International Journal of Advances in Engineering and Management (IJAEM)
Volume 2, Issue 1, pp: 1247-1248 www.ijaem.net ISSN: 2395-5252

Laboratory Study on a Warm Bituminous Mix

Anand Kumar Mishra[1], Mr. Satish Kumar[2], Dr. Satish Parihar[3]
[1]M.Tech Student, [2]Assistant Professor, [3]Head of Department
Department of Civil Engineering, Faculty of Engineering and Technology,
Rama University, Kanpur, Uttar Pradesh-209217

Date of Submission: 01-07-2020 Date of Acceptance: 16-07-2020

ABSTRACT
About 80%of road network in India comprises of flexible pavement in which Hot Mix Asphalt (HMA) is used in the bituminous layer. Warm Mix Asphalt (WMA) is helpful in certain situations when the problems associated with HMA may be reduced. Warm mix asphalt lowers the mixing temperatures at which asphalt pavement materials are mixed andlaid on road. The advantages of WMA are reduced emissions, improved workability and reduced energy consumption. In addition, it provides easier compaction in longer haul distances and extreme weather conditions. In this study, an experimental investigation has been carried out involving a warm mix chemical additive which can be easily available.
To decide the optimal concentration of additive for DBM mix, Warm Mix has been prepared by using additive with VG 30 at varying mixing temperatures of 110°C, 120°C, 130°C and 140°C. As per the specifications of MORTH, Marshall samples are prepared using dense bituminous macadam (DBM) grading and afterward Marshall properties were studied with optimum mixing temperature and optimum binder additive composition. It was observed that the DBM warm mix with additive provided higher indirect tensile strength (ITS) and higher Marshall stability with other reasonable satisfactory Marshall parameters. The retained stability and tensile strength ratio are also found to be reasonably satisfactory in such warm mixes. The resulting warm mixes are also observed to be quite comparable to the Control HMA.

I. INTRODUCTION
Warm mix asphalt is gaining acceptance now a days because of about 80% of the paved roads in India are comprises of flexible pavement, which consists of aggregate and asphalt binder which are heated and mixed together. Typically, the mixing temperatures of warm mix asphalt ranges from 100 to 135°C (Hurley and Prowell, 2005) compared to the mixing temperatures of 150 to 180°C (300 to 350°F) for hot mix asphalt.WMA uses chemical additives, organic additives and foaming technology to produce asphalt mix at lower temperature by decreasing the binder viscosity, which increases the workability of mixture without compromising the performance of asphalt.

Energy consumption, global warming, oxidative hardening of asphalt, and overhead total costs of the asphalt industry are reduced in warm mix asphalt and it creates a better working environment also. WMA is produced, placed and compacted at temperature10°C to 40°C lesser than the control Hot Mix Asphalt (D' Angelo et.al, 2008). However, the lower mixing temperatures have raised concerns on the performance of the mixtures. Therefore it is needed to thoroughly evaluate and characterize the WMA mixtures to ensure adequate performance.

Benefits of warm mix as compared to hot mix

As compared to Hot Mix Asphalt WMA offers some benefits as per Button (2007) and Zaumanis (2010) mentioned below.
i) Energy cost is reduced because of lower production and placement temperatures. ii) During the production of WMA, ageing of binder (called short-term-ageing) is controlled considerably which improves of pavement service life. iii) The construction season expands and also it increases haul distance.iv) Due to reduced temperature, it causes less wear on Asphalt plant. v) Because of lower temperature, it makes reduction in pavement cooling time.

Benefits of warm mix as compared to cold mix:
The advantages of Warm mix over Cold mix mentioned below according to Soto and Blanco (2004) and Els (2004). i) Provides the full coating of aggregates which produce better mix.
ii) Improves compaction and handling over cold mix

Objectives of study:

The primary objective of the study is to develop warm mix asphalt using additive and to

evaluate the effects of additive on the properties of binder and mixtures.

The specific objectives of the project include the following:

1. To investigate the viscosity and physical properties of the binders modified with additive at different temperatures.
2. To decide the optimum range of mixing temperatures for the mixtures.
3. To evaluate the warm bituminous mix prepared with additive in terms of Engineering Properties such as Marshall Characteristics and Indirect tensile strength.
4. To study performance of mix in terms of their retained stability value and tensile strength ratio.

Scope of the study:

The scope of this study is to focus on the characterization of additive modified warm bituminous mix. The evaluation of rheological properties of VG-30 bitumen binder with and without modification with additive from Brookfield viscometer followed by analysis of engineering properties of additive modified warm bituminous Mix is the main aim of this study. The rheological properties, Marshall Properties, Indirect tensile strength are studied.

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International Journal of Advances in Engineering and Management
ISSN: 2395-5252

IJAEM

Volume: 02 Issue: 01 DOI: 10.35629/5252

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Email id: ijaem.paper@gmail.com