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LABORATORY INVESTIGATION ON THE PROPERTIES OF ASPHALT AND POLYPHOSPHORIC ACID

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Abstract— The bitumen is also known as asphalt. Asphalt is used especially in road structure, wherein it's miles used as adhesive or binder mix to form bitumen concrete with combination debris. Specific laboratory tests are conducted by preparing asphalt concrete mixtures by adding 0.5%, 1.5%, and 2% by weight of binder. Volumetric homes of the mixes are decided and diverse strength assessments such as marshal stability are performed. On the basis of above tests conclusions are drawn.

Index Terms— component; Marshal Stability, Asphalt, PPA

I. INTRODUCTION

For a developing country like India a road network is pre-necessary for national blending in, country's growth and for developing. Over a last few years, the use of vehicles has increased, which has further evaluated the density on roads. Due to rise in cars and trucks, there is a huge demand for improved hard road surface sections which can resist the increasing loads. A highway hard road surface is a structure consisting of different layers of prepared materials above the natural soil subgrade. The first function of these layers is to thinly spread the applied vehicle load to the subgrade. The hard road surface should provide enough riding quality, capable skid resistance well enough smooth. The main aim is to make sure that stresses brought across due to wheel loads are effectively reduced so that they will not go away from the bearing ability of the soil subgrade. There are commonly two types of road surfaces which are mostly recognized as, Flexible and Rigid road surfaces.

II. LITERATIRE REVIEW

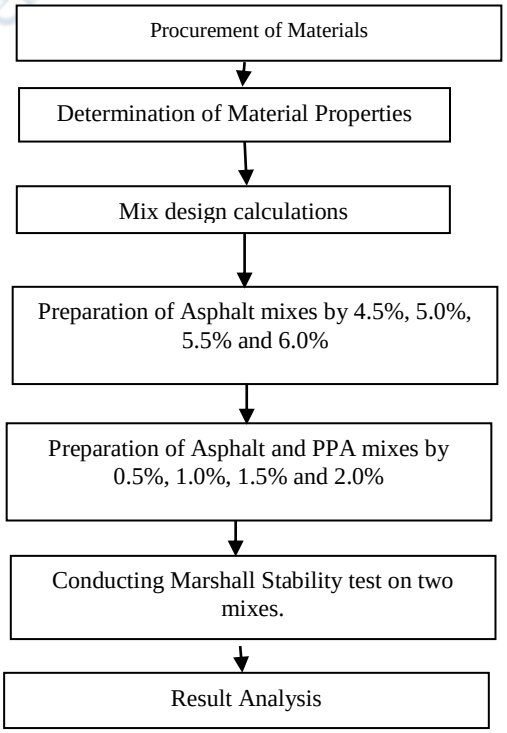
Straight-run bitumen production can be enhanced by acid modification. Research have shown that, when used in sufficient doses, the use of PPA for bitumen is very effective in improving binder properties to make it suitable for use in broader climatic conditions. A short overview of the recent work in the field of general acid modification and PPA modification

Yan et al. [12] examined the impact of PPA change of bitumen on physical, concoction and morphological properties utilizing customary and organization tests utilizing Corbett's Method. The adjusted bitumen is found to get solidified with upgraded relaxing point.

Daranga et al. [11] have considered the impact of PPA adjustment on two fasteners with low and high asphaltene content. Nearness of PPA doesn't advance oxidation; despite what might be expected, it appears that for certain folios it backs it off. This might be because of obstructing of the responsive destinations in the folio by response with PPA atoms and hydrogen bond arrangement.

Orange et al. [7] have seen that PPA has the impact of balance of polar communications between the stacked asphaltenes particles, either by protonation of essential locales or by esterification.

III. METHODOLOGY



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- Materials and Experimen-tal investigations

A. Materilas

In this study, bitumen VG-30 and PPA purchased locally. Polyphosphoric acid is a liquid which is hygroscopic, clear, and viscous. It was synthesized by reacting with phosphorous (V) oxide to phosphorus acid. For a wide variety of uses, it is a moderately heavy mineral acid.

B. Experimantal

In this paper the main purpose is to examine the marshal properties of bitumen and modified bitumen with different dosages

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Table 1 PROPERTIES OF AGGREGATES.

Property	Test	Test method	MoRT&H Specifications (2009)	Result
Strength	Abrasion Value	IS 2386 Part IV	25% maximum	29.2
	Impact Value		24% maximum	21.2
Toughness	Crushing Value	IS 2386 Part IV	30% maximum	28.4
Specific Gravity	Coarse aggregate	IS 2386 Part III	2.5 minimum	2.73
	Fine aggregate			2.69
	Stone Dust			2.61
Shape Test	Elongation Test	IS 2368 Part I	15% Maximum	14.5
	Flakiness Test		15% Maximum	4.98
Water Absorption	-	IS 2368 Part III	0.6% Maximum	0.25

Table 2 PROPERTIES OF BITUMEN.

Property	Result	Specified Limits as per BIS: 73-1992
Penetration at 25ºC/100 gm /5 sec, mm	65	60 – 70
Softening Point, ºC	43	40 – 55
Specific Gravity, at 27ºC	1.01	>0.99
Ductility, at 25ºC	98	>40

Table 3 MARSHAL PROPERTIES OF VG30 BITUMEN.

Bitumen Content (%)	Bulk Density (gm/cc)	Air voids (%) V_v	VMA (%)	VFB (%)	Stability (KN)	Flow (mm)
4.5	2.34	5.6	18.39	65.46	15	3.7
5.0	2.36	4.0	18.1	78.33	17.33	4.5
5.5	2.36	3.3	17.08	80.00	16.89	6.1
6.0	2.35	2.8	17.78	83.25	16.69	5.3

Table 5 MARSHAL PROPERTIES OF BITUMEN AND PPA

PPA (%)	Bulk Density (gm/cc)	Air voids (%) V_v	VMA (%)	VFB (%)	Stability (KN)	Flow (mm)
0.5	2.3	5.56	19.42	70.98	11.51	2.5
1.0	2.36	4.13	17.8	76.8	14.85	3.5
1.5	2.4	4.09	17.4	76.9	15.85	4
2.0	2.35	3.3	16.7	80.32	12.36	3.5

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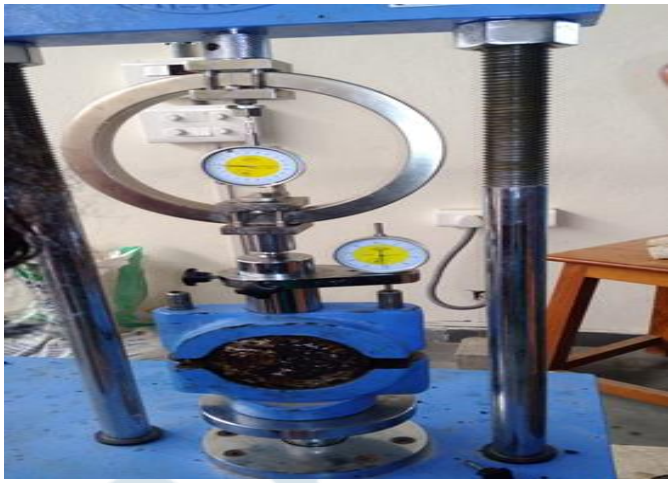
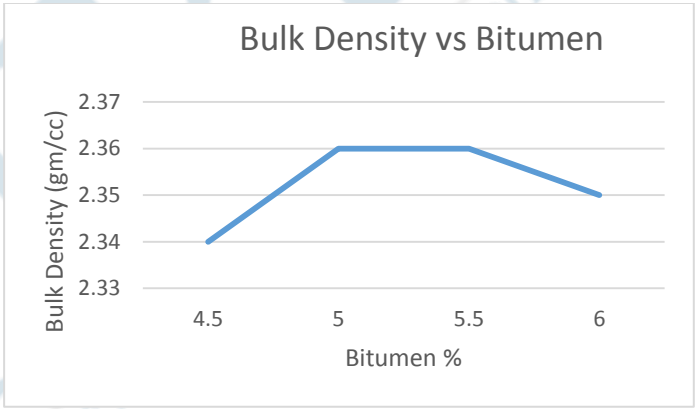
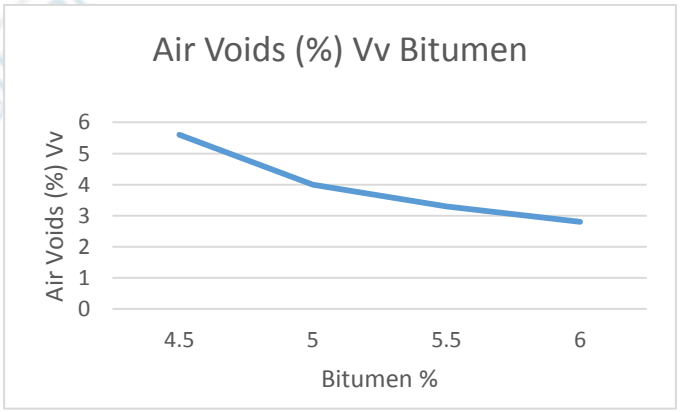


IV. RESULTS AND DISSCUSIONS





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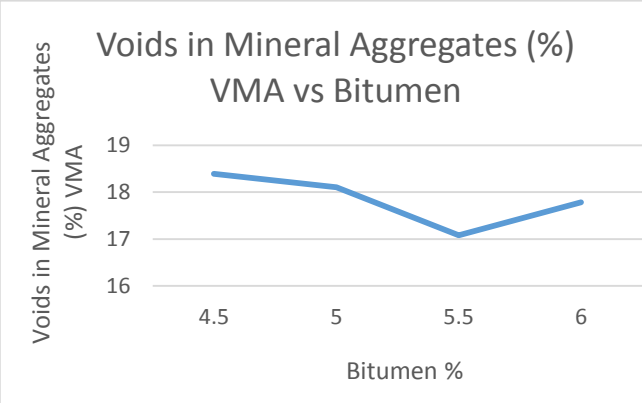
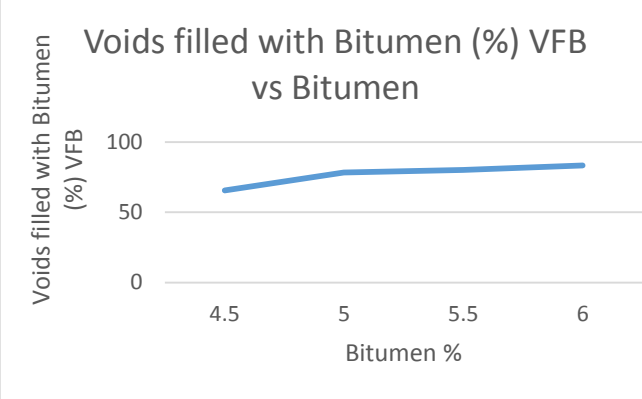
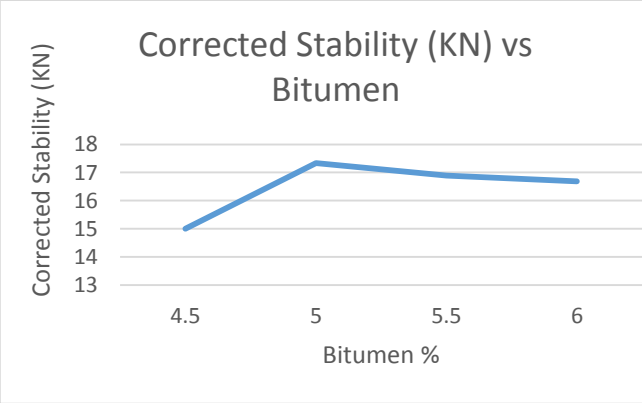
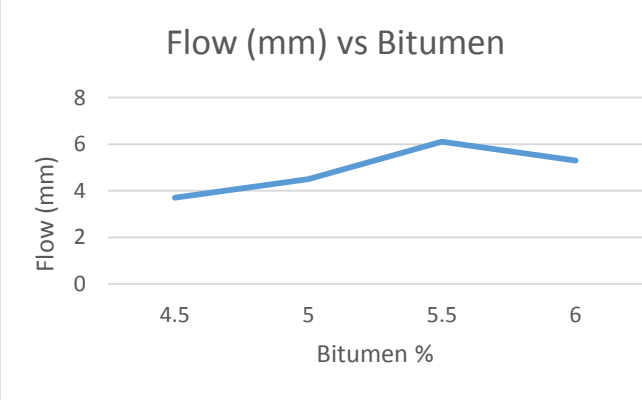
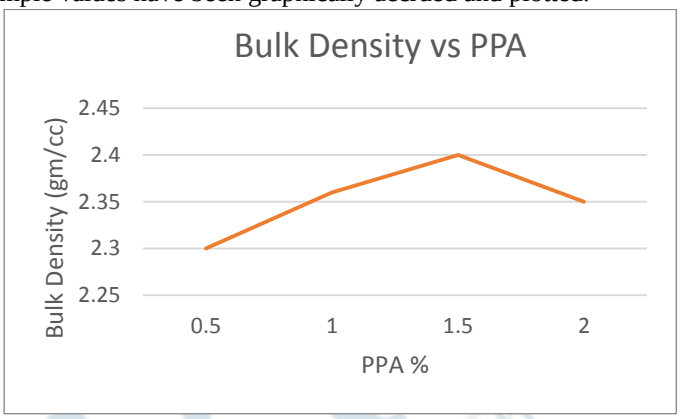


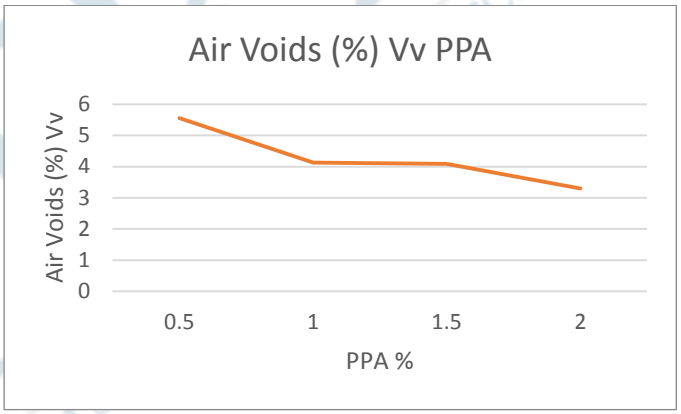


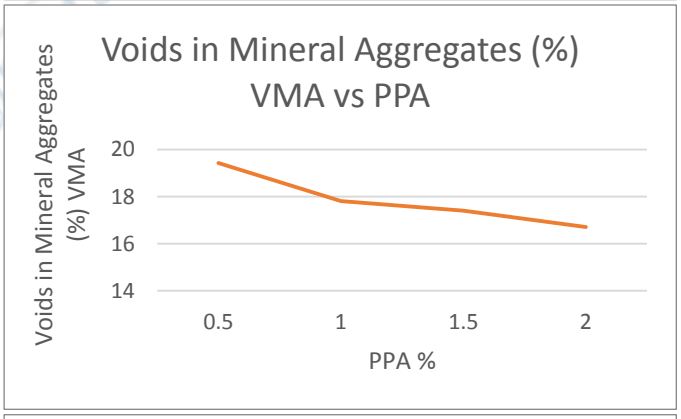


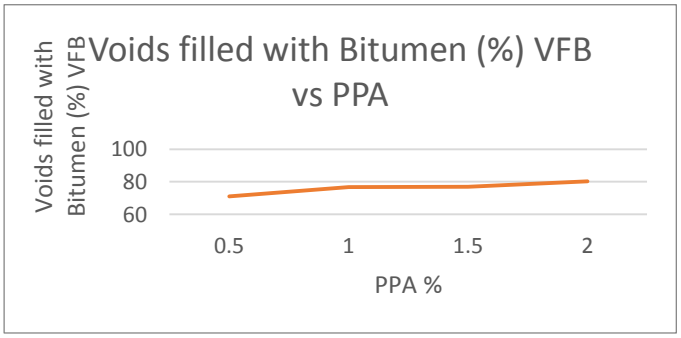


Marshall Mix samples were equipped to assess the optimum binder content (OBC) by adjusting the percentage of the asphalt binder VG30 without using any additives or modifiers. Stability and Flow investigation and volumetric evaluation were completed for the Marshall blend of samples with bitumen content wavering from 4.5% to 6%. The tested sample values have been graphically accrued and plotted.









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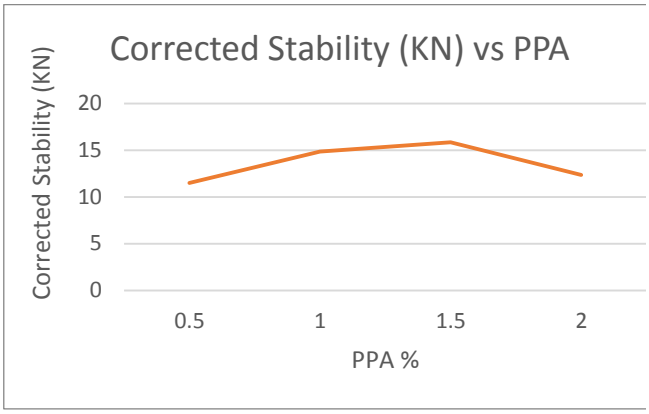

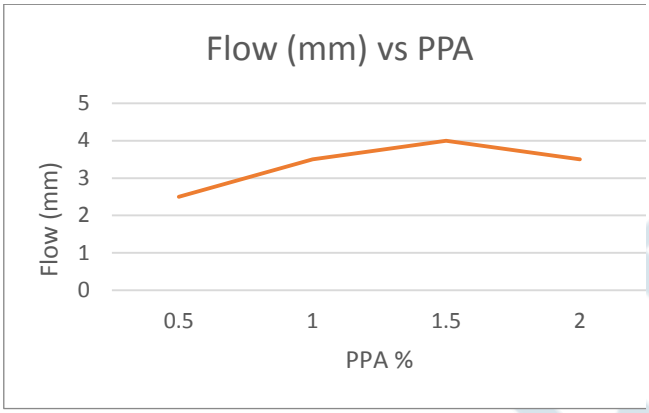

To compute the optimal PPA content, Marshall mix samples were arranged by wavering the percentages of PPA (0%,1%1.5%2%) with OBC.

From the above graphs PPA 1.5% is taken optimum.

V. CONCULTIONS

1) The optimum dose of VG-30 was evaluated to be 5%.

2.The optimum dose of PPA was evaluated to be 1.5% by weight of binder content.

3) Bitumen with PPA 1.5% can be used for road surfacing.

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