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GI2.5 Data fusion, integration, correlation and advances of non-destructive testing methods and numerical developments for engineering and geosciences applications

Incorporation of GPR data into characterization of the bitumen filled cracks in pavements: Lab and numerical study

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COST CA15202 SARCOS
SELF-HEALING AS PREVENTIVE REPAIR OF CONCRETE STRUCTURES

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1. Abstract & Introduction

Road pavements are subject to a range of problems due to traffic and temperature variations producing cracks that propagate to the pavement surface. Cracks need to be assessed to avoid deterioration and provide confidence in the functioning of the road system. Cracks are usually maintained after visual inspection by filling with bitumen as a first rehabilitation technique to avoid further deterioration and absorbing water leakages. Although this temporary solution does not extend the pavement life cycle it can help to avoid additional problems occurring within the pavement. This work is proposed to aid the development of understanding and characterization of cracks filled with bitumen in both rigid and asphalt pavements.

2. Methodology

This study reports on the results of several laboratory experiments that were performed to explore the capability of Ground Penetrating Radar (GPR) in the assessment of bitumen-filled cracks in both rigid and asphalt pavements, respectively. These tests were focused on the analysis of cracking filled with bitumen using a GPR system equipped with a ground-coupled antenna with a 2.3 GHz central frequency, and varying the antenna orientation with respect to the crack axis. Objectives:

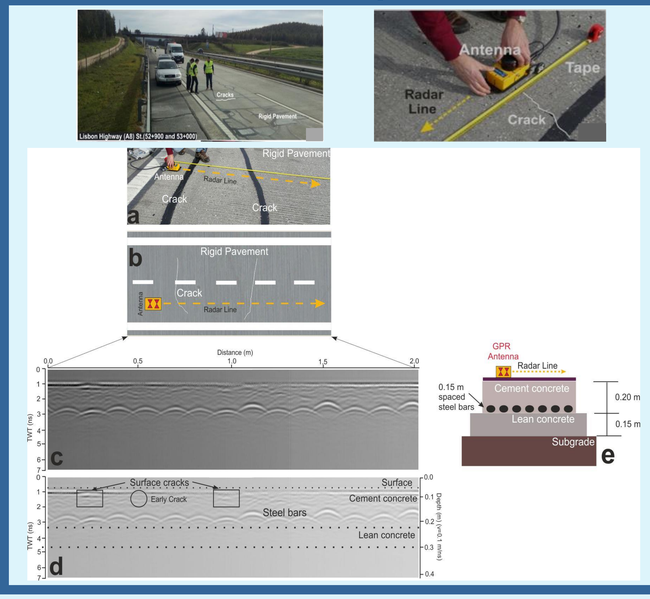
1. The identification of cracks by using GPR.
2. Characterization of Cracks filled with bitumen.
3. Using new methodologies and numerical modelling to validate results from Lab and Field.

3. Results

Results showed the variation in characterization and changes in amplitude that could be expected. when analysing bitumen-filled cracks in concrete and asphalt specimens, dependent upon the antenna orientation being used; GPR B-scans were compared to images from computational models using a Finite-Difference Time-Domain (FDTD) method-based software package (gprMax2D). Additionally, a field survey carried out provided images consistent with the comparable conditions of the lab tests. The results of this work proved the capability of the GPR method to detect and characterize cracks filled with bitumen in pavements across a range of crack dimensions and pavement types.

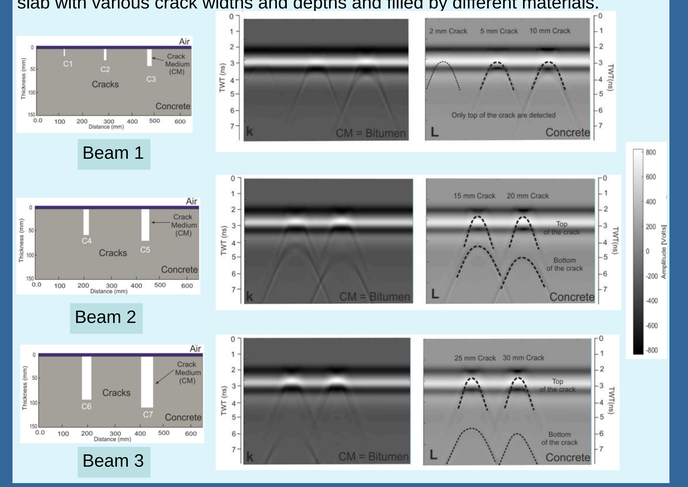
3.1 Lab Data

3.2 Case study Data



3.3 Numerical simulation

A numerical simulation Finite-Difference Time-Domain (FDTD) method is a useful tool in modelling electromagnetic waves and GPR applications to validate laboratory and field results. In this case, the objective of this modelling is to confirm and validate the results obtained in the laboratory testing of a concrete slab with various crack widths and depths and filled by different materials.



Author's Comments ;

This Poster is a part of a case study done in my PhD Thesis and still ongoing to achieve the objectives of the thesis, which is related to the part of the pavement inspection, detect cracks, filled cracks and interlayers.