

The effects of the Water Cement Ratio and Chemical Admixtures on the Workability of Concrete

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Concrete chemical admixtures are used to improve the fresh and hardened properties of mortar or concrete in different applications. Their addition can allow for the reduction of the water to cement ratio (w/c), without affecting the workability of the mixture. By reducing the amount of water, the cement paste will have higher density. However, the reduction of the water content in a concrete mixture should be done in such a way that complete cement hydration take place and sufficient workability is achieved. In order to maintain the workability of the concrete mix, the dosage of the admixture must be carefully calculated and must be taken into account in the calculation of the w/c ratio. In the present study, three types of chemical admixtures; Type A water-reducing, Type D water-reducing and retarding and Type F high range, water-reducing admixtures conforming to ASTM C 494/C 494M – 04 standards, were used to optimize the percentage of the admixture with respect to the w/c ratio. The suitable time for the addition of the admixture is also investigated. Results show that using 1.5 % of Type A admixture with 0.45 w/c gives 45.6 MPa, 28 day compressive strength with an associated slump of 110 mm, compared to 0.0 mm slump achieved without admixture. 1.0 % Type A admixture with 0.52 w/c gives 33 MPa, 28 day compressive strength with an associated slump of 95 mm, compared to 35 mm slump achieved without admixture. For Type D admixture, using 1.5 % with 0.5 w/c the slump was 190 mm with 47 MPa, 28 day compressive strength, compared to 15 mm slump achieved without admixture. 1.0% of Type F admixture with 0.35 w/c and 0.45 w/c gave slumps of 25 mm, 225 mm and strength of 63.5MPa and 55.3MPa respectively. For all mixes, the best slump results were achieved when the admixtures were added during the initial mixing process, while maximum compressive strengths were achieved for different times of inclusion of the admixtures.