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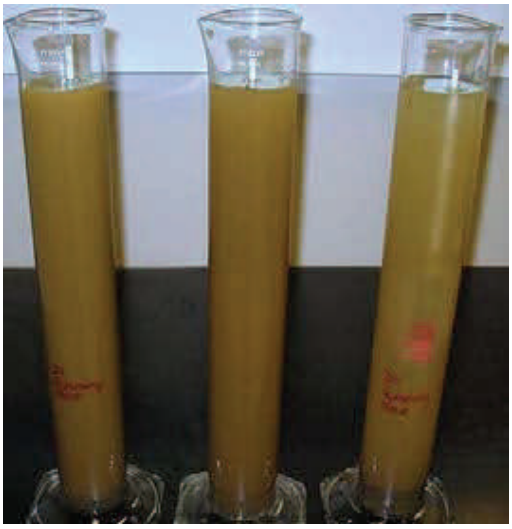
Use of the Micro-Deval Test for Assessing Alaska Aggregates



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Choosing the right material is half the battle in building roads for Alaska. The extreme conditions typical to cold regions require a durable, abrasion resistant and freeze-thaw resistant aggregate. Recently the state has been wondering exactly how effective and accurate its selection methods are. Currently there is limited information regarding the Alaska Testing Method 313 (sometimes known as the Washington degradation test) used by ADOT&PF to test abrasion and degradation value. This project will examine a new testing method, the Micro-Deval test — a wet test of how aggregates degrade when tumbling in a rotating steel drum with water and steel balls — to determine whether it can provide safe and cost-effective aggregate testing with reproducible results that correlate with field performance. The Micro-Deval test is easy, safe, and less costly to perform than traditional testing methods. It is suitable for smaller equipment, requires smaller sample quantities and uses a simple procedure. This study will provide data and recommendations on the suitability of the
Micro-Deval test as a as a rapid, simple, repeatable and inexpensive technique for assessing the durability of Alaska aggregates.

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EXECUTIVE SUMMARY

Aggregate used in the construction of roads must be durable, abrasion resistant, and freeze-thaw resistant in order to perform well in a pavement or as base course. Tests for properly characterizing aggregate durability are critical. Currently, AKDOT&PF Standard Specifications for Highway Construction (2004) specifies percentage of Los Angeles (LA) wear by the LA abrasion test and degradation value by Alaska Testing Method (ATM) 313 (or Washington degradation test) along with other parameters for evaluating durability of aggregates for asphalt concrete pavements and base courses. The main objectives of this project are to evaluate the feasibility of using the Micro-Deval test to assess the durability of Alaskan base course aggregates in pavement construction, and to explore the potential of utilizing it as a better alternative to the current Washington degradation test.

In this study, a thorough literature review was first conducted to summarize research findings, performance data, current practices, and other information relative to the testing and evaluation of the durability of aggregates used in base course. A variety of aggregates representing all physiographic regions in Alaska was then collected. The Micro-Deval, LA abrasion, sodium sulfate, and Washington degradation tests were conducted and compared. The results were used to examine how well these methods correlate with each other in terms of assessing aggregate durability and degradation.

The Micro-Deval test was found from the literatures to be a good indicator of aggregate durability, toughness, and abrasion resistance. It considers both degradations due to mechanical abrasion and weathering, which better simulates field performance during construction and under traffic and

undesirable environment. A number of state DOTs have been implementing specification requirement of Micro-Deval loss values for quality aggregates.

Within the scope of this study (16 aggregates from three regions of Alaska), the Micro-Deval test data had lower values of the coefficient of variation (COV) and standard deviation (SD) than LA abrasion test. Similar conclusions that the Micro-Deval test is a reliably repeatable procedure reported in the literatures (Hunt 2001; Nyland 2005; Jayawickrama et al. 2007). A more precise method of comparing test result data was achieved by normalizing each test result to its standard limiting criteria to pass durability. The Micro-Deval test was generally in high agreement with the other test methods regarding an overall pass/fail determination, and a best correlation was found between the Micro-Deval and Washington degradation tests.

The Micro-Deval test is a rapid, simple test — takes a couple of hours to complete. Smaller equipment size, lower sample quantities and a simpler procedure make this method easier and less costly to perform than traditional methods.

Our study along with practices in other states confirmed the feasibility of using Micro-Deval test to assess the durability of Alaskan base course aggregates in pavement construction. However, other aggregate tests had a long running track record which allowed for contractors as well as AKDOT&PF personnel to feel comfortable with results related to actual performance. It is recommended that the Micro-Deval test be an additional test for a period of time. This will allow for a history of performance to be built as well as a comfort level with the results. Tests of more Alaskan aggregates are also needed to facilitate the implementation of specification requirement of Micro-Deval loss values for quality aggregates.

As for the Washington degradation test, it has been used in only a few states according to current states practices. DOT materials engineers' experience also indicated the Washington degradation test results had more variations thus poorer repeatability than other tests. It is a clay leaching test dependent on surface area of charge, and finer samples will indicate more degradation. It indeed measures the size of fines (how fine) but not quantity of fines (how much). It is suggested the Micro-Deval test along with current LA abrasion and sodium sulfate tests be used to provide a more reliable assessment of Alaskan aggregates’ durability.