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16. Abstract

In 2003, the Michigan Department of Transportation constructed an unbonded concrete overlay with experimental features on northbound I-75 in Ogemaw County. The experimental features are:

- 10 and 12 foot transverse joint spacing. Standard spacing is 14 to 16 feet for jointed plain concrete pavement depending on thickness.
- No dowel bars at some of the transverse joints.
- Transverse joints cut at 1/8” and left unsealed or ¼” and sealed with hot-pour rubber. Standard transverse joints are 7/16” wide and sealed with preformed neoprene rubber.
- Longitudinal joints cut at 1/8” and left unsealed compared to the standard of ¼” and sealed with hot-pour rubber.
- New, more open-graded HMA separator layer.

The southbound direction was rubblized and then paved with HMA under a separate contract from the unbonded concrete overlay.

Both projects went very well with the unbonded overlay taking 69 days from start to completion of paving for 12 lane-miles plus shoulders. The rubblize and HMA surfacing took 51 days from start to completion of paving for 8 lane-miles plus shoulders.

Both projects will be monitored with visual evaluations, falling weight deflectometer testing, and ride quality measurements, for 15 years. Interim performance reports will be written at years 5 and 10, or as needed.

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MICHIGAN DEPARTMENT OF TRANSPORTATION
MDOT

UNBONDED CONCRETE OVERLAY DEMONSTRATION PROJECT ON I-75 IN OGEMAW COUNTY - CONSTRUCTION REPORT

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Testing and Research Section
Construction and Technology Support Area
Work Plan No. 03 WP-147
Research Project G-0333
Research Report R-1465

June 2005

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EXECUTIVE SUMMARY

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INTRODUCTION

Unbonded concrete overlays of existing concrete pavements have been a successful rehabilitation alternative in Michigan since the early 1980's. In a continuing effort to use concrete as a rehabilitation alternative, the Michigan Department of Transportation (MDOT) teamed with the Michigan Concrete Paving Association (MCPA) to try a more economical unbonded concrete overlay design.

Michigan's unbonded overlays have averaged about eight inches thick, joints spaced 15 to 27 feet, and sealed with preformed neoprene. Both reinforced and non-reinforced designs have been built with the smaller joint spacing corresponding to the non-reinforced design. The asphalt bond breaker layer has been either one or two inches thick with one inch being the predominant design in more recent projects. The experimental design is a non-reinforced 6 inch concrete. It is intended for pavements with low truck traffic (< 5000 trucks a day). After discussions between MDOT and MCPA, the project was split into five sections as follows:

1. A ¼ mile section with 10 foot joint spacing and no load transfer at the transverse joints. Transverse and longitudinal joints will be cut 1/8 inch wide and not sealed.
2. A ¼ mile section with 10 foot joint spacing and no load transfer at the transverse joints. Transverse and longitudinal joints will be cut ¼ inch wide and will be filled with hot-pour rubber.
3. A 1½ mile section with 12 foot joint spacing and no load transfer at the transverse joints. Transverse and longitudinal joints will be cut at 1/8 inch wide and not sealed.
4. A 1½ mile section with 12 foot joint spacing and no load transfer at the transverse joints. Transverse and longitudinal joints again will be cut ¼ inch wide and will be filled with hot-pour rubber.
5. A ½ mile control section with 12 foot joint spacing and load transfer bars at the transverse joints. Transverse and longitudinal joints will be cut ¼ inch wide and will be filled with hot-pour rubber.

For all sections, the load transfer bars will be 1 inch diameter which is now the standard for concrete pavements from 6 inches to less than 8 inches. Previous projects used 1¼ inch diameter bars, which was standard for pavements under 11 inches. Tie bars will also be used at the longitudinal joints in all sections. A table of the stationing, as well as typical cross-sections, for each section can be found in the Appendix.

The overlay is a minimum of six inches thick but was allowed to vary in case grade correction is needed. The asphalt separator layer (bond breaker layer) was also modified from the typical. The separator layer mix is more open to allow more drain ability than has been typical on other unbonded concrete overlays. The cracks and joints in the existing concrete pavement were sealed with an overband crack fill prior to the placement of the interlayer. Full-depth repairs were also utilized to prep the pavement for the overlay.

A section of I-75 in Ogemaw County near West Branch was chosen as the site for the experimental pavement. The limits are from Ski Park Rd. to the Ogemaw/Roscommon county line. A map showing the project location can be seen in Figure 1. The unbonded overlay was constructed on the northbound side only. The southbound side was rubblized and overlayed with 6 ½ inches of asphalt under a separate contract as a comparison to the unbonded overlay.

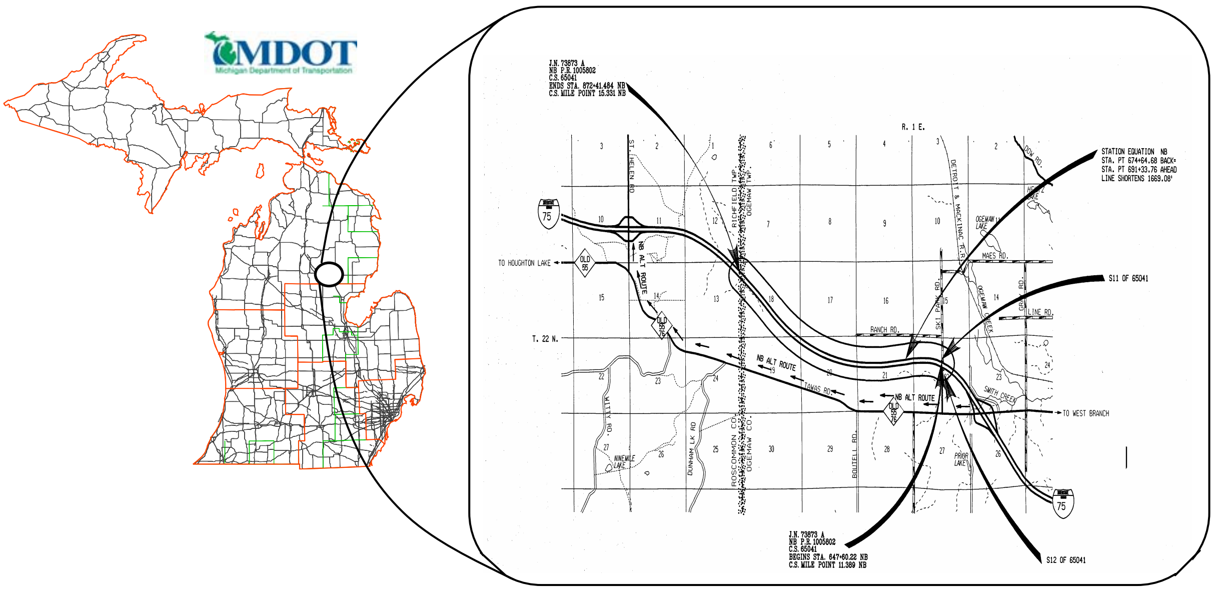


Figure 1. Project location.

BACKGROUND

The existing northbound pavement for this demonstration project is a three lane, 9" reinforced concrete with asphalt shoulders, built in 1973. The base is 4" of dense graded aggregate over 10" of sand subbase. Three different joint spacings of 71'-2", 57'-3", and 43'-4" were utilized as part of a joint spacing experiment. Plastic coated dowel bars for load transfer were also included as part of the experiment. A section of 71'-2" joint spacing with plain steel dowels, which were both the standards at the time, was also built for comparison to the experimental sections. The northern three-tenths of a mile is only two lanes.

2002 average daily traffic is 11,900 with 11.7% commercial traffic. One project was let in 1991 to fix deterioration at joints and cracks with full-depth repairs, crack sealing, and spall repair. Routine maintenance (pothole patching, etc.) done during the life of this pavement was not investigated. The southbound pavement has the same cross-section but is only two lanes.

CONSTRUCTION

Unbonded Concrete Overlay

Preparation work on the existing concrete pavement began on August 10 with full-depth repairs of deteriorated joints, cracks, and previous repairs. This work continued until August 21. Overband crack filling of the joints and cracks occurred behind the full-depth repair operation from August 14 to 22.

On August 27, work began on the inside (median) shoulder to widen it for traffic control purposes. The transition area from the Ski Park Road bridge approach slab to the unbonded overlay (235 feet) was removed starting on September 8. Paving of the inside shoulder began on September 9 with the separator layer paving of the inside shoulder and passing lane beginning on September 11. Concrete placement began on September 15 with both the 9" thick reinforced transition area and the unbonded overlay. Left shoulder and passing lane were completed on September 24 and traffic was shifted over on September 29.

Pavement removal for the transition area on the middle and traffic lanes began on September 29 with concrete placement beginning the next day. On October 2, separator layer paving began for the middle and traffic lanes and the outside shoulder and ends on October 7. The unbonded overlay paving began for the middle and traffic lanes on October 6 and is completed on October 9. The outside shoulder concrete was paved from October 15 to 17. Miscellaneous work occurred after that including pavement striping on October 23 and shoulder corrugation grinding on November 6.

In general, construction of the unbonded concrete overlay went smoothly. There were a few problems and changes however. A leaching trench was to be installed under both shoulders except on the high side of superelevated sections. However, the class II sand that was being removed from the inside shoulder was almost as permeable as the 2NS sand that was used for the trench backfill. Because of this, the leaching trench was eliminated under the outside shoulder.

Tie bars at longitudinal joints were placed by hand as seen in Figures 2 and 3. The tie bars placed on the edge of the paver were placed in the top third of the pavement for the first few days of paving until it was adjusted downward accordingly. In many cases, the bent portion of the bar was embedded in the concrete (Figure 4) and therefore could not be straightened prior to paving the adjacent lane.

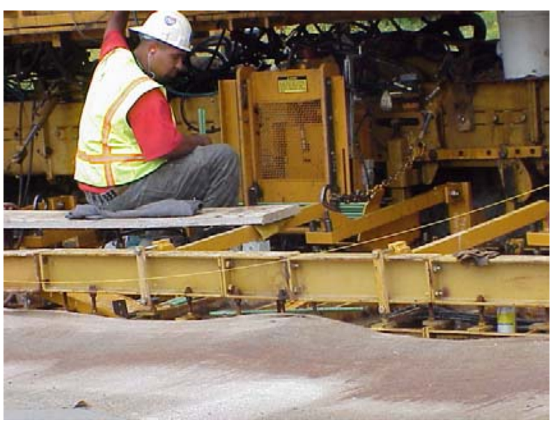


Figure 2. Set-up for placing lane tie bars during two lane paving.

Figure 3. Set-up for placing tie bars at edge of paver.

Figure 4. Tie bar embedded in the concrete. This bar can not be straightened and, therefore, is of no use.

When the passing lane and inside shoulder was paved, the separator layer was paved a foot wider than the concrete. This caused the paver track to run on the edge of the separator layer as shown in Figure 5. This broke up the edge as seen in Figures 6, 7 and 8, which caused slight headaches when paving the separator layer in the adjacent lane.

Figure 5. Paver track running on asphalt separator layer.

Figure 6. Asphalt separator layer broken from paver track.

Figure 7. Loose asphalt separator layer. Note embedded lane tie that can not be straightened for the adjacent lane

Figure 8. Missing asphalt separator layer.

Another problem with the extra one foot area was that fines from construction traffic and the concrete placement plugged the voids on the surface of the interlayer (see Figure 9). The idea of the coarse graded separator layer was drain ability of any water that reached it. Drain ability of that section of the separator layer could be a problem especially due to it's closeness to the longitudinal joint.

Figure 9. Voids in the separator layer are plugged with construction debris.

The sub-contractor paving the separator layer complained about working with it because of the coarseness of the stone, stickiness due to polymer, and it being only one inch thick. No changes were made to the layer and the sub-contractor just had to deal with the problems they cited.

Although not a problem per se, it should be noted that due to grade correction, depth of the overlay varied from about six inches to twelve inches as seen in Figures 10 and 11. The thicker sections were typically in super elevated areas. The majority of the pavement was in the seven inch range.

Figure 10. Concrete overlay close to the six inch proposed thickness.

Figure 11. Area where the concrete overlay was twelve inches thick. This was at the outside shoulder joint.

<u>Rubblize and asphalt overlay</u>

Work began on the southbound side with inside shoulder crushing in preparation for leaching trench placement on August 21. Paving of the inside shoulder after leaching trench began on August 23. Outside leaching trench was placed on August 26 and 27. Rubblization began on traffic lane on September 3. Base and leveling course paving began on September 5 and 6 respectively. The transition area at Ski Park Road bridge approach removal began on September 9 and concrete placement began the next day.

Rubblization of traffic lane was completed on September 17. Base and leveling course paving was completed on the traffic lane and outside shoulder on September 20.

On September 22, rubblization began on the passing lane. Transition area pavement removal began on September 23 and concrete placement started the next day. Rubblization was completed on the passing lane on September 26. Base course paving of the passing lane and inside shoulder occurred from September 30 to October 2. Leveling course was paved from October 6 to 9. Top course of asphalt was paved on the outside shoulder on October 9, and on the traffic lane on October 10. Passing lane and inside shoulder top course was paved October 11.

Miscellaneous work occurred until October 24 including rumble strip grinding and pavement marking on October 15. The authors did not follow the work on the southbound side so no problems or changes were known.

EVALUATION

For the unbonded concrete overlay on the northbound side, all distresses and full-depth repair locations were logged on paper - after the full-depth repairs were completed but prior to any paving. This was done to possibly match any problems or distresses that may occur in the overlay, with distresses in the underlying concrete. Visual evaluations of both northbound and southbound will occur every six months for the first two years and then once a year after that.

Distress Index (DI) data was requested from the MDOT's Pavement Management System (PMS) Operations Group. Pavements under MDOT's jurisdiction are surveyed every other year and the distresses are logged. The distresses are assigned point values based on their extent and severity. The points can then be aggregated over a specified distance which we call the DI for that section. Table 1 shows the 2001 and 2003 DI for northbound and southbound. Northbound has been broken down into the various test sections. When the DI reaches 50, the pavement is considered to have no life left and should be rehabilitated or reconstructed.

Table 1. Distress Index (DI) Values

Roadway	2001 DI	2003 DI
Southbound	NA	87.2
Northbound Section 1	57.6	72.1
Northbound Section 2	53.4	67.8
Northbound Section 3	41.2	63.6
Northbound Section 4	44.1	81.0
Northbound Section 5	44.4	86.7

NA = Data not available for southbound in 2001

Ride quality was also measured just prior to and several months after construction. The initial measurements occurred after construction had begun so only one lane in each direction was available to test. The outside lane in the northbound direction and the inside lane in the southbound direction were tested. Due to construction barrels on the southbound side, the left wheelpath laser was actually measuring the asphalt shoulder, so those numbers are not reported. All other numbers are an average of the left and right wheelpaths.

Table 2. Ride Quality Index (RQI) Values		
Roadway	**Before Construction RQI**	**After Construction RQI**
Southbound inside lane	70.3	24.0
Northbound Section 1 outside lane	74.9	36.9
Northbound Section 2 outside lane	76.4	33.8
Northbound Section 3 outside lane	67.9	20.8
Northbound Section 4 outside lane	69.5	23.5
Northbound Section 5 outside lane	77.5	33.5

All lanes were tested after construction. Ride quality measurements will continue yearly. Table 2 shows the results. For the after measurements, only the lanes measured before paving are reported. Michigan uses it's own ride quality scale. Ride quality of 30 or less is considered excellent, 31 to 53 is good, 54 to 69 is fair, and anything over 70 is poor. For both projects, any RQI measurement over 40 would have had to be corrected.

Falling Weight Deflectometer (FWD) testing was conducted in 2001 (at design inception) and again after construction was complete. Measurements were taken approximately every 500 feet in the traffic lane only, in both directions. Three drops equivalent to a 9000 pound load were done at each location. FWD testing will be done yearly. FWD results can be found in the appendix. Included in the appendix are:

- average maximum deflection at the load plate and 60 inches away
- average AASHTO corrected subgrade resilient modulus
- average modulus of elasticity of the concrete
- average modulus of subgrade reaction
- load transfer efficiencies at random joints and cracks

After paving, cores were taken in the unbonded concrete overlay project to verify concrete and separator layer thicknesses. Four inch and six inch diameter cores were taken in the middle and outside (right) lanes only due to traffic control restrictions. Thicknesses were measured to the nearest 1/16th of an inch at three equidistant points around the perimeter of each core, and then averaged. Table 3 shows the locations and thicknesses of each core.

Table 3. Data From Cores						
MDOT core no.	**Dia.**	**Station**	**Lane**	**Distance from outside shldr.**	**Concrete thickness**	**Sep. layer thickness**
1037	6”	651+78	outside	5.0’	10.19”	1.25”
1038	6”	698+94	center	16.1’	7.75”	1.19”
1039	6”	729+94	outside	9.0’	6.69”	1.06”
1040	6”	758+85	center	15.2’	8.44”	1.13”
1041	6”	789+00	outside	5.0’	6.44”	0.94”
1042	6”	819+12	center	16.6’	7.06”	1.0”
1043	6”	849+02	outside	7.6’	7.0”	1.06”
1044	4”	834+05	center	15.8’	7.81”	1.25”
1045	4”	803+99	outside	4.3’	7.06”	0.81”
1046	4”	773+90	center	16.3’	8.56”	1.25”
1047	4”	743+94	outside	4.9’	6.56”	1.06”
1048	4”	714+03	center	13.9’	7.06”	1.13”
1049	4”	664+85	outside	5.8’	9.56”	1.19”

The average concrete thickness was 7.64” for the outside lane and 7.78” for the center lane. The average separator layer thickness was 1.05” for the outside lane and 1.16” for the center lane.

The six inch cores were cut at the asphalt/concrete interface to remove the separator layer for further testing. The separator layer was tested for permeability according to ASTM Provisional Standard PS 129-01. After cutting, it was noted that much of the separator layer void structure near the asphalt/concrete interface was plugged with cement paste. After getting permeability results on each sample, they were cut again to try to eliminate the areas where the voids were plugged. The amount cut off was between 5/16” and 9/16”. A second round of testing was then conducted to see if permeabilities went up without the cement paste plugging the voids. Table 4 shows the results before and after cutting.

Table 4. Asphalt Separator Layer Permeability Results		
MDOT Core No.	**Permeability before cutting (ft./day)**	**Permeability after cutting (ft./day)**
1037	0.0	14.5
1038	0.8	31.2
1039	16.5	57.8
1040	3.2	45.8
1041	0.6	39.5
1042	3.3	30.0
1043	5.2	38.6

The mix design selected for the separator layer was an open one to allow for drainability of any water that infiltrated the overlay. The low permeability numbers before the plugged voids were cut off is a concern. However, we do not know the permeability required to effectively drain a significant storm event so these numbers are provided for information only.

SUMMARY

Construction for both the unbonded concrete overlay and the rubblize with asphalt overlay went very well. A few concerns were noted in the unbonded concrete overlay: misplaced or embedded lane tie bars, paver track running on the edge of the asphalt separator layer, and plugging of the asphalt separator layer with concrete.

The unbonded concrete overlay took 69 days to construct from start to completion of paving for roughly 12 lane-miles plus shoulders. The rubblize and asphalt overlay took 51 days from start to completion of paving for roughly 8 lane-miles plus shoulders.

Both projects will continue to be monitored visually, and will be tested on a regular basis with the Falling Weight Deflectometer and the Rapid Travel Profilometer (ride quality).

Appendix

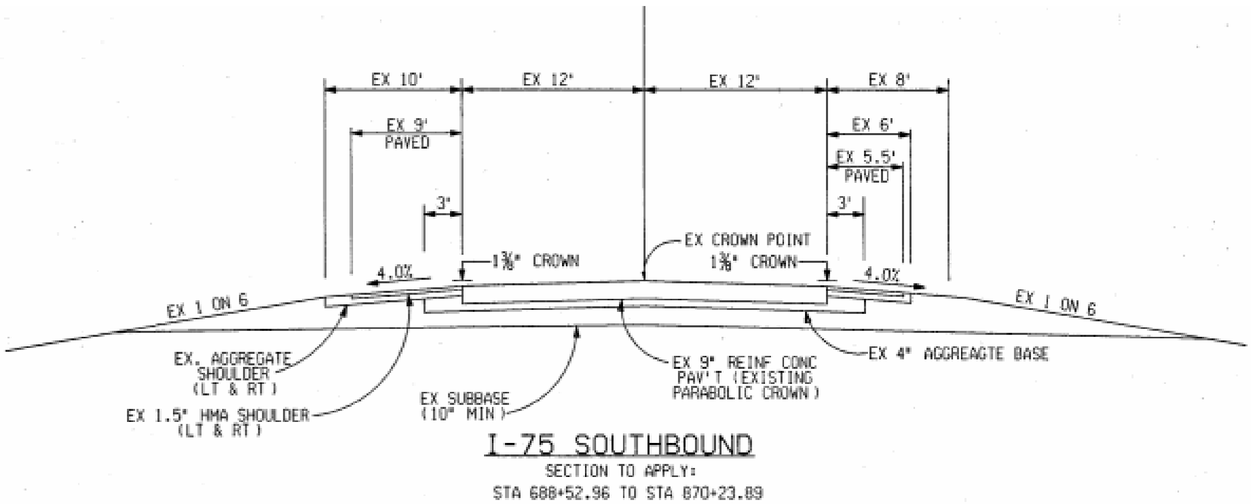
Test Section Stationing

UNBONDED CONCRETE OVERLAY JOINT TABLE FOR DETAILS OF ALL MODIFIED CONCRETE JOINTS SEE NEXT TYPICAL SHEET			
SECTION	**TRANSVERSE JOINT TYPE**	**LONGITUDINAL BULKHEAD JOINT TYPE**	**LONGITUDINAL LANE TIE JOINT TYPE**
STA 650+28.66 TO STA 664+00	MODIFIED (U) TRANSVERSE PLANE OF WEAKNESS JOINT AT 10' SPACING	MODIFIED (B) LONGITUDINAL BULKHEAD JOINT (UNSEALED JOINT WITHOUT SAWCUT)	MODIFIED (D) LONGITUDINAL LANE TIE JOINT (UNSEALED JOINT WITH 1/8" SAWCUT)
STA 664+00 TO STA 694+00 (SEE STA EQN)	MODIFIED (W) TRANSVERSE PLANE OF WEAKNESS JOINT AT 10' SPACING	MODIFIED (S) LONGITUDINAL BULKHEAD JOINT (SEALED JOINT WITH 1/4" SAWCUT)	MODIFIED (D) LONGITUDINAL LANE TIE JOINT (SEALED JOINT WITH 1/4" SAWCUT)
STA 694+00 TO STA 770+00	MODIFIED (U) TRANSVERSE PLANE OF WEAKNESS JOINT AT 12' SPACING	MODIFIED (B) LONGITUDINAL BULKHEAD JOINT (UNSEALED JOINT WITHOUT SAWCUT)	MODIFIED (D) LONGITUDINAL LANE TIE JOINT (UNSEALED JOINT WITH 1/8" SAWCUT)
STA 770+00 TO STA 845+00	MODIFIED (W) TRANSVERSE PLANE OF WEAKNESS JOINT AT 12' SPACING	MODIFIED (B) LONGITUDINAL BULKHEAD JOINT (SEALED JOINT WITH 1/4" SAWCUT)	MODIFIED (D) LONGITUDINAL LANE TIE JOINT (SEALED JOINT WITH 1/4" SAWCUT)
STA 845+00 TO STA 870+06.48	MODIFIED (Cp) OR (C3p) TRANSVERSE CONTRACTION JOINT AT 12' SPACING	MODIFIED (B) LONGITUDINAL BULKHEAD JOINT (SEALED JOINT WITH 1/4" SAWCUT)	MODIFIED (D) LONGITUDINAL LANE TIE JOINT (SEALED JOINT WITH 1/4" SAWCUT)

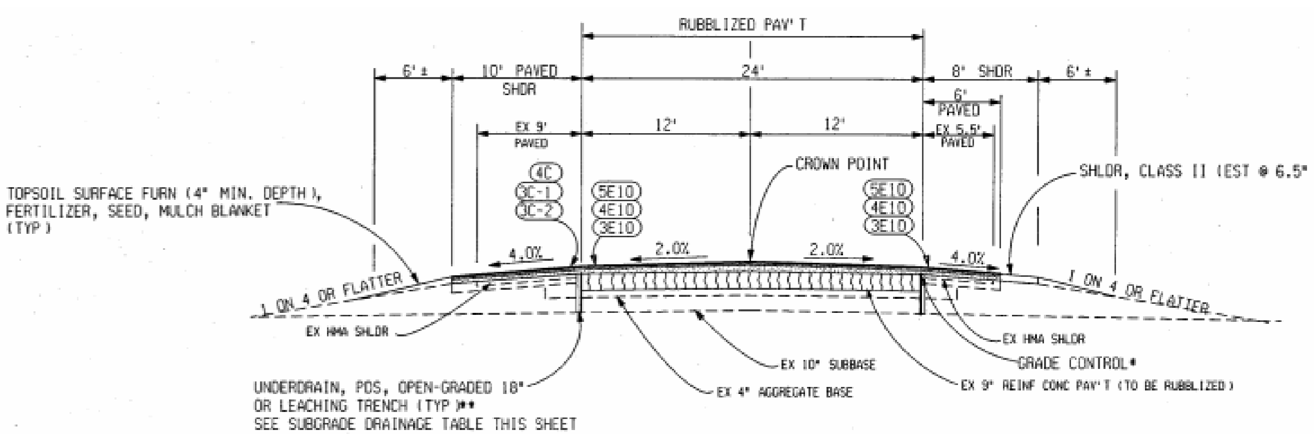
Typical Cross-Sections

Rubblize and Asphalt Overlay

Existing

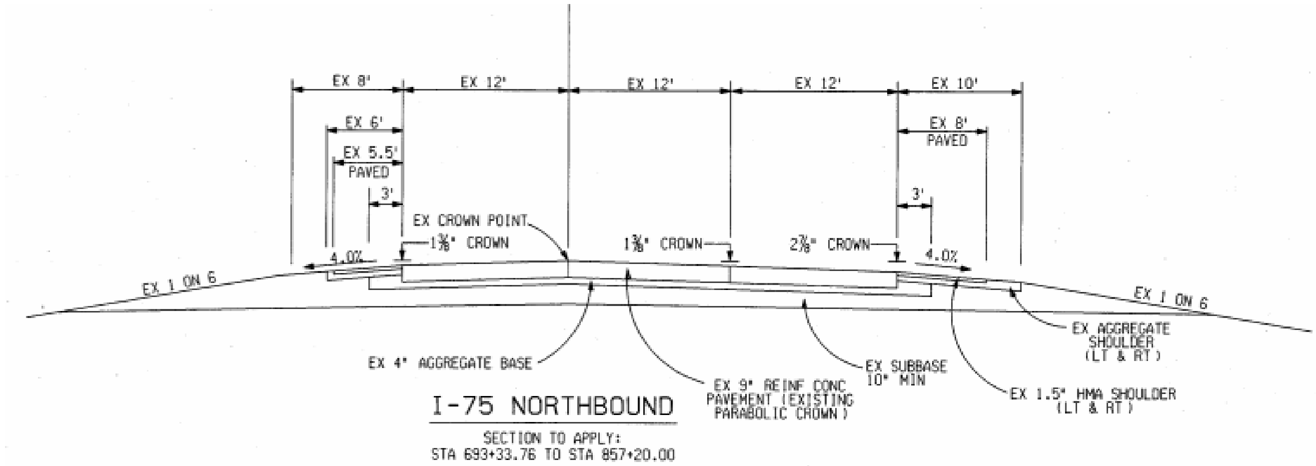


Proposed

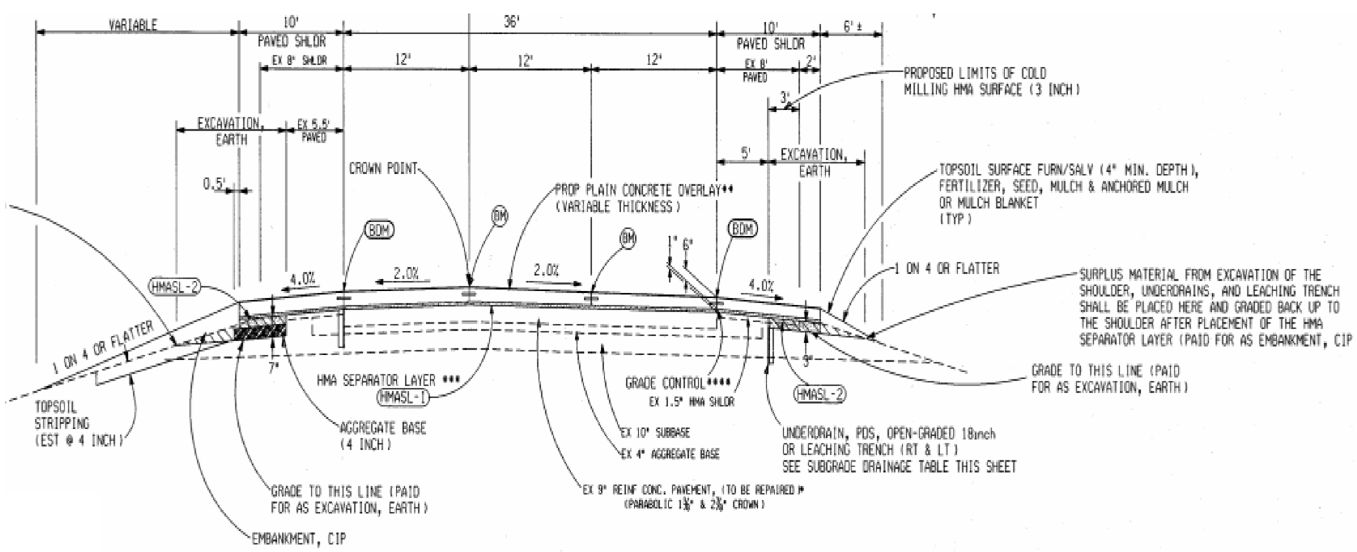


Unbonded Concrete Overlay

Existing



Proposed

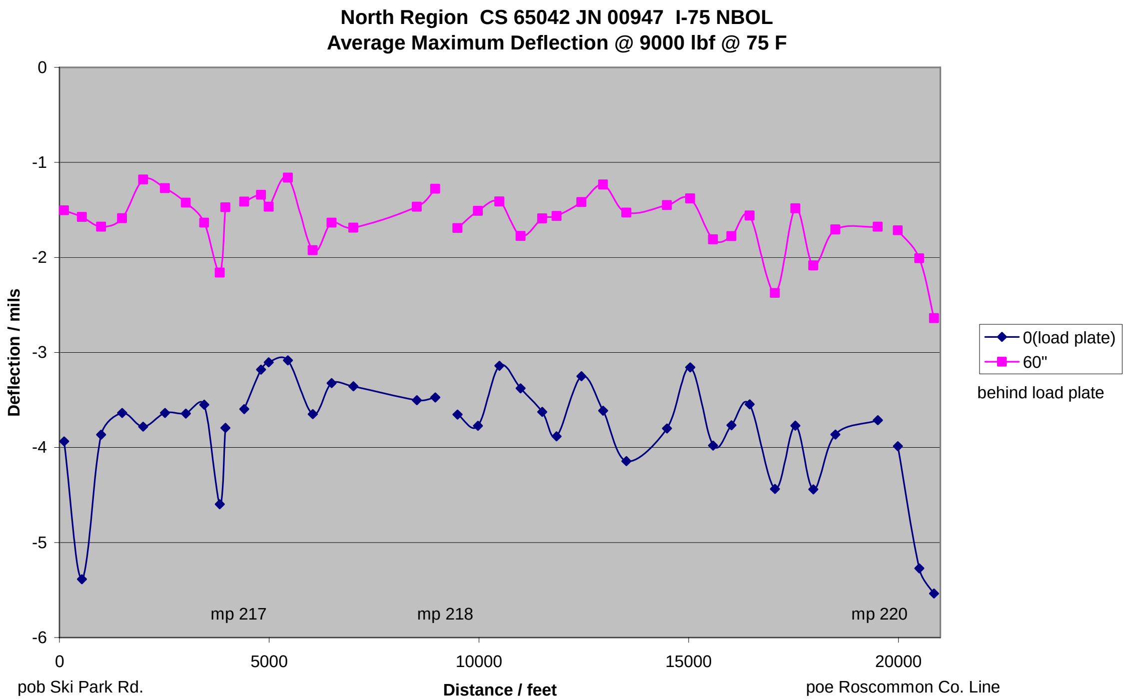


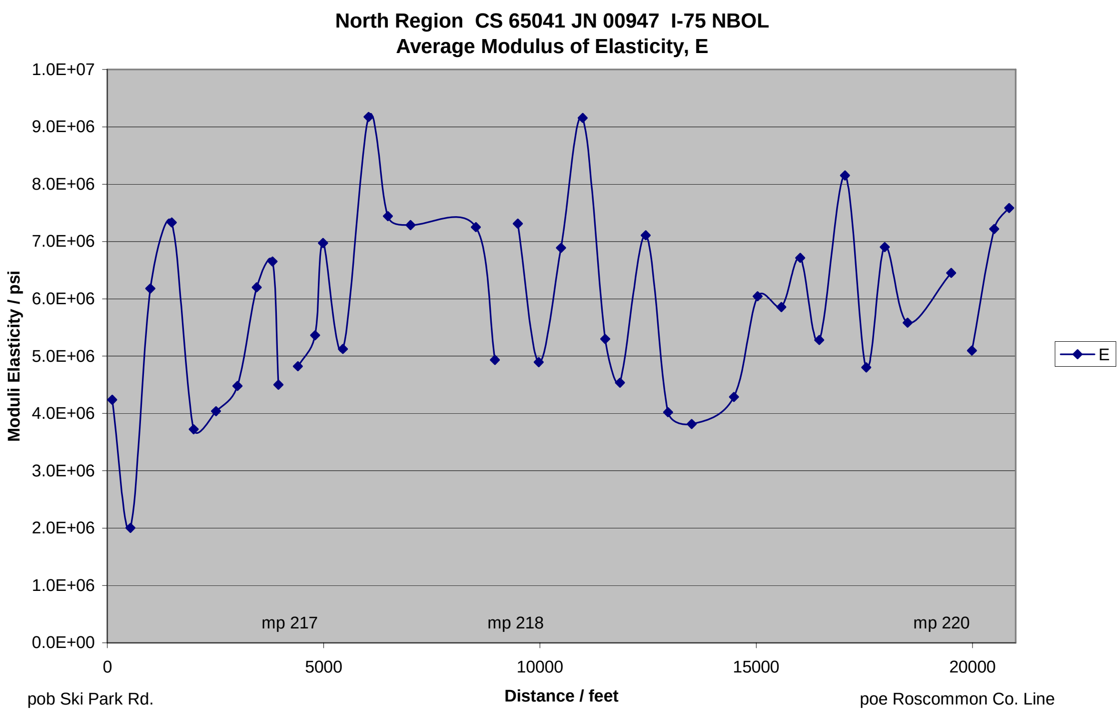
FWD Results
Before Construction

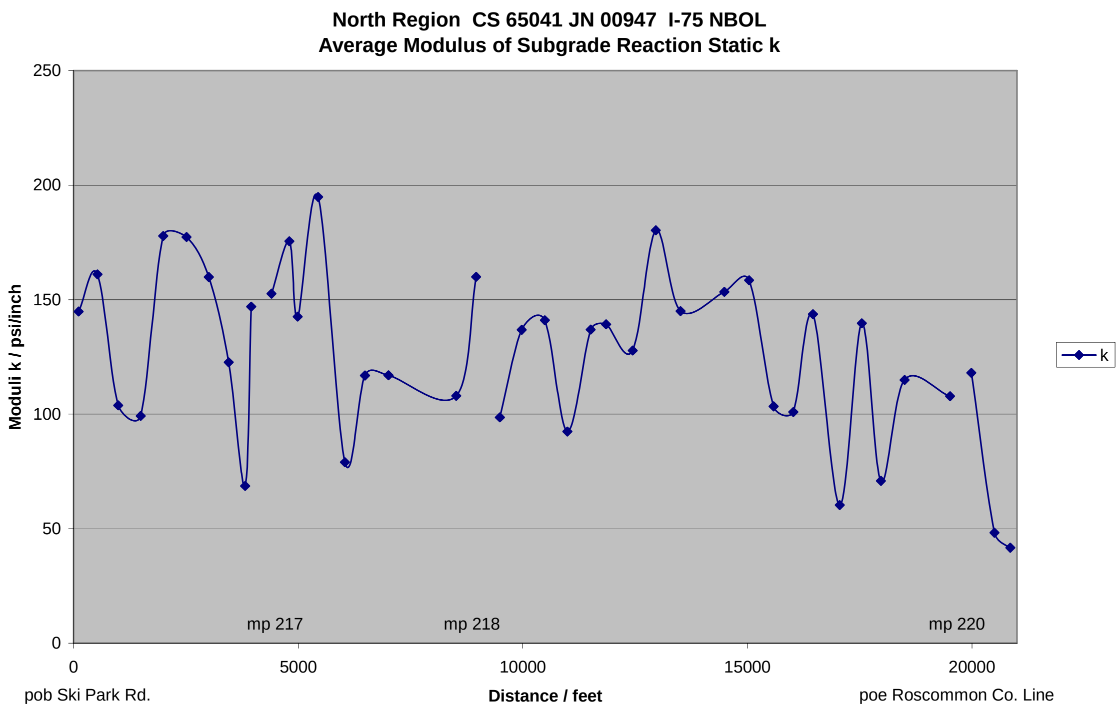
Northbound

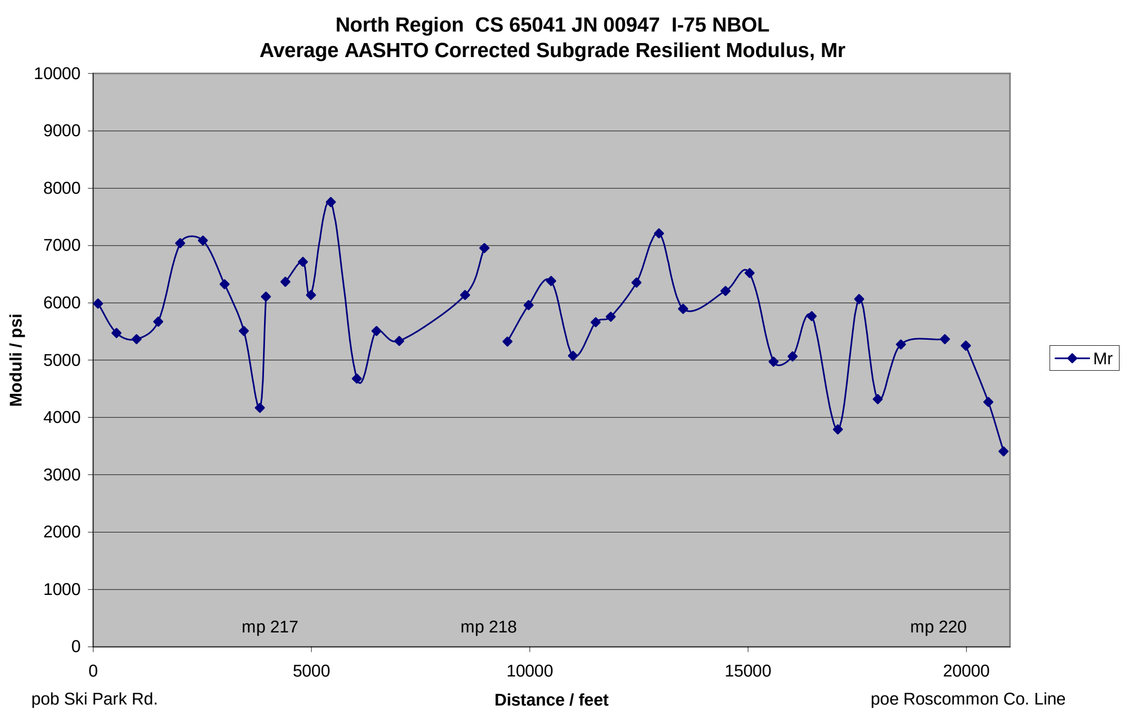
KUAB FWD FILE :	00947no.NOR
Project :	North Region 2001
Project Number :	CS 65041 JN 00947
Region :	North
Route :	I-75 NBOL (Passing)
Location :	from Ski Park Road to Ogemaw-Rosscommon
:	County Line
POB :	N. edge of Ski Park Road
POE :	Ogemaw-Rosscommon Co. Line
Surface Type :	Rigid
Customer/Client :	MDOT/North Region
Operator :	K.Bancroft
Traffic Control :	M.Palmer, Santino Curtis
Environment :	sunny,clear, mild
Traffic :	medium
Comments :	Santino Curtis TMA
:	
Date Created :	30-08-2001
Load Mode :	2 (3+3 buffers, 7 plates)
Plate Radius :	5.91 (in)
Extra Field Set :	COMP./RIGID
Drop Sequence :	22
No of drops :	13
Record Drop? :	NY
Drop Height :	1 2 3 4
Impact Load :	5000 9000 15500 20500 lbf
Sensor Number :	0 1 2 3 4 5 6 7 8
Sensor Distance :	0.00 12.00 12.00 8.00 12.00 18.00 24.00 36.00 60.00 (in)
Sensor Position :	CENTER FRONT LEFT BEHIND BEHIND BEHIND BEHIND BEHIND BEHIND
Reference Offset :	0 ft
Testpoint spacing:	500 ft

																C=0.25
														Modulus		AASHTO
														Subgrade		Corrected
		Load												Reaction	Modulus	Subgrade
		Plate	8"	12"	18"	24"	36"	60"						Static	Elasticity	Resilient
Distance	Load	D0	D3	D4	D5	D6	D7	D8	Air	Pave	Test	Test	Pvmt	Pvmt	k	Ec	Modulus
ft	lbf	mils	mils	mils	mils	mils	mils	mils	øF	øF	Pt.	Area	Dstrs	Sev.	psi/inch	psi	psi
0	pob N. edge of Ski Park Road structure																
111	9000	3.94	3.64	3.47	3.21	2.91	2.42	1.50	61	72	MD	FILL	TCK	POOR	126	2.6E+06	5987
534	9000	5.39	4.75	4.40	3.89	3.44	2.74	1.57	62	73	MD	CUT	TCK	FAIR	131	1.1E+06	5720
993	9000	3.87	3.69	3.54	3.31	3.05	2.64	1.68	61	71	MD	FILL	TCK	POOR	102	3.6E+06	5368
1492	9000	3.64	3.47	3.35	3.14	2.94	2.53	1.59	61	72	MD	FILL	TCK	POOR	104	4.1E+06	5672
1995	9000	3.78	3.46	3.28	3.00	2.68	2.13	1.18	61	71	MD	FILL	TCK	POOR	157	2.0E+06	7042
2514	9000	3.64	3.33	3.16	2.89	2.61	2.11	1.27	62	74	MD	CUT	TCK	POOR	152	2.3E+06	7087
3010	9000	3.64	3.36	3.19	2.91	2.68	2.24	1.42	62	74	MD	CUT	TCK	POOR	136	2.8E+06	6323
3452	9000	3.55	3.32	3.17	2.98	2.75	2.47	1.63	63	73	MD	CUT	TCK	POOR	108	4.2E+06	5510
3820	9000	4.60	4.40	4.21	4.02	3.79	3.31	2.16	62	73	MD	CUT	LCK	POOR	74	3.8E+06	4167
3956	9000	3.79	3.49	3.32	3.11	2.83	2.40	1.47	62	73	MD	GRADE	TCK	POOR	126	2.8E+06	6109
3996	mp 217																
4404	9000	3.60	3.33	3.19	2.93	2.69	2.25	1.41	61	73	MD	FILL	TCK	POOR	133	3.0E+06	6368
4804	9000	3.18	2.94	2.80	2.57	2.37	1.98	1.34	61	73	MD	CUT	TCK	POOR	146	3.5E+06	6716
4988	9000	3.10	2.93	2.77	2.60	2.41	2.08	1.47	62	72	MD	CUT	TCK	POOR	125	4.7E+06	6136
5445	9000	3.08	2.88	2.69	2.45	2.23	1.83	1.16	63	74	MD	CUT	TCK	FAIR	170	3.0E+06	7759
6040	9000	3.65	3.51	3.37	3.22	3.02	2.72	1.92	63	74	MD	CUT	TCK	FAIR	81	5.9E+06	4679
6488	9000	3.32	3.14	3.03	2.83	2.65	2.32	1.63	64	74	MD	GRADE	TCK	FAIR	106	5.0E+06	5510
7009	9000	3.36	3.17	3.02	2.84	2.66	2.35	1.69	64	72	MD	CUT	TCK	POOR	104	5.0E+06	5336
8520	9000	3.50	3.36	3.19	3.00	2.78	2.41	1.47	65	74	MD	FILL	TCK	POOR	114	4.0E+06	6136
8960	9000	3.47	3.23	3.08	2.85	2.58	2.16	1.28	65	75	MD	FILL	TCK	POOR	143	2.9E+06	6955
9304	mp 218																
9489	9000	3.65	3.49	3.34	3.16	2.95	2.54	1.69	66	79	MD	FILL	TCK	POOR	100	4.3E+06	5325
9975	9000	3.77	3.53	3.34	3.10	2.85	2.40	1.51	67	73	MD	CUT	TCK	POOR	123	2.9E+06	5960
10489	9000	3.14	2.96	2.82	2.64	2.43	2.11	1.41	68	76	MD	CUT	TCK	POOR	128	4.4E+06	6383
10992	9000	3.38	3.23	3.12	2.96	2.76	2.51	1.77	68	77	MD	CUT	TCK	POOR	89	6.2E+06	5075
11509	9000	3.63	3.41	3.23	2.97	2.74	2.35	1.59	69	77	MD	CUT	TCK	POOR	119	3.4E+06	5660
11853	9000	3.88	3.63	3.43	3.19	2.89	2.44	1.56	69	75	MD	CUT	TCK	POOR	121	2.8E+06	5757
12446	9000	3.25	3.07	2.94	2.78	2.58	2.18	1.42	67	75	MD	FILL	TCK	POOR	123	4.2E+06	6353
12961	9000	3.61	3.31	3.12	2.87	2.59	2.08	1.23	68	75	MD	FILL	TCK	POOR	156	2.3E+06	7212
13513	9000	4.14	3.82	3.68	3.33	3.03	2.48	1.53	66	76	MD	FILL	TCK	POOR	125	2.3E+06	5895
14484	9000	3.80	3.53	3.34	3.07	2.77	2.32	1.45	66	79	MD	FILL	TCK	POOR	132	2.6E+06	6207
15036	9000	3.16	2.96	2.81	2.61	2.39	2.05	1.38	67	79	MD	FILL	TCK	FAIR	137	3.9E+06	6522
15582	9000	3.98	3.79	3.62	3.37	3.13	2.68	1.81	65	78	MD	CUT	TCK	POOR	98	3.6E+06	4972
16019	9000	3.77	3.59	3.42	3.23	3.00	2.62	1.78	66	80	MD	CUT	TCK	POOR	97	4.2E+06	5066
16457	9000	3.55	3.33	3.13	2.92	2.68	2.27	1.56	65	80	MD	CUT	TCK	POOR	123	3.4E+06	5769
17056	9000	4.44	4.30	4.12	3.94	3.71	3.30	2.37	65	78	MD	CUT	TCK	FAIR	65	5.0E+06	3792
17545	9000	3.77	3.53	3.34	3.10	2.83	2.38	1.48	64	77	MD	FILL	TCK	FAIR	125	2.9E+06	6067
17973	9000	4.44	4.27	4.09	3.90	3.65	3.18	2.08	65	78	MD	FILL	TCK	FAIR	77	3.9E+06	4320
18500	9000	3.86	3.66	3.47	3.24	2.99	2.57	1.71	65	80	MD	FILL	TCK	FAIR	106	3.5E+06	5273
19511	9000	3.71	3.53	3.38	3.17	2.94	2.53	1.68	65	78	MD	CUT	TCK	FAIR	104	3.9E+06	5368
19885	mp 220																
19986	9000	3.99	3.78	3.58	3.28	3.07	2.56	1.71	66	79	MD	CUT	TCK	FAIR	109	3.1E+06	5253
20501	9000	5.27	5.40	5.30	4.89	4.38	3.51	2.01	66	77	MD	FILL	TCK	FAIR	75	2.7E+06	4269
20851	9000	5.54	5.46	5.26	5.03	4.72	4.10	2.64	66	76	MD	FILL	TCK	POOR	56	3.6E+06	3409
20889	poe Roscommon County Line																
Average			3.58	3.42	3.18	2.93	2.49	1.62	64	75					115	3.5E+06	5719
Stdev.			0.58	0.57	0.54	0.51	0.44	0.31	2	3					26	1043931	934
Max.			5.46	5.30	5.03	4.72	4.10	2.64	69	80					170	6.2E+06	7759
Min.			2.88	2.69	2.45	2.23	1.83	1.16	61	71					56	1.1E+06	3409
C. of V.			16%	17%	17%	17%	18%	19%	4%	4%					22%	29%	16%


North Region CS 65042 JN 00947 I-75 NBOL
Average Maximum Deflection @ 9000 lbf @ 75 F
Deflection / mils
0
-1
-2
-3
-4
-5
-6
mp 217
mp 218
mp 220
0
5000
10000
15000
20000
pob Ski Park Rd.
Distance / feet
poe Roscommon Co. Line
0(load plate)
60"
behind load plate


North Region CS 65041 JN 00947 I-75 NBOL
Average Modulus of Elasticity, E
Moduli Elasticity / psi
1.0E+07
9.0E+06
8.0E+06
7.0E+06
6.0E+06
5.0E+06
4.0E+06
3.0E+06
2.0E+06
1.0E+06
0.0E+00
mp 217
mp 218
mp 220
0
5000
10000
15000
20000
pob Ski Park Rd.
Distance / feet
poe Roscommon Co. Line
E


North Region CS 65041 JN 00947 I-75 NBOL
Average Modulus of Subgrade Reaction Static k
Moduli k / psi/inch
250
200
150
100
50
0
mp 217
mp 218
mp 220
0
5000
10000
15000
20000
pob Ski Park Rd.
Distance / feet
poe Roscommon Co. Line
k


North Region CS 65041 JN 00947 I-75 NBOL
Average AASHTO Corrected Subgrade Resilient Modulus, Mr
Moduli / psi
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
mp 217
mp 218
mp 220
0
5000
10000
15000
20000
pob Ski Park Rd.
Distance / feet
poe Roscommon Co. Line
Mr

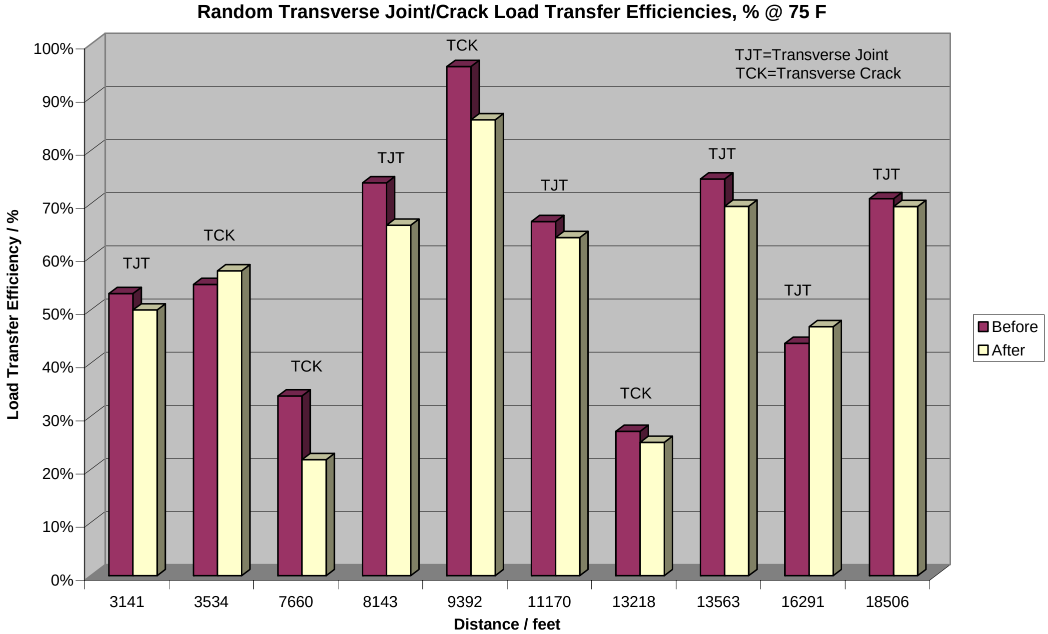
North Region CS 65041 JN 00947 I-75 NBOL
Transverse Joint/Crack Load Transfer Efficiency

Distance ft	Load lbf	Load Plate D0 mils	12" Front D1 mils	12" Behind D4 mils	60" Behind D8 mils	Air øF	Pave øF	Test Type	Test Area	Pvmt Dstrs	Test Loc.	Transverse Joint/Crack Load Transfer Efficiency	
0	pob Ski Park Road structure												
3141	9000	7.06	3.75	5.07	1.80	62	73	TJT	CUT	NA	BJT	53%	
3142	9000	7.57	5.76	3.79	1.61	63	73	TJT	CUT	NA	AJT		50%
3534	9000	8.23	4.51	6.19	1.74	62	73	TCK	CUT	SPALL	BCK	55%	
3535	9000	8.55	6.40	4.90	1.67	62	72	TCK	CUT	FAULT	ACK		57%
7660	9000	7.65	2.59	5.88	1.99	62	73	TCK	FILL	SPALL	BCK	34%	
7661	9000	13.12	10.16	2.87	1.32	63	73	TCK	FILL	FAULT	ACK		22%
8143	9000	7.27	5.37	5.57	1.74	64	74	TJT	CUT	SPALL	BJT	74%	
8145	9000	7.44	5.94	4.90	1.73	64	75	TJT	CUT	SPALL	AJT		66%
9392	9000	5.57	5.33	4.43	1.51	65	75	TCK	FILL	NA	BCK	96%	
9394	9000	6.07	4.80	5.21	1.67	65	75	TCK	FILL	FAULT	ACK		86%
11170	9000	7.53	5.02	5.81	1.85	68	76	TJT	CUT	SPALL	BJT	67%	
11171	9000	8.53	6.42	5.43	1.80	68	77	TJT	CUT	SPALL	AJT		64%
13218	9000	5.95	1.61	4.48	1.21	67	77	TCK	FILL	SPALL	BCK	27%	
13219	9000	8.20	6.11	2.06	0.82	67	77	TCK	FILL	FAULT	ACK		25%
13563	9000	6.59	4.92	4.93	1.74	67	77	TJT	FILL	SPALL	BJT	75%	
13565	9000	6.89	5.24	4.79	1.69	66	76	TJT	FILL	SPALL	AJT		70%
16291	9000	7.70	3.36	4.36	1.76	65	79	TJT	CUT	SPALL	BJT	44%	
16292	9000	6.98	4.92	3.27	1.54	65	79	TJT	CUT	SPALL	AJT		47%
18506	9000	8.34	5.91	6.39	1.94	65	78	TJT	FILL	SPALL	BJT	71%	
18507	9000	8.46	6.56	5.88	1.95	64	78	TJT	FILL	SPALL	AJT		69%
20899	poe Roscommon Co. Line												

TJT	Before	After
Average	64%	61%
Stdev.	0.13	0.10
Max	75%	70%
Min	44%	47%
C. of V.	0.20	0.16

TCK	Before	After
Average	53%	48%
Stdev.	0.31	0.30
Max	96%	86%
Min	27%	22%
C. of V.	0.59	0.63

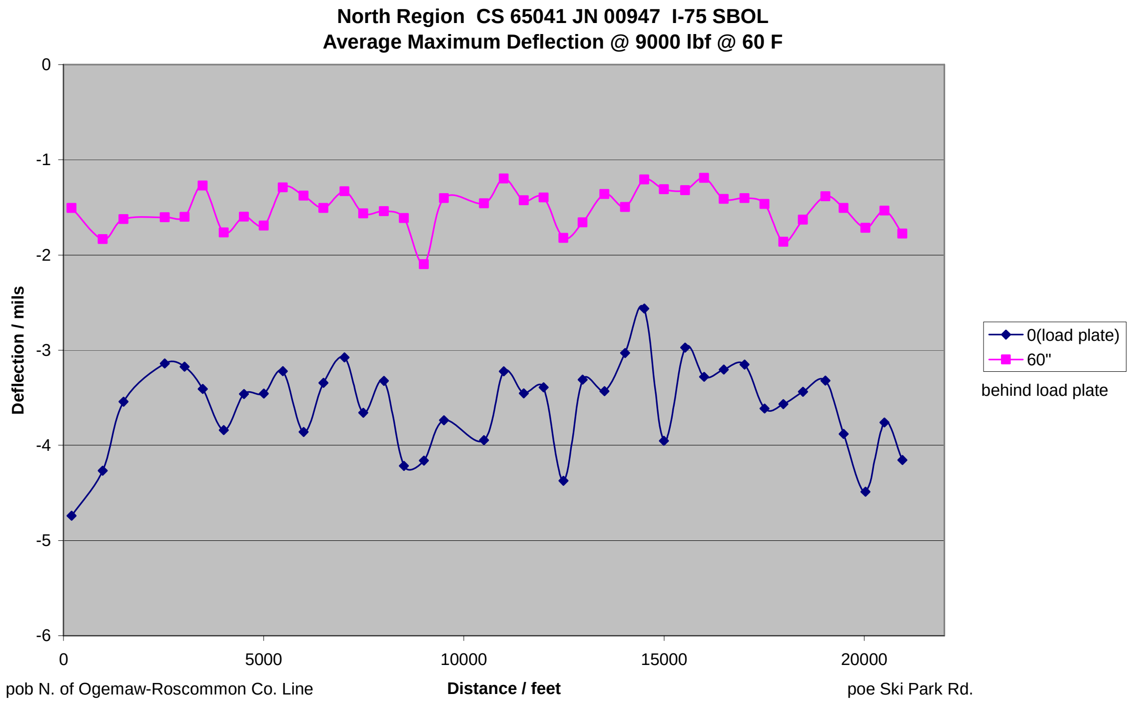
North Region CS 65041 JN 00947 I-75 NBOL
Random Transverse Joint/Crack Load Transfer Efficiencies, % @ 75 F

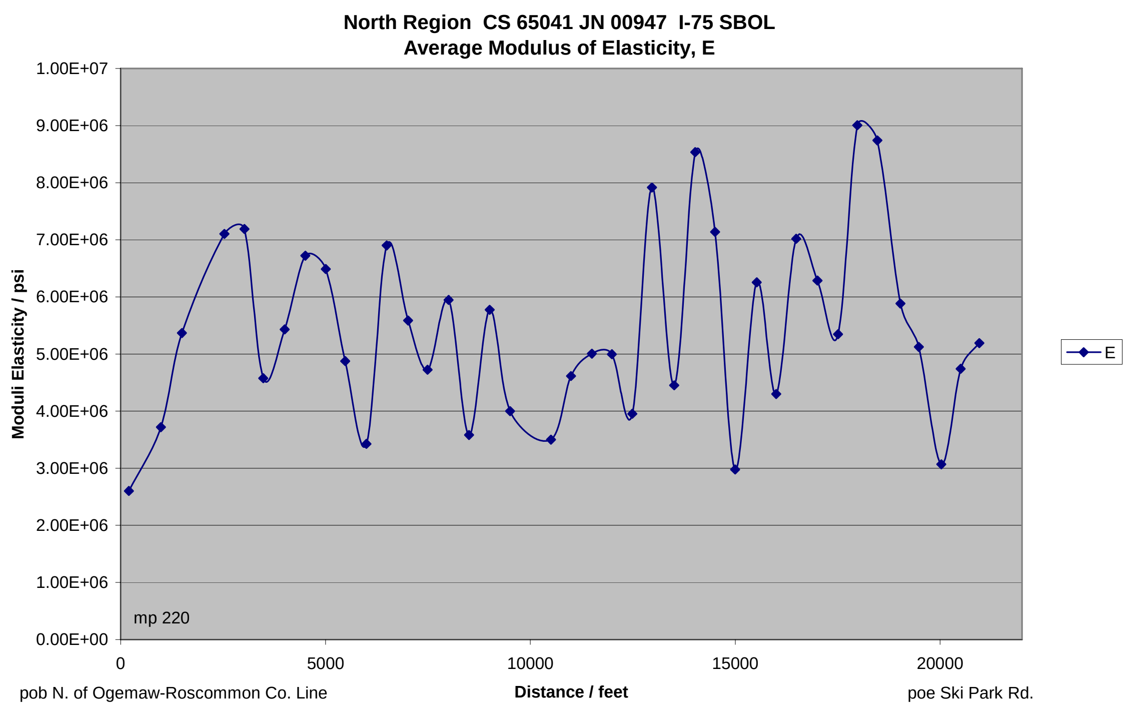


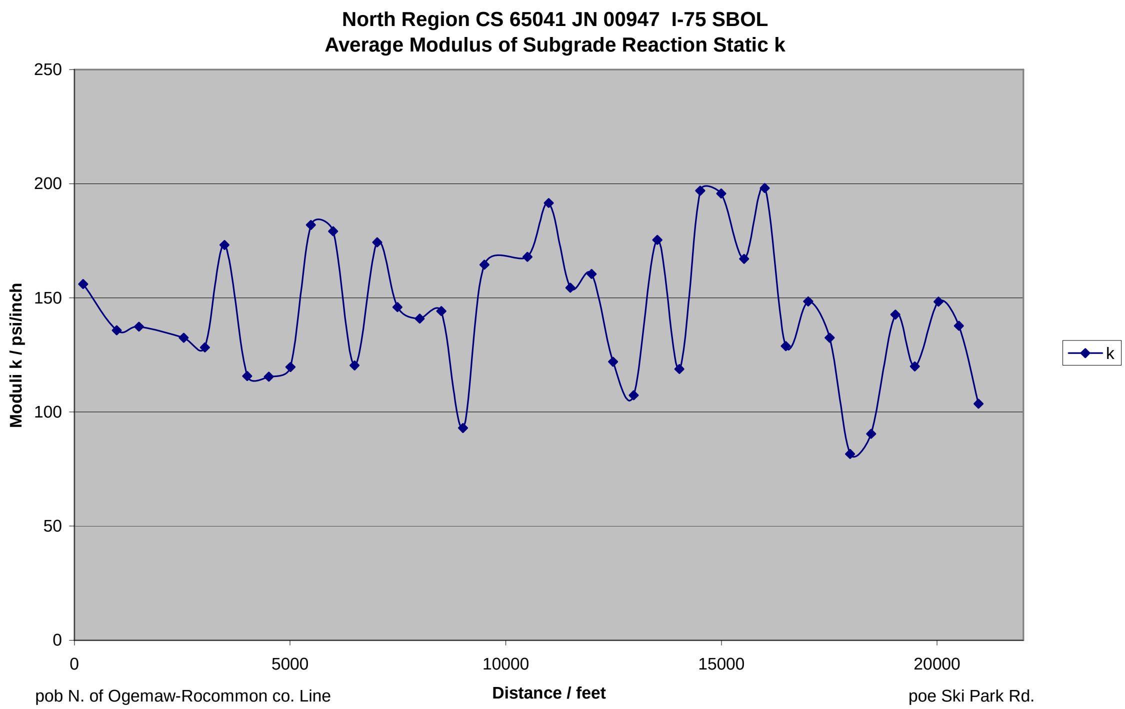
Southbound

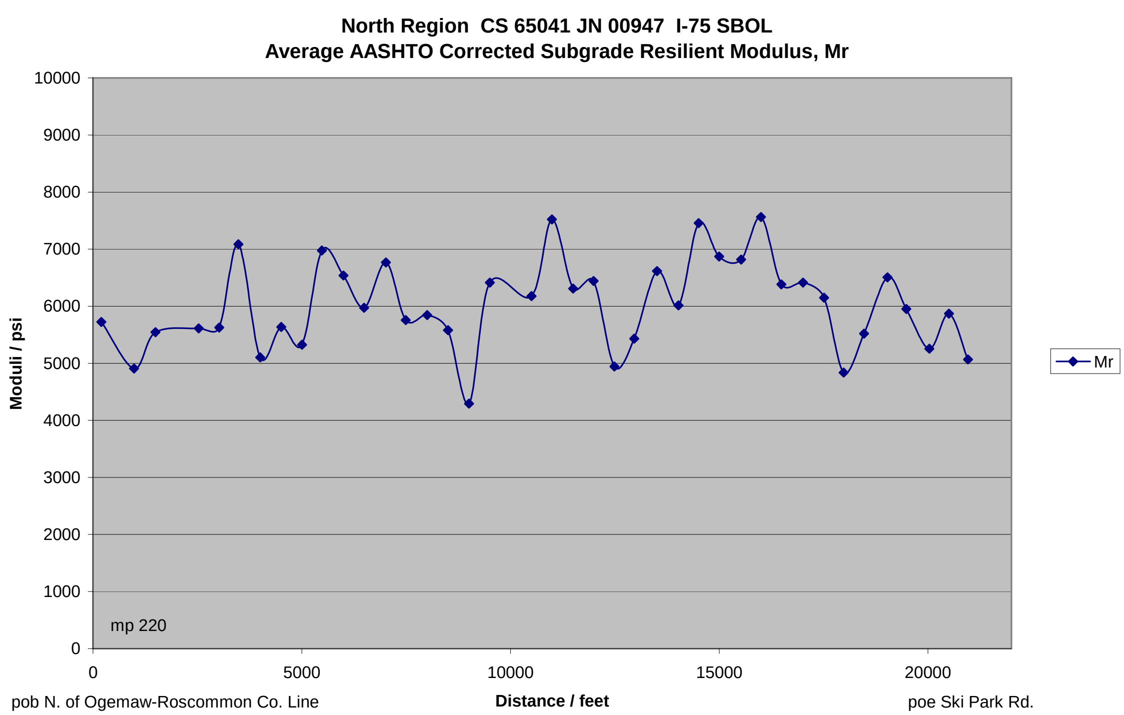
KUAB FWD FILE :	00947SO.NOR
Project :	North Region 2001
Project Number :	CS 65041 JN 00947
Region :	North
Route :	I-75 SBOL
Location :	Roscommon-Ogemaw County line to
:	Ski Park Road
POB :	poe flexible-pob rigid N. of county ln.
POE :	Ski Park Road
Surface Type :	Rigid
Customer/Client :	MDOT/North Region
Operator :	K.Bancroft
Traffic Control :	Megan Palmer
Environment :	sunny,clear,cold AM
Traffic :	light - medium
Comments :	Santino Curtis TMA
:	
Date Created :	14-09-2001
Load Mode :	2 (3+3 buffers, 7 plates)
Plate Radius :	5.91 (in)
Extra Field Set :	COMP./RIGID
Drop Sequence :	2
No of drops :	3
Record Drop? :	Y
Drop Height :	1 2 3 4
Impact Load :	5000 9000 15500 20500 lbf
Sensor Number :	0 1 2 3 4 5 6 7 8
Sensor Distance :	0.00 12.00 12.00 8.00 12.00 18.00 24.00 36.00 60.00 (in)
Sensor Position :	CENTER FRONT LEFT BEHIND BEHIND BEHIND BEHIND BEHIND BEHIND
Reference Offset :	0 ft
Testpoint spacing:	500 ft

Distance ft	Load lbf	Load Plate D0 mils	8" D3 mils	12" D4 mils	18" D5 mils	24" D6 mils	36" D7 mils	60" D8 mils	Air øF	Pave øF	Test Pt.	Test Area	Pvmt Dstrs	Pvmt Sev.	Modulus Subgrade Reaction Static k psi/inch	Modulus Elasticity Ec psi	C=0.25 AASHTO Corrected Subgrade Resilient Modulus psi
0	pob N. of Ogemaw-Roscommon Co. Line																
200	9000	4.74	4.27	4.00	3.63	3.24	2.62	1.51	38	49	MID	FILL	TCK	POOR	**126**	**1.5E+06**	**5973**
981	9000	4.27	3.91	3.72	3.43	3.14	2.68	1.83	41	50	MID	FILL	TCK	POOR	**105**	**2.5E+06**	**4909**
1498	9000	3.54	3.28	3.14	2.93	2.69	2.41	1.62	40	49	MID	FILL	TCK	POOR	**109**	**3.8E+06**	**5544**
2532	9000	3.14	2.93	2.83	2.66	2.48	2.19	1.60	44	51	MID	CUT	TCK	POOR	**107**	**5.3E+06**	**5613**
3023	9000	3.17	2.98	2.88	2.70	2.50	2.24	1.60	44	51	MID	CUT	TCK	POOR	**105**	**5.2E+06**	**5625**
3480	9000	3.41	3.14	2.97	2.72	2.50	2.07	1.27	44	51	MID	CUT	TCK	POOR	**145**	**2.7E+06**	**7087**
4003	9000	3.84	3.61	3.46	3.22	2.97	2.61	1.76	45	54	MID	CUT	TCK	POOR	**98**	**3.6E+06**	**5104**
4507	9000	3.46	3.26	3.17	2.98	2.76	2.38	1.60	47	54	MID	CUT	TCK	POOR	**104**	**4.3E+06**	**5637**
5006	9000	3.46	3.27	3.15	2.94	2.72	2.37	1.69	48	55	MID	CUT	TCK	POOR	**102**	**4.4E+06**	**5325**
5480	9000	3.22	2.96	2.81	2.57	2.36	2.01	1.29	49	55	MID	CUT	TCK	POOR	**146**	**3.1E+06**	**6977**
5998	9000	3.86	3.49	3.32	3.01	2.71	2.21	1.38	50	55	MID	FILL	TCK	POOR	**141**	**2.1E+06**	**6538**
6492	9000	3.34	3.16	3.04	2.85	2.65	2.29	1.51	50	58	MID	FILL	TCK	POOR	**111**	**4.3E+06**	**5973**
7019	9000	3.08	2.85	2.70	2.51	2.30	1.96	1.33	51	58	MID	FILL	TCK	POOR	**141**	**3.7E+06**	**6767**
7490	9000	3.66	3.39	3.22	2.99	2.73	2.35	1.56	50	57	MID	FILL	TCK	POOR	**118**	**3.1E+06**	**5757**
8003	9000	3.32	3.11	2.99	2.76	2.56	2.21	1.54	50	58	MID	FILL	TCK	POOR	**116**	**4.0E+06**	**5844**
8505	9000	4.22	3.89	3.71	3.40	3.06	2.54	1.61	51	57	MID	FILL	TCK	POOR	**117**	**2.2E+06**	**5579**
9005	9000	4.16	3.93	3.78	3.56	3.32	2.91	2.10	51	58	MID	CUT	TCK	POOR	**80**	**4.0E+06**	**4293**
9504	9000	3.74	3.45	3.26	3.00	2.70	2.23	1.40	51	58	MID	CUT	TCK	POOR	**135**	**2.4E+06**	**6413**
10504	9000	3.95	3.60	3.41	3.09	2.78	2.33	1.46	51	59	MID	FILL	TCK	POOR	**133**	**2.2E+06**	**6178**
10995	9000	3.22	2.96	2.82	2.59	2.33	1.94	1.20	51	59	MID	CUT	TCK	POOR	**156**	**2.8E+06**	**7521**
11499	9000	3.45	3.21	3.06	2.82	2.59	2.19	1.43	52	60	MID	CUT	TCK	POOR	**129**	**3.2E+06**	**6308**
11991	9000	3.39	3.14	3.00	2.76	2.53	2.16	1.40	52	59	MID	FILL	TCK	POOR	**131**	**3.2E+06**	**6444**
12488	9000	4.37	4.06	3.86	3.56	3.28	2.80	1.82	52	61	MID	CUT	TCK	POOR	**101**	**2.5E+06**	**4945**
12966	9000	3.31	3.17	3.03	2.84	2.66	2.34	1.66	52	61	MID	CUT	TCK	POOR	**99**	**5.1E+06**	**5433**
13511	9000	3.43	3.17	2.97	2.73	2.48	2.09	1.36	53	61	MID	FILL	TCK	POOR	**141**	**2.8E+06**	**6618**
14026	9000	3.03	2.88	2.78	2.62	2.43	2.18	1.50	53	62	MID	CUT	TCK	POOR	**108**	**5.7E+06**	**6013**
14509	9000	2.56	2.38	2.25	2.10	1.94	1.70	1.21	54	63	MID	CUT	TCK	POOR	**154**	**5.1E+06**	**7459**
14996	9000	3.95	3.54	3.30	2.97	2.66	2.14	1.31	53	64	MID	CUT	TCK	POOR	**153**	**1.7E+06**	**6870**
15526	9000	2.97	2.80	2.66	2.47	2.25	1.91	1.32	54	64	MID	CUT	TCK	POOR	**139**	**4.1E+06**	**6818**
16001	9000	3.28	3.02	2.84	2.59	2.31	1.93	1.19	55	64	MID	CUT	TCK	POOR	**160**	**2.6E+06**	**7563**
16491	9000	3.20	3.03	2.92	2.69	2.52	2.19	1.41	55	65	MID	FILL	TCK	POOR	**119**	**4.3E+06**	**6383**
17009	9000	3.15	2.94	2.85	2.65	2.43	2.11	1.40	55	65	MID	FILL	TCK	POOR	**124**	**4.2E+06**	**6413**
17509	9000	3.61	3.42	3.28	3.02	2.76	2.31	1.46	55	66	MID	FILL	TCK	POOR	**120**	**3.1E+06**	**6150**
17981	9000	3.57	3.43	3.34	3.15	2.96	2.63	1.86	55	67	MID	CUT	TCK	POOR	**81**	**5.7E+06**	**4839**
18470	9000	3.44	3.27	3.22	3.08	2.86	2.49	1.63	56	68	MID	CUT	TCK	POOR	**92**	**5.2E+06**	**5521**
19032	9000	3.32	3.11	3.01	2.78	2.56	2.17	1.38	55	67	MID	FILL	TCK	POOR	**125**	**3.6E+06**	**6506**
19483	9000	3.88	3.66	3.52	3.26	3.00	2.52	1.51	55	66	MID	FILL	TCK	POOR	**112**	**2.9E+06**	**5973**
20032	9000	4.49	4.05	3.85	3.51	3.19	2.66	1.71	55	68	MID	CUT	TCK	POOR	**114**	**2.0E+06**	**5253**
20505	9000	3.76	3.52	3.35	3.09	2.83	2.39	1.53	57	68	MID	GRADE	TCK	POOR	**118**	**2.9E+06**	**5870**
20957	9000	4.15	3.93	3.78	3.54	3.26	2.77	1.78	57	68	MID	FILL	TCK	POOR	**95**	**3.1E+06**	**5066**
21140	poe Ski Park Road																
Average			**3.33**	**3.18**	**2.94**	**2.70**	**2.31**	**1.52**	**51**	**60**					**120**	**3.5E+06**	**6028**
Stdev.			**0.41**	**0.38**	**0.35**	**0.32**	**0.27**	**0.20**	**5**	**6**					**20**	**1135739**	**776**
Max.			**4.27**	**4.00**	**3.63**	**3.32**	**2.91**	**2.10**	**57**	**68**					**160**	**5.7E+06**	**7563**
Min.			**2.38**	**2.25**	**2.10**	**1.94**	**1.70**	**1.19**	**38**	**49**					**80**	**1.5E+06**	**4293**
C. of V.			**12%**	**12%**	**12%**	**12%**	**12%**	**13%**	**9%**	**10%**					**17%**	**32%**	**13%**


North Region CS 65041 JN 00947 I-75 SBOL
Average Maximum Deflection @ 9000 lbf @ 60 F
Deflection / mils
0
-1
-2
-3
-4
-5
-6
0
5000
10000
15000
20000
pob N. of Ogemaw-Roscommon Co. Line
Distance / feet
poe Ski Park Rd.
0(load plate)
60"
behind load plate


North Region CS 65041 JN 00947 I-75 SBOL
Average Modulus of Elasticity, E
Moduli Elasticity / psi
1.00E+07
9.00E+06
8.00E+06
7.00E+06
6.00E+06
5.00E+06
4.00E+06
3.00E+06
2.00E+06
1.00E+06
0.00E+00
mp 220
0
5000
10000
15000
20000
pob N. of Ogemaw-Roscommon Co. Line
Distance / feet
poe Ski Park Rd.
E


North Region CS 65041 JN 00947 I-75 SBOL
Average Modulus of Subgrade Reaction Static k
Moduli k / psi/inch
250
200
150
100
50
0
0
5000
10000
15000
20000
k
pob N. of Ogemaw-Rocommon co. Line
Distance / feet
poe Ski Park Rd.


North Region CS 65041 JN 00947 I-75 SBOL
Average AASHTO Corrected Subgrade Resilient Modulus, Mr
Moduli / psi
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
mp 220
0
5000
10000
15000
20000
Mr
pob N. of Ogemaw-Roscommon Co. Line
Distance / feet
poe Ski Park Rd.

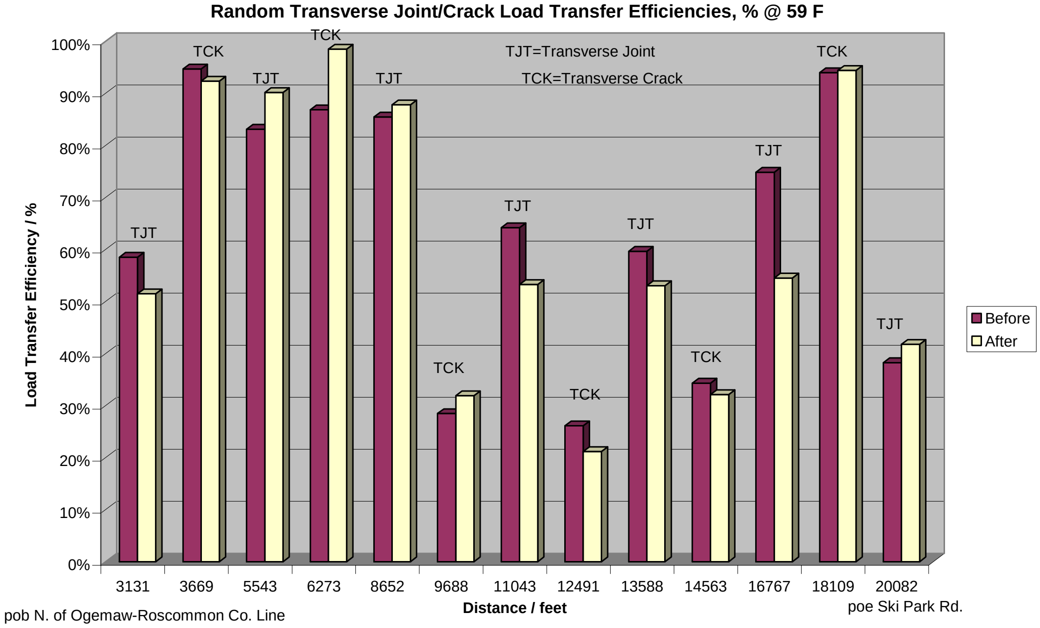
North Region CS 65041 JN 00947 I-75 SBOL
Transverse Joint/Crack Load Transfer Efficiency

Distance ft	Load lbf	Load Plate D0 mils	12" Front D1 mils	12" Behind D4 mils	60" Behind D8 mils	Air øF	Pave øF	Test Type	Test Area	Pvmt Dstrs	Test Loc.	Transverse Joint/Crack Load Transfer Efficiency	
0	pob N. of Ogemaw-Roscommon Co.Line												
3131	9000	16.32	9.55	11.95	3.91	43	51	TJT	CUT	NA	BJT	**59%**	
3132	9000	18.32	14.17	9.43	3.53	44	52	TJT	CUT	NA	AJT		**51%**
3669	9000	7.17	6.79	5.63	1.73	44	51	TCK	CUT	FAULT	BCK	**95%**	
3670	9000	7.17	5.73	6.62	1.99	44	52	TCK	CUT	MID	ACK		**92%**
5543	9000	10.48	8.71	8.31	2.47	49	54	TJT	CUT	NA	BJT	**83%**	
5544	9000	9.68	7.68	8.72	2.80	48	55	TJT	CUT	NA	AJT		**90%**
6273	9000	9.73	8.45	7.58	2.09	50	56	TCK	FILL	SPALL	BCK	**87%**	
6274	9000	8.54	6.86	8.41	2.55	50	55	TCK	FILL	MID	ACK		**98%**
8652	9000	11.86	10.13	9.38	2.87	51	56	TJT	CUT	SPALL	BJT	**85%**	
8653	9000	11.38	9.04	9.99	3.22	51	58	TJT	CUT	SPALL	AJT		**88%**
9688	9000	7.80	2.22	5.88	1.93	50	58	TCK	CUT	SPALL	BCK	**28%**	
9689	9000	8.03	5.91	2.56	1.23	51	59	TCK	CUT	SPALL	ACK		**32%**
11043	9000	9.41	6.04	7.09	2.06	51	60	TJT	CUT	NA	BJT	**64%**	
11044	9000	10.17	7.84	5.41	1.83	52	59	TJT	CUT	NA	AJT		**53%**
12491	9000	7.61	1.99	6.03	2.08	52	60	TCK	CUT	SPALL	BCK	**26%**	
12492	9000	9.80	7.47	2.07	1.14	52	60	TCK	CUT	MID	ACK		**21%**
13588	9000	6.96	4.15	5.21	1.54	52	65	TJT	FILL	SPALL	BJT	**60%**	
13589	9000	7.24	5.04	3.84	1.39	53	64	TJT	FILL	SPALL	AJT		**53%**
14563	9000	7.15	2.45	5.35	1.62	54	63	TCK	CUT	SPALL	BCK	**34%**	
14564	9000	7.34	5.54	2.36	1.12	54	61	TCK	CUT	SPALL	ACK		**32%**
16767	9000	6.67	4.99	5.07	1.53	54	64	TJT	FILL	NA	BJT	**75%**	
16768	9000	7.47	5.83	4.07	1.37	54	64	TJT	FILL	NA	AJT		**55%**
18109	9000	4.73	4.45	4.04	1.80	56	68	TCK	CUT	SPALL	BCK	**94%**	
18110	9000	4.56	3.96	4.31	1.84	55	67	TCK	CUT	SPALL	ACK		**94%**
20082	9000	10.40	3.98	5.50	1.80	56	67	TJT	CUT	SPALL	BJT	**38%**	
20084	9000	8.20	6.11	3.42	1.43	55	65	TJT	CUT	SPALL	AJT		**42%**
21140	poe Ski Park Rd.												

TJT	**Before**	**After**
Average	**66%**	**62%**
Stdev.	**0.16**	**0.19**
Max	**85%**	**90%**
Min	**38%**	**42%**
C. of V.	**0.25**	**0.31**

TCK	**Before**	**After**
Average	**61%**	**62%**
Stdev.	**0.34**	**0.37**
Max	**95%**	**98%**
Min	**26%**	**21%**
C. of V.	**0.56**	**0.60**

North Region CS 65041 JN 00947 I-75 SBOL
Random Transverse Joint/Crack Load Transfer Efficiencies, % @ 59 F



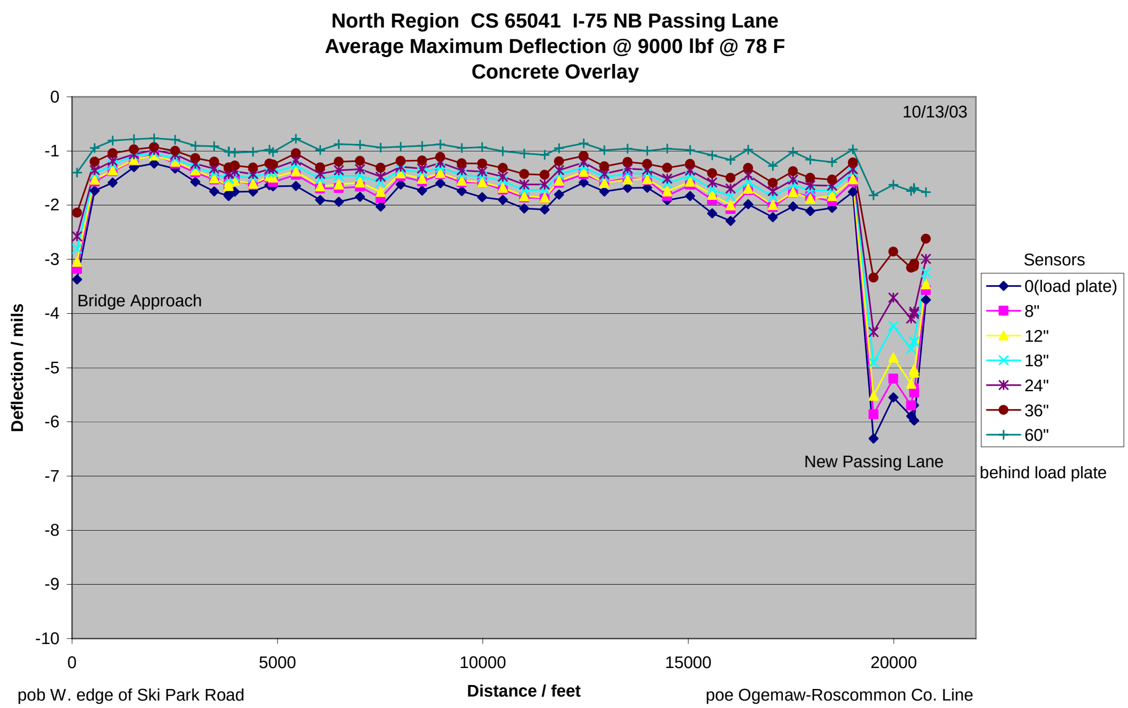
FWD Results
After Construction

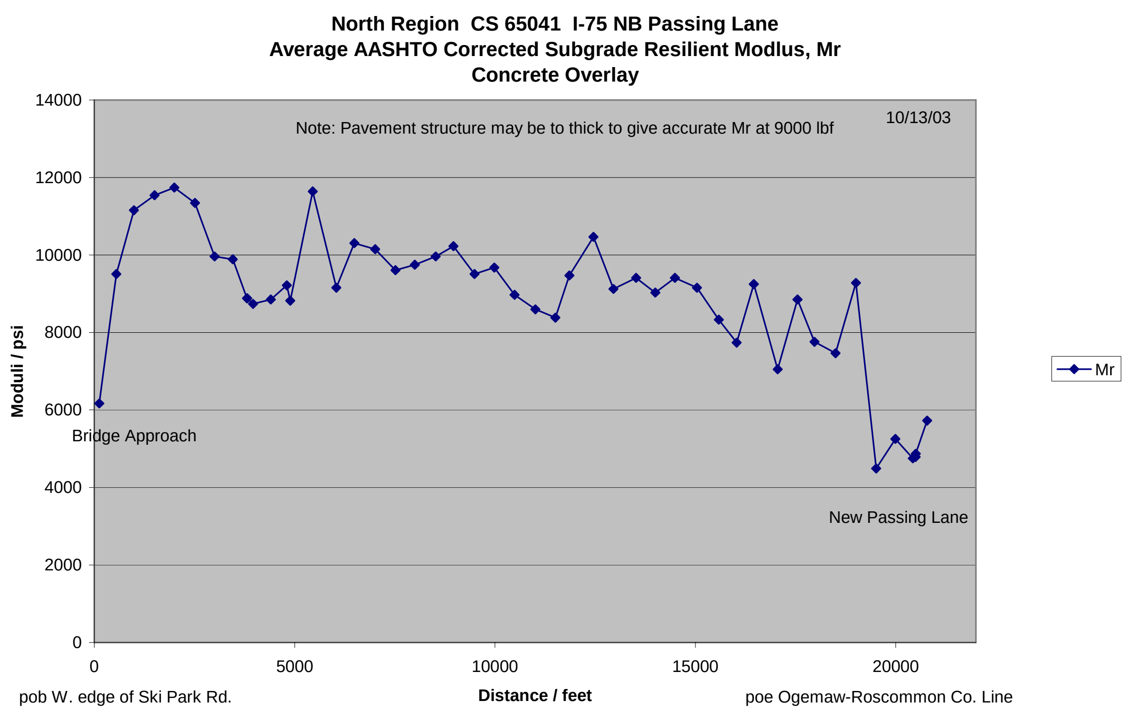
Northbound

KUAB FWD FILE :	65041NO.nor
Project :	North Region 2003
Project Number :	CS 65041
Region :	North
Route :	I-75 NBOL(passing lane)
Location :	Ski Park Road to Ogemae-Roscommon
:	County Line
POB :	W. edge of Ski Park Road structure
POE :	Ogemaw-Roscommon Co. Line
Surface Type :	Concrete Overlay
Customer/Client :	MDOT/Mike Eacker
Operator :	Kurt S. Bancroft
Traffic Control :	under construction
Environment :	sunny,mild
Traffic :	not open to traffic
Comments :	
:	
:	
:	
:	
:	
Date Created :	13-10-2003
Load Mode :	2 (3+3 buffers, 7 plates)
Plate Radius :	5.91 (in)
Extra Field Set :	COMP./RIGID
Drop Sequence :	22
No of drops :	13
Record Drop? :	NY
Drop Height :	1 2 3 4
Impact Load :	5000 9000 15500 20500 lbf
Sensor Number :	0 1 2 3 4 5 6 7 8
Sensor Distance :	0.00 12.00 12.00 8.00 12.00 18.00 24.00 36.00 60.00 (in)
Sensor Position :	CENTER FRONT RIGHT BEHIND BEHIND BEHIND BEHIND BEHIND BEHIND
Reference Offset :	0 ft
Testpoint spacing:	250 ft

Distance ft	Load lbf	D0 mils	D1 mils	D2 mils	D3 mils	D4 mils	D5 mils	D6 mils	D7 mils	D8 mils	Temperature Air F°	Temperature Pave F°	Test Lane	Test Point	Test Grade	Pvmt Cond.	Test Time	c=0.25 AASHTO Corrected Subgrade Resilient Modulus Mr psi	Random Transverse Joint Load Transfer
124	9000	3.37	3.03	3.03	3.18	3.04	2.81	2.58	2.14	1.40	73	80	NBCL	MID	FILL	NEW	12:15	**3353**	
549	9000	1.73	1.48	1.50	1.57	1.53	1.43	1.35	1.20	0.95	76	74	NBCL	MID	CUT	NEW	12:20	**6650**	
989	9000	1.59	1.48	1.40	1.37	1.36	1.25	1.19	1.04	0.81	76	74	NBPL	MID	GRADE	NEW	12:29	**7584**	
1505	9000	1.30	1.13	1.10	1.18	1.17	1.09	1.06	0.97	0.78	78	74	NBPL	MID	FILL	NEW	12:35	**8491**	
2000	9000	1.23	1.06	1.07	1.06	1.08	1.04	0.98	0.93	0.77	75	77	NBPL	MID	FILL	NEW	12:39	**9153**	
2513	9000	1.33	1.18	1.13	1.24	1.20	1.14	1.06	1.00	0.79	78	77	NBPL	MID	CUT	NEW	12:43	**8464**	
3005	9000	1.57	1.37	1.32	1.40	1.36	1.30	1.24	1.13	0.90	79	76	NBPL	MID	CUT	NEW	12:46	**7278**	
3459	9000	1.75	1.50	1.53	1.53	1.50	1.41	1.33	1.20	0.91	78	75	NBPL	MID	CUT	NEW	12:49	**6767**	
3808	9000	1.83	1.71	1.60	1.64	1.64	1.52	1.43	1.31	1.01	77	73	NBPL	MID	CUT	NEW	12:52	**6308**	
3818	9000	1.79	1.59	1.52	1.59	1.57	1.50	1.41	1.30	1.01	79	69	NBPL	MID	CUT	NEW	12:54	**6383**	
3963	9000	1.75	1.55	1.47	1.54	1.55	1.47	1.38	1.27	1.03	78	80	NBPL	MID	CUT	NEW	12:56	**6538**	
4405	9000	1.75	1.56	1.51	1.63	1.60	1.49	1.43	1.31	1.02	78	75	NBPL	MID	CUT	NEW	13:00	**6308**	
4805	9000	1.63	1.48	1.41	1.49	1.47	1.40	1.33	1.23	0.98	78	76	NBPL	MID	CUT	NEW	13:03	**6750**	
4891	9000	1.65	1.46	1.40	1.57	1.49	1.40	1.33	1.25	1.02	80	75	NBPL	MID	CUT	NEW	13:07	**6767**	
5449	9000	1.64	1.45	1.36	1.44	1.38	1.27	1.18	1.04	0.77	78	78	NBPL	MID	CUT	NEW	13:11	**7649**	
6040	9000	1.91	1.67	1.57	1.69	1.65	1.52	1.42	1.30	0.98	78	76	NBPL	MID	CUT	NEW	13:14	**6323**	
6045	9000	2.30	1.95	1.95	2.06	1.95	1.78	1.61	1.40	1.04	78	76	NBPL	**TJT**	CUT	**BJT**	13:16		**85%**
6046	9000	2.15	1.78	1.79	2.09	1.94	1.77	1.61	1.42	1.02	80	74	NBPL	**TJT**	CUT	**AJT**	13:18		**90%**
6492	9000	1.94	1.67	1.65	1.69	1.62	1.46	1.36	1.20	0.87	81	76	NBPL	MID	FILL	NEW	13:21	**5579**	
7010	9000	1.85	1.62	1.58	1.66	1.58	1.46	1.34	1.18	0.89	80	78	NBPL	MID	CUT	NEW	13:28	**5602**	
7513	9000	2.03	1.68	1.66	1.87	1.76	1.58	1.47	1.31	0.94	78	79	NBPL	MID	FILL	NEW	13:31	**6634**	
8002	9000	1.62	1.35	1.35	1.47	1.41	1.35	1.29	1.18	0.92	78	78	NBPL	MID	CUT	NEW	13:33	**6733**	
8521	9000	1.73	1.51	1.45	1.56	1.51	1.39	1.32	1.18	0.90	77	80	NBPL	MID	GRADE	NEW	13:36	**6109**	
8963	9000	1.60	1.38	1.33	1.43	1.41	1.31	1.22	1.11	0.88	79	78	NBPL	MID	GRADE	NEW	13:38	**6977**	
9488	9000	1.74	1.52	1.47	1.58	1.55	1.44	1.36	1.23	0.95	79	81	NBPL	MID	GRADE	NEW	13:42	**6801**	
9983	9000	1.85	1.67	1.57	1.59	1.58	1.47	1.38	1.23	0.93	80	82	NBPL	MID	CUT	NEW	13:44	**7397**	
10488	9000	1.90	1.74	1.62	1.72	1.68	1.55	1.47	1.31	1.00	80	81	NBPL	MID	CUT	NEW	13:50	**6618**	
11006	9000	2.06	1.70	1.70	1.86	1.83	1.73	1.62	1.43	1.05	77	80	NBPL	MID	CUT	NEW	14:08	**6522**	

11506	9000	2.08	1.86	1.75	1.87	1.86	1.71	1.62	1.44	1.07	78	78	NBPL	MID	CUT	NEW	14:11	**6109**	
11855	9000	1.80	1.58	1.52	1.59	1.55	1.44	1.35	1.19	0.95	79	79	NBPL	MID	CUT	NEW	14:13	**5556**	
11859	9000	2.23	1.93	1.89	1.93	1.88	1.70	1.58	1.42	1.01	79	81	NBPL	**TJT**	CUT	**BJT**	14:15		**87%**
11860	9000	2.16	1.85	1.83	2.06	1.93	1.75	1.63	1.42	1.03	79	81	NBPL	**TJT**	CUT	**AJT**	14:16		**89%**
12454	9000	1.58	1.37	1.32	1.43	1.38	1.30	1.21	1.09	0.86	77	78	NBPL	MID	FILL	NEW	14:19	**5556**	
12957	9000	1.75	1.54	1.47	1.58	1.59	1.49	1.42	1.28	0.99	78	80	NBPL	MID	FILL	NEW	14:21	**6650**	
13522	9000	1.68	1.51	1.45	1.50	1.53	1.42	1.32	1.20	0.96	77	78	NBPL	MID	FILL	NEW	14:24	**5684**	
14001	9000	1.68	1.49	1.44	1.54	1.52	1.41	1.35	1.24	1.00	76	78	NBPL	MID	FILL	NEW	14:26	**5510**	
14490	9000	1.91	1.62	1.62	1.83	1.75	1.60	1.51	1.31	0.96	75	81	NBPL	MID	FILL	NEW	14:29	**7438**	
14496	9000	1.85	1.58	1.58	1.71	1.71	1.59	1.49	1.30	0.97	75	80	NBPL	**TJT**	FILL	**BJT**	14:30		**86%**
14497	9000	1.77	1.50	1.49	1.59	1.60	1.54	1.45	1.28	0.96	77	80	NBPL	**TJT**	FILL	**AJT**	14:32		**90%**
15042	9000	1.83	1.54	1.51	1.62	1.57	1.46	1.36	1.24	0.98	78	81	NBPL	MID	GRADE	NEW	14:35	**6338**	
15583	9000	2.15	1.92	1.82	1.90	1.81	1.71	1.58	1.41	1.08	77	78	NBPL	MID	CUT	NEW	14:37	**6801**	
16027	9000	2.29	2.11	1.99	2.07	2.00	1.83	1.69	1.50	1.16	78	79	NBPL	MID	CUT	NEW	14:39	**6683**	
16458	9000	1.98	1.70	1.64	1.72	1.70	1.57	1.45	1.31	0.97	78	83	NBPL	MID	CUT	NEW	14:41	**5960**	
17056	9000	2.22	1.93	1.88	2.04	2.00	1.85	1.74	1.59	1.28	77	83	NBPL	MID	CUT	NEW	14:43	**6040**	
17551	9000	2.02	1.81	1.71	1.77	1.76	1.63	1.53	1.37	1.02	78	81	NBPL	MID	GRADE	NEW	14:45	**6221**	
17970	9000	2.11	1.80	1.73	1.84	1.88	1.73	1.63	1.50	1.16	79	80	NBPL	MID	FILL	NEW	14:47	**6601**	
18499	9000	2.05	1.85	1.75	1.93	1.83	1.73	1.64	1.53	1.21	79	79	NBPL	MID	GRADE	NEW	14:51	**5684**	
19005	9000	1.76	1.48	1.47	1.57	1.52	1.39	1.34	1.21	0.97	79	83	NBPL	MID	CUT	NEW	15:01	**5315**	
19500	pob new passing lane?																		
19511	9000	6.31	5.46	5.34	5.86	5.52	4.90	4.34	3.34	1.82	78	81	NBPL	MID	CUT	NEW	15:05	**9534**	
19992	9000	5.55	4.80	4.64	5.20	4.81	4.23	3.71	2.86	1.62	79	82	NBPL	MID	CUT	NEW	15:11	**8108**	
20426	9000	5.90	5.00	5.04	5.70	5.30	4.65	4.09	3.16	1.74	78	78	NBPL	MID	FILL	NEW	15:17	**9221**	
20496	9000	5.69	4.97	4.86	5.38	5.04	4.52	4.01	3.13	1.68	76	78	NBPL	MID	FILL	NEW	15:14	**8671**	
20501	9000	5.98	5.20	5.08	5.46	5.09	4.51	3.97	3.08	1.70	77	78	NBPL	MID	FILL	NEW	15:15	**8696**	
20783	9000	3.75	3.41	3.38	3.57	3.46	3.24	2.99	2.62	1.76	77	83	NBPL	MID	FILL	NEW	15:22	**10791**	
20873	poe concrete overlay																		
Average	**9000**	**2.28**	**NA**	**NA**	**2.08**	**2.01**	**1.84**	**1.71**	**1.48**	**1.07**	**78**	**78**						**6852**	
Stdev.		**1.28**	**NA**	**NA**	**1.23**	**1.13**	**0.98**	**0.85**	**0.61**	**0.27**	**1**	**3**						**1302**	
Max.		**6.31**	**NA**	**NA**	**5.86**	**5.52**	**4.90**	**4.34**	**3.34**	**1.82**	**81**	**83**						**10791**	
Min.		**1.23**	**NA**	**NA**	**1.06**	**1.08**	**1.04**	**0.98**	**0.93**	**0.77**	**73**	**69**						**3353**	
C. of V.		**56%**	**NA**	**NA**	**59%**	**56%**	**53%**	**50%**	**41%**	**25%**	**2%**	**4%**						**19%**	
Additional Tests																			
	pob NBCL adj. to new passing lane																		
19511	9000	2.16	1.88	1.81	1.96	1.86	1.72	1.62	1.44	1.12	79	83	NBCL	MID	CUT	NEW	15:38	**8060**	
19986	9000	2.08	1.71	1.76	1.92	1.84	1.67	1.58	1.43	1.07	79	83	NBCL	MID	CUT	NEW	15:41	**8411**	
20501	9000	2.22	1.91	1.88	2.02	1.91	1.80	1.68	1.53	1.16	77	80	NBCL	MID	CUT	NEW	15:44	**7736**	
20783	9000	2.92	2.65	2.62	2.80	2.72	2.49	2.31	2.01	1.40	77	84	NBCL	MID	FILL	NEW	15:48	**6429**	
	poe NBCL adj. to new passing lane																		
	pob new passing lane by station																		
85753	9000	5.89	5.07	4.94	5.54	5.15	4.55	3.98	2.99	1.62	77	81	NBPL	MID	CUT	NEW	16:13	**5017**	
86008	9000	5.54	4.88	4.75	5.27	4.92	4.40	3.92	3.08	1.77	78	80	NBPL	MID	CUT	NEW	16:15	**4875**	
86259	9000	5.39	4.75	4.63	5.05	4.78	4.24	3.76	2.92	1.63	78	76	NBPL	MID	CUT	NEW	16:18	**5143**	
86264	9000	5.85	5.10	5.02	5.39	5.04	4.43	3.89	3.01	1.68	79	78	NBPL	TJT	CUT	BJT	16:21	**4978**	
86265	9000	5.83	5.01	5.00	5.60	5.22	4.58	4.01	3.10	1.71	77	77	NBPL	TJT	CUT	AJT	16:23	**4844**	
86513	9000	5.94	5.18	5.00	5.54	5.18	4.60	4.07	3.13	1.78	76	80	NBPL	MID	GRADE	NEW	16:25	**4792**	
86753	9000	5.33	4.62	4.54	5.04	4.65	4.18	3.71	2.88	1.61	77	82	NBPL	MID	GRADE	NEW	16:27	**5208**	
87000	9000	5.95	5.10	4.96	5.53	5.22	4.59	4.04	3.10	1.65	77	82	NBPL	MID	GRADE	NEW	16:30	**4834**	
87210	9000	4.17	3.78	3.70	3.94	3.84	3.51	3.24	2.70	1.73	78	83	NBPL	MID	FILL	NEW	16:33	**5202**	
	poe new passing lane by station																		

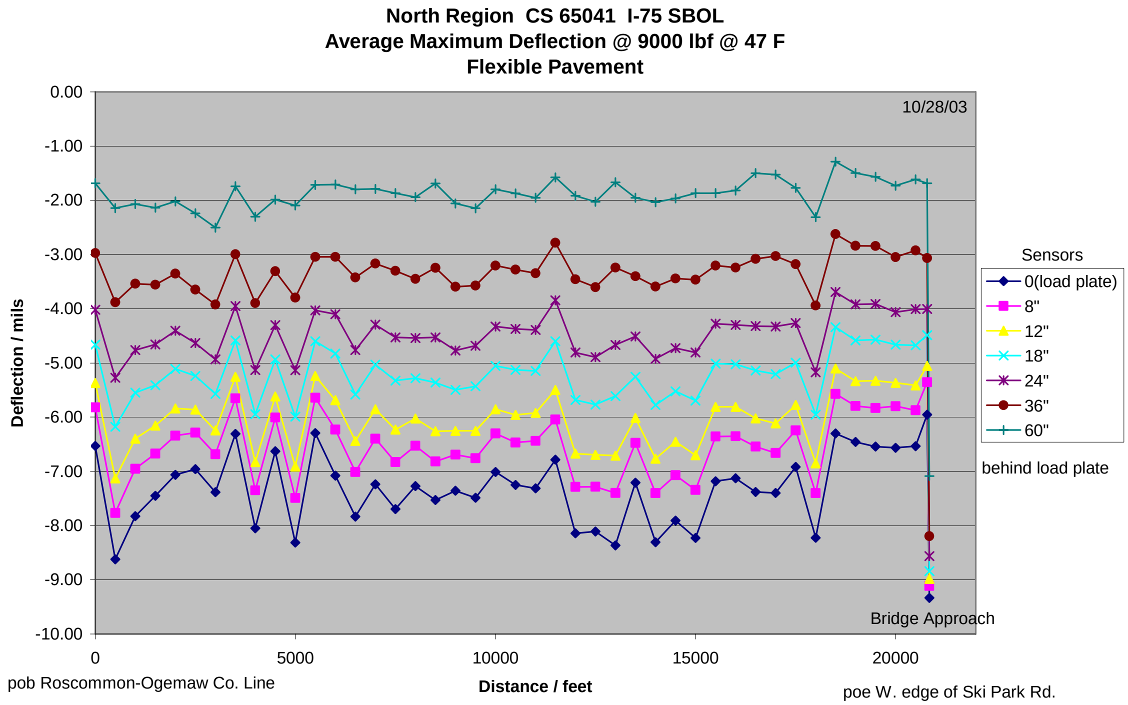

North Region CS 65041 I-75 NB Passing Lane
Average Maximum Deflection @ 9000 lbf @ 78 F
Concrete Overlay
10/13/03
Deflection / mils
Bridge Approach
New Passing Lane
Sensors
0(load plate)
8"
12"
18"
24"
36"
60"
behind load plate
Distance / feet
pob W. edge of Ski Park Road
poe Ogemaw-Roscommon Co. Line

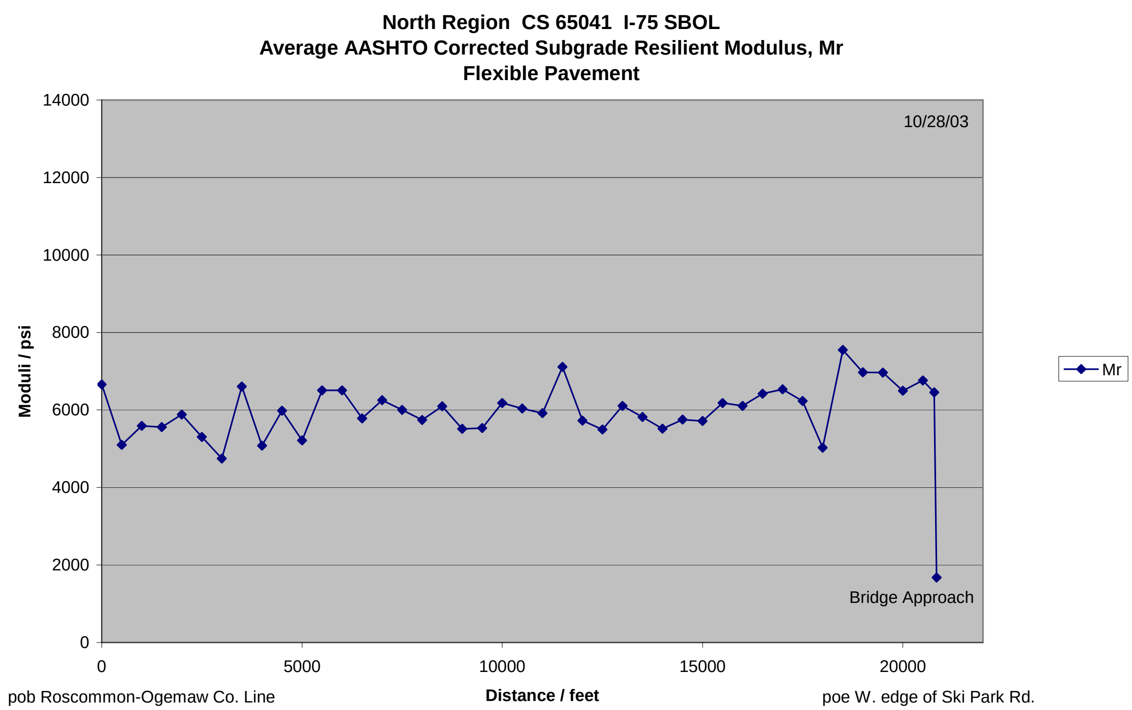

North Region CS 65041 I-75 NB Passing Lane
Average AASHTO Corrected Subgrade Resilient Modlus, Mr
Concrete Overlay
Note: Pavement structure may be to thick to give accurate Mr at 9000 lbf
10/13/03
Moduli / psi
Bridge Approach
New Passing Lane
Mr
Distance / feet
pob W. edge of Ski Park Rd.
poe Ogemaw-Roscommon Co. Line

Southbound

KUAB FWD FILE :	**65041SO.nor**
Project :	**North Region 2003**
Project Number :	**CS 65041**
Route :	**I-75**
Direction :	**SBOL**
Location :	**Roscommon-Ogemaw Co. Line to Ski Park Rd.**
:	
Region :	**North**
Customer/Client :	**MDOT/Mike Eacker**
Operator :	**Kurt S. Bancroft**
Traffic Control :	**Bob Farnum**
Pavement Type :	**Flexible,New**
Environment :	**cloudy,rainny,cool**
Traffic :	**medium**
Comments :	**TMA Mike Eacker**
:	**pob Roscommon-Ogemaw Co. Line**
:	**poe W. edge of Ski Park Rd.**
Date Created :	**28-10-2003**
Load Mode :	**2 (3+3 buffers, 7 plates)**
Plate Radius :	**5.91 (in)**
Extra Field Set :	**FLEXIBLE**
Drop Sequence :	**22**
No of drops :	**13**
Record Drop? :	**NY**
Drop Height :	**1 2 3 4**
Impact Load :	**5000 9000 15500 20500 lbf**
Sensor Number :	**0 1 2 3 4 5 6 7 8**
Sensor Distance :	**0.00 12.00 12.00 8.00 12.00 18.00 24.00 36.00 60.00 (in)**
Sensor Position :	**CENTER FRONT RIGHT BEHIND BEHIND BEHIND BEHIND BEHIND BEHIND**
Reference Offset :	**0 ft**
Testpoint spacing:	**500 ft**

									Temperature							c=0.33 **AASHTO Corrected Subgrade Resilient Modulus**
Distance ft	**Load lbf**	**D0 mils**	**D3 mils**	**D4 mils**	**D5 mils**	**D6 mils**	**D7 mils**	**D8 mils**	**Air F°**	**Pave F°**	**Test Lane**	**Test Point**	**Test Grade**	**Pvmt Type**	**Test Time**	**Mr psi**
0	9000	6.53	5.82	5.37	4.66	4.02	2.97	1.69	49	48	SBOL	OWP	FILL	FLEX	9:54	**6659**
500	9000	8.62	7.77	7.13	6.18	5.27	3.88	2.14	54	46	SBOL	OWP	FILL	FLEX	9:57	**5103**
1000	9000	7.83	6.95	6.40	5.55	4.76	3.54	2.07	49	46	SBOL	OWP	FILL	FLEX	10:01	**5593**
1500	9000	7.45	6.67	6.16	5.41	4.66	3.56	2.14	51	48	SBOL	OWP	FILL	FLEX	10:03	**5560**
2000	9000	7.06	6.34	5.84	5.11	4.41	3.35	2.02	49	44	SBOL	OWP	FILL	FLEX	10:06	**5881**
2500	9000	6.96	6.29	5.86	5.24	4.63	3.65	2.24	51	46	SBOL	OWP	CUT	FLEX	10:09	**5304**
3000	9000	7.38	6.68	6.24	5.57	4.94	3.92	2.50	51	48	SBOL	OWP	CUT	FLEX	10:11	**4746**
3500	9000	6.31	5.65	5.26	4.58	3.95	3.00	1.74	52	45	SBOL	OWP	CUT	FLEX	10:15	**6607**
4000	9000	8.05	7.35	6.83	5.95	5.13	3.90	2.30	53	45	SBOL	OWP	CUT	FLEX	10:27	**5081**
4500	9000	6.63	6.01	5.62	4.94	4.30	3.31	1.99	53	45	SBOL	OWP	CUT	FLEX	10:29	**5980**
5000	9000	8.31	7.49	6.91	5.99	5.14	3.80	2.10	56	48	SBOL	OWP	CUT	FLEX	10:34	**5215**
5500	9000	6.29	5.64	5.24	4.60	4.03	3.04	1.72	55	49	SBOL	OWP	GRDE	FLEX	10:36	**6506**
6000	9000	7.08	6.23	5.69	4.83	4.10	3.04	1.71	55	48	SBOL	OWP	FILL	FLEX	10:39	**6506**
6500	9000	7.83	7.01	6.44	5.58	4.76	3.42	1.80	57	44	SBOL	OWP	FILL	FLEX	10:41	**5784**
7000	9000	7.24	6.40	5.85	5.03	4.29	3.17	1.79	54	44	SBOL	OWP	FILL	FLEX	10:43	**6253**
7500	9000	7.70	6.83	6.23	5.33	4.53	3.30	1.87	56	48	SBOL	OWP	FILL	FLEX	10:46	**6000**
8000	9000	7.27	6.53	6.03	5.28	4.54	3.45	1.94	56	48	SBOL	OWP	FILL	FLEX	10:48	**5739**
8500	9000	7.53	6.82	6.26	5.36	4.53	3.25	1.69	58	47	SBOL	OWP	CUT	FLEX	10:50	**6099**
9000	9000	7.36	6.69	6.25	5.50	4.77	3.59	2.06	59	51	SBOL	OWP	CUT	FLEX	10:52	**5510**
9500	9000	7.49	6.76	6.25	5.43	4.68	3.57	2.15	59	48	SBOL	OWP	CUT	FLEX	10:54	**5534**
10000	9000	7.01	6.30	5.85	5.05	4.33	3.20	1.80	57	49	SBOL	OWP	GRDE	FLEX	10:57	**6181**
10500	9000	7.25	6.47	5.96	5.13	4.37	3.28	1.87	59	45	SBOL	OWP	CUT	FLEX	10:59	**6037**
11000	9000	7.31	6.44	5.92	5.15	4.39	3.35	1.95	61	45	SBOL	OWP	CUT	FLEX	11:01	**5916**
11500	9000	6.78	6.04	5.50	4.60	3.84	2.78	1.58	59	46	SBOL	OWP	FILL	FLEX	11:04	**7114**
12000	9000	8.14	7.29	6.67	5.68	4.81	3.46	1.92	60	47	SBOL	OWP	CUT	FLEX	11:07	**5728**
12500	9000	8.11	7.28	6.70	5.77	4.89	3.60	2.03	61	48	SBOL	OWP	CUT	FLEX	11:09	**5495**
13000	9000	8.37	7.40	6.71	5.61	4.67	3.24	1.67	62	48	SBOL	OWP	FILL	FLEX	11:16	**6105**
13500	9000	7.21	6.48	6.01	5.26	4.51	3.40	1.95	60	50	SBOL	OWP	GRDE	FLEX	11:20	**5818**
14000	9000	8.31	7.40	6.77	5.78	4.92	3.59	2.04	61	46	SBOL	OWP	CUT	FLEX	11:23	**5515**
14500	9000	7.91	7.07	6.45	5.52	4.73	3.44	1.96	65	50	SBOL	OWP	CUT	FLEX	11:25	**5750**
15000	9000	8.23	7.34	6.70	5.69	4.81	3.46	1.87	65	46	SBOL	OWP	CUT	FLEX	11:27	**5717**
15500	9000	7.18	6.36	5.81	5.01	4.28	3.20	1.87	62	48	SBOL	OWP	CUT	FLEX	11:30	**6181**
16000	9000	7.13	6.35	5.81	5.02	4.30	3.24	1.82	66	50	SBOL	OWP	CUT	FLEX	11:32	**6105**
16500	9000	7.38	6.54	6.02	5.14	4.32	3.08	1.50	64	50	SBOL	OWP	FILL	FLEX	11:34	**6422**
17000	9000	7.40	6.66	6.11	5.21	4.33	3.03	1.53	65	48	SBOL	OWP	FILL	FLEX	11:40	**6535**
17500	9000	6.92	6.25	5.78	4.99	4.27	3.18	1.77	64	49	SBOL	OWP	CUT	FLEX	11:42	**6233**
18000	9000	8.22	7.40	6.85	5.95	5.17	3.94	2.31	63	51	SBOL	OWP	CUT	FLEX	11:45	**5025**
18500	9000	6.30	5.57	5.10	4.34	3.69	2.62	1.29	65	45	SBOL	OWP	FILL	FLEX	11:48	**7548**
19000	9000	6.46	5.79	5.34	4.59	3.92	2.84	1.50	66	50	SBOL	OWP	FILL	FLEX	11:51	**6972**
19500	9000	6.54	5.83	5.33	4.57	3.91	2.84	1.57	67	46	SBOL	OWP	GRDE	FLEX	11:53	**6964**
20000	9000	6.56	5.80	5.37	4.66	4.06	3.05	1.73	67	46	SBOL	OWP	CUT	FLEX	11:56	**6499**
20500	9000	6.54	5.87	5.41	4.67	4.01	2.93	1.62	67	48	SBOL	OWP	FILL	FLEX	11:59	**6765**
20785	9000	5.95	5.36	5.05	4.49	4.00	3.07	1.69	68	48	SBOL	OWP	FILL	FLEX	12:01	**6457**
20843	9000	9.33	9.11	8.98	8.84	8.56	8.20	7.09	69	47	SBOL	OWP	FILL	RIGID	12:04	**1676**
20858	poe W. edge of Ski Park Road															
Average	**9000**	**7.31**	**6.54**	**6.03**	**5.21**	**4.47**	**3.32**	**1.87**	**59**	**47**						**6017**
Stdev.		**0.67**	**0.61**	**0.55**	**0.47**	**0.40**	**0.32**	**0.25**	**6**	**2**						**607**
Max.		**8.62**	**7.77**	**7.13**	**6.18**	**5.27**	**3.94**	**2.50**	**68**	**51**						**7548**
Min.		**5.95**	**5.36**	**5.05**	**4.34**	**3.69**	**2.62**	**1.29**	**49**	**44**						**4746**
C. of V.		**9%**	**9%**	**9%**	**9%**	**9%**	**10%**	**13%**	**10%**	**4%**						**10%**


North Region CS 65041 I-75 SBOL
Average Maximum Deflection @ 9000 lbf @ 47 F
Flexible Pavement
10/28/03
Deflection / mils
0.00
-1.00
-2.00
-3.00
-4.00
-5.00
-6.00
-7.00
-8.00
-9.00
-10.00
0
5000
10000
15000
20000
Distance / feet
pob Roscommon-Ogemaw Co. Line
poe W. edge of Ski Park Rd.
Sensors
0(load plate)
8"
12"
18"
24"
36"
60"
behind load plate
Bridge Approach


North Region CS 65041 I-75 SBOL
Average AASHTO Corrected Subgrade Resilient Modulus, Mr
Flexible Pavement
10/28/03
Moduli / psi
14000
12000
10000
8000
6000
4000
2000
0
0
5000
10000
15000
20000
Distance / feet
pob Roscommon-Ogemaw Co. Line
poe W. edge of Ski Park Rd.
Mr
Bridge Approach