Experimental Study of Replacement of Ingredients of Concrete with Local Waste of Industries

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Abstract: - Use of recycled waste fly ash bricks in concrete can be useful for environmental protection and economical terms. Recycle of fly ash bricks as replacement of coarse aggregate are the Materials for the future. Same as fly ash is also a by-product from various industries. Fly ash is a group of materials that can vary significantly in composition. Its residue left from burning coal, which is collected on an electrostatic precipitator or in a bag house. It mixes with flue gases that result when powdered coal is used to produce electric power. The advantages of using fly ash for outweigh the disadvantages. The most important benefit is reduced permeability to water and aggressive chemicals. Properly cured concrete made with fly ash creates a denser product because the sizes of the pores are reduced. This increases strength and reduces permeability. Globally, the concrete industry consumes large quantities of natural resources, which are becoming insufficient to meet the increasing demands. At the same time, large number of old buildings and other structures have reached the end of their service life and are being demolished, resulting in generation of demolished concrete. Some of this concrete waste issued as backfill material, and much being sent to landfills. Recycling of fly ash bricks by using it as replacement to new aggregate in concrete could reduce concrete waste and conserve natural sources of aggregate. In this thesis we also found that due to addition of fly ash bricks increasing voids in concrete so we used granite dust its provided strength and remove voids. Fly ash is known to be good pozzolanic increase the ultimate compressive strength and workability of fresh concrete. At the 30% we get good result for replacement of concrete ingredient.

Key Words: — ***Concrete, Recycled Waste, Fly ash bricks.***

I. INTRODUCTION

Concrete is a composite material composed of fine and coarse aggregate bonded together with a fluid cement (cement paste) that hardens (cures) over time. In the past lime-based cement binders were often used, such as lime putty, but sometimes with other hydraulic cements, such as a calcium aluminate cement or with Portland cement to form Portland cement concrete (named for its visual resemblance to Portland stone).[2][3] Many other non-cementitious types of concrete exist with other methods of binding aggregate together, including asphalt concrete with a bitumen binder, which is frequently used for road surfaces, and polymer concretes that use polymers as a binder.

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When aggregate is mixed with dry Portland cement and water, the mixture forms a fluid slurry that is easily poured and molded into shape. The cement reacts with the water and other ingredients to form a hard matrix that binds the materials together into a durable stone-like material that has many uses Often, additives (such as pozzolana or super plasticizers) are included in the mixture to improve the physical properties of the wet mix or the finished material. Most concrete is poured with reinforcing materials (such as rebar) embedded to provide tensile strength, yielding reinforced concrete.

1.1 Alternatives for Natural Sand

As the supplies of suitable natural sand near the point of consumption are becoming exhausted, the cost of this sand is increasing, which is ultimately increasing the cost of the construction.

The demand of sustainable growth of infrastructure in modern times is to find an alternative material that should *not only* satisfy the technical specification of fine aggregate, but it should also be abundantly available. A lot of research has been done in the past to find alternate source of fine aggregate. Crushed sands, fine aggregate produced from stone crushing, has become very popular in areas where natural sand is not abundantly available or where there is scarcity in the supply of natural sand.

1.2 Objective

The main objective is to study the potential of fly ash waste bricks to be used as a partial substitute of natural coarse aggregate in concrete. And also used sugar cane baggers ash replacement of cement.

In this study, concrete mixes are prepared with partial replacement of natural aggregate with fly ash waste bricks at different substitution rates of 10%, 20%, 30%, 40% and 50%, and different properties of concrete are compared with the control concrete mix containing 100% natural aggregate. And also using Granit dust to filled voids of fly ash bricks respectively partially replacement of sand Different objectives of this study are given below:

- To compare the workability of concrete mixes incorporating fly ash waste bricks as partial replacement of natural aggregate with control concrete mix.
- To compare the compressive strength, splitting tensile strength and density of concrete mixes incorporating fly ash waste bricks as partial replacement of natural aggregate with control concrete mix.
- To study various changes occurred in cement phases with inclusion of fly ash waste bricks partial substitute of natural coarse aggregate in concrete mixes by hand mixture.
- To find out the optimum percent replacement of natural sand with fly ash waste bricks so as to give acceptable workability, hardened and durability properties.

On field we find out the voids in fly ash bricks therefore we used granite dust to remove voids and provided strength in concrete, finally we tested compressive strength, flexural strength and other properties of fresh concrete in the laboratory.

II. LITERATURE REVIEW

R. NAGALAKSHMI [2], study on replacing 20% of FA for all concrete mix with cement and replacing 10%,20% and 30% of coconut shell as coarse aggregates of concrete having grade M-25 & gives strength characteristics as strength, split tensile strength & flexural strength of concrete for 7,14,28 days.

Dr. G. Vijayakumar, Ms H. Vishaliny, Dr. D. Govindarajulu [3], studied possibility of glass powder as replacement of binding material in concrete & replaced 10%, 20% 30 % and 40% as powder of glass & tested for flexural, tensile, compressive strength for 60 days & compared with conventional concrete & concluded that powder of glass used as replacement of cement up to size of particle < 75µm.

Marthong, T.P Agrawal [4], had a study on concrete properties effects with different grades of OPC & FA. Main points in study have different dosage of FA of 10 to 40%. The durability, Shrinkage and strength of concrete were analyzed and their test shown FA inclusion OPC.

III. MATERIALS USED

- Cement (PPC)
- Fine sand
- Coarse aggregate
- Water
- Fly Ash bricks
- Granite dust as filler voids of FAB

3.1 Fly Ash Bricks

Fly ash or flue ash, also Known as pulverized fuel ash in the United Kingdom, is a coal combustion product that is composed of the particulates (fine particles of burned fuel) that are driven out of coal-fired boilers together with the flue gases. Ash that falls to the bottom of the boiler's combustion chamber (commonly called a firebox) is called bottom ash. In modern coal-fired power plants, fly ash is generally captured by electrostatic precipitators or other particle filtration equipment before the flue gases reach the chimneys. Together with bottom ash removed from the bottom of the boiler, it is known as coal ash. Depending upon the source and composition of the coal being burned, the components of fly ash vary considerably, but all fly ash includes substantial amounts of silicon dioxide (SiO_2) (both amorphous and crystalline), aluminum oxide (Al_2O_3) and calcium oxide (CaO), the main mineral compounds in coal-bearing rock strata.

Fig.1. Fly Ash Bricks Sample

3.2 Granite Dust (GD)

Rocks and natural stone are the most common resources used for the production of building materials. Granite is one of the most widespread rocks among the main metamorphic ones used in construction. This is one of the most common rocks in the earth's crust.

Fig.2. Mix Granite dust powder

- *STAGE-1* Cube test in Concrete M30 Concrete.
- STAGE-2 Cube test in Concrete M30 Concrete where partially replacement of natural coarse aggregate with WFAB for 7 days' cubes & 28 days.
- STAGE-3 Flexural strength test in Concrete M30 Concrete where partially replacement of natural coarse aggregate with WFAB for 7 days& 28days beams.
- STAGE-4 Compressive strength Cube test in Concrete M30 Concrete where partially replacement of natural coarse aggregate with WFAB for 7 days& 28days cubes, sand replacement by GD.
- STAGE-5 flexural strength beam test in Concrete M30 Concrete where partially replacement of natural coarse aggregate with WFAB for 7 days& 28days beams.

IV. RESULT ANALYSIS

4.1 Comparison Between Average Value of Compressive Strength in 7 Days & 28 Days with Different Percentage of Partially Replacement of Coarse Aggregate, Sand

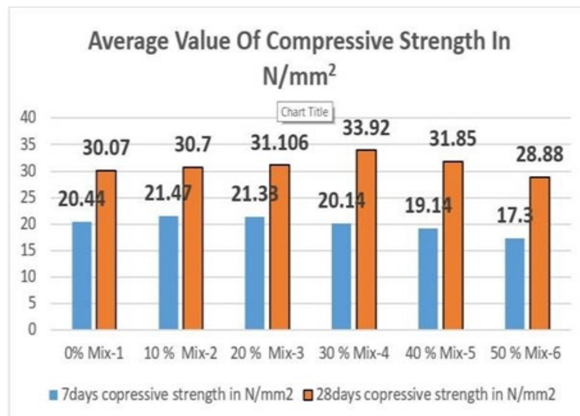

Fig.3. Compressive Strength Result for 7days & 28 days' coarse aggregate replacement on 0%, 10%, 20% 30, and 40 %. Percentage by WFAB

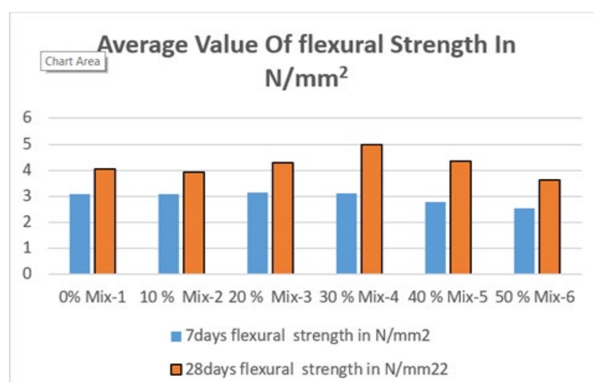

Fig.4. Flexural Strength Result for 7days & 28 Days Coarse Aggregate Replacement on 0%, 10%, 20% 30, And 40 %. Percentage by WFAB

4.2 Graphical Comparison Compressive Strength Cube Test in Concrete M30 Concrete Where Partially Replacement of Natural Coarse Aggregate with WFAB for 7 Days& 28days Cubes, Sand Replacement by GD On Different Percentage

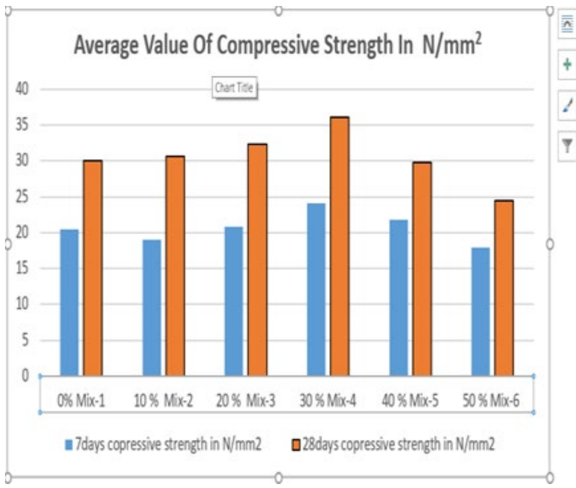

Fig.5. Average Compressive Strength Result for Coarse Aggregate Replacement On 0%, 10%, 20% 30, And 40 %. By WFAB and Also Replacement Fine Sand by GD

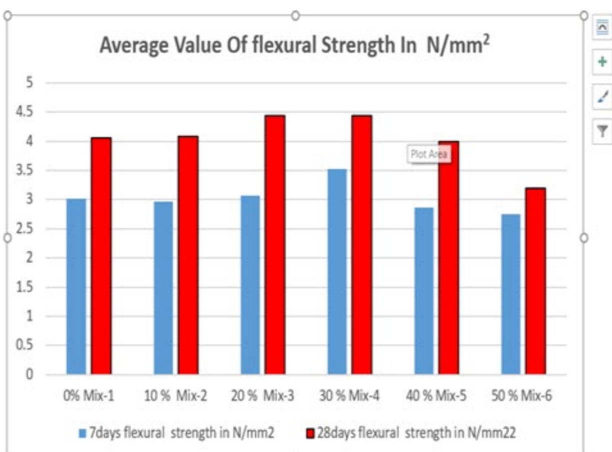

Fig.6. Flexural Strength Result for Coarse Aggregate Replacement On 0%, 10%, 20% 30, And 40 %. By WFAB and Also Replacement Fine Sand by GD

V. Result Description

The present experimental investigation was conducted to study the suitability of granite dust as a partial replacement of natural sand in concrete. Workability, compressive strength, splitting tensile strength, water absorption, rapid chloride-ion permeability of concrete was tested by replacing natural sand with granite dust where also replacement of natural coarse aggregate with the help of WFAB. At different varying percentages in concrete. Concrete mixes to study changes in cement phases as well as microstructure of concrete with the inclusion of granite dust as partial replacement of natural sand. Test results indicate that granite dust, an industrial by- product, is a suitable No. substitute of natural sand in concrete. And also, natural aggregate with WFAB.

VI. Conclusions

- The addition of WFAB & WGD has improved the compressive strength, split tensile strength and flexural strength of concrete.
- The results also revealed that addition of the WFAB & WGD in concrete increases and decrease the density of about 10 to 20% thereby the self–weight of the concrete.
- Workability of concrete was decreased as the percentage replacement of natural sand which granite dust was increased. The increase in specific surface area of fine aggregate due to the micro-fines present in quarry dust and the angular shape of quarry dust particles increased the water demand of concrete and consequently resulted in decrease in workability. However, workability of all concrete mixes up to 40% maximum sand replacement was suitable No. in structural uses.
- When we talk about over all in the condition of both materials' replacement (WFAB, GD) which increasing percentage where increasing strength but not more at 30% to 40%.
- Compressive strength in only replacement of WFAB not gives good result due to binding in concrete mixture required more compaction than we added the GD in WFAB with cement slurry.
- Water absorption of concrete was decreased with increase in replacement of natural sand with granite dust at all ages. Concrete mix with 30 to 50% sand replacement level had lowest water absorption among all mixes. The filling effect of quarry dust micro-fines reduced voids, which consequently decreased water absorption of concrete.
- Flexural strength in the both condition of partially replacement of sand and coarse aggregate by WFAB, GD we get best result from 20% to 30% of replacement so we can adopt 30% replacement.

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