

Another point to be remembered is that temperature stresses must be carefully guarded against and that extra reinforcement, in fact, increased scantlings over all, must frequently be adopted for this purpose, as the co-efficient of expansion of steel and of concrete is practically the same. In structures such as bridges these variations due to the temperature can be arranged for the ordinary hinges or expansion joints (of which the latter can be very rapidly and effectively made with thick sheet-lead, the area being such that no pressure it will experience will cause it to "squeeze out"), but in the case of structures where such are impossible, as for instance, in an exposed tank or bunker or silo, the only remedy appears to be a general increase in strength, particularly by means of increased reinforcement, and, although perhaps contrary to theory, this method has proved perfectly successful.

Centring.

With reference to the design and erection of forms or centring for keeping the soft wet concrete in place till it is properly set, there are two main conditions which must always be fulfilled. Firstly, it must be so supported and stayed that neither the weight of the concrete, nor the ramming of it, can make the centring bulge or sag; and secondly, it must be as close-jointed as possible, otherwise the water will leak out and carry with it an appreciable amount

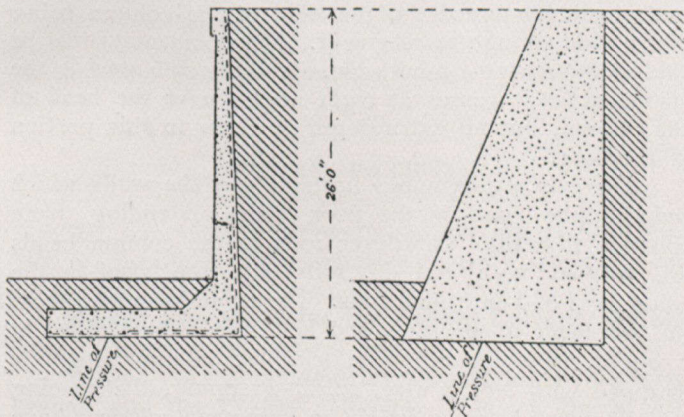


Fig. 7.—Comparison between Amount of Material required and useful space occupied in Mass Concrete and Reinforced Concrete Dock or Retaining Walls.

of cement, which will weaken the structure. There are many methods of obtaining a smooth face on the finished concrete, such as painting the boards with oil or whitewash, or any material to prevent the concrete adhering to them, but, given fair flush joints in the woodwork, the passing of a thin piece of sheet steel (an old hand-saw with the teeth ground off is excellent for this purpose), between the concrete and the boards gives perhaps the best result whenever the general arrangement permits of its use. When work is to be floated or rendered, a rough surface is, of course, desirable.

The question of centring leads naturally to that of the length of time it should remain in place. The author is frequently asked to state his opinion on this in general, but no general or hard-and-fast rule is possible—on some jobs or portions of them, 24 hours is ample, on others six weeks is too short. Much depends on the weather, particularly on frost, and much on the over-all scantlings of the various pieces, but, most of all and beyond everything, on experience; in fact, there is no material where experience on the part of the constructors is more important than in all matters connected with reinforced concrete or where more disastrous consequences are likely to follow the lack of such experience.

A contractor with considerable resources in the way of plant and materials is also very advisable. It is not long ago since a somewhat serious collapse occurred in a job where the concrete was put in on a Friday and the centring struck on the Monday, as the contractor had not, and could not get, any more timber.

Methods of Using.

Buildings in General.—All buildings should be of skeleton framework construction. The spaces or panels between the columns and beams can be $\frac{1}{8}$ in., filled in with reinforced concrete or with brickwork, or the whole frame covered with a skin of stone or brick; but as the main strength is in the frame, such panels can be quite thin, in fact, only of such thickness as is needed for dryness, not for strength, which results in a large increase in floor area, particularly in the lower storeys, where, otherwise, the walls would have to be of considerable thickness.

Boats and Barges.—These have been successfully built for several years, and, provided several are ordered of one size, that is, made off the same moulds, they are very much cheaper than steel.

Chimneys.—From current quotations these certainly appear to be cheaper than the same in brickwork, and, of course, do not need pointing; but there may be a difficulty when one needs to be felled, as at present it is not known how to bring one down in a small area. It is, however, a simple matter if there is space available for the chimney to fall in one length.

Drain and Sewer Pipes.—Many miles of these have now been laid and are giving great satisfaction both as regards first cost and upkeep. Great care is, however, necessary in their manufacture to ensure the reinforcement, both longitudinal and circular, being exactly in its correct position, otherwise there is a great risk if the sewage or water reaching some of the metal and the life of the pipes being therefore very short. One of the great advantages of reinforced concrete sewer pipes—particularly in bad ground, for instance, over old mine workings—is that they do not cost any more per yard when made in long lengths, up to, say, 18 ft. if required; thus about 75 per cent. in the number of joints is saved, and they are able to carry the weight of themselves and contents over spans practically equal to their own lengths. The same remarks also apply to water pipes.

Dock, Retaining and Reservoir Walls.—The author has already noted the saving in space in buildings due to the use of reinforced concrete, and the illustrations in Fig. 7 show that such is even more the case with these walls, the one being in reinforced, and the other in mass concrete. Both are drawn to the same scale and calculated for the same strength with the same factor of safety.

Engine and Dynamo Beds.—Probably many readers will remember the case of a large and important hotel in London having its own electric installation, where the vibration from its large turbo-alternator sets was a cause of serious complaint, notwithstanding the use of many different forms of soft anti-vibration materials beneath the beds. Finally, reinforced concrete bedplates were tried, the same being practically replicas (in plan) of the cast-iron ones, which rested on them, but only about 8 in. thick. These reinforced concrete bedplates are very carefully reinforced, and are only supported at points, that is, they do not rest directly on the old solid stone beds. The result has been very satisfactory, the difficulty of the vibration having been entirely eliminated.

Fence Posts.—The use of these is increasing very rapidly, but up to the present they are rather handicapped by the want of a cheaper method of attaching the wires to