

# Assessment of Coconut Shell Charcoal as Filler in Stone Matrix Asphalt

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**Abstract:** For improvement of pavement of road, the use of asphalt material and its mixture are used so that their durability and performance can be enhanced. For which suitable mixture that has been adopted is SMA Mix which is better than bituminous Concrete or dense graded mix (DGM). It was first implemented in European Countries and North America. In Stone Mix asphalt is the gap-graded mixture consisting of a Stone or Slag as a Coarse aggregate, different binders are used (natural or artificial) as stabilizers and high bitumen Content. For Minimizing the Cost and increasing the efficiency of roads, many different alternatives are used for improvement by using different waste materials as fillers among them Coconut shell charcoal is one of them. In this Research work, the main objective is to compare a results obtained by the using fillers like Stone dust, Portland cement, Fly ash with Coconut Shell charcoal. The Properties that of a Coconut Shell Charcoal possesses are the resistance to crushing, absorption, surface moisture, grading, resistance to freezing, light weight, heating and synthetic resin glues which is a most important for a pavement of roads. Therefore, its Stability and a flow parameters of an Air Void ratio are obtained so that it can be compared with the different types of Fillers. From that we can establish the perfect combination so that it can be useful as the substitute as a filler for an improving the quality and durability of the pavement of some roads. The Binder Content are varied as 4%, 5%, 5.5%, 6%, 7% by weight of aggregates. 0.3% by weight of an aggregate is used as a Optimum Binder Content. Binder of 60/70 penetration grade bitumen is used. For carrying out the experiment, Marshall test method is used for obtaining better results.

**Keywords:** SMA mix, Coconut shell charcoal, Filler, Binder and Marshall test.

## 1. Introduction

Generally, aggregates are a mixed with the bitumen are widely used all over the world for construction & maintenance of the flexible pavements. The close and well-uniform, or a dense graded aggregates mixed with the normal bitumen of generally perform very well in heavily congested roads therefore they are very common in paving industries. Basically to form the dense graded aggregate, it is very difficult to arrange the aggregates of different size which are found in sites. In such a situation, bituminous mix known as the stone matrix asphalt (SMA) consisting of a gap graded aggregates can be used.

## 2. Aim and Objective

*Aim:* To check the suitability of a coconut shell charcoal as a

filler in the Road pavements by comparing the results achieved with the other filler materials such as a Fly Ash, Stone dust, Portland Cement.

*Objectives:*

1. The main Objective is to check the suitability of a Coconut shell charcoal as a filler in SMA mix and then comparing its properties obtained with the different types of a fillers and then study its effect on the different properties of a SMA mix.
2. Study of a different Marshall Properties using different fillers (Stone dust, Portland cement, Fly ash etc.) and then comparing the results with the Coconut shell charcoal as a filler.
3. To find out the optimum binder of a Content using Marshall Method.

## 3. Related work

Mogawer and Stuart (1996), has been studied the effect of mineral fillers on properties of SMA mixtures. They chose a eight mineral fillers on the basis of their performance, gradation etc. They are evaluated the properties of a SMA mixtures in the terms of drain down of the mastic, rutting, low temperature cracking, workability, and moisture susceptibility

Brown and Haddock (1997) has been remarked that, due to the fact of that the strength of a SMA relies mostly on the stone-on-stone aggregate skeleton, steps should be taken as a to design the mix and place it with a strong coarse aggregate of a skeleton that would provide the desired strength and the stability to the mix.

Putman et al. (2004), In this paper followed a Super-pave mix design guide-lines to design the SMA mixes using the PG 76-22 a binder and stabilizers like a waste fiber such as a waste tires as the additives. They were compacted the specimen with the 50 gyrations of a Super-Pave Gyratory of a Compactor as per SC DOT procedures.

Mustafa Karasahin et al. (2006), In this paper used waste marble dust obtained from shaping process of a marble blocks and the lime stone as a filler and the optimum binder content was a determined by Marshall Test and the showed good result.

IS SIEVE	Cumulative %	mean	% retained	4%	5%	5.5%	6%	7%
19	100	100	0	0	0	0	0	0
13.2	90-100	95	5	57.6	57	56.6	56	55.8
9.5	50-75	67.5	32.5	374	370.5	373	369.4	362.8
4.75	20-28	24	38.5	443	438.9	436.5	435.1	434.1
2.36	16-24	70	4	45.8	45.6	45.4	45.1	45.12
1.18	13-21	17	3	34.5	34.2	34	33.7	33.5
0.6	12-18	15	2	23	22.8	22.5	22.2	22.3
0.3	10-12	15	3	34.5	34.2	34	33.7	33.5
0.075	8-12	10	2	23	22.8	22.5	22.4	22.3
Total				1152	1140	1134	1128	1116
Binder Used				48	60	66	72	84

#### 4. Methodology

##### A. Materials used

- Slag – Coarse aggregate
- Stone – Fine aggregate
- Mineral filler – stone dust, Portland cement, fly ash and Coconut shell charcoal.
- Binder – bitumen of penetration grade 60/70
- Stabilizer – Cellulose fibre (0.3% - 0.5%)

*Method Used:* Marshall Stability Mix Design Method.

##### B. Experimental Procedure

*Preparation of mixes:* Samples of a coarse and the fine aggregate are carried out by 13mm Stone matrix. Asphalt composition as specified by IRC: SP-79.

According to the composition, the total weight of each sample is 1200gm.

Two samples each of a 4%, 5%, 5.5%, 6% and 7% bitumen will be a prepared by a respectively and Marshall test will be a carried out to calculate their Stability, flow and VA respectively. The Samples that are going to be a prepared using slag as coarse aggregate and stone as fine aggregate with different fillers are as follows:

1. Stone dust
2. Coconut Shell Charcoal
3. Fly ash

The Samples that are going to be prepared by using Stone as a coarse aggregate and fine aggregate with different fillers are as follows:

1. Portland Cement
2. Stone dust

#### 5. Conclusion

1. In future the maximum stability obtained in case of stone dust as compare to coconut shell charcoal.
2. As the Stability value is more than approximate 8 KN in case of coconut shell charcoal as filler, it can be used as filler in SMA mix for pavement of roads.
3. In case of a coconut shell flow increases with increase in bitumen content in case of all fillers used in the sample.
4. Air voids decreases with increase in bitumen content for all of the fillers used in the sample.
5. From in this experiment, it can be a concluded that coconut shell charcoal can be used as a substitute for a filler as it satisfies all the criteria to be used as a filler.

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