Effects of Fly Ash And Silica Fumes With Recycled Aggregates on Durability of Concrete

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Abstract- *This is an experiment conducted with an objective to study the effects of Fly Ash and Silica Fumes with Recycled aggregates on Strength of Concrete. Primarily this is done with an aim to study the changes in compressive strength. The Quantity of material Recycled aggregate is varied 10%, 20 % and 30 % while Fly ash is Varied 0%, 20%, 25%, 30%,35% and Silica fume 5 % & 10%. To achieve it we utilized OPC grade 43. The moulds of size 15 x 15 x 15 cm are utilized. The replacement levels for OPC 43 with Fly ash were 0%, 20% and 25%, 30%, 35% and Adding Silica Fume were 5% and 10% by weight of cement. The concrete is cured for 7 and 28 days. The design mix is M25 type. The maximum compressive strength increased after curing period of 7 days was 20.36 N/mm^2 and. The results found at the end of the experiment showed that the maximum compressive strength increased to 31.33 N/mm^2 after curing period of 28 days. The cost analysis done is depended on market cost of binding material i.e. fly ash, Silica Fume and ordinary Portland cement. From the cost analysis it can be concluded that the cost of binding material reduced to 75.8 Rs Per Cubic Metre at the end of this study it was found that optimum percentage of replacement for a curing period of 28 days. Any further partial replacement tends to decrease the compressive strength drastically. Carbonation of concrete is a process by which Carbon di Oxide from the air penetrates into the concrete and reacts with calcium hydro-oxide to form calcium carbonates. Conversion of Ca(OH)2 into CaCO3 by action of CO2 by itself is not reactive. In the presence of moisture, CO2 changes into dilute carbonic acid which attacks the reinforcement and also reduces alkalinity of concrete. In this test Phenolphthalein solution is used as indicator. Carbonation of concrete is one of the main reasons for corrosion of reinforcement. Oxygen and moisture are the other components required for corrosion of embedded steel. In this test, the depth of carbonation is determined. Durability in Carbonation Test of Concrete is having Minimum Depth 4.5mm in M14 Design Mix*

I. INTRODUCTION

To construct a structure, we need a binding material which is chosen as per the standards accepted globally and simultaneously to support the "Goal of Save Environment Todays Need" is to use such ingredients which minimize the mining activity and for that we can use the different waste products which obtain from the different industry like fly ash from thermal power plant, silica fume and ground granulated blast furnace slag from steel industry , rice husk from agriculture field and recycled aggregate from construction sites or dismantled old site As Maximum As Possible. These are the waste product which we used in concrete matrix by replacing the small to medium in quantity with the original one, like few percentage of fly ash can replace the equal amount of cement, similarly silica fume. fresh aggregate replace with recycle aggregate. The cost of the structure depends on several factors- type of structure, purpose of structure and materials used. In this study I have used the Building material like cement, fly ash, silica fume, sand, fresh aggregate and Recycled aggregate in different percentage s and different combination to know the effect on compressive strength and other properties. Cement is known for its binding properties. In this study we have tried to partially replace the cement with Silica Fume (SF) and Fly ash (FA) because they also contain binding properties and Improves Strength. They are waste material which are produced in million tons all over the world. They are less costly then cement. We have chosen All of them to study their combined effect of FA & SF with Recycled Aggregate on Strength and Durability Aspects of Concrete.

II. MATERIAL UTILIZED

1. CEMENT-

A bonding material used in manufacturing of concrete is cement. Earlier limestone was used as cement but the cement used in modern construction is Portland cement. This name is derived from the Portland stone, Island of Portland, United Kingdom. Portland cement is of two types of Ordinary Portland Cement (OPC) and Pozzolana Portland Cement (PPC). The difference between OPC and PPC is that OPC contain just the basic silicates and aluminates while the PPC contains fly ash or other additives with silicates and aluminates. The strength giving properties is because of the

porous structure of gel. Argillaceous and calcareous material is used in the production of cement. Calcareous material like limestone and argillaceous material like fly ash. The good quality of cement must contain good strength

2. FLY ASH(FA)

Fly ash is a fine gray powder consisting mostly of spherical, glassy particles that are produced as a byproduct in coal-fired power stations. Fly ash has pozzolanic properties, meaning that it reacts with lime to form cementitious compounds. It is commonly known as a supplementary cementitious material. Fly ash can be used as prime material in many cement-based products, such as poured concrete, concrete block, and brick. One of the most common uses of fly ash is in Portland cement concrete pavement or PCC pavement. Road construction projects using PCC can use a great deal of concrete, and substituting fly ash provides significant economic benefits. Fly ash has also been used as embankment and mine fill, and it has increasingly gained acceptance by the Federal Highway Administration.

3. SILICA FUME

Silica fume is a byproduct of producing silicon metal or ferrosilicon alloys. One of the most beneficial uses for silica fume is in concrete. Because of its chemical and physical properties, it is a very reactive pozzolana. Concrete containing silica fume can have very high strength and can be very durable. Silica fume is available from suppliers of concrete admixtures and, when specified, is simply added during concrete production. Placing, finishing, and curing silica-fume concrete require special attention on the part of the concrete contractor.

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4. RECYCLED AGGREGATE

Recycled Coarse Aggregates (RCAs) are obtained by crushing of concretes from demolition of concrete structural components in many structures such as: old buildings, concrete pavements, bridges & structures, at the end of their service life & utility, structures deteriorated beyond the possibility of repairs, structures that are turned into debris resulting from natural disasters (such as floods, earthquake, tsunami, manmade disaster/war, etc.), structures not serving the needs in present scenario, old structures to be brought down to pave way for new construction for better economic growth. RCAs actually results from crushing of waste concrete and this material as a replacement for natural aggregates can be employed in many applications such as: construction of low rise buildings, manufacture of paving blocks &tiles, laying of flooring and approach lanes, in sewerage structures andsub-base course of pavement, besides drainage layer in highways

III. DURABILITY OF CONCRETE

CARBONATION TEST-:

Carbonation of concrete is a process by which Carbon di Oxide from the air penetrates into the concrete and reacts with calcium hydro-oxide to form calcium carbonates. Conversion of Ca(OH)2 into CaCO3 by action of CO2 by itself is not reactive. In the presence of moisture, CO2 changes into dilute carbonic acid which attacks the reinforcement and also reduces alkalinity of concrete. In this test Phenolphthalein solution is used as indicator. Carbonation of concrete is one of the main reasons for corrosion of reinforcement. Oxygen and moisture are the other components required for corrosion of embedded steel. In this test, the depth of carbonation is determined. The rate of carbonation depends on the grade of concrete, permeability of concrete, whether the concrete is protected or not, depth of cover, time, etc. This test is most commonly carried out by spraying the indicator on freshly exposed surfaces of concrete broken from the structure. Carbonation depth is accessed by using a solution of phenolphthalein indicator that appears pink in contact with alkaline concrete with pH value in excess of 9 when the concrete is not carbonized. Colorless at lower levels of pH value when concrete is carbonated and the protective layer gets destroyed and the steel is exposed to corrosion.

TABLE FOR 7 & 28 Days Carbonation test

S No	% SILICA FUME	% FLY ASH	%RECYCLED AGGREGATE	CARBONATION DEPTH (MM)	STRENGHT 7 DAYS N/mm^2
1	10	0	20	6.9	18.4
2	10	20	20	6.0	20.36
3	10	25	20	6.6	18.86
4	10	30	20	6.8	18.6
5	10	35	20	6.9	18.56
S No	% SILICA FUME	% FLY ASH	%RECYCLED AGGREGATE	CARBONATION DEPTH (MM)	STRENGHT 28 DAYS N/mm2
1	10	0	20	5.2	28.3
2	10	20	20	4.5	31.33
3	10	25	20	4.8	29.06
4	10	30	20	5.0	28.63
5	10	35	20	5.4	28.06

IV. CONCLUSIONS AND DISCUSSION

After the partial replacement of OPC with FA Silica fume and natural aggregates with recycled aggregates which varied in different proportion, it was found as follows.

1. The Results Show that the Optimum Replacement of Recycled Aggregate with natural aggregate is 20% above that (i.e. 30 %) the Compressive Strength Decreases.
2. By Replacing Cement and Coarse Aggregate with Fly Ash and Recycled Aggregate and adding Silica Fume. the Cost is Reduced Up to 75.8 Rs Per Cubic Metre
3. Carbonation test had been done for the Durability of Concrete
4. Durability of Concrete Obtained have Minimum Carbonation Depth that is 4.5 mm for the Concrete of Different Proportion that is10% SF, 20 % Recycled Aggregate and 20 % Fly Ash

V. RESULT

The similar preparation of FA taken for the partial replacement of ordinary Portland cement are shown in the table with the results obtained after the test including the graph for 7 days and 28 days respectively. They show the variation occurred in their compressive strength for M25 mix design of concrete. The maximum compressive strength observed for curing period of 7 days was 20.36 N/mm^2 and the maximum compressive strength observed for curing period of 28 days was 31.33 N/mm^2. Durability in Carbonation Test of Concrete is Minimum 4.5mm in M14 Design Mix

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