Using preformed foam as a concrete admixture

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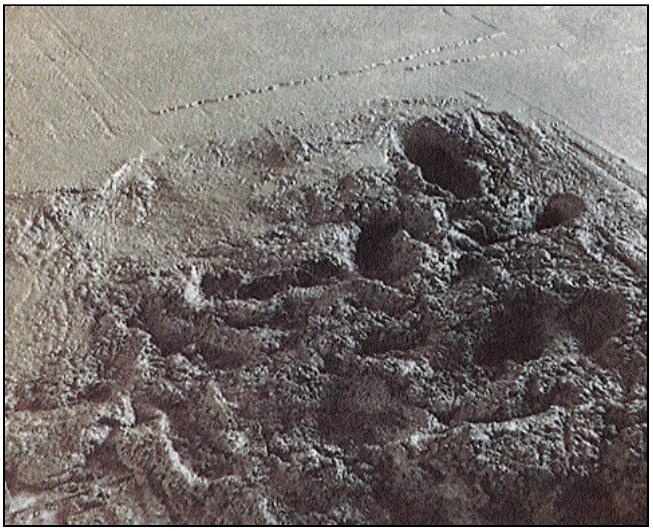
A preformed foam, commonly used to make lightweight cellular concrete, also can improve the properties of conventional concrete. Made with a foaming agent developed in Australia, the foam has been used to improve workability and to correct problems caused by poor sand grading.

Foaming agent, water, and compressed air are blended in a foam generator to make the foam, which looks like shaving cream from an aerosol can. The foam generator is portable and is powered by a 14-hp engine that runs the compressor and pump. A gallon of water makes 2 cubic feet of foam. It can be put in a ready mix truck before other ingredients are added, during mixing, or after the concrete is mixed. Adding fine sand, rock dust, silica fume, calcium chloride, or a superplasticizer won't break the bubbles or cause the foam to dissipate.

Because the bubbles don't coalesce or break, preformed foam remains stable even during long mixing periods. In one case, concrete containing foam was agitated in a truck mixer for 4 hours and still had a 5-inch slump when discharged.

How concrete properties are improved

A concrete mix made with the foam is very workable and easy to compact, float, and trowel. Because air bubbles serve the same function as fine sand, the foam corrects deficiencies in sand grading that cause bleeding. Adding 2 or 3 cubic feet of foam per cubic yard of concrete eliminates bleeding, even at an 8-inch slump (see photo).



There's no bleed water on the surface of this 7-inch-slump concrete containing preformed foam. The concrete is cohesive and easy to finish.

Air bubbles reduce strength but it's still possible to achieve strengths of 5000 psi or more. This is done by adding water reducers and lowering the water content to decrease the water-cement ratio. The typical mix shown in Table 1 was made with foam, a superplasticizer, and a water-reducing retarder. With a 7-inch slump, the foam-treated concrete was easily placed and finished. Unit weight was 138 pounds per cubic foot (pcf) and 28-day compressive strength was 5300 psi.

To make lightweight concrete with normal-weight aggregate, more foam can be added. The mix shown in Table 2 contained 8 cubic feet of foam and had a unit weight of 105 pcf. It was placed at an 8-inch slump in a 1½-inch-thick layer over a wood deck. The 28-day compressive strength was 2020 psi.

Experiment to find right amount of foam to use

Amounts of foam and required mix proportions vary with the source and grading of aggregates used in the concrete. When deciding how much foam to use, pay close attention to the fine aggregate grading. For example, some sands in California are called "quicksands" by finishers. Concrete made with these sands is hard to finish because mortar at the finished surface skids under the trowel and is picked up on the finisher's feet and kneeboards. This problem is due to use

TABLE 1. TYPICAL PROPORTIONS FOR A CUBIC YARD OF NORMAL-WEIGHT CONCRETE CONTAINING FOAM

Material	Amount
Cement	611 pounds
Water	224 pounds
Sand	1,500 pounds
¾-inch crushed stone	1,600 pounds
Superplasticizer	70 ounces
Water-reducing retarder	30 ounces
Preformed foam	2 cubic feet
Mix properties	**Amount**
Slump	7 inches
Unit weight	138 pcf
28-day compressive strength	5300 psi

TABLE 2. TYPICAL PROPORTIONS FOR A CUBIC YARD OF LIGHTWEIGHT CONCRETE MADE WITH FOAM

Material	Amount
Cement	611 pounds
Water	224 pounds
Sand	1400 pounds
Crushed stone	600 pounds
Superplasticizer	78 ounces
Water-reducing retarder	32.5 ounces
Mix properties	**Amount**
Slump	8 inches
Unit weight	105 pcf
28-day compressive strength	2020 psi

of sand that has more than 50 percent of the particles retained on the No. 30 and 50 sieves. However, adding 2 or 3 cubic feet of foam to concrete made with these sands corrects the problem. Each ready mix supplier has to experiment to find out how much foam is best for concrete made with his aggregates.

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