# EXPERIMENTAL STUDY ON ENGINEERING AND BASIC PROPERTIES OF WARM MIX ASPHALT USING EMULSION IN ROAD PAVEMENT

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**Abstract -** *Due to increase in energy costs and emission problems in hot mix asphalt usually used, it brought a great interest to the researchers to develop the warm mix technology for pavement Constructions. Commonly known as warm mix asphalt (WMA), it is a typical method in the bituminous paving technology, which allows production and placement of bituminous mixes at lower temperatures than that used for hot mix asphalt (HMA). The WMA involves an environmental friendly production process that utilises organic additives, chemical additives and water based technologies. The organic and chemical additives are normally very costly and still involve certain amount of environmental issues.*

***Key Words*: *Warm Mix Technology, Hot Mix Asphalt, Enivronmental Friendly, Water Based Technologies***

## 1. INTRODUCTION

Warm Mix Asphalt (WMA) is a fast emerging new technology with potential of revolutionizing the production of asphalt mixtures. WMA technology allows the mixing, and compaction of asphalt at 30°C to 40°C lower temperatures compared to Hot Mix Asphalt (HMA). The technology can reduce production temperatures by as much as 30 percent. Hot asphalt mixes are generally produced at 150º C where WMA mixes are produced at temperatures of about 120ºC or lower.

### 1.2 Warm Mix Asphalt Technologies

In this technology when small amount of water turns into steam at atmospheric pressure, it expands in volume by a factor of 1.673. This causes increase in the volume of asphalt binder, which helps in coating the aggregate and lowers the mix apparent viscosity.

### 1.3 Benefits of WMA over HMA

These are the benefits of WMA over HMA:

1. Mixed at low temperatures

2. Consumption of energy is less

3. WMA produces fewer emissions from the burning of fossil fuels than HMA

4. Decreased binder aging because the loss of lighter oils is less as compared to HMA at lower mixing temperatures

5. RAP (reclaimed asphalt pavement) will be increased in WMA compared to HMA during hot recycling

6. Production of dust is less due to lower temperatures and shorter heating time

7. The main economic benefit of WMA comes from the energy savings. There is a reduction of 20 to 75 percent energy in wma as compared to HMA

## 2. BINDER

Bitumen is a non-crystalline viscous material black/ dark brown in colour, which is substantially soluble in carbon disulphide (CS2), having adhesive and water-proofing qualities. It consists of hydrocarbons having 80% carbon and 15% hydrogen, the rest 5 % is oxygen, sulphur and nitrogen. Bitumen acts as a binder in SMA and DBM mix. In the study preparation of SMA and DBM mix VG 30 bitumen used as binder. Penetration Test determines the hardness of Bitumen by measuring the depth.

### 2.1 Emulsion (CMS)

Filler fills the voids between aggregate grains and improves the wearing capabilities of mix. It is stored and fed dry into the mix, during or after addition of binder. Stone dust, slag dust, hydrated lime, fly ash, mineral filler and cement are used as filler. Also fine aggregate below 75micron can be used as filler. For this observation stone dust and cement have been used as filler for SMA and DBM composition respectively. The filler also improve the binding property between the aggregate.

### 2.2 Sieve analysis

Sieve analysis was done by BIS sieve size of 19mm, 13.2mm, 9.5mm, 4.75mm, 2.36mm, 1.18mm, 0.6mm, 0.3mm and 0.075mm and aggregates were collected and stored. Total weight ofonesampleis1200gms.Thedistributionofaggregateswastakenasper Table 3.2 for SMA

Composition and Table 3.1 for DBM composition. The samples have been prepared by following steps.

### 2.3 Sampling for Mix

Sampling of coarse and fine aggregates is carried out by 13mm Stone Matrix Asphalt (SMA) composition and 3 samples based on 5%, 5.5%, 6%, 6.5% and 7% bitumen each

were prepared. Similarly sampling of coarse and fine aggregates is carried out by 19mm DBM composition and 3 samples based on4%, 5%, 6% and 7% bitumen each were prepared. Then emulsion was added to the samples according to the bitumen content and left for 24 hours. After sampling of aggregates was completed, the dry samples were kept in oven for 2 hours at1100C.

## 3. CONCLUSIONS

In this observation, two types of mixes i.e. SMA and DBM specimens were prepared using VG 30 as binder tested on Marshall Test Apparatus. By Marshall Method of mix design, the optimum binder contents for both the mixes were found 5.93% and 5.33% for SMA and DBM respectively. When using Cationic Medium Setting type emulsion with binder, the properties of Mix was improved. Maximum stability value was observed for SMA 11.65 KN and 13.28 KN for DBM mixes. Flow value of SMA and DBM samples gradually increases with increase in bitumen content. VA of Marshall test samples decreases with increase in bitumen content and VFB increases with increase in bitumen content.

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