A REVIEW ON DEVELOPMENT OF HIGH PERFORMANCE CONCRETE BY USING RECYCLED AGGREGATE AND FLY ASH

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ABSTRACT

There is a growing demand for the development of new type concrete due to its high strength, performance, durability, serviceability and overall economy in long term. High performance concrete meets all of the above criteria to fulfil our needs.

This project is aim at developing such High Performance Concrete that can provide the enhanced mechanical strength to the concrete. The concrete made of such strength uses Silica Fume, Recycled Aggregates and Super plasticizers that enhance the concrete properties. In this study the compressive strength and split tensile strength of High Performance Concrete mixtures for different percentage of replacement of cement with silica fume are reported. It is found that maximum increase in compressive strength and split tensile strength is for concrete mix in which 8% silica fume will replace with cement. Due to these outstanding properties, High Performance Concrete provides new possibilities of lighter and larger structures with economy and resource consumption than that of traditional concrete, steel and other building materials

Keyword :- *Recycled Aggregate, silica fume, fly ash*

1. INTRODUCTION

High performance concrete has low permeability and diffusion and also has high durability and long life in severe environments. To increase the strength of concrete water to cement ratio should be decreased. Due to which other properties will also improve. High performance concrete can be prepared by adding mineral admixture to the concrete at lower water to binder ratio.

As we also can say that when the general performance of concrete is higher than that of normal concrete then it would be termed as high performance concrete. The high performance concrete is not made by special materials but it was made by same materials by which normal concrete is made. Only difference in making high performance concrete is that its ingredients and proportion are specially take. Silica fume, Fly Ash and pozzolonic material is use to make high performance concrete. These materials are finer than the cement that fills the voids of cement by which concrete would be denser and hence increases its strength and also leads to lesser micro cracking in concrete. Dense concrete will more durable and possesses high strength.

Generally high performance concrete has high early strength, high modulus of elasticity, high abrasion resistance, volume stability and also less permeability. High performance concrete not always gives the required results some time it will fail before its life span. Long term stability of high performance concrete is further need to be study with those finer materials. High performance concrete increases the service life of the concrete structure so it would make economical than the normal type of concrete. For making high performance concrete cement should contain a little C_3A otherwise if C_3A will be more, heat of hydration will be more and that will result in reducing the ultimate strength of the concrete. The most important property of high performance concrete which differs from the normal concrete would be its higher durability.

Researchers up to this date show use of recycled aggregate as partially replaced with natural aggregate can be used. Literature available with the use of recycled coarse aggregate is enough. In this dissertation, study of important strength parameters on high performance concrete will be evaluated

2. LITERATURE SURVEY

The applications of recycled aggregate and high performance concrete in the construction area are very wide. There are many testing based on the recycled aggregate and high performance concrete have been carried out all around the world.

Adnan et al. [May 2008], compared the strength properties of natural aggregate and recycled aggregate. For this purpose, they investigate compressive strength of recycled aggregate concrete with various percentages (0%, 25%, 50%, 75%, and 100%). Their research also covered recycled aggregate concrete mixtures at different water-cement ratio (0.4, 0.5, and 0.6). They found that recycled aggregate concrete had lower compressive strength as compare to natural aggregate concrete. They also find that 28 days' compressive strength of recycled aggregate concrete with water-cement ratio 0.4 had the highest compressive strength.

Safiuddin et al. [September 2010] made an investigation on the potential use of various recycled material for producing construction materials. It is found that at lower percentage of recycled coarse aggregate strength is more as compared to the higher percentage of recycled coarse aggregate. Water requirement will be increased when the percentage of recycled aggregate will increase.

Butler et al. (2011) [2] however, concluded that recycled coarse aggregate concrete had higher compressive strength values than the natural aggregate concrete. This is likely due to the stronger mortar–aggregate bond between the RCA and the new mortar.

Salehlamein et al. [January 2015], suggested that there must be modification in using the recycled aggregate. They said that if in concrete, we used a huge amount of recycled aggregate then its strength was not gained. So before using the recycled aggregate, one should decide the percentage of recycled aggregate. So their research carried out the basic physical property of both natural aggregate and recycled aggregate and they also compared their basic properties like specific gravity, water absorption and crushing strength.

Magudeaswaran et al. [April 2015], studied the different behaviour of green high performance concrete using silica fume, fly ash and the other ingredients, which is locally available fine aggregate and coarse aggregates. They investigate that the carbon dioxide which released in the manufacturing process of OPC is in large amount and such large quantity was harmful to environment. They reduced the amount of Portland cement used in construction by partial replacement of cement with fly ash and silica fume and replaced sand with eco sand. Their results showed that the mechanical properties of concrete were assessed from the compressive strength, tensile strength and flexure.

Yang et al.[November 2015],made a research on behavior of concrete with recycled aggregate and synthetic macro fiber and micro silica. They replace 0-100% recycled aggregate with natural aggregate and to improve the mechanical properties an increment of 25% Synthetic macro fiber and micro silica were added to some of the concrete mixes .The aim of their project to determine maximum percentage of recycled aggregate that can be use without lowering much strength. They suggested that optimum fraction of recycled coarse aggregate in concrete which can we used would be from 20% to 50%.

3. OBJECTIVES

Objective of my work is to investigate the mix proportioning of high performance concrete such as we could get optimum content of recycled coarse aggregate with maximum value up to which that can be partially replaced with natural coarse aggregate. The scope of my work is include an examination of

- The effect of recycle coarse aggregate on the compressive strength of high performance concrete.
- The effect of replacement of recycled coarse aggregate on durability of high performance concrete.

- The effect of recycled coarse aggregate on the split tensile strength and flexural strength of high performance concrete.

4. PROPOSED METHODOLOGY

The experimental work planned in this investigation consists of mix proportioning of high performance concrete with varying percentage replacement of recycled coarse aggregate with natural coarse aggregate. In this investigation we will use workability test, compressive test, indirect tensile test, flexural test, and permeability test. Six batches of concrete mixes will prepare that will consist of 0% minimum recycled coarse aggregate and 50% maximum recycled aggregate with every mix differ by 10% from 0% to 50%. All batches consist of 30% of fly ash and water/binder ratio as 0.36.

The methodology for experimental work includes-

1. 0%, 10%, 20%, 30%, 40% and 50% of recycled coarse aggregate by weight of natural coarse aggregate replace for investigating the effect of replacement on HPC.
2. Compressive strength of concrete cubes will have noted on 21, 28, and 56 days.
3. The 28 and 56-day split tensile strength will test.
4. The 28 and 56-day flexure strength will test.
5. Coefficient of permeability of cube will test.

5. CONCLUSIONS AND RECOMMENDATIONS

A comparative study has been carried out to understand the performance of recycled coarse aggregate induced HPC mixes with fly ash as cementious material. Five properties of concrete which are namely slump, compressive strength, split tensile strength, flexural strength and permeability will choose for study in the present investigation however, long term effects need to be evaluate. 30% Fly ash replacement to cement and 30% recycled aggregate replacement to natural aggregate will recommend.

Further testing and studies on the recycled coarse aggregate concrete is highly recommend to indicate the strength characteristics of recycled coarse aggregate for application in high strength concrete.

Due to more water absorption of recycled coarse aggregate it may have less workability. Therefore, it is recommending that adding admixtures such as super plasticizer, fly ash, silica fume. etc into the mixing so that the workability can be improved.

More investigations and laboratory tests shall be done on the strength characteristics of recycled coarse aggregate. It is recommending that testing can be done on concrete slabs, beams and walls.

More trials with different particle sizes of recycled coarse aggregate and percentage of replacement of recycled coarse aggregate with fly ash as cementitious material with % replacement of cement are recommended to get different outcomes and higher strength characteristics in the recycled coarse aggregate concrete with fly ash.

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