



Florida Department of Transportation Research

Improving the Properties of Reclaimed Asphalt Pavement for Roadway Base Applications
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Over 90 percent of U.S. roads are paved with asphalt, which must be periodically resurfaced. Milling produces reclaimed asphalt pavement (RAP), which can be recycled in hot-mix asphalt, but at no more than 25%. Therefore, much RAP remains for other roadway applications. RAP is a well-drained, granular material available on site; however, 100% RAP has low bearing strength and creeps under load.

In this project, Florida Institute of Technology researchers sought to improve RAP bearing strength and reduce creep to levels acceptable for roadway base applications. Several processing methods and additives were tested. Specimens were evaluated wet and dry by strength tests, including limerock bearing ratio (LBR), unconfined compression, Marshall compression, and indirect tensile tests. Seven-day, one-dimensional consolidation tests evaluated creep deformation.

Among compaction methods, gyratory compaction increased density more than modified Proctor, vibratory, or Marshall compaction. At constant density, gyratory compaction doubled or tripled RAP strength over modified Proctor; but with little improvement in creep.

Fractionation improved strength and creep only when RAP was remixed to match the Talbot maximum density curve, but yielded unacceptable LBR or creep results for roadway base applications.

Blending RAP with limerock, cemented coquina, or recycled concrete aggregates improved LBR and creep performance. As the percent of



The asphalt removed from this milled road surface contributed to the many tons of asphalt reclaimed each year during road repair operations.

aggregate increased, LBR increased and creep decreased. At 75% aggregate, blends showed creep behavior similar to 100% aggregate. At 50% aggregate, blends did not produce LBR over 100; 75%+ limerock blends attained a soaked LBR near 100 and low creep without chemical stabilizer. In general, adding RAP to limerock

blends increased the soaked retained strength and improved permeability compared to 100% limerock, but blends with higher amounts of RAP exhibited higher creep deformation. As a result, researchers recommended that RAP blends without stabilizing agents be no more than 25% RAP for roadway base applications.

Chemical stabilization permitted higher RAP content in limerock blends to meet performance criteria. Stabilizers included Portland cement, cationic and anionic asphalt emulsions, and hydrated lime. Adding 1% of either asphalt emulsion or cement, 1:1 blends of RAP/limerock base attained a soaked LBR of 100 and acceptable creep. Hydrated lime as a stabilizer had no significant effect on either strength or creep for the RAP/limerock aggregates tested.

RAP blends studied in this report met criteria for use in road base courses, but final acceptance of the blend must be made on a source-by-source basis to ensure that the final product meets base course requirements. Reuse of on-site materials benefits the public through savings produced by reducing the amount of new material needed and reducing deliveries to work sites. Environmental savings are also produced by reducing the amount of petroleum-based materials needed for road construction.