MODIFIED MIX DESIGN FOR LOW NOISE ASPHALT PAVEMENT WITH RECRON FIBER

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Abstract - A pavement structure can be designed either as a flexible pavement or a rigid pavement based on its structural behaviour, with flexible pavements being widely preferred in India due to its advantages over rigid pavements and economy. The present report is utilized to determine the nature and properties of the permeable asphalt pavement with recron fibers. Permeable pavement allows water to pass through them at the same time providing the properties similar to asphalt pavement. Permeable pavements have low strength when compared to the normal pavement. The use of polymer fibers will increase the properties of permeable asphalt pavement. In this project we conducted marshall stability test

Key Words: Rigid pavement, Flexible pavement, Recron fiber, Asphalt pavement, Marshall stability

1. INTRODUCTION

Low noise asphalt pavements are cost efficient and cost effective alternative for road traffic noise mitigation comparing with noise barriers, façade insulation and other known noise mitigation measures. However, design of low noise asphalt mixtures strongly depends on climate and traffic peculiarities of different regions. Severe climate regions face problems related with short durability of low noise asphalt mixtures in terms of considerable negative impact of harsh climate conditions (frost-thaw, large temperature fluctuations, hydrological behavior, etc.) and traffic (traffic loads, traffic volumes, studded tires, etc.). Thus there is a need to find balance between mechanical and acoustical durability as well as to ensure adequate pavement skid resistance for road safety purposes. Porous asphalt is designed so that after laying and compacting, they form a surface with a void's more than 20 percent. They are used in wearing courses and always laid on impervious base course, was promising and effective in enhancing traffic safety. The use of porous asphalt also to reduce noise and glare with proper installation and maintenance, porous paving allows for infiltration of up to 80 percent of annual runoff volume.

2. METHODOLOGY

The first step in the mix design process is to select materials suitable for open grade friction coarse (OGFC). Materials needed for open grade friction coarse include aggregates, asphalt binders, and additives (such as fiber). Guidance for suitable aggregates is essentially based on similar recommendations for stone matrix asphalt (SMA). The coarse aggregate for open grade friction coarse must be adequately strong to carry the traffic loads because, similar to stone matrix asphalt, open grade friction coarse is designed to have stone-on-stone contact.

2.1 Tests on Aggregate

The basic properties of aggregates are determined by the following tests.

(i) Los Angeles Abrasion Test
(ii) Aggregate Impact Test
(iii) Specific Gravity
(iv) Water Absorption Test
(v) Shape Test

3. EXPERIMENTAL STUDY

3.1 Marshall Test

Marshall Test is basically an unconfined compression test where load is applied to a cylindrical specimen of bituminous mix and the sample is monitored till its failure. The resistance to plastic deformation of the cylindrical specimen of bituminous mixture is measured when loaded at the periphery at 5 cm per minute. Stability and flow, together with density, voids and percentage of voids filled with binder are determined at varying fiber contents to obtain an optimum fiber content for stability, durability, flexibility, fatigue resistance, etc

Selection of mid specification of aggregate gradation after that the aggregate is first sieved, washed, and dried to a constant weight at 110ºC. Coarse and fine aggregates are combined with mineral filler to meet the gradation; the combined aggregate is then heated to a temperature of (160ºC) before mixing with asphalt cement. The asphalt cement is heated to a temperature of (150ºC) to produce a kinematic viscosity of (170±20) centistokes. Then, asphalt cement is added to the heated aggregate to achieve the desired amount, and mixed thoroughly by hand using a spatula for two minutes until all aggregate particles are coated with asphalt cement. According to (ASTM D1559), this method includes preparation a cylindrical specimen of

4 inches (102 mm) in diameter and 2.5 ±0.05 inches (63.5 mm) in height. The temperature of mixture immediately prior to compaction temperature is (150ºC). The mould assembly is placed on the compaction pedestal and 50 blows on the top and the bottom of specimen are applied with specified compaction hammer of 4.535 kg sliding weight, and a free fall in 18 inches (457.2 mm). The specimen in mould is left to cool at room temperature for 24 hours, then it is extracted from the mould using mechanical jack.

4. RESULT AND DISCUSSIONS

Once the design gradation was determined, it was then used to prepare several specimens at various asphalt contents in order to determine the optimum asphalt content. Three asphalt contents were evaluated, 4.0%, 5.0% and 6.0 % asphalt cement. These three were selected based on engineering best practice after consultation with public and private sector experts. The specimens were evaluated based on an air void analysis. The results for each were utilized to determine the optimum asphalt content. The National Asphalt Pavement Association (NAPA, 2003) recommends that the optimum asphalt content for porous asphalt be determined by asphalt content that meets the following requirements: air voids greater than 18 %. The bitumen content of the specimen those shows higher stability value in marshall stability test is taken as optimum asphalt content. So here 5% is taken as optimum asphalt content.

Table -1: Marshall test result

Sl.No.	% Bitumen	Stability
1	4	1.4
2	5	11.6
3	6	7.0

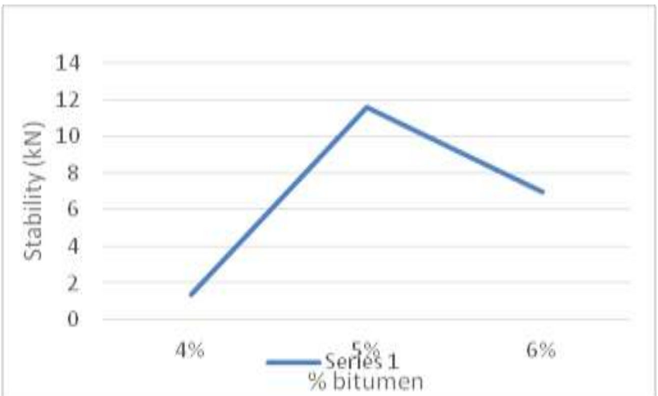

Chart -1: **Stability versus percentage bitumen**

Fig -1: Marshall test specimen

The test result of modified bituminous mix. Inorder to conclude the result a stability versus fiber content graph is drawn. The below graph fig 4.5 shows that the addition of recron fiber has significant effect on asphalt pavement mix. With the increase in the percentage of fiber content added to the mix the stability of the mix increased. Now the stability is much more than that of control mix

Table-2: Marshall test result of modified mix

Sl.No	% Fiber	Stability(kN)	Stability(Kg)
1	0	11.19	1141.25
2	10	12.14	1237.5
3	15	12.41	1265
4	20	12.81	1306.25

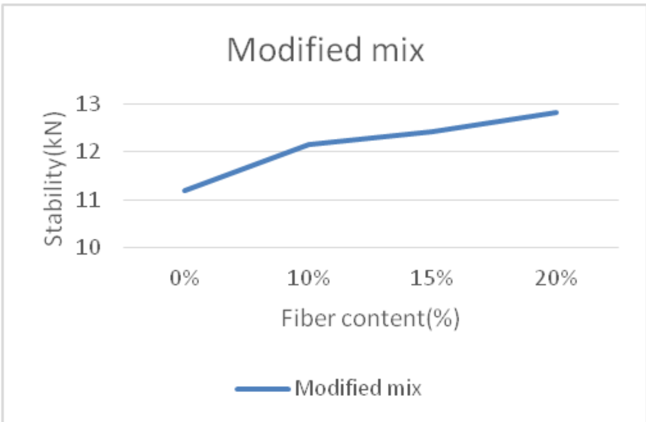

Chart-2: Stability versus fiber content

5. CONCLUSION

Low noise asphalt pavement will help to reduce the traffic noise. It is also a permeable pavement which will help the water to percolate into the ground and helping the environment. The use of fibers makes the pavement more stable ad stronger. This type of pavements is best suited for India. When additional polymer fibers are added to this asphlt pavement, it may provide additional strength, resistance to abrasion, stability and durability to the pavement. Preliminary studies on the use of recron fiber as a blending material with bitumen, suggest that the blends behave similar to Polymer Modified Bitumen, thus having improved properties compared to plain bitumen. It is also observed that this process of blending has limitation. At high percentage of blending the voids are being filled and not permitting the sound and water penetration.

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