Experimental Performance Analysis on Waste Plastic Modified Asphalt & Asphalt Mixture – A Comparative Case Study

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Abstract - Now a days environmental mainly hazard from the plastic. That only we have thing to reduce it from the usage of plastic road construction .Traditionally Asphalt (Bitumen), stone aggregates , sand, cement etc. are used for Flexible Road construction. In case of traditional method of construction cost of extracting good quality of natural material is increasing & affects the environment, concerned about this the we are looking for alternative material for highway construction. If these plastic waste materials can be suitably utilized in highway construction then the pollution and disposal problems of plastic waste may be Partly reduced. Therefore we are designing a asphalt mix with influence of plastic waste and compare the results with ordinary mix with convectional bitumen .Following tests are to be conducted for both convectional bitumen (60/70) and plastic modified Bitumen .Penetration test, Softening point test, Flash& fire point test, Ductility test, Viscosity test Further Asphalt mix design and following tests are to be executed for both convectional bitumen (60/70) mix and plastic modified Bitumen mix…Marshall Stability test ,Marshall Flow test ,Voids in mineral aggregates. (VMA)Voids in aggregates(VA),Voids filled with bitumen(VFB) In the mixing of bitumen & waste plastic if has give good strength compare to the normal road construction and reduce plastic waste in the environment.

Keywords – Flexible Road, Modified Bitumen, VA, VFB

I. INTRODUCTION

The 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. Traditionally soil, stone aggregates, sand, bitumen, cement etc. are used for road construction. Natural materials being exhaustible in nature, its quantity is declining gradually. Also, cost of extracting good quality of natural material is increasing. The possible use of these materials should be developed for construction of low volume roads in different parts of our country. Post construction pavement performance studies are to be done for these waste materials for construction of low volume roads with two-fold benefits: (a) it will help clear valuable land of huge dumps of wastes; (b) it will also help to preserve the natural reserves of aggregates, thus protecting the environment. Plastics are user friendly but not eco-friendly as they are non-biodegradable generally, it is disposed by way of land filling or incineration of materials which are hazardous. Road surface with neat bitumen can cause bleeding in hot climate, may develop cracks in cold climate, Useful life of bituminous overlays has reportedly declined 7-8 from average life of 5-6 years in the past to about 3-4 years at present as compared to average pavement life (5-6 years) in abroad. India has to raise transportation system to a higher level both in terms of length and quality.

II. PROPOSED ALGORITHM

A. Asphalt And Asphalt Mix

The word asphalt is derived from the late Middle English, in turn from French asphalte, based on Late Latin asphalton, asphaltum, which is the latinisation of the Greek a word meaning "asphalt/bitumen/pitch" which perhaps derives from α- "without" and "make fall". The expression "bitumen" originated in the Sanskrit, where we find the words jatu, meaning "pitch," and jatu-krit, meaning "pitch creating", "pitch producing" (referring to coniferous or resinous trees). The Latin equivalent is claimed by some to be originally gwitu-men (pertaining to pitch), and b others, pixtumens (exuding or bubbling pitch), which was subsequently shortened tobitumen, thence passing via

French into English. From the same root is derived the Anglo Saxon word cwidu (mastix), the German word Kitt (cement or mastic) and the old Norse word kvada.

B. Material Used

1. Plastic waste
2. Asphalt
3. 10mmAggregate
. Dust

C. Composition

The components of asphalt are classified into four classes of compounds: Saturates, saturated hydrocarbons, the %saturates correlates with softening point of the material Naphthene aromatics, consisting of partially hydrogenated polycyclic aromatic compounds. Polar aromatics, consisting of high molecular weight phenols and carboxylic acids Asphaltenes, consisting of high molecular weight phenols and heterocyclic compounds. Nickel and vanadium are found in the <10 ppm level, as is typical of some petroleum. The substance is soluble in carbon disulphide. It is commonly modelled as a colloid, with asphaltenes as the dispersed phaseand maltenes as the continuous phase and "it is almost impossible to separate and identify all the different molecules of asphalt, because the number of molecules with different chemical structure is extremely large". Asphalt/bitumen can sometimes be confused with "tar", which is a similar black, thermoplastic material produced by the destructive distillation of coal. During the early and mid-20th century when town gas was produced, tar was a readily available product and extensively used as the binder for road aggregates.

III. METHODOLOGY

A. Softening point test

Which is a standard ball will passes through a disc of bitumen contained in a ring .The liquid medium is then heated at the rate of 5°c increases per minute. Softened bituminous materials touches the bottom metal plate placed at a specified distance below the ring is recorded as the softening point.

B. Ductility test

The ductility of a binder is an indication of its elasticity and ability to deform binder load and return to original conditions upon removal of load.

C. Flash and fire test

The method involves a cup into which the bitumen is filled.

- The bitumen sample is heated at a rate of 5-60°c per minute.
- The test flame is applied at intervals.
- The flash point is the temperature when flash appear in bitumen surface.
- The fire point is the temperature at which bitumen surface has continually fired.

D. Sieving Test

Maximum size of an aggregate is the mesh size of the smallest sieve through which 100% of the material will pass. Nominal maximum size is the largest specified sieve size upon which any of the aggregate material is retain

E. Specific Gravity Test

The specific gravity of aggregates is an indirect measure of its strength

Description	**Test Results of bitumen Without Plastic**	**Test Results of bitumen With Plastic**
Flash Point	190°	185°
Fire Point	240°	230°
Specific Gravity	1.03	1.05
Softening Point	48°	45°
Ductility	100cm	85cm

The higher the specific gravity, the denser the rock is and stronger is the aggregate. Similarly water absorption depends on the pores and void age in the rock. The more the water absorption, the higher of the void age some rocks are adversely affect in their strength when water enters the material and softens it.

F. Aggregate stripping test

It is test conducted for aggregate and binder advisedness 200g of aggregate is heated and mixed with asphalts in 130°c. Then it has been cooled to room temperature. Then the mixer is placed in 40°c hot water for 24 hrs. After that binder strips from the aggregate % of stripping is notified from the physical eye examination.

Marshall Method of Design: The method uses standard test specimen of 6.35cm height and 10.16cm dia. The principal features of method are density-voids analysis and stability flow test of the compacted specimen. The stability of the test specimen is the maximum load in LPG & KG. which it will be develop at 60°c. The flow value in the total movement (or)strain in units of 1/100inch accruing in the specimen between no load and maximum load during the test

Description	**Test Results of bitumen Without Plastic**	**Test Results of bitumen With Plastic**
VA	3.5	3.0
VFB	71.5	70.3
VMA	14	13.5
Stability	950 Kgs	1050 Kgs
Flow	3.8	4.5

The voids in mineral aggregate are define as the intergranular void space between in the aggregate particles in the compacted mixture that includes the air voids and the effective asphalt content expressed as present of the total volume.

G.Voids Filled With Asphalt (Vfb)

The voids filled with asphalt are define as the intergranular void space between in the aggregate particles that are filled with asphalt. VFA is not including absorbed asphalt content it is determine using the formula VFA = 100 (VMA-Va) ÷ (VMA) **Voids Aggregate (VA)** The air voids VA in the total compacted mixture in consist of the

small air spaces between the coated aggregate particles. The volume percentage of air voids in a compacted mixture can be determine the using formula VA = 100 (Gmm-Gmb) ÷ (Gmm)

IV. CONCLUTIONS

If the all parameter of asphalt and asphalt mix satisfies the MORTH & IS Standards then the use of waste plastic is advisable in the national highways roads also. Therefore we can able to reduce the plastic waste which is more dangerous to the environment

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