

Investigate On Bituminous Mixes With Different Filler Materials

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Abstract- Fillers play an important role on engineering properties of the bituminous paving mixes. Conventionally, cement, lime and stone dust are used as fillers. In this study, an attempt has been made to assess the effects of different types of fillers (e.g. non-conventional and conventional) on the Marshall properties of bituminous paving mixes. For this purpose, non-conventional fillers such as groundnut shells and silica fume and conventional fillers such as cement and stone dust were used. All of these materials were tested according to the standard test procedure of AASHTO. Test specimens were prepared by using different types of filler having different amount in the mix of 5% to 7.5%. The Marshall properties obtained for both types of fillers reveal that, Nut shells and Silica Fume specimens have been found to exhibit higher stability value compared to cement and stone dust filler specimens. In addition, mixers containing Nut shells and Silica Fume as filler showed maximum stability at 6.5 % bitumen content and the percentage of air voids were found to be decreased with the increase of bitumen content.

This do research has influence of conventional and inexpensive fillers such as walnut shells and silica fumes in bituminous concrete flooring. As a result of this project it has been found that bituminous mixtures containing these unconventional loads produce satisfactory properties

Keywords- Rock dust; Groundnut Shell Ash; Silica Fume; AASHTO.

I. INTRODUCTION

Highway construction activities have taken a big leap in the developing countries since last decade. Construction of highway involves huge outlay of investment. Basically, highway pavements can be categorized into two groups, flexible and rigid. Flexible pavements are those which are surfaced with bituminous (or asphalt) materials. These can be either in the form of pavement surface treatments (such as abituminous surface treatment (BST) generally found on lower volume roads) or, HMA surface courses (generally used on higher volume roads such as the Interstate highway network). These types of pavements are called "flexible" since the total pavement structure "bends" or "deflects" due to traffic loads. A flexible pavement structure is generally composed of

several layers of materials which can accommodate this "flexing". On the other hand, rigid pavements are composed of a PCC surface course. Such pavements are substantially "stiffer" than flexible pavements due to the high modulus of elasticity of the PCC material. Flexible pavements being economical are extensively used as far as possible. A precise engineering design of a flexible pavement may save considerable investment; as well as reliable performance of the in-service highway pavement can be achieved.

In recent years, many countries have experienced an increase in truck tire pressures, axle loads, and traffic volumes. Tire pressure and axle load increases mean that the bituminous layer near the pavement surface is exposed to higher stresses. High density of traffic in terms of commercial vehicles, overloading of trucks and significant variations in daily and seasonal temperature of pavements have been responsible for development of distress symptoms like raveling, undulations, rutting, cracking, bleeding, shoving and potholing of bituminous surfaces. Suitable material combinations and modified bituminous binders have been found to result longer life for wearing courses depending upon the percentage of filler and type of fillers used

II. PROCEDURE FOR PAPER SUBMISSION

Evolution of mix design concepts

During the 1900's, the bituminous tiles technique was first used on extra-urban roads, so that the rapid removal of well powder particles of Macadam water, caused by the rapid growth of cars, will control. In the initial phase, heavy oils second-hand as palliative dust. An eye estimation process has been used, called pouch tests to educated guess the required amount of heavy oil in the blend. From first to last this process, the combine be exploited as a pancake form, and hard-pressed against a brown essay. Depending on the size of the stain on paper, the competence of the quantity. The first formal method of mix design was the Hubbard field method, which be originally developed in bituminous conglomerated sand. Mixtures with huge aggregate cannot be treated in the Hubbard method and this is one of the limitations of this procedure.

III. MATH

Filler	Design Value of optimum Filler content in %	Stability value (kg)	Flow value from graph	%Vv
Cement	5.13	1090.26	4.7	3.0
Lime	5.38	1170.00	3.7	4.7

IV. UNITS

Utilization of bitumen in various construction industries

Highways, airport and other paving	70%
Roof material	20%
Miscellaneous such as waterproofing, pipe coating, and auto undercoating	10%

The distribution shows the importance of bitumen in paving work that is job-engineered construction material. Bitumen is refined to meet specifications for paving purposes is called bitumen cement, abbreviated A.C. At normal temperature it exists as semisolid, with the degree of solidity measured by a penetration test. It is heated until liquefied before being blended with aggregates in paving mixtures. Various tests have been developed for use in the control of the products in the bitumen family.

3.1 RAW MATERIALS

The asphalt mixture is a mixture of aggregates classified continuously from the top, typically less than 25 mm in size, through the fine stucco is less than 0.075 mm. Sufficient bitumen so that the mixture is compacted and water-resistant dissipative and elastic properties will be efficiently added. The asphalt mix design is to conclude the bitumen ratio, filling, fine and coarse aggregates to produce a mixture that is aggregate achievable, strong, durable and economical. The basic materials used are the following:

- Aggregates
- Fly Ash
- Bituminous Binder
- Silica fume
- Ground nut shells

1. Coarse aggregates: Aggregates retained on a 4.75 millimeter sieve called large aggregates. Aggregate crushed aggregate should be angularly free of particles of dust, clay, vegetation and organic materials that provide compression strength and cutting properties and show good closure. In the present study, crushed stone is used as coarse aggregate specific weight 2.75.

2. Fine aggregates: Aggregates of the fine must be cleaned by hollow dust and must be free from clay, mud, vegetation or organic matter. Powders consisting of aggregate stone crusher were harvested by a 4.75 mm sieve sieves local loom shredder and kept at 0.075 millimeters IS. Collapses the gaps of the large aggregates and harden the binder. In this study, the beautiful stone and slag are used as a fine aggregate whose specific weight was found 2.6 and 2.45.

3. Filler: The aggregate passing through a 0.075 mm sieve is called as filler. It fills the voids, hardens the folder and provides permeability. In this study, stone and fly ash used as filler whose specific weight was found to be 2.7-2.3.

V. HELPFUL HINTS

Toughness is the property of a material to easiest impact. Due to moving loads the aggregates are subjected to pounding action or impact and there is possibility of stones breaking into smaller pieces. Therefore a test designed to evaluate the toughness of stones i.e., the resistance of the stones to fracture under repeated impacts may be called Impact test on aggregates. The aggregate Impact test has been standardized by Indian Standard Institution. The aggregate impact test is conducted as per IS-2386 Part IV.

A modified Impact test is also often carried out in the case of soft aggregates to find the wet Impact value after soaking the test sample.

The maximum allowable aggregate Impact value for water bound Macadam; Sub-Base coarse 50% where as cement concrete used in base course is 45%. WBM base course with Bitumen surface in should be 40%. Bituminous Macadam base course should have A.I.V of 35%. All the surface courses should possess an A.I.V below 30%.

Procedure:

- The test sample consists of aggregates passing 12.5 mm sieve and retained on 10mm sieve and dried in an oven for 4 hours at a temperature of 100 OC to 110 OC.

- The aggregates are filled up to about 1/3 full in the cylindrical measure and tamped 25 times with rounded end of the tamping rod.
- The rest of the cylindrical measure is filled by two layers and each layer being tamped 25 times.
- The overflow of aggregates in cylindrical measure is cut off by tamping rod using it has a straight edge.
- Then the entire aggregate sample in a measuring cylinder is weighted nearing to 0.01 gm and taken as W1 gm.
- The aggregates from the cylindrical measure are carefully transferred into the cup which is firmly fixed in position on the base plate of machine. Then it is tamped 25 times.
- The hammer is raised until its lower face is 38 cm above the upper surface of aggregates in the cup and allowed to fall freely on the aggregates. The test sample is subjected to a total of 15 such blows each being delivered at an interval of not less than one second. The crushed aggregate is then removed from the cup and the whole of it is sieved on 2.36 mm sieve until no significant amount passes. The fraction passing the sieve is weighed accurate to 0.1 gm. Repeat the above steps with other fresh sample.
- Let the original weight of the oven dry sample be w1gm and the weight of fraction passing 2.36 mm I.S sieve be W2 gm. Then aggregate Impact value is expressed as the % of fines formed in terms of the total weight of the sample.
- Two tests are done and the average value to the nearest whole number is reported as aggregate impact value.

$$\text{Aggregate Impact Value} = \frac{W2}{W1} \times 100$$

Where,

W1 = original weight of oven dry sample

W2 = weight of aggregate retained on 2.36 mm I.S sieve after the test

Specific Gravity and Water Absorption test:-

The specific gravity of an aggregate is considered to be a measure of strength or quality of the material. Aggregates having low specific gravity are generally weaker than those with high specific gravity. Water absorption also gives an idea on the internal structure of aggregate. Aggregates having more absorption are more porous in nature.

Procedure:

(I) About 2 kg of the aggregate sample is washed thoroughly to remove fines, drained and then placed in the wire basket

and immersed in distilled water at a temperature between 22°C to 32°C with a cover of at least 50 mm of water above the top of the basket. Immediately after immersion the entrapped air is removed from the sample by lifting the basket containing it 25 mm above the base of the tank and allowing it to drop 25 times at the rate of about one drop per second. The basket and the aggregate should remain completely immersed in water for a period of 24 hours.

(II) The basket and the sample are then weighed while suspended in water at a temperature of 22 °C to 32 °C. In case it is necessary to transfer the basket and the sample to a different tank for weighing. They should be jolted 25 times as described above in the new tank to remove air before weighing. This weight is noted while suspended in water W1 gm. The basket and the aggregate are then removed from water and allowed to drain for a few minutes. After which the aggregates are transferred to absorbent clothes. The empty basket is then returned to the tank of water. Jolted 25 times and weight in water W2 gm.

(III) The aggregates placed on the absorbent clothes are surface dried till no further moisture could be removed by this cloth. Then the aggregates are transferred to the second dry cloth spread in a single layer covered and allowed to dry for at least 10 minutes until the aggregates are completely surface dry. 10 to 60 minutes drying may be needed. The aggregates should not be exposed to the atmosphere, direct sunlight or any other source of heat while surface drying. A gentle current of unheated air may be used during the first ten minutes to accelerate the drying of aggregate surface. The surface dried aggregate is then weighed W3 gm. The aggregate is placed in a shallow tray and kept in an oven maintained at a temperature of 110 °C for 24 hours. It is then removed from the oven, cooled in an airtight container and weighed W4 gm.

(IV) Two tests are done and the average value to the nearest whole number is reported as aggregate abrasion value.

$$\text{Specific Gravity} = \frac{W4}{[W4 - (W1 - W2)]}$$

$$\text{Water Absorption} = \frac{[(W3 - W4) \times 100]}{W4}$$

Where,

W1 = Weight of saturated aggregate in water

W2 = Weight of basket in water

W3 = Weight of saturated aggregates in air

W4 = Weight of oven dry aggregates in air

Source of paving bitumen and penetration grade	Min ductility value (in cms)
Assam Petroleum A25	5
A35	10
A45	12
A65, A90 and A200	15
Bitumen from sources other than Assam Petroleum S35	50
S45, S65 and S90	75

VII. CONCLUSION

1. Binder mixtures containing Groundnut Shell Ash as filler shows maximum stability 6.5% Bitumen with an increase trend of 6.5% and then gradually diminishing, apparent density also showed a similar pattern with a satisfactory content value containing 6.5% bitumen.
2. Binder mixtures contain silica fume as filler shown for maximum stability to 6% bitumen content with an upward style up to 6% and consequently decrease the flow value was positive and similar trend was demonstrated. The percentage of openings diminished by increasing bitumen content, so that they contain 6% bitumen suitable results is obtained.
3. Increased bitumen content is required to meet design criteria and habitual tendencies.
4. It is clear from the foregoing that further tests can effectively use Groundnut shell Ash and silica fume as waste generated in the production of bituminous conglomerate Flooring mixes purposes.
5. Further modifications of design blends may involve the use of Groundnut shell and silica Fume as well Filler bituminous flooring partially solve waste disposal.

The main study considered here is to investigate the effect of using Non-Conventional filler on hot asphalt concrete mixture properties where the results can be concluded as the following:

- I. A satisfactory stability is indicated, where using Silica fume filler improve the Marshall Stability values for all mixtures compare to rock dust fillers.
- II. The average value of Marshall Flow is less than resulted from mixtures with rock dust filler

APPENDIX

This is to certify that the dissertation titled "EXPERIMENTAL INVESTIGATION ON BITUMUNIOUS MIXES WITH DIFFERENT FILLER MATERIALS" is a bonafide work done by me, impartial fulfillment of the requirements for the award of the degree M.Tech, in

Transportation Engineering and submitted to the department of Civil Engineering

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