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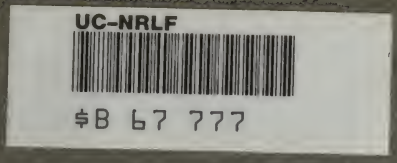

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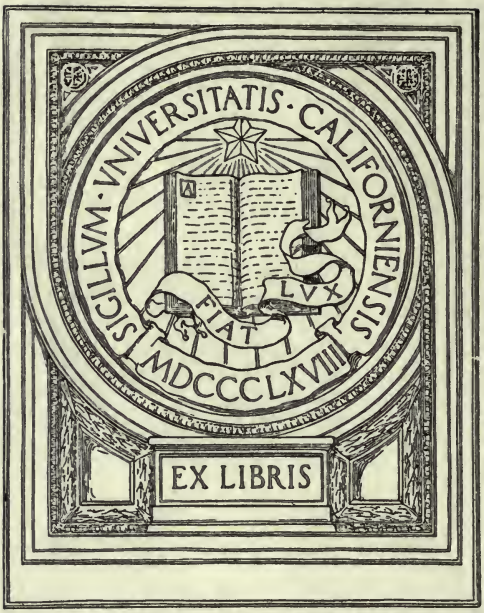
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CONCRETE SCHOOL HOUSES

UNIV. OF CALIFORNIA

PUBLISHED BY THE

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BELLEVUE COURT BUILDING, PHILADELPHIA

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A REQUEST TO THE READER

FREE HELP

SHOULD you find this bulletin helpful in building with concrete, we would consider it a favor to have you so inform us. Likewise, we would appreciate a description (and a photograph, if possible) of what you have built. In this way you will assist us in aiding others in the same way we trust we have helped you.

If you do not fully understand any part of this book, or if you desire further information, we would be glad to have you write to the

ASSOCIATION OF
AMERICAN PORTLAND CEMENT MANUFACTURERS

BELLEVUE COURT BUILDING, PHILADELPHIA, PA.

UNIV. OF CALIFORNIA

Concrete School Houses

AS IS the case in many of the institutions of our country, the school house is the result of a process of evolution or growth from small beginnings. Our first efforts toward education were carried on in private houses under the tutor system, in the "dame school" of New England, and in the log school house of pioneer days.

The school house has expanded in size with the increasing attendance and the development of the curriculum and educational system. Unfortunately, the standards of construction did not keep pace with the progress of education. While the larger schools were not built entirely of frame, and had masonry walls, the floor, stairways, and all the inside trimmings were of wood. These structures were called "fireproof!"

In concrete is the latest and probably the final development of school house construction. The number of these buildings is constantly increasing and will continue to do so as their advantages are more fully understood.

The Advantages of Concrete in School Houses

Fireproof Qualities.—When one is asked the chief requirement of a school house, there is no doubt or hesitancy in the reply—fireproofness. Not practically fireproof or almost fireproof, but *absolutely* fireproof. It is astonishing that school boards and officials, who as fathers give their children every protection that love can grant, should authorize the construction of school houses which, if not veritable fire-traps, are still far from fireproof or even fire resistant.

The reason for this seeming indifference or error in judgment is the fact that the types of school houses which have been built for the past fifty years were considered fireproof. That this is not the case is demonstrated in a terrible manner in a catastrophe such as that of the fire which destroyed the Lake View School at Collinwood, Ohio. In this building 165 children lost their lives, and yet before the fire doubtless most persons would have asserted that this school was "practically fireproof." No building, no matter of what the walls are composed, having combustible floors can be

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FIG. 1.—MONOLITHIC CONCRETE SCHOOL HOUSE, MINEVILLE, N. Y.

considered as proof against fire and a safe place to shelter children assembled in large numbers.

All the large office buildings, banks and institutions are of the most improved construction, made fireproof by every known method, with ponderous vaults to safeguard books, documents, records and currency. In contrast to this, the school house sheltering our children, who are more precious than all the stored wealth of the world, is built often in a haphazard fashion, without thought of its lack of protection from fire.

That reinforced concrete is the most fire-resistant construction known is conceded by the foremost engineers and architects. Not only is it fire resistant, but is a fire preventive. Figure 3 shows a corridor in the Norfolk High School. A glance will show that it is impossible for fire to spread along such a passageway. For example, should a fire begin in the woodworking shops, which are at the right on this corridor, the flames would be confined to that one room owing to lack of material for them to feed upon.

As an instance of this action of concrete in confining flames the following is interesting. Fire started in the fourth floor of the concrete building of the Dayton Motor Car Works, Dayton, Ohio. This building had been so recently completed that automatic fire doors had not been installed to protect the openings from the new building into an old five-story first-

FIG. 2.—LAKE VIEW SCHOOL, COLLINWOOD, OHIO. THIS FIRE COST THE LIVES OF 165 CHILDREN.

class mill construction building adjoining. The fire started in the upholstery department on the fourth floor of the concrete building, and after burning the contents of this floor spread to the brick building adjoining, where the roof, fifth and fourth floors fell in a charred mass and wrecked the building. The flames were confined to the fourth floor of the concrete structure and the balance of the building was uninjured. Within two days manufacturing on the burned-out floor of the concrete building was resumed.

The Thos. A. Edison Plant fire at West Orange, N. J., is another demonstration of the ability of concrete to withstand fire. Every other type of building which caught fire was totally destroyed, while the concrete structures are intact and are being used again for manufacturing.

The heat of burning contents of a factory imposes a much severer test upon the building than could ever occur in a school house, which gives the latter a large factor of safety.

Maximum Daylight Available.—While the safety of concrete is its great advantage, there are other very attractive points that claim atten-

FIG. 3.—CORRIDOR IN NORFOLK HIGH SCHOOL. NO OPPORTUNITY AFFORDED FOR SPREAD OF FIRE.

tion. In these days of efficiency engineering there can be no doubt of the advantage of plenty of light in the factory and office and therefore equally in the schools. Who can say how often the foundations for future eye trouble are laid in the dark school-rooms which are only too common?

Owing to the monolithic character of the concrete walls and columns and their great strength, large window area is possible. This is particularly true where a reinforced skeleton system is employed and the walls are only a veneer to keep out the elements. Concrete factories have window areas as high as 85 per cent of the total wall area, and it is stated by some owners that the large amount of light increases their employees' efficiency five to ten per cent. If such an increase is possible in the factory, it will be more than possible in the school-room. Children are very susceptible to their surroundings, and the influence of a bright, well-lighted room cannot help but be for increased efficiency.

Sanitary Qualities of Concrete.—Great stress is now laid on the teaching of hygiene and the inculcation of sound ideas on sanitation. As an object lesson nothing can be better than the example of a clean, wholesome, sanitary school. The sanitary qualities of concrete are self-evident. It is needless to say that a building entirely of concrete is absolutely vermin-proof. Where floors join the walls and partitions the floor can be

FIG. 4.—PHYSICAL LABORATORY, NORFOLK HIGH SCHOOL. NOTE SANITARY CONCRETE FLOOR AND ABSENCE OF WOODWORK WITH THE EXCEPTION OF DESKS.

coved or filleted so as to eliminate wooden base-boards and all cracks where dust and dirt may collect. The comparatively slow conductivity of heat by concrete results in a school house that is warm in winter and cool in summer.

Costs of Concrete Construction.—The cost of a building should not be measured by the first cost, but the ultimate cost also must be considered. In first cost reinforced concrete school houses are in general as low as brick and naturally higher than ordinary frame construction. In some cases concrete costs are even lower than for brick buildings with wooden floors. Since costs are dependent entirely on local conditions, such as labor, availability of materials, etc., it is impossible to give data covering all localities and conditions. As an evidence of the low first cost of concrete the following costs, as given by John T. Simpson, C. E., are interesting:

"The Board of Education at Irvington, N. J., a few weeks after the Collinwood fire, brought out plans for the erection of a four-class-room building. The original design called for typical brick walls with wood

FIG. 5.—CENTRAL AVENUE PUBLIC SCHOOL, MADISON, N. J.

floor construction. When the bids were received, it was found that this building could be duplicated in reinforced concrete for three hundred dollars less than the best prices received on the basis of brick and wood, and, as a result, to the town of Irvington, N. J., must be given the credit of being the first to adopt this type of construction for public schools in this section of the country. After several years of service, the building has proved so satisfactory that they have adopted this method of construction for all new school houses.

"While this building was in progress of construction the members of the Board of Education of Summit, N. J., who were planning to erect a nine-class-room and assembly-room building, visited the work and were so well pleased with the construction that they adopted reinforced concrete for their new Lincoln School.

"The neighboring town of Chatham, N. J., a few months later, obtained bids on both brick and wood and reinforced concrete. The result of the bidding showed that a reinforced concrete building could be built for the same price as the building of brick and wood. Unfortunately, however, as is often the case, the appropriation was made before the plans were drawn, and as the bids for a brick and wood building were taken on separate items, the Board was able to contract for as much of the building as the appropriation would provide for, and later made another appropriation to finish the work. This building is an exact duplicate, in floor plan,

Fig. 6.—Lincoln School, Summit, N. J.

of the building adopted about the same time by the Board of Education at Madison, N. J., for their Central Avenue School, and which building was built of reinforced concrete.

"It should be noted that in the Chatham building the second-story walls were but eight inches thick, the cornices were made of wood, the flashings of tin and the ceilings of stamped metal in order to keep the cost as low as possible; but, notwithstanding this, the price for the reinforced concrete building was no more than that paid for the brick and wood structure.

"At Millburn, N. J., competitive bids were taken on brick and wood and reinforced concrete on a four-class-room building. The average bid on the brick and wood basis was five thousand dollars higher than the price on the reinforced concrete basis. One bid, however, on the brick and wood was about the same as the price on the concrete basis. The Board decided in favor of the reinforced concrete building.

"Perhaps the best example of what can be done in reinforced concrete was the result of the bidding on Public School No. 11, at Bayonne, N. J. As this building is larger, the comparison would necessarily be better.

FIG. 7.—ROSLYN FARMS SCHOOL, CARNEGIE, PA. SPLENDID EXAMPLE OF SMALL CONCRETE SCHOOL HOUSE—COST $3,000 COMPLETE.

This building contains twenty-seven class-rooms, teachers' and principal's rooms, library and an assembly hall seating one thousand people. This does not include any of the rooms in the basement, several of which are used for class purposes.

"The lowest bid received on the basis of brick and wood was $132,700.00. The contract for the construction of the building was awarded on the reinforced concrete basis for $111,000.00—a saving of $21,700.00. All bids were without heating and plumbing work."

While first cost is the cost that is usually considered, the maintenance charges are also of importance.

Concrete buildings require practically no maintenance for the structure proper. It should not be considered that concrete is suitable only for large schools, for it can be utilized in small structures which otherwise would be built of wood. Aside from the question of fireproofness, it is here that maintenance costs are of importance. The wooden structure needing regular painting and the replacing of rotting boards is a constantly increasing expense, in striking contrast to concrete, which, besides needing no repairs or maintenance when new, actually grows stronger with age.

FIG. 8.—NORFOLK HIGH SCHOOL UNDER CONSTRUCTION. REINFORCED CONCRETE SKELETON AND FLOORS WITH BRICK VENEER.

Appearance.—On the score of appearance there now need be no hesitation in deciding on concrete. In every locality there is some work in concrete which shows its possibility in securing a surface and form that is pleasing to the eye. These demonstrate that no longer can it be said that concrete surfaces present a cold, uninviting appearance. By employing suitable aggregates and by finishing the surface with scrubbing, tooling, or sand blasting, there is produced a surface uniform in texture and color. These operations expose the aggregates to give the desired color, which, of course, depends upon the original color of the sand and stone.

The use of colored tile inserts and simple, dignified architectural details supply all the ornamentation needed. Ornamental band courses and entablatures over windows and doors are possible with concrete, and the most elaborate undercut details can be employed where required by the architectural design.

Types of Concrete Construction for Schools

Several types of concrete construction are utilized in school-house building. The one best suited for each particular case depends on the size of building, layout, and local conditions.

Monolithic Concrete.—In a monolithic school house there need be absolutely no wood other than furniture, desks and chairs, so that there is

FIG. 9.—HIGH SCHOOL, FORT WORTH, TEXAS. CONCRETE FLOORS AND SKELETON.

practically nothing inflammable in the building. The walls, floors, beams, and columns are all of concrete reinforced with steel in the form of rods, wire mesh, or expanded metal. Partitions are of concrete or cement plaster on metal lath. Stairways are also of reinforced concrete; one or more preferably enclosed with concrete walls so as to form a "tower fire-escape." Such a stairway would allow children on the upper floors to descend safely to the street even though an intermediate floor was a mass of flame. The best construction calls for metal doors and interior trim, metal window-sash and frames, and, where necessary, windows equipped with wire glass.

A building constructed in the manner described is practically a monolith; the walls, floors, beams and columns being all tied together by concrete and steel. Such structures, when tested in conflagrations, earthquakes, and cyclones, have demonstrated that reinforced concrete is the safest and most enduring construction known to man.

Reinforced Concrete Skeleton.—It is sometimes the case that a new building must be erected to conform in appearance to older structures, having walls of brick, stone or other material—or architectural considera-

FIG. 10.—CONCRETE BLOCK SCHOOL HOUSE, STUART, FLORIDA.

tions demand the use of such walls. Under these conditions it is possible to retain most of the advantages of monolithic construction and still comply with the requirements.

This is done by building floors, beams and columns of reinforced concrete, forming a skeleton frame upon which is installed the walls, consisting of a veneer of the desired material, properly tied to the concrete members. In this construction the walls bear none of the load of the floors and act merely as curtain walls to keep out the elements. As the strength of the building is independent of the walls, large window areas can be provided for, as before mentioned.

Concrete Blocks.—In many rural and suburban sections, the small number of pupils requires only a small school house of one or two stories, with only a few class-rooms. It is too often the case that such structures are of frame construction, requiring constant repairs and are always in danger from fire. Concrete blocks are especially fitted for such structures. No wall forms are required and the costs are very low. Blocks with air spaces are utilized, giving a wall that has excellent insulating properties against heat and cold. Such walls, however, are always furred, lathed and plastered on the interior face to prevent any possibility of condensation.

Needless to say, the best principles of concrete block school-house con-

FIG. 11.—JEFFERSON SCHOOL, SALT LAKE CITY. MONOLITHIC REINFORCED CONCRETE.

struction call for concrete floors—reinforced if self-supporting—and concrete stairways. A school house with wooden floors cannot be considered fireproof. The forms for floors are very simple and not costly, consisting merely of a temporary wooden floor supported by wooden studs—all of which are removed when the concrete becomes self-supporting. The floor forms then are used for upper floors or for other purposes.

Where the appearance of concrete blocks is objected to, Portland cement stucco can be applied to the outer surface of the blocks—which in this case are made with plain flat face. The prejudice against the appearance of blocks is now abating to a large extent, because of the improvements in manufacture which secure a more pleasing surface and avoid the imitation of other materials. Very pleasing color effects can be secured by the use of stucco, without, of course, affecting any of the desirable qualities of block construction.

The different types of concrete school houses are each adapted to certain conditions, but all fulfil the paramount requirement, that of safety from fire risk to child life.

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