Experimental Investigation on High Strength Concrete with Partial Replacement of Recycled Coarse Aggregate for Coarse Aggregate

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Abstract— This project work deals with an high strength concrete using waste aggregate. The use of concrete in recent years, have spread to highly harsh and hoist environment resulting in premature failure of number of structures. By replacing this type of waste aggregate to the concrete is a good solution to reduce the problem caused by this type of waste material. A recycled aggregate was obtained from the demolition of the concrete structures. These materials were collected and crushed in crusher and collected as aggregates. These collected materials were treated by several methods to remove the waste surrounded by it. Treatment can be done both by cooling and heating. The recycled coarse aggregate are replaced with 10%,15%,20%,25%and 30% to coarse with the treatment of NaOH -2N for 24hrs for compression and tensile strength.

Keywords: Coarse Aggregate, Tensile Strength

I. INTRODUCTION

Concrete has unlimited opportunities and applications for innovative design and construction techniques. Its great versatility and ability to fill wide range of needs, has made it a very competitive building material. The use of concrete in recent years, have spread to highly harsh and hoist environment resulting in premature failure of number of structures. Although compressive strength of concrete is a measure of durability to great extent it is not entirely true that the strong concrete is always durable. In addition to strength of concrete another factors what we call as exposure conditions has become an important consideration for durability. Coarse aggregate recycling is now a day's popular technique to utilize aggregate left behind when structures are demolished. Previously most of the concrete wastes were dumped in low lying lands to increase the level of ground. But when environment is taken into consideration recycled coarse aggregate promotes their reuse and lowers the construction cost. Concrete is the most widely used man made construction material. It is obtained by mixing of cement, water, fine & coarse aggregate in required proportions. The concrete has high compressive strength, but its tensile strength is very low. In situation where tensile stresses are developed, the concrete is strengthened by steel bars forming a composite construction called reinforced cement concrete. The concrete without reinforcement is termed plain cement concrete. The process of pouring concrete is called concreting. The strength, durability and other characteristics of concrete are depends on the proportion of mix, the method of compaction and other controls during placing, compaction and curing. The scarcity and availability at reasonable rates of sand and aggregate are now giving anxiety to the construction industry. Over years, deforestation and Extraction of natural aggregates from river beds, lakes and other water bodies have resulted in huge Environmental problems. Erosion of the existing to pography usually results in flooding and landslides. Moreover, the filtration of rain water achieved by deposits of natural sand is being lost, thereby causing contamination of water reserves used for human consumption. Hence, to prevent pollution authorities are imposing more and more stringent restrictions on the extraction of natural aggregates and its crushing. The best way to overcome this problem is to find alternate aggregates for construction in place of conventional natural aggregates.

A. *Need of High Strength Concrete*

- To put the concrete in to service as much earlier age for example opening the pavement at 3-days
- To build high-rise buildings by reducing column sizes and increasing available space
- To build the superstructures of long-span bridges and to enhance the durability of bridge decks

B. *Objectives and Research Significance*

The main objective of this study were

- To reduce the consumption of natural sources by replacing recycled coarse aggregate.
- To study the characteristics of the recycled coarse aggregate concrete for structural applications.
- To find the compressive strength, tensile strength, flexural strength of concrete with replacing of coarse aggregate by recycled coarse aggregate.
- To prepare a low cost concrete with good environmental factors.

II. LITERATURE REVIEW

T.Manikandan et al (2015) investigated the replacement of recycled coarse aggregate by M30 grade concrete with coarse aggregate. It is observed that the replacement was done up to 100% with coarse aggregate. The mix of 50% gives high strength of concrete at 90 days. By 50% replacement of RCA, the compressive strength attained is 0.4% less than that of normal concrete, but it reaches near the target strength of 33.85N/mm2 and the split tensile strength attained is 0.3% less than that of normal concrete, but it reaches the target strength of 3.42 N/mm2. The flexural tensile strength of concrete made using recycled aggregates will be lower than the same concrete made with new aggregates. From that they concluded, comparing the compressive strength & split tensile strength the most appropriate % of replacement is 50. So we recommend 50% replacement of coarse aggregate by RCA. D.V. Prasada Rao et al (2014) investigate the compressive strength of concrete by replacing the coarse aggregate with recycled coarse aggregate at concrete grades of M20,M25,M30 for 3, 7, 28 & 90 days. Recycled coarse aggregates are replaced by 100% for the coarse aggregate to compare the strength between conventional and recycled concrete. OPC 43 grade of cement is used. It is observed that the compressive strength of recycled concrete was has nearby strength to the conventional concrete for all concrete grades at 3, 7, 28, 90 days. From that they concluded replacing RCA at 100% to the concrete is provide required strength to the concrete. Thomas et al. (2013) Durability of Recycled Aggregate (RA) can be influenced by coarse aggregate replacement ratio, concrete age, w/c ratio, and moisture content; generally, a lower w/c ratio generates a more durable concrete mix. RA concrete is less durable due to high porosity of recycled aggregate. However, lower resistance to ingress of certain agents might be compensated by the combination of recycled aggregate with CO2 and chlorides which reduces their penetration rates. SCM are used to improve strength and durability of RA concrete. Fathei Ramadan salehlamein et al (2012) Examined the flexural strength of concrete using recycled coarse aggregate. In this test recycled coarse aggregates are taken at different sizes of 10mm and 20mm. Recycled coarse aggregates are replaced at 0%, 30%, 50% 65% for 28 days. OPC 53 grade of cement is used. It is observed that the flexural strength by using 20mm size of recycled coarse aggregate is provide more strength as compare to the using 10mm size of recycled coarse aggregate at 50% of replacing the RCA. The flexural strength of concrete using recycled coarse aggregate at 65% is reduced. It is concluded that the using 20mm size of recycled coarse aggregate is provide more strength at 50% replacement. From above study, provision of 20mm size of recycled coarse aggregate at 50% replacing is provide good flexural strength. Olorunsogo and Padayachee et al (2011) Investigated the durability of concrete made with different percentages of recycled concrete coarse aggregates (0%, 50%, and 100%). They showed that durability quality of recycled concrete is reduced with increases in the quantities of recycled aggregate, and the quality improved with the age of curing. They concluded that this phenomenon is due to cracks and fissures created within the recycled aggregate during processing, which make the aggregate susceptible to ease of permeation, diffusion and absorption of fluid. Ajdukiewicz and Kliszczewicz et al (2010) Examined the mechanical properties of high performance and high strength concretes made with recycled aggregates. In their work, they considered recycled aggregates produced from concrete with compressive strength 40-70 MPa. They concluded that the water content should be modified in the recycled concrete mix design to obtain the same workability. The results indicated that the compressive strength dropped by about 10% when using recycled aggregates, while the bond stress at failure dropped by 8-20%, depending on the type of fine aggregate used in the concrete. Frondistou- Yannas et al (2008) evaluated and compared the mechanical properties of conventional concrete and concrete containing pieces of concrete from demolition waste in the place of natural coarse aggregate [4]. He found out that recycled concrete best matches the mechanical behavior of conventional concrete when the recycled concrete is enriched in gravel at the expense of mortar. The recycled aggregate concrete has a compressive strength of at least 76% and modulus of elasticity from 60% to 100% of the control mix. It is concluded that the decrease in strength of concrete was observed due to the addition of Recycled Coarse Aggregate.Sudhir p. patil et al (2006) Investigate the compression and tensile strength of the concrete using recycled coarse aggregate for coarse aggregate. Recycled coarse aggregates were replaced at 0%, 25%, 50%, 75%, 100% for coarse aggregate to the concrete.M30 concrete grade were used. It was observed that the compressive strength of concrete containing 50% of RCA has strength close to the normal concrete. Tensile test shoes that the concrete has good strength when replace RCA up to 25-50%. The strength of the concrete was high during initial stages but gradually decrease during lateral stages.

Due to lack of treatment process to RCA was reduced the strength of the concrete.

III. Methodology

A. General

The methodology is the systematic, theoretical analysis of the methods applied to a field study, or the theoretical analysis of the body of methods and principles associated with a branch of knowledge. It typically, encompasses concepts such as paradigm, theoretical model, phases and quantitative or qualitative techniques. In this the industrial wastes were collected and replaced with the fine aggregate, in order to reduce the depletion of natural sources. The replacement ere done and the specimens were casted. The casted specimens are allowed for curing and it was tested. The test results were analysed and noted

B. Material and Its Properties

Materials that go for making concrete for this study were tested before casting the specimens.

- Cement
- Fineaggregate
- Coarse aggregate
- Recycled coarse aggregate

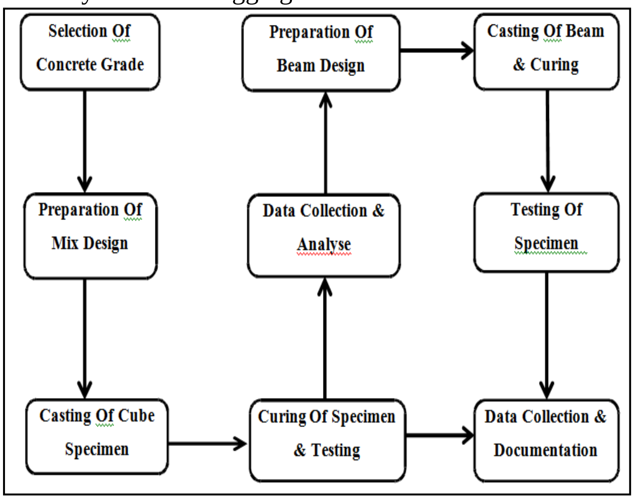

Fig. 1:

C. Cement

Cement is well known building material and has occupied an indispensable place in construction works. Cement is an extremely ground material having adhesive and cohesive properties, which provide a binding medium for the discreet ingredients. It is obtained by burning together, in a definite proportion, a mixture of naturally occurring argillaceous and calcareous material to a partial fusion at high temperature. The product obtained by burning, cooled and ground to the required fineness is known as cement. We are using Ordinary Portland cement of 53 grade.

D. Properties

Fineness - 4.5%
Consistency - 32%
Initial setting time - 50 minutes
Final setting time - 430 minutes
Specific gravity - 3.15

E. Fine Aggregates

Aggregates are generally imparted greater volume stability and durability to concrete. The aggregate is used primarily for the purpose of providing bulk to the concrete. The most important function of the fine aggregate also assists the cement paste to hold the coarse aggregate in suspension. Fine aggregate most of which passes through a 4.75 mm IS sieve and contains only so much fine material as its permitted by the specification. Sand is generally considered to have a lower size limit of about 0.07mm. Material between 0.06mm to 0.002mm classified as silt, and still smaller particles are called clay. Fine aggregate is added to concrete to assist workability and to prevent segregation of the cement paste and coarse aggregate during its transportation. It fills the voids in coarse aggregate. Usually, the natural river sand is used as fine aggregate. Ordinary river sand conforming IS 383-1970 is used in this project.

F. Properties

Fineness modulus- 3.415 (Zone II)
Specific gravity - 2.65
Moisture Content - 1%

G. Coarse Aggregates

In coarse aggregate most of which are retained on the 4.75mm IS sieve and contain only so much of coarse material as is permitted by the specification are termed coarse aggregate. Crushed gravel or stone obtained by the crushing of gravel or gravel or hard stone. Uncrushed gravel or stone resulting from the natural disintegration of rock. Partially crushed gravel or stone obtained as product of the building of the two types. The graded coarse aggregate is described by its nominal size i.e. 40mm, 20mm, 16mm and 12.5mm. The grading of coarse aggregates should be as per specifications of IS 383- 1970.

H. Properties

Finenessmodulus - 7.1
Specific gravity - 2.78
Water absorption - 1.5%

I. Recycled Coarse Aggregate

Recycled coarse aggregates are the materials which obtained while demolish the concrete buildings. From the demolished material the coarse aggregate is separately taken for the project and that coarse aggregate has some bonding agent on it. We can't use that coarse aggregate with bonding agent because it has more water absorption property. So, the recycled coarse aggregate is treated with NAOH at 2N for 24hrs.

J. Sieve Analysis

The sample is brought to an air-dry condition before weighing and sieving. This may be achieved either by drying at room temperature or heating at a temperature of 10000C to 11000C. Table 4.1 shows the sieve analysis of recycled coarse aggregate.

Materials	Fineness modulus
Natural coarse aggregate	7.14
Recycled coarse aggregate	7.92

Table 1: Sieve Analysis of recycled coarse aggregate

Materials Fineness modulus Natural coarse aggregate 7.14 Recycled coarse aggregate

1) Specific Gravity

The pycnometer is dried thoroughly and its weight is taken as W1. Fill two third part of no pycnometer with RCA and is weighed as W2. The pycnometer is filled with water up to the top without removing the copper RCA. Then it is shaken well and stirred thoroughly with the glass rod to remove the entrapped air. After the air has been removed, the pycnometer is completely filled with water up to the mark. Then outside of the pycnometer is dried with a clean cloth and is weighed as W3. The pycnometer is cleaned thoroughly. The pycnometer is completely filled with water up to top. Then outside of the pycnometer is dried with a clean cloth and is weighed as W4.Table 2 shows the specific gravity for RCA.

Sl. No.	Observations	Trial 1	Trial 2	Trial 3
1.	Weight of empty pycnometer W1(kg)	0.690	0.690	0.690
2.	Weight of pycnometer + sample W_2 (kg)	1.035	1.030	1.040
3.	Weight of pycnometer + sample + water W_3(kg)	1.765	1.760	1.770
4.	Wt of pycnometer + waterW_4 (kg)	1.510	1.510	1.510
5.	Specific Gravity	2.58	2.49	2.62

Table 2: Specific Gravity for RCA

Sl. No. Observations Trial 1 Trial 2 Trial 3
1. Weight of empty pycnometer W1(kg) 0.690 0.690 0.690
2. Weight of pycnometer + sample W2 (kg) 1.035 1.030 1.040
3. Weight of pycnometer + sample + water W3(kg) 1.765 1.760 1.770
4. Wt of pycnometer + waterW4 (kg) 1.510 1.510 1.510
5. Specific Gravity 2.58 2.49 2.62

Specific Gravity of RCA = (W2-W1) / [(W2-W1)-(W3-W4)]

Specific Gravity of RCA = 2.58

K. Moisture Content

Some quantity of RCA was taken in bucket and was taken as W1. Place it in oven for 24 hours and the dried sample was weighed as W2.

Weight of sample taken

Weight of sample after dried process= 1000gm
Percentage of free moisture content= 1038gm
Moisture content of RCA= [(W1-W2)/W1] x 100
Water absorption of RCA= 0.038%
Crushing value= 3.8

IV. CONCRETE MIX DESIGN

A. General

The objective of proportioning concrete is to arrive mix ratio to produce concrete that will satisfy the performance requirements under specified conditions of use. This chapter describes the mix design for M40 grade concrete using IS 10262:2009

B. Method of Mix Design

The mix design has been done for conventional cement concrete using Indian standard mix recommendation one of the ultimate aims of studying the various properties of the materials of concrete, plastic concrete and hardened concrete is to enable a concrete technologist to design a concrete mix for a particular strength and durability. Mix design can be defined as the process of selecting suitable ingredients of concrete and determining their relative proportions

C. Stipulations for Proportioning

1) Grade designation: M40
2) Type of cement: OPC 53 Grade: 20mm
3) Maximum nominal size of aggregate: 360kg/m3
4) Minimum Cement content: 0.40
5) Maximum w/c ratio
6) Workability: 75 mm (slump)
7) Exposure condition: Severe
8) Method of concrete placing: Normal pouring
9) 9. Degree of Supervision : Good
10) Type of aggregate: Crushed angular aggregate

D. Test Data for Materials

1) Specific gravity
   1) cement :3.15
   2) Fine Aggregate :2.65
   3) Coarse Aggregate:2.78
2) Water absorption of Coarse aggregate:0.4%
3) Free surface moisture for Fine aggregate:0.7%

E. Sieve Analysis

1) Fine aggregate : Sand conforming to zone II of IS 383:1970
2) Coarse aggregate : Aggregate conforming to IS 383:1970

F. The Mix Proportions Are

Cement =400kg/m^3
Fine aggregate =660.4 kg/m^3
Coarse aggregate =1168.68 kg/m^3
Water =165.58 kg/m^3
The ratio for one meter cube concrete is1: 1.65: 2.92: 0.4

G. Beam Design

1) Data

Size of the beam =1200×150×200mm
Materials: M-40 grade concrete
Fe-500 grade
Live load =160 KN
Dead load =0.15×0.2×25= 0.75KN/m
Total load =Live load+Dead load =(160/2)+0.75 =80.75 KN/m
W=80.75 KN
Effective depth (d)= 200-25-12/2=169mm=170mm

2) Calculation of Moment

Moment (M) =80.75×0.33=26.65 KN.m
M_u = 1.5×26.65 =39.98 KN.m=39.98 KN.m

3) Calculation of M_u, Limit:

M_u (limit) = 0.138fckbd^2
= 0.138×40×150×170^2
= 23.93 KN.m
Mu >M_u (limit), Design a doubly reinforced section

4) Main Reinforcements

M_u – M_u limit = 39.98-23.93 = 16.05 KN.m
f_{sc} = {0.0035 ($x_{u,max}$ - d^1)}/ $x_{u,max}$ ×E_s
= {0.0035 (0.48×170 – 30) / 0.48×170} ×2×10 ^{5}
= 442.65 N/mm^2
This is not less than 0.87 f_y = 0.87×500 = 435 N/mm^2
A_{sc} = [(M_u – $M_{u\ limit}$) / f_{sc} (d –d^1)]
= 361.74 mm^2
Provide 2 bars of 12 mm diameter (Asc = 226.08 mm^2)
A_{st2} = (A_{sc} f_{sc} / 0.87 f_y)
= (226.08×435/0.87×500)
= 226.08 mm^2
A_{st1} = [0.36 f_{ck} b $x_{u,\ limit}$ / 0.87 f_y]
= [0.36×40×150×0.48×170 / 0.87×500]
= 405.19 mm^2
Total tension reinforcement = A_{st} = (A_{st1} + A_{st2})
= 405.19 + 226.08
= 631.27 mm^2
Provide 2 nos .of 12mm diameter bar(A_{st} = 226.68mm^2)

5) Shear Reinforcements

Vu = Wu /2 = 80.75×1.5 / 2
=60.56 KN
τv = Vu / bd
= 60.56 ×10^3/ 150×170
= 2.37 N/ mm2
Pt = 100Ast /bd
= 100×226.68 / 150×170
= 0.92
Refer Table 19 0f IS: 456 -2000
τc = 0.62 N/mm2
since τv > τc ,shear reinforcement are required,
Vus = [Vu – (τc bd)]
= [60.56×10^3 – (0.62×150×170)]
= 44.75 KN
Using 10mm diameter 2 legged stirrups(157 mm2)
Sv = [0.87 fy Asv d / Vus]
= [0.87×500×157×170 / 44.75 ×10^3]
=259.44 mm
1) Sv > 0.75d = 0.75×170= 127.5 mm
2) Sv =259.44mm
3) S v = 300mm.

Therefore, S v = 150 mm c/c spacing

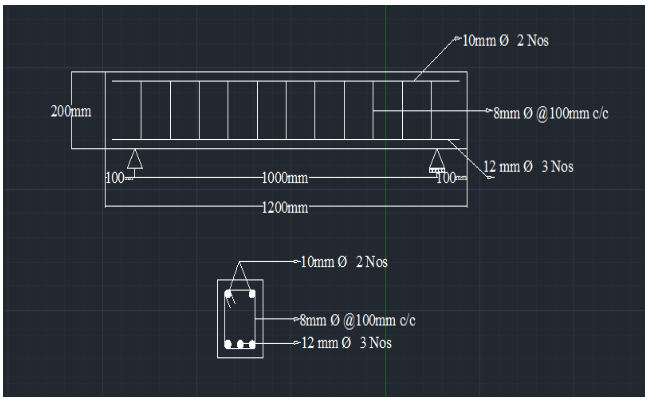

Fig. 2: Reinforcement Detail

V. CASTING OF SPECIMENS

A. General

The casting of concrete is done so that the strength of concrete can be measured. After arriving mix ratio, the exact quantities of materials for the mix is were weighed and kept ready before mixing is started. The specimens of cubes and cylinders were casted and tested. Size of 150 mm x 150 mm x 150 mm standard cubes for compressive strength and 150 mm diameter and 300 mm height standard cylinders for split tensile strength. Weigh batching is used in this project work.

B. Preparation of Mould

Cube moulds of standard size 150mm×150mm×150mm are used, which is made up of cast iron and the inside faces are machined plane. All the faces of moulds are assembled by using nuts and bolts and are clamped to the base plate. It is to be noted that, all the internal angle of the mould must be 90 . The faces must be coated with mould oil to prevent leakage during filling. The inside of the mould must also be preventing the concrete from sticking to it.


Fig. 3: Preparation of mould

C. Mixing

Mixing of concrete may be done by hand or by machine. Mixing should be done thoroughly so as to have a uniform distribution of ingredients which can be judged by uniform colour and consistency of concrete. The mass is then turned to obtain a workable mass and placed in the required area within 30 minutes. Hand mixing can be used for small quantity of concrete due to non-availability of machine or where noise of machine is to be avoided. In general a quantity of 10 % extra-cement is used to compensate the possible inadequacy.


Fig. 4: Mixing

D. Pouring of Concrete

After mixing the moulds are filled immediately by pouring the concrete inside. Concrete is filled in three layers and each layer is compacted well by using a tamping rod of standard size.

E. Compaction of Concrete

Compaction of concrete is process adopted for expelling the entrapped air from the concrete. In the process of mixing, transporting and placing of concrete are is likely to get concrete. Compaction was done using a tamping rod or vibrator. When hand compaction, the consistency of concrete is maintained at higher level. Concrete is filled in layers of 15mm to 20mm and each layer is compacted well using tamping rod or vibrator.

F. Trail Mixes with Recycled Coarse Aggregate

Certain percentages of recycled coarse aggregates (RCA) were replaced with the coarse aggregate in concrete. calcium carbide and calcium carbonates are added to the mix at 2% to the weight of cement. The percentages of trail mixes were listed below.

Replacement with RCA and adding calcium carbide

1) 100% C.A + 0% RCA + 2% of CAC2 - Mix 1
2) 90% C.A + 10% RCA + 2% of CAC2 - Mix 2
3) 85% C.A +15% RCA + 2% of CAC2 - Mix 3
4) 80% C.A +20% RCA + 2% of CAC2 - Mix 4
5) 75% C.A +25% RCA + 2% of CAC2 - Mix 5
6) 70% C.A +30% RCA + 2% of CAC2 - Mix 6

Replacement with RCA and adding calcium carbonate

1) 100% C.A + 0% RCA + 2% of CACO3 - Mix 7
2) 90% C.A + 10% RCA + 2% of CACO3 - Mix 8
3) 85% C.A +15% RCA + 2% of CACO3 - Mix 9
4) 80% C.A +20% RCA + 2% of CACO3 - Mix 10
5) 75% C.A +25% RCA + 2% of CACO3 - Mix 11
6) 70% C.A +30% RCA + 2% of CACO3 - mix 12

VI. RESULT AND DISCUSSION

A. Tests for Replacement of RCA and Addition Of CaC_2

SI.NO	%Of Replacement	Strength(KN)		Stress (N/mm2)	
		7 days	28 days	7 days	28 days
1	Mix 1	712.5	950	31.67	44.72
2	Mix 2	743.5	964	31.50	41.94
3	Mix 3	767.5	982	31.94	43.35
4	Mix 4	781.5	1020	34.64	45.58
5	Mix 5	800	1080	35.28	48.00
6	Mix 6	750	1000	33.33	46.2

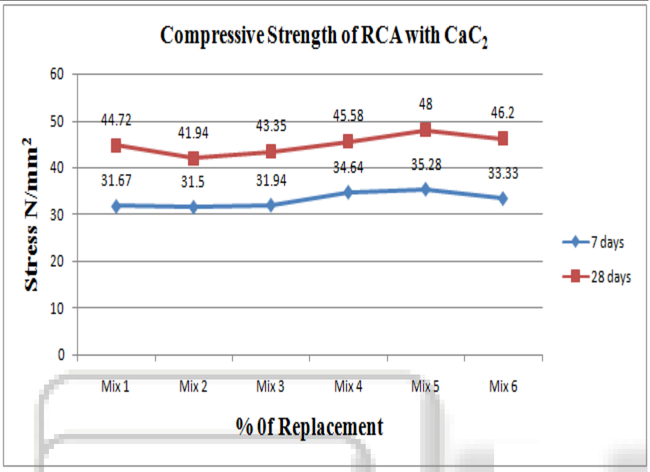

Fig. 5: Compressive Strength of RCA with CaC_2

B. Split Tensile Strength Test

SI.NO	% Of Replacement	Strength(KN)		Stress (N/mm^2)	
		7 days	28 days	7 days	28 days
1	Mix 1	220	314	3.1	4.44
2	Mix 2	243	348	3.43	4.92
3	Mix 3	290	392	4.1	5.54
4	Mix 4	307	408	4.34	5.77
5	Mix 5	312	412	4.41	5.82
6	Mix 6	252	358	3.96	5.62

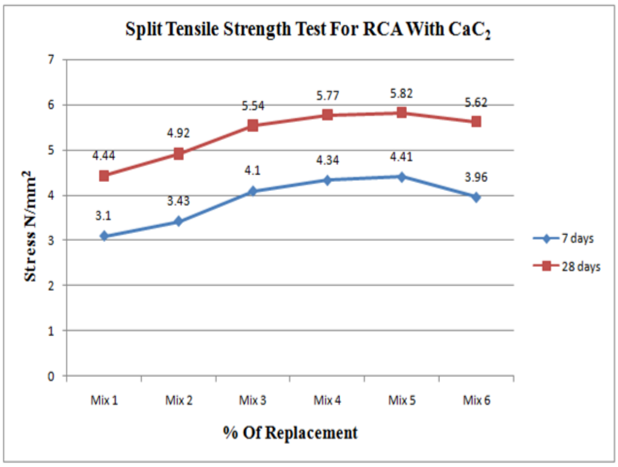

Fig. 6: Split Tensile Strength for RCA with CaC_2

C. Tests for Replacement of RCA and Addition of $CaCo_3$

SI.NO	% Of Replacement	Strength (KN)		Stress (N/mm^2)	
		7 days	28 days	7 days	28 days
1	Mix 7	712.5	950	31.67	42.22
2	Mix 8	700.5	934	31.3	41.5
3	Mix 9	741.75	989	32.97	43.96
4	Mix 10	735.25	983	32.77	43.70
5	Mix 11	735	980	32.67	43.56
6	Mix 12	732.75	977	32.57	43.32

Table Compressive Strength

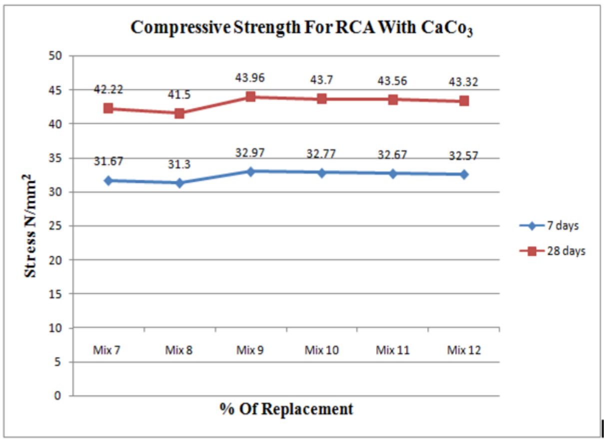

Fig. 7: Compressive Strength for RCA With $CaCo_3$

D. Comparison of Compressive Strength for $CaCo_3$ and CaC_2

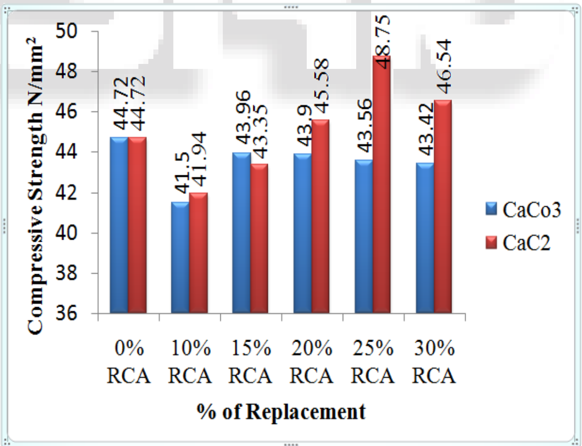

Fig. 8: Comparison of Compressive Strength for $CaCo_3$ and CaC_2

E. Flexural Strength Test for Conventional RC Beam

S.NO	Load (KN)	Deflection(mm)	Remarks
1	40.65	0.92	
2	60.21	1.72	
3	80.10	2.56	
4	101.23	3.80	CRACKING LOAD
5	120.12	4.46	
6	126.28	5.24	
7	132.21	5.96	

8	139.36	6.62	
9	143.54	7.46	
10	149.26	8.24	
11	151.47	9.16	
12	153.47	9.80	ULTIMATE LOAD

Table Load vs Deflection for conventional RC beam

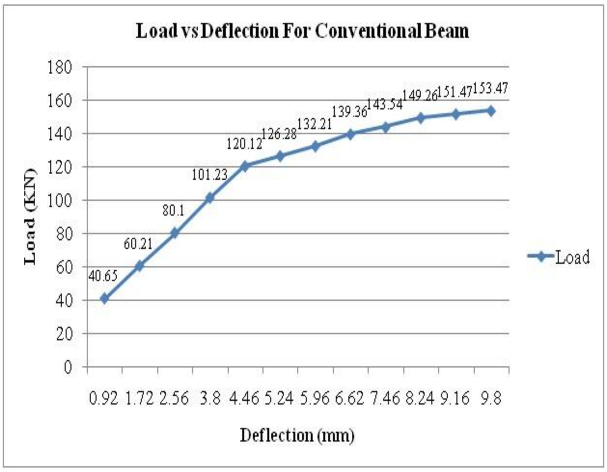

Fig. 9: Load vs Deflection for conventional RC beam

VII. CONCLUSION

Use of Recycled Coarse Aggregate is environmentally helpful to reduce the effects of waste material which produced from buildings. Replacing the building materials are more helpful to reduce lack of space in construction site. The compression and Tensile strength is evaluated by replacing RCA for coarse aggregate is compared with the conventional concrete as per IS codes. Admixtures like calcium carbide and calcium carbonate is used to achieve the high strength of concrete. Both admixtures are used at 2% to the weight of cement. By replacing RCA with the addition of CAC2 is provide high compressive strength at 25% replacement of RCA. The strength obtained at 25% replacement is 48 N/mm2 and the strength is gradually reduced. By replacing RCA with the addition of CACO3 is provide high compressive strength at 15% replacement of RCA. The strength obtained at 15% is 43.96 N/mm2 and the strength is gradually reduced. From the above study the flexural strength test is conducted for 25% of RCA with 2% of CaC2 and 15% of RCA with 2% of CaCo3.The flexural strength for 25% of RCA with 2% of CaC2 is 31.51 N/mm2 and for 15% of RCA with 2% of CaCo3 is 27.48 N/mm2.As compared to 25% of RCA with 2% of CaC2 is Provide more flexural strength than the use of 15% of RCA with 2% of CaCo3.From the above study replacing RCA for Coarse Aggregate at 25% with the addition of CAC2 is economical and increase both compressive and flexural strength of concrete.

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