Forensic Investigation of Premature Failure of a Roadway Pavement in Minna, Niger State, Nigeria

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Abstract

Field and laboratory studies were conducted to investigate the premature failure of a township roadway pavement in Minna, Niger state, Nigeria. Tests conducted on the pavement layers of the failed road included moisture content, particle size distribution of soil samples, Atterberg limit tests, in-situ density and dynamic cone penetrometer (DCP) tests. An empirical equation from published literature was used to compute the California bearing ratio (CBR) of various pavement layers from DCP data. Data from the tests indicate that the field moisture content of the pavement layers (i.e., subgrade, sub-base and base) were high, recording values above the optimum moisture content (OMC). Some soil materials from the pavement layers at the various failed sections had fines content above specification requirements for such layers. Atterberg limits tests revealed high liquid limits as well as plasticity index values. Generally, the field density values of the subgrade layers were found to be low equivalent to 82 - 98 percent degree of compaction, while the density of the sub-base and base layers at some failed locations were equally low achieving a degree of compaction of about 85 - 99 per cent, against specification requirement of 100 per cent. CBR values were mostly lower than recommended values by local codes. Overall, high proportion of fines and plasticity index values together with inadequate compaction of pavement layers as well as low CBR were identified as key factors responsible for the failure.

Keywords: California bearing ratio, degree of compaction, pavement, pre-mature failure

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