New Jersey Department of Transportation
Bureau of Research

Technical Brief

Evaluation of Warm Asphalt Technology

The project encompassed evaluating the different aspects of warm mix asphalt technology and the potential issues a state agency may have in its implementation. Different pavement distresses, most commonly to be associated with warm mix asphalt, were evaluated while a feasibility study was conducted to determine how practicable the implementation of warm mix asphalt would be. Additionally, field construction trials were observed, evaluated, and reported.

Background

The concept and use of warm mix asphalt (WMA) is becoming more popular in the asphalt industry. The promise of reduced energy consumption, reduced emissions, and a more workable product is very appealing to an industry pressured by environmentalists with sustainability agendas and state agencies applying pay adjustments based on ride quality and pavement density. However, the use of WMA may come with some potential issues as well. Lower production temperatures may result in softer asphalt due to the reduced oxidative aging. Also, poorly dried aggregates may create issues of moisture damage.

Research Objectives and Approach

To evaluate these issues, a research project was undertaken to evaluate the general performance of WMA and whether or not the NJDOT should begin its implementation. The research study was comprised of a lengthy laboratory investigation, as well as pilot projects produced at various asphalt plants. Prior to the laboratory investigation, a feasibility study was conducted to determine the potential pitfalls state agencies may encounter during implementation. The feasibility study also allowed for a literature review to aid in the laboratory test program development. It was determined that three major laboratory efforts consisting of evaluating

mixture compactability, rutting potential, and moisture damage was required to have better confidence in the material's performance. Additionally, two minor studies were conducted to evaluate the resultant change in asphalt binder performance grade and blending potential of RAP and virgin binder from plant produced asphalt mixtures. To conclude the study, a number of field trials were organized and evaluated and the resultant observations/performance reported.

Findings

Findings from the study were as follows:

- A number of WMA technologies currently exist that range from chemical packages, organic waxes, and foaming type systems. However, based on the scoping study evaluation, it was determined that the NJDOT would best benefit from these technologies when utilizing them as compaction aids (i.e. – increasing compactability of asphalt mixtures) and to reduce emissions during production and placement of asphalt mixtures.
- One of the possible issues with the adoption of WMA is that the reduced production temperatures associated with production may not thoroughly dry the aggregate blend, which could lead to moisture damage/stripping issues. Laboratory work conducted in this study demonstrated that moist aggregates heated at reduced mixing temperatures will be more prone to moisture damage than dry aggregates, as evaluated with the tensile strength ratio (TSR) and Hamburg Wheel Tracking device.
- Another potential issue with the adoption of WMA is that the reduced production temperatures may not stiffen/age the asphalt binder to the degree of hot mix asphalt. As a result, the WMA may not be as stiff and may be more susceptible to rutting. The laboratory testing conducted throughout the study did indeed show that WMA mixtures were less stiff, especially at the high test temperatures. A detailed evaluation indicated that a drop of approximately 80^{o}F in production temperature will ultimately drop the high temperature PG one grade (i.e. – from a PG76 to a PG70).
- To evaluate the general workability of WMA mixtures in the laboratory, a simple and effective test has been recommended based on the Marshall Compactor. The test procedure ranked the compactability/workability of the WMA mixtures the same as the torque-type device commonly associated with testing workability of mixtures.

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A final report is available online at: http://www.state.nj.us/transportation/refdata/research/. If you would like a copy of the full report, send an e-mail to: Research.Bureau@dot.state.nj.us.

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NJDOT Research Report No: FHWA-NJ-2011-005