

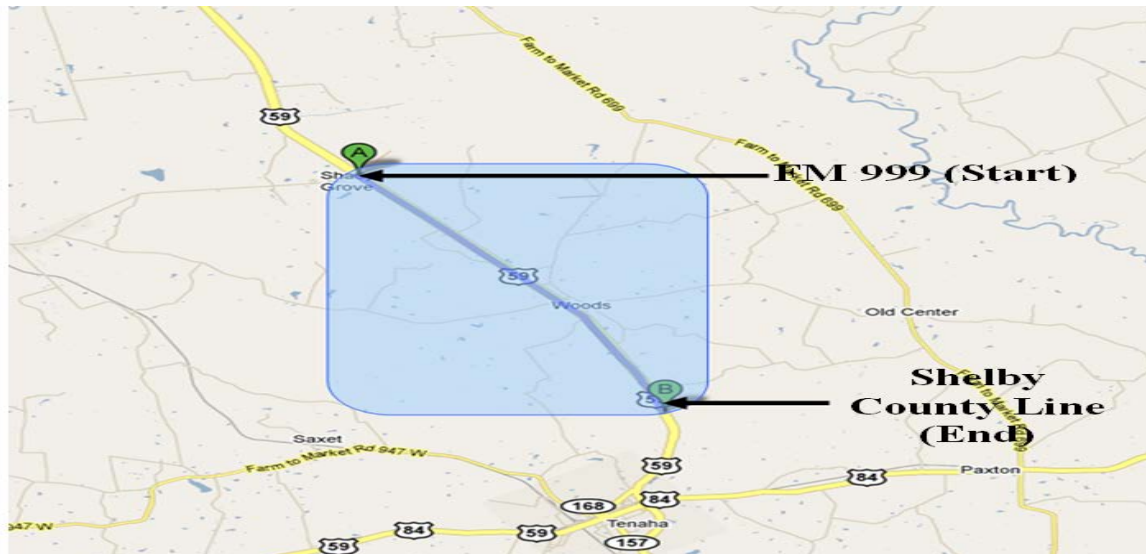
Technical Memo: Project 0-6132 (Task 6)

To: Miles Garrison, P.E. & Dale Rand PE
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From: Lubinda F. Walubita (lfwalubita@tamu.edu)

Date: April 25th, 2010

Subject: Construction & Lab Test Reports for US 59
(Panola County, Atlanta District)



Summary

The attached memo presents construction information on the test sections placed by Madden Construction on US 59 on March 26th 2010. The memo includes details of the mix design, shows photographs of the construction sequence, lab test data on the Control and Modified mixes. It also contains detailed descriptions of the condition of test sections including GPR data.

Plans are to periodically monitor both the Control and Modified sections twice per year during the cold (crack evaluation) and hot (rutting evaluation) weather seasons, respectively, starting this summer. Field performance evaluation tests will include: (1) visual crack surveys, (2) rut measurements, (3) surface profiles (ride quality), (4) GPR, (5) skid measurements (with TxDOT help), (6) FWD (with TxDOT help), and (7) coring (where applicable).

Special thanks go to Miles Garrison (of TxDOT) and Madden Construction Company for permitting TTI to conduct a crack survey, record the construction process, and collect materials including the plant-mix for lab testing.

CRACK SURVEY & CONSTRUCTION REPORT

US 59 S, Outside Lane; Carthage, TX [Date of Construction: March 26th, 2010]

PROJECT DETAILS

Highway: US 59 (Panola County)
Project length: 6 miles
HMA overlay thickness: $\approx 1\frac{3}{4}$ inch
Project limits: FM 999 to Shelby County line

Project start location: FM 999
Longitude: N 32° 02. 854'
Latitude: W 094° 17. 485'

Project end Location: Shelby County Line
Longitude: N 31° 58. 509'
Latitude: W 094° 14. 023'

Contractor: Madden



HMA MIX-DESIGN DETAILS

Mix type: Type D_Fine Surface (Item 341)
Material : Type D with 20% fractionated RAP

Asphalt-binder: 5.2% PG 64-22 (Lion)
Aggregate: Jones Mill Quartzite
Aggregate blend: 40% 1/2" CA quartzite +
+ 13% 3/8" CA quartzite
+ 20% RAP + 19% screenings
+ 8% fine sand

RAP proportion: 10% Coarse RAP and 10% Fine RAP
%age AC in RAP: 4.3% in Coarse & 7.2% in Fine
Ignition Oven for RAP: 4.4% in Coarse & 6.8% in Fine



TTI SECTION DETAILS

Direction: Outside SB lane
Test section length: ≈ 100 ft
HMA overlay thickness: $\approx 1\frac{3}{4}$ inch
AC content: 1) Control= 5.2% AC
2) Modified= 5.5% AC

Ignition Oven: 5.1% AC (Control)
5.3% AC (Modified)

PAVING EQUIPMENT

Milling equipment, Roadtec MTD, Paver, Infra-Red bar,
3 No. compactors,
Nuclear density gauge, etc; see example photos in Figure 1.

EXAMPLES OF CONSTRUCTION PHOTOS



Figure 1a. Roadtec Shuttle Buggy MTV.



Figure 1b. Roadtec Mixer/Paver.



Figure 1c. IR (Temp.) Bar Setup.



Figure 1d. Caterpillar Vibratory Compactor



Figure 1e. TTI Nuclear Density Measurements.



Figure 1f. Example of Finished HMA Mat.

TTI CONTROL TEST SECTION 01

AC = 5.2%; HMA overlay thickness = 1¾ inch, US 59 (Outside SB lane)

Actual section length: 1479 ft
Section start location: N 32° 02. 807'; W 094° 17. 437'
Section end location: N 32° 02. 473'; W 094° 17. 101' (Station# 491+60)



Figure 2. Start-End Points of TTI Control Section 01 (5.2% AC)

Construction Details

Air temperature: 54 F
Pavement surface temp.: 76 F
HMA mat temp. 300 F
Breakdown vibratory steel rolling passes: 6 (approx. 20 ton)
Finishing steel rolling passes (vibratory): 4 (approx. 5 ton)

Target HMA mat thickness: ≈ 1¾ inch
HMA mat density (Nuclear density): 142 pfc



Figure 3. Example of Finished HMA Mat on Control Section 01.

Crack Mapping

Table 1. Existing Transverse Cracks on Control Section 01

Crack#	Location from Crack#1	GPS Location	Remark	Severity
1	0 ft	N 32° 02. 660'; W 094° 17. 286'	Right side - Driveway/ Left side - Turnaround	
2	133 ft	N 32° 02. 642' W 094° 17. 269'		
3	655 ft	N 32° 02. 577' W 094° 17. 206'		
4	833 ft	N 32° 02. 552' W 094° 17. 182'		
5	1197 ft	N 32° 02. 506' W 094° 17. 135'	Driveway/Gated property on opposite side (US 59 N. bound)	
6	1306 ft	N 32° 02. 494' W 094° 17. 122'		
7	1393 ft	N 32° 02. 483' W 094° 17. 111'		



Figure 4. Example of Cracks on Control Section 01.

TTI MODIFIED SECTION

AC = 5.5%; HMA overlay thickness = 1¾ inch, US 59 (Outside SB lane)

Actual section length: 1848 ft
Section start location: N 32° 02. 473'; W094° 17. 101' (Station# 491+60)
Section end location: N 32° 01. 845'; W 094° 16. 478' (Station# 610+00)



Figure 5. Start-End Points of TTI Modified Section (5.5% AC)

Construction Details

Air temperature: 68 F
Pavement surface temp.: 80 F
HMA mat temp. 300 F
Breakdown vibratory steel rolling passes: 6 (approx. 20 ton)
Finishing steel rolling passes (vibratory): 4 (approx. 5 ton)

Target HMA mat thickness: ≈ 1¾ inch
HMA mat density (Nuclear density): 144 pfc



Figure 6. Example of Finished HMA Mat on Modified Section.

Crack Mapping

Table 2. Existing Transverse Cracks on Modified Section

Crack#	Location from Crack#1 (Section 1)	GPS Location	Remark	Severity
1	0 ft	N 32° 02. 078'; W 094° 16. 709'	Left side (US 59 N bound) – Fresh Water Pond and Turnaround	
2	365 ft	N 32° 02. 032'; W 094° 16. 664'		
3	383 ft	N 32° 02. 029'; W 094° 16. 658'		
4	553 ft	N 32° 02. 009'; W 094° 16. 638'		
5	567 ft	N 32° 02. 007'; W 094° 16. 634'		
6	655 ft	N 32° 01. 995'; W 094° 16. 628'		
7	727 ft	N 32° 01. 985'; W 094° 16. 618'		
8	807 ft	N 32° 01. 976'; W 094° 16. 606'		
9	918 ft	N 32° 01. 962'; W 094° 16. 623'		
10	1266 ft	N 32° 01. 918'; W 094° 16. 551'		
11	1350 ft	N 32° 01. 907'; W 094° 16. 551'		Very
12	1434 ft	N 32° 01. 897'; W 094° 16. 530'		
13	1700 ft	N 32° 01. 864'; W 094° 16. 496'		
14	1780 ft	N 32° 01. 854'; W 094° 16. 486'		
15	1813 ft	N 32° 01. 849'; W 094° 16. 483'		



Figure 7. Example of Severe Cracks on Modified Section.

TTI CONTROL TEST SECTION 02

AC = 5.2%; HMA overlay thickness = 1¾ inch, US 59 (Outside SB lane)

Actual section length:	1000 ft
Section start location:	N 32° 01. 845'; W 094° 16. 478' (Station# 610+00)
Section end location:	N 32° 01. 718'; W 094° 16. 354'



Figure 8. Start Point of TTI Control Section 02.

Construction Details

Air temperature:	69 F
Pavement surface temp.:	80 F
HMA mat temp.	300 F
Breakdown vibratory steel rolling passes:	6 (approx. 20 ton)
Finishing steel rolling passes (vibratory):	4 (approx. 5 ton)
Target HMA mat thickness:	≈ 1¾ inch
HMA mat density (Nuclear density):	142.8 pfc



Figure 9. Example of Transverse cracks in Section 02.



Figure 10. Example of Finished HMA Mat on US 59.

CONTRACT IR THERMAL RESULTS

Table 3. Summary IR Thermal Results

Profile ID:	U.S.59 SOUTH BOUND OUTSIDE LN	Profile Date:	3/26/2010 6:58:38 AM
Profile Number:	3	Letting Date:	
Status:	NH 2010(414)	Controlling CSJ:	0063-05-033
County:	PANOLA	Spec Year:	2010
Tested By:	MADDEN CONTRACTING	Spec Item:	341
Test Location:	43360	Special Provision:	204
Material Code:		Mix Type:	TYPE "D" RAP
Material Name:			
Producer:	LAI		
Area Engineer:	STEVE JUNEAU	Project Manager:	

Course/Lift:	1	Temperature Differential Threshold:	25.0
Segment Length (ft):	150	Sensors Ignored:	1, 2, 10, 11, 12

CONTRACT IR THERMAL RESULTS (CONTINUED)

Table 4. Summary IR Thermal Results (Continued)

Thermal Profile Results Summary				
Number of Profiles	Moderate 25.0°F < differential <= 50.0°F		Severe differential > 50.0°F	
	Number	Percent	Number	Percent
130	47	36	0	0

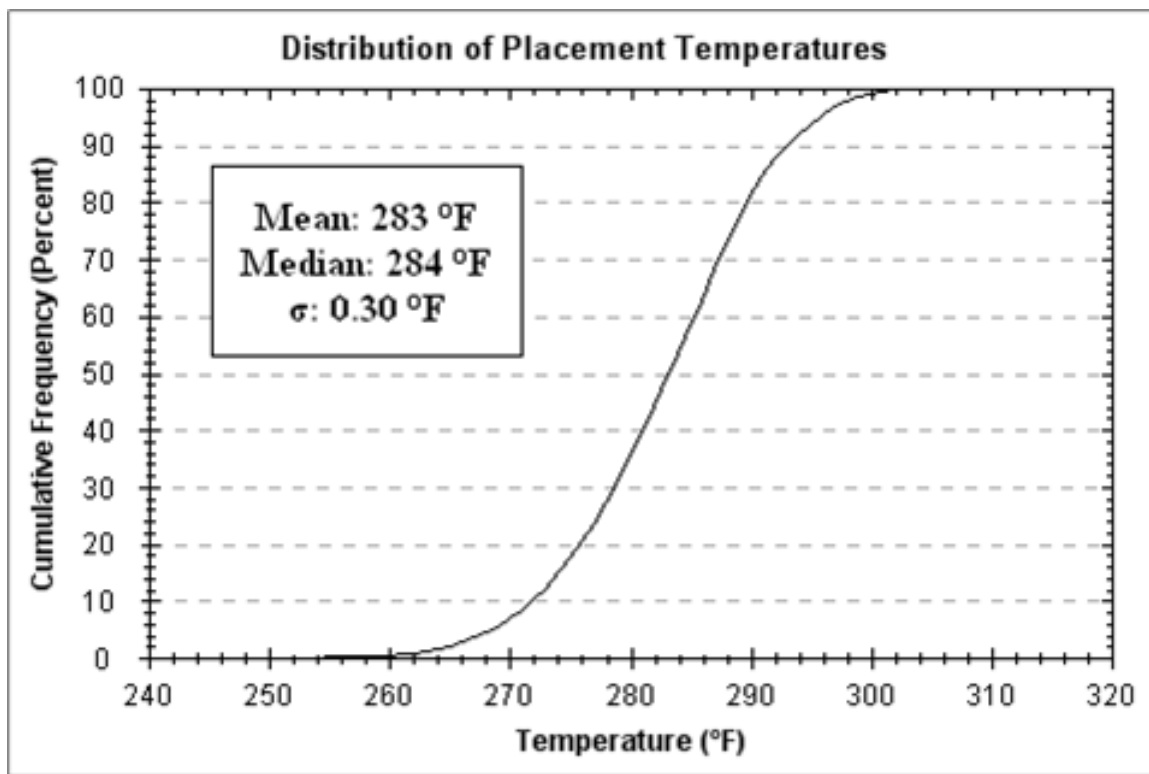
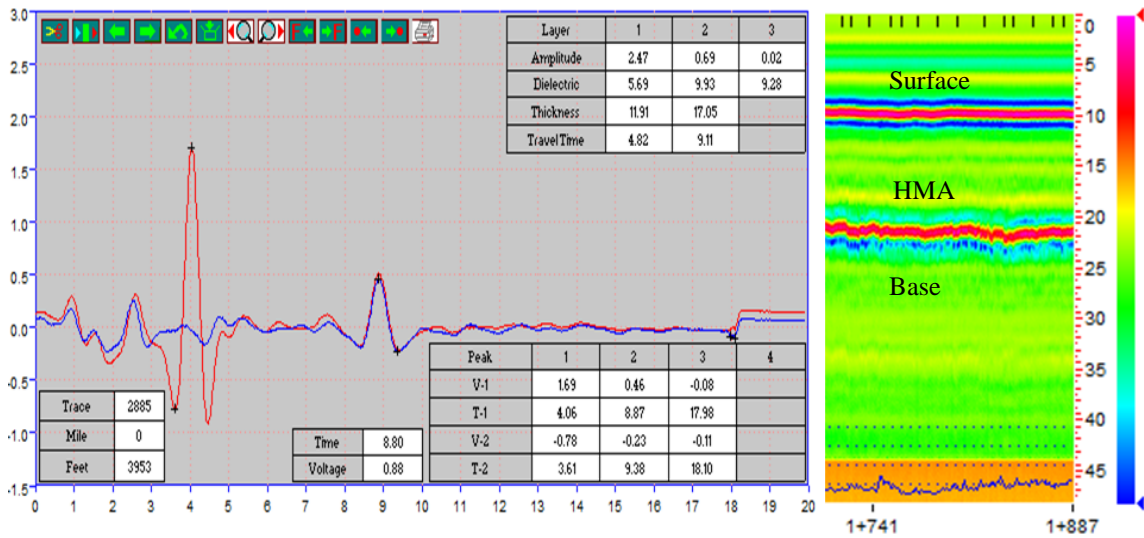
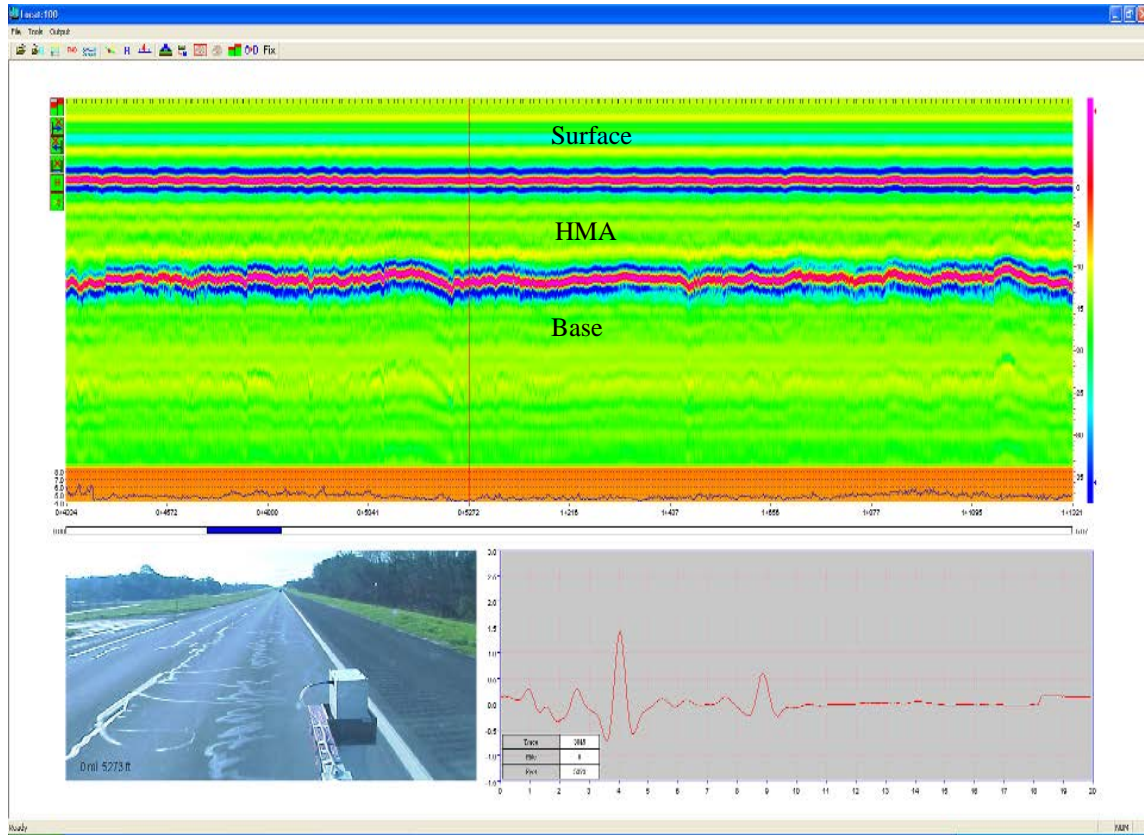


Figure 11. Cummulative-Frequency IR Thermal Plots.

GPR MEASUREMENTS PRIOR TO HMA OVERLAY



*Existing structure: Approx. 10 inches HMA + about 12 inches base (based on GPR)

Figure 12. GPR Measurements Prior to HMA Overlay Placement.

SUMMARY REPORT: LAB TEST RESULTS (US 59, ATLANTA DISTRICT)

HMA MIX-DESIGN DETAILS

Highway: US 59 (Panola County)
 Project length: 6 miles
 Project limits: FM 999 to Shelby County line
 GPS limits: N 32° 02.854' W 094° 17.485' to N 31° 58.509' W 094° 14.023'

TTI Test Sections:

Section 1: Control (5.2% AC): Length = 1479 ft
 Section 2: Modified (5.5% AC): Length = 1848 ft
 Section 3: Control (5.2% AC): Length = 1000 ft
 Target HMA mat thickness: ≈ 1¾ inch

Mix: Type D_Fine Surface (Item 341)
 Material: TYPE "D" HOTMIX WITH 20 % FRACTIONATED RAP
 Asphalt-binder + Aggregate: PG 64-22 (Lion) + Jones Mill Quartzite
 Aggregate blend: 40% ½" CA quartzite + 13% 3/8" CA quartzite + 20% RAP
 + 19% Screenings + 8% Fine Sand

20% RAP: 10% Coarse RAP and 10% Fine RAP
 %age Asphalt-binder in RAP: 4.3% in Coarse RAP & 7.2% in Fine RAP

IGNITION OVEN TESTS

Plant-mix: Control = 5.1% AC (5.2% design); Modified = 5.3% AC (5.5% design)
 RAP: 4.4% AC from Coarse RAP & 6.8% AC from Fine RAP

TEXAS GYRATORY (TGC), HWTT, OT, IDT, AND SCB RESULTS

Asphalt -Binder Content	TGC Lab Density	HWTT @ 15 k (mm)	OT		IDT		SCB	
			Cycles	P _{max} (lb)	σ _{IDT} (psi)	Max Disp (in.)	σ _{SCB} (psi)	Max Disp (in.)
5.2% (Plant-mix)	97%	3.1	269	757	126	0.42	124	0.82
5.5% (Plant-mix)	98%	4.1	506	686	104	0.41	100	0.85
TTI Molded from Raw Materials								
5.0%	97.2%	3.7	--	---	---	---	---	---
5.2%	97.5%	3.7	225	864	149	0.41	134	0.83
5.4%	97.9%	4.2	347	814	130	0.37	117	0.84
5.6%	98.2%	4.6	469	763	134	0.41	114	0.86
5.8%	98.4%	5.3	577	755	126	0.38	111	0.86
6.2%	98.7%	5.8	655	738	103	0.38	89	0.88

GRAPHICAL RESULTS

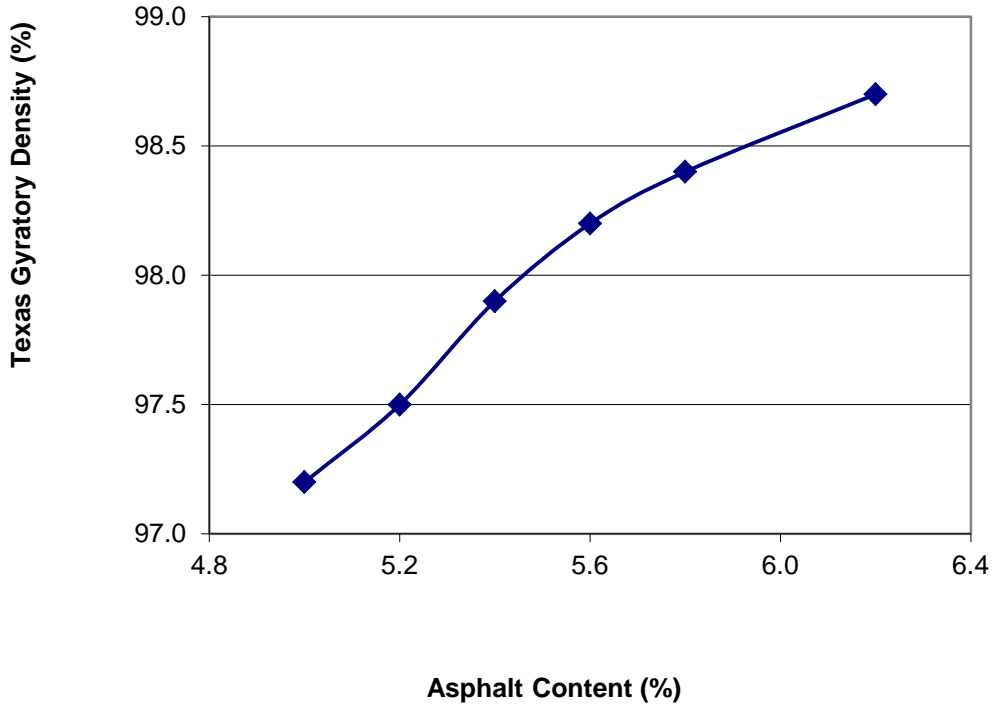


Figure 1. Texas Gyrotory Density vs. AC Content.

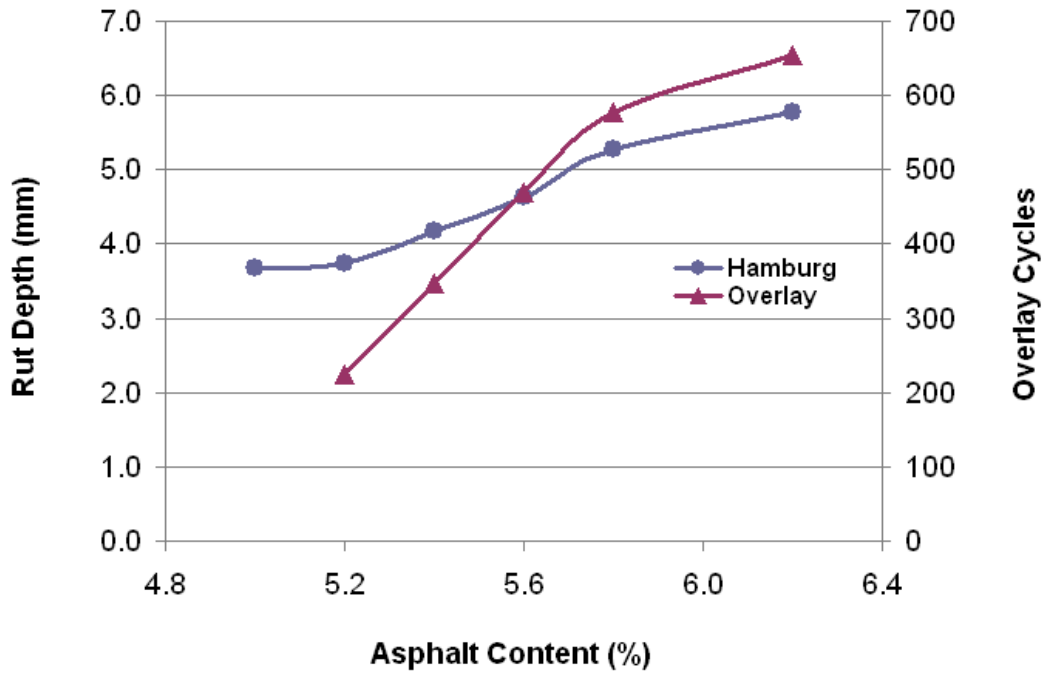


Figure 2. Hamburg and Overlay Results vs AC Content.

GRAPHICAL RESULTS (Continued)

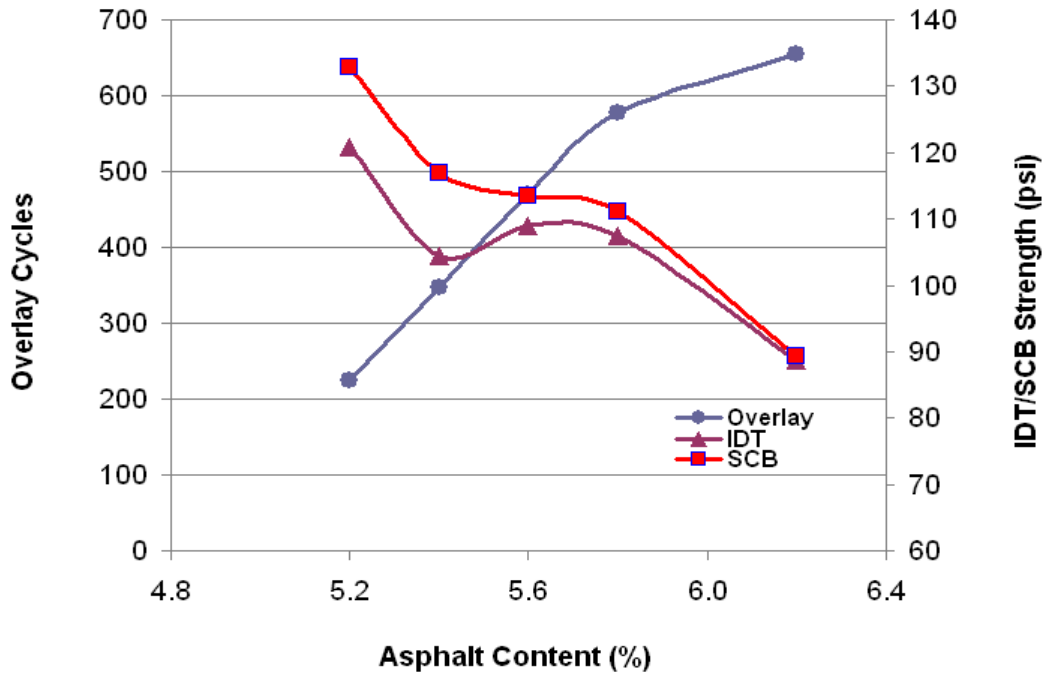


Figure 3. Overlay (Cycles), IDT & SCB (Strength) Results - σ vs AC Content.

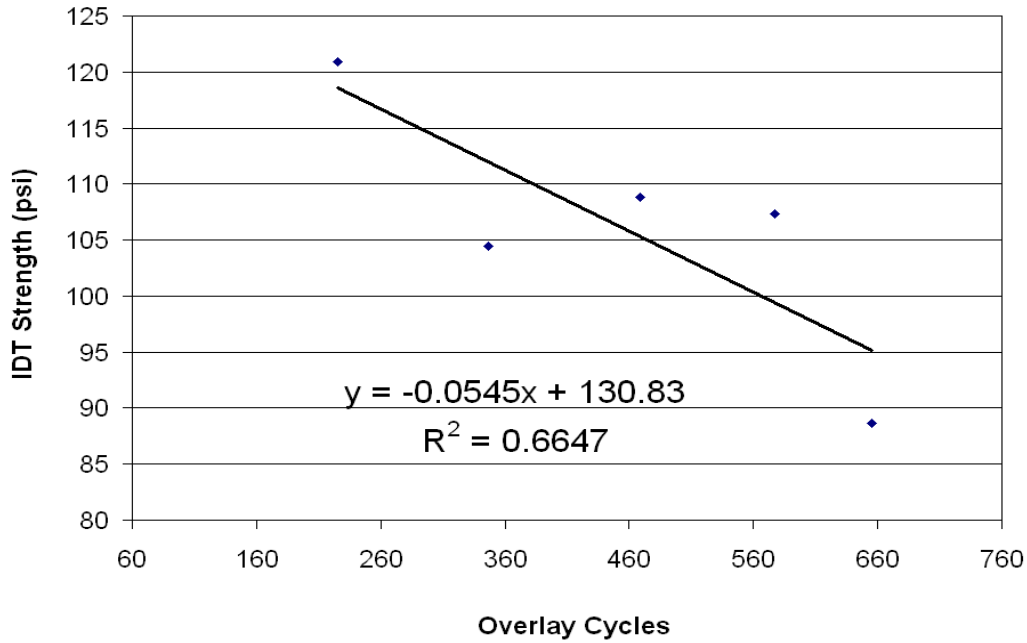


Figure 4. IDT Strength vs Overlay Cycles.

GRAPHICAL RESULTS (Continued)

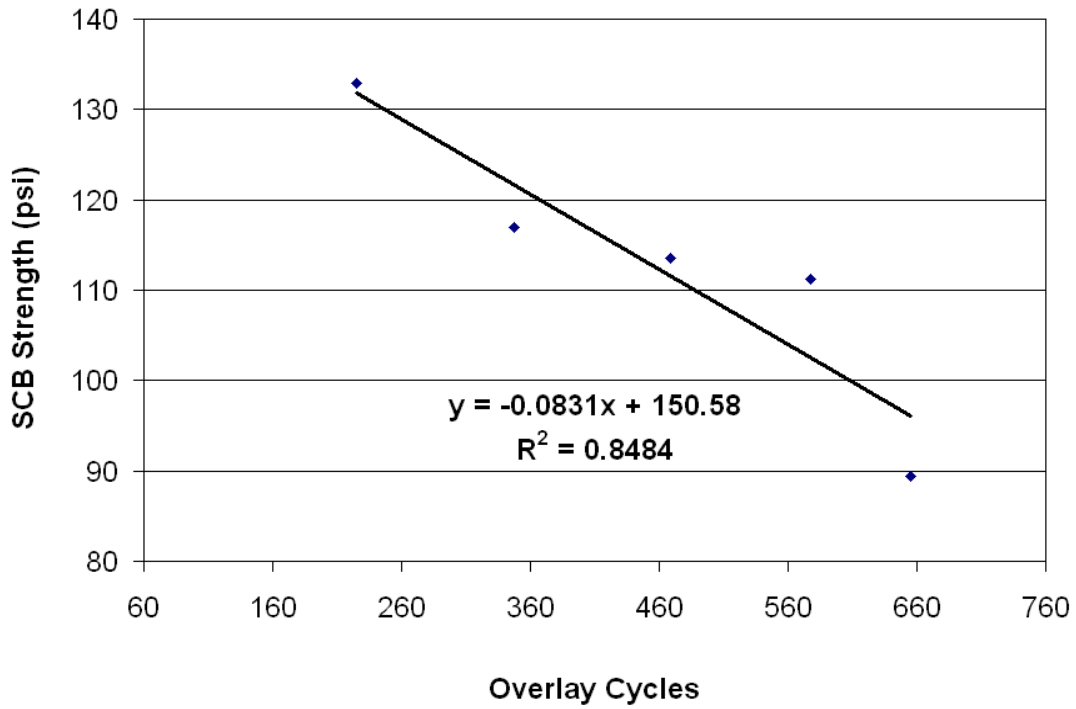


Figure 5. SCB Strength vs Overlay Cycles.

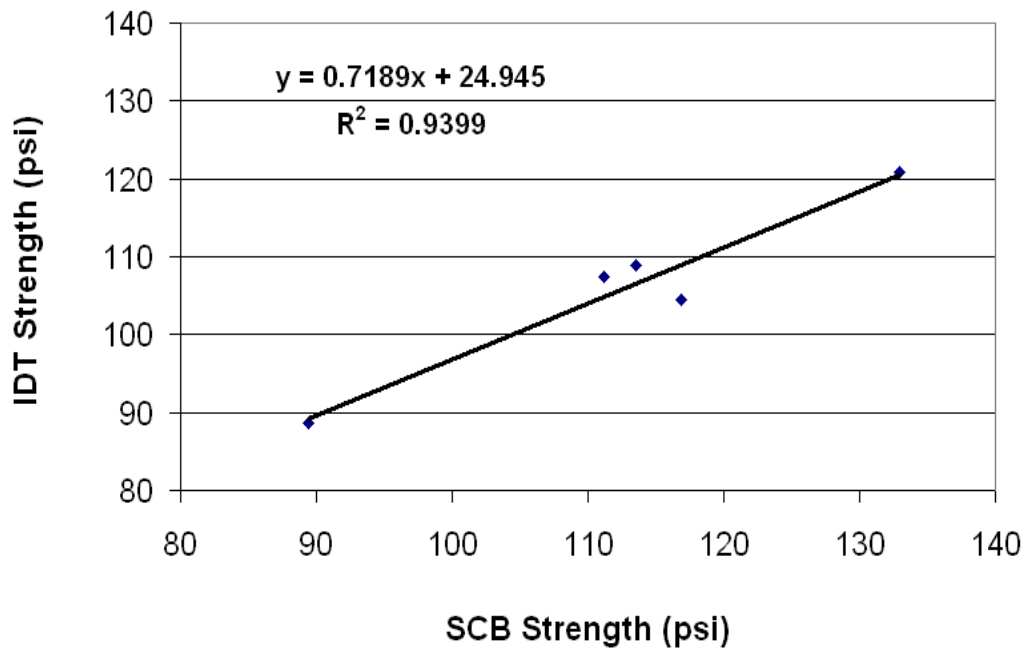


Figure 6. IDT Strength vs SCB Strength.

LAB PICTURES



Figure 7. Comparison of 5.2% AC (3.1 mm) and 5.5% AC (4.1 mm) Hamburg Specimens.

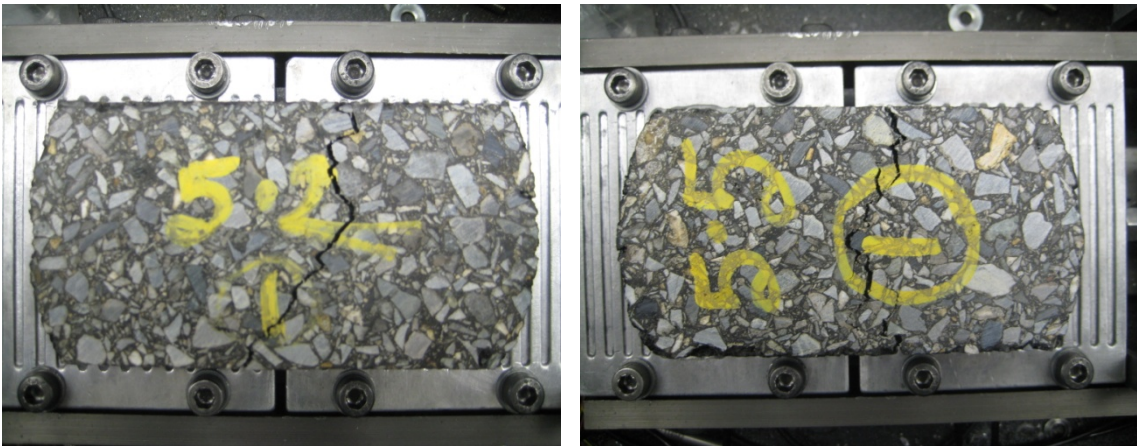


Figure 8. Comparison of 5.2% AC (269 cycles) and 5.5% AC (506 cycles) OT Specimens



Figure 16. Comparison of 5.2% AC (126 psi) and 5.5% AC (104 psi) IDT Specimens.

LAB PICTURES (Continued)



Figure 10. Comparison of 5.2% AC (124 psi) and 5.5% AC (100 psi) SCB Specimens.