Effects of Gradation and Compaction Energy on the Hydraulic Conductivity of an Aggregate Base Commonly Used in Oklahoma

Master’s Thesis Defense

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Abstract

Aggregate base plays an important role in a pavement structure. It supports the asphalt concrete (AC) layer and reduces the wheel load-induced stresses on the underlying layers so that the stresses transmitted to the subgrade do not result in excessive deformation. The base layer also functions as a drainage layer. Consequently, it is important to understand the drainage and strength characteristics of aggregate bases. Hydraulic conductivity and resilient modulus of aggregate bases are frequently used by highway agencies in Oklahoma to characterize aggregate bases. A laboratory study was conducted to evaluate the hydraulic conductivity and resilient modulus of a limestone aggregate base that is commonly used in Oklahoma. Five different gradations, namely, ODOT Type A, modified AASHTO No. 57 and No. 67, OKAA Type N, and OKAA Type K, were used in preparing the specimens. For each gradation, specimens were prepared using two different levels of compaction: standard Proctor and modified Proctor methods. Hydraulic conductivity was measured using the falling head approach, while resilient modulus was evaluated using cyclic triaxial tests. Results show that specimens having the modified AASHTO No. 67 lower limit gradation and compacted using the standard Proctor method have the highest coefficient of permeability (0.62 cm/sec). On the other hand, specimens prepared using the ODOT Type A gradation, which is currently used in Oklahoma, are barely permeable. Results show significant differences in permeability due to the compaction methods used. The resilient modulus values obtained for the five different gradations are similar. The experimental results were also used to develop regression models correlating moisture content, dry density, gradation characteristics and compaction methods to hydraulic conductivity and resilient modulus. The regression models were found to be significant when evaluated using the F-test. The laboratory results as well as the statistical models from this study are expected to be useful in designing better pavements in Oklahoma.