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Study on Bituminous Pavement Wastes Used As Replacement Material in Cement Concrete

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Abstract -In general, aggregate make up 60-75% of concrete volume, so their selection is important, also they control concrete properties. Aggregate provide strength and wear resistance in these applications. Hence, the selection and proportioning of aggregate should be given careful attention. The aggregate is generally coarse gravel or crushed rocks such as limestone, or granite, along with a fine aggregate such as sand or stone dust. Bulk of pavement structure is formed by aggregate. This paper presents a review on the use of bituminous pavement wastes in cement concrete. This will help in achieving economy in road construction as well as saving environmental degradation in term of reduced mining and less pollution.
Keywords—Recycled Asphalt pavement (RAP), Virgin coarse aggregate (CA), Hot mix asphalt (HMA)

I. INTRODUCTION

Concrete is a composite construction material composed primarily of aggregate, cement and water. In general, aggregate make up 60-75% of concrete volume, so their selection is important, also they control concrete properties. Aggregate provide strength and wear resistance in these applications. Hence, the selection and proportioning of aggregate should be given careful attention. The aggregate is generally coarse gravel or crushed rocks such as limestone, or granite, along with a fine aggregate such as sand or stone dust. Bulk of pavement structure is formed by aggregate. The major function of he pavement is to transfer wheel load to the sub grade. In this load transfer mechanism aggregates have to bear stresses occuring due to wheel loads on the pavement and on the surface course, they also have to resist wear due to abrasive action of traffic. Therefore the properties of aggregate are of considerable significance to the highway engineers. The aggregate are categorized based on their size, shape, texture and gradation. The aggregate serves as reinforcement to add strength to the overall composite material. Aggregates are also used as base material under foundations, roads and railroads.

Recycled asphalt pavement (RAP) is the removed and reprocessed pavement material containing asphalt and aggregate. The use of recycled asphalt pavement has become a common practice in the construction of new, and reconstruction of old, hot mix asphalt pavement. But little research has been done to examine the potential of incorporating RAP in to cement concrete. In the present study, the physical and mechanical properties of cement concrete comprising of RAP, in different proportions, are investigated through laboratory experiments. Recycled asphalt pavement used in the present study is obtained from the debris of dismantled asphalt road.

II. LITERATURE REVIEW

Recycled asphalt pavement has been widely used in the United States since the 1970's and is a major benefits to the paving industry. According to kelly (1998) about 100 million ton worn out asphalt pavement is recovered annually and about 80% of recovered material is currently recyled and the remaining 20% is used in landfills. Two thirds of recycled material is used as aggregate for road base and remaining one third of recycled material is reused as aggregate for new asphalt hot mixes.

III. IMPORTANCE OF THE RESEARCH TOPIC

The topic "Use of Bituminous Pavement Waste in Cement Concrete" has been selected for the present study to examine the physical and the mechanical properties of RAP incorporated in cement concrete.

Economy in road construction as well as saving environmental degradation in term of reduced mining and less pollution. Use of RAP will also conserve resources, landfill space and will generate profit for the recyclers. The aim of this project is to determine the strength characteristic of RAP for application in high strength concrete, which will give a better understanding on the properties of concrete with RAP as an alternative economy in road construction as well as saving environmental degradation in term of reduced mining and less pollution. Use of RAP will also conserve resources, landfill space and will generate profit for the recyclers. material to fresh coarse aggregate in concrete. This will help in achieving economy in road construction as well as saving environmental

degradation in term of reduced mining and less pollution. Use of RAP will also conserve resources, landfill space and will generate profit for the recyclers.

IV. HISTORICAL BACKGROUND

Recycled asphalt pavement is being used more widely throughout the world in various applications. Most of the RAP is put back into the roadways as a base or surface material. The use of recycled material in Portland cement concrete has become more. and more popular in recent year.

Murshed Delwar et al. (1997) investigated the use of combinations of coarse and fine RAP aggregate in normal concrete mixes and compared the results of compressive strength to conventional mixes with 0.4 and 0.5 water cement ratios. Compressive strength values were found to decrease with the increase in RAP content.

Bashan Huang, et al (2005) found that RAP could be incorporated into Portland concrete without any modification to the conventional equipment or procedures. Without any treatment, there was a systematic reduction in compressive and split tensile strength with the incorporation RAP in concrete.

Salim Al-oraimi, et a1. (2007), used RAP as a coarse aggregate, substitute in two normal concrete mixes having 28 days cube compressive strengths of 33 and 50 Mpa. RAP was used with 25, 50, 75, 100% replacement of coarse aggregate. According to test result, the slump decreased with the Increase in RAP content. The compressive and flexural strength decreased with the increase in RAP content .The surface absorption was not insignificantly affected by the addition of RAP. The results indicated the viability of RAP as an aggregate in non- structural concrete applications.

The percentage of RAP should be limited according to the application. Low slump should also be considered when utilizing RAP in the mixes.

Fidelis o.okafor (2010) found that the strength of concrete made from RAP is dependent on the bond strength of the "asphalt-mortar" (asphalt binder-sand-filler matrix) coatings on the aggregates and may not produce concrete with compressive strength above 25 MPa. He prepared six concrete mixes of widely differing water/cement ratios and mix proportions were made using RAP as coarse aggregate. The properties tested include the physical properties of the RAP aggregate, the compressive and flexural strengths of the concrete. These properties were compared with those of similar concretes made with fresh aggregate. However, for middle and low strength concrete, the RAP material was found to be comparable with natural gravel aggregate.

In the present study virgin coarse aggregate is replaced by RAP in different proportions i.e. 0, 25, 50, 75 and 100. Proportion of aggregate is modified accordingly to meet the required gradation and their corresponding compressive and flexural strength were studied. Water cement ratio in all batches is kept constant as 0.45.

V. CONCLUSIONS

The research work on the topic “Recycling of Bituminous Aggregate in Cement Concrete – An Experimental Study” has been selected to examine the physical and mechanical properties of RAP used as coarse aggregate in cement concrete. In this project, various tests on aggregate (both virgin and RAP) are carried out in laboratory to determine the physical and mechanical properties of aggregates. Compressive strength and flexural tensile strength tests are carried out on the concrete mixes, made up of a virgin and RAP aggregates in different proportion (mix A to E) Based on the test results, the following conclusions are drawn:

A. Based on the Properties of aggregates

1) Presently RAP aggregate is treated as waste material and is economical than fresh aggregate. Therefore concrete made up of RAP aggregate will natural be economical.

2) It observed that specific gravity of fresh aggregate is in the range of 2.55 to 2.36 and that of RAP is 2.556,which is less than 8.2% than fresh aggregate.

3) It is observed that the water absorption of fresh aggregate is 0.5 and that of RAP is 1.3. This indicates that the workability of concrete mix will reduce at same water cement ratio, as the percentage of RAP aggregate in cement concrete increases.

4) It is observed that the gradation of recycled asphalt pavement aggregate satisfied the desired gradation requirement specified by IS code: 383-1970. This means that fresh coarse aggregate of size 20mm and 10mm can be partially/fully replaced by recycled asphalt pavement aggregate.

5) It is observed that the crushing value of RAP and fresh aggregate are 17.28% and 17.09% respectively. Indicating in no significant difference between the two.

6) It is also observed that the value of all the properties of RAP aggregate except bitumen content, does not exceed to the

permissible limits for mix designs specified by IS code: 383-1970. Thus the recycled asphalt pavement aggregate used in present study is suitable for concrete mix designs.

B. Based on the Compressive strength of concrete

1) It is observed that the compressive strength of the recycled asphalt pavement concrete mixes i.e. mix B, mix C, mix D, and mix E as compare to fresh concrete mix M30 (mix A), after 7day, is laser by 10.4%, 28.35%, 26.89% and 25.61% respectively. This indicates that there is a gradually reduction in the compressive strength of concrete mix (M30) (after 7 days) as percentage of RAP content increase. It is also found that the minimum compressive strength of the concrete mix (M30) made of a RAP aggregate after 7 days is approximately 60% to that of the fresh aggregate concrete mix (M30).

2) It is observed that the compressive strength of recycled asphalt pavement concrete mixes I.e. mix B, mix C, mix D, and mix E as compare to fresh concrete mix M30 (mix A), after 28 days is lesser by 6.9%, 37.38%,34.78% and 30.04% respectively. This indicates that there is a gradually reduction in the compressive strength of concrete mix (M30) (after 28 days) as percentage of RAP content increases. It is also found that the minimum compressive strength of the concrete mix (M30) made up of RAP aggregate after 28 days is approximately 67% to that of the fresh concrete mix (M30).

3) It is observed that mixing of RAP reduces the rate of gain of compressive strength as compared to fresh aggregate.

C. Based on the flexural strength of concrete

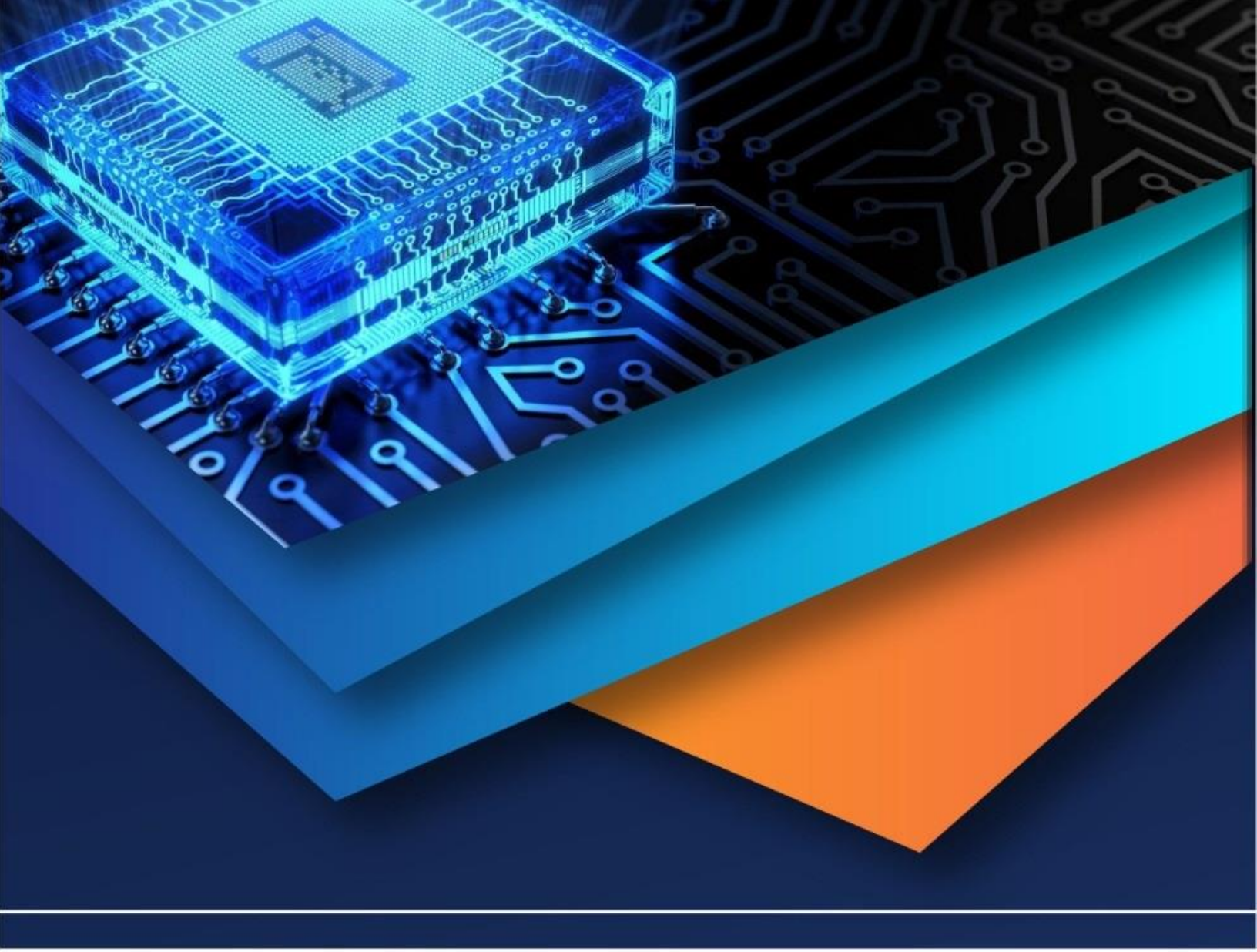
1) It is observed that the flexural tensile strength of recycled asphalt pavement concrete mixes i.e mix B, mix C, mix D and mix E as compare to fresh concrete mix M30 (mix A), after 28 days is lesser by 4.12%, 8.23%, 18.98% and 29.11% respectively. This indicates that there is a gradual reduction in the flexural tensile strength of concrete mix (M30) after 28 days as percentage of RAP content increases. It is found that the minimum flexural strength of the concrete mix (M30) made up of RAP aggregate after 28 days is approximately 70% to that of the fresh concrete mix (M30).

2) From the results it is observed that inclusion of RAP affects the compressive strength more than the flexural strength.

Hence, at locations where low strength of concrete is required, the recycled asphalt pavement aggregate may be used as an alternative material for fresh coarse aggregate.

REFERENCES

[1] IS : 383-1970, specification of coarse and fine aggregate from natural sources for concrete
[2] IS : 2386 (part 3)-1963, for specific gravity and water absorption
[3] IS : 2386 (part 4)-1963, for crushing strength and impact test
[4] IRC :44-2008, for mix design
[5] ASTM 2127, for determining the bitumen content
[6] IS: 516-1959, for testing strength of concrete
[7] MORTH specification, for checking gradation of aggregate
[8] Murshed delwar, F. Mostafa and R Taha (1997), "Use of reclaimed asphalt pavement as an aggregate in Portland cement concrete", ACI material journal, vol94 (3)251-256
[9] Baoshan huang, Xiang Shu, Guoqiang Li(2005),"Laboratory investigation of Portland cement concrete containing RAP", cement and concrete research,58(5):313-320
[10] Salim al-oraimin, Hossam F. Hassan and Abdulwahid Hago (2007), "Recycling of reclaimed asphalt pavement in Portland cement concrete", the journal of engineering research,vol 6 no-1 (2009) 37-45
[11] Fields o.okafor (2010), "Performance of recycled asphalt pavement as coarse aggregate in concrete ",Leanardo electronic journal of practice and technologies ISSN 1583-1078, p47-58
[12] Kelly, T.D. (1998), the substitution of crushed cement concrete for construction aggregate : us geological survey circular 1177,15p. http://greenworld .cr.usgs.gov/pub/circular/c1177
[13] Concrete book by M L Gambir
[14] http://Wikipedi .com
[15] Building Innovation & Construction Technology (1999), "Recycling hits new high in urban infrastructure first". http://www.cmit.csiro.au/innovation/1999-02/recyclestreet.htm
[16] Environmental council of concrete organizations, "recycling concrete saves resources, eliminates dumping". http://www.ecco.org/pdfs/ev15.pdf
[17] Kajima Corporation, annual report (2002), "Research and development page 16".
[18] Kawano, H., 1995. The state of reuse of demolished concrete in Japan, Integrated design and environmental issues in concrete technology. Proceedings of the International Workshop 'Rational Design of Concrete Structures under severe Conditions' Hakodate, japan, 7-9 August 1995, 243-249.
[19] Market development study for recycled aggregate product, report to waste reduction advisory committee, may (2001) file 15-14-96



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