Research Project 41

Determination of Moisture Damage (Stripping) Potential of HMA With Recycled Materials Using Accelerated Loading Equipment

Recycled Materials Resource Center

University of New Hampshire

Federal Highway Administration

Project Description

Across the United States, recycled materials, most notably the Recycled Asphalt Pavement (RAP) are used widely as an alternative source of pavement material for construction. Most state agencies allow the use of at least 10%-15% RAP in their mixtures. To develop a performance based mix design procedure with RAP, it is important to monitor the performance the HMA mixes with RAP under repeated traffic loads and environmental conditions. One of the important performance indicators is the resistance of the mix against moisture damage or stripping. Stripping occurs when the cohesive bond between asphalt film and aggregate is lost due to the simultaneous action of existing moisture in the pavement and traffic load. At the plant, the RAP is mixed with preheated virgin aggregates before the virgin asphalt is added. In the lab, as performed by NH DOT and contractors, RAP is preheated for 2 hours before mixing with virgin aggregates and virgin asphalt. Both of these processes and the underlying design procedure assume that complete blending between virgin asphalt and asphalt already present in RAP occurs. It has been reported in various studies that complete blending does not occur and addition of RAP to a HMA mix changes the mechanical properties of the mix which includes the volumetric properties and stiffness. In many situations the field RAP particles contain moisture. The incomplete blending of binders and change of mechanical properties can cause any moisture trapped inside the pores or on the surface of the RAP aggregates to induce more damage under loading than it would have caused without RAP. Therefore, there is a need to investigate the effect of RAP on the resistance of HMA against moisture damage.

Any moisture damage study should include the application of traffic load in the presence of moisture and simulate the field conditions in laboratory as closely as possible. Recent studies on Accelerated Pavement Tests (APT) have shown that APT can be successfully used to predict moisture susceptible mixes. In this project, the one-third scaled accelerated loading equipment, the Model Mobile Load Simulator (MMLS3), will be used to test HMA specimens with different percentages of RAP and RAP sources. This device applies a wheel load which is one-third of the actual field load with same tire pressure and works on the application of the dimensional similarity principle. In recent research this has been proved to be an effective method for studies on moisture damage. In this research, two sets of HMA mixes will be used; one with no RAP as the controlling mix and the other with different RAP percentages and sources of RAP. The mixes will be designed to obtain the field density. The compacted HMA specimens with RAP will then be placed in a mold with continuously circulating hot water and loaded under MMLS3 accelerated traffic loads. This procedure will simulate the exact field condition in laboratory in terms of presence of moisture, temperature and traffic load. The rut depths and moisture damage of the specimens will be determined at the end of the traffic and the effect of RAP on the moisture damage potential of the mixes will be identified. The relation between number of load applications, percent change in mechanical properties due to moisture damage and percent of RAP will be developed in this research.

End Products

This study will provide a comprehensive method of identifying moisture susceptible HMA mixes with RAP. The results of this research will provide the state agencies a method to select correct percentages of RAP to be used with virgin materials to produce the moisture resistant HMA. It will ultimately provide an upgraded process of mix design with RAP to produce moisture resistant mixes.

Further Information

The Recycled Materials Resource Center (RMRC), a cooperative agreement between the University of New Hampshire and the Federal Highway Administration, is a national center that promotes the appropriate use of recycled materials in the highway environment. Its focus is on the long-term performance and environmental implications of using recycled materials.

For detailed quarterly progress reports for Project 41, as well as all RMRC-funded research projects, please see: http://www.rmrc.unh.edu/Research/researchlevel2.asp.

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