Station	Temp Mid °F	Temp. Adj Fact.	Peak Spring Defl. mils	Spring Subgrade Modulus ksi	AASHTO Effective Values CBR	SN	Calculated Spring Axle Load to Achive Design Deflection in Tons AASHTO Soil Fact.	Inv 183	TONN Method	10-year Overlay Structure inches	9-ton inches	10-ton inches	20-year Overlay Structure inches	9-ton inches	10-ton inches	LTPP Forwardcalculation for HMA Eac	Egb	Esg	SN
4.8	53.9	1.1	34	11.7	7.8	2.2	10.4	10.3 8.4	9.1	0.5	0.0	1.0	1.2	0.0	1.0	307	55.1	24.3	2.6
4.8	53.9	1.1	34	11.6	7.8	2.2	10.5	10.4 8.5	9.2	0.5	0.0	1.0	1.2	0.0	1.0	309	54.9	24.2	2.6
4.8	53.9	1.1	35	11.4	7.6	2.2	10.3	10.2 8.4	9.0	0.6	0.5	1.0	1.3	0.5	1.0	295	53.9	23.8	2.6
4.8	53.9	1.1	35	11.4	7.6	2.2	10.4	10.3 8.5	9.0	0.6	0.0	1.0	1.3	0.0	1.0	302	53.6	23.7	2.6
4.9	54.3	1.1	35	9.5	6.3	2.3	11.0	10.8 9.1	8.9	0.8	0.5	1.0	1.6	0.5	1.0	242	44.8	19.8	2.5
4.9	54.3	1.1	35	9.5	6.3	2.3	11.1	10.9 9.2	9.0	0.8	0.5	1.0	1.6	0.5	1.0	249	44.8	19.8	2.5
4.9	54.3	1.1	35	9.3	6.2	2.3	11.3	11.0 9.4	9.0	0.8	0.0	1.0	1.6	0.0	1.0	260	43.7	19.3	2.5
4.9	54.3	1.1	34	9.2	6.1	2.3	11.4	11.2 9.5	9.1	0.8	0.0	1.0	1.6	0.0	1.0	268	43.3	19.1	2.5
5.0	55.2	1.1	33	10.2	6.8	2.4	11.5	11.4 9.5	9.6	0.5	0.0	0.5	1.3	0.0	0.5	388	48.1	21.2	2.7
5.0	55.2	1.1	32	10.0	6.7	2.4	11.8	11.6 9.7	9.7	0.5	0.0	0.5	1.2	0.0	0.5	396	47.4	20.9	2.7
5.0	55.2	1.1	33	9.9	6.6	2.4	11.7	11.5 9.7	9.7	0.5	0.0	0.5	1.3	0.0	0.5	392	46.8	20.7	2.7
5.0	55.2	1.1	32	9.8	6.5	2.4	11.9	11.7 9.8	9.8	0.5	0.0	0.5	1.3	0.0	0.5	401	46.4	20.5	2.7
5.1	53.4	1.1	32	9.0	6.0	2.5	12.5	12.2 10.4	9.9	0.5	0.0	0.5	1.3	0.0	0.5	277	42.4	18.7	2.6
5.1	53.4	1.1	31	9.0	6.0	2.5	12.6	12.4 10.5	10.0	0.5	0.0	0.0	1.2	0.0	0.0	285	42.3	18.7	2.6
5.1	53.4	1.1	31	8.8	5.9	2.5	13.0	12.7 10.9	10.2	0.4	0.0	0.0	1.1	0.0	0.0	305	41.4	18.3	2.6
5.1	53.4	1.1	30	8.7	5.8	2.6	13.2	12.9 11.1	10.4	0.4	0.0	0.0	1.1	0.0	0.0	313	40.9	18.0	2.6
5.2	54.4	1.1	36	10.1	6.7	2.2	10.4	10.2 8.6	8.6	0.9	0.5	1.5	1.6	0.5	1.5	240	47.6	21.0	2.5
5.2	54.4	1.1	36	10.1	6.8	2.2	10.5	10.3 8.6	8.7	0.8	0.5	1.5	1.6	0.5	1.5	244	47.9	21.1	2.5
5.2	54.4	1.1	35	9.8	6.5	2.3	10.9	10.7 9.0	8.9	0.8	0.5	1.0	1.6	0.5	1.0	262	46.1	20.4	2.5
5.2	54.4	1.1	35	9.6	6.4	2.3	11.0	10.8 9.1	9.0	0.8	0.5	1.0	1.6	0.5	1.0	268	45.4	20.0	2.5
5.2																			
5.3	54.6	1.1	32	9.6	6.4	2.4	12.1	11.9 10.0	9.8	0.5	0.0	0.5	1.3	0.0	0.5	288	45.1	19.9	2.6
5.3	54.6	1.1	32	9.5	6.4	2.4	12.2	11.9 10.1	9.9	0.5	0.0	0.5	1.3	0.0	0.5	293	45.0	19.9	2.6
5.3	54.6	1.1	31	9.2	6.1	2.5	12.7	12.4 10.6	10.2	0.4	0.0	0.0	1.2	0.0	0.0	312	43.4	19.2	2.6
5.3	54.6	1.1	31	9.1	6.1	2.5	12.8	12.5 10.7	10.2	0.4	0.0	0.0	1.2	0.0	0.0	319	43.1	19.0	2.6
5.4	54.1	1.1	33	9.4	6.2	2.4	11.8	11.6 9.8	9.5	0.6	0.0	0.5	1.4	0.0	0.5	279	44.1	19.5	2.6
5.4	54.1	1.1	33	9.3	6.2	2.4	11.9	11.7 9.9	9.6	0.6	0.0	0.5	1.4	0.0	0.5	282	44.1	19.5	2.6
5.4	54.1	1.1	32	9.1	6.1	2.5	12.5	12.2 10.4	10.0	0.5	0.0	0.5	1.3	0.0	0.5	322	42.9	19.0	2.6
5.4	54.1	1.1	31	9.0	6.0	2.5	12.6	12.4 10.5	10.0	0.5	0.0	0.0	1.2	0.0	0.0	332	42.6	18.8	2.6
5.4																			

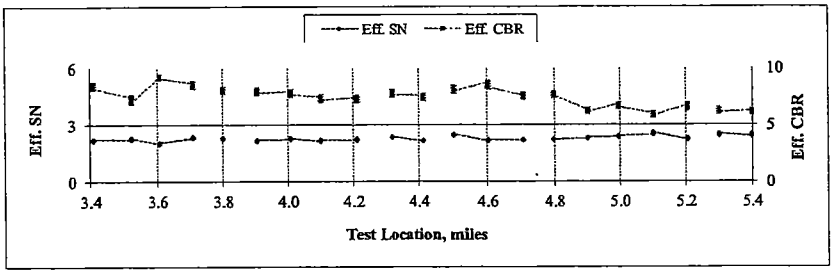


EXHIBIT D

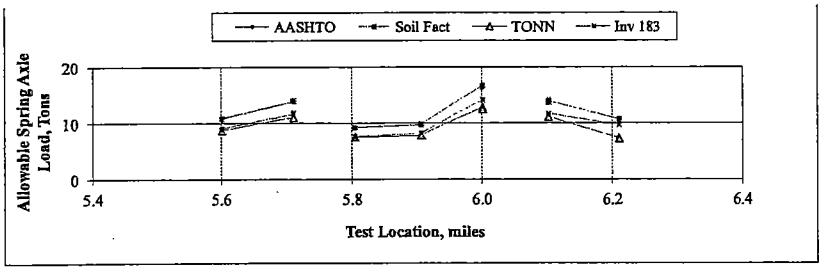
American Engineering Testing, Inc.
550 Cleveland Avenue North
St. Paul, Minnesota 55114
Phone: (651) 659-9001
Fax: (651) 659-1379

AET Project No. 28-00500
County: Pepin
Test Date: Mar 30, 2012
Section: 5
Roadway: CTH SS
From: CTH N
To: 0.8 mi W

Prev. Day's Avg. Air Temp.: 45 °F
Total AC: 3.7 in.
Daily ESALs: 10.0
Annual Growth: 2.0%
Pavement Condition Index: 60.0
Soil Type: NP
Seasonal Correction Factor: 1.10
Daily Haul ESALs: 63.0

Design Period: 10 Years
Projection Factor: 1.2
Growth Factor: 10.97
10-year Design ESALs: 270,189
Design Period: 20 Years
Projection Factor: 1.5
Growth Factor: 24.41
20-year Design ESALs: 549,387

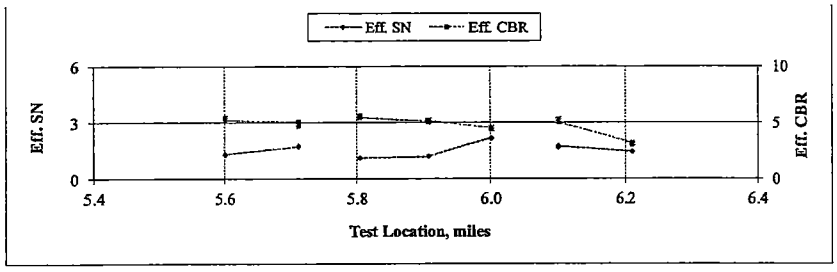
Station	Drop	Time	Air °F	Bit °F	Load	D9	D1	D2	D3	D4	D5	D6	D7	D8	Effective Values CBR %	Effective Values SN inches	10 Year Overlay Thickness inches	10 Year Spring Capacity tons/axle	Comments
5.4																			RIGHT ON CO RD SS"
5.6	2	12:40	46.4	57.9	5818	0.0	18.1	13.6	10.6	6.7	4.7	2.3	1.5	1.1	5.4	1.3	3.0	8.7	
5.6	3	12:40	46.4	57.9	8782	0.0	27.5	20.8	16.3	10.5	7.4	3.6	2.3	1.7	5.3	1.3	3.0	8.7	
5.6	4	12:40	46.4	57.9	8803	0.0	27.3	20.7	16.2	10.6	7.4	3.7	2.4	1.7	5.2	1.3	3.0	8.7	
5.7	1	12:41	46.4	59.6	5774	0.0	13.6	11.3	9.2	6.7	5.0	2.5	1.4	0.9	5.0	1.7	2.2	11.1	
5.7	2	12:41	46.4	59.6	5752	0.0	13.5	11.1	9.1	6.6	4.9	2.5	1.4	1.0	5.0	1.7	2.1	11.2	
5.7	3	12:41	46.4	59.6	8749	0.0	21.1	17.5	14.3	10.5	7.8	4.0	2.2	1.5	4.8	1.7	2.2	10.9	
5.7	4	12:41	46.4	59.6	8760	0.0	21.1	17.5	14.3	10.4	7.8	4.0	2.2	1.6	4.7	1.8	2.2	10.9	
5.7																			B14"
5.8	1	12:42	46.4	59.2	5807	0.0	21.5	16.4	12.6	8.2	5.4	2.3	1.4	1.1	5.5	1.1	3.4	7.5	
5.8	2	12:42	46.4	59.2	5785	0.0	21.2	16.2	12.5	8.1	5.4	2.3	1.4	1.1	5.5	1.1	3.3	7.6	
5.8	3	12:42	46.4	59.2	8738	0.0	32.3	24.5	18.9	12.4	8.3	3.4	2.0	1.6	5.6	1.1	3.3	7.5	
5.8	4	12:42	46.4	59.2	8738	0.0	32.2	24.5	18.9	12.4	8.3	3.5	2.0	1.7	5.4	1.1	3.4	7.5	
5.9	1	12:43	46.4	59.3	5818	0.0	20.9	17.6	8.5	5.8	4.4	2.5	1.6	1.2	5.1	1.2	3.4	7.7	
5.9	2	12:43	46.4	59.3	5774	0.0	20.6	17.4	8.4	5.8	4.3	2.5	1.6	1.2	5.0	1.2	3.4	7.8	
5.9	3	12:43	46.4	59.3	8738	0.0	30.9	25.9	12.6	8.7	6.5	3.6	2.4	1.8	5.2	1.2	3.3	7.8	
5.9	4	12:43	46.4	59.3	8727	0.0	30.7	25.7	12.5	8.7	6.5	3.7	2.4	1.8	5.1	1.2	3.3	7.9	
6.0	1	12:44	46.4	60.2	5774	0.0	11.4	10.1	8.6	6.6	5.1	2.8	1.4	1.1	4.5	2.2	1.4	12.8	
6.0	2	12:44	46.4	60.2	5752	0.0	11.4	10.0	8.6	6.5	5.1	2.8	1.4	1.0	4.5	2.2	1.4	12.8	
6.0	3	12:44	46.4	60.2	8749	0.0	18.1	15.8	13.5	10.3	8.0	4.3	2.2	1.6	4.4	2.1	1.5	12.4	
6.0	4	12:44	46.4	60.2	8749	0.0	18.1	15.8	13.5	10.3	8.0	4.3	2.2	1.7	4.4	2.1	1.5	12.4	
6.0																			PLUMMER RD"
6.1	1	12:45	48.2	55.0	5829	0.0	13.5	10.9	8.7	6.0	4.5	2.4	1.5	1.0	5.3	1.7	2.2	11.0	
6.1	2	12:45	48.2	55.0	5774	0.0	13	10.6	8.5	5.9	4.4	2.4	1.4	1.0	5.2	1.7	2.1	11.1	
6.1	3	12:45	48.2	55.0	8814	0.0	20.4	16.5	13.2	9.3	7.0	3.8	2.3	1.6	5.0	1.7	2.2	11.1	
6.1	4	12:45	48.2	55.0	8814	0.0	20.3	16.4	13.1	9.2	7.0	3.8	2.3	1.6	5.0	1.7	2.2	11.1	
6.2	1	12:46	48.2	60.2	5654	0.0	22.4	18.1	14.5	10.2	7.3	3.9	2.4	1.7	3.2	1.4	3.6	7.3	
6.2	2	12:46	48.2	60.2	5654	0.0	22.3	18.0	14.5	10.2	7.3	3.9	2.3	1.7	3.1	1.5	3.6	7.3	
6.2	3	12:46	48.2	60.2	8541	0.0	34.6	27.9	22.6	15.9	11.5	6.0	3.6	2.6	3.1	1.4	3.6	7.2	
6.2	4	12:46	48.2	60.2	8574	0.0	34.6	27.9	22.7	16.0	11.7	6.2	3.6	2.6	3.0	1.5	3.5	7.2	
6.2																			B15"



	Summary of Analysis Results														
					Axle Load for Design Defl. Tons				10-year Overlay			20-year Overlay			
	$_{SB}BB_m$	Esg	Eff.	SN				TONN	Structure	9-ton	10-ton	Structure	9-ton	10-ton	
	mils	ksi	CBR	inches	AASHTO	S.F	Inv. 183	Tons	inches	inches	inches	inches	inches	inches	
Avg. =	39.8	7.2	4.8	1.5	12.1	12.1	10.2	9.4	2.7	0.8	1.4	3.4	0.8	1.4	
Median =	41.5	7.6	5.0	1.4	10.7	10.7	9.7	8.7	3.0	0.5	1.5	3.8	0.5	1.5	
Std.Dev. =	8.0	1.2	0.8	0.4	2.6	2.6	2.2	2.0	0.8	0.9	1.3	0.8	0.9	1.3	
85th % =	47.9	6.6	4.4	1.2	9.7	9.7	8.1	7.5	3.4	2.0	2.5	4.1	2.0	2.5	

15.7 Pestimg: 9.0

							Calculated Spring Axle Load to Achive Design Deflection in Tons				10-year Overlay			20-year Overlay			LTPP Forwardcalculation for HMA			
	Temp	Temp.	Peak Spring	Spring Subgrade	AASHTO Effective Values					TONN	Structure	9-ton	10-ton	Structure	9-ton	10-ton				
Station	Mid °F	Adj Fact.	Defl. mils	Modulus ksi	CBR	SN	AASHTO	Soil Fact.	Inv 183	Method	inches	inches	inches	inches	inches	inches	Eac	Egb	Esg	SN
5.4																				
5.6	53.8	1.1	41	8.1	5.4	1.3	10.6	10.7	8.8	8.7	3.0	0.5	1.5	3.8	0.5	1.5	225	23.8	16.9	1.7
5.6	53.8	1.1	42	7.9	5.3	1.3	10.7	10.7	8.9	8.7	3.0	0.5	1.5	3.8	0.5	1.5	232	23.2	16.5	1.7
5.6	53.8	1.1	41	7.8	5.2	1.3	10.8	10.9	9.1	8.7	3.0	0.5	1.5	3.8	0.5	1.5	237	22.9	16.2	1.7
5.7	55.0	1.1	33	7.6	5.0	1.7	13.9	13.9	11.6	11.1	2.2	0.0	0.0	2.9	0.0	0.0	531	22.2	15.8	2.0
5.7	55.0	1.1	32	7.5	5.0	1.7	14.0	14.1	11.8	11.2	2.1	0.0	0.0	2.9	0.0	0.0	535	22.0	15.6	2.0
5.7	55.0	1.1	33	7.1	4.8	1.7	14.0	14.0	11.8	10.9	2.2	0.0	0.0	3.0	0.0	0.0	524	21.0	14.9	2.0
5.7	55.0	1.1	33	7.1	4.7	1.8	14.0	14.1	11.9	10.9	2.2	0.0	0.0	2.9	0.0	0.0	523	20.8	14.7	2.0
5.7																				
5.8	54.8	1.1	48	8.3	5.5	1.1	9.1	9.2	7.6	7.5	3.4	2.0	2.5	4.1	2.0	2.5	206	24.3	17.3	1.6
5.8	54.8	1.1	48	8.3	5.5	1.1	9.1	9.2	7.6	7.6	3.3	1.5	2.5	4.1	1.5	2.5	209	24.4	17.3	1.7
5.8	54.8	1.1	48	8.4	5.6	1.1	9.1	9.1	7.5	7.5	3.3	2.0	2.5	4.1	2.0	2.5	203	24.6	17.5	1.6
5.8	54.8	1.1	48	8.2	5.4	1.1	9.2	9.2	7.7	7.5	3.4	2.0	2.5	4.1	2.0	2.5	204	24.0	17.0	1.6
5.9	54.8	1.1	46	7.7	5.1	1.2	9.7	9.7	8.1	7.7	3.4	1.5	2.5	4.1	1.5	2.5	231	22.5	16.0	1.7
5.9	54.8	1.1	46	7.6	5.0	1.2	9.8	9.8	8.2	7.8	3.4	1.5	2.5	4.1	1.5	2.5	238	22.2	15.8	1.7
5.9	54.8	1.1	46	7.8	5.2	1.2	9.7	9.7	8.1	7.8	3.3	1.5	2.5	4.1	1.5	2.5	231	23.0	16.3	1.7
5.9	54.8	1.1	46	7.7	5.1	1.2	9.8	9.9	8.2	7.9	3.3	1.5	2.5	4.1	1.5	2.5	234	22.6	16.1	1.7
6.0	55.5	1.1	28	6.8	4.5	2.2	16.7	16.7	14.2	12.8	1.4	0.0	0.0	2.0	0.0	0.0	1079	20.0	14.2	2.0
6.0	55.5	1.1	28	6.8	4.5	2.2	16.7	16.7	14.2	12.8	1.4	0.0	0.0	2.0	0.0	0.0	1032	20.0	14.2	2.0
6.0	55.5	1.1	29	6.6	4.4	2.1	16.4	16.4	14.0	12.4	1.5	0.0	0.0	2.1	0.0	0.0	968	19.3	13.7	2.0
6.0	55.5	1.1	29	6.6	4.4	2.1	16.4	16.4	14.0	12.4	1.5	0.0	0.0	2.1	0.0	0.0	946	19.3	13.7	2.0
6.0																				
6.1	51.9	1.1	33	7.9	5.3	1.7	13.8	13.8	11.3	11.0	2.2	0.0	0.0	2.9	0.0	0.0	417	23.3	16.5	2.0
6.1	51.9	1.1	32	7.9	5.2	1.7	13.8	13.8	11.5	11.1	2.1	0.0	0.0	2.9	0.0	0.0	418	23.1	16.4	2.0
6.1	51.9	1.1	33	7.5	5.0	1.7	13.9	13.9	11.7	11.1	2.2	0.0	0.0	2.9	0.0	0.0	420	22.1	15.7	2.0
6.1	51.9	1.1	32	7.5	5.0	1.7	13.9	14.0	11.7	11.1	2.2	0.0	0.0	2.9	0.0	0.0	419	22.1	15.7	2.0
6.2	55.5	1.1	49	4.7	3.2	1.4	10.7	10.6	9.6	7.3	3.6	2.0	3.0	4.2	2.0	3.0	272	13.9	9.8	1.7
6.2	55.5	1.1	49	4.7	3.1	1.5	10.8	10.7	9.7	7.3	3.6	2.0	3.0	4.2	2.0	3.0	276	13.8	9.8	1.7
6.2	55.5	1.1	50	4.6	3.1	1.4	10.6	10.6	9.6	7.2	3.6	2.0	3.0	4.2	2.0	3.0	271	13.6	9.6	1.7
6.2	55.5	1.1	50	4.5	3.0	1.5	10.7	10.6	9.7	7.2	3.5	2.0	3.0	4.2	2.0	3.0	274	13.3	9.4	1.7
6.2																				



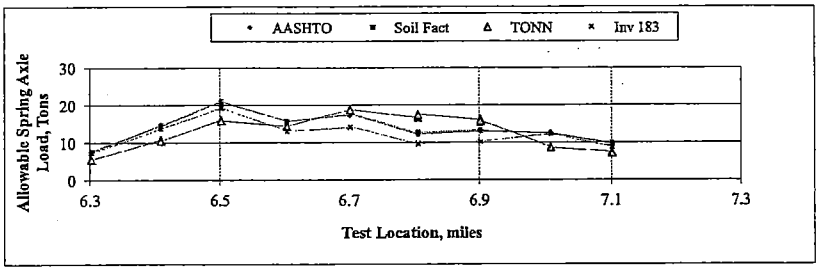
American Engineering Testing, Inc.
550 Cleveland Avenue North
St. Paul, Minnesota 55114
Phone: (651) 659-9001
Fax: (651) 659-1379

AET Project No. 28-00508
County: Pepin
Test Date: Mar 30, 2012
Section: 6
Roadway: CTH SS
From: 0.8 mi W
To: CTH D

Prev. Day's Avg. Air Temp.: 45 °F
Total AC: 2.4 in.
Daily ESALs: 12.0
Annual Growth: 2.0%
Pavement Condition Index: 82.0
Soil Type: F
Seasonal Correction Factor: 1.07
Daily Haul ESALs: 63.0

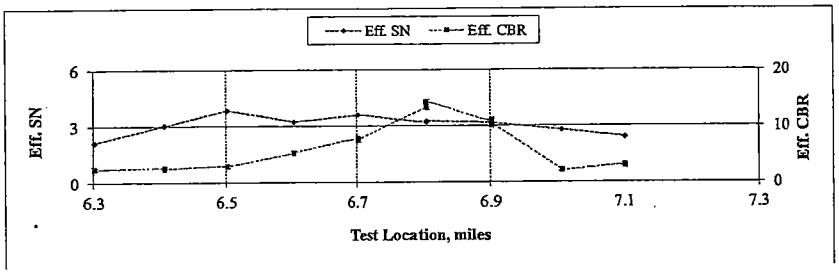
Design Period: 10 Years
Projection Factor: 1.2
Growth Factor: 10.97
10-year Design ESALs: 278,206
Design Period: 20 Years
Projection Factor: 1.5
Growth Factor: 24.41
20-year Design ESALs: 567,221

Station	Drop	Time	Air °F	Bit °F	Load	D9	D1	D2	D3	D4	D5	D6	D7	D8	Effective Values CBR %	Effective Values SN inches	10 Year Overlay Thickness inches	10 Year Spring Capacity tons/axle	Comments
6.3	1	12:47	46.4	59.9	5512	0.0	36.3	24.5	16.3	8.6	5.6	3.3	2.5	2.0	2.5	2.1	2.0	5.5	
6.3	2	12:47	46.4	59.9	5512	0.0	36	24.3	16.3	8.7	5.7	3.4	2.5	2.0	2.4	2.1	1.9	5.5	
6.3	3	12:47	46.4	59.9	8235	0.0	53.9	37.1	25.2	13.6	8.7	4.9	3.8	3.0	2.5	2.1	2.0	5.5	
6.3	4	12:47	46.4	59.9	8224	0.0	53.3	36.8	25.2	13.7	8.8	5.1	3.8	3.1	2.4	2.1	1.9	5.5	
6.4	1	12:48	48.2	60.3	5435	0.0	16.5	12.2	9.4	6.3	4.9	3.1	1.9	1.7	2.6	3.0	0.0	10.8	
6.4	2	12:48	48.2	60.3	5424	0.0	16.3	12.1	9.3	6.3	4.8	3.0	2.0	1.7	2.7	3.0	0.0	11.0	
6.4	3	12:48	48.2	60.3	8443	0.0	25.9	19.3	15.1	10.2	7.9	4.9	3.5	2.7	2.6	3.0	0.0	10.7	
6.4	4	12:48	48.2	60.3	8410	0.0	26.5	19.1	15.2	10.5	8.1	5.0	3.4	2.7	2.5	3.0	0.0	10.5	
6.5	1	12:49	50.0	59.0	5545	0.0	10.3	7.9	6.3	4.4	3.7	2.8	1.9	1.5	3.0	3.8	0.0	16.1	
6.5	2	12:49	50.0	59.0	5512	0.0	10.1	7.8	6.2	4.4	3.7	2.7	1.9	1.5	3.0	3.9	0.0	16.2	
6.5	3	12:49	50.0	59.0	8574	0.0	16.2	12.5	9.9	7.2	6.0	4.3	3.2	2.6	2.9	3.8	0.0	15.9	
6.5	4	12:49	50.0	59.0	8563	0.0	16.1	12.5	10.0	7.2	6.1	4.4	3.2	2.6	2.9	3.8	0.0	15.9	
6.6	1	12:50	50.0	59.0	5523	0.0	11.4	7.9	5.5	3.2	2.3	1.6	0.9	0.7	5.2	3.2	0.0	14.4	
6.6	2	12:50	50.0	59.0	5545	0.0	11.3	7.9	5.5	3.2	2.3	1.6	1.0	0.7	5.3	3.2	0.0	14.5	
6.6	3	12:50	50.0	59.0	8639	0.0	17.9	12.6	8.9	5.3	3.9	2.4	1.6	1.2	5.3	3.2	0.0	14.3	
6.6	4	12:50	50.0	59.0	8618	0.0	17.7	12.5	8.9	5.4	3.9	2.4	1.6	1.2	5.3	3.2	0.0	14.4	
6.7	1	12:51	48.2	58.5	5555	0.0	7.8	5.4	3.7	2.3	1.7	1.0	0.8	0.7	7.9	3.6	0.0	18.8	
6.7	2	12:51	48.2	58.5	5545	0.0	7.7	5.4	3.7	2.3	1.6	1.0	0.8	0.7	7.9	3.6	0.0	18.9	
6.7	3	12:51	48.2	58.5	8672	0.0	12.3	8.5	5.9	3.8	2.7	1.7	1.3	1.1	7.5	3.6	0.0	18.7	
6.7	4	12:51	48.2	58.5	8650	0.0	12.2	8.5	5.9	3.7	2.6	1.7	1.3	1.0	7.6	3.6	0.0	18.8	
6.8	1	12:52	50.0	57.5	5588	0.0	8.9	5.7	3.8	2.0	1.3	0.6	0.4	0.3	13.2	3.2	0.0	16.6	
6.8	2	12:52	50.0	57.5	5501	0.0	8.6	5.5	3.7	1.9	1.3	0.6	0.4	0.2	13.4	3.2	0.0	16.8	
6.8	3	12:52	50.0	57.5	8661	0.0	12.9	8.3	5.5	2.9	1.9	0.9	0.6	0.4	13.6	3.3	0.0	17.4	
6.8	4	12:52	50.0	57.5	8650	0.0	12.7	8.1	5.4	2.9	1.9	0.9	0.6	0.4	14.3	3.3	0.0	17.5	
6.9	1	12:53	46.4	57.5	5501	0.0	9.2	6.4	4.3	2.5	1.6	0.8	0.6	0.4	10.8	3.2	0.0	16.1	
6.9	2	12:53	46.4	57.5	5523	0.0	9.1	6.3	4.3	2.4	1.6	0.7	0.6	0.4	11.1	3.2	0.0	16.3	
6.9	3	12:53	46.4	57.5	8574	0.0	15.2	10.4	7.1	4.1	2.6	1.3	0.9	0.7	10.1	3.1	0.0	15.5	
6.9	4	12:53	46.4	57.5	8486	0.0	14.6	10.0	6.8	4.0	2.5	1.2	0.8	0.6	10.4	3.2	0.0	15.8	
7.0	1	12:55	46.4	58.0	5326	0.0	20.7	15.9	12.1	8.5	6.3	3.7	2.3	1.7	2.1	2.8	0.5	8.8	
7.0	2	12:55	46.4	58.0	5326	0.0	20.6	15.8	12.1	8.4	6.3	3.7	2.3	1.7	2.2	2.8	0.5	8.8	
7.0	3	12:55	46.4	58.0	8311	0.0	32.9	25.5	19.8	13.9	10.5	6.0	3.8	2.8	2.1	2.8	0.5	8.7	
7.0	4	12:55	46.4	58.0	8279	0.0	32.8	25.4	19.7	14.0	10.5	6.0	3.8	2.8	2.0	2.8	0.5	8.7	
7.1	1	12:56	46.4	59.7	5545	0.0	25.4	18.7	13.8	8.7	6.0	2.7	1.5	1.0	3.1	2.4	1.4	7.5	
7.1	2	12:56	46.4	59.7	5545	0.0	25.1	18.6	13.8	8.7	6.0	2.7	1.5	1.0	3.1	2.4	1.3	7.6	
7.1	4	12:56	46.4	59.7	8454	0.0	41.0	30.8	23.1	14.9	10.3	4.4	2.3	1.6	2.9	2.4	1.4	7.1	
7.1																			TURNING ON CO RD D"



	Summary of Analysis Results														
					Axle Load for Design Defl. Tons				10-year Overlay			20-year Overlay			
	$_{SB}E_{SB}$	Esg	Eff.	SN				TONN	Structure	9-ton	10-ton	Structure	9-ton	10-ton	
	mils	ksi	CBR	inches	AASHTO	S.F	Inv. 183	Tons	inches	inches	inches	inches	inches	inches	
Avg. =	37.4	8.4	5.6	3.0	13.8	13.8	12.1	12.7	0.4	0.8	1.1	0.9	0.8	1.1	
Median =	28.1	4.6	3.0	3.2	13.0	13.2	12.4	14.4	0.0	0.0	0.0	0.0	0.0	0.0	
Std.Dev. =	17.0	6.0	4.0	0.5	3.9	3.9	3.4	4.5	0.7	1.5	1.8	1.1	1.5	1.8	
85th % =	56.0	3.7	2.4	2.4	9.6	9.5	8.8	7.2	1.4	2.0	2.9	2.1	2.0	2.9	
				15.7			Posting:	9.0							

							Calculated Spring Axle Load to Achive Design Deflection in Tons											LTPP Forwardcalculation for HMA			
	Temp	Temp.	Peak Spring	Spring Subgrade	AASHTO Effective Values							10-year Overlay			20-year Overlay						
	Mid	Adj	Defl.	Modulus							TONN	Structure	9-ton	10-ton	Structure	9-ton	10-ton				
Station	°F	Fact.	mils	ksi	CBR	SN	AASHTO	Soil Fact.	Inv 183	Method	inches	inches	inches	inches	inches	inches	inches	Esc	Egb	Esg	SN
6.3	56.6	1.0	74	3.7	2.5	2.1	7.6	7.5	7.2	5.5	2.0	4.5	5.5	3.1	4.5	5.5	131	31.4	11.2	2.6	
6.3	56.6	1.0	73	3.6	2.4	2.1	7.7	7.6	7.3	5.5	1.9	4.5	5.5	3.0	4.5	5.5	137	30.9	11.0	2.6	
6.3	56.6	1.0	74	3.8	2.5	2.1	7.5	7.5	7.1	5.5	2.0	4.5	5.5	3.0	4.5	5.5	144	32.0	11.4	2.7	
6.3	56.6	1.0	73	3.6	2.4	2.1	7.7	7.6	7.3	5.5	1.9	4.5	5.5	3.0	4.5	5.5	147	30.7	10.9	2.7	
6.4	57.0	1.0	37	4.0	2.6	3.0	14.7	14.6	13.7	10.8	0.0	0.0	0.0	0.9	0.0	0.0	473	33.7	12.0	3.0	
6.4	57.0	1.0	37	4.0	2.7	3.0	14.9	14.7	13.9	11.0	0.0	0.0	0.0	0.8	0.0	0.0	490	33.9	12.1	3.0	
6.4	57.0	1.0	38	3.8	2.6	3.0	14.8	14.6	13.9	10.7	0.0	0.0	0.0	0.9	0.0	0.0	492	32.5	11.6	3.0	
6.4	57.0	1.0	38	3.7	2.5	3.0	14.6	14.4	13.8	10.5	0.0	0.0	0.0	1.0	0.0	0.0	425	31.8	11.3	3.0	
6.5	56.0	1.0	25	4.5	3.0	3.8	21.2	21.0	19.3	16.1	0.0	0.0	0.0	0.0	0.0	0.0	969	38.1	13.6	3.0	
6.5	56.0	1.0	25	4.5	3.0	3.9	21.2	21.1	19.4	16.2	0.0	0.0	0.0	0.0	0.0	0.0	969	38.2	13.6	3.0	
6.5	56.0	1.0	26	4.4	2.9	3.8	20.9	20.8	19.1	15.9	0.0	0.0	0.0	0.0	0.0	0.0	944	37.5	13.4	3.0	
6.5	56.0	1.0	25	4.4	2.9	3.8	21.1	20.9	19.3	15.9	0.0	0.0	0.0	0.0	0.0	0.0	982	37.0	13.2	3.0	
6.6	56.0	1.1	28	7.8	5.2	3.2	15.8	15.8	13.2	14.4	0.0	0.0	0.0	0.0	0.0	0.0	471	66.3	23.7	3.0	
6.6	56.0	1.1	28	7.9	5.3	3.2	15.8	15.9	13.2	14.5	0.0	0.0	0.0	0.0	0.0	0.0	484	67.5	24.1	3.0	
6.6	56.0	1.1	28	8.0	5.3	3.2	15.6	15.6	13.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0	494	67.7	24.2	3.0	
6.6	56.0	1.1	28	8.0	5.3	3.2	15.7	15.7	13.1	14.4	0.0	0.0	0.0	0.0	0.0	0.0	507	67.6	24.1	3.0	
6.7	55.6	1.1	22	11.8	7.9	3.6	17.4	17.6	14.0	16.8	0.0	0.0	0.0	0.0	0.0	0.0	660	100.4	35.8	3.0	
6.7	55.6	1.1	21	11.9	7.9	3.6	17.5	17.7	14.1	16.9	0.0	0.0	0.0	0.0	0.0	0.0	685	101.2	36.1	3.0	
6.7	55.6	1.1	22	11.3	7.5	3.6	17.7	17.9	14.3	16.7	0.0	0.0	0.0	0.0	0.0	0.0	661	95.7	34.2	3.0	
6.7	55.6	1.1	22	11.4	7.6	3.6	17.7	17.9	14.3	16.8	0.0	0.0	0.0	0.0	0.0	0.0	668	96.6	34.5	3.0	
6.8	54.8	1.1	24	19.8	13.2	3.2	12.2	12.5	9.6	16.6	0.0	0.0	0.0	0.0	0.0	0.0	424	168.3	60.1	3.0	
6.8	54.8	1.1	24	20.2	13.4	3.2	12.2	12.5	9.6	16.8	0.0	0.0	0.0	0.0	0.0	0.0	436	171.1	61.1	3.0	
6.8	54.8	1.1	23	20.4	13.6	3.3	12.5	12.9	9.9	17.4	0.0	0.0	0.0	0.0	0.0	0.0	442	173.0	61.8	3.0	
6.8	54.8	1.1	23	21.5	14.3	3.3	12.3	12.7	9.7	17.5	0.0	0.0	0.0	0.0	0.0	0.0	447	182.4	65.1	3.0	
6.9	54.8	1.1	25	16.2	10.8	3.2	13.0	13.3	10.3	16.1	0.0	0.0	0.0	0.0	0.0	0.0	530	137.4	49.0	3.0	
6.9	54.8	1.1	25	16.7	11.1	3.2	12.9	13.2	10.2	16.3	0.0	0.0	0.0	0.0	0.0	0.0	538	141.6	50.6	3.0	
6.9	54.8	1.1	26	15.1	10.1	3.1	12.9	13.2	10.3	15.5	0.0	0.0	0.0	0.0	0.0	0.0	481	128.1	45.7	3.0	
6.9	54.8	1.1	26	15.5	10.4	3.2	13.0	13.3	10.3	15.8	0.0	0.0	0.0	0.0	0.0	0.0	498	132.0	47.1	3.0	
7.0	55.2	1.0	46	3.2	2.1	2.8	12.6	12.4	12.3	8.8	0.5	0.5	1.5	1.8	0.5	1.5	411	27.3	9.7	2.9	
7.0	55.2	1.0	46	3.2	2.2	2.8	12.7	12.5	12.4	8.8	0.5	0.5	1.5	1.8	0.5	1.5	424	27.4	9.8	2.9	
7.0	55.2	1.0	47	3.1	2.1	2.8	12.6	12.4	12.4	8.7	0.5	0.5	1.5	1.9	0.5	1.5	440	26.2	9.4	2.9	
7.0	55.2	1.0	47	3.1	2.0	2.8	12.5	12.3	12.4	8.7	0.5	0.5	1.5	1.9	0.5	1.5	432	26.0	9.3	2.9	
7.1	56.6	1.0	54	4.6	3.1	2.4	9.8	9.7	8.8	7.5	1.4	2.0	2.5	2.0	2.0	2.5	292	39.4	14.1	2.8	
7.1	56.6	1.0	53	4.6	3.1	2.4	9.9	9.8	9.0	7.6	1.3	1.5	2.5	2.0	1.5	2.5	303	39.3	14.0	2.9	
7.1	56.6	1.0	57	4.3	2.9	2.4	9.5	9.4	8.7	7.1	1.4	2.0	3.0	2.2	2.0	3.0	308	36.5	13.0	2.9	
7.1																					



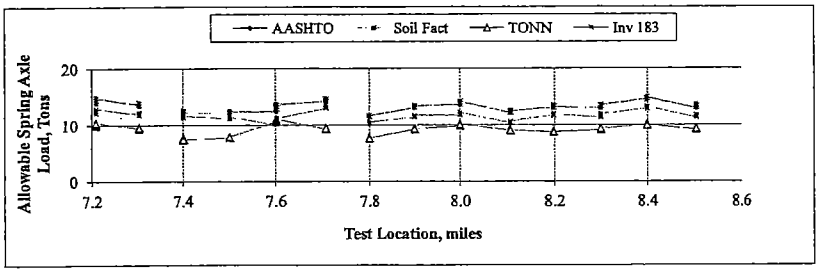
American Engineering Testing, Inc.
550 Cleveland Avenue North
St. Paul, Minnesota 55114
Phone: (651) 659-9001
Fax: (651) 659-1379

AET Project No. 28-00500
County: Pepin
Test Date: Mar 30, 2012
Section: 7
Roadway: CTH D
From: CTH SS
To: Klein Ln

Prev. Day's Avg. Air Temp.: 45 °F
Total AC: 3.2 in.
Daily ESALs: 3.0
Annual Growth: 2.0%
Pavement Condition Index: 59.0
Soil Type: F
Seasonal Correction Factor: 1.07
Daily Haul ESALs: 63.0

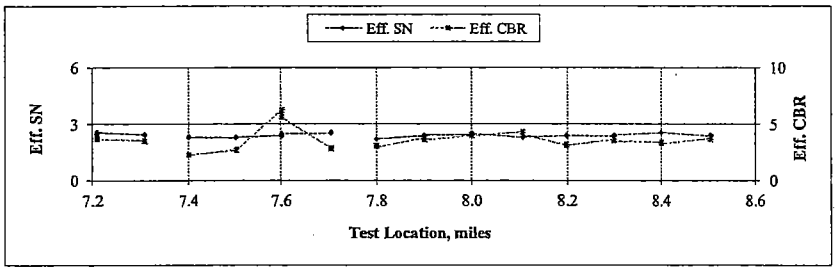
Design Period: 10 Years
Projection Factor: 1.2
Growth Factor: 10.97
10-year Design ESALs: 242,132
Design Period: 20 Years
Projection Factor: 1.5
Growth Factor: 24.41
20-year Design ESALs: 486,967

Station	Drop	Time	Air °F	Bit °F	Load	D9	D1	D2	D3	D4	D5	D6	D7	D8	Effective Values CBR %	Effective Values SN inches	10 Year Overlay Thickness inches	10 Year Spring Capacity tons/axle	Comments
7.1																			B16"
7.2	1	12:57	46.4	60.6	5763	0.0	16.4	11.3	7.9	4.7	3.5	2.3	1.6	1.2	3.8	2.5	1.1	9.9	
7.2	2	12:57	46.4	60.6	5730	0.0	15.9	11.1	7.8	4.6	3.5	2.3	1.6	1.2	3.7	2.5	1.0	10.1	
7.2	3	12:57	46.4	60.6	8749	0.0	23.8	16.9	12.1	7.4	5.5	3.5	2.4	1.9	3.7	2.5	0.9	10.2	
7.2	4	12:57	46.4	60.6	8760	0.0	23.5	16.9	12.1	7.4	5.7	3.6	2.5	1.9	3.7	2.6	0.9	10.4	
7.3	1	12:58	48.2	62.3	5752	0.0	17.4	12.1	8.3	5.1	3.8	2.4	1.6	1.2	3.6	2.4	1.3	9.5	
7.3	2	12:58	48.2	62.3	5720	0.0	16.8	11.8	8.2	5.1	3.8	2.4	1.6	1.2	3.6	2.5	1.2	9.7	
7.3	3	12:58	48.2	62.3	8683	0.0	26.4	18.7	13.2	8.2	6.0	3.6	2.4	1.8	3.6	2.4	1.3	9.4	
7.3	4	12:58	48.2	62.3	8661	0.0	25.9	18.4	13.0	8.2	6.1	3.7	2.5	1.8	3.5	2.5	1.3	9.5	
7.3																			B17"
7.4	1	12:59	48.2	63.4	5643	0.0	22.4	16.4	11.9	7.9	6.1	3.6	2.4	1.7	2.3	2.3	1.5	7.6	
7.4	2	12:59	48.2	63.4	5665	0.0	22.1	16.2	11.9	7.9	6.1	3.7	2.4	1.8	2.3	2.3	1.5	7.7	
7.4	3	12:59	48.2	63.4	8519	0.0	35.2	25.8	19.0	12.5	9.3	5.4	3.6	2.6	2.3	2.3	1.7	7.4	
7.4	4	12:59	48.2	63.4	8508	0.0	34.7	25.5	18.9	12.6	9.5	5.6	3.6	2.6	2.3	2.3	1.6	7.4	
7.5	1	13:00	48.2	61.7	5654	0.0	21.6	14.3	9.0	5.7	4.6	3.1	2.2	1.7	2.7	2.3	1.7	7.8	
7.5	2	13:00	48.2	61.7	5698	0.0	21.3	14.2	9.0	5.8	4.7	3.2	2.2	1.8	2.7	2.3	1.6	7.9	
7.5	3	13:00	48.2	61.7	8596	0.0	32.5	21.9	14.1	8.7	6.8	4.6	3.4	2.6	2.8	2.3	1.7	7.8	
7.5	4	13:00	48.2	61.7	8585	0.0	32.2	21.8	14.1	9.0	7.1	4.8	3.4	2.6	2.7	2.3	1.6	7.9	
7.6	1	13:01	48.2	58.0	5588	0.0	14.0	9.4	6.2	3.6	2.4	1.3	0.8	0.6	6.3	2.4	0.1	10.5	
7.6	2	13:01	48.2	58.0	5588	0.0	13.7	9.2	6.1	3.6	2.5	1.4	0.8	0.6	6.1	2.4	0.0	10.7	
7.6	3	13:01	48.2	58.0	8639	0.0	21.0	14.2	9.7	5.7	3.9	2.2	1.3	0.9	5.9	2.4	0.1	10.9	
7.6	4	13:01	48.2	58.0	8661	0.0	20.7	14.0	9.6	5.8	4.1	2.3	1.4	0.9	5.6	2.5	0.1	11.0	
7.7	1	13:02	48.2	60.6	5730	0.0	17.7	12.2	8.6	5.5	4.3	3.0	2.2	1.6	2.9	2.5	1.1	9.3	
7.7	2	13:02	48.2	60.6	5741	0.0	17.4	12.1	8.5	5.6	4.4	3.0	2.2	1.6	2.9	2.5	1.1	9.5	
7.7	3	13:02	48.2	60.6	8694	0.0	26.9	18.8	13.5	8.8	6.9	4.6	3.3	2.5	2.8	2.5	1.1	9.3	
7.7	4	13:02	48.2	60.6	8683	0.0	26.3	18.6	13.4	8.9	7.0	4.7	3.3	2.6	2.8	2.6	1.0	9.5	
7.7																			B18"
7.8	1	13:03	46.4	60.6	5610	0.0	21.8	15.4	10.3	6.2	4.6	2.7	1.7	1.1	3.1	2.2	1.9	7.6	
7.8	2	13:03	46.4	60.6	5632	0.0	21.5	15.3	10.3	6.3	4.7	2.8	1.7	1.1	3.0	2.2	1.8	7.7	
7.8	3	13:03	46.4	60.6	8541	0.0	33.2	23.6	16.1	9.7	7.1	4.1	2.5	1.7	3.1	2.2	1.9	7.6	
7.8	4	13:03	46.4	60.6	8552	0.0	33.0	23.6	16.2	10.0	7.3	4.3	2.6	1.8	3.0	2.2	1.8	7.7	
7.9	1	13:04	48.2	61.3	5599	0.0	17.4	12.2	8.4	5.2	3.8	2.2	1.4	0.9	3.7	2.4	1.3	9.2	
7.9	2	13:04	48.2	61.3	5632	0.0	17.2	12.2	8.4	5.2	3.9	2.3	1.4	1.0	3.7	2.4	1.3	9.3	
7.9	4	13:04	48.2	61.3	8585	0.0	26.3	18.9	13.3	8.4	6.2	3.6	2.2	1.5	3.6	2.4	1.3	9.3	
8.0	1	13:05	48.2	61.2	5698	0.0	16.3	11.5	7.9	4.7	3.4	2.1	1.3	0.9	4.0	2.4	1.0	9.8	
8.0	2	13:05	48.2	61.2	5720	0.0	16.0	11.4	7.8	4.8	3.5	2.1	1.3	1.0	4.0	2.5	0.9	10.0	
8.0	3	13:05	48.2	61.2	8738	0.0	24.4	17.5	12.2	7.5	5.4	3.2	2.0	1.5	4.1	2.5	0.9	10.0	
8.0	4	13:05	48.2	61.2	8738	0.0	24.0	17.3	12.2	7.7	5.6	3.3	2.1	1.5	4.0	2.5	0.9	10.1	
8.1	1	13:06	48.2	60.3	5566	0.0	17.4	11.9	7.8	4.7	3.5	1.9	1.3	0.7	4.3	2.3	1.1	9.0	
8.1	2	13:06	48.2	60.3	5588	0.0	17.1	11.7	7.8	4.7	3.5	1.9	1.3	0.8	4.3	2.3	1.1	9.2	
8.1	3	13:06	48.2	60.3	8552	0.0	27.2	18.6	12.6	7.5	5.4	3.0	1.7	1.3	4.2	2.3	1.2	8.9	
8.1	4	13:06	48.2	60.3	8552	0.0	26.8	18.5	12.5	7.7	5.6	3.1	1.8	1.3	4.1	2.3	1.2	9.0	
8.2	1	13:07	48.2	61.3	5665	0.0	19	12.9	8.7	5.5	4.1	2.7	1.8	1.5	3.1	2.4	1.5	8.7	
8.2	2	13:07	48.2	61.3	5632	0.0	18.3	12.6	8.6	5.5	4.1	2.7	1.9	1.5	3.1	2.4	1.4	8.9	
8.2	3	13:07	48.2	61.3	8563	0.0	28.3	19.6	13.4	8.4	6.2	4.0	2.9	2.3	3.2	2.4	1.5	8.8	
8.2	4	13:07	48.2	61.3	8519	0.0	28.1	19.2	13.3	8.5	6.3	4.1	2.9	2.3	3.1	2.4	1.4	8.8	
8.3	1	13:08	48.2	62.4	5752	0.0	18.3	12.4	8.2	4.9	3.7	2.4	1.6	1.2	3.6	2.4	1.4	9.1	
8.3	2	13:08	48.2	62.4	5687	0.0	17.6	12.1	8.0	4.9	3.7	2.3	1.6	1.2	3.6	2.4	1.3	9.2	
8.3	3	13:08	48.2	62.4	8672	0.0	26.9	18.7	12.7	7.8	5.8	3.6	2.4	1.8	3.6	2.4	1.3	9.2	
8.3	4	13:08	48.2	62.4	8672	0.0	26.6	18.5	12.7	7.9	5.9	3.7	2.5	1.8	3.5	2.4	1.3	9.4	
8.4	1	13:09	48.2	62.5	5687	0.0	16.2	11.6	8.6	5.6	4.0	2.5	1.8	1.3	3.4	2.5	1.1	10.0	
8.4	2	13:09	48.2	62.5	5698	0.0	15.9	11.5	8.6	5.6	4.1	2.5	1.7	1.3	3.4	2.6	1.1	10.1	
8.4	3	13:09	48.2	62.5	8672	0.0	25.1	18.1	13.5	8.8	6.4	3.8	2.7	2.0	3.4	2.5	1.2	9.9	
8.4	4	13:09	48.2	62.5	8661	0.0	24.7	17.9	13.4	8.9	6.5	4.0	2.7	2.1	3.3	2.6	1.1	10.0	
8.5	1	13:11	48.2	60.9	5654	0.0	17.6	11.4	7.4	4.5	3.4	2.3	1.5	1.1	3.7	2.4	1.3	9.1	
8.5	2	13:11	48.2	60.9	5665	0.0	17.4	11.3	7.4	4.5	3.4	2.3	1.5	1.1	3.7	2.4	1.3	9.3	
8.5	3	13:11	48.2	60.9	8585	0.0	26.5	17.4	11.5	7.0	5.3	3.4	2.4	1.7	3.7	2.4	1.3	9.2	
8.5	4	13:11	48.2	60.9	8563	0.0	25.9	17.1	11.4	7.1	5.4	3.5	2.4	1.7	3.6	2.4	1.3	9.4	
8.5																			KLEIN LN, END OF TESTING"



	Summary of Analysis Results														
					Axle Load for Design Defl. Tons				10-year Overlay			20-year Overlay		
	$_5BB_{90}$	Esg	Eff.	SN				TONN	Structure	9-ton	10-ton	Structure	9-ton	10-ton
	mils	ksi	CBR	inches	AASHTO	S.F	Inv. 183	Tons	inches	inches	inches	inches	inches	inches
Avg. =	39.7	5.3	3.6	2.4	13.2	13.3	11.7	9.2	1.2	0.4	1.1	1.8	0.4	1.1
Median =	38.8	5.4	3.6	2.4	13.2	13.3	11.7	9.3	1.3	0.0	1.0	1.7	0.0	1.0
Std.Dev. =	4.3	1.3	0.8	0.1	0.9	0.9	0.9	0.9	0.4	0.7	0.9	0.5	0.7	0.9
85th % =	46.2	4.2	2.8	2.3	12.2	12.2	10.6	7.8	1.6	1.5	2.5	2.4	1.5	2.5
				15.7			Posting:	9.0						

							Calculated Spring Axle Load 40 Kdrive Design Deflection in Tons				10-year Overlay			20-year Overlay			LTPP Forwardcalculation for HMA			
	Temp	Temp.	Peak Spring	Spring Subgrade	AASHTO Effective Values					TONN	Structure	9-ton	10-ton	Structure	9-ton	10-ton				
	Mid	Adj	Defl.	Modulus																
Station	°F	Fact.	mils	ksi	CBR	SN	AASHTO	Soil Fact.	Inv 183	Method	inches	inches	inches	inches	inches	inches	Eac	Egb	Esg	SN
7.1																				
7.2	56.4	1.1	37	5.6	3.8	2.5	13.9	14.0	12.1	9.9	1.1	0.0	0.5	1.5	0.0	0.5	219	42.1	17.0	2.6
7.2	56.4	1.1	36	5.6	3.7	2.5	14.3	14.4	12.4	10.1	1.0	0.0	0.0	1.4	0.0	0.0	234	42.0	17.0	2.6
7.2	56.4	1.1	35	5.6	3.7	2.5	14.5	14.6	12.6	10.2	0.9	0.0	0.0	1.4	0.0	0.0	260	42.0	17.0	2.6
7.2	56.4	1.1	35	5.5	3.7	2.6	14.8	14.9	12.9	10.4	0.9	0.0	0.0	1.3	0.0	0.0	275	41.1	16.7	2.7
7.3	57.6	1.1	38	5.3	3.6	2.4	13.6	13.7	11.9	9.5	1.3	0.0	0.5	1.7	0.0	0.5	220	39.9	16.2	2.6
7.3	57.6	1.1	37	5.3	3.6	2.5	13.9	14.0	12.2	9.7	1.2	0.0	0.5	1.6	0.0	0.5	232	40.0	16.2	2.6
7.3	57.6	1.1	38	5.4	3.6	2.4	13.5	13.5	11.8	9.4	1.3	0.0	1.0	1.7	0.0	1.0	236	40.2	16.3	2.6
7.3	57.6	1.1	38	5.2	3.5	2.5	13.8	13.9	12.2	9.5	1.3	0.0	0.5	1.6	0.0	0.5	245	39.0	15.8	2.6
7.3																				
7.4	58.4	1.0	47	3.5	2.3	2.3	12.4	12.4	11.8	7.6	1.5	1.5	2.5	2.6	1.5	2.5	215	25.9	10.5	2.5
7.4	58.4	1.0	47	3.5	2.3	2.3	12.6	12.6	12.0	7.7	1.5	1.5	2.5	2.6	1.5	2.5	224	25.8	10.5	2.5
7.4	58.4	1.0	49	3.5	2.3	2.3	11.9	11.9	11.3	7.4	1.7	2.0	3.0	2.7	2.0	3.0	212	26.2	10.6	2.5
7.4	58.4	1.0	48	3.4	2.3	2.3	12.2	12.2	11.6	7.4	1.6	2.0	3.0	2.7	2.0	3.0	220	25.3	10.3	2.5
7.5	57.2	1.1	46	4.1	2.7	2.3	12.1	12.2	11.2	7.8	1.7	1.5	2.5	2.4	1.5	2.5	133	30.4	12.3	2.4
7.5	57.2	1.1	45	4.0	2.7	2.3	12.4	12.4	11.4	7.9	1.6	1.5	2.0	2.4	1.5	2.0	142	30.2	12.3	2.4
7.5	57.2	1.1	46	4.2	2.8	2.3	12.1	12.2	11.1	7.8	1.7	1.5	2.5	2.4	1.5	2.5	146	31.1	12.6	2.4
7.5	57.2	1.1	45	4.0	2.7	2.3	12.4	12.4	11.4	7.9	1.6	1.5	2.0	2.4	1.5	2.0	151	30.1	12.2	2.4
7.6	54.5	1.1	34	9.4	6.3	2.4	12.3	12.5	10.1	10.5	0.1	0.0	0.0	0.8	0.0	0.0	201	70.2	28.5	2.5
7.6	54.5	1.1	34	9.2	6.1	2.4	12.7	12.9	10.4	10.7	0.0	0.0	0.0	0.7	0.0	0.0	209	68.7	27.8	2.5
7.6	54.5	1.1	33	8.8	5.9	2.4	13.0	13.2	10.7	10.9	0.1	0.0	0.0	0.8	0.0	0.0	221	65.9	26.7	2.6
7.6	54.5	1.1	33	8.4	5.6	2.5	13.5	13.7	11.2	11.0	0.1	0.0	0.0	0.8	0.0	0.0	227	62.7	25.4	2.6
7.7	56.4	1.1	39	4.3	2.9	2.5	14.2	14.3	13.0	9.3	1.1	0.0	1.0	1.8	0.0	1.0	199	32.3	13.1	2.5
7.7	56.4	1.1	38	4.3	2.9	2.5	14.5	14.5	13.2	9.5	1.1	0.0	0.5	1.7	0.0	0.5	209	32.3	13.1	2.5
7.7	56.4	1.1	39	4.2	2.8	2.5	14.3	14.4	13.1	9.3	1.1	0.0	1.0	1.8	0.0	1.0	215	31.6	12.8	2.6
7.7	56.4	1.1	38	4.2	2.8	2.6	14.7	14.7	13.4	9.5	1.0	0.0	0.5	1.7	0.0	0.5	227	31.1	12.6	2.6
7.7																				
7.8	56.4	1.1	47	4.6	3.1	2.2	11.4	11.5	10.3	7.6	1.9	1.5	2.5	2.4	1.5	2.5	169	34.5	14.0	2.5
7.8	56.4	1.1	47	4.6	3.0	2.2	11.6	11.7	10.5	7.7	1.8	1.5	2.5	2.4	1.5	2.5	176	34.1	13.8	2.5
7.8	56.4	1.1	47	4.7	3.1	2.2	11.4	11.4	10.2	7.6	1.9	1.5	2.5	2.4	1.5	2.5	177	35.2	14.2	2.5
7.8	56.4	1.1	47	4.5	3.0	2.2	11.6	11.6	10.5	7.7	1.8	1.5	2.5	2.4	1.5	2.5	183	33.5	13.6	2.5
7.9	56.9	1.1	39	5.6	3.7	2.4	13.0	13.1	11.3	9.2	1.3	0.0	1.0	1.8	0.0	1.0	216	42.0	17.0	2.6
7.9	56.9	1.1	39	5.6	3.7	2.4	13.2	13.3	11.5	9.3	1.3	0.0	1.0	1.7	0.0	1.0	225	41.6	16.9	2.6
7.9	56.9	1.1	39	5.4	3.6	2.4	13.3	13.4	11.7	9.3	1.3	0.0	1.0	1.7	0.0	1.0	242	40.3	16.3	2.6
8.0	56.9	1.1	37	6.0	4.0	2.4	13.6	13.7	11.7	9.8	1.0	0.0	0.5	1.5	0.0	0.5	236	44.7	18.1	2.6
8.0	56.9	1.1	36	6.0	4.0	2.5	13.8	13.9	11.9	10.0	0.9	0.0	0.5	1.5	0.0	0.5	250	44.9	18.2	2.6
8.0	56.9	1.1	36	6.1	4.1	2.5	13.7	13.8	11.8	10.0	0.9	0.0	0.5	1.5	0.0	0.5	259	45.9	18.6	2.6
8.0	56.9	1.1	35	6.0	4.0	2.5	14.1	14.2	12.1	10.1	0.9	0.0	0.0	1.4	0.0	0.0	272	44.5	18.0	2.6
8.1	56.2	1.1	40	6.5	4.3	2.3	12.1	12.2	10.4	9.0	1.1	0.0	1.0	1.8	0.0	1.0	181	48.4	19.6	2.5
8.1	56.2	1.1	39	6.5	4.3	2.3	12.4	12.5	10.6	9.2	1.1	0.0	1.0	1.7	0.0	1.0	191	48.4	19.6	2.5
8.1	56.2	1.1	40	6.4	4.2	2.3	12.1	12.2	10.3	8.9	1.2	0.5	1.0	1.8	0.5	1.0	185	47.5	19.2	2.5
8.1	56.2	1.1	40	6.2	4.1	2.3	12.4	12.5	10.6	9.0	1.2	0.0	1.0	1.8	0.0	1.0	193	46.1	18.7	2.5
8.2	57.0	1.1	41	4.7	3.1	2.4	13.1	13.1	11.7	8.7	1.5	0.5	1.5	2.0	0.5	1.5	180	35.1	14.2	2.5
8.2	57.0	1.1	40	4.6	3.1	2.4	13.4	13.4	12.0	8.9	1.4	0.5	1.0	1.9	0.5	1.0	192	34.7	14.1	2.5
8.2	57.0	1.1	41	4.8	3.2	2.4	13.0	13.0	11.6	8.8	1.5	0.5	1.5	2.0	0.5	1.5	191	36.1	14.6	2.5
8.2	57.0	1.1	41	4.7	3.1	2.4	13.2	13.2	11.8	8.8	1.4	0.5	1.5	2.0	0.5	1.5	183	34.8	14.1	2.5
8.3	57.8	1.1	40	5.4	3.6	2.4	12.9	13.0	11.3	9.1	1.4	0.0	1.0	1.8	0.0	1.0	187	40.7	16.5	2.5
8.3	57.8	1.1	39	5.4	3.6	2.4	13.2	13.3	11.6	9.2	1.3	0.0	1.0	1.7	0.0	1.0	195	40.4	16.4	2.5
8.3	57.8	1.1	39	5.4	3.6	2.4	13.2	13.3	11.6	9.2	1.3	0.0	1.0	1.7	0.0	1.0	209	40.4	16.4	2.5
8.3	57.8	1.1	38	5.3	3.5	2.4	13.5	13.6	11.9	9.4	1.3	0.0	1.0	1.7	0.0	1.0	217	39.4	16.0	2.6
8.4	57.9	1.1	36	5.1	3.4	2.5	14.6	14.6	12.9	10.0	1.1	0.0	0.5	1.5	0.0	0.5	281	38.0	15.4	2.7
8.4	57.9	1.1	35	5.0	3.4	2.6	14.9	14.9	13.2	10.1	1.1	0.0	0.0	1.4	0.0	0.0	294	37.6	15.3	2.7
8.4	57.9	1.1	37	5.0	3.4	2.5	14.4	14.5	12.8	9.9	1.2	0.0	0.5	1.5	0.0	0.5	284	37.6	15.3	2.7
8.4	57.9	1.1	36	4.9	3.3	2.6	14.8	14.8	13.1	10.0	1.1	0.0	0.5	1.5	0.0	0.5	296	36.5	14.8	2.7
8.5	56.7	1.1	39	5.6	3.7	2.4	12.9	13.0	11.3	9.1	1.3	0.0	1.0	1.8	0.0	1.0	154	41.8	16.9	2.4
8.5	56.7	1.1	39	5.6	3.7	2.4	13.1	13.2	11.5	9.3	1.3	0.0	1.0	1.7	0.0	1.0	160	41.5	16.8	2.5
8.5	56.7	1.1	39	5.6	3.7	2.4	13.1	13.1	11.4	9.2	1.3	0.0	1.0	1.7	0.0	1.0	166	41.8	17.0	2.5
8.5	56.7	1.1	38	5.5	3.6	2.4	13.4	13.5	11.7	9.4	1.3	0.0	1.0	1.7	0.0	1.0	173	40.9	16.6	2.5
8.5																				



Appendix C

AET Project No. 28-00500

Ground Penetrating Radar Field Exploration and Testing
GPR Data and Analysis Results Sheet

Appendix C
Ground Penetrating Radar Field Exploration and Testing
AET Project No. 28-00500

C.1 FIELD EXPLORATION

The pavement structural conditions at the site were evaluated nondestructively using Ground Penetrating Radar (GPR). The description of the equipment precedes the GPR Data and Analysis Results in this appendix.

C.2 EQUIPMENT DESCRIPTION

C.2.1 GSSI GPR Test System

The GPR test system owned by AET is a GSSI Roadscan System that consists of a bumper-mounted, 2 GHz air-coupled antenna and a SIR-20 control and data acquisition processor, featuring dual channels. The GPR processor, including a SIR-20 data acquisition system, wheel-mounted DMI (Distance Measuring Instrument), and a tough book with the SIR-20 Field Program constitutes the newest, most sophisticated GSSI Test System, which fulfills or exceeds all requirements to meet ASTM-4748, ASTM D-6087 Standards. Figure C1 provides a view of this equipment.

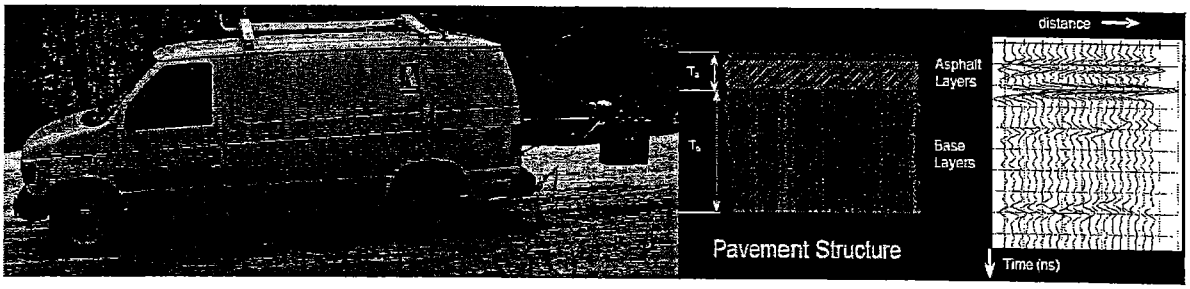


Figure C1 GSSI 2 GHz air-coupled GPR Test System

The GPR antenna emits a high frequency electromagnetic wave into the material under investigation. The reflected energy caused by changes in the electromagnetic properties within the material is detected by a receiver antenna and recorded for subsequent analysis. The 2 GHz air-coupled GPR is capable of collecting radar waveforms at more than 100 signals per second, allows for data to be collected at driving speeds along the longitudinal dimension of the pavements or bridge decks with the antennas fixed at the rear or in front of the vehicle.

The antenna used for Roadscan is the Horn antenna Model 4105 (2 GHz). The 2 GHz antenna is the current antenna of choice for road survey because it combines excellent resolution with reasonable depth penetration (18-24 inches in pavement materials). The data collection is performed at normal driving speeds (45-55 mph), requiring no lane closures nor causing traffic congestion. At this peed the 2 GHz antenna is capable of collecting data at 1-foot interval (1 scan/foot).

The data were collected at a rate of about 1 vertical scans per foot. Each vertical scan consisted of 512 samples and the record length in time of each scan was 12 nanoseconds. Filters used during acquisition were 300 MHz high pass and 5,000 MHz low pass.

In a GPR test, the antenna is moved continuously across the test surface and the control unit collects data at a specified distance increment. In this way, the data collection rate is independent of the scan rate. Alternatively, scanning can be performed at a constant rate of time, regardless of the scan distance. Single point scans can be performed as well. Data is reviewed on-screen and in the field to identify reflections and ensure proper data collection parameters.

Field testing is performed in accordance with the standard ASTM procedures as described in ASTM D 4695-96, "Standard Guide for General Pavement Deflection Measurements".

C.2.2 System Calibrations

Horn antenna processing is used to get the velocity of the radar energy in the material by comparing the reflection strengths (amplitudes) from a pavement layer interface with a perfect reflector (a metal plate). The calibration scan is obtained with the horn antenna placed over a metal plate at the same elevation as a scan obtained over pavement.

The same setting for data collection is used for metal plate calibration. Fifteen seconds are need for jumping up and down on the vehicle's bumper to collect the full range of motion for the vehicle's shocks. The filename of raw calibration file is recorded.

Survey wheel is calibrated by laying out a long distance (> 50 feet) with tape measure.

C.2.3 Linear Distance and Spatial Reference System
Distance measuring instrument (DMI) is a trailer mounted two phase encoder system. When DMI is connected to the SIR-20 it provides for automatic display and recording distance information in both English and metric units with a 1 foot (0.3 meters) resolution and four percent accuracy when calibrated using provided procedure in the Field Program.

Spatial reference system is a Trimble ProXH Global Positioning System (GPS) that consists of fully integrated receiver, antenna and battery unit with Trimble's new H-Star™ technology to provide subfoot (30 cm) post processed accuracy. The External Patch antenna is added to the ProXH receiver for the position of the loading plate. The External Patch antenna can be conveniently elevated with the optional baseball cap to prevent any signal blockage.

C.2.4 Camera Monitoring System
A battery operated independent DC-1908E multi-functional digital camera with a SD card is used for easy positioning of the loading plate or of the pavement surface condition at the testing locations.

C.3 SAMPLING METHODS
At the project level, the testing interval is set at 12 scans per foot in the Outside Wheel Path (OWP) = 2.5 ft ± 0.25 ft (0.76 m ± 0.08 m) for nominal 12 ft (3.7 m) wide lanes at a survey speed of approximately 10 mph. Where a divided roadbed exists, surveys will be taken in both directions if the project will include improvements in both directions. If there is more than one lane in one direction the surveys will be taken in the outer driving lane (truck lane) versus the passing lane of the highway. GPR tests are performed at a constant lateral offset down the test section. When GPR tests are performed on bridge decks, multiple survey lines are followed transversely at 2-foot spacing between survey lines.

At the network level, GPR tests on one scan per foot are set to be able to collect data on pavements at driving speeds, without statistically compromising the quality of the data collected. If GPR tests are for the in situ characterization of material GPR data will be collected at two scan per foot at slower driving speeds.

C.4 QUALITY CONTROL (QC) AND QUALITY ASSURANCE (QA)
Beside the daily metal plate calibration the DMI is also calibrated monthly by driving the vehicle over a known distance to calculate the distance scale factor. The GPR will be monitored in real time in the data collection vehicle to minimize data errors. The GPR units will be identified with a unique number and that number will accompany all data reported from that unit as required in the QC/QA plan.

Scheduled preventive maintenance ensures proper equipment operation and helps identify potential problems that can be corrected to avoid poor quality or missing data that results if the equipment malfunctions while on site. The routine and major maintenance procedures established by the LTPP are adopted and any maintenance has been done at the end of the day after the testing is complete and become part of the routine performed at the end of each test/travel day and on days when no other work is scheduled.

To insure quality data, the GPR assessments only took place on dry pavement surfaces, and data was collected in each wheel path.

C.5 DATA ANALYSIS METHODS

C.5.1 Data Editing
Field acquisition is seldom so routine that no errors, omissions or data redundancy occur. Data editing encompasses issues such as data re-organization, data file merging, data header or background information updates, repositioning and inclusion of elevation information with the data.

C.5.2 Basic Processing
Basic data processing addresses some of the fundamental manipulations applied to data to make a more acceptable product for initial interpretation and data evaluation. In most instances this type of processing is already applied in real-time to generate the real-time display. The advantage of post survey processing is that the basic processing can be done more systematically and non-causal operators to remove or enhance certain features can be applied.

The Reflection Picking procedure is used to eliminate unwanted noise, detects significant reflections, and records the corresponding time and depth. It uses antenna calibration file data to calculate the radar signal velocity within the pavement.

C.5.3 Advance Processing
Advanced data processing addresses the types of processing which require a certain amount of operator bias to be applied and which will result in data which are significantly different from the raw information which were input to the processing.

C.5.4 Data Interpretation
The EZ Tracker Layer Interpretation procedure uses the output from the first step to map structural layers and calculate the corresponding velocities and depths.

C.6 TEST LIMITATIONS

C.6.1 Test Methods
The data derived through the testing program have been used to develop our opinions about the pavement conditions at your site. However, because no testing program can reveal totally what is in the subsurface, conditions between test locations and at other times, may differ from conditions described in this report. The testing we conducted identified pavement conditions only at those points where we measured pavement thicknesses and observed pavement surface conditions. Depending on the sampling methods and sampling frequency, every location may not be tested, and some anomalies which are present in the pavement may not be noted on the testing results. If conditions encountered during construction differ from those indicated by our testing, it may be necessary to alter our conclusions and recommendations, or to modify construction procedures, and the cost of construction may be affected.

B.6.2 Test Standards
Pavement testing is done in general conformance with the described procedures. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

C.7 SUPPORTING TEST METHODS

C.7.1 Falling Weight Deflectometer (FWD)
If the pavement layer moduli and subgrade soil strength are desired the deflection data are collected using a Dynatest 8000 FWD Test System that consists of a Dynatest 8002 trailer and a third generation control and data acquisition unit developed in 2003, called the Dynatest Compact15, featuring fifteen (15) deflection channels. The new generation FWD, including a Compact15 System and a standard PC with the FwdWin field Program constitutes the newest, most sophisticated Dynatest FWD Test System, which fulfills or exceeds all requirements to meet ASTM-4694, ASTM D-4695 Standards. The system provides continuous data at pre-set spacing.

C.7.2 Soil Boring/Coring Field Exploration
If both pavement thicknesses and subgrade soil types and conditions are desired the shallow coring/boring and sampling is used. The limited number of coring/boring is necessary to verify the GPR layer thickness data.

C.7.3 Pavement Surface Condition Survey
The type and severity of pavement distress influence the deflection response for a pavement. Therefore, GPR operators record any distress located from about 1 ft (0.3 m) in front of vehicle to about 30 ft (9 m) ahead. This information is recorded in the FWD file using the comment line in the field program immediately following the test.

American Engineering Testing, Inc.
550 Cleveland Avenue North
St. Paul, Minnesota 55114
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Fax: (651) 659-1379

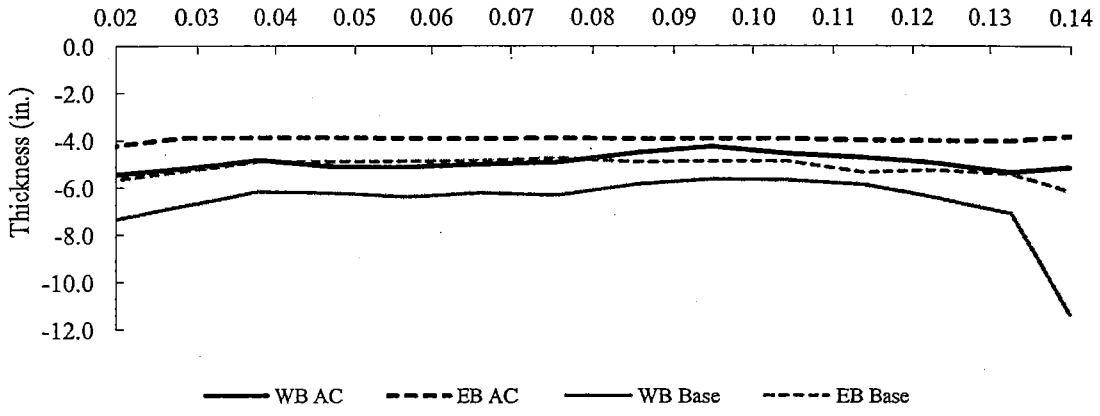
SUMMARY OF PAVEMENT SURVEY					
COUNTY	PEPIN			Test Date	Date
PROJECT NO.	28-00500			3/26/12	4/17/12
SECTION	1				
ROAD	CTH P				
TERMINI	USH 10	TO	660 FT W OF USH 10		

SUMMARY STATISTICS

Units: inches

Layer	WB				EB			
	Average	CV	15th	Min.	Average	CV	15th	Min.
AC	5.0	7%	4.6	4.3	4.0	3%	3.9	3.8
GB	1.7	76%	1.1	1.1	1.2	32%	0.9	0.8

Ground Penetrating Radar Pavement Thickness Survey



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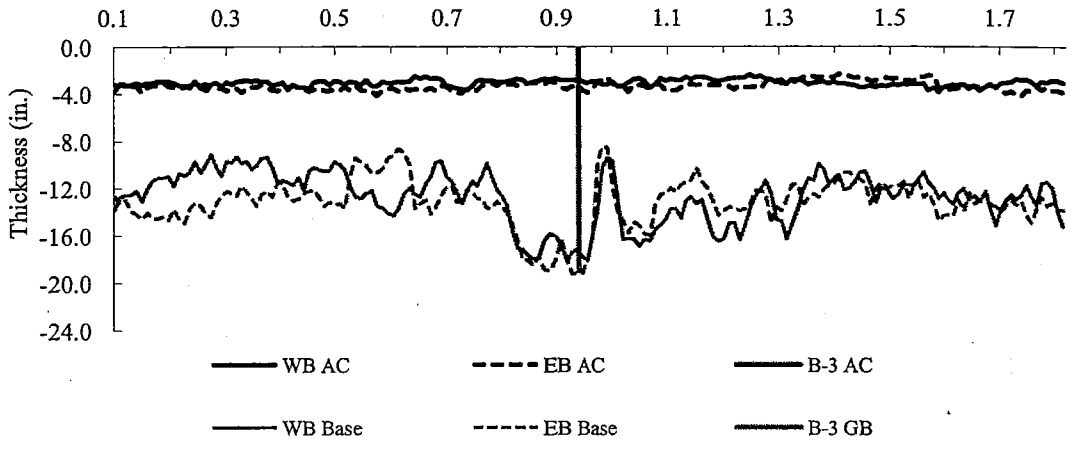
SUMMARY OF PAVEMENT SURVEY			
COUNTY	PEPIN	Test Date	Date
PROJECT NO.	28-00500	3/26/12	4/17/12
SECTION	2		
ROAD	CTH P		
TERMINI	660 FT W OF USH 10 TO CTH O		

SUMMARY STATISTICS

Units: inches

Layer	WB				EB			
	Average	CV	15th	Min.	Average	CV	15th	Min.
AC	3.1	9%	2.8	2.4	3.3	12%	2.9	2.3
GB	9.7	24%	7.2	5.9	9.9	21%	8.5	4.9

Ground Penetrating Radar Pavement Thickness Survey



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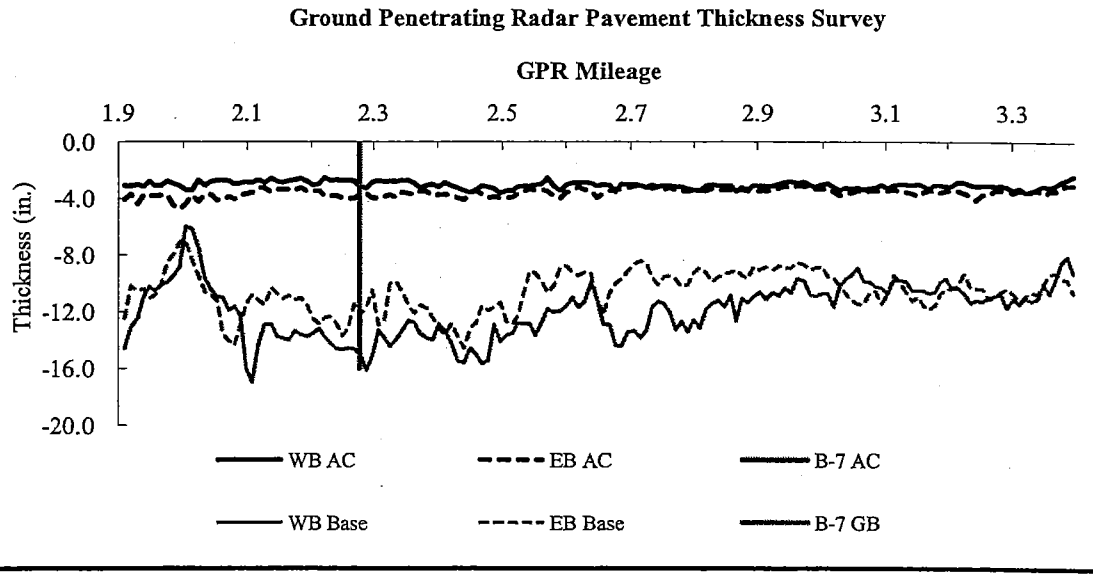
SUMMARY OF PAVEMENT SURVEY					
COUNTY	PEPIN			Test Date	Date
PROJECT NO.	28-00500			3/26/12	4/17/12
SECTION	3				
ROAD	CTH P				
TERMINI	CTH O	TO	CTH N		

SUMMARY STATISTICS

Units: inches

Layer	WB				EB			
	Average	CV	15th	Min.	Average	CV	15th	Min.
AC	3.1	8%	2.8	2.4	3.6	8%	3.3	3.0
GB	8.9	22%	7.0	2.6	7.0	20%	5.7	2.3



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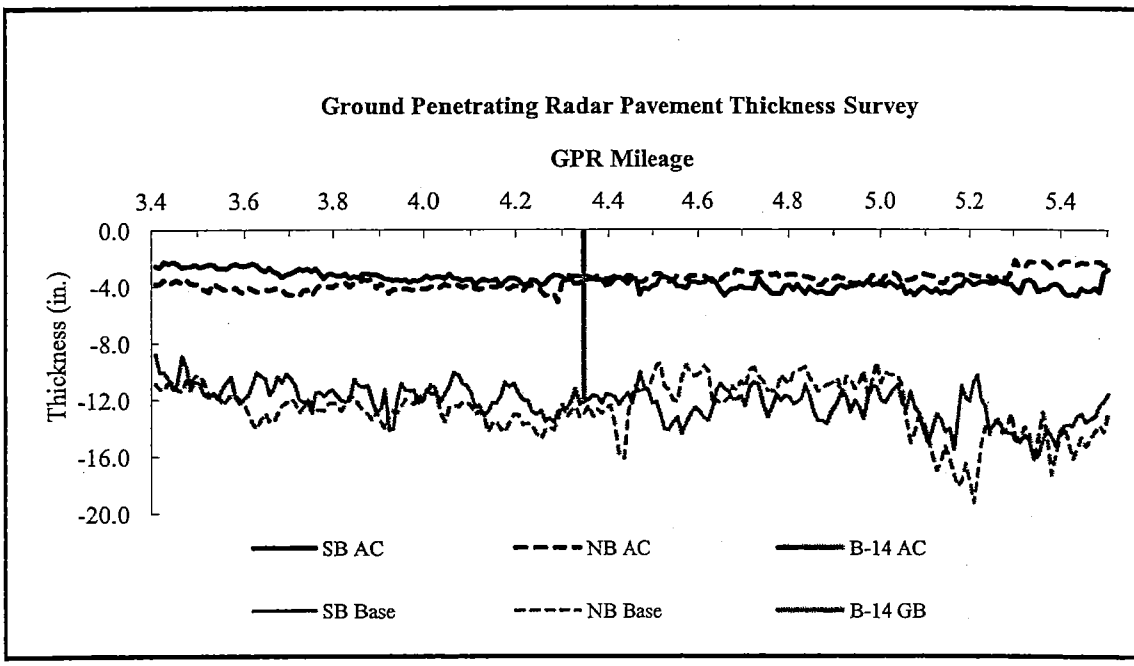
SUMMARY OF PAVEMENT SURVEY					
COUNTY	PEPIN			Test Date	Date
PROJECT NO.	28-00500			3/26/12	4/17/12
SECTION	4				
ROAD	CTH N				
TERMINI	CTH P	TO	CTH SS		

SUMMARY STATISTICS

Units: inches

Layer	SB				NB			
	Average	CV	15th	Min.	Average	CV	15th	Min.
AC	3.6	16%	2.9	2.3	3.6	18%	3.1	1.2
GB	8.6	13%	7.5	5.5	9.1	23%	7.1	5.8



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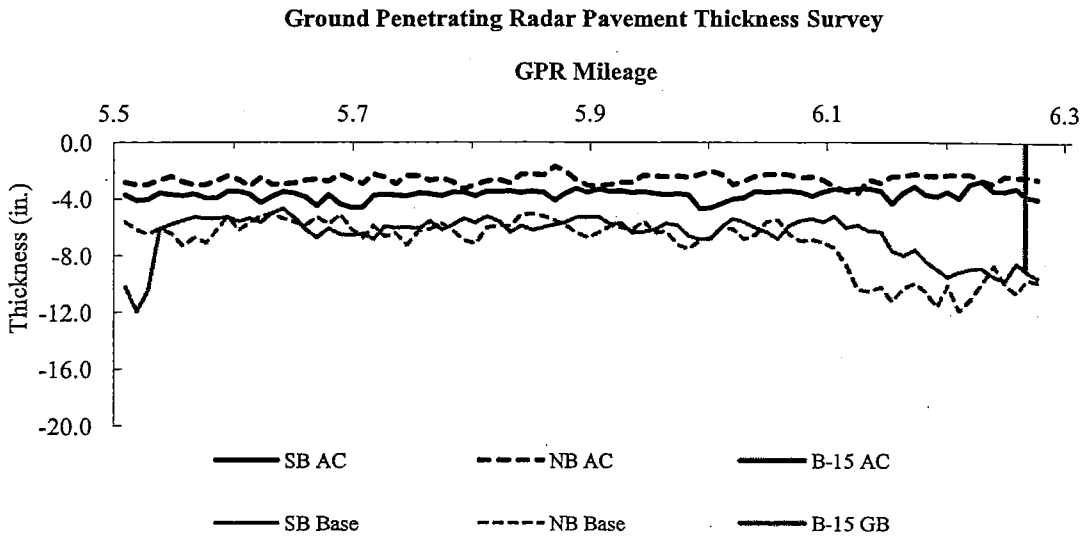
SUMMARY OF PAVEMENT SURVEY					
COUNTY	PEPIN			Test Date	Date
PROJECT NO.	28-00500			3/26/12	4/17/12
SECTION	5				
ROAD	CTH SS				
TERMINI	CTH N	TO	0.8 MI W OF CTH N		

SUMMARY STATISTICS

Units: inches

Layer	SB				NB			
	Average	CV	15th	Min.	Average	CV	15th	Min.
AC	3.7	10%	3.4	2.7	2.6	13%	2.3	1.7
GB	3.0	54%	1.7	1.2	4.5	42%	2.9	2.1



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SUMMARY OF PAVEMENT SURVEY					
COUNTY	PEPIN			Test Date	Date
PROJECT NO.	28-00500			3/26/12	4/17/12
SECTION	6				
ROAD	CTH SS				
TERMINI	0.8 MI W OF CTH N	TO	CTH D		

SUMMARY STATISTICS

Units: inches

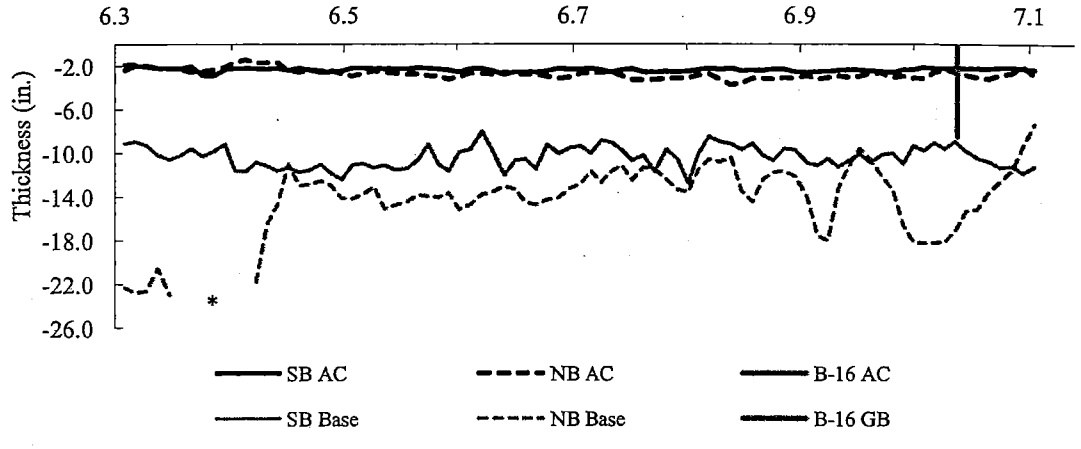
Layer	SB				NB			
	Average	CV	15th	Min.	Average	CV	15th	Min.
AC	2.4	8%	2.2	1.9	2.7	17%	2.3	1.4
GB	8.0	12%	7.0	5.8	12.6	42%	8.6	4.5

* out of depth of investigation

Subbase observed at B-16, but below the depth of our investigation

Ground Penetrating Radar Pavement Thickness Survey

GPR Mileage



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SUMMARY OF PAVEMENT SURVEY			
COUNTY	PEPIN	Test Date	Date
PROJECT NO.	28-00500	3/26/12	4/17/12
SECTION	7		
ROAD	CTH D		
TERMINI	CTH SS to 1 MI S OF CTH SS		

SUMMARY STATISTICS

Units: inches

Layer	SB				NB			
	Average	CV	15th	Min.	Average	CV	15th	Min.
AC	3.2	12%	2.9	2.5	2.6	13%	2.3	1.8
GB	6.5	14%	5.6	4.2	6.0	20%	4.9	4.3
SB	7.8	12%	6.7	5.1	7.9	12%	6.9	4.8