FINITE-ELEMENT EVALUATIONS OF GEOGRID-REINFORCED ASPHALT OVERLAYS OVER FLEXIBLE PAVEMENTS

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Abstract: Geosynthetics have been extensively implemented as a pavement maintenance solution to minimize reflective cracking. However, geosynthetics within asphalt overlays can also be used to improve the pavement structural capacity, potentially resulting in reduced permanent displacements and strains in pavement structural layers. Combination of accelerated pavement testing techniques and numerical simulations would be particularly suitable to assess the comparatively new use of geogrids for increased structural capacity of asphalt overlays. Accordingly, this study focuses on two-dimensional finite-element simulations conducted to identify the variables that govern the performance of geogrid-reinforced asphalt overlays and their effect on the response of flexible pavements. The finite-element model is validated by comparing the numerical predictions with the experimental results obtained in large-scale accelerated paved models. A series of finite-element parametric evaluations is conducted by varying the stiffness of both the geogrid and the subgrade materials. The strains mobilized within the geogrid under static loading are also evaluated. The numerical predictions indicate that the presence of the geogrids significantly affects the structural behavior of the pavement, as observed through reduced vertical displacements and strains, although such reductions are not significantly affected by the increases in geogrid stiffness. A reduction in pavement stresses is observed, mainly in the base course layer. The finite-element parametric evaluations show that geogrids placed within the asphalt layers are able to increase the overall bearing capacity of the pavement system, even for cases involving weak subgrades. Finally, the mechanisms of structural enhancement can be associated with numerically predicted geogrid strain distribution, which is found to be particularly consistent with experimental results.

Full reference:

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