

CASE STUDY

National Concrete Programme Trial (Highways England, 2019-2020)



The Challenge

Rigid construction (i.e. with either exposed concrete surfaces or with less than 50mm of asphalt surfacing) makes up around 4% of the Strategic Road Network (SRN) pavement asset. The great majority of this length comprises jointed concrete.

The nature of the behaviour of these pavements as they deteriorate is such there is a real and demonstrable risk of sudden, catastrophic failures which, while infrequent, have an extreme impact on road user safety and network availability.

Non-destructive methods that are able to identify those lengths which are most at risk and provide early-warning was of huge interest for network management.



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Our Approach

We carried out Ground Penetrating Radar (GPR) non-destructive traffic-speed surveys utilising an antenna array (so-called 3D-GPR), with the subsequent data analysis. This approach resulted in a safer way to collect data with respect to standard techniques and, at the same time, a quicker and cheaper way to obtain a higher number of key information and in general more detailed data that cannot otherwise be obtained from the standard suite of techniques.

GPR surveys allowed us to provide:

- Structural analysis of the sites, providing 3D information about interface depths;
- Voiding analysis (analysing and mapping variations in the amplitude of the signal reflected from the interfaces between materials), to identify the areas with high risk of failure due to voids within the materials;
- Moisture analysis (looking at the differential signal attenuation between higher and lower frequencies), to identify the areas where the materials have an increased moisture content;
- Dowel depths along transverse joints.

The Results

With this non-invasive approach we demonstrated that it is possible to obtain key information on the status of rigid pavements, allowing to promptly act to solve possible critical situation that could lead to catastrophic failures.

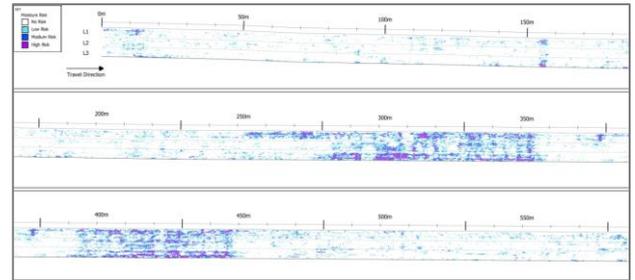


Figure 1: Example of risk-based heat map relative to moisture amount

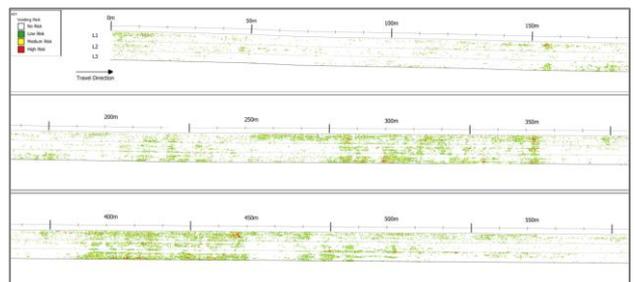


Figure 2: Example of risk-based heat map relative to voiding

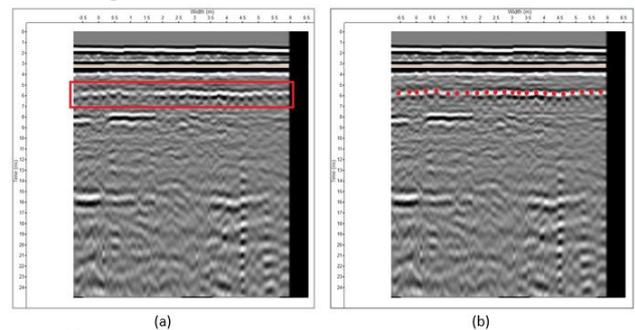


Figure 3: Example of dowels on a transverse joint, (a) highlighted by the red square and (b) identified singularly by the red dots.

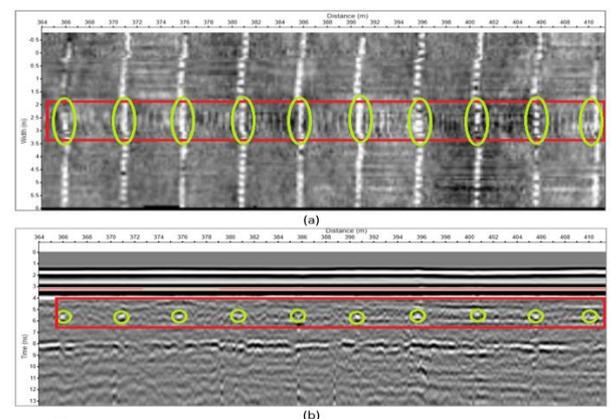


Figure 4: Example of dowels on longitudinal joints from above (a) and in a longitudinal profiles (b); in both figures, the dowels are highlighted by the red square while the green circles highlight the transverse joints.