An experimental analysis of Warm Mix Asphalt By Using Sasobit as WMA additive

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Abstract- Warm Mix Asphalt (WMA) is a quick developing new innovation which can possibly supplant Hot Mix Black-top (HMA) and altogether decreases the creation temperature of black-top blends through bringing down the consistency of black-top covers. The innovation can diminish creation temperatures by as much as 30 percent. Black-top blends are by and large delivered at 150º C or more prominent temperatures depending mainly on type of binder utilized. WMA blends can be created at temperatures of around 135ºC or lower.

In the present study sasobit additive used WMA mix of about the dosage rate 1% to 5% by the weight of bitumen. In this study, the fundamental properties of asphalt binders modified with additive (Sasobit) were evaluated.

Keywords – warm mix asphalt, Additive, Sasobit, Indirect tensile strength

I. INTRODUCTION

Warm Mix Asphalt (WMA) is the generic term for a variety of technologies that allow producers of Hot Mix Asphalt (HMA) pavement material to lower temperatures at which the material is mixed and placed on the road. Customary hot blend black-top (HMA) is the essential clearing material, as the greater part of the cleared streets are made of HMA, which contains totals and fastener, which are warmed and blended combindly. HMA has been utilized as a part of black-top clearing in past decades. The hot blend black-top is created either drum blenders or clump blend plants. The regular blend delivered at the temperature of 150°c to 170°c. Be that as it may, contrasted with regular HMA blends, warm-blend black-top (WMA) blends have demonstrated incredible conceivable, and offer advantage, since the WMA blends can create at bring down temperatures, without trading off an asphaltic asphalt execution.

II. OBJECTIVES AND METHODOLOGY

2.1 objectives

The primary target of this examination is to assess the execution qualities of the bituminous cement (BC) blend utilizing Sasobit of differing level of 1% to 6%by weight of binder.

1. Evaluate the physical properties of aggregates and bitumen by basic test on materials.
2. To determine OBC by Marshall Mix design
3. To add Sasobit additive in mix and find Marshall stability values
4. To Determine the Indirect Tensile Strength of bituminous mix.
5 Compare the results of warm mix asphalt with conventional mix

3. Materials& Methodology

The details of the various materials and additive used in the laboratory experimentation are reported in the following sections.

2.2 *Materials*

In this overview, Coarse aggregates, fine aggregates and binder materials are used for present study.

Coarse Aggregates

Coarse aggregates comprised of stone chips gathered from a neighborhood source, up to 4.75 mm IS sieve estimate. Its particular gravity was found as 2.72. Standard tests were led to decide their physical properties as abridged in underneath table.

The aggregates utilized as a part of the examination are gathered from a quarry close Bangalore (yelhanka)

Fine Aggregates

Fine aggregates, comprising of stone crusher tidies were gathered from a yelhanka quarry (stone dust)with parts passing 4.75 mm and held on 0.075 mm IS sieve.

3.2.2 Binder

Here 60/70 penetration grade bitumen is used as binder for preparation of Mix. Black-top Binder Bitumen is produced from raw petroleum.

3.2.3 WMA additive (sasobit)

Sasobit is fine crystalline long chain aliphatic hydrocarbon. Also known as WAX and it is available in a solid form.

Table 1: Physical properties of aggregates

SL. NO	Test	Obtained value	Test method	Specification as per MORT&H
1	Aggregate impact test	23%	IS: 2386 part 4-1963	Max 27%
2	Crushing test	13%	IS:2386 part 4-1963	Max 30%
3	Los angeles abrasion test	18%	IS: 2386 part 4-1963	Max 40%
4	Flakiness and elongation test	17%	IS :2386 part 1-1963	Max 30%
5	Specific gravity	2.7	IS :383-1970	>2.5

Table 2: Physical properties of control and WMA modified binder

SL.NO	Test	Test method	Control binder	Sasobit modified binder	Requirement as per MORT&H
1	Penetration	IS: 1203-1925	68	48	50-70
2	Ductility	IS: 1208-1978	85	89	Min 75
3	Softening point	IS : 1205-1978	62	71	Min 74
4	Flash point	IS :1209-1978	290	310	Min 220
5	Specific gravity	IS :1202	1.03	1.02	-

Gradation as per JMF

In this present study three different sizes of aggregates (20 mm down, 12.5 mm down, 4.75 mm down) were considered. For this study BC grade II were adopted.

Blending of aggregates proportions are

- 39% for 20 mm down size
- 23% for 12.5 mm down size
- 25% for 6 mm down size aggregates
- 13% for M sand

Specimen Preparation
Number of specimen: at least three specimens are prepared for each combination of aggregates and bitumen content.
Preparation of aggregates
Preparation of mould

Determination of specific Gravity
Compaction of the Specimen: These study 75 blows were applied on each side.
Basic parameters of Marshall Test: Mould is put out on Marshall Apparatus and Marshall Stability as well as Marshall Flow is measured by proving ring and flow dial gauge respectively. After that calculate the other factors like unit weight, VMA(%), VFB (%), etc.

III. RESULTS AND DISCUSSION

3.1 *OBC values for HMA*

The OBC value for present study found 5.7%

Marshall Stability esteems

The Marshall stability for the HMA blend without substance are observed to be 1250.3Kg with the WMA of sasobit of 1% 2% 3% 4% and 5% measurements are observed to be 890 kg 1165 kg 1252 kg 1230 kg and 1150 kg.

5.1 *INDIRECT TENSILE TEST ON BITUMINOUS MIX*

The ITS esteems for the WMA blend utilizing a sasobit with the level of 1%,2%, 3%, 4% and 5% measurements are observed to be 440.21, 446.22, 452.36, 461.20and 469.56 kPa.

The ITS esteems are observed to increment with the increasing the dose of sasobit additive in the mix.

Table 3: Marshall Stability of varying % of with and without additive

Mix	Dosage (%)	% air voids	VMA (%)	VFB (%)	Gb(Kg/m3)	Stability (kg)	Flow (mm)
HMA	0	3.8	16.32	74.54	2360.53	1250.3	4.7
WITH SASOBIT	1	4.1	17.1	75.2	2357.3	890	5.6
	2	4	16.9	76.32	2353.3	1165	5.3
	3	3.8	16.5	77.15	2363.6	1252	4.8
	4	3.5	16.42	79.15	2355.6	1230	4.2
	5	3.38	16.21	80.1	2373.33	1150	4.1

Table 4: Tensile Strength Ratio Results

Dosage (%)	Mix	Unconditioned (kPa)	Conditioned (kPa)	TSR (%)
0	HMA	545.2	492.6	90.3
1	Sasobit added with Bituminous Mix	430.2	330.2	76.7
2		432.5	342.6	79.2
3		425.6	390.1	91.68
4		471.2	388.6	82.4
5		468.6	375.2	80.0

IV.CONCLUSION

The physical properties were directed on the totals utilized as a part of the present examinations fulfills the necessities according to the MORT&H details.

The Physical properties of aggregate and bitumen results were satisfactory

Expanding level of added substance measurements to rate of Marshall Properties additionally increments and fulfills the MoRT&H determinations and the Marshall properties of HMA in the present examinations fulfills the MoRT&H determinations.

The optimum bitumen content was observed to be 5.7% for HMA blend at 160°c temperature.

The most extreme strength for 60/70 review bitumen is accomplished at 135°c temperature with the added substance measurement rate of 3% of sasobit by the weight of binder.

The expansion of added substance of sasobit enhances mass thickness of the blend. The Percentage air voids in the blend were found to diminish with the expansion of WMA added substance 5% of sasobit at 135°c was most reduced when contrasted with HMA.

The Indirect tensile strength of a blend with WMA added substance sasobit of 5% has 0.48 N/mm2. The WMA added substance meets the necessity of HMA.

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