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Aggregate replacing with Marbles in M30 grade concrete

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ABSTRACT

In order to solve these environmental problems, resources recycling have to be done in environmentally safer methods. As there is a vast scarcity the production of aggregates for concrete the recycled materials have great demand. The present study mainly focuses on investigating the effect of using marble as a replacement of coarse aggregate on the strength properties by using CTM. In this report, M30 grade concrete was used and tests were conducted for various proportions of marble replacement with coarse aggregate of 0%, 10%, 20% and 30% in concrete.

The marble waste recycling is processed before use. The natural and recycled aggregates were characterized. Concrete mix designs with 25%, 50%, 75% and 100% of aggregates substitution were formulated. The performances of the ‘‘recycled aggregates” concrete was measured through tests of density, air content, workability and compressive and tensile strength. The concrete specimens were tested for compressive strength, splitting tensile strength; durability and density at 28 days of age and the results obtained were compared with those of normal concrete.

They discovered that 20% replacement of fine aggregates by waste glass showed 15% increase in compressive strength at 7 days and 25% increase in compressive strength at 28 days. Fine aggregates can be replaced by waste glass up to 30% by weight showing 9.8% increase in compressive strength at 28 days.

Key words: M30 grade concrete, Marble Stone.

Introduction:

At present no construction activity is possible without using concrete. It is the most common material used in construction worldwide. The main reason behind this is because of its high strength, durability and workability. The total world consumption of concrete per year is about one ton for every living human being. Man consumes no materials except water in such tremendous quantities. Due to privatization and globalization, the construction of important infrastructure

projects like Highways, Airports, Nuclear plants, Bridges, Dams etc. in India is increasing year after year. Such developmental activities consume large quantity of precious natural resources. Use of stone in building construction is traditional in the places where it is produced, through its high cost imposes limitations on its use. Stone has been used in the construction of most of the important structures since prehistoric age. Most of the forts world Over the TajMahal of India.

Materials:

Aggregates

One of the most particular and general but most important material used for making concrete is AGGREGATE. Aggregates are used as filler with binding materials in production of concrete. Aggregates occupy about 72-75% of volume of concrete and they greatly influence the strength of concrete. These are cheaper than cement and admixtures. The aggregate impart density to concrete. Aggregates may be fine or coarse. The coarse aggregates form the main matrix of concrete and fine aggregate form the filler matrix between coarse aggregates. They may be available naturally or made artificial.

Marble

Marble is a non-foliated metamorphic rock composed of re crystallized carbonate minerals, most commonly calcite or dolomite. Geologists use the term "marble" to refer to metamorphosed limestone however, stonemasons use the term more broadly to encompass un metamorphosed limestone. Marble is commonly used for sculpture and as a building material.

Chemical Composition of Marble, Granite and Kotastone.

Chemical Composition	Marble	Granite	Kota Stone
Lime	28-32%	1-4%	37-39%
Silica	3-30%	72-75%	24-26%
MgO	20-25%	05-1%	4-6%
$FeO+Fe_2O_3$	1-3%	-	-
Loss of ignition	20-45%	5-10%	32-35%

Table 1: Chemical Composition

Experimental Investigations: A crushed granite rock with a maximum size of 12 mm was used as a coarse aggregate. The individual term absorption of the aggregates.

Specific Gravity Of Coarse Aggregate

Empty weight of bottle (W1) = 0.564

Empty weight of bottle + dry sand (W2) = 1.112

Empty weight of bottle + dry sand + water (W3) = 1.602

Empty weight of bottle + water (W4) = 1.412

(W2-W1) / (W4-W1)-(W3-W2)

Specific Gravity of Coarse Aggregate = 2.88

Specific gravity of waste marbles

Empty weight of bottle (W1) = 0.564

Empty weight of bottle + dry sand (W2) = 1.112

Empty weight of bottle + dry sand + water (W3) = 1.602

Empty weight of bottle + water (W4) = 1.412

(W2-W1) / (W4-W1)-(W3-W2)

Specific Gravity of Coarse Aggregate = 2.88

Aggregate Impact Value

With respect to concrete aggregates, toughness is usually considered the resistance of Material to failure by impact. Several attempts to develop a method of test for aggregates impact value have been made. The most successful is the one in which a sample of standard aggregate kept in a mould is subjected to fifteen blows of a metal hammer of weight 14 Kgs.falling from a height of 38 cms. The quantity of finer material (passing through 2.36 mm) resulting from pounding will indicate the toughness of the sample of aggregate. The ratio of the weight of the

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fines (finer than 2.36 mm size) formed, to the weight of the total sample taken is expressed as a percentage. This is known as aggregate impact value IS 283-1970specifies that aggregate impact value shall not exceed 45 per cent by weight for aggregate used for concrete other than wearing surface and 30 per cent by weight, for concrete for wearing surfaces, such as run ways, roads and pavements.

The impact strength for aggregate = B/A *100

Where,

B is the material passed through 2.36mm sieve

A is the total weight of the material taken.

Impact value for Coarse aggregate

The impact strength for Coarse aggregate = B/A *100

Where,

B is the material passed through 2.36mm sieve = 83.52grams

A is the total weight of the material taken = 450 grams

Therefore impact strength for coarse aggregate = 83.52/450 * 100

= 18.56%

Impact value for waste Marbles

The impact strength for Waste Marbles = B/A *100

Where,

B is the material passed through 2.36mm sieve = 148.14grams

A is the total weight of the material taken = 450 grams

Therefore impact strength for coarse aggregate = 148.14/450 * 100

= 32.92%

Fineness modulus of coarse aggregate

A crushed granite rock with a maximum size of 12 mm was used as a coarse aggregate. The individual term absorption of the aggregates

sieve size	Weight retained (kg)	Cumulative weight (kg)	Cumulative% retained
80 mm	_	0	0
40 mm	_	0	0
20 mm	2.372	2.372	47.44
10mm	2.620	4.992	99.84
4.75 mm	0.008	5	100
2.36 mm	_	_	100
1.18 mm	_	_	100
600 micron	_	_	100
300 micron	_	_	100
150 micron	_	_	100

Fineness modulus of waste marbles

sieve size	Weight retained (kg)	Cumulative weight (kg)	Cumulative% retained
80 mm	_	0	0
40 mm	_	0	0
20 mm	2.425	2.425	48.12
10mm	2.560	4.792	98.84
4.75 mm	0.008	5	100
2.36 mm	_	_	100
1.18 mm	_	_	100
600 micron	_	_	100
300 micron	_	_	100
150 micron	_	_	100

Fineness modulus of waste marbles = 7.46

TESTS	For Marbles	For Coarse aggregate

Fineness	7.46	7.47
Specific gravity	2.45	2.52
Impact value	32.96%	18.56%

Table: Comparison between the properties of waste marbles and coarse aggregate Results and Discussion:

S.No	% of replacement for Marble stone	Specimen size	Load, P KN	Compressive strength (P/A) For 28 days	Average compressive strength of concrete for 28 days
1	0%	150x150x150mm	960	42.66 N/mm^2	42.22 N/mm^2
		150x150x150mm	950	42.22 N/mm^2	
		150x150x150mm	940	41.77 N/mm^2	
		150x150x150mm	970	43.11 N/mm^2	
2	10%	150x150x150mm	975	43.33 N/mm^2	43.33 N/mm^2
		150x150x150mm	980	43.55 N/mm^2	
3	20%	150x150x150mm	995	44.22 N/mm^2	44.13 N/mm^2
		150x150x150mm	989	43.95 N/mm^2	
		150x150x150mm	995	44.22 N/mm^2	
4	30%	150x150x150mm	930	41.33 N/mm^2	40.95 N/mm^2
		150x150x150mm	920	40.88 N/mm^2	
		150x150x150mm	915	40.66 N/mm^2	