HR-278 Beneficial Effects of Selected Additives on Asphalt Cement Mixtures

Key Words: Asphalt additives, Binder blends

ABSTRACT

Effects of polyolefins, neoprene, styrene butadiene styrene (SBS) block copolymers, styrene butadiene rubber (SBR) latex, and hydrated lime on two asphalt cements were evaluated. Physical and chemical tests were performed on a total of 16 binder blends. Asphalt concrete mixes were prepared and tested with these modified binders and two aggregates (a crushed limestone and a gravel), each at three asphalt content levels.

Properties evaluated on the modified binders (both original and thin film oven aged) included: viscosity at 250° C, 60° C and 1350° C with capillary tube and cone-plate viscometer, penetration at 50° C and 250° C, softening point, force ductility, and elastic recovery at 10° C, dropping ball test, tensile strength, and toughness and tenacity tests at 25° C. From these the penetration index, viscosity-temperature susceptibility penetration-viscosity number, critical low temperature, long loading time stiffness, and the cracking temperature were calculated. In addition, the binders were studied with x-ray diffraction, reflected fluorescence microscopy, and high-performance liquid chromatography techniques.

Engineering properties evaluated on the 72 asphalt concrete mixes containing additives included: Marshall stability and flow, Marshall stiffness, voids properties, resilient modulus, indirect tensile strength, permanent deformation (creep), and effects of moisture by vacuum saturation and Lottman treatments. Pavement sections of varied asphalt concrete thicknesses and containing different additives were compared to control mixes in terms of structural responses and pavement lives for different subgrades.

Although all of the additives tested improved at least one aspect of the binder/mixture properties, no additive was found to improve all the relevant binder/mixture properties at the same time. On the basis of overall considerations, the optimum beneficial effects can be expected when the additives are used in conjunction with softer grade asphalts.