

About Admixtures for Ready Mixed Concrete



What are chemical admixtures for ready mixed concrete?

Chemical admixtures are ingredients added to ready-mixed concrete during its mixing to enhance or modify the concrete's properties. These admixtures are typically used to improve various aspects of concrete performance, such as workability, durability, strength, and setting time. Admixtures have the capacity to improve the durability, workability, or strength aspects of a particular concrete blend.

Admixtures are instrumental in addressing challenging construction scenarios, such as extreme temperature conditions during placement, the need for efficient pumping, rapid strength development, or adherence to stringent low water-to-cement ratio criteria.

What are some of the most common admixtures?

1. Air-Entraining Admixtures

Air-Entraining Admixtures are liquid chemicals added to concrete during mixing to create tiny air bubbles called entrained air. These micro-bubbles help concrete resist damage from freezing, thawing, and de-icing salts. They can also make freshly mixed concrete easier to work with and reduce problems like bleeding and separation.

For exterior flatwork projects like parking lots, driveways, sidewalks, pool decks, and patios that face freezing weather or de-icing salts, it's recommended to include about 4% to 7% air in the concrete, depending on the size of the rocks in the mix. However, air isn't needed for indoor structural concrete since it doesn't experience freezing and thawing. And if you want a smooth, troweled finish for your concrete flatwork, it's best to avoid air-entraining admixtures.

Keep in mind that in concrete mixes with high cement content, adding entrained air can make the concrete about 5% weaker for every 1% of air added. But in mixes with low cement content, adding air has a smaller impact and might even slightly increase strength because it reduces the need for extra water. When choosing air-entraining admixtures, be sure they meet ASTM C 260 standards.

2. Water Reducing Admixtures serve two main purposes:

1. They decrease the water content in fresh concrete, making it stronger.
2. They increase the workability (slump) of concrete without adding extra water.

These additives typically reduce the amount of water needed for a specific concrete consistency, which means you can achieve the same strength with less water. They work by spreading the cement particles more efficiently in the concrete mix, resulting in increased strength or allowing for a reduction in the cement content while maintaining the same strength. Water reducers are useful for improving how concrete flows without adding water. This is handy for tasks like pumping concrete and working in hot weather when you might need more water. However, some water reducers may speed up the loss of slump over time. Make sure the water reducers you use meet the Type A requirements in ASTM C 494.

Mid-range water reducers are popular because they have an even greater ability to reduce the water content in concrete. These admixtures are favored for their ability to improve the finish of concrete flatwork. They must meet at least the Type A requirements specified in ASTM C 494 since they do not have a separate classification in admixture specifications.

3. Retarders

Retarders are chemicals that slow down the beginning of the concrete setting process, often postponing it by an hour or longer. They are useful in hot weather when the heat can make concrete set too quickly. When you have extensive projects or are working in hot conditions, it's a good idea to choose concrete with a retarder. This gives you extra time for placing and finishing the concrete. Additionally, most retarders also serve as water reducers. Retarders should meet the specifications for Type B or D in ASTM C 494.

4. Accelerators

Accelerators speed up the concrete's initial setting time and promote early strength development. They don't act as antifreeze, but rather, they quicken the setting process and the rate at which the concrete becomes strong. This helps the concrete withstand freezing temperatures better. Accelerators are valuable in situations where construction needs to progress rapidly, allowing for early removal of forms, opening structures to traffic, or applying loads.

Liquid accelerators that meet ASTM C 494 Types C and E requirements are introduced at the concrete batch plant. There are two main types: chloride-based and non-chloride-based accelerators. Calcium chloride, available in liquid or flake form, is one of the cost-effective and efficient accelerators and must meet the requirements of ASTM D 98. For unreinforced concrete, it can be used up to 2% of the cement's weight. However, chloride can potentially corrode reinforcing steel. So, lower chloride limits apply to reinforced concrete.

It's important to avoid chloride-based materials in pre-stressed concrete and concrete with embedded aluminum or galvanized metal, as they can increase the risk of corrosion. Non-chloride accelerators are a better choice when there's concern about corrosion of embedded metals or reinforcement in the concrete.

5. High-Range Water Reducers

High-Range Water-Reducers (HRWR) belong to a special category of water-reducers often referred to as **superplasticizers**. These HRWRs can substantially cut down the amount of water in a given concrete mix, usually by an impressive 12 to 25%. The primary purposes of HRWRs are to enhance concrete strength and reduce its permeability by minimizing the water content in the mix. Alternatively, they can significantly increase the slump, transforming the concrete into a more flowable state without the need for additional water.

HRWRs play a crucial role in creating high-strength and high-performance concrete blends, especially those with elevated levels of cementitious materials or containing silica fume. For instance, adding a standard amount of HRWR to concrete with a 3 to 4-inch slump can elevate the slump to approximately 8 inches.

It's worth noting that some HRWRs may lead to a faster slump loss over time, causing the concrete to return to its original slump within 30 to 45 minutes. In certain situations, HRWRs can be added to the concrete mix at the job site under controlled conditions. The specifications for HRWRs are detailed in ASTM C 494 under Types F and G, as well as in ASTM C 1017 under Types 1 and 2.

Other Products

In addition to the common admixtures mentioned above, there is a range of specialized products available to enhance various aspects of concrete for a wide array of applications. These products encompass corrosion inhibitors, substances that reduce shrinkage, anti-washout agents, admixtures that stabilize hydration or delay setting, additives that mitigate the risk of alkali aggregate reactions, aids for pumping, moisture-resistant additives, and a diverse selection of colors and products designed to enhance the visual appeal of concrete.