Research Project 15

Determination of N_{design} for CIR Mixture Design

COMPLETE!

Recycled Materials Resource Center

University of New Hampshire

Federal Highway Administration

The final report for Project 15 is available on-line at:
http://www.rmrc.unh.edu/Research/Rprojects/Project15/P15finalreport.asp

Project Objectives

- Determine CIR mixture design compactive effort, using the SGC, required to match field unit weights.
- Determine N_{design} number of revolutions.
- Determine mixture compaction temperature.
- Determine ram compaction pressure.
- Determined using field produced CIR mixtures compared to their field compacted unit weights.

Project Description

As the name implies, cold in-place recycling (CIR) is a pavement rehabilitation process that recycles reclaimed asphalt pavement (RAP) without added heat. CIR is a viable technique, however, its acceptance has been hampered by a lack of mix design procedures, especially designs consistent with Superpave technology. The purpose of this project was to develop a protocol for the compaction of CIR by determining the compactive effort or N_{design} (number of revolutions in a Superpave gyratory compactor (SGC)) required to duplicate field unit weights of CIR mixtures. Dr. Stephen Cross of the University of Kansas collected RAP and emulsified asphalt cement from seven CIR projects around the country: two in Kansas and one each in New York, South Dakota, Vermont, Iowa and Arizona. The physical properties of the RAP samples were characterized, then a series of tests looked at how the density of the RAP-asphalt mixtures changed with the number of gyrations in a SGC. The project also looked at how cure time and RAP physical properties affected N_{design}. Dr. Cross found that the in-place density could be attained following AASHTO TP-4 and using 30 gyrations for samples compacted without an initial cure, and 35 gyrations for samples compacted after the cement breaks. However, 3:1 flaky coarse aggregates were shown to affect density and N_{design}, though further work is needed to quantify the effects of RAP shape. Project 15 was completed during the summer of 2002.

End Products

- CIR mix design specification submission to ASTM
- CIR "Technology for Implementation" submitted to AASHTO

Project Partners

- Kansas DOT

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. Please visit http://www.rmrc.unh.edu.

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