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Study of a rehabilitated road using GPR and FWD

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This work focus on the structural evaluation of a rehabilitated road after the conclusion of the first phase of the improvement works. The activities developed in the study comprised the characterization of the pavement layers condition (before the application of the asphalt surface layer) and the prediction of the pavement bearing capacity (taking into account the contribution of the wearing course, to be placed in accordance with the project specifications). For this study two non-destructive tests (NDT) were combined: Falling Weight Deflectometer (FWD) and Ground Penetrating Radar (GPR).

The original pavement was essentially composed by a granular layer treated with a bituminous emulsion. The main objectives of the rehabilitation works were the enlargement of the road platform in selected locations, with the construction of a new pavement, and also the reinforcement of the existing pavement to increase its bearing capacity.

The FWD tests were performed to assess the bearing capacity of the pavement and were conducted along the outer wheel path, in both directions. The spacing between measurement points was 75 m and the applied impulse load was 50 kN. The results showed a great variability of the deflections measured along the section under study. A preliminary zonation of the pavement was carried out, and was latter adjusted based on the results of the GPR.

To determine the thickness of the pavement layers a GPR survey was carried out using a 1.8 GHz antenna and a radar control unit SIR-20, both from GSSI. The GPR tests were performed continuously along the same line as the FWD tests. The GPR tests allowed for the identification of the different structures of the pavement, corresponding to the zones with the new pavement and the existing pavement with reinforcement.

Some cores were extracted to calibrate the thickness of the GPR bituminous layers, to verify the conditions of adhesion between layers and also to perform laboratory tests to characterize the bituminous mixtures. Test pits were also carried out to calibrate the GPR thickness for the granular layers.

It was concluded that the areas with higher deflections coincided with the new pavement areas. The GPR results showed that in the existing reinforced pavement zones the total thickness of the reinforcement layers were higher than design values. On the other hand, for the new pavement zones, it was observed lower thicknesses for the base and sub-base layers and also for the binder layer, in comparison with the design values. The results of the laboratory tests carried out on samples of the bituminous mixtures showed that, in general, those mixtures had percentages of bitumen and porosities above the expected values.

Based on the tests carried out, pavement response models were established and their predictable load capacity was estimated.

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