

Some Hints on Waterproofing Concrete.

The Elastic versus the Rigid Method.

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(This interesting paper was read at the annual convention at Chicago of the National Association of Cement Users, and was specially sent with others, which will appear in subsequent issues, to the "Canadian Cement and Concrete Review" for publication.)

THE importance of waterproofing in these days is not so much in keeping water out of buildings as in protecting and preserving the embedded steel.

What is first necessary is to determine upon method, and having done that, then decide upon materials. In looking over the field it will be found that all waterproofing efforts are divided into two totally dissimilar lines of action, viz.:

1. Treating concrete to make it, in itself, impermeable.

2. Protecting concrete or masonry with something apart therefrom to waterproof them.

Aside, therefore, from any consideration of materials, it will be found that the question dividing these two dissimilar lines of action is one of method, i.e.:

Shall water reach the concrete, or shall it not reach the concrete?

We will first consider treating concrete to make it, in itself, impermeable. Under this head comes those materials and methods for making concrete impermeable—first, by mixing certain chemicals with the concrete for the purpose of making the solid mass impermeable; and, second, by applying a coating or wash to the hardened surface of the concrete, or applying thereto a cement plaster. The ingredients generally used are lime, silicate, soda, lye, soap, alum, etc.

Among many objections to the first process is that the mixing of the chemicals with the cement will not lessen the present general difficulty of having concrete properly mixed in the field. Without, or with, the chemicals, therefore, there will always exist zones weak in quality and density. The second objection is the uncertain effect the addition of the chemicals will have in time upon the concrete, and particularly upon the embedded steel.

Objections to Coatings or Washes.

One of the chief, among numerous, objections to the second method, i.e., using coatings or washes, is the poor judgment in basing dependence for permanent waterproofing upon one thickness or layer of any single thing, which in this case happens to be a wash almost imperceptible in its thinness. This, aside from any consideration of the fact that but one infinitesimal pore imperfectly closed, by permitting the entrance of water, which would soon spread, would make valueless the balance of the washed surface. Such treatment is not even consistent with the doctrine of *similia similibus curantur*, because we are not curing like with like, but adding a bad thing to a bad thing.

Most seriously, however, neither of these methods make any provision whatever for the cracking of concrete, which is entirely overlooked. That concrete will

crack is indisputable. That it can be made impermeable is possible. Why, however, make it impermeable if its impermeability will not prevent cracking, or provide waterproofness for practical, every-day conditions? Are not, then, the extensive laboratory tests as to the waterproofness of briquettes and water-filled boxes of cement, or tubes filled with water, whether under 10 or 50 feet pressure, resting on blocks and cubes of specially treated cement, an expenditure of time and energy in the wrong direction, at least from the viewpoint of practical waterproofing? Would it not be impossible to extend into monolithic form in the field concrete so perfect in texture and mixture as the specially prepared laboratory sample? Masses of concrete in the open, especially in this climate, where the temperature ranges over 120° F., are subject to inequalities of settlement, contraction, and expansion, and other conditions impossible, to the same degree, in a laboratory sample.

Testing the strength and quality of cement, as cement, is a different thing.

Percolation of Water through Concrete.

We have seen water drawn up fifteen or twenty feet by concrete. We have also seen water come through concrete over twenty feet thick. It may take two or three years to do so; meanwhile the assumption is that the concrete is fairly water-tight. But, with the average concrete, water will come through it **in time**. When the concrete thus becomes damp, wet and saturated with moisture, it is impossible to get the moisture out. If the moisture freezes—expanding ten times its volume in so doing—it requires no stretch of imagination to calculate the effect upon the concrete or masonry. Enough water will be taken in through a crack, **before the crack is filled**, to attack and injure the steel. Filling the crack after that is simply patching without curing.

It has often been, not facetiously, but seriously, suggested that all that is needed to solve the difficulty is for some one to invent something to fill the cracks and make a water-tight joint, with special reference to structures above ground level. The United States Patent Office will not entertain an application for patent on an invention claiming perpetual motion, on the assumption that there is no such thing in mechanics. A perpetual crack-filler which will make a crack water-tight under a temperature of 120° F. in August and 20° F. below zero in January is beyond the pale of possibility, or even perpetual motion.

We sincerely believe that a great deal of harm will come to the cement industry from the indiscriminate use of the numerous preparations on the market for hardening the surface of concrete, or, in other words, for the purpose of making the concrete impermeable. We think that this has been already observed in attempts to make concrete blocks impervious by the use of such preparations, and the recommending and using of such blocks for situations and purposes for which they were never intended. Some of these waterproofing preparations are