iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 Issue: VII Month of publication: July 2021

DOI: https://doi.org/10.22214/ijraset.2021.36200

Utilization of Waste Material in Concrete for Construction of Rigid Pavement

Prof.Jagruti V. Chavan[1], Ms. Dharti D. Mule[2], Ms. Shubhangi V. Khandagale[3], Mr. Md. Sd. Saqib[4], Mr. Gaurav A. Rajput[5], Mr. Harshwardhan M. Dhavle[6]

[1]Asistant Professor, [2, 3, 4, 5, 6]U.G. Student, Department Of Civil Engineering, Pankaj Laddad Institute Of Technology And Management Studies Buldana, Maharashtra, India

Abstract: Millions of tons of waste is produced in the world each year and most of it is not recyclable. Furthermore, recycling waste consumes energy and produces pollution. In addition, accumulation of waste in the suburbs and the disposal of waste are very dangerous for the environment. Using waste material in concrete production is an appropriate method for achieving two goals: eliminating waste and adding positive properties in concrete. Since the green concrete industry is expanding, it is necessary to evaluate concrete that contains waste from all aspects in order to determine its capability. This literature study consists of two parts i.e. the use of waste as a substitute for cement and as a substitute for aggregates. Leading waste material that has been used as substitutes is highlighted and the characteristics of the resulting concrete are evaluated. Among other findings, rubber was found to have improved fire resistance and ductility in concrete and agricultural and PET wastes were successfully used in non-structural concrete, while glass helped to improve thermal stability.

Keywords: Concrete, environment, sustainable development, waste materials

I. INTRODUCTION

A. Overview

A highway pavement is a structure consisting of superimposed layers of processed materials above the natural soil sub-grade, whose primary function is to distribute the applied vehicle loads to the sub-grade. The pavement structure should be able to provide a surface of acceptable riding quality, adequate skid resistance, favorable light reflecting characteristics, and low noise pollution. The ultimate aim is to ensure that the transmitted stresses due to wheel load are sufficiently reduced, so that they will not exceed bearing capacity of the sub-grade. Two types of pavements are generally recognized as serving this purpose, namely flexible pavements and rigid pavements. This chapter gives an overview of pavement types, layers, and their functions, and pavement failures. Improper design of pavements leads to early failure of pavements affecting the riding quality.

1) Need of Rigid Pavement: There are two main reasons to use rigid pavement, both of which stem from its hardness. Since the surface is harder, it is also more durable over time. This keeps the road in good working order far longer than softer surfaces. The other advantage of concrete roads is in their shaping. Since the surface can withstand a lot of weight without deformation, it is possible to create groves and channels in the road to provide extra traction and move water off the road's surface.

B. Role Of Rigid Pavement In Construction

The environmental problem such as disposal of waste plastic is major concern. To overcome the problems the modifiers (waste plastic) are used. In general there are two types of roads rigid pavement and flexible pavement for rigid roads material used is concrete. This is mix of plastic coated aggregates. The concept of using plastic in flexible pavement and rigid pavement has been done since several years ago in India. Plastic has played a very vital role in increasing the strength of bitumen as well as aggregate. These plastics are considerably non-biodegradable thus can be used as a modifier in concrete and aggregates to increase their strength. This study presents the proper utilization of waste plastic on aggregates and aggregate to enhance pavement performance, to protect environment and to provide low cost roads. The present study investigates about the use of waste plastic as coating over aggregates and as a fine filler material of plastic.

C. Organisation of This Thesis

Waste materials on which prominent and significant researches are conducted in past and going on in present also apart from them there are also different new types of industrial wastes on which there is only a few studies are carried out, materials such as coconut shells, rubber scrap, recycled concrete aggregates, plastic wastes, waste tins, lagoon ash, sugar cane bagasse ash, cement kiln dust, marble dust, metaoklin, granulated blast furnace slag, paper industry sludge, bottom ash, pond ash, glass powder, foundry sand etc.. should also be experimented and investigated to find their usage potential in concrete making, not only this combination of wastes and inclusion with fibres can also be experimented to attain improved results there by reducing constructional costs of rigid pavements, reducing problems related to industrial wastes resulting in innovative and sustainable pavement construction.

II. LITERATURE REVIEW

A. Coconut Shell

1) *Siti Aminah Bt Tukiman and Sabarudin Bin Mohd (2009):* Investigation the combination of coconut shell and grained palm kernel to replace aggregate in concrete: A technical review replaced the coarse aggregate by coconut shell and grained palm kernel in their study. Percentage of replacement by coconut shell were 0%, 25%, 50%, 75% and 100% respectively. Conclusion is that the combination of these materials has potential of being used as lightweight aggregate in concrete and also has reduce the material cost in construction.
2) *Olutoge (2010):* Investigations on Sawdust and Palm Kernel Shells as Aggregate Replacement studied the saw dust and palm kernel shells (PKS). Fine aggregates are replaced by saw dust and coarse aggregates by palm kernel shells in reinforced concrete slabs casting. Conventional aggregates were replaced by saw dust and PKS in same ratios of 0%, 25%, 50%, 75% and 100%. Compressive and flexural strengths were noted at different time intervals. It was seen that at 25% sawdust and PKS can produce lightweight reinforced concrete slabs that can be used where low stress is required at reduced cost. 7.43% reduction can be achieved in terms of cost for every cubic meter of slab production with use of sawdust/PKS.

B. Scrap Tyre

1) *Toutanji H. A (1996):* "The use of rubber tyre particles in concrete to replace mineral aggregates" Cement concrete investigated the effect of replacement of mineral coarse aggregate by rubber tyre aggregate. Shredded rubber tyres used had a maximum size of 12.7mm and a specific gravity of about 0.61. The incorporation of these rubber tyre chips in concrete exhibited a reduction in compressive and flexural strength. The specimens which contained rubber tyre aggregate exhibited ductile failure and underwent significant displacement before fracture. The toughness of flexural specimens was evaluated for plain and rubber tyre concrete specimens. The test revealed that high toughness was displayed by specimens containing rubber tyre chips as compared to control specimens.

C. Recycled Aggregates

1) *N. Parekh et al. (2011):* Characterization of recycled aggregate concrete this paper reports the basic properties of recycled fine aggregate and recycled coarse aggregate. It also compares these properties with natural aggregates. Basic changes in all aggregate properties were determined and their effects on concreting work were discussed at length. Similarly the properties of recycled aggregate concrete were also determined and explained here. Basic concrete properties like compressive strength, flexural strength, workability etc. are explained here for different combinations of recycled aggregate with natural aggregate. Use of recycled aggregate has been found useful for pavement construction. Reasons, of use of recycled aggregate concrete in pavement construction, with technical proofs are explained here in detail. Individual performance of recycled fine aggregate in concrete, use of silica fumes in recycled aggregate concrete, use of fly ash in recycled aggregate concrete etc. are shown with experimental reasons.

III. SYSTEM DEVELOPMENT

A. Test Conduct on Plastic Coated Aggregates

1) Aggregate impact value test.
2) Aggregate crushing value test.
3) Lossangeles abrasion value test.
4) Aggregate alteration test.
5) Elongation test.
6) Flakiness test.
7) Sieve analysis test.

B. Aggregate Tests Results, Graphs

1) Aggregate Impact Value

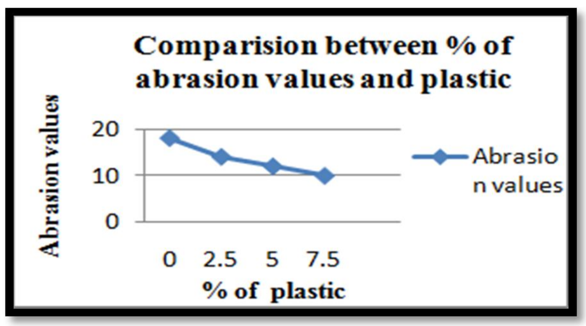
Table 3.2.5 Impact values with plastic percentage

Percentage of plastic	Impact value
0	16%
2.5	12%
5	10%
7.5	9%

2) Aggregate Abrasion Value

Table 3.2.6 Abrasion values with plastic percentage

Percentages of plastic	Abrasion value
0	18%
2.5	14%
5	12%
7.5	10%

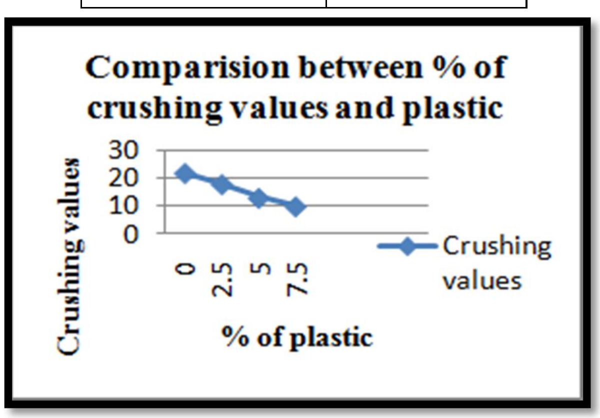


Graph no 3.2.5 Abrasion values with plastic percentage

3) Aggregate Crushing Value

Table 3.2.7 Crushing values with plastic percentage

Percentage of plastic	Crushing value
0	22%
2.5	18%
5	13%
7.5	10%

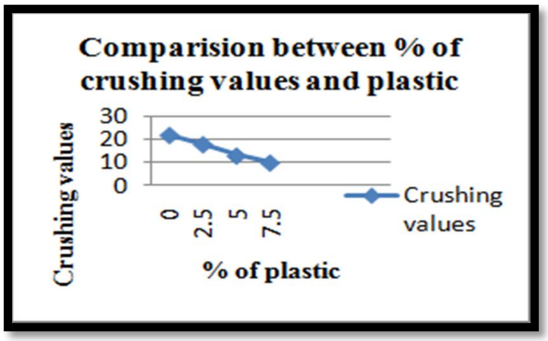


Graph no 3.2.7 Crushing values with plastic percentage

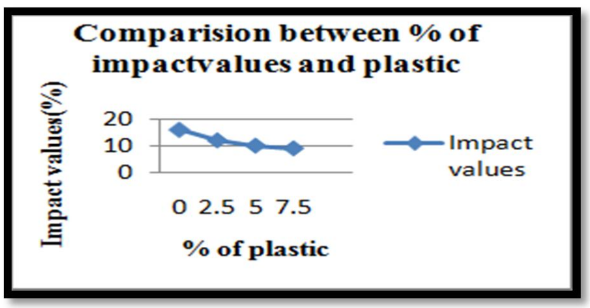
4) Aggregate Crushing Value

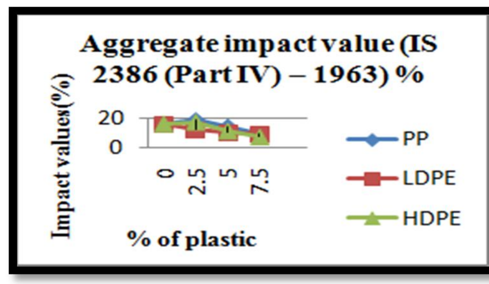
Table 3.2.8 Crushing values with plastic percentage

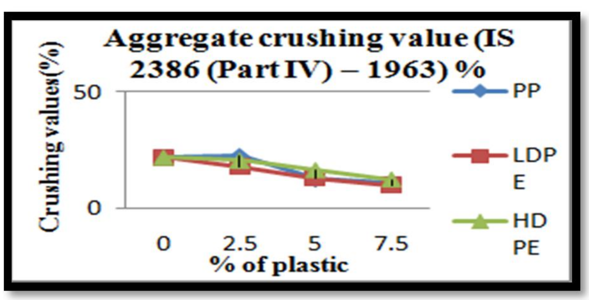
Percentage of plastic	Crushing value
0	22%
2.5	18%
5	13%
7.5	10%

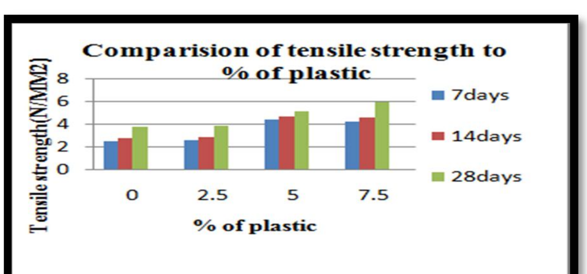


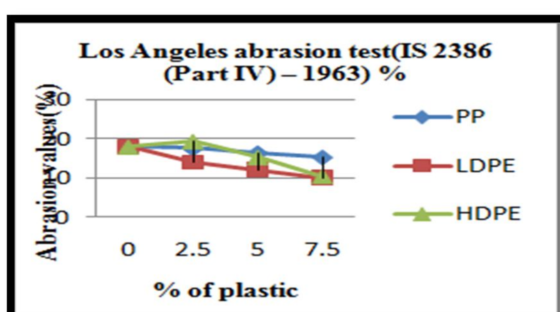
Graph no 3.2.8 Crushing values with plastic percentage











Graph no 3.2.9 Comparison of aggregate properties to different types of plastic

C. Advantages of Rigid Pavement
1) Low maintenance and operation cost.
2) Higher life span (Life span may be up to 40 years whereas flexible pavement has a life span of only 10-20 years).
3) It has high flexural strength.
4) It has good resistance to petroleum products, oils and chemicals.
5) More environment-friendly than flexible pavement.
6) It distributes loads in a wider area and can bear a large amount of load due to slab action.

D. Disadvantages of Rigid Pavement
1) High initial cost required for construction.
2) Maintenance is difficult than flexible pavement
3) Requires at least 28 days of curing before high traffic movement because concrete gains its 99% efficiency/strength in 28 days
4) Any excessive deformations occurring due to heavier wheel loads are not recoverable in this pavement type(settlement is permanent)

IV. CONCLUSIONS

A. Conclusions

This review focuses on study of the various types of Recycled Materials and their potential for use in concrete (rigid) Pavement. At present, the rising cost of construction materials is the factor of great concern. Therefore there is need to use recycled materials for preserving virgin aggregate resources.

From available literature it can be concluded that use of the recycled aggregate have many advantages over other recycled materials. Nowadays, the applications of recycled aggregate in construction areas are wide. The applications are different from country to country.

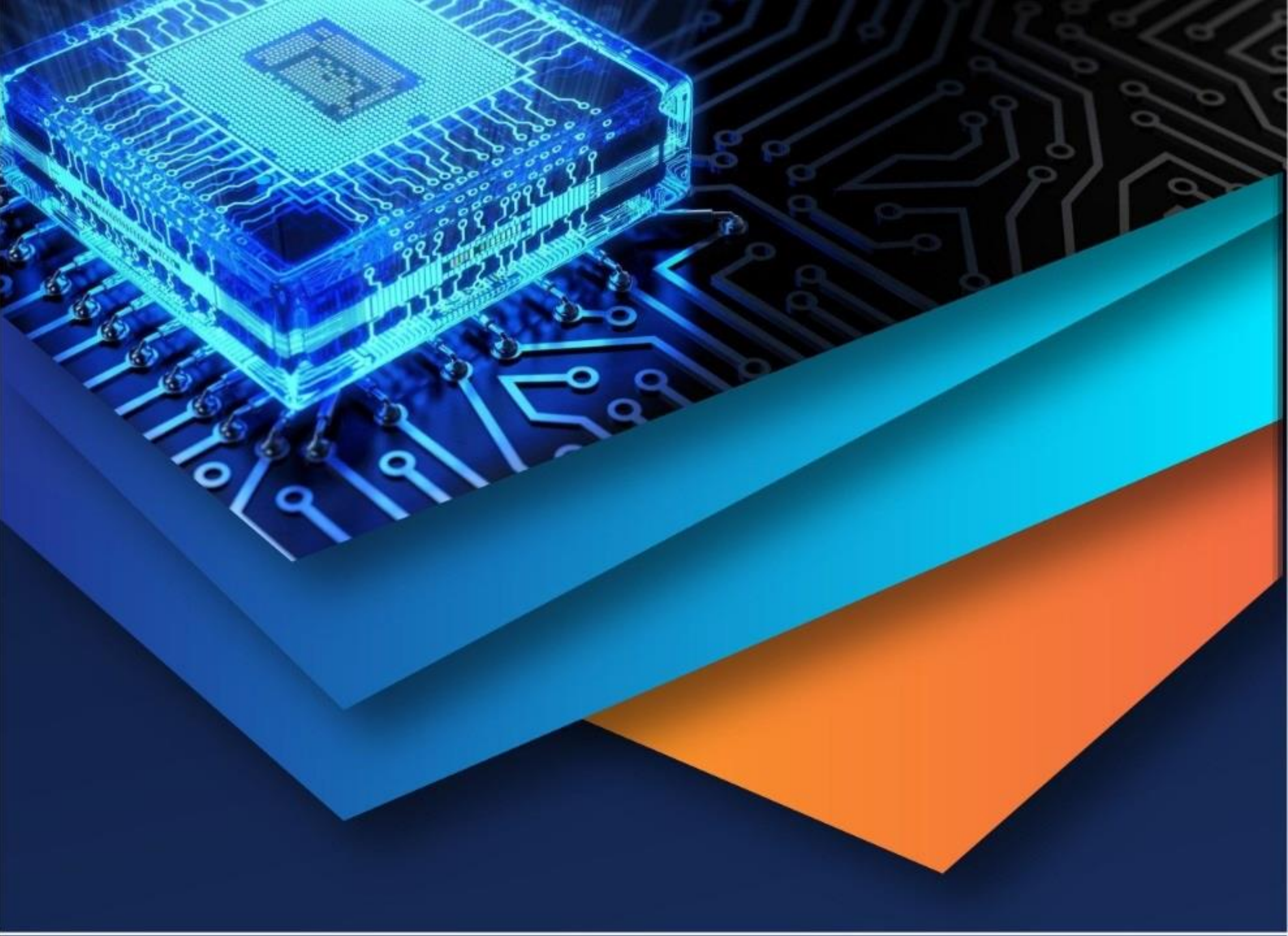
1) Recycled aggregates are easily available in large quantities such as from construction and demolition site, RMC plants etc.
2) It can save energy to transport the recycled materials to the recycling plants. Because everything can be done on the construction site i.e. processing, manufacturing and utilization.
3) The cost of recycled aggregate is cheaper than virgin aggregate. It is just around one and half of the cost for natural aggregate that used in the construction works. The transportation cost for the recycled aggregate is reduced due to the weight of recycled aggregate is lighter than virgin aggregate.
4) The markets for recycled concrete aggregate are wide. According to Environmental Council of Concrete Organization, recycled concrete aggregate can be used for sidewalk, curbs, bridge substructures and superstructures, concrete shoulders, residential driveways, general and structural fills. It also mentioned that recycled concrete aggregate can be used in sub bases and support layers such as unsterilized base and permeable bases.

B. Future Scope
1) Investigate using waste material and the feasibility of using sand or aggregates to create concrete for the construction of dams, tunnels, roads etc.
2) Make sure of the durability and health, through long-term tests, of the concrete that uses waste
3) Use neural networks or fuzzy systems for the prediction of parameters of other samples and for developing the results
4) Evaluate the properties of other waste and new types of waste such as LCD waste etc.
5) Investigate the usage of waste in concrete for improving the environment
6) Investigate the use of waste in improving the durability of concrete sewerage pipes
7) Improve concrete containing waste by finding its weaknesses and improving its characteristics by using combinations

REFERENCES

[1] IRC: 44-2008, “Recommended guidelines for mix design of Cement Concrete Pavements”
[2] Nagesh Tatoba, Suryawanshi Samitinjay S Bhansode et al, “Usage of Eco Friendly Material like Fly Ash in Rigid Pavement Construction and Its Cost-Benefit Analysis” International Journal of Emerging Technology and Advanced Engineering, Vol-4, Issue-12, December 2012, e-ISSN 2250-2459
[3] Vanitha Agarwal, Gupta S.M, Sachdeva S.N, “Investigations on Fly Ash Concrete for Pavements”, International Journal of Civil and Structural Engineering, Vol-2, Issue-3, 2012, ISSN-0976-4399.
[4] S. Antony jeteandran, S. Kathirvel, “Durability Study on High Volume Fly Ash Concrete With and Without Fibres for Pavements”, International Journal of

Advanced Structures and Geotechnical Engineering, Vol- 3, Issue-4, December- 2014, e-ISSN: 2319-5347.
[5] S. Pavan, S. Krishna Rao, "Effect of Fly Ash on Strength Characteristics of Roller Compacted Concrete Pavement", IOSR International Journal of Mechanical and Civil Engineering, Vol-11, Issue-6, Nov-Dec 2014, pp-04-08, e-ISSN: 2278:1614.
[6] Amit Kumar Ahirwar, Rajesh Joshi, Kapil Soni, "Laboratory Analysis of Fly Ash Mix Concrete for Rigid Pavements", International Journal of Engineering Research and Applications, Vol-5, Issue-2, February-2015, pp-86-91, e-ISSN: 2248-9622.
[7] R. Illangovana, N. Mahendrana, K. Nagamanib, "Strength and Durability Properties of Concrete Containing Quarry Rock Dust as Fine Aggregate", APRN Journal f Engineering and Applied Sciences, Vol-3, Issue-5, October- 2008, e-ISSN:1819-6608.
[8] VenkataSairam Kumar, Dr.B.Panduranga Rao, Krishna Sai M.L.N, "Experimental study on partial replacement of cement with quarry dust", International Journal of Advanced Engineering Research and Studies, E-ISSN: 2249–8974. IS: 2720 (Part - 16)-1979, "Laboratory determination of CBR". June 2013.
[9] A.V.S Sai Kumar, Krishna Rao, "A Study on Strength of Concrete with Partial Replacement of Cement with Quarry Dust and Metaoklin", International Journal of Innovative Research in, Vol-3, Issue-3, and March -2014, e-ISSN: 2319-8753.
[10] Ramarao Chimita, Venkateswara rao .J, "Innovative usage of Quartzite Rock Dust and Effect of Glass Fibres in Rigid Pavements", International Journal for Research in Applied



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY