FOAMED BITUMEN STABILISATION TECHNOLOGY IN TANZANIA

ABSTRACT

The foamed bitumen stabilisation technology was introduced in Tanzania under the initiation of NORAD in 1990 when the Same - Himo road (82km) along the T2 trunk road rehabilitation project was being carried as part of the multi donor financed Sixth Highway rehabilitation program of 1980s. The original 6.0m wide old and deteriorated road pavement was constructed in 1968/69 and comprised a cement stabilised base course of variable thickness and a double seal surfacing.

Initial rehabilitation design was based on the Kenyan Road Manual and a pavement structure 'Type 9' utilising crushed stone base course was specified. This design was amended with technical advice from Norwegian Road Research Laboratory-NRRL and a cold bitumen stabilised base course (Norwegian Technology) was introduced as a pilot project with the view of technical and economical benefits for Tanzania.

The technique of foaming bitumen has been known for decades, however manipulations of the methods in which the water is being introduced and homogenised with the bitumen have over the years brought about developments in the stability of the foam and the degree of volume increase of the bitumen. In Tanzania only the Nodest AS Co Ltd (Norwegian) foaming technique was used.

Compared to hot mixed materials reduction of energy costs and the opportunity to use existing pavement layers and generally to accept a poorer quality of aggregate without adverse effects are considered the major cost saving of this technology. Bitumen foaming however require specialised equipment, which may not be widely accessible.

Prior to full scale production, trial sections were constructed to ensure the concept is successfully implemented under the prevailing conditions on the project. Six sections each 100m long were constructed by milling the existing pavement out of which three were stabilised by emulsion and the remaining three with Pen 80/100 foamed bitumen. Two sections for each treatment (foamed bitumen or emulsion) were stabilised to 150mm thickness, of which one had 2% cement added while the third was stabilised to a shallow depth of 7.5mm. The target bitumen content was fixed at 4%

These trials were constructed with the intention of deciding whether bitumen emulsion or foamed bitumen was the preferable option, to Confirm if sufficient initial stability of the bitumen stabilised material and assess whether addition of cement filler was required and also to confirm the practical and operational sides of the milling operation.

Accelerated trafficking was applied around the clock for 18days aimed at assessing early stability of the stabilised layer. Subsequent assessment of the sections and observations during construction showed that all alternative methods gave sufficient initial stability of the base course and that addition of cement filler was not required. No particular operational problems were observed during the milling/mixing, and the construction method gave satisfactory results while mixes made of bitumen emulsion were more sensitive to moisture. Foamed bitumen was therefore the preferred option and an increase of bitumen content from 4.0% to 4.4% was recommended.

Two methods of cold bitumen stabilisation was used in this pilot project; Recycling through milling of the existing pavement materials and in situ mixing/stabilisation with foamed

bitumen (4.4%) and Premixing of materials in a ‘Freefall’ mixing plant, also with foamed bitumen.

When the road was completed in 1992 a long term performance monitoring of program was launched and was concentrated on three identified sections each 100m long and one 1km long section. The result of monitoring over the road’s initial eight years in service and about 40% of the design traffic loading, indicated no structural or functional defects in the pavement. One of the monitored sections had a steady development of surface cracks, while the others have not had this development. The crack development has not had adverse effects on riding quality.

The E-Modulus of the bituminous base course, measured by testing indirect tensile strength of core samples, increased considerably during the first 3 years in service, from 1500MPa to reach a max about 4000MPa but decreased constantly and appears to have levelled out after eight years in service at values just above the design value of 2000MPa. The bituminous binder hardened severely over the years, but no relation to other performance parameters could be seen

The monitoring program was not concluded but indicated for the eight years in service the structural and functional performance of the pavement was acceptable.