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AN EXPERIMENTAL STUDY ON RECYCLED CONCRETE AGGREGATES USED IN FRESH CONCRETE

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Abstract: Concrete has been a leading construction material since its first use and will definitely retain its key role in the future due to its durability, free service health care, adaptability to any situation and size, various structural properties and cost-effectiveness. Concrete is the most important building material used in the area. It is a composite product obtained by mixing cement, water and an inert matrix of sand and gravel or crushed stone. Many activities, such as travel, storage, congestion, and treatment, are performed. The dividing material of concrete is the ability to harden underwater. Ingredients can be divided into two groups namely active and inactive. The working group contains cement and water, while the working group contains fine and strong aggregates. The inactive group is sometimes called the inert matrix. Concrete has a high pressure but its strength is very low.
Any building project requires a number of materials such as concrete, metal, bricks, stone, glass, clay, mud, wood, and so on. However, cement concrete remains an important building material used in the construction industry. To be suitable and adaptable to the changing environment, concrete must be consistent in order to conserve resources, protect the environment, save and lead to efficient use of energy. To achieve this, much attention should be paid to the use of waste in the concrete used for new construction. Large quantities of demolished concrete are found in various construction sites, now causing a major problem for dumping in urban areas. This can also be easily applied as a composite and applied to concrete. Research and Development activities have been taken around the world to prove this practicality, economic efficiency and cost effectiveness

Index Terms - concrete admixtures, flexural strength, compressive strength, Slump test, Polyester fiber, workability.

I. INTRODUCTION

The reconstituted themes consist of crushed particles inserted into a phase, which are processed using different percentages of reconstituted compounds. Investigations will be conducted using performance tests, pressure strength tests, indirect rigid tests, belt strength tests, flexibility and carbon tests from materials used in the construction and demolition of waste. The purpose of this existing project is to determine the integrated renewable energy element for the installation of concrete in a building. The scope of the concept is to determine and compare the strength of concrete bonds using different percentages of composites used. Ingredients can be divided into two groups namely active and inactive. The working group contains cement and water, while the working group contains fine and strong aggregates. The inactive group is sometimes called the inert matrix. Concrete has a high pressure but its strength is very low. Large quantities of demolished concrete are found in various construction sites, now causing a major problem for dumping in urban areas. This can also be easily applied as a composite and applied to concrete. Research and Development activities have been taken around the world to prove feasibility, economic efficiency and cost effectiveness. The new replaces the old and the next in terms of architecture. Old buildings require the reconstruction of better and higher economic benefits and also due to obsolescence of buildings or operations and due to the damage caused by natural disasters and wars.

II.CONTENT

The selection of mixing materials and their required quantity is done through a process called mix design. There are many ways to determine the composition of concrete joints. The methods used in India are in line with the BIS (Bureau of Indian Standards). The purpose of concrete construction is to determine the extent to which the ingredients of concrete - cement, water, fine-grained and intermediate joints should be mixed to provide specific strength, performance and durability and may meet other requirements as set out in standards such as: IS: 456-2000. The specification of concrete compositions should therefore describe the materials and strength, performance and durability to be obtained. IS: 10262-1982 provides guidelines for concrete assembly designs. In this study, six mixing particles were determined. Mixtures were taken with (1: 1.52: 2.8, w / c = 0.42). Frauded natural compounds were replaced by reconstituted composites in the range of 0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90% & 100%. Features such as density, X rays diffraction (XRD) and electron microscopy (SEM) scans were studied.

III.MATERIALPROPERTIES

The mechanical and physical characteristics of cement, sand, excessive environmental collection and aggregation from demolished concrete in accordance with IS: 2386-1963 are determined.

Cement

Portland standard cement grade 43 (Source: Shree Ultra Cement) compliant with IS: 8112-1989 used. Cement was tested according to IS 4031-1968. The test results of the cement are given in the Table 1.

Table 1 Physical properties of cement 43-grade

S.No.	Properties	Observed values	Values specified by IS:8112-1989
1.	Fineness % (90 µm I.S. Sieve)	4	Not more than 10
2.	Soundness (mm) (Le Chatelier Method)	1.0	Not more than 10
3.	Normal Consistency (%)	29	……………………
4.	Initial Setting Time (minutes)	220	>=30
5.	Final Setting Time (minutes)	300	<=600
6.	Compressive Strength (MPa) i) 3days ii) 7days	26.07 31.40	>23 >33
7.	Specific gravity	3.15	…………..

NATURAL FINEAGGREGATE

Yamuna Coarse sand was used as a fine aggregate. The grading of sand and other properties are given in the table 2. The sand conforms to zone II as per IS:383- 1970.

Table 2 (a) Sieve Analysis of Natural Fine Aggregate (River Sand)Weight of Sample Taken=1000gm

IS Sieve Size (mm)	Weight Retained (gm)	Cumulative Weight Retained (gm)	Cumulative percentage of Weight Retained	Percentage Passing
4.75	152	152	15.2	84.8
2.36	51	203	20.3	79.7
1.18	116	319	31.9	68.1
.6	114	433	43.3	56.7
.3	379	812	81.2	18.8
.15	144	956	95.6	4.4
0.75	25	981	98.1	1.9
Pan	-	-	-	-

∑F=385.6

Fineness Modulus (F.M.)=3.86

Sand conform to grading zone II of I.S. 383-1970

Table 2 (b) Physical Properties of Natural Fine Aggregate

S. No.	Property	Observed Values
1.	Bulk Density (Loose), kg/m^3	1682
2.	Bulk Density (Compacted), kg/m^3	1886
3.	Specific Gravity	2.54
4.	Free Moisture %	1.48
5.	Water Absorption %	14.30

NATURAL COARSEAGGREGATE

Coarse aggregate of 10mm and 20mm sizes were used. The grading and properties of the coarse aggregate are given in the tables 3.3 and 3.4 respectively.

Table 3 (a) Sieve Analysis of Coarse Aggregate (10mm)Weight of Sample Taken = 2000gm

IS Sieve Size (mm)	Weight Retained (gm)	Cumulative Weight Retained (gm)	Cumulative percentage of Weight Retained	Percentage Passing
25	0	0	0	100
20	0	0	0	100
12.5	8	8	0.4	99.60
10	541	549	27.45	72.55
4.75	1414	1963	98.15	1.85
2.36	32	1995	99.75	0.25
Pan	-	-	-	-

$\sum C=125.6$

Fineness Modulus (F.M.)=6.2

Table 3 (b) Physical Properties of Coarse Aggregate (10 mm)

S. No.	Property	Observed Values
1.	Bulk Density (Loose), kg/m^3	1307
2.	Bulk Density (Compacted), kg/m^3	1469
3.	Specific Gravity	2.61
4.	Free Moisture %	0
5.	Water Absorption %	0.50

Table 4 (a) Sieve Analysis of Coarse Aggregate (20mm)

Weight of Sample Taken = 2000gm

IS Sieve Size (mm)	Weight Retained (gm)	Cumulative Weight Retained (gm)	Cumulative percentage of Weight Retained	Percentage Passing
25	0	0	0	100
20	72	72	3.6	96.40
16	740	812	40.6	59.40
12.5	577	1389	69.45	30.55
10	546	1935	96.75	3.25
4.75	54	1989	99.45	0.55
Pan	-	-	-	-

$\sum C$=199.8

Fineness Modulus (F.M.)=6.99

Table 4 (b) Physical Properties of Coarse Aggregate (20 mm)

S. No.	Property	Observed Values
1.	Bulk Density (Loose), kg/m^3	1415
2.	Bulk Density (Compacted), kg/m^3	1478.20
3.	Specific Gravity	2.66
4.	Free Moisture %	0
5.	Water Absorption %	1.84

COARSE AGGREGATE FROM DEMOLISHED CONCRETE

The composite is produced by crushing the old concrete slab. All combined sizes were tested to give the composite size higher than 4.75mm but less than 20mm. composite sizes 20mm-10mm and 10mm- 4.75mm were separated. Different sizes complement each other and thus increase strength.

The particle structure of the crushed concrete (reconstituted composite) was round and the earth was strong and heavy. This was to be expected due to the presence of an old natural drug lump. The specific gravity of the demolished concrete coarse aggregate was lower than the corresponding value of natural coarse aggregate and water absorption higher due to presence of low density porous mortar. The crush resistance was slightly lower than the natural combination. The properties of the demolished concrete coarse aggregate are given in the Table 3.5a-b.

Table 5 (a) Sieve Analysis of Recycled Aggregate

Weight of Sample Taken =2000gm

IS Sieve Size (mm)	Weight Retained (gm)	Cumulative Weight Retained (gm)	Cumulative percentage of Weight Retained	Percentage Passing
25	0	0	0	100
20	30	30	1.50	98.50
16	289	319	15.95	84.05
12.5	491	810	40.50	59.50
10	904	1714	85.70	14.30
4.75	261	1975	98.75	1.25
2.36	7	1982	99.10	0.90
Pan	-	-	-	-

$\sum C$=185.95

Fineness Modulus (F.M.)=6.86

Table 5 (b) Physical Properties of Recycled Aggregate

S. No.	Property	Observed Values
1.	Bulk Density (Loose), kg/m^3	1128
2.	Bulk Density (Compacted), kg/m^3	1294.92
3.	Specific Gravity	2.32
4.	Free Moisture %	2.03
5.	Water Absorption %	5.60

WATER

Water used for mixing and curing was free from deleterious materials as per clause no 5.4 of IS 456-2000. Potable water is generally considered satisfactory for mixing and curing of concrete.

MIX PROPORTION

The ratio of recycled to total aggregate (by weight) is termed as the RCA percentage replacement (R%). The mix proportion of the concrete are given in Table: 6

Table 6 Mix proportion

S. No.	R%	Cement (kg/m^3)	FA (kg/m^3)	NCA (kg/m^3)	RCA (kg/m^3)	Water (kg/m^3)	Remark
1.	0	420	635	1171	0	131.5	%R=0
2.	10	420	635	1054	117	131.5	%R=10
3.	20	420	635	937	234	131.5	%R=20
4.	30	420	635	820	351	131.5	%R=30
5.	40	420	635	703	468	131.5	%R=40
6.	50	420	635	585.5	585.5	131.5	%R=50
7.	60	420	635	468	703	131.5	%R=60
8.	70	420	635	351	820	131.5	%R=70
9.	80	420	635	234	937	131.5	%R=80
10.	90	420	635	117	1054	131.5	%R=90
11.	100	420	635	0	1171	131.5	%R=100

CASTINGSPECIMENS

The mix types chosen was 1:1.52:2.8, w/c=0.42. The concrete mix was prepared using masses of 10mm and 20mm obtained from demolished concrete from an old building in the city of Ambala. Add up to an equal amount of natural aggregate amounti.e. equal weights of both {(NCA=100%)+(RCA=00)} to {(NCA=0%)+(RCA=100%)} were prepared and used to cast the specimens.
In all of the above mixes performance was measured by fall tests, compaction factor tests and flow table tests. The test models were 150mm x 150mm x 150mm cubic with compressive strength. Specimens are entered according to IS: 516-1959. Specimens tested at 7 and 28 years of age. The aggregates used were in a full, dry state on the surface. Test procedures were followed according to standard Indian data. The batching was done byweight.

Table 7 Size of Moulds

S. No.	Moulds	Size (mm x mm)	Specimen Casted
1.	Cube	150x150x150	Compressive Strength

PREPRATION OF CONCRETE FROM DEMOLISHED CONCRETE AGGREGATE

Research on the use of waste materials is very important because waste disposal is slowly increasing with population growth and urban development. Recycled aggregate is easy to obtain and costs cheaper than virgin aggregate. Virgin aggregate needs to be mined but recycled aggregate can be easily obtained.

SOURCE OF DEMOLISHED CONCRETEAGGREGATE

In the current investigation, old pieces of concrete pieces of building beams from the city of Ambala were used to prepare for the demolition.Preparation of Aggregate from DemolishedConcrete.

Reconstructed or demolished concrete obtained by demolition will definitely have a variety of exterior materials such as finishes, fittings, dirt, metal, hardware, wood, plastics and other materials directly or indirectly attached to concrete. This is a waste that is why it needs to be removed in order to get the final amount of foreign material. In the current investigation, the revitalized scales were produced by crushing old building materials, from the town of Ambala, in a jawbone with an opening at 20 mm in a closed area. The milled products were then processed and reconstituted to obtain the required range.

PROCESSING OF DEMOLISHED CONCRETEAGGREGATE

Old concrete pieces of RCC were crushed first using 200 tones capacity compression testing machine and later 5 kg hammer was used for further breaking it into smaller pieces. These smaller pieces were fed in a jaw crusher with the opening set at 20mm in the closed position. The crushed products were then purified and reassembled to obtain the desired arrangement in accordance with IS 383-1970. In the present investigation, coarse aggregate obtained from demolished concrete had the grading as per IS: 383- 1970.

MIXING AND COMPACTION

The building materials were weighed on a measuring machine. The combination is done manually. Cement, fine-grained and mixed mortar are well mixed in a dry state to obtain a uniform consistency. Water is then added slowly to obtain a uniform mixture. The mixing time was 4-5 minutes in the whole mixture. Metal mold was used to spread the specimens. Specimens are entered according to IS: 516-1959. Squeezing is done by vibrating the mold for about 2 minutes using a table vibrator. Excessive material was extinguished using a stick. The upper bouts featured two cutaways, for easier access to the higher frets. The concrete types are removed from the mold after 24 hours. Specimens were kept in fresh, fresh water for treatment in water tanks and cured until tested. The cubes were tested at the age of 7 and 28days.

CURING

The test sample should be stored at a temperature of 27 ° +/- 2 ° C for 24 +/- 0.5 hours. from the timely addition of water to the dry ingredients. After this time the template should be marked and removed from the mold and immediately immersed in clean clean water or a solution of full lime and stored there until it is extracted out just prior to the test. The water or solution in with the specimen s are kept should be renewed every seven days and should be maintained at a temperature of 27° +/- 2°c.

PROPERTIES OF FRESH CONCRETE(WORKABILITY)

Many different methods are available to measure the performance of new concrete, but none of them are completely satisfactory. Each test only measures its own aspect and there is no way to fully measure the performance of concrete. However, by looking at and controlling the similarity of usability it is easy to ensure the same quality of concrete and hence the same strength of a particular work. In the current work, the following tests are performed to determine performance..

- The Slump Test
- The Compaction Factor Test
- The Flow Test

The values obtained from above tests have been given in table 8

Table 8 Properties of Fresh Concrete

S. No.	Mix ID	W/C	%R	Slump Value (mm)	Compaction Factor Value	Flow Value (%)
1.	MRA 0	0.42	0	25	0.85	47.5
2.	MRA 10	0.42	10	24	0.82	48.6
3.	MRA 20	0.42	20	22	0.79	50.8
4.	MRA 30	0.42	30	20.5	0.76	53.4
5.	MRA 40	0.42	40	19	0.73	54.9
6.	MRA 50	0.42	50	18	0.72	56.0
7.	MRA 60	0.42	60	17	0.71	61.2
8.	MRA 70	0.42	70	16	0.70	68.4

9.	MRA 80	0.42	80	14	0.69	72.3
10.	MRA 90	0.42	90	12	0.68	79.4
11.	MRA 100	0.42	100	10	0.67	86.0

IV.TESTINGPROCEDURE

After a set period of treatment the species were removed from the treatment tank and their areas cleared. Various tests were performed as described below: Pressure Capacity Cubes for 7 & 28 days.

❖ COMPRESSIVE STRENGTH

Specimens tested at 7 and 28 years of age. The tubes were tested on a universal test machine after being set up at room temperature according to IS 516-1959. The load is applied continuously without impacts and similarly @ 140N / cm2 / min. The loading was continued until the sample failed and a large sample load was recorded. The pressure to compensate for a cube is obtained by considering the average of three species each year.

❖SPLITTING TENSILE STRENGTH

The cylinder mould shall is of metal,3mm thick. Each mold can be opened long enough to facilitate removal of the template and provided ways to keep it closed while in use. The average inside diameter of the mold is 15 cm ± 0.2 mm and the height is 30 +0.1 cm. Each mold is given a stainless steel mold and the base plate should be coated with a thin film of moldy mold before use, to prevent adhesion of concrete.

❖SCANNING ELECTRON MICROSCOPE (SEM)

Electron microscope (SEM) is a type of electron microscope that produces sample images by scanning it with a fixed electron beam. Electrons interact with atoms in the sample, producing a variety of detectable signals and containing details about the shape of the earth and the shape of the sample. The electron beam is usually scanned with a raster scanning pattern, and the beam position is integrated with the signal obtained to produce the image. SEM can achieve better refinement than 1 nanometer. Specimens can be seen in the upper vacuum, the lower vacuum, in wet (environmental (SEM) conditions, and in the wide range of cryogenic or high temperatures.

❖XRD (X-RAY DIFFRACTION)

The X-ray diffraction technique was used for identification of phases present in the hardened concrete made with RCA as replacement of N.A at the age of 28 days. The XRD investigations were performed for diffraction angle 2θ ranged between 10° and 80°in steps of 2θ = 0.017. The diffraction pattern, list of d-spacing and relative intensities of diffraction peaks was prepared and was compared with the standard peaks of compounds in the diffraction database released .XRD spectrums was in the powdered form of powder mortar paste are presented.

V.CONCLUSION

Research on the use of waste materials is very important because waste disposal is slowly increasing with population growth and urban development. Reconstructed combinations are easier to find and cost a chapter than virgins. Virgin aggregate needs to be mined but renewable integration can be easily found. The purpose of the present work is to define the combined composite energy features such as compression, to separate the dynamic strength from the potential use of high-strength concrete. Studies show that the total amount of concrete used increases exponentially when its concentration is 50 percent. This is classified as a medium-strength concrete and can be used for infrastructure, requiring compressive strength of up to 30MPa. Renewable integration is cheaper compared to natural integration. Therefore, builders can do construction work at a lower cost of materials. It has been observed in this work that the reduction of the W / C ratio in recycled mixes, improved compression strength and separation strength strength. Regenerated composites can be used in buildings, but low water content can create less performance. Whenever a recycled compound is used, the water content in the concrete mix should be carefully considered as the absorption capacity of the recycled mixture varies.

Follow-up drawings were drawn based on observations and discussions of test results:

1. Compressive strength of Natural aggregate is more than Recycled concrete aggregates. The compressive strength decrease 26.66% for 7 days curing and 21.72% for 28 days curing samples.
2. 50% replacement of RCA with NA compressive strength increases 4.05% and 5.23% for 7 days and 28 days curing samples respectively.
3. RCA possess relatively lower bulk density, specific gravity and high water absorption as compared to NCA. This is mainly due to the mud adhering to the composite of recycled concrete. Splitting tensile strength Recycled concrete aggregates decrease 20.70% for 7 days curing and 14.74% for 28 days curing samples.

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