Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
TX-00/2966-4		

4. Title and Subtitle
FIELD PERFORMANCE EVALUATION OF HYDRATED, FLY-ASH BASES IN THE ATLANTA DISTRICT - YEAR 4

5. Report Date
October 2000

6. Performing Organization Code

7. Author(s)
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8. Performing Organization Report No.
Report 2966-4

9. Performing Organization Name and Address
Texas Transportation Institute
The Texas A&M University System
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10. Work Unit No. (TRAIS)

11. Contract or Grant No.
Project No. 7-2966

12. Sponsoring Agency Name and Address
Texas Department of Transportation
Construction Division
Research and Technology Transfer Section
P. O. Box 5080
Austin, Texas 78763-5080

13. Type of Report and Period Covered
Research:
September 1999 - August 2000

14. Sponsoring Agency Code

15. Supplementary Notes
Research performed in cooperation with the Texas Department of Transportation.
Research Project Title: Durability of Surface Treatments as the Wearing Course Placed on Crushed Fly Ash and Long-Term Performance of Crushed Fly Ash for Flexible Base

16. Abstract

Hydrated fly ash is produced by allowing a Class C powder fly ash (ASTM C 618) from coal power plants to cure with moisture. The hydrated (cured) fly ash becomes a stiff material that can be crushed to form a synthetic aggregate. When properly processed and compacted to optimum moisture content, the hydrated fly ash continues to gain strength after placement as a base material.

The Atlanta District has constructed six pavement sections since 1993 using hydrated fly ash as the flexible base material. This research project was initiated to evaluate and monitor performance and changes in material properties for these six pavements through the year 2001 and to evaluate a problem experienced during construction where the asphalt surface treatment did not bond well to the base.

Evaluation of pavement base performance was based on visual documentation, falling-weight deflectometer tests, ground-penetrating radar, and compressive strengths of field cores. This report is an interim report documenting the performance evaluations conducted in the spring of 2000. This report covers the fourth annual evaluation in a series of five.

Based on visual evaluations, FWD data, and compressive strengths of cores, the hydrated fly-ash test pavements are performing well, and none are exhibiting any significant signs of deterioration.

17. Key Words
Hydrated Fly Ash, Coal Combustion By-products, Fly Ash, Stabilized Bases, Highway Construction

19. Security Classif.(of this report)	20. Security Classif.(of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	38	

FIELD PERFORMANCE EVALUATION OF HYDRATED, FLY-ASH BASES IN THE ATLANTA DISTRICT: YEAR 4

by

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Report 2966-4
Project Number 7-2966
Research Project Title: Durability of Surface Treatments as the
Wearing Course Placed on Crushed Fly Ash and Long-Term Performance
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Sponsored by the
Texas Department of Transportation

October 2000

TEXAS TRANSPORTATION INSTITUTE
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The contents of this report reflect the views of the author, who is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the Texas Department of Transportation (TxDOT). This report does not constitute a standard, specification, or regulation, nor is it intended for construction, bidding, or permit purposes. The engineer in charge of this project was Cindy Estakhri (#77583).

ACKNOWLEDGMENTS

The author would like to acknowledge the participation and assistance provided by the Atlanta District personnel. Thanks to Mr. Miles Garrison, Mr. Chappy Shelton, and Mr. James Voss for providing the field cores, falling weight deflectomerer (FWD) data, and field assistance, and special thanks also to Mr. Garrison for providing direction to the study as the project director. Thanks also go to the district and area maintenance office personnel who provided traffic control for the field evaluations. The author would also like to thank TTI's Research Technician Lee Gustavus for assisting with collection of the field data and for performing the laboratory tests on cores.

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BACKGROUND

Hydrated fly ash is produced by allowing a Class C powder fly ash (ASTM C 618) from coal power plants to cure with moisture. The hydrated (cured) fly ash becomes a stiff material that can be crushed to form a synthetic aggregate. When properly processed and compacted to optimum moisture content, the hydrated fly ash continues to gain strength after placement as a base material (1).

The Atlanta District constructed six pavement sections in 1993 through 1995 using hydrated fly ash as the flexible base material. District personnel are pleased thus far with the performance of this industrial by-product as a base material; however, its long-term performance is in question. While performance of the material as a base has been acceptable, the district has encountered problems with surface treatments separating from the base course. This research project was initiated to evaluate and monitor performance and changes in material properties for these six pavements through the year 2001. Evaluation of performance shall be based on the following types of data:

- visual evaluations of surface distress,
- nondestructive field testing (falling weight deflectometer, as a minimum), and
- compressive strength of field cores.

Research report 2966-2 presents results of a laboratory investigation into the cause of and cure for the failure of the surface treatments on the hydrated fly-ash base courses.

HISTORY

The Atlanta District first began evaluating crushed fly ash in 1990. The district laboratory's initial investigation of the material found the following material properties for the fly ash:

- triaxial classification: *Super* Class 1,
- unconfined compressive strength: 220 psi,
- dry loose unit weight: 68.0 lb/ft^3 ,
- compacted dry density at optimum moisture of 28.6 percent: 85.5 lb/ft^3,

- Los Angeles abrasion: 47, and
- five cycles of freeze-thaw (15 hours freeze-thaw at room temperature for nine hours) showed no damage and no volume change.

Based on promising test results from the laboratory investigation, the district worked with Southwestern Electric Power Company (SWEPCO) to construct a test section for the power plant haul road. This was a successful venture, and performance of the pavement was promising, which led to the construction of six test pavements throughout the district. These six test pavements are the subject of this study.

Table 1 includes a description of each of the six test sites, their locations, and typical cross sections. At the time these pavements were constructed, the final surface for all of the pavements (except the IH 20 frontage road, which was designed for a surface treatment followed by an asphalt concrete surface course) was to have been a one/two course surface treatment directly over the primed fly-ash base. However, several problems occurred soon after placement of surface treatments whereby the surface treatment delaminated from the underlying base material. It should be noted also that the projects on SH 154, FM 1326, and FM 1520 did not have these delamination problems except in some isolated spots. These problems eventually subsided.

Table 1. Test Site Descriptions.

Roadway	County	Project Length	Location		Project Designation	Job Completion Date	Typical Pavement Cross Section
			From	To			
LP 390	Harrison	2.5 mi	US 59 in Marshall	0.3 mi S. of SH 43	1575-05-005 STP 92(7)UM	12/10/93	Grade 4 Seal Coat 2.0 in. Type C Hot Mix MC-30 Prime 10.0 in. Fly-Ash Base 8.0 in. Lime/FA Subgrade
IH 20 (FR)	Harrison	3000 ft	1.0 mi E. of Gregg Co. Line	0.6 mi W. of Loop 281	0495-08-056 CC 495-8-56	7/13/94	2.0 in. Type C Hot Mix One-Course Surface Trt. MC-30 Prime 11.0 in. Fly-Ash Base 8.0 in. Lime/FA Subgrade
SH 154	Upshur	2000 ft	0.1 mi E. of US 259	0.5 mi E. of US 259	0402-02-018 HES 000S(661)	6/8/93	Grade 4 Seal Coat One-Course Surface Trt. MC-30 Prime 6.5 - 13.0 in. FA Base
FM 1326	Bowie	400 ft	3.0 mi N. of US 82	3.0 mi N.	1570-02 Maint. Forces	9/93	CRS-2p Grade 5 CRS-2p Grade 4 5.5 in. Fly-Ash Base 2.0 in. Asphalt Concrete 5.0-7.0 in. Indeterminate (LRA or Black Base)
FM 1520	Camp	7800 ft	0.1 mi E. of Picket Spring Branch	FM 1521	1232-03-09 A 1232-3-9	8/9/93	One-Course Surface Trt. MC-30 Prime 9.0 in. Fly-Ash Base 8.0 in. Lime/FA Subgrade
FM 560	Bowie	2300 ft	Barkman Creek and Relief	2300 ft N.	1021-01-007 BR 90(241)	4/28/95	1.8-2.5 in. Hot Mix MC-30 Prime One-Course Surface Trt. 6.0 - 12.0 in Fly Ash Base 0-6.0 in. Bank-Run RG

VISUAL CONDITION SURVEYS

In this research study, visual condition surveys are performed annually in late spring on all six test pavements. The most recent survey was performed on March 20 and 21, 2000. The manual survey was conducted in accordance with the procedures set up for a Strategic Highway Research Program (SHRP) Long Term Pavement Performance (LTPP) distress survey (2). In addition to measuring the quantity of each distress at each severity level, a map showing the location of crack-distress was also produced.

LOOP 390

This project begins at US 59 in Marshall and extends to 0.3 mi south of SH 43. The total length of the project is about 2.5 mi. For visual condition surveys, the project was evaluated at 13 locations (200 ft survey length per location) in the eastbound travel lane.

In 1997 there were three types of distress beginning to be evident on Loop 390: alligator cracking, a slight flushing of the seal coat surface, and rutting. However, between the 1997 and 1998 evaluations, a Grade 4 chip seal was placed on the surface and there is no longer evidence of alligator cracking at this time. Table 2 shows quantities of distress at each survey location for every year evaluated.

The chip-seal surface exhibits flushing at some locations. Between 1999 and 2000, the flushing of the chip seal seems to have stabilized. There has been a gradual but progressive increase in rutting over the four years in which the pavement has been evaluated. This rutting may be occurring within the hot-mix asphalt concrete overlay and is not necessarily attributed to problems associated with the hydrated fly-ash base.

Other than the locations where this pavement is experiencing significant rutting, the pavement is in good condition. This hot-mix asphalt was scheduled to be milled and replaced with a new Type C hot-mix surface immediately following the survey in March of 2000.

Table 2. Loop 390 Distress.

Location (each location represents a 200 ft length)	Alligator* Cracking (sq ft) 1997	Alligator* Cracking (sq ft) 1998	Alligator* Cracking (sq ft) 1999	Alligator* Cracking (sq ft) 2000	Flushing (sq ft) 1997	Flushing (sq ft) 1998	Flushing (sq ft) 1999	Flushing (sq ft) 2000	Rutting (in) Left Wheelpath 1997	Rutting (in) Left Wheelpath 1998	Rutting (in) Left Wheelpath 1999	Rutting (in) Left Wheelpath 2000	Rutting (in) Right Wheelpath 1997	Rutting (in) Right Wheelpath 1998	Rutting (in) Right Wheelpath 1999	Rutting (in) Right Wheelpath 2000
1	0	0	0	0	0	590 (s)	1080 (m)	1200 (s)	0	0.1	0.4	0.3	0	0.3	0.6	0.5
2	0	0	0	0	0	97 (s)	960 (m)	1000 (s)	0	0.2	0.6	0.3	0	0.3	0.4	0.5
3	0	0	0	0	0	260 (s)	720 (s)	720 (s)	0.1	0.1	0.2	0.3	0.1	0.1	0.1	0.3
4	0	0	0	0	0	330 (s)	600 (s)	800 (s)	0.1	0.1	0.3	0.2	0.1	0.1	0.2	0.3
5	0	0	0	0	0	260 (s)	720 (s)	720 (s)	0.2	0.2	0.8	0.8	0.2	0.3	0.8	0.9
6	600 (s)	0	0	0	600 (s)	800 (s)	860 (s)	860 (s)	0.4	0.6	0.5	0.6	0.5	0.6	0.4	0.5
7	1000 (s)	0	0	0	1200 (s)	400 (s)	480 (s)	480 (s)	0.5	0.5	0.7	0.6	0.5	0.5	0.4	0.4
8	1000 (s)	0	0	0	1200 (s)	600 (s)	600 (s)	1200 (s)	0.4	0.4	0.6	0.8	0.4	0.4	0.6	0.6
9	600 (s)	0	0	0	1000 (s)	300 (s)	300 (s)	300 (s)	0.4	0.3	0.4	0.4	0.4	0.4	0.2	0.3
10	0	0	0	0	400 (s) 200 (m)	250 (s)	200 (s)	200 (s)	0.1	0.1	0.2	0.2	0.1	0.1	0.3	0.4
11	0	0	0	0	600 (s)	0	0	0	0.1	0.1	0.1	0.2	0.1	0.1	0.2	0.1
12	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1

Severity Levels : (s) slight, (m) moderate.

* A Grade 4 seal coat was constructed on the pavement between the 1997 and 1998 evaluations.

IH 20 FRONTAGE ROAD

The IH 20 frontage road project begins 0.9 miles east of the Gregg County line and continues eastward for 3000 feet. This pavement remains in very good condition after four years of evaluation. There is some evidence of raveling in the hot-mix asphalt surface which, of course, would be unrelated to the hydrated fly-ash base that is of interest in this study. However, there is some distress which can be attributed to the base that is evident in the form of cracking. There is about 14 linear feet of longitudinal cracking and about 18 square feet of alligator cracking as shown in Table 3. This represents an increase over that which was observed in 1999. This cracking is in isolated locations and the researcher considers this pavement to still be performing very well.

Table 3. IH 20 Frontage Road Distress.

Location (each location represents a 200 ft length)	Raveling (sq ft)				Longitudinal Cracking (ft)				Alligator Cracking (sq ft)			
	1997	1998	1999	2000	1997	1998	1999	2000	1997	1998	1999	2000
Core Location 1	43 (s)	43 (s)	43 (s)	200 (s)	0	0	0	6 (s)	0	5 (s)	5 (s)	8 (s)
Core Location 2	54 (s)	54 (s)	54 (s)	80 (s) 10 (m)	0	0	0	8 (s)	0	3 (s)	3 (s)	10 (s)
Core Location 3	43 (s)	43 (s)	43 (s)	60 (s)	0	0	0	0	0	0	0	0

Severity Level: (s) slight, (m) moderate.

SH 154

This project is located in Diana, beginning 0.1 mi east of US 259 and extending to 0.5 mi east of US 259. The entire length of this pavement was visually evaluated in the westbound lane. This pavement received a Grade 4 lightweight chip seal prior to the evaluation conducted in March of 2000. This seal masked the cracking which had been evident previously as shown in Table 4. Prior to the chip seal, the primary distress of interest on this pavement was some slight transverse cracking. These cracks began in the shoulder and most had not progressed all the way across the main lanes of travel; however, the cracks were very evenly spaced (every 12 to 13 ft) and might be attributable to shrinkage of the fly-ash base. Note in Table 4 that there was no appreciable increase in the amount of cracking observed from 1997 through 1999.

Table 4. SH 154 Distress.

Location (beginning at east end of project)	**Transverse Cracking in westbound lane (linear ft)**				**Longitudinal Cracking in westbound lane (linear ft)**			
	1997	**1998**	**1999**	**2000***	**1997**	**1998**	**1999**	**2000***
0 - 200 ft (1st core location)	6 (s)	8 (s)	10 (s)	0	0	0	24 (s)	0
200 - 400 ft	24 (s)	24 (s)	3 1 (s)	0	0	0	0	0
400 - 600 ft	12 (s)	12 (s)	16(s)	0	0	0	12 (s)	0
600 - 800 ft	17 (s)	7 (s)	7 (s)	0	0	0	0	0
800 - 1000 ft (2nd core location)	8 (s)	8 (s)	8 (s)	0	8 (s)	7 (s)	50 (s)	0
1000 -1200 ft	38 (s)	38 (s)	42 (s)	0	56 (s)	36 (s)	36 (s)	0
1200 -1400 ft	6 (s)	0	2 (s)	0	0	0	0	0
1400 - 1600 ft	0	0	0	0	0	0	0	0
1600 - 1800 ft (3rd core location)	0	0	0	0	0	0	0	0
1800 - 2000 ft	26 (m)	44 (m)	48 (m)	0	22 (m)	22 (m)	28 (s)	0

Severity Level: (s) slight, (m) moderate.
*A Grade 4 Lightweight Seal Coat was placed prior to the evaluation in March of 2000.

FM 1326

The FM 1326 project begins about 3.0 mi north of US 82. It was constructed by district maintenance forces and is about 400 feet in length. The entire length of pavement (both lanes) was evaluated visually. This pavement is performing very well; however, distress in the form of slight transverse cracking is beginning to appear, as shown in Table 5.

Table 5. FM 1326 Distress.

Location, ft	Transverse Cracking			
	1997	1998	1999	2000
0 - 100	0	0	0	36
100 - 200	0	0	0	96
200 - 300	0	0	0	48
300 - 400	0	0	0	0

FM 1520

The FM 1520 project is located in Camp County and begins 0.1 miles east of Pickett Spring Branch extending to FM 1521. Its total length is about 7800 feet. This project was visually evaluated at eight locations as shown below in Table 6. There is almost no change in the pavement since last year and is considered to be performing very well.

Table 6. FM 1520 Distress.

Location (each location represents a 200 ft length)	Flushing (sq ft)				Rutting (in)							
					1997		1998		1999		2000	
	1997	1998	1999	2000	LWP	RWP	LWP	RWP	LWP	RWP	LWP	RWP
1	1000 (s)	1000 (s)	1000 (s)	1000 (s)	0	0	0	0	0	0.1	0	0.1
2	1200 (s)	1200 (s)	1200 (s)	1200 (s)	0	0	0	0	0	0.1	0	0.1
3	1500 (s)	1500 (s)	1500 (s)	1500 (s)	0	0	0	0	0.1	0.1	0.1	0.1
4	320 (s)	320 (s)	320 (s)	320 (s)	0	0	0	0	0.1	0.1	0.1	0.1
5	0	0	0	0	0	0	0	0	0.1	0.1	0.1	0.1
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0

FM 560

The FM 560 project is located near Hooks and begins at Barkman Creek and Relief and extends north for 2300 feet. This pavement received an overlay prior to the 1999 evaluation; therefore, there was no evidence of any distress during the April 1999 evaluation and still none in the March 2000 evaluation. Previous distress data is shown in Table 7. This pavement is performing well.

Table 7. FM 560 Distress.

Location (each location represents 200 ft in length)	Flushing (sq ft)				Longitudinal Cracking (linear ft)				Transverse Cracking (linear ft)			
	1997	1998	1999*	2000	1997	1998	1999*	2000	1997	1998	1999*	2000
1 Core Location 1	1000 (m)	1000 (m)	0	0	0	12 (s)	0	0	0	23 (s)	0	0
2 Core Location 2	150 (m) 120 (s)	150 (m) 120 (s)	0	0	5 (s)	5 (s)	0	0	10 (s)	10 (s)	0	0
3 Core Location 3	0	0	0	0	0	0	0	0	0	0	0	0

Severity Level: (s) slight, (m) moderate.

* An overlay was constructed on the pavement between the 1998 and 1999 evaluations.

FIELD CORE AND FIELD TESTING DATA

TxDOT staff attempted to obtain three 6-inch diameter cores from each of the six test pavements. Laboratory staff from the Atlanta District performed the coring operations using district coring equipment. Water was used to cool the bit during the coring operations. It was not possible to obtain as many cores as desired because, in some cases, the cores were not retrievable. They broke into pieces when attempting to remove them from the pavement or core bit.

TTI performed unconfined compressive-strength testing on the field cores. Plaster was used to cap the ends of the specimens prior to testing. For unconfined compressive strength, it is desirable to have a sample length (L) to diameter (D) ratio of at least 2. However, some of the cores were very short. Adjustment factors were used to facilitate comparing cores of different thickness as described in Tex 418-A . Table 8 shows results of the field core strength tests. Figure 1 compares results with previous years' results.

At the time the pavements were visually evaluated, Atlanta District personnel also performed FWD testing. The FWD is a test that nondestructively measures stiffness and relative deflection of the various layers of a pavement system. A load that simulates a truck load is applied to the pavement through a 12-inch-diameter load plate. Pavement deflection is measured by geophones placed at various distances from the plate, yielding a "deflection bowl." Deflection magnitudes and bowl shape are used to calculate stiffness and relative deflection of each layer. In general, the lower the deflection and higher the stiffness, the better the pavement's ability to distribute and carry load without rutting and cracking. FWD deflections were measured at regular intervals along the length of each test pavement.

Moduli values of the pavement layers were calculated using the TTI Modulus Analysis System (Version 5.1). Results of the analysis are presented in Tables 9 through 14. The moduli values for the base (E2) are of particular interest for this project.

Table 8. Field Cores - Unconfined Compressive Strengths.

Sample ID	Sample Height (in)	Failure Load (lbs)	Adjustment Factor	Corrected Failure Stress (psi)
FM 1520 Core 1	5.3	31,500	0.83	925.2
FM 1520 Core 2	6.0	34,300	0.87	1020.6
FM 1520 Core 3	5.0	37,850	0.82	1098.3
IH 20 Core 1	6.6	47,500	0.91	1529.5
IH 20 Core 2	6.9	52,000	0.91	1674.5
IH 20 Core 3	6.5	39,900	0.90	1270.7
SH 154 Core 1	10.5	24,100	0.98	835.7
SH 154 Core 2	11.8	24,550	1.00	868.7
SH 154 Core 3	11.7	32,700	1.00	1157.1
FM 1326 Core 1	5.6	38,500	0.85	1158.0
FM 1326 Core 2	5.3	32,650	0.83	958.9
FM 1326 Core 3	5.1	30,520	0.82	885.6
FM 560 Core 1	9.3	16,000	0.97	549.2
FM 560 Core 2	6.9	30,200	0.91	972.5
FM 560 Core 3	5.3	58,650	0.83	1722.5

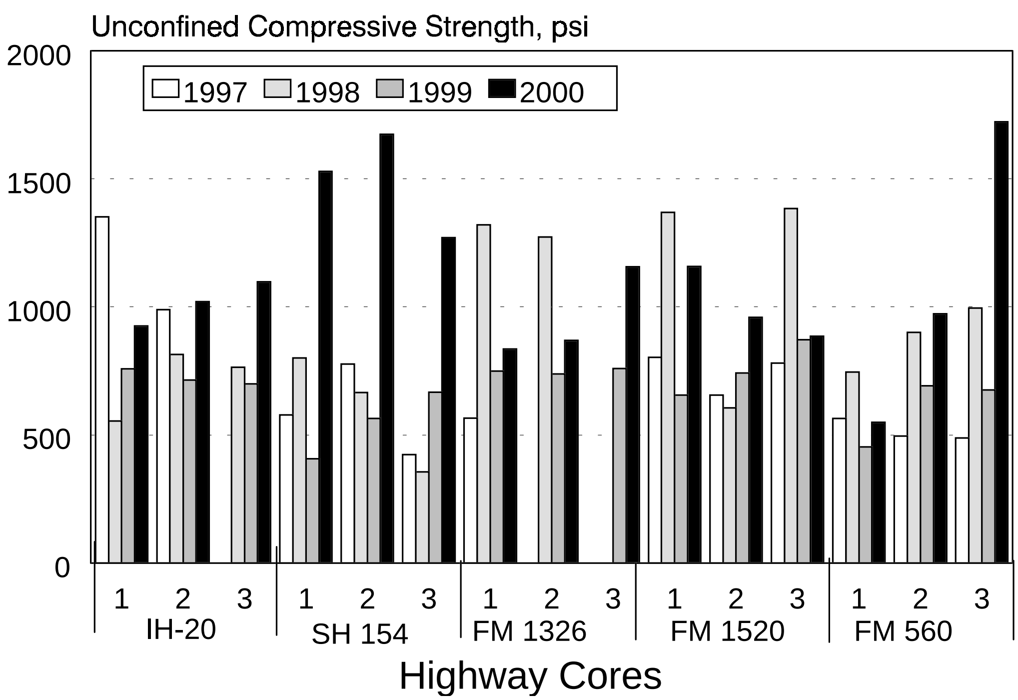

Figure 1. Unconfined Compressive Strength of Highway Cores.

Table 9. FWD Data Analysis - Loop 390.

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

District: 19
County: 103
Highway/Road: Sl0390

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
Pavement:	2.00	199,980	200,020	H1: u = 0.35
Base:	10.00	30,000	500,000	H2: u = 0.30
Subbase:	8.00	5,000	500,000	H3: u = 0.25
Subgrade:	194.50	27,100		H4: u = 0.45

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
319.000	11,392	11.34	7.67	3.98	2.16	1.42	1.06	0.87	200.	261.6	11.4	38.0	7.53	102.94
842.000	10,113	7.19	4.69	2.95	1.85	1.12	0.75	0.56	200.	500.0	13.0	43.5	2.63	36.00
1370.000	11,202	9.06	5.20	3.46	2.52	1.86	1.43	1.15	200.	244.0	126.3	27.0	2.37	300.00
1898.000	11,082	9.52	6.70	4.64	3.44	2.51	1.82	1.34	200.	437.7	55.1	18.4	1.59	218.77
2426.000	10,816	8.52	4.74	3.13	2.12	1.59	1.24	0.99	200.	247.7	106.3	30.7	2.92	300.00
2961.000	10,403	14.61	8.29	4.47	2.62	1.80	1.28	0.83	200.	131.7	15.8	26.4	4.22	162.11
3485.000	10,431	9.18	5.82	3.37	2.45	1.87	1.41	1.02	200.	265.1	56.9	25.9	6.23	198.59
4011.000	10,546	15.18	10.53	6.08	3.85	2.69	1.99	1.62	200.	190.9	10.6	18.0	5.47	299.81
4539.000	10,912	14.37	8.91	5.67	3.87	2.72	2.07	1.69	200.	165.4	34.0	17.1	2.57	300.00
5020.000	11,110	10.70	5.75	3.91	2.80	2.11	1.63	1.21	200.	169.0	147.5	24.0	2.37	227.31
5088.000	10,693	10.84	5.91	3.60	2.53	1.86	1.48	1.22	200.	167.1	78.6	26.2	4.13	300.00
5596.000	10,979	12.61	7.98	4.61	2.96	2.15	1.63	1.27	200.	204.2	23.1	23.1	5.44	300.00
6022.000	10,610	8.32	4.95	3.67	2.85	2.10	1.54	1.24	200.	256.2	243.0	21.5	1.02	251.89
6651.000	12,620	15.06	9.68	5.75	3.61	2.43	1.75	1.36	200.	217.0	15.4	23.3	3.23	211.59
7180.000	11,023	12.93	7.81	4.53	2.83	1.85	1.35	1.12	200.	193.1	18.4	26.3	2.68	170.74
7706.000	11,813	12.13	6.24	3.71	2.73	1.92	1.57	1.30	200.	148.9	86.6	28.0	4.25	291.18
7907.000	11,579	11.27	7.46	4.56	2.98	2.04	1.42	1.12	200.	306.1	19.7	25.4	2.70	187.21
8236.000	10,673	10.39	5.89	4.02	2.98	2.19	1.65	1.33	200.	182.1	134.0	21.7	1.50	300.00
8766.000	10,407	14.31	8.44	4.95	3.13	2.14	1.62	1.30	200.	146.7	20.9	21.3	3.10	241.72
9291.000	10,347	8.44	4.68	3.09	2.25	1.64	1.22	0.97	200.	226.6	128.0	28.7	1.70	281.78
9819.000	10,038	7.06	4.72	3.07	2.19	1.54	1.13	0.89	200.	500.0	15.6	38.7	11.61	254.90
10348.000	10,200	14.62	11.17	7.65	5.10	3.30	2.18	1.48	200.	311.0	5.0	15.0	1.61	155.74
10880.000	10,069	12.40	7.05	4.05	2.53	1.74	1.30	1.03	200.	155.3	25.0	25.5	3.12	250.43
11403.000	11,166	10.06	4.15	2.04	1.16	0.90	0.72	0.61	200.	135.9	56.0	56.4	6.73	24.00
11930.000	10,308	5.75	3.29	2.11	1.51	1.06	0.71	0.53	200.	443.4	102.6	43.8	1.61	36.00
12461.000	10,196	9.76	5.54	3.60	2.67	1.94	1.41	1.04	200.	192.8	99.7	23.9	2.09	218.48
12989.000	10,991	12.01	6.24	3.19	1.96	1.28	0.96	0.74	200.	150.4	26.1	37.5	3.61	166.29
13522.000	10,574	19.93	12.64	6.36	3.37	2.06	1.46	1.17	200.	105.7	6.1	23.5	7.19	96.83
Mean:		11.34	6.86	4.15	2.75	1.92	1.42	1.11	200.	237.7	60.0	27.8	3.76	214.58
Std. Dev:		3.10	2.25	1.27	0.79	0.53	0.38	0.29	0.	110.1	57.9	9.3	2.38	253.91
Var Coeff(%):		27.33	32.84	30.67	28.82	27.41	26.40	26.38	0.	46.3	96.4	33.5	63.39	118.33

Table 10. FWD Data Analysis - IH 20 Frontage Road.

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

District: 19
County: 103
Highway/Road: IH0020

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
Pavement:	2.00	200,000	1,000,000	H1: u = 0.35
Base:	11.00	100,000	2,000,000	H2: u = 0.35
Subbase:	8.00	20,000	700,000	H3: u = 0.25
Subgrade:	INFINITY	23,700		H4: u = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
200.000	9,172	47.76	21.83	6.62	2.66	1.50	1.09	1.06	200.	100.0	20.0	27.8	43.67	55.51
401.000	10,244	2.84	2.11	1.70	1.35	1.04	0.81	0.61	711.	1817.5	106.6	60.8	0.90	36.00
675.000	10,618	2.26	1.65	1.30	1.02	0.79	0.61	0.49	1000.	2000.0	39.7	104.9	6.81	24.00
800.000	10,661	2.73	2.00	1.54	1.18	0.89	0.67	0.53	691.	2000.0	47.8	80.9	0.33	24.00
1000.000	10,606	2.83	2.23	1.73	1.37	1.07	0.83	0.64	1000.	2000.0	43.7	67.0	1.32	36.00
1200.000	10,371	10.51	6.16	3.67	2.51	1.80	1.37	1.04	383.	177.5	20.0	37.1	1.43	261.65
1234.000	10,200	11.07	6.38	3.33	2.32	1.80	1.43	1.09	1000.	114.9	24.1	35.8	4.56	300.00
1400.000	10,586	7.79	3.82	2.83	2.14	1.68	1.34	1.10	506.	165.6	284.9	38.3	0.87	300.00
1602.000	10,395	9.70	6.54	3.96	2.85	2.09	1.57	1.19	322.	246.2	20.0	32.2	2.50	258.15
2010.000	10,590	17.85	9.71	5.08	3.05	2.07	1.63	1.28	200.	100.0	20.0	27.4	11.09	200.31
2199.000	10,733	8.52	4.83	2.77	2.06	1.69	1.35	1.05	1000.	154.0	76.8	39.8	4.38	296.68
2246.000	10,705	11.43	6.30	3.42	2.34	1.74	1.35	1.09	1000.	106.1	33.6	35.4	4.24	300.00
2344.000	10,534	10.69	6.54	3.54	2.30	1.69	1.32	1.10	394.	161.5	20.0	39.4	3.51	300.00
2400.000	10,681	12.68	7.57	3.80	2.53	1.96	1.46	1.23	1000.	100.0	21.0	33.3	4.93	300.00
2599.000	10,030	11.75	7.08	3.88	2.66	1.96	1.46	1.13	326.	140.0	20.0	32.6	3.65	294.38
2800.000	10,042	7.11	4.96	3.09	2.18	1.61	1.22	0.95	414.	369.6	20.0	41.4	2.64	300.00
3001.000	10,884	8.44	3.93	1.75	1.11	0.76	0.61	0.48	249.	249.1	25.3	83.0	8.97	24.00
3117.000	10,113	8.50	3.82	1.72	1.03	0.71	0.50	0.39	200.	177.4	59.1	59.1	29.30	24.00
3172.000	10,435	7.82	3.92	2.09	1.20	0.83	0.60	0.47	231.	231.0	23.1	77.0	2.13	36.00
3400.000	10,050	2.41	1.63	1.13	0.78	0.56	0.43	0.34	1000.	1292.3	49.2	120.7	1.07	24.00
3602.000	10,276	2.40	1.57	1.07	0.71	0.49	0.36	0.31	998.	1252.0	43.3	144.4	0.63	16.00
3806.000	10,153	2.12	1.39	0.98	0.68	0.48	0.35	0.30	667.	1752.6	52.7	146.6	0.12	16.00
Mean:		9.51	5.27	2.77	1.82	1.33	1.02	0.81	613.	668.5	48.7	62.0	6.32	57.79
Std. Dev:		9.55	4.38	1.44	0.77	0.56	0.44	0.35	333.	765.5	57.2	37.3	10.40	55.10
Var Coeff(%):		99.99	83.00	51.85	42.58	42.34	43.08	42.84	54.	100.0	100.0	60.1	164.49	95.35

Table 11. FWD Data Analysis - SH 154.

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

District: 19			MODULI RANGE(psi)		
County: 230		Thickness(in)	Minimum	Maximum	Poisson Ratio Values
Highway/Road: SH0154	Pavement:	0.50	199,980	200,020	H1: u = 0.35
	Base:	13.00	15,000	2,000,000	H2: u = 0.30
	Subbase:	0.00	0	0	H3: u = 0.25
	Subgrade:	158.10	18,700		H4: u = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
100.000	10,185	36.59	18.61	7.26	3.73	2.67	2.07	1.65	200.	32.5	0.0	13.2	10.41	74.53
200.000	10,900	36.08	15.91	5.13	2.46	1.91	1.54	1.12	200.	30.6	0.0	19.5	16.91	53.95
299.000	10,475	50.24	25.16	9.66	4.22	2.75	2.17	1.67	200.	22.2	0.0	11.8	16.40	67.05
400.000	11,750	9.69	7.45	5.83	4.02	2.30	1.82	1.50	200.	431.9	0.0	19.6	7.82	99.77
491.000	12,365	5.30	4.57	3.56	2.70	2.00	1.41	1.20	200.	1455.4	0.0	25.7	5.09	193.72
512.000	11,678	8.06	6.38	4.72	3.10	2.21	1.67	1.27	200.	560.3	0.0	22.3	5.19	270.12
610.000	12,632	5.33	4.62	3.83	3.13	2.49	1.49	1.24	200.	1748.5	0.0	22.8	5.53	110.48
702.000	12,131	4.17	3.58	2.96	2.40	1.87	1.48	1.18	200.	2000.0	0.0	29.1	5.69	300.00
802.000	12,894	6.09	4.76	3.68	2.80	2.09	1.57	1.17	200.	1113.0	0.0	27.2	3.53	227.49
900.000	11,619	7.00	4.60	3.54	2.73	2.11	1.61	1.35	200.	665.4	0.0	27.4	6.34	300.00
1037.000	12,111	6.22	4.58	3.98	3.34	2.70	2.00	1.69	200.	1423.2	0.0	20.5	3.63	266.74
1102.000	11,666	5.58	4.77	4.02	3.11	2.55	2.02	1.63	200.	1767.0	0.0	18.4	2.89	300.00
1235.000	11,817	6.35	5.55	4.46	3.50	2.65	2.01	1.50	200.	1340.1	0.0	18.1	3.95	231.22
1251.000	11,805	6.22	5.33	4.24	3.17	2.38	1.91	1.52	200.	1242.7	0.0	20.0	5.27	300.00
1300.000	11,380	6.11	5.19	4.19	3.30	2.46	1.93	1.57	200.	1301.0	0.0	18.8	3.43	300.00
1401.000	11,337	7.22	5.30	4.15	3.20	2.44	1.90	1.53	200.	760.7	0.0	21.6	3.05	300.00
1500.000	12,099	4.59	3.59	3.00	2.41	1.99	1.69	1.22	200.	2000.0	0.0	26.4	4.57	192.51
1601.000	11,476	7.83	6.61	5.12	4.01	3.10	2.39	1.88	200.	929.0	0.0	15.8	2.98	300.00
1700.000	11,956	8.39	7.07	4.98	3.37	2.20	1.70	1.41	200.	543.9	0.0	21.6	7.37	167.72
1800.000	12,064	8.63	5.20	3.93	3.11	2.43	1.88	1.46	200.	485.9	0.0	26.2	10.33	294.07
1903.000	12,060	9.76	6.73	4.83	3.70	2.51	1.88	1.42	200.	428.4	0.0	21.5	2.16	214.87
2066.000	12,135	12.88	8.91	5.84	3.87	2.32	1.71	1.30	200.	238.8	0.0	19.6	4.80	114.60
2202.000	11,225	24.58	12.28	5.17	2.68	1.91	1.53	1.11	200.	58.5	0.0	19.2	11.97	88.35
Mean:		12.30	7.68	4.70	3.22	2.35	1.80	1.42	200.	894.7	0.0	21.2	6.49	171.69
Std. Dev:		12.31	5.38	1.46	0.53	0.32	0.25	0.21	0.	651.8	0.0	4.4	4.11	118.28
Var Coeff(%):		99.99	69.98	31.16	16.53	13.43	13.87	14.83	0.	72.8	0.0	20.9	63.29	68.89

Table 12. FWD Data Analysis - FM 1326.

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

District: 19
County: 19
Highway/Road: FM1326

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
Pavement:	0.50	199,980	200,020	H1: u = 0.35
Base:	5.50	20,000	800,000	H2: u = 0.30
Subbase:	8.00	4,000	180,000	H3: u = 0.35
Subgrade:	99.30	12,900		H4: u = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	10,101	60.40	22.28	7.79	4.22	3.28	2.69	2.28	200.	26.1	8.7	10.3	12.65	58.31
51.000	10,228	47.11	22.68	8.83	4.69	3.32	2.74	2.26	200.	53.4	10.5	9.4	10.27	74.93
100.000	11,047	18.48	10.75	5.81	3.19	2.04	1.53	1.28	200.	237.7	42.6	16.8	1.59	111.08
149.000	11,273	13.48	9.69	6.52	4.35	2.93	2.02	1.56	200.	521.2	134.3	12.7	1.48	183.31
200.000	10,904	16.13	9.29	5.94	3.93	2.71	2.09	1.56	200.	134.6	162.9	15.0	3.83	262.84
249.000	11,325	14.84	10.04	6.10	3.74	2.60	2.00	1.56	200.	352.6	102.6	14.4	5.18	249.98
300.000	11,206	14.34	10.50	6.46	4.08	2.74	2.07	1.65	200.	567.1	92.2	12.7	5.18	213.17
350.000	11,603	14.41	10.39	6.09	3.67	2.39	1.73	1.29	200.	659.1	66.2	14.5	4.67	171.18
388.000	12,203	20.63	14.04	7.70	4.31	2.71	1.94	1.56	200.	421.4	35.3	13.1	3.29	124.42
450.000	10,502	53.45	24.29	8.48	4.00	3.18	2.41	1.87	200.	45.8	7.7	10.4	11.90	58.91
Mean:		27.33	14.40	6.97	4.02	2.79	2.12	1.69	200.	301.9	66.3	12.9	6.00	113.25
Std. Dev:		18.56	6.15	1.12	0.42	0.40	0.39	0.35	0.	235.3	55.1	2.4	4.11	63.17
Var Coeff(%):		67.91	42.73	16.10	10.44	14.47	18.28	20.75	0.	77.9	83.1	18.3	68.52	55.78

Table 13. FWD Data Analysis - FM 1520.

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

District: 19
County: 32
Highway/Road: FM1520

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
Pavement:	0.50	199,980	200,020	H1: u = 0.35
Base:	10.00	20,000	400,000	H2: u = 0.30
Subbase:	8.00	4,000	150,000	H3: u = 0.35
Subgrade:	126.70	17,400		H4: u = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	11,023	13.41	8.70	4.46	3.12	2.26	1.61	1.11	200.	217.9	26.1	21.1	6.91	300.00
201.000	12,052	12.79	8.13	4.93	3.06	2.06	1.33	0.91	200.	299.0	20.0	24.2	1.92	138.17
224.000	11,972	19.55	10.04	5.33	3.36	2.25	1.51	1.20	200.	111.1	29.2	21.0	2.02	159.67
600.000	11,925	16.37	10.76	6.47	4.14	2.56	1.83	1.22	200.	246.2	12.5	18.5	1.26	130.33
1200.000	11,436	19.07	9.27	5.24	3.45	2.23	1.55	1.29	200.	105.0	35.2	20.0	2.93	159.72
2075.000	11,793	29.06	18.00	8.43	5.57	3.97	3.14	2.29	200.	86.1	13.5	12.4	8.93	299.61
2425.000	11,440	19.68	11.99	7.36	3.77	2.80	2.07	1.55	200.	163.2	11.4	17.2	5.32	87.14
2999.000	11,086	20.32	13.03	6.69	4.07	2.49	1.72	1.26	200.	154.8	7.8	18.5	3.30	126.63
3601.000	11,694	24.18	13.94	6.30	3.26	2.02	1.72	1.35	200.	102.5	8.4	21.9	6.56	88.71
4177.000	10,784	10.42	4.44	1.95	1.24	0.94	0.67	0.59	200.	184.7	64.8	42.0	15.27	36.00
4210.000	11,194	11.79	6.04	3.54	2.33	1.44	1.07	0.80	200.	189.8	54.0	28.6	4.51	125.97
4800.000	11,865	16.91	8.53	4.28	3.31	2.48	2.14	1.61	200.	131.8	40.2	22.6	13.74	300.00
5400.000	12,234	28.70	17.67	8.65	5.09	2.83	1.83	1.69	200.	114.4	4.8	18.1	4.34	96.90
6001.000	11,400	12.62	7.97	4.33	2.96	2.08	1.45	0.96	200.	239.3	31.1	22.9	4.63	149.78
6547.000	12,012	16.94	11.23	6.13	3.61	2.49	1.76	1.32	200.	218.3	11.3	20.6	4.07	170.86
6611.000	12,207	18.29	11.70	7.30	4.31	3.04	1.94	1.44	200.	212.3	13.5	16.9	2.15	177.57
7200.000	11,825	19.85	10.67	6.37	3.88	2.50	1.82	1.41	200.	124.2	25.9	18.1	0.94	160.73
7800.000	11,281	29.76	18.67	10.34	6.05	3.87	2.74	2.06	200.	104.0	6.4	11.7	3.25	166.72
8400.000	12,028	7.50	5.89	3.98	2.76	2.03	1.47	1.07	200.	400.0	83.8	27.9	15.41	205.89
8933.000	10,359	22.31	15.45	8.87	4.79	2.77	1.92	1.43	200.	156.6	4.0	15.5	2.28	108.05
Mean:		18.48	11.11	6.05	3.71	2.46	1.76	1.33	200.	178.1	25.2	21.0	5.49	145.22
Std. Dev:		6.20	4.06	2.07	1.11	0.69	0.53	0.40	0.	78.3	21.6	6.6	4.49	93.54
Var Coeff(%):		33.57	36.54	34.20	30.02	28.24	30.04	30.09	0.	44.0	85.7	31.2	81.86	64.41

Table 14. FWD Data Analysis - FM 560.

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

District: 19
County: 19
Highway/Road: FM0560

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
Pavement:	4.00	200,000	2,000,000	H1: u = 0.35
Base:	6.50	20,000	1,000,000	H2: u = 0.30
Subbase:	6.00	10,000	700,000	H3: u = 0.35
Subgrade:	283.50	17,700		H4: u = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
0.000	9,903	17.62	12.87	8.66	6.09	4.49	3.42	2.74	1317.	27.5	94.4	10.1	0.33	300.00
150.000	9,910	16.20	11.19	7.37	5.15	3.74	2.82	2.29	848.	48.9	66.2	12.3	0.29	300.00
299.000	10,109	5.03	4.13	3.54	3.00	2.44	1.96	1.59	1709.	856.6	700.0	18.0	0.81	300.00
450.000	9,950	12.72	8.76	6.04	4.31	3.09	2.25	1.67	378.	191.0	51.1	15.5	0.33	283.50
600.000	9,994	13.69	9.98	7.04	5.03	3.57	2.59	1.97	452.	238.1	26.2	13.6	0.25	298.14
759.000	9,966	11.78	9.33	6.70	5.01	3.75	2.76	2.08	2000.	54.3	180.8	12.0	2.37	300.00
899.000	9,950	10.61	8.00	6.00	4.43	3.25	2.41	1.87	393.	485.9	59.4	14.9	0.06	300.00
1050.000	10,042	8.41	5.94	4.27	3.15	2.41	1.89	1.56	1173.	136.5	238.3	19.4	0.78	300.00
1200.000	9,954	7.64	4.98	3.57	2.67	2.06	1.63	1.38	854.	126.3	492.4	22.7	0.61	300.00

TTI MODULUS ANALYSIS SYSTEM (SUMMARY REPORT) (Version 5.1)

District: 19
County: 19
Highway/Road: FM0560

	Thickness(in)	MODULI RANGE(psi) Minimum	Maximum	Poisson Ratio Values
Pavement:	4.00	200,000	2,000,000	H1: u = 0.35
Base:	9.50	20,000	1,000,000	H2: u = 0.30
Subbase:	3.50	10,000	700,000	H3: u = 0.35
Subgrade:	283.00	17,600		H4: u = 0.40

Station	Load (lbs)	Measured Deflection (mils): R1	R2	R3	R4	R5	R6	R7	Calculated Moduli values (ksi): SURF(E1)	BASE(E2)	SUBB(E3)	SUBG(E4)	Absolute ERR/Sens	Dpth to Bedrock
1351.000	9,958	8.76	5.83	3.74	2.71	2.06	1.63	1.35	1433.	70.4	665.9	21.6	0.68	300.00
1500.000	9,803	11.82	8.35	5.42	3.66	2.63	1.95	1.54	1547.	56.4	55.7	17.2	0.32	300.00
1614.000	9,950	9.93	6.54	4.33	3.02	2.23	1.73	1.45	930.	93.2	136.0	20.7	0.96	300.00
1799.000	10,014	8.64	5.62	3.25	1.93	1.08	0.55	0.37	2000.	46.3	17.1	41.7	10.43	36.00
1950.000	9,867	10.51	6.96	4.50	2.92	1.98	1.52	1.19	807.	117.3	12.5	23.2	1.63	265.54
2082.000	9,910	9.80	6.69	4.38	2.98	2.14	1.61	1.23	1179.	98.5	53.7	21.4	0.67	300.00
2250.000	10,018	5.75	4.51	3.80	3.13	2.50	2.00	1.68	548.	1000.0	479.1	18.4	0.28	300.00
2401.000	9,704	15.19	10.15	6.32	3.98	2.56	1.77	1.35	1073.	45.0	10.0	17.1	2.23	178.01
2550.000	9,585	25.46	17.19	9.22	5.01	3.06	2.19	1.73	487.	20.0	10.0	12.2	7.18	115.96

TTI experience has shown that for stabilized bases, moduli values between 145,000 and 500,000 psi are optimum in terms of field performance. Bases with moduli values between 500,000 and 1,000,000 psi give variable field performance, and values above 1,000,000 psi seem to be too stiff and exhibit transverse/shrinkage cracking. In Figures 2 through 7, the base moduli values are plotted for each test pavement and compared with previous years' data.

For subgrades, moduli values less than 4000 psi are considered poor while good values are those greater than 16,000 psi.

Below is a discussion of the FWD test results and the field core data.

LOOP 390

No cores were obtained from this pavement. Unsuccessful attempts were made in 1997, 1998, 1999, and again in 2000. As shown in Figure 2, there is some variation in the moduli values since 1997; however, it does not appear that the base is exhibiting a deteriorating strength overall. Some locations indicate an increase in stiffness while others show a decrease.

IH 20 FRONTAGE ROAD

Three cores were obtained from this pavement as shown in Figure 1. The pavement core strengths are greater than the core strengths measured last year. There is very little change in the FWD data exhibited in Figure 3 since 1997. Note in Figure 3 that the last data point may coincide with the beginning of a different type of pavement section.

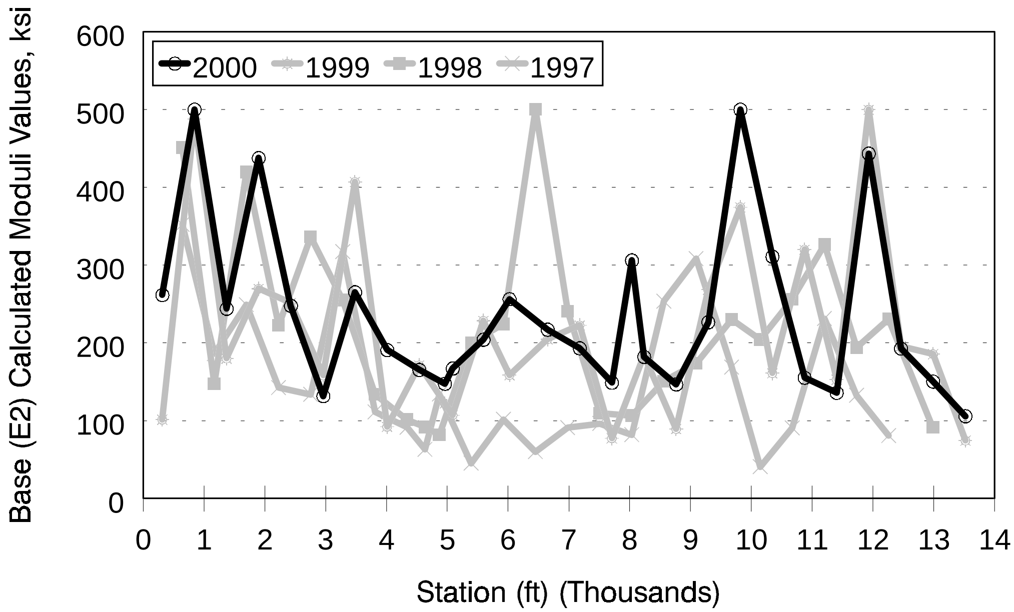

Figure 2. Base Moduli Values for Loop 390.

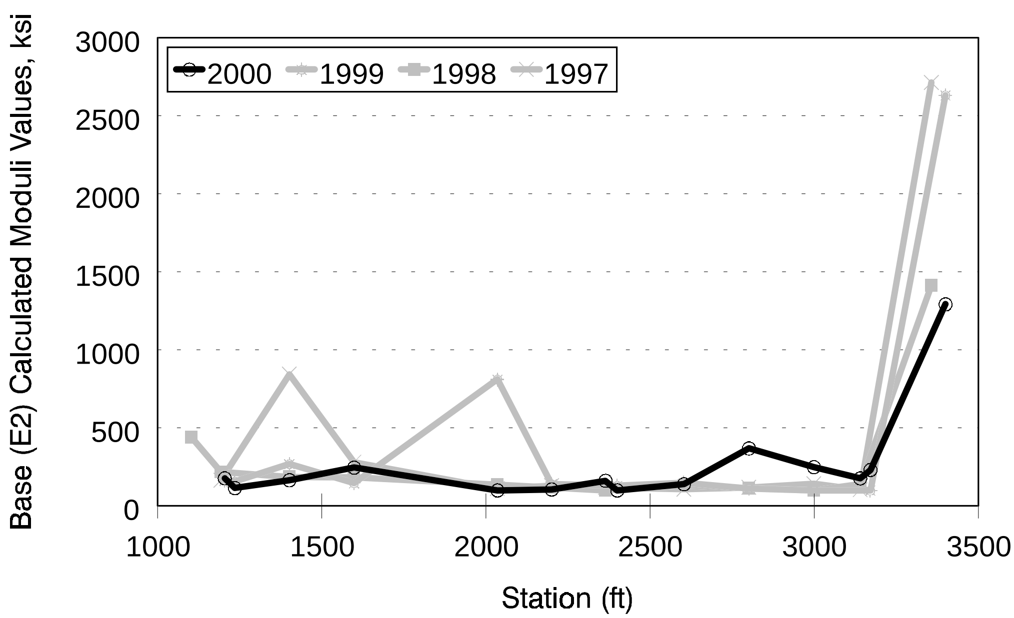

Figure 3. Base Moduli Values for IH 20 Frontage Road.

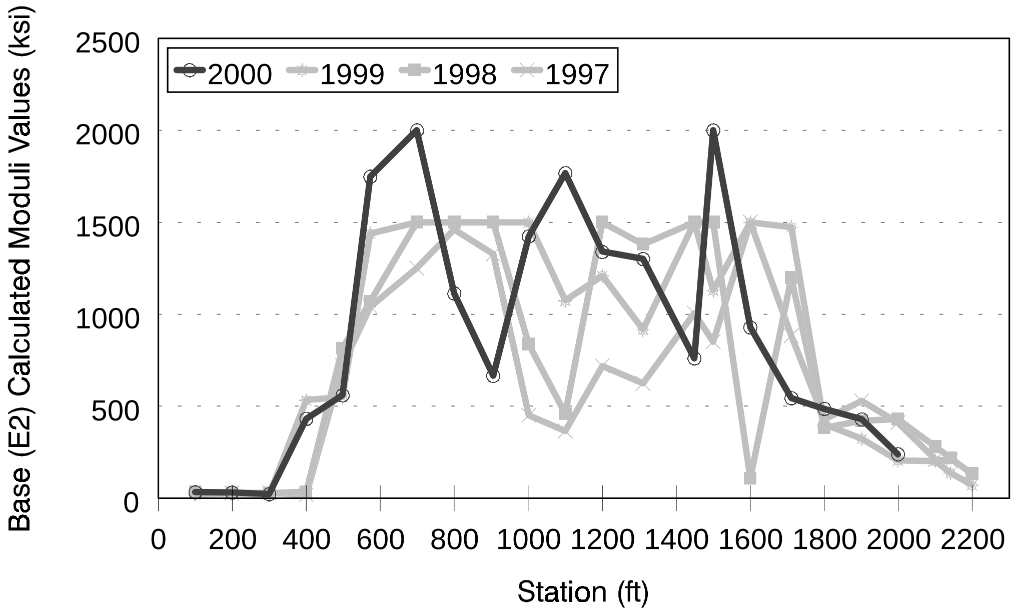

Figure 4. Base Moduli Values for SH 154.

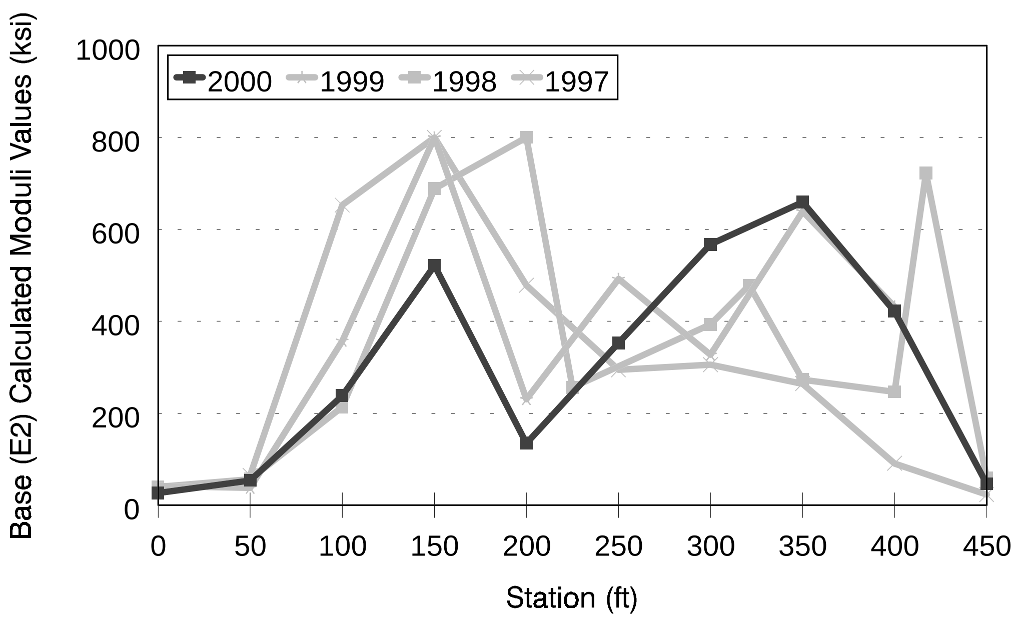

Figure 5. Base Moduli Values for FM 1326.

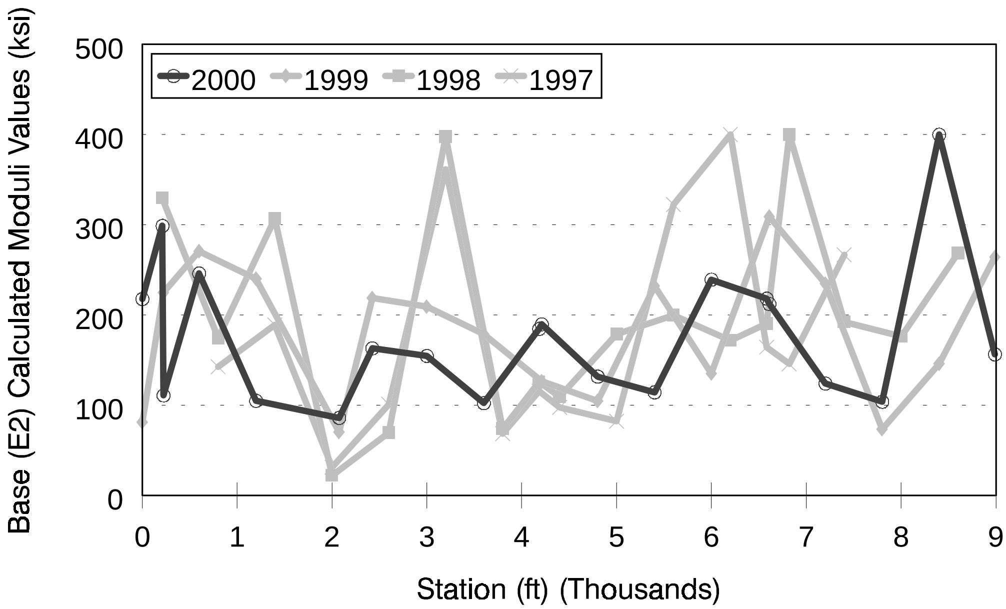

Figure 6. Base Moduli Values for FM 1520.

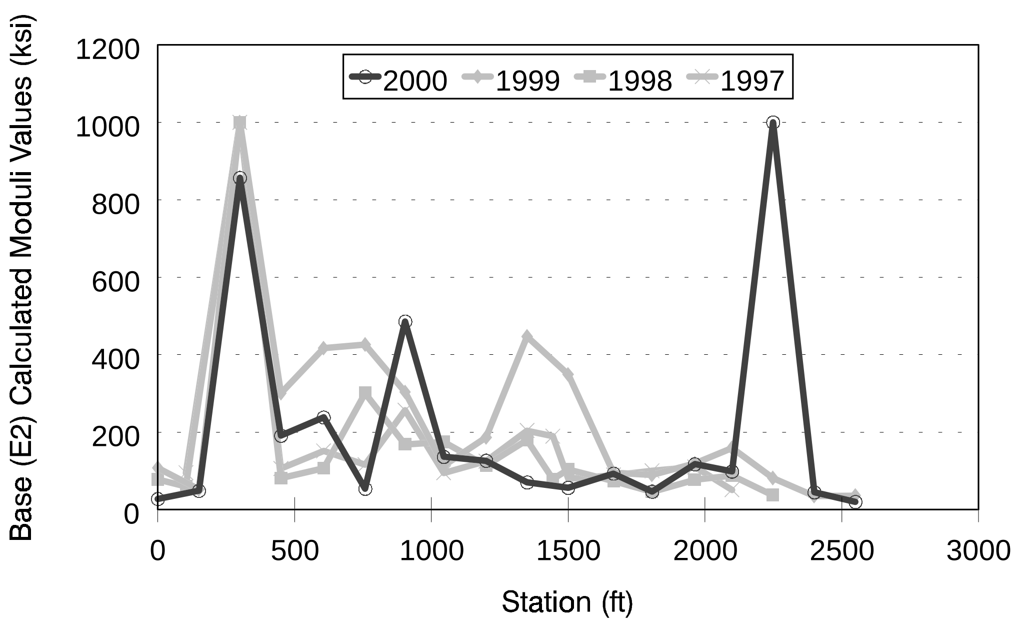

Figure 7. Base Moduli Values for FM 560.

SH 154

From what has appeared to be shrinkage cracking, one would expect this pavement to be the stiffest of the six. This is true in terms of FWD data (Figure 4). Base moduli values along the pavement exceed 1,000,000 psi in some locations. Base moduli values in 2000 are similar to values observed in previous years. Compressive strengths of the cores taken in 2000 are much greater than strengths observed in previous years.

FM 1326

Cores obtained from FM 1326 in 1999 show a significant decrease in strength over that exhibited in 1998. But, the strengths in 2000 are greater than those of 1999. The base moduli values as calculated from FWD data (shown in Figure 5) show an increase in stiffness at some locations and a decrease in other locations.

FM 1520

Three cores were obtained from FM 1520, and these cores had an average strength higher than last year's core data. FWD data (Figure 6) on this pavement indicate that there may be a general decrease in moduli values since last year; however, most of the values still fall between 100,000 and 300,000 psi as in previous years.

FM 560

All three cores obtained from FM 560 had higher compressive strengths than the cores obtained in 1999. The base on this pavement has two different thicknesses along its length: 9 inches and 16 inches. Because of the difference in thicknesses, two separate FWD analyses were performed as shown in Table 14. Results from both analyses, however, were combined for Figure 7. Moduli values for this pavement are generally lower in 2000 than in 1999 but comparable to values observed in previous years.

CONCLUSIONS

- All of the hydrated fly-ash test pavements are continuing to perform well. Cracking distress has been exhibited in four of the six test pavements; however, not to a significant degree. For these pavements that have some distress, that distress is generally in isolated areas, and the distress is not affecting the serviceability of the roadway.
- There has been little change observed in the performance of the six pavements since 1997. Four of the six hydrated fly-ash test pavements have exhibited distress that might be attributable to deficiencies in the fly-ash base material. In 1997 Loop 390 exhibited a small amount of alligator cracking in an area where the FWD data indicated the base is weak. However, by 1998 the surface had a new seal coat, and no further cracking distress has been evident. Loop 390 also exhibited some rutting, but it appears it may be within the hot-mix asphalt concrete layer. SH 154 has exhibited transverse cracking (which appears to be from shrinkage of the base), and the FWD data indicates this pavement is very stiff. This pavement was recently chip-sealed and no distress is currently exhibited on the surface. IH 20 and FM 1326 are beginning to exhibit some signs of slight cracking distress.
- Year 2000 FWD data were compared to that taken in 1999, 1998, and 1997. Modulus of the fly-ash base materials were back-calculated from the FWD data. There is no indication of any significant weakening of these base materials with time.
- Cores were taken on all of the test pavements except Loop 390. No intact core could be obtained from Loop 390. Compressive strengths for the cores from the other five test pavements were higher than the strengths observed in 1999.
- Based on visual evaluations, FWD data, and compressive strengths of cores, the hydrated fly-ash test pavements are performing well, and none are exhibiting any significant signs of deterioration.

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