UTC Project Information	
Project Title	MPC-522 – Development of a Guideline for Selection of Tack Coats in South Dakota
University	South Dakota State University
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Brief Description of Research Project	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 half-moon-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.
Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	This study determines the optimum tack coat application rates for different types of the pavement surfaces and textures. This study also evaluates the effect of freeze-thaw cycles and the effectiveness of different tack coat emulsions in combatting the moisture effect. The developed database will be readily implementable after comparing it with some field observations.

Impacts/Benefits of Implementation (actual, not anticipated)	Outcomes will aid state DOTs improve their current practice of selection of tack coat type and application rate. The developed database will help pavement engineers in the selection of tack coat type and application rate and development of quality control measures for tack coats for enhanced performance. Additionally, it will benefit DOTs by reducing tack coat-related failures and pavement maintenance costs. These recommended application rates are given in terms of residual application rate to help the user pick the rate and compare it with the equivalent rates to minimize related errors.
Web Links • Reports • Project Website	• MPC Research Report – Development of a Guideline for the Selection of Tack Coats in South Dakota • Journal Article – Effect of Tack Coat Emulsion Type, Application Rate, and Surface Type and Texture on Early-Age Interlayer Shear Strength of Pavements in Cold Regions • Conference Paper – Application of Modified Binder Bond Strength Test for Evaluating the Effects of Curing, Moisture, and Aging on Tensile Bond Strength of Tack Coats • SDSU Master's Thesis – Evaluation of the Effect of Tack Coat Type, Application Rate, and Surface Type on Interlayer Shear Strength