Inhibition of Crack Propagation Through Reinforcement of Asphalt Pavements

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Introduction

Reinforcements are widely used and generally accepted to improve the life of an asphalt pavement. As yet general guidelines for the specification and design of reinforced pavements do not exist. In 2006 COST Action 348 was formed to "enhance the processes of material assessment and design for road construction and maintenance using reinforcement in the bound or un-bound layers." Although this collaboration has confirmed the improvements made by introducing reinforcement, gaps in knowledge still limit the use of this technology.

Aims

The aims of this research are to:

- build upon current knowledge of reinforcements
- produce a guide for the pavement engineer to enable accurate design of reinforced asphalt pavements

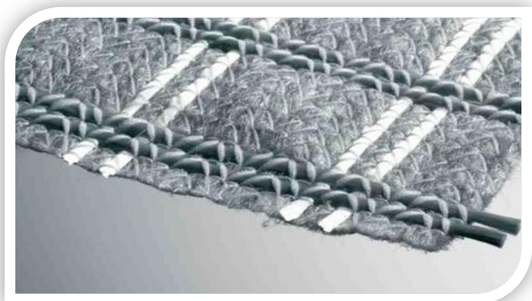
Technology

Reinforcements are classified into five groups as shown below. Products available within each group are widely varying in design and physical properties. Typical reported improvements in the reduction of reflective cracking are around half for a fabric, whereas they could be in the region of ¼ or better for a grid type reinforcement. Many pavement types have been treated with these products but there is no clear picture of which product is best suited to a particular pavement type.

(A)

(B)

(C)



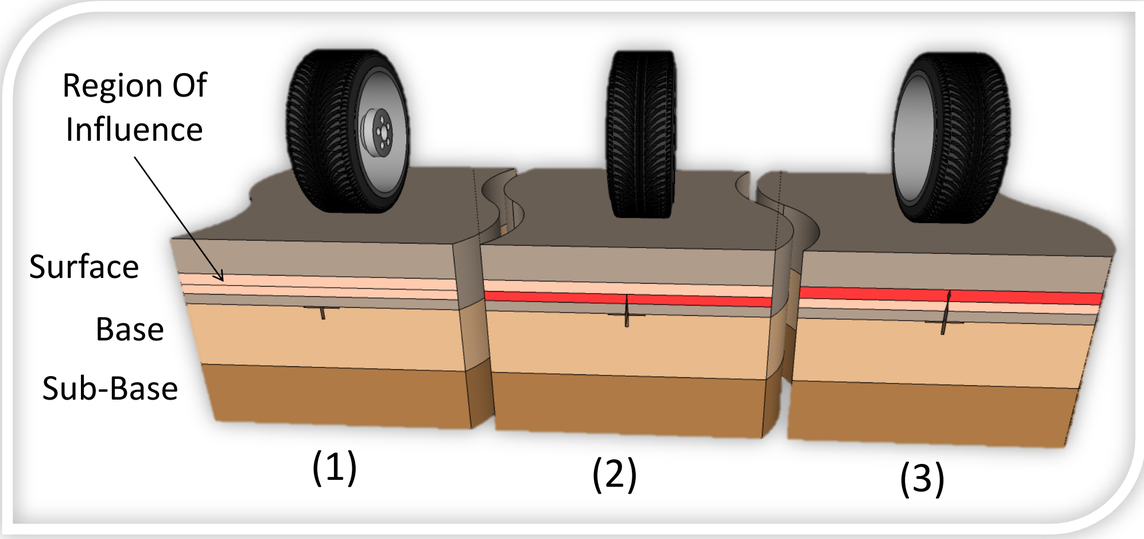
(D)

(E)

(A) Steel meshes
(B) Glass Grids
(C) Polymer Grids
(D) Composites
(E) Non-woven fabrics

Mechanism

Reinforcement creates a permanent strain strain relieving boundary into the pavement system which inhibits the propagation of cracks. Initially this has little effect and cracks initiate as they would in at the bottom of an unreinforced asphalt layer (1).



As the crack enters the region of influence (up to a distance of 40mm either side of the reinforcement as a conservative estimate) of the reinforcement boundary (2) , the elastic behaviour of the reinforcement acts to reduce the plastic deformation in the region between the reinforcement and the crack tip. This effect increases as the distance between the crack tip and the reinforcement reduces. Eventually the crack does propagate through the reinforcement boundary, but the reinforcement stays generally intact. Thus the reinforcement continues to reduce the propagation of the crack as it continues to progress beyond the reinforcement boundary (3).

Method

Testing of various reinforcement products and asphalt mix designs will be carried out as follows:

- Tensile Stiffness testing of reinforcement material using UTM.
- Thermal cracking resistance using the Overlay Tester.
- Resistance to cracking due to bending using the Four Point Bending Machine.

Models will also be developed to describe the mechanisms involved in the reduction of crack propagation and the results will be used to further develop existing OLCRACK and THERMCR modelling software.

Contact

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