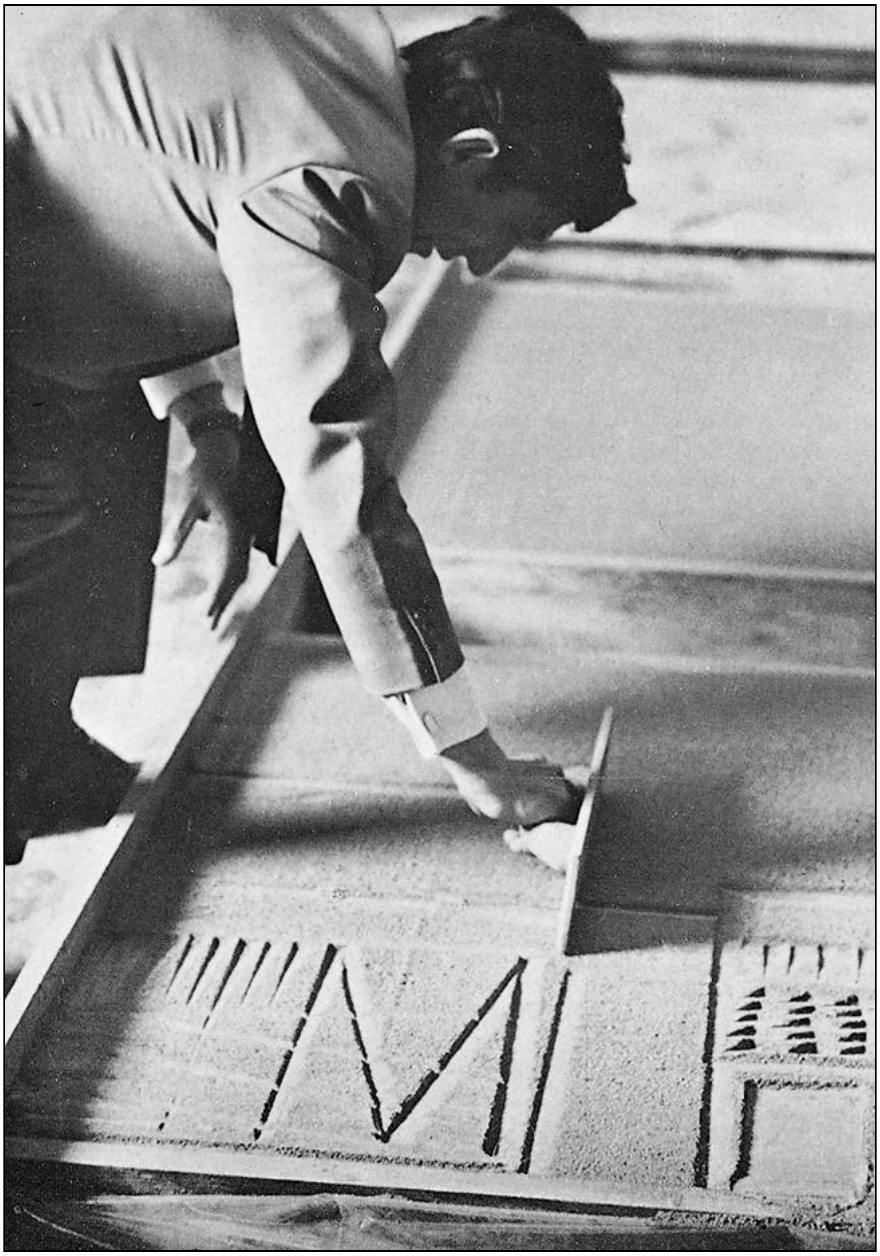
An Introduction to Dry-cast Concrete

This new concrete variant calls for water to be added after other ingredients are in the mold, compacted and finished.

By W. Ernest Willis*



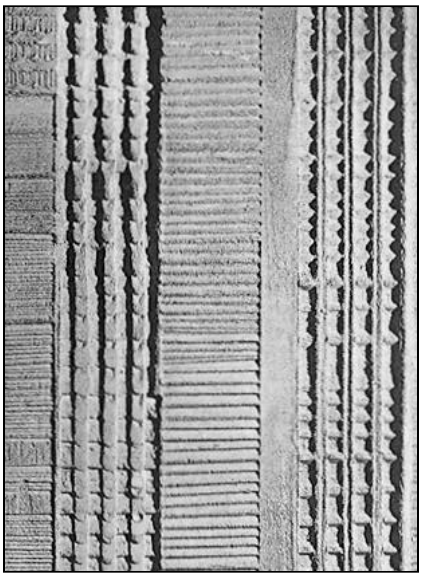
Impressive and unique properties and advantages have been obtained from a new concrete variant called dry-cast concrete, which has been developed by Gabriel-Willis Associates after 4 years of intensive research and testing. It differs from conventional concrete primarily in that water addition is accomplished by one of several infusion techniques after the mixture of aggregates and cement is placed in the mold, compacted and finished.

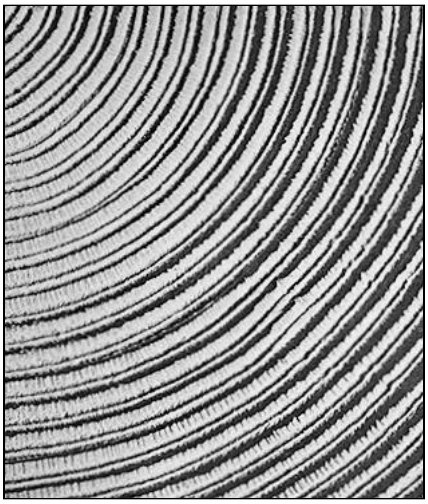
Wet troweling is unnecessary, and special architectural effects and finishes can be worked into the dry material at little cost by means of hand tools, shaped screeds or rollers having patterned surfaces. The resulting concrete is virtually free of air bubbles and honeycombing, and the surfaces are characterized by exceptional form definition.

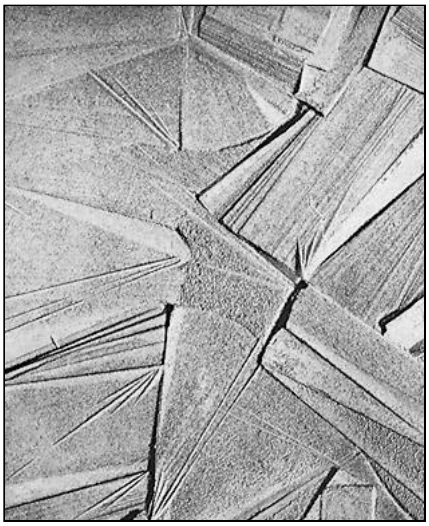
The photo shows William Mitchel, a design consultant from England, hand sculpting a 4-foot-square panel. Some of the finished panels he made are pictured. The panels were done face up without any mold. The same patterns can be rolled into panels with blank surfaces by wrapping a rubber sheet with the pattern cast in it around a roller.

Other significant advantages over conventional wet-mixed concrete are higher strengths, lower shrinkages, lower water permeabilities, reduced over-all concrete construction costs, more rapid curing rates, and reduced hydrostatic pressures. An approximate 50 percent reduction in wales and snap-ties is possible in vertical walls of dry-cast concrete.

*Mr. Willis is a general partner of Gabriel-Willis Associates, the two-man team that developed the new concrete process. He is a mechanical engineer and inventor. Lester H. Gabriel, his partner, is a professor of civil engineering at Sacramento (California) State College and was the first of the two co-inventors to start work on the invention.







Less shrinkage, creep

Both shrinkage and creep are reduced because all of the aggregate particles are in contact with each other, instead of being separated by the cement-water paste formed in the wet-mix process of producing concrete. The already compacted aggregate particles must of necessity resist the shrinkage of the cement, with the result that the particles are preloaded to increase the compressive strength of the concrete.

The dry-mixed materials are compacted by any of the several techniques, such as vibration, tamping and rolling, used in compacting soils. Compaction is the primary influence on the properties of dry-cast concrete. Properly formulated, cement content is less important.

Several inexpensive and effective techniques have been developed to bring about the water infusion that is so essential to the entire process. Among them are surface fog-spraying, casting against perforated cardboard, and using cast-in disposable perforated tubes. Choice of infusion technique is largely determined by the size and shape of the finished concrete. Regardless of the particular infusion technique employed, capillary attraction disperses the optimum amount of water throughout the compacted dry materials.

Higher strength

In some highly compacted mixes produced in the laboratory, infused water has amounted to less than 3 gallons per sack of cement, an important factor in achieving the very high compressive and flexural strengths. Even without accelerated curing, a 7-sack mix of dry-cast concrete achieved compressive strength and flexural tensile strength of 4,000 psi and 600 psi respectively in one day, and of 10,000 psi and 1,200 psi respectively in 28 days.

With moderate compaction, dry-cast concrete shows 28-day shrinkages as low as .02 percent; further reduction is attainable by means of heavier compaction. Since porosities of 4 percent or less can be achieved, cured, unsealed dry-cast concrete approaches watertightness.

Gabriel-Willis Associates believes the process is widely adaptable to both cast-in-place and precast concrete work, and that conventional ready mixed concrete plants, augmented by facilities for surface drying aggregates, will be adequate for production.

In jobsite work the material can be delivered and stored indefinitely before use, and casting started one day can be completed the following day without risk of creating a cold joint. The dry materials may be handled successfully on jobsites using either conventional equipment or bulk-handling facilities not normally applicable to wet-mix concrete.

Lower costs

A 35 percent savings is anticipated on poured-in-place walls and site-cast precast panels, a 10 percent savings on supported slabs, and a 25 percent savings on brick work set in concrete. These figures do not allow for such advantages as greater job control and hence less overtime, reduction in clean-up costs, shorter mold turn-around time, and earlier load-bearing capabilities.

PUBLICATION#C690457