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Topic-Effect of Recycled Aggregate of Different Size on Shear Strength of Concrete.

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ABSTRACT -

In this research work, recycled aggregate was used to replace coarse aggregate in the concrete and present work is planned to find out the effect of recycled aggregate size on the shear strength of concrete. One point loading method was used to test the beam in the shear. To check the effect of recycled aggregate sizes of recycled aggregate (16.5mm ,12.5 mm) were used to replacement 50% of natural coarse aggregate to prepare beam at percentage of longitudinal steel (3.2%) and compare it with beam designed according to ACI 318-02 with normal concrete. As a result, the shear behavior of beam with recycled aggregate concrete was found similar to shear behavior of beam with normal concrete.

Key words –

Normal Concrete(NC), recycled concrete aggregate (RCA) and recycled aggregate (RA), The recycled coarse aggregate concrete (RCAC), Recycled aggregate concrete Containing recycled aggregate of size16.5mm replacing 50% natural aggregate (RAC16.5),Recycled aggregate concrete Containing recycled aggregate of size12.5mm replacing 50% natural aggregate (RAC12.5)

Introduction-

Concrete is the largest amount of construction material used worldwide for construction. Also the usage of concrete is very large as compared to other materials. The production of concrete exceeds the production of steel by multiple of 10 in tonnage and by more a multiple of 30 in the volume. The consumption of concrete by a person in the present time exceeds 1.7 tons of concrete per year. The total consumption of concrete in the world is more than 10 billion tons per year. The consumption of concrete exceeds by the multiple of 10 times than the total weight of steel consumed.

The increasing growth of infrastructure in the developed and developing countries had resulted in the increase in the demand of natural aggregate. This results in overexploitation of natural resources and has resulted in the endangered its sustainability and has caused damage to the environment. The large quantities of natural aggregate are required in the production of the concrete, as the demand of the concrete are increasing day by day and the natural resources are non- renewable , so the natural resources are no able to fulfill the increasing demand of the natural aggregate.

Due to this reason there is increased trend toward using the waste construction material as the recycled aggregate for the replacement of natural aggregate. Many countries have formed guidelines for using the recycled aggregate formed by the waste material of concrete in construction

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Objective and Methodology:-

In this research work, recycled aggregate was used to replace coarse aggregate in the concrete and present work is planned to find out the effect of recycled aggregate size on the shear strength of concrete. One point loading method was used to test the beam in the shear.

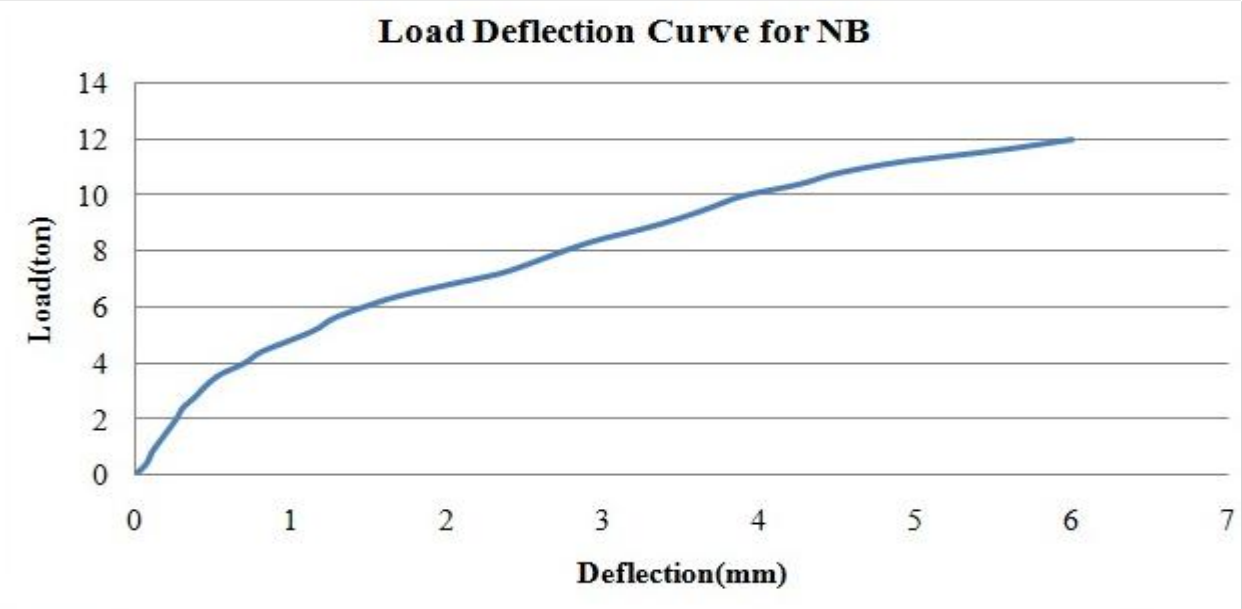
To check the effect of recycled aggregate sizes of recycled aggregate (16.5mm ,12.5 mm)were used to replacement 50% of natural coarse aggregate to prepare beam at percentage of longitudinal steel (3.2%) and compare it with beam designed according to ACI 318-02 with normal concrete.

The beam size of 100×150×1000 mm was used. One point loading method was used to test the beam in the shear.Shear span to depth ratio (a/d =1.5) is kept constant for the test.All the beam of span 1000mm were tested simply supported. The loading method used was one point loading method. Universal testing machine of capacity 200 tons was used for testing.

Table 1- Physical properties of beam

S.NO.	Beam series	Type of concrete	%age of steel	No of bars
1.	NB	NC	3.2	2(16)
2.	RAC12	RAC16.5	3.2	2(16)
3.	RAC22	RAC12.5	3.2	2(16)

Normal Beam: The normal beam is tested and deflections are noted at fixed interval till the failure of beam. Load at FC (first crack) and deflection at FC is also observed. Finally the ultimate load and deflection at ultimate load is measured. The results of deflection and load is summarized under



Graph 1:- Load-deflection curve for NB

The beam consists of 3.2% longitudinal steel with normal concrete. curve Thegraph 1 shows the load deflection curve when the beam is subjected to shear test. This graph is constructed between load and deflection value of NB. This graph shows that with increase in load deflection in the beam increase gradually. The first crack appeared at the load 7.2 ton and with deflection of 2.330mm.

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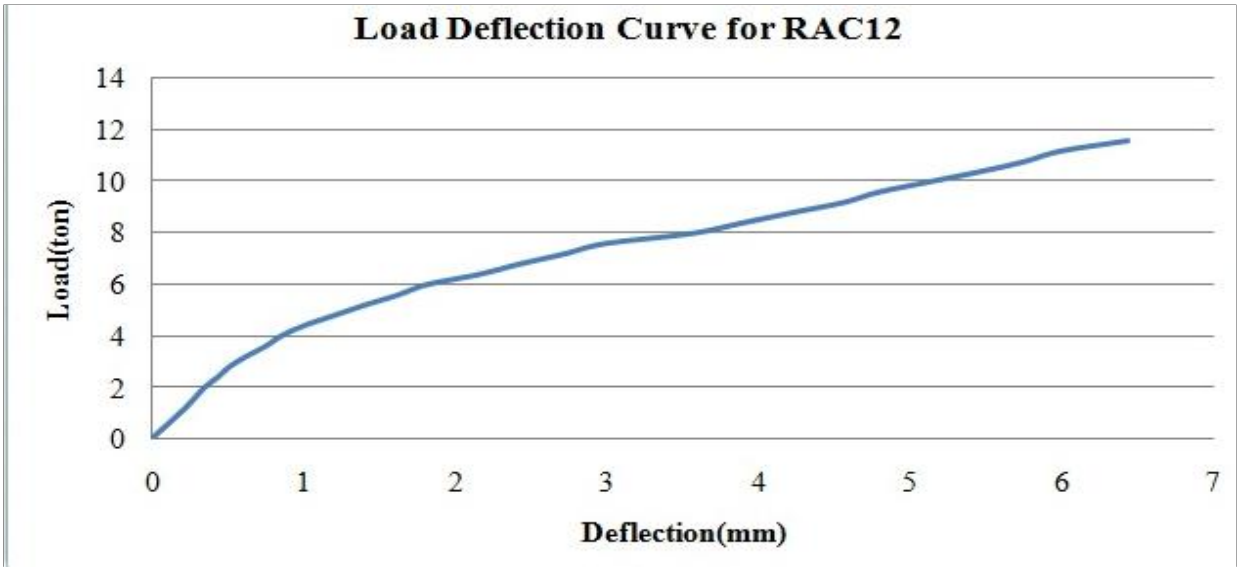
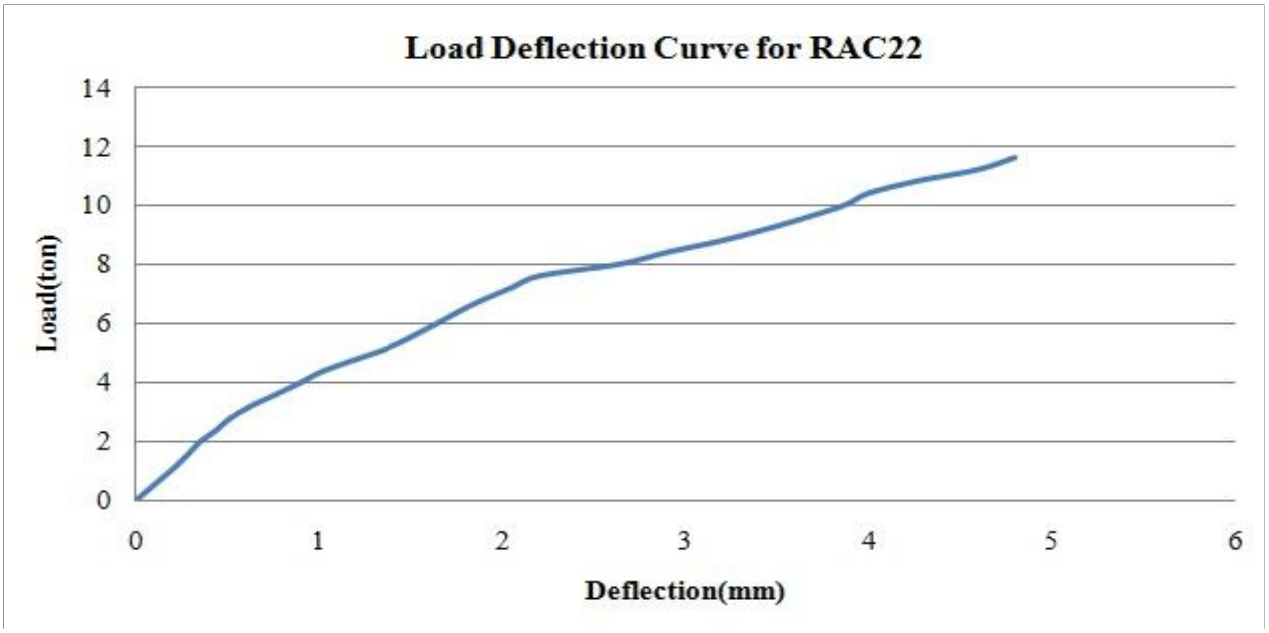
After first crack beam continues to carry load, as the load increases, deflection increases gradually and fail suddenly. The load at failure is the ultimate load, the ultimate load for NB1 is 12 ton and deflection at ultimate load is 6mm.

RAC12:- Deflections are noted at load interval of 0.4 ton. Load and deflection at FC and UL are also noted. The variation of load and deflection for the beam RAC12 are shown in the graph 2As the load increases, the deflection also increases gradually. First crack appears at load of 8 ton and deflection at first crack is 3.565 mm. The ultimate load is 11.6 ton and deflection at ultimate load is 6.432mm, In comparison to normal beam containing normal concrete and same amount of longitudinal steel.



Graph.2 Load-deflection curve for RAC 12

RAC 22:-The graph is plotted between load and deflection using the values of load and deflection. The graph 3 shows deflection of beam increases with increase in the load. At first crack, value of load is 8 ton and deflection is 2.640 mm. The value of ultimate load is 11.6 ton and deflection is 4.795 mm.



Graph 3:- Load-deflection curve of RAC22

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TABLE 2 :- Comparison between NB, RAC 12 and RAC22

Designation of the beam	a/d	%age of longitudinal steel	Concrete type	Load (ton)		Deflection (mm)		Shear strength of concrete (N/mm_2)
				First crack (FC)	Ultimate load	Δ_{FC}	$\Delta_{ultimate}$	
NB1	1.5	3.2%	NC	7.2	12.0	2.330	6	8
RAC12	1.5	3.2%	RAC16.5	8	11.6	3.565	6.432	7.73
RAC22	1.5	3.2%	RAC12.5	8	11.6	2.640	4.795	7.73

It is evident from the table 2 shear strength of beam RAC12(Beam having recycled aggregate of size 16.5mm , longitudinal steel 3.2%) and RAC22(Beam having recycled aggregate of size 16.5mm , longitudinal steel 3.2%) is similar. But the shear strength of beam RAC12 and RAC22 decreases by3.3% as compared NB1 (beam having normal concrete, 3.2% longitudinal steel).

CONCLUSION-

The following are the conclusions drawn from the study:

1. The shear behavior ofbeam with recycled aggregate concrete is similar to shear behaviour of beam with normal concrete.
2. Replacement of coarse aggregate with recycled aggregate in the concrete has resulted reduction of shear strength of beam but this reduction is very small.
3. Recycled aggregate concrete can be used as a replacement of conventional concrete.

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