HIGH STRENGTH CONCRETE USING DIFFERENT MATERIALS, A REVIEW

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Abstract - *Natural resources are quickly decreasing as a result of increased urbanisation and infrastructure construction. Fast urbanisation has resulted in rapid urbanisation, and the construction of transportation and residential amenities to accommodate people continues, resulting in the construction of dense structures that require high-quality concrete. The development of high-strength concrete may be a solution to achieve these high-quality constructions. Because of advancements in material technology, developing high-strength concrete is no longer a challenge, but maximising the use of available resources to achieve and sustain excellent construction quality at a cheap cost is a key need for study. Experimenting with several concrete mixtures to find the optimal ones for obtaining the desired mean strength. Using fly ash and Silica fume as a supplementary cementitious material enhances the durability of concrete by lowering CO2 emissions from cement manufacturing. Fly ash and silica fumes are two types of silica fumes. Because of the fineness of the particles, silica fume and fly ash improve concrete's long-term strength and reduce permeability and shrinkage. The purpose of this study is to compare the mechanical qualities of fresh concrete to the mechanical properties of hardened concrete in terms of strength parameters and cost.*

1.INTRODUCTION

The main goal of a mix design approach is to determine the quantities of concrete components that can be used in a trial batch to achieve a certain strength, long-term qualities, and performance. Most natural aggregates can achieve a compressive strength of 120 MPa by boosting the cement paste's strength. Water type and dosage, as well as water-content ratio partial replacement admixtures and other components, can all influence this. In recent years, HSC has grown in popularity. By reducing porosity, inhomogeneity, and microcracks, better strength can be achieved in the transition zone and concrete. Fly ash, silica fume, granulated blast furnace slag, and natural pozzolans are examples of superplasticizers and extra cementing elements that can aid achieve this. The following concrete classification is based on IS:456-2000 and the most recent improvements in concrete ingredients and production technology.

- Ordinary Concrete starting from grade M-20
- Standard Concrete from grade M-25 to grade M-55
- High Strength Concrete grade M-60 and above.

According to its strength, high-strength concrete is further divided into the following categories.

- Category-I (60-75MPa)
- Category-II (80- 100 MPa)
- Category-III (105-125MPa)

Despite the fact that high-strength concrete is generally regarded of as a new construction material, its development has been gradual over several decades. Year after year, the definition of high-strength concrete has changed as improvements and development have happened. In both developed and developing countries, HSC is increasingly being used in construction, particularly for multi-story buildings. The high strength might be beneficial to compression members like columns, bridge piers, and piles.

1.1 Need of Research

We live in a fast expanding world, where science and technology are constantly reaching new heights in every field, and development is accelerating. Any building project requires concrete. The primary goal of this research is to examine the properties of concrete as a result of changes in mix proportions and the use of advanced materials, in order to ensure that resources are efficiently used and that high-quality concrete is produced, which could aid in the construction of high-quality roads, high-rise buildings, and other civil engineering projects.

1.2 Objective of the Research

- The purpose of this study is to compare and establish the strength parameters of design mixes.
- Workability, consistency, and their influence on HSC strength were investigated.
- From an economic aspect, compare and analyse design mixes.

2. Literature Review-

- **P.Nath , P.Sarker (2011)-** Six high-strength concrete formulations were used to assess the effects of fly ash concentrations of 30 and 40% on concrete durability until 180 days of age. . They concluded that 28-day strength decreased when fly ash was used as a partial replacement for cement and the water-binder ratio was left unchanged. However, fly ash may be used to make HSC with a water-binder ratio of 0.31 and 40% fly ash, resulting in a 28-day strength of 60 N/mm2.

- **M. Mendis P., Wu D. Sofi (2010)** –The components of HSC have been discussed. Concrete's essential ingredients, including as SF, slag, and FA, are mostly industrial waste that would otherwise end up in landfills. This should be considered while evaluating if HSC is an environmentally friendly material. They discussed the main engineering elements of HSC, such as the compressive strength that is required to cover for.In their studies, they focused on durability and fire resistance.

- **Sundararajan and Perumal (2004) –** To identify the maximum amounts of cement replacement with silica fume, they looked at how partial cement replacement with silica fume influenced the strength and durability of HSC as well as HPC trial mix grades M60, M70, and M110, which have varied strength and durability properties. The strength and durability of these blends are compared to those lacking silica fume. The application of silica fume in the place resulted in compressive strengths of 60 N/mm2, 70 N/mm2, and 110 N/mm2 after 28 days.

- **A.Annadurai, A. Ravichandran -** The results of a mix design for high strength concrete containing silica fume and a high range water reduction additive are presented in this study (HRWR). It is the process of discovering the best concrete mixtures for achieving the desired mean strength through experimentation. Based on the ASTM C 127 standard for estimating the relative quantities and proportions for the grade of concrete M60, 53 grade ordinary Portland cement, locally available river sand, and 10 mm graded coarse aggregate were chosen in this research effort. ACI 211.4R-93 criteria were used to create this design. The following conclusions were drawn from the investigation into the mix design of high strength concrete employing silica fume and a high range water reducing additive (HRWR).The fineness modulus of fine aggregate plays a critical role in the development of high-strength concrete, and in this study, the fineness modulus of fine aggregate was chosen at 3.0 after extensive testing of numerous samples .Because of the increased fineness, an increase in the proportion of Micro silica necessitates a greater demand for water. The application of a superplasticizer is required to keep the concrete workable.

- **Vanchai Sata, Chai Jaturapitakkul , Kraiwood Kiattikomol -** The impact of pozzolan derived from a variety of by-product materials on the mechanical properties of high-strength concrete were explored experimentally in this work. To cast high-strength concrete, ground pulverised coal combustion fly ash (FA), ground fluidized bed combustion fly ash (FB), ground rice husk–bark ash (RHBA), and ground palm oil fuel ash (POFA) with median particle sizes less than 11 lm were used in part to substitute Portland cement type I. High-fine FA, FB, RHBA, and POFA pozzolanic materials (median particle size less than 11 lm) are exceptionally reactive pozzolanic materials that can be utilised to make high-strength concrete with compressive strength in the range of 80–91 MPa at 28 days. High-strength concretes with FA, FB, RHBA, and POFA have better compressive strength than CT concrete after 28 to 180 days of curing.

- **DR. MAHESH M AWATI, DR. R B KHADIRANAIKAR -** High-performance concrete (HPC) is concrete that meets certain performance and uniformity standards that aren't always met by standard materials, placement, and curing techniques. Only by adjusting the w/c ratio and adding mineral and chemical admixtures can this be accomplished. This research focuses on concrete mix design for pressures ranging from 60 to 120 MPa. Mechanical parameters like as compressive strength, tensile strength, elastic modulus, and Poison's ratio are also determined throughout the testing process. The proposed mix design method is simple to use and successful in creating HPC with the appropriate strength. The compressive strength of concrete and the split tensile strength and flexural strength are related in good agreement with ACI and Irvani Said30's equations, which are valid up to 120 MPa of force.The proposed study's elastic modulus is compared to others, and it is discovered that the proposed equation is nearly identical to Mary Beth's. The Poisson's ratio on

average is 0.165, which is considered acceptable (0.15 -0.25).

3. CONCLUSIONS

- To acquire the desired HSC, a thorough analysis will be carried out to evaluate or connect the properties of fresh and hardened concrete using various components in different amounts.
- HSC's diverse features and performance with various materials and mix proportions, as well as its application in the field, must all be investigated.
- When mineral admixture, chemical admixture, and a change in mix proportion with a low water-cement ratio are utilised, the literature provides a summary of the various characteristics of HSC.
- It's tough to make high-strength concrete with a water cement ratio of 0.29, but it's achievable with the use of high-range water reducers, and our research has found that the best HRWRA dosage is 1%.

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