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Utilization of building waste in road construction

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Abstract

Roads are major consumers of aggregate and the influence of aggregate cost is more in total construction cost of the roads. In order to reduce the cost of construction of roads, the possibility of using building waste as aggregate in sub-base and base course has been studied. Experimental studies were carried out to determine the engineering properties of the recycled aggregate and compared with conventional aggregate. It has been observed that the building debris can be effectively used as road material as it is satisfying the MoRTH (ministry of road transport & highways) requirements. Brick aggregate was found to be relatively soft compared with other recycled aggregate which may be used as sub-base course.

Keywords: Building waste, aggregate, sub-base, base course, road, MoRTH.

Introduction

Aggregate generated from quarries, produce number of environmental problems like noise and dust pollutions (Gopala Raju *et al.*, 2007). Generally, quarries are located on the outskirts of city limits. But as cities grow, these quarries have to be relocated further away from the urban centers. The cost involved in transporting the aggregate increases tremendously due to this increase in distance between urban centers and aggregate production. Every year, tons of concrete being used in various construction activities (Annette *et al.*, 2001). The problem arises while disposing the demolished concrete once its design life is over (Pasetto, 2000). The availability of landfill sites for disposal of waste has been drastically decreased over the past 15 years due to strong environmental lobby (Berendsen, 1997). With the limited supply of landfill sites and great demand for waste disposal, the cost of dumping of waste has been increased in recent times.

In the present work, use of recycled aggregate from building waste as base course and sub-base course has been studied in order to reduce the material transport cost and disposal cost. Different types of building waste have been collected from various sources such as: 1. Crushed concrete (fresh), 2. Crushed concrete (20 years old), 3. Stone masonry (fresh), 4. Stone masonry (20 years old), 5. Brick masonry and 6.Conventional aggregate..

Fig. 1. Steps involved in the study methodology

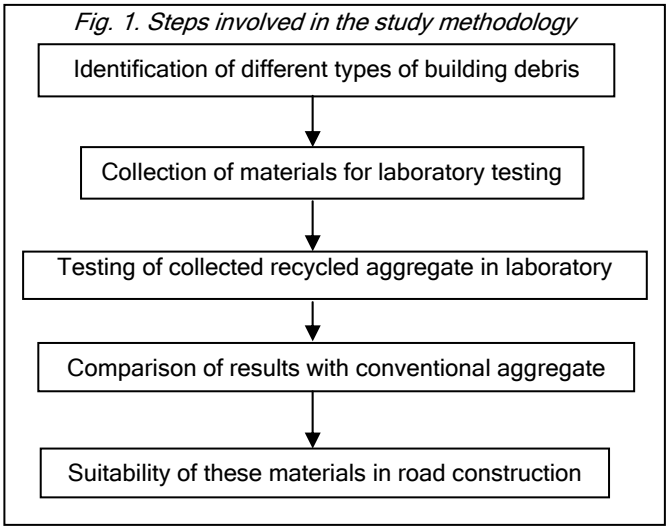
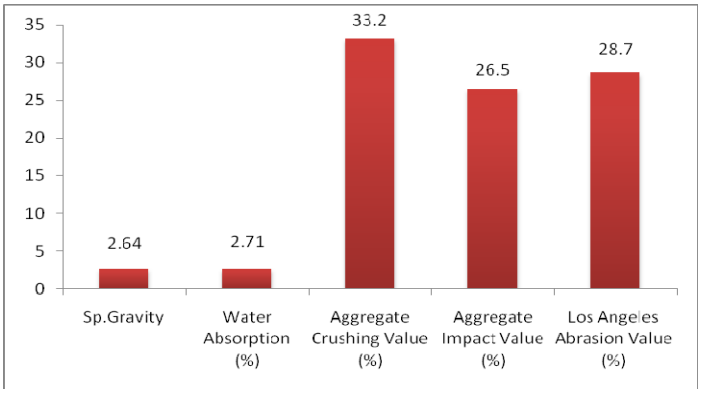


Fig. 2. Laboratory test results for crushed concrete (fresh)



Methodology

The methodology followed in the present work has shown in Fig.1.

Results

The waste collected from various sources has been tested for their properties such as specific gravity, water

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Fig. 3. Laboratory test results for crushed concrete (20 yrs. old)

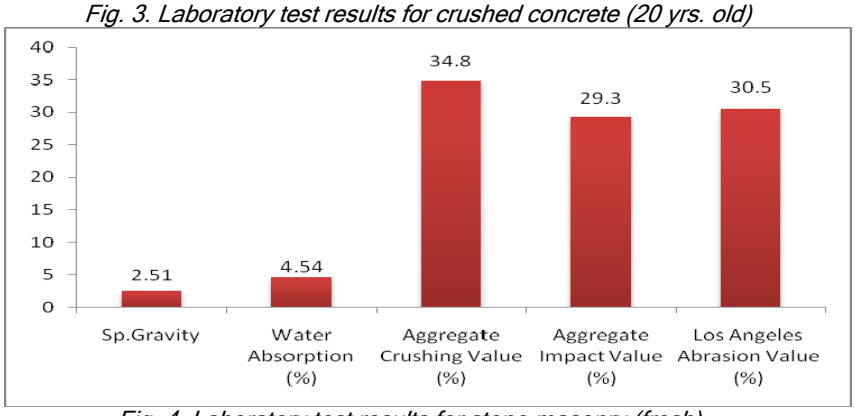

Fig. 4. Laboratory test results for stone masonry (fresh)

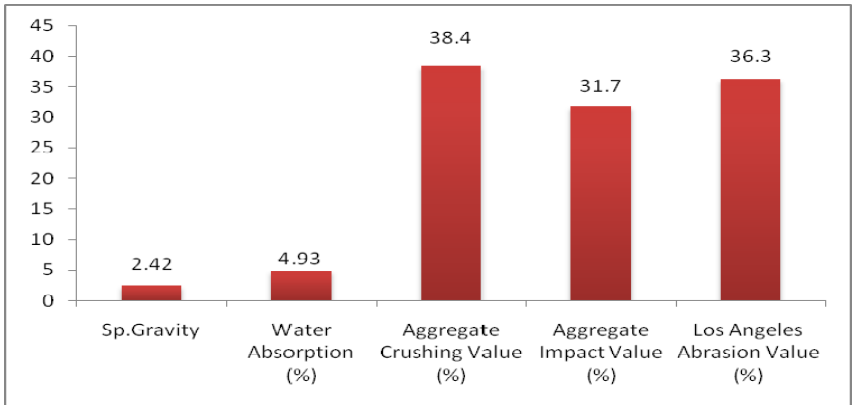

Fig. 5. Laboratory test results for stone masonry (20 yrs old)

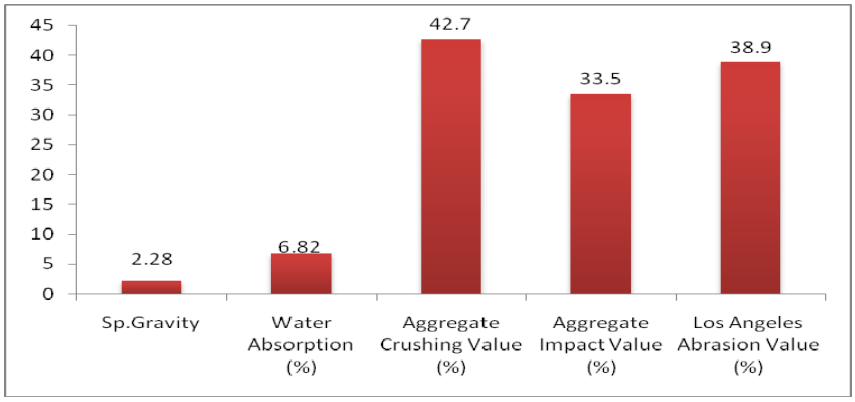

Fig. 6. Laboratory test results for brick masonry

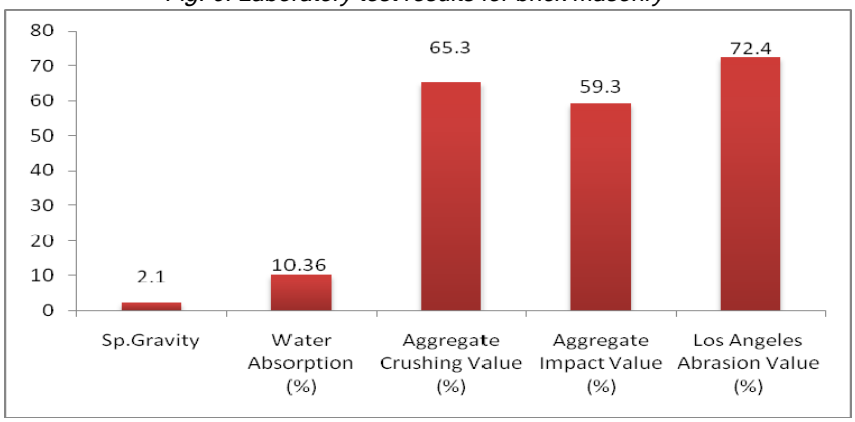

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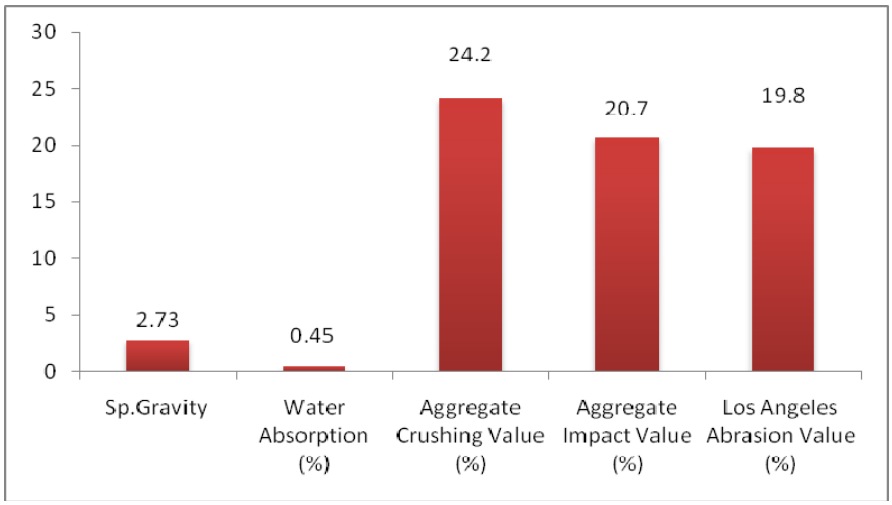
Table 1. Laboratory results for different types of materials

Description of material	Sp. gravity	Water absorption (%)	Aggregate crushing value (%)	Aggregate impact value (%)	Los Angeles abrasion value (%)
Crushed concrete (fresh)	2.64	2.71	33.2	26.5	28.7
Crushed concrete (20 yrs. old)	2.51	4.54	34.8	29.3	30.5
Stone masonry (fresh)	2.42	4.93	38.4	31.7	36.3
Stone masonry (20 yrs. old)	2.28	6.82	42.7	33.5	38.9
Brick masonry	2.10	10.36	65.3	59.3	72.4
Conventional aggregate	2.73	0.45	24.2	20.7	19.8

Fig. 7. Laboratory test results for conventional aggregate



absorption, crushing strength, impact value and Los Angeles abrasion value in the laboratory. The results obtained from laboratory testing are presented in Table 1. The variation of different parameters for various materials is represented in Fig. 2 to 7.

Discussion

The specific gravity value for brick masonry is observed low (2.10) and high (2.73) for conventional aggregate. The maximum permissible value of water absorption is 2% as per the MoRTH (ministry of road transport and highways) specifications. For all materials, the observed water absorption is above 2%. According to MoRTH specifications, the upper limit for Impact value is 30%. The Impact values obtained for crushed concrete were observed with in the specified limits and can be used for road construction. As per MoRTH specifications the upper limit for Los Angeles abrasion value is 40%. Except brick masonry all other waste materials showed less abrasion values.

Conclusion

Based on the experimental results obtained, the following conclusions are drawn: Crushed concrete can be effectively used as a road material in different layers as the properties satisfying the MoRTH requirements. Brick aggregate found to be relatively soft compared with other recycled aggregate and can be used as a sub-base material but not in base course and wearing course. Water absorption of all types of waste materials found to be high compared with conventional aggregate. Except brick masonry, all other materials satisfying the specific gravity requirements. Los Angeles abrasion value for all the materials found to be within the limits as per MoRTH specifications except brick aggregate.

Acknowledgement

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