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EXPERIMENTAL INVESTIGATION ON COMPRESSIVE STRENGTH OF M20 & M40 GRADE CONCRETE BY FULL REPLACEMENT OF DIFFERENT AGGREGATES

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Abstract:

Concrete is a mixture of cement, fine aggregate, coarse aggregate and water. Concrete plays a vital role in development of infrastructure i.e; buildings, industrial structures, bridges and highways etc. sand is basic material in concrete making that is required in large quantities But in the present scenario it is necessary to find the suitable substitute for sand, easy to produce and has all the required qualities for use in concrete. Manufactured sand is one among such materials to replace river sand, which can be used as an alternative fine aggregate in mortars and concretes.

Keywords: Concrete, aggregate, bridges, ingredients, fly ash, specimens.

1. INTRODUCTION

Now a day's the most commonly used structural material for all types of construction is concrete. Concrete owes its unique position as the structural material to the fact, that it is economically highly resistant to fire, wind, water, and earthquakes .In the recent times its use in construction has been increased considerably thus the cities and the towns are virtually becoming concrete jungles. The demand is likely to increase in the future to match the growing population, housing, transportation, and other amenities.As modern engineering practices become more demanding, there is a corresponding need for special types of materials with novel properties. Scientists, engineers and technologies, are continuously on the lookout for the materials which can act as substitute for conventional materials are which posses such properties as wood enable new design and innovations resulting into economy, so that the structure can be built economically. Fly ash is finely divided residue resulting from the combustion of the ground or pulverized bituminous coal or sub- bituminous coal. It is available in large quantities in the country as a waste product from a number of thermal power stations and industrial plants using pulverizes coal or lignite as fuel for the boilers. The effective use of flyash for complete replacement of cement as an admixture in cement motor and concrete as established in the country in the recent years. In India, only government educational and research institutions and construction departments are responsible for research while in advanced countries, the most remarkable breakthrough have been achieved by the building material industries and their R & D laboratories. An accepted fact is that these encouraging results on the use of admixtures are not penetrating into the user community and the entire research work is getting flocked at their orgination. With the result the very purpose of research work is questioned. Along with R & D units. The policy maker and consultants

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should take more interest in handling these issues directly keeping not only the techno economics in view but also national obligations.

2. RELATED WORK

Cement is a material that has cohesive and adhesive properties in the presence of water. Such cement is called hydraulic cements. These consist primarily of silicates and aluminates of lime obtained from limestone and clay. There are different types of cement, few of them are, Ordinary Portland cement Portland slag cement Ordinary Portland cement (OPC) is the basic Portland cement and is best suited for use in general concrete construction. It is of three types, 33 grades, 43 grades, 53 grades. One of the important benefits is the faster rate of development of strength. Portland slag cement is obtained by mixing Portland cement clinker, gypsum and granulated blast furnace slag in suitable proportion and grinding the mixture to get a thorough and intimate mixture between the constituents.

Fig.1.Basic specimen

This type of cement can be used for all purposes just like OPC. It has lower heat of evolution and is more durable and can be used in mass concrete production. in which a prediction equation has proposed which estimates the 28 days compressive strength of fly ash concrete and also be used to modify any basic cement concrete mix so that the concretes with and without sand replacement by fly ash have similar strength. The prediction equation also considers the different levels of replacement of sand. And fly ash concretes with FA at sand replacement levels of 20%, 40%, 60% were prepared. Actual FA quantity added was varied from 1.0 to 1.6 times the quantity of sand replaced to study the effect of higher quantity of fly ash in concrete. Compressive strength of these mixes was determined at 7 and 28 days. They reached their target mean strength and compared with proposed prediction equation. So by partially replacing cement with pozzolanic material such as fly ash, the cement industry can serve both the purposes of meeting the demands of construction industry and at the same time producing green and clean environment. Fly ash is of two types class F and C. Class F fly ash is produced by burning of harder, older anthracite and bituminous coals. This fly ash is pozzolanic in nature and contains less than 7% lime (CaO). However, class C fly ash is produced by burning of younger lignite sub-bituminous coal.

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3. IMPLEMENTATION

The aim of the present study was to study the effect of fly ash on compressive strength of concrete by partial replacement of cement with 0%, 10%, 20% and 30% of fly ash. The concrete mix of M20 grade was prepared as per IS10262:2009 having mix design ratio as 1:1.4:2.96 and w/c ratio of 0.50. To carry out the experimental investigation total 24 cubes of size 150mm x 150mm were casted. 6 cubes were casted to determine the compressive strength of normal concrete with no fly ash. Similarly, each set of 6 cubes were casted to determine the compressive strength for 10%, 20% and 30% replacement of cement with fly ash respectively. From these 6 cubes, 3 cubes were utilized to determine the compressive strength of concrete after 7 days of curing and rest 3 cubes were used to determine the compressive strength of concrete at 28 days. Compression Testing Machine of 2000kN capacity was used to determine the total compressive load taken by concrete at different ages. This ultimate load divided by the cross-sectional area of the cube (150mm x 150mm) yields the compressive strength of concrete. The process of selecting suitable ingredients of concrete and determining their relative amounts with the objective of producing a concrete of the required, strength, durability and workability as economically as possible, is termed the concrete mix design. The proportioning of ingredient of concrete is governed by the required performance of concrete in 2 states, namely the plastic and the hardened states. If the plastic concrete is not workable, it cannot be properly placed and compacted. The property of workability, therefore, becomes of vital importance The compressive strength of hardened concrete which is generally considered to be an index of its other properties, depends upon many factors, e.g., quality and quantity of cement, water and aggregates; batching and mixing; placing, compaction and curing. The cost of concrete is made up of the cost of materials, plant and labour. The variations in the cost of materials arise from the fact that the cement is several times costly than the aggregates, thus the aim is to produce as lean a mix is possible. From technical point of view the rich mixes may lead to high shrinkages and cracking in the structural concrete, and to evolution of high heat of hydration in mass concrete which may cause cracking. The actual cost of concrete is related to the cost of materials required for producing a minimum mean strength called characteristic strength that is specified by the designer of the structure. This depends on the quality control measures, but there is no doubt that the quality controls add to the cost of concrete. The extent of quality control is often an economic comprise, and depends on the size and type of job. The cost of labour depends on the workability of mix, e.g., a concrete mix of inadequate workability may result in a high cost of labour to obtain a degree of compaction with available equipment.

4. ANALYSIS

Simplicity and under normal circumstances, have a margin of strength above that specified. However, due to variability of mix ingredients the nominal concrete for a given workability varies widely in strength. 2. Standard mixes The nominal mixes of fixed cement-aggregate ratio (by volume) vary widely in strength and may result in under or over-rich mixes. For this reason, the minimum compressive strength has been included in many specifications. These mixes are termed standard mixes. IS 456-2000 has designed the concrete mixes into a number of grades as M10, M15, M20, M25, M30, M35 and M40. In this designation the letter M refers to the mix and the number to the specified 28 days cube strength of mix in

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Fig.2.Compression Testing

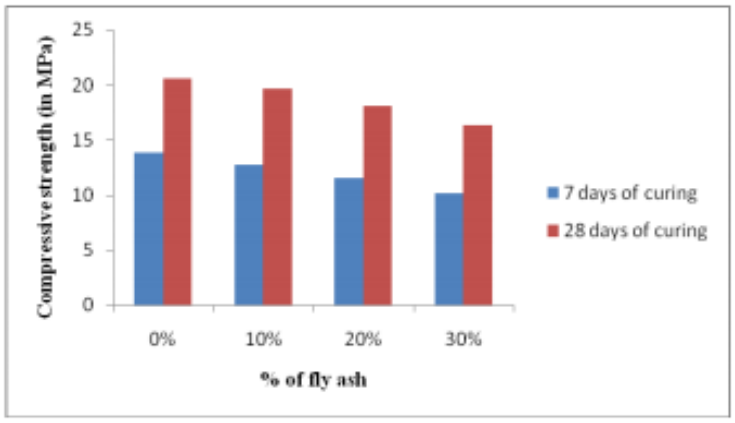

Fig.3.Compressive output

N/mm2. The mixes of grades M30 and M40 correspond approximately to the mix proportions (1:1.25:2.75) and (1:1.65:92) respectively. The increase in fly ash content also leads to retardation in the setting time of concrete. It was observed as the compressive strength for normal concrete with no fly ash at 7 days was 67% of characteristic compressive strength, whereas the compressive strength for concrete with 30% fly ash at 7 days was 60% of characteristic compressive strength.

CONCLUSION

The compressive strength of concrete decreases with increase in fly ash content. The reduction in compressive strength of concrete at the age of 28 days was found to be 4.57%, 12.20% and 20.55% for 10%, 20% and 30% replacement of cement with fly ash. As the cement was replaced with fly ash, the reduction in compressive strength of concrete was higher at the age of 7 days as compared to 28 days. This occurs as the secondary hydration due to pozzolanic action is slower at initial stages for fly ash concrete.

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