

Green Highway-“Innovative Approaches and Materials in Road Construction”

Mr. Priyank Shah¹ Gaurav Singh² Parth Purohit³ Pankaj Tripathi⁴ Dilip Solanki⁵

¹Assistant Professor

^{1,2,3,4,5}Department of Civil Engineering
^{1,2,3,4,5}(SVBIT), Gandhinagar, India

Abstract— Nowadays, the increasing amount of wastes is a concerning and the environmental aspects has become a major priority. Following this worry, the purpose of this experimental study is to investigate the possibility of using waste and inorganic wastes, in bituminous mixtures to reduce environmental effects of these wastes disposal and construct the road buy using this waste. The tests to be conducted on aggregate are impact value test, abrasion test and on bitumen are penetration test, ductility test. We will try to increase the strength, flexibility and durability of pavement as well as reduce the wear and tear.

Key words: Waste Material; Environment; Pavement

I. INTRODUCTION

A green highway is a roadway constructed as per a relatively new concept for roadway design that integrates transportation functionality and ecological sustainability. An environmental approach is used throughout the planning, design, and the construction. The result is a highway that will benefit transportation, the ecosystem, urban growth, public health and surrounding communities.

As India is a developing country so many new industries are opening and old industries are spreading which produces huge amount of waste materials. Disposal of different wastes which are producing from these industries is a great problem. Following this worry, the purpose of this experimental study is to investigate the possibility of using waste and inorganic wastes, in bituminous mixtures to reduce environmental effects of these wastes disposal.

Disposal of different wastes produced from different Industries is a great problem. These materials pose environmental pollution in the nearby locality because many of them are non-biodegradable.

In recent years, applications of industrial wastes have been considered in road construction with great interest in many industrialized and developing countries.

The use of these materials in road making is based on technical, economic, and ecological criteria.

The waste materials are fly ash, blast furnace slag, cement kiln dust, waste plastic bags, which are the industrial wastes posing problems in the disposal and being deposited near the industries in India.

II. NEED OF STUDY

- 1) In developing country like India road network are veins of country so road network must be durable, economical and long lasting.
- 2) Bitumen is major source of carbon production in atmosphere, so the amount of it is needed to be reduced.
- 3) The amount of waste materials increasing which is producing ill effects.

III. OBJECTIVE

- 1) To reduce the amount of waste materials by proper use.
- 2) To increase the strength and stability of road.
- 3) To reduce the cost of construction.
- 4) To reduce ill effect of waste material.
- 5) To save the environment.
- 6) To improve the properties of bitumen.

IV. PROPOSED METHODOLOGY

A. Introduction to Project:

The industries which are growing in our country producing waste which is to be disposed with affecting environment. Using these wastes in road construction is a good option. Use of these wastes in road construction may increase its strength as well as may increase may reduce its cost.

B. Problem Definition:

Bituminous properties can be improved by using waste materials. The use of waste materials also helps in reducing their ill effects in environment. The scope is to strengthen flexible pavement, make it eco-friendly & economically viable and also improve its life period. The objective is to reduce cost as well as thickness.

C. Collection of Literature Review & Research Papers:

To get the knowledge of our topic & study it in detail different research papers & literature reviews are studied for our project.

D. Selection of Materials:

The different types of waste material selected for the project are

- 1) Fly ash
- 2) Quarry Dust
- 3) Plastic Bottle (Pepsi Bottle)
- 4) Cota stone
- 5) Coconut Shell
- 6) Plastic bag (Milk Bag)

E. Test To Be Performed:

According to literature review we have shortlisted and we are going to perform test

Two types of test to be performed

- 1) Aggregate Test
 - Impact Value Test
 - Los Angeles Test
- 2) Bituminous Test
 - Ductility Test
 - Penetration Test
 - Marshall Test

Above test are done with the use of waste material and without the use of waste material and after compared the properties of bituminous mix.

V. TEST RESULTS

A. Aggregate Test

Los Angeles test result
Grading of aggregate= B
No. of spheres used= 11
Weight of charge=390gm to 445gm
No. of revolution= 500

Description	Sample 1	Sample 2
Weight of sample(W1) kg	5	5
Weight of sample retained on 1.70 mm IS sieve (W2) kg	4.425	4.335
Percentage wear(W1-W2)*100/W1)	11.5	13.3
Average percentage wear	11.5	

Table – 1: Los Angeles Test Result

B. Flakiness Index Test Result:

Size of aggregate	Individual weight retained between sieves(kg)	Weight of aggregate passing through respective slot of the gauge(kg)
20 mm to 16 mm	W1=2.253	W1=0689
16 mm to 12.5 mm	W2=1.382	W2=0.397
12.5 mm to 10 mm	W3=0.435	W3=0.082

Table 2: Flakiness Index Test Result

– Flakiness Index = $(1.168/4.07)=28.69$

C. Elongation Index Test Result:

Size of aggregate	Individual weight retained between sieves(kg)	Weight of aggregate passing through respective slot of the gauge
20 mm to 16 mm	W1=2.253	W1=1.948
16 mm to 12.5 mm	W2=1.382	W2=1.222
12.5 mm to 10 mm	W3=0.435	W3=0.360

Table 3: Elongation Index Test Result

– Elongation index = $(3.53/4.07)*100 = 86.73$

D. Impact Value Test:

Description	Sample 1	Sample 2
Weight of Sample,(W1)gm	375	345
Weight of aggregate passing through 2.36mm sieve,(W2	58	53
Aggregate Impact Value in % I.V.= $(W2/W1)*100$	15.46	15.36

Average Aggregate Impact Value in %	15.36
-------------------------------------	-------

Table 4: Impact Value Test

E. Bitumen Test:

– Penetration Test Result

Sr. No	Initial Reading	Final Reading	Difference	Average
1	0	150	-	105
2	0	115	35	
3	0	50	65	

Table 5: Penetration Test Result

F. Ductility Test:

	Sample 1	Sample 2	Sample 3
Initial Reading	0	0	0
Final Reading	31.7	16.8	9.3
Ductility	31.7	16.8	9.3
Average	19.26		

Table 6: Difficulty Test

VI. ACKNOWLEDGMENT

This is the place to admit that while there appear only authors on the cover, this work just as any other, is a product of the interaction with and support during our thesis work, among them, first we express our gratitude to our guides Mr. Priyank Shah & Dr. V.M. Patel, for their affection throughout guidance, advice and encouragement. Thanks to all our family members for their affection, care and encouragement. Special thanks to our college for giving us the invaluable knowledge. Above all we are thankful to almighty God for everything.

REFERENCES

- [1] History, materials used as waste
- [2] Stephen T. Muench, Jeralee Anderson, and Tim Bevan , Green roads: A Sustainability Rating System for Roadways, ISSN 1997-1400 Int. J. Pavement Res. Technol. 3(5):270-279
- [3] Tara Sen and Umesh Mishra : Usage of Industrial Waste Products in Village Road Construction, International Journal of Environmental Science and Development, Vol. 1, No. 2, June 2010 ISSN:2010-0264
- [4] G.R.Harish, M.N.Shivakumar: Performance evolution of bituminous concrete incorporating crumb rubber and waste shredded thermoplastic, IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308
- [5] Dr. D S V Prasad, Dr. G V R Prasad Raju , M Anjan Kumar Utilization of Industrial Waste in Flexible Pavement Construction Electronic journal of geotechnical engineering Vol. 13
- [6] Miss Apurva J Chavan, Use of plastic waste in flexible pavement, International journal of application or innovation in engineering & management.