"GREEN" OVERLAYS. A NEW, ENVIRONMENTALLY FRIENDLY METHOD FOR THE STRUCTURAL REPAIR OF DAMAGED CONCRETE PAVEMENTS

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ABSTRACT

A Pavement Repair System (PRS) has been developed at Coventry University offering a pioneering approach to road rehabilitation.

A bonded polymer modified and fibre reinforced overlay with the superior mechanical properties of concrete to sustain high strength and the special workability of asphalt to facilitate fast construction by asphalt paving machinery has been developed.

The utilization of the residual structural potential of the existing worn pavement makes it more sustainable in both environmental and economic terms as an alternative to the wholesale reconstruction of the existing structural concrete pavement.

A unique concrete mix was designed and optimized by a new, specially developed method described elsewhere, offering superior mechanical properties and practical construction solutions for fast repairing techniques. The problems associated with achieving structurally effective bonded concrete overlays, such as reflective cracking due to flexural failure, shear failure and delamination were examined in detail by a large number of rigorously conducted laboratory experiments and an appropriate number of numerical models.

Essentially, a series of tests were carried out on Polymer Modified Concrete beams with 1%, 1.5% and 2% by volume of steel fibres to evaluate its impact on the shear, tensile-splitting, flexural and compressive strength levels. The same PMC was experimentally tested at early ages and proved to have very high strength at an early stage. This can minimise the duration of traffic control and be beneficial for both highways authorities and road users.

A corresponding number of numerical models were developed at the same time depicting successfully the laboratory tests and results. These models were used for the appropriate parametric and sensitivity studies and provided the necessary confidence and experience regarding the various modes and mechanisms of failure. Essentially, the finite element models depicted successfully cracks developing due to predominant shear and/or flexural stresses, their propagation through the 'old' concrete pavement and finally their 'reflection' through the new overlay. They also depicted the delamination process, clearly showing the separation of the two materials.

The development of the material and the improvement of its structural performance will hopefully permit pavement engineers to further exploit its advantages such as economy, convenience and long, maintenance free life that PRS could offer.

Keywords: concrete, cracks, shear, flexure, delamination/deboning, finite element analysis.

Suggested (new) Theme: Experimental & Laboratory Simulation