Florida Department of Transportation Research

Perform an Investigation of the Effects of Increased Reclaimed Asphalt Pavement (RAP) Levels in Dense Graded Friction Courses

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Current Situation

The Florida Department of Transportation currently allows up to 20% recycled asphalt pavement (RAP) in asphalt mixes to be used for roadway surfaces. The abundance of RAP and savings in cost and to natural resources make increased use of RAP desirable.

Research Objectives

In this project, University of Florida researchers examined the possibility of increasing the percentage of RAP used in dense graded asphalt friction coursemixes for roadway surfaces without reducing pavement cracking performance.

Nationwide, stockpiles of recovered asphalt pavement are available for use in new road surfaces.

Project Activities

Researchers used RAP from two sources: one coarser, composed mainly of limestone with heavily aged binder, typical of Florida; the other finer in texture, composed mainly of granite with medium-aged binder, less likely for Florida.

In binder studies, recovered RAP binder was blended with virgin binders, either PG 76-22PMA or PG 76-22ARB, at various ratios. Superpave binder tests, multiple stress creep recovery (MSCR), and binder facture energy (BFE), and other tests were conducted on blended and virgin binders. RAP binder increased the stiffness of virgin binder, but all blended binders met FDOT specifications for virgin-modified binders. Both MSCR and BFE test results showed that even 40% RAP binder exhibited good elastomeric behavior. Thus, for binder, up to 40% RAP was acceptable.

Asphalt mixes were made with 0%, 20%, 30%, and 40% RAP and virgin binders. Mixes were tested with either short-term oven aging (STOA) or long-term oven aging followed by cyclic pore pressure conditioning (LTOA+CPPC), which previous work by the research group showed most closely resembled field aging. A variety of mixtures tests evaluated the relative cracking performance of mixtures, primarily the Superpave indirect tensile test at 10°C and the energy ratio (ER) parameter, derived from the hot-mix-asphalt fracture mechanics model HMA-FM. Higher RAP content generally resulted in higher ER values, indicating improved fracture characteristics. This trend reversed between 30% and 40% RAP content, but ER at 40% RAP was still well above 1.0 and greater than ER for 20% RAP mixtures. According to limited tab study, test results indicated that well designed mixtures can include up to 40% RAP.

Project Benefits

The ability to use higher amounts of RAP in new asphalt mixtures could offer cost savings and environmental benefits by reducing the need for new supplies of this oil-based product and by reusing a material that would otherwise require disposal in landfills.

For more information, please see dot.state.fl.us/research-center