Durability

The increased hydration of the Portland cement particles within concrete containing Hydramax 1609® gives many benefits to the concrete's performance. One of those notable performance benefits is an improvement to the concrete's durability characteristics.

What is concrete durability? According to Concrete Terminology by The American Concrete Institute, concrete durability is defined as 'the ability of concrete to resist weathering action, chemical attack, abrasion, and other conditions of service'.

What does Hydramax® 1609 do?

1. Naturally reduces the amount of water in a mix design - This reduces the quantity of pores, capillaries and bleed tracts that can form in the concrete at an early stage.
2. Enhances compressive, flexural and tensile strengths - This reduces the potential of cracking from settlement and loading.
3. Reduces shrinkage and distortion of the cured concrete mass - This again has the potential to reduce cracking.
4. Hydrates more Portland cement particles – Gives greater density to the concrete mass.
5. Increases Fluidity - Allows for easy placement and compaction, making it ideal for high-performance concrete or concrete structures that are complex shapes.
6. Improves Portland cement particle dispersion - Results in better strength development and a denser microstructure.

What does this mean for durability?

1. Closes the number of entry points, as well as significantly reducing the movement of liquids within the concrete matrix. This ensures the restriction of aggressive chemicals entering or moving about the hardened concrete mass.
2. Reduction in the amount of cracking adds to durability in a similar way as the reduction of the pore, capillary and bleed tracts. Less cracking from loading, transportation and placement means less entry points for liquids, aggressive chemicals and the like to enter deep into the matrix of the concrete.
4. A greater hydration rate (up to 95%+(1)) results in a greater mass of calcium silicate hydrate being produced, thus creating a denser matrix. The increased use of water in the hydration process results in minimal free water being left behind, thus contributing to a denser matrix.
5. The increase in fluidity of the concrete in its plastic state, makes placement and compaction easier, thus giving a more homogenous final mix.
6. The improved Portland cement particle dispersion ensures that the calcium hydroxide produced is more evenly dispersed over the concrete mass. This benefit, in combination with the increased density detailed above, ensures that the calcium hydroxide is physically bound within the calcium silicate hydrate mix.

Conclusion

The addition of Hydramax 1609® to a concrete mix design can significantly aid the durability of the concrete. Hydramax 1609® cannot eliminate the complete effect aggressive chemicals may have upon the concrete, but the manner in which it changes the structure of the concrete helps limit the extent of degradation the aggressive chemicals can generate. The denser matrix of the concrete ensures the attack can only be at the surface. Aggressive chemicals are severely restricted from entering the concrete matrix, and therefore harmful reactions with activators, such as calcium hydroxide, are virtually eliminated.

(1) Based on a Hydramax 1609® dosage rate of 2.5% of OPC by weight, added to a comparable mix containing no admixtures.

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