

# Performance Evaluation of Bitumen with Waste Materials



S.Sivakumar, T.Suresh, M.Manojkumar, M.Ariramachandran

**Abstract**— This examination researches the appropriateness of waste materials i.e., sawdust and rice husk as a filler materials in bitumen. The waste materials (Rice husk and Saw dust) were tried to decide its appropriateness in the bitumen asphalt. The suggestions are surmised upon the Marshall and volumetric properties. Reuse of waste item is perfect to lessen contamination, since transfer is diminished or dispensed with. In this examination, Rice husk and saw residue waste was ground utilizing a pounding ball to shape a fine powder. It was then sieved in 300µm. At the research center, Rice husk and saw residue were blended in with bitumen to supplant 5%, 10%, and 15% of the all the weight ,while 0% addressed the control test. The Penetration test, Softening Point test, Flash and Fire Point test, Viscosity test, Ductility test and Marshall Stability test were looked into in this examination on the mix degree on bitumen in with rice husk and saw dust. Rice husk and Sawdust were incorporated into bitumen and perfect rate is gotten the chance to improve the presentation of bitumen.

**Keywords :** Sawdust, Rice husk, Asphaltic Concrete.

## I. INTRODUCTION

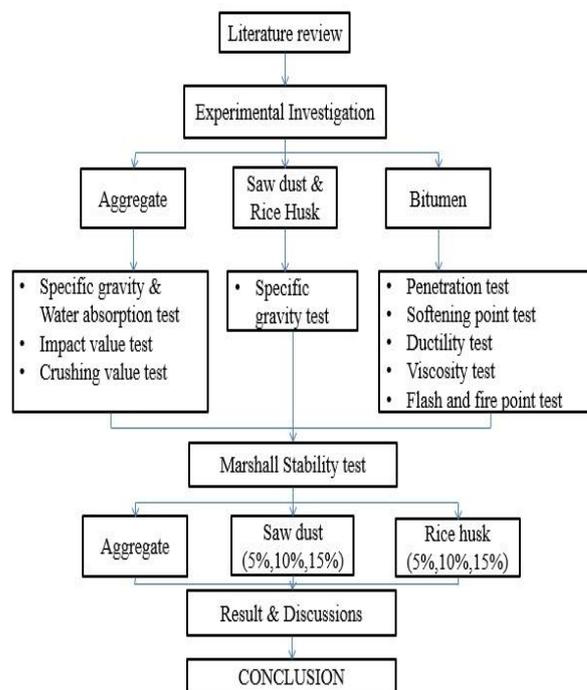
The utilization of changed black-top cement blends in surface bound layers makes an interest for assessment of the exhibition of those altered blends. Black-top alteration is finished by including modifiers in black-top or by including the modifier straightforwardly in the blend of bitumen and total during blending process. The massiveness of utilizing waste materials (sawdust and rice husk) in the difference in dim top hard and fast blend is one of the essential zone of research. In making nations like India, broad proportion of sawdust and rice husk is delivered every year. This gigantic measure of waste makes critical measure of issues as for taking care of and capacity, which are significant both from the monetary just as ecological perspective.

The usage of waste material as a swap for creating hot blend black-top can give a great deal of advantages to the human. Saw residue is a one of the elective that can be

utilized to supplant totals in setting up an adaptable asphalt. Saw residue is made accessible from misuse of saw plant. In creating nations where bounteous saw factory squanders are released, these squanders can be utilized as favorable position of decrease in the expense of development material and furthermore as a mean of transfer of squanders. Materials like saw residue and rice husk is perfect and no pretreatment is required. saw residue are not usually utilized in the business however observed residue were increasingly appropriate as low quality giving light weight total when used to supplant basic coarse total in solid creation. Thusly, saw residue and rice husk can be utilized to supplant common total in the street development of wearing course.

The goal of the examination is to inspect the conduct and execution of bitumen changed with various waste materials like saw residue and rice husk. The properties of the materials were resolved utilizing standard methods. Rice husk and saw residue were included at 5%, 10%, and 15% of the complete weight.

## II. EXPERIMENTAL METHODOLOGY



## III. LITERATURE STUDY

Use of waste materials in the bitumen was done since 2000. Asphaltic strong models were set up with sawdust flotsam and jetsam at 0, 5, 10, 15, 20, and 25 % by weight of the stone filler.



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The outcomes from this examination demonstrated that the physical properties of stone totals which included total squashing esteem, flakiness list, extension file, water ingestion and explicit gravity fulfilled the particulars for street materials. The specific gravity estimation of 2.19 for sawdust flotsam and jetsam showed that the sawdust trash was a light weight material. Along these lines, the sawdust garbage can improve the properties of asphaltic cement. The usage of rice husk has extended the life of asphalt, extended marshall sufficiency regards, increase in exhaustion resistance, great bond among totals and black-top and great strength. This will be a financially savvy technique to accomplish a significant sparing of bitumen just as totals.

A trial study so as to explore the flexural execution of recently created punctured pillar framework is directed. Distinguishing the areas of such apertures in the bar is a significant undertaking just as the fortification around the opening ought to be organized so as to keep from untimely disappointment. The nearness of different openings and the asked fortification around the openings are the fundamental parameters done in this examination. The stream or filling capacity of the solid around the punctures are accomplished by utilizing self compacted concrete.

**IV. MATERIAL PROPERTIES**

*1. Bitumen*

Bitumen is a thermoplastic material and its solidness is dependent upon temperature. As per these judgments, there are four evaluations VG-10, VG-20, VG-30 and VG-40. A few capacity tests like unequivocal gravity, water content, flexibility, adversity on warming were removed from IS: 73-1992 conclusions as these tests don't have any relationship either with the quality or execution of the thing.

*2. Agreggates*

The total utilized in the thick black-top blend comprised of total stones with most extreme size not surpassing 12.5mm. By volume, total by and large records for 92% to 96% of Bituminous concrete and about 70% to 80% of Portland bond concrete.

*3. Saw dust*

Sawdust is the rule section of particleboard. Wood buildup is a sort of particulate issue, or particulates. The compound relationship of Sawdust is Carbon (60.8%), Oxygen (33.8%), Hydrogen (5.2%), Nitrogen (0.9%), Sulfur (0.01%) and Phosphorous (0.005%).

*4. Rice Husk*

Rice husks themselves are a class-A warm securing material since they are difficult to expend and progressively loath to empower soddenness to cause shape or life forms. It is also used as material in the wake of mixing it in with mud and water. The compound association of Rice husk is Carbon (35%), Oxygen (34.3%), Hydrogen (4.5%), Nitrogen (0.25%), Sulfur (0.06%) and Phosphorous (0.008%).

**V. TEST RESULTS**

The accompanying tests were led to decide the material properties as arranged beneath.

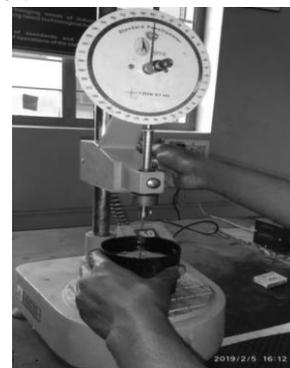
**Table – 1 Material Properties**

Tests Conducted	Values Obtained
Specific gravity of aggregate	2.75
Water Absorption of aggregate	0.50%
Aggregate Impact Value	16.3%
Aggregate Crushing Value	24.4%
Specific gravity of saw dust	1.25
Specific gravity of Rice husk	1.30

**VI. EXPERIMENTAL WORK**

*1. Penetration value*

The passage of a bituminous material is the partition in tenths of a millimeter, which a standard needle would penetrate vertically, into a case of the material under standard conditions of temperature, time and weight. It is assessed using Penetrometer.



**Fig.1 Standard Penetrometer**

**Table 2 Penetration Test for Different Bituminous Mix**

Test	Bitumen	Bitumen Mixed with Sawdust			Bitumen Mixed with Rice husk		
		5%	10%	15%	5%	10%	15%
Penetration test (mm)	43.7	20.4	15.8	10.4	25.6	23.2	14.5

*2. Softening Point of Bitumen*

The standard behind this test is that molding point is the temperature at which the substance achieves a particular degree of progressing under decided condition of the test. This is passed on by ring and ball contraction.



**Fig 2. Ring and Ball Apparatus**

**Table 3 Softening Point Test for Different Bituminous Mix**

Test	Bitumen	Bitumen Mixed with Sawdust			Bitumen Mixed with Rice husk		
		5%	10%	15%	5%	10%	15%
Softening Point (°c)	45.7	47.1	50.05	53.0	46.2	48.4	52.1

**3. Viscosity of Bitumen**

Consistency is the turnaround of straightforwardness. The level of straightforwardness at the application temperature basically impacts the breaking point of bituminous material to spread, go into voids furthermore coat the total and thusly sway the quality and attributes of coming about clearing blends.



**Fig 3 Tar Viscometer**

**Table 4 Viscosity Test for Different Bituminous Mix**

Test	Bitumen	Bitumen Mixed with Sawdust			Bitumen Mixed with Rice husk		
		5%	10%	15%	5%	10%	15%
Viscosity Test (sec)	84	129	145	168	110	121	148

**4. Marshall Stability Test**

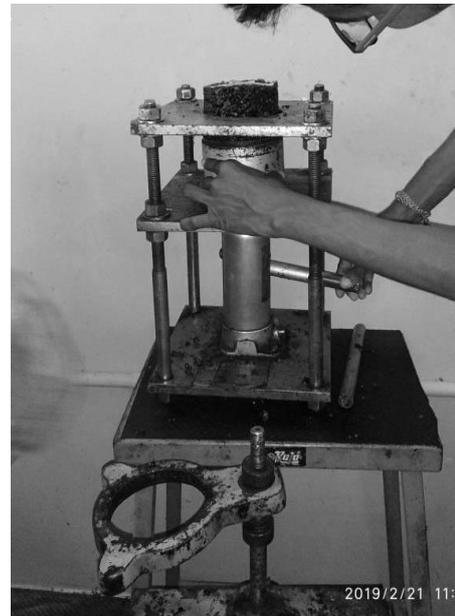
The Marshall Stability and stream test gives the show desire measure to the Marshall mix plan methodology. The security bit of the test appraises the most outrageous weight reinforced by the test model at a stacking pace of 50.8mm/minute. Weight is applied to the model till dissatisfaction, and the most extraordinary weight is allocated a security. During the stacking, a joined dial check gauges the model's plastic stream (deformation) in view of the stacking. The stream worth is recorded in 0.25mm (0.01inch) increases all the while when the best weight is recorded



**Figure 4 Sample Preparation**



**Figure 5 Casting the Mould**



**Figure 6 Sample Extraction**



Figure 7 After Remolding

*Marshall Stability and Flow values:*

Marshall reliability of a test model is the most phenomenal weight required to make dissatisfaction when the model is preheated to a grasped temperature set in a momentous test head and the store is applied at an enduring strain (5 cm for consistently). While the quality test is in progress dial check is utilized to quantify the vertical misshapening of the model. The twisting at the misstep point passed on in units of 0.25 mm is known as the Marshall Flow estimation of the model.

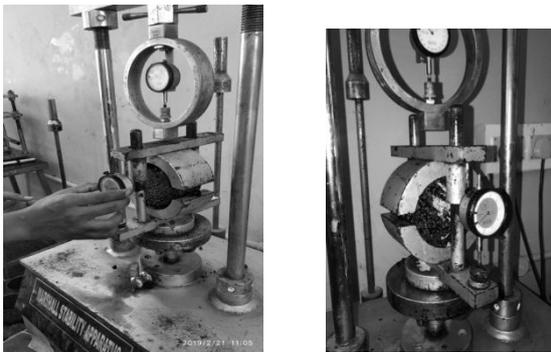


Fig 8 Testing of Samples

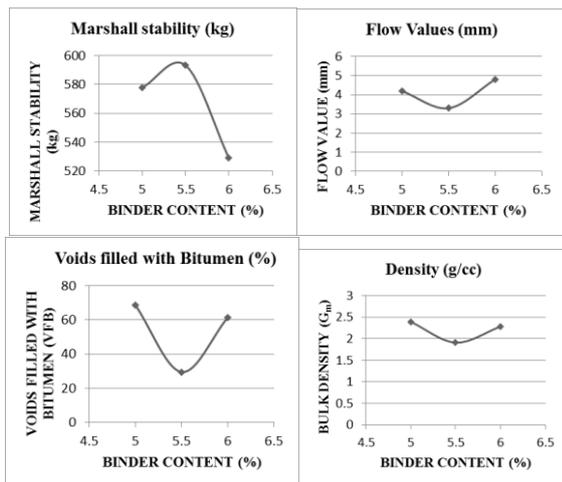


Figure 9 Graphical Representation of the result

**VII. RESULT AND DISCUSSION**

The experimental work has been concluded with the following results:

1. The outcomes from this examination demonstrated that physical qualities of bitumen, which included Penetration, Softening Point, Ductility, Viscosity, Flash and Fire Point and Specific gravity.

2. The penetration test value is 33% reduced as we compare to the ordinary bitumen, but viscosity is rapidly increased around 50% to the addition of Rice husk.

3. Sawdust also reduced the penetration value, but increases the viscosity of the bitumen. Simultaneously when we compare the Marshall Stability value of Sawdust and Rice husk shows that 15% of addition of Rice husk increases the Stability value around 50% increase the value of bitumen 6% adding the Asphaltic concrete.

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