EFFECT OF USING PONDASH AS FILLER IN BITUMINOUS MIX

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***Abstract*—** This study investigates the effects of using Pond ash (PA) in bituminous mixture as a replacement of common filler. In perspective of the same, samples were prepared for various bitumen content differing from 4.0-5.5% at 0.5% addition and percentage of filler changing from 2 to 6 % of Pond ash was used. By means of Marshall mix design the optimal binder content were assessed for all the mixes. The results from the experiments indicates higher stability value with optimum binder content for the mix having 4.456 % of bitumen at 4% of Pond ash as optimum filler in comparison with the standard specifications. In this experimental study the feasibility of using Pond ash as alternative filler instead of conventional filler can be used by satisfying the standard specifications.

***Key words*—** *Pond ash, Marshall, Filler, Rutting, Optimum Binder Content*.

I. INTRODUCTION

Hot mix asphalt pavements are progressively built in India, as the government is allotting tremendous measure of assets to update the current road network across the country. In any case, it is accounted for that basic untimely asphalt troubles, for example, perpetual distortion (rutting) and lethargy cracks are being seen inside the couple of years in the wake of opening the ways to traffic. Accordingly, this prompts expansive measure of support and street clients cost that would have negative impact on the country's economy. Nowadays, due ecological and money related concern analysts have broadly inspected the use of waste materials rather than standard filler. Lake fiery debris is a pozzolanic material, obtained by combustion of coal that is used in thermal power plant basically left behind for no use. The present examination was passed on to watch the effect of Pond fiery remains and their substance on Marshall properties of Dense bituminous macadam (DBM). Considering the test outcomes, the common sense of Pond slag as filler in ideal extent is surveyed contrasting and control mixture.

II.MATERIALS AND METHODS

Aggregates

Aggregates having specific gravity of 2.696 and 2.65 for coarse and fine aggregates were respectively used which are brought from I. Pangidi village in west Godavari district of Andhra Pradesh, India. The aggregate gradation of DBM having grading zone -2 of having a nominal maximum aggregate size of 26.5 mm, with a layer thickness of 50-75 mm by IRC:111-2009 specifications was used.

TABLE 1 AGGREGATE GRADATION FOR DBM

S SIEVE SIZE (MM)	CUMULATIVE PERCENTAGE BY WEIGHT OF TOTAL AGGREGATE PASSING
37.5	100
26.5	90-100
19	71-95
13.2	56-80
4.75	38-54
2.36	28-42
0.3	7-21
0.075	2-8

Bitumen

Viscosity grade (VG) 30 grade paving bitumen supplied by Hindustan Petroleum, Visakh refinery, India(fig.1) was used in this investigation to prepare HMA mixes after confirming the results with IS 73-2013.



Fig.1 Bitumen

TABLE 2 TEST RESULTS OF BITUMEN

Property	Test method	Results obtained	Recommended values
Penetration at 25^0C, 100g, @0.1mm	IS:1203-1978	52	50-70
Softening point (Ring & Ball)	IS:1205-1978	52.5^0 C	min 47^0 C
Ductility @27º C	IS:1208-1978	45 cm	min 40 cm
Specific gravity	IS:1202-1978	1.022	0.95 - 1.05
Absolute viscosity	IS:1206-1978	2510 poises	min 2410 poises

Filler

In this present study, Pond ash marketed by jeetmulljaichandlall Pvt. Ltd. Chennai, Tamilnadu was used. The physical characteristics and chemical characteristics are given in below table.

TABLE 3 PHYSICAL CHARACTERISTICS OF PONDASH

1.	Moisture content	0.18%
2.	Specific gravity	2.06
3.	Bulk density	825 Kg/m^3
4.	pH	7.0 - 8.0

TABLE 4 CHEMICAL COMPOSITION OF PONDASH

Sl. no.	Constituent Elements	Composition in%
1	Silica SiO_2	61.85 %
2	Alumina Al_2O_3	30.48 %
3	Iron oxide Fe_2O_3	3.23 %
4	Titanium oxide TiO_2	2.19 %

Method

Design of Dense Bituminous Macadam (DBM)

The method for DBM was adopted from marshal mix design method for the preparation of specimens. The standard Marshall specimens were prepared by applying 75 blows on each side of the specimen according to MS -2, 7th edition, asphalt institute, asphalt mix design method having five different bitumen percentages ranging from 4 – 5.5 % by total weight of aggregates at an increase of 0.5%, and filler from 2-6% at an increase of 2%.

Marshall stability, flow and Marshall quotient tests

The primary reason for Marshall mix design is to find the optimum binder content with respect to different blend proportions. For these reasons, it is required to perform Marshall stability and flow test on each sample under a loading rate of 50.5 mm/min at 60^0C based on MS-2, asphalt mix design method. Marshall quotient, which is a kind of pseudo stiffness, can be calculated as the ratio of stability to flow.

III. RESULTS AND DISCUSSION

As discussed earlier, the Marshall method of mix design was used to ascertain the optimum bitumen content of mixes relative to filler ratio in comparison with the standards given in IRC: 111-2009.The optimum binder content was calculated from the data shown in table5 and selected at 4% air voids. The other Marshall properties like Marshall quotient, flow, stability, voids filled with bitumen (VFB), voids in mineral aggregate (VMA) were given in Table 5.

TABLE 5

FILLER TYPE	FILLER PERCENTAGE	OBC (%)	VMA%	VFB%	STABILITY (kN)	FLOW (mm)
PA	2	4.693	14.2	73.5	16.05	3.09
	4	4.45	13.55	72.5	16.25	2.4
	6	4.73	14.39	72.8	15.68	4.2

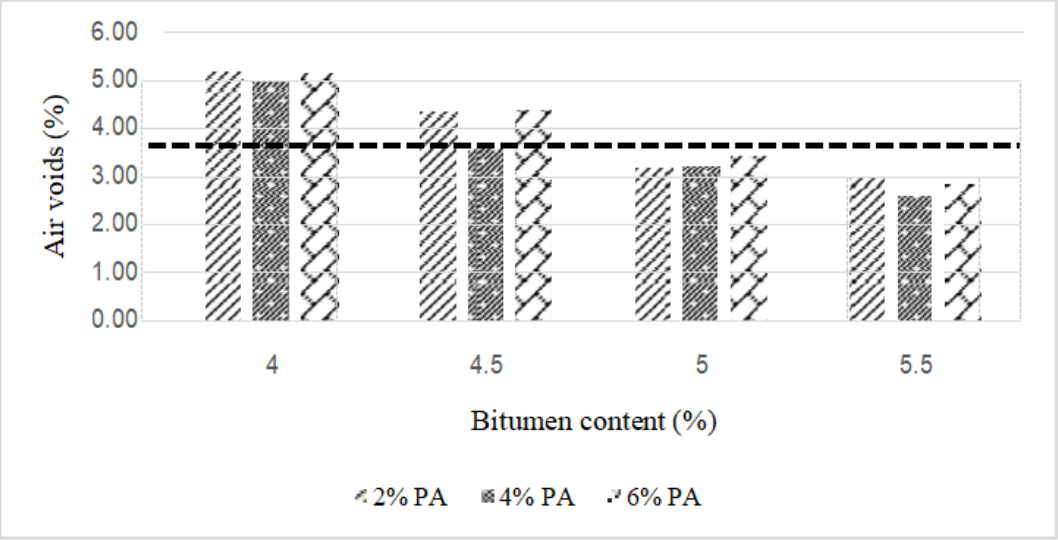


Fig .2. Variation of air void (%) vs bitumen content at different filler content.

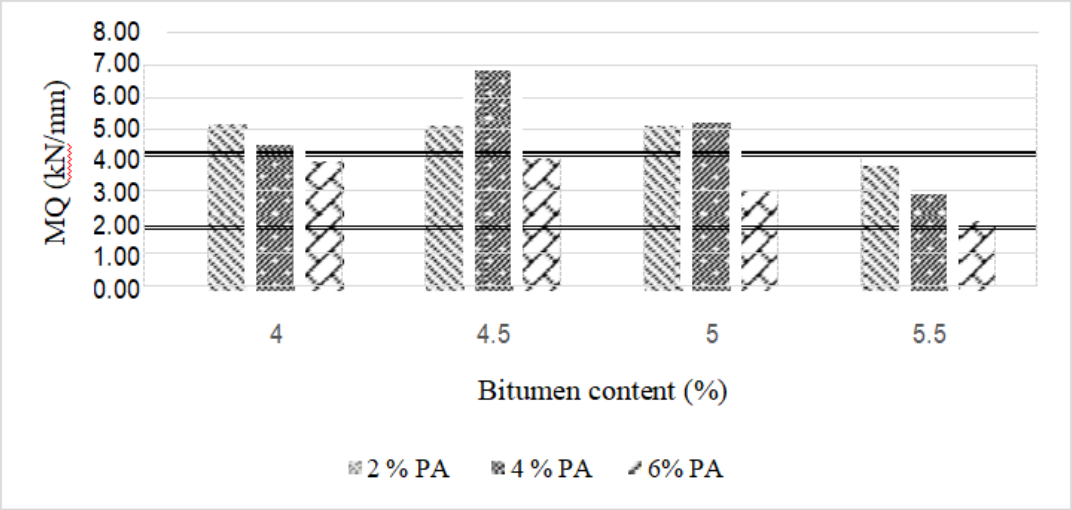


Fig.3.Variation of MQ values vs bitumen content at different filler content

Addition of Pond ash at 2, 4 and 6 %, the optimum binder content 4.69, 4.45 and 4.73 respectively. the optimum binder content values at 2 % PA is 4.69 and decreased at 4 % PA is 4.45 and again raised at 6 % PA at 4.73.

IV. CONCLUSION

Based on results obtained from Marshall test properties, the following conclusions are done. The Marshall stability value is found maximum at 16.25kN at 4% Pond ash. The max density is found at 2.442 g/cc at 4.46% bitumen content. At 4% of air voids the bitumen content obtained as 4.69%, it is also observed that air voids are decreased, which is required for better strength and service life of the pavement and the Flow and VFB is increased by addition of bitumen. The optimum bitumen content obtained at 4% of air voids are 4.46.

The potential utilization of Pond ash, in bituminous mix was investigated through Marshall mix design. According to the obtained results the addition of 4% of Pond ash will satisfy all the recommendation's prescribed in IRC:111-2009.

So, by using Pond ash we can replace the conventional fillers like hydrated lime, fly ash, cement. The results obtained from this clearly shows that Pond ash as a filler not only satisfies the all the standard specifications but also gives lesser deformation with better strength.

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