

NCHRP Project 9-40 Update Optimization of Tack coat for HMA Placement

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Research Team

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Outline

- Project Objectives
- Methodology
- Conduct Laboratory Experiment.
 - Tack Coat Quality
 - Equipment Development
 - Interface Bond Strength
 - Equipment Development
 - Calibration
 - Computerized Tack Coat Distributor
 - Field/Laboratory Experiment
 - Spray Of Emulsion
 - Overlay Construction
- Preliminary Results



Project Objectives

- Determine for the various uses of tack coats
 - optimum application methods,
 - equipment type and calibration procedures,
 - application rates, and
 - asphalt binder materials
- Recommend revisions to relevant AASHTO methods and practices related to tack coats

Methodology

PHASE 1

- Task 1: Literature Review
- Task 2: Design A Comprehensive Experiment To Study Tack Coat Variables
 - Identify Laboratory And Field Test Devices
 - Develop Laboratory Experiment To Evaluate Tack Coats
 - Develop Field Experiment To Evaluate Tack Coats
- Task 3: Prepare And Submit Interim Report

PHASE 2

- Task 4: Conduct Experiment Approved In Task 3
- Task 5: Recommend Test Methods, Criteria, And Construction Guidelines
- Task 6: Demonstrate The Use Of Recommended Test Methods And Construction Guidelines
- Task 7: Prepare Instructional Materials For A Training Course
- Task 8: Prepare And Submit Final Report

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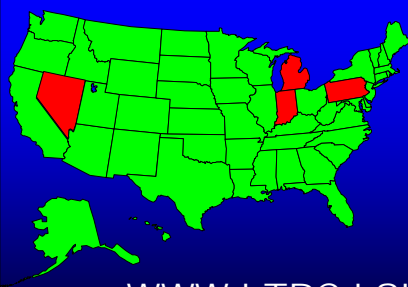
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Task 1: Literature Review

- A worldwide survey was conducted to determine various tack coat practices
- Survey Objective
 - Collect information on the state of the practice related to:
 - types of materials used for tack coats;
 - dilution rates of tack coat materials;
 - residual application rates;
 - determination of rate for different types of surfaces;
 - methods used for tack coat distribution; and
 - pavement failures related to tack coat application
- Survey sections:
 - Tack Coat Materials
 - Tack Coat Application Methods
 - Characterization of Tack Coat Application
- 27 Questions

Literature Review - States Responded

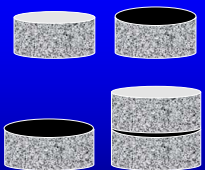


- 46 state DOTs, Washington D.C.
- 5 Provinces in Canada.
- Other countries
 - Denmark
 - Finland
 - South Africa
 - Netherlands

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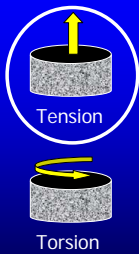
Development of Test Equipment

- Tack Coat Quality
 - Equipment Development
- Interface Bond Strength
 - Equipment Development




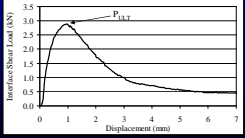
Measurement of Tack Coat Quality

- Force Application
 - Tension
 - Torsion
- Response
 - measured



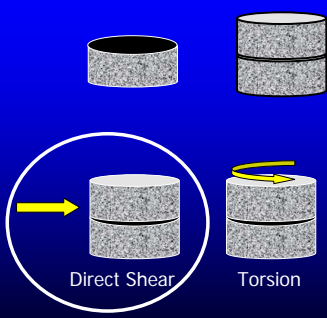
Measurement of Tack Coat Quality Louisiana Tack Coat Quality Tester -- LTCQT

- Developed equipment
 - Updated ATacker
 - Tack coat quality residual
 - Tension
- User friendly
- Easy to use
- Adopted
 - Laboratory and field
- Draft test method in AASHTO format is developed
- Tensile load
 - Displacement
 - Tensile Force
 - Time

Measurement of Interface Bond Strength

- Force Application
 - Direct shear
 - Torsion
- Response
 - Measured



Measurement of Interface Bond Strength Test Louisiana Interlayer Shear Strength Tester (LISSST)

- Developed equipment
 - Interface Bond Strength Shear
- Easy to use
- Portable
- Adoptable to existing load frames
- Reasonable cost
- Accommodate both 100 and 150-mm sample diameter
- Accommodate confinement
- Draft test method in AASHTO format

Experimental Test Factorial

- Variables and their ranges were carefully selected
 - through a worldwide survey
 - on the state of the practice
 - on the use of tack coats

Experimental Test Factorial

- Pavement surface types:
 - existing HMA, milled HMA, New HMA, and PCC
- Construction surface condition:
 - clean and dirty/dusty (before)
 - Wet and Dry (after)
- Tack coat material types
 - Hot AC
 - PG 64-22
 - Emulsion
 - CRS-1, Trackless, SS-1h, SS-1
- Application rates (residual):
 - high, medium, and low
- Surface coverages by tack coat:
 - 100% and 50%

Experimental Test Factorial

Surface Type:	HMA					PCC				Milled		
	1	1	1	1	1	1	1	1	1	1	1	
Tack Coat Type	PG 64-22	SS-1h	CRS-1	Trackless	No Tack	PG 64-22	SS-1h	SS-1	SS-1h	SS-1	SS-1	
Coverage Rate	50 & 100%	50 & 100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Residual Rate (gal/yd ²)	3	3	3	3	1	3	3	3	3	3	3	
	0.031	0.031	0.031	0.031		0.031	0.031	0.031	0.031	0.031	0.031	
	0.062	0.062	0.062	0.062		0.062	0.062	0.062	0.062	0.062	0.062	
	0.155	0.155	0.155	0.155		0.155	0.155	0.155	0.155	0.155	0.155	
Surface Condition	2	2	1	1	1	2	2	1	2	1	1	
	Wet & Dry	Wet & Dry	Dry	Dry	Dry	Wet & Dry	Wet & Dry	Dry	Wet & Dry	Dry	Dry	
Cleanliness	2	2	1	1	1	1	1	1	1	1	1	
	High & Low	High & Low	High	High	High	High	High	High	High	High	High	
Temperature	1	1	1	1	1	1	1	1	1	1	1	
	77.5°	77.5°	77.5°	77.5°	77.5°	77.5°	77.5°	77.5°	77.5°	77.5°	77.5°	
Normal Load	2	2	2	2	2	2	2	2	2	2	2	
	0 & 20 psi	0 & 20 psi	0 & 20 psi	0 & 20 psi	0 & 20 psi	0 & 20 psi	0 & 20 psi	0 & 20 psi	0 & 20 psi	0 & 20 psi	0 & 20 psi	
Replicates	3	3	3	3	3	3	3	3	3	3	3	
Subtotal	144	144	18	18	6	36	36	18	36	18	18	
Total	330					90				54		
Grand Total	474											

Specimen Preparation

- Bond Strength Test
- Full-scale test site was designed and constructed
 - LTRC Pavement Research Facility
- Selected tack coat materials were applied
 - computerized distributor truck on an existing HMA pavement surface
- Followed by the placement of a 75-mm HMA overlay.
- Cores were extracted





Field Layout – Pavement Research Facility

LTRC Pavement Research Facility
Pavement Laboratory
February 2008

Parking Strip: Not to be Used


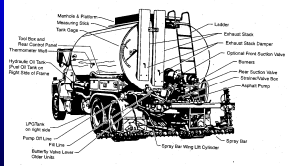
Survey of Test Lanes at the PRF

- Survey of the condition of the surface of the test lanes at the LTRC pavement research facility
 - identify and document surface irregularities
 - avoid them during the coring processes
- Surface texture measurement

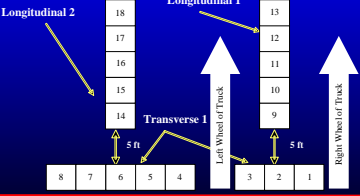
Distributor Truck Calibration

- Equipments
 - Asphalt Products Unlimited, Inc
 - Computerized tack coat distributor truck
 - Etnyre, Model 2000

Distributor Truck Calibration

- Geotextile Pad layout
 - ASTM 2995
 - One transverse direction and two longitudinal directions

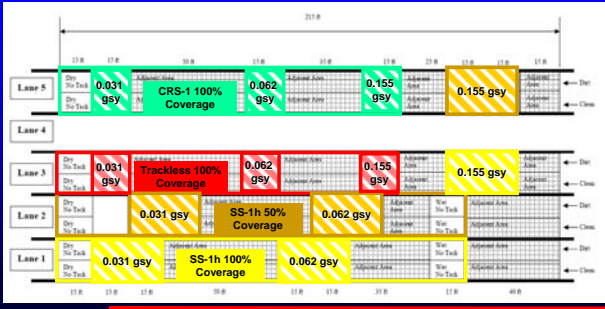


Distributor Truck Calibration






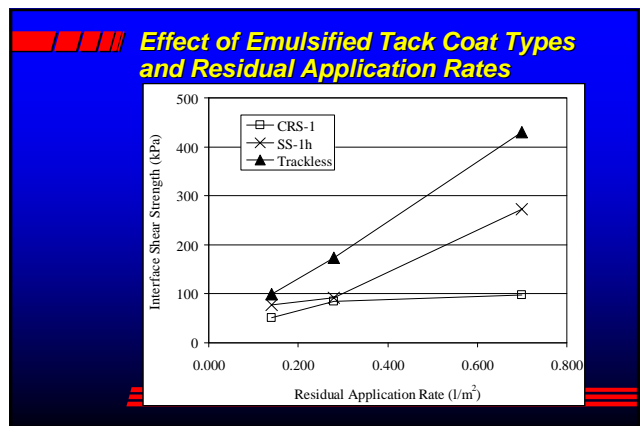
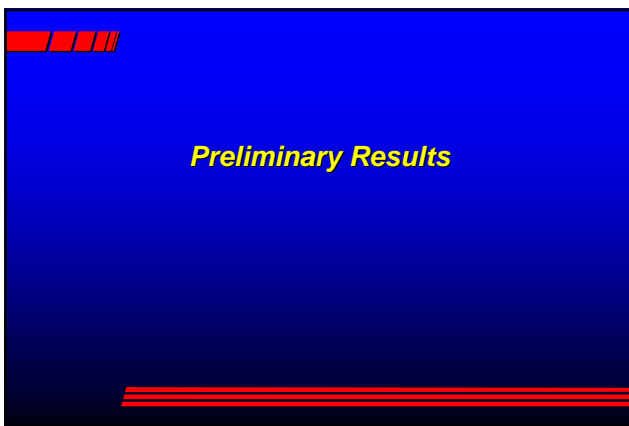
Lane Layout - Existing HMA Surface PRF



Spray of Emulsion



100% Coverage 50% Coverage



- ### Summary
- Conducted a worldwide survey
 - determine various tack coat practices
 - A direct shear device was developed
 - Louisiana Interlayer Shear Strength Tester (LISST)
 - Characterize the interface shear strength of cylindrical specimens
 - Developed a method to measure the bonding characteristics of tack coat in the field
 - Louisiana Tack coat Quality Tester (LTCQT)
 - Field quality control
 - Research is on-going
 - Determine for the use of various types of tack coats
 - optimum application rates for the various surfaces,
 - calibration procedures,
 - Prepare Instructional Materials For A Training Course

Acknowledgement

- APU
 - Distributor Truck
 - SS-1h, CRS-1
- Costal
 - HMA Overlay
- Blackledge Emulsions, Inc.
 - Trackless

