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Role of ingredients for high strength and high performance concrete – A review

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Abstract. The performance characteristics of high-strength and high-performance concrete are discussed in this review. Recent developments in the field of high-performance concrete marked a giant step forward in high-tech construction materials with enhanced durability, high compressive strength and high modulus of elasticity particularly for industrial applications. There is a growing awareness that specifications requiring high compressive strength make sense only when there are specific strength design advantages. HPC today employs blended cements that include silica fume, fly ash and ground granulated blast-furnace slag. In typical formulations, these cementitious materials can exceed 25% of the total cement by weight. Silica fume contributes to strength and durability; and fly ash and slag cement to better finish, decreased permeability, and increased resistance to chemical attack. The influences of various mineral admixtures such as fly ash, silica fume, micro silica, slag etc. on the performance of high-strength concrete are discussed.

Keywords: high performance concrete; high strength concrete; mineral admixtures; curing

1. Introduction

Although high-strength concrete is often considered as a relatively new material, the development of the material has been gradual, spreading over decades. As development continued, the definition of high-strength concrete underwent continual change. For example, high-strength concrete in the 1950s meant concrete with a compressive strength of 34 MPa. This rose to 41-52 MPa and 62 MPa in the 1960s and early 1970s, respectively. 138 MPa have been classified as high strength concrete instead of have come to be used. For many years, concretes with compressive strengths in excess of 41 MPa were available at only a few locations. However, they have become common place with increasing demands from the construction industry. Currently available grades of concrete may be classified as: M50 (as normal strength concrete); M50-M100 (high-strength concrete); and beyond M150 (ultra-high strength concrete). The evolution of high-strength concrete is driven by developments in materials technology and specialty requirements of the construction industry. Several modern high-tech structures and superstructures would have been possible had it not been for high-strength concretes. This review focuses on the role of ingredients (such as admixtures), design aspects for strength, water-cement ratio (w/c), curing of concrete, strength and durability.

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