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ABSTRACT

This document reviews the literature previously announced in RIE that is concerned with the renovation and modernization of obsolescent school buildings. The bulk of the literature emphasizes the use of modular components for both support systems and unique learning environments. Topics covered include planning, modernization techniques, modification designs, cost estimates, space analysis, and mechanical systems. (Author)

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Building Renovation and Modernization

Alan M. Baas

Too often the deterioration of a school building becomes evident only after a stream of minor repair costs has cut deeply into available funds. At such a time there is a hesitancy to take such a major step as an overall renovation program simply because so much money has already been invested in the existing structure.

However, for a majority of the schools built in the 1950s or earlier, renovation and modernization is becoming a necessity. Beyond the physical considerations of structural deterioration and service system obsolescence, contemporary instructional techniques call for vast changes in the nature of the school building.

New modular scheduling techniques require a wide range of variable spaces. Growing interest in instructional materials and media centers suggests innovative reevaluation of traditional library and audiovisual spaces. Advancements in vocational training programs demand modernization of shops to accommodate new equipment and provide greater flexibility for student projects.

Fortunately, educators are becoming aware of the financial traps represented by aging facilities and piecemeal solutions. They are beginning to treat the school building as a total system where individual maintenance and modernization needs are evaluated with respect to the building's future worth as an educational environment.

The literature in the field does not lend itself readily to categorization. Documents range from a state-wide general

feasibility study to case studies of specific renovation projects. The bulk of it emphasizes the use of modular components for both support systems and unique learning environments. For additional information the reader should make use of the vast array of material available from the architecture and building trade journals on various specific aspects of construction. The next review in this series will be devoted to "systems building techniques" as applied to new school construction. Much of the data contained therein will be applicable to renovation and modernization problems.

All except five of the documents are available from the ERIC Document Reproduction Service. Complete instructions for ordering documents are given at the end of the review.

PLANNING FOR MODERNIZATION

A report by the Washington State Board of Education (1963) concludes that modernization of school buildings is feasible if the cost does not exceed 20 to 40 percent of the cost of new or replacement construction. Variables influencing modernization requirements include site, type of interior and exterior construction, and number of teaching stations.

The document stresses that the teaching staff must correlate educational changes with proposed building changes and that building changes should also be reviewed in coordination with the local planning commission, fire and health officials, engineering office, and architectural services. Of incidental interest in this study are a formula for state aid to help defray modernization costs and a statement of the role of the state education department in modernization programs. The appendix includes the preliminary modernization survey instrument developed in the Washington program.

Jackson (1961) presents information regarding causes and effects of school building obsolescence, reasons for abandonment, and problems in the modernization process. His report details building materials, surface treatments, and construction costs for interior partitions, and supplies criteria for flooring materials, maintenance, and functional properties of materials. Finishing materials, acoustics, reverberation control, and insulation of ceilings are also discussed. He stresses that school boards must seek skilled advice when contemplating modernization.

A textbook by Leu (1965) on planning educational facilities contains a chapter on modernizing school buildings. Other sections of the book discuss the historical development of educational facilities and methods of determining school building needs.

Preprimary education receives attention in the reports of the Conference on Planning and Development of Facilities for Pre-Primary Education (University of Georgia 1969). The conversion and modernization of facilities is one of eleven topics discussed at the conference. Other topics detail related information and provide useful background materials for the administrator considering renovation.

GREAT CITIES PROGRAM FOR SCHOOL IMPROVEMENT

A detailed report of a workshop (Research Council of the Great Cities Program

for School Improvement 1965) provides criteria for evaluating and procedures for saving older school buildings. The report points out that population pressure, economic necessity, and sentiment are the main reasons for saving such structures.

It recommends that the adequacy of school buildings be evaluated in terms of educational requirements, administrative functions, safety, operations and maintenance, pupil capacity, aesthetics, site adaptability of structure for conversion, and the financial ability of the district. Other considerations are:

- fire resistance of building
- capacity for future enrollment
- age and need for repair
- environment—light, heat, and ventilation
- degrees of alteration required for modernizing
- location and size of site in relation to future enrollment
- factors of cost
- integration and community redevelopment plans

The study includes the criteria for contractors' evaluation of plumbing, heating, electrical facilities, ventilation, and structural renovations of the buildings. In addition, school modernization programs conducted in fifteen major cities are reviewed.

A geometric approach to school modernization is explained by Graves (1967), project director of school facilities for the research council. Graves summarizes the investigations of the research council that led to Project TACTICS (Technological/ Architectural Coordination To Improve City Schools), which advances the idea that old and obsolete school facilities, particularly those in large cities, can support a flexible system of readily transportable learning shelters.

This system consists of "component units" constructed for arrangement in a variety of interconnecting patterns. Such a system, according to Graves, would be more sensitive to fluctuating enrollment needs and changes in educational methodology than are conventional building solutions and would be available to provide immediate shelter structures for emergency situations.

Graves delineates realistic modernization programs undertaken by the Great Cities to explore the new functions and activity relationships embodied in the project. He concludes that a maintenance- or rehabilitation-oriented approach is not a realistic answer to continued facility usage. In addition, he notes guidelines showing that project feasibility should be questioned if modernization costs for an additional twenty to thirty years approach 50 percent of estimated replacement costs.

NEW LIFE FOR OLD SCHOOLS

New Life for Old Schools, a newsletter published by the research council from September 1965 through October 1968, summarizes its research and experimentation in the problems of school modernization and renovation. Various issues provide background perspectives, discuss specific solutions of individual problems, and detail aspects of the "component approach" to mechanical systems and transportable teaching-learning shelters. Due to the unavailability of the majority of these newsletters, only those listed in *Research in Education* are considered here.

Decision-making criteria for the administrator who must either remodel or rebuild are given by Shobe (1967) in newsletter

sixteen. These criteria include construction quality, room size, site capability, and architectural remodeling potential. The same issue gives diagrams and brief analyses of five approaches for creating additions to existing schools: perimeter, short link, long link, plug in, and phased construction.

Educational adequacy is rated more important than building age in newsletter twenty-two. L'Hote (1967) describes building techniques that meet changing educational needs through renovation rather than new construction. He stresses that important criteria in the modernization process include provisions for teaching needs and educational methods as well as such physiological provisions as lighting and climate control.

Ensign (1968) compares the advantages and disadvantages of renovation and new construction and relates them to changing educational needs and methods. He emphasizes utilizing existing structures through renovation and provides a formula for comparing renovation with new school construction costs. Also included are examples of the successful renovation of gymnasiums, auditoriums, and classrooms.

RESEARCH COUNCIL DESIGN SOLUTIONS

Other documents published by the Great Cities research council describe in detail the renovation and modernization techniques applied by member cities to specific school buildings.

A description of the Pittsburgh master plans for achieving educational excellence and racial and cultural integration introduces a study of the Liberty Elementary School (1967b) in that city. Proposed urban design solutions for the neighborhood encompass new housing, traffic circulation, parking provisions, landscaping, and developmental phasing.

School design solutions were limited because of district policies on facility modernization costs and the need to continue using the school during its modernization. The solutions described in this report were developed by architectural students who worked in conjunction with six specialists in school facilities design.

Further design alternatives are illustrated in a document discussing the modernization of Pittsburgh's Wightman Elementary School (1967c). A comparison of modernization costs with replacement costs is included with cost and space analyses and a discussion of such design influences as the site, the educational specifications, the school district policy, the legal restrictions, and the existing facility.

The five winning entries in a design competition for the renovation of New York City's Joseph H. Wade Junior High School are explained and illustrated with diagrams, plans, sections, and perspectives in another document published by the research council (1967a). Major emphases are divided into four areas: space and flexibility to accommodate new educational concepts, semi-autonomous subschools for different student population cross-sections, enlarged resource amenities and guidance facilities, and special instructional media installations.

MODERNIZATION SOLUTIONS IN ENGLAND

Two documents by England's Department of Education and Science approach

the problems of school modernization and expansion in that country. The first (1966) discusses the need for additional facilities to accommodate increased numbers of students at the secondary level. Suggestions for a range of buildings using standard components to provide extra teaching accommodations are related to the educational approach underlying the design studies. Technical illustrations are included with a number of sketches demonstrating the proposed solutions.

The second document (1967) deals with the planning problems of developing comprehensive schools (age range 11-18) that incorporate existing school buildings. The report describes five case studies illustrating the resolution of these problems. In each case it explains the organization of accommodations for individuals, social groups, work groups, teachers, staff, administration, circulation, and the site.

A document published by the Ministry of Education (1963) presents experiences gained from school building renovation projects in England. A brief discussion of several general principles and practical considerations is followed by case studies of a girls' high school and five primary schools. The development plan, planning considerations, treatment of the facilities, and costs for each case study are explained. Site plans, floor plans, sketches, and photographs illustrate each major area of discussion.

FURTHER DESIGN SOLUTIONS

A speech by Moore (1961) points out that increased enrollment and extended use have rendered inadequate such facilities as cafeterias, libraries, physical education facilities, auditoriums, play areas, and the general lighting and interior environments of many school buildings. As a possible solution to building needs where the site prohibits expansion, Moore suggests the construction of stack classrooms as two-story units.

Taylor and Hull (1969) discuss principles of building redesign with respect to the development of instructional materials centers in older buildings. Their report includes experiences in remodeling Madison, Wisconsin, elementary schools.

Price (1966) describes the conversion of a limited-use, "white elephant" auditorium into a flexible instructional space with electromechanical aids to provide numerous educational potentials.

As Kohn (1967) points out, high school auditoriums are often much too large, serve a limited number of functions, and are unused a major portion of the year. He presents modification designs aimed at making auditoriums more usable for such diversified functions as small lectures, lunchrooms, and libraries.

A document published by the Educational Facilities Laboratories ([1968]) reports on the purchase and conversion of commercial and industrial structures for use as teaching facilities. To consider this purpose, the Philadelphia Board of Education purchased a six-story fireproof loft building. The EFL-funded study investigated the possibilities and limitations of conversion and identified the capabilities and difficulties of such an approach. The report is divided into a description of the spatial and structural characteristics of the loft building, an analysis of its capacity to meet general design criteria for teaching spaces, an outline of the program for an intensive learning center,

and a design proposal incorporating specific design recommendations.

MECHANICAL SYSTEMS

Rutgers (1969) focuses on the modernization of mechanical systems in relation to school building renovation. He points out that, according to school management publications, approximately 42 percent of elementary and 59 percent of secondary schools are fifteen years old or older.

School plants built twelve to fifteen years ago are today second-class facilities deserving more attention than they receive—particularly their thermal and acoustical environments. When mechanical equipment is to be modernized, Rutgers urges that a qualified mechanical engineer and a mechanical contractor write a combined report relaying the existing condition of the system and estimating the cost required to update it.

Price (1961) discusses when a school board should consider modernizing mechanical and electrical equipment and explores the specifics of lighting, heating, and ventilation. Besides stressing the need for research on air conditioning in existing buildings, he emphasizes its importance in the construction of new buildings. He also provides technical data on types of light fixtures and their output in terms of foot candles.

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RESEARCH HIGHLIGHTS

- Educational obsolescence and poor location are major reasons for inadequacy of existing structures. *(Jackson 1961)*
- Building deterioration is usually manifested in several areas simultaneously:
  - inadequate interior plumbing
  - no central heating
  - insufficient lavatory facilities
  - outdated service systems
  - library and AV facilities too small
  - cafeterias and gymnasiums inflexibly designed *(Jackson 1961)*
- If modernization costs for an additional twenty to thirty years approach fifty percent of estimated replacement costs, project feasibility should be questioned. *(Graves 1967)*
- Population pressures, economic necessity, and sentiment are found to be main reasons for retaining obsolescent structures. *(Research Council 1965)*
- Planning must be comprehensive if economies are to be obtained, meaning that all the areas requiring modernization must be identified and incorporated into a central design program. *(Shobe 1967)*
- Professional help should be consulted throughout the planning process. *(Jackson 1961)*
- The same engineer and architect should be retained for structural and mechanical planning. *(Jackson 1961)*
- The remodeling of commercial buildings such as warehouses has provided some school districts with workable solution to their modernization needs. *(Educational Facilities Laboratories [1968])*
- Modular components and systems approaches currently used by the building industry can greatly assist the development of cost-effective flexible spaces. *(Graves 1967)*

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