

Mix Design of Reclaimed Aggregates with Concrete Debris

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Abstract: *The trend of reclaimed aggregate from old roads and concrete debris from various demolition sources getting popular day by day. In this study, the reclaimed aggregates and crushed concrete debris are used for modification of bitumen and the experimental programme is organized in order to check the engineering properties of reclaimed aggregates and concrete debris from various demolition sources. The main motive of the study is to replace the some amount of percentage of reclaimed aggregates as coarse aggregates with natural aggregates and concrete debris as fine aggregates from 5% to 30% and then by performing several tests related to aggregates such as crushing test, impact test, abrasion test, flakiness and elongation test, specific gravity test and related to bitumen such as penetration test, softening point, ductility test. Specific gravity test. The main scope of this study is to reduce the material cost which affects the final yield of project and to find field performance etc. Afterwards the results is examined and compared with the unmodified sample. The result is discussed for improving the performance of sub grade and sub base layers in the roadways.*

Keywords: *Reclaimed aggregates, concrete debris, aggregates.*

I. INTRODUCTION

Construction and Demolition debris includes bricks, concrete debris, aggregates, soil, rocks, paving materials etc. Reuse of Construction waste materials pulls new Technology, costs, employment and Social values. It will also help to reduce the reliance on virgin materials and importation of foreign materials. At the construction site reclaimed aggregates materials can be reclaimed to replace virgin materials for instant needs. Recycling of construction waste materials in India would save the country a substantial amount of money. India is a developing country where urban and rural areas at this time already facing problems of providing suitable aggregate supplies at reasonable price due to distance and there is a critical shortage of natural aggregates for road construction. The issues of recycling of construction waste materials cannot be ignored. Natural aggregates are generally consumed by the several construction companies in substantial amounts and they also producing large quantities of construction and demolition waste. The presence of construction and demolition waste and other still matters makes up third half of the total.

Now, some private contractors remove this waste for their own reserved, land for a price, or more common, dumped it in an unofficial manner through roads or other public land.

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The total quantity of waste from the industries approximately to be between 12 million to 14 million tons per annum, out of which half of this are concrete debris and brick waste. According to surveys 60% of the answerer said they are not aware of new recycling techniques and the remaining 40% have specify that they are not even aware of recycling ideas.

II. OBJECTIVES

- To determine the physical and mechanical performance of reclaimed aggregate with concrete debris in lieu of natural aggregates.
- To find the optimum content of reclaimed aggregates with concrete debris.
- To assess and compare the results of modified and reference samples.
- Cost analysis will be taken into count.

III. METHODOLOGY

- To check the performance of bitumen by using standard test.
- To check the behavior of aggregates through standard test.
- Now, examine the optimum binder content by marshal stability test.
- Different proportions of reclaimed aggregates and crushed concrete debris in fine and coarse aggregates are mixed in different percentages.
- Therefore, evaluate the optimum content of reclaimed aggregates with crushed concrete debris.
- Stability and flow value of prepared modified is calculated by performing the marshal test.

IV. EXPERIMENTAL STUDY ON MATERIALS

Demolished materials samples are collected for the study of reclaimed aggregates and concrete debris. Reclaimed aggregates and concrete debris are collected carefully. Concrete debris is crushed into the size of fine aggregates with the help of crusher. Sieve analysis is performed on the crushed concrete debris to determine the engineering properties of the material. Reclaimed aggregates are collected and were soaked in water for 2 days for the



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reason to clean the attached material and after that the soaked materials was dried under sunlight.

Therefore number of test on aggregates, bitumen, reclaimed aggregates and concrete debris was performed to check their properties. Number of test performed is listed below.

TABLE 1- TEST ON AGGREGATES

S.NUMBER	NAME OF AGGREGATES TEST	TEST RESULTS	MORTH SPECIFICATIONS
1	Aggregate impact value test	15.60%	Max 24%
2	Aggregate crushing value test	21.80%	
3	Specific gravity test	2.4	2.4-3
4	Los Angeles abrasion test	22.9%	Max 30%
5	Water absorption	1.04%	Max 2%
6	Flankiness and elongation test	26.22%	Max 35%

➤ TEST RESULT OF AGGREGATES:

➤ TEST RESULT ON BITUMEN

TABLE 2- TEST ON BITUMEN

S.NUMBER	NAME OF BITUMEN TEST	TEST RESULT	IS SPECIFICATIONS (IS 1203-1978)
1	Penetration test	38mm	
2	Softening point test	50.67cc	Min. 47
3	Ductility test	52.4cm	Min. 40
4	Specific gravity test	1.030	Min. 0.99

➤ TEST RESULT ON RECLAIMED AGGREGATES

S. NUMBER	NAME OF AGGREGATES TEST	TEST RESULTS	MORTH SPECIFICATIONS
1	Aggregate impact value test	19.30%	Max 24%
2	Aggregate crushing value test	23.50%	
3	Specific gravity test	2.7	2.4-3
4	Los Angeles abrasion test	22.4%	Max 30%
5	Water absorption test	2.04%	Max 2%
6	Flankiness and elongation test	28.22%	Max 35%

TABLE 3- TEST ON RECLAIMED AGGREGATES

V. PREPARATION OF MODIFIED MIX SAMPLES

- To prepare a sample, take aggregates (coarse and fine aggregates), recycled aggregates and concrete debris of weight 1200g in a pan and kept in oven at a temperature of 180°C.
- Heat the bitumen to its melting points in the oven at 170-175°C.
- Now, mix the all the aggregates and bitumen at a temperature of 160°C and transfer the mix to the pre-heated mould and compacted with the hammer with 75 numbers of blows for both the side.
- Afterword's, the sample is left to cool at room temperature for 24 hours.
- Before the testing, the weight in air and weight in water of sample is calculated and then the sample is kept in water bath at 60°C for 30 minutes.
- Find the value of stability and flow in marshal stability test apparatus.

➤ RESULT OF MODIFIED MARSHAL TEST



TABLE 4: TEST ON MODIFIED MARSHAL SAMPLE

Percentage	VA	VMA	VFB	STABILITY	FLOW
5%	4.91	16.17	69.64	1794.67	1.92
10%	4.39	15.65	72.03	2610.43	2.46
15%	4.08	15.38	73.47	2671.61	2.88
20%	3.64	15.06	75.69	2202.55	3.35
25%	3.27	14.67	77.70	1957.82	3.96
30%	2.83	14.23	80.07	1886.44	4.86

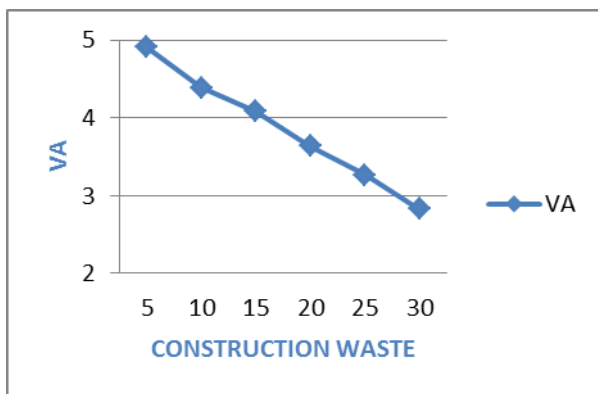


FIGURE 1: Effect of construction waste on air voids of bitumen mix.



FIGURE 2: Effect of construction waste on voids on volume of mineral aggregates of bitumen mix



FIGURE 3: Effect of construction waste on voids filled with bitumen of bitumen mix



FIGURE 4: Effect of construction waste on flow value of bitumen mix.

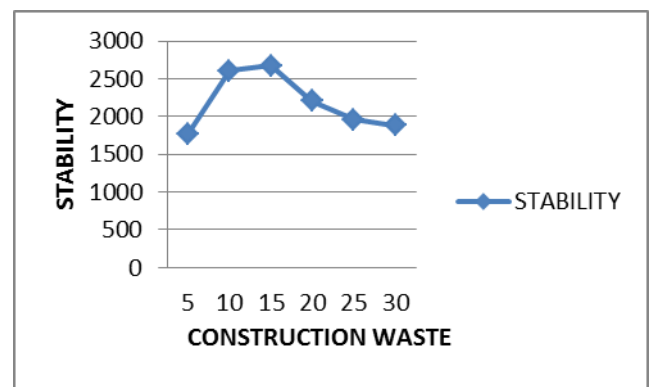


FIGURE 5: Effect of construction waste on stability value of bitumen mix.

VI. CONCLUSION

- Tests were carry out to study the properties of reclaimed aggregates and concrete debris in pavement design.
- The result of natural aggregates and concrete debris are compared to study the effect on the properties of road pavement.
- The optimum value of reclaimed aggregates and concrete debris was found to be 25% which minimize the constructional waste and can be helpful in controlling the environmental pollution.

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