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Abrasion Resistance of Concrete with Crushed Sand

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Abstract: ***The studies measure Abrasion Resistance of Concrete with Crushed Sand. Pune is developing in construction activity so Pune province was chosen as a case study. Due to increase in Automobile and IT Industry increases Infrastructure faculty in Pune. Increases concrete demands for construction of Infrastructure faculty such as Fly over, Metro rails & Ring road around Pune city. To Gratifications in the demand of concrete and to supply this concrete demand increase in demand of natural sand Construction activity of Infrastructure & heavy traffic in Pune. Natural sand are replace with Crushed Fine and Coarse Aggregate Concrete (CCA)***

Keywords: Crushed Fine and Coarse Aggregate, Engineering properties, Natural aggregate.

I. INTRODUCTION

In developed countries are increases in Infrastructure construction activity, due to increase in Infrastructure Floor space index (FSI) increases. Old structures are demolished due to increase in FSI. Increase in construction activity and increase demand of concrete. Increase in demand and decrease in natural sources namely fine aggregate for the production of concrete has resulted in the need to identify new sources of fine aggregates. Due to increased levels of construction activities expected in the years to come, it is expected that fine aggregates suitable for use in concrete will become scarce of uneconomical to produce. With the expected shortfall in natural sands, manufactured sands offer a viable alternative to natural sand. The possibility of using crushed rock as substitute for the fine aggregate (sand) in concrete is discussed in this. Natural sand deposits are being depleted and causing serious threat to environment as well as to the society. Increased extraction of natural sand from riverbeds is causing many problems. Depletion of water-retaining sand strata, depending of the river courses causing bank-slides, loss of vegetation on the banks of rivers, exposing the intake well, etc. are few examples.

Descending sand resources, incidental government restrictions on sand quarrying and non- availability of sand in the neighbourhood has increased the cost of sand significantly. In this background, people connected with construction industry opted for inexpensive and easily available, alternative material to river sand. Stone crusher was identified as the best substitute to natural sand. Recent studies have shown that these fine particles may help to increase the compressive strength of concrete. In this dissertation work, physical properties of artificial sand are studied. For zone II, III and IV mix is designed for M20 concrete. For each gradation of artificial sand workability, and compressive strengths are studied and optimum mix is ascertained.

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II. MATERIALS AND METHODS

The constituent materials describe as follows:

2.1 Cement

Regular Portland cement of 53 grades obtainable in the resident market in the Investigation confirming to IS 12269: 2013 is used. Its Physical Properties are Fineness 5.2%, Specific Gravity 2.95, Standard Consistency 31 % , Preliminary setting Time 62 min, Final Setting Time 537 min, Compressive Strength 53.12 MPa

2.2 Fine Aggregate:

Locally available River, crushed RMC waste concrete aggregate used as fine aggregate that confirms to zone II of IS 383-1983. River sand surface is smooth and rounded, Crushed sand is angular in shape and rough in surface. The specific gravity of River & crushed, is 2.82, & 2.75. Fineness modulus of River, crushed sand fine aggregate is 2.62 and 2.94

2.3 Coarse Aggregate

River sand and Crushed angular metal from a local source was utilizd as coarse aggregate which had size between 10mm to 20mm. The definite gravity of coarse aggregate is 2.68 & 2.62. Fineness modulus is 6.4 &6.9. Water absorption is 0.7% & 1.2 %

2.4 Water:

Mixing and curing Potable water was utilized.

1.5 Mix Proportions In the experimental work Near about Pune crushed according to fine & coarse aggregate. Natural River and crushed sand is used. OPC of 53 grade and potable water is used for mixing. As per IS standard mix proportion was prepared. Replace with Natural Fine & Coarse aggregate in 20% interval up 100% as shown in Table 1 for M30 Grade concrete & Table 2 for M40 Grade concrete. Indispensable in dry mix water amount concrete existed mould and by mechanical vibrator the compaction was done.

After 24 hours, the samples was removed from moulds & 28 days place in water for curing. Afterward at an age of samples 28 days were testing for permitted.

Table 1 Mix Proportions of M30 Grade concrete

Mix	Cement	NFA	Crushed Fine Aggregate	NCA	Crushed Coarse Aggregate	Mixing Ratio
NAC	382	716	--	1294	--	1:1.88:3.38
CCA 20	382	573	143	1027	257	1:1.88:3.38
CCA 40	382	430	286	770	514	1:1.88:3.38
CCA 60	382	286	430	514	770	1:1.88:3.38
CCA 80	382	143	573	257	1027	1:1.88:3.38
CCA 100	382	--	716	--	1294	1:1.88:3.38

Table 2 Mix Proportions of M40 Grade concrete

Mix	Cement	NFA	Crushed Fine Aggregate	NCA	Crushed Coarse Aggregate	Mixing Ratio
NAC	410	654	--	1105	--	1:1.60:2.69
CCA 20	410	523	131	931	233	1:1.60:2.69
CCA 40	410	392	262	698	466	1:1.60:2.69
CCA 60	410	262	392	466	698	1:1.60:2.69
CCA 80	410	131	523	233	931	1:1.60:2.69
CCA 100	410	--	654	--	1105	1:1.60:2.69

III. Experimental Work

3.1 CASTING:

The cubes of proportions 15cm x 15cm x 15cm was cast to freshen out the compression strength. The amounts of mixes assessed for 10 to 15 mm slumps. The mixes are proposed for concrete M 20 grade according to IS Codes. The 7 days old RMC waste fine & Coarse aggregate, Natural Fine & coarse aggregate and cement were dry mixed on mixer cautiously till the time uniform mix is attained. Four mix are prepared Natural Aggregate Concrete (NAC), in next mix Cement Natural Fine & Coarse Aggregate replace 20 %

3.2 Compressive Strength Test:

By making use of the UTM machine test the compressive strength test is shown 60Tone (UTM). On UTM platform cubes was placed & the constant, load rate was applied up fails. The specimen ultimate load noted and finding compressive strength shown in Table 3 & 4 and Figure 1 & 2 shows compressive strength of M30 & M40 Concrete

Table 3 M30 Compressive Strength of Concrete

Mix	Ultimate Load(KN)	Compressive Strength (N/mm^2)
NAC	677	30.09
CCA 20	688	30.58
CCA 40	690	30.67
CCA 60	702	31.20
CCA 80	712	31.64
CCA 100	718	31.91

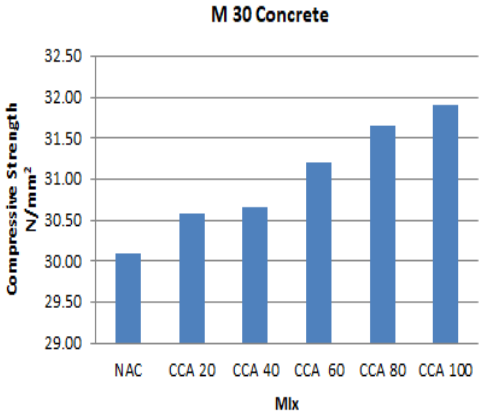

Figure 1 Compressive Strength of M 30 Concrete

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Table 4 M40 Compressive Strength of Concrete

Mix	Ultimate Load(KN)	Compressive Strength (N/mm^2)
NAC	902	40.09
CCA 20	920	40.89
CCA 40	932	41.42
CCA 60	945	42.00
CCA 80	950	42.22
CCA 100	962	42.76

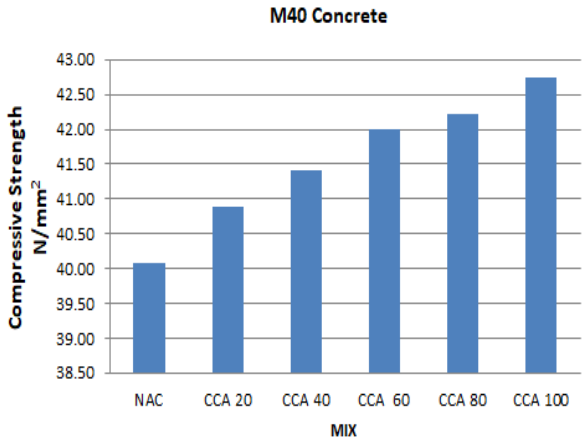

Figure 2 Compressive Strength of M40 Concrete

3.3 Abrasion test on concrete

Abrasion test was implemented on the samples that dimensions 15 cm x 15 cm x 15 cm. This test was carried out according to ASTM C 944 regulation (ASTM, 2012). According to this standard, three surfaces of the specimens are exposed to abrasion test. Each surface is exposed to abrasion along 120 second. Totally, one specimen is exposed to abrasion along 6 minutes. After 6 minutes, loss of mass is weighted and then reported. This test was implemented on 28 days' age specimens. During this period of time abrasion module of machine revolved 60 rev/min. Abrasion resistance test machine can be viewed seen in Figure 3 below. Results of Abrasion Test on concrete is Figure 4 & 5 are shown in results.

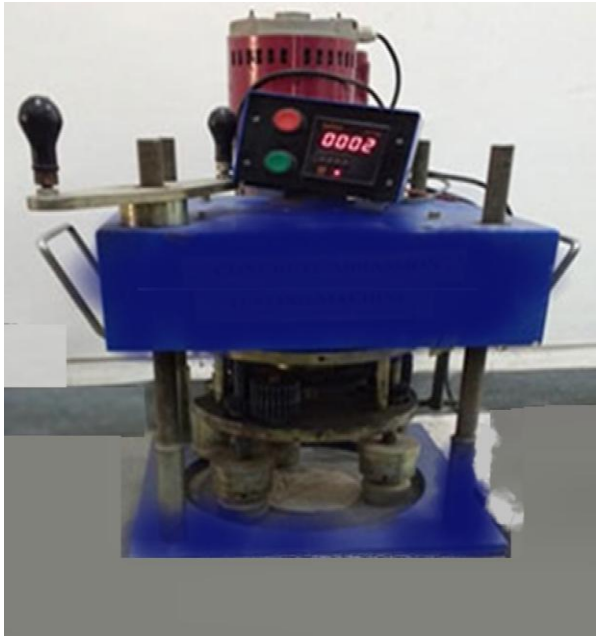

Figure 3 Abrasion Testing Machine

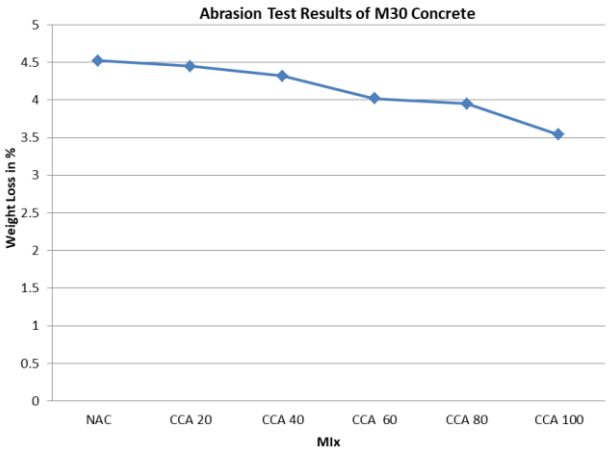

Figure 4 Abrasion Test results of M30 concrete

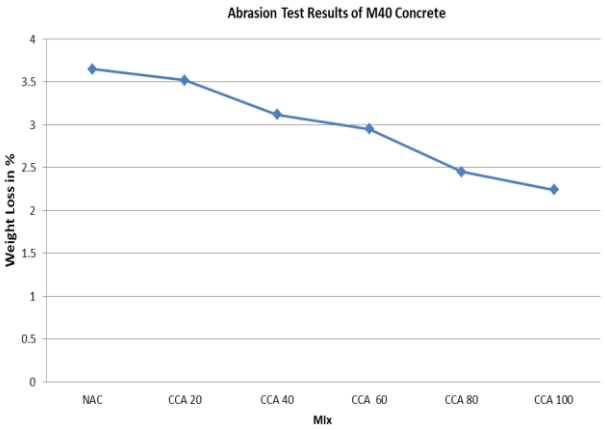

Figure 5 Abrasion Test results of M40 concrete

IV. RESULTS AND DISCUSSION

In this paper seven days old Crushed aggregate is replace with natural aggregate to see the effect on concrete properties for sustainability concrete technology. In this study, it was focused on the compression strength and abrasion resistance of concrete specimens.

Compressive strength test results shown in Table 1 & Figure 1 of M30 concrete specimens was measured at 28 days age. These average results were tabulated in Figure 4. NAC compressive strength 30.09 MPa, CCA concrete aggregate replace 20% with natural aggregate compressive strength 30.09 MPa. CCA concrete aggregate replace 40% with natural aggregate compressive strength 30.67 MPa. CCA concrete aggregate replace 60% with natural aggregate compressive strength 31.20 MPa. CCA concrete aggregate replace 80% with natural aggregate compressive strength 31.64 MPa, CCA concrete aggregate replace 100% with natural aggregate compressive strength 31.91MPa & weight loss in percentage NAC in Abrasion

Test is 4.52% , CCA concrete aggregate replace 20% with natural aggregate Abrasion Test results 4.45%, CCA concrete aggregate replace 40% with natural aggregate Abrasion Test results 4.32%. CCA concrete aggregate replace 60% with natural aggregate Abrasion Test results 4.02%. CCA concrete aggregate replace 80% with natural aggregate Abrasion Test results 3.95%. CCA concrete aggregate replace 100% with natural aggregate Abrasion Test results 3.54%. Compressive strength test results shown in Table 2 & Figure 2 of M40 concrete specimens was measured at 28 days age. These average results were tabulated in Figure 5. NAC compressive strength 40.09 MPa, CCA concrete aggregate replace 20% with natural aggregate compressive strength 40.89 MPa. CCA concrete aggregate replace 40% with natural aggregate compressive strength 41.42 MPa. CCA concrete aggregate replace 60% with natural aggregate compressive strength 42 MPa. CCA concrete aggregate replace 80% with natural aggregate compressive strength 42.22 MPa, CCA concrete aggregate replace 100% with natural aggregate compressive strength 42.76 MPa & weight loss in percentage NAC in Abrasion Test is 3.65 % ,

CCA concrete aggregate replace 20% with natural aggregate Abrasion Test results 3.52 %, CCA concrete aggregate replace 40% with natural aggregate Abrasion Test results 3.12 %. CCA concrete aggregate replace 60% with natural aggregate Abrasion Test results 2.95 %. CCA concrete aggregate replace 80% with natural aggregate Abrasion Test results 2.45 %. CCA concrete aggregate replace 100% with natural aggregate Abrasion Test results 2.24 %. The Strength of Concrete contenting Crushed Fine and Coarse Aggregate (CCA) gives more compressive strength and more abrasion resistance less loss in weight.

V. CONCLUSION

This paper presents the effect of CCA concrete aggregate materials on engineering properties of concrete. CCA materials are sand, RMC plants waste concrete aggregates in concrete.

- Compressive strength of concrete increases with incresae in CCA concrete aggregate.
- Abrasion resistance of concrete was increases with CCA aggregate increases because it content rough surface.
- Mass loss of specimen decreases with replacing conventional concrete material with CCA

For this purpose, four sets of specimens were produced at constant w/b ratio to implement a series of tests to see the mechanical properties of concrete produced with waste materials at fresh state and hardened state.

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