RECENT TRENDS IN REPLACEMENT OF FINE AGGREGATEWITH DIFFERENT ALTERNATIVES

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ABSTRACT

Cement, Fine aggregate and Coarse aggregate are the basic materials for any construction. Fine aggregate is a prime material used for the preparation of concrete, which plays an important role in the mix design. Now a day's erosion of rivers considering environmental issues, there is a scarcity of river sand. The reduction in the natural resource and the requirement for reduction in the cost of Concrete production and to gain high strength concrete. Many researches are finding different alternative materials like quarry dust, foundry sand and others are being researched from past two decades, by using different proportions of alternative materials in the view of the replacement of sand. This paper summarizes conclusion of experiments conducted for the properties like strength, durability, etc. It was observed the results have shown positive changes and improvement in mechanical properties due to addition of alternative materials in different proportions instead of fine aggregate

KEYWORDS:- Fine aggregate, Quarry dust, Alternative materials, Mechanical properties.

1. INTRODUCTION:-

Cement, fine aggregate (sand) and aggregate are essential needs for any construction industry. Sand is the important material used for the preparation of motor and plays an major role in mix design. Hence the demand of natural sand is very high in developing countries to satisfy the rapid infrastructure growth. As the river sand used as fine aggregate in concrete is derived from river banks. Rivers and has been the most popular choice for the fine aggregate. Rapid extraction of sand from river bed causing so many problems like losing water retaining soil strata, deepening of the riverbed sand causing bank slides, loss of vegetation on the bank of rivers, disturb the aquatic life as well as disturb the agriculture due to lowering of water table in the well etc. Recently natural sand is of high cost due to its demand in construction. Hence researches and engineers have

Come out with their own ideas to decrease or replace the use of river sand and use of recent innovations such as copper slag, granulated blast furnace, washed bottom ash, quarry dust, foundry sand etc are successfully replaced in the place of fine aggregate.

1.1. EFFECTIVEALTERNATIVEMATERIALSTOFINEAGGREGATE:-

Concrete is the second largest consumable material after water, with nearly three tons used annually for each person on earth. India consumes an essential 450 million cubic meter of concrete annually and which comes to 1 tone per Indian. Considering the scarcity of sand from natural resources, has evolved number of alternatives which are ultimately aimed at conservation of natural resources apart from promoting use of various waste materials without compromising in quality use of these alternatives materials such as fly ash, slag, not only help in conserving our precious natural resources but also improve durability of structures made using these

COPPERSLAG:-

Copper slag is an abrasive blasting grit made of granulated slag from metals melting process also called iron silicate. At present about 33million tones of copper slag is generating annually world wide among that India contributing 6 to 6.5 million tones. India a study has been carried out by Central Road Research Institute (CRRI) shown that copper slag may be used as partial replacement for rivers and as fine aggregate in concrete upto 50% in pavement concrete with out any loss of compressive and flexural strength.

GRANULATED BLAST FURNANCE (GBFS):-

GBFS is obtained by quenching molten iron slag from blast furnace in water or stream. Then it is dried and made into a fine powder. GBFS increases the compressive strength of motor and concrete. Use of GBFS up to 75% can be recommended

WASHED BOTTOM ASH (WBA):-

The WBA is a waste material that is taken from the electric power plant and the source material is called as bottom ash. The mechanical properties of special concrete made with 30% of replacement of natural sand with washed bottom ash by weight has optimum usage in order to get the good strength and increment of ages

QUARRYDUST:-

Quarry dust is a fine rock particle. When the boulders are broken into small pieces

Quarry dust is formed. The ideal percentage of the replacement ofsand with quarry dust is 55% to 75% in case of compressive strength

FOUNDARY SAND:-

It is a type of sand in which silica content is high and used for casting and it obtained by metal industry. But international studies found that 50% sand is replaced and sustainable development of concrete

CONSTRUCTIONANDDEMOLITIONWASTE:-

It is generated when ever any construction/demolition activity takes palace such as building sand fly over, subway, remodeling etc. A part of this waste comes to municipal stream.
Recycled sand and aggregate from C&D waste is said to have 10-15% lesser strength then normal concrete and used in non structural applications like flooring and filling.

3. PHYSICAL AND MECHANICAL PROPERTIES DIFFERENT ALTERNATIVES

3.1 COPPERSLAG:-

The sieve analysis for copper slag infers that the gradation properties of fine aggregate at all the replacement for zone II as per IS:383

SIEV E SIZE IN (MM)	WEIGHT RETAINED (G)	CUMULATIVE WEIGHT RETAINED (G)	SLAG RETAINED	SOIL PASSING OF SOIL
4.75	4	0.4	0.4	99.6
2.36	17	1.7	2.1	97.9
1.18	225	22.5	24.6	75.4
600 MICRO	433	43.3	67.9	32.4
300 MICRO	281	28.1	96	4
150 MICRON	37	3.7	99.7	0.3
75 MICRON	3	0.3	100	0
PAN	0	0	100	0

The results of concrete were obtained by adding copper slag to sand in various percentages ranging from 0, 20, 40, 60, 80 and 100 percentages. In these the highest compressive for 40% replacement of sand and strength obtained was 35.11 MPa but corresponding mix for control mix was30MPa.

3.2 GRANULATED BLAST FURNANCE (GBFS):-

Investigation was carried out on cement motor mix 1:3 and GBFS at 0, 25, 50, 75 and 100 % replacement to naturals and for constant w/c ratio of 0.5 (table2) from these studies GBFS can be used as replacement to sand but there is a decrease in workability for all replacement levels. The workability can be increased by adding suitable chemical admixtures and plasticizer

Description	Compressive strength N/mm2		
	3 days	7 days	28 days
25%GBFS+50%NS	27.73	35.6	49.07
50%GBFS+50%NS	26.01	31.87	48.11
100%GBFS+0%NS	21.73	25.61	44.81
0%GBFS+100%NS	23.94	34.91	48.02

The results taken. The workability of shown that there is an increase in the compressive strength of concrete which the increment is about 55to75% depending on the replacement if the sand with quarry dust, form where it was concrete is decreasing with increase in replacement of quarry dust, so as to increase the workability small quantity of fly ash is replaced in place of cement

Property	Quarry dust	Natural sand	Test method
Specific gravity	2.54- 2.60	2.60	IS2386 (partIII)-1963
Bulk density(Kg/m3)	1720-1810	1460	IS2386 (partIII)-1963
Absorption(%)	1.20-1.50	NIL	IS2386 (partIII)-1963

FOUNDRY SAND :-

Foundry sand consists of silicas and, coated with a thin film of burnt carbon residual binder and dust. The fine aggregate has been replace by used foundry sand with 0, 10, 30 & 50% by
Weight for M-20 grade concrete. The maximum strength was achieved with 50% replacement of fine aggregate with foundry sand and It was found that the overall increase in the split tensile and Flexural strength of plain concrete

CONSTRUCTION AND DEMOLISHION WASTE:-
The fine aggregate was replaced with crushed wastes and crete block in various percentages in the steps of 10startingfrom10% to amaximumof100%, results showed placing 50% of CWSB aggregate after 28 days curing attained the design compressive strength as conventional concrete. Thus it can be added as a alternative material for sand

Moisture content	NIL	1.50	IS2386(partIII)-1963
Fineparticles <0.75mm(%)	12-15	6	IS2386(partIII)-1963
Sieve analysis	Zone-II	Zone-II	IS383-1970

4. CONCLUSION:-

Copper slag:- The results of compressive & split-tensile indicated that the strength of concrete increases with respect to percentage of copper slag added by weight of fine aggregate

Granulated Blast Furnance Slag:- There is a consider increase in compressive strength thus GBFS could be utilized partially as alternative construction material with adding chemical admixture or super plasticizer

Washed Bottom Ash:- 30% WBA replacement is found to be optimum amount in order to get a favorable strength development pattern over the increment ages. The cos is less than conventional concrete

Quarry Dust:-The study suggests that stone dust is quite appropriate to be selected as the substitution of fine aggregate. Quarry dust has the potential to provide alternative to fine aggregate thus minimizing waste materials and disposal problems associated with it

Foundry Sand:- Waste foundry sand can as fine aggregate in place of conventional river sand, in concrete. The maximum strength wasattainedby50%replacementoffine aggregate

Construction and Demolition Waste:- The density of the concrete decreases as the percentage of SGP increases ,but decrease with the age of curing increase because of alkali silica reaction. Similarly the flexural strength of the beam of concrete for all mix increases with increase in SGP content

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