TECHNICAL INFORMATION ON BUILDING MATERIALS

FOR USE IN THE DESIGN OF LOW-COST HOUSING

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THE NATIONAL BUREAU OF STANDARDS
UNITED STATES DEPARTMENT OF COMMERCE
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INTEGRAL WATERPROOFING FOR CONCRETE

This is a digest of that portion of Bureau of Standards Research Paper RP394 (December 1931), "Tests of Integral and Surface Waterproofing for Concrete",[1] by C. H. Jumper, dealing with integral waterproofing.

Purpose of tests: To determine the permeability, absorption and compressive strength of concrete treated with integral waterproofing compounds.

Materials used: Fifty commercial treatments were classified in accordance with their chemical compositions and grouped as follows:

(1) Calcium Chloride
(2) Calcium Chloride plus Miscellaneous Materials
(3) Soaps
(4) Hydrated Lime plus Soap
(5) Finely Subdivided Materials used as Fillers
(6) Miscellaneous Materials

These were incorporated into a 1:3:6 concrete, applied as directed and in amounts specified by the manufacturers. The specimens so treated were subjected to a water pressure of 20 pounds per square inch for one year, and their permeability compared with untreated concrete of the same quality (established as standard) and tested in a similar manner. Compression and absorption tests were also made.

Lean concrete was purposely adopted for use to simulate that segregated portion of concrete through which leaks generally occur. Since it

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[1] Obtainable from Superintendent of Documents, Government Printing Office, Washington, D. C. (Price 10 cents)

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is not difficult to make concrete that is impermeable to water under pressure of 20 pounds per square inch, this being in excess of pressures generally encountered, the use of admixtures seems needless. However, even in placing excellent concrete, partial segregation into its constituents may develop at certain places, allowing the passage of water. Consequently, waterproofing becomes a matter for consideration. Of the admixtures used, some reduced the permeability of the concrete while others seemed to be of no value. No doubt, some of the integral agents produce unctuousness and allow ease of placing, which tend to prevent segregation and may react with cement to reduce the voids.

Stearates and calcium chloride treatments were as effective as any used and are readily obtainable on the open market without paying fanciful prices.

In the summary here given statements are somewhat general and apply more particularly to the results obtained for the materials as a group.

(1) Calcium Chloride group: The addition of calcium chloride did not materially reduce permeability or absorption. It did, however, seem to increase the compressive strength. Further amounts of calcium chloride per bag of cement decreased the initial permeability.

(2) Calcium Chloride plus Miscellaneous Materials group: The incorporation of such materials as soap, silica, and aluminum chloride with calcium chloride did not materially reduce the permeability nor absorption. Compressive strength was only slightly affected. Additions of soap to calcium chloride caused a reduction in absorption but without the usual increase in strength as with calcium chloride alone.

(3) Soaps group: The addition of soap alone caused increases in permeability. The strength of concrete containing oleate soap was appreciably reduced. Other soaps reduced the strength only slightly. In general, the presence of soap caused a reduction in absorption, and a higher permeability than the other waterproofings which were used.

(4) Hydrated Limes and Soaps group: Hydrated limes mixed with soaps gave a higher permeability than the standard, however, not so high as when soaps alone were added as in group (3). The compressive strength of this group was generally decidedly less than standard.

(5) Finely Subdivided Materials used as Fillers group: The finely subdivided compounds used as fillers generally reduced the permeability and increased the compressive strength of the specimens The absorption was about the same or greater than standard.

(6) Miscellaneous Materials group: The permeability of concrete was not reduced by the addition of such miscellaneous materials as cellulose and wax, or by the addition of materials containing uncombined fatty acids, fluosilicate, naphalene, vaseline, butyl stearate, or coal tar. These compounds in general lowered the compressive strength but reduced absorption. The presence of a mixture of heavy mineral oil and a saponifiable oil reduced the permeability, absorption, and also the strength.

Utility of Waterproofings

If any benefit is to be derived from the use of waterproofings, the type used should be selected according to the exposure of the concrete.

In order that concrete resist water under pressure, the only compounds to be considered are calcium chloride or the group of finely divided materials.

Adding approximately 2 percent (by weight of cement) of commercial calcium chloride to the concrete should hasten the hardening and tend to reduce the permeability, especially if the period of damp curing is short. The addition of finely divided materials to concrete mixtures which are deficient in fine particles, should reduce permeability under pressure. The amount to be added depends on the quantity of fine particles present in the mix.

The addition of integral waterproofings of the water repellent type such as the soaps and fatty acids (stearates) should be used only for reduction of capillarity. The amount to be added to the concrete mix should provide a fatty acid content equal to from 0.1 to 0.2 percent of the weight of the cement.