

A framework to improve pavements design applied to portuguese conditions

Summary

Comparing different design methods to identify the most efficient pavement design approach has always been an important challenge for the road agencies. Current pavement design method used in Portugal is mostly based on SHELL pavement design approach. This thesis aims to study and develop a framework for the consideration of a possible adoption of Mechanistic-Empirical Pavement Design Guide (ME Design), developed by AASHTO, for Portugal roads considering Portuguese conditions. One of the main tasks in this study is to have a damage comparison between both methods. For this purpose, the performance criteria used in ME method were justified based on Portuguese conditions and experience. Three main factors – service temperature, moisture content and traffic – were also reviewed in both methods of ME and SHELL and the values were adjusted to have the similar background for both approaches. The results of damage comparison for three selected Portuguese roads indicated that they were substantially different for the two methodologies. The AC bottom-up fatigue cracking was the main performance criterion for SHELL method while the total rutting was the one for ME method.

The results also showed that SHELL method was more conservative. The damage results were then verified by a sensitivity analysis of obtained distresses to design inputs' variations for ME Design. For this task, the results of 750 ME sensitivity analysis projects for the three selected roads with several design inputs (continuous and categorical inputs) were extracted and the tornado diagrams, normalized sensitivity index (NSI) values, and the input/output diagrams were prepared and analyzed. As result, the thickness of different layers, resilient modulus of subgrade layer and AADTT are seen as the most influential inputs in this study. Finally, it can be said that ME Design methodology has a great potential to be used as one of the most reliable approaches to design pavements in the Portuguese technology context, despite the type of a very specific data treatment needed, once it allows a certain extent of simplification.

Keywords

Road pavement, mechanistic empirical pavement design guide, shell method, performance criteria, sensitivity analysis, portuguese conditions.



PhD student

Bahareh Tavallaee

PhD program

Transportation Systems (IST, University of Lisbon)

Supervisor

Luís Picado Santos (CERIS, IST, University of Lisbon)

Co-supervisor

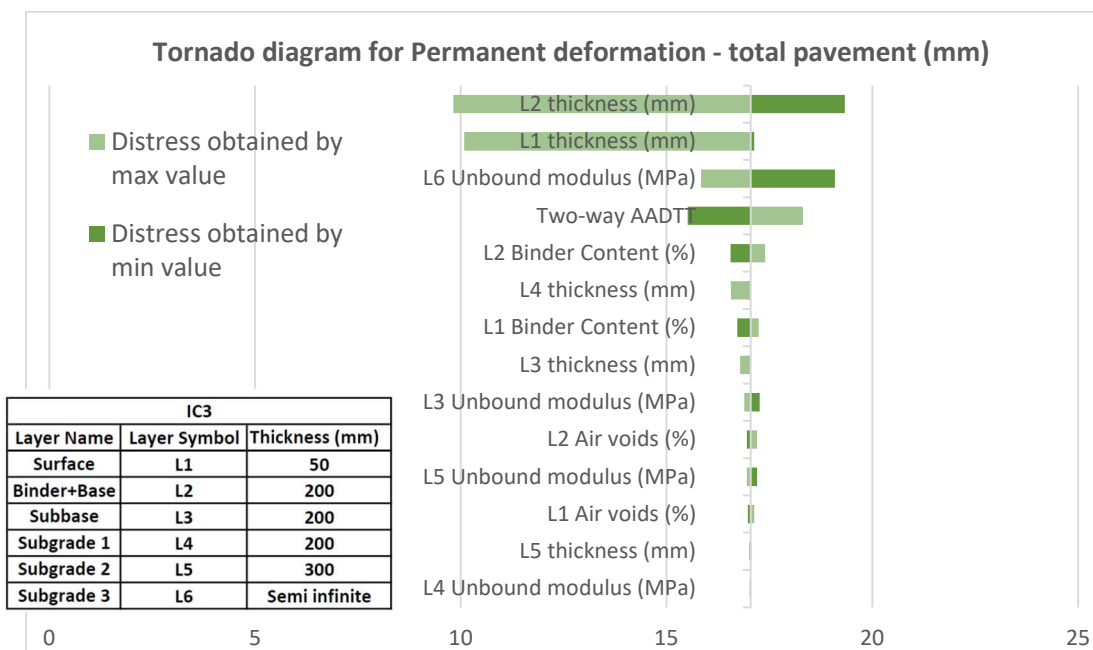
José Coelho das Neves (CERIS, IST, University of Lisbon)

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Tornado chart for the sensitivity analysis of total permanent deformation_IC3 road.