

Experimental Study on Hot Bituminous Mix

Raushan Kumar

Research Scholar Department of Civil Engineering, Sandip University, Madhubani, Bihar, India

Pappu Kumar, Onkar Yadav, Ajay kumar

Assistant Professor Department of Civil Engineering, Sandip University, Madhubani, Bihar, India

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ABSTRACT

About 80% of paved roads in India are made of flexible pavement, which is made by heating and mixing aggregates and asphalt binders, so warm-mix asphalt is becoming more prevalent these days. Hot mix asphalt typically has a mixing temperature in the range of 100 to 135 °C (Hurley and Prowell, 2005), whereas hot mix asphalt has a mixing temperature of 150 to 180 °C (300 to 350 °F). WMA uses chemical and organic additives and foaming technology to produce asphalt mixes at low temperatures by reducing binder viscosity, making the mix workable without affecting asphalt performance. Energy consumption, global warming, asphalt oxidation hardening, and the total cost of the asphalt industry are reduced by warm-mix asphalt while also creating a better working environment. WMA is produced, placed and compacted at temperatures 10°C to 40°C lower than control hot-mix asphalts (D'Angelo et al., 2008). However, the low blending temperature raises concerns about blend performance. Therefore, WMA blends should be thoroughly evaluated and characterized to ensure adequate performance.

1. INTRODUCTION

For appropriate stress distribution between pavement layers under significant traffic loads, modern flexible pavement is typically designed and built in multiple layers. The multi-layered pavement system's interlayer bonding is crucial to the pavement's long-term performance. In order for several layers to function as a monolithic structure, enough bonding between the layers must be achieved. A tack coat is typically sprayed in between the layers of bituminous pavement to achieve strong binding strength. Because the applied stresses are spread equally across the pavement system, there is less chance of structural damage to the pavements.

2. POTENTIAL BENEFITS AND DRAWBACK

Warm Mix Asphalt (WMA) is a method that lowers the temperatures during production and compaction. The advantages vary depending on the specific WMA technology employed. Hence, rewards are divided into three groups: 2010 (Zaumanis)

- **Environmental:** Because the temperature is relatively low and the air pollution is lower, emissions and fumes (reducing emissions of CO₂ and other greenhouse gases) are decreased.

- **Production:** The manufacture and paving technique significantly reduces bitumen binder ageing, which increases pavement serviceability. Urban environments make plant locations easier to obtain permits for because of the decreased emissions, dust, and noise.
- **Paving**
 1. Since bitumen viscosity at paving temperature is reducing, compaction and workability are improved.
 2. Both the haul distance and the construction season are getting longer.
 3. Because of the low beginning temperature, pavement cooling time is shortened

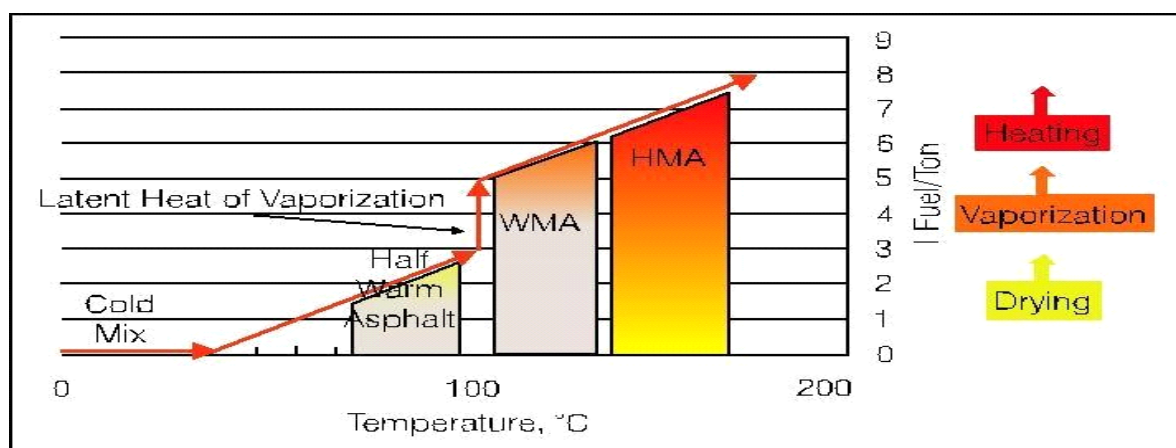


Figure 1: Classification by temperature range (D' Angelo et.al, 2008)

3. RESEARCH OBJECTIVE

The study's main goals are to create warm mix asphalt using additives and to assess how those additives affect the characteristics of the binder and mixtures.

The following are some of the project's specific goals:

- To look at the viscosity and other physical characteristics of the binders that have been added-to at various temperatures.
- To select the mixtures' ideal temperature range for mixing.
- To assess the engineering properties, such as Marshall Characteristics and Indirect Tensile Strength, of the warm bituminous mix made with additive.
- To examine the mix's performance in terms of its tensile strength ratio and maintained stability value.

4. LITERATURE REVIEW

Several warm mix additives and processes are utilised to produce warm mix asphalt (WMA). The main goal is to use a variety of approaches to lower the binder's viscosity to enable full coating and subsequent compactability at lower temperatures. Three categories of WMA technologies exist (Zaumanis, 2010, Erik Olesen, Erik Nielsen).

- Organic additives
- Chemical additives
- Foaming Technology

Hurley and Prowell (2005) suggested that WMA uses lower blending temperatures, making the blends less resistant to moisture and rutting, and WMA manufacturers are concerned about the drying and compatibility of the additives used. concluded that a sufficient amount of anti-

stripping agent should be used to achieve a good balance. Mix the mixture and make sure the mixture temperature is low.

Wasiouddin et al. (2007) evaluated the rheological properties and rutting potential of binders. Here, Sasobit and Aspha-min were used to investigate additives in WMA mixtures and observed that the rutting potential of the mixture decreased with decreasing manufacturing temperature.

Diefenderfer and Hearon (2008) investigated his Sasobit hot mix materials and concluded that the performance of HMA and WMA are comparable with respect to fatigue resistance, rutting potential and moisture sensitivity.

Malick et al. (2008) determined the effect of Sasovit on asphalt mixtures using a high proportion of recycled material and suggested that Sasovit reduces the viscosity of the asphalt binder at elevated temperatures.

Russell M. et al. (2009) using Sasobit wax additives he conducted experimental field studies on WMA and control HMA mixtures and concluded that the Young's modulus of bituminous mixtures was unaffected. And the resulting mixture is poorly resistant to moisture damage from performing TSR.

Austerman et al. (2009) evaluated that the addition of 3.0% Sasobit® and 1.5% Sasobit reduced the workability and viscosity of the binder compared to the control binder.

Harley et al. (2005 & 2006) he studied Evotherm™ and reported that this technology lowers the mixing and compacting temperatures of the asphalt mixture, significantly improving the compaction of the asphalt mixture and resulting in reduced voids. Evotherm reduces mix and compression temperatures, makes them more susceptible to moisture and more prone to rutting.

From the literature, it is clear that different types of aggregates, binder grades, and techniques were used to produce hot mixes. It has been observed that the methods and techniques used to prepare hot mixes are not only expensive, but also difficult to obtain in the laboratory or in the field. Easy to manufacture warm mix asphalt. Therefore, such readily available additives were used in the current work to prepare warm bituminous mixtures, their basic technical properties were studied, and the same results were compared with conventional his HMA. That is the driving force behind my current work.

5. BASE MATERIALS

5.1. Basic materials

The basic materials which compose concrete are:

- Aggregate (Coarse & Fine)
- Filler
- Asphalt Binder
- Tack coat Materials
- Admixture

✓ Binder Test Results

In this study, it is suggested to make warm mix using VG 30 and various addition percentages at mixing temperature determined by Brookfield viscometer. The DBM warm mix Marshall characteristics are greatly improved by the mixing temperature. Researchers have explored mixtures made at various mixing temperatures. For the preparation of the sample, mixing temperatures of 110°C, 120°C, 130°C, and 140°C were taken into account.

✓ **Determination of Mixing Temperature for Warm DBM mix**

In this study, the absolute viscosity of the binder is tested at various temperatures in a Brookfield viscometer to determine the mixing temperature. For making hot mix asphalt, the VG-30 binder's viscosity is tested at 110°C, 120°C, 130°C, 140°C, 150°C, and 160°C (HMA). But in order to create warm mix asphalt, the viscosity of VG-30 with various addition percentages is evaluated at 110°C, 120°C, and 130°C (WMA). The results are not provided in this article for publishing.

✓ **Determination of Physical properties of VG 30 with different percentages of additive**

Testing the physical characteristics of the binder is important before utilising this additive in the construction of roads. Hence, the physical qualities are examined here in terms of softening point, penetration value, elastic recovery, and ductility after the additive has been added to VG 30. The results are not provided in this article for publishing.

6. CONCLUSIONS

In this work, an effort has been made to create DBM warm mix utilising a chemical ingredient. Marshall Properties has researched the impact of the additive concentration addition on DBM mix.

- Satisfactory Marshall All DBM mixes with their matching ideal binder contents that were made at their respective mixing temperatures shared characteristics.
- It has been found that additives containing heated DBM mix have greater tensile strength ratios and preserved stability values.

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