

CONCRETE IN PRACTICE

**CIP
15**

What, Why & How? **Chemical Admixtures for Concrete**

WHAT are Admixtures?

Admixtures are natural or manufactured chemicals which are added to the concrete before or during mixing. The most often used admixtures are air-entraining agents, water-reducers, retarders and accelerators.

WHY Use Admixtures?

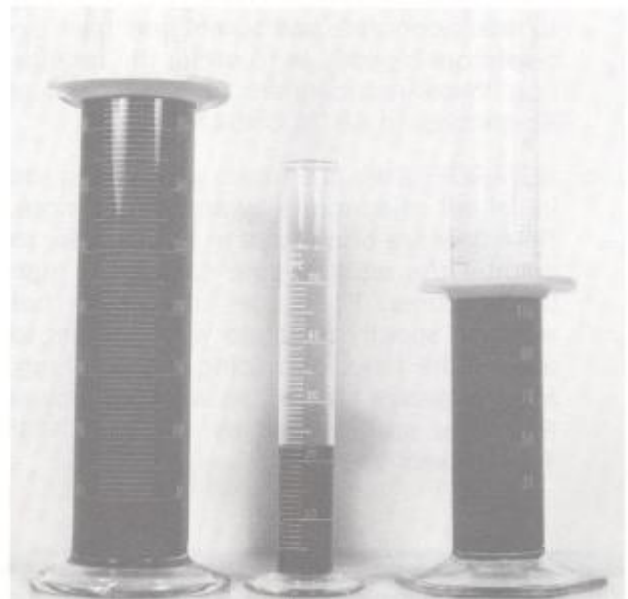
Admixtures are used to give special properties to fresh or hardened concrete. Admixtures may enhance the durability, workability or strength characteristics of a given concrete mixture. Admixtures are used to overcome difficult construction situations such as hot or cold weather placements, pumping requirements, early strength requirements or very low water-cement ratio specifications.

HOW to Use Admixtures

Consult your Ready Mixed Concrete Supplier about which admixture(s) may be appropriate for

your application. Admixtures should be evaluated for compatibility with cement(s), construction practices, job specifications and economic advantage before being used.

Chemical Admixtures for Concrete



**L to R: HRWR, Air-Entraining Agent, Retarder
Relative quantities for one cu.yd.**

FOLLOW THIS GUIDE to Use Admixtures

- a. **AIR-ENTRAINING AGENTS¹** are liquid chemicals added during mixing to produce microscopic air bubbles in concrete. These bubbles improve the concrete's durability and increase its resistance to damage from freezing and thawing and deicing salts. Air-entraining admixtures improve workability and may reduce bleeding and segregation. For exterior flatwork (parking lots, driveways, sidewalks, pool decks, patios) that is subject to freezing and thawing weather cycles, or in areas where deicer salts are used, specify an air content of 5 to 7%. Air-entrainment is not necessary for interior structural concrete since it is not subject to freezing and thawing. In high cement content concretes adding air will reduce strength by about 5% for each 1% of air added; but in low cement content concretes adding air has less effect and may increase strength slightly.
- b. **WATER-REDUCERS** are used for two different purposes: (1) to lower the water content and increase the strength; (2) to obtain higher slump using the same water content. Water-reducers will generally reduce the required water content for a given slump by about 10%. This increases strength or allows the cement content to be reduced and maintain the same water-cement ratio. Water-reducers are used to increase slump for pumping concrete and are used in hot weather to offset the increased water demand. Water-reducers may aggravate slump loss problems. Water reducers tend to retard concrete and sometimes have accelerators blended in to offset the retardation. Water-reducers are Type A Chemical Admixtures in ASTM C 494.²
- c. **RETARDERS** are chemicals which delay the initial set of concrete by an hour or more. Retarders are often used in hot weather to counter the rapid setting caused by high temperatures. For large jobs, or in hot weather, specify concrete with retarder to allow more time for placing and finishing. Most retarders also act as water reducers. Retarders are covered by ASTM C 494² Types B and D.
- d. **ACCELERATORS** reduce the initial set time of concrete. Liquid accelerators are added to the concrete at the plant. Accelerators are recommended in cold weather to get high-early strength. Accelerators do not act as an antifreeze; rather, they speed up the strength gain and make the concrete stronger to resist damage from freezing. Accelerators are sometimes used to allow finishing operations to begin early. Calcium chloride is the most commonly used accelerator, although non-chloride (non-corrosive) accelerators are available. Calcium chloride is specified at not more than 2% by the weight of the cement. Prestressed concrete and concrete with embedded aluminum or galvanized metal should not contain any calcium chloride because of the potential for corrosion. See NRMCA Publication No. 173.³ Accelerators are covered by ASTM C 494² Types C and E.
- e. **HIGH RANGE WATER-REDUCERS (HRWR)** are a special class of water-reducers. Often called superplasticizers, HRWRs reduce the water content of a given concrete from 12 to 25%, which increases strength.⁴ HRWRs can also greatly increase the slump to produce "flowing" concrete. For example, adding a normal dosage of HRWR to a concrete with a slump of 3 to 4 inches will produce a concrete with a slump of about 8 inches. Within 30 to 60 minutes the concrete will return to its original slump. HRWRs are covered by ASTM Specification C 494.² Types F and G, and C 1017⁵ Types 1 and 2.

References

1. ASTM C 260 "Standard Specification for Air-Entraining Admixtures for Concrete," American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.
2. ASTM C 494 "Standard Specification for Chemical Admixtures for Concrete."
3. "Understanding Chloride Percentages," NRMCA Publication No. 173.
4. "Superplasticizers in Ready Mixed Concrete," NRMCA Publication No. 158.
5. ASTM C 1017 "Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete."



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