Transportation Management TechTips

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SEDIMENT MEASUREMENTS FROM MULTIPLE AGGREGATE SOURCES: NOT ALL AGGREGATES PERFORM IDENTICALLY

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BACKGROUND

The Rocky Mountain Research Station and the Willamette National Forest performed a study to investigate the sediment production of several aggregates. Nine basalts, three quartzites, two welded tuffs, two alluvial, and one each of glacial outwash and limestone were tested. Each aggregate was used widely, had a maximum size of 25 mm, and was dense graded. Of the aggregates studied, 11 were good and 7 were of marginal (but still useable) quality, as originally identified by the design engineers.

Test

Investigators ran a wide range of performance tests on all aggregates. Based on these tests results and test simplicity, the sand equivalent test was chosen as the single indicator of perceived aggregate quality.

Each aggregate received an initial simulated rainstorm, heavy truck traffic from a logging truck simulator, and a final simulated rainstorm with an intensity of 50 millimeters per hour and a duration of 30 minutes. By adding flow during the post-traffic storm, the impact of a longer cross-drain spacing was simulated. All work was done on a 6 percent road grade.

Results

The sediment production from the most erodible aggregate was 100 times that of the least erodible; a large range that should be considered when choosing aggregate surfacing material. Sediment production differences between the good and marginal aggregates became less apparent as either the distance between cross drains or the degree of rutting increased, suggesting the importance of timely maintenance to minimize deep rutting and establishment of the surface cross slope prior to heavy rainfall periods.

The best predictor of sediment production from each of the three road sections was the fraction passing the 0.6-mm sieve. Infiltration was controlled by the size of the pore space between the larger aggregates. Increasing fines filled the pore space and reduced infiltration, resulting in increased runoff. This greater runoff led to transport of the finer sizes and the observed higher sediment production.

These results suggest that to minimize sediment production one should minimize the fraction that is smaller than 0.6 mm. However, without sufficient fine material to hold the larger sizes in place, a loss of vehicle traction occurs. This tradeoff between sediment production and fines needed for aggregate stability is an ongoing topic of study.

The complete study was presented at the 2003 Low-Volume Roads Conference and is available on the web at http://forest.moscowfsl.wsu.edu/cgi-bin/engr/library/searchpub.pl?pub=2003c.

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Approximate Metric to English System Conversion Factors

To Change	To	Multiply by
millimeters	inches	0.03937

Approximate English to Metric System Conversion Factors

To Change	To	Multiply by
inches	millimeters	25.4