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Research and Development in use of Recycle Aggregate Concrete (RAC)

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Abstract -*Construction and Demolition (C&D) waste generation has risen due to the rapid growth of urbanization. The increase in the economic growth after development and redevelopment projects in the country and subsequent increase in the urbanization in the cities has made construction sector to increase drastically, but also environmental impacts from Construction and Demolition (C & D) waste are increasingly becoming a major issue in urban solid waste management. Environmental issues such as increase in the flood levels due to the illegal dumping of construction and demolition waste into the rivers, resource depletion, shortage of landfill and illegal dumping on hill slopes are evident in the metro cities. The study report stresses the importance of recycling construction waste, creating awareness about the problem of waste management and the availability of technologies for recycling.*

Demolished waste contributes a major portion of total solid waste production in the world and the most of it is used in landfill. Demolished waste generation and handling issue have been in focus to achieve sustainable goals. Owing to growth in construction in India it is appropriate to link generation of waste with the growth. If measure growth to minimize and handle waste are not developed and efficiently adopt, it may threat environment and sustainable moment of Indian construction industry. The paper concludes future scope of construction industry in India and benefits to the society by adopting the practice production of recycled aggregate concrete (RAC)

Key Words: Construction & demolition, Demolition waste, RAC, Recycling waste, Waste management, Recycle Aggregate, Recycle Concrete

1.INTRODUCTION- Construction and demolition waste has been defined as "wastage which are arising from construction, renovation, explosion activities, surplus and damaged products and material arising in the course of construction work and on-site work. Construction and demolition waste are generated whenever any construction/demolition activity takes place, such as, building roads, bridges, fly over, subway, remodeling etc. construction. In India, the traditional concrete is mostly prepared by using natural sand obtained from the riverbeds as fine aggregate. India is a developing country where the growth rate is increasing and side by side waste material is also increased so there is a need of management of C&D in India. In major cities there is surge in C&D concrete quantities causing adverse effect on environment.

The use of such waste as Recycled fine aggregate in concrete can be useful for both environmental and economic aspect in the construction industry. This study discussed the possibility to replace natural\crushed fine aggregate with demolished concrete waste in structural concrete.

An investigation into the properties of recycle concrete as a fine aggregate is made using crushing and grading of concrete collected from demolished site, test will be carried out of different grade of concrete. The concrete could be transformed into useful recycle fine aggregate and used in concrete production with properties suitable for most structural concrete application in India.

1.1 Aim and Objectives- Construction and demolition waste is major problem in construction industries. The main aim is Reduce, Recycle, and Reuse of C&D waste. And other aim increasing cost of river sand and crush sand (fine aggregate). The main objectives of the project as follows:

- To study the properties of demolished aggregate.
- To study the C&D waste generation, its sources and streams.
- To determine the suitability and effect of concrete waste as replacement of fine aggregates in concrete production.
- Avoiding and minimizing building waste through better management and operating practices.
- Recycle and Reuse of demolished concrete to save environment, cost and energy.
- Reduce use of river sand which help in reduction in silting of river and result in economic al construction.

1.2 Scope of project- Now days construction activities are taking place as per demand. Due to which their hike in the rate of construction material. As here constant use of such materials there is a scarcity of such materials in the market leads high rates.

- To reduce the disposal of waste demolished concrete.
- To recycle and reuse of recycle demolish concrete.
- Crushed concrete is perfect replacement and prevent the formation of voids by filling the gaps of aggregates.
- Select appropriate medium for mass awareness.
- Demolition waste is a problem which many of us face. What is required is that the municipality

when inform by any citizen should visit the place and stop all the section till the time waste is removed.

2. Methodology

1. Test on natural aggregates (NA)

Table -1: observation table of specific gravity test and water absorption test

Test results	Natural Aggregates	
Size	Fine aggregates	Coarse aggregate
Specific gravity (%)	2.65	2.68
Water absorption (%)	0.96	0.98

2. Impact test and crushing test of NA

Table -2: observation table of impact value test

Sr No.	DETAILS	SAMPLE 1	SAMPLE 2
1	Total weight of dry aggregates filling the cylindrical measure (W1) g	250	240
2	Weight of aggregate passing through 2.36mm sieve after the test (W2) g	40	50
3	Aggregate impact value =(W2/W1) X 100 (%)	16%	20.83%

Average impact value is 18.43%

Sr No.	DETAILS	SAMPLE 1	SAMPLE 2
1	Total weight of aggregate (W1) in g	3000	3000
2	Weight of crushed aggregate passing through 2.36mm sieve (W2) in g	575	565
3	Aggregate crushing value (%)	19.2	18.8

Table-3: Observation of crushing test of NA

Average crushing value is 19%

3. Concrete mix design

Table-4: mix proportion of conventional concrete

1	Design Grade of concrete	M25
2	Characteristic strength of concrete (MPa)	25
3	Target mean strength (MPa)	31.6
4	Exposure conditions	Mild
5	Type of cement	OPC 43 grade
6	Nominal size of aggregates	20mm
7	Specific Gravity of cement	3.15

General data for mix design

Table-5: Concrete Mix Design data for Conventional concrete

Material	Proportions	Per cubic volume
Water	0.45	210.73 lit
Cement	1	468.30 kg
Fine aggregate/Sand	1.21	569.84 kg
Coarse aggregate (>20mm)	1.66	779.09 kg
Coarse aggregate (<20mm)	1.11	519.39 kg

3.1 Compressive strength on concrete with NA

Table-6: Observation of compressive test of concrete block with NA

Type of Mix	7days (N/mm^2)	14days (N/mm^2)	28days (N/mm^2)
Natural	25.56	36.06	45.13

4. Test on Demolished aggregates (DA)

4.1- Observation table of specific gravity test and water absorption test

Test results	Recycled Concrete Aggregate
Size	Fine aggregate
Specific gravity (%)	2.31
Water absorption (%)	1.8

5. Concrete mix design with RCA

5.1: - Concrete mix design with 75% replacement of RCA (The Indian Standard Method (IS) adopted for concrete mix design as per IS 10262:2009)

Table7- Concrete Mix Design data with 75% replacement of sand

Material	Proportions	Per cubic volume
Water	0.45	210.74 lit
Cement	1	468.31 kg
Fine aggregate/Sand	0.30	142.46 kg
Coarse aggregate (>20mm)	1.66	779.09 kg
Coarse aggregate (<20mm)	1.11	519.39 kg
Recycled concrete aggregate	0.91	427.38 kg

Table-8: Results of compressive strength test on concrete 75% replacement of sand by RCA

Type of Mix	7days (N/mm^2)	14days. (N/mm^2)
Recycled aggregate with 75% replacement	21.36	29.65

5.2: - Concrete mix design with 100% replacement of sand by RCA. (The Indian Standard Method (IS) adopted for concrete mix design as per IS 10262:2009)

Table-9: Concrete Mix Design data with 100% replacement of sand

Material	Proportions	Per cubic volume
Water	0.45	210.74 lit
Cement	1	468.31 kg
Coarse aggregate (>20mm)	1.66	779.09 kg
Coarse aggregate (<20mm)	1.11	519.39 kg
Recycled concrete aggregate	1.21	569.84 kg

Table-10: Results of compressive strength test on concrete 100% replacement of sand by recycled concrete aggregate

Type of Mix	7days (N/mm^2)	14days (N/mm^2)
RCA with 100% replacement	20.56	28.68

Fig no-1
Tested concrete block of 75% replacement by RCA

Fig no-2
Tested concrete block of 100% replacement by RCA

5.3:- Concrete Mix Design data with 100% replacement of sand with admixture Sika Viscocrete 5210 NS.

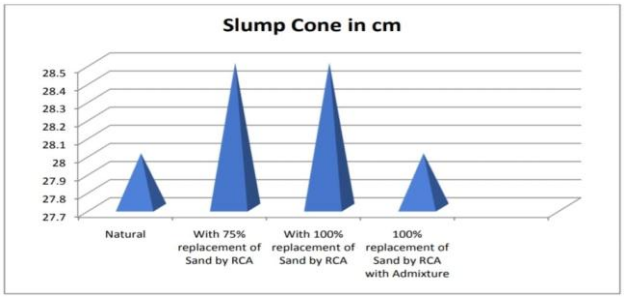
Table-:11 Concrete Mix Design data with admixture Sika Viscocrete 5210 NS.

Material	Proportions	Per cubic volume
Water	0.4	191.58 lit
Cement	1	478.95 kg
Coarse aggregate (>20mm)	1.44	699.87 kg
Coarse aggregate (<20mm)	0.96	466.58 kg
RCA	1.05	488.09 kg
Admixture	0.5% of weight of cement	2.39 lit

Table-:11 Results of compressive strength test on concrete with admixture

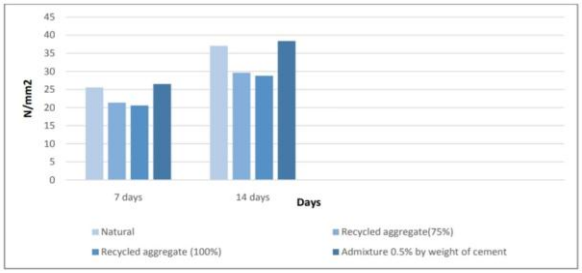
Type of Mix	7days (N/mm^2)	14days (N/mm^2)
0.5% Admixture by weight of cement	26.52	38.42

6. Result



Graph no-1: Comparison of Slump Cone test results

As shown in graph, on Y-axis Slump Cone height is represented in cm shows that slump decreases as recycled concrete aggregate are added in natural concrete mix design resulting in decrease in workability of concrete. After addition of admixture to the recycled aggregate concrete design, gives slump equal to that of conventional concrete.



Graph no-2: Comparison of Compressive strength test

As shown in the graph, on Y-axis strength of concrete is represented in N/mm^2 and it is observed that there is decrease in compressive strength of concrete with recycled concrete aggregates as compared to conventional concrete. After adding admixture 0.5% by weight of cement concrete gives compressive strength greater than conventional concrete which indicates that admixture prevailing conditions are fulfilled.

From the laboratory setup on RCA it has been observed that water absorption of RCA is greater than normal concrete aggregates and also the specific gravity of RCA is found to be less. The strength of concrete blocks casted using RCA is 21.7% less than normal concrete.

7. CONCLUSIONS

When admixture added to concrete with recycled concrete aggregate to increase the properties of concrete mix effectively. In order to use recycled aggregates as sand in concrete mix with maximum utility, attempts are made to add different percentage of NA:RA (Natural Aggregate: Recycled Aggregate) and admixture: cement ratio so as to determine the combination to achieve best results.

When properly processed and categorized, RA may be constructed as another type of normal aggregate, fit for use in constructions as per national and international specifications Using crushed concrete in fresh concrete decreases the demolished waste in the country, but also it will decrease the use of river sand, which is becoming hard to come by, and also it will make the construction much cheaper.

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