
Monday, July 10, 2017

Prepared for: Omar Fateh

Prepared by: Jim Byerly, Electronic Resources Librarian

Resources searched: ASCE Civil Engineering Database, MnDOT Library Catalog, Transport Database, Research in Progress

Summary: Results are compiled from the databases named above. Links are provided for full-text, if applicable, or to the full record citation. I completed my searches using the following terminology: tack coats, performance based specifications. Results are divided into most relevant and least relevant.

Most Relevant Results

<table>
<thead>
<tr>
<th>Title</th>
<th>Trackless Tack Coat Materials: A Laboratory Evaluation for Performance Acceptance.</th>
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<tbody>
<tr>
<td>Author</td>
<td>Clark Trenton M; Rorrer Todd M; McGhee Kevin K</td>
</tr>
<tr>
<td>Source</td>
<td>2012/6. 18p</td>
</tr>
</tbody>
</table>

Abstract: The purpose of this study was to develop, demonstrate, and document laboratory procedures that could be used by the Virginia Department of Transportation (VDOT) to evaluate non-tracking tack coat materials. The procedures would be used to qualify candidate material formulations for field validation. The procedures were developed and were demonstrated through an evaluation of five "trackless" tacking materials and two conventional tacking materials. The evaluation demonstrated that the trackless materials outperformed the conventional materials in the laboratory tracking test and in the bond performance tests for tensile and shear strength. The study recommends that VDOT formalize the described laboratory procedures to produce a Virginia Test Method to qualify candidate non-tracking tack coat materials for field verification. It further recommends that VDOT formalize the field verification system and includes general direction on the elements to include in that process. This work is part of a program of research designed to support a move to performance-oriented specifications for the interlayer bond for pavement construction. The non-tracking tack coat materials investigated in this study are expected to facilitate the improved performance of this bond and, as a consequence, the pavement system as a whole. This work supports an anticipated incremental improvement to an annual asphalt concrete program that is worth between $200 million and $400 million per year (not including new construction). When applied to investments on this scale, even nominal improvements easily translate into considerable savings.

http://rip.trb.org/view/1407108

Abstract: Tack coat is a light application of asphalt, usually an asphalt emulsion, onto an existing relatively non-absorptive pavement surface. Tack coat is normally applied between two asphaltic concrete pavement layers or between a new asphalt pavement layer that is placed over an existing Portland cement concrete (PCC) surface. It is used to provide an adequate bond between the pavement being placed and the existing surface, achieving a monolithic system capable of withstanding traffic and environmental stresses. Insufficient bonding between pavement layers decreases the pavement bearing capacity and may cause slippage. In addition, insufficient bonding may cause tensile stresses to be concentrated at the bottom of the wearing course. There has been a pronounced increase in interest regarding tack coat specifications, materials, and construction practices in the past few years, primarily due to: (1) Release of National Cooperative Highway Research Program (NCHRP) Report 712, “Optimization of Tack Coat for Hot Mix Asphalt (HMA) Placement” in 2012; (2) Creation and marketing of several new reduced-tracking tack coat products; and (3) Implementation of Tack Coat workshops in virtually every state in 2015 and 2016 by the Federal Highway Administration (FHWA) and the Asphalt Institute (AI). As a result of these factors, state agencies across the United States are reevaluating their tack coat specifications, the materials they use, and the practices by which the tack coats are placed. As states review their tack coat related activities, the work being done in the area by other states becomes highly interesting. The previously mentioned FHWA/AI Tack Coat Workshops in each state included both pre-workshop and post-workshop meetings between personnel from state agencies, FHWA, AI, and other industry partners. The meetings established each state’s current tack coat specifications, materials, and construction practices, plus a discussion of what might be changed as a result of the information provided in the workshop. The goal of this study is to provide an overview of the current state of practice regarding specifications, materials, and construction practices. This information will aide state agencies as they review their current practices regarding tack coats, and assess what changes to their current specifications should be implemented. In addition this study will help agencies identify gaps in their current specifications and practices, and provide them with research information necessary to ensure a sufficient bond between subsequent pavement lifts. Specific goals include: (1) state of the practice on the use of tack coat materials and application rates for the various types of pavement surfaces; (2) state practice of quality control (QC) and quality assurance (QA) for tack coat material; and (3) state specifications for methods of payment of tack coat materials. Information will be gathered by literature review and a survey of the state departments of transportation (DOTs). Current FHWA guidance and AI guidance will also be reviewed. Topics to be studied include research and practice on the following items (not inclusive list): (1) Whether the tack coat is paid for as a separate bid item, or whether the cost of tack coat is included in the bid price for asphalt mixtures; (2) What tack coat products are available; (3) The method of acceptance for the tack coat materials (testing of material samples, certification, testing of bond strength, etc.); (4) For states testing tack coat bond strength, is the test monotonic or cyclic? Is the application of stress in tensile, shear, or torsion mode; (5) How each state chooses the best product for their agencies. Either based on performance, environment, cost, and availability; (6) The proper application rate based on the material type and surface upon which it is applied; (7) How each state verifies that the appropriate application rate of tack coat was applied; (8) Whether or not the tack coat is allowed to be diluted, and if so, whether it is allowed to be diluted in the field or whether it is required to be diluted at the supplier’s terminal; (9) Construction-related issues such as specification verbiage regarding pavement cleanliness, allowable surface temperatures, spraying vertical surfaces, nighttime application, verification of uniform application, limitations on distances allowed to be tacked in front of the paver, how to handle vehicle tracking of tack, etc.; and (10) The number of states that use spray pavers, and under what conditions they are used.
Tack Coat Performance and Materials Study.
http://rip.trb.org/view/1344124

Abstract: Tack coats provide a bond between asphalt layers so they can act monolithically as one pavement section. Studies have shown that pavement layers that are not fully bonded fail significantly earlier than fully bonded sections. Conversely, application of too much tack material can result in flushing of the new mat or slippage failures. Currently the Ohio Department of Transportation (ODOT) typically specifies SS-1H, rubberized tack or Trackless Tack as the tack coat for paving layers. Application rates are typically between 0.04 to 0.075 gallons of emulsion per square yard. Some limited information tends to show that higher rates of tack may have delayed longitudinal cracking in pavements. Even when tack is properly placed, projects have significant issues with tack being picked up by construction traffic prior to paving. The Department has seen a need for specification of a new Trackless Tack product due to construction issues that arise with other tack coat materials on certain projects. While the benefits during placement of Trackless Tack can be immediately noted, the premium cost and unknown long term performance of the material has limited its use. A study to analyze the pavement performance of different tack materials, application methods, and spray rates is needed. This would allow better decisions about the value of more costly tack materials and the rates at which they should be applied. The goal of the Department for this research is to evaluate the current practice as well as new equipment and application rates with regard to tack coat.

http://rip.trb.org/view/1339682

Abstract: This research will explore options for tack coat quality acceptance tests and processes. The deliverables will include a draft Indiana Test Method, draft standard specification and, if needed, calibration factors for MEPDG interface bonding inputs.

Least Relevant Results

<table>
<thead>
<tr>
<th>Title</th>
<th>Tack coat testing - measuring field bond strength / prepared by Eddie N. Johnson, Melissa K. Cole, and John Pantelis.</th>
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<tbody>
<tr>
<td>Summary</td>
<td>This report summarizes lessons learned in evaluating the bonding strength of hot mix asphalt (HMA) layers. Testing included: determining an optimal range for the bond strength of a tacked hot mix asphalt interface, and implementing the findings. The research method used a Florida Bond Test fixture along with a Marshall asphalt mixture testing load frame to evaluate tack bond shear strength and deformation. Specimens were obtained from state, county and city paving projects from around Minnesota. Results were compared to related research conducted in the United States. Recommendations for a tack bond test program: Equipment includes the Marshall load frame already used by many HMA laboratories, HMTS software or similar, and the Florida Bond Test apparatus. Follow Minnesota modifications of Florida Bond Test protocol. Compute the average and standard deviation of peak shear stress from specimen sets. Cores exhibiting layer separation during coring or during removal will be included in the specimen set and assigned a peak shear stress of 0 psi. Average peak shear stress will be 100 psi or greater. The standard deviation of peak shear stress will be 25 psi or less.</td>
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Title: SURFACE TREATMENT.


Abstract: This compendium contains selected pages from the following texts: Dust-Laying on Unsurfaced Earth and Gravel Roads (Road Research Laboratory, U.K., 1971); Guide on Prime Coats, Tack Coats, and Temporary Surfacing for the Protection of Bases (National Institute for Road Research, South Africa, 1970); Specifications for Performance Requirements for Mechanical Sprayers of Bituminous Material (National Association of Australian State Road Authorities, 1969); Asphalt Surface Treatments and Asphalt Penetration Macadam (The Asphalt Institute, 1975); Specifications for Asphalt Cements and Liquid Asphalts (The Asphalt Institute, 1964); A Basic Asphalt Emulsion Manual (The Asphalt Institute, 1979); Seven Fundamentals for Durable Spraybar Work--Jobs You Can Be Proud Of (Roads and Streets, August, 1975); A General Method of Design of Seal Coats and Surface Treatments (Proceeding of the Association of Asphalt Paving Technologists, 1969), and Highway Maintenance Manual (Ministry of Public Works, Hashemite Kingdom of Jordan).

Publication Year: 1980

Development of a Guideline for Selection of Tack Coats in South Dakota.
http://rip.trb.org/view/1440609

Abstract: In recent years, several pavement failures, specifically in overlay projects, have been reported in Region 8 States including South Dakota. The primary causes of failures were insufficient or excessive tack coat application and moisture penetration in interface of two layers, resulting in inadequate bond between layers. Inadequate interlayer bond leads to distresses such as halfmoon-shaped cracks, delamination (debonding) followed by longitudinal wheel path cracking, potholes, fatigue cracks, slippage, and rutting (Mohammad et al., 2011; Hu and Walubita, 2011; Rahman et al., 2009; TxDOT, 2001). In some cases, application of inadequate or excessive amount of tack coat occurs due to lack of a widely-accepted specification and error in calculation of the application rate. Currently, four different tack coat rates are used in the technical documents: (i) application rate at application temperature; (ii) rate at 60°F (15.6°C) and some at 59°F (15.0°C); (iii) original emulsion application rate; and (iv) residual rate. However, the most important quantity in tack coat application is the residual amount of asphalt (not the asphalt concentration in diluted emulsion) which ultimately affects the bond strength. Currently, selection of tack coat type in South Dakota is generally made based on experience/judgment. This is primarily due to lack of specific guidelines for the selection of tack coat type, application rate, placement and evaluation (Mohammad et al., 2012). It is also important to evaluate the effectiveness of the selected type and application rate of tack coats in extreme weather conditions which asphalt pavements experience in South Dakota as a quality-control procedure, prior to construction. This will help minimize the maintenance cost in the future, as a result of improved interlayer bond strength.

The interlayer bond strength is mainly governed by the selection of an optimum tack coat material and application rate. Other factors affecting the bond quality are application methods, equipment type and calibration procedures, asphalt layer surface type (old, milled or new), Portland cement concrete (PCC) surface, surface cleanliness, moisture and temperature. In order to achieve adequate interface bond, the tack coat application rate should be adjusted with the
pavement surface’s conditions (Mohammad et al., 2012). Excessive tack coat application results in shear-induced slippage at the interface (Mohammad et al., 2012). Therefore, determining the type and optimum amount of tack coat application rate is vital to performance and service life of pavement.

The proposed study will evaluate the effectiveness of tack coats commonly used by the South Dakota Department of Transportation (SDDOT) with respect to their types and application rates, pavement surface conditions, moisture-damage and temperature. Interlayer shear strength of tack coat determined by using a Louisiana Interlayer Shear Strength Tester (LISST), developed by Mohammad et al. (2012) will be used for evaluation of the tack coats. Also, laboratory compacted samples and a number of field cores (based on their availability) collected from selected construction sites in South Dakota will be tested to evaluate the tack coat performance. The proposed project will improve the current practice used for the selection of tack coat type and application rate in South Dakota. Results from this study will be used to develop recommendations and possible development of quality control measures for tack coats used by SDDOT for enhanced performance. Such measures will benefit SDDOT by reducing pavement maintenance costs in long term as a result of minimizing tack coat-related pavement failures. The database developed during the course of this study, based on the performance of tack coats in the laboratory, not only will help pavement engineers in the selection of tack coat type and application rate, but also will provide them with a valuable tool to have an estimate on the effects of the moisture and temperature on the overall performance of selected tack coats.