

# Analysis of Plastic Pavement

<sup>1</sup>Shweta J Chahan, <sup>2</sup>Akshar Patel, <sup>3</sup>Brijen Prajapati, <sup>4</sup>Nilay Kanojia

<sup>1</sup>Assistant Professor, <sup>2,3,4</sup>Student

Sardar Patel College of Engineering- Bakrol (Anand) India

**Abstract:** Wrappers of betel nuts, chocolates, chips, hand bags, cold drink bottles and all other forms of plastic create significant environmental and economic problem. They consume massive energy and other natural resources, depleting the environment in various ways. In manufacturing firms, construction industries and products delivery services, use of plastic is a priority to handle and pack things comfortably due to its light weight, cost effectiveness and strength. Plastics cannot be banned as it will result in usage of natural resources like paper, wood at a great extent. It is made up of various chemical elements and is regarded as a highly pestilent material which does not easily degrade in the natural environment after its usage. Waste plastics are made up of Polyethylene, Polystyrene and Polypropylene. Temperature varying between 120°C - 160°C gives the softening point of these plastics. They do not produce any toxic gases during heating but the softened plastics have tendency to form a lamination or coating over the aggregate, when it is sprayed over the hot aggregate at 160°C. The main objective of this paper is to discuss the significance of plastic in terms of cost reduction, increase in strength and durability when these plastics are heated and coated upon the aggregates (160°C) to compensate the air voids with plastic and binds with aggregate to provide stability.

**Keywords:** Aggregates, Shredded Plastic, Stripping, Marshal Stability, Optimum Bitumen Content, Flexible Pavement

## INTRODUCTION

Plastic is everywhere in today's lifestyle and its disposal is a great problem. It is a non-biodegradable product due to which these materials pose environmental pollution and problems like breast cancer, reproductive problems in humans and animals and genital abnormalities. If a ban is put on the use of plastics on emotional grounds, the real cost would be much higher, the inconvenience much more, the chances of damage or contamination much greater... Hence the question is not "plastics vs no plastics" but it is more concerned with the judicious use and re-use of plastic-waste. Both the issues when taken together lead to a single solution that we can use this waste plastic in Flexible Pavements in such a manner that it gets coated over the surface of aggregate by heating (140°C - 160°C) because plastics like PE, PS, PP used in PET Bottles, disposal glasses, handbags, covers of various appliances etc. soften up to 160°C. The experiments conducted in the laboratory depict fruitful results can substantially increase the stability and durability of roads plus, making it a very effective step towards eco-friendliness compared to conventional and traditional techniques of flexible pavements construction.

## TESTS FOR AGGREGATE

1. Specific Gravity & Water Absorption Test [IS: 2386 (Part 3) 1963]
2. Aggregate Impact Value Test [IS: 2386 (part 4) 1963]
3. Aggregate Crushing Value [IS: 2386 (Part 4) 1963]
4. Los Angeles Abrasion Value

## TESTS FOR BITUMEN

1. Penetration Test [Is: 1203-1978]
2. Softening Point Test [Is: 1205-1978]
3. Ductility Test [IS: 1208-1978]
4. Flash Point and Fire Point

## TEST FOR AGGREGATES

Specific Gravity and water absorption [IS: 2386 (Part 3) 1963]

The specific gravity and water absorption of aggregates are important properties that are required for the design of concrete and bituminous mixes. The specific gravity of a solid is the ratio of its mass to that of an equal volume of distilled water at a specified temperature. Because the aggregates may contain water-permeable voids, so two measures of specific gravity of aggregates are used apparent specific gravity and bulk specific gravity.

Water absorption- The difference between the apparent and bulk specific gravities is nothing but the water permeable voids of the aggregates. We can measure the volume of such voids by weighing the aggregates dry and in a saturated, surface dry condition, with all permeable voids. The specific gravity of aggregates normally used in road construction ranges from about 2.5 to 3.5. Water absorption values ranges from 0.1 to about 2.0 percent for aggregates normally used in road surfacing.

#### Aggregate Impact Value Test [IS: 2386 (part 4) 1963]

The aggregate impact test is carried out to evaluate the resistance to impact of aggregates. Aggregates passing 12.5 mm sieve and retained on 10 mm sieve is filled in a cylindrical steel cup of internal dia 10.2 mm and depth 5 cm which is attached to a metal base of impact testing machine. The material is filled in 3 layers where each layer is tamped for 25 numbers of blows. Metal hammer of weight 13.5 to 14 Kg is arranged to drop with a free fall of 38.0 cm by vertical guides and the test specimen is subjected to 15 number of blows. The crushed aggregate is allowed to pass through 2.36 mm IS sieve. And the impact value is measured as percentage of aggregates passing sieve (W2) to the total weight of the sample (W1). Aggregates to be used for wearing course, the impact value shouldn't exceed 30 percent. For bituminous macadam the maximum permissible value is 35 percent. For Water bound macadam base courses the maximum permissible value defined by IRC is 40 percent. The coating of plastics improves Aggregate Impact Value, thus improving the quality of the aggregate. Moreover a poor quality of aggregate can be made useful by coating with polymers. It helps to improve the quality of flexible pavement. This shows that the toughness of the aggregate to face the impacts. Its range should be less than 10%.

#### Aggregate Crushing Value

The aggregate with lower crushing value indicate a lower crushed fraction under load and would give a longer service life to the road. Weaker aggregate would get crushed under traffic load. It is clearly seen from Table- that plastic coated aggregates shows the lower crushing value and which can be withstand to traffic load more efficiently than the plain aggregates. The results show that the aggregates are within the range according to ISS. Its range should be less than 30-35.

#### Los Angeles Abrasion Value

The repeated movement of the vehicle will produce some wear and tear over the surface of pavement. This test gives that wear and tear in percentage. Under this study the percentage of wear and tear values of plastic coated aggregate is found to be in decreasing order with respect to the percentage of plastics. When the Los Angeles abrasion value of plain aggregate value is compared with the plastic coated aggregates the values are less for coated aggregates. The results obtained are within the range hence can be used for the construction. Its range should be less than 35%

### TESTS FOR BITUMEN

#### 1. Softening point test.

This test is conducted using Ring and ball apparatus. The principle behind this test is that softening point is the temperature at which the substance attains a particular degree of softening under specified condition of the test

#### 2. Penetration Index Test

It is measured using Penetrometer. The penetration of a bituminous material is the distance in tenths of a millimeter, which a standard needle would penetrate vertically, into a sample of the material under standard conditions of temperature, load and time.

#### 3. Ductility Index Test

The ductility of a bituminous material is measured by the distance in cm to which it will elongate before breaking when a standard briquette specimen of the material is pulled apart at a specified speed and a specified temperature.

#### 4. Flash and Fire point test-

In the interest of safety, legislation has been introduced in most countries fixing minimum flash point limits to prevent the inclusion of highly inflammable volatile fractions in kerosene distillates.

Test	Result	Range
Softening Point	46.80°C	45°-600° C
Flash Point Test	255°	>180° C
Fire Point	367°	>180° C
Penetration value	64 mm	60-70 mm
Ductility Test	76.50	40 mm

#### Reference

- [1] <http://nbmcw.com/articles/roads/930-use-of-waste-plastic-in-construction-of-flexible-pavement.html>  
 [2] ISI, "Indian Standards Specifications for Roads Tar", IS: 215, Indian standard Institution.

- [3] Ministry of Road Transport and High Ways, Manual for construction and supervision of Bituminous works, New Delhi, November 2001.
- [4] Sri Ram Institute for Industrial Research, Plastics Processing and Environmental Aspects, New Delhi –.

