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Review on Effect of Percentage Seeding on Strength of High Strength Concrete

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Abstract-

One method for creating high strength concrete is seeding. Research on the impact of seeding on high strength concrete is few. Consequently, it was decided to conduct an inquiry into the seeding effect. The study discusses the impact of different cement seeding percentages (2%, 4%, 6%, 8%, and 10%) on the strength of M50-grade high strength concrete. The partially hydrated cement mortar cubes of ages 3 days, 7 days, 14 days, 21 days, and 28 days were employed as the seeding in this study. The comparatively low seeding rate of 4% produces good results. When 4% seeding powder is used, the strength of plain M50 concrete is increased by 25.41%. Compared to seeding powder of various ages, the 14-day seeding powder provides good strength.

Keywords – Seeding Technique, High strength Concrete, M50 Grade, Seeding powder etc.

1. Introduction

High-Strength Concrete (HSC) has attracted more attention from structural and civil engineers during the past few years. The life cycle cost-performance ratio and outstanding engineering qualities of this relatively new construction material, such as higher compressive and tensile strengths, higher stiffness, and better durability when compared to the conventional Normal Strength Concrete (NSC), can both be used to explain some of the growth in its commercial use. From a historical perspective, high-strength concrete was regarded in the middle of the 20th century as having a typical strength of 25 MPa. For instance, in the 1950s, concrete made with a compressive strength of 30 MPa was considered to be of excellent strength. Concretes that had compressive strengths of 40–50 MPa in the 1960s, 60–70 MPa in the 1970s, and 100–plus MPa in the 1980s gradually advanced and were employed in real constructions. Despite the recent significant advancements in concrete technology, HSC continues to be defined as concrete having a compressive strength more than 40 to 60 MPa. In more recent times, cast-in-place structures have been employed with compressive strengths around 130 MPa. HSC was mostly specified for projects as a backup design about twenty years ago. However, HSC is now being defined as a practical option for concrete construction at the early design stage. Today, high strength concrete can be made using technology that has evolved enough for concrete with compressive strengths up to roughly 120 MPa to be commercially available and considerably greater strengths to be created in laboratories. The numerous recent construction projects where high strength concrete has been employed successfully serve as evidence of the high strength concrete's great economic advantages.

2. Problem Statements

- • High Stability Concrete has a very low water to cement ratio, a higher binder content, and the ideal packing density to completely remove capillary pore and give an incredibly solid matrix.
- It is a high strength material made of a unique mixture of Portland cement, admixtures, fine aggregate, coarse aggregate, high-range water reducer (i.e. SP), and water as constituent ingredients.One method for creating high-strength concrete is seeding. In order to create a concrete mixture with a high strength, a little amount of finely crushed, fully or partially hydrated Portland cement is added.

3. Objectives

The following are the goals of the planned work:

- To investigate the impact of different seeding percentages, such as 2%, 4%, 6%, 8%, and 10%, on the durability of M50-grade high strength concrete.
- To comprehend the concrete seeding effect.
- To investigate the impact of the mortar's age on the production of seed powder.

4. Literature Review

Mija H. Hubler, Jeffrey J. Thomas, Hamlin M. Jennings, Mija Hubler and his team's study of the effects of adding pure calcium silicate hydrate (C-S-H) to alkali-activated slag (AAS) paste led to a much earlier and larger hydration rate peak measured with isothermal calorimetry as well as a significantly higher compressive strength after one day of curing is represented in this research. This is related to the same nucleation seeding effect as has previously been demonstrated for tricalcium silicate pastes and Portland cement. The fact that seeding accelerated AAS hydration suggests that nucleation and growth are in charge of regulating the early hydration rate. For the tests described here, the curing technique had a significant impact on how C-S-H seed affected the strength growth of AAS paste between 1 and 14 days of curing. The strength increased while being sealed, however it reduced when being cured underwater due to breaking. Differential strains brought on by chemical and autogenous shrinkage are thought to be the cause of this cracking. Portland cement paste was the subject of similar research.

R. Yu, P. Spiesz, H. J. H. Brouwers, J.H. Brouwers provides information on how nano-silica affects the hydration and microstructure development of Ultra High Performance Concrete (UHPC) with a low binder quantity. The modified Andreasen and Andersen particle packing model served as the foundation for UHPC's design. The findings show that this packing approach can produce a thick and uniform UHPC skeleton at a relatively low binder concentration (approximately 440 kg/m3). Additionally, the latent period of the cement hydration is prolonged as a result of the large amount of super plasticizer used to manufacture UHPC in this study. However, the retardation impact of the super plasticizer can be greatly offset by the nucleation action of nano-silica. Additionally, adding nano-silica increases UHPC's viscosity dramatically, trapping more air in the new mixtures and causing a commensurate rise in porosity in the cured concrete. Contrarily, the hydration of cement can be encouraged and additional C-S-H gel can be formed due to the nucleation impact of nano-silica. Therefore, it can be said that there is an ideal amount of nano-silica for creating UHPC with the lowest porosity, at which the favourable effects of nucleation and the adverse effects of trapped air can be well balanced.

Tayfun Uygunoglu, In this study, which was conducted by the Construction Department of the Technical Education Faculty at Afyon Kocatepe University in Afyonkarahisar, Turkey, it was examined whether it was possible to reuse hydrated mortars made from concrete waste as an additive to partially replace the Portland cement content in different weight ratios. Setting time, compressive and flexural strengths, alkali-silica reactivity, apparent porosity, water absorption, ultrasonic pulse velocity, and dynamic modulus of elasticity were among the parameters analysed. The findings revealed that all specimens with Hydrated Mortar Waste (HMW) material had lower compressive strengths than the control specimens, However, the results obtained by substituting HMW for 10–20% of the Portland cement fell within allowable bounds. Because the 28-day compressive strength decreased by 29% when HMW replaced 40% of the Portland cement, HMW with replacement ratios of more than -40% could not be used to replace regular Portland cement. Furthermore, when more than 20% of the cement was substituted by HMW, the expansion of mortars caused by the alkali-silica reaction was greatly reduced. Longer setting times resulted from increasing the cement replacement ratio. It was determined that ground HMW can be used as a cementitious material to partially replace Portland cement after taking into account all the experimental findings.

5. Research Methodology

Making high performance concrete with a 50 MPa grade and replacing 2–10% (i.e., 2%, 4%, 6%, 8%, and 10%) of the cement with seeding powder constitutes the experimental inquiry. The setup entails gathering the necessary supplies, casting the mortar cube, curing it, making cement powder from the mortar cube, casting the plain concrete cubes, casting the plain concrete cubes with seeding powder, curing the plain concrete cubes with and without seeding powder, and testing the plain concrete cubes for the strength investigation. As demonstrated in fig.1, the approach for this investigation is presented as a flow chart.

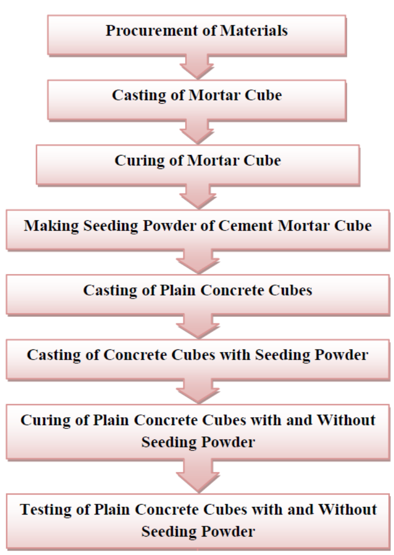

Fig. 1 : Flowchart

6. Conclusion

Research on the impact of seeding on high strength concrete is few. Consequently, it was decided to conduct an inquiry into the seeding effect. The study describes the impact of different seeding percentages by cement weight. Today, concretes with compressive strengths up to roughly 120MPa are commercially accessible, and strengths far higher than that can be generated in laboratories because to advancements in high strength concrete production technology. The numerous recent construction projects where high strength concrete has been employed successfully serve as evidence of the high strength concrete's great economic advantages.

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