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Reinforced-Brick Walls Reduce Steelwork

Walls require functional properties not satisfied by prefabricated wall sheets—Same economy provided by reinforced brick, which meets all functional requirements

By L. B. Lent
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THOSE who think of reducing building costs by the use of prefabricated walls or wall sections often forget two important considerations: (1) Outer walls must meet certain functional or service requirements; and (2) their cost represents only a fraction of the total cost of any building.

Wall costs of industrial buildings are usually not more than 15 per cent of the total; and for commercial (office) buildings wall costs are more often a smaller item unless expensive cut-stone covering is used. Hence, reducing outer-wall costs by as much as 50 per cent would reduce the total cost only 7½ per cent. But such a large reduction is highly improbable if all service requirements are to be met.

These essential service requirements are: strength (compressive, flexual and shearing), fire-resistivity, weather resistance and durability. Resistance to heat and sound transmission are important secondary requirements. Pleasing appearance is often a prime consideration.

Functions analyzed

Strength in masonry panel walls stiffens the frame against distortion. Informed designers take advantage of this knowledge to reduce the size, and hence the cost, of the framing members. In panel walls the designer must allow for a strength that will be sufficient to resist wind (and sometimes earthquake) force.

Fire-resistivity is a prime requisite. The outer walls of a fully protected or "fireproof" building must develop a resistance period of not less than four hours, according to most building codes. Not all wall types can meet such a requirement. Solid masonry walls not more than 8 in. thick will do so, but certain metals and alloys (frequently mentioned as rational materials for wall "shells") will not. In fact, most thin metal sections would fail to develop a four-hour resistance period.

Durability is desirable despite some ideas about obsolescence. The investment should be protected for a reasonable number of years. Cheap walls may also be durable, but this is not the general rule.

There is no single material that meets all service requirements in the highest degree, whether it be stone, brick, concrete, steel, aluminum or whatnot. Each may possess superiority in one or more respects, but not in all.

Combination of materials best

Obviously, outer walls may be built of a single material, or of some combination of materials. Some combination would seem to meet all service requirements best. A judicious choice might result in lowest cost. For example, a wall section might consist of

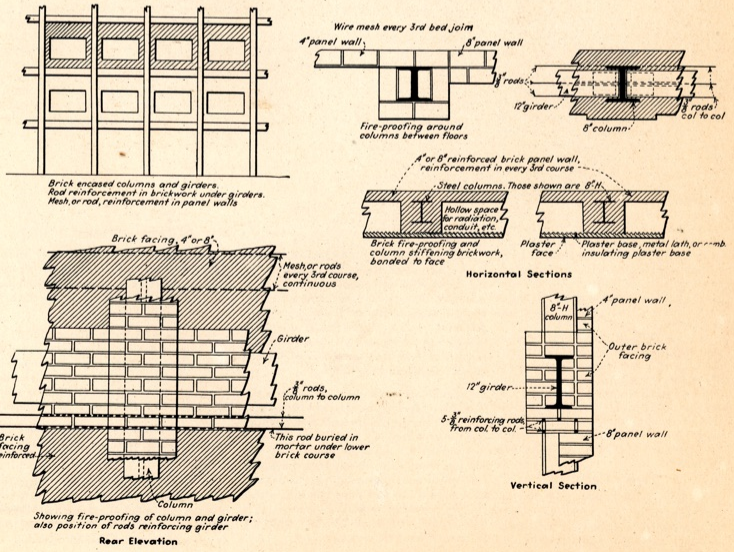


Fig. 1—Details of proposed reinforced-brick wall construction for steel-frame buildings.

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an outer shell that would be fire-resistive, watertight and durable against the severest attack of the elements, adding real strength to the structure and withal possessing beauty; an inner mass or filling that would be resistant to heat transmission and perhaps contribute to the strength; and an inner covering that would form a pleasing decorative surface.

Such combination wall sections are, as a matter of fact, the ones more often used. Brick or stone facing is backed up by other brick, tile or concrete; and an inner finish of lath and plaster completes the wall section, either as a bearing wall or as a filler wall in framed buildings.

Possible steel economy

If we were to apply some recently acquired knowledge, it would seem possible to reduce both framing costs and wall costs and still fully meet service requirements.

Recent tests at the Bureau of Standards have shown that slender steel columns incased in masonry (brickwork in these tests) can be counted on to carry compressive loads up to the yield point of the steel before failure occurs. To be specific, columns 24 ft. long with an l/r of 163, incased in brickwork, failed at about 40,000 lb. per sq.in., whereas steel columns tested bare failed at about 22,000 lb. per sq.in. Coupons 8 in. long cut from these columns also failed at about 40,000 lb. It would therefore appear that our column formulas can be revised. Tests of columns incased in concrete confirm this conclusion.

Again, information recently acquired indicates that steel spandrel beams may also be safely reduced in size if designed to function in combination with a reinforced-concrete or reinforced-brickwork beam. Since steel spandrels have to be fireproofed with brick or concrete, why not incorporate reinforcement in the fireproofing and so develop a combination beam in which the reinforced masonry carries a substantial part of the load? Recent tests indicate that such a combination functions satisfactorily and that the strength of a steel I-beam combined with a reinforced-brickwork beam (the brickwork also furnishing the fireproofing) is about four times as strong as the bare steel beam.

In view of these facts is it not reasonable to assume that the whole outer steel framing may be safely made much lighter and hence less costly? It seems entirely feasible also to reduce the weights and costs of outer inclosure walls without going far afield in any search for new materials, if we wish to use present knowledge to good advantage.

Suggested design

Without further discussion, let me suggest a design that should meet all requirements and probably be less expensive than any other wall type that will likewise meet service requirements. Figs. 1 and 2 indicate the details.

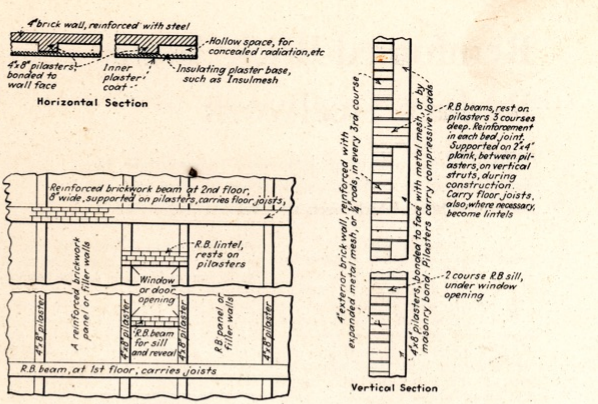


Fig. 2—Reinforced-brick wall construction for residences with self-supporting walls carrying floor joists.

The framing will consist of structural-steel members, the columns well incased in masonry, with spandrels of combination steel and reinforced masonry beams, the masonry in each case forming the fireproofing for the steel.

Panel, or inclosure, walls may be either 4 in. of reinforced brickwork or its equivalent in reinforced concrete, if the appearance of bare concrete is deemed satisfactory. To meet fire-resistance requirements, it may be necessary to increase this wall thickness to 8 in.

In order to provide masonry depth for pleasing window reveals, 8-in. or 12-in. pilasters next to window frames may be necessary. But such pilasters, together with the column masonry, will provide the base for fastening plaster grounds. The inner plaster coating thus incloses a hollow space within the wall that may be utilized as a chase for piping and for electric conduit. It may also be used for concealed radiation, or to carry the piping for a modern panel heating system, thus removing all radiation from the outer rooms. Such construction, using only 4-in. reinforced brickwork walls, has been satisfactorily used in England for several years. There is no apparent reason why such walls should be unsatisfactory in this country.

Editor's Note:

L. B. LENT, a Lt. Colonel in the Reserves, for some time Chief Engineer of the Brick Manufacturers Association of America, was one of the pioneers in recognizing the value of Reinforced Brick Masonry. Some of the first tests on Reinforced Brick Masonry were made under his direction at the Case School of Applied Science in Cleveland, Ohio.

A graduate of Stevens Institute; in the Air Corps during the war and the author of numerous articles on both construction and aeronautics, he enjoys a national reputation for clear thinking. At the present time he is manager of the Scientific Instrument Manufacturers Association of America. In this paper he calls attention to a rather original utilization of 4 inch Reinforced Brick Masonry walls on skeleton frame construction.

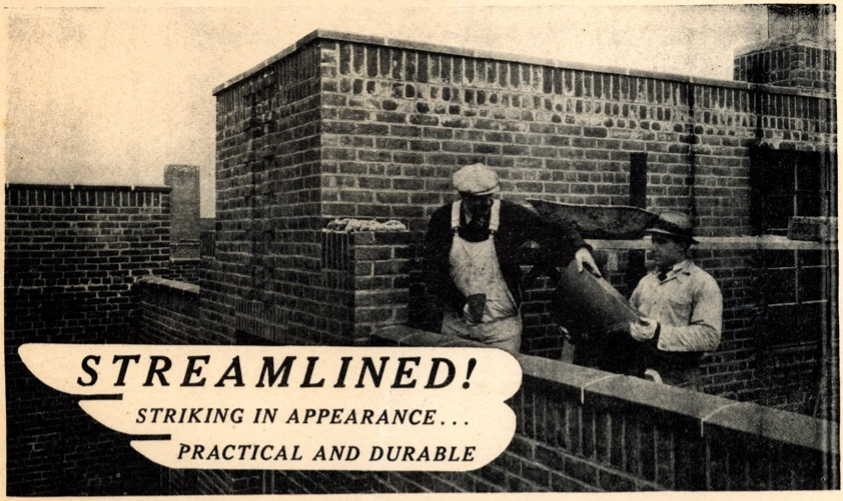
BRICK ENGINEERS' DIGEST

The dearth of organized and collated information on brick masonry is becoming increasingly evident. It has too long been considered a subject about which there was little to learn.

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These reprints will bring your files up to date, for quick reference, on the latest data on the subject.

By special arrangement with the publishers, both here and abroad, we can cover most of the technical magazines. However, suggestions of articles that have not come to our attention will be appreciated.



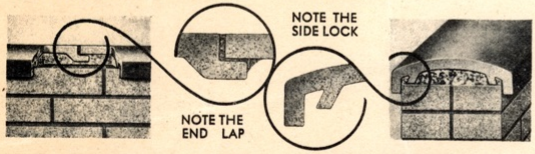
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