MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

RESEARCH SUMMARY

Hydraulic and Environmental Behavior of Recycled Asphalt Pavement in Highway Shoulder Applications

WHAT WAS THE NEED?

Recycled asphalt has also been identified as America's #1 recycled material. Recycled asphalt pavement (RAP) is an excellent material for use as a base course aggregate or hot mix asphalt (HMA) aggregate. However, there is limited guidance on the use of RAP in highway shoulder applications and a lack of information regarding its hydraulic performance and environmental suitability when used to address the highway shoulder edge drop-off created by pavement resurfacing or overlay.

WHAT WAS THE GOAL?

The goal of this study was to investigate the environmental impacts associated with the use of RAP in highway shoulder edge drop-off applications.

WHAT DID THE RESEARCH TEAM DO?

The study was divided into five tasks:

1. **RAP Collection and Characterization** – RAP samples obtained from different highways around Maryland and covering a wide range of characteristics, were investigated.

2. **Hydraulic Conductivity Tests –** Laboratory tests, using a flexible wall permeameter to determine the vertical hydraulic conductivities of the RAP samples, were performed.

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3) **Batch Leaching Tests –** The goal of the batch leaching tests was to obtain baseline data useful for comparison to regulatory standards. These data were useful for comparison of the leachate concentrations obtained from different RAP samples.
4) **Column Leaching Tests –** These tests were conducted to understand the leaching performance of RAP samples and evaluate the potential for leaching of metals into surrounding ground- and surface-waters. These tests simulated the flow conditions likely to exist in the field.
5) **Computer Model** - An analytical framework was developed to simulate variably saturated (saturated and unsaturated) flow and transport of metals leaching from RAP-incorporated roadways into surface waters.

WHAT WAS THE OUTCOME?

Hydraulic conductivity of seven Maryland (RAPs) was evaluated and was found to be comparable to that of natural aggregates with the gradation of clean sand-gravel mixture as it ranged from 6.9 x 10-3 cm/s to 1.1 x 10-2 cm/s.

The results of the batch leaching tests showed that the concentrations of all metals, except copper, were below the water quality limits. Column leaching tests yielded generally low or non-detectable metal concentrations. The deviation from this trend occurred for copper and zinc concentrations, but they were still below regulatory limits.

Concentrations of all metals from RAP conformed to the water quality standards in surface waters. In all cases, the metal concentrations in RAP and control material leachates decrease even further in the surface waters with the increasing horizontal distance. Once the leachates enter the surface waters, the metal concentrations decrease by 50% at a horizontal distance of 26 m and remain below the EPA WQLs; however, these water quality limits are related to drinking water standards and do not apply to stormwater runoff.

Maryland RAPs can be deemed as environmentally sound materials for the construction of highway shoulder edge drop-off applications. They can be classified as free-draining materials, but should be avoided in shoulder applications that are in direct contact with waterways or surface waters.

HOW WILL MDOT SHA USE THE RESULTS?

MDOT SHA will seek approval from the Maryland Department of the Environment to use RAP has a highway shoulder edge drop-off material for pavement preservation applications such as resurfacing or overlays in appropriate locations that are not directly draining to the waterways.

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