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ED 015 620 EF 000 467

MATERIALS FOR MODERNIZATION.

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PUB DATE 61

EDRS PRICE MF-$0.25 HC-$0.36 7P.

DESCRIPTORS- *BUILDING IMPROVEMENT, *BUILDING MATERIALS, *CEILINGS, *FLOORING, *SPACE DIVIDERS, ACOUSTICAL ENVIRONMENT, BUILDING OBSOLESCENCE, FLEXIBLE FACILITIES, PHYSICAL DESIGN NEEDS, PSYCHOLOGICAL DESIGN NEEDS,

CHOICES AND ISSUES IN SELECTING MATERIALS FOR MODERNIZATION OF SCHOOL BUILDINGS ARE DISCUSSED IN THIS REPORT. BACKGROUND INFORMATION IS INTRODUCED IN TERMS OF REASONS FOR ABANDONMENT, THE CAUSES AND EFFECTS OF SCHOOL BUILDING OBSOLESCENCE, AND PROBLEMS IN THE MODERNIZATION PROCESS. INTERIOR PARTITIONS ARE DISCUSSED IN TERMS OF BUILDING MATERIALS, SURFACE TREATMENT, AND CONSTRUCTION COSTS. CRITERIA FOR FLOORING INCLUDE MATERIALS AND MAINTENANCE AND FUNCTIONAL PROPERTIES OF MATERIALS. CEILINGS ARE MENTIONED WITH RESPECT TO FINISHING MATERIALS, ACOUSTICS AND REVERBERATION CONTROL, AND INSULATION. GENERAL COMMENTS ARE INCLUDED ON PLANNING FOR MODERNIZATION. (MM)

Materials for Modernization

by R. Graham Jackson*

THE LIFE CYCLE OF SCHOOL BUILDINGS CAN BE CONTROLLED, TO A CONSIDERABLE EXTENT, IF MODERNIZATION IS WELL INTEGRATED INTO THE TOTAL, LONG RUN SCHOOL PLAN

The most common reasons for the abandonment of school buildings are: educational obsolescence, poor location, lack of interior plumbing, lack of central heat, lack of hand washing facilities. These facts are brought out in a study by Professor A. Benjamin Handler of the University of Michigan. In most situations the discarded schools suffered from more than one defect.

Professor Handler points out that educational obsolescence is undoubtedly more important than indicated by his survey. Many of the defects in plumbing, heating and safety could be corrected if the building were usable otherwise. Educational obsolescence and poor location consequently assume even larger roles as reasons for abandonment than is immediately evident. If legal grounds must be established for abandonment, the justification is made in reference to safety and health in almost every instance.

In our rapidly changing society, much may happen in twenty years to affect the standards of adequacy in school buildings. New techniques and methods may render certain parts of a school building obsolete and considerable capital outlay may result. Such development is most likely to occur in two areas:

1. Service systems involving heating, lighting, and plumbing.

2. Curriculum and teaching methods.

During the first twenty year period in the life of school buildings and even for ten to fifteen years thereafter, capital outlays for modernization are likely to be piece-meal and sporadic. After about twenty years the school building enters the second phase of its life cycle. Deterioration has been gradually setting in as a result of use, weather, and general aging. The effect is a gradual increase in the

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annual maintenance costs as more parts of the building and its fixed equipment wear out. During this third decade the number of defects becomes marked and much of the equipment needs to be replaced. The jolting discovery may be made that one of the service systems or the roof needs to be replaced. Often this discovery coincides with the recognition that the building requires general overhauling. The brickwork needs re-pointing, light fixtures need replacing. When faced with such problems, school administrators and school boards are inclined to see them singly and treat them as they do smaller problems of maintenance and repair, in a piecemeal fashion. One project after another is tackled, with an occasional lumping together of projects. Sometimes a general overhaul occurs, including the structure and the service systems. The most up-to-date items feasible in the circumstances are installed. Equipment required because of educational development is added; but whatever is done is unlikely to involve complete modernization and the things that are done are not well integrated into the total school plan.

Materials for use in a modernization program should be chosen with greatest care. Appearance, utility, and cost of maintenance are all factors to be considered. Initial cost and anticipated life of materials are also important.

The cost of interior partitions amounts to nearly one-sixth of the cost of the school building. Costs of partitions plus ceilings, finished floors, and built-ins (and including painting) amount to nearly one-quarter of the total cost.

Yet clear cost advantages are difficult to define because maintenance costs may be as important a consideration as initial cost. The following comments are suggestive of some of the choices and issues. They are far from exhaustive.

<u>Interior Partitions</u>: Opinions regarding interior partitions vary as much as their costs. There is a tremendous range of acceptable partitions. Essentially, there are three issues in addition to cost: <u>flexibility</u>, <u>acoustics</u>, and <u>esthetics</u>. In many localities the least expensive classroom partition will be a lightweight aggregate concrete block, painted. This economy can be lost if care is not taken in locating conduits and pipes or if blocks are laid with fashionable stacked joints (all vertical joints in a straight line). Such walls present problems of sound transmission. Plastering on one side only or spraying with plastic on both sides will improve their acoustic qualities. But such walls, while they are acceptable to many, still remain esthetically unsatisfactory to some. One architect has written of them as "a material fit for garages and basements, not for walls within which one wants to live, learn, or teach; rough and clammy to the touch, wet in Summer, cold in Winter, hard characterless, etc., it cracks, it peels, it cannot be laid straight. . . enough said. . ."

Further, such walls do not provide the vaunted flexibility so often claimed. The statement that these wells can be "knocked out with a hammer" is fantasy. . . .they are almost never destroyed. Once up, they are there for good. For who, without a feeling of guilt, will assume responsibility for destroying or otherwise disposing of public property?

Steel studs or wood studs with half-inch thick dry wall applied with taped joints on each side provide low cost, acoustically satisfactory partitions.

Prefabricated metal partitions of the type ordinarily used in offices will be expensive initially, especially for good ones which provide the needed acoustic isolation. The additional cost will not be justified unless they will be moved several times in the life of the building. But at least their movement does not involve their destruction, for they are movable.

The amount of floor space occupied by the partitions should also be considered in looking toward economy, particularly in large schools where it mounts up.

Protective surface treatment of at least the lowest third of interior walls is highly desirable or absolutely required according to the importance attached to maintenance. This protective wearing surface, should be of a material that does not soil, or show that it has been soiled, and should be easily cleanable. It should require no refinishing to be restored to its original condition. In other words, it should be impervious, hard enough to resist denting or scratching, but also pleasing to the eye in color and texture, smooth, warm, soft to the touch, and free of glare. Which of these conflicting requirements will be given preference will depend on whether the choice will be made from the point of view of the child or of the custodian -- each has valid claims for preference. In classrooms, the wainscot may be, in the reverse order of their first costs: Plywood, plastic (vinyl), or plastic laminate (formica). In corridors, in addition to these: ceramic tile, glazed ceramic units (glazed terra cotta), and glazed brick are often chosen. The cheapest alternate to all these, applicable to concrete block walls only, is the very serviceable vitreous coating (spectra-glaze). The desirability of ceramic tile for walls of toilet rooms, kitchens, and backs of sinks even in classrooms is well known. Applied plastic films may cost 75 cents or more per square foot. Their economy against paint at 6 cents per square foot is open to question. It is doubtful if their life will justify the difference.

Flooring: Flooring offers perhaps the clearest and easiest to understand case study of low initial cost and high maintenance versus high initial cost and low maintenance. Pick any period of time and there will be a most economical flooring. But we cannot ordinarily know in advance the period for which the building will be used, or when major remodeling will occur. Furthermore, because the flooring materials industry is extremely competitive and continues to develop new, better, more economical, and more suitable floorings, we can look for considerable future advancement. The floor you wear out ten years from now will likely be replaced with a flooring not now available.

In classrooms and for general use, 1/8-inch asphalt tile floors provide good economy. The grease-proof type can be used in cafeterias. The premium cost of 3/16-inch tile is not justified by additional length of life as tile is usually replaced because of cupping or brittleness before it wears through. The cost of vinyl asbestos tile is almost double. It is true that vinyl tile can be used without waxing for awhile (usually not over six-months), but once it has been waxed the cost of upkeep is about the same as for asphalt tile. Terrazzo floors cost more, last longer, are easier to maintain, and are usually only justifiable in halls. Among the special purpose floors for toilet rooms and kitchens, ceramic tile floors are generally considered essential for long-term economy.

Quarry tile, long a favorite with kitchen planners, is made to stand up under the wheels of industrial trucks, its application in school kitchens can waste money on unused qualities unless heavy traffic indicates its use.

Gymnasium floors of maple are ordinarily considered necessary for competitive games, although they are expensive and costly to maintain.

For playroom use and for the elementary school gym cork asphalt pavement and plastic cork tile have lately entered the competitive field. The latter, made with a plastic binder combines the softness, insulating qualities, and resiliency of cork tile with the permanence of an impervious plastic surface and pleasing colors. Stage floors must always be non-splintering soft wood, which is easy both to put nails into and to pull nails out of.

Vestibule floors must be non-slip, neither affected by water nor eroded by the daily rubbing in of sand and clay or by the scuffing of black composition soles. Here may be the only economically justifiable use of slate, flagstones, brick pavement, or quarry tile; the smallness of the areas involved allows the best suitable flooring to be selected regardless of the cost. For storage rooms, shops, closets, receiving spaces, boiler rooms, and other areas of hard wear where there is no need for appearance, trowelled concrete with a surface hardener should be used. It is uneconomical to paint concrete floors because of the need for frequent repainting. If a concrete floor is going to be painted for improved appearance, it is more economical to install asphalt tile in the first place. Concrete floors are acceptable for use in corridors only if part of an extreme austerity budget.

<u>Ceilings</u>: There is a tendency to think of a ceiling as being merely the underside of something else (floor or roof above), which has been chosen for other considerations before the ceiling was thought of as such. This line of thinking sometimes lets the choice of ceiling deteriorate into a process of making the most of what we have.

A ceiling as the finished or unfinished underside of the framed floor or roof above provides economies on a limited scale. Occasionally the saving of the cost of a furred ceiling can be nibbled away if there is increased cost of finishing or painting the exposed framing members or fitting acoustic or other finish materials to the underside of deck or girders, or if there is extra expense for exposed piping and wiring and even duct work or installing lighting. If finishing materials such as acoustic tiles are used, their cost represents the greater part of any ceiling, furred or exposed. Nevertheless, the system employing a type of deck the underside of which has acoustic properties, remains the most economical ceiling. Exposed structural members often contribute to the esthetics of the building. Furred and finished ceilings are the alternate choice, desirable in classrooms because they provide:

1. Space between finished ceiling and framed deck in which to run pipes, wiring, ducts.

2. Cheap insulation of an air space if there is roof above.

3. Level unbroken surfaces, to which to apply finish, to space lighting fixtures, and to serve, if so designed, as light reflector.

4. A finished appearance.

Furred ceilings of plaster or fire code plasterboard will sometimes add half to one-hour fire resistance to unprotected steel framing, which is rated at no resistance at all.

Among the means of reverberation control within the classroom are: Acoustic tiles fastened to all or part of the ceiling and/or upper reaches of the walls, heavy drapes, rugs, and students, all of which absorb sound. It has been found that two or three rows of tiles on the wall and the same amount on the ceiling along the line where walls and ceilings meet, are as effective as, or more effective than, tiles over the entire ceiling in typical classrooms. Often tiles on half the ceiling are enough. An excessively dead (acoustically absorptive) classroom will put a strain on the teacher who must make himself heard and the children who must hear and be heard. But acoustic problems, like other school building problems, must be approached room by room, school by school.

Acoustic tiles may be of perforated or fissured vegetable fiber or of many other materials. The greater the thickness, the more effective they are, although the differences in effectiveness are basically insignificant. Normally they range from 60 per cent to 80 per cent absorptive.

Vegetable fiber tiles are combustible even when flameproofed, and they should only be applied to a solid fire resistant surface such as plaster or plaster-board not laid in a grid of open framework (suspended ceiling).

Mineral fiber tiles should be used in damp locations (kitchens, locker rooms, certain shops) where fire resistance is important.

Perforated metal (aluminum or painted steel) or perforated asbestos sheets, all backed by an absorbent blanket of Fiberglas, are fire resistant and will stand dampness; for large unbroken ceiling areas where the economy of large units becomes effective, they are almost competitive in price with the vegetable fiber tiles. They are especially adapted to use in kitchens, corridors and lobbies.

The simplest and cheapest form of acoustical insulation, one perfectly acceptable for gymnasium and shops, is the use of a type of roof deck, the exposed underside of which has acoustical properties. These may be either lightweight prefabricated panels or gypsum or lightweight concrete poured over a permanent form of acoustical fiberboard. For furred ceilings, acoustic plaster is also available, but it is seldom competitive in price with other forms of sound absorption. It loses its acoustical value after several coats of paint. Another tool of the acoustical engineer is the design of the shape of the ceiling (and even of the walls) the use of baffles, directional breaks, and reflecting, sometimes floating, surfaces used in the same manner in which the lighting engineer uses wall and ceiling surfaces as light reflectors.

The special acoustical problems of music rooms, auditoriums, and large group teaching rooms usually call for an acoustical consultant.

The decision to modernize is probably the least rational of any building decision made by the average school board. It is usually taken with the least skilled advice and the least foresight; and is usually based on the least amount of data. Since it aims at the same objectives as new building and involves comparable amounts of money, a comparable degree of study and of architectural and engineering skill should enter into the decision. The question is the ratio of benefits received to money spent over the remaining useful life of the building. Whether this ratio is greater for a modernized building than for a new one or for the old one maintained un-modernized should constitute the crux of the decision and this problem is seldom seriously analyzed.

If a building is properly constructed and well maintained, structure and fire hazards should present no problem. Proper planning can practically eliminate inadequacies of site and physical environment and can go far toward preventing a school from becoming poorly located with respect to the school population and organization. We can do a great deal to make school buildings adaptable to the future technological changes in service systems and future changes in educational requirements. This does not mean that we should try to go on using our school buildings indefinitely. Adaptability has its limits and unforeseen changes are bound to somewhat upset the best of planning. What it does mean is that we should eliminate some problems, cut down the magnitude of others, plan for modernization, and try to foresee the need for abandonment as far in advance of the actual event as possible. If we adopt such a course, we can, to a considerable extent, control the life cycle of school buildings in the interest of obtaining the best possible facilities for our ever changing educational requirements at the lowest long run cost.

Someone has said that a good school fits its neighborhood in many different ways. A good school not only fits its neighborhood, it also fits its community's educational goals and its tenant -- the children who are educated in that school.

When modernization is being considered, the school board should seek skilled advice in the same manner that they seek it when planning a new building. A comparable degree of study by Architects, Engineers and School Consultants should enter into all of the decisions that are made