Geophysical Research Abstracts
Vol. 20, EGU2018-7118, 2018
EGU General Assembly 2018

Assessment of a cold in-place recycled pavement through non-destructive geophysical surveying

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The present study aims to demonstrate the reliability of the well-established Ground Penetrating Radar (GPR) system in the framework of a structural assessment of a severely damaged heavily trafficked asphalt pavement that has been rehabilitated and reinforced based on deep cold in-place recycling (CIR) technology with Foamed Asphalt (FA) as a stabilizer. From a sustainable perspective, the foamed asphalt layer constitutes a low-energy mix, above which hot mix asphalt (HMA) overlay exists. The severe distresses of the old pavement section as well as the construction of the new layers raised the complexities and the challenges of the structural assessment of the pavement section under investigation. Thus, a Long-Term Pavement Performance (LTPP) site was developed and monitored by the research team of the Laboratory of Pavement Engineering of the National Technical University of Athens (NTUA).

Upon assessing the bearing capacity of pavement layers, a site experiment was conducted using mainly non-destructive methods, such as the Falling Weight Deflectometer (FWD), that simulates vehicle loading and generates deflections required as input for the back-analysis procedures for the estimation of the material moduli. Another crucial factor for the accuracy of back-analysis is the knowledge of the pavement layer thicknesses. The most common method for that is to obtain cores from the pavement body, however intensive coring is often not possible as it is a destructive process and it cannot provide reliable layer thicknesses in relative deep and/or brittle pavement structures. As such, in that type of rehabilitated structure, core extraction may probably lead to ambiguous information and subsequently at non-reliable back-calculated moduli. On the contrary, the integration of non-destructive geophysical methods for layer thickness determination, such as the GPR system was proved to be a suitable and very promising alternative, as GPR can effectively accommodate several complex pavements structures serving monitoring and analysis purposes.

The innovation of the present research lies on the integration of existing equipment (FWD, GPR) for the development of a methodological framework analysis of deep CIR pavements based on extended geophysical site surveying. Via this technique, it became feasible to investigate the impact of the variable thickness of the layer which has been induced underneath the recycled layer during the construction of the upper layers. According to the analysis results it can be concluded, that the remaining layer thickness underneath the recycled layer, plays an important role on the accuracy of the back-analysis results. Thus, in this case study, geosciences applications seem to offer a unique possibility in efficiently dealing with a practical pavement engineering problem where other traditional methods would probably fail.