INVESTIGATION ON BEHAVIOUR OF M30 CONCRETE BY PARTIAL REPLACEMENT OF FINE AGGREGATE BY BOTTOM ASH AND COARSE AGGREGATE BY RECYCLED COARSE AGGREGATE

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ABSTRACT:- The paper presents the laboratory investigations carried out by replacing fine aggregate by bottom ash and coarse aggregate by recycled concrete aggregate to study and compare the different parameters of concrete prepared from the above two types of and a comparison is made to ascertain the quality and performance of the concrete. The fine aggregate is replaced with 10%, 15%, 20%, 25%, 30% of bottom ash and coarse aggregate is replaced with 15%, 30%, 45%N, 60%,75%. . Concrete cubes are tested at the age of 7 and 28 days of curing. A design mix for M30 was made as per IS code and the results are compared with the conventional concrete.

Key words: Bottom ash, Recycled coarse aggregate, Compressive strength, Tensile strength

I. INTRODUCTION:

Energy is the main backbone of modern civilization of the world over, and the electric power from thermal power stations is a dominant source of energy, in the order of electricity. In India, over 70% of electricity generated is by combustion of fossil fuels, out of which approximately 61% is contrived by coal-fired plants. This results in the origination of around 100 ton of ash. Most of the ash has to be disposed of either dry, or wet to an open area serviceable near the plant or by grounding both the fly ash and bottom ash hand mixing it with suitable amount of water and pumping into artificial lagoon or dumping yards this brings out the pollution in water bodies and ruin of productive land.

Recycling as part of environmental considerations has become a common feature in the construction industry. Concrete debris is the waste material that results from the construction, renovation, or demolition of any structure, including buildings, roads, and bridges. As what most people do in the preservation of the environment and for economic purposes, studies, researches and experiments are being done to discover new ways on how to find solution considering where else to put these debris and what can be done to lessen its disposal to landfills and since there is an increasing environmental problem regarding the waste disposal to landfills, it is necessary to think of possible ways on how to avoid these problems and at the same time secure safety and convenience, and that is to recycle

II . MATERIAL USED

A. Cement: Ordinary Portland cement 53 grade from Shankar Cement Company was used for this study. This cement is the most widely used one in the construction industry in India.

B. Coarse and fine aggregates: Locally available river sand with specific gravity 2.65 and fineness modulus 3.39 and locally available quarried and crushed stones of 20 mm and down size with specific gravity 2.76 and fineness modulus 7.81 were used as fine and coarse aggregates respectively throughout the investigation in all concrete mix.

C. Water: Water is required for the cement to hydrate and solidify. Water having qualities of potable water was used in the experiment.

D. Bottom ash : Bottom ash is the coarser material, which drops into the bottom of the furnace in latest large thermal power plants and constitute about 20% of gross ash content of the coal fed in the boilers. It consists of non combustible materials, and is the residual part from the incineration of household and similar waste. Raw bottom ash is a granular material that consists of a mix of inert materials such as sand, stone, glass, porcelain, metals and ash from burnt materials.This coal bottom ash is physically coarse, porous, glassy, granular, greyish and incombustible materials that are collected from the bottom of furnaces that burn coal. The type of bottom ash produced depends on the type of furnace and also the sources of coal. From the burning process of coal, 80% of product will become fly ash and remain 20% of product is bottom ash.

PROPERTIES:
Specific gravity - 2.6
Water absorption - 3.61%
Fineness modulus – 3.12

E. Recycled coarse aggregate: Concrete aggregate collected from demolition sites is put through a crushing machine. Crushing facilities accept only uncontaminated concrete, which must be free of trash, wood, paper and other such materials. Metals such as rebar are accepted, since they can be removed with magnets and other sorting devices and melted down for recycling elsewhere. The remaining aggregate chunks are sorted by size. Larger chunks may go through the crusher again. Crushing at the actual construction site using portable crushers reduces construction costs and the pollution generated when compared with transporting material to and from a quarry. Large road-portable plants can crush concrete and asphalt rubble at 600 tons per hour or more. These systems normally consist of a rubble crusher, side discharge conveyor, screening plant, and a return conveyor from the screen to the crusher inlet for reprocessing oversize materials.

PROPERTIES:
Specific gravity - 2.68
Water absorption – 6.4%

III. MIX DESIGN

A. Ratio:-

Mix Design is carried out by using Indian standard codes i.e. IS 456 -2000, & IS 10262-1982. In my dissertation work I am using M30 grade conventional concrete & the mix details are as follows.

M30 GRADE	CEMENT (KG)	FA (KG)	CA (KG)	WATER
Quantity	450	762.85	987.7	186
Proportions	1	1.6	2.1	0.40

B. TRAIL MIXES:-

Conventional Mix:
Mix 1[100% cement+100% Fine Aggregate+100% Course Aggregate]
% of Replacement Mix:
Trial 1[100% Cement+10%bottom ash+15%RCA]
Trial 2[100% Cement+15%bottom ash+30%RCA]
Trial 3[100% Cement+20%bottom ash+45%RCA]
Trail 4[100% Cement+25%bottom ash+60%RCA]
Trail 5[100% Cement+30%bottom ash+75%RCA]

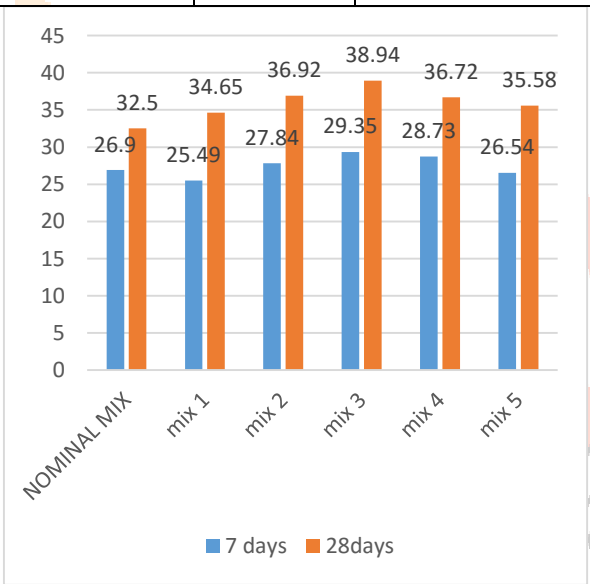
IV. TESTING RESULT

A. Compressive strength Test:

A compression testing apparatus is used to determine the compressive strength of the concrete. The cubes were tested and the ultimate loads were recorded.

Compressive strength = P/A

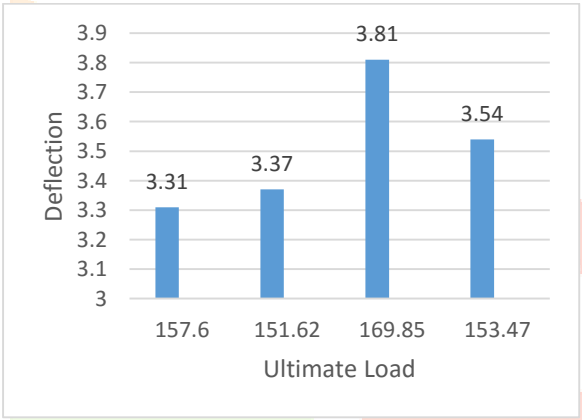
S.NO	REPLACEMENT	MIX	7 DAYS N/mm^2	28 DAYS N/mm^2
1	100% Cement+0%bottom ash+0%RCA	MIX 1	26.9	32.5
2	100% Cement+10%bottom ash+15%RCA	MIX 2	25.49	34.65
3	100% Cement+15%bottom ash+30%RCA	MIX 3	27.84	36.92
4	100% Cement+20%bottom ash+45%RCA	MIX 4	29.35	38.94
5	100% Cement+25%bottom ash+60%RCA	MIX 5	28.73	36.72
6	100% Cement+30%bottom ash+75%RCA	MIX 6	26.54	35.58



B. Flexural strength Test:

A Flexural testing apparatus is used to determine the compressive strength of the concrete. The Beams were tested and the ultimate loads were recorded

S.NO	REPLACEMENT	MIX	28 DAYS N/mm2	
			Ultimate load	Deflection
1	100% Cement+0%bottom ash+O%RCA	Mix 1	157.6	3.31
2	100% Cement+20%bottom ash+25%RCA	Mix 2	151.62	3.37
3	100% Cement+25%bottom ash+35%RCA	Mix 3	169.85	3.81
4	100% Cement+30%bottom ash+45%RCA	Mix 4	153.47	3.54



V RESULT AND DISCUSSION

The following conclusions were made based on experimental study

- For M30 grade of mix design, obtained mix ratio is 1:16:2.1 as per IS 10262:2009.
- The compaction factor show the workability of the concrete is good.
- The compressive strength of cube at 7 and 28 days of curing were calculated. The maximum compressive strength of cube is 38.94 N/mm^2. There was slight difference in our obtained results.
- The flexural strength of prism at 7 and 28 days were calculated based on IS 456-2000 the flexural strength value should be $0.7\sqrt{f_{ck}}$ N/mm^2 of average characteristic cube compressive strength of concrete. The maximum flexural strength of beam is 3.81 N/mm^2. There was slight difference in our results.
- The compression and flexural strength is evaluated by replacing RCA for coarse aggregate and bottom ash by fine aggregate is compared with the conventional concrete as per IS codes.
- From the above investigation by replacing 20% of bottom ash and 45% RCA is found to be economical and helps to increase the strength of concrete.

VI REFERENCE

1) Claudio Javier Zega and Angel Antonio Di Maio Recycled Concretes Made withWaste Ready-Mix Concrete as Coarse Aggregate. American Society of Civil Engineers, 2011.

2) Dhir Kelvin A.Paine "Value Added Sustainable Use Of Recycled Aggregate InConcrete", Indian Concrete Journals,March 2010.

3) G. Fathifazl; A. Abbas; A. G. Razaqpur; O. B. Isgor; B. Fournier; and S. Foo, New Mixture Proportioning Method for Concrete Made with Coarse Recycled Concrete Aggregate ASCE, 2009.

4) Ishtiyaq Gull, Testing of Strength of Recycled Waste Concrete and ItsApplicability, ASCE 2011.

5) Montgomery, D.G. and Sturgiss, D. 1996. Properties of Concrete Incorporating Recycled Concrete Aggregates. Proceedings of the National Symposium on the Use of Recycled Materials in Engineering Construction. Sydney.

6) M C Limbachiya, A Koulouris, J J Roberts and A N Fried Kingston University, UK, Performance of recycled aggregate concrete (2004).

7) R KumuthAa and K. Vijay, "Strength of concrete incorporating aggregate recycled from demolition waste". APRN journal of Engineering and applied sciences, May 2010.

8) S. K. Singh, Scientist, Structural Engineering Division, Central Building ResearchInstitute, Roorkee"RECYCLED AGGREGATES In CONCRETE".

9) SRINIVASA RAO, P., "Problems in Quality Assurance And Quality Control Of High Strength Concretes," National Seminar On High Strength Structural Concrete, Bangalore, Dec. 5th & 6th, 1991, I.109-117.

10) TOMOSAWA, F., MASADA, M. ABE, A.SHIMIZU, AND NAKANE, S., "High Strength Concretes For High-Rise Buildings In Japan," High Strength Concrete Structure, Second International Symposium, SP-121, ACI, 1990, PP.33-45.