ROAD-MAKING USING OIL PALM FIBRE (BIT5)

by: WAN HASAMUDIN WAN HASSAN and ROSNAH MAT SOOM

MAY 2002
183
MPOB TT No. 171

MPOB INFORMATION SERIES ISSN 1511-7871

Oil palm industries generate at least 30 million tonnes of lignocellulosic biomass annually in the form of oil palm trunks (OPT), empty fruit bunches (EFB), oil palm fronds (OPF) and palm pressed fibres (PPF). At present, the biomass is either left to rot in the plantations to provide organic nutrients to the oil palm trees (mulching) or used as solid fuel in the boilers to generate steam and electricity at the mills. An oil palm plantation produces about 55 t ha^{-1} yr^{-1} of total dry matter in the form of fibrous biomass as compared to only about 5.5 t ha^{-1} of palm oil and palm kernel oil. The fibrous biomass is yet to be commercially exploited. Technology development in the industry is still focused on process development and improvement rather than creating and inventing newer products for value-added application. Cellulose, hemicellulose and lignin are the major components of oil palm biomass and structurally formed bundles of strong fibres of certain inherent properties unique to oil palm biomass. The chemical components and nature of oil palm fibres provide various opportunities to efficiently utilize for food and non-food industries through development of indigenous processes and technologies for value-added products. Oil palm biomass may provide a potential alternative source revenue for oil palm industries besides achieving zero wastes target at plantation.

HISTORY OF STONE MASTIC ASPHALT

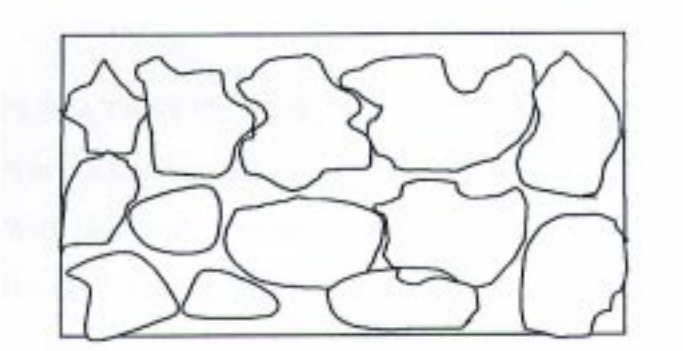
Stone mastic asphalt (SMA), an asphalt paving mixture, originated in Germany in the 1970s to provide maximum resistance to surface deterioration from the studded tyres on European roads. Stradbad, a large German construction company, led to the development of SMA. After the use of studded tyres was no longer allowed, it was found that SMA provided durable pavements which exhibited such high resistance to rutting by heavy truck traffic and proved to be extremely effective in combating wear. Since then, SMA has spread throughout Europe, North America and Asia Pacific. In the United States, Australia, New Zealand, China, South Korea, Taiwan and other major countries in Asia; the use of SMA is increasing in popularity amongst road authorities and the asphalt industry.

COMPOSITION OF SMA

SMA is characterized by its high stone content which forms a gap-graded skeleton-like stone structure. The voids of the structural matrix are filled with a high viscosity bituminous mastic. The high stone content of at least 70% ensures stone-on-stone contact after compaction. The required degree of mastic stiffness is achieved through the addition of crushed sand.

SMA mixes have a bitumen content of minimum 6.5%. The bitumen in the gap-graded mix is stabilized during the mixing process, intermediate storage, transportation, surfacing and compaction through the addition of cellulose fibre stabilizing additive. The content of cellulose fibre is in the range of 0.3%–0.6% by weight of mixture. The most commonly used cellulose fibre stabilizing additive today is supplied as pellets – the fibres are mixed with bitumen creating a palletized form that may be easily handled and added during mixing. Bit5 is developed and formulated based on SMA technology. EFB fibres are used in the preparation of Bit5.

Addition of cellulose fibre does not chemically modify the bitumen, but rather enhances properties change of the finish product by allowing the use of higher bitumen contents. It tends to thicken the bitumen by creating a kind of netting pattern so that it does not run off the aggregate prior to compaction.



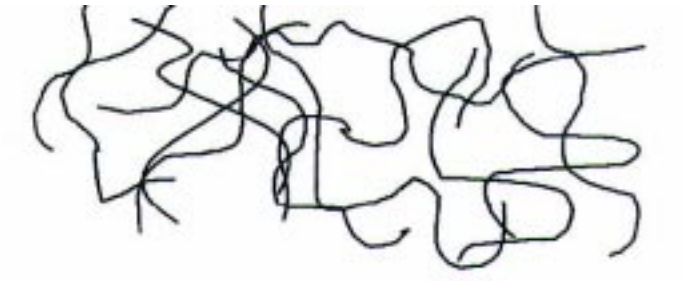
Stone Skeleton

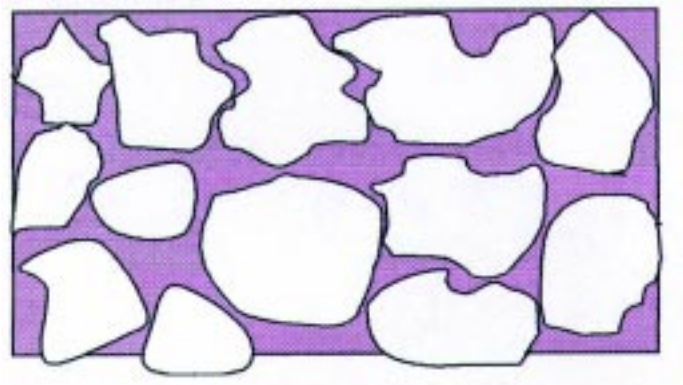
STONES

Filler + Sand + Bitumen

+ MASTIC

\+ CELLULOSE FIBRES





Stone Skeleton filled with Mastic

= STONES MASTIC ASPHALT

Figure 1. Formulation of stone mastic asphalt (SMA).

APPLICATION OF Bit5

SMA is outstanding for use on heavy traffic roads and industrial applications:

- with high lorry frequency;
- intense wheel tracking;
- at traffic lights;
- at intersections;
- on highways;
- on gradients;
- on bridge;
- in bus lane;
- at bus-stops;
- in car parks;
- in harbours;
- on airport runways; and
- on un/loading areas.

COST COMPETETIVENESS

Normally, SMA mixes cost about 20% more to produce than conventional mixes. The present calculation indicates that the cost of polymer modified asphalt is about RM 20 m^{-2} as compared to RM 15 m^{-2} for the conventional one. The cost of polymer resin used in the asphalt formulation is RM 5000 t^{-1}. It is very much more expensive than the cost of EFB fibre which is RM 300-RM 500 t^{-1}. Hence, the Bit5 formulation has great potential for the pavement constructions. Moreover, the use of Bit5 is expected to provide longer service life, thus giving better return on investment than most alternative materials even though the initial costs may be higher. Given that a life span increase of at least five to 10 years can be obtained and that additional advantages covered earlier are gained, it is clear that the choice of Bit5 can be a good investment.

For more information kindly contact:

Director-General
MPOB
P. O. Box 10620
50720 Kuala Lumpur, Malaysia.
Tel: 03-89259155, 89259775,
Homepage: http: //mpob. gov. my
Telefax: 03-89259446