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Comparison of performance of Stone Matrix Asphalt (SMA) using ViaTop pellets and Sisal Fibers

Raghuram K Chinnabhandar[a], A U Ravi Shankar [b], Chethan B A[c] *and* Avinash H T[d]

[a] Research Scholar, NITK, Surathkal, India, raghuramkchinnabhandar@gmail.com
[b] Professor, NITK, Surathkal, India, aurshankar@gmail.com
[c] Research Scholar, NITK, Surathkal, India, chethanba@gmail.com
[d] Research Scholar, NITK, Surathkal, India, avinashmng@gmail.com

***Abstract*— During the last few years, the technology of asphalt materials and mixtures has vastly improved. Especially for surface layers, more durable and rut resistant mixtures have been developed such as gap-graded mixtures like Stone Matrix Asphalt (SMA) which consists of 70-80% of coarse aggregates, 6-7% of binder, 8-12% of filler and 0.3-0.5% of fibre. Since SMA has higher coarse aggregate content, it provides more strength and consequent rutting resistance, and higher binder content improves the durability of asphalt mixtures. The fibres added will help to hold the binder in the mixture during production, transportation and construction processes. The present study investigates the performance of ViaTop pellets, a natural fibre coated with bitumen and Sisal fibre, also a natural fibre. The Optimum Fiber Content (OFC) for mixes produced using ViaTop and Sisal fibres was determined to be 0.3% by weight of the total mixture based on drain down test results. The bitumen used for the present investigation was VG-30 which is used for most applications for Indian climatic conditions. The Optimum Binder Content (OBC) was determined by adding bitumen from 5% to 7% by weight of the total mix in increments of 0.5%. Various tests were conducted such to determine Marshall properties, volumetric properties, Indirect Tensile Strength test, Moisture susceptibility test, rutting tests using Immersion Wheel Tracking Device (IWTD) and fatigue tests. The results indicate that ViaTop pellets can be used in SMA mixtures as a replacement for Sisal fibres.**

***Keywords*— Stone Matrix Asphalt, ViaTop pellets, Sisal fibres, drain down, Optimum Fiber Content**

I. Introduction

One of the main objectives of research in pavement engineering is to improve the quality of pavement materials and pavement itself. This can be achieved either by exploring new materials which can be used in pavements or improving the characteristics of the available materials. In the present study, the latter approach was taken, and an attempt has been made to prepare Stone Matrix Asphalt (SMA) mixture using two natural fibres viz. ViaTop pellets and Sisal fibres.

SMA is a gap graded mixture which was developed in the 1960s to resist the rutting caused by studded tyres. The general idea of SMA is to fracture hard, durable, good quality stones into cubical shape and size consistent with the proposed layer thickness and then glue them together with the right quantity of moisture-resistant, durable mortar in such a way to possess stone-stone contact between the coarse aggregates. It consists of 70% of coarse aggregates which forms an aggregate skeleton, and the stone-stone contact between the aggregate particles renders strength and load-bearing capacity to the mixture. (Sarang, Lekha, Krishna, & Ravi Shankar, 2016).

SMA can be defined as a Hot Mix Asphalt (HMA) prepared with a gap-graded aggregate gradation in order to maximize the asphalt binder content and coarse aggregate fraction ("nchrp_rpt_425.pdf," n.d.).

A study to determine the feasibility of using waste fibres such as those obtained from processing scrap tyres and carpet manufacturing. It was determined that there was no significant difference in permanent deformation or moisture susceptibility in mixes containing the waste fibres compared to cellulose or polyester but the tyre, carpet and polyester fibres exhibited a significant improvement in toughness over cellulose fibres (Putman & Amirkhanian, 2004). Utilization of coconut fibre as a non-conventional fibre in SMA was evaluated and an addition of 0.3% fibre was able to contain the drain down within permissible limits and also vastly increased the Marshall properties of the mix (Panda, Suchismita, & Giri, 2013). Asphalt rubber produced by blending ground tyre rubber and asphalt was evaluated for its potential use in SMA. The tests revealed that asphalt rubber prepared with AC-20 and 30% ground tyre rubber with a maximum size of 0.85 mm was not feasible but SMA mixtures were produced meeting the volumetric requirements with AC-20 mixed with 20% ground tyre rubber with a maximum size of 0.60 mm (Chiu & Lu, 2007). SMA mixes were

*Corresponding author: **Raghuram K Chinnabhandar** raghuramkchinnabhandar@gmail.com

Principal
Jawaharlal Nehru New
College of Engineering (JNNCE)
Shivamogga