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DEVELOPING SPECIFICATIONS FOR USING RECYCLED ASPHALT PAVEMENT AS BASE, SUBBASE, OR GENERAL FILL MATERIALS, PHASE II

PROBLEM STATEMENT

Recycled Asphalt Pavement (RAP) stockpiles in Florida have grown because more stringent asphalt pavement SUPERPAVE specifications prevent re-using RAP as aggregate in Hot Mix Asphalt (HMA) production. Furthermore, the application of RAP as a Florida Department of Transportation (FDOT) approved base course, sub-base, and subgrade has been hindered due to low reported laboratory Limerock Bearing Ratio (LBR) tests.

In a previous project (Phase I), lab studies focused on evaluating RAP's LBR and developing a database of geotechnical strength parameters. The field study involved evaluating RAP's strength gains, at two-month intervals, for 12 months post-construction.

RAP was classified as an A-1-a material. The moisture-density behavior did not follow traditional Proctor behavior of displaying a well-defined peak. The engineering properties of RAP proved to be desirable and provided a sound basis to establish RAP as an accepted structural fill or as a roadway construction material.

The field site showed the strength of RAP to be highly dependent on temperature. Initial LBR values for RAP averaged 16 and increased to 40 within two months. RAP LBR values exceeding 100 were recorded during the cooler months but could not be sustained during the warmer months. A correlation was developed between the Impulse Stiffness Modulus (ISM) determined from the Falling Weight Deflectometer (FWD) and LBR values.

OBJECTIVES

The objectives of this second phase of work were to (1) validate Phase I developmental specifications for using RAP as a base, sub-base or general fill, (2) evaluate the strength gain of RAP within the first two months post-construction, (3) evaluate RAP-Soil mixes in the laboratory, and (4) evaluate the environmental performance of RAP in the field.

FINDINGS AND CONCLUSIONS

Phase I Specifications were updated to allow RAP as a sub-base below rigid pavements. The second field site, constructed with RAP and a Limerock control section in addition to surface water and leachate water collection systems in both the RAP and Limerock, was used to evaluate the strength and environmental concerns. Construction with RAP was equivalent to or better than construction with Limerock, due to the excellent drainage characteristics of the RAP material.

During Phase I, a significant increase in strength occurred in the two months following construction. This behavior was further evaluated in Phase II. Researchers found that the strength-deformation behavior of RAP increased throughout the 8-week study period, based on Field CBR data converted to LBR, ISM values from the FWD, and stiffness values from both the Clegg Impact Hammer and the Soil Stiffness Gage (SSG). LBR, Clegg, and ISM data indicated that RAP experienced a 50 percent strength gain over 8-weeks, while the SSG results indicated that the strength gain was 15 percent. The Clegg, FWD, and SSG testing also indicated that RAP had stiffness similar to Limerock, while the Field CBR tests revealed that the RAP was only about 55% as strong as Limerock.

RAP-Soil mixes were evaluated by adding varying percentages of poorly graded sand classified as an A-2-6 soil. An 80 percent RAP - 20 percent A-2-6 soil mix produced the most desirable engineering behavior, yielding a 100 percent improvement in LBR values. Based on these results, the RAP proved to be an excellent stabilizing material, and the LBR results for the RAP-soil mixtures exceeded the required value of 40 for stabilized subgrade. However, the preliminary creep testing indicated that both the 100 percent RAP and the 80/20 Rap-Soil mix pose long-term deformation concerns.

RAP poses no environmental concerns when used as a highway material. All concentrations reported of the heavy metals were well below the EPA standards. However, the fact that RAP creeps under constant loading and that there may be a significant variability of this material from various locations throughout Florida is of concern.

BENEFITS

This results of this research supports the recommendations made in the Materials Bulletin issued in November 2000 concerning the use of RAP material in roadway construction. The research confirmed that RAP material may be used as a stabilizer in subgrade provided a minimum LBR of 40 and the required density can be achieved., and RAP can be used in embankment construction provided the requirements in the Materials Bulletin are followed Due to the low LBR values of RAP and the potential for long-term deformation, no RAP or mixtures of RAP and limerock base material are allowed in the construction of pavement base subjected to traffic. Due to the potential for long-term deformation, RAP is not permissible for use as a Mechanically Stabilized Earth (MSE) wall backfill.

This research has introduced a new application for RAP material and developed a new specification, allowing RAP to be used as a stabilizing material for sub-base below rigid pavements, which will lead to increased re-use of RAP. This specification may allow Districts to use RAP in alternative applications when suitable materials are not available or when they are too costly.

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