Journal of Civil Engineering and Environmental Technology
Print ISSN: 2349-8404; Online ISSN: 2349-879X; Volume 1, Number 4; August, 2014 pp. 99 - 102

http://www.krishisanskriti.org/jceet.html

Use of Low Cost Alternatives as Admixtures to Concrete

T. Sravani, P. Chandra Babu, C.M. Vivek Vardhan

Dept.of Civil Engineering,
Annamacharya Institute of Technology and Sciences,
Tirupati, Andhra Pradesh, India.

Abstract :**With explosion in population, the demand for infrastructure facilities has risen exponentially to meet domestic and industrial requirements. The cost of construction materials also have escalated high, warranting the need for Low Cost and endemically available alternatives. To this end, the use of locally available Low Cost materials such as Building Demolition Waste, Granite Cutting Slurry, and Laundry Wash Water were tried as replacements to conventionally used ingredients of concrete. Various proportions of Building Demolition Waste, Granite Cutting Slurry and Laundry Wash Water were tried as ingredients to concrete as replacement for Coarse Aggregates and Water, and its influence on workability and compressive strength were investigated. It was observed that the replacement of Building Demolition Waste and Granite Cutting Slurry almost retained the workability characteristics of conventional concrete. The compressive strength also remained the same except a very negligible reduction of 7% compared to conventional concrete. The use of Laundry Wash Water did not alter the characteristics of concrete much. From this it can be concluded that Building Demolition Waste, Granite Cutting Slurry and Laundry Wash Water can be safely used as Low Cost alternatives to conventional concrete.**

KEY WORDS: Demolished Coarse Aggregate, Granite Cutting Slurry, Laundry Wash Water, Concrete, Workability, Compressive Strength.

1. INTRODUCTION

Rapid industrialization and subsequent urbanization has resulted in serious depletion of natural resources particularly construction materials. On the other hand demolition of existing infrastructure facilities has resulted in piling of huge quantities of wastes.As the cost of construction materials, especially aggregates have risen high there is a need to utilize the waste materials as partial substitutes to them. Several works have already been carried out to verify the application of partial substation of wastes products in place of aggregates.Omar et.al.,[1] have investigated on utilization of lime stone waste and marble powder wastes as partial replacements to fine aggregate and have reported a significant increase of 12% and 6% compressive strengths respectively. MalekBatayneh et.al.,[2] have successfully demonstrated the application of demolished concrete, glass and plastics as partial substitutes to concrete. Even cement can be replaced with other materials as Mr.R. Balamurugan [3] observed that on partial substitution of 20% of cement with hypo sludge in concrete, the compressive strength was 21.11MPa.

Granite Cutting Slurry (GCS)has the same physical characteristics of cement and fine aggregate, as its size and properties are very close to cement and sand. Also the surface of granite cutting slurry is partially rough compared to fine aggregate. This rough surface leads to higher binding compared to a smoother surface.

In India, huge quantities of construction and demolition wastes are produced every year. These waste materials need a large dumping space and its disposal has become a serious social and environmental issue. Hence it becomes imperative to find a way to use these wastes as resources.

In this investigation it is proposed to utilize Building Demolition Waste like Demolished Coarse Aggregate (DCA), Granite Cutting Slurry (GCS), and Laundry Wash Water (LWW) as partial substitutes in the production of concrete.

2. MATERIALS AND METHODS

2.1. Cement

In this present investigation Ordinary Portland Cement of 53 grade was used.

2.2. Fine Aggregate

The sand used for the experimental procedure was locally procured and confirmed to Indian Standard Specifications[4]. It was passed througha 4.75 mm sieve,washed to removeany dust and then used as it was for further investigations.

2.3. Coarse Aggregate

Broken granite stonesaregenerally used as a Coarse Aggregates. The nature of work decides the maximum size of the Coarse Aggregate. Locally available Coarse Aggregate having the maximum size of 20 mm were used in our work. The aggregates were washed to remove any dust and were dried.The aggregates were tested as per Indian Standard Specifications [4].

2.4. Granite CuttingSlurry (GCS)

The GCS used for the experimentalprogramme was locally procured from a granite cutting industry. It was dried in Sunlight until the moisture got completely evaporated. It was made to pass through a 4.75 mm sieve[4], washed and used for further studies.

2.5. Demolished Coarse Aggregate (DCA)

The DCA was procured locally and was investigated for use as a substitute for the conventionally used Coarse Aggregate. It was sieved and the aggregate passing through 20mm sieve and that which retained on 4.75mm sieve[4]was used for all further studies.

2.6. Laundry Wash Water (LWW)

Potable water alone is suitable for use in preparing concrete. LWWobtained from laundries consist of chemicals and soil particles rendering it unsuitable for use in preparing concrete. However in the present work, LWW was pretreated using simple sedimentation by allowing it to stand for 20 days. The lather formed was manually removed and the supernatant was collected to be used. As the pH of this water was found to 8.2, it was mixed with a 20% locally available fresh water to reduce its pH to 7.2 and was used for all further investigations.

2.7. Methodology

Cement used for the study was tested for the parameters, Fineness, Consistency, Initial & Final Setting times and Specific Gravity[6]. Aggregates were tested for Fineness Modulus, Water Absorption [5] and Impact value [4], as per IS codes.LWW was tested for pH, Acidity, Alkalinity and Chlorine and it was found within the permissible limit as per IS-456:2000 [7]. Concrete was tested for Workability by Slumpcone test and for Compressive strength under four cases as per M 20 mix design. In case-A, conventionally used Cement, Fine Aggregate andcoarse aggregate were mixed with LWW and analyzed for strength parameters. In case-B,only 90% of cement and 70% of fine aggregates were used and the remaining 40%was topped up with GCS and the other ingredients were the same as in case-A.

In case-C,coarse aggregate was completely replaced by DCA and the other ingredients were the same as in Case-A.In case-D, coarse aggregate was completely replaced by DCA and90%cement and 70% fine aggregate were replaced with 40% of GCS and the other ingredients are the same as in case-A.

3. RESULTS AND DISCUSSION

The various results of tests done for cement on using LWW are presented in table-1. All the parameters were observed to be within the permissible limits, though the initial setting time was found to be at a slightly upper level.

Table 1. Results of tests done on Cement

Type of tests	Results
Fineness	0.1%
Consistency	30%
Initial Setting Time	55 min
Final Setting Time	510 min
Specific Gravity	3.15

The results of tests done on aggregates are presented in table-2, and all the parameters were within the permissible limits.

Table 2. Results of tests done on Aggregates

Type of Tests	Coarse Aggregate	DCA
Fineness Modulus	7.01	5.05
Water Absorption	0.9	0.55
Impact value	15.3	12.6

The results of tests done on LWW after neutralizing it with 20% available fresh water are presented in table-3.

Table 3. Results of tests done on LWW

Type of tests	Results
pH	7.2
Acidity	150 mg/L
Alkalinity	30 mg/L
Chlorides	50 mg/L

The results of Slump cone test on four cases are presented in table-4. It was observed that concrete of all the four cases presented good workability albeit case-D which gave a slump value of 3.6cm, which too was within the permissible limit. This is far better than the slump value of 9.2cm obtained on 20% replacement of cement by hypo sludge by Mr.R.Balamurugan [3].

Table 4. Results of slump cone test on Concrete

Type of Concrete	Slump value, cm
Case-A	1.5
Case-B	2.6
Case-C	2.2
Case-D	3.6

The results of Compressive strength test on four cases are presented in table-5**.** It was observed that concrete of all the four cases exhibited good compressive strength.A similar trend was observed in case of a 50% substitution of waste ceramic tiles with coarse aggregate with a compressive strength of 22.89 MPa [8].

Table 5. Results of compressive strength on Concrete

Type of Concrete	Compressive strength of cubes, MPa	
	7 days	28 days
Case-A	18.20	25.50
Case-B	14.10	22.70
Case-C	16.80	22.10
Case-D	13.20	21.90

A graphical comparison of 7 day compressive strengths of all the four cases of mix designs is presented in figure 1.It can be observed that case-C exhibited a compressive strength of 16.8 MPa, which is close to the conventionally used case-A mix design. This is far better than the complete replacement of coarse aggregate with coconut shells which gave a 7 day compressive strength of 3.91 MPa [9].

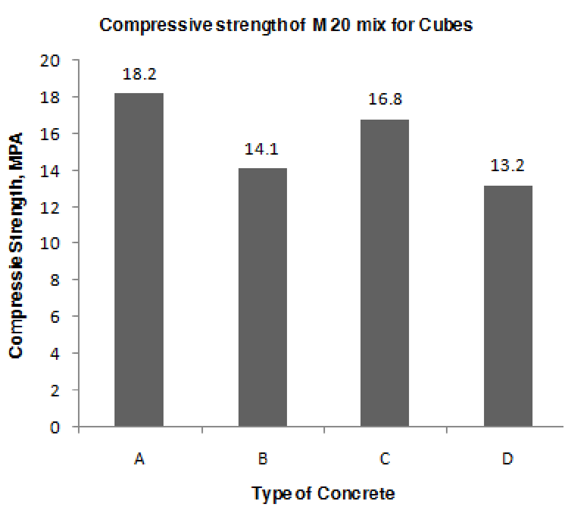

Figure 1. Compressive strength of 7 days for cube

Figure 2.depictsthe 28 day compressive strengths of four cases of mix designs. In case-B which has partial replaced cement and fine aggregate the 28 day compressive strength was observed to be 22.7 MPa which is a quite satisfactory value. This is a high value in comparison with the use of coconut shells alone in complete replacement of coarse aggregate [9].

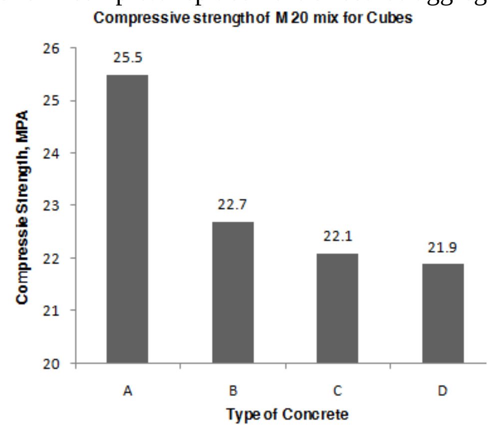

Figure 2. Compressive strength of 28 days for cube

The use of LWW in concrete is comparable to the use of domestic waste water [10] as both of them showed a slight increase in compressive strength compared to their original mix designvalues.

4. CONCLUSION

The following conclusions were drawn from the experimental investigation.

- Application of LWW in place of potable water almost retained the 28 day compressive strength of concrete.
- Partial replacement of a 10% of cement and 30% of fine aggregate with GCSgave a compressive strength of 22.7 MPa which is close to that of conventional concrete.
- Substitution of coarse aggregate with DCA along with simultaneous use of LWW resulted in a compressive strength of 22.1 MPawhich is well tolerable.
- Partial replacement of cement, fine aggregate, coarse aggregate as well as water with GCS, DCA and LWW showed very encouraging results in terms of workability and compressive strength.
- This type of concrete can be used for low cost constructions such as pavements, shoulders, median barriers, sidewalks, curbs and gutters very safely.

5. REFERENCE

[1] Omar M.Omar, GhadaD.AbdElhameed,Mohamed A. Sherif, Hassan A.Mohamadien,"Influence of limestone waste as partial replacement material for sand and marble powder in concrete properties", *Housing and Building National Research Center*, 8, 5, October 2012, pp. 193-203

[2] MalekBatayneh, Iqbal Marie, Ibrahim Asi, "Use of selected waste materials in concrete mixes", *Waste Management*, Volume 27, Issue 12, 2007, pp. 1870–1876

[3] Mr. R. Balamurugan,Mr.R.Karthickraja, " An Experimental Investigation of Partial Replacement of Cement by Industrial Waste (Hypo Sludge)", *International Journal of Engineering Research and Applications,*Vol. 4, Issue 4, April 2014, pp.430-435.

[4] "Specification for coarse and fine aggregates from natural sources for concrete", *Bureau of Indian Standards*, New Delhi, IS: 383-1970.

[5] "Methods of test for Aggregates for concrete, Part-III specific gravity, density, voids, absorption and bulking", *Bureau of Indian Standards*, New Delhi, IS: 2386(P-III)-1963.

[6] "Ordinary Portland Cement,53 grade- specification", *Bureau of Indian Standards*, New Delhi, IS: 12269-1987.

[7] Code of Practice for Plain and Reinforced Concrete",*Bureau of Indian Standards*, New Delhi, IS 456 -2000.

[8] Umapathy U,Mala C, Siva K, " Assessment of Concrete Strength Using Partial Replacement of Coarse Aggregate for Waste Tiles and Cement for Rice Husk Ash in Concrete",*International Journal of Engineering Research and Applications*, Vol. 4, Issue 5, May 2014, pp.72-76.

[9] Parag S. Kambli, Sandhya R. Mathapati, "Application of Coconut Shell as Coarse Aggregate in Concrete: A Technical Review:, *International Journal of Engineering Research and Applications*, Vol. 4, Issue 3, March 2014, pp.498-501.

[10] Prof.A.B. More, Prof. R. B. Ghodake, Himanshu. N. Nimbalkar, Pritam. P. Chandake, Sagar. P. Maniyar, Yogita. D. Narute,"Reuse of Treated Domestic Waste Water in Concrete- A Sustainable Approach",*Indian Journal of Applied Research*, Vol. 4, Issue 4, April 2014, pp.182-184.