schools, nine (9) middle schools and seven (7) high schools. Of the twenty-eight (28) elementary schools, nine (9) prototype designs had been used twice, two (2) had been used three (3) times, three (3) had been used four (4) times and one had been used five (5) times. Of the nine (9) middle schools, one had been used twice, three (3) had been used three (3) times, and one had been used five (5) times. Two (2) high schools were used twice and one was used three (3) times. According to Steven Taynton AIA, Chief of School Planning, Division of School Support at the North Carolina Department of Public Instruction, of the two hundred (200) projects last year, thirty-four (34) were new schools and prototype plans are used frequently. (DePatta, March/April 2006).

Florida

The Florida SMART Schools Clearinghouse maintains a SMART Schools Design Directory. In order to be listed, a school design must be approved by the state. There are seventeen (17) schools listed as of August 2006, and information is available for each project.

Pennsylvania

The Pennsylvania State Department of Education is developing a website to showcase school building designs that meet cost efficiency and design standards established by the Department. The website (www.sdcpublic.ed.state.pa.us/PublishScreens/wfSDCHome.aspx) is designed to provide the public school districts and design professionals access to design and cost information on completed public school construction projects. The website is a work in progress, and as of August 2006 there were no projects on the site.

Case Studies

New York

In the early 1960s, the New York State Legislature passed a law authorizing the preparation of eighteen (18) prototype designs. Private architects were commissioned for the design and production of working drawings and specifications. Only nine (9) designs were developed, incorporating the educational spaces currently thought to be desirable. Fallout shelters were also included. Approximately \$650,000 of the \$1,000,000 appropriated was expended to develop these nine (9) designs. After the plans became available in 1963, only two (2) schools were built: a junior high school and a senior high school. None of the other designs were used. (Arkansas Public Relations Committee, 2004)

New York State reported that they had encountered the following problems:

- Architects felt that it would be unwise for them as adapting architects to use plans sealed and signed by another architect.

- A major problem was the updating of the plans.
- Construction costs proved to be about the same as for custom designed buildings and the time of construction was not reduced.
- Adaptation of plans to meet size and programmatic requirements proved to be extremely difficult. (Georgia Department of Education, 1991)

New York City Prototype Schools Program

A 1994 report prepared by the Levy Commission in response to concerns about the crumbling school stock cited grim statistics: 343 schools were still heated by dangerous coal-fired boilers, 47 schools were falling into disrepair each year, and 424 required full scale modernization. The Levy Commission argued that the most basic tenets of education and design were being ignored; "School buildings must be clean, safe, adequate in size to accommodate enrollment and reasonably commodious so as to invite learning." With over 20,000 new students entering the system each year, the report concluded that "learning is suffering and imminent calamity is at our door." (Clark, 1997)

To address this critical need New York City initiated a Prototype School Program to build new schools. A newly formed School Construction Authority was empowered to cut through much of the local government's bureaucratic red tape. In 1989, the City hired four (4) respected firms to develop flexible, modular designs that could be built on a variety of sites. The firms were Gruzen Sampton Steinglass, Perkins & Will, Ehrenkrantz, Eckstut & Whitelaw, and Richard Dattner. (Graves, 1993)

In a *New York Times* article titled "Architecture View: Schools That Level The Playing Fields for New Yorkers", printed January 16, 1994, Herbert Muschamp writes that the Prototype School Plan, which was concerned primarily with alleviating overcrowding, may be the most important initiative the City has undertaken in response to the recent wave of immigration that has swelled its population".

The prototype designs featured a series of pre-designed modules: a classroom module, an administrative module, a special education module and a student commons module that included the gymnasium, cafeteria and auditorium. These modules can be arranged in various configurations so each prototype can be designed to fit on different sites. Over 20 prototype schools were built using this module design. (www.prakashnairconsulting.com)

"They're good-looking, solidly planned and subliminally educational. Like a giant set of building blocks, each is a habitat lesson in how to put things together. Not dramatic design statements, these are friendly, neighborhood buildings whose beauty is more than building skin deep." (Muschamp, 1994)

Prakash Nair, who served as the Program Manager, thinks the idea was good for the time because of the desperate need for space. The richness of community involvement was missing in the process; there was a lack of ownership in the community. "Today, however, a different approach to prototype may be necessary that captures the speed and cost efficiency of prototyping while still allowing each school to be tailored to local context and community and have the flexibility to adapt to future program changes." (Prakash Nair, personal communication, November 2006)

Philadelphia School District "Little School House" Program

The School District of Philadelphia, with 275 school facilities and over 200,000 students, was faced with the need to quickly and efficiently provide additional space for growing enrollments in a number of its schools. Due to the urban character of the district and limited funding, opportunities to acquire additional land to support this initiative were almost non-existent. The use of temporary classroom units or modular construction was ruled out as being an unacceptable long-term solution to the problem.

In 1997 the District retained the architecture firm VITETTA to develop conceptual solutions to the problem. Utilizing conventional construction methods and materials, VITETTA developed a conceptual prototype which used a common core containing administration, multipurpose, and physical plant facilities. The common core could be combined with various classroom wing configurations to provide capacity for up to 400 students. The flexible modular design allows for both capacity and the footprint to be modified based on the requirements of each school campus. The exterior of the buildings feature masonry materials that can be changed to help blend or tie to other facilities on the site.

Since that time, 11 of these so-called "Little School House" facilities have been constructed on existing school sites. The repetitive nature of the facilities has led to a high degree of predictability in terms of both construction cost and schedule, as well as a significant reduction in the occurrence of design and construction change orders. In 1999, the "Little School House" facilities were awarded the Facility of the Month Award by School Construction Magazine. (Richard Sherman, personal communication, December 12, 2003)

Clark County School District, Nevada

The Clark County School District enrollment growth rate is among the highest in the United States. The school district's enrollment has grown by 10,000 students each year since 1994. As a result, the Clark County School District operates one of the nation's largest construction and modernization programs, with approximately \$3.7 billion to be spent through 2008.

By using prototype schools, the Clark County School district has seen major savings. The use of prototype schools has resulted in a 2-3% savings on design and 3-8% savings during construction.

The school district has used prototype designs since the 1960s. Since 1990, over twenty-five (25) different prototype school designs have been designed and used in the district. New prototypes are being developed for elementary schools, middle schools and career and technical schools. Currently there are six (6) elementary school prototypes, two (2) middle school prototypes, one career and technical school prototype and one high school prototype being used. The Clark County School District has built sixty-eight (68) schools since 1998 and now has ten (10) under construction.

Although the majority of new schools have used prototype designs, some are unique designs. Out of the 317 schools built since the 1960s, twenty-six (26) elementary schools, five (5) middle schools, ten (10) high schools, and nine (9) special education schools were non-prototype schools.

The Clark County School District has been pleased by the success of the prototype school design program. Without using prototype designs, the School District would not have been able to provide the number of classrooms required by the unprecedented growth when needed.

In response to a 2003 questionnaire, Dale Scheideman, Director of New Schools & Facilities Planning at the Clark County School District, said the use of prototype school plans saves approximately one year in the overall schedule and results in a cost savings of 5-10%. Following the death of Mr. Scheideman, Rory D. Lorenzo assumed the role of Acting Director, in addition to being the Director of Renovation Services and Special Projects. Mr. Lorenzo explained that the program is supported by a staff that oversees the planning, design and construction of the schools. Long range planning is critical to meeting the demand for new classrooms. Sites must be identified and purchased as well.

Minor changes, to reflect lessons learned, changes in the educational programs, code changes, site adaptation and community input, are made as long as the anticipated cost savings can be realized. Since most of the sites are flat, the major site issues relate to the conflicts between sun orientation, entrances, pedestrian and vehicle access, and the most direct utility connections. If the modifications needed result in substantial changes, a new prototype may be initiated or a site-specific design used. The district is developing a new elementary prototype for 720 students.

The prototype school design process allows refinement of the design from lessons learned which has resulted in fewer change orders. Change orders are less than ½ percent. Contractors are pre-qualified and are able to realize efficiencies after constructing the first schools. This makes the cost estimating and scheduling process more predictable.

The architect who designed the original prototype school is used when the prototype design is reused. This avoids copyright and liability issues that arise when plans are reused with a different architect. Conflicts with architectural registration laws are also avoided.

Clark County School District's new schools program is challenged to respond to changing educational needs and trends in educational facilities design. New prototypes will reflect energy conservation strategies including high performance criteria, daylighting and water conservation. (R. Lorenzo, personal communication, July 2006)

Loudoun County Public Schools, Virginia

The Loudoun County School Division is the fastest growing school division in the Commonwealth of Virginia. In the last ten (10) years the population has doubled from 19,967 to 47,350 students. By 2009 the enrollment is projected to grow to 65,000 students.

Loudoun County has developed prototype designs for new elementary, middle and high schools (cmsweb1.loudounk-12.va.us). The use of prototypes began in the 1990s and since then, twenty (20) elementary schools, eight (8) middle schools and six (6) high schools have been constructed. In the fall of 2005, three (3) elementary schools and two (2) high schools were opened, and in 2006, three (3) middle schools and one high school are scheduled to open.

The design process includes value engineering to insure an extended life for materials and systems. Finishes are selected for durability and minimum maintenance. One advantage of using a prototype design is reduced fees. Fees are reduced by 1/3 to 1/2. Change orders are also reduced. The change order rate for prototype schools is less than 1 percent.

A plan reviewer constantly reviews the prototype designs to identify areas where improvements can be made. By using the same specification for operating systems, maintenance efficiencies are realized.

The major disadvantages are:

- All facilities look alike
- Prototypes create an institutional image
- Prototypes do not allow for design diversity (Sullivan, 2004)

Orange County, Florida

Orange County has similar results to Loudoun County. With 22 million square feet of schools, Orange is the 14th largest school district in the nation. It initially had 3 elementary school prototypes that it used but now they use 2. One is designed for a population of 830 students and the other is designed for a population of 650 students. In 5 years they have built 27 elementary schools and they will build an

additional 24 within the next 4 years. While there was an expression of regret that the County couldn't have more unique schools designed specifically for a given site, the School department finds their program to be very cost effective. With a large internal staff the prototype is constantly being improved for greater program flexibility, for durability and to improve maintenance. (S. Gertel, personal communication, November, 19, 2003.)

The Design and Construction Division of the Orange County Public Schools is organized into the following departments:

- Facilities Strategic Planning Department
- Pre-Construction
- Standards and Design Department
- Construction Management Teams
- Facilities Controls and Archives (Herron, 2004)

Steven J. Gertel, RA, Director, New and Replaceable Schools, Orange County Public Schools, recommends the use of prototypes to save design costs, minimize construction costs and to standardize material and equipment specifications. Although Orange County has not developed comparison data on the cost of using a prototype design versus the cost of a unique design, the County is continuing to develop prototype designs based on the premise that one-of-a-kind designs are more expensive and wasteful. We are not aware of any studies that compare the cost of staffing the prototype school design program with the savings realized by using prototype designs.

Brockton, Massachusetts

School construction in Massachusetts is very different from school construction in Florida. Massachusetts' school districts have all of the disadvantages and few of the advantages that can lead to cost effective use of prototypes. The school districts tend to be smaller with only a handful of elementary schools. They rarely will build more than three new schools at a time. The sites tend to be small and invariably constrained by wetlands or by topography so that site modification, combined with design costs for the specific site undermine cost savings. Significant community involvement in the design of each school is often critical for the passage of a bond issue. In addition, grade configuration can vary within a district and student population can vary from school to school within a district.

Brockton, one of the larger cities in Massachusetts will have completed 5 elementary schools within 7 years. The original intent was to have all of the schools be similar in appearance and have consistent programs, materials and specifications. After the first 3 were completed, the decision was made to change architects and also to enlarge the school size. The design of the new schools was initiated, but, due to a State funding moratorium, the project was postponed for 2 years. Even within that short timeframe, there was a major

change to the Massachusetts Energy Code, new more sustainable materials and systems came on the market and other products were no longer available. The entire specification is being rewritten and significant portions of the drawings are being changed. The two new schools will be identical to one another but significantly different from the first three. (P. Lewis, personal communication, July 2006)

The anticipated cost savings will not be realized due to the delay and the need to modify the drawings.

Haverhill, Massachusetts

An explosion in this industrial city's school age population created a need for four K-5 schools on separate sites in the city with a corresponding need to assure educational equity in these differing parts of the community. The four (4) sites, each with a limited area, were very different in topography, configuration and space. Several of the sites had wetlands and required extensive conservation reviews and permits.

The prototype design, a compact three-story school, required a varying degree of site work on each site. Community meetings were held in all four (4) districts and the subsequent designs responded to the community input. Attention to detail resulted in facades that belie their potentially daunting three-story height. A residential scaled canopy at each entrance reinforces the sense of intimacy for children approaching their school. Window size, bays and bright brick patterns further reduced the scale of the structure. The traditional red brick color and familiar forms of pitched roofs and bay windows carry schoolhouse associations and allow building placement in a variety of settings without looking foreign. The use of a different color scheme for each school helped to differentiate the four prototypes.

The schools were built in phases. The first two schools, the Golden Hill and Silver Hill Schools, opened in 1993. The second pair, the Bradford and Pentucket, was completed five (5) years later. The plans were modified for the second pair to incorporate code changes and minor program changes.

The City realized cost savings from a reduced fee for the second school of approximately 2%. The additional cost for site work for the Golden Hill School was approximately 20%. Although the site for the Golden Hill School was a difficult site, a site-specific design would have resulted in reduced site costs of more than the 2% savings from the reduced fee. (J. Miller, personal communication, July 2006)

The Golden Hill School and the Silver Hill School were awarded the 1994 William W. Caudill Citation by *American School & University*. That this important award was given to a prototype school disproves the notion that prototype designs cannot be worthy of architectural recognition.

Dr. Thomas Fowler-Finn, the Superintendent of Schools in Haverhill in the 1990s, was instrumental in promoting a

prototype design for the four elementary schools. He said the City was extremely pleased with the end results, which achieved equity of school facilities across the City and generated pride in each community. He noted that the plan to design one school and build it four times was presented to the community as a cost-saving strategy. This strategy was instrumental in creating a favorable vote for the school bonds. (T. Fowler-Finn, personal communication, July 2006).

Findings

State Controlled Prototype School Design Programs

Our research identified one constant regarding the use of prototype school designs: the idea that prototype school designs should be used when building new schools to save time and money. Legislative initiatives have typically resulted in studies to investigate the feasibility of using prototype school designs. We reviewed studies prepared by Arkansas, California, Georgia, North Carolina, Virginia and Washington.

These studies concluded that a state-run program to provide prototype school designs for its school districts was not practical and would not result in cost savings. The conclusions were based on the need to maintain a significant number of prototype designs and the cost to develop the designs and to keep them current. California estimated that 32 designs would be required to respond to: grade configuration, number of students, varying terrain, climate conditions (temperature, wind, snow), soil conditions and appropriate design (mountain, desert, coastal). There would also be a significant cost to update the designs and to develop new designs as the designs in the pool became obsolete. Cost savings due to fee reductions would be off-set by the need to maintain a staff to constantly modify and update the prototype designs due to: site issues, code changes, product changes, changing educational programs and lessons learned from previous use of a prototype.

Disadvantages of a prototype school design program include: the loss of an inclusive community process, the lack of diversity of design, slowness to adapt to improved systems and products, and potential legal and liability exposure. A limited number of prototype designs could not address a wide variety of educational programs and delivery options. Unless the use of a prototype design was mandatory, there would be no assurance that the prototype school designs in the pool would be used. This was the case in New York in the 1960s when the State passed legislation to create eighteen (18) prototype school designs. Of nine (9) designs developed, only two (2) were built. (Arkansas Public Relations Committee, 2004)

Our research found no successful state programs where the state developed a pool of prototype school designs for the

use by the school districts in the state. According to the American Institute of Architects' 2006 stock plans issues brief, twenty-five (25) states have used prototype school designs and all twenty-five (25) have abandoned the use when the school districts realized they were losing money and receiving an inferior product.

Prototype School Design Programs in Large, Rapidly Growing School Districts

Prototype school designs are being used in a number of school districts experiencing rapid growth. These include Clark County, Nevada, Loudoun County, Virginia and Orange County, Florida. These communities endorse the use of prototype school plans due to the success of their programs that create cost-effective and educationally sound learning environments in a condensed timeframe.

The Clark County School District has been able to provide new schools to house the influx of between 10,000 to 13,000 students each year, in part by using prototype school designs. Clark County School District estimates that the schedule for design and construction can be reduced by one year and cost savings of approximately 5 to 10% can be realized. The success of the Clark County School District Prototype program can be attributed to a number of factors, including:

- An experienced Facilities Planning Department that oversees the program;
- Long-term planning, including projecting population growth and acquiring sites;
- Ability to accurately schedule new schools and estimate their cost;
- Similar sites;
- The same educational program across the district;
- Using the same architect that designed the original prototype designs for projects that reuse the plans;
- Modifying designs to reflect changes in educational programs, technology, codes and lessons learned;
- Modifying designs to incorporate new materials and systems;
- Developing new prototypes to keep pace with new trends and improvements including: universal design, sustainable design and new educational programs;
- Using site specific designs when appropriate;
- Involving the Community in the process; and,
- Post occupancy evaluation.

The use of the architect that designed the original prototype for subsequent projects that reuse the original documents addresses several issues. The architectural registration laws in most states do not allow an architect to stamp drawings that were not prepared under the responsible control of the architect. Many state laws are modeled after the Legislative Guidelines published by the National Council of Architectural Registration Boards (NCARB). The NCARB Model Regulations state that a "registered architect shall not

sign or seal technical submissions unless they were prepared by or under the responsible control of the architect."

There are also issues of ownership of the documents and copyright laws. Professional liability coverage of the designer may be affected if an architect is retained to modify plans prepared by another architect. All of these potential problems are solved if the original architect is used to modify the drawings and for reuse of the original documents.

When prototype designs are used repeatedly and consistently over an extended time to create large numbers of school buildings expeditiously and where site conditions are favorable, efficiencies of scale should and do appear to accrue in both initial cost and long term quality of the school.

The size of the school district correlates strongly with cost effective use of prototype schools. This is in part due to the resources the larger school systems bring to bear upon their school construction programs. There tend to be significant internal resources focused on project management, engineering and quality control programs. Systems, components, technology and building codes are constantly changing in construction and the prototype drawings and specifications need to be constantly reviewed and updated. In many states the building codes and energy codes are undergoing major changes. New and cost-effective materials and systems that address environmental sustainability have been proliferating. It is rare for a design that is developed one year to be able to be used two or three years later without some modifications to incorporate new codes and materials. Large districts are able to stay on top of the changes and even handle minor modifications and specification updates in-house.

The ability to perform on-going assessment of the completed schools and incorporate the results into the next set of documents is critical. Not only does the review correct problem areas noted during construction, but also education based changes, system and material upgrades and maintenance concerns can be addressed through careful post-occupancy evaluations. These types of modifications can save money during construction, save money over the life of the building and create better learning environments for the students and teachers.

There are also economies that result through building, operating and maintaining the same systems across a school district. The local contractors become familiar with the designs and specifications and can bid them precisely and build them with few errors. The maintenance staff need only be trained on a single set of systems and components only need to be stockpiled for one set of systems. This doesn't necessarily impact construction cost but can favorably impact long term operating costs.

While some components of the planning, design and construction process cannot be reduced through the use of prototypes, being able to modify a given design can shave several months off the design time. Once the prototype is constructed several times the construction becomes well understood and the construction period can be defined fairly precisely with little chance of delay. Saving time saves money but it also allows planning and constructing of large building programs within tighter and better-defined overall time frames. Frequent repetition of prototypes diminishes errors and develops internal expertise both for the school district and also for the contractors who are building the same building over and over again. These are important factors in keeping costs down.

In districts that use prototypes successfully there is typically significant continuity across the district. For instance, the grade configurations do not vary. This means that the district is able to create one elementary school, one middle school prototype and one high school prototype that can be repeated across that district. Larger school systems may have more than one prototype for different student populations or conversely an additional “wing” that can be added to the original prototype to accommodate a larger than normal student population.

Another important common thread among districts that use prototypes successfully is that the districts typically have large sites dispersed around the district to allow relatively easy placement of the prototypes without significant modification. While there is almost always some modification required to assure the prototype fits the site, in these communities the modifications are minor.

The disadvantages of using prototypes include a limited or nonexistent community process. School planners and architects agree that community involvement in the planning process of a school project is one of the most important components. This was a focus of the 2005 National Summit on School Design. In 2004, the Council of Educational Facility Planners International published “The CEFPI Guide for Educational Facility Planning—Creating Connections”, which describes the critical importance of “Community Partnership in the Planning Process.”

Another disadvantage is the loss of design diversity that comes with site-specific designs, depending on the level of modifications allowed for neighborhood and community context. The sameness of a prototype design can diminish the importance of the school as a unique source of civic pride within a community.

We were not able to locate any detailed studies or reports comparing the cost of maintaining the staff required to operate a responsive prototype school design program with the cost savings that result from the use of prototypes.

Prototype School Designs in Smaller School Districts

There are many examples of smaller school districts across the United States that have used or are currently using prototype school designs. Typically these school districts are experiencing an enrollment surge and need more than one school of a specific grade configuration. The primary goal is to reduce architects’ fees. There are also other benefits such as combining two or more schools on the same bid to achieve lower bids and increase construction efficiencies. The same design for a number of schools can address equity issues across a district.

As an example, the four (4) prototype schools that the City of Haverhill, Massachusetts, built in the 1990s were needed to accommodate a surge in K-5 enrollment. However, the cost savings of 2% in the fee for the second school was more than offset by the additional cost for site development required for the second school. A site-specific design would have resulted in more overall savings to the City. Since the third and fourth schools were built five (5) years after the first pair, the plans had to be modified to respond to code changes, educational program changes and lessons learned. The fees for the second pair of schools were adjusted and the savings reduced. However, the rate of change orders was lower for the third and fourth schools. (J. Miller, personal communication, July 2006)

The Superintendent of Schools, Dr. Thomas Fowler-Finn considers the use of a prototype design in Haverhill to be a complete success. The bond issue was passed in part due to the expectation of savings that would result from a prototype design used four times. The design received the 1994 William W. Caudhill Citation awarded by American School & University (J. Miller, personal communication, July 2006).

This one-time use of a prototype school design in response to an enrollment surge is typical of the use of prototype designs by many school districts. The expectation of significant savings from reduced fees was not realized. At best, the savings are a very small percentage of the total project cost. In many cases the cost is increased. There are, however, other benefits such as equity of educational facilities within the district, operational and maintenance savings resulting from the use of the same materials and building systems, and construction economies resulting from multiple schools being bid and construction by the same contractor.

However, few communities who attempt to build schools from a prototype are able to document the benefits experienced by large school districts. While there is less documentation, there is significant anecdotal evidence of communities that have initiated the construction of prototypical schools and are no longer using prototypes. In some case this is simply because they are no longer building new schools but in most cases we have determined that these communities found the benefits were insignificant and that

there are in fact negative impacts that arise from the use of prototypical designs

These negative impacts often arise because the communities do not have the attributes described above. They are not building large quantities of schools. They do not have the internal resources to manage a prototypical school building program cost effectively. They do not have the appropriate sites available and perhaps, often as important, there are variations in the needs of the individual community that cannot be easily accommodated within a “one size fits all” school design. Communities often find that there are significant advantages to be gained by involving the teachers and immediate community members in the design process both in terms of user satisfaction and community buy-in. Conversely there can be a general dissatisfaction with the institutionalized results that can arise from a prototype program.

While it is difficult to pin down an exact district size that assures cost effective use of prototypes, the school districts that are the most consistently successful in their use prototypical school designs tend to be those that are building a large number of school continuously over an extended time period.

Kit of Parts

Kit of Parts is a variation of prototype school design in which schools are designed by architects using a series of pre-approved modules that can be arranged in various configurations so each prototype can be designed to fit different sites.

New York City built twenty (20) prototype schools using the following pre-designed modules: classroom module, administration module, special education module and student commons module. The prototype school design program was conceived to address overcrowding in the 1990s. The program was a success since it resulted in needed schools in a shortened timeframe. The following factors contributed to this success:

- A School Construction Authority was established that could expedite the approval process
- Four (4) experienced and respected architects were hired to design the prototypes, and these firms were selected using a qualification-based selection process and not on the basis of a low bid. (Graves, 1993)
- The Kit of Parts approach allowed each school to be designed for its site and neighborhood.
- The Kit of Parts approach reduced design schedules and allowed the City to provide new classrooms quicker.
- The use of pre-designed modules resulted in the equity of facilities.

Prakash Nair, the Program Manager, acknowledged that the program was a success at the time due to the desperate need for space. He thinks a different approach would be appropriate in the future to achieve a full community partnership and ownership by the community.

During the same period, the City of Philadelphia was also confronted with the need to provide classroom space for a growing enrollment. The architecture firm VITETTA was hired to design a flexible modular prototype design, which was dubbed “Little School House”. Eleven (11) “Little School House” schools were constructed. The repetitive nature of the design resulted in a high level of predictability in cost estimating, scheduling and construction, and resulted in a low percentage of change orders. The design was awarded the Facility of the Month Award by School Construction Magazine. (Richard Sherman, personal communication, December 12, 2003)

The Kit of Parts or modular approach to prototype school design represents a significant improvement over the rigid, “one size fits all” prototype. Although the Kit of Parts prototype programs in New York City and Philadelphia succeeded in addressing a critical classroom need, neither program is active today.

Clearinghouse of Prototype School Designs

The clearinghouse or library of prototype school designs is another variation of a prototypical school design program. California, North Carolina, Florida and Pennsylvania have created websites that feature school designs. The typical goal of a clearinghouse is to make school designs available to school districts to reduce the time it takes to design a school and to reduce fees paid to architects and engineers. We did not find research that evaluated actual savings. There are, however, a number of examples where a prototype school design has been used for multiple schools.

A clearinghouse of school designs has significant benefits that go beyond any savings from reduced fees. Websites provide easy access to successful designs that can inform and educate architects, educational planners, school district educators and administrators, and the public on current trends in school design, best practices and project data, including costs.

A school district can negotiate the re-use of a design with the architect if the design meets its criteria. The school district can also retain the architect to modify a design it likes to adapt to site-specific issues, to meet program needs or neighborhood design criteria. The architect and school district can use the website to see how other school districts solved their unique problems.

The website is an excellent marketing tool for the architect. It also provides valuable information to the architect by providing examples of new educational trends, green

projects, energy saving solutions and many more. Clearinghouse websites can be a valuable service provided by a state.

While websites provide valuable information, the decision to reuse a school design from a clearinghouse requires careful research and planning by a school district. Guidelines on how to use prototype school designs are published by the State of California, State Allocation Board.

Systems Approach to School Buildings

In the 1960s, California, Toronto and Boston developed and used a system approach to school design and construction. The expectation of savings from standardizing building systems and materials while providing interior flexibility were not realized and all three programs were ultimately abandoned.

Factory-built components and standardized building systems are being used and studied by school districts. Clark County is investigating factory-built components and a factory-built alternate was included in a recent bid. Since the alternate bid was not lower than the base bid, it was not accepted. (R. Lorenzo, personal communication, July 2006)

Conclusion

Research clearly demonstrated that there is a strong correlation between the design of a facility and the achievement of the students who attend the school (OPSC, 2003). The Report from the National Summit in School Design, 2006, includes: "School design should create a welcoming and nurturing environment for learning. Schools are a visible and daily symbol to students and teachers of the communities' commitment to education." Schools must be designed to support a variety of learning styles and be healthy, comfortable and flexible. Children's ability to learn can be enhanced by well-designed schools that have addressed design elements such as space, color, daylighting, ventilation, and acoustics.

Four (4) key factors must be addressed in planning a school: Program, Budget, Quality and Time. In most cases these are prioritized and compromises are made. Time becomes a priority when a school district is confronted with increased enrollment and the need to build new schools quickly.

The solution adopted by many school districts is to implement a prototype school design program. Clark County, Nevada, is an example of a school district that was able to meet its need by using prototype school designs. New York City achieved a similar result using a Kit of Parts prototype school design program over a short time frame.

Some large school districts with well-funded and staffed school building divisions have been able to build much needed school facilities in a condensed timeframe while addressing program needs, maintaining a desired quality and keeping within budget. The reduced schedule often results in significant cost savings. Time as a top priority is often achieved at the cost of the planning process. Limiting the community planning process to achieve a shorter schedule by using a prototype must be carefully weighed against the benefits of a site-specific design.

A Kit of Parts approach is more flexible and allows site-specific adaptation and more community involvement. A Kit of Parts approach has many advantages and should be considered if time and cost savings can be achieved similar to those that result from a Clark County model. However, even a Kit of Parts approach requires continual updating and modification.

Smaller school districts confronted with a short-term enrollment bulge often opt for a prototype school design plan. The benefits enjoyed by larger school districts cannot be realized by smaller school districts that are building two (2) or three (3) schools at one time. The anticipated cost savings may not be realized if the selected prototype needs to be adapted to neighborhood requirements or specific site constraints. The school district should analyze the benefits of using a prototype against the real disadvantages. If the goal is to achieve design excellence, the planning process should include the eight (8) recommendations made at the 2005 National Summit on School Design. If cost savings are questionable then a site-specific design should be used.

Our research indicates that statewide prototype school design programs are not effective. Most states that have considered a prototype school design program have rejected it after careful study. Four (4) states have implemented a web-based clearinghouse of prototype school designs.

The goal of a Clearinghouse of Prototype School Designs is to reduce costs by encouraging reuse of existing designs. We found no detailed cost analysis of projects using prototype school designs that would document the cost savings, if any, when compared to site-specific designs.

A clearinghouse website has more benefits as a valuable resource for architects, educational planners, school district educators and administrators, and the public. A logical extension of state run websites currently in use would be a National Clearinghouse of School Designs.

The decision to select a prototype school design from a Clearinghouse of School Designs should be carefully considered since there are a number of problems that may negate any benefit. The following recommendations should be considered:

- Conduct a thorough analysis of any anticipated cost and/or time savings
- Study the design to determine that it will support the educational program and will allow for future changes
- Establish goals for sustainable design (green, high performance) similar to California’s Collaborative for High Performance Schools (CHPS) and measure the prototype school design against them
- Provide for a community process in the selection of a prototype school design;
- Use the architect that designed the original prototype school for reuse to avoid the liability issues and conflicts with architectural registration laws, which may arise if a second architect is retained;
- Provide a Lifecycle Cost Analysis to determine the long-term costs of repairs and maintenance;
- Perform a quality control review of the design documents; and
- Perform a value engineering review of the design documents.

If a school district decides to develop one or more prototype school designs to use over a period of time, the recommendations listed above would be relevant. In addition, the school district should:

- Use the eight (8) recommendations included in the Report from the National Summit on School design;
- Allow time to develop each prototype—a good prototype takes additional effort to develop;
- Design the prototype to facilitate educational changes;
- Use a quality-based selection process for architect selection. Hiring an Architect based on fee bidding may not result in design excellence; and
- Consider using a modular or Kit of Parts approach.

Based upon our review of literature related to prototype school design and school districts that have used prototype school designs, the evidence leads to the following conclusions:

- State-run Prototype School Design Programs are not practical and will not result in cost savings.
- Prototype School Design Programs in large school districts can result in significant savings in time and cost when a large number of school buildings are being built within a short time frame.
- There is a lack of research that documents cost savings when a school district used a prototype design that required modification for site adaptation, educational program changes or code changes.
- Web-based clearinghouses of prototype school designs are a valuable resource. However, there is a lack of research that documents cost savings from the reuse of these plans as well.

- A Kit of Parts approach to prototype school design has been used successfully when a large number of school buildings are being built within a short time frame. This variation of a prototype design addresses a number of the disadvantages of a the one-size-fits-all approach.

Educators advocate that schools should be designed to meet the needs of the individual student. Architects and educational planners advocate that schools should be designed to take advantage of and respond to site-specific characteristics. The report from the National Summit on School Design and the Council for Educational Facility Planners International’s Guide for Educational Planning strongly recommend a public planning process. A site-specific design process is the best way to respond to these goals and recommendations. The decision to use a prototype design is usually a trade off and should only be made after a careful analysis of the benefits and disadvantages.

Our research found a lack of data that compares the cost of designing and constructing a prototype school with the cost of designing and constructing a non-prototype school. Most studies are based on surveys, opinions and anecdotal reports. While this is all useful information from which to make a decision, it would be helpful to have more analytical data. This would help to inform the ongoing debate on the use of prototype schools.

Appendix

List of Benefits and Disadvantages When Prototype Schools Are Used

The studies, reports and papers that have been written about prototype school design list many of the same benefits and disadvantages of using prototypes.

Benefits

- Reduced time for design and construction.
- Reduction of costs.
- Provides design consistency and equity of facilities.
- Prototype designs can be improved from lessons learned.
- Review and approval processes are faster.
- Savings are realized through bulk purchasing.

Disadvantages

- Expectations are unrealistically high.
- Anticipated cost savings are not realized.
- Prototype School Designs are not effective when used as a “quick-fix” without proper research and planning.
- Modifications are required due to site, educational needs, product and code changes, potentially negating cost savings.
- Community control and involvement is reduced or eliminated, reducing neighborhood pride and ownership.

- Lack of design diversity.
- Costs of developing a pool of designs may exceed potential savings.
- Prototype school plans have a limited shelf life due to changing educational needs, code changes, availability of new materials and systems.
- Problems are created regarding architectural registration laws, copyright laws and liability insurance coverage.
- Prototypes cannot accommodate unique educational programs, teacher input, differing sites, number of students and grade configurations in as effective a manner as site-specific design.
- Prototype design programs operated by a state or a large school district require a large staff for administration and quality control.
- Prototype school designs cannot offer the benefits of a site-specific design.
- Poor designs can be perpetuated and errors can be repeated.
- Prototypes can result in higher costs due to a lack of competitive bidding if proprietary specifications are used.

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