

DISCUSSION OF METAL AND WOODEN FORMS IN CONCRETE CONSTRUCTION.

By L. C. Wason,

President of the Aberthaw Construction Co., Boston.

There is a great field for research and inventive genius in the production of cheap, durable forms, sufficiently flexible for many different uses, as the cost of this part of the work is at present one of the greatest handicaps to the reduction of the cost and the more general use of concrete construction. The writer has used metal forms to some extent, and has observed their use by other contractors. If sheet metal is placed on a wooden back or on a metal stiffening frame there is danger of its becoming dented, bent, or otherwise defaced so as to give an imperfect surface to the concrete, and if the metal covering is sufficiently thick and strong to resist damage it is too heavy and expensive for general use. Moreover, such forms are not flexible, so that they can be used for various purposes. The use of heavy cast-iron moulds, as proposed by Mr. Edison, is far more expensive still. Therefore, up to date wood has proved to be the most economical and flexible in the way of being changed from one use to another of anything which the writer has yet seen, and his study has been concentrated on the most effective and economical use of lumber. When a sheet metal form becomes dented it is usually cheaper to throw the covering away and start anew than to straighten and re-use that which is bent. With the rough, careless class of mechanics called carpenters, which is the only possible kind to get for concrete forms, there is great danger of a rapid deterioration in the value of the material. Thoroughly good mechanics, those who are capable of doing a nice job of carpentry, cannot be induced to work on this class of construction. The quality of these rough carpenters is also becoming poorer, usually on account of the trade unions' restriction to the employment of apprentices. Any man who can buy a few tools and use a saw and hammer can hire out as a carpenter. He is so poor that he is constantly discharged, and after a considerable time of practising on one job after another may show a little intelligence, but he is a very inferior workman at best.

In considering the cost of construction as a whole it is as likely to be governed by the cost of the forms as the cost of the concrete. For illustration, in the cost of columns, although they are made so as to be reduced in size as easily as possible this is somewhat expensive in labor, and after they are reduced the girders and beams which meet at a column are too short, and have to be spliced out, which adds to the cost, and these costs are likely to exceed that which can be saved in concrete. It is, therefore, more economical to run the columns one size through the full height of a low building, or to reduce the size only twice or at most three times in the height of a high building. For instance, the actual cost of labor (without regard to wastage of lumber) in reducing columns from 16-inch to 12-inch on a certain job amounted to \$5.70, whereas the cost of the concrete saved by the reduction was \$2.30. In the writer's office a set of plans in pamphlet form has been compiled for standard forms for all kinds of work, and where special framing is required plans are made for these special cases, and in spite of this care and study the above figures represent actual experience. Therefore, in designing and handling form work the cost of labor is the principal item to be considered. The opinion was expressed by Mr. Larned that the forms could be cheapened by the use of common and rough lumber instead of a fairly good grade of dressed lumber. The fact that it is almost universal to use a good grade of dressed stock would seem to disprove the above statement. The cost of dressing varies according to the mill from \$1.50 to \$4 per thousand feet for planing four sides. The price of second grade hemlock and spruce differs but little from that which has small sound knots and is free from wind shakes or large season cracks, and such lumber works so much easier as to cut down the labor cost more than the equivalent of the difference in cost of material. Some builders use $\frac{3}{8}$ -inch stock, others $1\frac{1}{2}$ -inch,

and some 2 inches thick. The thicker lumber will stand the wear and tear longer than the light, and can, therefore, be used so many more times than the thin that it is more economical in the long run if the work in hand is large enough, so that the forms can be used several times without delaying the rapid progress of the work. With planed stock tighter joints can be obtained between boards, which prevents leakage of the fine materials and weakening and roughening the surface, and the boards are of even thickness, so that a fairly good surface is obtained, which needs little treatment after the forms are removed except where an ornamental appearance is especially desired. If rough lumber is used, in order to get even a passable surface finish considerable labor must be spent upon dressing the concrete after the forms are removed, and this must be done by mechanics. If a cement finisher, who is in no sense a plasterer, is used, and his wages are 45 or 50 cents an hour, only a fair job can be obtained. If plasterers are used, their pay is 60 cents per hour, and the job is properly finished, but in either case the cost is greater than the cost of planing lumber and of using a good quality. Rough lumber can only be used economically in work which is never exposed to view, or where appearance is no object whatever.

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On page 406 of our issue of June 5th there appeared an interesting and valuable article on "The Rental Value of a Power Plant." Credit for this article should have been given to Mr. Charles T. Main.