

State of Wisconsin/Department of Transportation
RESEARCH PROGRESS REPORT FOR THE QUARTER ENDING: March 31, 2006

Program: SPR-0010(36) FFY99	Part: II Research and Development
Project Title: Field Validation of Wisconsin Modified Binder Selection Guidelines	Project ID: 0092-03-13
Administrative Contact: Nina McLawhorn	Sponsor: WHRP
WisDOT Technical Contact: Len Makowski	Approved Starting Date: Jan 31, 2003
Approved by COR/Steering Committee: \$125,006.00	Approved Ending Date: Jul 31, 2006
Project Investigator (agency & contact): Hussain Bahia, UW Madison	

Percent Complete: 61%

Project Description: The study will be conducted over 36 months, and be completed in 5 phases:

- Task 1: Select Field Section and Define Grades to be Compared
- Task 2: Collect Samples and Conduct Testing
- Task 3: Monitor Performance of Sections
- Task 4: Database Development
- Task 5: Reporting

Progress This Quarter:

Testing

a) Mixing and Compaction Temperatures

The viscosity binder testing was completed for all the selected projects. The mixing and compaction Zero Shear Viscosity temperatures were determined for the remaining projects (USH95 Arcadia, USH95 Arcadia Intersection and USH51 Iron County). The Superpave mixing and compaction temperatures were also calculated. Table 1 shows the summary of the mixing and compaction information

Table 1: Summary of Mixing and Compaction Data

Project	PG Grade	Mixing Temperatures [°C]			Compaction Temperatures [°C]		
		ZSV	Superpave	Provider	ZSV	Superpave	Field (Range)
Hanley Rd. Int. Hudson (72000570)	70 - 28	161	179 - 184	160	150	168 - 173	71 - 111
I - 94 Baldwin (10200174)	70 - 28	174	169 - 175	135 - 149	148	158 - 163	61 - 106
Lindale Dr. Appleton (20050412025)	64 - 28	151	167 - 173	165	139	154 - 159	N/A
STH 17 Rhinelander Bypass (90400970)	58 - 34	155	150 - 156	N/A	140	136 - 142	77 - 130
Madison Beltline (53000474)	64 - 28	154	164 - 170	157 - 163	138	152 - 157	55 - 130
Arcadia	58 - 28	136	142 - 148	N/A	123	129 - 134	N/A
Arcadia (Intersection)	64 - 28	154	157 - 163	N/A	140	145 - 150	60 - (100)
USH 51, Iron County (11701370)	64 - 34	187	166 - 172	N/A	164	155 - 160	N/A

From the information gathered from the eight projects, some conclusions can be stated:

- For 5 of the projects, Superpave results in higher mixing temperatures than ZSV.
- In general, ZSV gives lower compaction temperatures than Superpave. This is effective for 6 of the 8 projects considered.

The compaction temperatures obtained from laboratory binder testing were compared with the field data. As it was reported in previous quarterly reports, the temperature at which the pavements are compacted in the field are lower than the laboratory compaction temperatures. The range of field compaction temperatures goes from 120°C (after the paver) to 50°C (cold roller). Table 2 includes the density after each

of the roller passes for one of the projects (10200174). It also includes the surface temperature measured at time the density was taken.

Table 2: Field Compaction Data, I-94 Baldwin, 2003 (10200174)

Roller Type	Pass #	Average	
		% Max. Density	Temperature
Paver	1	70%	223
Neumatic	1	79%	226
Breakdown (Vibratory)	1	87%	210
	2	86%	206
Dynapack (Vibratory)	1	90%	151
	2	90%	142
	3	90%	138
Cold (Vibratory)	1	91%	126
	2	91%	123
	3	90%	114
	(Static) => 4	91%	110

*E30 Mix, PG70-28

One of the objectives for the workability task of the project, is to analyze the dependency of the compaction on the binder temperature. For this reason, the average increase in density per roller pass for different temperature ranges was calculated for the field data. Table 3 shows the increase in density for the 10200174 project at various temperature ranges.

Table 3: Density Gain per Roller Pass, I-94 Baldwin, 2003 (10200174)

Temperature °C	Average Density Gain Per Roller Pass
101 - 110	9.0%
96 - 99	3.5%
61-66	2.0%
51-60	0.4%
41-49	0.0%

After comparing the data from tables 1, 2 and 3, it can be seen that the compaction temperatures from lab testing are higher than the compaction temperatures in the field. For this reason, it was decided that it is necessary to take a look at the viscosity of the binders at lower temperatures (50°C to 120°C). In the next quarter, the DSR will be used to determine the viscosities at lower temperatures.

a) Direct Tension Testing

Direct tension testing was pursued for three projects:

- Project # 90400970, PG58-34. (STH 17, Rhinelander)
- Project # 11301271, PG64-28. (USH 41, De Peere – Green Bay)
- Project # 31200670, PG64-28. (STH 110, Waupaca county)

The testing was carried out at three different temperatures for each binder (PG-10°C, PG-16°C & PG-4°C). Four different strain rates were considered: 0.3%, 1%, 3% and 10%. The results for –18°C and three strain rates (10%, 3% and 1%) are shown in figure 1.

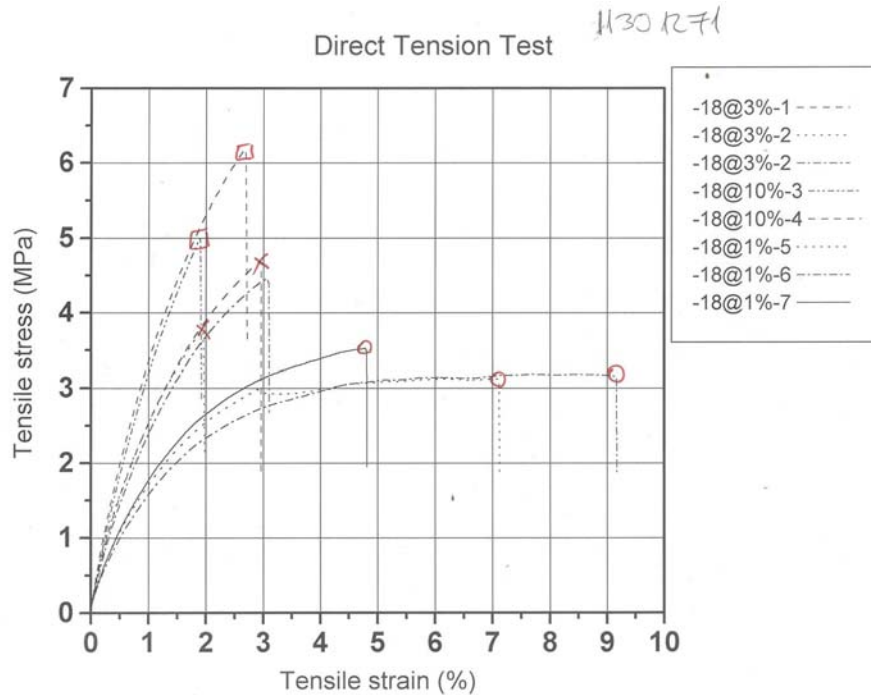


Figure 1: DTT results for Project # 11301271, PG64-28, 18°C

Work Next Quarter:

For the next quarter, the DSR will be used to determine the viscosities of the binders at temperatures in the range from 50°C to 120°C. The relationship of this viscosities and the compaction field data will be studied. The low temperature testing will be also continued.

Request for No Cost Time Extension

The research team would like to request a one year no-cost time extension. The reasons for this request are as follows:

1. There were significant delays the first year in finding the projects to conduct monitoring of the compaction and also projects for which asphalts are available and performance was readily accessible.
2. Adding one more year will allow us to get more performance data and better validation for the recommended procedures.
3. Just recently the FHWA has proposed a new test for asphalt binder rutting which is a modification of the original NCHRP 9-10 procedure. Also the Wisconsin DOT is in the process of recommending a Superpave Plus specification including an elastic recovery test. It will be a good opportunity to validate both these procedures as a part of this study.

Gantt Chart:

PROJECT I.D.		STARTING DATE	COMPLETION DATE	MONTH	REPORT #										PERCENT OF					
PROJECT # WISDOT		Jan-31-03	Jul-31-06	JAN - 05	10										Project Complete	Task Complete Last Report	Task Complete This Report	Project Complete		
CONSULTANT FIRM NAME			% TIME ELAPSED	TOTAL PROJECT FUNDING	CONTRACT FUNDING															
UNIVERSITY OF WISCONSIN - MADISON			93%	125.006	100%															
NAME OF STUDY		FIELD VALIDATION OF WISCONSIN MODIFIED BINDER SELECTION GUIDELINES																		
TASK *	YEAR	2003				2004				2005				2006		Project Complete	Task Complete Last Report	Task Complete This Report	Project Complete	
	MONTH	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 5	Qtr 6	Qtr 7	Qtr 8	Qtr 9	Qtr 10	Qtr 11	Qtr 12	Qtr 13	Qtr 14					
TASK 1 : Defiene binder grades Select field sections	SCHEDULED																			
	COMPLETED																10	8	0	8
TASK 2 : Collect samples Conduct testing	SCHEDULED																			
	COMPLETED																50	35	4	39
TASK 3 : Monitor performance of sections	SCHEDULED																			
	COMPLETED																10	3	0	3
TASK 4: Database development	SCHEDULED																			
	COMPLETED																15	2	0	2
TASK 5: Reporting	SCHEDULED																			
	COMPLETED																15	8	1	9
SHOW PROGRESS BY USE OF A BAR CHART:		SCHEDULED																		
		COMPLETED														100	56	5	61	