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Comparative Study on the Use of Stone dust and Bagasse Ash as Filler in Hot Mix Asphalt

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Abstract: ***This paper develops a study on the comparative use of conventional filler Stone Dust (SD) and Bagasse Ash (BA) in Hot Mix Asphalt. Stone Dust is mainly used as conventional filler in Pakistan while Bagasse Ash is a byproduct of sugarcane industry. In this study the Bagasse Ash is used as filler in full and partial replacements of Stone Dust. The SD was replaced by Bagasse Ash in different percentages. The Marshal Mix Design was used for this study. The marshal stability and flow of SD samples and BA modified samples were assessed. The results obtained shows that the BA can be used as filler material and the stability of BA modified samples were enhanced. Thus the use of BA as filler material in Asphalt concrete is very much promising and economical. The results show that BA has huge capability to be used as filler material.***
Keywords: Bagasse Ash, Filler, Stone Dust, Hot Mix Asphalt

I. INTRODUCTION

Pakistan is an agricultural country. It highly depends on its agricultural resources. It exports a huge quantity of its agricultural products to other countries of the world. Sugarcane is similarly cultivated and produced in huge quantity every year. It is one of the largest sugarcane producing countries. There are several sugar mills running around the country that produces sugar from sugarcane. Sugarcane bagasse is the waste product of the sugar industries when the juice is extracted from the sugarcane in the sugar mills. After the juice extraction, the remaining known as sugarcane bagasse is kept in sunlight to dry. After making it moisture free, it is then used as a fuel source in the sugar industries by burning it to generate heat. When the sugarcane bagasse is burnt, the ash thus generates is termed as bagasse ash or sugarcane bagasse ash. Bagasse ash is the waste product of sugar mills. Bagasse ash being an ash is almost in powder form. Thus this ash is checked and used as filler material in Hot Mix Asphalt.

Hot Mix Asphalt is basically a combination of coarse aggregates, fine aggregates, filler material and bitumen. In this study the filler material is being focused. A comparison is made between Stone Dust and Bagasse Ash used as filler materials. This paper has a comparative analysis of SD and BA by replacing the conventional SD with BA by 10%, 20% and 100%. The total amount of filler is taken as 3% by weight in whole sample.

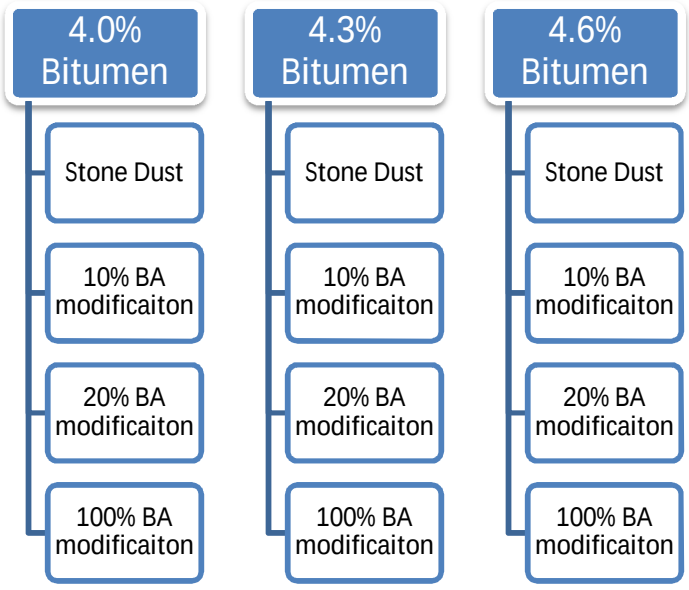
A. Experimental Investigation

Here in this study, the experimental job consisted of preparation of a total of 36 marshal samples. Three different bitumen contents (4.0%, 4.3% and 4.6%) and 3% filler were selected for this research study. The marshal sample requires a total of 1250 gram of aggregates, filler and bitumen in which the filler quantity is kept as 3%. The details for the rest of the aggregates are as follow;

Table 1: Details of Percentages of Aggregates Used

BY %AGE OF TOTAL AGGREGATES	
Size	%age usage
10-20mm	39
5-10mm	33
Crushed stone	25
Filler	3

The samples were first made with the conventional filler i.e. Stone Dust and then other samples were made by replacing the SD with BA and then they were tested using Marshall Stability Tester. Three samples were made for each condition in order to take average of all the test result values in accordance to the code specifications. A total of 12 samples were made against each bitumen content. i.e. 12 samples for 4.0% bitumen , 12 for 4.3% bitumen and 12 for 4.6% bitumen. The methodology is represented as follow;



B. Experimental Results

The Results that were obtained from Marshall Stability Test are shown in the tables along with graphical plots. All the result values are the average of the three samples in each case.

STONE DUST		
3% FILLER		
Bitumen Content	Marshall Stability (KN)	Flow (Unit)
4	10.59	9.18
4.3	11.72	10.63
4.6	10.23	11.77

10% BAGASSE ASH MODIFICATION		
3% FILLER		
Bitumen Content	Marshall Stability (KN)	Flow (Unit)
4	12.29	10.23
4.3	14.00	11.80
4.6	13.17	12.72

20% BAGASSE ASH MODIFICATION		
3% FILLER		
Bitumen Content	Marshall Stability (KN)	Flow (Unit)
4	13.82	11.88
4.3	15.71	12.68
4.6	14.33	13.91

100% BAGASSE ASH MODIFICATION		
3% FILLER		
Bitumen Content	Marshall Stability (KN)	Flow (Unit)
4	11.11	16.08
4.3	12.29	17.79
4.6	11.00	18.66

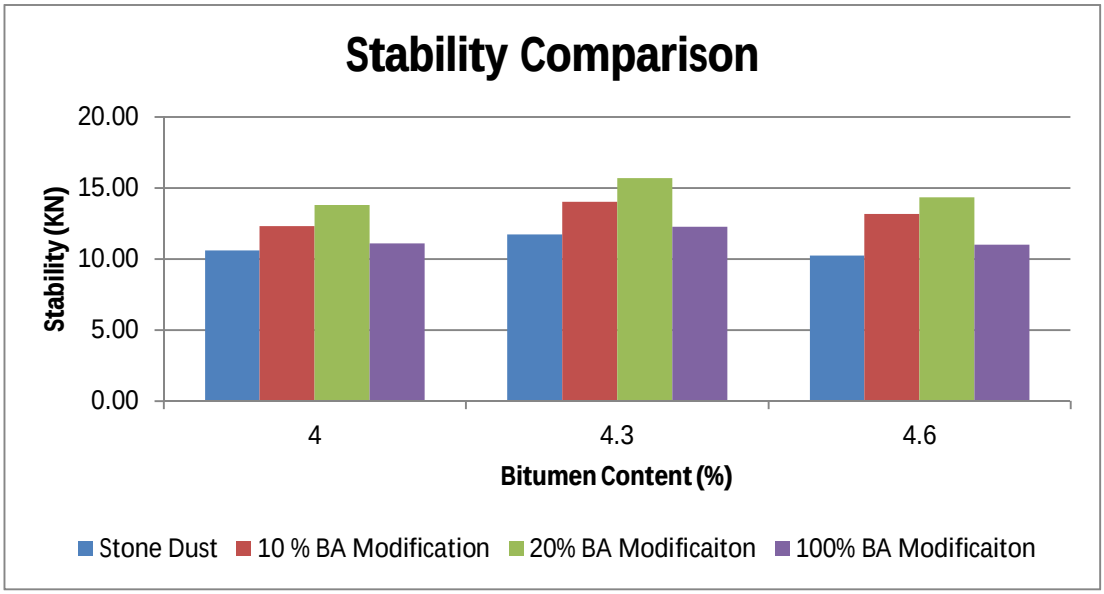


Figure 1: Comparison of Marshall Stability of Different Fillers at Different Bitumen Contents

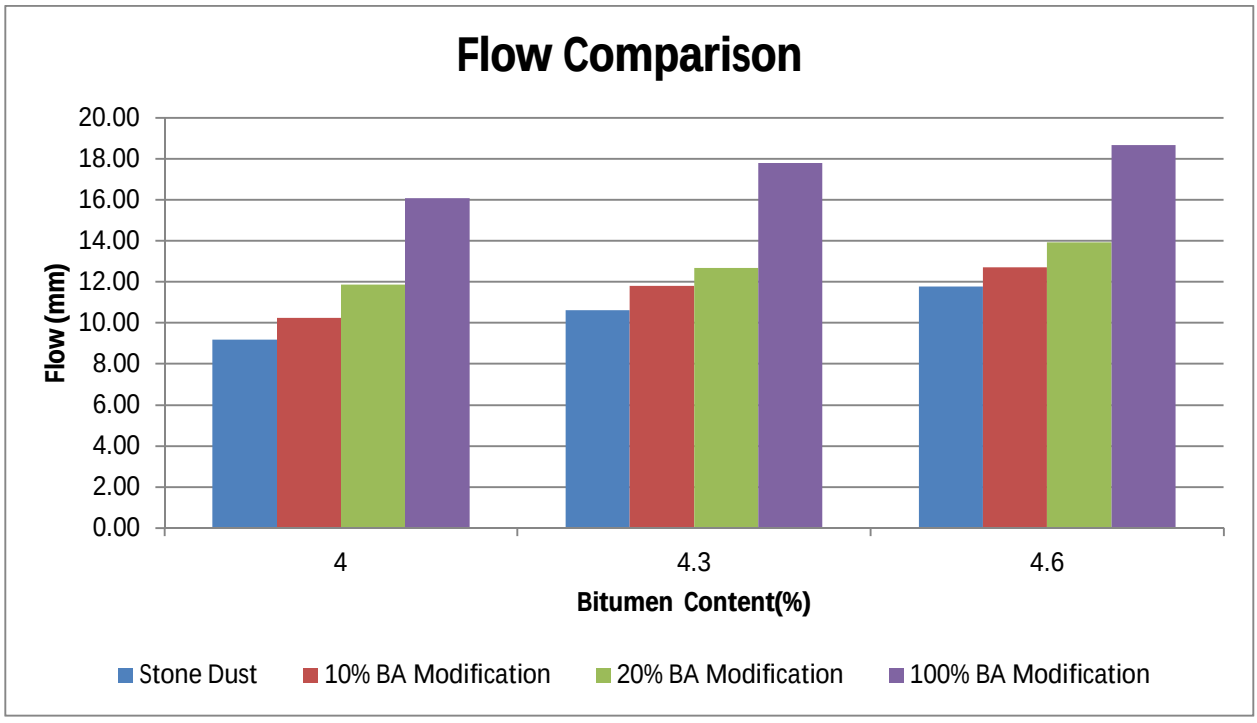


Figure 2: f Marshall Flow of Different Fillers at Different Bitumen Contents

II. CONCLUSION

It is quite evident from the results that the marshal stability of BA modified samples has increased as compared to the conventional stone dust filler. It is also very clear that at the BA replacement of 20%, the stability was maximum at all percentages of bitumen content. Furthermore, the flow of the modified samples is increased especially at the modification of 100% by BA. Thus it shows that inspite of increased flow, the stability of BA modified samples has quite good results.

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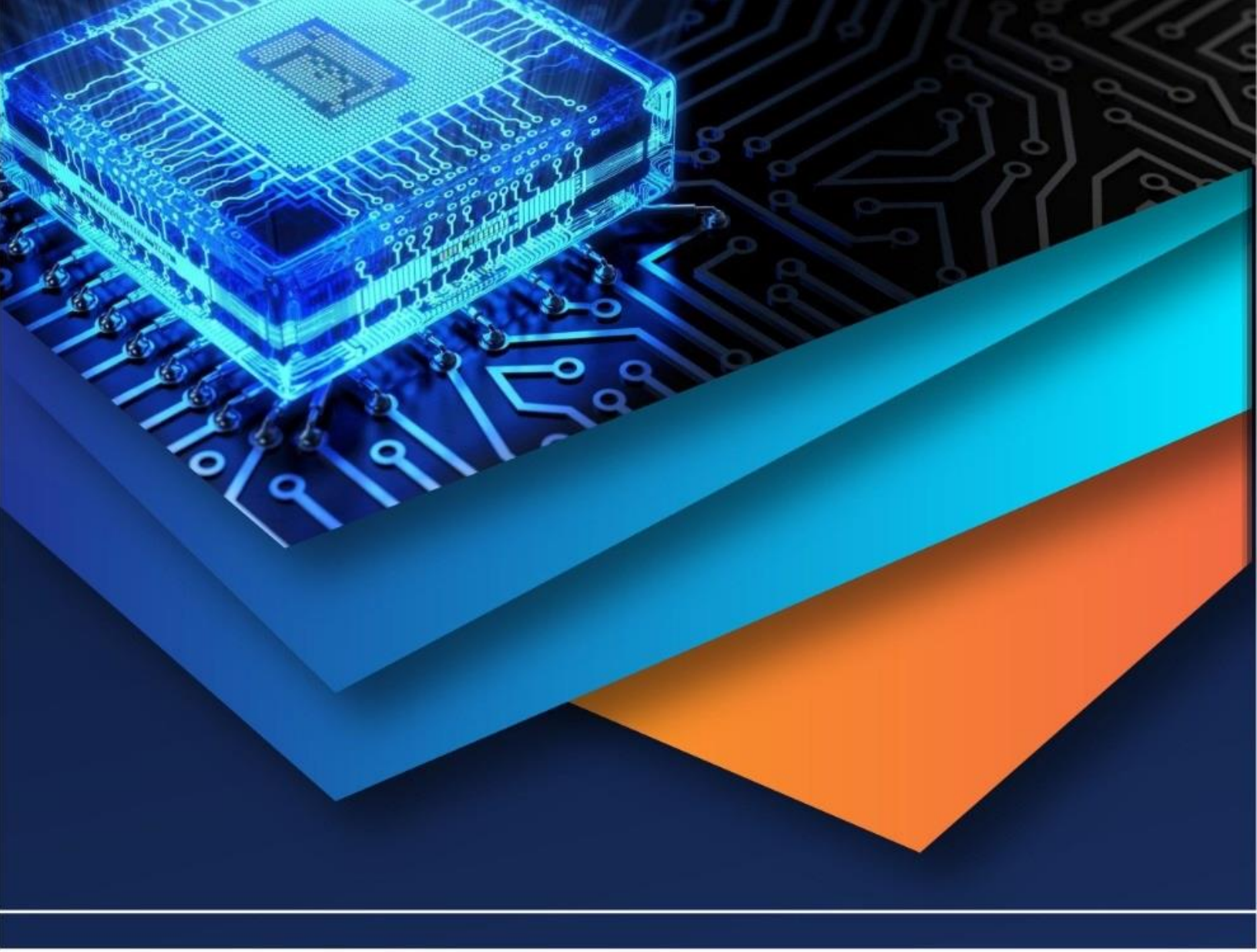

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