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EXPERIMENTAL INVESTIGATION OF PREFABRICATED BITUMINOUS WEARING COURSE

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Abstract - *Due to increase in traffic the demands on the construction and maintenance of roads become complex. At optimum time interval, the construction of wear course should be completed with high quality and durability. In 1970 SBS (styrene-butadiene-styrene) modified bitumen was first introduced by the US. This project's ultimate aim is to reduce the noise attenuation, sturdiness, lastingness which make prefabrication construction simple and easy. This pavement could be a skinny layer that will be rolled and unrolled sort of a carpet. This layer can be laid by the system of heatwaves, which create a fast bonding system and eco-friendly to the surroundings. The tested dimension of one prefabricated unit is 1'x1'x1.2".*
The paper can concentrate on the prefab thought and also the results of the post-test sections.

Key Words: Prefabricated, lastingness, sturdiness, noise attenuation, modified bitumen, SBS.

1. INTRODUCTION

Due to the increase in traffic, the demands on the construction and maintenance of roads become complex. At optimum time interval, the construction of wear course should be completed with high quality and durability.

The attachment of modified bitumen wearing course with the base course can be done by a base bonding polymer layer which is good adhesive when softened. The society of Dura Vermeer Infrastructure (Road-Contractor) and INTRON (Consultancy in material engineering) was developed a prefabricated road in 2005.

Those units might be laid and replaced quickly so that the delays for road users is minimized. The foremost vital role is that internal control has already been administered on the assembly site. As a result, no failures should show up at the ultimate design. A bonding layer is usually modified using less costly polymers like Styrene Butadiene-Styrene (SBS) and Atactic Polypropylene (APP) which were used in small quantities. The thickness of a base sheet ranges from 20mm to 30mm. The properties and dimensions of the unit are often modified supported performance, like noise attenuation, slipperiness, and sturdiness. The bituminous membrane is modified with SBS polymer. SBS first holds up the wearing course which is vital in the process of rolling and unrolling. Secondly, it functions as a bonding layer. This layer is often bonded and unbonded to the prevailing underlying layer very quickly and simply by heatwaves.
This paper describes the producing method and the results of the material under supervision.

2. MANUFACTURING PROCESS

This process is begun after the basic test done for aggregates and bitumen concerning changes due to polymers that were used. The mix was designed using volumetric procedures. To find the optimum point of mix proportion, various mix design was made. Based on the flawless texture, thickness, air void, absorption measurement was taken on the laboratory to find the optimum mix proportion. Coarse aggregate with a maximum size of 6 mm is used so that, optimum texture with high quality can be obtained. A thickness of 30 mm was chosen.

Fig -1: Precast of the bituminous unit

Fig -2: Bituminous wearing course

The great polymer modified bitumen and a good quality stone will resist raveling in the wearing course. Resistance in permanent deformation will increase when stone-to-stone contact and optimum polymer content is high.

3. LAYING PROCESS

A prefabricated wearing course is normally made with various layers of bitumen mix, a strong adhesive layer (polymer sheet), that ensures the bearing capacity of the whole pavement. RS-1 emulsion is used as a bond (tack) coat which creates extra bonding between the layers.

After the bitumen emulsion is softened, the hot mix asphalt is laid on the bond coat. Due to the heat, the water evaporates and the bitumen is melted then layers are bonded irreversibly. Laying maybe also done as patchwork. The unit can be prefab separately or may be cut from a large unit.

Fig -3: Rolled prefabricated wearing course

The laying process is based on the principle of electromagnetic induction field, which is applied on the metal grid on the bond layer. During the process of heating the bond layer, the asphalt layer doesn't get affected. Since this bonding method is a reversible process the prefabricated unit can be removed as soon as possible while the prefabrication unit gets damaged.

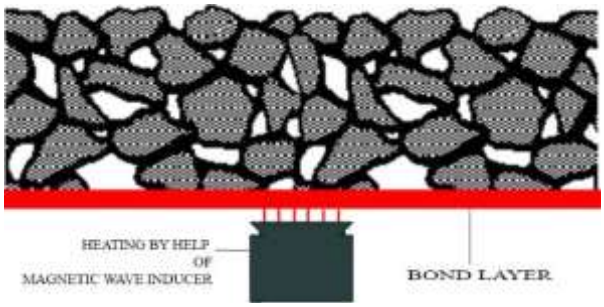

Fig -4: Activation of prefabricated wearing course (Source: http://data.abacus.hr/)

The bond-layer is again heated which weakens the layer and can be rolled again.

Fig -4: Laying of prefabricated wearing course

For patchworks, transportation and operation of the layer are minimum and very simple. But for large-scale purpose transportation is harder and operation needs higher energy.

4. POST-TEST

There are many tests for pavement, but this project considers mainly on two tests.

The first test about changes in density, which shows in the percent which the wearing course sustains for moving load. After laying, on medium traffic rate from 7 to 30 days the wearing course is left, then change in density is calculated. It shows good results up to SBS polymer content 10% of bitumen.

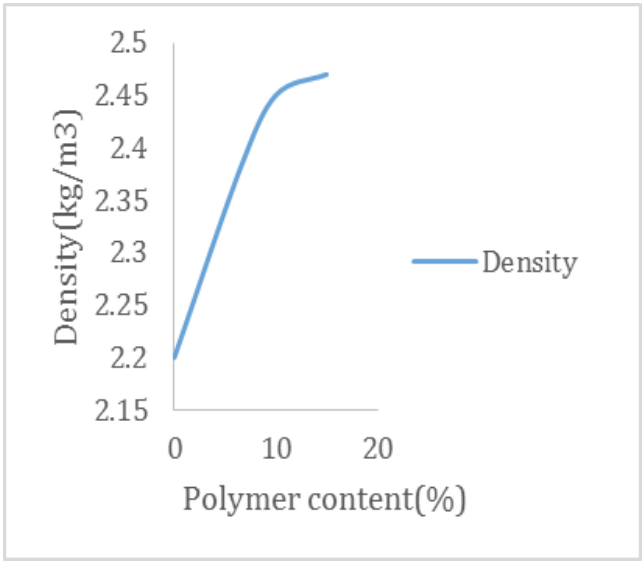

Chart -1: Polymer content (%) vs Density of wearing course (kg/m^3)

The second test is slipperiness, this pavement is designed for slipperiness and it shows good results. Other simple tests give a good result, but the curvature test didn't give a good result. So we're are increasing the polymer and bitumen content.

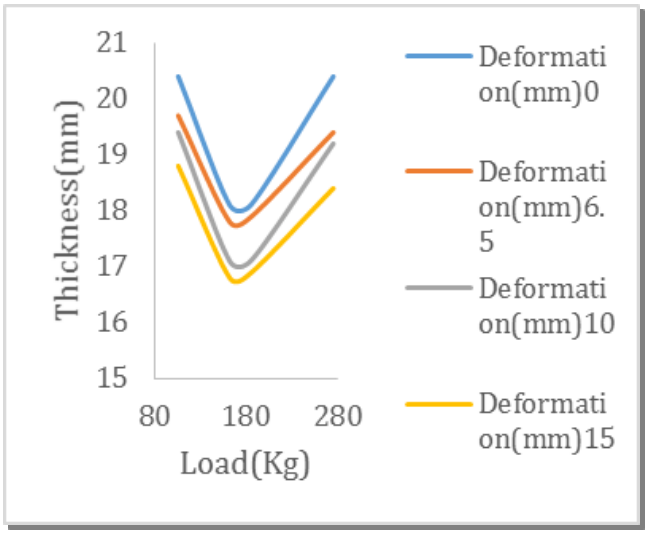

Chart -2: Load (kg) vs Thickness corresponding to polymer content (mm)

With help of chart 2, deflection of wearing course can be obtained.

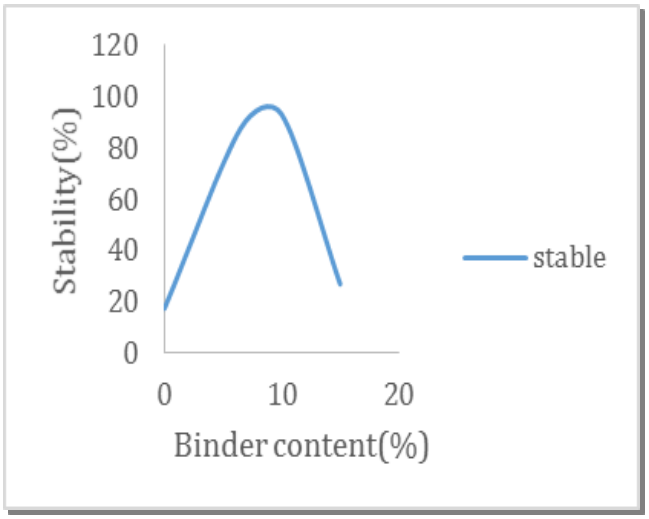

Chart -3: Polymer content vs Stability percentage

Due to the increment of polymer and bitumen, it will increase deflection on the pavement.

5. CONCLUSION

The standard of the prefab is assured while implementing the prefab wearing course on roads. It can be laid in almost all climatic conditions because it is precast at a controlled climate. In future advancement, this prefab can be made weightless and more flexible under standardized specifications.

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REFERENCES

[1] R. Naus & P. Bhairo, J. Voskuilen, J. van Montfort Intron, “Rollpave, a prefabricated asphalt wearing course”, The Netherlands, 2005.

[2] Groenendijk, J., “Evaluatie Proefvakken Rollpave A35 Hengelo en A37 Nieuw-Amsterdam”. Report number RWS/DVS-2009/1, Delft, The Netherlands, 2009.

[3] Houben, L.J.M., Van der Kooij, J., Naus, R.W.M., Bhairo, P.D., “APT Testing of Modular Pavement Structure ‘Rollpave’ and Comparison with conventional asphalt motorway structures”. Minneapolis, USA, 2004.

[4] Liu, K.K.Y., Paroli R.M., and Smith, T.L., Blistering in “SBS Polymer Modified Bituminous Roofs", NRC Construction Technology Update No. 38, 2000.

[5] Griffin and Fricklas, “The Manual of Low-Slope Roof Systems” 3rd ed., McGrawHill, 1995.

[6] Duchesne, C., Lelong, M., and Kersey, T., “Durability of Two-ply SBS Modified Bitumen Roofing Membranes: 10 Year Performance Results," Proceedings of the 4th International Symposium on Roofing Technology, September 1997.

[7] Dupuis, R., Test Program to Determine Membrane Factors on Siplast Products, 1988.

[8] Bhattacharya, P.G. and Pandey, B.B,”Flexural Fatigue Strength of Lime-laterite Soil Mixtures” Transportation Research Record, No 1089, pp. 86-91, 1986.

[9] Brunton, J.M., Brown, S.F., and Pell, PS., "Development to Nottingham Analytical Design Method for Asphalt Pavements, Proc. of 6th Int. Conf. on Struct. Des. of Asph. Pavements, Vol. 1, pp. 366-377, 1987.

[10] Research Scheme, “Use of Rubber and Polymer Modified Bitumen in Bituminous Road Construction”, by Central Road Research Institute, R-54 MORTH, 2000.

[11] IRC:37-2012,”TENTATIVE GUIDELINES FOR THE DESIGN OF FLEXIBLE PAVEMENTS”.