VERMONT AGENCY OF TRANSPORTATION RESEARCH PROGRAM

University of New Hampshire

Recycled Asphalt Shingles as an Full Depth Reclamation Mechanical Stabilizer

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Research Need and Problem Statement

Recycled asphalt shingles (RAS) contain valuable materials like asphalt binder, aggregate, and fibers, making them suitable for reuse in road construction, potentially reducing reliance on new materials and lowering environmental impact. However, while RAS can improve rutting resistance of asphalt mixtures, it may also decrease cracking resistance, leading to restrictions on its use.

Vermont produces about 25,000 tons of asphalt shingles annually, which is why it is appropriate to recycle them. There is a growing interest in using RAS in full-depth reclamation (FDR) to further enhance cost and environmental benefits. This research aims to determine if RAS can be used in its "as-is" form or requires processing and whether it can provide mechanical stabilization in FDR.

Figure 1. “As is” architectural waste shingles and resized processed waste shingles

Methodology

A comprehensive review of the state of the art and practice was conducted and used to develop an experimental plan. Laboratory characterization will include initial evaluation of the physical properties of RAS and FDR materials. In a second stage, mechanical tests will be performed on the FDR and RAS material samples. Additionally, the study will explore the use of recycling agents to enhance RAS's stabilizing effects. The results will be applied in a pavement design system to evaluate the life cycle cost benefits of using RAS in FDR.

State of the art and practice review
↓
Experimental design & materials selection
↓
Laboratory characterization
↓
Data analysis
↓
Develop recommendations

Figure 2. Research Approach

Select Data and Results

FDR materials were sampled from two different VTrans projects (Marshfield-Danville NH PS19(1) and Cambridge-Johnson STP 2925(1)). RAS of three different sizes ("as is", “fully processed” (3/8 inch), and “partially processed” (6 inch)) from two different sources are being considered and sampled to assess whether their variability affects the performance of the final products. Preliminary material analysis is now underway (the particle size distribution of RAS and FDR materials, the actual contribution of the binder within the RAS by cohesion test, and the optimum moisture content and density of the FDR).

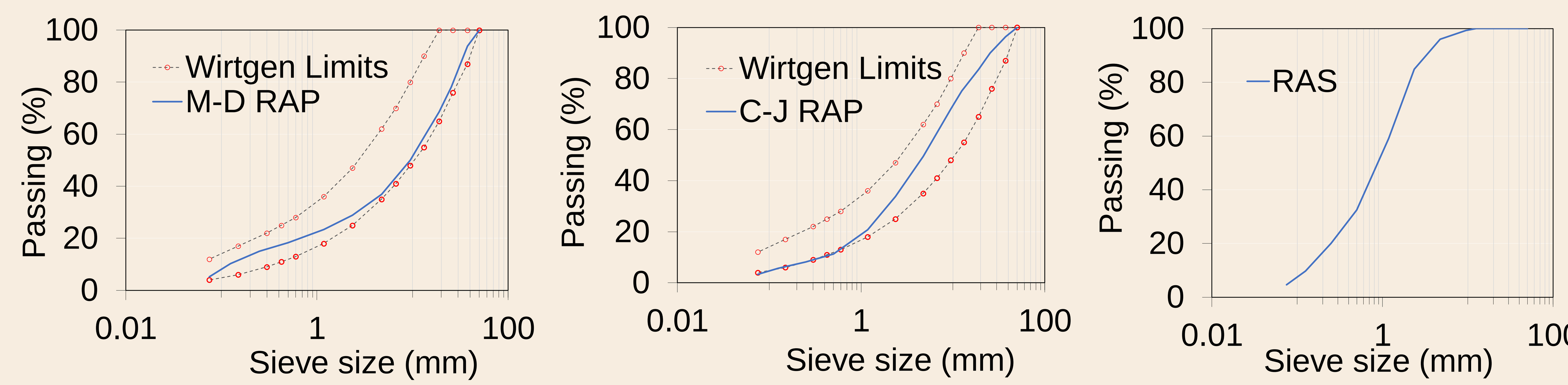

Figure 3. Gradation of M-D RAP, C-J RAP and one source of RAS

Preliminary analysis will allow determination of the “optimal” RAS content. Laboratory experimentation will then continue with mechanical characterization of RAS-stabilized FDRs and control materials through measurement of indirect tensile strength, resilient modulus, and shear strength. RAS and FDR with RAS will be evaluated for environmental contaminants, particularly PCBs, PFASs and PAHs, including the use of Synthetic Precipitate Leaching testing.

Conclusions

This study will result in recommendations for VTrans to revise FDR construction and material specifications to include RAS. It will also provide quantitative data on the mechanical stabilization potential of RAS in FDR, guidance on optimal dosages, and lab procedures for validation. Additionally, preliminary life cycle cost analyses comparing pavements rehabilitated using unstabilized FDR with those using RAS stabilized FDR will be conducted.

Acknowledgments

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