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USE OF RECYCLED COARSE AGGREGATE IN CONCRETE

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ABSTRACT

While there is a crucial reduction of virgin aggregate, the accessibility of demolished concrete for use as recycled concrete aggregate (RCA) is increasing day by day. Using the waste concrete as RCA conserves fresh aggregate, reduces the impact on landfills, decreases energy consumption and can provide cost savings. Recycled aggregates are the materials for the future. The use of recycled aggregate has been taking place in many Asian countries for structural projects. It also compares these properties with natural aggregates. Basic changes in all aggregate properties were determined. Vital concrete properties like compressive strength, flexural strength, workability etc., are explain here for different combinations of recycled course aggregate with natural aggregate. In general, present status & consumption of recycled coarse aggregate in India with their future requirement is discussed.

I. INTRODUCTION

Recycled aggregates are combination of crushed inorganic particles getting from constructions and flattening debris. The scope of this project is to compare the strength of concrete by using different percentage of recycled coarse aggregates. The investigation was carried out using workability test, Compressive strength, Split tensile test, Flexural strength. The concrete mixes, consist of every 20% increment of recycled coarse aggregate replacement from 0% to 100% for M20 Grade of Concrete. Concrete is the most widely used construction material across the world. It is used in all types of civil engineering works like infrastructure, low and high-rise buildings, defence structure, and environment protection structure. Concrete is a artificial product, essentially consisting of cement, coarse & fine aggregates, water and/or admixture(s). Recycling of concrete is needed from the perspective of environmental preservation and effective utilization of resources. At present, use of recycled aggregate is limited mainly to sub bases of roads and backfill works. A large portion of concrete waste ends up at disposal sites. It is anticipated that there will be an increase in the amount of concrete waste, a shortage of disposal sites, and lessening in natural resources especially. These lead to the utilize the RCA in new concrete production, which is deemed to be a more effective consumption of concrete waste. However, there was no proper information on concrete using recycled aggregate , and it will be worthwhile to get more detailed information about the characteristics of concrete using recycled aggregate. Recycling is the perform of processing the used material for use in creating new product.. These materials are generally getting from buildings, roads, bridges etc.,

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II.COMPARISON OF RECYCLED AND NATURAL AGGREGATE

• Texture

Recycled aggregate is an asymmetrical shape, sharp and lengthened particles where natural aggregate is soft and condensed aggregate. The freshly mixed concrete properties will be affected by the shape and surface texture of the aggregate. The irregular – texture, sharp and lengthened particles require more water content than the soft and condensed compact aggregate when producing the workable concrete. The void content will more for RCA when compared to normal aggregate.

• Quality

The quality of the recycled aggregate is different with natural aggregate. The physical and chemical property of sources influences the quality of normal aggregate, whereas for recycled aggregates contamination of demolished debris influences. It also stated that natural resources are fit for multiple product and it have larger marketing area, but recycled aggregate have limited product mixes and it has less market area.

• Density

The density of the recycled concrete aggregate is less than natural aggregate. It is because of the porous and less dense residual mortar lumps that is adhering to the surfaces. Increase in particle size increase the volume percentage of residual mortar.

• Strength

The strength of recycled aggregate is less than natural aggregate because , the weight of recycled aggregate is lighter than natural aggregate. This is the common effect that will decrease the strength of reinforced concrete.

The experimental study was divided into four major segments viz.

1)Material and their testing

2)Concrete mix design

3)Checking for the fresh properties of M-20 grade concrete

(i)Slump test

4) Tests on Hardened concrete specimen

(i) Compression test

(ii) Split tensile test

(iii) Flexure strength test

III.PROPERTIES OF FINE AGGREGATE

S. No	Particulars	Sand
1	Specific gravity	2.5
2	Fineness Modulus	2.77
3	Density	1732 Kg/m^3

PROPERTIES OF NATURAL AND RECYCLED COARSE AGGREGATE

S. No.	Particulars	Natural aggregate	Recycled aggregate
1	Max Aggregate size	20 mm	20 mm
2	Specific gravity	2.8446	2.74
3	Fineness Modulus	7.086	7.476
4	Density	1805.62 Kg/m^3	1660.4 Kg/m^3

IMPACT TEST VALUE:

particulars	2.36 mm passing	Tot wt.(gm)	Impact value(%)
Natural aggregate	26 gm	326 gm	8
Recycled aggregate	38 gm	294 gm	12.92

CONCRETE MIX PROPORTION:

w/c ratio	Proportion	Cement (Kg/m$^{3)}$	Sand (Kg/m$^{3)}$	Coarse Aggregate (Kg/m$^{3)}$	Water (Kg/m$^{3)}$
0.55	1:2.06:3.87	327	679.25	1265.5	180

0.5	1:2.12:3.46	360	763.51	1245.73	180
0.45	1:1.87:3.06	400	751.6	1226.3	180

DETAIL OF TEST AND TEST SPECIMEN FOR M20 GRADE CONCRETE:

S. No	Tests	Test age	No of speci-mens	specimen type
1	Compressive Strength(150 mmx150mmX 150mm)	3,7, 28 days	54	cube
2	Split tensile (150 mm dia)	28 days	18	cylinder
3	Flexure strength(100mmx100mmx550mm)	28 days	18	beam

DETAILS FOR MIX BATCHES:

Mix ratio	MIX	Recycled coarse aggregate
M-20	Mx1 Mx2 Mx3 Mx4 Mx5 Mx6	0% 20% 40% 60% 80% 100%

SLUMP VALUE FOR MIX BATCHES:

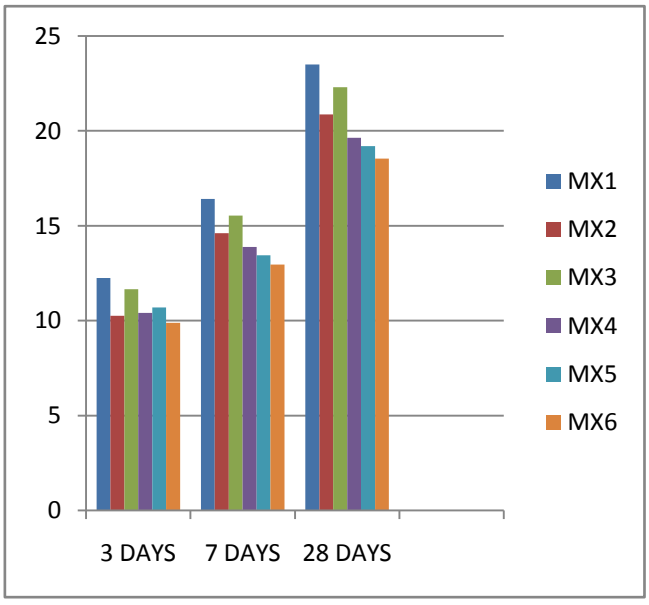
Mix ratio	MIX	SLUMP value
	Mx1	130

M-20	Mx2 Mx3 Mx4 Mx5 Mx6	127 114 114 108 112

COMPRESSIVE STRENGTH OF CUBES OF VARIOUS CONCRETE MIXES OF M-20 GRADE CONCRETE:

Sr No	MIX	Avg. Compressive strength in N/mm^2		
----------	----------	3 DAYS	7 DAYS	28 DAYS
1	Mx1	12.24	16.42	23.5
2	Mx2	10.25	14.61	20.87
3	Mx3	11.65	15.54	22.30
4	Mx4	10.40	13.89	19.64
5	Mx5	10.70	13.45	19.20
6	Mx6	9.89	12.96	18.54

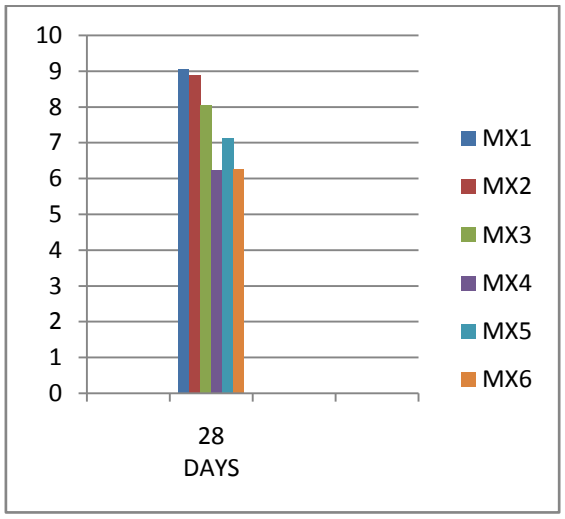
IV.COMPRESSIVE STRENGTH OF CUBES AT VARIOUS CONCRETE OF M-20 GRADE



IV.RESULT OF FLEXURAL STRENGTH TEST FOR BEAM(100 MM X 100MM X500 MM) OF M-20 GRADE CONCRETE

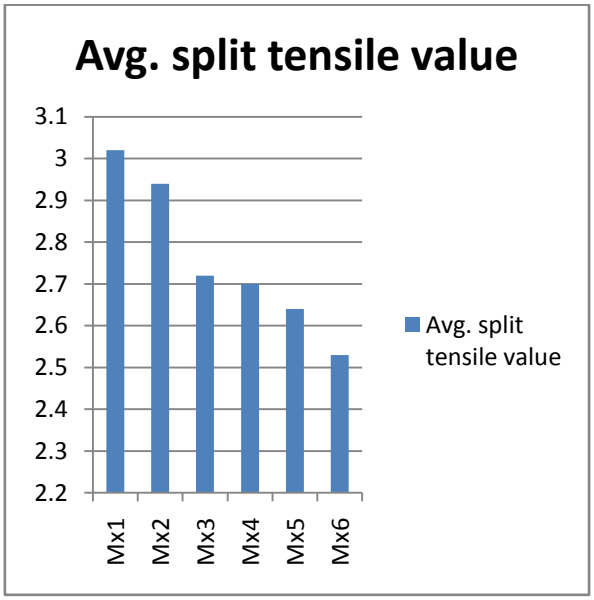
Type	Avg. Flexural Strength(MPa)
Mx1	9.047
Mx2	8.882
Mx3	8.057
Mx4	6.242
Mx5	7.122
Mx6	6.27

FLEXURAL STRENGTH FOR BEAM OF M-20 GRADE CONCRETE:



SPLIT TENSILE TEST FOR M-20 GRADE CONCRETE

MIX	SPLIT TENSILE VALUE(MPa)
Mx1	3.02
Mx2	2.94
Mx3	2.72
Mx4	2.70
Mx5	2.61
Mx6	2.53



V.CONCLUSION

The usage of waste construction materials is very important due to the materials waste is gradually increasing with the increase of population and increasing of urban development. There are two reasons for using Recycled aggregate one is easy to obtain and another one is reduction in cost

After detailed study of the result and analysis the following conclusions were made.

• The experimental results shows that the compressive strength of both natural aggregate and recycled aggregate were same.

•The workability of concrete decreases with increase in percentage of RCA. According to the result, the highest slump and the lowest slump obtained was 130mm and 102mm rspectively for M20 grade concrete where the range is from 75mm to 150mm. The workability was good and can be satisfactorily improved from 0% recycled aggregate to 100% recycled aggregate.

•The compressive strength was increases at the early age with 60% replacement of RCA. However, it shows that the strength of concrete increases gradually upto 40% replacement and decreases at 100% replacement. The target strength for M20 grade is 22.6Mpa, that are achieved for all the specimens tested in the study. The 40% replacement of recycled aggregate gives more strength when compared to other replacements. From the obtained result, it is possible to use 40% recycled aggregate for higher strength of concretes.

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