Evaluation of Frost Related Effects on Pavements

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16. Abstract

This report describes the field data and analysis techniques used to evaluate the effect of winter ground freezing on WSDOT pavement structures during two thaw periods. Six field test sites were selected in District 2 for deflection testing and in situ instrumentation as well as materials sampling.

The results show that a principal mechanism which necessitates load restrictions for some of the WSDOT pavement structures is the weakened condition of the base course during thawing periods. Presented in the report is a single revised load restriction table and a criterion to use in determining the time that load restrictions should be established.

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EVALUATION OF FROST RELATED EFFECTS ON PAVEMENTS

by

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Prepared by the

Washington State Transportation Center

and the

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for the

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CHAPTER I

INTRODUCTION

BACKGROUND

District engineers throughout the State of Washington (and all other northern states) are faced with the recurring problem of weakened pavement structures during spring thaw. One option available to reduce the pavement deterioration which can occur during this time period is load restrictions for truck traffic. When such restrictions are used, several questions arise such as:

1. Which pavement sections require load restrictions?
2. Are the present load restrictions adequate?
   - (a) How much damage do the current load restrictions preclude?
   - (b) How do the current load restrictions relate to enforcement polices?
   - (c) If the current load restrictions are inadequate, what restrictions should be used?
     - (i) Fixed (or constant) tire or axle loads?
     - (ii) Variable tire or axle loads?
     - (iii) Should tire pressures be considered?
3. When should load restrictions be applied and removed?

Two load restriction levels are currently in use by the Washington State Department of Transportation (WSDOT), emergency and severe emergency (refer to Tables 1 and 2, respectively). These load restrictions are based on an allowable maximum load per tire for a given tire size. There have been suggestions within WSDOT to change the load restrictions from tire sizes to axle weights as used by other states (such as Minnesota, Nebraska, and Alaska). The original WSDOT load restrictions were published in 1952. No significant revisions have been made except for the addition in 1957 of tubeless tire sizes and their corresponding restrictions.

To begin to address some of the above questions, the initial study effort included discussions by the research team with the central

Table 1. Current WSDOT Emergency Load Restriction Table.

EMERGENCY LOAD RESTRICTIONS

CONVENTIONAL TIRES		TUBELESS OR SPECIAL WITH .5 MARKING	
SIZE TIRE WIDTH	GROSS LOAD EACH TIRE	SIZE TIRE WIDTH	GROSS LOAD EACH TIRE
7.00	1800 lbs.	8-22.5	2250 lbs.
7.50	2250 lbs.	9-22.5	2800 lbs.
8.25	2800 lbs.	10-22.5	3400 lbs.
9.00	3400 lbs.	11-22.5	4000 lbs.
10.00	4000 lbs.	11-24.5	4000 lbs.
11.00	4500 lbs.	12-22.5	4500 lbs.
12.00*	4500 lbs.	12-24.5*	4500 lbs.

* OR OVER

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Table 2. Current WSDOT Severe Emergency Load Restriction Table.

SEVERE EMERGENCY LOAD RESTRICTIONS

CONVENTIONAL TIRES		TUBELESS OR SPECIAL WITH .5 MARKING	
SIZE TIRE WIDTH	GROSS LOAD EACH TIRE	SIZE TIRE WIDTH	GROSS LOAD EACH TIRE
7.00	1800 lbs.	8-22.5	1800 lbs.
7.50	1800 lbs.	9-22.5	1900 lbs.
8.25	1900 lbs.	10-22.5	2250 lbs.
9.00	2250 lbs.	11-22.5	2750 lbs.
10.00	2750 lbs.	11-24.5	2750 lbs.
11.00 OR OVER	3000 lbs.	12-22.5 OR OVER	3000 lbs.

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maintenance office, the Materials Laboratory and District 2. From these discussions,the following observations were made:

1. Generally, district personnel know where significantly thaw weakened roads or road sections are located.
2. There is a reluctance to apply load restrictions to known problem roads or road sections until surface damage is observed during the spring thawing period. (This suggests that substantial fatigue damage can occur due to questions stemming from when to apply load restrictions.)
3. Enforcement of load restrictions is a major concern to WSDOT personnel. Some of these concerns include:
   (a) The current load restrictions essentially preclude all large trucks due in part to steering axle limitations,
   (b) No recognition is given to the varying pavement support conditions during the thaw period (i.e., the load capacity of a pavement structure varies with time).

In order to determine whether WSDOT should use restrictions based on tire size or axle weights, and to answer some of the questions posed above, District 1 conducted a load restriction study in 1980 [1]. The District 1 recommendation was to gather considerably more data in order to develop a method for determining when to apply and remove restrictions and what restrictions should be used.

STUDY OBJECTIVE

The overall objective of this research was to evaluate the effect of freeze-thaw in pavement layers on pavement structural capacity. More specifically the objectives were to:

1. Measure the variation of base and subgrade moisture content, frost depth and location, and pavement deflection (surface and in situ).
2. Develop procedures to utilize easily obtained data, or otherwise provide for predicting when load restrictions should be applied on a given pavement structure.
3. Determine an appropriate load restriction criterion, such as a nomograph, new table, etc.

To accomplish these objectives, it was necessary to:

1. Collect data at several test sites, including measurement of:
   - (a) frost depth using frost tubes;
   - (b) moisture contents using soil cells;
   - (c) soil temperature using soil cells;
   - (d) dynamic deflection basins using the Falling Weight Deflectometer (FWD);
   - (e) static deflections using a Benkelman Beam, and
   - (f) dynamic and static deflections using an extensometer permanently buried in the pavement structure.
2. Collect weather data

   This data, obtained from NOAA Climatic Reports, or the WSDOT maintenance offices, was used to calculate freezing indices, and to estimate depth of freeze using the Modified Berggren Equation.
3. Obtain pavement samples

   Samples of the base and subgrade materials, and cores of the asphalt concrete were obtained for laboratory resilient modulus determination. At the time of sampling, the in situ density and moisture content of the base and subgrade were determined.

REPORT ORGANIZATION

The report contains five chapters and a series of appendices. Chapter 1 is used to provide background information and the study objectives. Chapter 2 is used to describe, in detail, the field study (including information on site selection, instrumentation, and data collected). Chapter 3 is used to discuss the results obtained from the data collected and Chapter 4 the data analysis. The study's findings, conclusions and recommendations are presented in Chapter 5.

CHAPTER II

FIELD STUDY

SITE SELECTION

District 2 of WSDOT was chosen for the location of all field test sites. Several criteria were used as a basis for test site selection. They were:

1. two basic types of pavement sites were selected: those which did and those which did not exhibit past occurrences of frost heave in the winter and thaw weakening in the spring.
2. each site should have a different subgrade material, and
3. the pavement should be plowed in the winter to keep it snow free.

In order to satisfy the above criteria, two trips were made to District 2 and several sites were examined and documented. After consideration of all factors, six sites were selected for deflection testing with four of those sites also instrumented with frost tubes, soil cells and on two sites, extensometers. The six sites are shown on Figure 1 and listed in Table 3. Each test site was 500 feet (152 m) long and will be discussed briefly below.

SR 97, MP 183.48 - 184.00

This site, located near the intersection of SR 97 and SR 2, was selected as a control section. Frost heave problems were not anticipated as precautions had been taken during recent reconstruction to have sufficient depth of non-frost susceptible material. In 1982, 0.25 ft (7.62 cm) of ACP, 0.25 ft (7.62 cm) of crushed surfacing top course (CSTC) and 0.50 ft (15.24 cm) of ballast were placed over the existing roadway.

SR 2, MP 117.38 - 117.62 (Sunnyslope)

This is a four lane highway in the Wenatchee area at an elevation of approximately 1,000 ft. (300 m). The frost heave at this site seems to be associated with cuts in layered sands and silts. The current roadway section is badly deteriorated with alligator cracking in the wheel paths and considerable patching in the areas of worst heave. This site received major reconstruction during the summer of 1984.

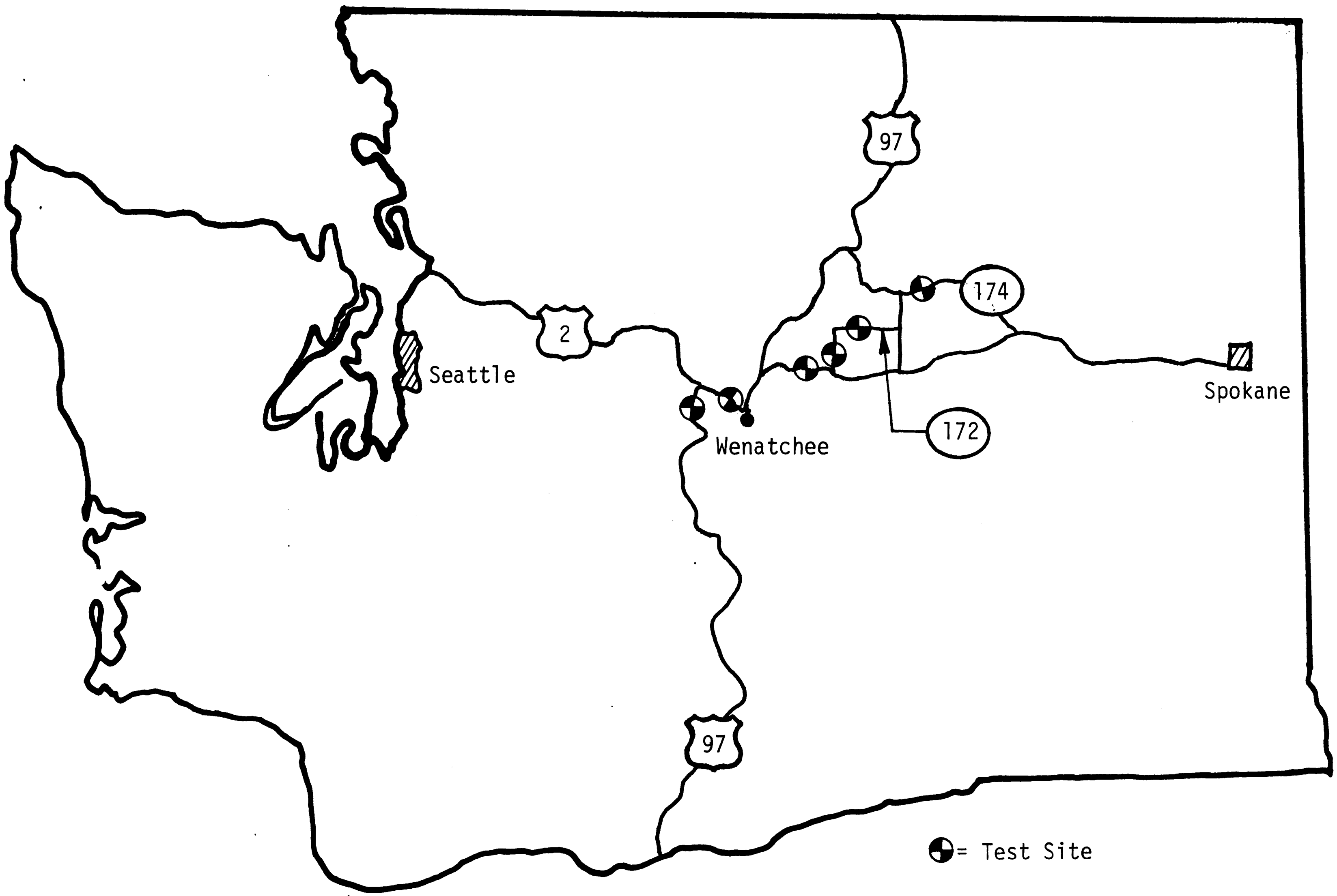


Figure 1. Location of Field Test Sites

Table 3. Location of Six Sites Selected for Instrumentation and Testing.

No.	State Route Nos.	Mileposts From	Mileposts To	Instrumentation Placed
1	SR 97 Northbound	183.48	184.00	2 frost tubes 1 moisture tube*
2	SR 2 Eastbound	117.38	117.62	2 frost tubes 2 moisture tubes 1 extensometer
3	SR 2 Eastbound	159.60	160.00	2 frost tubes 1 moisture tube
4	SR 172 Southbound	2.00	1.90	FWD testing only
5	SR 172 Southbound	21.40	21.00	FWD testing only
6	SR 174 Eastbound	2.30	2.00	2 frost tubes 1 moisture tube 1 extensometer

*Each moisture tube consisted of four moisture cells

SR 2, MP 159.60 - 160.00

This site is located near Waterville at an approximate elevation of 2,500 ft. (760 m). It is a two lane pavement which was reconstructed with CSTC and a bituminous surface treatment (BST) in 1982. The pavement structure consists of BST over approximately nine inches (23 cm) of CSTC over one to two feet (30 to 61 cm) of fine, stoney, silty sand over basalt. Moderate frost heave occurs in a small cut area.

SR 172, MP 2.00 - 1.90

This site, located near Waterville, has an approximate elevation of 2,500 ft. (760 m). It is a two lane pavement which consists of approximately six inches (15 cm) of gravel overlain by BST and seal coats (applied as needed over the last 30 years).

The frost heaves occur predominantly in small cuts at the summit of vertical curves where the sandy silt (loess) is only two to three feet (61 - 91 cm) thick over basalt bedrock. Major patching is evident in the frost heave areas.

SR 172, MP 21.4 - 21.0

This site, with an approximate elevation of 2,500 ft. (760 m), is located near Mansfield. The two lane roadway was constructed in 1969 with 1.5 ft. (46 cm) of gravel overlain by a BST. Additional BST's were placed in 1973 and 1975.

Frost heave at this site seems to be associated with fine, sandy silt located at the beginning and end of a cut.

SR 174, MP 2.3 - 2.0

Located near Coulee Dam, at an elevation of approximately 2,500 ft. (760 m), this site consists of about 10 inches (25 cm) of base course material overlain by 1.7 inches (4.3 cm) of asphalt concrete. A BST was applied to this section during late summer 1983 with a leveling treatment applied to fill in the ruts. Frost heave is associated with cuts made in layered silts. Cross sections of the sites are shown in Figures 2 through 7.

INSTRUMENTATION

A main objective of this study was to measure changes in pavement strength over an 18 month period. To this end, four of the six sites

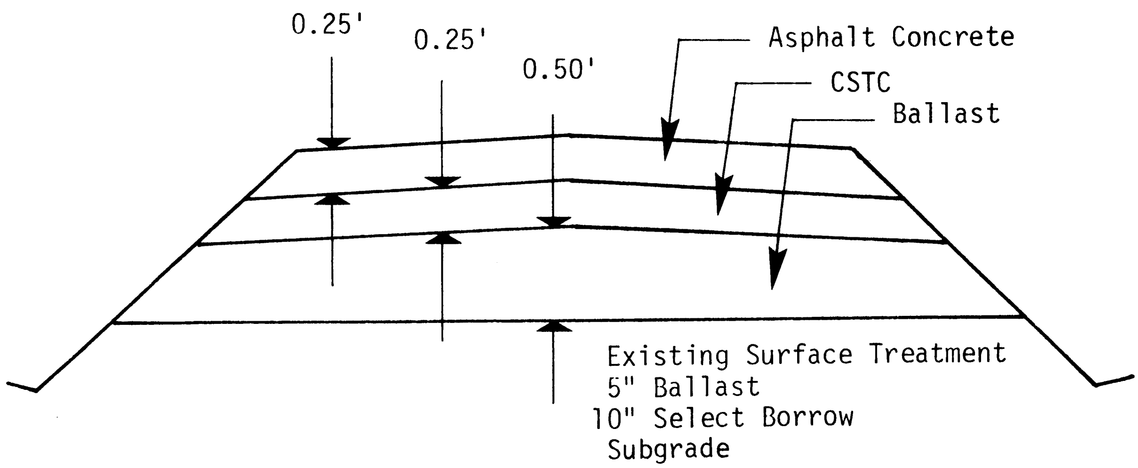


Figure 2. SR 97, MP 183.48-184.00 - Cross Section.

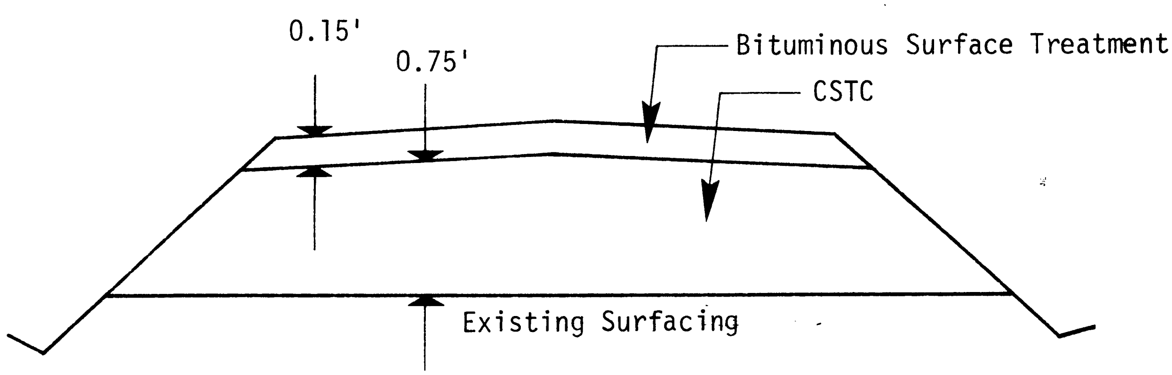


Figure 3. SR 2, MP 159.6-160.00 - Cross Section

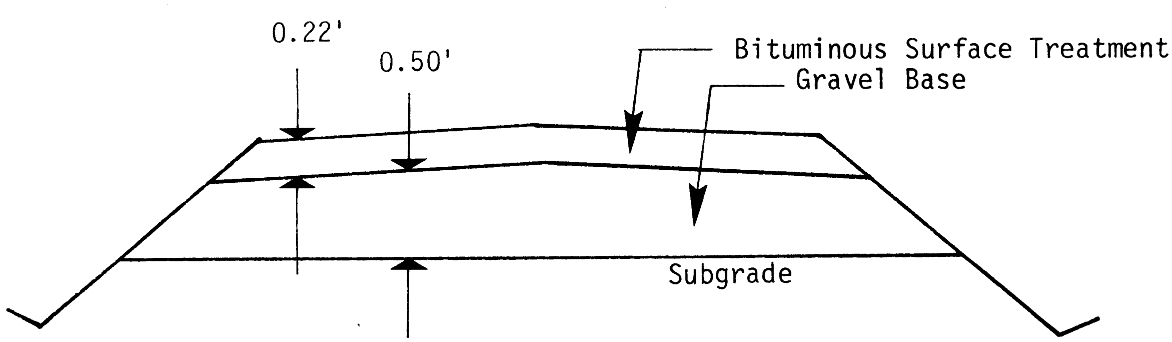


Figure 4. SR 172, MP 2.00-1.90 - Cross Section

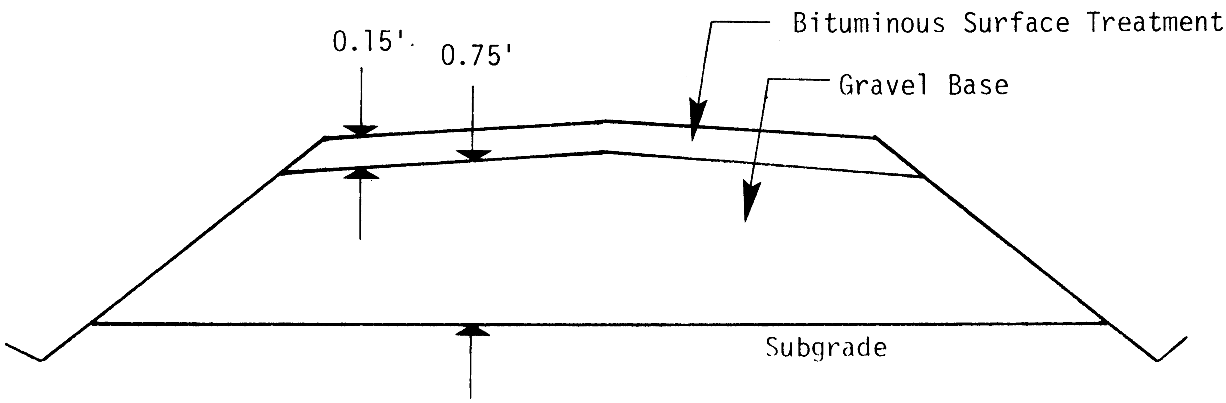


Figure 5. SR 172, MP 21.4-21.0 - Cross Section

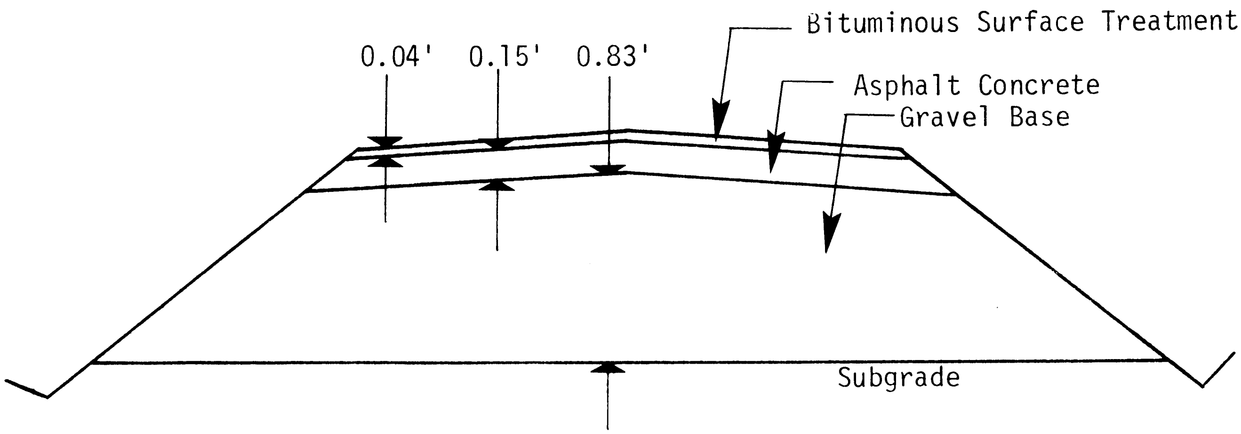


Figure 6. SR 174, MP 2.3-2.0 - Cross Section

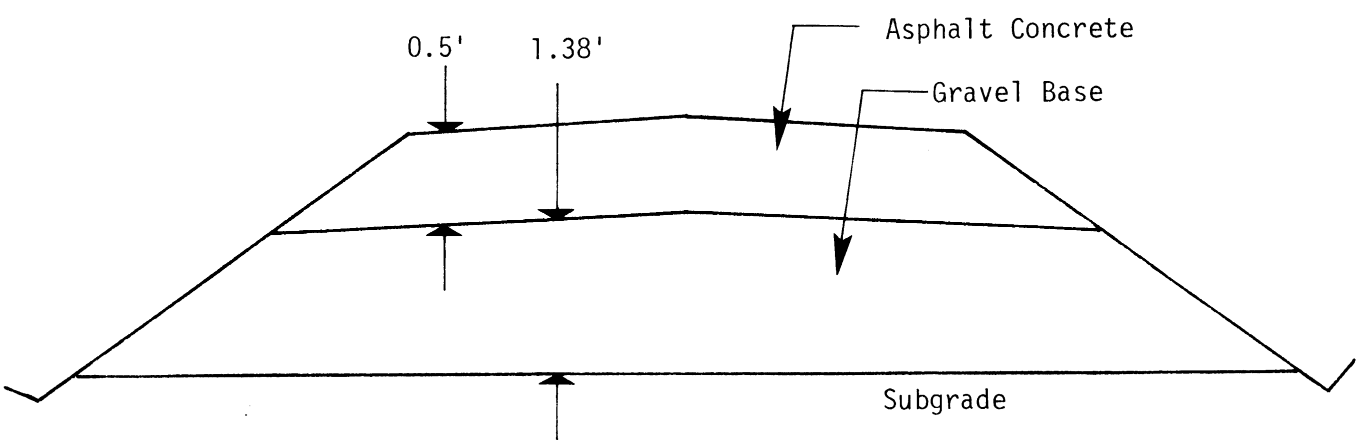


Figure 7. SR 2, MP 117.38-117.52 (Sunnyslope) - Cross Section.

were instrumented, as indicated in Table 3, with frost tubes to measure depth of freezing, and soil cells to measure subgrade and base course moisture contents and temperatures. Extensometers were installed at two sites to measure in situ structural bearing capacity. Paint marks were also placed on the pavement surface to facilitate repeatable deflection testing locations.

The University of Washington (UW) manufactured and/or assembled all instrumentation in the laboratory and the Washington State Department of Transportation (WSDOT) provided the drill rig and personnel to install the instrumentation in the field. The frost tubes, moisture sensors and extensometers were installed during December 1982 in below freezing temperatures and two feet (0.6 m) of snow cover (less than desirable conditions). Each instrument type is discussed below.

Frost Tubes

Generally it is recognized that if freezing temperatures penetrate a frost susceptible subgrade, the subsequent spring thaw results in lower subgrade strength [2].

In the past, frost depths were measured by drilling/digging holes adjacent to the pavement structure. This method, although accurate, was both costly and time consuming. Subsequently, starting with WSDOT District 1, a tube filled with methylene blue dye was constructed and inserted in the ground. When frozen the dye changed color which indicated the depth of freezing within a reasonable accuracy. The initial tubes built for this study often cracked due to repeated cycles of freezing and thawing. The dye then would leak out and the instrument would be left unusable. Modifications have since been made to allow for expansion within the tube when the water inside freezes.

The present frost tube apparatus (shown in Figure 8) consists of an outer opaque PVC tube with an inner diameter of one inch (2.54 cm) which is permanently installed in the ground. This outer tube houses the actual frost tube which is constructed of a rigid, clear polyethylene tube, 7/8 inches (2.2 cm) in outer diameter. Another hollow, flexible tube is placed within this polyethylene tube to allow for the expansion of the water upon freezing. The tube is then filled with Ottawa sand saturated by a 0.1% solution of methylene blue, a fluorecein dye. When thawed,

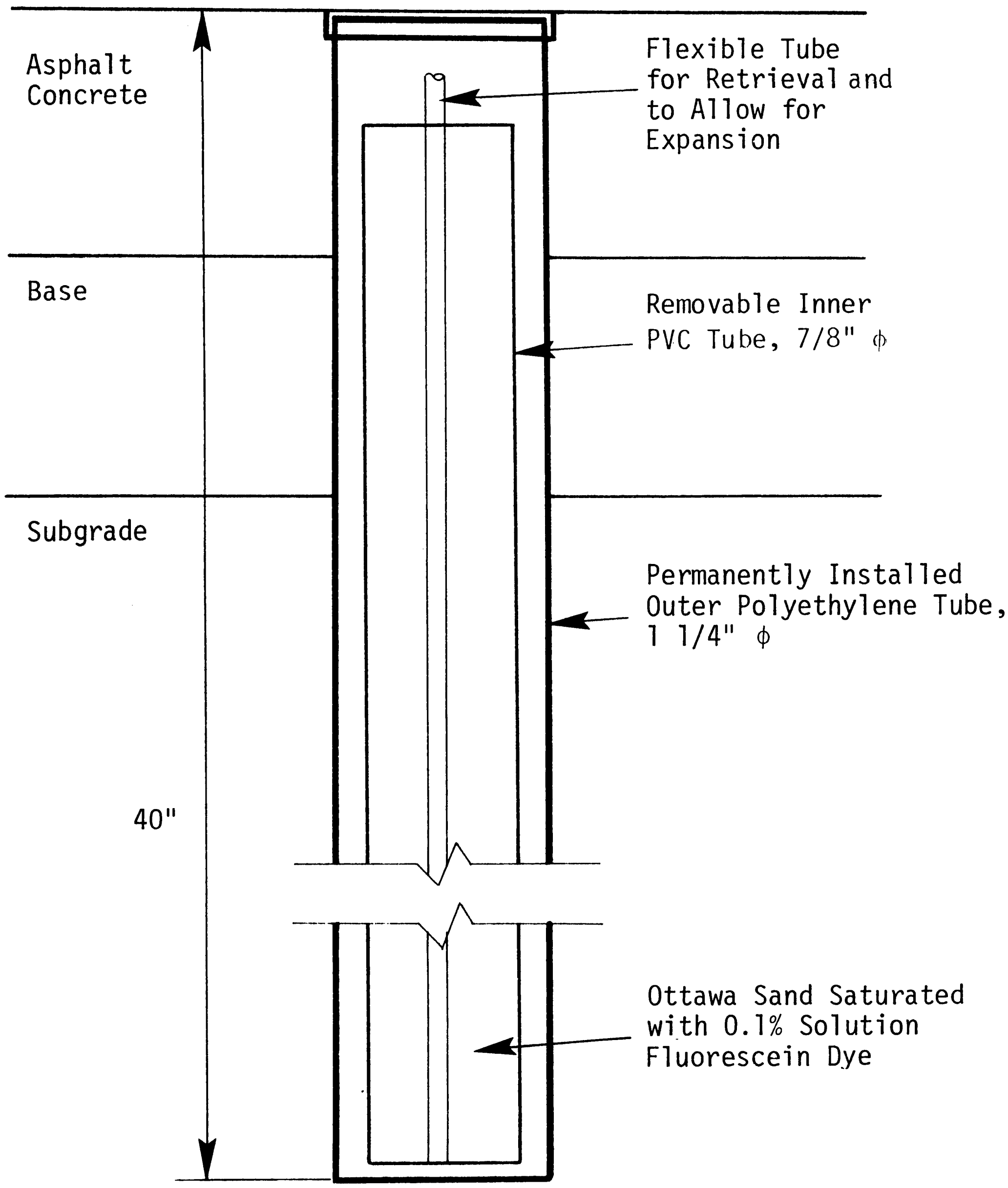


Figure 8. Schematic of In Situ Frost Tube.

this mixture is green in color. It changes to a pale, pinkish brown when frozen. These tubes can easily be read and are relatively inexpensive to construct.

The tubes were installed two inches (5 cm) below the pavement surface and along the fog stripe in order to make readings possible without interrupting traffic.

Soil Cells

Soiltest, Inc., MC-310A standard soil moisture-temperature cells were implanted in the subgrades of four of the sites at depths of four, three and two feet (1.2, 0.9, and 0.6 m) below the pavement surface and in the base course at a depth of one foot (0.3 m) to allow measurement of temperature and soil resistivity for determination of moisture content. (Figure 9 shows a typical site layout.) These cells were chosen for their relative ease of use, durability, low cost and wide range of sensitivity.

The cells are made up of two metal plates separated by a fiberglass binding which provides a coupling that varies with soil moisture content. Each cell has dimensions of approximately 1 x 1 1/2 x 1/8 inch (2.5 x 3.8 x 0.3 cm). A small thermistor is also contained within the cell to measure soil temperature. Each cell has color-coded six foot leads (1.8 m) and the leads are coded with numbers to distinguish one cell from another. A photograph of a soil cell is shown in Figure 10.

The resistivity and temperature of the soil are read using a Soiltest MC-300B moisture-temperature meter as shown in Figure 11. This meter is an alternating-current ohmmeter which is entirely self-powered. To obtain moisture contents from resistivity measurements, it is necessary to calibrate the cells and soils in the laboratory. (A description of the calibration procedure is presented in Appendix A.) In order to get accurate calibration curves, it is necessary to compact the soil sample used during calibration to the same dry density as the soil in which the cell is placed in the pavement structure. A typical curve of resistivity versus moisture content is shown in Figure 12. The laboratory calibration of the soil cells is straightforward; however, the density of the soil and carefully obtained weight measurements made in

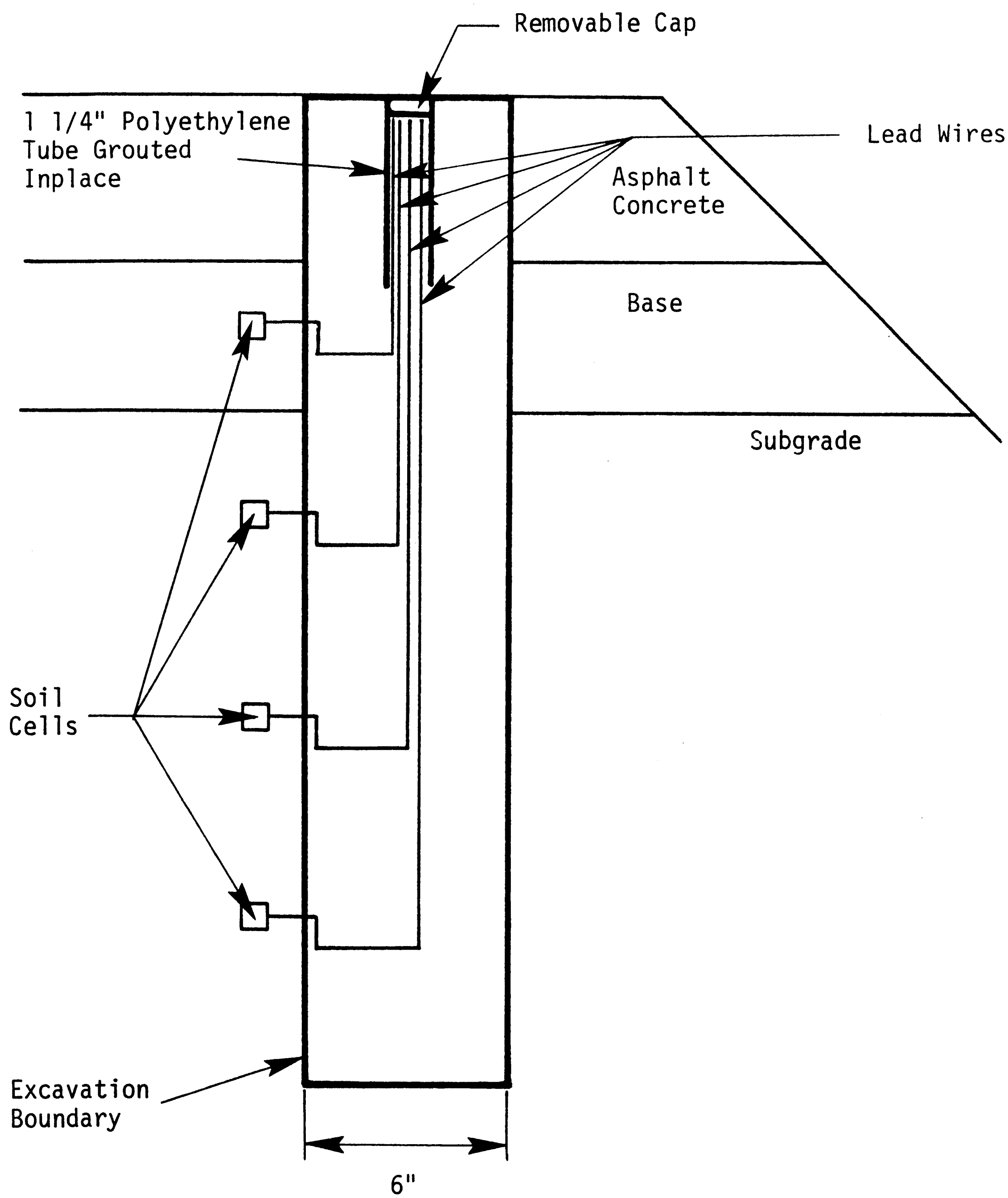


Figure 9. Typical Soil Cell Layout.

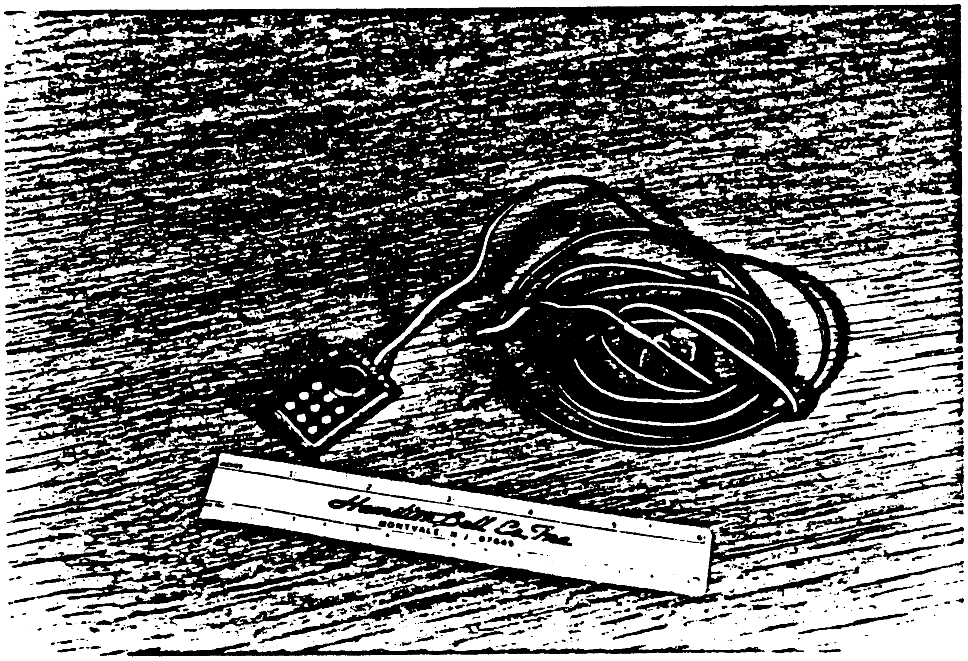


Figure 10. MC-310A Standard Soil Moisture-Temperature Cell.

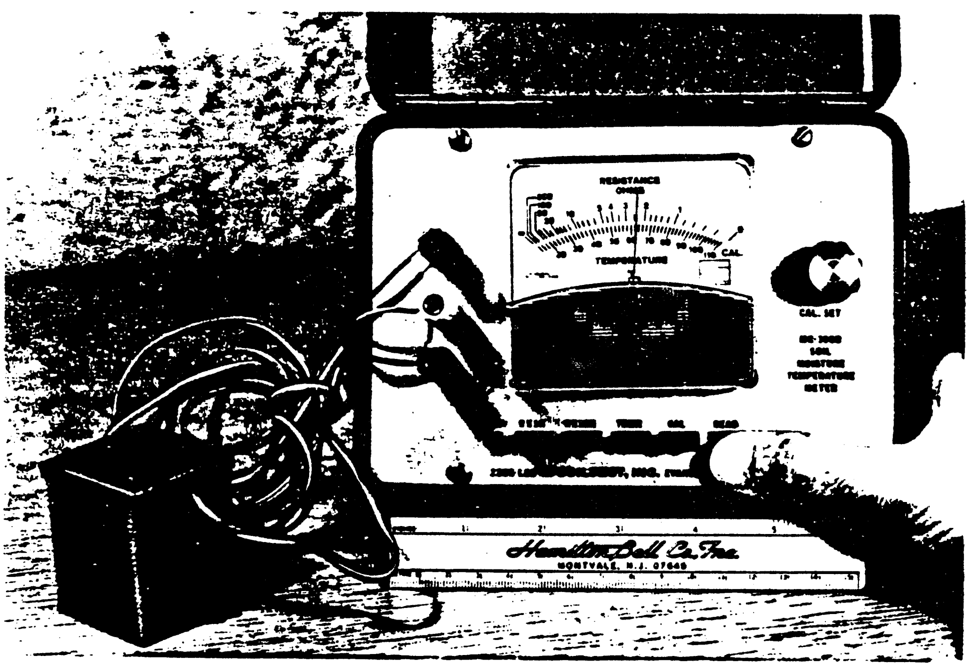


Figure 11. MC-300B Soil Moisture-Temperature Meter.

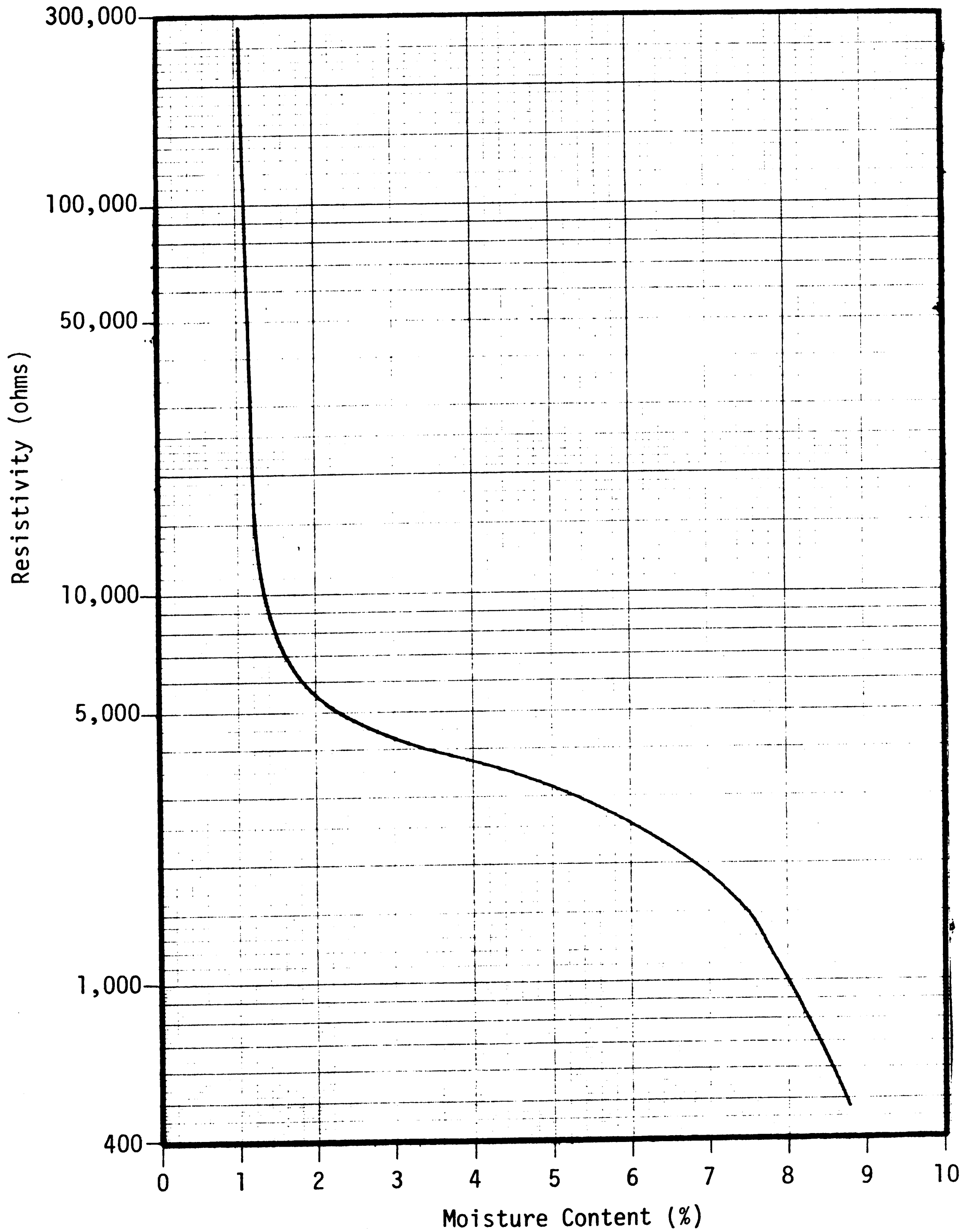


Figure 12. Typical Curve of Resistivity Versus Moisture Content.

the laboratory are critical for development of a functional calibration curve (resistivity versus moisture content).

The cells were also installed along the fog stripe, as were the frost tubes so that measurements could be made without excessively disrupting traffic.

Deflection Equipment

Extensometer

One of the best ways to measure in situ structural bearing capacity of pavements is to measure in situ deflections. There are presently several ways to perform deflection tests, including: Benkelman Beam, Falling Weight Deflectometer, Dynaflect, Road Rater, etc. Each of these machines specialize in one particular aspect of the overall load-deflection relationship. There is no machine currently available which takes into account all possible variables that go into load-deflection relationships. For example, a Benkelman Beam measures only the rebound deflection in an almost static loading situation. The Falling Weight Deflectometer measures dynamic deflections from 3 to 24 kip (1.4 to 10.8 kg) loadings and simulates a vehicle moving at speeds greater than 30 mph (13.4 m/s) but is unable to simulate the rotation of principal stresses which actually takes place due to a moving vehicle. There is a need to measure in situ deflections that take into account all the variables. An extensometer (Figure 13) is capable of doing just that.

One advantage of the extensometer is that deflections under actual tire prints and varying loads can be measured. The limitation of the extensometer is that it measures deflection only at one point (the point where it is installed).

The typical extensometer used in this study consists of two 1-inch Bison coils (2.54 cm) placed parallel to each other in a modular PVC tube six feet (1.8 m) in length. Each coil is attached to a steel rod, one rod is fixed (lower rod) and the other of which is allowed to moved freely (upper rod). The idea of placing sensors (coils) parallel to each other is to relate the electromagnetic coupling between the coils to the spacing between them. This is done by the introduction of an inductance bridge wherein an output voltage as a function of strain is obtained,

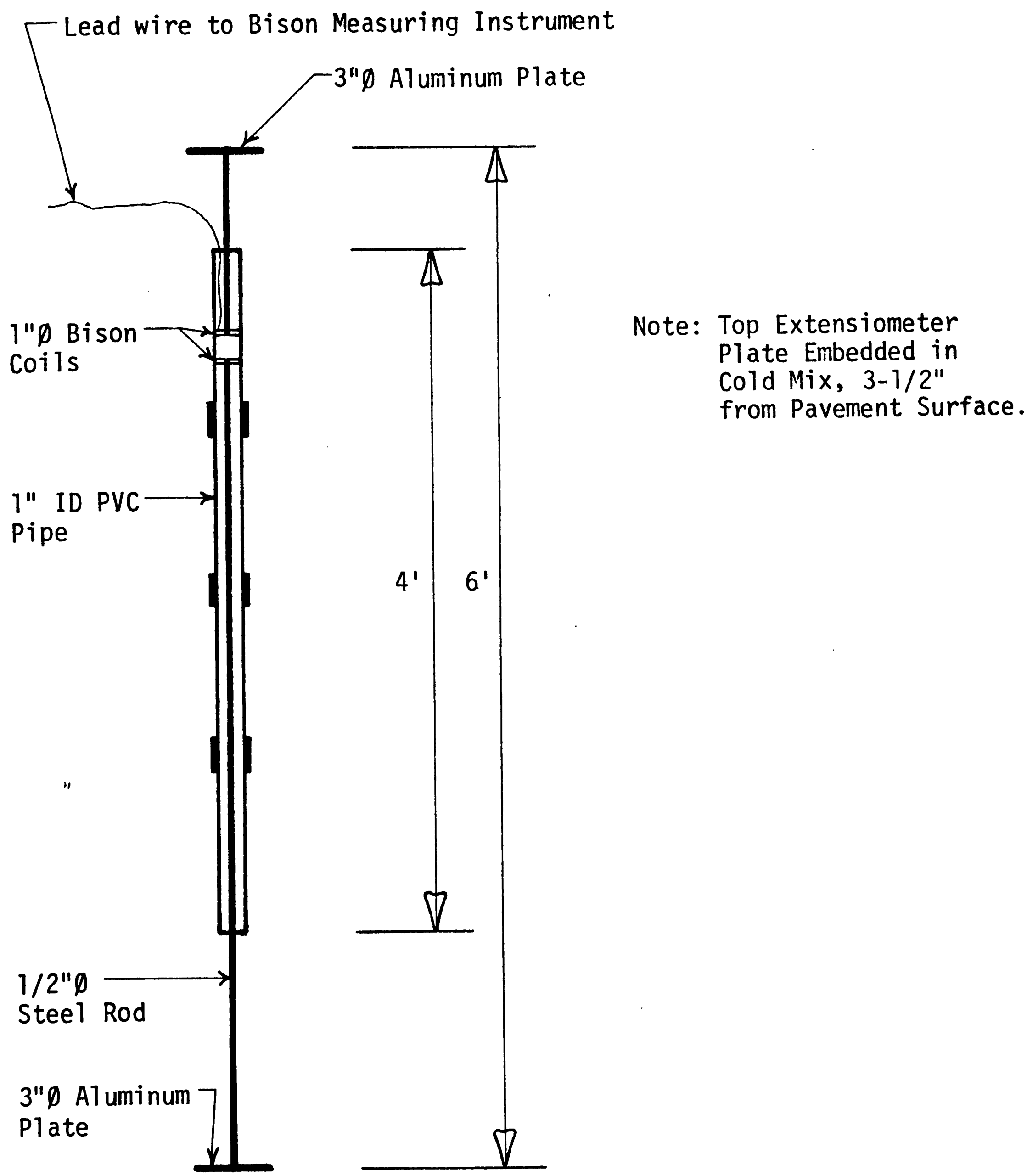


Figure 13. Schematic Drawing of Extensometer

since a change in spacing from the initial spacing produces a bridge unbalance.

The external instrument package to which the sensors are connected contains all the necessary driving, amplification, balancing, read out and calibration controls and is self-powered. This instrument is manufactured by BISON Instruments, Inc. and is pictured in Figure 14.

The extensometers were calibrated in the laboratory before installation at the site.

Falling Weight Deflectometer (FWD)

The FWD is a device that measures dynamic deflections under a peak force magnitude of up to 24,000 lbs (10,900 kg). By virtue of the incorporation of a variable falling mass/buffer system, loads as low as 1,500 lbs (680 kg) are also possible. The associated electronic package is used to read the peak values of the applied plate pressure (stress) and seven deflection bowl readings simultaneously. The duration of the load pulse is normally "buffered" between 23 and 30 milliseconds, but other loading times are also possible. The standard loading plate, equipped with a small hole in the center for center deflection readings, is 11.8 inches (300 mm) in diameter. See Figure 14 for a schematic of an FWD. Figure 15 shows a photograph of a FWD and a corresponding sketch.

FWD deflections were taken at 50 ft. (15 m) intervals at each test site during most site visits. Four stress levels (drop heights) were used so that material stress sensitivities could be calculated.

Benkelman Beam

The Benkelman Beam is a device which measures maximum pavement deflection (actually pavement surface rebound) under static conditions. It is constructed of a long beam designed so that the tip can be placed between the dual tires on a single rear axle, dual tire truck. A dial gage attached to a reference point is used to measure pavement rebound. A standard load of 18,000 lbs (8,200 kg) is generally used [3]. (See Figure 16 for a schematic of a Benkelman Beam.)

The University of Washington Soiltest Benkelman Beam was used to gather deflections, and for comparison to extensometer data during some of the site visits.

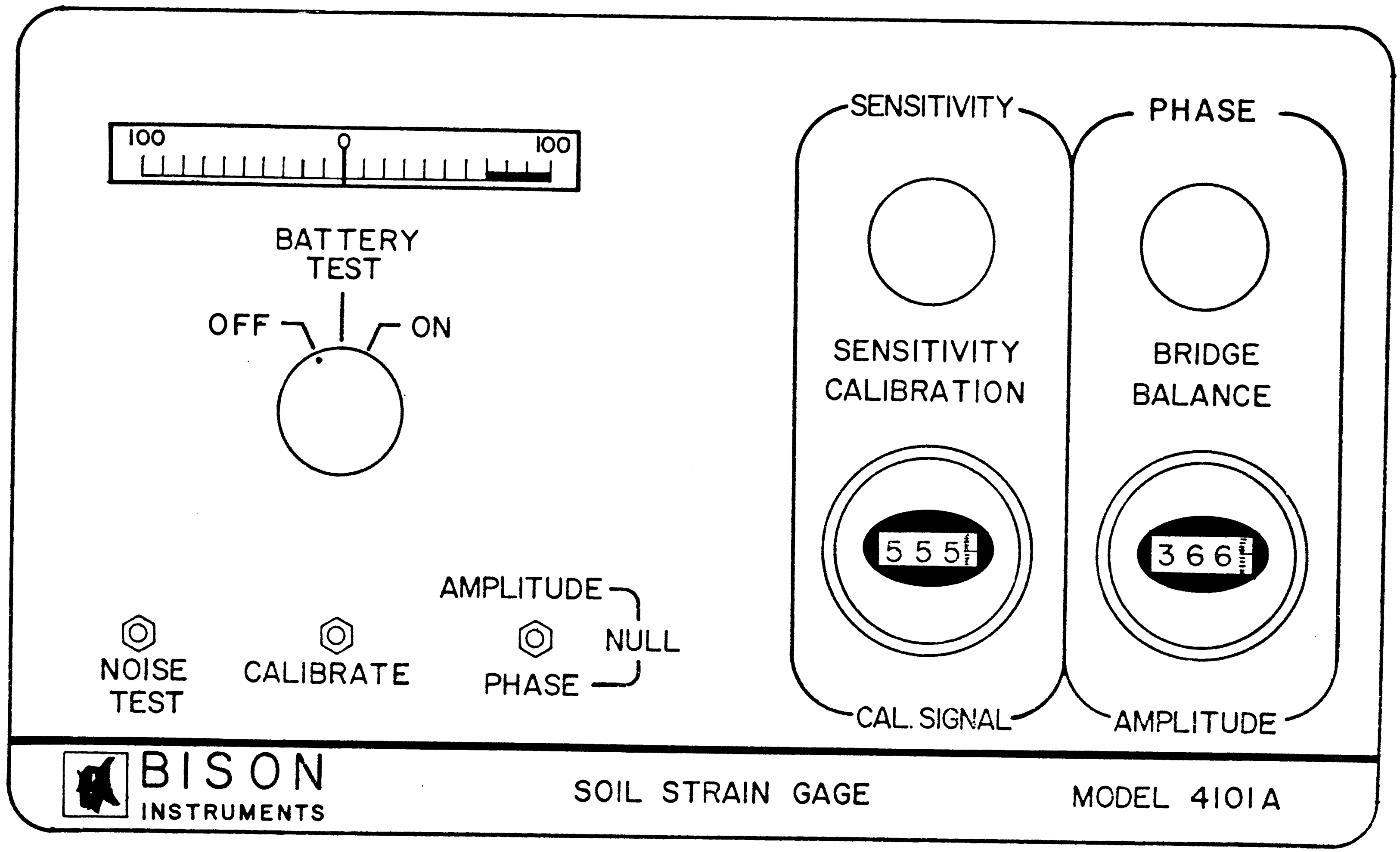


Figure 14. Front Panel of Bison Instrument.

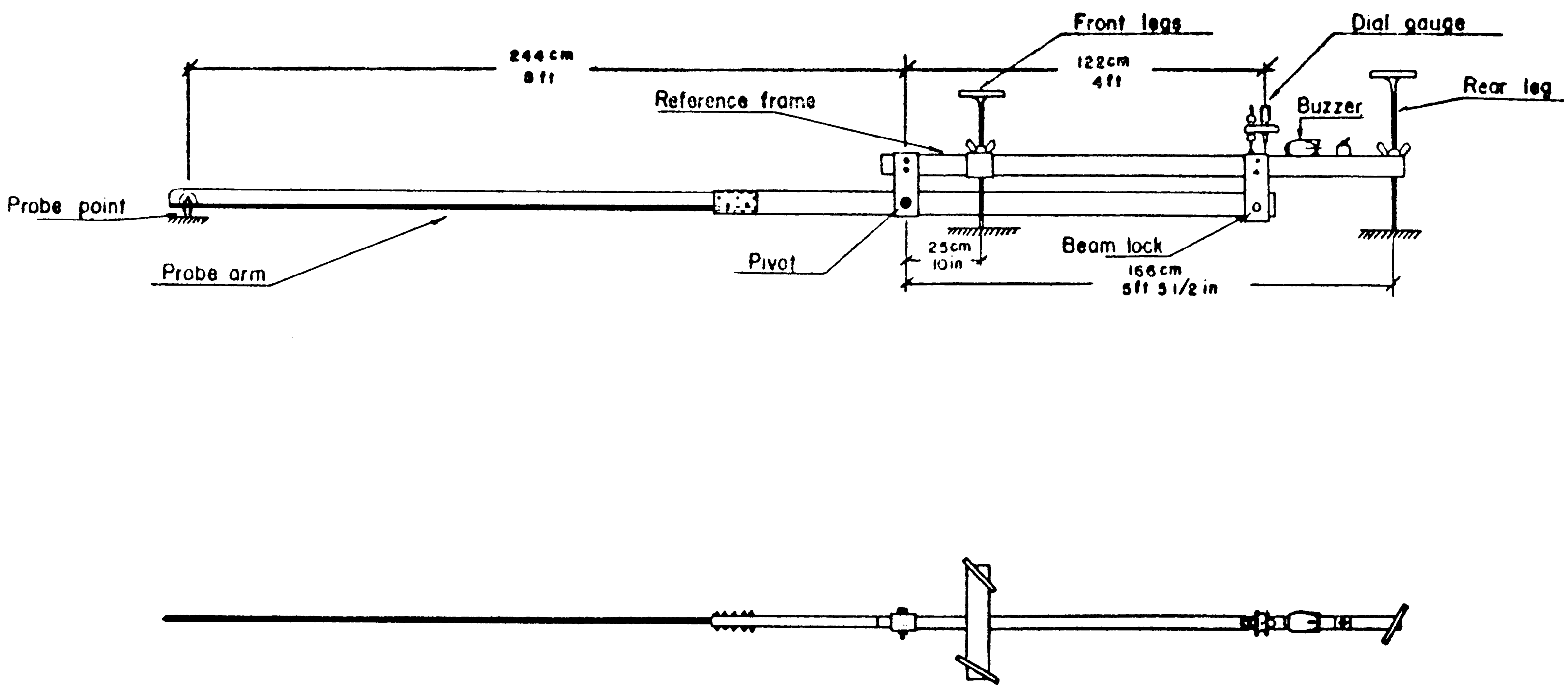
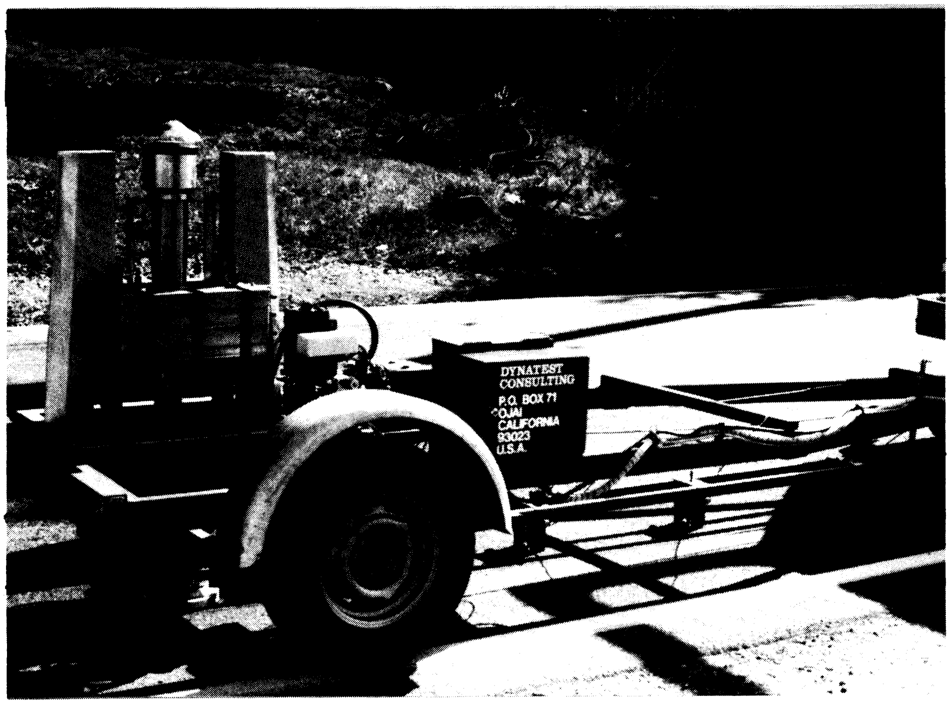
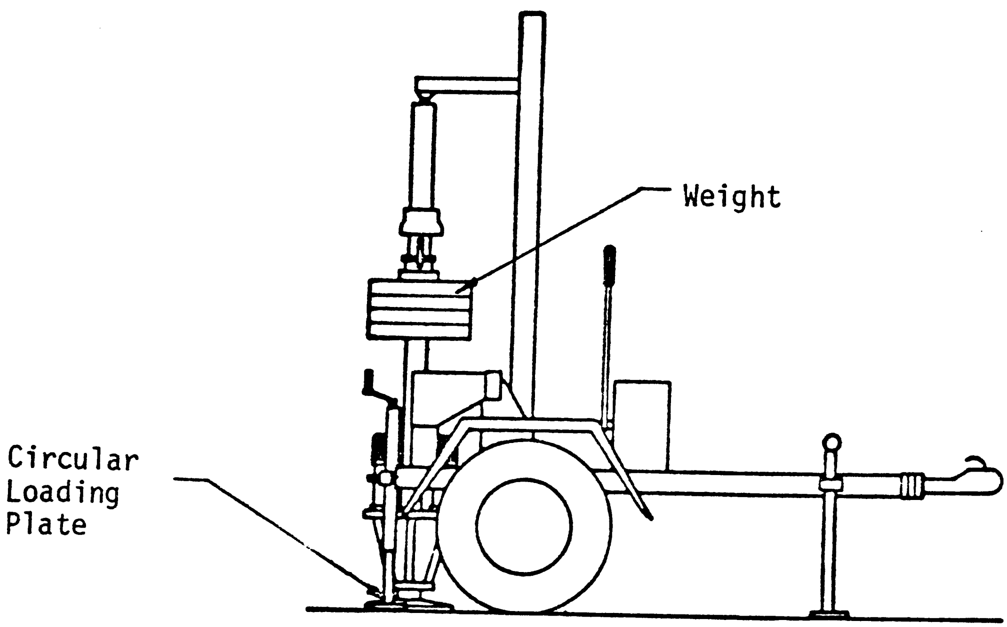


Figure 16. Schematic of a Benkelman Beam



(a) Photograph of a Falling Weight Deflectometer.



(b) Sketch of a Falling Weight Deflectometer.

Figure 15. Illustrations of a Falling Weight Deflectometer.

To facilitate repeatability of the location of deflection measurements (both FWD and Benkelman Beam, and hence comparisons of deflections between visits), paint marks were placed on the roadway at 50 ft. (15 m) intervals. Measurements were taken in the outer wheel path at each point during the site visits.

DATA COLLECTED

Field data was collected at the six sites over a 15 month period beginning in January of 1982, with special emphasis on the spring thaw periods. The following data were collected during some or all site visits:

1. surface pavement deflection using the FWD and/or Benkelman Beam,
2. extensometer readings,
3. pavement temperature,
4. subgrade and base course temperature,
5. soil cell resistivity, and
6. frost penetration depth.

Table 4 provides a summary of the site visit dates and data collected for each of the six test sites.

Table 4. Site Visit Dates and Data Collected for the Six Test Sites

Site	Date	FWD Deflections	Benkelman Beam Deflection	Extensometer Readings	Pavement Temperature Measurement	Soil Cell Moisture and Temperature Readings	Frost Depth Checked
SR 97 MP 183.48	02/23/83	X	X		X	X	X
	03/04/83	X	X		X	X	X
	03/09/83	X	X		X		X
	03/18/83	X	X		X	X	X
	03/24/83	X	X		X	X	X
	08/11/83					X	
	08/16/83	X			X	X	
	01/11/84	X			X	X	X
	01/17/84					X	X
	01/31/84	X			X	X	X
	02/21/84	X			X	X	X
	02/29/84					X	X
	03/06/84	X			X	X	
	03/19/84	X			X	X	X
SR 2 MP 159.6	02/24/83	X	X		X	X	X
	03/03/83	X			X	X	X
	03/09/83	X			X		
	03/17/93	X	X		X	X	X
	03/24/83	X	X		X	X	X
	08/10/83					X	
	08/17/83	X			X		
	01/10/84	X			X	X	X
	01/31/84					X	X
	02/22/84	X			X	X	X
	03/01/84	X			X	X	X
	03/09/84	X			X	X	X
	03/20/84	X			X	X	X

Table 4. Site Visit Dates and Data Collected for the Six Sites (cont.)

Site	Date	FWD Deflections	Benkelman Beam Deflection	Extensometer Readings	Pavement Temperature Measurement	Soil Cell Moisture and Temperature Readings	Frost Depth Checked
SR 2 Sunnyslope	02/23/83	X	X	X	X	X	X
	03/04/83	X	X	X	X	X	X
	03/09/83	X			X		
	03/18/83	X	X	X	X	X	X
	03/24/83	X	X	X	X	X	X
	08/11/83					X	
	08/16/83	X			X		
	01/11/84	X			X	X	X
	01/17/84					X	X
	01/31/84	X			X	X	X
	02/21/84	X			X	X	X
	02/29/84	X			X	X	X
	03/06/84	X			X	X	
	03/19/84	X	X	X	X	X	X
SR 172 MP 2.0	02/24/83	X			X		
	03/03/83	X			X		
	03/09/83	X			X		
	03/17/83	X			X		
	08/17/83	X			X		
	01/10/83	X			X		
	03/01/84	X			X		
	03/07/84	X			X		
	03/20/84	X			X		
SR 172 MP 21.4	02/24/83	X			X		
	03/03/83	X			X		
	03/09/83	X			X		
	03/17/83	X			X		
	08/17/83	X			X		
	01/10/84	X			X		
	03/01/84	X			X		
	03/07/84	X			X		
	03/21/84	X			X		

Table 4. Site Visit Dates and Data Collected for the Six Sites (cont.)

Site	Date	FWD Deflections	Benkelman Beam Deflection	Extensometer Readings	Pavement Temperature Measurement	Soil Cell Moisture and Temperature Readings	Frost Depth Checked
SR 174 MP 2.0	02/24/83	X	X	X	X	X	X
	03/03/83	X	X	X	X	X	X
	03/09/83	X			X		
	03/17/83	X	X	X	X	X	X
	03/24/83	X	X	X	X	X	X
	08/09/83	X			X	X	
	01/10/84	X			X	X	X
	01/17/84						X
	01/31/84				X	X	X
	02/23/84					X	X
	03/01/84	X			X	X	X
	03/07/84	X			X	X	X
	03/20/84	X	X	X	X	X	X

CHAPTER III

DATA COLLECTION RESULTS

In this chapter the data that were collected, both field and laboratory, are presented and summarized. This includes deflection data, subgrade and base course moisture contents, frost depths, weather data and resilient modulus data. It should be noted that the data was collected as a joint effort between the UW and WSDOT.

DEFLECTION DATA

Two types of surface deflection data were collected at the six test sites, Benkelman Beam data and Falling Weight Deflectometer (FWD) data. In situ deflection data was measured using extensometers.

Benkelman Beam Deflections

Benkelman Beam was proposed to be the method for collecting deflection data prior to the acquisition of the Falling Weight Deflectometer by WSDOT. The FWD was however, available before the beginning of data collection. Thus, the Benkelman Beam data was collected during the Winter and Spring of 1983 (and to a lesser degree during March 1984). Previous, earlier work by WSDOT indicates a correlation of 1:1 to exist between the Benkelman Beam and the FWD [4]. The Benkelman Beam Data is summarized in Table E1 in Appendix E.

The Benkelman Beam was also used to measure deflections on the extensometer and is discussed in that context later in this chapter.

Falling Weight Deflectometer Deflection Data

The FWD, as stated earlier, measures both maximum pavement deflection (the first sensor deflection) and the pavement deflection basin. The maximum pavement deflection averaged over the test section and normalized to a 9,000 lb (4,000 kg) load is plotted versus time in Figures 17 through 23. Also shown on these plots, where measured, is the base and subgrade moisture content variation with time. The maximum pavement deflections were calculated for a "standard" 9,000 lb (4,000 kg) FWD load to enable a "standardized" presentation of such data in Figures 17 through 23.

As indicated in these figures, spring was indeed the period of highest deflection, and was therefore the time when the pavement was

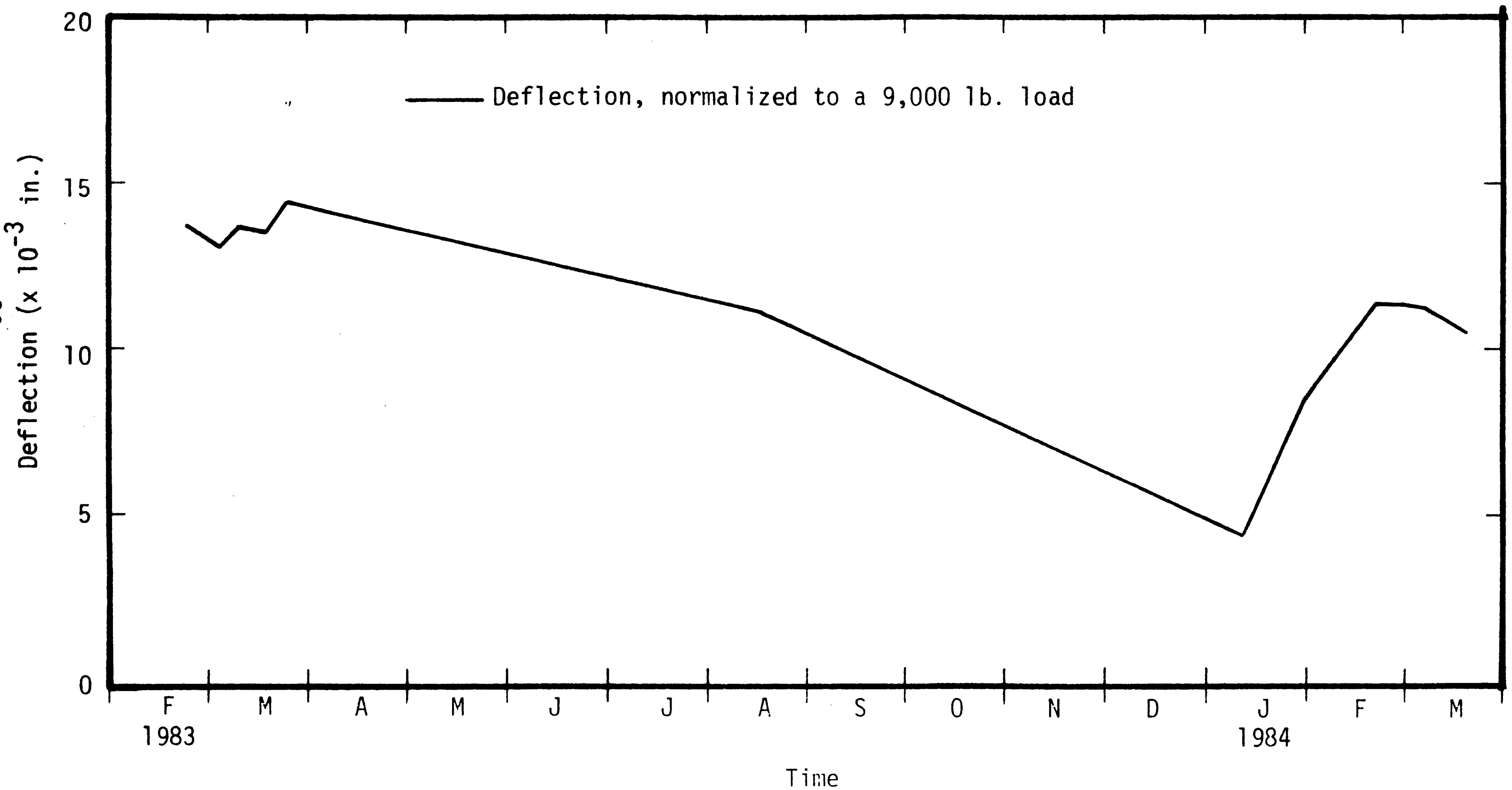


Figure 17. SR 97, MP 183.48 - Plot of FWD First Sensor Deflection Versus Time.

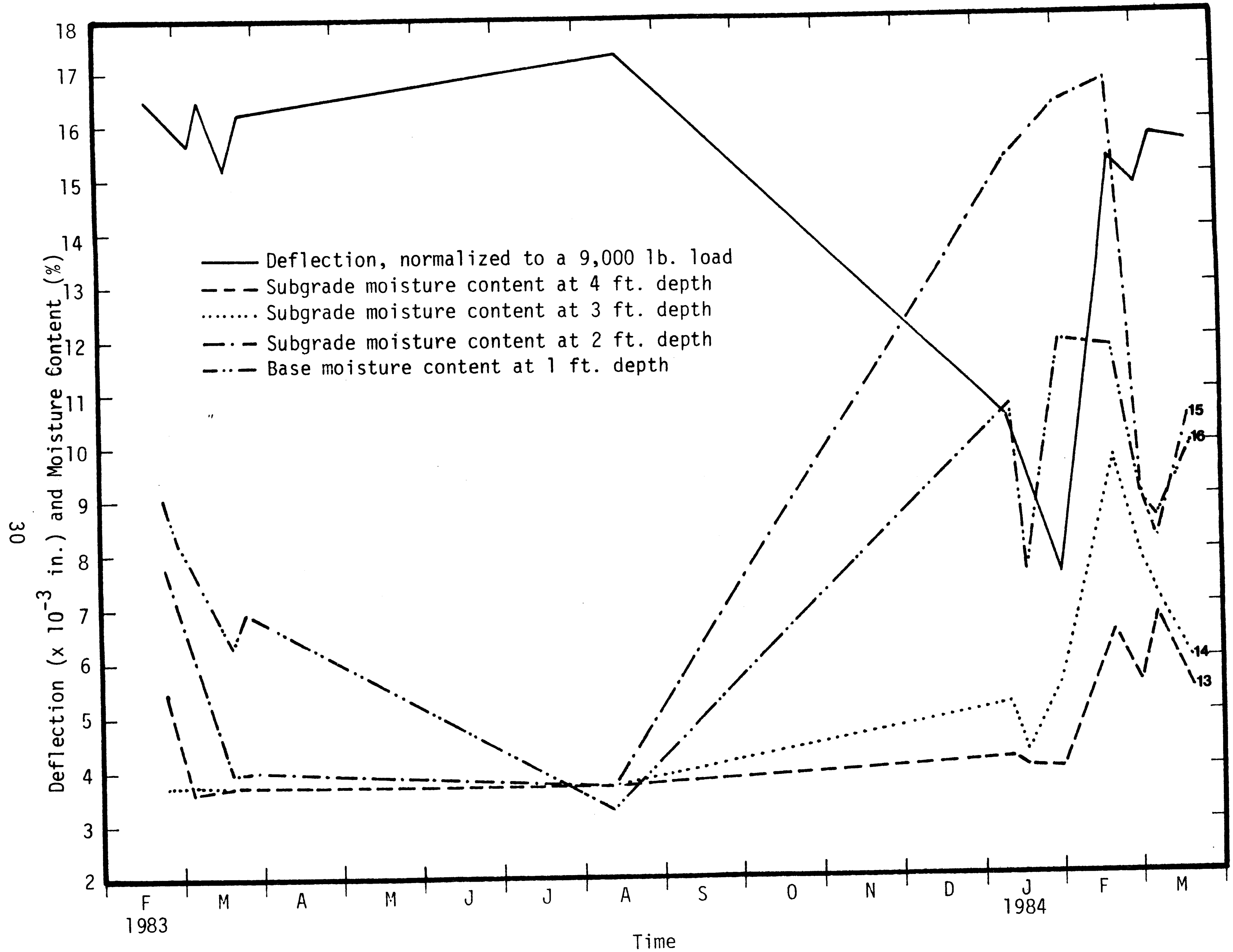


Figure 18. SR 2, Sunnyslope - Plot of FWD First Sensor Deflection and Base and Subgrade Moisture Contents (near MP 117.4) Versus Time.

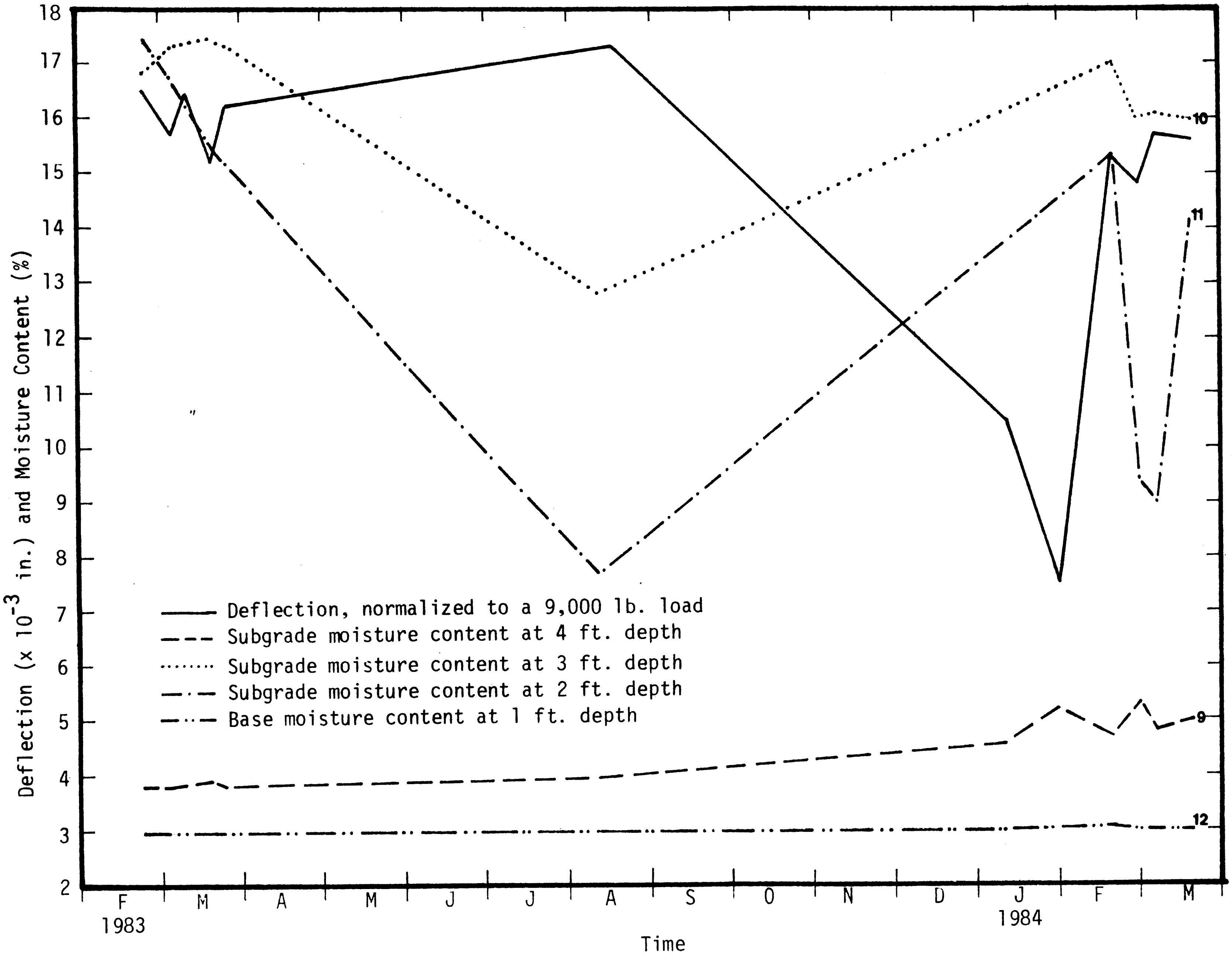


Figure 19. SR 2, Sunnyslope - Plot of FWD First Sensor Deflection and Base and Subgrade Moisture Contents (near MP 117.6) Versus Time.

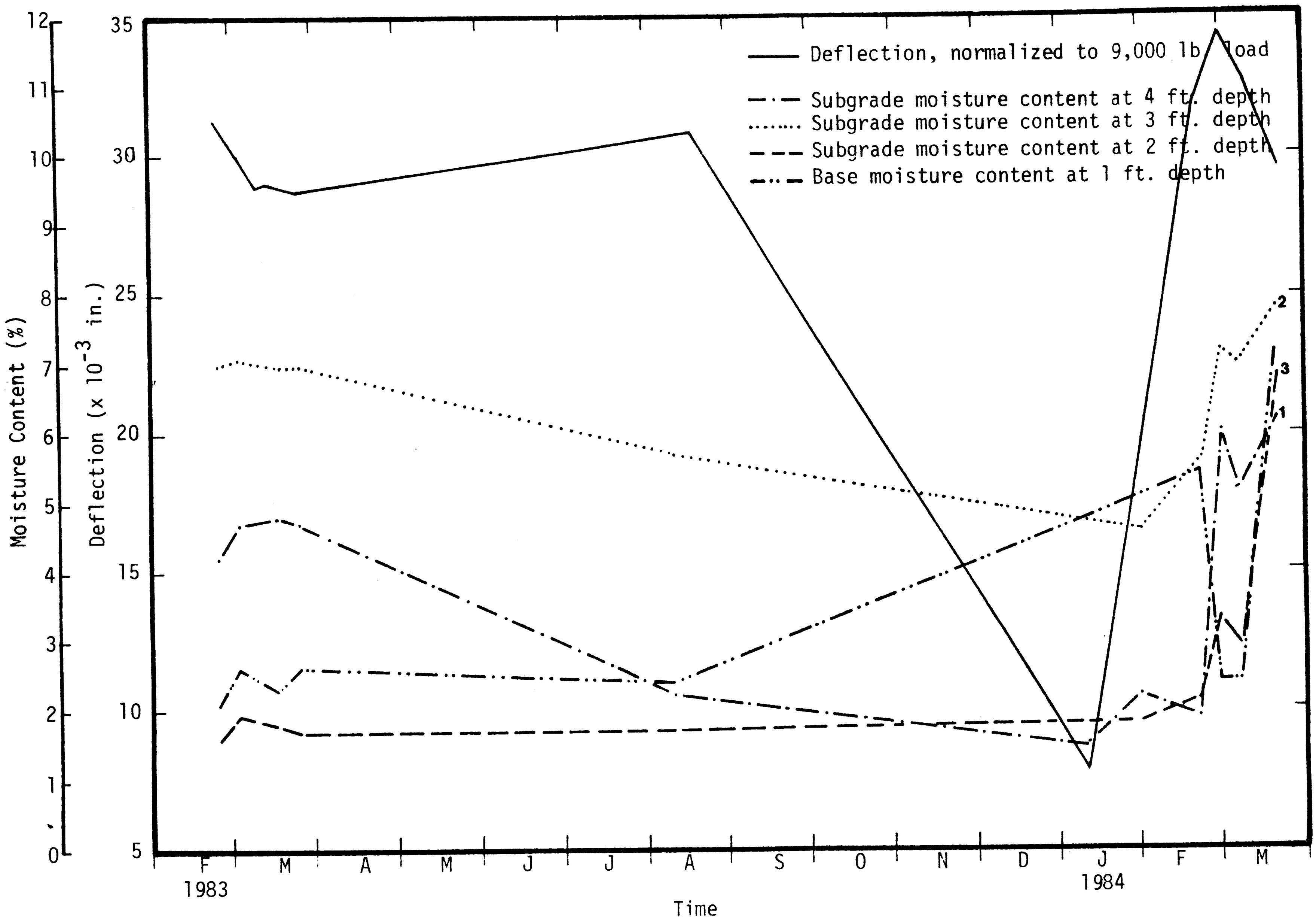


Figure 20. SR 2, MP 159.6 - Plot of FWD First Sensor Deflection and Base and Subgrade Moisture Contents Versus Time.

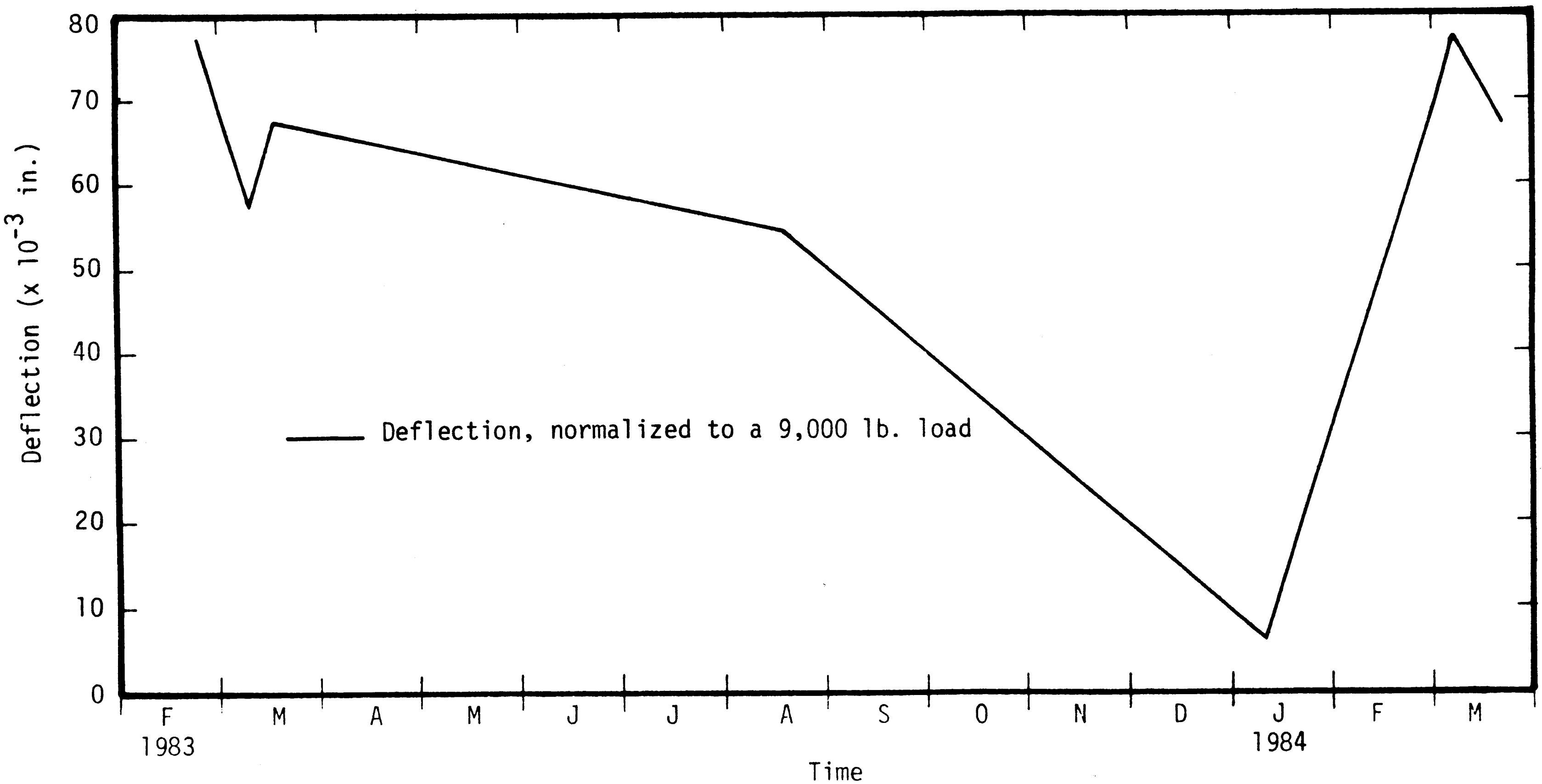


Figure 21. SR 172, MP 2.0 - Plot of FWD First Sensor Deflection Versus Time.

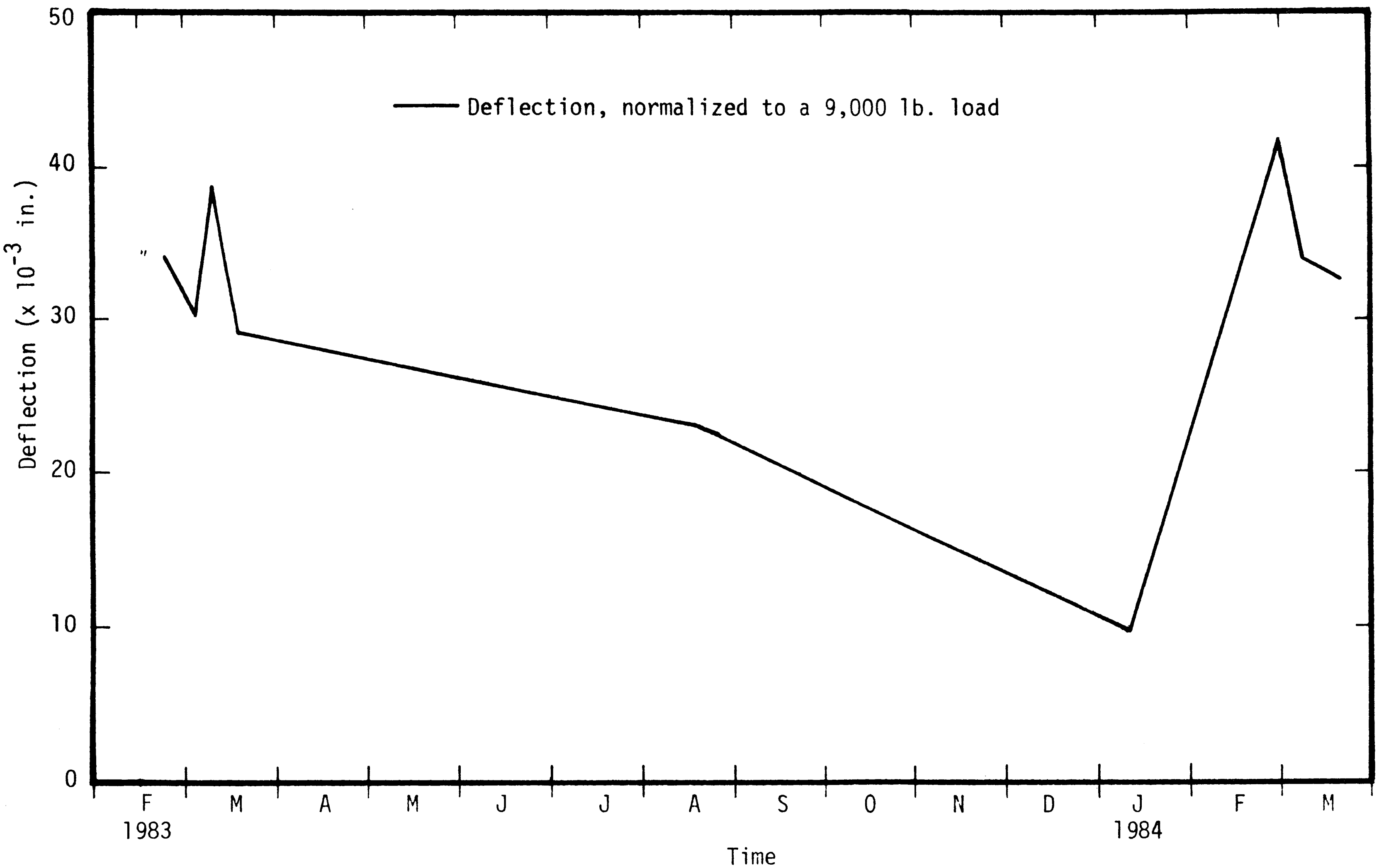


Figure 22. SR 172, MP 21.4 - Plot of FWD First Sensor Deflection Versus Time.

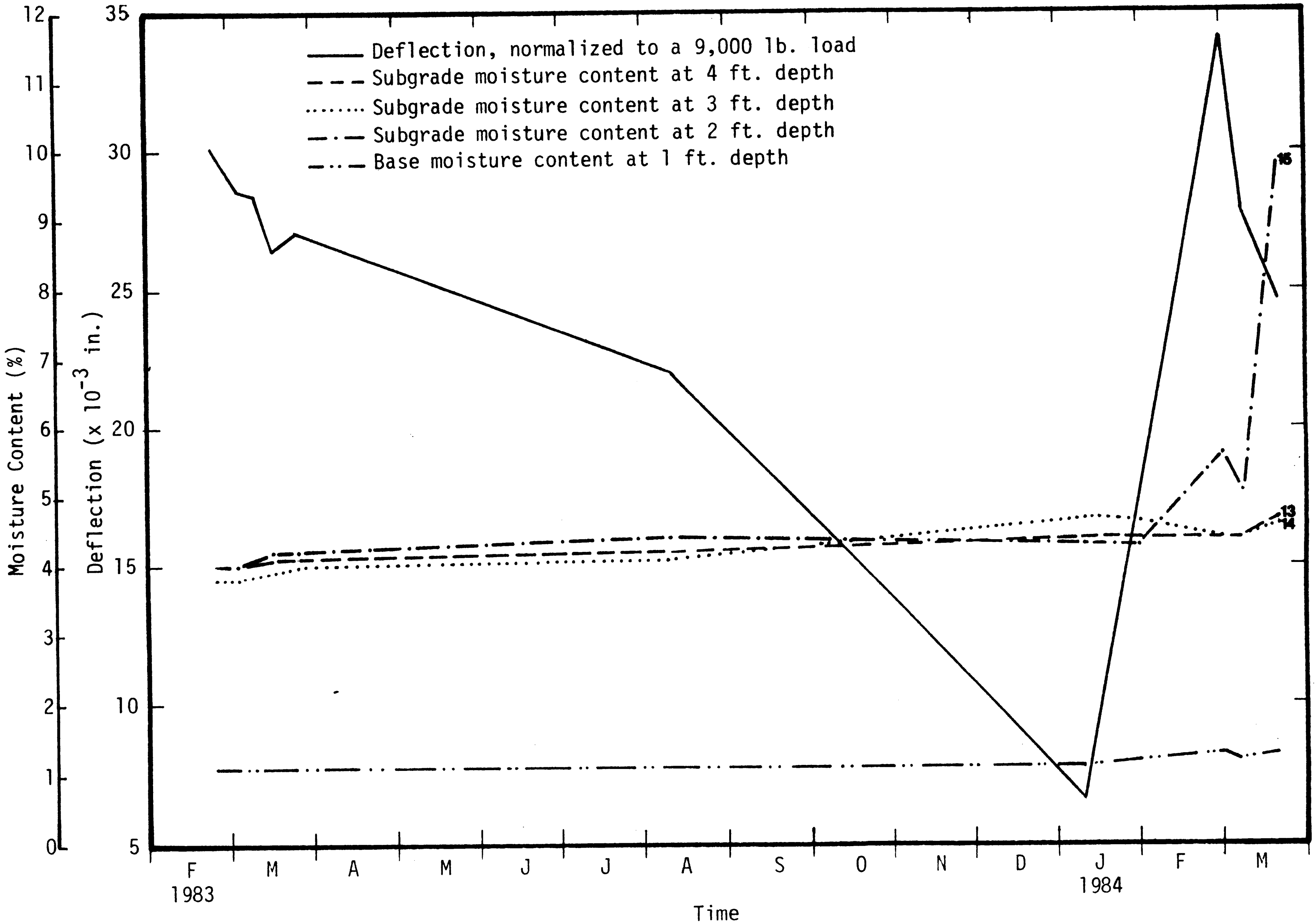


Figure 23. SR 174, MP 2.0 - Plot of FWD First Sensor Deflection and Base and Subgrade Moisture Contents Versus Time.

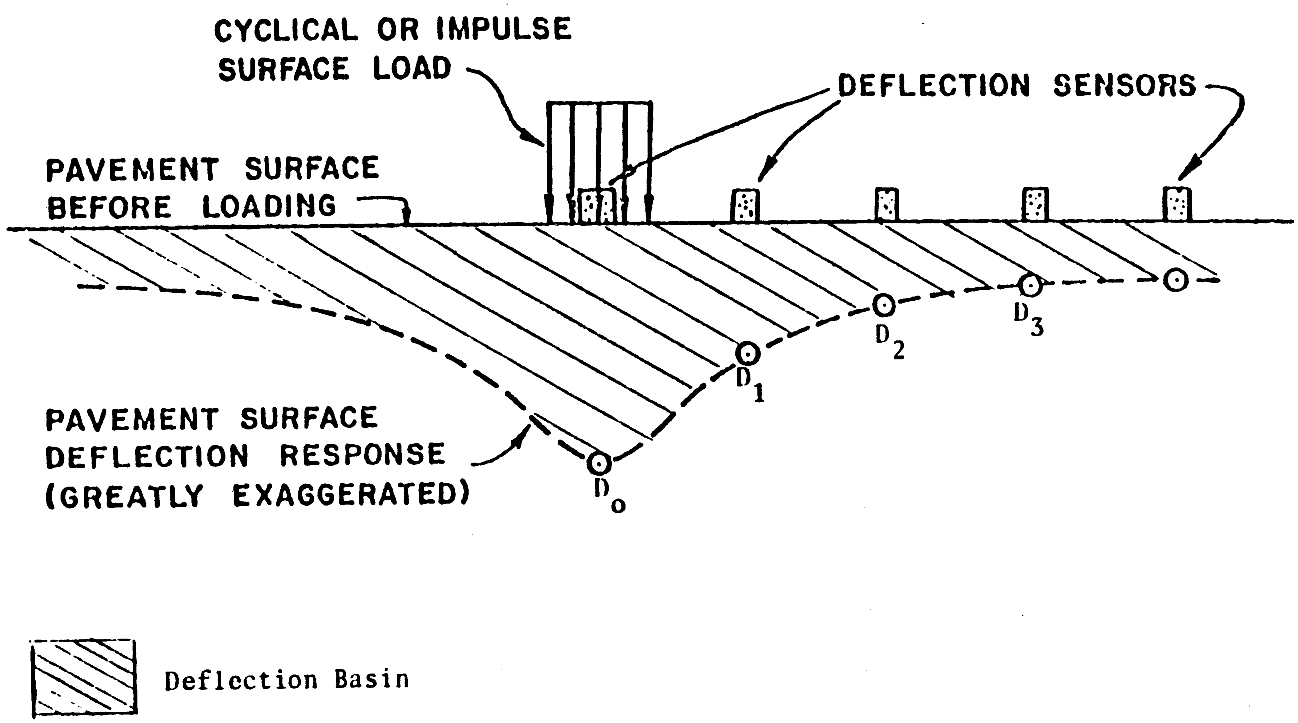
weakest structurally, as expected. The only exception to this was SR 2, Sunnyslope, where the summer deflection was the maximum deflection. This may be due to the high temperature on the day of summer testing (99°F) and the poor asphalt concrete condition (extensive alligator cracking). The deflections for 1984 in all cases reached a maximum value in late February or early March 1984 and had decreased from that maximum at the last site visit made about March 20, 1984.

It is also interesting to note that during January 1984 the pavement deflections at all sites were very low, as low as 8% (for SR 172, MP 2.0) of the maximum value recorded. It appears that the pavement structure was frozen at that time, as is indicated by the soil cell temperatures.

One problem with plots such as these shown in Figures 17 through 23 is that deflection measurements are taken only a few times per year and straight lines are drawn between the points. These lines mask the actual variation in deflection that occurred during the time period evaluated. It is important to realize these figures show only general trends.

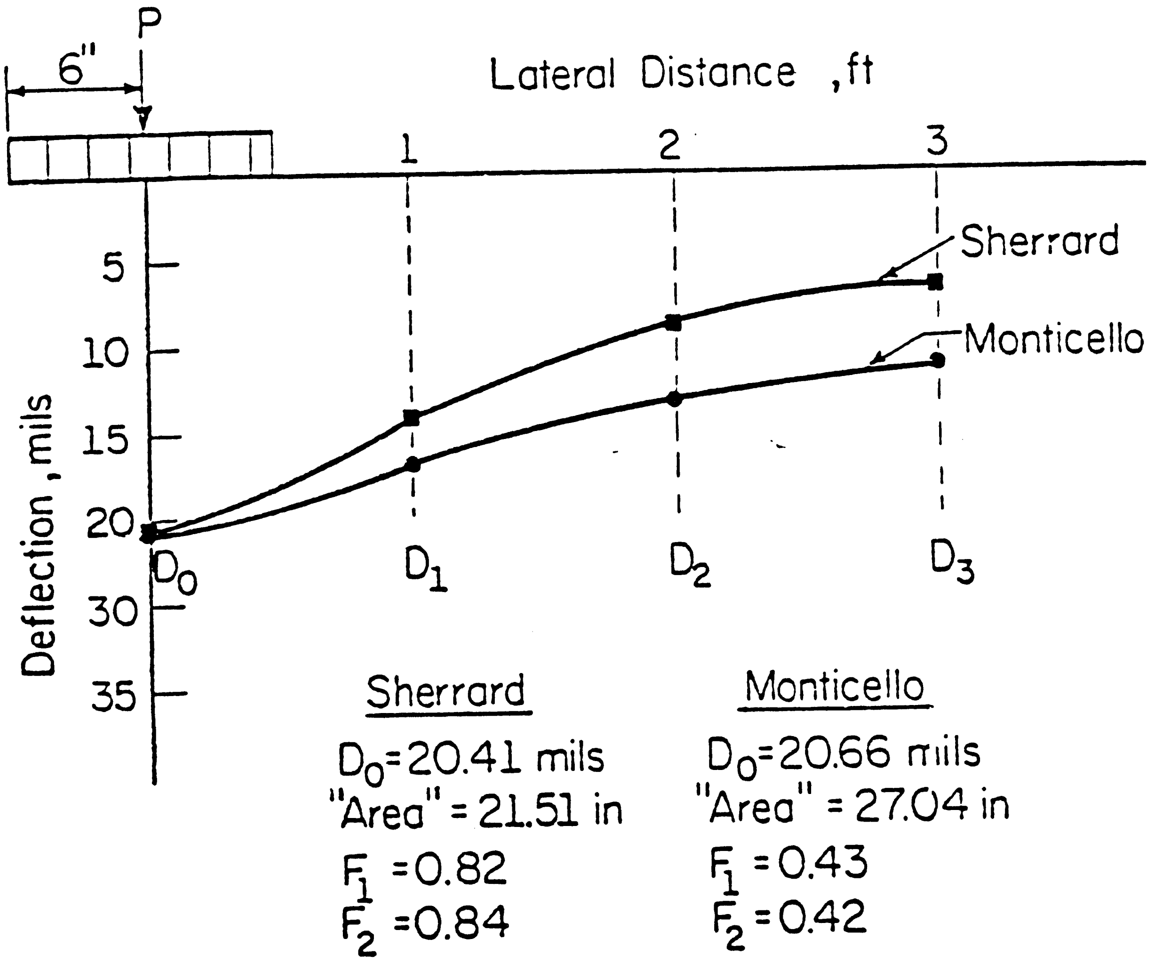
The deflection basins measured by the FWD are important as they can be used to backcalculate the moduli of the various pavement layers. Several researchers, including Vaswani, Scrivner et. al, Moore, Hoffman and Thompson, and Cogill use deflection basins in their pavement evaluation methods [5]. A typical deflection basin is shown in Figure 24.

To show the importance of the use of a deflection basin, versus the use of only maximum pavement deflection, to evaluate a pavement section, an example will be presented. Figure 25 shows recorded deflection basins for two sections. The sections had nearly identical maximum deflections. Using the mechanistic technique developed by Hoffman and Thompson [5] and a basin parameter termed the "area", the moduli of the two sections were calculated. It can be seen that the moduli of the Monticello section were about four times larger than the moduli of the Sherrard section. Without the benefit of the deflection basin data, and based only on maximum pavement deflection, these two sections would have been erroneously assumed to be structurally equivalent. The use of the FWD data collected during this study to determine material properties at the sites is discussed in Chapter 4.



D_0, D_1, D_2, D_3 - Used by Hoffman and Thompson [5] to Denote FWD Deflections

Figure 24. Deflection Basin Schematic (after Ref. 6).



BACKCALCULATED MATERIAL PROPERTIES

Sherrard	Monticello
E_1/E_2 = 8	E_1/E_2 = 45
E_1 = 75,000 psi	E_1 = 288,000 psi
E_2 = 9,400 psi	E_2 = 6,400 psi

Figure 25. Road Rater Deflection Basins and Backcalculation of Material Properties (after Ref. 5.).

Deflection basin shape can also be used to provide information about the pavement structural strength characteristics. In general [7]:

1. a concave shape indicates a weak surface,
2. a convex shape indicates a weak subgrade,
3. a steep slope indicates general weakness,
4. a flat slope indicates strength,

Two average deflection basins for each test section were chosen for plotting in Figures 26 through 31. They were the basin measured during the summer and the basin with the highest maximum pavement deflection (spring). These basins, for comparative purposes, were normalized to a basin under a 9,000 lb (4,000 kg) FWD load.

With the exception of SR 2, Sunnyslope and SR 2, MP 159.6 there were substantial differences between the spring and summer deflection basins, particularly within the first five sensors (at 0, 7.87, 11.81, 17.71 and 25.59 inches (0, 200, 300, 450 and 650 mm) from the center of the load). This suggests that the main difference in strength for most of the sections occurred in the surface and base course with little variation occurring in the subgrade.

Extensometer In Situ Deflection Data

The extensometer data was collected using a standard "Benkelman Beam truck" with dual tires on a single rear axle and a rear axle weight of 18,000 lbs.(8,200 kg). At the same time the extensometer reading was obtained, a corresponding Benkelman Beam reading was taken.

Calibration curves were used to convert the change in voltage to a deflection. The results are presented in Table 5. At the SR 2, MP 117.38 (Sunnyslope) site the extensometer deflection readings and associated Benkelman Beam deflections were within about 25% of one another. At the SR 174 site there was a much higher variation between the two deflections. Overall however, the comparisons are favorable.

BASE AND SUBGRADE MOISTURE CONTENTS

The resistivity of the soil was recorded during most site visits at the sections instrumented with soil cells (see Table 3 in Chapter 2) so that moisture contents of the base and subgrade could be determined.

In general, all soils exhibit a decrease in strength with increasing moisture content. This is caused by a decrease in friction

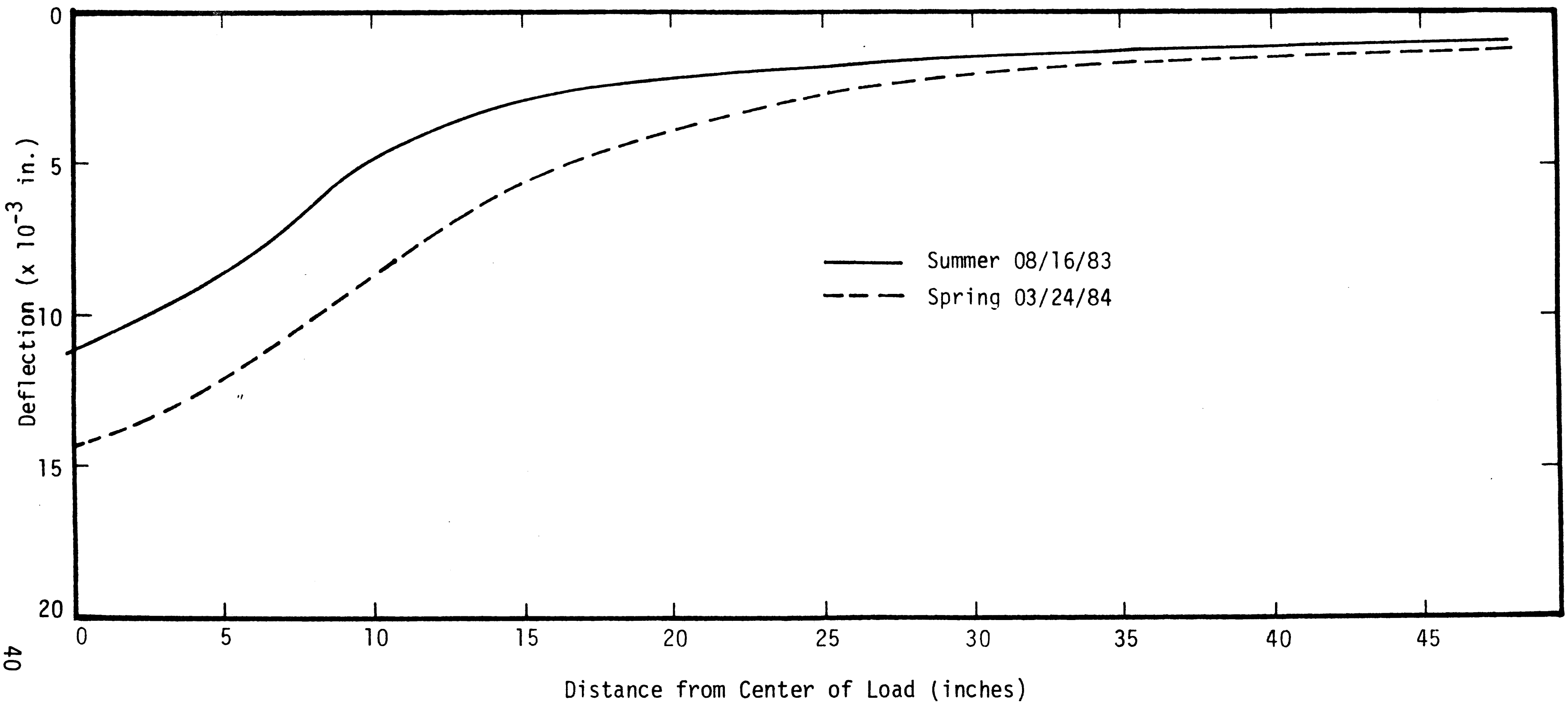


Figure 26. SR 97, MP 183.48 - Spring and Summer Deflection Basins.

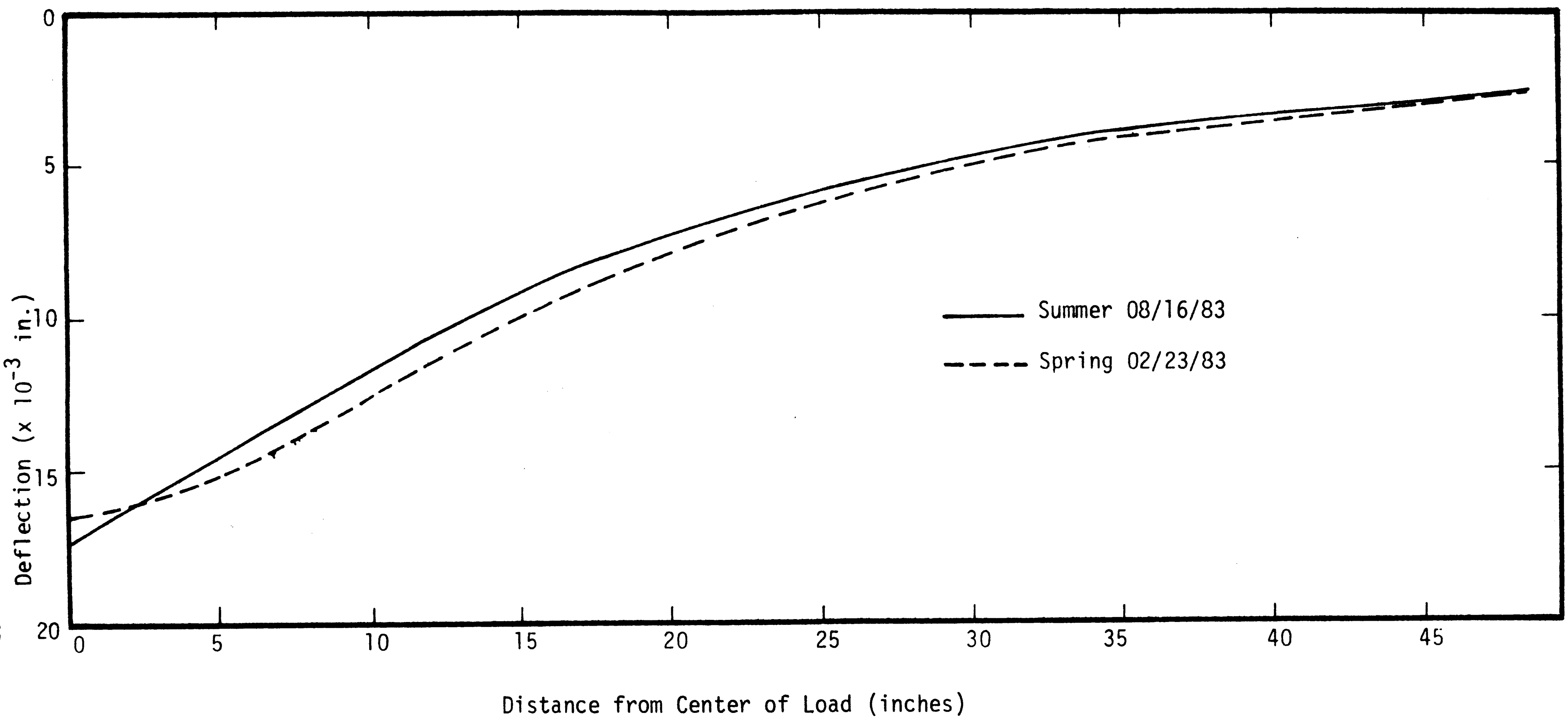


Figure 27. SR 2, Sunnyslope - Spring and Summer Deflection Basins.

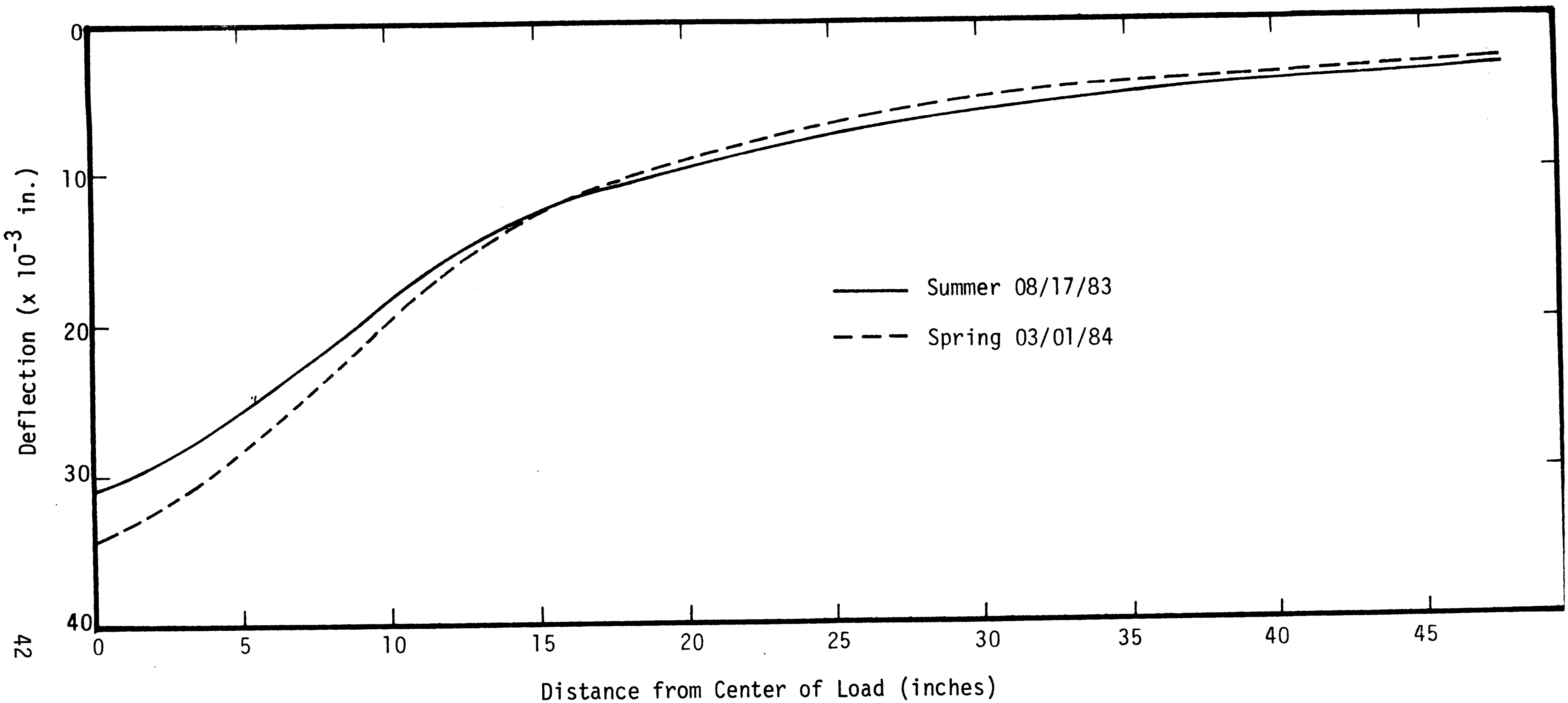


Figure 28. SR 2, MP 159.6 - Spring and Summer Deflection Basins.

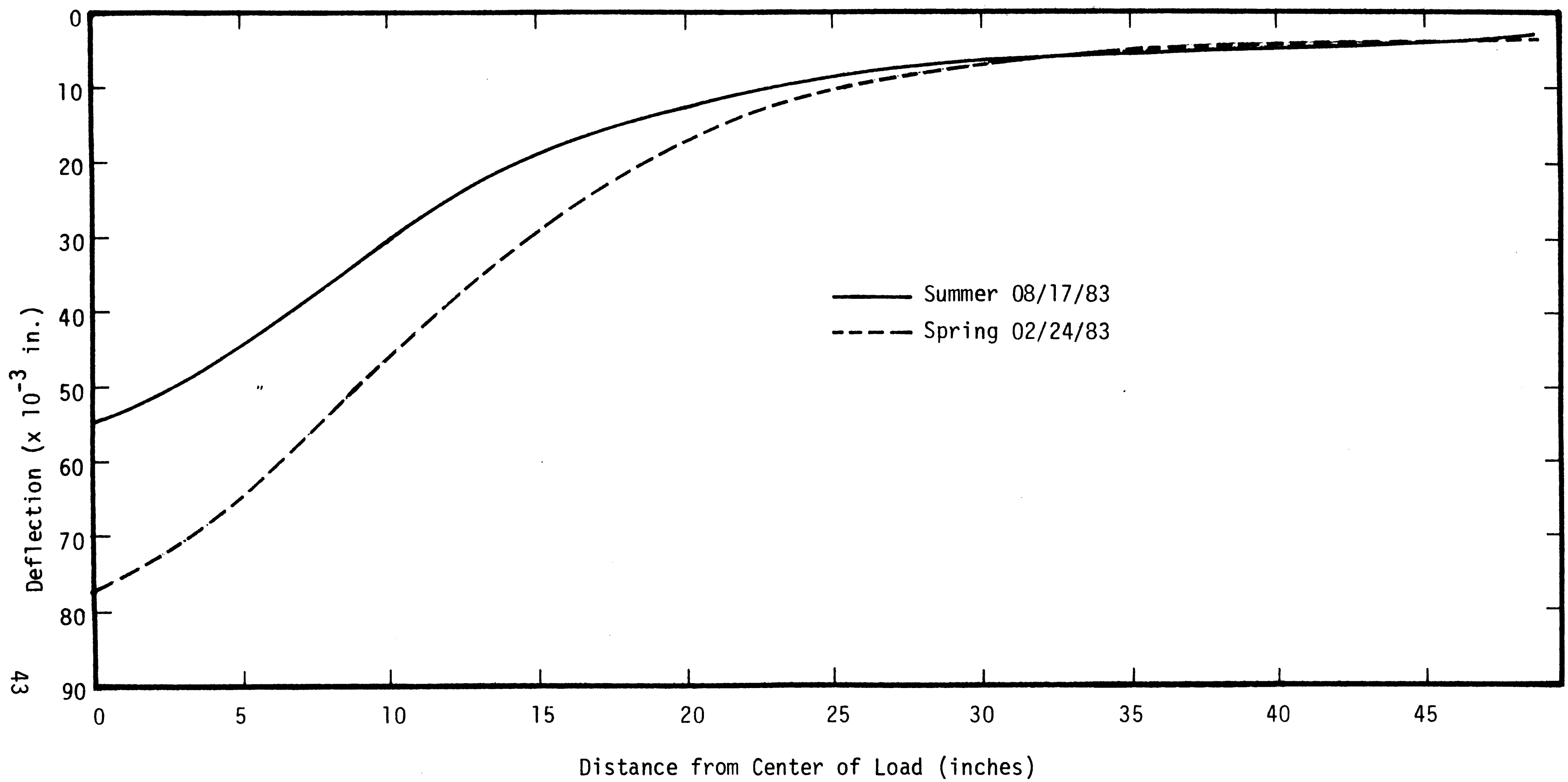


Figure 29. SR 172, MP 2.0 - Spring and Summer Deflection Basins.

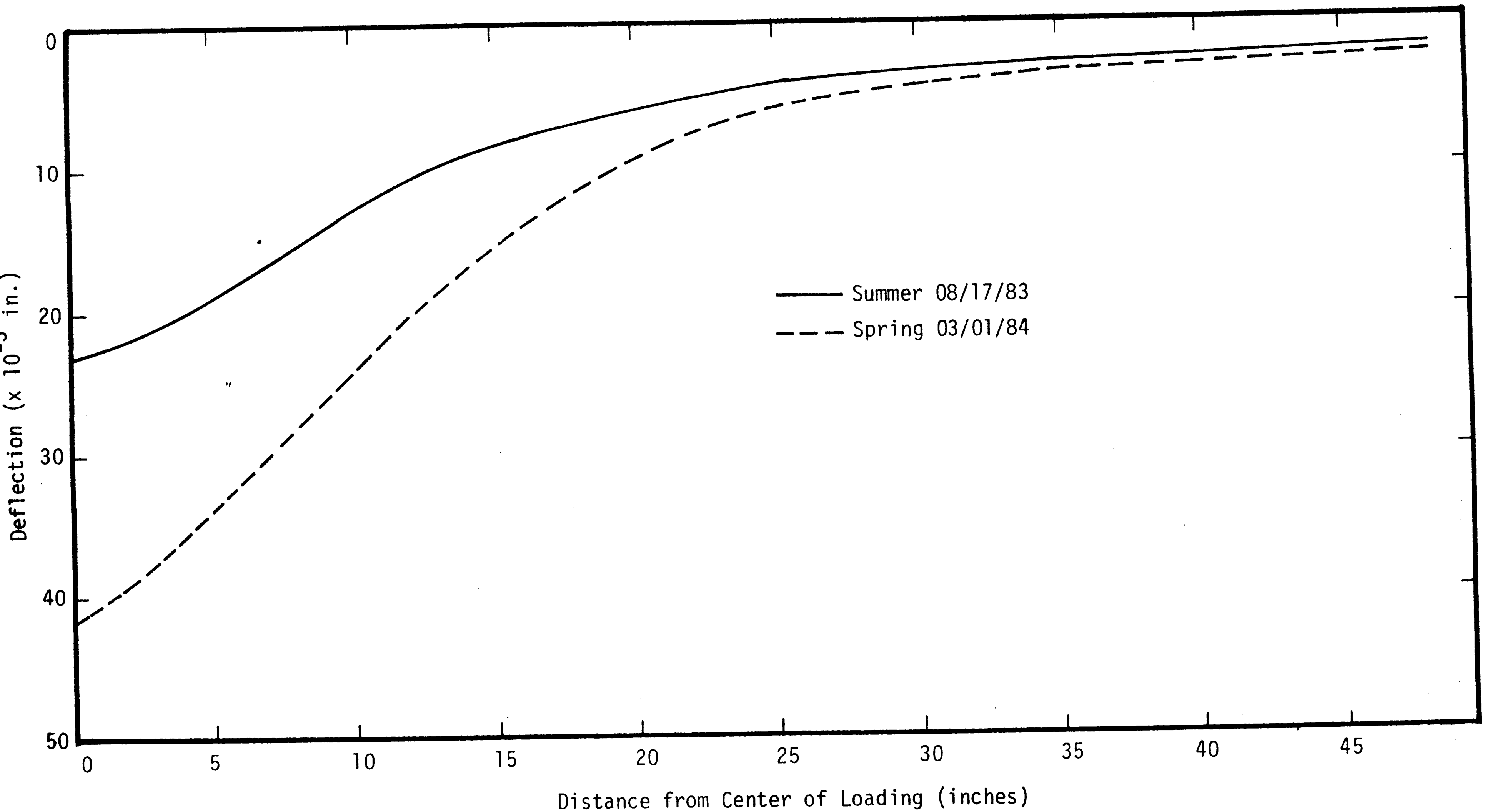


Figure 30. SR 172, MP 21.4 - Spring and Summer Deflection Basins.

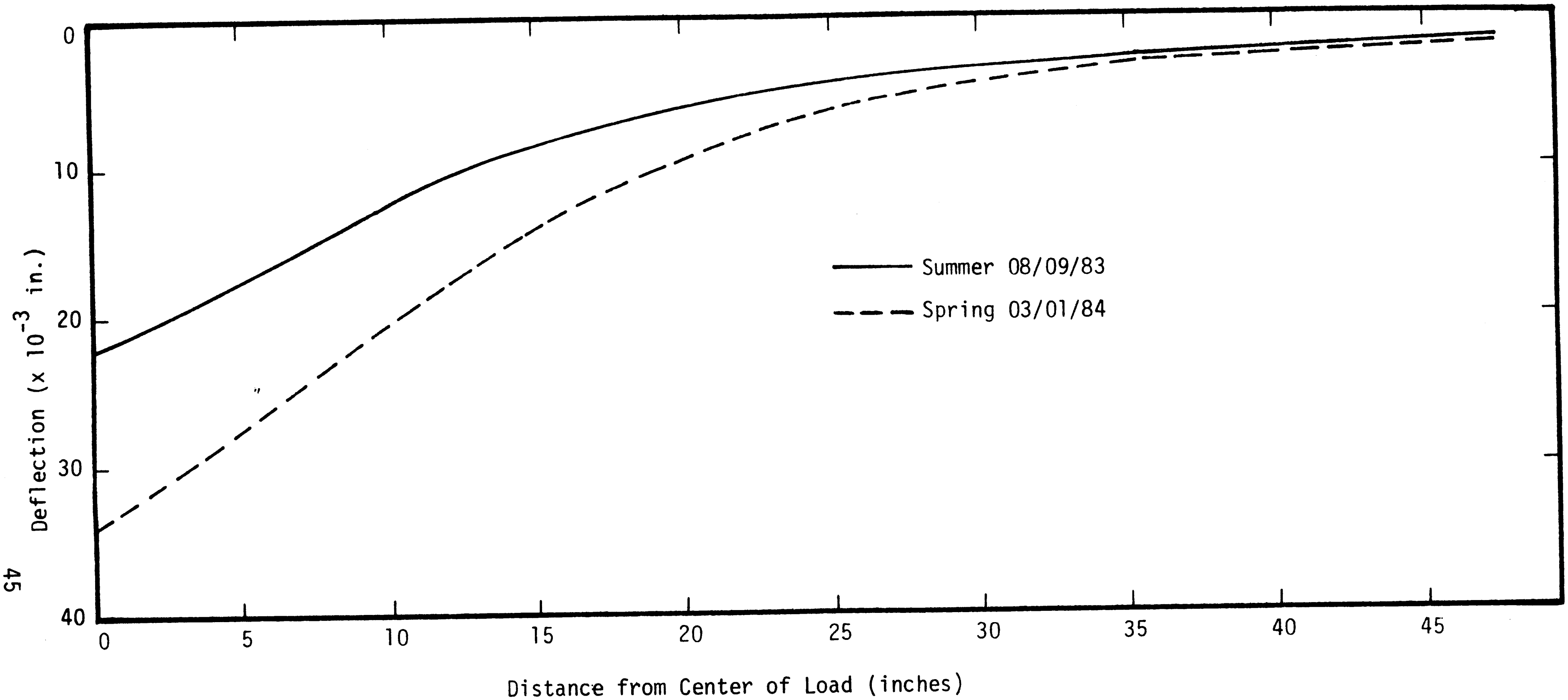


Figure 31. SR 174, MP 2.0 - Spring and Summer Deflection Basins.

Table 5. Measurement of Deflection Using an Extensometer.

Site	Date	Rear Axle Weight (lbs)	Tire Size	Tire Spacing (in.)	Extensometer Data			Calibration	Sensitivity	Deflection (x 10^{-3} in)	Benkelman Beam Deflection (x 10^{-3} in.)
					Amplitude		Range				
					Unloaded	Loaded					
SR 2 Sunny Slope	02/23/83	17,750	9 1/2 x 8	4 1/4	970	961	2	1000	Max.	27.9	27
	03/04/83	18,000	9 1/2 x 8	4 1/4	966	960	2	1000	Max.	18.4	20
	03/18/83	18,100	8 1/4 x 8	4 1/2	966	957	2	1000	Max.	27.5	20
	03/24/83	18,300	8 1/4 x 8	4 1/2	441	421	3	1000	Max.	20.4	25.4
	03/19/84	18,000	8 1/4 x 8	4 1/2	939	922	2	1000	1/2 Max.	23.3	20.8
SR 174	02/24/83	18,110	8 x 10	5 1/2	445	408	2	1000	Max.	29.8	28
	03/03/83	18,110	8 x 10	5 1/2	436	392	2	1000	Max.	35.1	31.5
	03/17/83	18,110	8 x 10	5 1/2	379	318	2	1000	Max.	46.2	27
	03/24/83	18,110	8 x 10	5 1/2	353	313	2	1000	Max.	29.9	36.1
	03/20/84	18,780	8 x 10	5 1/2	93	27	2	1000	Max.	14.4	33.2

between particles due to the higher amounts of free water surrounding the soil particles. Since pavement deflection is substantially a function of the strength of the supporting layers (base and subgrade), it is likely that pavement deflection would increase with increasing moisture contents. The variation in moisture content with time is shown in Figures 18, 19, 20 and 23 presented in the preceding section.

Two sets of soil cells were installed at the SR 2, Sunnyslope site. Figures 18 and 19 show the moisture content variations for the two sets of cells. For the cells at the lower end of the test section (Figure 18), the moisture contents in the base and subgrade followed the same general trend. The moisture contents started out high in the Spring of 1983, decreased to a low in August of that year, increased dramatically during February of 1984. The moisture contents then decreased in March with the two cells closest to the surface showing an increase in moisture content at the last site visit. It is interesting to note that all the soil cells indicate peak moisture contents at or around February 21, 1984. This is the same time that the deflection increased to an almost peak value. The same general trend occurred at the upper end of the test section (Figure 19) with the exception being no variation in the moisture content of the base course or at a depth of four feet (1.2 m) below the surface.

It should be noted that when the soil is frozen, the resistivity readings are meaningless (as ice and water have different resistivities). So, for the deflection data taken when a pavement structure was frozen, no moisture contents were plotted.

The same trend which existed at SR 2, Sunnyslope also occurred at SR 2, MP 159.6 with sharp increases in both base and subgrade moisture contents during March 1984.

SR 174, MP 2.0 on the other hand, indicated very little variation in moisture content, at any level, throughout the year. The exception to this being a large increase in the subgrade moisture content at a depth of two feet (0.6 m) during March 1984. This lack of variation could be expected since the base and subgrade are both sandy, free-draining materials.

While four soil cells were installed in the SR 97 test section, no calibration curves were constructed as soil samples from the pavement structure were not obtained, nor were in situ densities determined. The only samples obtained were those from the road shoulder. Use of these soils, and calibration with only a guess at the in situ dry densities would produce dubious results. However, looking at the variation in resistivities over time, it appears that the moisture contents were lowest in the summer, highest in the Winter/Spring of 1983 and higher again in Winter/Spring of 1984. Looking at the plot of deflection versus time for this site, this mirrors the trend in deflections.

The field soil cell resistivities and the corresponding moisture contents for all instrumented sites can be found in Appendix A.

FROST DEPTH AND FREEZING INDICES

Frost depth was measured using two different methods. The first was through the use of frost tubes and the second through the use of the thermistors in the soil cells. Frost depth can also be calculated using temperature based freezing indices and the modified Berggren Equation. Each will be described below.

Frost Tubes

Frost tubes were installed at four of the six test sites. The tubes were pulled from their casing during most site visits to determine the depth of frost penetration, if any. As stated in Chapter 2, the dye in the tubes changes from a green color to brown upon freezing. This color demarcation between the frozen and unfrozen layers is accurate to within about two inches (5 cm). A summary of the depths of freezing as measured by the frost tubes is found in Table 6. Also contained in this table are the soil cell temperatures.

The frost tubes indicated that the pavement structure was partially or completely frozen during late February and early March 1983 and during January 1984. It is the authors' opinion however that the indication of frozen conditions was the result of a problem with the dye rather than actual frozen ground. There have been considerable problems with these tubes in the past as far as the dye "disappearing" or "disintegrating". The dye manufacturer was contacted and questioned about the possibility of a chemical reaction occurring between the dye and the PVC tubing. No such reaction was anticipated. However, new frost tubes were constructed during February 1984 and the old tubes replaced. The old tubes were

Table 6. Frost Depth as Measured by the Frost Tubes and Soil Temperatures from the Soil Cells.

Site Location	Date	Frost Depth(1)		Soil Cell Temperatures (°F)			
		Tube 1	Tube 2	1' Depth	2' Depth	3' Depth	5' Depth
SR 97	02/23/83	top 5"	bottom 17"	38	39	38	38
MP 183.48		bottom 16"					
	03/04/83	top 5"	bottom 17"	40	40	41	40
	01/11/84	bottom 37"	bottom 31"	29	30	32	30
	01/17/84	frozen	-	24	30	31	30
	01/31/84	bottom 34"	bottom 34"	28	30	31	30
	02/17/84	replaced	replaced				
SR 2	02/23/84	top 7"	bottom 38"	40	42	42	42
Sunnyslope		bottom 9"		39	41	41	39
MP 117.38	03/04/83	top 8"	bottom 16"	45	-	45	45
		bottom 9"		-	44	44	42
	01/11/84	no water	bottom 32"	32	29.5	32	31.5
		in tube		34	32	32	36
	01/17/84	-	frozen	30	28	31.5	32
	01/31/84	-	0	34	31	34	34
	02/17/84	replaced	replaced				
SR 2	02/24/83	top 9"	top 6½"	38	39	38	39
MP 159.6	03/03/83	top 10"	top 6"	38	39	40	40
	01/10/84	top 15½"	frozen	31	29.5	30.5	38
	01/17/84	top 16"	frozen	-	-	-	-
	01/31/84	bottom 36"	-	31	32	36	37
	02/17/84	replaced	replaced				
SR 174	02/24/83	top 23"	top 15"	39	39	39	40
MP 2.0	01/10/84	bottom 37"	paved over	30.5	33.5	37	36
	01/17/84	frozen	-	-	-	-	-
	01/31/84	bottom 33"	-	30	32	36	36
	02/17/84	replaced					
	02/23/84	bottom 37"	-	30	34	34	34

Note: These were the only dates where the frost tubes indicated freezing or the soil cells indicated below freezing temperatures. All other visits had no indication of frozen conditions.

(1) The frost tubes are 40 inches long.

returned to the laboratory and observed to see if the green color, indicative of unfrozen conditions, returned. It did not. All of the tubes, or portions thereof, remained a grey-brown.

Another indication that the tubes may have been malfunctioning is a comparison between their predictions of frost depth and the corresponding soil cell temperatures as described below.

Soil Cell Temperatures

Soil cells were placed at depths of 4, 3, 2, and 1 feet (1.2, 0.9, 0.6 and 0.3 m) below the pavement surface. Each cell contained a thermister for temperature measurement. The results are presented in Table 6 for the dates when the frost tubes indicated frozen material. As can be seen from the data the comparisons did not indicate a good correlation.

According to the soil cells frozen material occurred at SR 97 during January 1984, at SR 2 Sunnyslope most of January 1984, at SR 2, MP 159.6 during the same time period and at SR 174 during January and part of February 1984. These temperature measurements correspond well to the low deflections, indicative of a frozen or partially frozen pavement structure, measured at the sites during that time frame. There is also no reason to doubt the accuracy of the thermistors. Hence, doubts about the accuracy and usefulness of the frost tubes must be raised.

Freezing Indices

A summary of the site specific temperature data collected from various WSDOT maintenance facilities is contained in Appendix F. The freezing indices calculated from the temperature data for each test site follows:

		1982-83	1983-84
1.	SR 97 MP 183.48-184.00	475°F-days	676°F-days
2.	SR 2 MP 117.38-117.62	_	510°F-days
3.	SR 2 MP 159.60-160.00	384°F-days	732°F-days

4. SR 172		
MP 2.00-1.90	474°F-days	719°F-days
MP 21.4-21.0		
5. SR 174		
MP 2.3-2.0	172°F-days	470°F-days

The above data illustrates the obvious difference in severity between the Winters of 1982-83 and 1983-84 as characterized by freezing index. The <u>design freezing indices</u> (the average of the three coldest winters out of the last 30 years of record) range between 900 to 1100°F-days throughout much of District 2 with the average freezing index for a 30 year record of about 500°F-days. Thus, the Winter of 1982-83 was slightly less severe than average and 1983-84 above average.

By use of the modified Berggren equation (discussed in greater detail in Chapter IV), various estimates of the depth of ground freezing were made. By assuming the pavement structure and the upper portion of the subgrade can be characterized as a homogeneous granular material (γ_d = 130 pcf, w = 5%), the following depths were calculated for the freezing indices for each test site:

Test Site Location	Winter	Probable Date of Maximum Depth of Freeze	Calculated Depth of Freeze (ft)[1]	Measured Depth of Freeze (ft)[2]
1. SR 97				
MP 183.48-184.00	1982-83	2/9/83	3.3	-
	1983-84	1/23/84	4.0	5
2. SR 2				
MP 117.38-117.62	1983-84	1/23/84	3.4	3+
3. SR 2				
MP 159.60-160.00	1982-83	2/11/83	3.1	-
	1983-84	1/23/84	4.1	3+
4. SR 172				
MP 2.00-1.90	1982-83	2/15/83	3.3	-
MP 21.4-21.0	1983-84	1/23/84	4.2	-
5. SR 174				
MP 2.3-2.0	1982-83	1/5/83	2.0	-
	1983-84	1/24/84	3.3	2+

Notes: (1) Calculated by use of modified Berggren equation

(2) Depths shown were obtained from Table 6 and are considered to be approximate. Limited soil temperature data was available for the Winter 1982-83.

The calcualted and measured depths of freeze are within the same ranges. The maximum calculated depth of freeze for a granular material and a freezing index of 1100°F-days is about 5 to 6 ft. Thus, the winter of 1983-84 depths of freeze are, in general, about 1 to 2 ft. less than would occur during one of the three coldest winters out of 30.

Overall, the temperature data and associated calculations suggest that typical depths of freeze beneath the District 2 test sites are about 3 to 4 ft. with the maximum frost penetration occurring in late January through mid-February. As will be shown in Chapter IV, relatively few thawing degree days are required to place these pavement structures into the "critical period".

LABORATORY DATA

Asphalt concrete cores and base and subgrade soil samples were obtained from the four instrumented test sites. The soil samples were sent to the WSDOT Materials Laboratory to determine the gradations of each soil and to do limited resilient modulus testing. The asphalt concrete cores were kept at UW where limited resilient modulus work was completed. The results of this testing can be found in Appendix B.

CHAPTER IV

DATA ANALYSIS

This chapter is used to describe the method used to determine the material properties, and their variations over time, for the six test sites as well as development of a criterion for establishing when to establish load restrictions. Evaluation of load restriction criteria is also included. The first section in the chapter is used to discuss the use of the BISDEF computer program to develop, using FWD data, the resilient moduli and the stress-sensitivity relationships of the pavement layers. The second section discusses the use of the PSAD2A computer program to determine appropriate surface deflections and pavement layer strains during the weakest and strongest times of the year for the sites. Presented in the third section is a discussion of the results of the analysis. A fourth section is used to discuss the development of a criterion for when to establish load restrictions.

BISDEF COMPUTER PROGRAM [8]

BISDEF is a layered elastic computer program, developed at the U.S. Army Corps of Engineers Waterways Experiment Station, which can be used to determine the resilient moduli of pavement layers and the stresses at any point in the pavement structure. This program uses the concept of minimizing the difference for (or error) between the program calculated and actual measured deflection basins (as provided by the FWD data). The program varies the layer modulus values until a match is made between the input basin and the BISDEF predicted basin. An explanation of the internal operation of the program, along with an operation flowchart, is contained in Appendix C.

BISDEF was used in this analysis to determine the resilient moduli of the pavement layers during each site visit for the six test sites. It was also used to calculate bulk stress at the middle of the base course and bulk or deviator stress at the top of the subgrade. Since three or four stress levels (or load magnitudes) were used during each site visit, it was possible to develop the stress sensitivity relationships (M_R-θ or M_R - σ_d) for the base and subgrade layers. These relations were necessary as inputs for the PSAD2A program as discussed in the next section.

The required inputs for BISDEF are:

1. measured deflections (mils) and their distances from the center of the load (inches),
2. the range of modulus values for each layer (psi),
3. an initial estimate of the modulus value for each layer (psi),
4. the thickness of each layer (inches),
5. Poisson's ratio of each layer,
6. the load stress (psi) and load radius (inches), and
7. points in the pavement structure where stresses are desired.

The measured deflections input were the average deflection values over each test section for each site visit. The deflection spacings were the spacings of the FWD sensors. FWD sensors (and corresponding deflections) 1, 3, 5 and 7 were used in this analysis. This resulted in spacings of 0, 11.81, 25.59 and 47.24 inches (0, 300, 650 and 1200 mm) from the center of loading.

The range of allowable modulus values for each layer gives an upper and lower bound for the layer modulus (i.e., the predicted modulus value must be within the specified range). This allows the program user to specify the modulus value of a given layer, should that value be known, by limiting the range to a small value which brackets the known modulus value.

An initial estimate of each layer modulus was based on judgment and other previously completed work. It should be noted that the more accurate this estimate, the faster (hence less expensive) BISDEF provides the final modulus values.

The thicknesses of the layers were obtained from cross-sectional data provided by WSDOT and by measurement of the thicknesses of the layers during sampling in the summer of 1983. (The cross sections are shown in Figures 2-7 in Chapter II). Only three layer systems were analyzed so when CSTC and ballast or gravel base both were present, their thicknesses were combined. The subgrade was given a thickness of 212 inches (538 cm) underlain by a layer of infinite thickness with a modulus of 1,000,000 psi (70,300 kg/cm^2). The 1,000,000 psi (70,300 kg/cm^2) layer was used to counteract the tendency of layered elastic theory to over-predict the deflection in layers of infinite thickness. Using this layer gave the subgrade a finite thickness.

Poisson's ratios were determined from research presented in the literature [9]. The Poisson's ratio of the asphalt concrete layer materials was assumed to be 0.35, that of the base course to be 0.35 and that of the subgrade to be 0.45.

The load radius was the radius of the loading plate on the FWD and was equal to 5.91 inches (150 mm). The load stresses were the actual stresses applied to the pavement structure by the FWD.

As stated earlier, it was desirable to determine the bulk stress ($\theta = \sigma_1 + \sigma_2 + \sigma_3$) at the middle of the base course layer and the bulk and deviator stress ($\sigma_d = \sigma_1 - \sigma_3$) at the top of the subgrade. It was possible to do this by requesting BISDEF to provide the radial, tangential and vertical stresses at those points. It was necessary to specify the layer and the depth from the top of the pavement structure at which stresses were to be determined. The program uses the BISAR structural subroutine to calculates stresses. Table 7 shows the layer thicknesses, Poisson's ratios and stress points for the six test sites.

The results of the BISDEF analysis are shown in Tables 8 through 13. The stress relationships presented are of the form $M_R = k_1\theta^{k_2}$ for layers that behaved as coarse-grained materials and $M_R = k_1\sigma_d^{-k_2}$ for layers that behaved as fine-grained materials (M_R decreasing with increasing stress). From these tables it is apparent that the pavement sections were frozen in the winter when base course moduli were in the range of 100,000 to 150,000 psi (7,000 to 10,500 kg/cm^2) and subgrade moduli on the order of 40,000 to 70,000 psi (2,800 to 4,900 kg/cm^2).

In general, for all the sections, the base and subgrade moduli were higher during the August 1983 site visit than at other times of the year. It should be noted that the SR 172, MP 2.0 test section was run as a two layer system with the bituminous surface treatment and base course combined into one layer. This was done as the computer program would not close when the system was run as a three-layer system. It was felt this was justified due to the weak structural condition of the pavement structure at this site.

These results, specifically the stress relationships and the asphalt moduli obtained from the BISDEF analysis were used as inputs for the PSAD2A computer program as discussed below.

Table 7. Summary of the Layer Characteristics for BISDEF Input.

Site	Layer	Thickness (inches)	Poisson's Ratio	Depth from Surface for Stress Determination (inches)
SR 97 MP 183.48-184.00	asphalt concrete	2.6	0.35	
	base	14.0	0.35	9.6
	subgrade	212.0	0.45	16.6
SR 2 MP 117.38-117.62	asphalt concrete	6.2	0.35	
	base	16.6	0.35	14.5
	subgrade	212.0	0.45	22.8
SR 2 MP 159.6-160.00	asphalt concrete	1.8	0.35	
	base	9.0	0.35	6.3
	subgrade	212.0	0.45	10.8
SR 172 MP 2.0-1.9	bituminous surface treatment	2.5	0.35	
	base	6.0	0.35	5.5
	subgrade	212.0	0.45	8.5
SR 172 MP 21.4-21.0	bituminous surface treatment	1.5	0.35	
	base	9.0	0.35	6.0
	subgrade	212.0	0.45	10.5
SR 174 MP 2.3-2.0	bituminous surface treatment	1.7 / 2.7 (1)	0.35	
	base	10.3	0.35	6.85 / 7.85 (1)
	subgrade	212.0	0.45	12.0 / 13.0 (1)

(1) A BST was applied to the roadway during late summer of 1983. The thickness of the layer was increased 1" due to the fact that the rut depths were filled in and then the BST applied.

Table 8. SR 97, MP 183.48 Results of BISDEF Analysis for Determination of Resilient Moduli, Stresses and Stress Relationships for each Site Visit.

Date	Pavement Surface Temperature (^oF)	Applied Stress (psi)	AC M_R (psi)	Base M_R (psi)	Subgrade M_R (psi)	Base θ (psi)	Subgrade σ_d (psi)	Base Stress Relationship	Subgrade Stress Relationship
02/23/83	40	59.52 88.94 121.27	2,050,000 2,286,000 2,214,535	24,500 29,400 34,800	27,500 28,900 28,600	11.91 17.34 23.26	6.076 8.862 11.87	$6,685\theta^{0.522}$ $r^2 = 0.998$	$24,784\ \sigma_d^{0.062}$ $r^2 = 0.633$
03/04/83	46	55.04 78.20 111.75	1,765,000 2,000,000 2,000,000	29,600 31,500 36,000	30,000 29,900 29,200	11.61 15.88 22.10	5.861 8.050 11.20	$13,855\theta^{0.305}$ $r^2 = 0.964$	$32,418\ \sigma_d^{-0.042}$ $r = 0.849$
03/09/83	46	54.68 76.74 109.21	1,677,000 1,796,000 1,987,000	25,400 30,500 33,400	32,500 29,500 28,800	11.40 15.98 21.73	6.113 8.074 11.03	$9,113\theta^{0.426}$ $r^2 = 0.973$	$46,214\ \sigma_d^{-0.202}$ $r = 0.871$
03/18/83	58	54.74 77.68 111.30	1,500,000 1,536,000 1,589,000	28,000 32,800 35,800	34,000 32,000 31,700	12.54 17.14 24.04	6.292 8.568 12.01	$10,972\theta^{0.376}$ $r^2 = 0.965$	$41,013\ \sigma_d^{-0.107}$ $r^2 = 0.830$
03/24/83	62	52.74 76.49 107.78	1,600,000 1,458,000 1,553,000	24,200 29,500 32,800	32,500 31,100 30,600	11.84 17.09 23.36	5.975 8.557 11.69	$8,038\theta^{0.450}$ $r^2 = 0.984$	$38,073\ \sigma_d^{-0.090}$ $r^2 = 0.952$
08/16/83	99	104.05 141.37	266,000 300,000	77,700 82,700	43,800 43,500	31.61 41.67	13.08 17.18	$35,637\theta^{0.226}$	$46,733\ \sigma_d^{-0.025}$
01/11/84	34	75.31 107.59 147.85	1,867,000 1,500,000 1,500,000	170,900 180,000 180,000	80,500 80,900 73,400	17.19 25.49 33.64	7.783 11.22 14.76		

Table 8. SR 97, MP 183.48 Results of BISDEF Analysis for Determination of Resilient Moduli, Stresses and Stress Relationships for each Site Visit (Cont.).

Date	Pavement Surface Temperature (°F)	Applied Stress (psi)	AC M_R (psi)	Base M_R (psi)	Subgrade M_R (psi)	Base θ (psi)	Subgrade σ_d (psi)	Base Stress Relationship	Subgrade Stress Relationship
01/31/84	34	69.5 97.7 139.4	1,724,000 1,500,000 1,500,000	52,600 68,100 73,800	61,800 56,900 56,300	17.55 26.43 33.79	8.639 11.81 16.17	$11,703\theta^{0.528}$ $r^2 = 0.977$	$84,120\ \sigma_d^{-0.148}$ $r^2 = 0.833$
02/21/84	50	74.2 96.0 127.7	1,700,000 1,700,000 1,800,000	41,300 44,000 48,000	35,000 32,000 30,000	16.06 20.59 24.95	7.998 9.902 12.49	$16,098\theta^{0.337}$ $r^2 = 0.970$	$71,299\ \sigma_d^{-0.345}$ $r^2 = 0.986$
02/29/84	51	81.1 105.7 142.3	1,900,000 2,000,000 2,000,000	42,000 49,600 55,200	34,800 35,500 32,900	17.02 21.52 27.45	8.524 10.76 13.74	$8,418\theta^{0.571}$ $r^2 = 0.982$	$45,658\ \sigma_d^{-0.119}$ $r^2 = 0.520$
03/06/84	60	68.8 96.5 131.2	2,000,000 1,804,000 1,900,000	38,500 45,600 49,000	35,800 35,700 33,000	14.56 22.92 26.28	7.320 10.19 13.14	$13,133\theta^{0.400}$ $r^2 = 0.995$	$47,216\ \sigma_d^{-0.133}$ $r^2 = 0.710$
03/19/84	50	66.6 89.4 118.2	2,500,000 1,900,000 1,900,000	41,800 48,000 52,000	34,900 32,000 30,000	12.13 17.74 22.40	6.254 8.884 11.24	$17,173\theta^{0.357}$ $r^2 = 1.000$	$55,981\ \sigma_d^{-0.257}$ $r^2 = 0.999$

Table 9. SR 2, Sunnyslope - Results of BISDEF Analysis for Determination of Resilient Moduli, Stresses and Stress Relationships for each Site Visit.

Date	Pavement Surface Temperature (°F)	Applied Stress (psi)	AC M_R (psi)	Base M_R (psi)	Subgrade M_R (psi)	Base θ (psi)	Subgrade σ_d (psi)	Base Stress Relationship	Subgrade Stress Relationship
02/23/83	40	63.22	450,000	13,000	15,000	5.56	2.44	$1{,}247\theta^{1.36}$	$20{,}900\ \sigma_d^{-0.370}$
		92.32	460,000	18,000	13,500	7.23	3.32		
		154.35	468,000	26,200	11,600	9.32	4.88	$r^2 = 0.998$	$r^2 = 0.998$
03/04/83	48	63.40	460,000	19,000	14,500	5.11	2.33	$8{,}226\theta^{0.530}$	$18{,}419\ \sigma_d^{-0.298}$
		89.33	460,000	23,000	12,900	6.28	3.04		
		123.80	468,000	24,000	12,200	8.16	4.08	$r^2 = 0.916$	$r^2 = 0.970$
		154.58	460,000	27,000	11,500	9.20	4.85		
03/09/83	46	57.74	350,000	19,400	13,800	4.92	2.21	$9{,}623\theta^{0.428}$	$17{,}311\ \sigma_d^{-0.296}$
		81.40	432,000	20,100	15,600	6.02	2.85		
		112.81	400,000	23,000	11,500	7.64	3.78	$r^2 = 0.964$	$r^2 = 0.976$
		142.92	450,000	24,600	11,200	8.79	4.55		
03/18/83	58	65.32	400,000	21,600	15,000	5.44	2.46	$11{,}588\theta^{0.375}$	$18{,}799\ \sigma_d^{-0.2[illegible]4}$
		91.98	433,000	24,000	13,600	6.77	3.22		
		126.66	466,000	26,100	12,500	8.22	4.14	$r^2 = 0.968$	$r^2 = 0.916$
		156.66	450,000	27,200	12,500	10.10	5.12		
03/24/83	62	60.74	320,000	17,000	14,200	5.53	2.42	$3{,}245\theta^{0.998}$	$20{,}059\ \sigma_d^{-0.380}$
		86.88	400,000	21,800	13,300	6.68	3.12		
		117.52	400,000	25,700	11,800	7.77	3.89	$r^2 = 0.990$	$r^2 = 0.982$
		146.30	400,000	27,900	11,200	8.82	4.64		
08/16/83	99	84.67	247,000	25,900	13,600	7.34	3.26	$5{,}216\theta^{0.804}$	$24{,}794\ \sigma_d^{-0.509}$
		113.84	240,000	29,800	12,200	8.74	4.06		

Table 9. SR 2, Sunnyslope - Results of BISDEF Analysis for Determination of Resilient Moduli, Stresses and Stress Relationships for each Site Visit (Cont.).

Date	Pavement Surface Temperature (°F)	Applied Stress (psi)	AC M_R (psi)	Base M_R (psi)	Subgrade M_R (psi)	Base θ (psi)	Subgrade σ_d (psi)	Base Stress Relationship	Subgrade Stress Relationship
01/11/84	34	69.96 94.62 126.55	350,000 385,000 400,000	53,000 61,600 60,700	18,400 16,700 15,400	4.97 5.39 6.54	3.23 3.89 4.99		$29{,}336\ \sigma_d^{-0.404}$ $r^2 = 0.941$
01/31/84	34	67.4 93.4 125.3 155.9	500,000 500,000 550,000 500,000	116,300 99,000 98,000 99,000	18,400 17,500 16,200 15,000	2.57 3.67 3.97 4.54	1.69 2.41 3.06 3.61		$21{,}537\ \sigma_d^{-0.266}$ $r^2 = 0.941$
02/21/84	50	72.3 94.1 123.2 152.2	390,000 418,000 445,000 450,000	23,500 25,200 25,400 26,200	16,000 13,600 12,000 11,400	6.16 6.90 7.93 9.23	2.76 3.29 4.02 4.82	$15{,}052\theta^{0.253}$ $r^2 = 0.884$	$28{,}676\ \sigma_d^{-0.604}$ $r^2 = 0.949$
02/29/84	51	71.0 93.6 122.8	413,000 410,000 410,000	26,300 28,000 31,000	13,500 12,500 11,500	5.00 6.04 6.93	3.23 4.07 5.02	$11{,}782\theta^{0.493}$ $r^2 = 0.949$	$20{,}711\ \sigma_d^{-0.363}$ $r^2 = 0.998$
03/06/84	60	67.3 89.4 115.9	363,000 360,000 400,000	25,200 27,000 27,000	13,300 12,500 11,300	5.00 6.16 7.01	3.17 4.04 4.87	$17{,}912\theta^{0.216}$ $r^2 = 0.856$	$20{,}643\ \sigma_d^{-0.374}$ $r^2 = 0.956$
03/19/84	50	67.4 91.3 120.3	392,000 350,000 395,000	24,000 31,400 29,000	13,400 11,900 11,500	4.99 5.65 7.16	3.15 3.93 5.04	$13{,}524\theta^{0.410}$ $r^2 = 0.297$	$19{,}060\ \sigma_d^{-0.321}$ $r^2 = 0.887$

Table 10. SR 2, MP 159.6 - Results of BISDEF Analysis for Determination of Resilient Moduli, Stresses and Stress Relationships for each Site Visit.

Date	Pavement Surface Temperature (°F)	Applied Stress (psi)	AC M_R (psi)	Base M_R (psi)	Subgrade M_R (psi)	Base θ (psi)	Subgrade σ_d (psi)	Base Stress Relationship	Subgrade Stress Relationship
02/24/83	50	57.86	1,200,000	14,800	13,900	21.86	11.67	$1{,}266\theta^{0.814}$	$29{,}862\ \sigma_d^{-0.307}$
		88.17	1,500,000	20,800	13,100	28.42	15.85		
		123.01	1,200,000	29,400	11,700	49.18	20.29	$r^2 = 0.962$	$r^2 = 0.944$
03/03/83	45	56.72	1,200,000	21,600	13,100	18.94	10.51	$6{,}706\theta^{0.396}$	$17{,}462\ \sigma_d^{-0.118}$
		83.06	1,200,000	24,400	13,000	26.53	14.96		
		121.37	1,268,000	27,500	12,100	34.75	20.38	$r^2 = 0.997$	$r^2 = 0.791$
03/09/83	47	55.80	1,000,000	25,300	13,500	18.98	10.51	$9{,}508\theta^{0.327}$	$25{,}782\ \sigma_d^{-0.268}$
		82.44	1,222,000	26,400	13,000	25.71	14.62		
		116.70	1,300,000	30,000	11,500	31.02	18.74	$r^2 = 0.836$	$r^2 = 0.864$
03/13/83	60	42.70	1,100,000	15,200	10,000	13.90	7.27	$2{,}787\theta^{0.658}$	$21{,}904\ \sigma_d^{-0.199}$
		83.96	1,029,000	26,800	12,700	26.90	15.10	$r^2 = 0.953$	$r^2 = 0.926$
		121.83	1,267,000	28,000	12,200	35.08	20.53		
		152.87	1,318,000	30,500	11,500	40.01	24.33		
03/24/83	40	58.52	2,155,000	16,800	13,000	17.84	9.90	$4{,}245\theta^{0.474}$	$21{,}088\ \sigma_d^{-0.201}$
		88.36	2,460,000	18,800	12,800	25.05	14.20		
		125.46	1,600,000	26,300	12,200	34.44	20.41		
		150.67	2,400,000	20,800	10,600	36.41	22.05	$r^2 = 0.669$	$r^2 = 0.632$
08/17/83	72	80.08	931,000	28,800	11,100	23.08	13.50	$282\theta^{1.473}$	$6{,}152\ \sigma_d^{0.227}$
		125.98	1,000,000	43,300	12,000	30.44	19.04		

Table 10. SR 2, MP 159.6 - Results of BISDEF Analysis for Determination of Resilient Moduli, Stresses and Stress Relationships for each Site Visit (Cont.).

Date	Pavement Surface Temperature (°F)	Applied Stress (psi)	AC M_R (psi)	Base M_R (psi)	Subgrade M_R (psi)	Base θ (psi)	Subgrade σ_d (psi)	Base Stress Relationship	Subgrade Stress Relationship
01/10/84	34	76.63							
		108.83							
		144.39							
02/21/84	42	71.0	1,096,000	20,800	12,900	24.54	13.50	$6,277\theta^{0.376}$	$21,492\ \sigma_d^{-0.197}$
		95.7	1,140,000	23,000	12,200	30.73	17.30		
		129.2	1,258,000	24,600	11,700	38.35	22.16	$r^2 = 0.988$	$r^2 = 0.994$
03/01/84	48	71.3	1,184,000	16,500	12,500	25.30	13.75	$4,628\theta^{0.398}$	$26,576\ \sigma_d^{-0.287}$
		95.9	1,327,000	18,800	11,800	31.05	17.31		
		125.8	1,462,000	19,300	11,000	37.60	21.46	$r^2 = 0.886$	$r^2 = 0.994$
03/09/84	60	66.6	972,000	24,700	12,800	22.26	12.39	$4,461\theta^{0.554}$	$26,189\ \sigma_d^{-0.282}$
		91.0	552,000	30,400	12,000	30.80	16.83		
		121.8	579,000	32,700	11,000	37.29	21.03	$r^2 = 0.984$	$r^2 = 0.968$
03/21/84	49	66.0	658,000	30,300	12,900	22.53	12.36	$18,504\theta^{0.151}$	$17,637\ \sigma_d^{-0.122}$
		93.3	819,000	29,600	12,600	30.00	16.86		
		127.1	700,000	33,000	12,000	39.20	22.19	$r^2 = 0.536$	$r^2 = 0.947$

Table 11. SR 172, MP 2.0 - Results of BISDEF Analysis for Determination of Resilient Moduli, Stresses and Stress Relationships for each Site Visit.

Date	Pavement Surface Temperature (°F)	Applied Stress (psi)	1st Layer M_R (psi)	Subgrade M_R (psi)	1st Layer θ (psi)	Subgrade σ_d (psi)	1st Layer Stress Relationship	Subgrade Stress Relationship
02/24/83	50	47.46 72.69 103.32	13,400 14,800 24,300	5,000 5,700 5,700	47.58 73.09 97.88	15.91 24.62 28.70	$613\theta^{0.781}$ $r^2 = 0.788$	$2,593\ \sigma_d^{0.239}$ $r^2 = 0.937$
03/03/83	38	49.54 71.65 105.24	25,900 28,000 29,900	5,800 5,900 5,900	46.72 67.02 97.54	13.55 19.03 27.07	$12,272\theta^{0.195}$ $r^2 = 0.996$	$5,457\ \sigma_d^{0.024}$ $r^2 = 0.741$
03/09/83	47	47.95 68.40 101.05	28,800 31,000 33,500	6,800 6,700 6,600	45.45 64.20 93.67	13.34 18.40 26.01	$12,978\theta^{0.209}$ $r^2 = 0.999$	$7,634\ \sigma_d^{-0.045}$
03/17/83	39	49.22 70.68 102.86	21,200 23,700 22,800	6,600 6,600 6,700	48.25 68.36 100.23	15.34 21.06 31.43	$14,995\theta^{0.096}$ $r^2 = 0.386$	$6,205\ \sigma_d^{0.021}$ $r^2 = 0.806$
08/17/83	75	74.70 105.82	26,000 29,000	8,600 8,600	73.76 103.09	23.85 32.32	$6,393\theta^{0.326}$	$8,600\ \sigma_d^{0.0}$
01/10/84	34	72.84 104.21 143.49	371,100 348,300 326,800	59,900 59,300 50,500	65.82 94.82 128.97	17.08 25.06 32.96		
03/01/84	46	56.8 78.5 110.0	23,700 32,000 39,200	4,500 4,800 5,100	52.39 70.38 96.80	14.36 17.86 23.27	$952\theta^{0.817}$ $r^2 = 0.982$	$2,268\ \sigma_d^{0.258}$ $r^2 = 0.994$
03/07/84	60	55.2 74.9 103.9	19,900 19,000 27,400	5,300 5,500 5,800	53.14 72.79 97.13	16.19 22.69 27.56	$2,355\theta^{0.520}$ $r^2 = 0.619$	$3,352\ \sigma_d^{0.163}$ $r^2 = 0.935$
03/21/84	50	57.1 77.6 107.0	28,400 27,000 31,600	6,000 5,800 5,700	53.42 72.80 98.14	15.20 20.82 26.49	$13,761\theta^{0.173}$ $r^2 = 0.432$	$7,719\ \sigma_d^{-0.093}$ $r^2 = 0.988$

Table 12. SR 172, MP 21.4 - Results of BISDEF Analysis for Determination of Resilient Moduli, Stresses Stress Relationships for each Site Visit.

Date	Pavement Surface Temperature (°F)	Applied Stress (psi)	AC M_R (psi)	Base M_R (psi)	Subgrade M_R (psi)	Base θ (psi)	Subgrade θ (psi)	Base Stress Relationship	Subgrade Stress Relationship
02/24/83	50	55.35	2,146,000	9,100	14,700	22.51	16.05	$1,025\theta^{0.708}$	$10,605\theta^{0.119}$
		85.59	2,500,000	12,900	15,500	33.57	23.08		
		118.63	2,500,000	15,100	15,900	46.25	31.24	$r^2 = 0.976$	$r^2 = 0.978$
03/03/83	38	56.87	3,000,000	18,100	15,000	19.95	13.45	$34,790\theta^{-0.235}$	$11,365\theta^{0.110}$
		83.83	3,000,000	13,800	16,200	31.25	21.74		
		121.45	3,000,000	15,100	16,400	45.17	31.07	$r^2 = 0.487$	$r^2 = 0.906$
03/09/83	44	54.74	2,714,000	11,900	14,700	20.72	14.46	$3,149\theta^{0.410}$	$13,066\theta^{0.047}$
		79.68	2,000,000	10,300	15,600	33.49	23.42		
		115.78	2,500,000	17,400	15,000	42.85	28.54	$r^2 = 0.312$	$r^2 = 0.298$
03/17/83	34	58.28	2,586,000	16,500	14,000	21.18	14.17	$8,559\theta^{0.210}$	$10,172\theta^{0.127}$
		85.28	3,000,000	17,100	15,500	30.88	20.86		
		122.80	3,000,000	19,200	15,300	43.38	29.14	$r^2 = 0.896$	$r^2 = 0.682$
08/17/83	75	88.0	1,500,000	35,800	18,200	37.99	20.37	$15,719\theta^{0.226}$	$12,656\theta^{0.120}$
		121.51	1,500,000	38,700	18,900	53.60	27.86		
01/10/84	34	72.28	3,500,000	115,500	34,800	21.20	13.39		
		102.30	3,500,000	125,300	34,000	28.18	18.14		
		140.82	2,500,000	129,900	31,900	35.92	23.80		
03/01/84	38	63.8	2,614,000	6,200	13,300	23.53	17.89	$1,699\theta^{0.422}$	$11,085\theta^{0.064}$
		86.9	2,886,000	7,900	13,600	31.69	23.39		
		118.1	2,850,000	8,000	13,800	42.95	31.79	$r^2 = 0.781$	$r^2 = 0.974$
03/07/84	40	62.6	2,785,000	12,600	13,900	22.99	15.92	$9,366\theta^{0.092}$	$10,692\theta^{0.095}$
		86.8	2,870,000	12,700	14,400	31.99	22.22		
		117.6	2,570,000	13,400	14,800	44.92	30.77	$r^2 = 0.850$	$r^2 = 0.996$
03/20/84	39	62.6	2,623,000	12,700	13,800	23.30	16.04	$4,718\theta^{0.321}$	$13,360\theta^{0.012}$
		87.9	3,000,000	14,800	13,900	31.02	21.24		
		120.4	3,000,000	15,400	13,900	42.26	28.82	$r^2 = 0.884$	$r^2 = 0.729$

Table 13. SR 174, MP 2.3 - Results of BISDEF Analysis for Determination of Resilient Moduli, Stresses and Stress Relationships for each Site Visit.

Date	Pavement Surface Temperature (°F)	Applied Stress PSI	AC M_R (psi)	Base M_R (psi)	Subgrade M_R (psi)	Base θ (psi)	Subgrade σ_d (psi)	Base Stress Relationship	Subgrade Stress Relationship
02/24/83	46	58.42	2,091,000	10,200	16,200	19.68	10.12	$1{,}675\theta^{0.629}$	$18{,}256\ \sigma_d^{-0.047}$
		89.33	2,300,000	15,700	16,300	28.87	14.95		
		123.53	2,732,000	16,600	16,000	37.65	19.62	$r^2 = 0.872$	$r^2 = 0.624$
		154.16	2,750,000	17,500	15,500	45.93	24.10		
03/03/83	35	58.54	3,903,000	9,300	15,500	16.16	8.37	$2{,}559\theta^{0.457}$	$16{,}299\ \sigma_d^{-0.021}$
		86.14	4,300,000	10,400	15,500	23.11	12.03		
		125.31	4,300,000	12,800	15,700	33.71	17.66	$r^2 = 0.986$	$r^2 = 0.246$
		154.16	4,400,000	14,000	15,000	40.32	21.29		
03/09/83	44	56.51	2,200,000	14,400	16,300	18.58	9.60	$5{,}431\theta^{0.333}$	$18{,}915\ \sigma_d^{-0.065}$
		82.51	2,500,000	16,000	16,000	25.82	13.43		
		119.29	2,856,000	17,900	15,700	35.23	18.51	$r^2 = 0.999$	$r^2 = 0.984$
		148.11	3,000,000	18,900	15,400	42.45	22.44		
03/17/83	34	61.06	4,748,000	9,000	17,300	16.23	8.39	$925\theta^{0.808}$	$22{,}797\ \sigma_d^{-0.133}$
		89.07	5,000,000	11,400	16,600	23.28	12.13		
		128.72	5,000,000	15,000	14,800	32.01	17.03	$r^2 = 0.994$	$r^2 = 0.682$
		159.35	4,000,000	19,400	15,600	42.08	22.51		
03/24/83	37	60.26	3,600,000	11,800	16,800	17.55	9.11	$1{,}923\theta^{0.638}$	$21{,}696\ \sigma_d^{-0.113}$
		89.89	3,600,000	15,100	16,500	25.78	13.50		
		126.94	2,836,000	21,200	15,200	36.00	19.12	$r^2 = 0.904$	$r^2 = 0.854$
		157.60	3,489,000	19,500	15,400	43.01	22.92		

Table 13. SR 174, MP 2.3 - Results of BISDEF Analysis for Determination of Resilient Moduli, Stresses and Stress Relationships for each Site Visit (Cont.).

Date	Pavement Surface Temperature (°F)	Applied Stress (psi)	AC M_R (psi)	Base M_R (psi)	Subgrade M_R (psi)	Base θ (psi)	Subgrade σ_d (psi)	Base Stress Relationship	Subgrade Stress Relationship
08/09/83	76	46.97	1,308,000	22,400	19,300	18.30	9.10	$4{,}238\theta^{0.573}$	$24{,}808\ \sigma_d^{-0.108}$
		78.62	2,000,000	27,200	19,300	25.62	13.25		
		123.52	2,000,000	33,400	17,800	36.75	19.31	$r^2 = 0.999$	$r^2 = 0.750$
01/10/84	34	81.72	600,000	165,900	50,800	23.16	11.45		
		113.21	600,000	170,300	48,000	30.16	15.30		
		154.91	600,000	181,800	44,500	38.59	19.68		
03/01/84	38	69.7	817,000	7,100	15,400	18.64	9.85	$1{,}301\theta^{0.586}$	$18{,}399\ \sigma_d^{-0.078}$
		95.0	820,000	9,000	15,000	25.41	13.55		
		126.5	830,000	10,000	14,700	33.55	17.90	$r^2 = 0.962$	$r^2 = 0.988$
03/07/84	38	68.8	709,000	13,700	15,800	19.13	10.35	$7{,}250\theta^{0.199}$	$15{,}244\ \sigma_d^{0.018}$
		95.0	960,000	12,600	16,200	24.61	13.31		
		129.4	853,000	15,200	16,000	33.96	18.55	$r^2 = 0.372$	$r^2 = 0.187$
03/20/84	40	67.5	789,000	18,500	16,000	17.50	9.69	$16{,}362\theta^{0.041}$	$13{,}752\ \sigma_d^{0.090}$
		95.9	893,000	18,400	16,800	24.60	13.60		
		132.8	1,009,000	19,000	16,700	32.66	18.18	$r^2 = 0.550$	$r^2 = 0.689$

PSAD2A COMPUTER PROGRAM [10]

PSAD2A is a layered elastic computer program which calculates moduli, stresses and strains under single and dual tire loading conditions. The program uses an iterative approach to determine the moduli of the different layers. For this study, the program was used to calculate deflections and strains under a given load for the summer or strongest condition and the spring or weakest condition for each of the sites. This was done to determine the difference in strains and deflections between the two cases so that the spring load could be found which induced the same deflections and strains, and hence damage, as in the summer under maximum loading.

Several inputs are required for the program. Each layer must be characterized by:

1. Poisson's ratio,
2. dry density,
3. thickness,
4. stress relationship, and
5. an initial estimate of modulus for each layer.

Poisson's ratios for the individual layers were the same as those used in BISDEF (see Table 7). The dry density of the asphalt concrete was assumed to be 140 pcf (2,400 kg/m^3), that of the bituminous surface treatment to be 125 pcf (2,000 kg/m^3), and the dry densities of the soils were as measured in the field. Where field data was not available estimates were made based upon material types. The thicknesses of the layers were the actual thicknesses of the pavement components. The stress relationships were those developed from the BISDEF results. The asphalt concrete modulus or bituminous surface treatment modulus was that obtained for the site visit date analyzed as determined by the BISDEF computer program. Table 14 summarizes the inputs for PSAD2A for the six sites, and gives the dates of the two cases, strongest and weakest, analyzed for each site.

It should be noted that the subgrade layer in this program must be characterized as a fine-grained material (i.e., M_R decreasing with increasing deviator stress) or as a layer with a constant resilient modulus. Two sites, SR 172, MP 2.0-1.9 and SR 172, MP 21.4-21.0, had subgrades where modulus increased with increasing stress. To circumvent

Table 14. Inputs Used in PSAD2A.

Site	Date	Layer	Thickness (inches)	Dry Density (pcf)	Poisson's Ratio	Asphalt Concrete or BST M_R (psi)	Stress Relationship
SR 97 MP 183.48-184.00	08/16/83	ACP	2.6	140	0.35	285,000	$M_R = 35{,}637\theta^{0.226}$
		Base	14.0	135	0.35		$M_R = 46{,}733\ \sigma_d^{-0.025}$
		Subgrade	∞	-	0.45		
	03/24/83	ACP	2.6	140	0.35	1,540,000	$M_R = 8{,}038\theta^{0.450}$
		Base	14.0	135	0.35		$M_R = 38{,}073\ \sigma_d^{-0.090}$
		Subgrade	∞	-	0.45		
SR 2 MP 117.38-117.62	08/16/83	ACP	6.2	140	0.35	245,000	$M_R = 5{,}216\theta^{0.804}$
		Base	16.6	135	0.35		$M_R = 24{,}794\ \sigma_d^{-0.509}$
		Subgrade	∞	-	0.45		
	02/21/84	ACP	6.2	140	0.35	425,000	$M_R = 15{,}052\theta^{0.253}$
		Base	16.6	125	0.35		$M_R = 28{,}676\ \sigma_d^{-0.604}$
		Subgrade	∞	-	0.45		
SR 2 MP 159.6-160.0	03/13/83	BST	1.8	140	0.35	1,200,000	$M_R = 2{,}787\theta^{0.658}$
		Base	9.0	137	0.35		$M_R = 21{,}904\ \sigma_d^{-0.199}$
		Subgrade	∞	-	0.45		
	03/01/84	BST	1.8	140	0.35	1,300,000	$M_R = 4{,}628\theta^{0.398}$
		Base	9.0	137	0.35		$M_R = 26{,}576\ \sigma_d^{-0.287}$
		Subgrade	∞	-	0.45		
SR 172 MP 2.0-1.9	08/17/83	Combined BST & Base	8.6	120	0.35		$M_R = 6{,}393\theta^{0.326}$
		Subgrade	212	100	0.40		$M_R = 8{,}600\theta^{0.0}$
	02/24/83	Combined BST & Base	8.6	120	0.35		$M_R = 613\theta^{0.781}$
		Subgrade	212	100	0.40		$M_R = 2{,}593\theta^{0.239}$

Table 14. Inputs Used in PSAD2A (Cont.).

Site	Date	Layer	Thickness (inches)	Dry Density (pcf)	Poisson's Tatio	Asphalt Concrete or BST M_R (psi)	Stress Relationship
SR 172 MP 21.4-21.0	08/17/83	BST	1.5	125	0.35	1,500,000	
		Base	9.0	115	0.35		$M_R = 15{,}719\theta^{0.226}$
		Subgrade	212	110	0.40		$M_R = 12{,}656\theta^{0.120}$
	03/01/84	BST	1.5	125	0.35	2,800,000	
		Base	9.0	115	0.35		$M_R = 1{,}699\theta^{0.422}$
		Subgrade	212	110	0.40		$M_R = 11{,}085\theta^{0.064}$
SR 174 MP 2.3-2.0	08/09/83	ACP	1.7	140	0.35	1,800,000	
		Base	10.3	132	0.35		$M_R = 4{,}238\theta^{0.573}$
		Subgrade	∞	-	0.45		$M_R = 24{,}808\ \sigma_d^{-0.108}$
	03/01/84	ACP	1.7	140	0.35	822,000	
		Base	10.3	132	0.35		$M_R = 1{,}301\theta^{0.586}$
		Subgrade	∞	-	0.45		$M_R = 18{,}399\ \sigma_d^{-0.078}$

this program requirement, the subgrade at those sites was characterized by a layer of infinite thickness, a constant modulus of 1,000,000 psi (6,900,000 KN/m^2) and a Poisson's ratio of 0.45. In the program, the layer above the subgrade was characterized by the actual subgrade data and given a thickness of 212 inches (538.5 cm). To evaluate the effect of this, the program was rerun with a bottom layer modulus of 1,000 psi (6,900 KN/m^2) and the same Poisson's ratio. No difference between outputted deflections, stresses, or strains were observed so this bottom layer was assumed to have no influence on the results.

For all sites the strongest case was found to be during the summer (the August site visit). At the SR 2, MP 159.6 site, however, the M_R - θ and M_R - σ_d relationships for that date were unrealistic with the k_2 value of $M_R = k_1 \theta^{k_2}$ for the base course equal to 1.473. Further, the subgrade relationship had a positive slope whereas all other site visits the subgrade stress relationship had a negative slope. Therefore it was decided to use the next strongest case where the asphalt concrete surface temperatures were similar. That turned out to be March 13, 1983.

The next question to be addressed was which loads would be analyzed. Since the vast majority of trucks on the highway use tubeless tires it was decided that those tire sizes would be used. Sizes 8-22.5, 9-22.5, 10-22.5, 11-22.5, 12-24.5, 14-17.5 and 16-22.5 were chosen for evaluation. These were considered to be the most common sizes on the road today. Only single tires on single axles were evaluated as these were considered to be the most critical cases. Next, the wheel loads had to be determined.

Summer Condition Tire Loads

For the summer cases, the loading condition was one where the maximum allowable load per tire would be input. This maximum was determined by The Revised Code of Washington (RCW) 46.44.042 which states: "Maximum gross weights - tire factor... it is unlawful to operate any vehicle upon public highways with a gross weight, including load, upon any tire concentrated upon the surface of the highway in excess of 550 lbs per inch tire width of such tire, up to a maximum width of 12 inches and for a tire having a width of 12 inches or more there shall be allowed a 20 percent tolerance above 550 lbs per inch width of such tire". Thus, maximum loads were calculated by 550 x the tire width in inches for tires up to twelve inches (30 cm) wide and 660 x the tire width in inches for tires greater than 12 inches (30 cm) wide. These values are shown in Table 15.

Note that if the 16 inch tire is allowed to carry 660 lb. x tire width, the results would be an allowable load on the tire of 10,560 lbs (4,800 kg). On a single tire, single axle this would result in a gross axle weight of 21,120 lbs (9,600 kg) which exceeds the legal maximum of 20,000 lbs (9,000 kg). Thus, a maximum tire load of 10,000 lbs (4,500 kg) was assumed for the 16-22.5 tire.

It was also necessary to determine what tire pressure would be appropriate for use with these different tires sizes. According to work previously completed by Sharma, Hallin and Mahoney at the University of Washington [11], it was most accurate to use a variable radius, variable pressure analysis method rather than fixed radius or fixed pressure. Thus it was decided to use the recommendations of The Tire and Rim Association, Inc. on tire pressures for a given load for a given tire size. Table 16 gives the needed information for diagonal (bias) ply tires for trucks, buses and trailers used in normal highway service for tires mounted on 15^{o} drop center rims.

The way Table 16 was used is as follows. For a given tire size, say 8-22.5, the table was entered in the "S" (for single tire) row. In this row the load closest to the maximum allowable load for an 8 inch (20 cm) tire = 4,400 lb (2,000 kg) was located. The tire pressure of that column was used in the analysis. In the example case the tire pressure was 105 psi. These pressures are also listed in Table 15.

<u>Spring Condition Tire Loads</u>

For the spring condition it was decided to run the following three cases:

1. the maximum load and tire pressure as used for the summer condition,
2. 75% of the maximum load and the corresponding appropriate tire pressure, and
3. 50% of the maximum load and the corresponding appropriate tire pressure.

Table 15. Tire Loads and Tire Pressures for the Summer Condition.

Tire Size	Tire Pressure (psi)	Load/Tire (lbs)
8-22.5	105	4,400
9-22.5	115	4,950
10-22.5	105	5,500
11-22.5	100	6,050
12-24.5	115	7,920
14-17.5	100	9,240
16-22.5	90	10,000

Table 16. **DIAGONAL (BIAS) PLY**

TIRES FOR TRUCKS, BUSSES AND TRAILERS USED IN NORMAL HIGHWAY SERVICE

TIRES MOUNTED ON 15° DROP CENTER RIMS

TIRE AND RIM ASSOCIATION STANDARD

TABLE TTB-1B

DUAL (D) SINGLE (S)

TIRE SIZE DESIGNATION		TIRE LOAD LIMITS (LBS.) AT VARIOUS COLD INFLATION PRESSURES (PSI) (The pressure is minimum for the load)												
		55	60	65	70	75	80	85	90	95	100	105	110	115
8-19.5	D	2230	2350	**2460**(D)	2570	2680	**2780**(E)	2880	2980	**3070**(F)				
	S	2270	2410	2540	2680	**2800**(D)	2930	3060	**3170**(E)	3280	3400	**3500**(F)		
8-22.5	D	2490	2620	**2750**(D)	2870	2990	**3100**(E)	3210	3320	**3430**(F)				
	S	2530	2680	2840	2990	**3140**(D)	3270	3410	**3530**(E)	3660	3780	**3910**(F)		
9-22.5	D	2960	3120	3270	3410	**3550**(E)	3690	3820	**3950**(F)	4070	4200	**4320**(G)		
	S	3010	3190	3370	3560	3730	3890	**4050**(E)	4210	4350	**4500**(F)	4640	**4790**	**4920**(G)
10-22.5	D	3510	3690	3870	**4040**(E)	4200	4360	**4520**(F)	4670	4820	**4970**(G)			
	S	**3560**	**3770**	4000	4210	4410	**4610**(E)	4790	4970	**5150**(F)	5320	5490	**5670**(G)	
11-22.5	D			4380	4580	**4760**(F)	4950	5120	**5300**(G)	5470	5630	**5800**(H)		
	S			4530	4770	4990	5220	**5430**(F)	5640	5840	**6040**(G)	6240	6430	**6610**(H)
11-24.5	D			4660	4870	**5070**(F)	5260	5450	**5640**(G)	5820	6000	**6170**(H)		
	S			4820	5070	5310	5550	**5780**(F)	6000	6210	**6430**(G)	6630	6840	**7030**(H)
12-22.5	D			4780	4990	**5190**(F)	5390	5590	**5780**(G)	5960	6150	**6320**(H)		
	S			4940	5200	5450	5690	**5920**(F)	6140	6370	**6590**(G)	6790	7010	**7200**(H)
12-24.5	D			5080	5300	**5520**(F)	5730	5940	**6140**(G)	6330	6530	**6720**(H)		
	S			5240	5520	5790	6040	**6290**(F)	6530	6770	**7000**(G)	7220	7440	**7660**(H)

NOTE: Letters in parentheses denote Load Range for which Bold Face Loads are maximum.
IMPORTANT: For speed limitations, inflation requirements, and rim and wheel load restrictions, see pages 2-04 and 2-05.
GENERAL DATA SHOWN ON PAGE 2-26.
CAUTION — ALWAYS USE APPROVED TIRE AND RIM COMBINATIONS FOR DIAMETERS AND CONTOURS. SEE PAGE 2-29 FOR APPROVED TIRE AND RIM COMBINATIONS.

Table 16. **DIAGONAL (BIAS) PLY** (Continued)

WIDE BASE TIRES FOR TRUCKS, BUSSES AND TRAILERS USED IN NORMAL HIGHWAY SERVICE

TIRES MOUNTED ON 15° DROP CENTER RIMS

TIRE AND RIM ASSOCIATION STANDARD

TABLE WBTB-1B
DUAL (D) SINGLE (S)

TIRE SIZE DESIGNATION		TIRE LOAD LIMITS (LBS.) AT VARIOUS COLD INFLATION PRESSURES (PSI) (The pressure is minimum for the load)														
		30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
14-17.5	D	2820	3080	3340	**3570**(D)	3800	4020	**4220**(E)	4430	4620	**4810**(F)	5000	5180	**5360**(G)		
	S			3210	3500	3790	**4060**(D)	4320	4570	**4800**(E)	5030	5255	**5470**(F)	5680	**5890**	**6090**(G)
15-19.5	D	**3600**(D)	3930	4250	**4560**(E)	4850	5120	**5390**(F)	5650	5900	**6150**(G)					
	S			**4090**(D)	4470	4830	**5180**(E)	5510	5820	**6130**(F)	6420	6710	**6980**(G)			
15-22.5	D				**5000**(E)	5320	5620	**5910**(F)	6200	6480	**6740**(G)	7000	7250	**7500**(H)		
	S						**5680**(E)	6040	6390	**6720**(F)	7040	7360	**7660**(G)	7950	8240	**8520**(H)
16.5-19.5	D				5310	5640	5970	6270	6580	6870	7150	**7430**(H)				
	S						6030	6410	6780	7130	7480	7810	8130	**8440**(H)		
16.5-22.5	D				5800	6170	6520	6860	7190	7520	7820	**8120**(H)				
	S						6590	7010	7410	7790	8170	8540	8890	**9230**(H)		
18-19.5	D				5900	6270	6640	**6980**(G)	7310	7640	**7960**(H)	8260	8560	**8850**(J)		
	S						6700	7130	7540	**7930**(G)	8310	8680	**9040**(H)	9390	**9730**	**10060**(J)
18-22.5	D				6430	6850	7230	**7610**(G)	7980	8330	**8680**(H)	9010	9340	**9650**(J)		
	S						7310	7780	8220	**8650**(G)	9070	9470	**9860**(H)	10240	**10610**	**10970**(J)
19.5-19.5	D				6950	7390	7820	8230	8620	9010	**9370**(J)					
	S						7900	8400	8890	9350	9800	10240	**10650**(J)			

NOTE: Letters in parentheses denote Load Range for which Bold Face Loads are maximum.
IMPORTANT: For speed limitations, inflation requirements, and rim and wheel load restrictions, see pages 2-04 and 2-05.
GENERAL DATA SHOWN ON PAGE 2-27.
CAUTION — ALWAYS USE APPROVED TIRE AND RIM COMBINATIONS FOR DIAMETERS AND CONTOURS. SEE PAGE 2-29 FOR APPROVED TIRE AND RIM COMBINATIONS.

The tire pressures were determined through the use of Table 16 as described in the previous section. The spring condition loads and tire pressures are presented in Table 17. These conditions were chosen so that the strains determined by the summer conditions would fall in the range of strains obtained during the spring conditions and therefore an equivalent load could be found. This equivalent load would be the tire load in the spring which caused the same deflections and strains as the maximum load during the summer.

Determination of Equivalent Summer and Spring Loads

The outputs from PSAD2A which were of interest in both the summer and spring analyses were: the surface deflection (θ), the horizontal strain at the bottom of the asphalt concrete or bituminous surface treatment (ε_t), the vertical strain at the top of the base course (ε_{vb}), and the vertical strain at the top of the subgrade (ε_{vs}). These values for all analysis cases can be found in Appendix D.

As a check on the accuracy of the stress relationships determined by BISDEF, a comparison was made between the PSAD2A predicted surface deflection and the surface deflection measured in the field. In order to get the best comparison, the PSAD2A stress and load radius closest to one measured in the field were used. Table 18 shows the results of the comparison. The deflections compared reasonably well.

Once the PSAD2A deflections and strains were calculated, the determination of the spring load which caused the same damage as the maximum allowable load during the summer could be computed. This was done using a plot such as the one shown in Figure 32. This plot is for SR 172, MP 21.4, tire size = 11-22.5. The plot was constructed as follows:

1. surface deflection versus load was plotted for the three loads used in the spring analysis, and a curve fitted through the points,
2. ε_t, ε_{vb} and ε_{vs} versus load were plotted for the same three loads, and similar curves were drawn.

These lines are labeled as in the figure.

The next step was to determine the spring load which would result in the same deflections and strains as the summer case. This was accomplished by entering the plot on the vertical axis with the summer deflec-

Table 17. Tire Loads and Tire Pressures for the Spring Condition.

Percent of Maximum Load	Tire Size	Tire Pressure (psi)	Load/Tire (lbs)
100	8-22.5	105	4,400
	9-22.5	115	4,950
	10-22.5	105	5,500
	11-22.5	100	6,050
	12-24.5	115	7,920
	14-17.5	100	9,240
	16-22.5	90	10,000
75	8-22.5	80	3,300
	9-22.5	75	3,712
	10-22.5	70	4,125
	11-22.5	65	4,538
	12-24.5	80	5,940
	14-17.5	100	6,930
	16-22.5	75	7,500
50	8-22.5	55	2,200
	9-22.5	55	2,475
	10-22.5	55	2,750
	11-22.5	65	3,025
	12-24.5	65	3,960
	14-17.5	65	4,620
	16-22.5	55	5,000

Table 18. Comparison Between PSAD2A Predicted and Actual Field Surface Deflections.

Site	Season	PSAD2A Stress (psi)	PSAD2A Load Radius (inches)	PSAD2A Predicted δ ($\times 10^{-3}$ in.)	Field Stress (psi)	Field δ ($\times 10^{-3}$ in.)
SR 97 MP 183.48-184.00	Summer	100	5.42	11.4	104	13.4
	Spring	75	5.64	12.0	76.5	13.6
SR 2 MP 117.38-117.62	Summer	115	4.68	18.0	113.8	24.0
	Spring	90	5.95	19.4	94.1	17.5
SR 2 MP 159.6-160.0	Summer	90	5.95	34.8	84.0	30.4
	Spring	90	5.95	38.8	95.9	39.2
SR 172 MP 2.0-1.9	Summer	55	5.38	55.9	56.8	57.4
	Spring	75	5.64	83.6	72.7	72.8
SR 172 MP 21.4-21.0	Summer	90	5.95	26.1	88.0	24.5
	Spring	90	5.95	45.9	86.9	43.2
SR 174 MP 2.3-2.0	Summer	90	5.95	25.6	78.6	21.2
	Spring	90	5.95	36.6	95.0	38.0

Note: The FWD load radius was a constant of 5.91 inches.

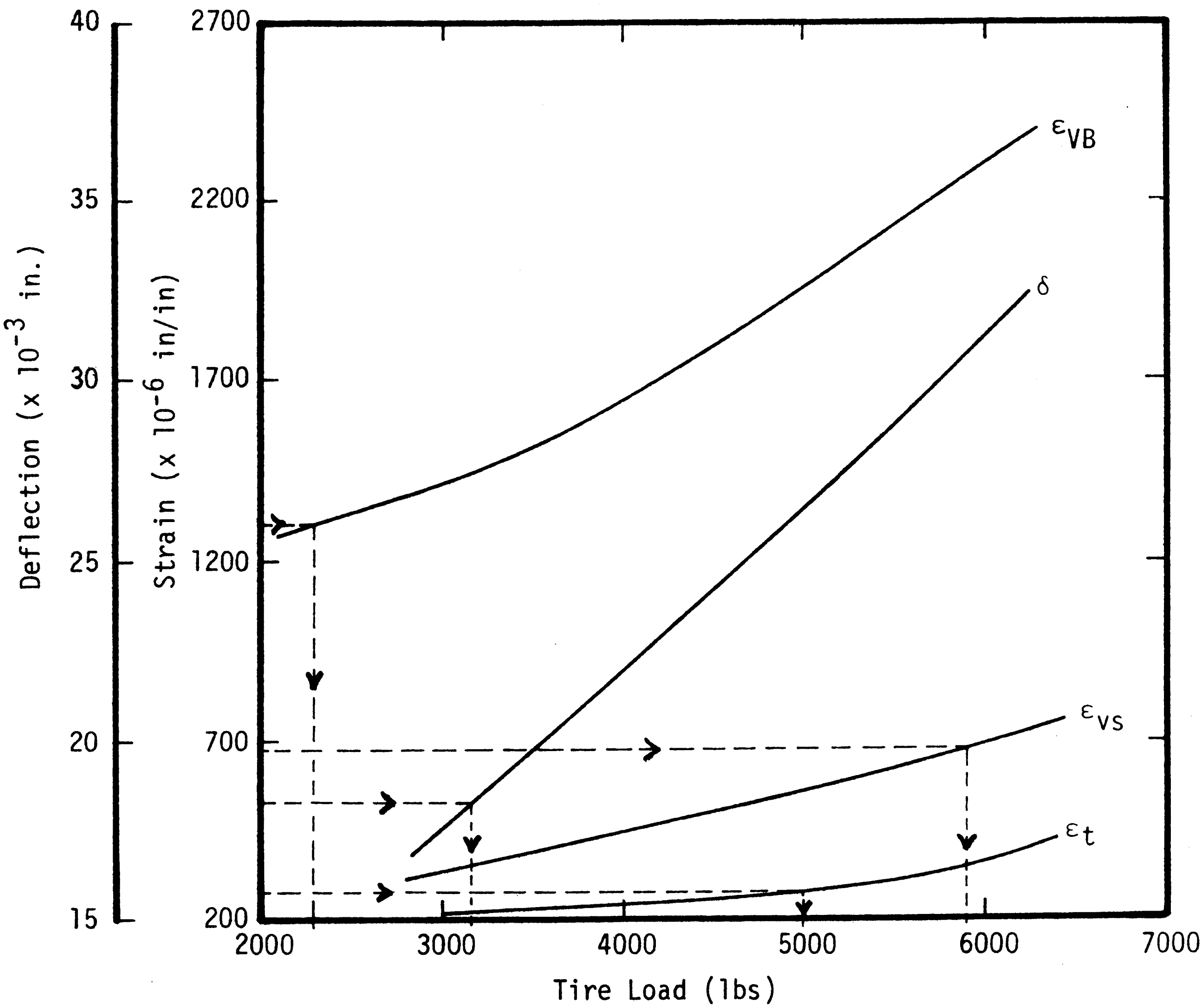


Figure 32. Plot of PSAD2A Results for Determination of Allowable Spring Loads (SR 172 - MP 21.4, 11-22.5 tire size).

tion, ε_t, ε_{vb} or ε_{vs} value. A horizontal line was then drawn across to intersect the appropriate curve. At the intersection points vertical lines were drawn down to intersect the horizontal or "tire load" axis (refer to Figure 32). These values were the tire loads which would result in the same deflection and strains as obtained during the summer under maximum allowable loading. In other words, these loads were the loads that would cause the same damage to the pavement structure in the spring as the maximum allowable load did during the summer when the pavement structure was strongest.

The allowable spring wheel loads as determined by this analysis are presented in Tables 19 through 24. The allowable spring load for each tire size considered for the different criteria evaluated are listed as well as the percent of the legal load for a given tire which this load represents. The plots used to obtain these values (like the plot in Figure 32) are presented in Appendix D.

It should be noted that for the SR 172, MP 2.0-1.9 only two criteria were evaluated, σ and ε_{vs}. This was due to the fact that the surface course and base were combined into one layer. Hence, ε_t and ε_{vb} values did not exist, at least not in the traditional sense.

In addition to the analysis described above, one other condition was studied. This condition was that of keeping the tire pressure at a constant value of 95 psi and varying the load and load radius. The value of 95 psi was chosen as this was the average value found during a study at the Fife Way Station [11]. Two sites were chosen for this analysis, SR 174, MP 2.3-2.0 and SR 172, MP 21.4-21.0. The same tire loads, etc. were analyzed as described for the variable pressure, variable radius evaluation. The raw data is contained in Appendix D and the results are shown in Tables 25 and 26. The most critical criterion is the vertical strain in the base for both test sites regardless of tire pressure; however, the use of 95 psi reduces the spring allowable loads by about 10 percent. In other words, with the lower tire pressures used in Tables 23 and 24, the maximum legal loads would be reduced by about 40 to 50 percent. Using 95 psi tire pressure, the maximum legal loads would be reduced about 50 to 60 percent.

Table 19. SR 97, MP 183.48 - Spring Allowable Loads and Corresponding Percent of the Maximum Legal Load.

Tire Size	Maximum Legal Tire Load (lbs)	Spring Allowable Load for δ (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_t (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_{vb} (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_{vs} (lbs)	% of Maximum Legal Load
8-22.5	4,400	3,775	86	5,740	130	5,440	124	3,980	90
9-22.5	4,950	4,325	87	6,100	123	5,980	121	4,580	92
10-22.5	5,500	4,900	89	5,900	107	6,080	110	4,950	90
11-22.5	6,050	4,875	80	6,200	102	6,230	104	5,400	89
12-24.5	7,920	6,300	80	7,660	97	7,950	100	6,775	85
14-17.5	9,240	6,840	74	6,020	65	7,100	77	7,850	85
16-22.5	10,000	7,320	73	5,990	60	7,450	74	8,470	85

δ = surface deflection
ε_t = horizontal strain at the bottom of the asphalt concrete
ε_{vb} = vertical strain at the top of the base
ε_{bs} = vertical strain at the top of the subgrade

Table 20. SR 2, MP 117.38 - Spring Allowable Loads and Corresponding Percent of the Maximum Legal Load.

Tire Size	Maximum Legal Tire Load (lbs)	Spring Allowable Load for δ (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_t (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_{vb} (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_{vs} (lbs)	% of Maximum Legal Load
8-22.5	4,400	5,390	122	6,000	136	5,460	124	5,200	118
9-22.5	4,950	5,460	110	6,320	128	6,020	122	5,910	119
10-22.5	5,500	6,230	113	6,900	125	6,570	119	6,300	114
11-22.5	6,050	6,770	112	7,000	116	6,770	112	6,880	114
12-24.5	7,920	8,550	108	9,500	120	9,200	116	9,200	116
14-17.5	9,240	9,380	102	>10,000	>108	>10,000	>108	9,600	104
16-22.5	10,000	11,100	111	>11,200	>112	>11,200	>112	>11,200	>112

δ = surface deflection
ε_t = horizontal strain at the bottom of the asphalt concrete
ε_{vb} = vertical strain at the top of the base
ε_{vs} = vertical strain at the top of the subgrade

Table 21. SR 2, MP 159.6 - Spring Allowable Loads and Corresponding Percent of the Maximum Legal Load.

Tire Size	Maximum Legal Tire Load (lbs)	Spring Allowable Load for δ (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_t (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_{vb} (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_{vs} (lbs)	% of Maximum Legal Load
8-22.5	4,400	4,020	91	4,080	93	3,670	83	4,400	100
9-22.5	4,950	4,600	93	4,600	93	4,190	85	4,920	99
10-22.5	5,500	5,050	92	5,020	91	4,600	84	5,390	98
11-22.5	6,050	5,570	92	5,830	96	4,990	82	5,900	98
12-24.5	7,920	7,170	90	7,120	90	6,180	78	7,600	96
14-17.5	9,240	8,115	88	6,640	72	6,020	65	8,790	95
16-22.5	10,000	8,900	89	7,820	78	6,760	68	9,560	96

δ = surface deflection
ε_t = horizontal strain at the bottom of the asphalt concrete
ε_{vb} = vertical strain at the top of the base
ε_{vs} = vertical strain at the top of the subgrade

Table 22. SR 172, MP 2.0 - Spring Allowable Loads and Corresponding Percent of the Maximum Legal Load.

Tire Size	Maximum Legal Tire Load (lbs)	Spring Allowable Load for δ (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_{vb} (lbs)	% of Maximum Legal Load
8-22.5	4,400	1,820	41	2,330	53
9-22.5	4,950	2,180	44	2,720	55
10-22.5	5,500	2,400	44	2,980	54
11-22.5	6,050	2,450	40	3,200	53
12-24.5	7,920	3,800	48	4,400	56
14-17.5	9,240	4,400	48	4,920	53
16-22.5	10,000	4,680	47	5,300	53

δ = surface deflection
ε_{vb} = vertical strain at the top of the subgrade

Table 23. SR 172, MP 21.4 - Spring Allowable Loads and Corresponding Percent of the Maximum Legal Load.

Tire Size	Maximum Legal Tire Load (lbs)	Spring Allowable Load for δ (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_t (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_{vb} (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_{vs} (lbs)	% of Maximum Legal Load
8-22.5	4,400	2,400	54	3,600	82	2,400	54	4,400	100
9-22.5	4,950	2,720	55	4,230	85	2,730	55	4,930	100
10-22.5	5,500	2,980	54	4,375	80	2,750	50	5,375	98
11-22.5	6,050	3,150	52	5,000	83	2,290	38	5,900	98
12-24.5	7,920	4,210	53	5,530	70	3,600	45	7,500	95
14-17.5	9,240	4,730	51	4,830	52	3,460	37	8,220	89
16-22.5	10,000	5,000	50	4,300	43	3,320	33	9,050	90

δ = surface deflection
ε_t = horizontal strain at the bottom of the asphalt concrete
ε_{vb} = vertical strain at the top of the base
ε_{vs} = vertical strain at the top of the subgrade

Table 24. SR 174, MP 2.0 - Spring Allowable Loads and Corresponding Percent of the Maximum Legal Load.

Tire Size	Maximum Legal Tire Load (lbs)	Spring Allowable Load for δ (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_t (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_{vb} (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_{vs} (lbs)	% of Maximum Legal Load
8-22.5	4,400	3,140	71	4,750	108	3,130	71	4,900	111
9-22.5	4,950	3,490	70	5,440	110	3,490	70	5,460	110
10-22.5	5,500	3,810	69	5,600	102	3,700	67	6,000	109
11-22.5	6,050	4,200	69	5,900	98	3,850	64	6,590	109
12-24.5	7,920	5,500	69	7,650	97	4,780	60	8,500	107
14-17.5	9,240	6,180	67	6,800	74	4,670	50	10,200	110
16-22.5	10,000	6,720	67	7,700	77	4,780	48	10,330	103

δ = surface deflection
ε_t = horizontal strain at the bottom of the asphalt concrete
ε_{vb} = vertical strain at the top of the base
ε_{vs} = vertical strain at the top of the subgrade

Table 25. SR 172, MP 21.4 - Constant 95 psi Tire Pressure Analysis, Spring Allowable Loads and Corresponding Percent of the Maximum Legal Load.

Tire Size	Maximum Legal Tire Load (lbs)	Spring Allowable Load for δ (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_t (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_{vb} (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_{vs} (lbs)	% of Maximum Legal Load
8-22.5	4,400	2,280	52	3,000	68	1,910	43	4,400	100
9-22.5	4,950	2,550	52	3,300	67	2,100	42	4,950	100
10-22.5	5,500	2,800	51	3,300	60	2,100	38	5,460	99
11-22.5	6,050	3,080	51	3,400	56	2,180	36	5,800	96
12-24.5	7,920	3,960	50	3,830	48	3,060	38	7,400	93
14-17.5	9,240	4,460	48	3,000	32	2,450	26	8,390	91
16-22.5	10,000	4,810	48	3,400	34	3,000	30	9,000	90

δ = surface deflection
ε_t = horizontal strain at the bottom of the asphalt concrete
ε_{vb} = vertical strain at the top of the base
ε_{vs} = vertical strain at the top of the subgrade

Table 26. SR 174, MP 2.0 - Constant 95 psi Tire Pressure Analysis, Spring Allowable Loads and Corresponding Percent of Maximum Legal Load.

Tire Size	Maximum Legal Tire Load (lbs)	Spring Allowable Load for δ (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_t (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_{vb} (lbs)	% of Maximum Legal Load	Spring Allowable Load for ε_{vs} (lbs)	% of Maximum Legal Load
8-22.5	4,400	3,060	70	4,800	109	2,700	61	4,950	112
9-22.5	4,950	3,400	69	5,270	106	2,960	60	5,500	111
10-22.5	5,500	3,820	69	5,500	100	3,125	57	6,120	111
11-22.5	6,050	4,100	68	5,480	90	3,460	57	6,710	111
12-24.5	7,920	5,400	68	6,100	77	3,960	50	8,480	107
14-17.5	9,240	6,150	66	6,525	71	4,100	44	9,600	104
16-22.5	10,000	6,620	66	7,500	75	4,300	43	10,280	103

δ = surface deflection
ε_t = horizontal strain at the bottom of the asphalt concrete
ε_{vb} = vertical strain at the top of the base
ε_{vs} = vertical strain at the top of the subgrade

LOAD ANALYSIS RESULTS

The data in Tables 19 through 26 indicate the surface deflection (δ) and the vertical strain at the top of the base (ε_{vb}) are the critical parameters for determining the allowable spring load per tire. It is obvious that the sites with the most critical conditions are the two test sites on SR 172. This was expected as this state route often has load restrictions placed on it whereas load restrictions are normally not placed on the other test sites. It is also apparent that SR 2, MP 117.38 (Sunnyslope) was weakest in the summer. This may have been due to the poor asphalt concrete condition at the site coupled with the 99°F (37°C) temperature on the day of testing in August 1983. Table 27 shows a summary of the results, noting the critical criterion, spring allowable load, and percent of maximum legal load, for the six test sites.

Based on the results in Table 27, forty percent of the maximum legal load appears to be the lower cut-off for the most critical case. However, test sites located on routes such as SR 97 and SR 2 show that 60 to 85 percent of the maximum legal loads give equivalent pavement response to the summer baseline condition. Given the observed and expected variation among the test sites (and it is reasonable to expect similar variations on other routes in the area), a load restriction policy can be formulated by at least two approaches:

1. Restrictive: load restrictions are a function of the pavement responses on the weakest routes (such as SR 172 and 174).
2. Variable: load restrictions are tailored to each individual route based on the pavement response as compared to summer conditions (as illustrated by the range of percentages shown in Table 27.) An example of this approach is illustrated in Reference 13 (Alaska DOTPF report).

Currently, there are major difficulties associated with a load restriction policy based on Item 2 above due to the necessary enforcement (both personnel, equipment and weight enforcement sites). Thus, it is necessary to continue at this time a reasonable restrictive policy. Therefore, a restrictive load policy that applies to the weaker routes a blanket 60 percent reduction from the allowable legal load is recommended. Table 28 shows a comparison between the existing load restrictions and the new proposed restrictions. It must be noted that

Table 27. Summary of the Critical Criteria and Corresponding Spring Allowable Load for Each Tire Size Modeled.

Tire Size	Site	Critical Criterion for Each Site	Spring Allowable Load (lbs)	% of Maximum Legal Load
8-22.5	SR 97, MP 183.48	δ	3,775	86
	SR 2, MP 117.38	ε_t	5,200	118
	SR 2, MP 159.6	ε_{VB}	3,670	83
	SR 172, MP 2.0	δ	1,820	41 (critical)
	SR 172, MP 21.4	ε_{VB}	2,400	54
	SR 174, MP 2.0	ε_{VB}	3,130	71
9-22.5	SR 97, MP 183.48	δ	4,325	87
	SR 2, MP 117.38	δ	5,460	110
	SR 2, MP 159.6	ε_{VB}	4,190	85
	SR 172, MP 2.0	δ	2,180	44 (critical)
	SR 172, MP 21.4	ε_{VB}	2,730	55
	SR 174, MP 2.0	ε_{VB}	3,490	70
10-22.5	SR 97, MP 183.48	δ	4,900	80
	SR 2, MP 117.38	δ	6,230	113
	SR 2, MP 159.6	ε_{VB}	4,600	84
	SR 172, MP 2.0	δ	2,400	44 (critical)
	SR 172, MP 21.4	ε_{VB}	2,750	50
	SR 174, MP 2.0	ε_{VB}	3,700	67
11-22.5	SR 97, MP 183.48	δ	4,875	80
	SR 2, MP 117.38	δ	6,770	112
	SR 2, MP 159.6	ε_{VB}	4,990	82
	SR 172, MP 2.0	δ	2,450	40
	SR 172, MP 21.4	ε_{VB}	2,290	38 (critical)
	SR 174, MP 2.0	ε_{VB}	3,850	64
12-24.5	SR 97, MP 183.48	δ	6,300	80
	SR 2, MP 117.38	δ	8,550	108
	SR 2, MP 159.6	ε_{VB}	6,180	78
	SR 172, MP 2.0	δ	3,800	48
	SR 172, MP 21.4	ε_{VB}	3,600	45 (critical)
	SR 174, MP 2.0	ε_{VB}	4,780	60
14-17.5	SR 97, MP 183.48	ε_t	6,020	65
	SR 2, MP 117.38	δ	9,380	102
	SR 2, MP 159.6	ε_{VB}	6,020	65
	SR 172, MP 2.0	δ	4,400	48
	SR 172, MP 21.4	ε_{VB}	3,460	37 (critical)
	SR 174, MP 2.0	ε_{VB}	4,670	50
16-22.5	SR 97, MP 183.48	ε_t	5,990	60
	SR 2, MP 117.38	δ	11,100	111
	SR 2, MP 159.6	ε_{VB}	6,760	68
	SR 172, MP 2.0	δ	4,680	47
	SR 172, MP 21.4	ε_{VB}	3,320	33 (critical)
	SR 174, MP 2.0	ε_{VB}	4,780	48

Table 28. Comparison of the Current and Proposed Load Restrictions.

Emergency Load Restriction		Severe Emergency Load Restriction		Proposed Load Restriction	
Tire Width	Gross Load Each Tire (lbs)	Tire Width	Gross Load Each Tire (lbs)	Tire Width	Gross Load Each Tire (lbs)
8-22.5	2,250	8-22.5	1,800	8	1,800
9-22.5	2,800	9-22.5	1,900	9	2,000
10-22.5	3,400	10-22.5	2,250	10	2,200
11-22.5 11-24.5	4,000	11-22.5 11-24.5	2,750	11	2,400
12-22.5 12-24.5	4,500	12-22.5	3,000	12	3,200
14-17.5	4,500	14-17.5	3,000	14	3,700
16-22.5	4,500	16-22.5	3,000	16	4,000

the FWD and associated analysis provide an excellent mechanism for individual route load restriction polices if needed in the future.

If one looks at the case of the 95 psi constant pressure analysis, the vertical strain at the top of the base becomes even more critical however only at the larger tire sizes (14 and 16 in.) do the values fall much below the 40 percent of maximum allowable load value. Thus, even based on these findings, the proposed load restrictions are reasonable.

CRITERION FOR ESTABLISHING WHEN TO APPLY LOAD RESTRICTIONS

A basic issue which was addressed in the study was when to establish load restrictions on a specific highway (assuming that load restrictions would be necessary). One criterion which provides certainty as to the need for load restrictions is the use of deflection measurements. Such measurements can be obtained with the FWD, Benkelman Beam, or other deflection measuring devices. Unfortunately, for the near future, it will be difficult for WSDOT equipment and/or personnel to be at all the necessary locations during the critical months of January, February, and March. An alternative approach is to use temperature data which suggests the depth of thaw in a pavement and hence if it is near or in the "critical period".

Figure 33 was prepared from calculating the depth of thaw for various thaw indices by use of the modified Berggren equation as shown below [12]:

$$x = \lambda \sqrt{\frac{48 k_{avg}\ n\ TI}{L}}$$

where: x = depth of thaw (ft),

λ = dimensionless coefficient which corrects formula for neglected effects of volumetirc heat,

n = conversion factor for air thawing index to surface thawing index,

TI = air thawing index (°F·days),

L = latent heat (BTU/ft^3).

The pavement structure was assumed to be homogeneous and composed of either a coarse-grained or fine-grained soil (fixed dry densities of 130

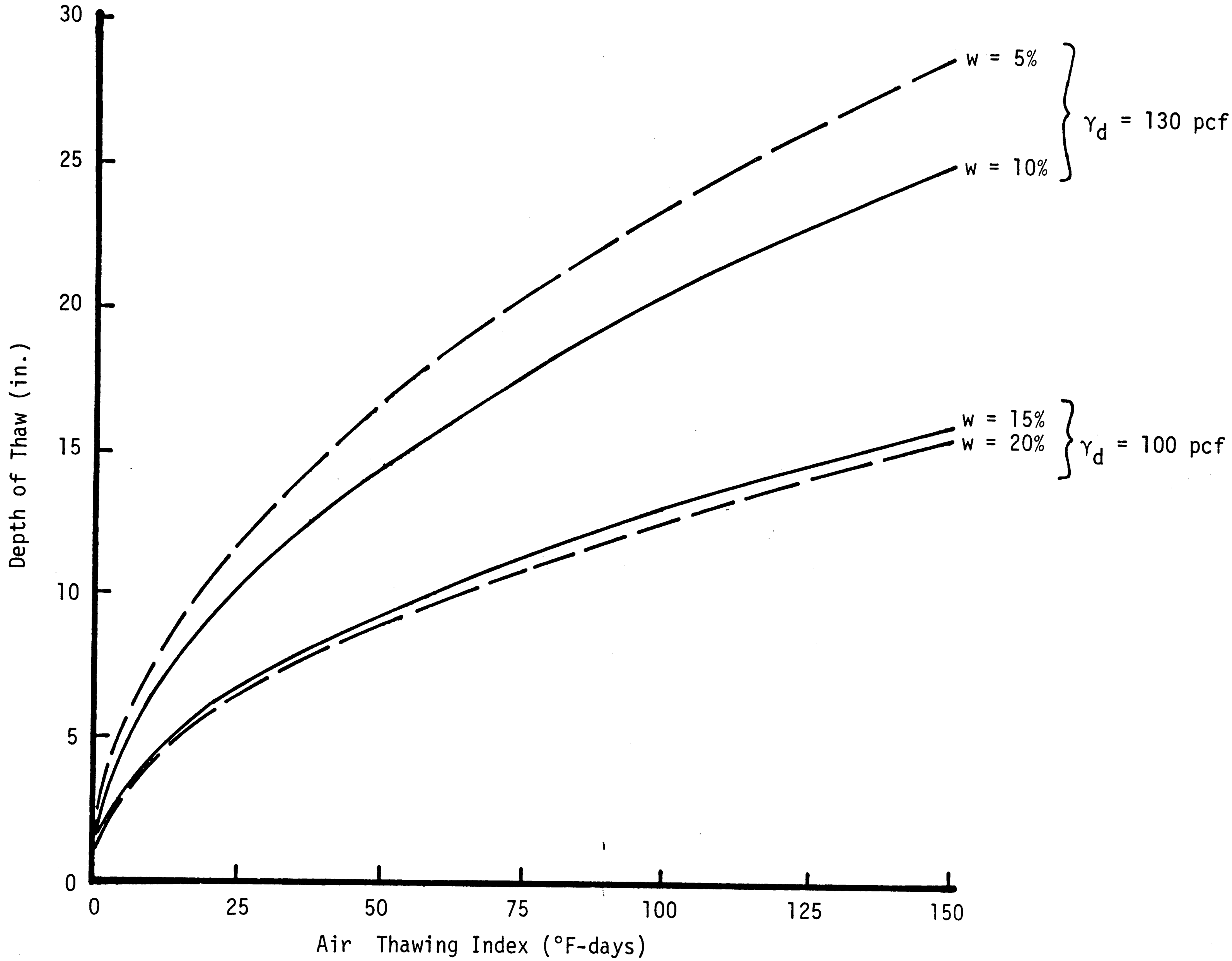


Figure 33. Air Thawing Index vs. Depth of Thaw for Thin Asphalt Surfaced Pavements

and 100 pcf, respectively). An n = 1.5 was assumed (dark asphalt surface) along with λ = 0.7 for the fine-grained soil and λ = 0.6 for the coarse-grained soil (based on calculations of λ for Washington and Oregon which represent several hundred locations). The pavement surface thickness was assumed to have a negligible effect on the depth of thaw (an assumption quite valid for bituminous surface treatments but less so for increasing thicknesses of asphalt concrete). As shown in Figure 33 the depth of thaw for equal thawing indices is clearly greater for coarse-grained soils as opposed to fine-grained. Normally, it is reasonable to expect that the upper portions of all WSDOT pavement structures will behave as a coarse-grained soil. Thus, at an air TI≃30 the depth of thaw will be about 12 in and at a TI≃ 50 about 15 in. For most pavement structures this would result in the surface and base courses being thawed but not necessarily all of the subgrade.

To further examine the above approach, the test sites used in the study and previously described were reviewed. Specifically, on those dates for which FWD deflection basins were obtained during January through early March 1984, the temperature conditions were summed prior to the deflection testing date. The results of this review are shown in Table 29 for each of the test sites. The results suggest that an air thawing index of about 30 to 50 results in an unfrozen state (as modeled by the FWD deflection basins and the BISDEF computer program). This generally agrees with the estimated depth of thaws shown in Figure 33. Thus, district personnel can tentatively adopt a TI≃30 to indicate pavement structures approaching a "critical condition" and a TI ≃ 50 to indicate pavement structures in a "critical condition". Obviously, such a criterian based on temperature data will vary from site to site but the field data suggests that the recommended thawing index is reasonable.

An air thawing index of 30 can be achieved within <u>one day</u> (unlikely however) if the mean daily temperature is 62°F (i.e., 62°F - 32°F = 30°F-day) or <u>over several days</u> (e.g. 10 days at 35°F or (35°F - 32°F) x (10 days) = 30°F-day). The district peronnel at the various maintenance offices throughout a district currently record daily high/low temperatures. Thus, the mean daily temperatures based on an average of the high and low temperatures can be accumulated. When the mean daily temperature is above 32°F consistently and accumulatively approaches 30°F to 50°F-

Table 29. Summary of Freezing and Thawing Indices Preceeding Deflection Test Dates.

Test Site	Deflection Test Date	Preceeding Time Period	Freezing Index	Thawing Index	Base Course State
SR 97 (MP 183.48)	-	Prior to 1/3	555	-	-
	01/11/84	1/3 thru 1/11	-	34	Frozen
	-	1/12 thru 1/23	164	-	-
	01/31/84	1/24 thru 1/31	-	21	Marginally Frozen
	02/21/84	2/1 thru 2/21	0	0	Unfrozen
SR 2 (MP 117.38)	-	Prior to 1/5	441	-	-
	01/11/84	1/5 thru 1/11	-	39	Marginally Frozen
	-	1/12 thru 1/23	108	-	-
	01/31/84	1/24 thru 1/31	-	46	Frozen
	02/21/84	2/1 thru 2/21	-	50	Unfrozen
SR 2 (MP 159.6)	01/10/84	Thru 1/10	566	-	Frozen
	-	1/11 thru 1/23	166	-	-
	02/21/84	1/24 thru 2/21	-	60	Unfrozen
SR 172 (MP 2.0 and MP 21.4)	01/10/84	Thru 1/10	564	-	Frozen
	-	1/11 thru 1/23	181	-	-
	-	1/24 thru 2/1	-	34	-
	-	2/2 thru 2/14	24	-	-
	03/01/84	2/15 thru 2/29	-	19	Unfrozen
SR 174 (MP 2.3)	-	Thru 1/3	375	-	-
	01/10/84	1/4 thru 1/10	-	26	Frozen
	-	1/11 thru 1/23	121	-	-
	03/01/84	1/24 thru 3/1	-	103	Unfrozen

days, the need for load restrictions is likely (again, if required for a specific pavement structure)

CRITERION FOR DURATION OF LOAD RESTRICTIONS

The available data from the test sites were used in developing a criterion for how long to apply load restrictions (if required at all). The most probable critical period date generally fell within a two week range (last week of February through the first week of March). Further, once the critical period is reached, it appears that about two weeks (at a minimum) is required for the pavement structure to overcome some of the low stiffness condition associated with the critical period. However, such conditions are quite site specific as one would expect. At best once load restrictions are applied, the two week load restriction application period is only suggested as a "rule-of-thumb". Clearly, the "best" method to determine the continuing need for load restrictions (or lack of) is the use of the FWD (or in general any kind of pavement surface deflection).

Due to the inherent variability of each pavement structure, no single item of in situ equipment appears to be completely adequate for assessing the need for load restrictions. Only equipment such as the FWD meets all the needed requirements for making such evaluations (at least at this time).

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The following conclusions are warranted:

1. The Falling Weight Deflectometer (FWD) is an excellent device for collecting the necessary information required to evaluate the structural capacity of pavements. Further, Benkelmen Beam and FWD maximum deflections correlated well; however, the deflection basins obtainable with the FWD provide significantly improved ability to analyze the pavement structure.
2. For the field test sites which normally require seasonal load restrictions (SR 172 sites and to a lesser extent SR 2 (MP 159.6)), the base course moduli vary more than the subgrade moduli. In fact, the subgrade moduli are relatively stable throughout the year (except when frozen). The base course weakness is due to excessive moisture available during the thawing period. The sources of the moisture include both surface or lateral infiltration and thawing of ice; however, the relative contribution of each is unknown. The excessive moisture in the base course is exacerbated by either a still frozen subgrade and/or a low permeability subgrade soil (i.e., a water drainage path is temporarily reduced or eliminated).
3. Multilayered elastic analysis was used along with FWD data to characterize the materials in the pavement layers for each test site with time. Criteria were developed which essentially reduces the allowable loads for a "summer" condition to equivalent loads during the critical period ("spring thaw"). Based on this analysis for the more critical test sites, a reduction in legal loads of about 60 percent is required. A single load restriction table has been prepared as a function of tire size based on the analysis (refer to Table 28, Chapter IV). Further, the analysis reinforces the current WSDOT load restriction tables.
4. A criterion was developed which can be used to determine <u>when</u> load restrictions should be initiated on a pavement structure in need of such limitations (the criterion does not identify

which pavements require load restrictions). The criterion is based on thawing degree days and can be readily used by the various WSDOT maintenance offices which record daily high and low temperatures. Both field data and an analytical procedure suggest that pavements susceptible to weakening during the critical period will approach this condition after 30 thawing degree days have occurred and will be in the critical period after accumulating 50 thawing degree days. (one thawing degree day is equal to an average daily temperature of 1^{o}F above freezing). Clearly, site specific deflection data is the single "best" criterion to use in assessing the need for load restrictions but this data can be expensive to obtain and difficult to get at the needed time. A temperature based criterion is the next best alternative (and least expensive).

5. Based on the limited duration associated with this study, the critical period for a pavement structure can be expected to start within a two week period (last week of February through the first week of March). Further, at a minimum, the duration of the critical period is about two weeks. At best the above beginning date range and duration of the critical period can only be used as a very approximate "rule-of-thumb".
6. Full legal loads and possibly loads in excess of legal limits should be encouraged when the pavement structures are frozen. This is the time that the various pavement layers have the highest moduli values and hence are better able to accommodate heavy loads.

RECOMMENDATIONS

The following recommendations are warranted:

1. The criterion to determine when to enforce load restrictions based on thawing degree days is recommended for trial use during the winter/spring of 1985.
2. Based on the analysis performed in this study, additional consideration for future maintenance/rehabilitation/reconstruction projects should be given to pavement base course subsurface drainage, base stabilization, or base gradation changes on

those routes which experience significant seasonal strength variation.

3. WSDOT will benefit significantly if a systematic program is initiated to obtain FWD deflection basin data during the critical spring thaw period on WSDOT routes subject to significant ground freezing. This activity will further identify problem locations and enhance our collective understanding of this phenomenon.

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13. Stubstad, R. and Conner, B., "Prediction of Damage Potential on Alaskan Highways During Spring Thaw Using the Falling Weight Deflectometer," Research Report No. AK-RD-83-11, Alaska Department of Transportation and Public Facilities, Fairbanks, Alaska, August 1982.

APPENDIX A

CALIBRATION OF RESISTIVITY GAUGES

APPENDIX A

CALIBRATION OF RESISTIVITY GAUGES

This appendix is used to describe the laboratory soil cell calibration procedure used to develop relationships between resistivity and subgrade moisture content. The data used to plot the curves as well as the calibration curves are also included.

CALIBRATION OF GAUGES FOR MOISTURE CONTENT

The procedure used for developing a calibration curve of resistivity versus subgrade moisture content is that recommended by Soiltest, Inc. It is as follows:

1. Use a box 2 inches high, 1 9/16 inches wide and 1 9/16 inches thick with a cover. The four sides and bottom are to be made of 20 x 200-mesh stainless steel screen (stainless is used because of its resistance to corrosion). There is a notch in the top rim of the box to pass the lead wires.
2. Weigh the box plus cover plus soil cell.
3. Place the soil cell vertically in the center of the box and pack air-dry soil around the cell to fill the box to within 1/4-inch of the top. The soil is to come from the location the soil cell is to occupy in the field, and should be packed uniformly in the box to its apparent field density. This will require some practice.
4. Weigh the filled box plus cover. The oven-dry weight of the soil is calculated by determining the air-dry moisture content of a duplicate sample of the same soil. The total weight of the box, including cover, soil cell, and oven-dry soil, now becomes the gross oven-dried weight. The oven-dry weight becomes the basis for soil-moisture determinations.
5. Half-submerge the filled box in distilled water until the soil is saturated. Then dry the outside of the box, cover it, and place it in a tightly closed chamber. This chamber can be made of a bell-jar resting on a flat plate. Wick-equipped beakers inside are filled with a saturated solution of lead nitrate $Pb(NO_3)_2$, to maintain the air at 98 percent relative humidity. The soil boxes can rest on a wire rack in the chamber. Insu-

lated wires leading from the chamber make it possible to measure soil resistances while the soil boxes are inside.

6. Leave the box in the chamber overnight; then measure the soil-cell resistance, remove it from the chamber, and weigh it for moisture determination.
7. Expose the box to evaporation in the laboratory until its moisture content has dropped several percent; then replace it in the humidity chamber and leave it there overnight. Measure resistance and weigh it in the morning. This cycle of drying, resting in the chamber, and measurement is repeated until the soil is dry. Resistances must be corrected to 60°F. It is a good practice to wet and dry the soil in the box once or twice before taking resistance measurements. This permits a stable structure to develop in the soil. It is also advantageous to run the soil through more than one series of drying cycles because the characteristic moisture-log resistance curve is double-S shaped and in the first drying some important points along the curve may be missed.

The chart for correcting resistivities to 60°F (15.6°C) is present in Figure A1. Tables A1, A2, A3, A4, A5 and A6 are used to summarize the laboratory data obtained for plotting resistivity versus base or subgrade moisture contents for the three test sites. The curves are plotted in Figures A2 to A7. Tables A7 through A9 are used to present the results of the field resistivity measurements and the corresponding moisture contents. Table A10 is provided for SR 97 and shows only the field obtained resistivities.

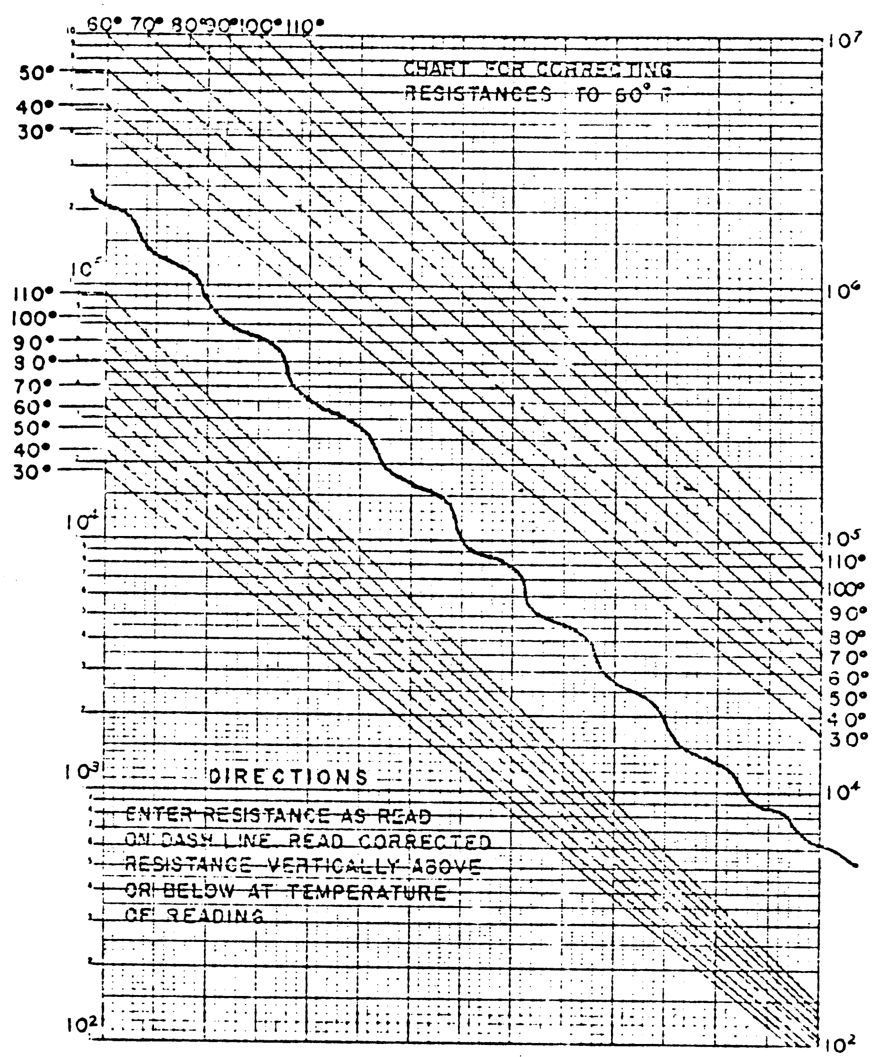

Figure A1. Chart for Correcting Resistances to 60°F

Table A1. Laboratory Data for Moisture Content Calibration of SR 2, Sunnyslope Base Course.

Gross Wet Weight (gm)	Oven Dry Weight of Sample (gm)	Weight of Water in Sample (gm)	Moisture Content (%)	Measured Resistance (ohms)	Temperature (°F)	Resistance Corrected to 60°F (ohms)
213.71	138.10	17.11	12.4	480	65.0	510
213.47	138.10	16.87	12.2	520	65.0	540
212.87	138.10	16.27	11.8	600	65.0	630
211.94	138.10	15.34	11.1	710	65.0	760
211.74	138.10	15.14	11.0	750	65.0	790
211.52	138.10	14.92	10.8	780	65.0	820
211.34	138.10	14.74	10.7	800	65.0	840
204.33	138.10	7.73	5.6	5500	65.0	5800
203.69	138.10	7.09	5.1	6000	65.0	6500
203.17	138.10	6.57	4.8	6350	65.0	6800
202.94	138.10	6.34	4.6	6450	65.0	6900
202.31	138.10	5.71	4.1	7000	66.4	7600
202.23	138.10	5.63	4.1	7200	66.6	7800
201.67	138.10	5.07	3.7	7400	69.8	8600
200.56	138.10	3.96	2.9	26000	70.0	32000
200.48	138.10	3.88	2.8	130000	70.6	170000
200.45	138.10	3.85	2.8	220000	71.2	285000

Weight of container + soil cell = 58.5 gm

Table A2. Laboratory Data for Moisture Content Calibration of SR 2, Sunnyslope Subgrade.

Gross Wet Weight (gm)	Oven Dry Weight of Sample (gm)	Weight of Water in Sample (gm)	Moisture Content (%)	Measured Resistance (ohms)	Temperature (°F)	Resistance Corrected to 60°F (ohms)
195.46	120.3	19.4	16.1	1,600	73.8	1,890
195.09	120.3	19.0	15.8	1,800	73.6	2,140
194.31	120.3	18.2	15.1	1,950	73.8	2,300
193.87	120.3	17.8	14.8	1,950	73.2	2,300
192.97	120.3	16.9	14.0	2,400	73.2	2,810
191.87	120.3	15.8	13.1	2,600	73.4	3,100
191.41	120.3	15.3	12.7	2,700	73.0	3,250
189.94	120.3	13.8	11.5	2,800	73.0	3,350
189.51	120.3	13.4	11.1	2,900	72.8	3,450
182.15	120.3	6.0	5.0	8,400	71.6	10,200
181.83	120.3	5.7	4.8	8,700	71.8	10,500
181.68	120.3	5.6	4.6	8,900	71.8	10,800
181.49	120.3	5.4	4.5	9,000	71.8	10,900
181.34	120.3	5.2	4.4	9,500	71.8	11,800
181.23	120.3	5.1	4.3	10,000	71.8	12,300
180.95	120.3	4.8	4.0	10,750	72.0	13,300
180.86	120.3	4.8	4.0	11,325	71.4	13,800
180.82	120.3	4.7	3.9	12,000	71.2	14,100
180.73	120.3	4.6	3.8	14,000	71.2	17,100
180.49	120.3	4.4	3.6	750,000	71.0	870,000

Weight of container + soil cell = 55.8 gm

Table A3. Laboratory Data for Moisture Content Calibration of SR 2, MP 159.6 Base Course.

Gross Wet Weight (gm)	Oven Dry Weight of Sample (gm)	Weight of Water in Sample (gm)	Moisture Content (%)	Measured Resistance (ohms)	Temperature (°F)	Resistance Corrected to 60°F (ohms)
218.06	149.0	13.3	8.9	280	75.8	320
217.79	149.0	13.0	8.7	410	76.1	475
217.12	149.0	12.3	8.3	510	76.2	600
216.59	149.0	11.8	7.9	540	76.3	630
216.10	149.0	11.3	7.6	680	76.6	810
215.15	149.0	10.4	6.9	980	75.5	1,150
214.25	149.0	9.4	6.3	1,180	74.5	1,400
213.98	149.0	9.2	6.2	1,320	75.0	1,600
213.56	149.0	8.8	5.9	1,450	75.0	1,720
212.96	149.0	8.2	5.5	1,700	74.6	2,050
210.51	149.0	5.7	3.8	3,900	74.4	4,800
210.03	149.0	5.2	3.5	4,300	72.4	5,300
208.95	149.0	4.2	2.8	5,800	71.3	7,000
208.92	149.0	4.1	2.8	6,000	71.6	7,200
208.73	149.0	3.9	2.6	5,900	73.0	7,200
208.67	149.0	3.9	2.6	6,000	72.4	7,200
208.57	149.0	3.8	2.5	6,100	75.1	7,500
208.36	149.0	3.6	2.4	7,300	73.0	9,000
208.34	149.0	3.5	2.4	8,200	73.9	10,400
208.15	149.0	3.4	2.2	14,000	72.6	17,500
207.99	149.0	3.2	2.1	235,000	69.6	300,000

Weight of container and soil cell = 55.8 gm

Table A4. Laboratory Data for Moisture Content Calibration of SR 2, MP 159.6 Subgrade.

Gross Wet Weight (gm)	Oven Dry Weight of Sample (gm)	Weight of Water in Sample (gm)	Moisture Content (%)	Measured Resistance (ohms)	Temperautre (°F)	Resistance Corrected to 60°F (ohms)
221.45	147.3	14.4	9.7	440	68.0	429
221.30	147.3	14.2	9.6	570	68.0	545
221.07	147.3	14.0	9.5	730	67.7	710
220.45	147.3	13.4	9.1	900	68.0	875
220.06	147.3	13.0	8.8	950	67.8	920
219.47	147.3	12.4	8.4	1,080	66.4	1,020
218.96	147.3	11.9	8.0	1,170	68.2	1,130
218.50	147.3	11.4	7.7	1,310	67.8	1,270
217.39	147.3	10.3	7.0	2,050	68.1	1,960
217.25	147.3	10.2	6.9	2,250	68.2	2,180
215.80	147.3	8.7	5.9	3,500	68.6	3,350
214.94	147.3	7.8	5.3	4,400	66.0	4,100
211.42	147.3	4.3	2.9	7,300	66.8	6,900
211.24	147.3	4.1	2.8	7,400	68.1	7,150
210.98	147.3	3.9	2.6	7,500	69.5	7,500
210.72	147.3	3.6	2.4	7,900	69.8	7,900
210.37	147.3	3.3	2.2	8,300	68.8	8,150
209.47	147.3	2.4	1.6	13,750	66.5	12,800
209.18	147.3	2.1	1.4	18,050	69.0	17,900
208.60	147.3	1.5	1.0	130,000	64.5	115,000
208.54	147.3	1.4	0.98	170,000	66.6	160,000

Weight of container + soil cell = 59.8 gm

Table A5. Laboratory Data for Moisture Content Calibration of SR 174 Base Course.

Gross Wet Weight (gms)	Oven Dry Weight of Sample (gms)	Weight of Water in Sample (gm)	Moisture Content (%)	Measured Resistance (ohms)	Temperature (°F)	Resistance Corrected to 60°F (ohms)
214.60	147.51	12.6	8.5	600	67.1	650
214.33	147.51	12.3	8.4	670	68.4	720
214.04	147.51	12.0	8.2	750	68.2	820
213.06	147.51	11.0	7.5	1,420	67.2	1,540
212.78	147.51	10.8	7.3	1,600	66.8	1,710
211.50	147.51	9.5	6.4	2,100	66.1	2,260
210.44	147.51	8.4	5.7	2,500	<66	2,650
209.81	147.51	7.8	5.3	2,800	<60	2,980
209.22	147.51	7.2	4.9	3,000	<66	3,200
205.86	147.51	3.8	2.6	4,100	<66	4,400
205.40	147.51	3.4	2.3	4,500	68	5,000
205.14	147.51	3.1	2.1	5,050	66.6	5,300
205.03	147.51	3.0	2.0	5,500	<65	5,700
204.67	147.51	3.7	1.8	12,700	63	13,200
203.81	147.51	1.8	1.2	16,100	63	16,900
203.78	147.51	1.8	1.2	24,800	66	27,000
203.68	147.51	1.7	1.1	113,000	62	120,000

weight of container + soil cell = 54.5 gm

Table A6. Laboratory Data for Moisture Content Calibration of SR 174 Subgrade.

Gross Wet Weight (gm)	Oven Dry Weight of Sample (gm)	Weight of Water in Sample (gm)	Moisture Content (%)	Measured Resistance (ohms)	Temperature (°F)	Resistance Corrected to 60°F (ohms)
215.27	130.8	29.8	22.7	500	71.4	570
214.63	130.8	29.1	22.2	780	71.7	880
213.59	130.8	28.1	21.4	1,100	72.1	1,270
211.04	130.8	25.5	19.5	1,270	71.5	1,440
210.28	130.8	24.8	18.9	1,330	71.3	1,510
209.59	130.8	24.1	18.4	1,390	71.1	1,560
208.61	130.8	23.1	17.6	1,530	70.8	1,730
203.36	130.8	17.9	13.6	8,200	69.2	9,500
202.41	130.8	16.9	12.9	9,000	69.0	10,500
192.30	130.8	6.8	11.7	11,950	71.8	14,600
192.04	130.8	6.5	5.1	13,000	71.2	15,600
191.77	130.8	6.3	4.8	15,000	71.2	18,000
190.62	130.8	5.1	4.0	64,500	73.3	86,000
190.46	130.8	5.0	3.8	82,000	74.6	115,000
190.36	130.8	4.9	3.7	110,000	75.1	156,000
189.92	130.8	4.4	3.66	750,000	72.8	1,100,000

Weight of container + soil cell = 54.7 gm

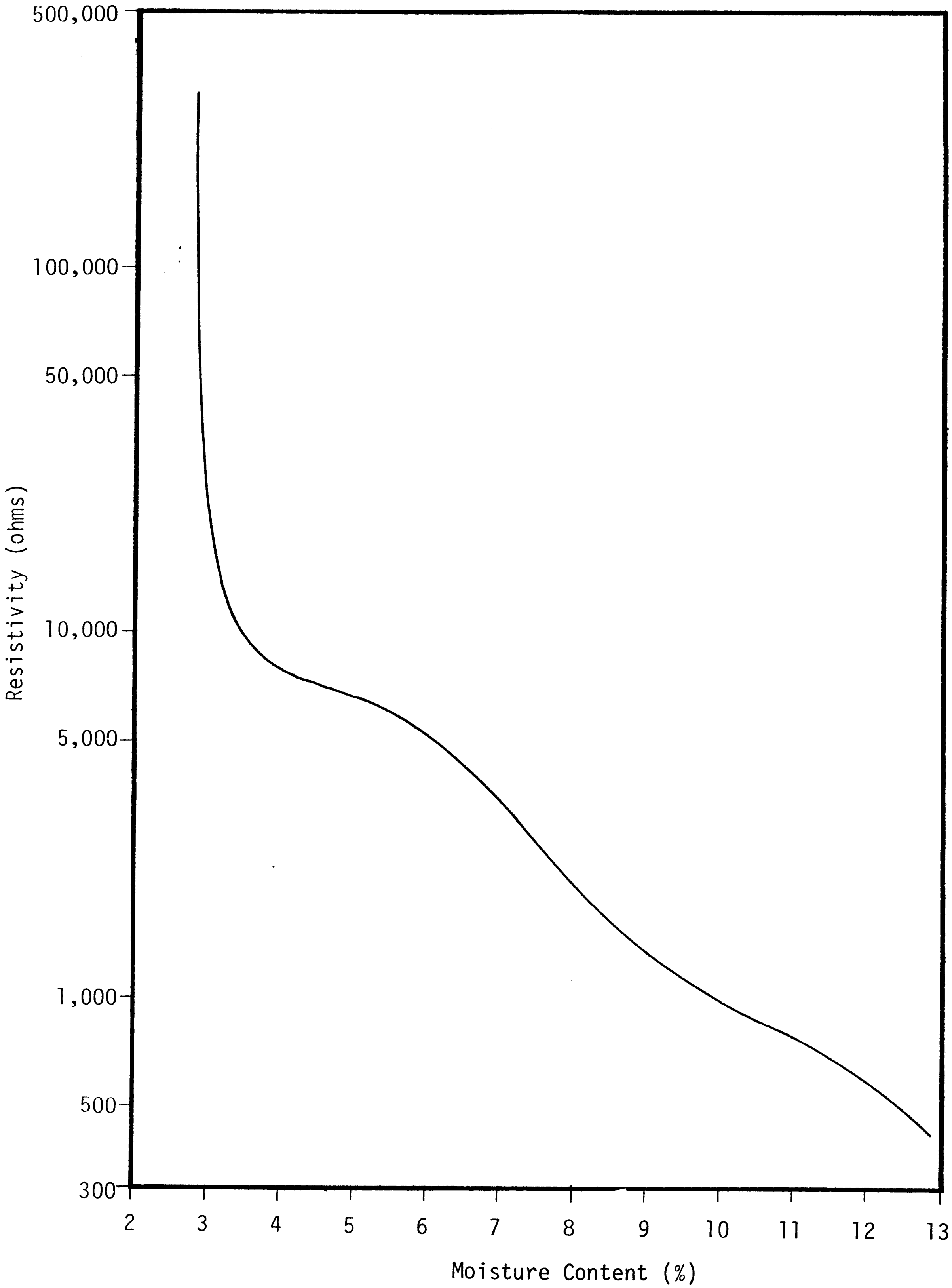

Figure A2. SR 2, Sunnyslope - Calibration Curve of Resistivity Versus Base Course Moisture Content.

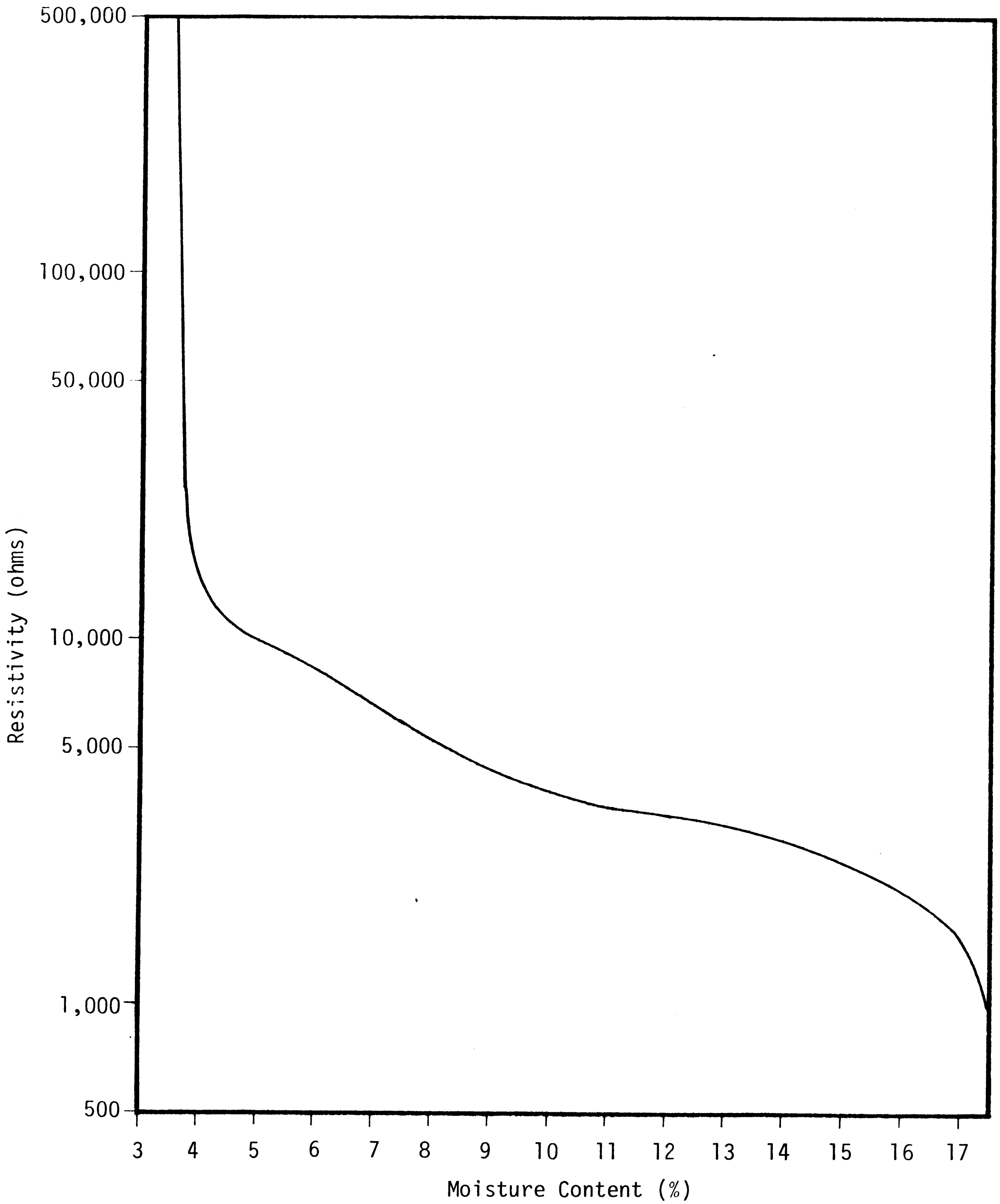

Figure A3. SR 2, Sunnyslope - Calibration Curve of Resistivity Versus Subgrade Moisture Content.

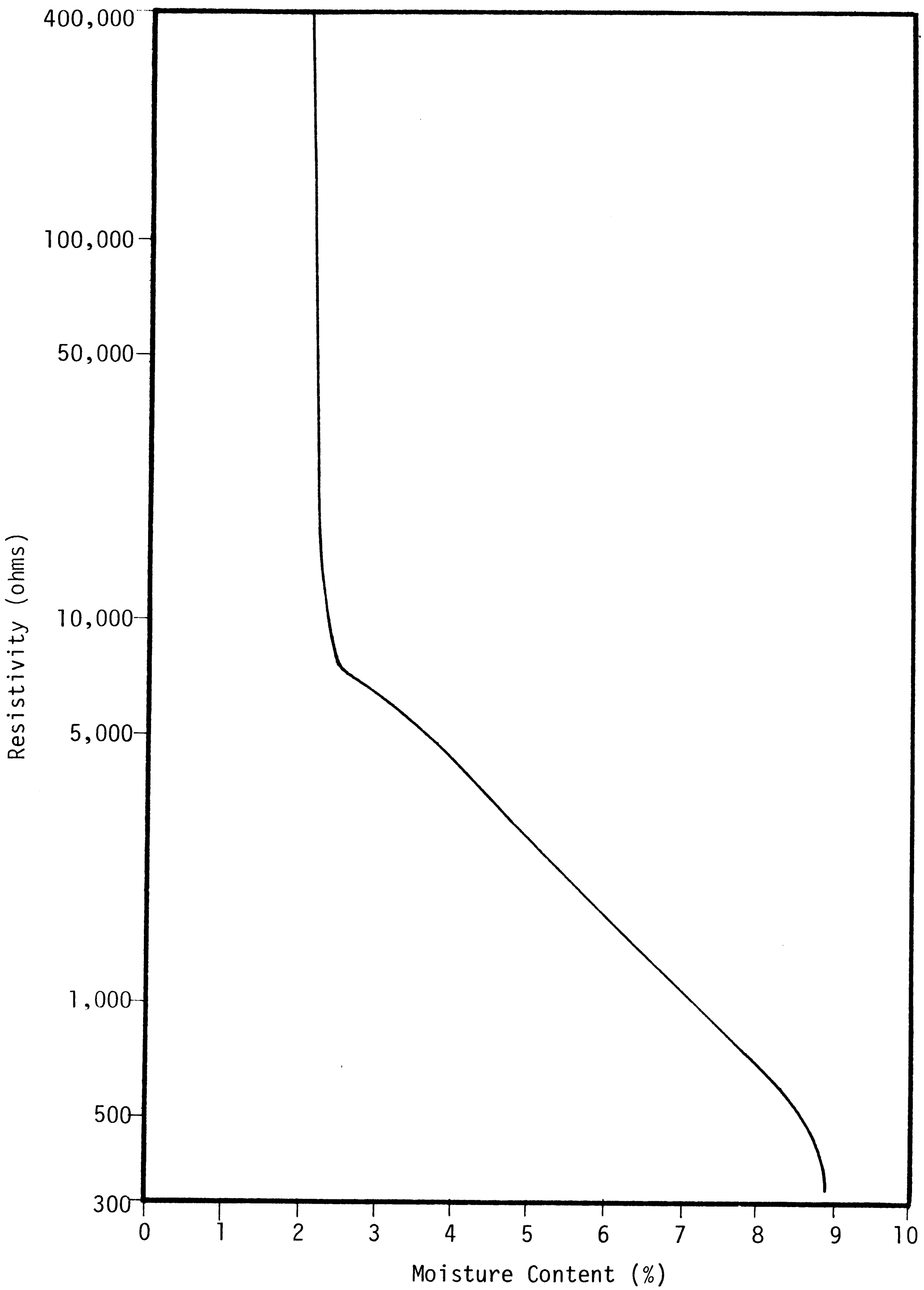

Figure A4. SR 2, MP 159.6 - Calibration Curve of Resistivity Versus Base Course Moisture Content

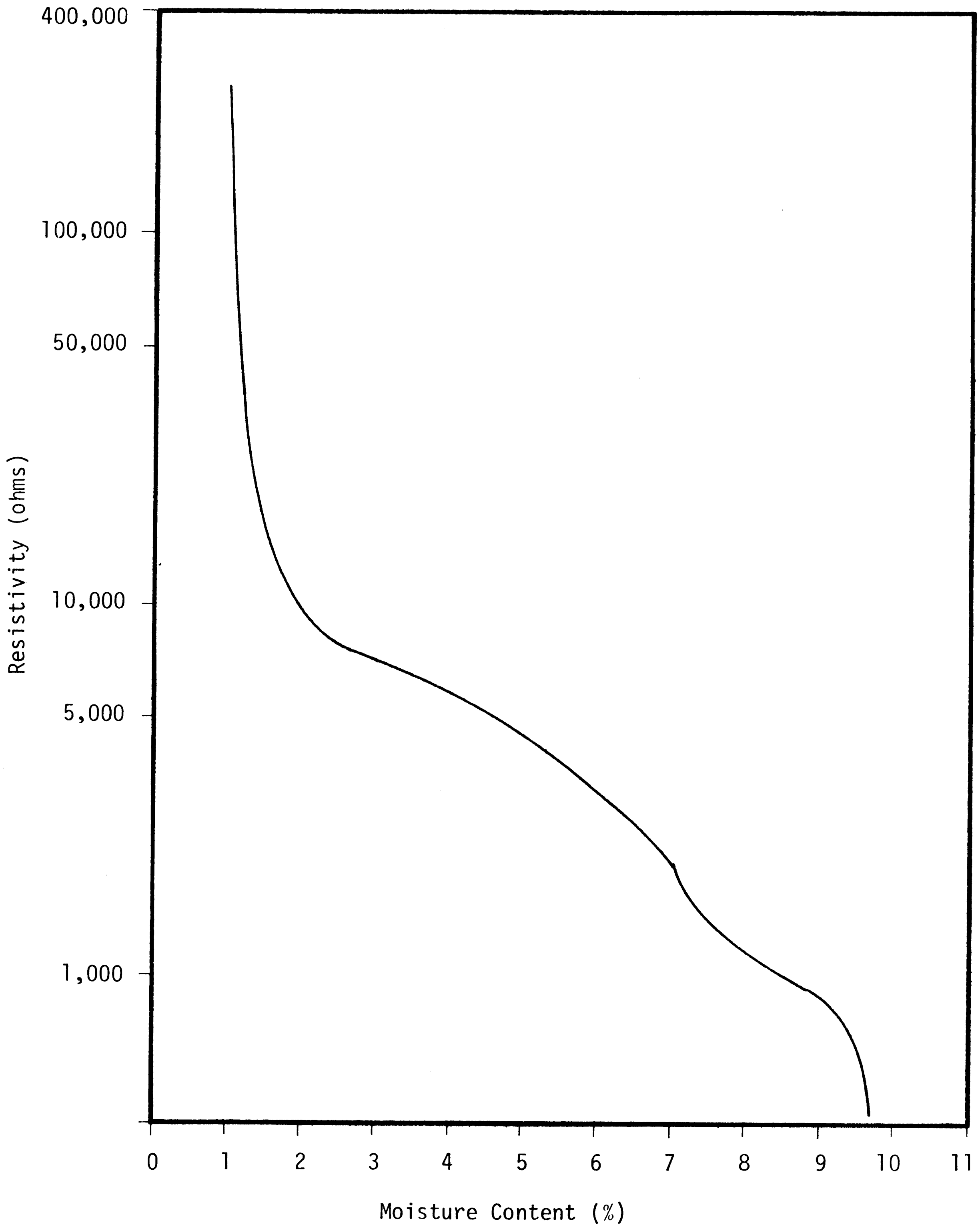

Figure A5. SR 2, 159.6 - Calibration Curve of Resistivity Versus Subgrade Moisture Content.

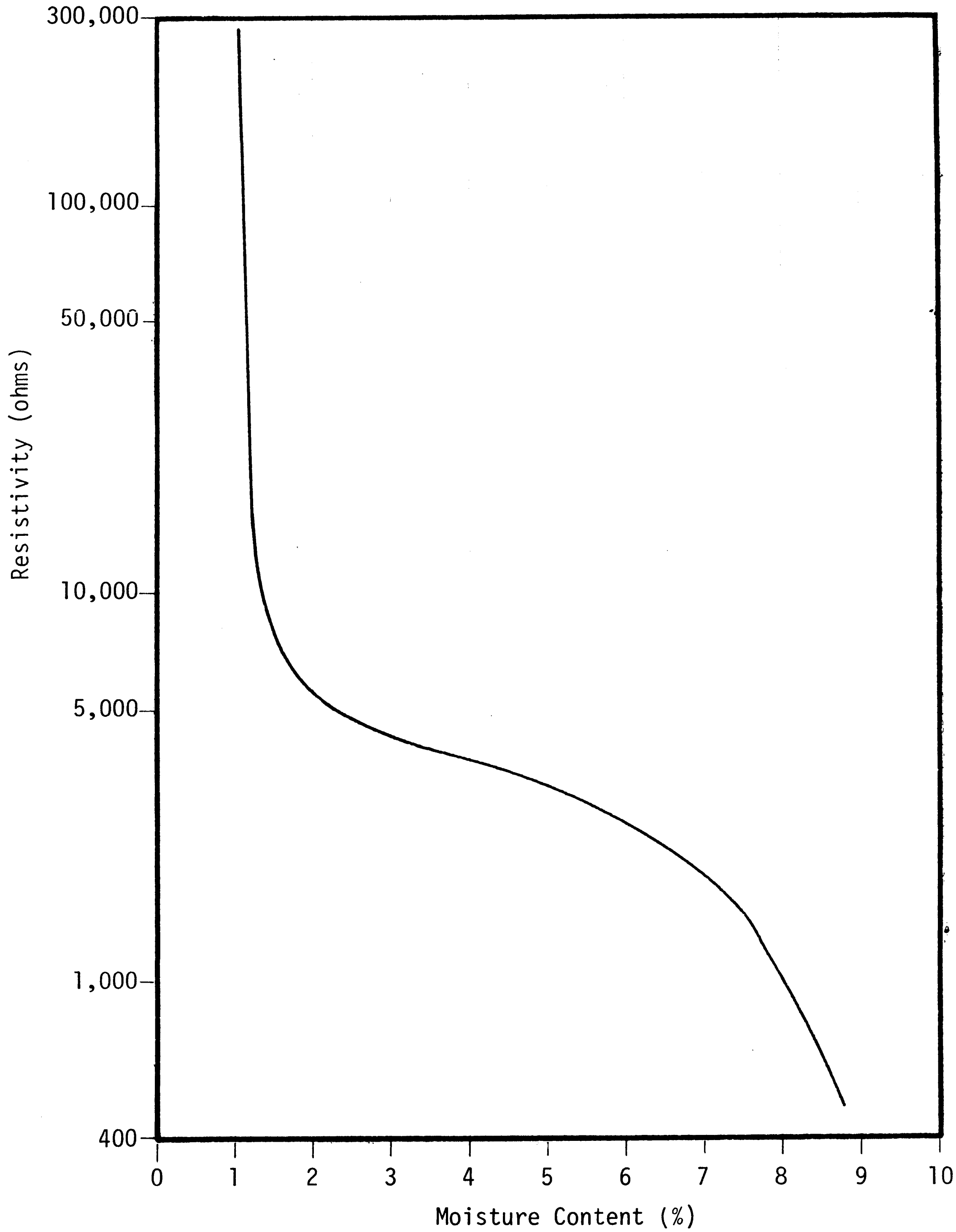

Figure A6. SR 174, MP 2.0 - Calibration Curve of Resistivity Versus Base Course Moisture Content.

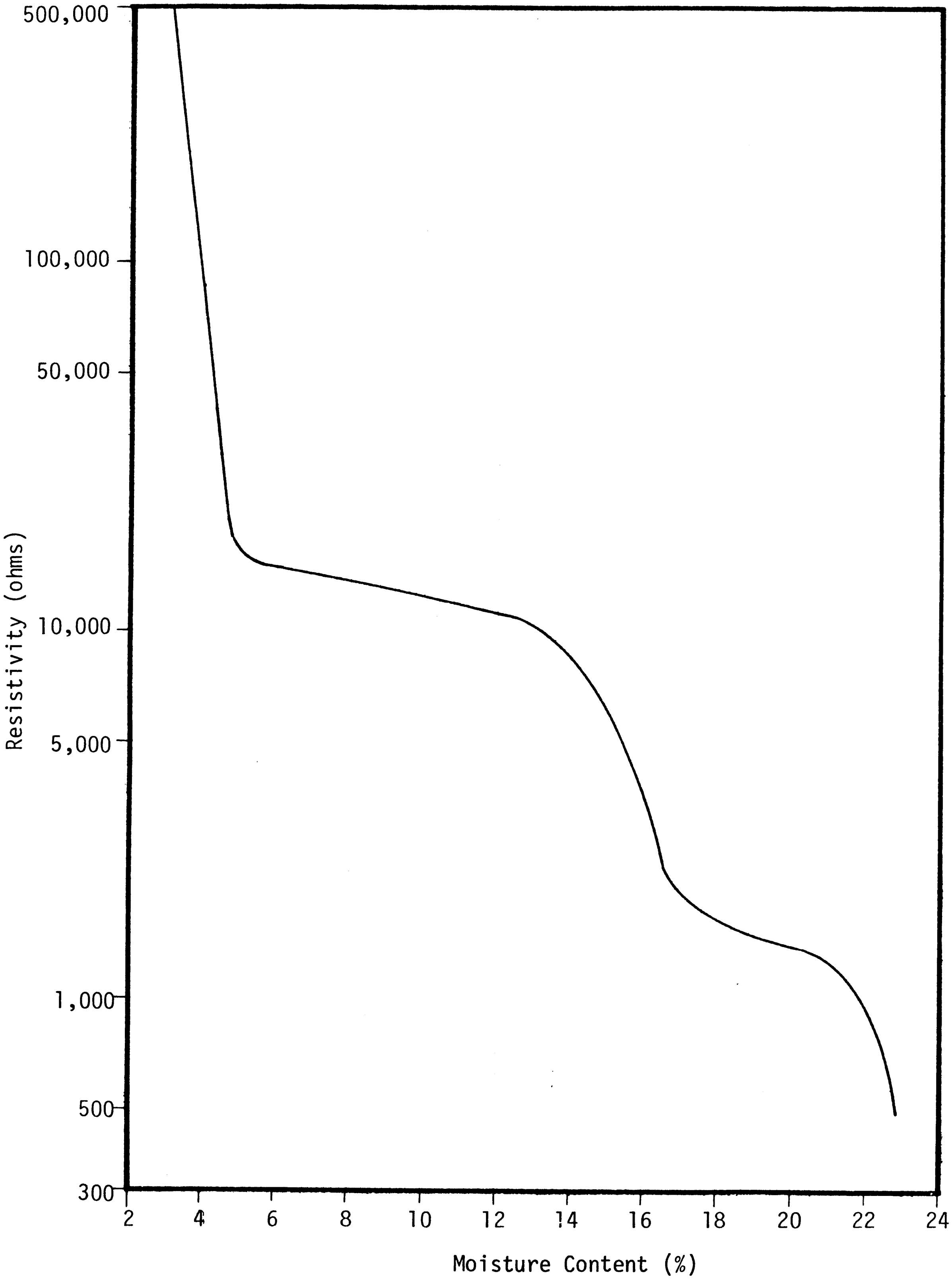

Figure A7. SR 174, MP 2.0 - Calibration Curve of Resistivity Versus Subgrade Moisture Content.

Table A7. SR 2, Sunnyslope-Field Soil Cell Resistivities and Corresponding Moisture Content.

Date	Cell No.	Temperature (°F)	Correction Factor	Measured Resistivity (ohms)	Resistivity Corrected to 60°F (ohms)	Moisture Content (%)
02/23/83	13	42	1.08	12,960	9,200	5.4
	14	42	1.07	34,240	24,700	3.7
	15	40	1.00	8,000	5,600	7.8
	16	42	1.07	1,605	1,220	9.1
	9	39	1.07	33,170	23,000	3.8
	10	41	1.08	2,160	1,590	16.8
	11	41	1.08	1,404	1,050	17.4
	12	39	1.08	49,680	33,900	2.9
03/04/83	13	45	1.08	97,200	72,000	3.6
	14	45	1.07	32,100	23,500	3.75
	15	-	1.00		-	
	16	45	1.07	2,354	1,830	8.2
	9	42	1.07	26,750	18,200	3.8
	10	44	1.08	1,620	1,140	17.3
	11	44	1.08	2,160	1,660	16.75
	12	-	1.08	43,200	39,000	2.9
03/18/83	13	48	1.08	32,400	26,700	3.7
	14	49	1.07	42,800	35,000	3.7
	15	47	1.00	20,000	15,400	3.9
	16	49	1.07	5,564	4,550	6.3
	9	46	1.07	21,400	16,000	3.9
	10	49	1.08	1,188	1,000	17.4
	11	49	1.08	2,700	2,250	15.4
	12	46	1.08	37,450	28,000	2.9

Table A7. Continued.

Date	Cell No.	Temperature (°F)	Correction Factor	Measured Resistivity (ohms)	Resistivity Corrected to 60°F (ohms)	Moisture Content (%)
03/24/83	13	50	1.08	37,800	31,000	3.7
	14	50	1.07	42,693	35,000	3.7
	15	47	1.00	18,000	13,900	4.0
	16	49	1.07	4,280	3,500	6.9
	9	47	1.07	23,540	18,000	3.8
	10	50	1.08	1,296	1,100	17.3
	11	49	1.08	2,808	2,350	15.2
	12	48	1.08	38,880	31,000	2.9
08/11/83	13	85	1.08	34,560	56,000	3.7
	14	86	1.07	29,960	51,000	3.7
	15	82	1.00	21,000	32,000	3.7
	16	84	1.07	6,420	9,500	3.3
	9	80	1.07	10,700	15,200	3.9
	10	86	1.08	2,160	3,100	12.8
	11	84	1.08	3,780	5,600	7.7
	12	82	1.08	18,360	28,000	2.9
01/11/84	13	31.5	1.08	21,600(f)	12,500	4.2
	14	32	1.07	16,692(f)	9,500	5.2
	15	29.5	1.00	3,700(f)	2,300	15.3
	16	32	1.07	1,220	830	10.7
	9	36	1.07	17,120	10,800	4.6
	10	32	1.08	324,000(f)	-	
	11	32	1.08	275,400(f)	-	
	12	34	1.08	31,320	18,400	3.0

Table A7. Continued

Date	Cell No.	Temperature (°F)	Correction Factor	Measured Resistivity (ohms)	Resistivity Corrected to 60°F (ohms)	Moisture Content (%)
01/17/84	13	32	1.08	24,840(f)	14,500	4.0
	14	31.5	1.07	20,330(f)	12,000	4.3
	15	28	1.00	16,800(f)	-	
	16	30	1.07	3,959(f)	2,500	7.6
	9	Leads frozen in ground				
	10					
	11					
	12					
01/31/84	13	34	1.08	23,220	14,000	4.0
	14	34	1.07	14,445	9,000	5.5
	15	31	1.00	2,950(f)	1,900	16.3
	16	34	1.07	856	600	11.9
	9	34	1.07	16,050	9,500	5.2
	10	32	1.08	216,000(f)	-	
	11	31	1.08	56,700(f)	31,500	3.7
	12	32	1.08	28,620(f)	16,500	3.1
02/20/84	13	39.5	1.08	10,260	7,000	6.5
	14	39	1.07	5,564	3,900	9.7
	15	37	1.00	2,425	1,700	16.7
	16	39	1.07	835	630	11.8
	9	34	1.07	16,960	10,400	4.7
	10	33	1.08	2,214	1,440	17.0
	11	33.5	1.08	3,510	2,300	15.3
	12	34	1.08	30,240	18,100	3.1

Table A7. Continued

Date	Cell No.	Temperature (°F)	Correction Factor	Measured Resistivity (ohms)	Resistivity Corrected to 60°F (ohms)	Moisture Content (%)
02/29/84	13	41	1.08	11,070	7,800	5.6
	14	41	1.07	7,597	5,300	7.9
	15	38.5	1.00	6,250	4,300	9.1
	16	40.5	1.07	1,755	1,300	9.0
	9	36.5	1.07	14,850	9,400	5.3
	10	-	1.08	2,916	2,050	16.0
	11	38	1.08	5,832	4,100	9.4
	12	36.5	1.08	29,430	18,200	3.0
03/06/84	13	44	1.08	10,500	8,400	6.8
	14	44	1.07	7,750	6,200	7.2
	15	42	1.00	7,000	5,100	8.2
	16	42	1.07	1,950	1,520	8.6
	9	39	1.07	14,000	10,000	4.8
	10	40	1.08	2,500	1,950	16.1
	11	42	1.08	5,500	4,350	9.0
	12	41	1.08	25,000	18,300	3.0
03/19/84	13	48.5	1.08	10,700	9,200	5.4
	14	49	1.07	9,250	8,100	6.0
	15	47	1.00	4,600	3,650	10.5
	16	49	1.07	1,120	1,010	9.9
	9	45	1.07	12,500	9,800	5.0
	10	48	1.08	2,250	2,000	16.0
	11	48	1.08	3,150	2,750	14.1
	12	45.5	1.08	26,730	20,000	3.0

Table A8. SR 2, MP 159.6 - Field Soil Cell Resistivities and Corresponding Moisture Contents.

Date	Cell No.	Temperature (°F)	Correction Factor	Measured Resistivity (ohms)	Resistivity Corrected to 60°F (ohms)	Moisture Content (%)
02/24/83	1	39	1.08	8,100	5,580	4.2
	2	38	1.00	2,700	1,910	7.0
	3	39	1.07	17,120	11,400	1.6
	4	38	1.07	149,800	93,000	2.1
03/03/83	1	40	1.08	7,020	4,850	4.7
	2	40	1.00	2,400	1,750	7.1
	3	39	1.07	14,980	10,300	1.9
	4	38	1.07	10,700	7,300	2.6
03/17/83	1	42	1.08	6,480	4,750	4.8
	2	-	1.00	2,600	2,000	7.0
	3	43	1.07	14,980	10,900	1.8
	4	43	1.07	17,120	12,200	2.3
03/24/83	1	43	1.08	6,696	4,900	4.7
	2	44	1.00	2,500	1,930	7.0
	3	43	1.07	16,050	12,000	1.7
	4	45	1.07	9,630	7,300	2.6
08/10/83	1	70	1.08	7,560	8,700	2.2
	2	72	1.00	3,000	3,550	5.7
	3	78	1.07	8,560	11,700	1.7
	4	82	1.07	6,420	9,200	2.4
01/10/84	1	38	1.08	15,336	10,100	1.5
	2	30.5	1.00	7,300(f)	-	
	3	29.5	1.07	22,470(f)	-	
	4	31	1.07	535,000(f)	-	

Table A8. Continued.

Date	Cell No.	Temperature (°F)	Correction Factor	Measured Resistivity (ohms)	Resistivity Corrected to 60°F (ohms)	Measured Content (%)
01/31/84	1	37	1.08	13,554	8,800	2.2
	2	36	1.00	7,600	5,000	4.6
	3	32	1.07	19,528(f)	11,600	1.8
	4	31	1.07	428,000(f)	-	
02/22/84	1	36	1.08	16,200	10,400	1.9
	2	-	1.00	5,600	3,700	5.6
	3	32.5	1.07	14,980	9,200	2.1
	4	31	1.07	3,772(f)	2,400	5.4
03/01/84	1	36.5	1.08	4,698	3,170	6.0
	2	36.5	1.00	2,475	1,700	7.2
	3	35.5	1.07	10,326	6,700	3.3
	4	35.5	1.07	12,358	7,950	2.4
03/07/84	1	38	1.08	5,800	4,250	5.2
	2	38	1.00	2,900	2,020	7.0
	3	39	1.07	10,000	7,200	2.9
	4	40	1.07	11,400	8,400	2.4
03/20/84	1	42	1.08	3,750	2,950	6.2
	2	42.5	1.00	1,680	1,260	7.8
	3	43	1.07	3,300	2,640	6.4
	4	43	1.07	1,180	985	7.1

Table A9. SR 174 - Field Soil Cell Resistivities and Corresponding Moisture Contents.

Date	Cell No.	Temperature (°F)	Correction Factor	Measured Resistivity (ohms)	Resistivity Corrected to 60°F (ohms)	Moisture Content (%)
02/24/83	13	39	1.09	119,900	77,000	4.0
	14	39	1.08	172,800	109,000	3.8
	15	39	1.08	129,600	83,000	4.0
	16	40	1.08	86,400	57,000	1.1
03/03/83	13	41	1.09	109,000	73,000	4.0
	14	41	1.08	151,200	100,000	3.8
	15	40	1.08	108,000	71,000	4.0
	16	40	1.08	75,600	50,500	1.1
03/17/83	13	42	1.09	87,200	60,000	4.1
	14	42	1.08	129,600	90,000	3.9
	15	43	1.08	70,200	49,500	4.2
	16	44	1.08	64,800	47,000	1.1
03/24/83	13	44	1.09	81,750	59,500	4.1
	14	44	1.08	110,160	79,000	4.0
	15	46	1.08	64,800	48,000	4.2
	16	47	1.08	57,240	44,000	1.1
08/09/83	13	72	1.09	34,880	45,000	4.2
	14	73	1.08	43,200	57,000	4.1
	15	78	1.08	23,760	33,500	4.4
	16	82	1.08	31,320	49,500	1.1
01/10/84	13	37	1.09	50,140	32,000	4.4
	14	33.5	1.08	31,320	18,500	4.7
	15	30.5	1.08	1,296,000(f)	-	
	16	36	1.08	71,280	43,000	1.1

Table A9. Continued.

Date	Cell No.	Temperature (°F)	Correction Factor	Measured Resistivity (ohms)	Resistivity Corrected to 60°F (ohms)	Moisture Content (%)
01/31/84	13	36	1.09	54,500	33,500	4.4
	14	36	1.08	33,480	21,000	4.6
	15	32	1.08	73,440	41,500	4.3
	16	30	1.08	- (f)	-	
03/01/84	13	36	1.09	49,050	31,000	4.4
	14	36	1.08	55,350	34,000	4.4
	15	34.5	1.08	24,840	15,000	5.6
	16	31	1.08	22,950(f)	13,100	1.3
03/07/84	13	38	1.09	42,500	30,000	4.4
	14	36	1.08	50,500	31,500	4.4
	15	38	1.08	23,000	16,000	5.1
	16	40	1.08	23,000	16,500	1.2
03/20/84	13	43.5	1.09	25,000	19,500	4.7
	14	43	1.08	28,000	21,000	4.6
	15	44	1.08	16,000	12,500	9.8
	16	44	1.08	15,000	11,800	1.3

Table A10. SR 97 - Field Soil Cell Resistivities

Date	Cell No.	Temperature (°F)	Correction Factor	Measured Resistivity (ohms)	Corrected Resistivity (ohms)
02/23/83	5	39	1.08	108	< 100
	6	38	1.08	2592	1860
	7	38	1.09	1744	1280
	8	38	1.07	321	249
03/04/83	5	40	1.08	216	170
	6	41	1.08	2484	1800
	7	40	1.09	1853	1350
	8	40	1.07	321	250
03/18/83	5	44	1.08	108	< 100
	6	46	1.08	1620	1300
	7	46	1.09	872	700
	8	45	1.07	321	265
03/24/83	5	46	1.08	108	< 100
	6	47	1.08	1512	1250
	7	47	1.09	872	700
	8	47	1.07	214	182
08/ /83	5	79	1.08	540	660
	6	82	1.08	1944	2600
	7	82	1.09	3815	5200
	8	78	1.07	2033	2610
01/11/84	5	30	1.08	86,400(f)	-
	6	32	1.08	324,000(f)	-
	7	30	1.09	1,199,000(f)	-
	8	29	1.07	535,000(f)	-

Table A10. SR 97 - Field Soil Cell Resistivities (Continued)

Date	Cell No.	Temperature (°F)	Correction Factor	Measured Resistivity (ohms)	Corrected Resistivity (ohms)
01/17/84	5	30	1.08	2,646(f)	-
	6	31	1.08	243,000(f)	-
	7	30	1.09	1,417,000(f)	-
	8	24	1.07	2,140,000(f)	-
01/31/84	5	30	1.08	4,860(f)	-
	6	31	1.08	432,000(f)	-
	7	30	1.09	545,000(f)	-
	8	28	1.07	214,000(f)	-
02/21/84	5	35	1.08	626	455
	6	36.5	1.08	2,700	1870
	7	36	1.09	4,687	3050
	8	33.5	1.07	4,601	2950
02/29/84	5	36.5	1.08	680	495
	6	38.5	1.08	3,996	2800
	7	38	1.09	6,867	4700
	8	36.0	1.07	4,173	2800
03/06/84	5	38	1.08	400	315
	6	40	1.08	3800	2900
	7	40	1.09	3500	2730
	8	38	1.07	3500	2610
03/19/84	5	43.5	1.08	600	520
	6	45.5	1.08	3200	2690
	7	44.5	1.09	5700	4700
	8	42.5	1.07	3600	2850

APPENDIX B

LABORATORY TESTING DATA

APPENDIX B

LABORATORY TESTING DATA

Contained in this appendix are the results of the laboratory tests conducted on the asphalt concrete cores, and the base and subgrade materials. The results include soil classification, gradation and estimated "R" value, as well as the resilient modulus data.

Table B1. Asphalt Concrete Resilient Modulus Data at 70°F.

Site	Sample	Side 1 M_R (psi)	Side 2 M_R (psi)	Average M_R (psi)
SR 174	A1	922,000	936,000	929,000
	A2	1,166,000	1,148,000	1,157,000
	A3	1,096,000		1,096,000
			Average	1,060,000
SR 97	G1		583,000	583,000
	G2	605,000	502,000	554,000
	G3	434,000	485,000	460,000
	H1	801,000	583,000	692,000
	H2	489,000	453,000	471,000
	H3	604,000	596,000	600,000
			Average	560,000

Table B2. Results of Subgrade Resilient Modulus Testing for SR 97.

Material	Dry Density (pcf)	Moisture Content (%)	Confining Pressure (psi)	Resilient Modulus, M_R (psi)			
				Deviator Stress, σ_d (psi)			
				4	9	18	27
Subgrade (top)	122.7	6	2	15,803			
			3		15,690		
			6			20,954	
			9				27,566
Subgrade (ditch)	120.0	5	2	17,103			
			3		18,049		
			6			22,997	
			9				28,796

Table B3. Results of Base and Subgrade Resilient Modulus Testing for SR 2, Sunnyslope.

Material	Dry Density (pcf)	Moisture Content (%)	Confining Pressure (psi)	Resilient Modulus, M_R (psi) — Deviator Stress, σ_d (psi): 4	9	18	27
Base (bottom)	125.1	5	2	11,062			
			3		10,915		
			6			15,716	
			9				24,000
Base	117.4	5.5	2	13,828			
			3		14,767		
			6			17,646	
			9				27,556
Base (bottom)	119.3	7	2	13,828			
			3		15,690		
			6			21,865	
			9				28,626
Subgrade (bottom)	107.3	6.5	2	15,882			
			3		14,038		
			6			15,810	
			9				19,197

Table B4. Results of Base and Subgrade Resilient Modulus Testing for SR 2, MP 159.6.

Material	Dry Density (pcf)	Moisture Content (%)	Confining Pressure (psi)	Resilient Modulus, M_R (psi) — Deviator Stress, σ_d (psi) 4	9	18	27
Base (6"-9" depth)	125.6	5	2	15,882			
			3		16,846		
			6			21,529	
			9				28,796
Base (3"-9" depth)	127.3	5.5	2	18,713			
			3		17,498		
			6			23,370	
			9				30,667
Base (2"-5" depth)	122.8	5.5	2	10,157			
			3		12,835		
			6			18,074	
			9				23,517
Subgrade (top)	124.9	6	2	18,897			
			3		17,675		
			6			22,533	
			9				27,291
Subgrade (bottom)	123.5	7	2	37,058			
			3		19,438		
			6			24,092	
			9				29,188

Table B5. Results of Base and Subgrade Resilient Modulus Testing for SR 174.

Material	Dry Density (pcf)	Moisture Content (%)	Confining Pressure (psi)	Resilient Modulus, M_R (psi)			
				Deviator Stress, σ_d (psi)			
				4	9	18	27
Base (2"-4" depth)	120.6	5.5	2	15,882			
			3		18,049		
			6			21,997	
			9				27,730
Base (5"-8" depth)	119.6	5.5	2	18,529			
			3		19,438		
			6			22,997	
			9				28,796
Base (5"-9" depth)	118.4	5	2	18,621			
			3		20,322		
			6			24,400	
			9				30,102
Subgrade (12"-18" depth)	102.5	8	2	18,529			
			3		16,846		
			6			18,069	
			9				22,349
Subgrade (18"-24" depth)	105.2	7.5	2	18,437			
			3		15,690		
			6			17,341	
			9				21,890

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SOIL TEST DATA

Job No. HR-605 S.R. No. 97 Section Frost Study

Field Sample No.	15.	16.				
Laboratory No.	S-5297	S-5298				
Sample from Station						
Offset						
Depth	Subgrade-Top	Subgrade-Ditch				
Textural Classification	SANDY	SANDY				
	STONE	STONE				
Liquid Limit						
Plasticity Index						
Grading - Maximum Size	2"					
% Passing 1½"	100					
1"	99					
3/4"	99	100				
3/8"	84	85				
#4	60	60				
10	46	47				
40	25	26				
200	9	7				
pH Factor						
HRB Class. & Group Index	A-1-a(0)	A-1-a(0)				
Proctor (ASTM D698-42T): Opt. Moist. Cont.						
Max. Density						
Resilient Modulus "M_r"						
Estimated Resistance Value "R"	78	75				
Equilibrium Swell Pressure (psi)						
Theoretical Total Surfacing and Bituminous Mat, Design Traffic Index						

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ob No. HR-605 S.R. No. 2 Section (Sunnyslope) Frost Study

eld Sample No.	1.	2.	3.	4.	4B.	
boratory No.	S-5292	S-5293	S-5294	S-5295	S-5296	
mple from ~~Station~~ M.P.	200	200	200	200	200	
fset						
pth	Base-Bottom	Base Course	Subgrade-Top	Base Course-B'tt'm	Subgrade-B'tt'm	
xtural Classification	SILTY SANDY GRAVEL	SILTY SANDY GRAVEL	STONY SILTY SAND	SILTY SANDY GRAVEL	GRAVELLY SILTY SAND	
quid Limit						
asticity Index						
ading - Maximum Size	2½"	2½"	2½"	2½"	2½"	
% Passing 1½"	79	92	97	84	98	
1"	63	80	94	67	96	
3/4"	54	73	91	58	94	
3/8"	43	62	85	45	89	
#4	37	54	79	40	81	
10	33	48	71	37	71	
40	21	21	49	27	50	
200	7	7	16	7	19	
Factor						
B Class. & Group Index	A-1-a (0)	A-1-a (0)	A-1-b (0)	A-1-a (0)	A-1-b (0)	
octor (ASTM D698-42T): Opt. Moist. Cont.						
Max. Density						
Resilient Modulus "M_r"						
Estimated Resistance Value "R"	75	74	66	76	66	
Equilibrium Swell Pressure (psi)						
eoretical Total Surfacing and Bituminous Mat, Design Traffic Index						

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SOIL TEST DATA

Job No. HR-605 S.R. No. 2 Section (Farmer) Frost Study

Field Sample No.	5.	6.	7.	8.	9.	
Laboratory No.	S-5287	S-5288	S-5289	S-5290	S-5291	
Sample from ~~Station~~ M.P.	159.6	159.6	159.6	159.6	159.6	
Offset						
Depth	6"-9"	3"-9"	2"-5"	Subgrade-Top	Subgrade-B'tm	
Textural Classification	SILTY SANDY STONE	SILTY SANDY STONE	SILTY SANDY STONE	SILTY SANDY STONE	SILTY SANDY STONE	
Liquid Limit						
Plasticity Index						
Grading - Maximum Size	2½"	2½"		3"	2½"	
% Passing 1½"	96	94		88	94	
1"	92	91		80	85	
3/4"	89	89	100	74	82	
3/8"	67	66	88	60	68	
#4	47	48	56	47	55	
10	28	34	35	35	41	
40	13	16	16	18	23	
200	7	7	8	9	12	
pH Factor						
HRB Class. & Group Index	A-1-a(0)	A-1-a(0)	A-1-a(0)	A-1-a(0)	A-1-a(0)	
Proctor (ASTM D698-42T): Opt. Moist. Cont.						
Max. Density						
Resilient Modulus "M_r"						
Estimated Resistance Value "R"	78	77	80	80	79	
Equilibrium Swell Pressure (psi)						
Theoretical Total Surfacing and Bituminous Mat, Design Traffic Index						

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SOIL TEST DATA

Job No. HR-605 S.R. No. 174 Section Frost Study

Field Sample No.	10.	11.	12.	13.	14.	
Laboratory No.	S-5299	S-5300	S-5301	S-5302	S-5303	
Sample from Station						
Offset						
Depth	2"-4"	5"-8"	5"-9"	12"-18"	18"-24"	
Textural Classification	SANDY STONE	SILTY SANDY GRAVEL	SILTY SANDY GRAVEL	STONY SILTY SAND	SILTY SANDY STONE	
Liquid Limit						
Plasticity Index						
Grading - Maximum Size		3"	2½"	2"	3"	
% Passing 1½"	100	82	85	95	92	
1"	100	71	74	89	86	
3/4"	100	65	68	85	82	
3/8"	85	53	55	78	72	
#4	57	44	45	70	66	
10	41	37	36	55	48	
40	21	21	19	32	36	
200	7	9	9	18	22	
pH Factor						
HRB Class. & Group Index	A-1-a(0)	A-1-a(0)	A-1-a(0)	A-1-b(0)	A-1-b(0)	
Proctor (ASTM D698-42T): Opt. Moist. Cont.						
Max. Density						
Resilient Modulus "M_r"						
Estimated Resistance Value "R"	76	74	72	62	55	
Equilibrium Swell Pressure (psi)						
Theoretical Total Surfacing and Bituminous Mat, Design Traffic Index						

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APPENDIX C

BISDEF COMPUTER PROGRAM

APPENDIX C

BISDEF COMPUTER PROGRAM

A program called BISDEF was used to determine a set of modulus values that provide the best fit between a measured deflection basin and a computed deflection basin when given an initial estimate of the modulus values, a range of modulus values, and a set of measured deflections. An overview of this computer program is provided in Figure C1.

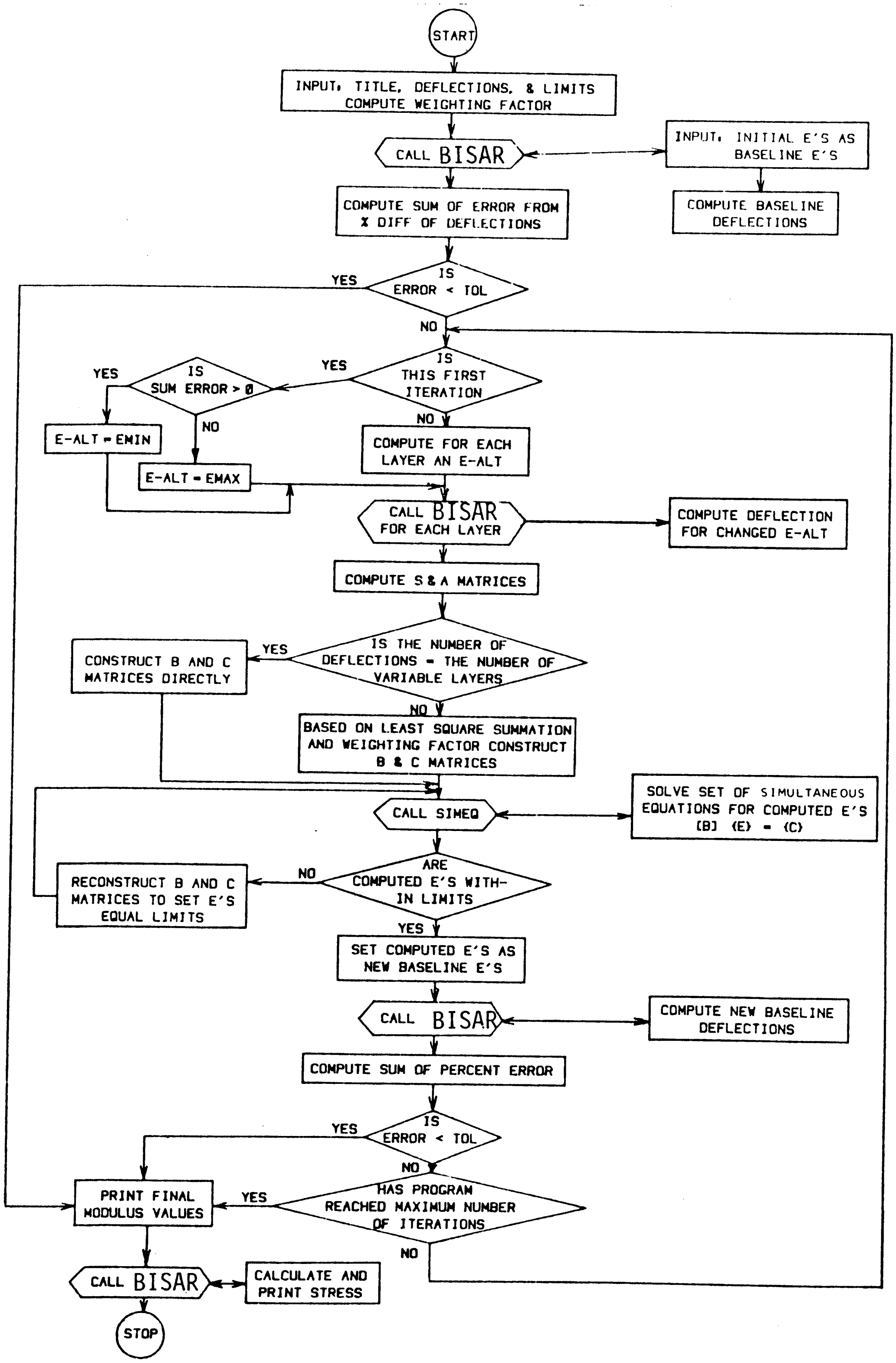

Figure C1. Flow Chart for the BISDEF Computer Program.

APPENDIX D

RESULTS OBTAINED FROM THE PSAD2A COMPUTER PROGRAM AND PLOTS FOR DETERMINATION OF SPRING ALLOWABLE LOAD

APPENDIX D

RESULTS OBTAINED FROM THE PSAD2A COMPUTER PROGRAM AND PLOTS FOR DETERMINATION OF SPRING ALLOWABLE LOAD

This appendix contains the output of interest obtained from the PSAD2A computer. This includes surface deflection (δ), horizontal strain at the bottom of the apshalt concrete (ε_t), vertical strain at the top of the base (ε_{vb}), and vertical strain at the top of the subgrade (ε_{vs}) under all the loading conditions analyzed.

Also included are the plots of these data. The plots were used for determination of spring allowable load as described in Chapter IV.

Table D1. SR 97, MP 183.48-184.00 - Results of the PSAD2A Analysis for Spring and Summer Loading Conditions.

Tire Size Modeled	Tire Load (lbs)	Tire Pressure (psi)	Load Raduis (in.)	Summer Condition				Spring Condition			
				δ (x 10^{-3} in.)	ε_t (x 10^{-6})	ε_{vb} (x 10^{-6})	ε_{vs} (x 10^{-6})	δ (x 10^{-3} in.)	ε_t (x 10^{-6})	ε_{vb} (x 10^{-6})	ε_{vs} (x 10^{-6})
8-22.5	4400	105	3.65	7.029	212.1	-738.0	-118.5	8.028	167.8	-614.4	-132.0
	3300	80	3.62					6.217	131.3	-490.0	-96.06
	2200	55	3.57					4.300	92.68	-354.5	-59.25
9-22.5	4950	115	3.70	7.750	226.6	-794.6	-132.6	8.872	183.4	-668.4	-149.2
	3712	75	3.97					6.819	134.2	-509.9	-108.5
	2475	55	3.78					4.742	97.89	-377.8	-67.42
10-22.5	5500	105	4.08	8.138	206.5	-759.6	-145.5	9.625	184.2	-688.8	-165.1
	4125	70	4.33					7.411	135.8	-527.6	-120.6
	2750	55	3.99					5.168	102.5	-398.7	-75.51
11-22.5	6050	100	4.39	8.589	194.9	-746.0	158.4	10.36	186.5	-710.4	-180.9
	4538	65	4.71					7.966	135.7	-539.5	-132.4
	3025	65	3.85					5.689	115.3	-441.1	-85.76
12-24.5	7920	115	4.68	10.62	211.5	-846.9	-203.7	13.00	219.9	-843.6	-237.8
	5940	80	4.86					10.04	166.0	-657.8	-174.7
	3960	65	4.40					7.116	129.2	-507.9	-114.3
14-17.5	9240	100	5.42	11.37	171.9	-766.1	-230.5	14.52	213.6	-858.4	-272.5
	6930	100	4.70					11.57	196.0	-759.6	-206.9
	4620	65	4.76					8.065	136.9	-547.9	-133.7
16-22.5	10000	90	5.95	11.67	146.4	-706.5	-243.8	15.29	204.9	-850.7	-290.4
	7500	75	5.64					12.01	172.0	-712.3	-217.8
	5000	55	5.38					8.462	128.9	-538.3	-142.2

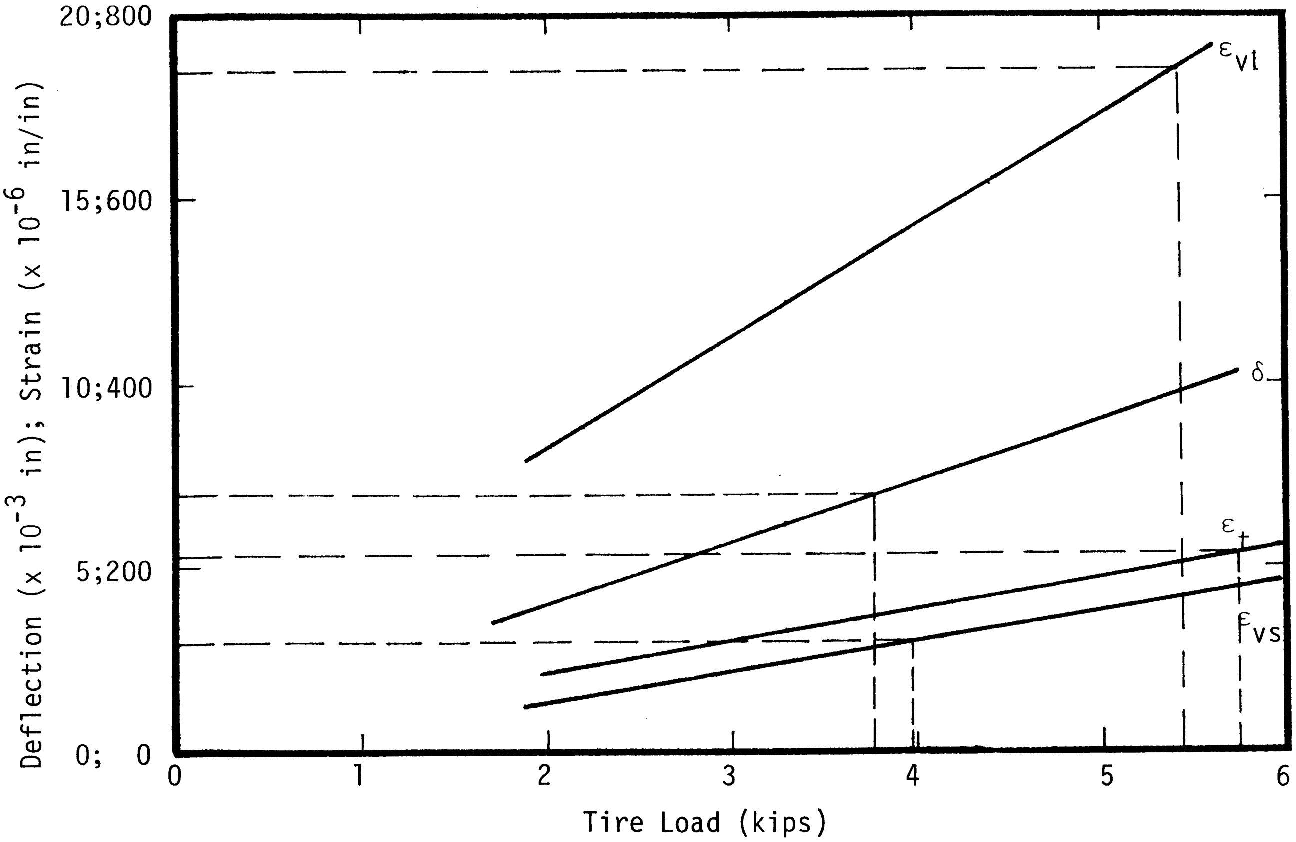

Figure D1. SR 97 - Tire Size 8-22.5.

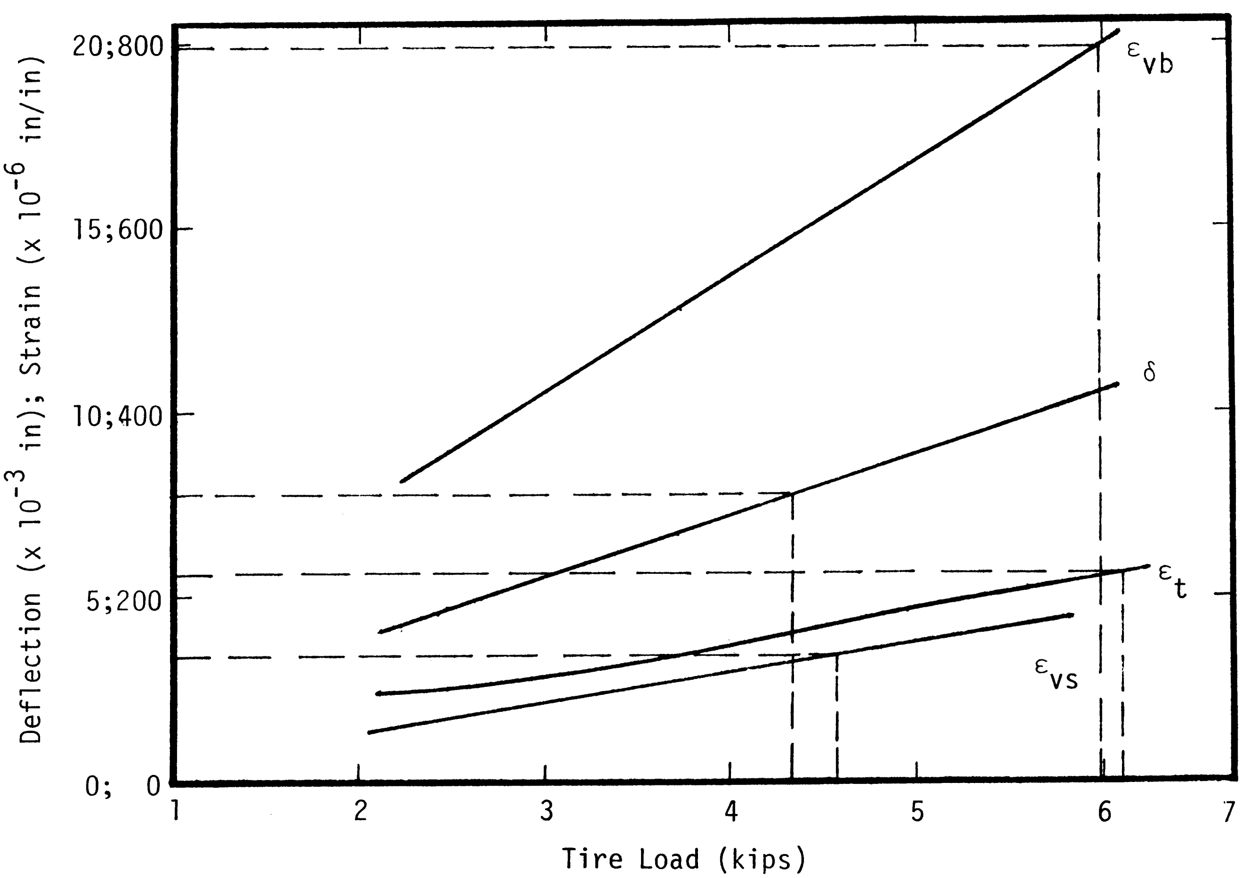

Figure D2. SR 97 - Tire Size 9-22.5.

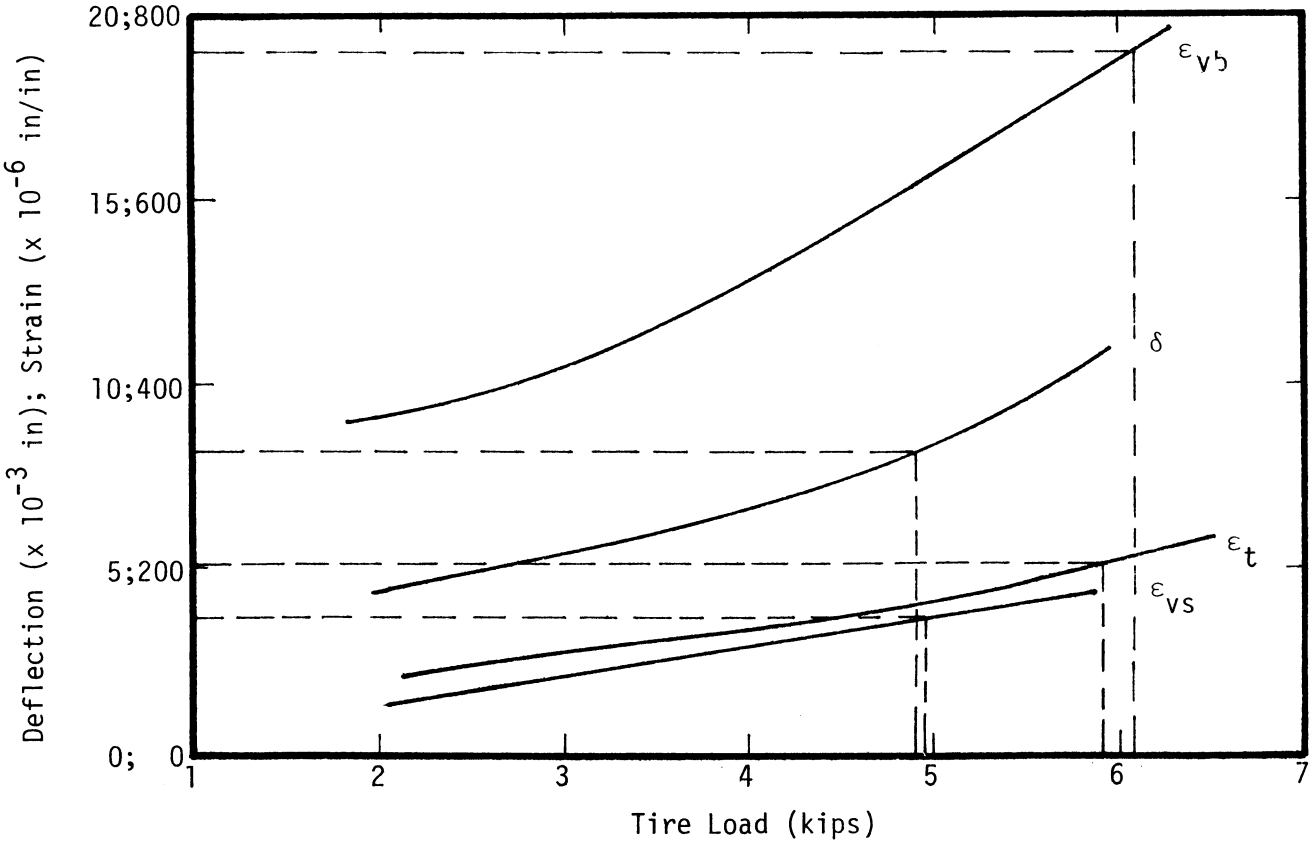

Figure D3. SR 97 - Tire Size 10-22.5.

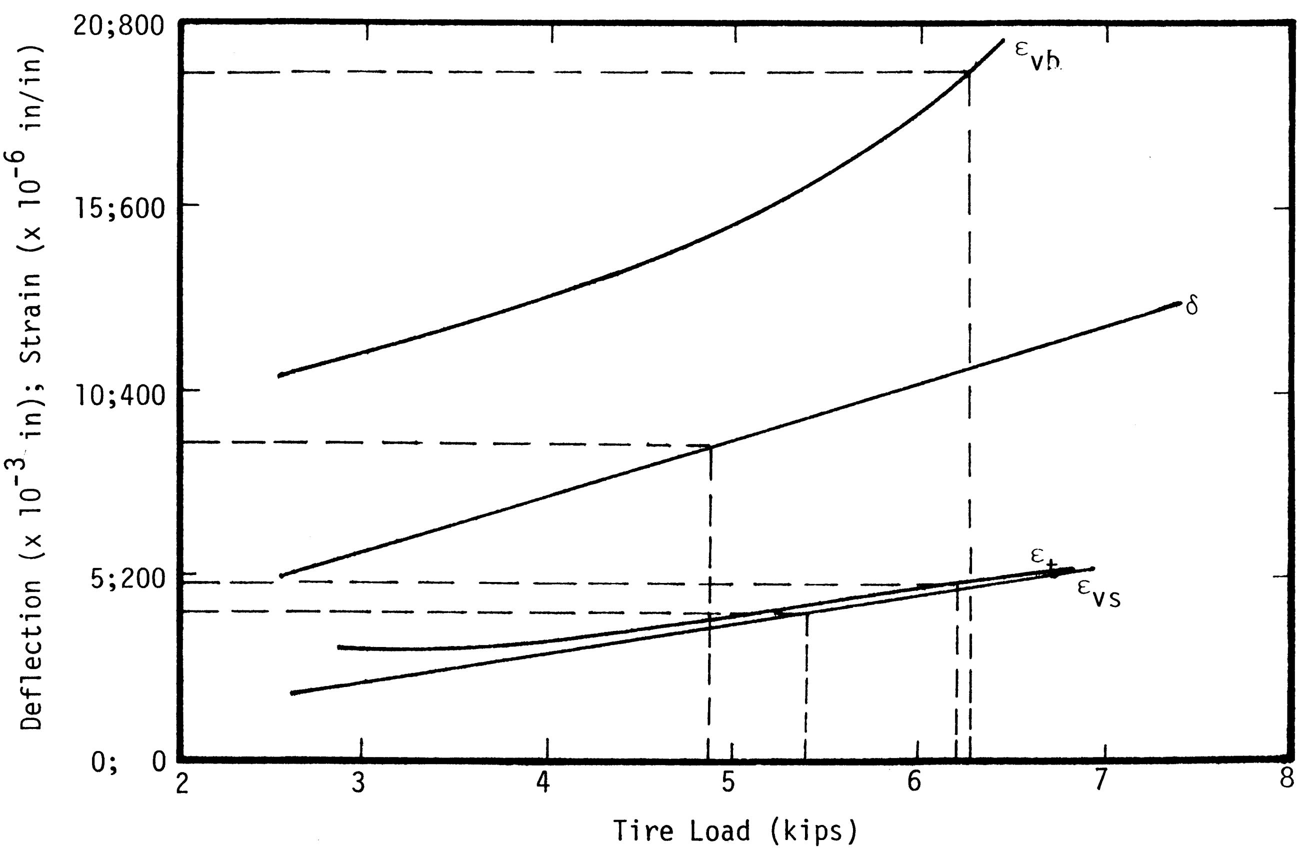

Figure D4. SR 97 - Tire Size 11-22.5.

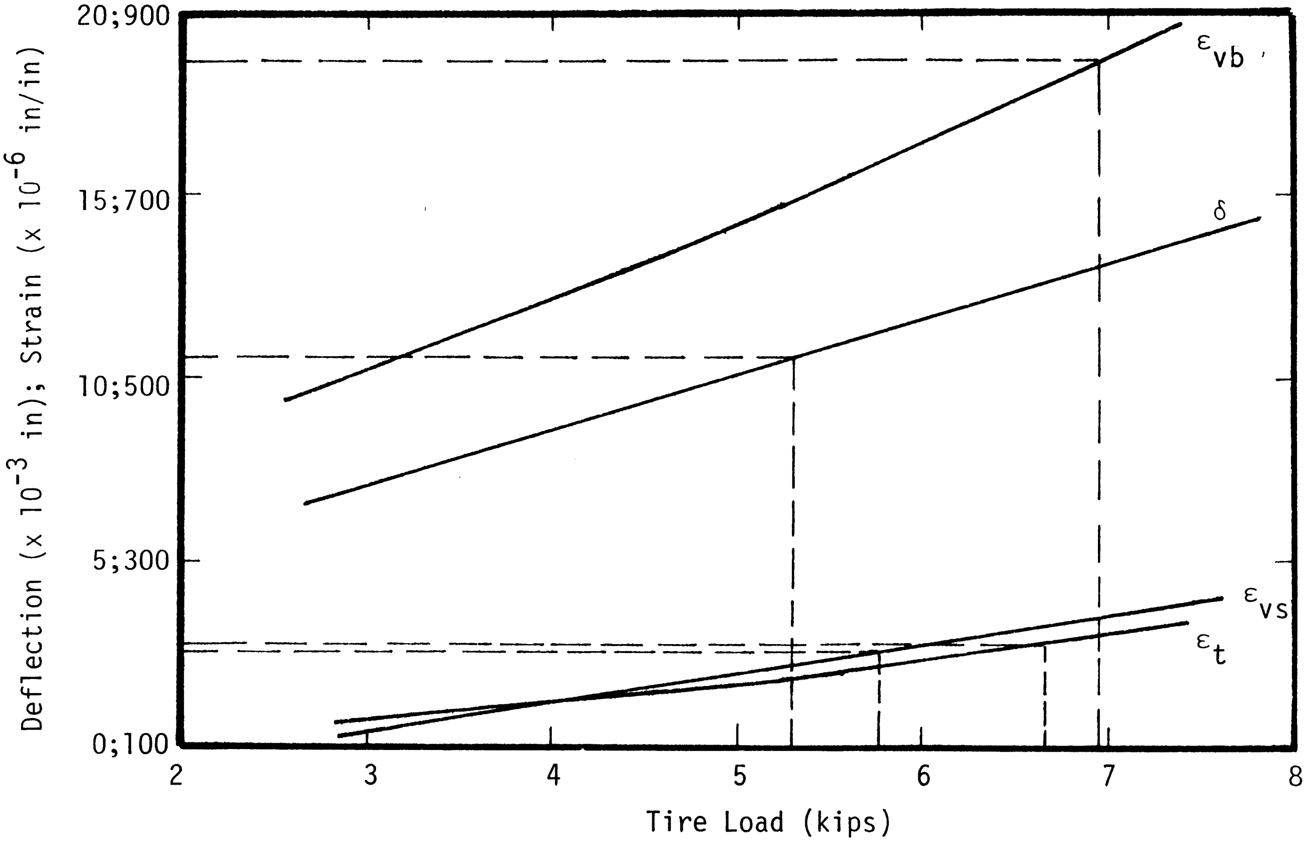

Figure D5. SR 97 - Tire Size 12-24.5.

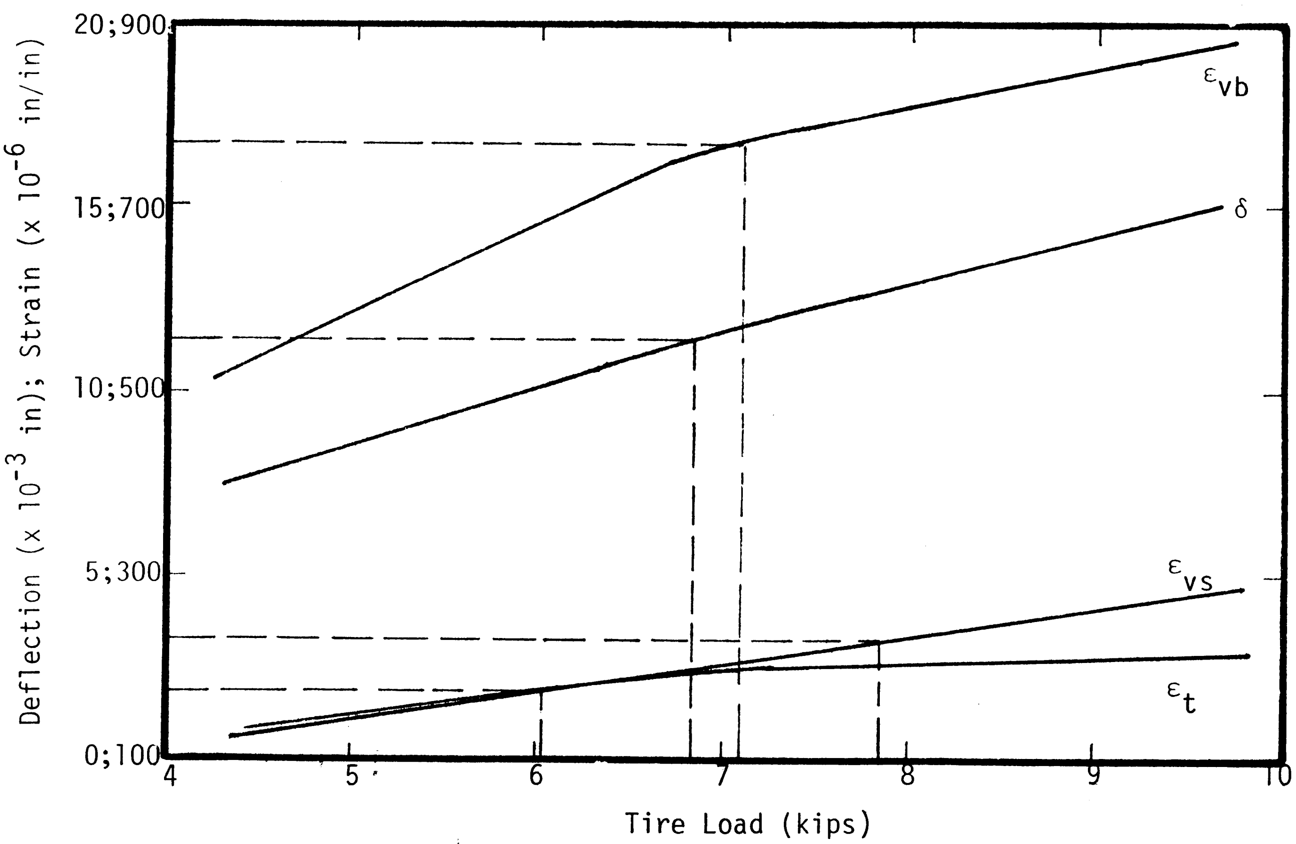

Figure D6. SR 97 - Tire Size 14-17.5.

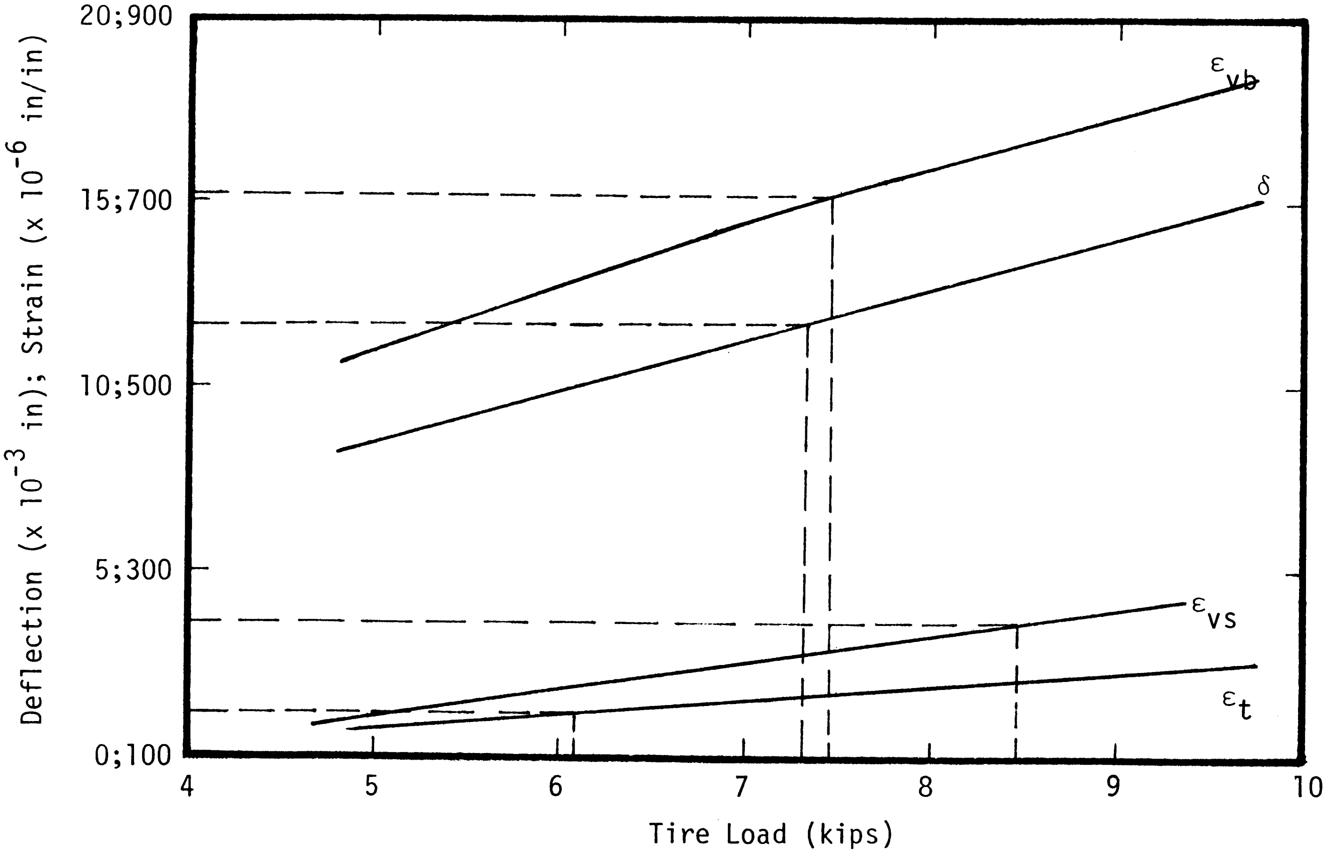

Figure D7. SR 97 - Tire Size 16-22.5.

Table D2. SR 2, MP 117.38-117.62 - Results of the PSAD2A Analysis for Spring and Summer Loading Conditions.

Tire Size Modeled	Tire Load (lbs)	Tire Pressure (psi)	Load Radius (in.)	Summer Condition				Spring Condition			
				δ ($\times 10^{-3}$ in.)	ε_t ($\times 10^{-6}$)	ε_{vb} ($\times 10^{-6}$)	ε_{vs} ($\times 10^{-6}$)	δ ($\times 10^{-3}$ in.)	ε_t ($\times 10^{-6}$)	ε_{vb} ($\times 10^{-6}$)	ε_{vs} ($\times 10^{-6}$)
8-22.5	4400	105	3.65	9.845	188.5	-498.9	-140.2	8.122	143.5	-408.8	-116.6
	3300	80	3.62					5.899	110.7	-315.5	-81.5
	2200	55	3.57					3.838	75.7	-219.2	-50.2
9-22.5	4950	115	3.70	11.18	207.7	-547.0	-162.1	9.265	161.8	-453.7	-135.2
	3712	75	3.97					6.543	118.0	-338.5	-93.9
	2475	55	3.78					4.295	82.1	-237.9	-58.2
10-22.5	5500	105	4.08	12.20	215.0	-568.8	-184.8	10.25	169.9	-479.0	-155.3
	4125	70	4.33					7.211	124.0	-358.1	-105.8
	2750	55	3.99					4.740	88.3	-256.4	-65.8
11-22.5	6050	100	4.39	13.35	224.6	-597.2	-208.5	11.37	181.4	-512.1	-175.8
	4538	65	4.71					7.928	131.8	-381.4	-119.9
	3025	65	3.85					5.300	98.6	-283.8	-73.9
12-24.5	7920	115	4.68	18.03	276.0	-729.7	-292.7	15.63	223.7	-628.1	-252.4
	5940	80	4.86					10.76	164.1	-473.4	-169.8
	3960	65	4.40					6.850	118.0	-342.6	-101.1
14-17.5	9240	100	5.42	20.52	280.7	-752.1	-347.6	18.11	233.4	-664.8	-302.4
	6930	100	4.70					13.14	195.2	-553.8	-209.9
	4620	65	4.76					7.969	130.0	-379.2	-121.4
16-22.5	10000	90	5.95	21.87	278.1	-755.0	-377.8	19.42	233.7	-673.5	-329.4
	7500	75	5.64					13.75	183.4	-537.6	-227.2
	5000	55	5.38					8.450	127.8	-379.3	-132.2

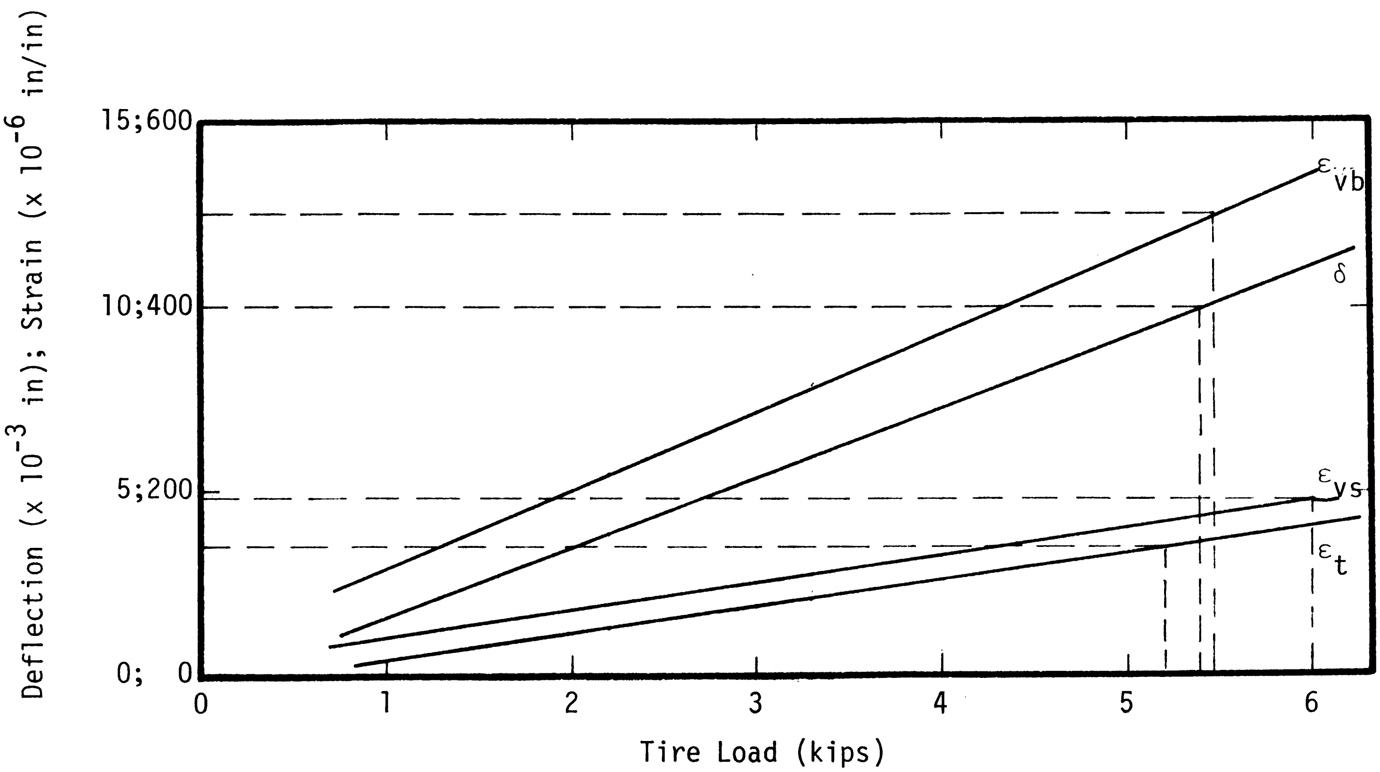

Figure D8. SR 2, Sunnyslope - Tire Size 8-22.5.

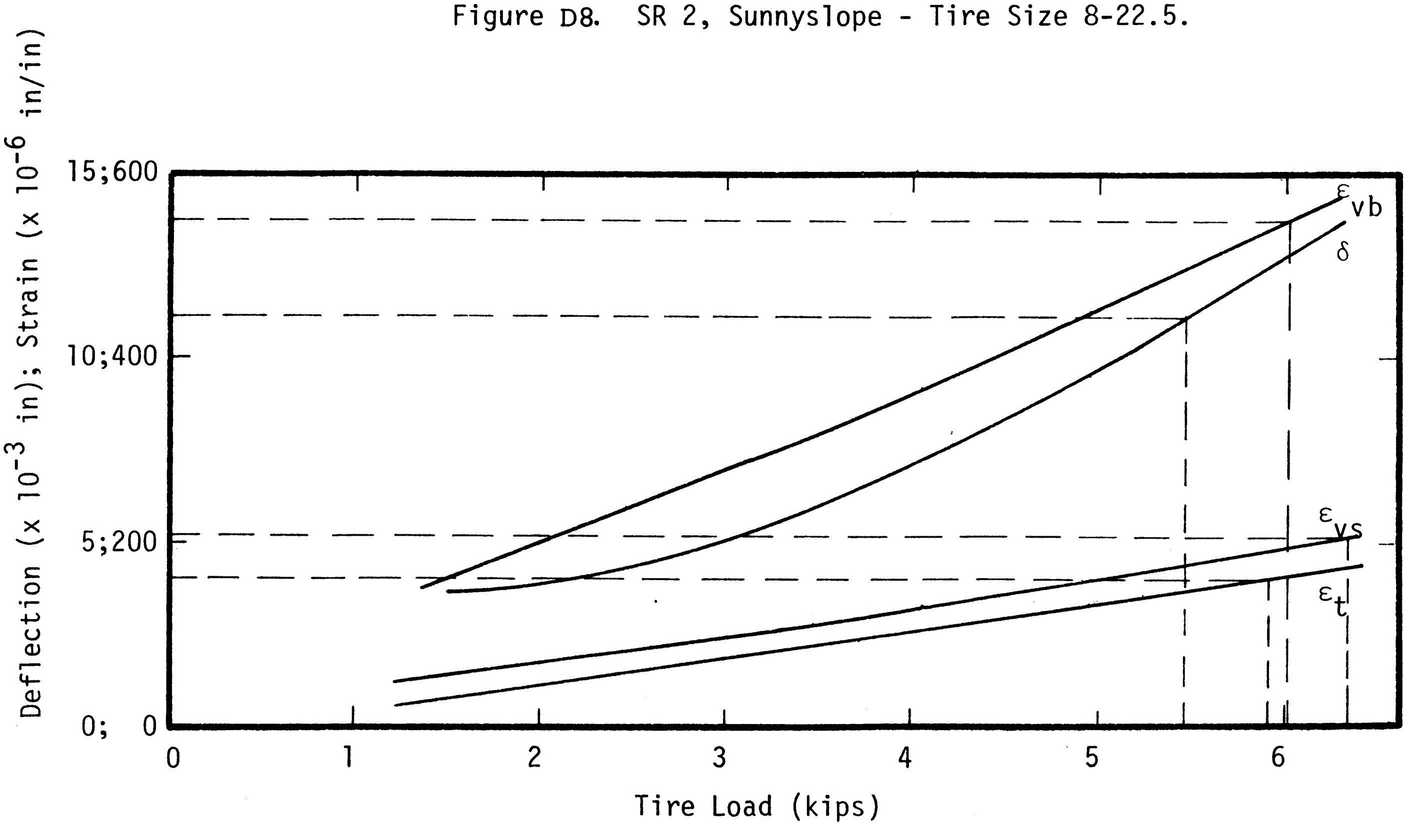

Figure D9. SR 2, Sunnyslope - Tire Size 9-22.5.

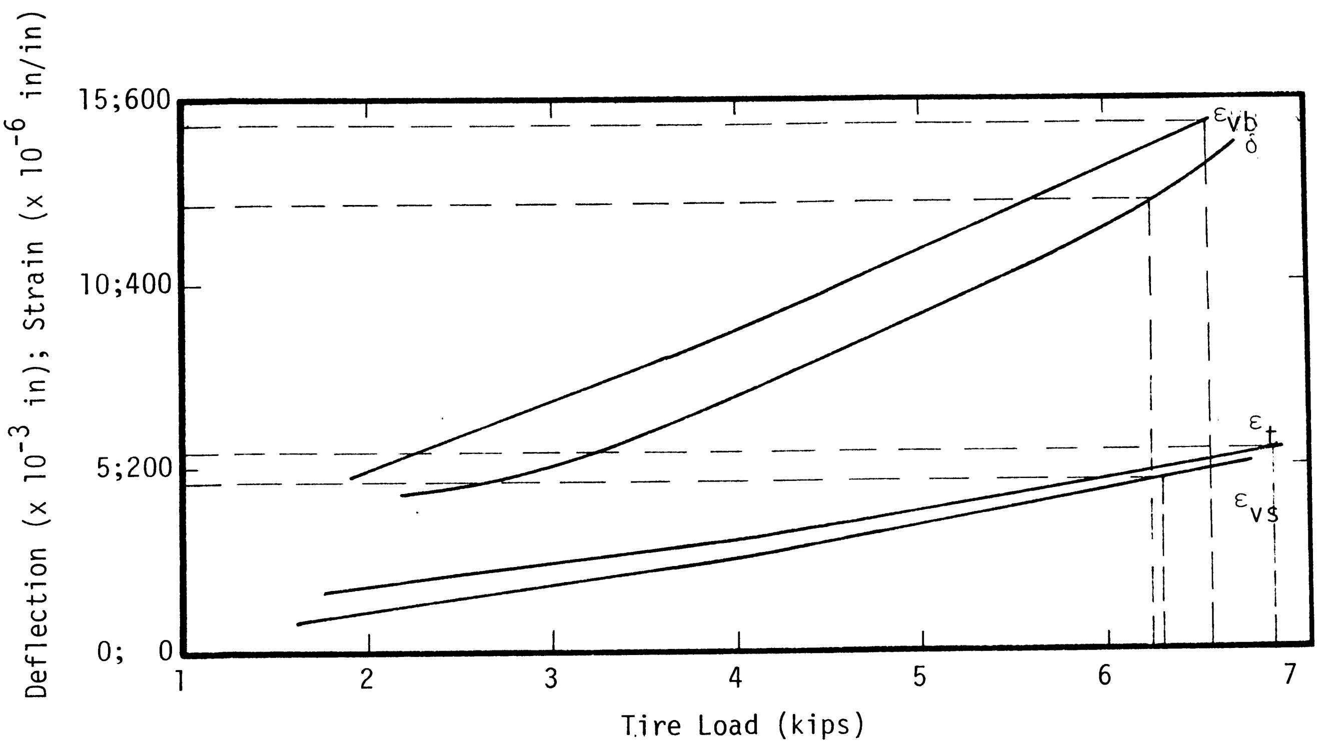

Figure D10. SR 2, Sunnyslope - Tire Size 10-22.5.

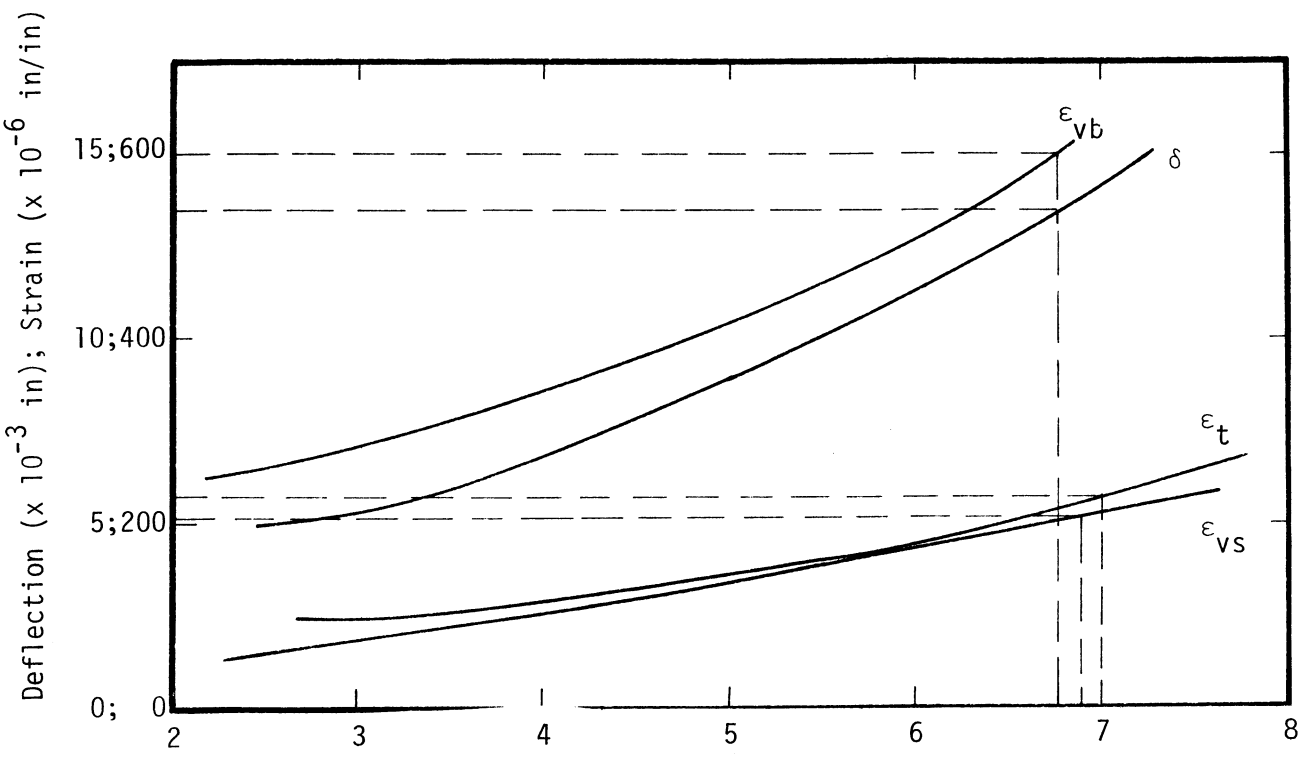

Figure D11. SR 2, Sunnyslope - Tire Size 11-22.5.

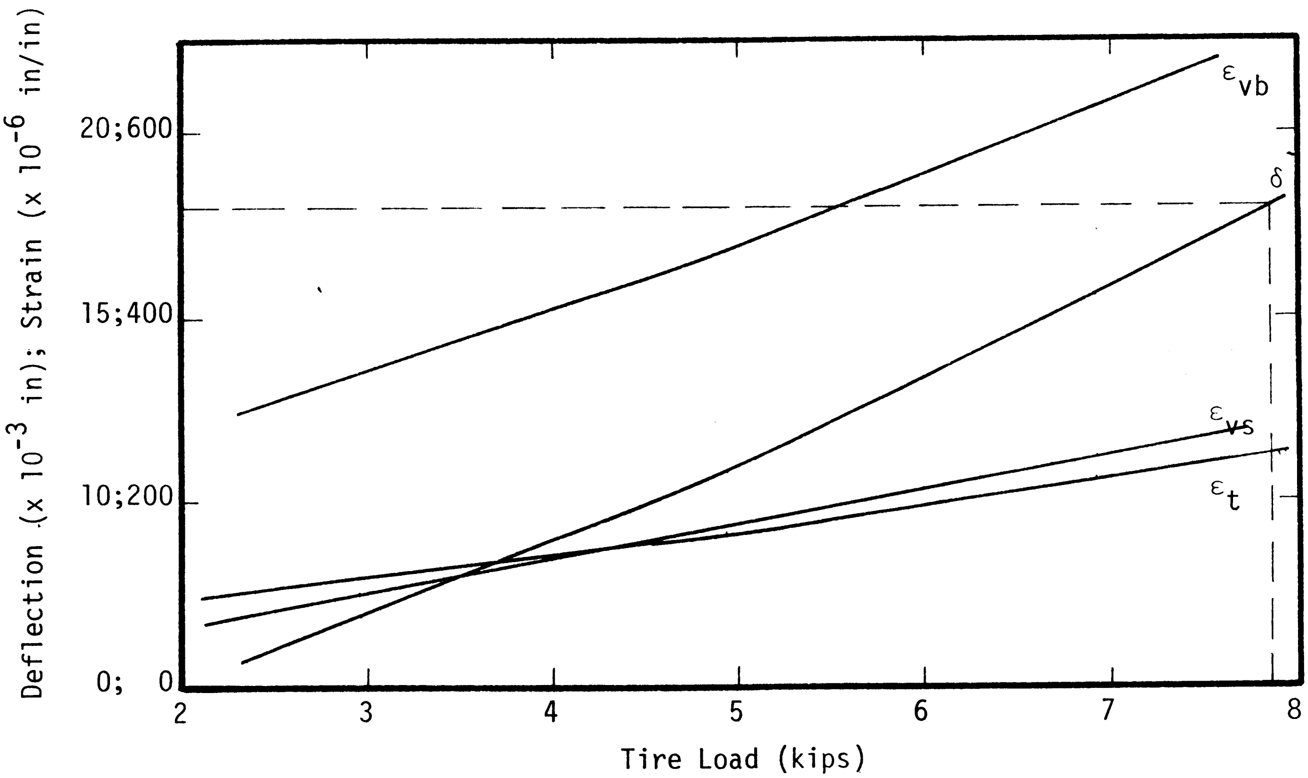

Figure D12. SR 2, Sunnyslope - Tire Size 12-24.5.

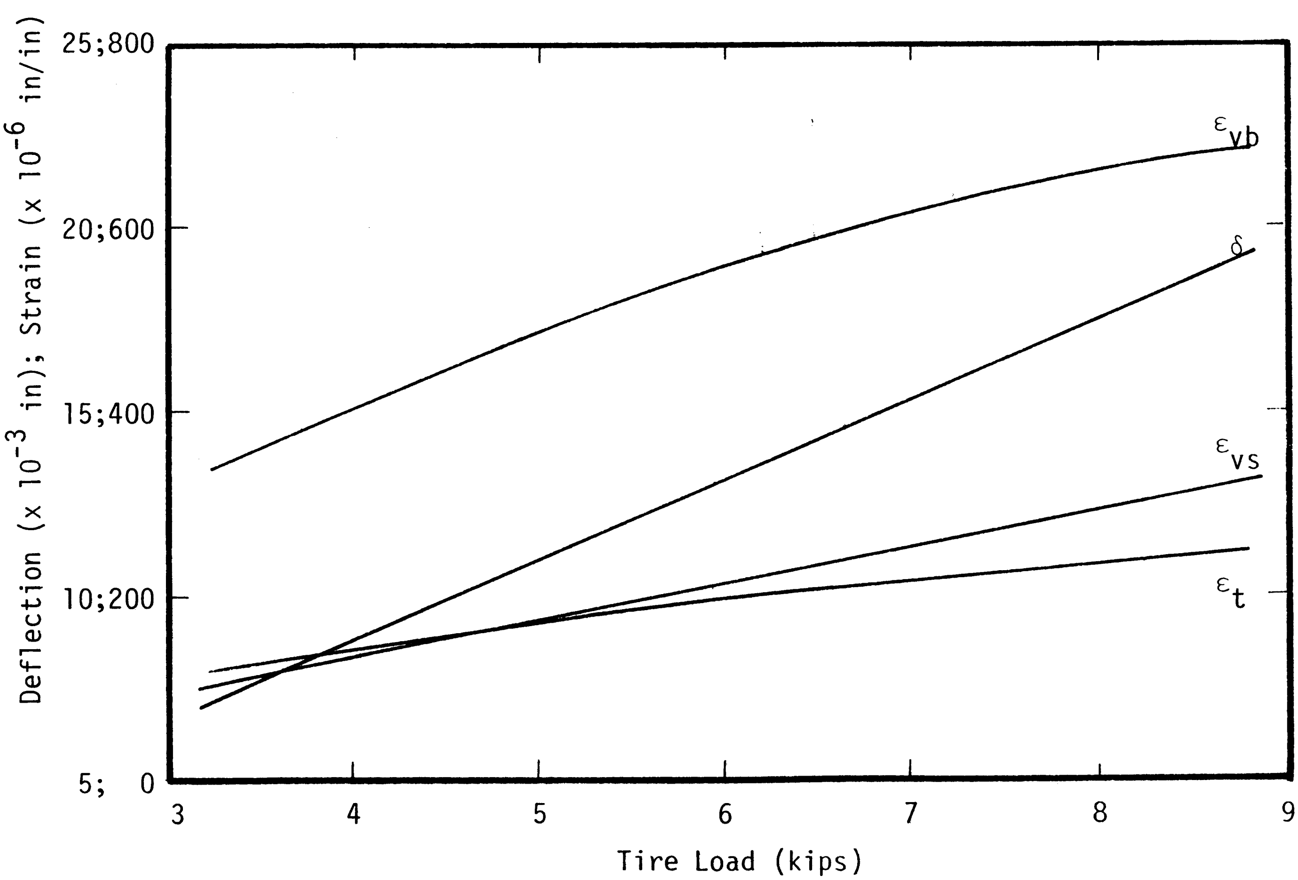

Figure D13. SR 2, Sunnyslope - Tire Size 14-17.5.

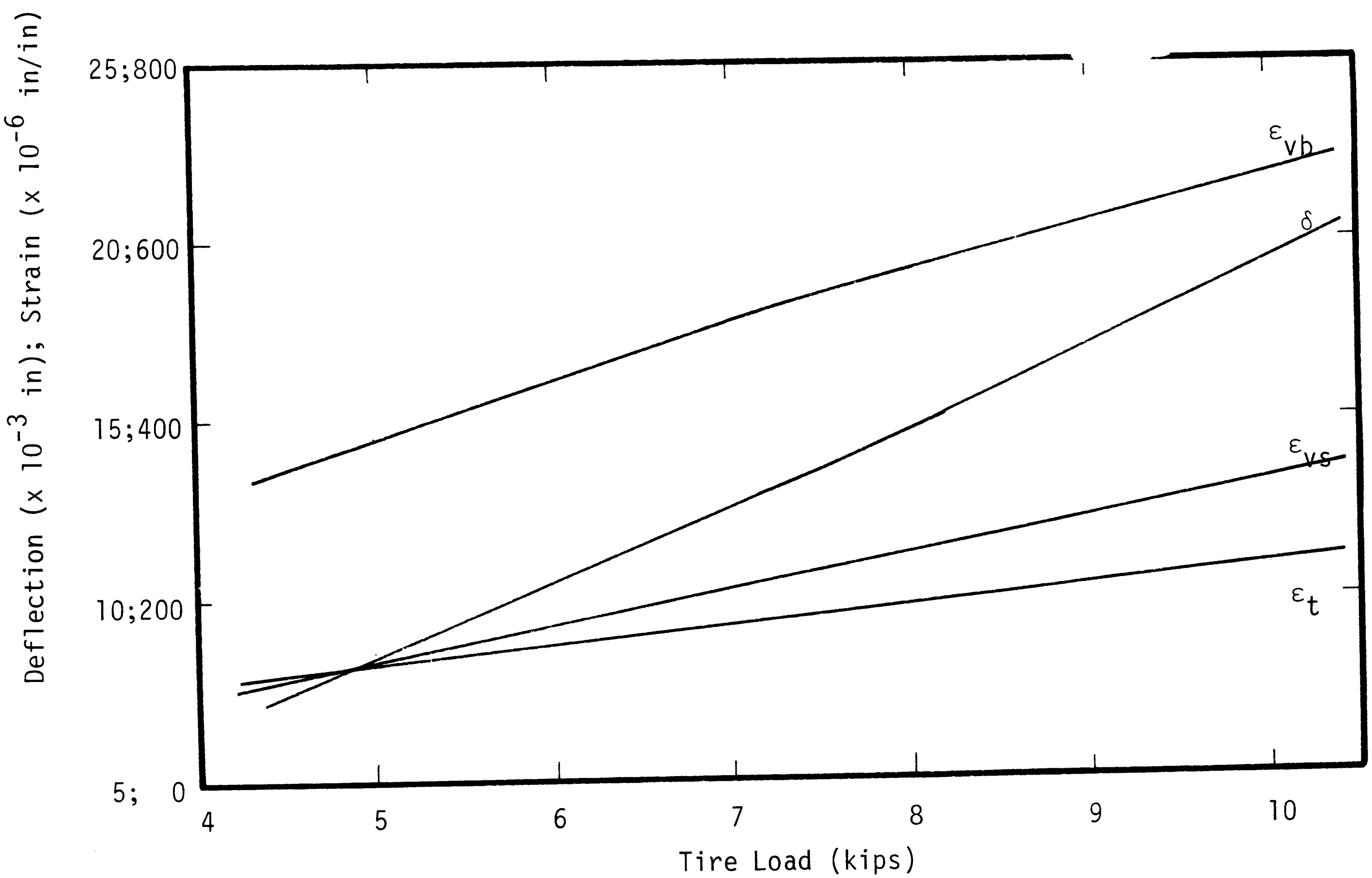

Figure D14. SR 2, Sunnyslope - Tire Size 16-22.5.

Table D3. SR 2, MP 159.6-160.0 - Results of the PSAD2A Analysis for Spring and Summer Loading Conditions.

Tire Size Modeled	Tire Load (lbs)	Tire Pressure (psi)	Load Raduis (in.)	Summer Condition				Spring Condition			
				δ (x 10^{-3} in.)	ε_t (x 10^{-6})	ε_{vb} (x 10^{-6})	ε_{vs} (x 10^{-6})	δ (x 10^{-3} in.)	ε_t (x 10^{-6})	ε_{vb} (x 10^{-6})	ε_{vs} (x 10^{-6})
8-22.5	4400	105	3.65	17.73	319.2	-1210.	-561.1	19.60	342.1	1416.	568.3
	3300	80	3.62					14.28	246.1	1121.	397.8
	2200	55	3.57					9.664	186.3	817.8	244.1
9-22.5	4950	115	3.70	19.93	348.6	-1313.	-642.5	21.61	375.6	1548.	650.2
	3712	75	3.97					15.85	268.8	1169.	449.5
	2475	55	3.78					10.69	195.7	869.6	276.3
10-22.5	5500	105	4.08	21.60	342.4	-1324.	-703.5	23.49	372.9	1581.	715.2
	4125	70	4.33					17.33	269.9	1203.	499.0
	2750	55	3.99					11.74	204.4	919.3	309.5
11-22.5	6050	100	4.39	23.24	340.7	-1344.	-764.6	25.47	375.9	1628.	783.6
	4538	65	4.71					18.64	267.7	1232.	540.3
	3025	65	3.85					13.01	231.3	1017.	351.4
12-24.5	7920	115	4.68	29.59	392.2	-1545.	-1002.	32.92	444.3	1931.	1048.
	5940	80	4.86					24.25	328.6	1495.	735.6
	3960	65	4.40					16.45	255.5	1161.	466.4
14-17.5	9240	100	5.42	33.06	367.8	-1526.	-1125.	37.01	425.8	-1951.	-1185.
	6930	100	4.70					28.70	393.3	-1735.	-897.9
	4620	65	4.76					18.90	269.5	-1124.	-548.5
16-22.5	10000	90	5.95	34.76	344.9	-1488.	-1181.	38.83	403.0	-1921.	-1241.
	7500	75	5.64					29.42	335.5	-1605.	-909.8
	5000	55	5.38					19.76	249.3	-1217.	-572.8

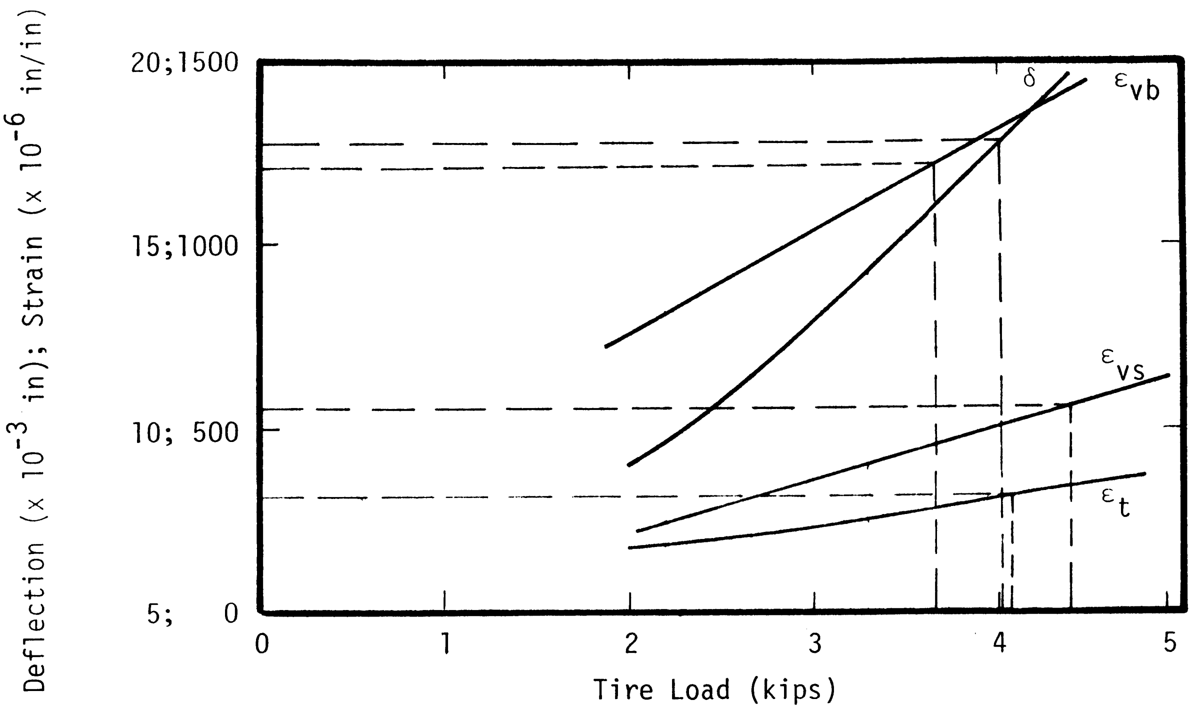

Figure D15. SR 2, MP 159.6 - Tire Size 8-22.5

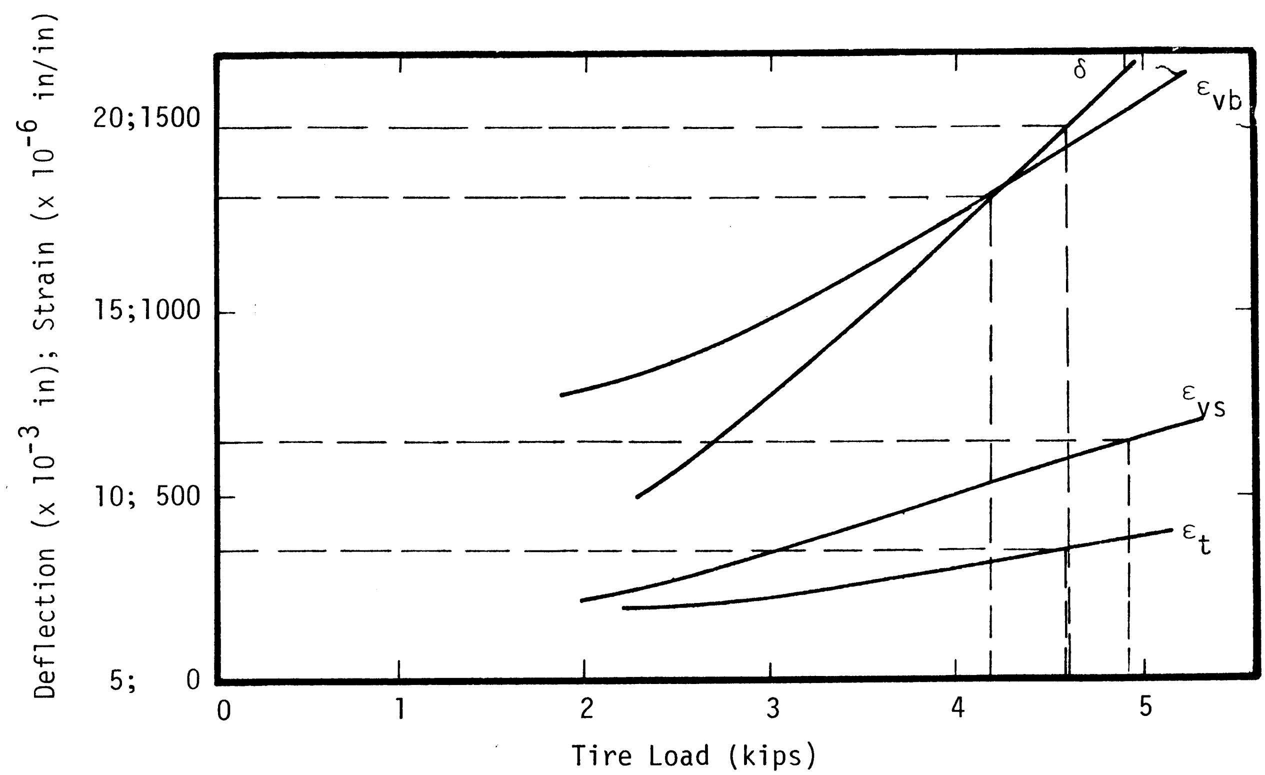

Figure D16. SR 2, MP 159.6 - Tire Size 9-22.5.

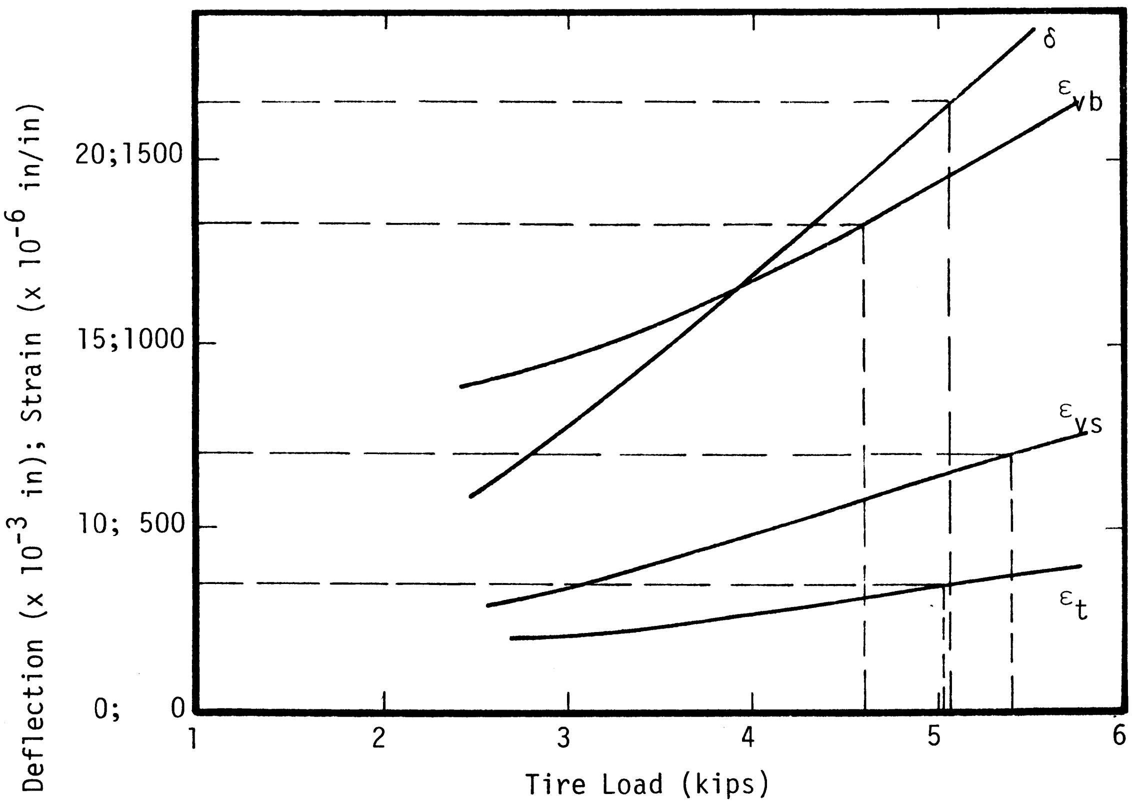

Figure D17. SR 2, MP 159.6 - Tire Size 10-22.5.

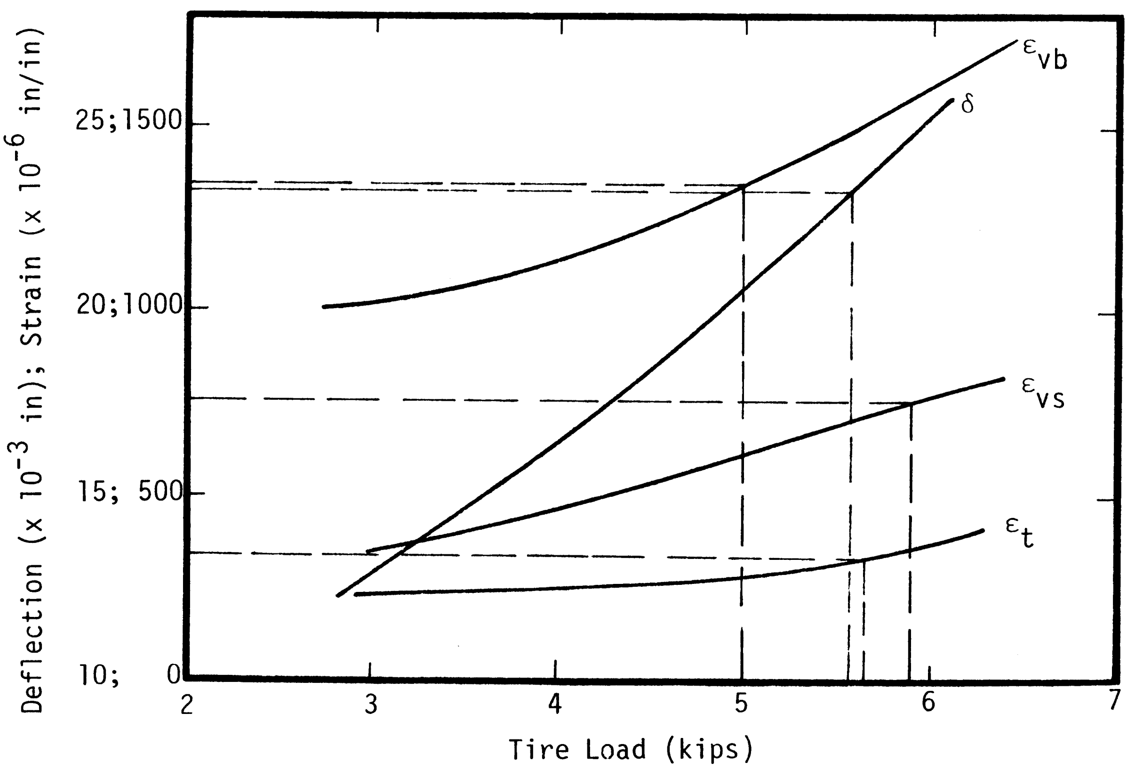

Figure D18. SR 2, MP 159.6 - Tire Size 11-22.5.

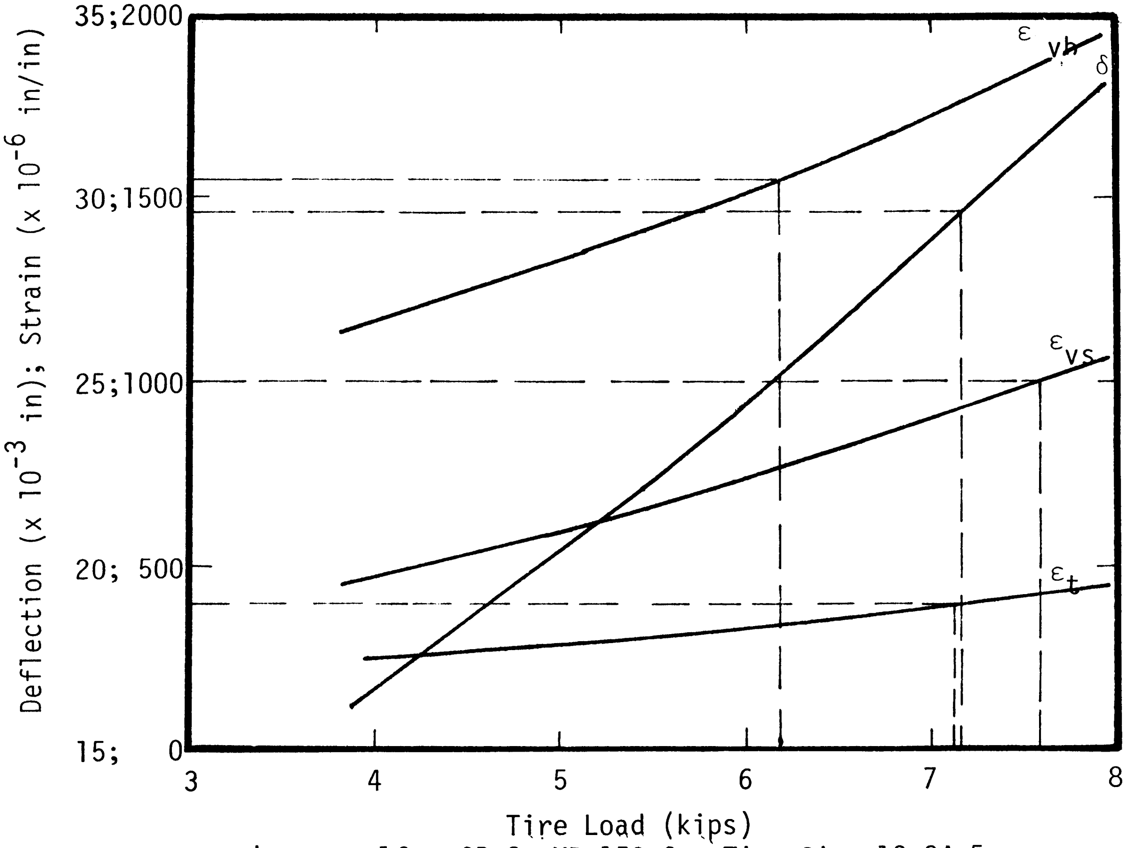

Figure D19. SR 2, MP 159.6 - Tire Size 12-24.5.

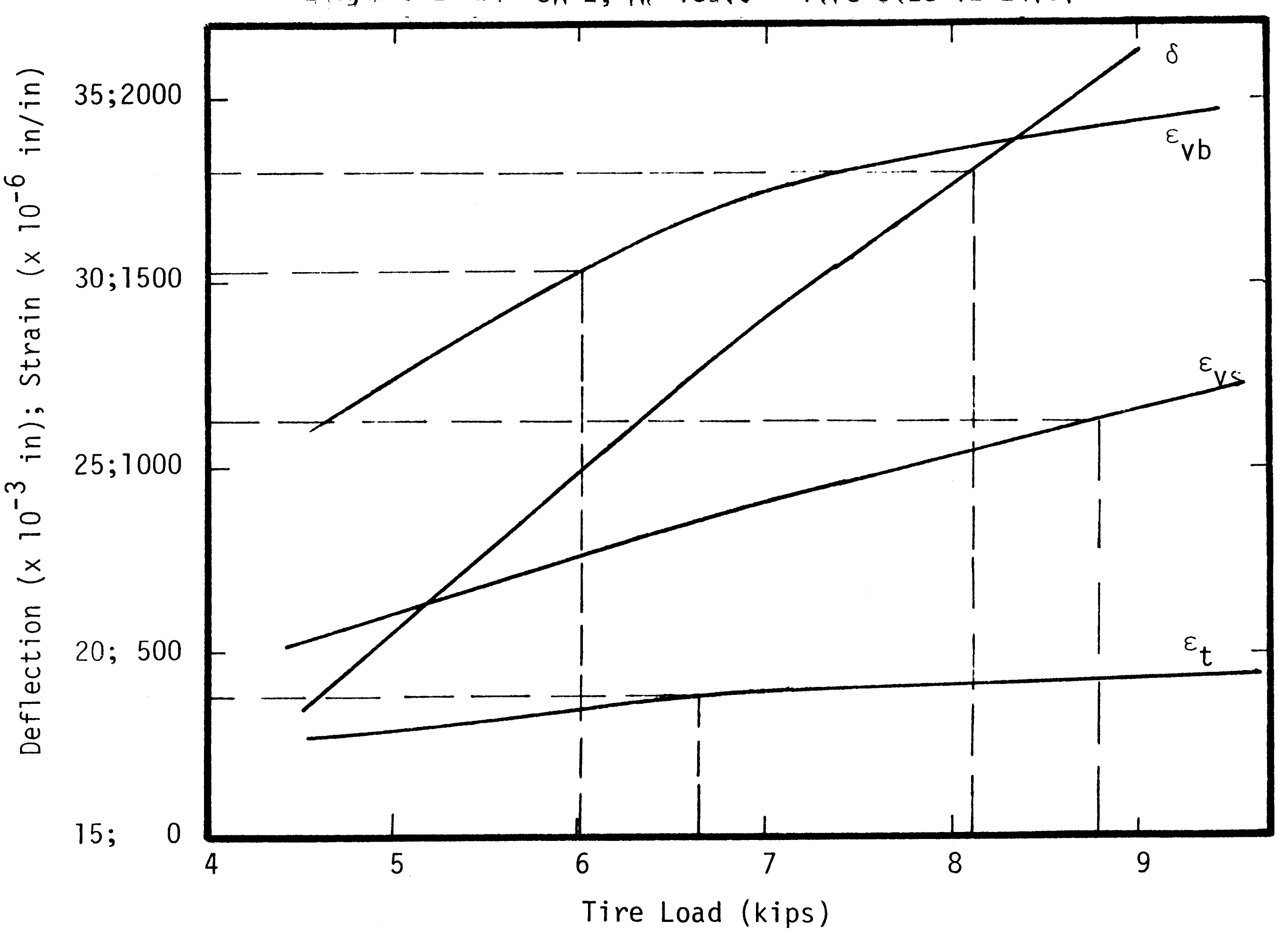

Figure D20. SR 2, MP 159.6 - Tire Size 14-17.5.

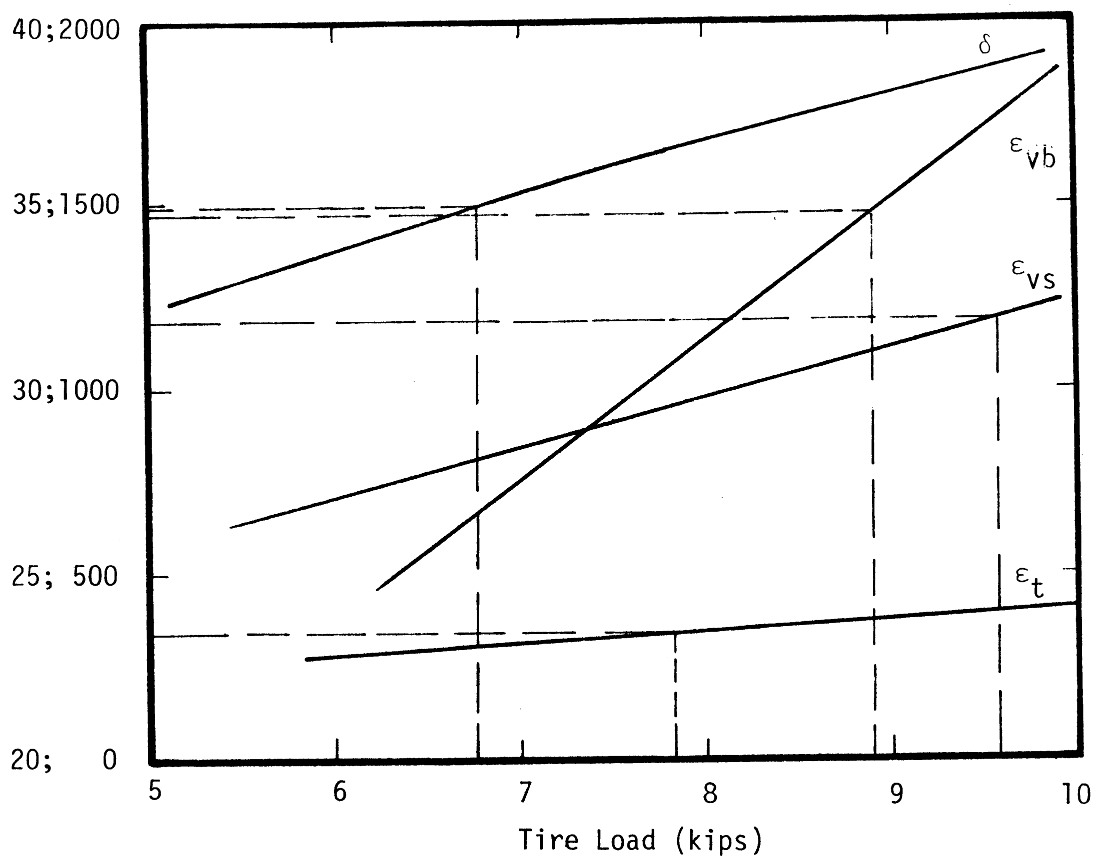

Figure D21. SR 2, MP 159.6 - Tire Size 16-22.5.

Table D4. SR 172, MP 2.0-1.9 - Results of the PSAD2A Analysis for Spring and Summer Loading Conditions.

Tire Size Modeled	Tire Load (lbs)	Tire Pressure (psi)	Load Radius (in.)	Summer Condition			Spring Condition		
				δ ($\times 10^{-3}$ in.)	ε_{vb} ($\times 10^{-6}$)	ε_{vs} ($\times 10^{-6}$)	δ ($\times 10^{-3}$ in.)	ε_{vb} ($\times 10^{-6}$)	ε_{vs} ($\times 10^{-6}$)
8-22.5	4400	105	3.65	39.58	-2989.	-1995.	65.83	-5763.	-3238.
	3300	80	3.62				55.17	-5172.	-2603.
	2200	55	3.57				43.33	-4458.	-1898.
9-22.5	4950	115	3.70	43.64	-3224.	-2223.	70.18	-5894.	-3509.
	3712	75	3.97				58.13	-4965.	-2818.
	2475	55	3.78				46.25	-3499.	-2085.
10-22.5	5500	105	4.08	45.51	-3024.	-2375.	74.09	-5676.	-3776.
	4125	70	4.33				60.91	-4744.	-3011.
	2750	55	3.99				48.87	-4451.	-2255.
11-22.5	6050	100	4.39	47.71	-2899.	-2527.	77.48	-5433.	-4002.
	4538	65	4.71				63.35	-4497.	-3175.
	3025	65	3.85				51.78	-4707.	-2427.
12-24.5	7920	115	4.68	58.28	-3173.	-3142.	90.93	-5655.	-4810.
	5940	80	4.86				74.72	-4789.	-3863.
	3960	65	4.40				59.47	-4580.	-2927.
14-17.5	9240	100	5.42	61.90	-2770.	-3369.	97.91	-5092.	-5216.
	6930	100	4.70				83.20	-5315.	-4359.
	4620	65	4.76				61.96	-4457.	-3215.
16-22.5	10000	90	5.95	63.23	-2491.	-3430.	101.0	-4712.	-5357.
	7500	75	5.64				83.63	-4419.	-4376.
	5000	55	5.38				65.62	-4035.	-3311.

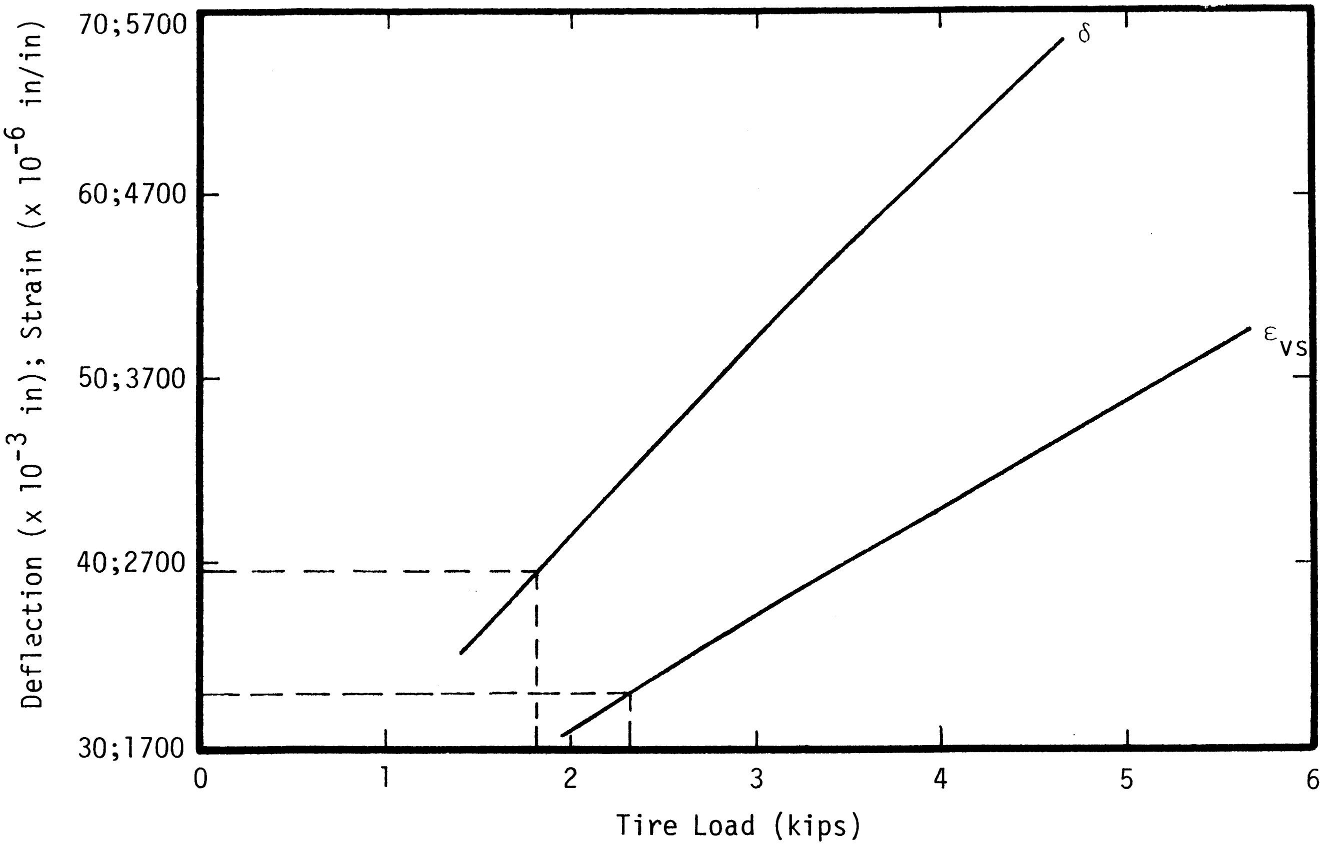

Figure D22. SR 172, MP 2 - Tire Size 8-22.5.

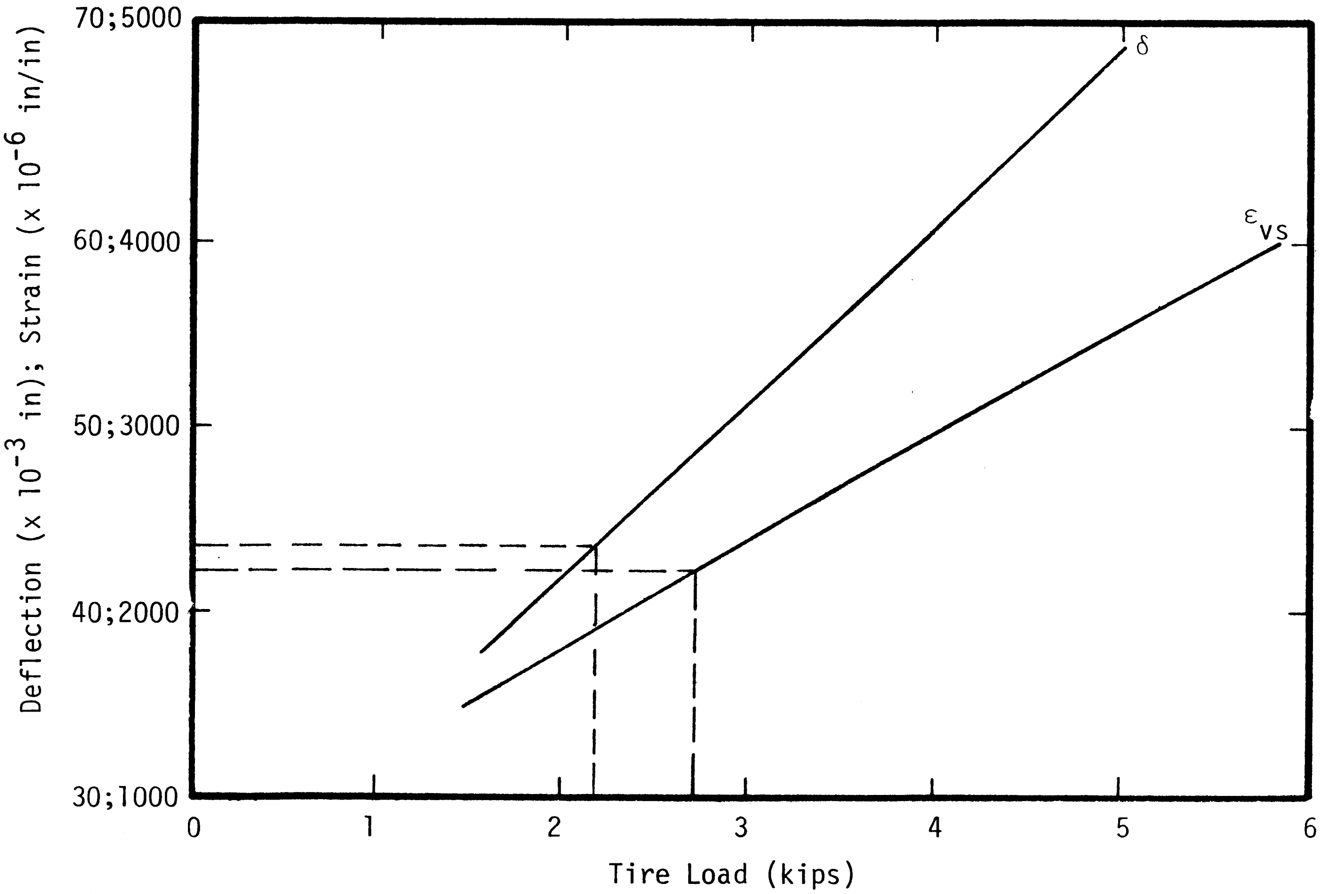

Figure D23. SR 172, MP 2 - Tire Size 9-22.5.

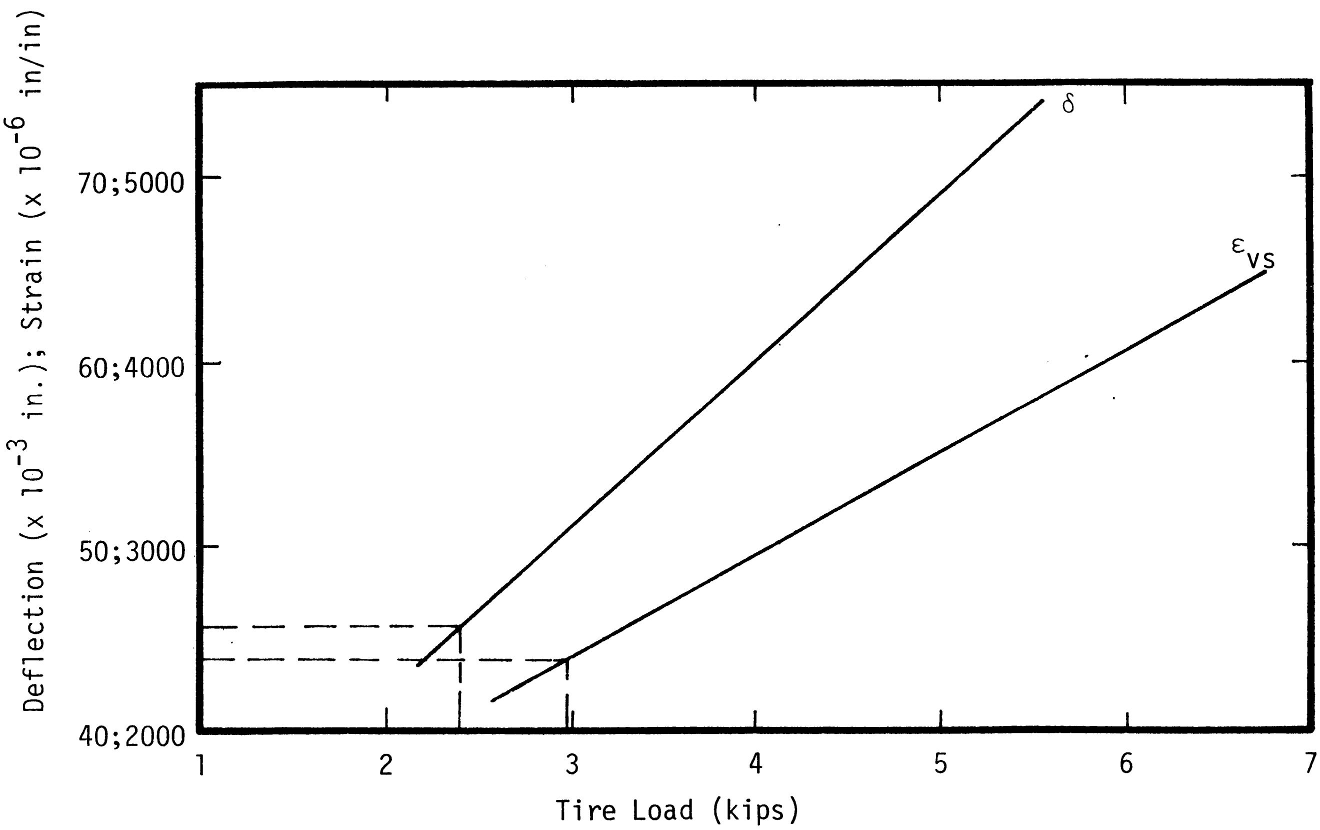

Figure D24. SR 172, MP 2 - Tire Size 10-22.5.

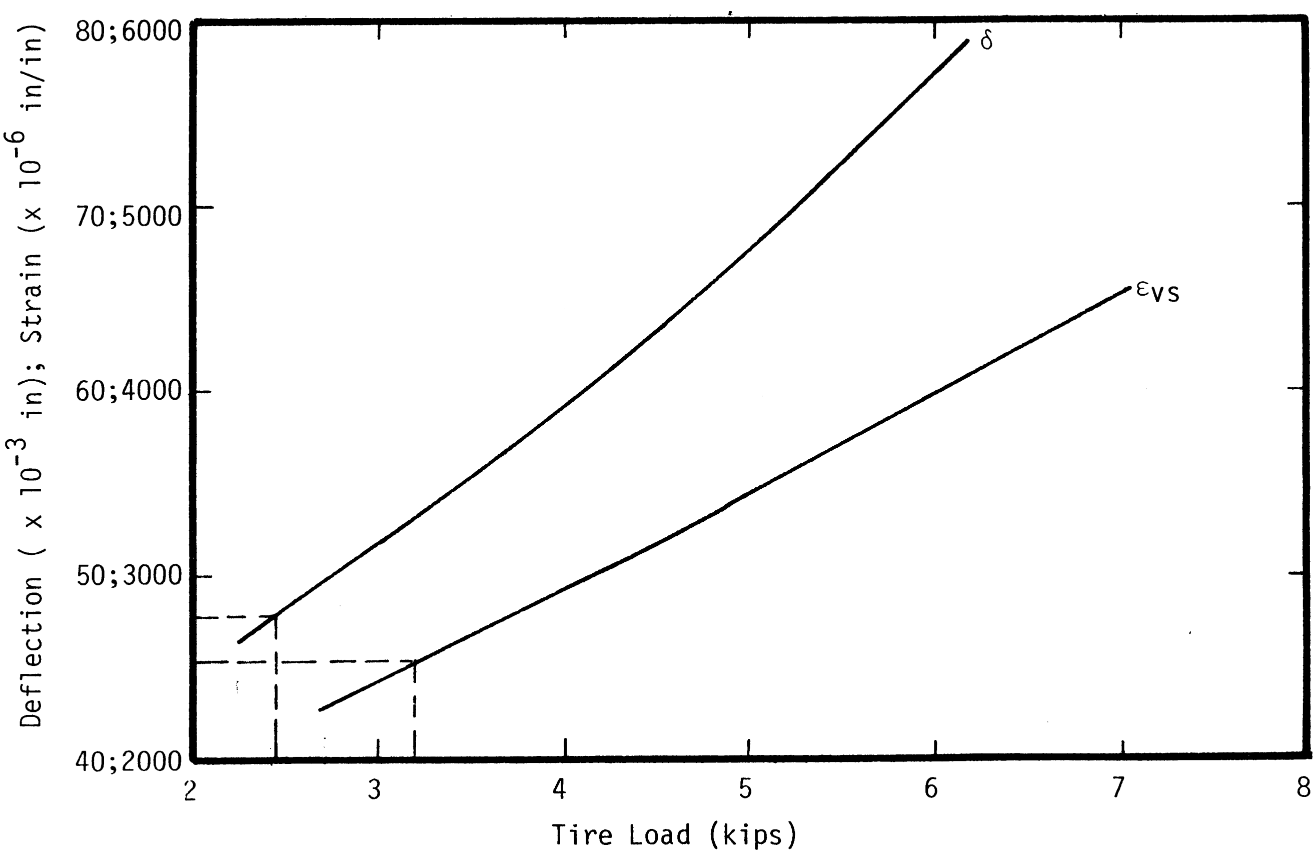

Figure D25. SR 172, MP 2 - Tire Size 11-22.5.

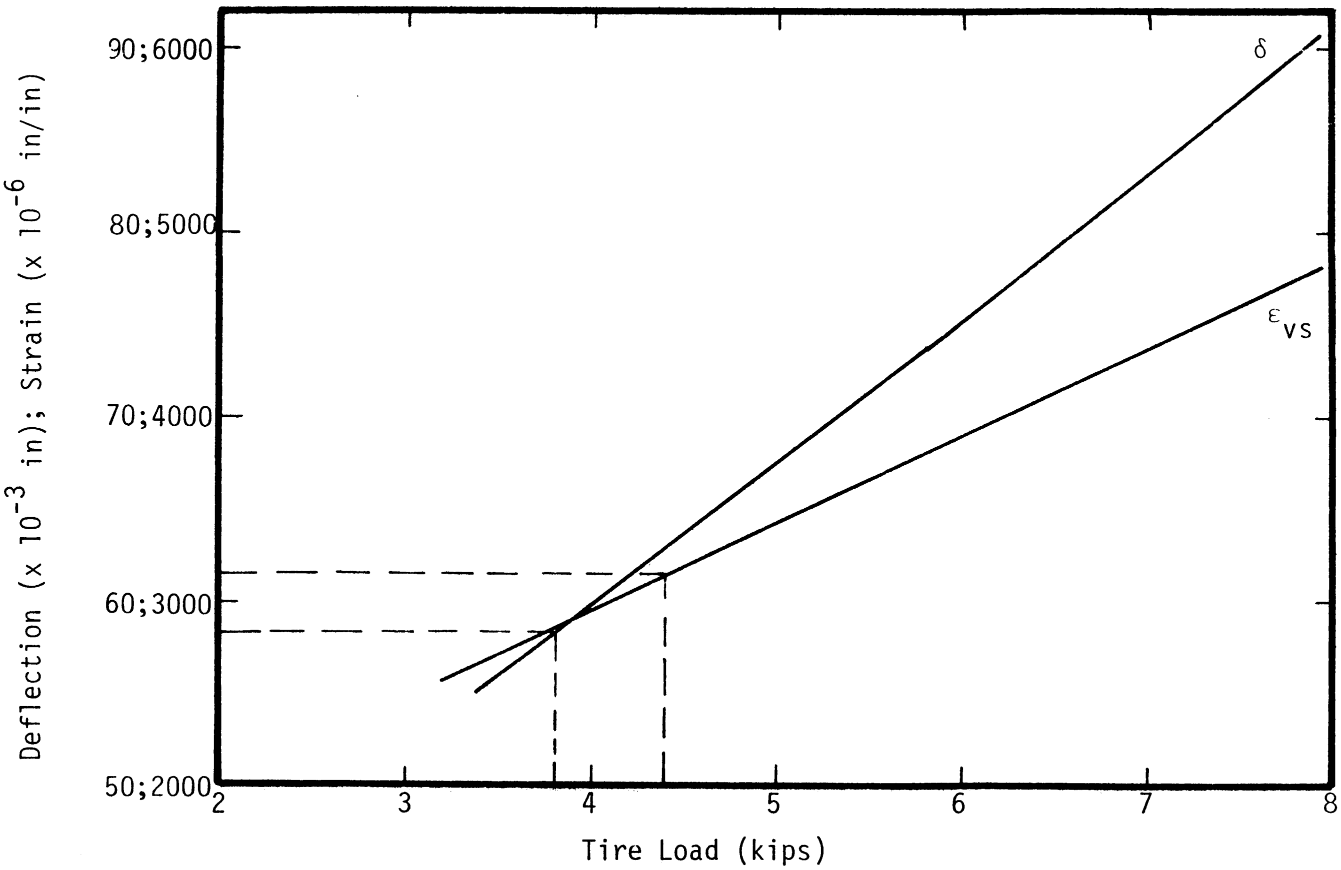

Figure D26. SR 172, MP 2 - Tire Size 12-24.5.

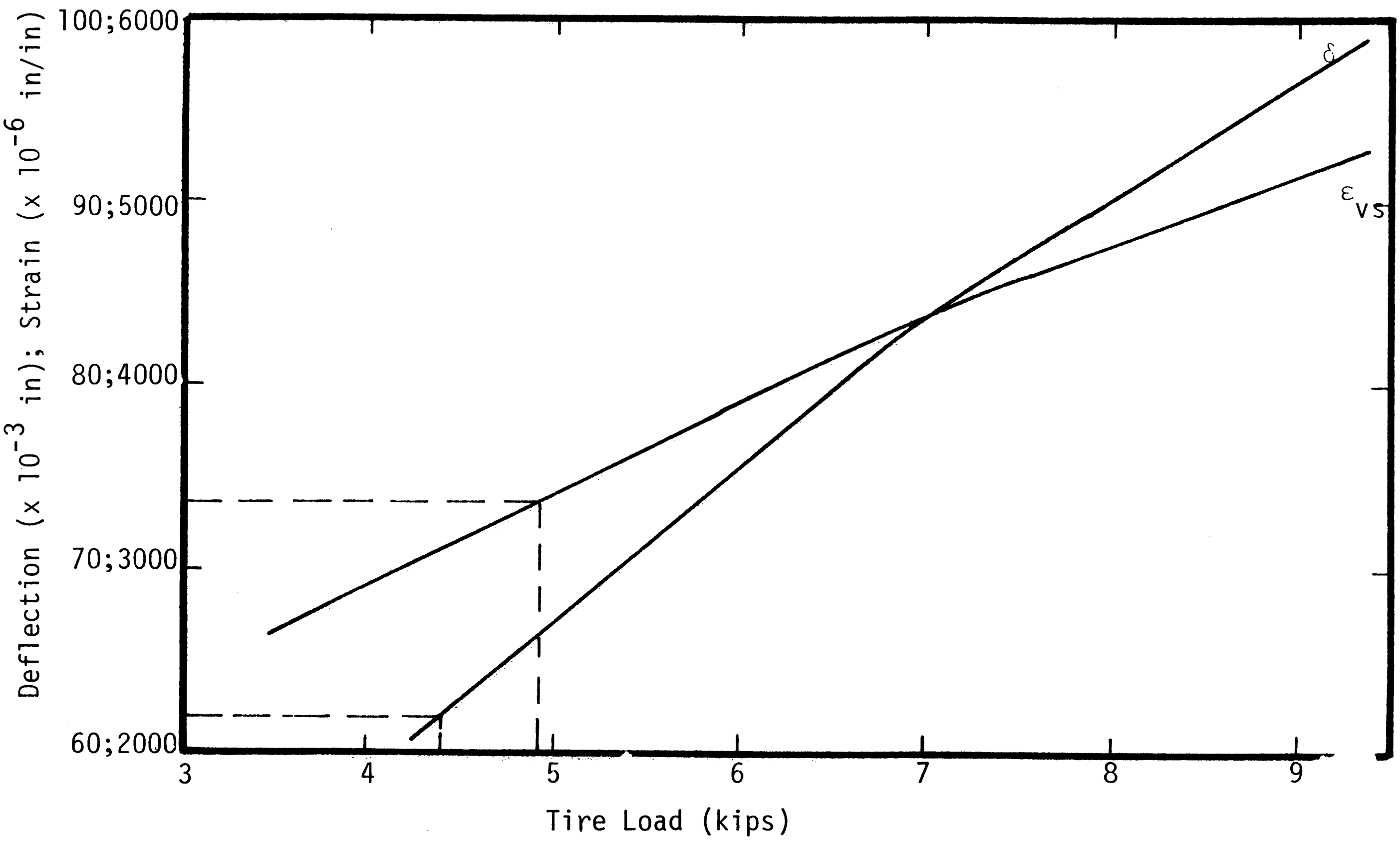

Figure D27. SR 172, MP 2 - Tire Size 14-17.5.

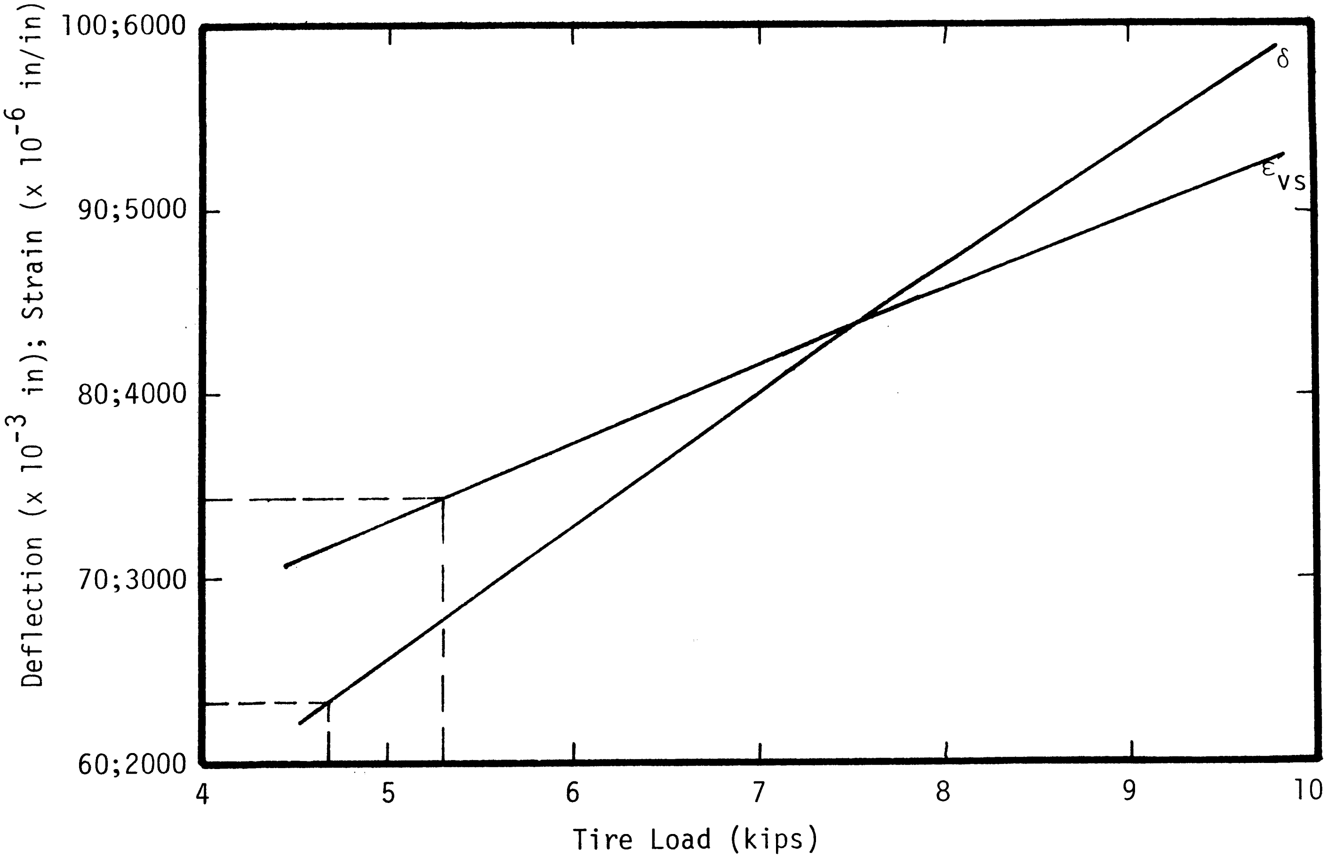

Figure D28. SR 172, MP 2 - Tire Size 16-22.5.

Table D5. SR 172, MP 21.4-21.0 - Results of the PSAD2A Analysis for Spring and Summer Loading Conditions.

Tire Size Modeled	Tire Load (lbs)	Tire Pressure (psi)	Load Radius (in.)	Summer Condition				Spring Condition			
				δ ($\times 10^{-3}$ in.)	ε_t ($\times 10^{-6}$)	ε_{vb} ($\times 10^{-6}$)	ε_{vs} ($\times 10^{-8}$)	δ ($\times 10^{-3}$ in.)	ε_t ($\times 10^{-6}$)	ε_{vb} ($\times 10^{-6}$)	ε_{vs}
8-22.5	4400	105	3.65	14.40	269.4	-1179.	-518.9	24.27	317.7	-1929.	-516.0
	3300	80	3.62					19.05	246.2	-1527.	-378.4
	2200	55	3.57					13.39	171.3	-1110.	-245.6
9-22.5	4950	115	3.70	15.99	294.5	-1292.	-579.5	26.99	351.1	-2118.	-582.9
	3712	75	3.97					20.93	256.6	-1650.	-421.9
	2475	55	3.78					14.79	182.8	-1201.	-276.0
10-22.5	5500	105	4.08	17.14	282.9	-1289.	-628.1	29.26	356.3	-2216.	-641.2
	4125	70	4.33					22.71	261.5	-1740.	-464.3
	2750	55	3.99					16.16	193.5	-1292.	-306.0
11-22.5	6050	100	4.39	18.31	277.5	-1306.	-676.6	31.51	364.1	-2320.	-700.1
	4538	65	4.71					24.36	264.1	-1811.	-505.4
	3025	65	3.85					17.73	218.0	-1419.	-340.5
12-24.5	7920	115	4.68	22.99	320.6	-1551.	-860.7	39.21	437.0	-2812.	-917.6
	5940	80	4.86					30.54	326.9	-2218.	-669.1
	3960	65	4.40					21.87	248.4	-1678.	-442.9
14-17.5	9240	100	5.42	25.16	288.3	-1502.	-954.5	43.87	434.6	-2972.	-1039.
	6930	100	4.70					35.07	387.8	-2544.	-794.8
	4620	65	4.76					24.70	266.4	-1838.	-514.1
16-22.5	10000	90	5.95	26.06	216.3	-1434.	-994.3	45.94	420.6	-2996.	-1099.
	7500	75	5.64					36.33	346.7	-2488.	-823.0
	5000	55	5.38					26.01	254.6	-1857.	-542.4

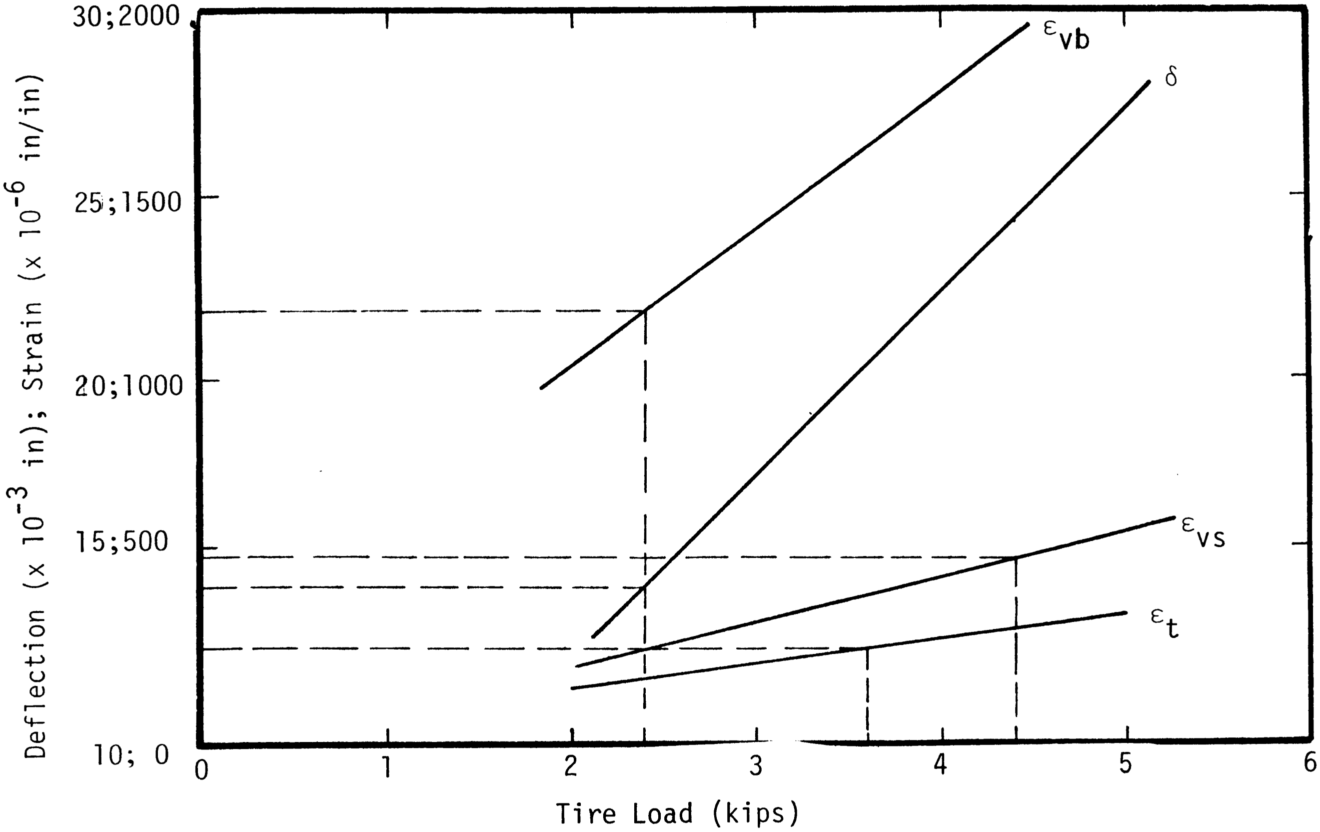

Figure D29. SR 172, MP 21.4 - Tire Size 8-22.5.

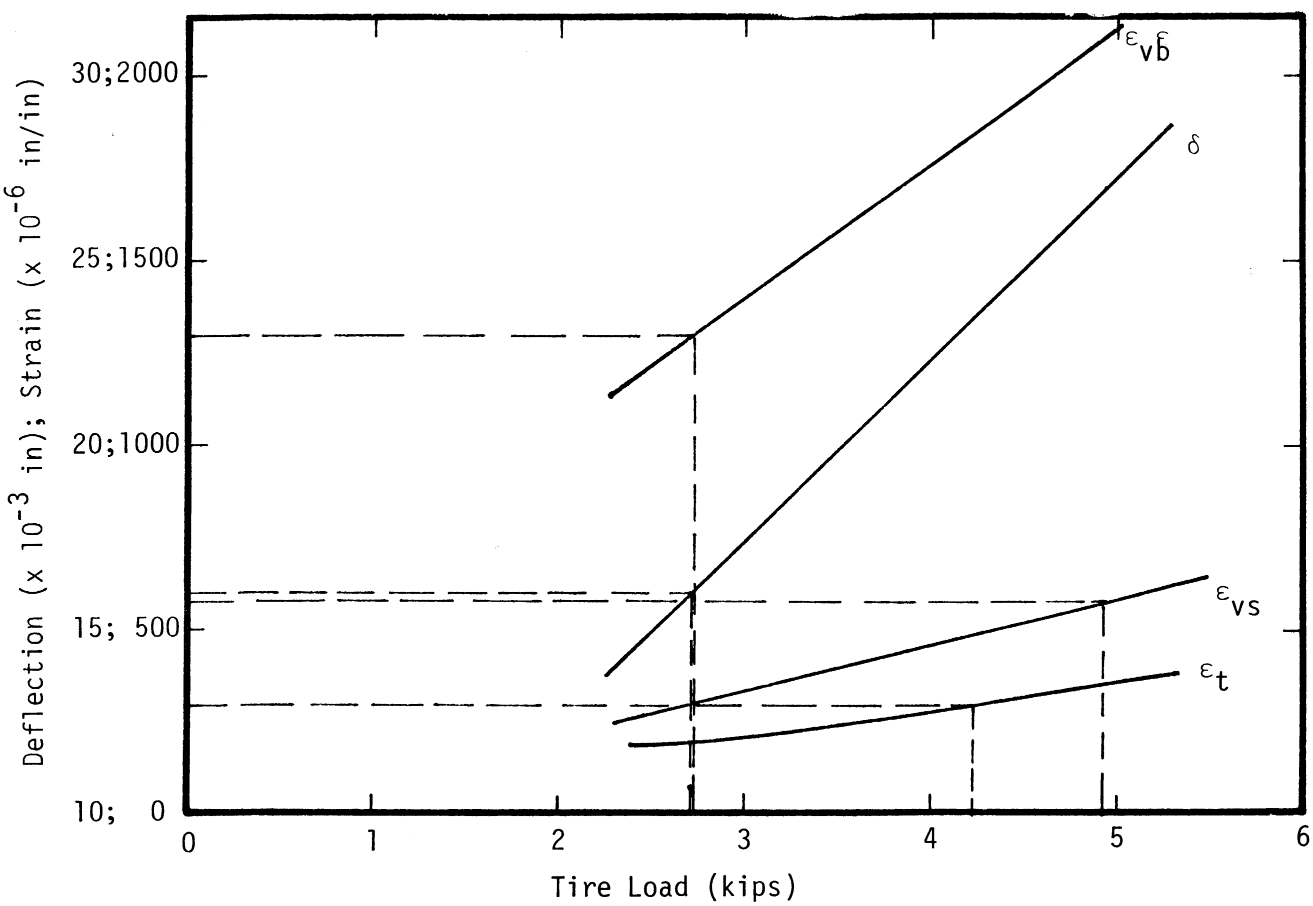

Figure D30. SR 172, MP 21.4 - Tire Size 9-22.5.

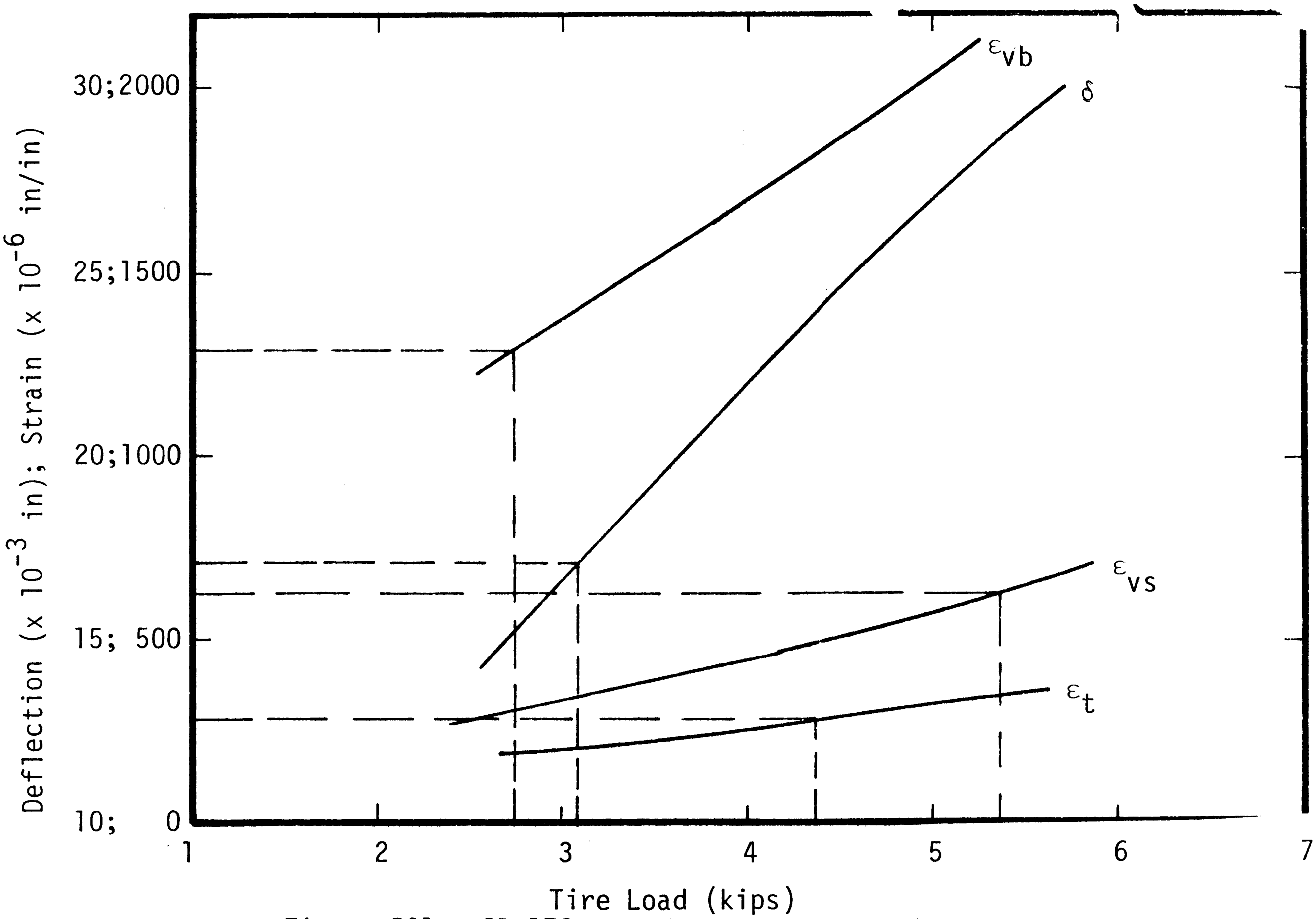

Figure D31. SR 172, MP 21.4 - Tire Size 10-22.5

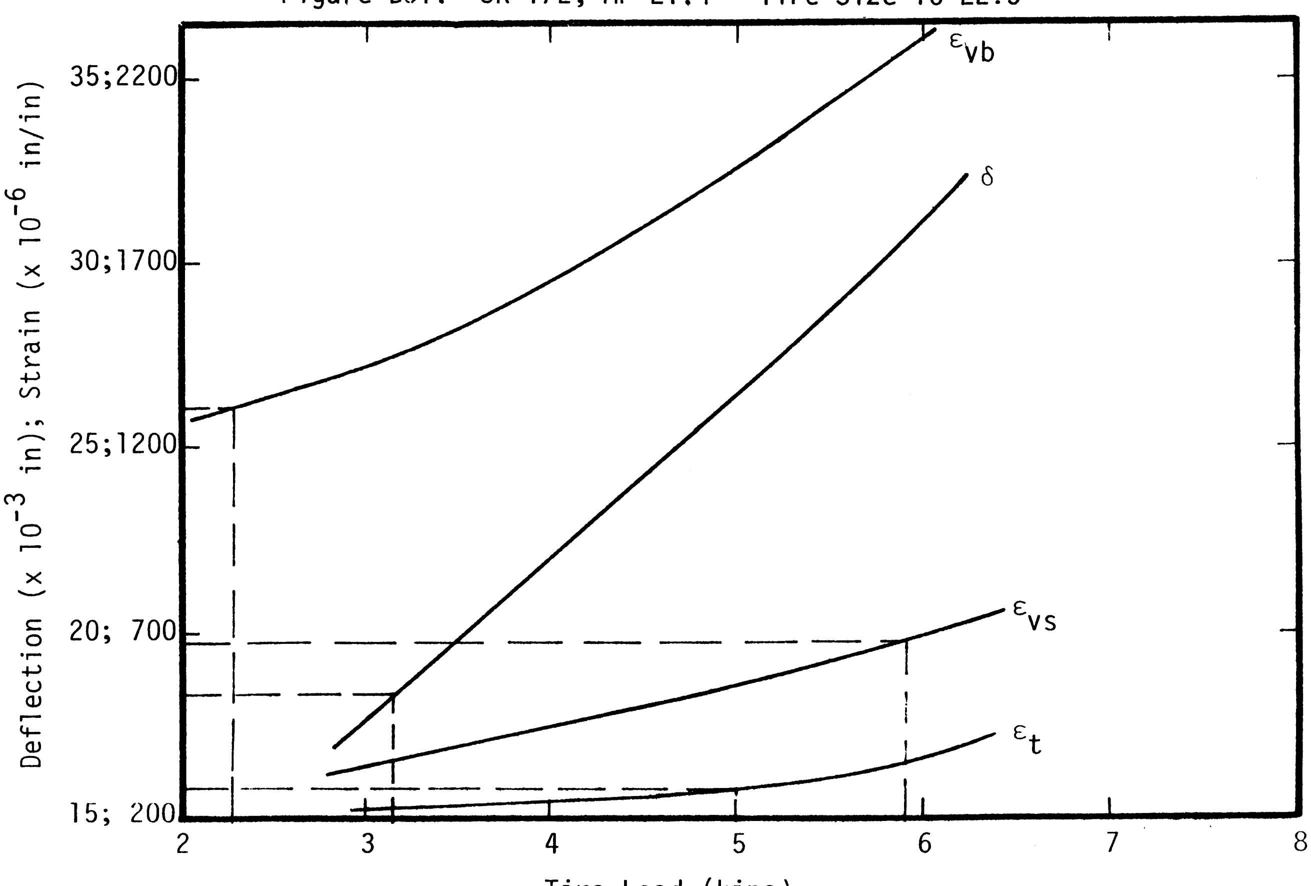

Figure D32. SR 172, MP 21.4 - Tire Size 11-22.5

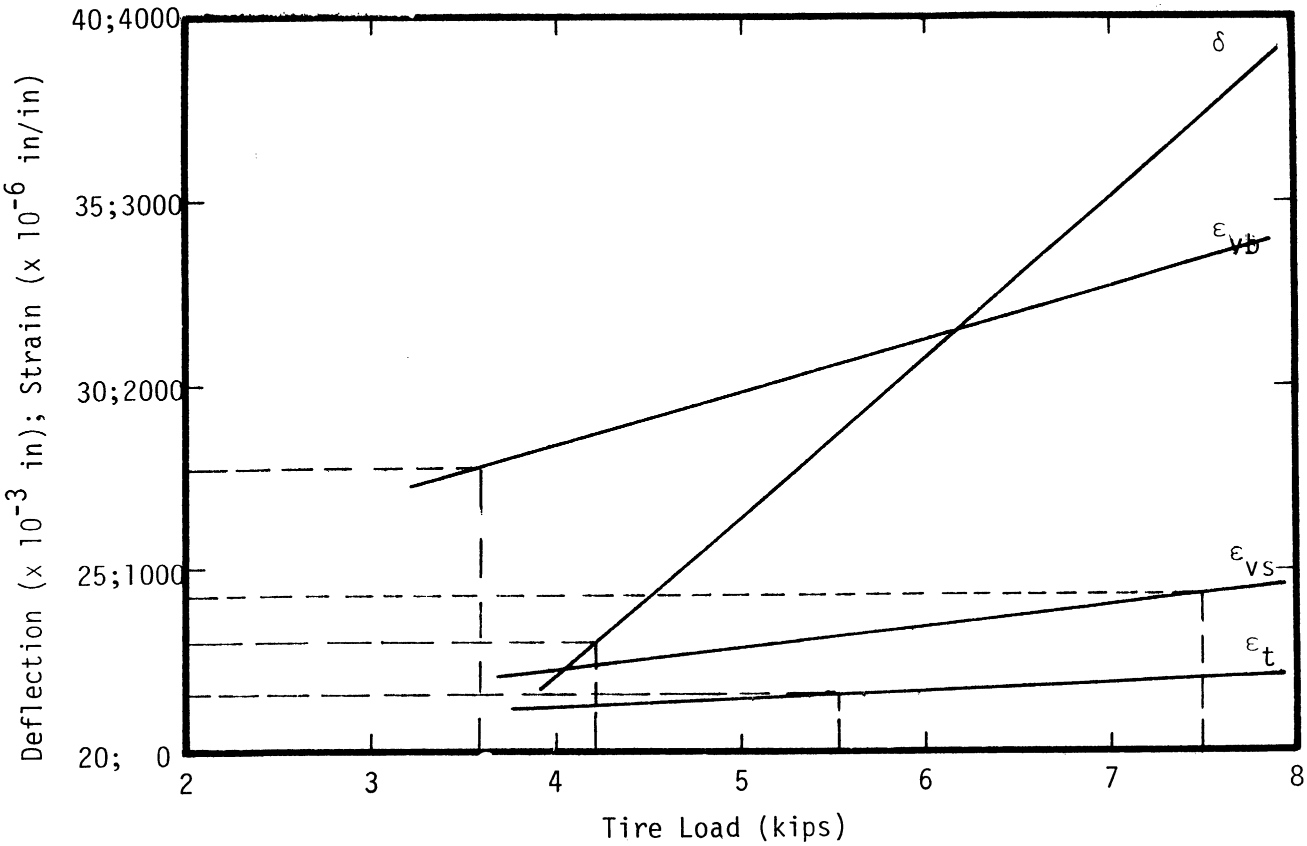

Figure D33. SR 172, MP 21.4 - Tire Size 12-24.5.

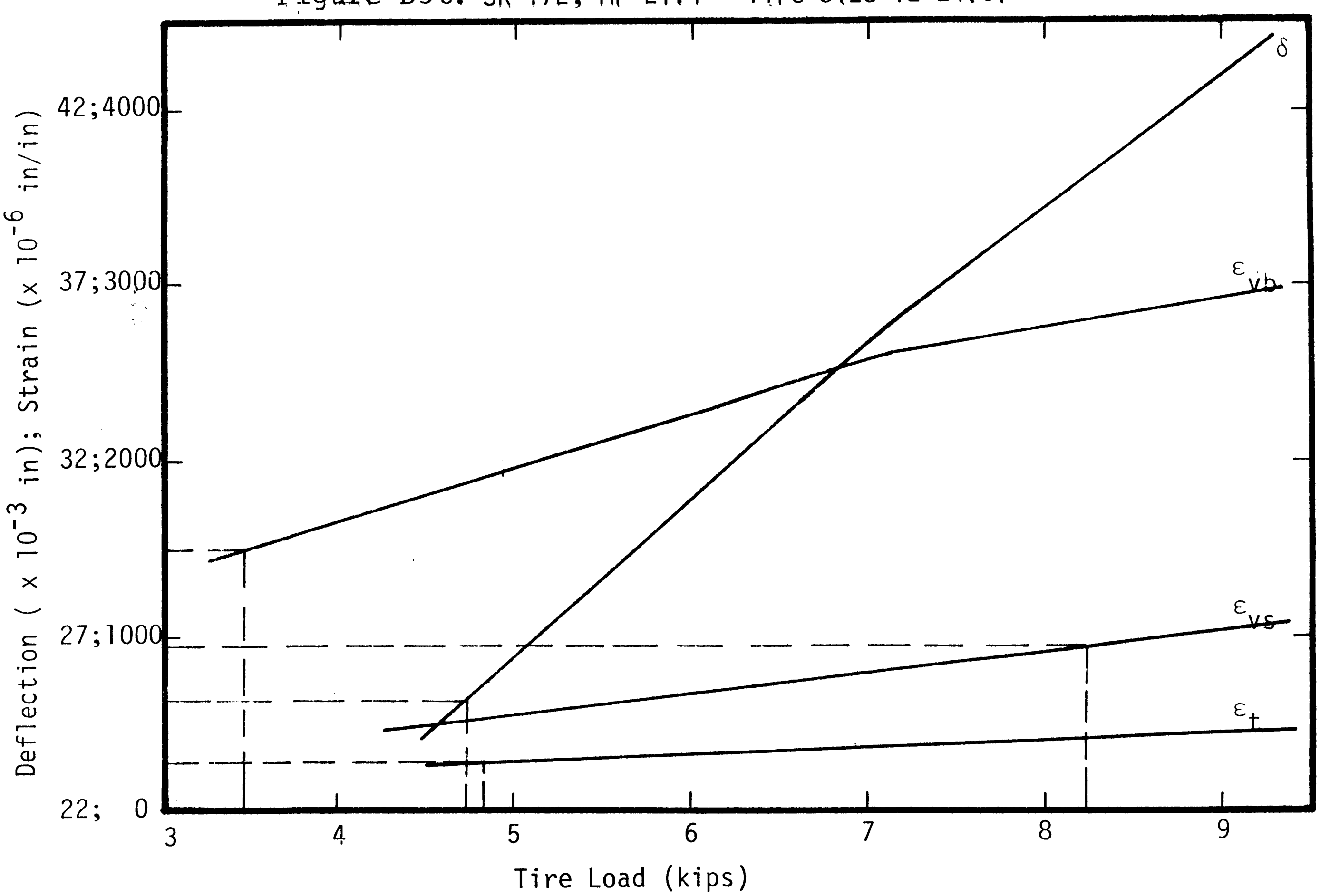

Figure D34. SR 172, MP 21.4 - Tire Size 14-17.5.

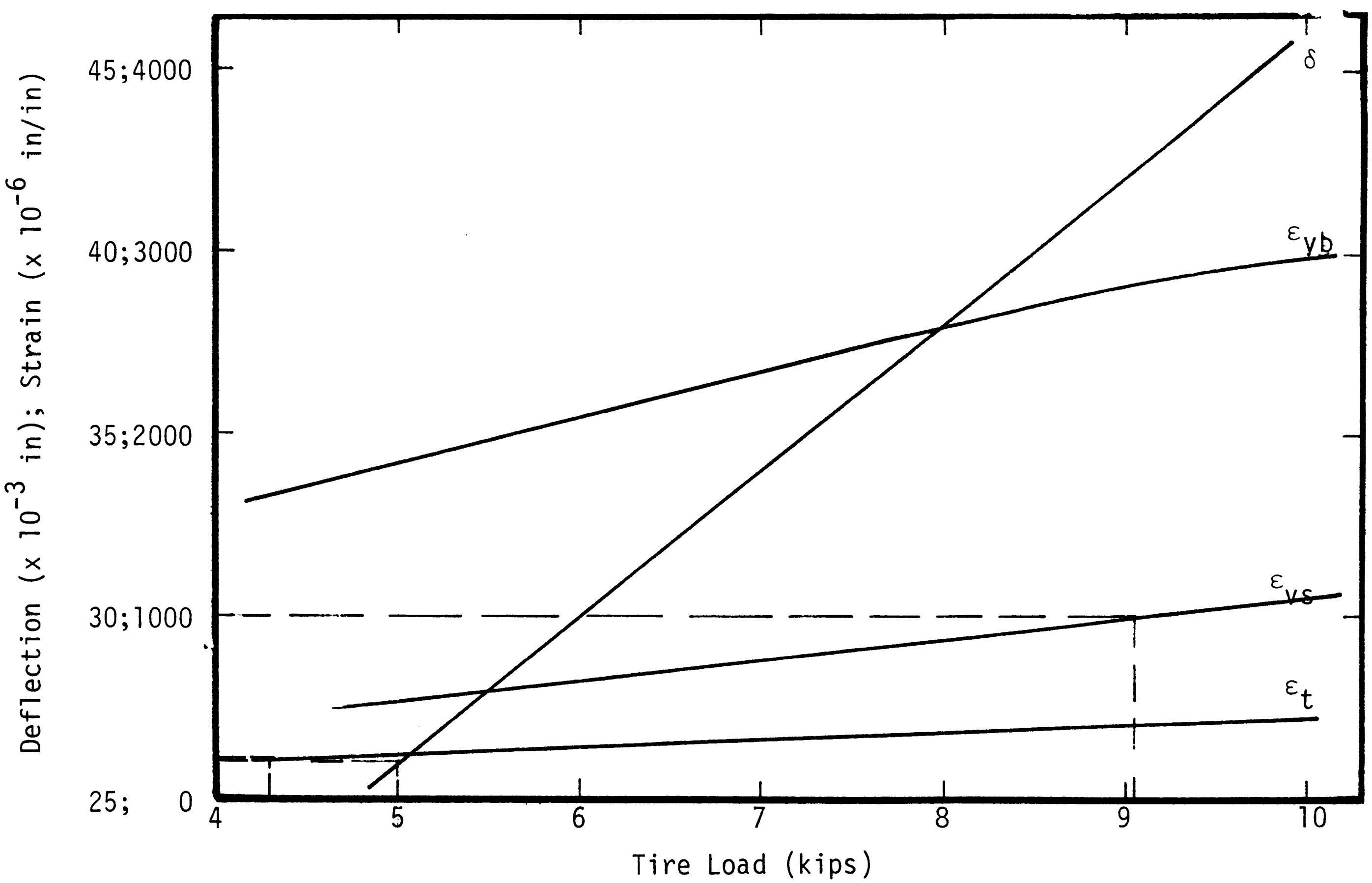

Figure D35. SR 172, MP 21.4 - Tire Size 16-22.5.

Table D6. SR 174, MP 2.3-2.0 - Results of the PSAD2A Analysis for Spring and Summer Loading Conditions.

Tire Size Modeled	Tire Load (lbs)	Tire Pressure (psi)	Load Raduis (in.)	Summer Condition				Spring Condition			
				δ ($\times 10^{-3}$ in.)	ε_t ($\times 10^{-6}$)	ε_{vb} ($\times 10^{-6}$)	ε_{vs} ($\times 10^{-6}$)	δ ($\times 10^{-3}$ in.)	ε_t ($\times 10^{-6}$)	ε_{vb} ($\times 10^{-6}$)	ε_{vs} ($\times 10^{-6}$)
8-22.5	4400	105	3.65	13.58	243.0	-988.5	-362.4	18.50	227.8	-1279.	-314.9
	3300	80	3.62					14.66	177.9	-1059.	-222.1
	2200	55	3.57					10.41	124.6	-709.9	-134.5
9-22.5	4950	115	3.70	15.09	265.2	-1077.	-409.5	20.52	251.3	-1399.	-361.8
	3712	75	3.97					16.09	185.1	-1114.	-251.8
	2475	55	3.78					11.44	133.0	-855.8	-153.8
10-22.5	5500	105	4.08	16.30	260.3	-1089.	-449.0	22.28	256.3	-1462.	-401.0
	4125	70	4.33					17.47	190.3	-1175.	-279.4
	2750	55	3.99					12.45	140.9	-906.1	-171.1
11-22.5	6050	100	4.39	17.55	259.7	-1111.	-489.5	24.09	263.8	-1563.	-441.2
	4538	65	4.71					18.83	193.5	-1224.	-308.2
	3025	65	3.85					13.56	157.7	-984.3	-195.7
12-24.5	7920	115	4.68	21.92	297.0	-1278.	-634.4	30.11	316.4	-1821.	-595.7
	5940	80	4.86					23.47	238.3	-1472.	-420.0
	3960	65	4.40					16.71	180.5	-1140.	-263.9
14-17.5	9240	100	5.42	24.30	277.1	-1262.	-712.7	33.86	316.9	-1922.	-683.8
	6930	100	4.70					26.88	280.9	-1657.	-508.5
	4620	65	4.76					18.96	194.9	-1250.	-310.5
16-22.5	10000	90	5.95	25.61	260.6	-1240.	-753.3	35.82	310.4	-1959.	-726.1
	7500	75	5.64					28.20	255.5	-1643.	-528.2
	5000	55	5.38					20.04	188.0	-1272.	-328.9

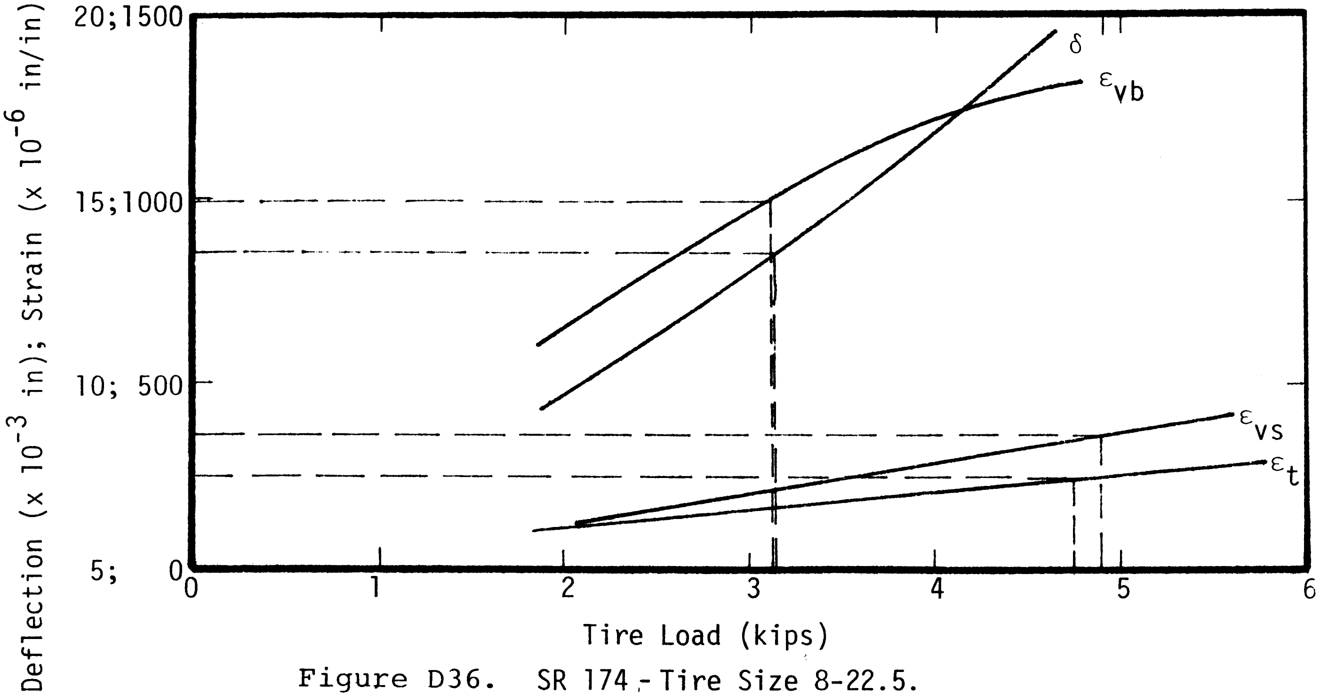

Figure D36. SR 174 - Tire Size 8-22.5.

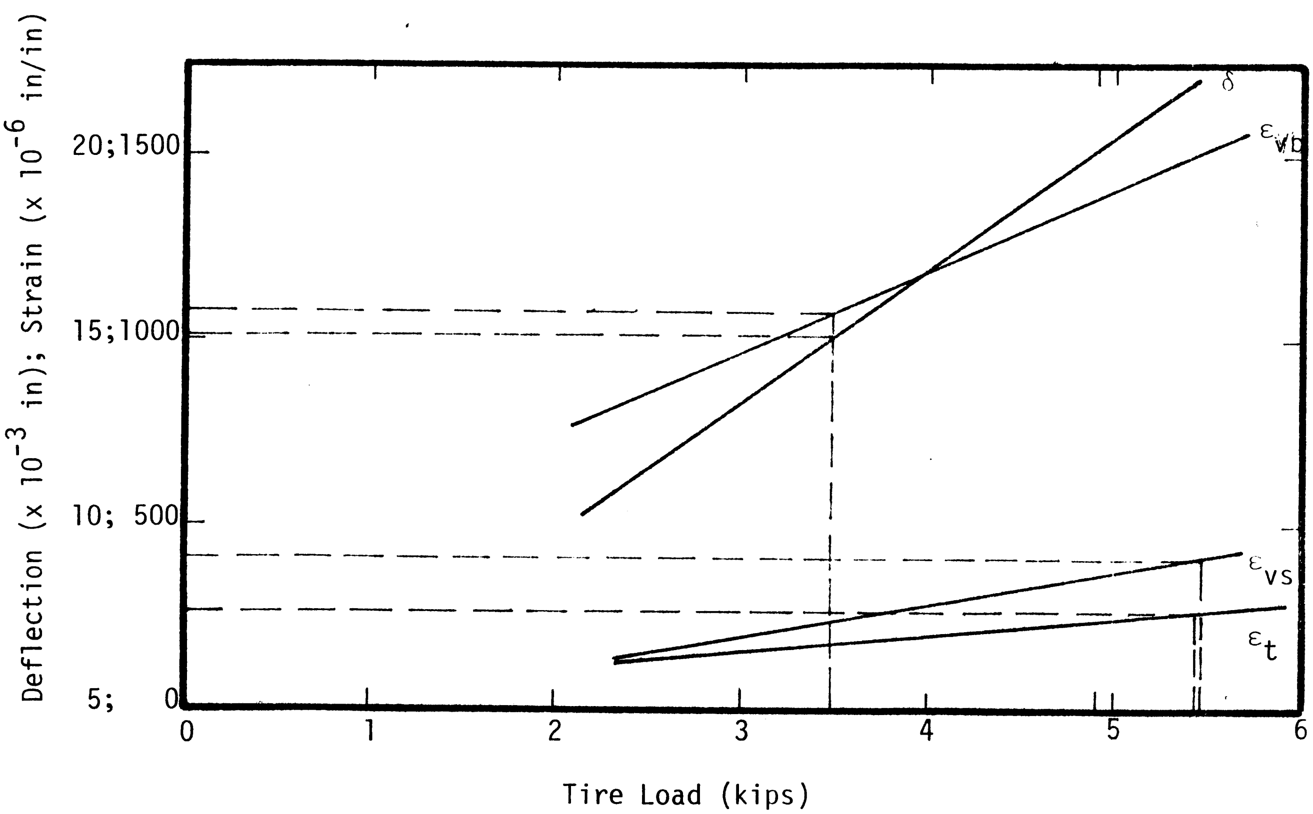

Figure D37. SR 174 - Tire Size 9-22.5.

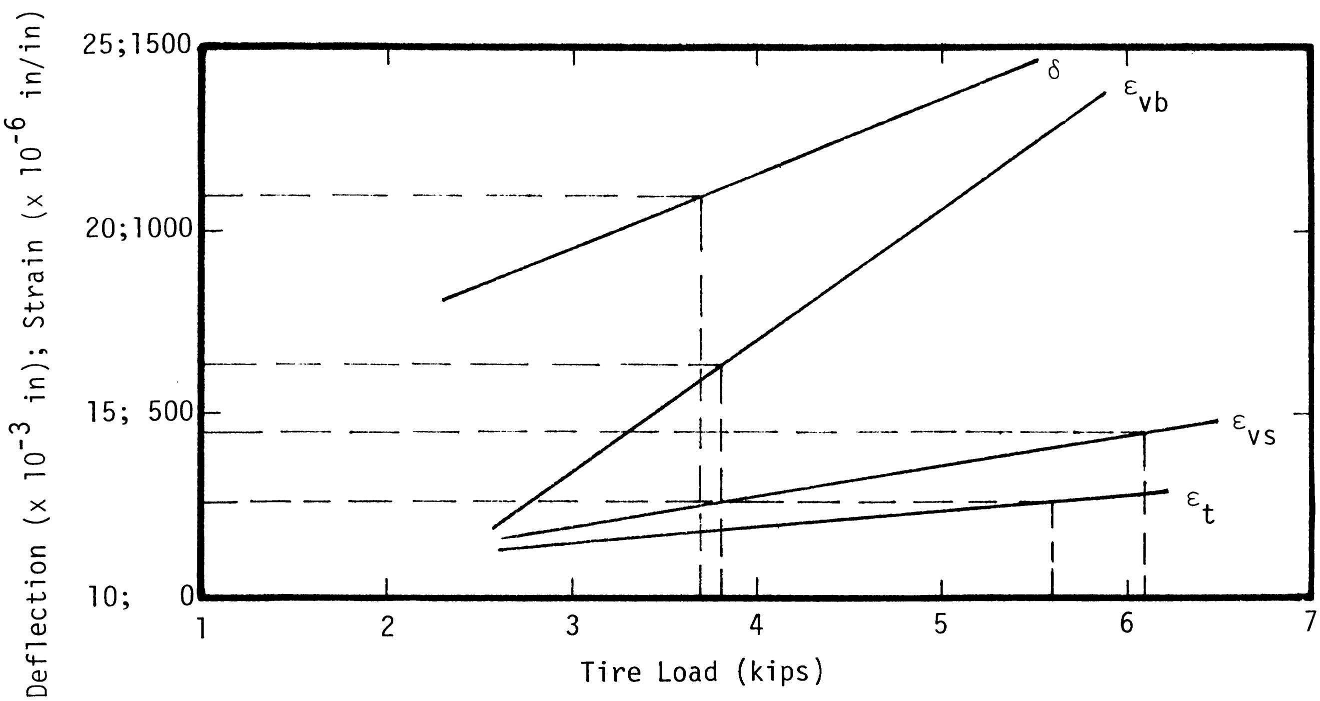

Figure D38. SR 174 - Tire Size 10-22.5.

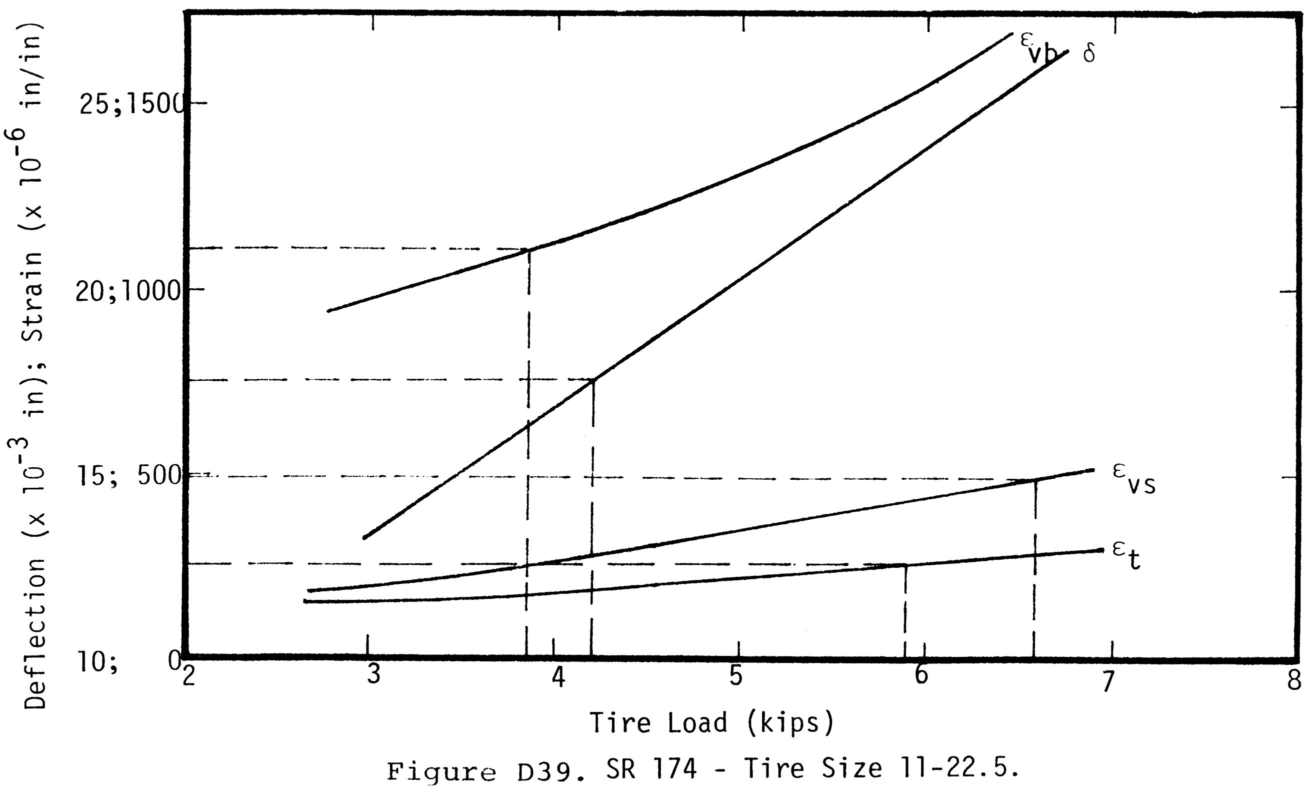

Figure D39. SR 174 - Tire Size 11-22.5.

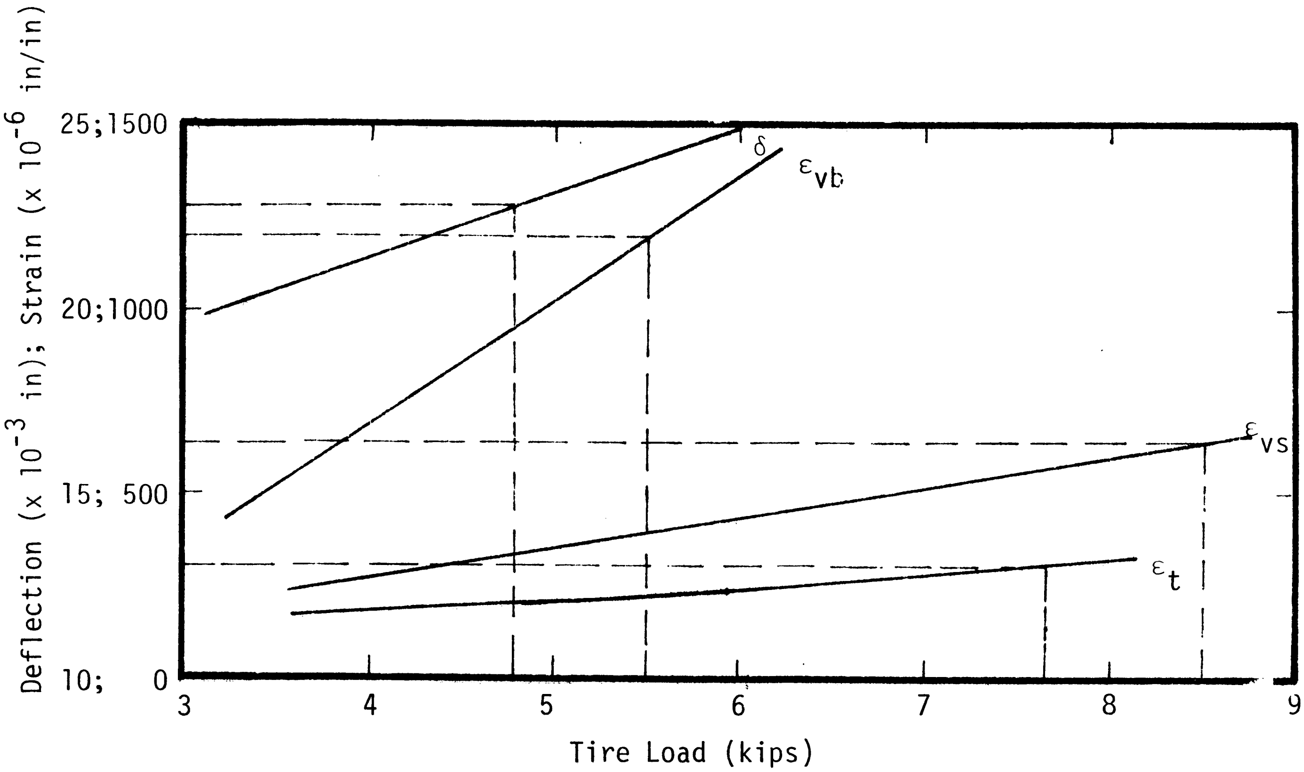

Figure D40. SR 174 - Tire Size 12-24.5.

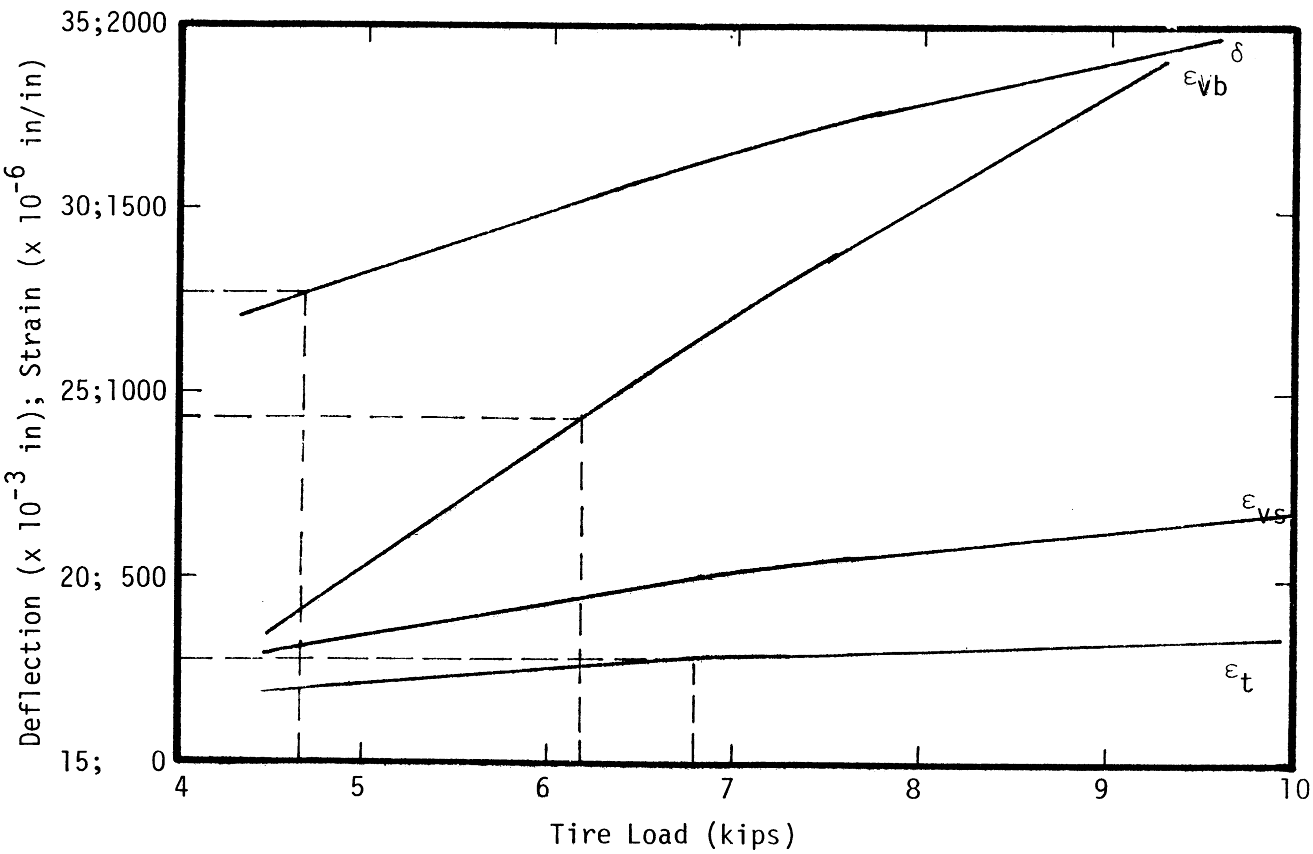

Figure D41. SR 174 - Tire Size 14-17.5.

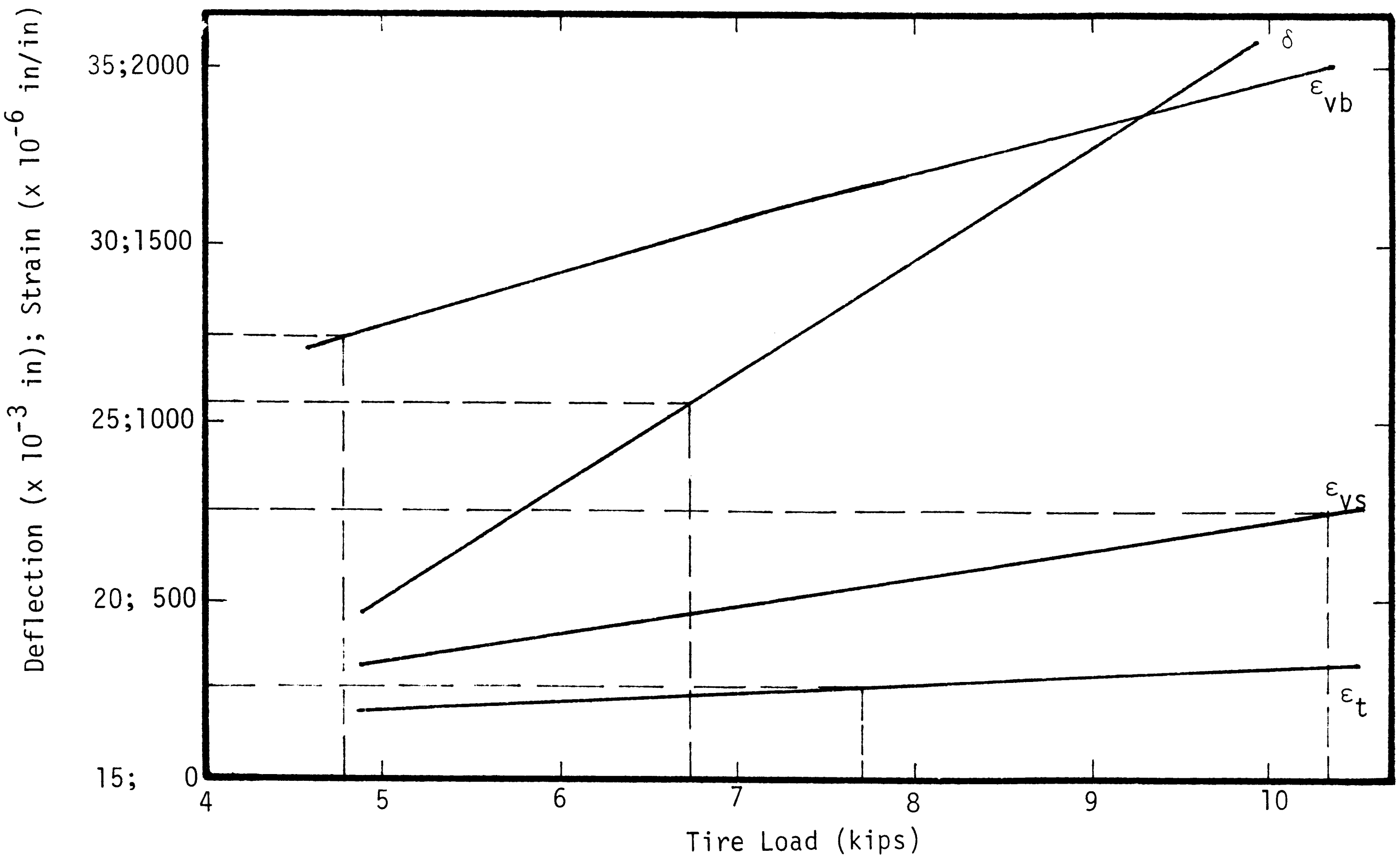

Figure D42. SR 174 - Tire Size 16-22.5.

Table D7. SR 172, MP 21.4-21.0 - Results of the PSAD2A Analysis for a Constant Tire Pressure of 95 psi, Spring and Summer Loading Conditions.

Tire Size Modeled	Tire Load (lbs)	Tire Pressure (psi)	Load Radius (in.)	Summer Condition				Spring Condition			
				δ ($\times 10^{-3}$ in.)	ε_t ($\times 10^{-6}$)	ε_{vb} ($\times 10^{-6}$)	ε_{vs} ($\times 10^{-6}$)	δ ($\times 10^{-3}$ in.)	ε_t ($\times 10^{-6}$)	ε_{vb} ($\times 10^{-6}$)	ε_{vs} ($\times 10^{-6}$)
8-22.5	4400	95	3.84	14.22	252.6	-1129.	-514.4	24.10	304.9	-1890.	-511.8
	3300	95	3.33					19.23	263.3	-1592.	-383.6
	2200	95	2.72					13.82	209.3	-1229.	-256.0
9-22.5	4950	95	4.07	15.56	258.0	-1177.	-568.6	26.71	324.6	-2048.	-572.6
	3712	95	3.53					21.19	280.8	-1724.	-430.3
	2475	95	2.88					15.26	224.4	-1333.	-288.0
10-22.5	5500	95	4.29	16.90	262.8	-1222.	-622.3	29.14	341.6	-2180.	-634.0
	4125	95	3.72					23.12	297.0	-1844.	-477.2
	2750	95	3.04					16.66	238.5	-1431.	-319.7
11-22.5	6050	95	4.50	18.20	267.2	-1272.	-674.0	31.40	356.5	-2305.	-696.5
	4533	95	3.90					25.00	311.9	-1958.	-524.2
	3025	95	3.18					17.92	251.0	-1512.	-352.0
12-24.5	7920	95	5.15	22.22	273.6	-1388.	-837.4	38.44	396.6	-2659.	-899.8
	5940	95	4.46					30.80	352.6	-2274.	-684.9
	3960	95	3.64					22.21	289.3	-1782.	-453.1
14-17.5	9240	95	5.56	24.72	273.1	-1442.	-939.9	43.18	418.8	-2875.	-1037.
	6930	95	4.82					34.76	376.9	-2485.	-791.8
	4620	95	3.93					25.32	314.1	-1965.	-536.1
16-22.5	10000	95	5.79	26.16	272.2	-1468.	-998.7	45.92	431.3	-3018.	-1110.
	7500	95	5.01					36.94	388.9	-2592.	-853.0
	5000	95	4.09					26.92	325.9	-2049.	-580.2

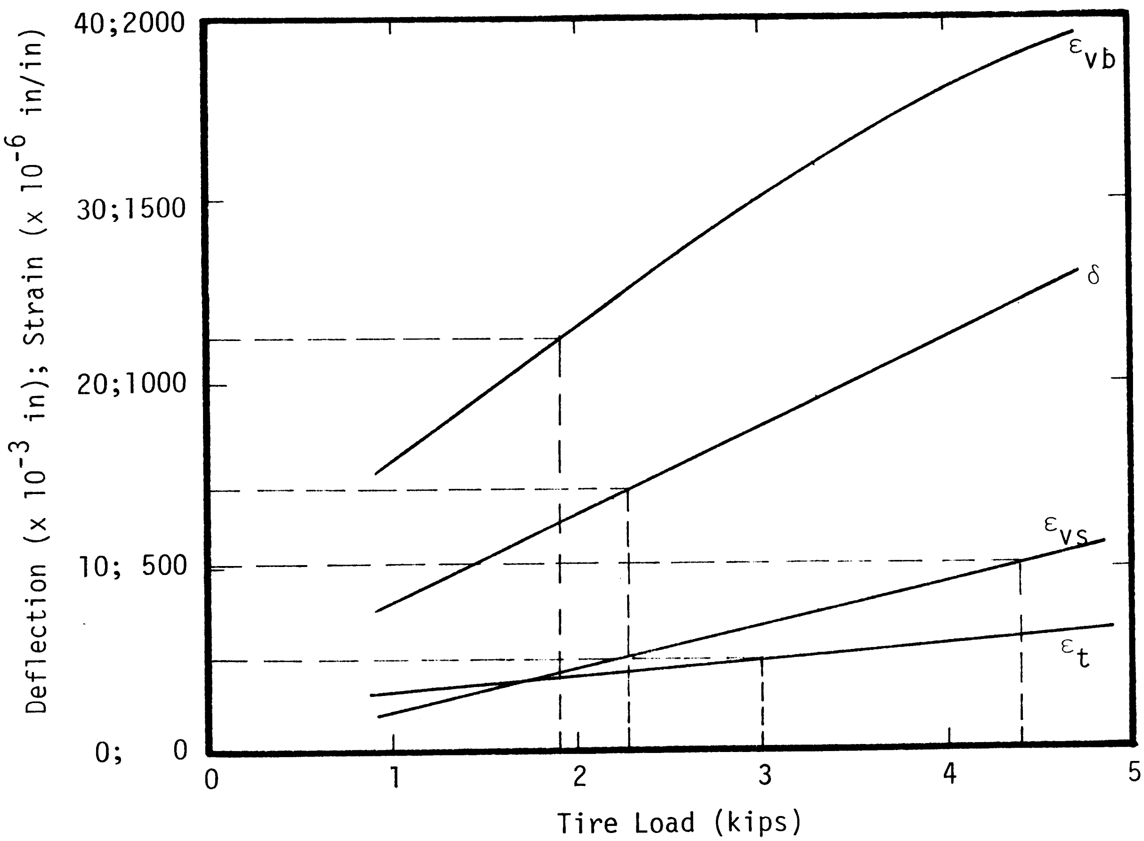

Figure D43. SR 172, MP 21.4 - Tire Size 8-22.5, Tire Pressure 95 psi.

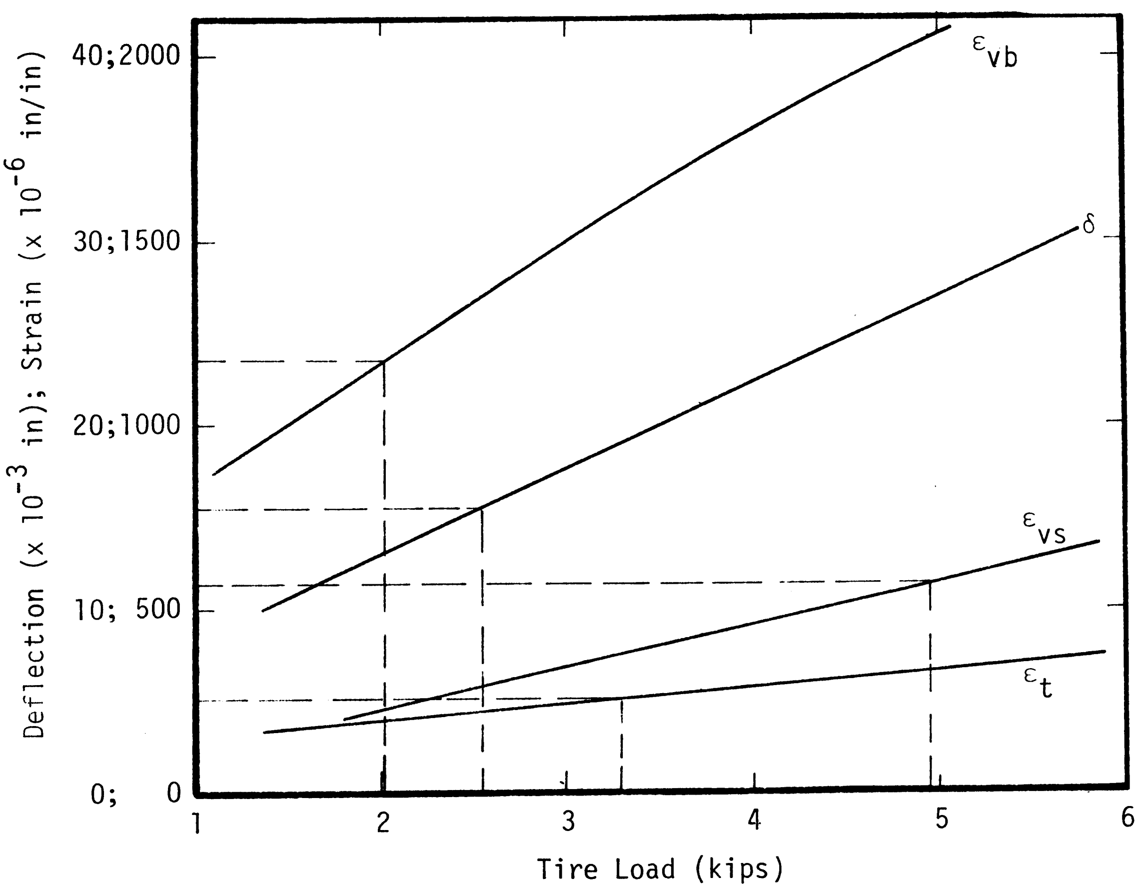

Figure D44. SR 172, MP 21.4 - Tire Size 9-22.5, Tire Pressure 95 psi.

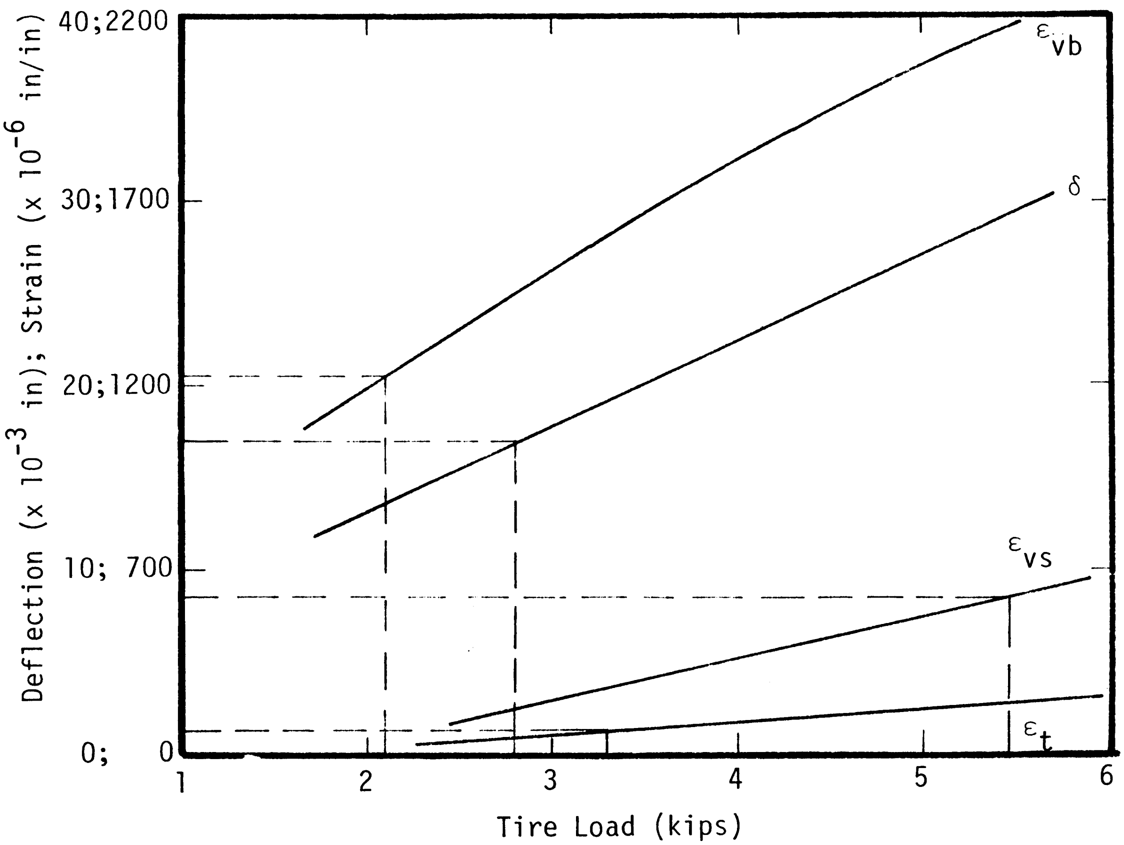

Figure D45. SR 172, MP 21.4 - Tire Size 10-22.5, Tire Pressure 95 psi.

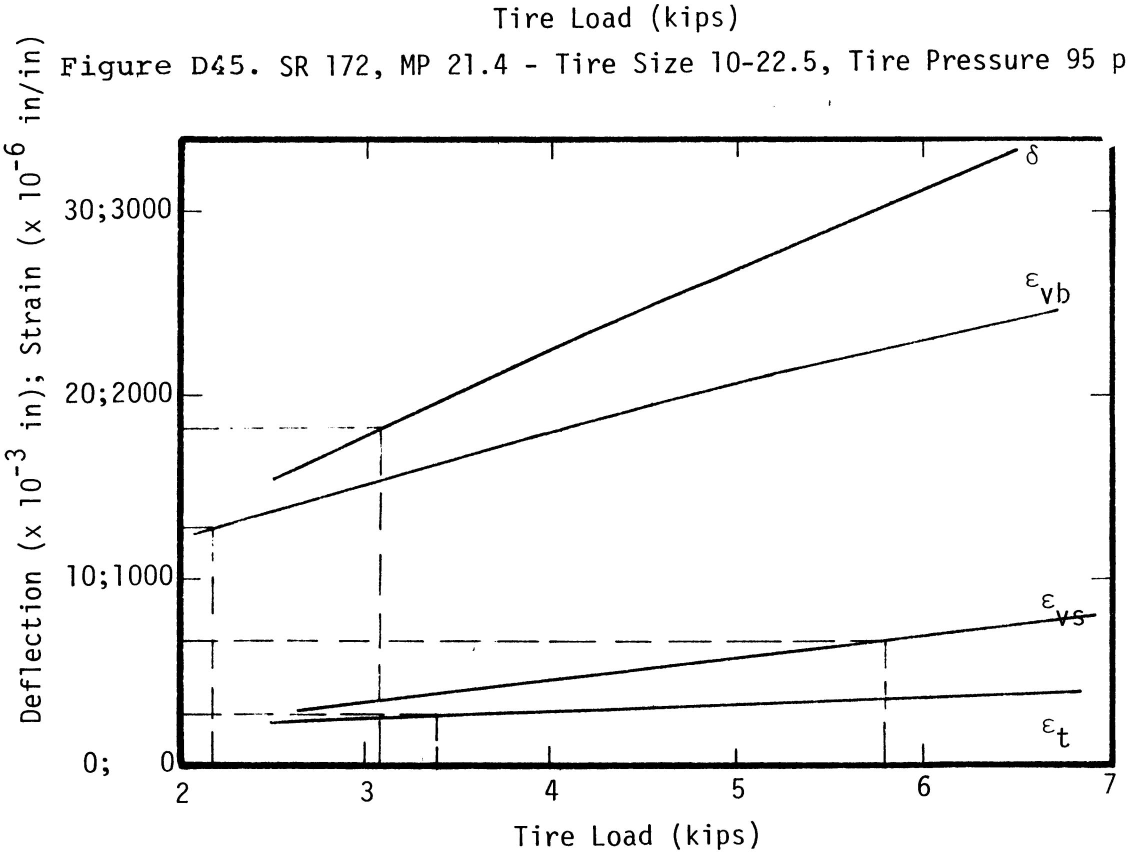

Figure D46. SR 172, MP 21.4 - Tire Size 11-22.5, Tire Pressure 95 psi.

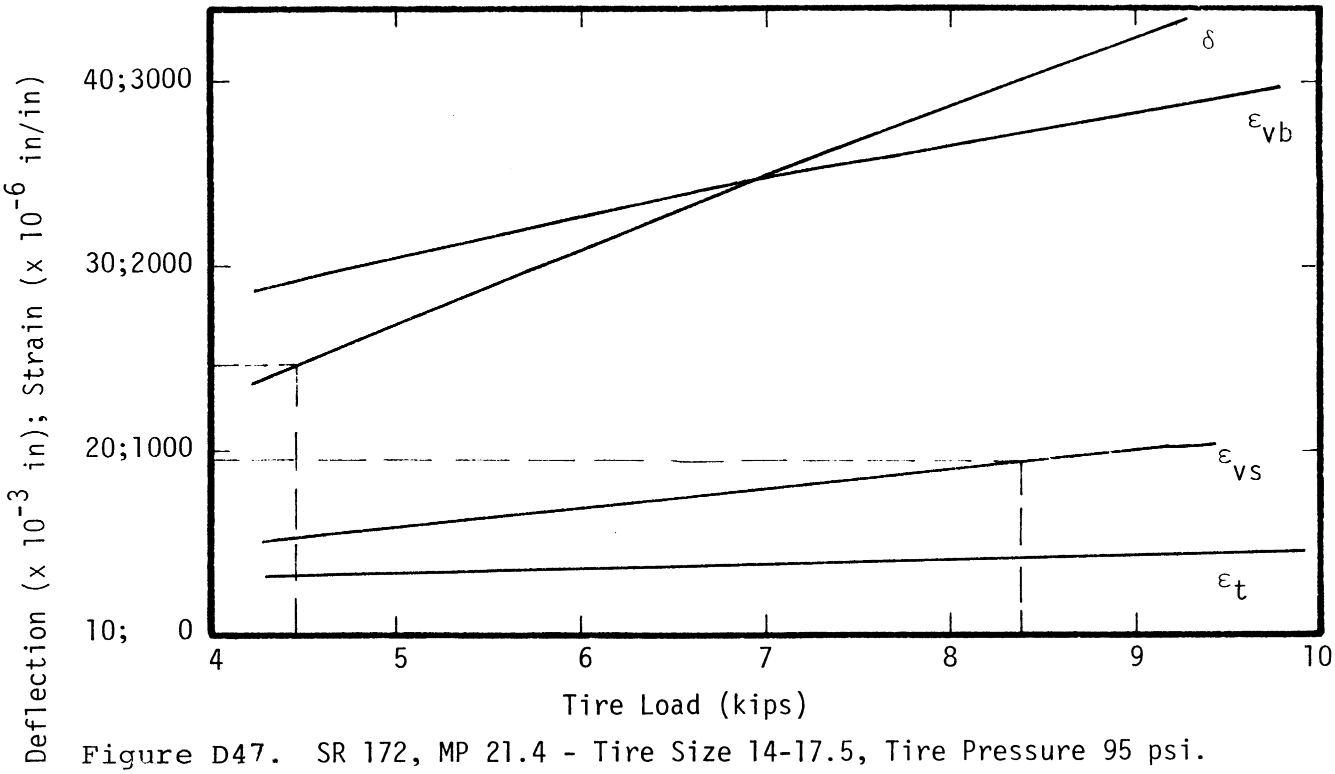

Figure D47. SR 172, MP 21.4 - Tire Size 14-17.5, Tire Pressure 95 psi.

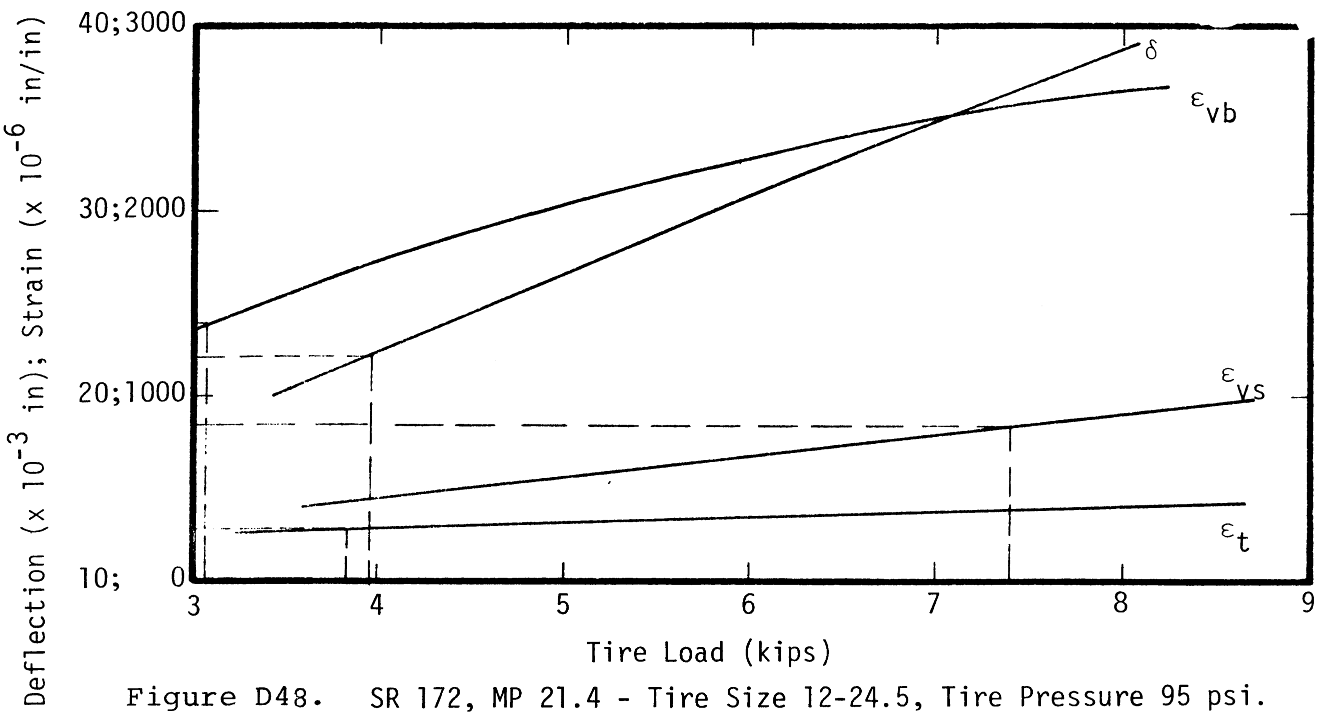

Figure D48. SR 172, MP 21.4 - Tire Size 12-24.5, Tire Pressure 95 psi.

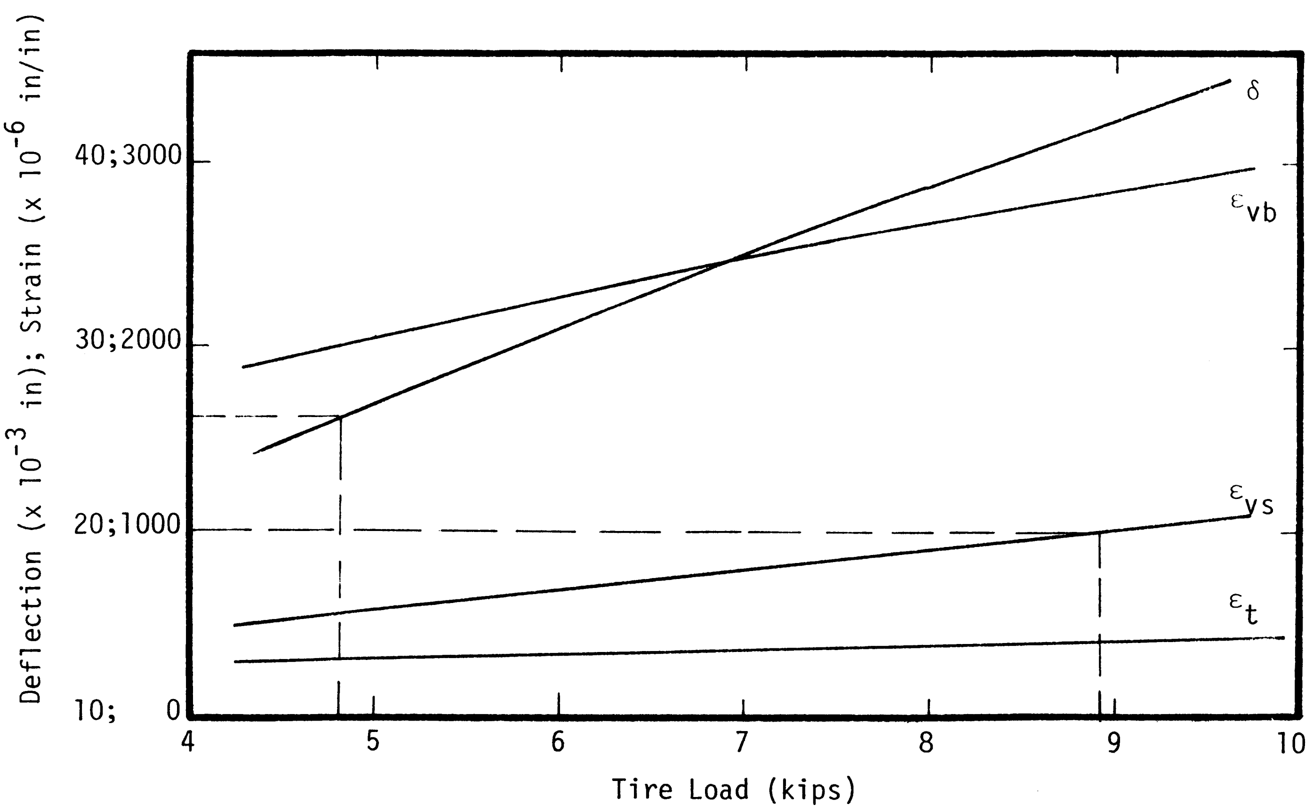

Figure D49. SR 172, MP 21.4 - Tire Size 16-22.5, Tire Pressure 95 psi.

Table D8. SR 174, MP 2.3-2.0 - Results of the PSAD2A Analysis for a Constant Tire Pressure of 95 psi, Spring and Summer Loading Conditions.

Tire Size Modeled	Tire Load (lbs)	Tire Pressure (psi)	Load Radius (in.)	Summer Condition				Spring Condition			
				δ ($\times 10^{-3}$ in.)	ε_t ($\times 10^{-6}$)	ε_{vb} ($\times 10^{-6}$)	ε_{vs} ($\times 10^{-6}$)	δ ($\times 10^{-3}$ in.)	ε_t ($\times 10^{-6}$)	ε_{vb} ($\times 10^{-6}$)	ε_{vs} ($\times 10^{-6}$)
8-22.5	4400	95	3.84	13.44	230.7	-959.8	-358.4	24.62	220.0	-1267.	-313.1
	3300	95	3.33					14.72	188.8	-1084.	-227.6
	2200	95	2.72					10.48	149.5	- 840.4	-143.0
9-22.5	4950	95	4.07	14.88	239.5	-1008.	-404.0	20.43	234.2	-1365.	-353.8
	3712	95	3.53					16.17	201.3	-1159.	-258.8
	2475	95	2.88					11.66	160.7	-917.0	-163.5
10-22.5	5500	95	4.29	16.14	246.1	-1051.	-443.9	22.31	247.2	-1452.	-396.1
	4125	95	3.72					17.62	213.2	-1233.	-290.2
	2750	95	3.04					12.70	170.5	-974.5	-185.7
11-22.5	6050	95	4.50	17.42	251.7	-1089.	-485.5	24.04	258.3	-1524.	-438.6
	4538	95	3.90					19.01	224.0	-1300.	-321.3
	3025	95	3.18					13.75	180.1	-1033.	-206.9
12-24.5	7920	95	5.15	21.47	263.7	-1189.	-619.1	29.93	291.5	-1766.	-579.7
	5940	95	4.46					23.71	256.4	-1517.	-426.9
	3960	95	3.64					17.07	208.7	-1208.	-276.9
14-17.5	9240	95	5.56	24.19	268.4	-1242.	-708.4	33.90	310.3	-1910.	-678.0
	6930	95	4.82					26.80	274.6	-1639.	-500.5
	4620	95	3.93					19.26	226.0	-1312.	-327.8
16-22.5	10000	95	5.79	25.71	270.1	-1268.	-758.3	36.13	319.8	-1986.	-733.8
	7500	95	5.01					28.58	284.3	-1708.	-546.7
	5000	95	4.09					20.56	235.3	-1372.	-357.1

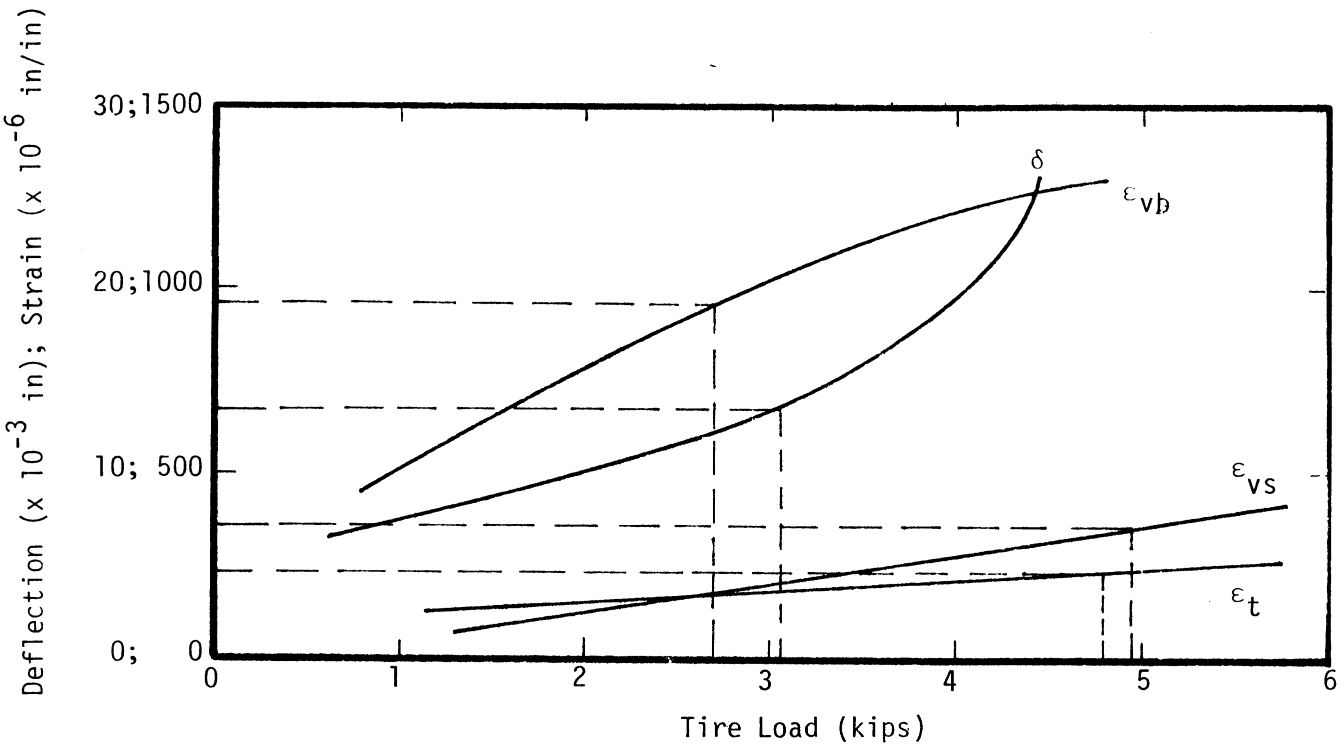

Figure D50. SR 174 - Tire Size 8-22.5, Tire Pressure 95 psi.

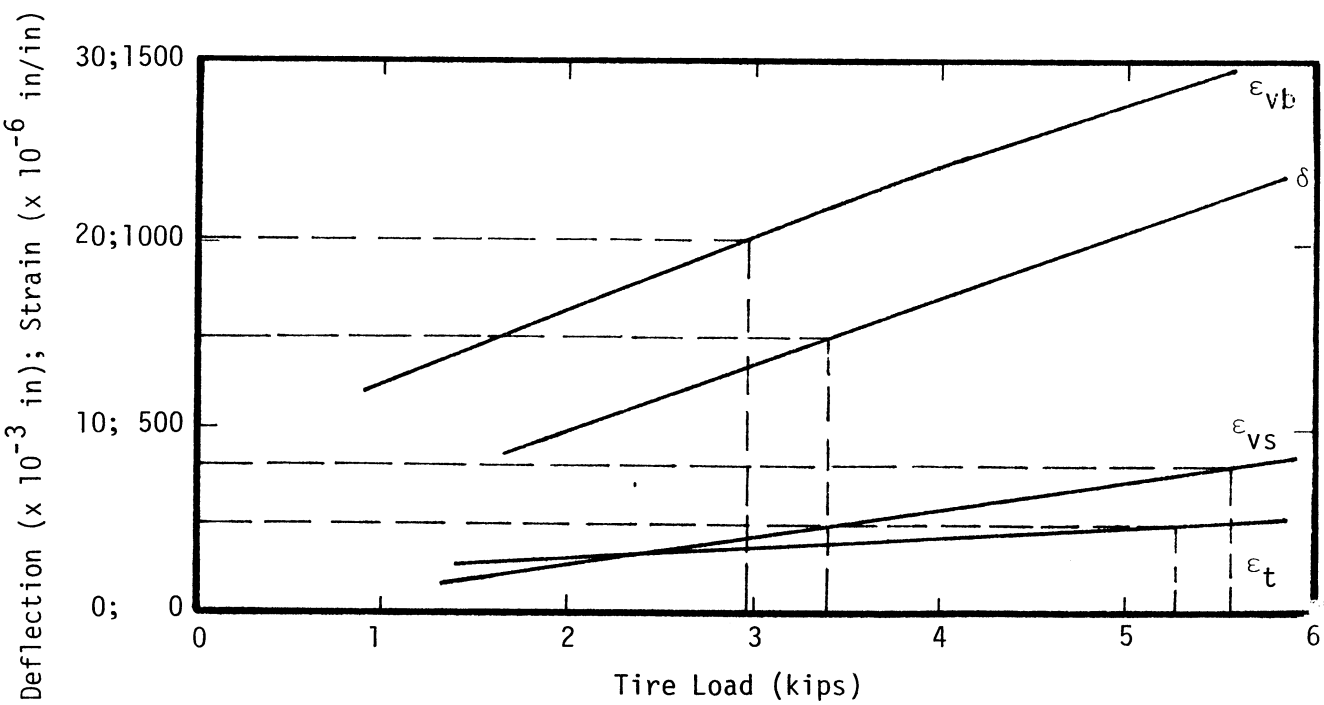

Figure D51. SR 174 - Tire Size 9-22.5, Tire Pressure 95 psi.

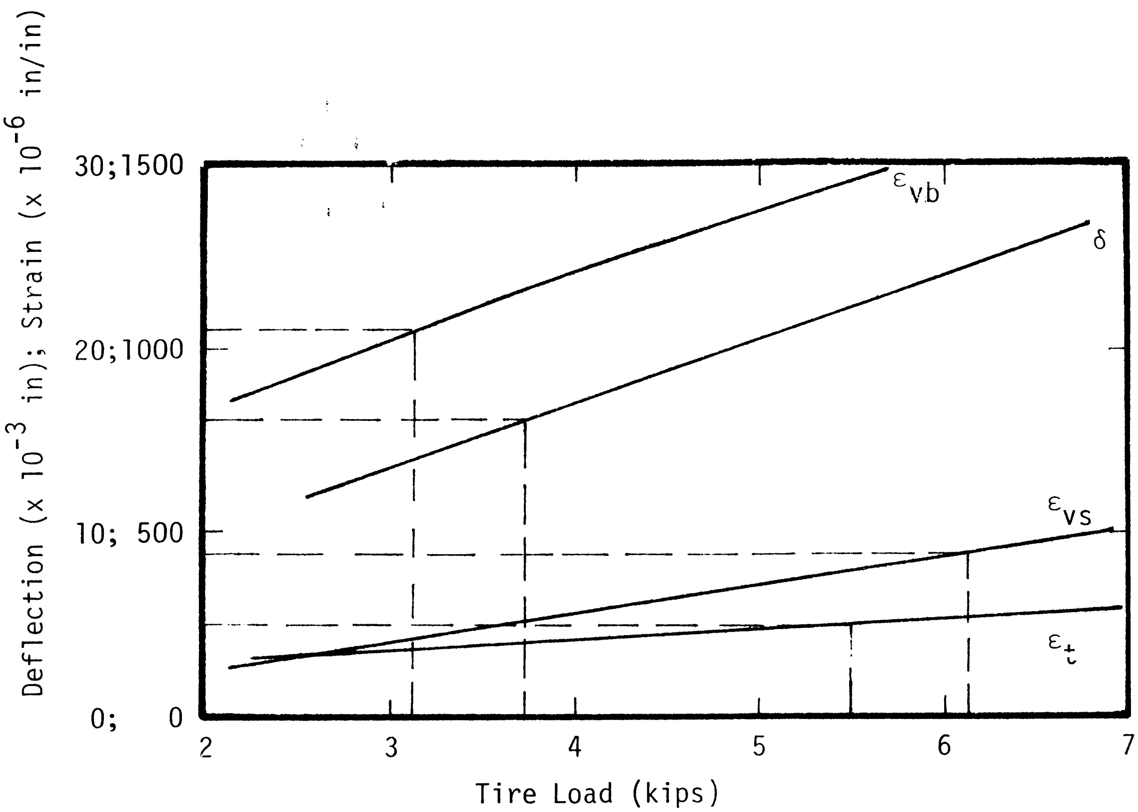

Figure D52. SR 174 - Tire Size 10-22.5, Tire Pressure 95 psi.

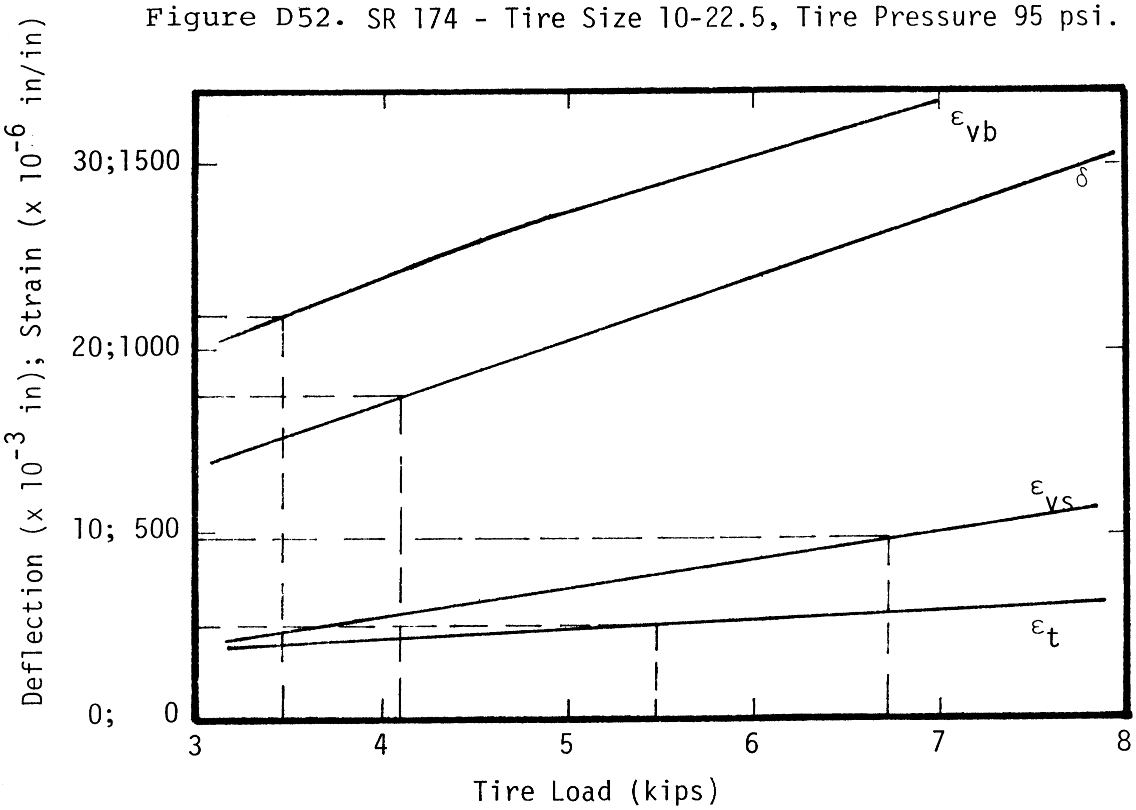

Figure D53. SR 174 - Tire Size 11-22.5, Tire Pressure 95 psi.

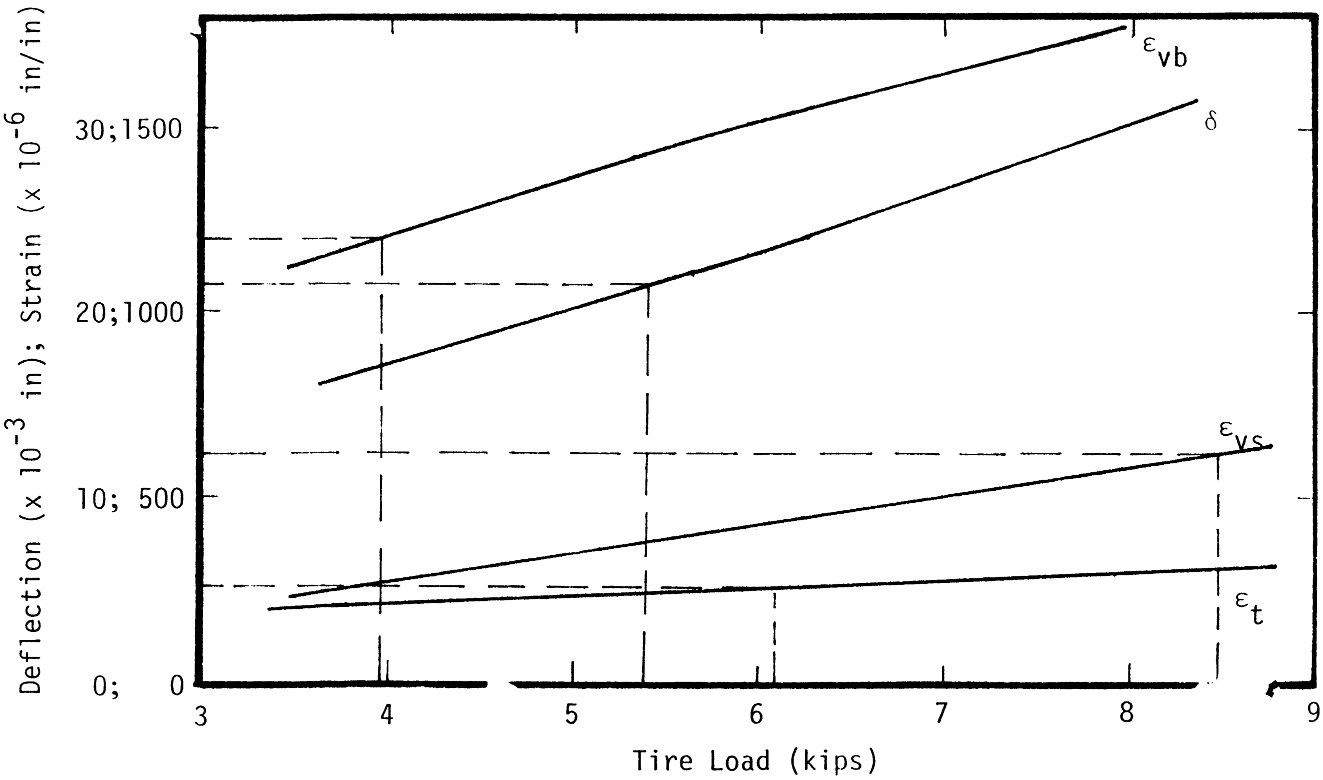

Figure D54. SR 174 - Tire Size 12-24.5, Tire Pressure 95 psi.

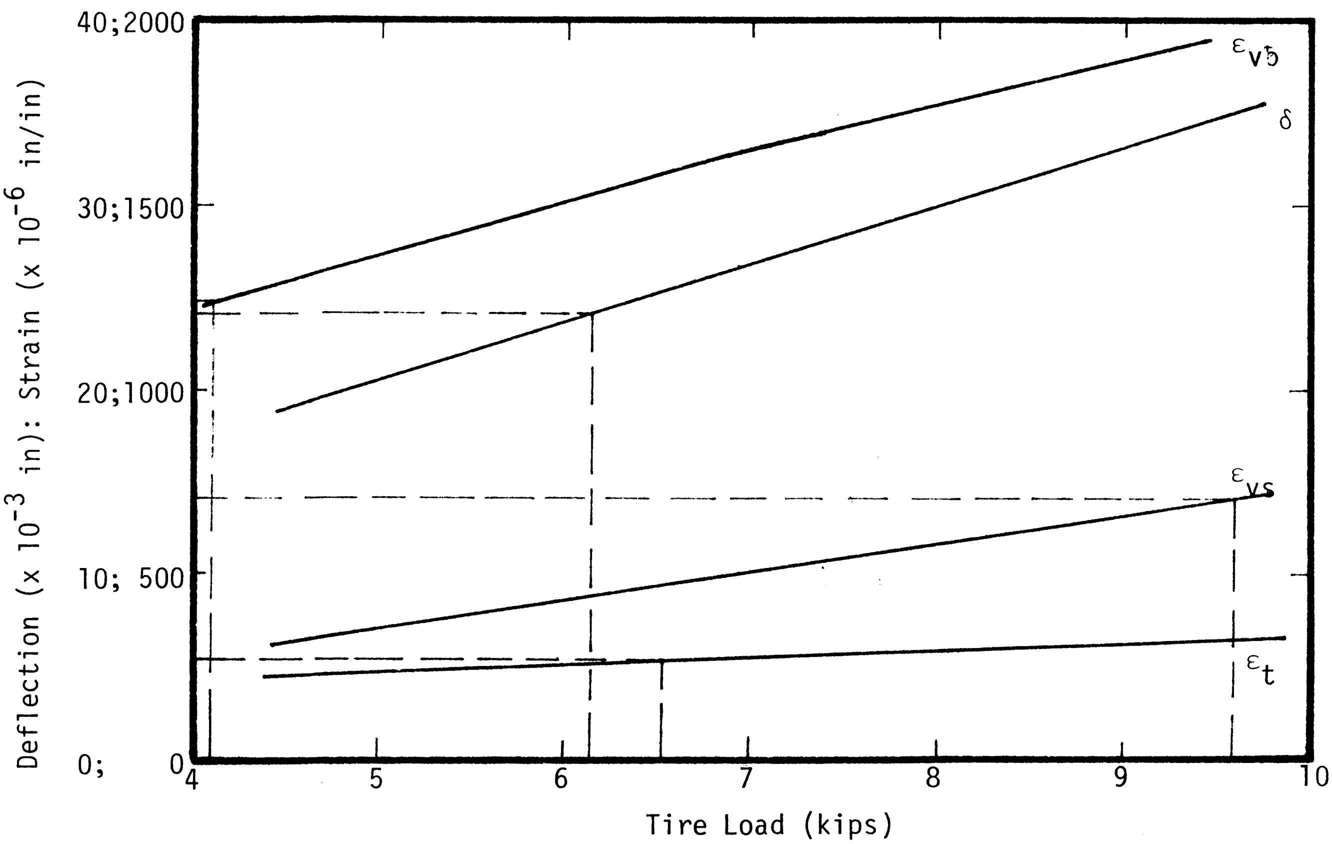

Figure D55. SR 174 - Tire Size 14-17.5, Tire Pressure 95 psi.

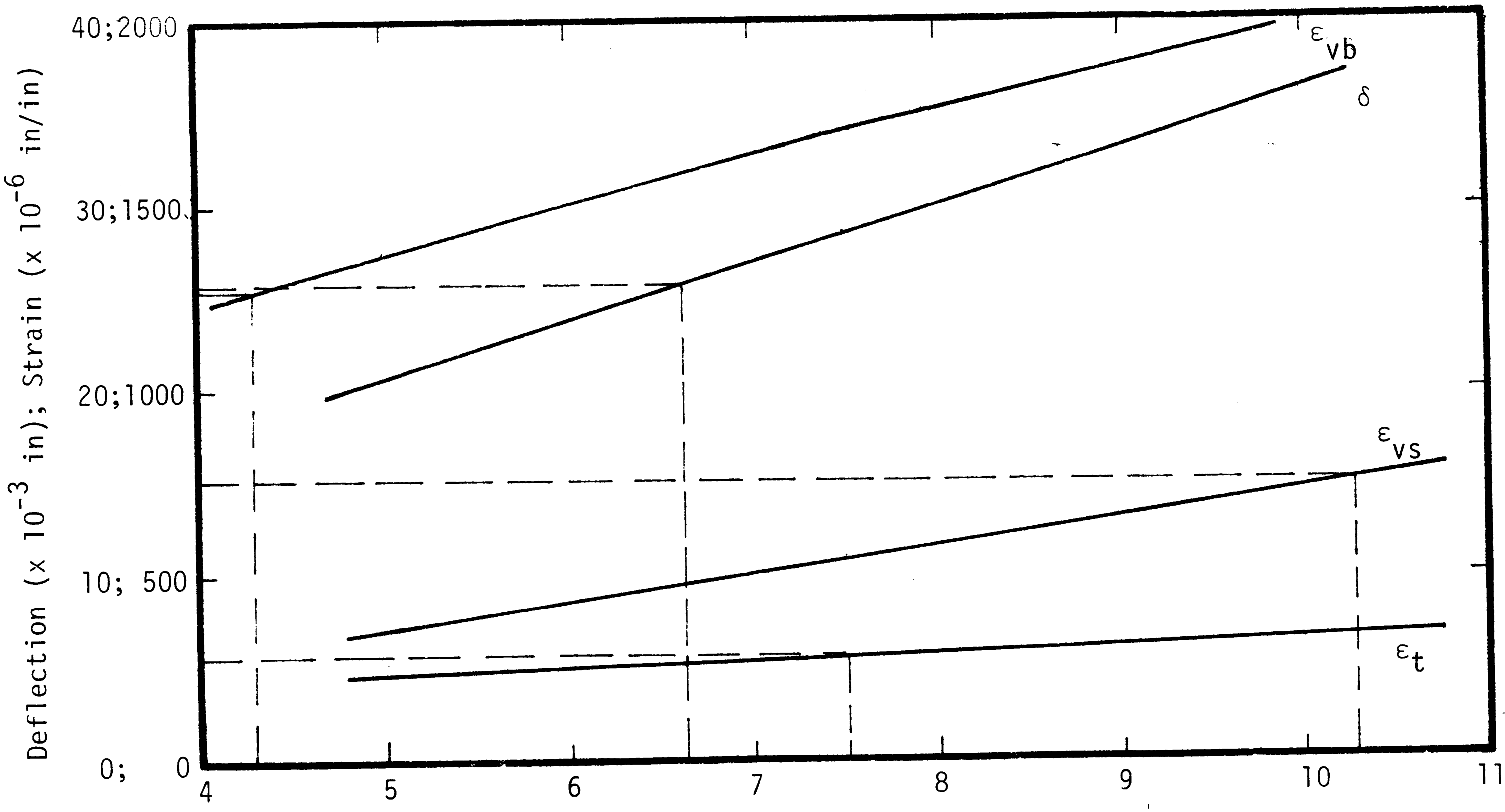

Figure D56. SR 174 - Tire Size 16-22.5, Tire Pressure 95 psi.

APPENDIX E

DEFLECTION DATA

Table E1. Benkelman Beam Deflections

Site Location	Date	Benkelman Beam Deflections	
		Avg. $x10^{-3}$ in	St. Dev. $x10^{-3}$ in
SR 97	02/23/83	15.58	2.54
	03/04/83	14.32	3.20
	03/18/83	16.0	2.82
	03/24/83	18.64	2.29
SR 2	02/23/83	19.6	7.60
MP 117.38	03/04/83	18.55	6.61
to MP 117.62	03/18/83	19.59	5.95
	03/24/83	21.85	8.63
SR 2	02/24/83	26.59	9.87
MP 159.6	03/17/83	28.68	8.82
	03/24/83	27.23	7.65
SR 174	02/24/83	28.75	8.46
MP 2.21	03/03/83	23.13	5.72
	03/17/83	25.32	5.61
	03/24/83	26.15	6.56

Table E2. SR 97 - FWD Data, 08/16/83, Surface Temperature = 99°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	110.6	13.4	7.3	4.5	2.6	1.7	1.4	1.1
50	108.2	13.7	8.5	4.8	3.0	2.0	1.4	0.9
100	107.3	13.9	8.0	5.1	3.3	2.4	1.9	1.3
150	107.3	13.1	7.8	5.0	3.5	2.5	1.7	.13
200	116.1	13.7	7.3	4.6	3.1	2.3	1.7	1.3
250	103.0	12.3	7.3	4.6	2.8	2.0	1.4	1.1
300	97.6	12.7	8.1	5.2	3.1	2.4	1.6	1.2
350	97.5	13.8	8.7	5.6	3.4	2.3	1.7	1.3
400	99.6	15.9	9.5	6.0	3.6	2.4	1.7	1.2
450	103.2	11.6	7.3	4.9	3.0	1.9	1.3	1.0
500	94.1	12.8	7.8	5.2	3.1	2.0	1.4	1.0
$\bar{x}$	104.0	13.4	8.0	5.0	3.1	2.2	1.6	1.2
s	6.6	1.1	0.7	0.4	0.3	0.2	0.1	

Table E2. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	144.2	16.8	9.2	5.9	3.5	2.4	1.9	1.5
50	141.0	17.1	10.1	6.0	3.7	2.5	1.8	1.3
100	142.8	17.9	10.4	6.7	4.3	3.2	2.4	1.8
150	141.0	16.8	10.1	6.9	4.5	3.2	2.3	1.7
200	143.8	16.7	9.1	5.9	4.0	2.8	21.	1.7
250	141.9	15.6	9.1	5.9	3.7	2.6	1.9	1.4
300	138.3	16.8	10.9	7.1	4.4	3.5	2.2	1.7
350	139.7	18.9	12.1	8.2	5.2	3.5	2.6	1.9
400	142.8	21.5	13.0	8.4	5.2	3.4	2.6	1.9
450	146.4	15.2	9.7	6.8	4.4	2.9	2.0	1.5
500	133.1	17.5	10.7	7.4	4.7	3.0	2.1	1.6
$\bar{x}$	141.4	17.3	10.4	6.8	4.3	3.0	2.2	1.6
s	3.5	1.7	1.2	0.9	0.6	0.4	0.3	0.2

Table E3. SR 97 - FWD Data, 01/11/84, Surface Temperature = 34°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	79.8	3.4	2.3	1.7	1.1	0.7	0.6	0.5
50	76.7	4.4	2.6	1.8	1.1	0.7	0.5	0.4
100	78.3	3.7	2.2	1.8	1.1	0.8	0.5	0.4
150	76.6	3.7	2.4	1.8	1.2	0.8	0.6	0.5
200	76.2	3.9	2.3	2.2	1.1	0.6	0.5	
250	75.0	4.1	2.3	1.6	1.1	0.7	0.6	0.5
300	74.1	4.0	2.5	1.7	1.1	0.7	0.6	0.5
350	73.2	4.7	3.0	2.2	1.4	0.9	0.7	0.6
400	72.7	4.7	3.0	2.0	1.4	0.9	0.7	0.6
450	74.0	3.4	2.3	1.8	1.2	0.9	0.6	0.6
500	71.8	3.8	2.6	2.1	1.4	1.1	0.8	0.6
$\bar{x}$	75.3	4.0	2.5	1.9	1.2	0.8	0.6	0.5
s	2.4	0.4	0.3	0.2	0.2	0.1	0.1	0.05

Table E3. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	114.2	5.1	3.2	2.3	1.5	1.0	0.8	0.8
50	109.9	6.0	3.7	2.5	1.6	1.0	0.8	0.6
100	112.6	5.4	3.2	2.2	1.6	1.1	0.9	0.8
150	110.4	5.3	3.4	2.5	1.7	1.2	0.9	0.7
200	108.0	5.6	3.7	2.3	1.6	1.1	1.0	0.7
250	106.2	0.1	3.3	2.3	1.6	1.1	0.9	0.7
300	106.3	5.6	3.3	2.4	1.5	1.1	0.9	0.7
350	104.2	6.5	4.0	3.0	2.0	1.3	1.0	0.8
400	104.4	6.8	4.2	3.1	2.1	1.4	1.1	0.9
450	103.7	5.0	3.2	2.5	1.8	1.3	1.0	0.8
500	102.8	5.4	3.7	2.9	2.2	1.6	1.2	0.9
$\bar{x}$	107.5	5.7	3.6	2.5	1.7	1.2	1.0	0.8
s	3.8	0.6	0.4	0.3	0.2	0.2	0.1	0.1

Table E3. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	158.1	7.2	4.5	3.2	2.2	1.5	1.3	1.1
50	152.5	8.7	5.2	3.7	2.4	1.6	1.2	1.0
100	154.5	7.9	4.6	3.4	2.4	1.8	1.4	1.2
150	151.8	7.4	4.8	3.6	2.5	1.8	1.4	1.2
200	149.4	7.9	4.8	3.6	2.4	1.6	1.3	1.1
250	147.7	8.6	4.7	3.3	2.2	1.6	1.3	1.1
300	147.9	8.3	4.8	3.4	2.3	1.6	1.3	1.1
350	144.8	9.0	5.6	4.2	2.8	2.0	1.5	1.2
400	138.0	9.7	6.0	4.4	3.0	2.1	1.6	1.3
450	139.1	7.4	4.7	3.6	2.6	1.9	1.4	1.2
500	142.4	7.9	5.3	4.2	3.2	2.4	1.8	1.3
$\bar{x}$	147.8	8.2	5.0	3.7	2.6	1.8	1.4	1.2
s	6.4	0.8	0.5	0.4	0.3	0.3	0.2	0.2

Table E3. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	195.3	9.1	5.6	4.1	2.8	2.0	1.6	1.4
50	187.6	10.9	6.6	4.7	3.1	2.1	1.6	1.2
100	191.3	9.9	5.7	4.2	3.0	2.3	1.9	1.6
150	191.5	9.5	6.0	4.4	3.2	2.4	1.8	1.5
200	184.3	9.7	5.8		3.0	2.0	1.6	1.4
250	182.8	10.6	5.7	4.1	2.8	2.1	1.7	1.4
300	186.4	10.4	6.0	4.2	2.8	2.0	1.6	1.4
350	174.4	11.6	6.9	5.2	3.7	2.6	2.0	1.6
400	162.6	12.0	7.4	5.4	3.8	2.8	2.1	1.7
450	160.7	9.1	5.9	4.5	3.3	2.5	1.9	1.5
500	174.6	9.9	6.7	5.3	4.2	3.1	2.4	1.8
$\bar{x}$	181.0	10.2	6.2	4.6	3.2	2.4	1.8	1.5
s	11.6	0.9	0.6	0.5	0.4	0.4	0.3	0.2

Table E4. SR 97 - FWD Data, 01/31/84, Surface Temperature = 34°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	69.4	5.8	3.7	2.6	1.6	0.9	0.7	0.6
50	67.8	8.7	5.7	3.8	2.1	1.1	0.7	0.6
100	71.4	7.3	4.4	3.1	1.7	1.0	0.8	0.7
150	68.8	7.2	4.3	2.9	1.5	0.8	0.6	0.6
200	72.5	7.1	4.3	3.5	1.1	0.9	0.8	0.2
250	68.4	7.6	4.5	2.9	1.5	0.9	0.7	0.6
300	69.9	8.0	4.6	4.1	1.7	0.8	0.7	0.4
350	69.8	8.0	5.0	3.3	1.9	1.1	0.9	0.7
400	68.8	10.9	6.5	4.3	2.4	1.3	0.9	0.9
450	69.4	5.9	4.3	3.2	2.1	1.2	0.7	0.7
500	68.8	5.5	3.9	2.8	1.8	1.2	0.9	0.7
$\bar{x}$	69.5	7.4	4.6	3.3	1.8	1.0	0.8	0.6
s	1.4	1.5	0.8	0.6	0.4	0.2	0.1	0.2

Table E4. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	101.4	7.7	5.0	3.5	2.2	1.4	1.0	0.9
50	100.2	11.3	7.1	4.8	2.8	1.5	1.0	0.8
100	102.8	10.0	6.1	4.3	2.6	1.6	1.2	1.0
150	97.6	8.8	5.2	3.6	2.1	1.3	1.0	0.9
200	104.6	9.1	5.4	3.6	1.9	1.1	0.9	0.8
250	98.0	9.9	5.9	3.8	2.2	1.3	1.1	0.9
300	100.5	10.8	6.7	3.3	2.6	1.6	1.0	
350	99.3	10.9	6.7	4.6	2.8	1.8	1.4	1.1
400	99.5	15.1	8.9	6.2	3.5	2.0	1.4	1.2
450	96.7	8.9	5.9	4.4	3.0	1.8	1.1	0.9
500	96.3	8.0	5.4	4.0	2.6	1.7	1.3	1.0
$\bar{x}$	99.7	10.0	6.2	4.2	2.6	1.6	1.1	1.0
s	2.6	2.0	1.1	0.8	0.4	0.3	0.2	0.1

Table E4. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	139.4	10.4	6.7	4.9	3.1	2.0	1.5	1.3
50	141.9	14.7	9.6	6.5	3.9	2.1	1.5	1.1
100	140.6	13.7	8.4	5.9	3.6	2.3	1.9	1.5
150	137.4	11.6	7.0	4.9	3.0	2.0	1.5	1.3
200	145.0	11.7	7.0	4.6	2.6	1.6	1.3	1.1
250	138.0	13.1	7.7	5.1	3.0	2.0	1.7	1.4
300	141.9	14.6	8.5	5.7	3.5	2.1	1.5	1.5
350	140.0	14.4	8.9	6.3	3.9	2.6	2.1	1.7
400	140.5	20.2	12.0	8.2	4.9	2.9	2.1	1.8
450	133.6	12.1	8.1	6.1	4.1	2.5	1.7	1.3
500	134.7	11.2	7.5	5.6	3.8	2.6	1.9	1.5
$\bar{x}$	139.4	13.4	8.3	5.8	3.6	2.2	1.7	1.4
s	3.3	2.7	1.5	1.0	0.6	0.4	0.3	0.2

Table E4. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	172.9	13.1	8.4	6.0	3.9	2.6	1.9	1.6
50	176.4	18.3	11.9	8.2	4.9	2.9	2.0	1.5
100	173.9	16.1	10.0	7.0	4.6	3.0	2.4	2.0
150	170.0	13.8	8.3	5.9	3.7	2.5	2.0	1.7
200	182.3	13.9	8.3	5.5	3.3	2.1	1.8	1.5
250	173.3	15.6	9.1	6.1	3.7	2.6	2.1	1.8
300	176.4	17.6	10.0	6.9	4.2	2.6	2.0	1.9
350	173.5	17.6	10.8	7.6	5.0	3.4	2.7	2.2
400	173.9	24.7	14.6	10.7	6.1	3.8	2.8	2.3
450	164.6	14.5	9.6	7.4	5.0	3.2	2.2	1.7
500	168.1	13.9	9.3	7.0	4.8	3.3	2.5	1.9
$\bar{x}$	173.2	16.3	10.0	7.1	4.5	2.9	2.2	1.8
s	4.6	3.3	1.9	1.4	0.8	0.5	0.3	0.3

Table E5. SR 97 - FWD Data, 02/21/84, Surface Temperature = 50°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	79.2	8.9	6.4	4.8	3.2	1.9	1.2	0.9
50	72.5	10.0	6.4	5.1	3.0	1.6	1.0	0.6
100	74.9	11.0	7.2	5.3	3.5	2.1	1.5	1.1
150	75.0	10.4	7.4	5.6	3.7	2.3	1.5	1.1
200	71.7	10.3	6.8	5.3	3.2	1.8	1.3	0.9
250	73.1	10.4	6.9	4.9	3.0	1.8	1.3	0.9
300	71.8	10.5	7.6	5.7	3.7	2.2	1.5	1.1
350	72.3	11.3	8.0	5.9	3.7	2.2	1.4	1.1
400	76.3	12.0	9.4	6.9	4.4	2.5	1.5	1.1
450	72.7	8.9	6.9	5.4	3.8	2.3	1.3	0.8
500	76.3	8.7	6.5	5.1	3.4	2.0	1.2	0.7
$\bar{x}$	74.2	10.3	7.2	5.4	3.5	2.1	1.3	0.9
s	2.4	1.2	0.9	0.6	0.4	0.3	0.2	0.2

Table E5. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	94.7	11.1	7.9	6.0	4.1	2.6	1.5	1.1
50	95.3	12.2	8.1	6.0	3.9	2.2	1.4	1.0
100	98.0	13.9	9.2	6.9	4.5	2.8	1.9	1.4
150	98.0	13.5	9.5	7.2	4.8	3.0	1.9	1.3
200	97.3	12.9	8.9	6.5	4.3	2.6	1.7	1.3
250	95.3	12.6	8.3	5.9	3.7	2.3	1.6	1.2
300	95.4	13.5	9.0	7.6	5.0	4.6	3.0	1.6
350	93.1	15.0	10.2	7.7	5.2	3.1	2.0	1.4
400	98.8	16.4	11.6	8.7	5.7	3.4	2.0	1.4
450	93.2	11.7	8.6	6.9	4.9	3.0	1.7	1.1
500	97.3	12.0	8.3	6.9	4.6	2.9	1.7	1.1
$\bar{x}$	96.0	13.2	9.0	6.9	4.6	3.0	1.8	1.3
s	2.0	1.5	1.1	0.8	0.6	0.6	0.4	0.2

Table E5. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	127.7	14.7	10.4	8.0	5.6	3.6	2.3	1.7
50	129.2	16.8	10.9	8.0	5.2	3.0	1.9	1.3
100	129.5	18.6	12.3	9.3	6.3	4.1	2.8	2.0
150	127.9	17.8	12.4	9.6	6.6	4.3	2.7	2.0
200	129.3	17.1	11.7	8.7	5.9	3.6	2.4	1.8
250	127.9	16.5	10.8	7.8	5.1	3.1	21.	1.6
300	127.4	18.0	12.4	9.9	6.8	4.3	2.8	2.0
350	126.0	10.5	13.4	10.3	7.1	4.5	3.0	2.1
400	129.5	21.2	14.8	11.4	7.7	4.8	3.0	2.1
450	125.5	15.6	11.5	10.0	6.6	4.2	2.5	1.6
500	124.4	15.9	11.1	8.7	6.1	4.0	2.5	1.6
$\bar{x}$	127.7	17.4	12.0	9.2	6.3	4.0	2.5	1.8
s	1.7	1.9	1.3	1.1	0.8	0.6	0.4	0.3

Table E5. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	158.1	18.0	12.7	9.7	6.9	4.6	3.0	2.2
50	156.0	20.4	13.2	9.8	6.4	3.8	2.4	1.7
100	157.0	22.5	15.0	11.4	7.8	5.2	3.6	2.6
150	156.7	21.4	14.9	11.5	8.0	5.3	3.4	2.4
200	156.5	20.6	14.1	10.6	7.3	4.6	3.0	2.2
250	155.7	20.0	13.0	9.4	6.2	4.0	2.8	2.0
300	154.4	21.9	15.0	12.0	8.3	5.4	3.6	2.6
350	156.4	23.1	16.0	12.4	8.7	5.7	3.9	2.7
400	157.1	25.6	18.0	13.8	9.6	6.1	3.9	2.8
450	152.9	19.3	14.0	11.3	8.1	5.3	3.2	2.2
500	157.1	18.8	13.0	10.4	7.4	4.9	3.1	2.2
$\bar{x}$	156.2	21.0	14.4	11.1	7.7	5.0	3.3	2.3
s	1.4	2.2	1.6	1.3	1.0	0.7	0.5	0.3

Table E6. SR 97 - FWD Data, 02/29/84, Surface Temperature = 51°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	78.3	10.2	7.6	4.1	3.9	2.2	1.3	0.8
50	81.1	11.1	8.1	4.9	3.6	2.0	1.1	0.7
100	82.5	11.7	8.3	6.3	3.9	2.4	1.6	1.0
150	83.6	11.0	8.2	6.1	4.2	2.5	1.6	1.2
200	80.9	10.9	7.9	5.9	3.7	2.2	1.5	1.1
250	81.7	11.1	7.5	5.4	3.4	2.0	1.3	1.2
300	82.4	11.6	8.7	6.4	4.2	2.5	1.5	1.2
350	80.9	12.4	9.2	6.8	4.3	2.5	1.6	1.1
400	78.2	13.8	9.9	7.2	4.5	2.4	1.5	1.1
450	84.7	10.0	7.3	5.8	4.0	2.4	1.3	0.9
500	77.9	9.2	6.9	5.4	3.6	2.1	1.2	0.9
$\bar{x}$	81.1	11.2	8.1	5.8	3.9	2.3	1.4	1.0
s	2.2	1.2	0.9	0.9	0.3	0.2	0.2	0.2

Table E6. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	103.2	11.7	8.3	6.2	4.4	2.6	1.6	1.2
50	107.4	12.6	8.9	6.4	4.3	2.5	1.5	1.1
100	108.2	14.0	10.0	5.9	5.0	3.1	1.8	-
150	106.7	13.4	9.6	6.7	5.0	3.0	1.9	1.5
200	106.4	12.6	9.0	6.8	4.4	2.7	1.8	1.3
250	105.6	12.6	8.3	6.2	3.9	2.4	1.6	1.3
300	107.0	14.3	10.2	7.8	5 3	3.2	2.0	1.4
350	104.7	15.0	10.7	8.1	5.4	3.3	2.0	1.4
400	103.8	16.1	11.5	8.8	5.6	3.2	2.0	1.4
450	107.6	12.1	8.6	6.9	4.9	3.0	1.7	1.1
500	102.2	11.9	8.5	6.7	4.7	3.0	1.7	1.2
$\bar{x}$	105.7	13.3	9.4	7.0	4.8	2.9	1.8	1.3
s	2.0	1.4	1.1	0.9	0.5	0.3	0.2	0.1

Table E6. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	140.2	15.2	11.1	8.3	6.0	3.7	2.3	2.1
50	145.0	16.6	11.8	8.6	5.6	3.2	2.0	1.4
100	146.0	18.5	13.1	10.7	6.9	4.5	3.1	2.0
150	141.8	17.6	12.7	9.7	6.8	4.4	2.9	2.0
200	145.0	16.6	11.9	9.2	6.1	3.8	2.5	1.8
250	142.2	16.1	11.0	8.2	5.3	3.3	2.3	1.6
300	141.9	18.3	13.3	10.2	7.1	4.4	2.9	2.0
350	138.9	19.3	14.0	10.8	7.4	4.8	3.1	2.2
400	145.5	21.8	16.3	11.9	8.0	4.8	3.0	2.2
450	142.6	15.9	11.3	8.9	6.6	4.2	2.5	1.7
500	136.6	15.8	11.5	9.0	6.5	4.3	2.6	1.7
$\bar{x}$	142.3	17.4	12.5	9.6	6.6	4.1	2.6	1.9
s	3.0	1.9	1.6	1.2	0.8	0.6	0.4	0.3

Table E6. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	173.0	18.9	13.3	10.1	7.7	4.7	3.0	2.3
50	177.4	19.9	13.9	10.8	7.0	4.3	2.7	1.8
100	174.6	22.2	15.7	11.5	8.3	5.6	3.7	2.9
150	168.8	20.8	15.1	11.9	8.4	5.5	3.6	2.6
200	176.2	19.9	14.3	11.1	7.5	4.8	3.2	2.4
250	170.4	19.2	13.0	9.6	6.5	4.1	2.9	2.2
300	171.3	21.7	15.9	12.2	8.6	5.6	3.6	2.6
350	167.4	23.0	16.6	12.8	9.1	6.0	3.9	2.8
400	169.6	24.6	18.0	13.6	9.4	5.9	3.9	2.8
450	173.5	18.9	13.4	10.6	7.9	5.1	3.1	2.1
500	165.2	18.9	13.9	10.7	7.9	5.4	3.2	2.2
$\bar{x}$	171.6	20.7	14.8	11.4	8.0	5.2	3.3	2.4
s	3.8	1.9	1.6	1.2	0.8	0.6	0.4	0.3

Table E7. SR 97 - FWD Data, 03/06/84, Surface Temperature = 60°F.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	65.6	8.2	5.7	4.1	2.6	1.5	1.0	0.8
50	68.1	9.3	6.5	4.7	2.8	1.6	1.0	0.7
100	68.9	10.0	7.0	5.2	3.1	2.0	1.3	1.0
150	68.8	8.9	6.9	5.2	3.3	2.0	1.3	1.0
200	67.5	9.6	6.9	5.0	3.0	1.8	1.2	1.0
250	67.3	8.9	6.4	4.5	2.8	1.6	1.1	0.9
300	69.8	10.6	7.4	5.4	3.4	2.0	1.4	1.0
350	71.0	10.8	8.0	5.8	3.6	2.1	1.4	0.9
400	71.2	12.0	8.9	6.4	3.8	2.1	1.4	1.1
450	69.8	8.0	6.3	4.9	3.3	1.9	1.1	0.7
500	69.1	9.0	6.3	4.8	3.1	1.8	1.1	0.8
$\bar{x}$	68.8	9.6	6.9	5.1	3.2	1.8	1.2	0.9
s	1.65	1.2	0.9	0.6	0.4	0.2	0.2	0.1

Table E7. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	95.1	10.8	7.4	5.5	3.5	2.1	1.5	1.1
50	96.0	12.1	8.2	6.0	3.8	2.2	1.4	1.0
100	97.0	13.4	9.2	6.8	4.3	2.7	1.9	1.4
150	96.6	12.4	8.9	6.7	4.5	2.8	1.9	1.3
200	97.0	13.0	8.7	6.4	4.1	2.5	1.7	1.3
250	94.3	12.0	8.1	5.9	3.7	2.2	1.5	1.1
300	98.0	14.0	9.6	7.2	4.6	2.7	1.8	1.3
350	97.2	14.7	10.5	7.7	5.0	3.0	2.0	1.4
400	98.0	15.9	11.3	8.2	5.1	2.8	1.8	1.4
450	95.9	11.3	8.1	6.3	4.3	2.6	1.5	1.1
500	96.0	12.4	8.4	6.5	4.3	2.6	1.6	1.2
$\bar{x}$	96.5	12.9	8.9	6.6	4.3	2.6	1.7	1.2
s	1.14	1.5	1.1	0.8	0.5	0.3	0.2	0.1

Table E7. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	128.0	14.2	9.9	7.4	5.0	3.1	2.1	1.5
50	136.1	16.0	10.8	8.0	5.0	3.0	1.9	1.3
100	133.8	17.8	12.4	9.4	6.1	4.0	2.6	1.9
150	129.0	16.3	11.8	9.1	6.2	3.9	2.6	1.9
200	131.2	17.2	11.4	8.5	5.5	3.4	2.2	1.7
250	126.4	15.4	10.6	7.8	5.0	3.1	2.1	1.6
300	132.8	18.3	12.7	9.5	6.4	4.0	2.7	1.9
350	130.5	18.9	13.7	10.3	6.9	4.4	3.0	2.1
400	134.4	20.7	14.8	10.8	7.0	4.3	2.8	2.0
450	128.2	14.9	10.8	8.5	5.9	3.6	2.2	1.5
500	132.2	16.0	11.3	8.7	5.9	3.7	2.4	1.7
$\bar{x}$	131.2	16.9	11.8	8.9	5.9	3.7	2.4	1.7
s	3.0	1.9	1.4	1.0	0.7	0.5	0.3	0.2

Table E7. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	157.3	17.6	12.0	9.1	6.3	4.1	2.8	2.1
50	162.5	19.9	13.2	9.8	6.2	3.8	2.4	1.7
100	163.9	21.7	15.0	11.4	7.6	5.1	3.4	2.6
150	163.5	20.2	14.5	11.2	7.7	5.2	3.4	2.5
200	166.8	20.8	13.8	10.3	6.9	4.4	3.0	2.2
250	156.4	18.4	12.6	9.3	6.1	3.9	2.7	2.0
300	157.8	21.9	15.2	11.4	7.8	5.0	3.3	2.5
350	158.8	22.7	16.5	12.4	8.6	5.6	3.9	2.8
400	161.6	25.0	17.6	13.2	8.7	5.5	3.6	2.7
450	155.5	18.2	13.0	10.3	7.2	4.5	2.9	2.0
500	161.5	19.6	13.7	10.6	7.3	4.8	3.0	2.2
$\bar{x}$	160.5	20.5	14.3	10.8	7.3	4.7	3.0	2.3
s	3.6	2.2	1.7	1.3	0.9	0.6	0.4	0.3

Table E8. SR 97 - FWD Data, 03/19/84, Surface Temperature = 50°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	72.4	8.0	5.9	4.6	3.0	1.7	1.1	0.8
50	67.3	9.1	6.6	4.8	3.1	1.8	1.2	0.9
100	64.3	9.2	6.6	4.8	3.3	2.0	1.3	1.0
150	71.7	9.1	6.5	5.1	3.5	2.0	1.3	1.0
200	67.8	9.0	6.5	4.8	3.0	1.8	1.2	0.9
250	66.3	8.0	5.9	4.2	2.6	1.5	1.0	0.7
300	61.2	8.7	6.5	4.8	3.3	1.9	1.2	0.9
350	61.7	9.6	7.2	5.3	3.5	2.0	1.3	0.9
400	64.2	10.6	7.8	5.8	3.4	1.9	1.2	0.9
450	68.2	7.2	5.4	4.3	2.9	1.7	1.0	0.7
500	67.8	8.4	6.1	4.6	3.1	1.8	1.1	0.8
$\bar{x}$	66.6	8.0	6.4	4.8	3.2	1.8	1.2	0.9
s	3.6	0.9	0.6	0.4	0.3	0.2	0.1	0.1

Table E8. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	101.6	10.6	7.6	5.9	4.0	2.4	1.5	1.1
50	89.9	11.3	7.8	6.1	4.0	2.4	1.5	1.1
100	87.2	12.3	8.7	6.5	4.5	2.8	1.9	1.3
150	92.0	12.0	8.6	6.5	4.5	2.8	1.8	1.3
200	91.2	11.7	8.2	6.1	4.0	2.5	1.7	1.2
250	86.7	10.6	7.5	5.4	3.5	2.1	1.3	1.0
300	74.4	11.3	8.2	6.2	4.3	2.6	1.7	1.2
350	87.3	13.2	9.5	7.3	4.9	3.1	1.9	1.4
400	89.8	14.3	10.1	7.7	4.8	2.8	1.8	1.3
450	92.2	10.0	7.2	5.7	3.9	2.5	1.5	1.1
500	91.1	11.3	8.0	6.3	4.3	2.6	1.7	1.2
$\bar{x}$	89.4	11.7	8.3	6.3	4.2	2.6	1.7	1.2
s	6.4	1.2	0.9	0.7	0.4	0.3	0.2	0.1

Table E8. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	137.1	14.0	10.2	7.9	5.4	3.4	2.3	1.6
50	122.9	14.9	10.4	8.0	5.4	3.2	2.0	1.4
100	117.9	16.8	11.5	8.8	6.1	4.0	2.6	2.0
150	121.5	15.6	11.3	8.7	6.1	3.8	2.5	1.8
200	125.1	15.8	10.8	8.2	5.5	3.5	2.3	1.7
250	113.2	13.9	9.6	7.1	4.8	3.0	1.9	1.5
300	105.7	15.5	11.1	8.4	6.0	3.8	2.4	1.8
350	106.6	17.2	12.3	9.6	6.7	4.4	2.8	2.0
400	113.0	18.4	13.0	10.0	6.5	4.0	2.6	2.0
450	119.5	13.3	9.6	7.7	5.5	3.5	2.2	1.5
500	117.4	14.8	10.6	8.4	5.9	3.7	2.4	1.7
$\bar{x}$	118.2	15.5	10.9	8.4	5.8	3.7	2.4	1.7
s	8.8	1.5	1.0	0.8	0.6	0.4	0.3	0.2

Table E8. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	157.3	16.9	12.1	9.4	6.6	4.3	2.9	2.0
50	151.0	18.5	12.8	9.8	6.7	4.1	2.6	1.9
100	147.8	20.5	14.2	10.9	7.6	5.1	3.5	2.5
150	147.0	19.0	13.5	10.7	7.5	4.8	3.2	2.3
200	148.3	19.0	12.9	9.9	6.7	4.4	3.0	2.2
250	140.3	16.0	11.4	8.6	5.9	3.8	2.5	1.9
300	137.4	18.0	13.1	10.4	7.3	4.8	3.2	2.4
350	138.0	20.9	15.0	11.8	8.3	5.6	3.7	2.7
400	138.1	22.0	15.3		8.0	5.1	3.4	2.6
450	147.6	16.3	11.8	9.4	6.7	4.4	2.9	2.0
500	145.0	22.5	12.9	10.4	7.3	4.7	3.1	2.2
$\bar{x}$	145.2	19.2	13.2	10.1	7.1	4.6	3.1	2.2
s	6.3	2.1	1.2	0.9	0.7	0.5	0.4	0.3

Table E9. SR 2, Sunnyslope - FWD Data, 08/16/83, Surface Temperature = 99°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	83.84	26.9	19.6	15.7	11.7	7.8	5.3	3.5
50	82.69	20.8	15.0	11.5	8.7	5.6	3.4	2.1
100	91.95	11.2	6.5	5.6	4.8	3.7	2.8	2.1
150	84.42	13.6	9.8	8.3	6.7	4.8	3.3	2.3
200	81.38	17.2	13.1	10.9	8.4	5.9	3.9	2.7
250	87.03	18.4	14.1	11.7	9.1	6.5	4.6	3.1
300	86.45	19.7	15.0	12.8	10.0	7.3	5.1	3.6
350	78.63	18.7	14.8	12.7	10.0	7.4	5.3	3.7
400	87.32	14.4	11.1	9.2	7.0	4.9	3.3	2.4
450	82.98	18.3	13.8	11.1	8.1	5.2	3.3	2.3
500								
$\bar{x}$	84.67	17.9	13.3	11.0	8.4	5.9	4.0	2.8
s	3.70	4.3	3.5	2.8	2.0	1.3	1.0	0.6

Table E9. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	110.78	34.2	25.0	20.2	15.2	10.5	7.2	4.8
50	110.49	28.7	21.0	16.5	12.8	8.5	5.2	3.3
100	123.23	15.4	9.3	7.9	6.8	5.5	4.2	3.2
150	112.52	18.6	13.6	11.7	9.6	7.2	5.0	3.6
200	110.64	22.9	17.5	14.7	11.6	8.3	5.7	4.1
250	117.01	24.7	19.3	15.9	12.8	9.3	6.7	4.5
300	116.57	26.2	20.0	17.0	13.7	10.2	7.2	5.2
350	110.78	25.9	20.2	17.5	14.1	10.7	7.7	5.5
400	115.56	19.3	15.1	12.8	10.1	7.3	5.1	3.7
450	110.78	24.3	18.5	15.2	11.4	7.8	5.2	3.6
500								
$\bar{x}$	113.84	24.0	18.0	14.9	11.8	8.5	5.9	4.2
s	4.21	5.4	4.4	3.4	2.5	1.7	1.2	0.8

Table E10. SR 2, Sunnyslope - FWD Data, 01/11/84, Surface Temperature = 34°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	75.4	16.0	11.0	8.8	6.4	4.3	2.9	2.2
50	75.2	9.7	8.2	7.3	6.1	4.7	3.2	2.2
100	76.6	3.9	3.0	2.8	2.5	2.1	1.8	1.4
150	75.3	6.0	5.0	4.3	3.9	3.2	2.4	1.8
200	70.8	10.4	7.7	6.4	5.0	3.6	2.5	1.8
250	66.1	10.3	7.4	6.0	4.0	2.8	2.0	1.6
300	66.8	9.1	5.9	4.7	3.6	2.9	2.4	1.9
350	62.2	9.1	6.1	5.2	4.2	3.2	2.5	1.9
400	64.7	8.9	6.8	5.7	4.4	3.0	2.2	1.6
450	66.6	10.2	7.6	6.1	4.5	3.0	2.0	1.5
500								
$\bar{x}$	70.0	9.2	6.9	5.7	4.4	3.3	2.4	1.8
s	5.3	3.2	2.1	1.7	1.1	0.7	0.4	0.3

Table E10. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	101.4	19.8	14.0	11.3	8.5	5.9	4.2	3.1
50	101.2	13.7	11.4	10.2	8.7	6.8	4.7	3.3
100	104.9	5.8	4.4	4.1	3.7	3.2	2.6	2.1
150	101.9	8.3	7.2	6.2	5.6	4.5	3.4	2.6
200	95.8	13.3	10.2	8.4	6.7	5.0	3.6	2.7
250	89.9	12.5	9.3	7.7	5.4	3.9	2.9	2.2
300	92.4	11.2	7.8	6.4	5.0	4.1	3.3	2.7
350	78.0	10.1	8.2	7.1	5.8	4.5	3.6	2.7
400	89.9	11.4	9.1	76.	6.0	4.3	3.1	2.3
450	90.9	12.9	10.0	8.3	6.2	4.4	3.0	2.3
500								
$\bar{x}$	94.6	11.9	9.2	7.7	6.2	4.7	3.4	2.6
s	8.1	3.7	2.6	2.0	1.5	1.0	0.6	0.4

Table E10. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	133.7	26.3	18.8	15.7	11.7	8.3	5.9	4.3
50	133.4	18.7	16.2	14.4	12.4	9.7	7.0	4.8
100	139.2	8.0	6.2	5.7	5.2	4.6	3.8	3.0
150	134.3	11.6	10.0	9.1	8.0	6.6	5.1	3.8
200	123.0	17.9	14.0	11.7	9.5	7.1	5.2	3.9
250	119.5	16.8	12.6	10.5	7.6	5.6	4.2	3.3
300	126.8	14.8	11.0	9.2	7.4	6.0	4.9	3.9
350	112.2	14.2	11.7	10.1	8.4	6.6	5.3	4.0
400	120.4	15.5	12.4	10.6	8.4	6.2	4.5	3.5
450	123.1	17.6	13.8	11.6	8.9	6.4	4.5	3.3
500								
$\bar{x}$	126.6	16.1	12.6	10.9	8.7	6.7	5.0	3.8
s	8.4	4.8	3.4	2.8	2.1	1.4	0.9	0.5

Table E10. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	160.3	32.0	22.8	19.2	14.3	10.3	7.3	5.3
50	161.3	23.9	20.5	18.5	15.7	12.6	9.0	6.2
100	171.5	10.1	8.0	7.4	6.7	5.9	4.9	3.9
150	162.2	14.8	12.8	11.7	10.3	8.5	6.6	5.0
200	144.0	22.0	17.2	14.5	11.8	9.0	6.7	5.0
250	142.3	20.5	15.4	12.9	9.5	7.1	5.2	4.1
300	152.6	18.6	13.8	11.6	9.4	7.6	6.3	5.0
350	141.6	17.7	14.7	12.8	10.6	8.5	6.8	5.2
400	145.3	18.9	15.4	13.2	10.6	8.0	5.9	4.5
450	146.7	21.5	17.2	14.5	11.4	8.3	5.8	4.4
500								
$\bar{x}$	152.8	20.0	15.8	13.5	11.0	8.6	6.5	4.9
s	10.4	5.8	4.0	3.4	2.5	1.8	1.1	0.7

Table E11. SR 2, Sunnyslope - FWD Data, 01/31/84, Surface Temperature = 43°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	71.4	9.3	8.1	7.1	6.0	4.6	3.3	2.3
50	70.1	4.6	3.5	3.1	2.9	2.5	2.0	1.5
100	68.2	7.0	5.8	5.3	4.4	3.4	2.5	1.8
150	62.3	9.7	7.6	6.3	4.8	3.5	2.5	1.9
200	66.6	6.5	4.8	4.1	2.9	2.2	1.7	1.3
250	70.4	4.7	3.7	3.1	2.6	2.2	1.8	1.5
300	65.4	4.0	3.3	3.0	2.6	2.2	1.8	1.4
350	65.6	4.5	3.7	3.3	2.9	2.4	1.9	1.5
400	68.6	6.2	4.7	4.1	3.5	2.7	2.0	1.5
450	65.9	4.4	3.5	3.1	2.6	2.1	1.7	1.3
500								
$\bar{x}$	67.4	6.1	4.9	4.2	3.5	2.8	2.1	1.6
s	2.8	2.1	1.8	1.5	1.2	0.8	0.5	0.3

Table E11. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	96.9	13.9	11.7	10.4	8.7	6.8	4.9	3.4
50	99.3	6.5	5.1	4.8	4.3	3.7	3.1	2.4
100	94.3	10.0	8.3	7.6	6.4	5.0	3.7	2.6
150	88.3	13.3	10.5	8.8	6.8	5.1	3.6	2.7
200	94.1	9.1	6.7	5.8	4.2	3.2	2.4	1.9
250	98.6	6.8	5.1	4.4	3.8	3.2	2.6	2.1
300	90.8	5.7	4.9	5.7	3.8	3.3	2.7	2.2
350	92.2	6.8	5.4	4.9	4.2	3.5	2.8	2.2
400	92.7	8.8	6.8	6.0	5.0	4.0	3.0	2.2
450	87.2	6.5	5.1	4.5	3.9	3.2	2.5	2.0
500								
$\bar{x}$	93.4	8.7	7.0	6.3	5.1	4.1	3.1	2.4
s	4.1	2.9	2.4	2.0	1.6	1.2	0.8	2.4

Table E11. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	131.8	20.1	16.7	14.9	12.5	10.1	7.2	5.0
50	133.2	9.3	7.3	6.8	6.1	5.3	4.3	3.5
100	125.7	14.4	12.0	11.1	9.3	7.4	5.5	3.9
150	118.4	18.3	14.6	12.5	9.8	7.4	5.4	4.0
200	125.1	12.6	9.5	8.1	6.1	4.8	3.7	2.9
250	131.2	9.7	7.6	6.5	5.7	4.8	3.9	3.2
300	122.1	8.5	7.2	6.5	5.7	4.8	3.9	3.2
350	122.1	10.0	8.2	7.3	6.4	5.3	4.2	3.3
400	123.5	12.9	9.9	8.8	7.5	6.0	4.6	3.4
450	120.3	9.4	7.6	6.9	5.9	4.8	3.8	3.0
500								
$\bar{x}$	125.3	12.5	10.1	8.9	7.5	6.1	4.6	3.5
s	5.1	4.0	3.3	2.9	2.3	1.7	1.1	0.6

Table E11. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	159.6	25.6	21.2	18.3	16.0	12.6	9.2	6.4
50	169.3	11.5	9.4	8.7	7.9	6.9	5.7	4.4
100	157.2	18.6	15.5	14.1	12.0	9.6	7.1	5.2
150	148.4	23.1	18.5	15.9	12.4	9.6	7.0	5.2
200	158.4	15.8	12.0	10.4	7.8	6.1	4.6	3.7
250	160.4	12.3	9.7	8.4	7.2	6.1	5.0	4.2
300	151.6	11.0	9.3	8.5	7.4	6.2	5.1	4.2
350	151.2	13.0	10.7	9.6	8.3	6.9	5.5	4.3
400	151.8	16.1	12.8	11.4	9.6	7.8	5.8	4.4
450	151.3	12.3	10.0	8.9	7.7	6.3	4.9	3.9
500								
$\bar{x}$	155.9	15.9	12.9	11.4	0.6	7.8	6.0	4.6
s	6.3	5.1	4.2	3.5	2.9	2.2	1.4	0.8

Table. E12. SR 2, Sunnyslope, 02/21/84, Surface Temperature = 50°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	76.4	12.4	9.8	8.6	7.1	5.2	3.5	2.4
50	80.4	5.3	3.7	3.5	3.1	2.6	2.1	1.7
100	76.6	8.8	7.1	6.3	5.3	4.1	2.9	2.0
150	70.1	17.1	13.2	11.1	8.7	6.2	4.1	2.8
200	69.5	17.7	13.6	11.6	8.9	6.0	3.9	2.7
250	69.9	17.9	13.2	11.0	8.6	6.1	4.1	2.8
300	70.8	15.7	12.0	10.3	8.4	6.3	4.4	3.1
350	71.2	12.8	10.2	8.7	6.8	5.0	3.2	2.2
400	69.1	16.7	12.5	10.5	7.8	4.9	3.1	2.1
450	69.1	10.6	8.5	7.2	5.7	4.1	2.8	1.9
500								
$\bar{x}$	72.3	13.5	10.4	8.9	7.0	5.0	3.4	2.4
s	4.0	4.3	3.2	2.6	1.9	1.2	0.7	0.4

Table E12. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	99.3	16.4	13.3	11.7	9.7	7.3	5.0	3.4
50	106.4	7.1	5.3	4.9	4.4	3.8	3.0	2.3
100	99.0	11.8	9.6	8.6	7.3	5.6	4.1	2.9
150	91.5	22.6	17.6	14.9	11.8	8.5	5.8	3.8
200	90.2	23.1	18.0	15.2	11.9	8.1	5.2	3.6
250	91.1	23.1	17.4	14.6	11.5	8.1	5.6	3.8
300	91.1	20.1	15.7	13.7	11.2	8.5	5.8	3.9
350	93.5	16.2	13.3	11.5	9.1	6.7	4.5	3.1
400	90.2	21.0	16.0	13.7	10.5	6.8	4.4	3.0
450	88.3	13.9	11.3	9.7	7.8	5.7	3.9	2.8
500								
$\bar{x}$	94.1	17.5	13.8	11.8	9.5	6.9	4.7	3.3
s	5.7	5.4	4.1	3.3	2.4	1.5	0.9	0.5

Table E12. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	128.7	22.4	18.1	16.1	13.5	10.3	7.1	4.9
50	137.8	9.8	7.3	6.9	6.2	5.3	4.3	3.3
100	127.6	16.1	13.2	11.9	10.2	8.0	5.9	4.2
150	120.3	30.4	23.9	20.4	16.3	11.8	8.0	5.5
200	119.5	31.1	24.3	20.8	16.3	11.2	7.3	5.0
250	121.2	30.8	23.5	19.8	15.6	11.3	7.6	5.3
300	119.9	26.9	21.6	18.9	15.5	11.8	8.2	5.7
350	122.5	21.3	17.7	15.4	12.6	9.4	6.5	4.6
400	121.2	27.0	21.2	18.2	14.2	9.6	6.4	4.4
450	113.8	18.5	15.0	13.1	10.7	8.0	5.7	4.0
500								
$\bar{x}$	123.2	23.4	18.6	16.2	13.1	9.7	6.7	4.7
s	6.6	7.1	5.5	4.4	3.3	2.1	1.2	0.7

Table E12. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	157.0	27.7	22.6	20.0	16.9	13.0	9.1	6.4
50	169.3	12.3	9.4	8.8	7.9	6.7	5.6	4.3
100	156.0	20.2	16.7	15.0	12.9	10.2	7.5	5.4
150	147.4	37.5	29.6	25.4	20.4	14.9	10.3	7.1
200	146.4	38.6	30.2	25.9	20.3	14.0	9.2	6.3
250	148.9	37.8	29.0	24.4	19.4	14.0	9.6	6.7
300	148.6	33.7	27.0	23.6	19.5	14.8	10.4	7.2
350	152.2	26.4	21.7	19.0	15.6	11.8	8.4	6.0
400	147.8	32.3	26.8	22.1	17.6	12.2	8.3	5.7
450	148.7	22.3	18.5	16.2	13.4	10.2	7.3	5.3
500								
$\bar{x}$	152.2	28.9	23.2	20.0	16.4	12.2	8.6	6.0
s	7.0	8.7	6.7	5.4	4.0	2.6	1.5	0.9

Table E13. SR 2, Sunnyslope - FWD Data, 02/29/84, Surface Temperature = 51°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	75.6	10.8	8.9	7.8	6.4	4.9	3.3	2.3
50	78.3	4.8	3.7	3.4	3.0	2.6	2.0	1.6
100	74.3	8.4	6.9	6.1	5.2	4.0	2.9	2.0
150	69.9	14.6	12.0	10.2	8.1	5.7	3.8	2.6
200	70.4	16.7	14.6	10.9	8.3	5.6	3.7	2.7
250	71.5	19.2	14.5	12.0	9.3	6.7	4.6	3.2
300	70.2	13.7	11.2	9.9	8.2	6.3	4.4	3.1
350	69.9	12.6	10.3	8.9	7.0	5.0	3.3	2.2
400	63.0	16.7	13.2	10.6	7.9	4.6	3.0	2.0
450	66.8	11.2	8.9	7.6	6.1	4.4	3.1	2.2
500								
$\bar{x}$	71.0	12.8	10.4	8.7	7.0	5.0	3.4	2.4
s	4.4	4.3	3.4	2.6	1.8	1.2	0.8	0.5

Table E13. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	100.5	15.1	12.5	11.1	9.2	7.1	5.0	3.4
50	104.4	6.8	5.3	4.8	4.3	3.7	3.0	2.4
100	98.2	11.5	9.4	8.4	7.2	5.6	4.1	2.9
150	93.5	19.2	15.9	13.7	11.0	7.9	5.2	3.7
200	92.8	21.9	18.8	14.4	11.2	7.6	5.1	3.7
250	94.1	23.8	18.5	15.6	12.2	8.9	6.2	4.3
300	91.8	18.6	15.3	13.6	11.3	8.8	6.2	4.3
350	92.2	16.4	13.4	11.7	9.4	6.9	4.7	3.2
400	85.7	20.9	16.9	13.8	10.5	6.5	4.3	3.0
450	83.1	14.4	11.5	10.0	8.0	5.9	4.1	2.9
500								
$\bar{x}$	93.6	16.9	13.8	11.7	9.4	6.9	4.8	3.4
s	6.4	5.1	4.2	3.3	2.4	1.6	1.0	0.6

Table E13. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	130.6	20.7	17.3	15.4	13.0	10.1	7.2	5.0
50	136.0	9.4	7.4	6.8	6.1	5.3	4.3	3.4
100	127.4	15.6	13.0	11.6	10.0	8.0	5.9	3.4
150	121.5	25.4	21.2	18.2	14.9	20.9	7.4 1	5.2
200	21.2	28.8	24.4	19.3	15.2	10.5	7.0	5.0
250	125.0	30.6	24.3	20.0	16.3	12.0	8.4	5.9
300	120.5	26.0	21.4	18.9	16.0	12.0	8.9	6.2
350	121.9	21.9	18.1	15.8	12.9	9.7	6.7	4.7
400	115.6	27.0	21.9	18.2	14.3	9.3	6.3	4.4
450	108.6	18.9	15.4	13.4	10.9	8.3	5.9	4.1
500								
$\bar{x}$	122.8	22.4	18.4	15.8	13.0	9.6	6.8	4.8
s	7.6	6.5	5.4	4.2	3.2	2.1	1.3	0.8

Table E13. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	159.1	25.8	21.7	19.3	16.3	12.7	9.1	6.3
50	170.2	11.8	9.3	9.1	7.8	6.8	5.5	4.3
100	156.2	19.6	16.4	14.6	12.8	10.2	7.6	5.5
150	151.8	30.8	25.9	22.3	18.3	13.5	9.4	6.6
200	149.6	35.3	29.6	23.6	19.3	13.1	8.8	6.3
250	151.2	36.3	29.1	23.5	19.8	14.6	10.3	7.4
300	147.6	32.6	26.9	24.0	20.2	15.7	11.3	7.9
350	149.9	26.5	22.1	19.4	16.0	12.1	8.6	6.2
400	141.2	32.1	26.2	22.0	17.6	11.9	8.2	5.8
450	136.7	23.0	18.8	16.5	13.6	10.4	7.5	5.4
500								
$\bar{x}$	151.4	27.4	22.6	19.4	16.2	12.1	8.6	6.2
s	9.2	7.7	6.4	4.8	3.8	2.5	1.6	1.0

Table E14. SR 2, Sunnyslope - FWD Data, 03/06/84, Surface Temperature = 60°F.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	67.3	12.9	10.1	8.7	7.0	5.1	3.5	2.3
50	74.4	5.7	3.9	3.5	3.1	2.6	2.1	1.6
100	68.9	9.2	7.2	6.3	5.2	3.9	2.7	1.9
150	65.3	14.5	11.9	10.1	7.9	5.7	3.8	2.5
200	65.6	15.7	12.4	10.6	8.4	5.6	3.7	2.6
250	68.5	15.7	13.0	10.7	8.5	6.1	4.1	2.8
300	65.6	13.9	11.2	9.8	8.1	6.1	4.4	3.0
350	66.8	12.6	10.2	8.7	6.7	4.8	3.1	2.2
400	66.9	15.4	11.7	9.7	7.1	4.6	2.8	2.0
450	63.7	11.3	8.7	7.4	5.9	4.2	2.8	2.0
500								
$\bar{x}$	67.3	12.9	10.0	8.6	6.8	4.9	3.3	2.3
s	2.9	3.2	2.8	2.3	1.7	1.1	0.7	0.4

Table E14. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	87.8	17.3	13.9	12.1	9.8	7.2	4.9	3.3
50	99.5	7.8	5.5	5.0	4.5	3.8	3.0	2.3
100	92.7	12.9	9.9	8.8	7.3	5.6	3.9	2.8
150	87.5	20.0	15.7	13.5	10.8	7.8	5.3	3.6
200	89.0	20.7	16.4	14.2	11.2	7.7	5.1	3.5
250	91.4	21.6	17.2	14.4	11.5	8.3	5.7	3.9
300	86.7	18.9	15.3	13.6	11.3	8.6	6.1	4.3
350	87.3	16.2	13.3	11.5	9.1	6.6	4.4	3.1
400	89.0	21.1	15.7	13.0	9.8	6.7	4.1	3.0
450	83.1	14.8	11.7	10.2	8.1	5.8	4.0	2.8
500								
$\bar{x}$	89.4	17.1	135	11.6	9.4	6.8	4.6	3.3
s	4.4	4.4	3.6	2.9	2.2	1.4	0.9	0.6

Table E14. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	110.9	23.9	19.2	16.8	13.8	10.3	7.2	4.9
50	130.2	10.5	7.7	7.0	6.3	5.4	4.3	3.3
100	118.2	16.9	13.5	12.0	10.1	7.8	5.6	4.0
150	113.5	26.5	21.1	18.3	14.8	10.9	7.6	5.3
200	116.6	27.4	21.7	19.0	15.2	10.6	7.2	4.9
250	119.2	28.3	22.6	19.2	15.4	11.4	7.9	5.5
300	113.0	26.1	21.5	19.1	15.9	12.3	8.8	6.2
350	113.8	21.7	17.7	15.5	12.4	9.1	6.4	4.5
400	116.6	26.7	21.0	17.2	13.4	9.5	6.1	4.3
450	107.0	19.4	15.6	13.6	11.1	8.2	5.9	4.1
500								
$\bar{x}$	115.9	22.7	18.2	15.8	12.8	9.6	6.7	4.7
s	6.2	5.7	4.7	3.9	3.0	2.0	1.3	0.8

Table E14. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	142.0	30.0	24.1	21.3	17.6	13.2	9.3	6.3
50	161.2	13.3	9.8	8.9	8.1	6.9	5.6	4.3
100	148.6	21.3	17.2	15.4	13.0	10.2	7.4	5.3
150	144.7	32.3	25.9	22.5	18.3	13.6	9.6	6.7
200	142.8	33.7	26.9	23.4	18.9	13.1	9.0	6.3
250	142.6	34.1	27.1	23.4	18.9	13.9	9.7	6.9
300	142.8	32.8	27.1	24.3	20.2	15.6	11.2	7.8
350	144.4	26.5	21.8	19.1	15.6	11.7	8.3	6.0
400	141.3	31.8	25.3	21.0	16.5	12.0	8.0	5.7
450	142.2	23.7	19.4	17.0	13.9	10.5	7.5	5.4
500								
$\bar{x}$	145.3	28.0	22.5	19.6	16.1	12.1	8.6	6.1
s	6.0	6.8	5.6	4.8	3.6	2.4	1.6	1.0

Table E15. SR 2, Sunnyslope, 03/19/84, Surface Temperature = 50°F.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	71.4	11.7	9.5	8.3	6.8	5.1	3.6	2.5
50	62.7	4.4	3.5	3.1	2.8	2.4	1.9	1.5
100	71.2	7.5	6.2	5.5	4.7	3.7	2.6	1.9
150	63.1	14.9	12.2	10.3	8.0	5.8	3.8	2.7
200	64.2	16.5	12.7	10.6	8.2	5.7	3.7	2.6
250	68.9	19.2	15.1	12.4	9.2	6.4	4.3	3.0
300	67.9	14.1	11.6	9.8	8.0	6.1	4.2	2.9
350	68.1	12.1	10.2	8.7	6.9	4.9	3.1	2.2
400	66.8	16.5	13.1	10.7	8.0	4.7	3.0	2.0
450	69.2	11.5	8.9	7.6	5.9	4.3	2.8	2.0
500								
$\bar{x}$	67.4	12.8	10.3	8.7	6.8	4.9	3.3	2.3
s	3.1	4.4	3.4	2.7	1.9	1.2	0.8	0.4

Table E15. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	93.8	15.8	13.0	11.5	9.4	7.2	5.1	3.5
50	93.8	8.7	5.1	4.4	4.1	3.5	2.8	2.2
100	95.6	10.6	8.9	8.0	6.9	5.4	4.0	2.8
150	87.5	20.2	16.5	14.2	11.1	8.1	5.6	3.8
200	86.7	21.7	16.8	14.3	11.2	8.0	5.3	3.7
250	94.6	24.4	19.4	16.3	12.3	8.7	6.0	4.2
300	88.8	19.2	15.7	13.6	11.1	8.5	6.1	4.1
350	90.2	16.0	13.5	11.8	9.4	6.9	4.4	3.2
400	89.9	21.9	17.0	14.3	11.0	6.9	4.4	3.1
450	91.7	15.0	12.1	10.4	8.3	6.1	4.3	3.0
500								
$\bar{x}$	91.3	17.4	13.8	11.9	9.5	6.9	4.8	3.4
s	3.1	5.1	4.3	3.5	2.5	1.6	1.0	0.6

Table E15. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	122.1	21.8	18.1	16.0	13.1	10.3	7.4	5.1
50	124.5	9.7	7.1	6.4	5.9	5.0	4.1	3.1
100	126.1	14.9	12.5	11.3	9.8	7.9	5.8	4.2
150	113.5	26.9	22.0	19.1	15.1	11.2	7.9	5.6
200	115.4	28.2	22.0	18.7	14.7	10.4	6.9	4.6
250	124.5	31.6	25.3	21.5	16.4	11.9	8.3	5.9
300	116.6	26.2	21.6	18.8	15.5	12.0	8.5	5.9
350	119.2	21.3	18.9	15.9	13.0	9.7	6.5	4.8
400	121.4	27.9	22.0	18.8	14.8	9.7	6.5	4.5
450	120.0	19.9	16.3	14.2	11.5	8.7	6.1	4.4
500								
$\bar{x}$	120.3	22.8	18.6	15.1	13.0	9.7	6.8	4.8
s								

Table E15. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	154.1	27.0	22.4	20.0	16.8	13.1	9.5	6.6
50	149.6	14.6	9.4	8.2	7.5	6.5	5.2	4.1
100	157.0	18.7	15.7	14.3	12.4	10.0	7.5	5.4
150	148.3	32.6	26.5	23.2	18.6	13.9	9.8	7.0
200	143.1	34.5	26.9	23.1	18.5	13.4	9.2	6.5
250	151.9	37.1	29.7	25.9	19.6	14.4	10.1	7.2
300	146.7	32.4	26.9	23.5	19.5	15.0	10.7	7.5
350	150.6	26.1	24.1	19.4	16.0	12.1	8.4	6.2
400	150.0	32.9	26.5	22.5	18.1	12.2	8.3	5.9
450	151.0	23.9	19.8	17.3	14.1	10.9	7.8	5.7
500								
$\bar{x}$	150.2	28.0	22.8	19.7	16.1	12.2	8.6	6.2
s	3.8	7.3	6.2	5.3	3.8	2.5	1.6	1.0

Table E16. SR 2, MP 159.6 - FWD Data, 08/17/83, Surface Temperature = 72°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	80.1	42.1	28.9	19.4	12.4	7.0	4.1	2.8
50	89.5	35.8	26.6	19.6	14.7	9.6	6.1	4.0
100	88.2	35.4	25.6	18.5	12.2	7.6	4.8	3.4
150	87.9	34.3	23.9	17.3	11.4	7.2	4.7	3.3
200	92.2	25.9	17.9	12.8	9.2	6.4	4.4	3.2
250	98.0	21.0	14.6	11.0	7.8	5.8	4.0	2.8
300	97.6	19.6	13.5	9.6	6.5	4.7	3.6	2.7
350	94.6	20.7	13.5	9.4	6.6	4.7	3.1	2.4
400	94.1	28.2	18.3	13.4	9.4	6.3	4.6	3.1
450	88.0	34.3	23.9	17.2	11.4	7.4	4.8	3.3
500	89.2	35.7	26.6	20.4	14.6	9.6	5.7	4.1
$\bar{x}$	90.6	30.5	21.4	15.4	10.6	7.0	4.5	3.2
s	5.0	7.2	5.5	4.0	2.8	1.6	0.8	0.5

Table E16. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	123.1	48.1	36.7	28.5	21.2	14.1	9.1	6.1
50	121.6	47.1	34.5	25.9	17.6	11.2	7.0	5.1
100	120.9	45.5	32.5	24.3	16.5	10.8	7.3	5.1
150	128.0	34.9	24.8	18.3	13.5	9.5	6.6	4.7
200	134.7	27.7	19.8	15.1	11.1	8.3	5.8	4.2
250	134.8	26.2	18.5	13.7	9.7	7.0	6.1	4.1
300	128.3	27.2	18.3	13.4	9.7	6.9	4.7	3.5
350	129.5	37.3	25.2	18.9	13.8	9.3	6.2	4.1
400	119.5	43.3	31.5	23.4	16.2	10.5	6.8	4.6
450	119.5	45.2	32.6	24.2	16.7	11.1	7.4	5.2
500								
$\bar{x}$	126.0	38.2	27.4	20.6	14.6	9.9	6.7	4.7
s	5.9	8.8	7.0	5.4	3.7	2.2	1.2	0.7

Table E17. SR 2, MP 159.6 - FWD Data, 01/10/84, Surface Temperature = 34°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	76.3	6.8	3.6	2.5	2.2	1.8	1.4	1.1
50	76.7	9.4	5.9	4.4	3.6	3.0	2.3	1.9
100	75.8	8.4	4.5	3.5	3.0	2.5	2.0	1.6
150	75.5	7.4	4.4	3.2	2.6	2.2	1.9	1.4
200	77.5	8.0	4.2	3.1	2.6	2.3	1.8	1.4
250	77.5	6.9	3.2	2.7	2.3	2.0	1.6	1.3
300	76.8	6.3	3.4	2.4	2.1	1.8	1.5	1.2
350	76.9	6.9	3.7	2.2	1.8	1.6	1.3	1.1
400	76.1	7.4	4.5	3.2	2.4	1.9	1.4	1.2
450	76.9	6.0	3.9	3.0	2.6	2.2	1.8	1.4
500	76.9	6.3	3.8	2.9	2.6	2.2	1.9	1.4
$\bar{x}$	76.6	7.3	4.1	3.0	2.5	2.1	1.7	1.4
s	0.6	1.0	0.8	0.6	0.5	0.4	0.8	0.2

Table E17. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	104.6	9.1	5.2	3.7	3.3	2.6	2.1	1.6
50	110.1	13.1	8.7	6.6	5.5	4.5	3.5	2.8
100	108.6	11.6	6.8	5.4	4.6	3.8	3.0	2.4
150	107.4	10.8	6.4	5.0	4.0	3.3	2.8	2.2
200	110.4	11.3	6.2	4.8	4.0	3.4	2.8	2.2
250	110.3	10.0	4.6	4.1	3.5	2.9	2.4	
300	110.9	8.9	4.8	3.5	3.0	2.7	2.2	1.9
350	108.8	9.1	5.0	3.2	2.7	2.3	1.9	1.6
400	109.5	10.9	6.8	4.9	3.8	3.0	2.2	1.8
450	108.6	8.6	5.8	4.5	3.9	3.3	2.7	2.1
500	108.0	9.1	5.5	4.5	3.9	3.4	2.8	2.2
$\bar{x}$	108.8	10.2	6.0	4.6	3.9	3.2	2.7	2.1
s	1.8	1.4	1.2	1.0	0.8	0.6	0.6	0.4

Table E17. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	140.4	13.0	7.8	5.7	4.9	4.0	3.2	2.5
50	151.8	18.6	12.7	9.9	8.2	6.7	5.3	4.2
100	149.4	16.8	10.1	8.1	6.8	5.6	4.5	3.5
150	147.1	15.1	9.5	7.3	5.9	5.0	4.1	3.3
200	151.0	15.8	9.1	7.1	5.9	5.0	4.0	3.2
250	151.8	14.0	6.9	6.0	5.1	4.3	3.5	3.0
300	154.8	12.4	6.9	5.3	4.5	3.8	3.4	2.7
350	148.6		7.0	4.8	4.0	3.5	2.9	2.3
400	152.1	15.5	10.0	7.4	5.8	4.5	3.4	2.7
450	149.0	12.4	8.5	6.8	5.8	4.9	3.9	3.2
500	147.3	13.0	8.2	6.8	5.8	5.0	4.1	3.3
$\bar{x}$	149.4	14.7	8.8	6.8	5.7	4.8	3.8	3.1
s	3.8	2.1	1.8	1.4	1.2	0.9	0.7	0.5

Table E17. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	172.2	16.4	10.2	7.5	6.4	5.2	4.1	3.3
50	187.9	23.8	16.6	13.0	10.8	8.9	7.0	5.4
100	185.5	21.6	13.4	10.7	9.0	7.4	5.9	4.6
150	183.5	19.4	12.4	9.6	7.8	6.4	5.3	4.2
200	186.2	19.8	11.8	9.3	7.7	6.4	5.2	4.2
250	187.0	17.1	9.0	7.8	6.7	5.6	4.6	3.8
300	194.3	15.6	8.9	6.8	5.8	5.0	4.2	3.5
350	185.5	15.2	8.8	6.2	5.2	4.5	3.7	3.1
400	187.5	19.5	13.0	9.6	7.5	5.8	4.4	3.5
450	184.3	15.8	11.2	8.8	7.6	6.4	5.2	4.0
500	182.8	16.6	10.8	8.8	7.6	6.6	5.5	4.3
$\bar{x}$	185.2	18.3	11.5	8.9	7.5	6.2	5.0	4.0
s	5.3	2.8	2.4	1.9	1.5	1.2	0.9	0.7

Table E18. SR 2, MP 159.6 - FWD Data, 02/21/84, Surface Temperature = 42°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	64.3	36.2	25.5	17.1	10.1	5.5	3.1	2.2
50	66.8	33.4	23.8	16.9	11.0	6.7	4.4	3.2
100	65.7	33.0	23.0	15.6	9.3	5.3	3.5	2.8
150	67.3	28.1	19.8	13.4	8.1	4.8	3.1	2.4
200	71.4	25.7	17.2	12.2	8.1	5.3	3.6	2.6
250	75.7	21.2	13.0	9.8	6.7	4.4	3.0	2.4
300	77.2	18.8	12.7	8.5	5.5	3.8	2.7	2.1
350	78.5	18.2	12.8	8.5	5.6	3.8	2.7	2.0
400	76.4	25.5	17.6	12.6	8.2	5.4	3.7	2.6
450	70.1	30.6	20.9	13.6	8.1	5.3	3.6	2.5
500	68.1	35.8	23.8	15.8	9.5	5.9	4.0	2.9
$\bar{x}$	71.0	27.9	19.1	13.1	8.2	5.1	3.4	2.5
s	5.1	6.5	4.8	3.1	1.8	0.9	0.5	0.4

Table E18. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	86.3	50.5	35.0	24.5	14.8	7.9	4.4	3.0
50	94.3	44.6	32.3	23.9	15.7	9.9	6.5	4.5
100	89.2	43.5	30.7	21.3	13.3	7.7	5.2	4.0
150	92.7	37.5	26.7	18.3	11.8	7.1	4.6	3.5
200	97.9	34.3	22.9	16.7	11.2	7.4	5.0	3.6
250	103.7	28.5	17.4	13.3	9.3	6.2	4.3	3.4
300	103.8	24.5	16.7	11.7	7.8	5.4	4.0	3.0
350	103.2	23.7	16.6	11.4	7.8	5.4	3.7	2.8
400	100.8	34.4	23.5	17.0	11.4	7.7	5.1	3.5
450	93.5	38.7	26.9	18.2	11.1	7.2	5.0	3.3
500	87.8	45.1	30.0	20.9	13.1	8.3	5.7	3.9
$\bar{x}$	95.7	36.8	25.3	17.9	11.6	7.3	4.9	3.5
s	6.5	8.8	6.5	4.5	2.6	1.3	0.8	0.5

Table E18. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	112.2	70.8	50.7	35.7	22.0	11.5	6.3	4.2
50	122.6	59.6	43.8	33.2	22.8	14.5	9.8	6.5
100	119.8	57.7	41.3	29.5	18.9	11.3	7.7	5.8
150	127.1	50.6	36.7	25.2	16.9	10.4	6.8	5.2
200	131.3	45.8	31.5	23.2	16.2	10.8	7.2	5.3
250	138.3	37.4	23.4	18.2	13.0	8.9	6.3	5.0
300	141.6	32.5	22.4	16.2	11.1	7.9	5.7	4.3
350	138.0	30.8	22.0	15.7	11.0	7.6	5.4	3.9
400	139.4	45.3	31.7	23.4	15.9	10.7	7.1	4.8
450	129.5	49.8	35.4	24.8	15.5	10.2	7.0	4.3
500	121.9	58.0	39.3	28.1	18.2	11.9	8.2	5.5
$\bar{x}$	129.2	48.9	34.4	24.8	16.5	10.5	7.0	5.0
s	9.5	12.3	9.3	6.5	3.9	1.9	1.2	0.8

Table E18. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	146.1	90.8	64.9	45.0	30.0	15.1	8.0	5.4
50	151.0	72.6	54.2	37.8	28.6	18.6	12.3	8.1
100	148.4	70.3	51.3	36.7	24.3	14.5	10.1	7.4
150	155.7	61.8	45.4	31.5	21.5	13.3	8.8	6.6
200	162.0	55.9	39.2	29.2	20.4	14.0	9.4	6.9
250	168.1	45.5	28.8	22.7	16.3	11.5	8.2	6.5
300	169.9	39.1	27.3	20.1	14.3	10.2	7.4	5.6
350	169.6	37.4	26.9	19.6	13.9	9.8	7.0	5.1
400	169.9	54.4	38.8	29.0	19.9	13.5	9.0	6.0
450	158.0	58.9	49.6	30.6	19.4	13.0	8.7	5.4
500	147.1	68.7	47.0	34.3	22.7	14.0	10.6	7.0
$\bar{x}$	158.7	59.6	43.0	30.6	21.0	13.4	9.0	6.4
s	9.7	15.8	12.2	7.8	5.2	2.4	1.5	0.9

Table E19. SR 2, MP 159.6 - FWD Data, 03/01/84, Surface Temperature = 48°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	60.5	36.5	23.3	15.4	9.0	5.0	2.9	1.9
50	66.2	31.6	22.2	16.5	11.0	6.9	4.3	3.0
100	68.1	39.8	26.9	18.3	10.9	6.1	3.9	3.0
150	68.8	36.9	26.7	18.9	11.6	6.5	4.0	2.9
200	80.1	24.0	16.3	11.6	7.8	5.2	3.5	2.7
250	80.8	19.9	12.4	9.4	6.9	4.5	3.1	2.4
300	80.9	20.6	14.0	9.2	5.7	3.9	2.9	2.2
350	77.9	17.6	11.7	7.9	5.3	3.7	2.7	2.0
400	71.1	24.8	15.6	10.7	7.0	4.7	3.1	2.1
450	64.6	42.9	28.6	19.1	10.9	5.9	3.4	2.3
500	65.0	41.7	30.4	19.9	11.8	6.3	4.0	2.8
$\bar{x}$	71.3	30.6	20.7	14.3	8.9	5.3	3.4	2.5
s	7.4	9.5	6.9	4.6	2.4	1.1	0.5	0.4

Table E19. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	82.8	50.6	34.9	23.0	13.5	7.3	4.2	2.8
50	88.3	43.5	30.8	23.4	15.8	10.0	6.3	4.3
100	90.8	51.4	35.1	24.9	14.9	8.7	5.7	4.1
150	92.0	47.6	34.4	24.7	15.6	8.9	5.9	4.2
200	102.8	31.7	21.6	15.9	10.9	7.3	4.9	3.5
250	105.0	26.1	16.4	12.8	9.3	6.2	4.3	3.4
300	108.3	24.5	17.1	12.1	8.1	5.7	4.1	3.1
350	107.4	25.6	15.9	10.9	7.4	5.1	3.6	2.8
400	101.4	31.7	20.7	14.8	9.9	6.7	4.4	2.9
450	89.3	47.2	32.9	23.5	14.4	8.5	5.0	3.5
500	86.3	51.4	36.9	26.0	16.0	8.9	5.6	3.9
$\bar{x}$	95.9	39.2	27.0	19.3	12.3	7.6	4.9	3.5
s	9.2	11.2	8.6	5.9	3.3	1.5	0.9	0.6

Table E19. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	108.9	70.8	49.7	34.2	20.4	11.1	6.2	4.1
50	114.7	59.0	42.3	32.4	22.5	14.5	9.1	6.2
100	118.2	67.3	47.1	34.5	21.4	12.6	8.3	5.9
150	117.0	62.3	48.8	33.3	21.4	12.6	8.3	5.7
200	128.4	41.7	28.9	21.7	15.2	10.2	6.9	5.1
250	144.4	35.7	22.2	17.4	12.6	8.6	6.2	5.0
300	141.0	31.9	22.4	16.4	11.5	8.1	5.9	4.5
350	139.4	33.1	21.2	15.3	10.6	7.3	5.2	3.9
400	137.0	42.3	28.3	20.9	14.3	9.7	6.3	4.0
450	120.3	60.6	42.8	31.2	19.5	11.9	7.1	4.7
500	115.1	65.9	50.5	34.2	22.0	12.7	8.1	5.5
$\bar{x}$	125.8	51.9	36.7	26.7	17.4	10.8	6.9	5.0
s	12.6	15.0	12.1	7.6	4.6	2.2	1.0	0.8

Table E19. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	134.5	89.7	60.9	44.0	27.1	14.8	8.1	5.5
50	138.3	73.1	53.4	40.7	29.1	18.8	11.9	8.0
100	135.4	81.6	57.9	43.2	26.8	16.3	10.6	7.6
150	135.8	75.0	53.7	40.0	26.6	16.3	10.2	7.3
200	152.9	50.7	35.5	27.0	19.2	13.1	8.9	6.4
250	169.4	41.8	27.1	21.1	15.6	10.8	7.9	6.1
300	171.7	38.1	27.3	20.4	14.4	10.3	7.7	5.8
350	168.3	39.6	26.2	18.9	13.5	9.5	6.8	5.1
400	165.7	51.7	35.1	26.3	18.4	12.8	8.2	5.1
450	147.4	72.4	51.7	38.4	24.8	15.1	9.0	5.6
500	142.0	79.1	70.5	42.2	28.7	16.5	10.4	6.9
$\bar{x}$	151.0	63.0	45.4	32.9	22.2	14.0	9.1	6.3
s	15.1	18.8	15.6	10.1	6.0	2.9	1.5	1.0

Table E20. SR 2, MP 159.6 - FWD Data, 03/07/84, Surface Temperature = 60°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	57.3	36.7	22.9	15.9	9.4	5.3	3.2	2.2
50	65.3	28.3	20.6	15.0	10.3	6.7	4.3	3.0
100	62.3	27.4	19.4	13.6	8.3	5.2	3.5	2.5
150	63.4	26.2	17.2	12.5	8.0	5.1	3.5	2.5
200	67.0	21.2	13.7	11.9	6.7	4.6	3.2	2.3
250	71.0	17.7	12.2	8.3	5.9	4.2	2.9	2.2
300	73.3	17.9	10.9	7.6	5.2	3.7	2.8	2.1
350	69.9	18.5	11.3	7.7	5.2	3.6	2.6	2.0
400	70.5	23.8	15.5	10.9	7.4	5.0	3.2	2.2
450	65.7	28.1	18.9	13.2	8.6	5.6	3.6	2.5
500	66.2	29.4	19.5	13.3	8.7	5.6	3.7	2.7
$\bar{x}$	66.2	25.0	16.6	11.8	7.6	4.8	3.3	2.4
s	4.5	5.9	4.1	2.9	1.7	0.7	0.5	0.3

Table E20. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	76.0	51.1	32.9	23.6	14.3	7.9	4.6	3.1
50	85.6	39.7	28.5	20.4	14.9	9.8	6.2	4.2
100	88.5	39.3	27.2	18.3	12.1	7.6	5.0	3.6
150	89.5	37.3	25.2	17.6	11.9	7.7	5.2	3.7
200	94.5	29.9	19.4	13.3	9.9	6.7	4.6	3.4
250	96.9	24.4	16.7	11.2	8.5	6.1	4.3	3.2
300	100.1	24.5	15.0	10.7	7.6	5.4	4.0	3.0
350	96.2	24.9	15.2	10.8	7.4	5.2	3.6	2.7
400	96.2	32.2	20.9	15.5	10.4	7.0	4.4	3.0
450	88.9	37.6	25.6	17.3	12.1	7.7	4.9	3.4
500	88.3	39.2	26.4	18.7	12.4	8.0	5.4	3.7
$\bar{x}$	91.0	34.6	23.0	16.1	11.0	7.2	4.7	3.4
s	6.8	8.3	5.9	4.2	2.5	1.3	0.7	0.4

Table E20. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	105.0	70.8	42.2	31.5	21.3	11.9	7.0	4.5
50	114.7	53.6	39.1	27.8	21.4	14.2	9.1	6.0
100	122.2	53.5	34.6	25.4	17.6	11.1	7.4	5.4
150	120.2	51.0	32.9	23.9	17.3	11.2	7.6	5.2
200	127.0	40.3	26.4	18.6	14.3	9.8	6.8	4.8
250	128.2	32.6	22.5		12.2	8.7	6.2	4.6
300	130.8	31.9	20.2	15.0	10.8	7.8	5.7	4.3
350	127.7	32.5	20.6	15.1	10.7	7.4	5.2	3.8
400	128.9	42.4	28.3	20.6	14.8	10.1	6.3	4.1
450	118.3	50.1	34.0	23.4	17.3	10.9	7.0	4.7
500	117.3	52.1	35.3	23.9	17.7	11.3	7.6	5.2
$\bar{x}$	121.8	46.4	30.6	22.7	15.9	1.04	6.9	4.8
s	7.8	11.9	7.5	5.0	3.7	1.9	1.1	0.6

Table E20. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	136.0	91.0	64.9	42.4	28.7	16.1	93.	5.9
50	136.3	66.7	46.1	34.3		18.5	11.9	7.9
100	136.8	65.2	41.5	30.4	22.3	14.4	9.7	7.0
150	144.8	63.2	41.5	30.3	22.3	14.5	9.9	6.8
200	153.5	49.5	33.2	23.3	18.3	12.7	8.9	6.3
250	163.0	40.2	28.1	19.6	15.7	11.4	8.1	6.0
300	158.3	38.3	24.9	18.4	13.8	10.0	7.5	5.6
350	156.5	39.3	25.2	18.4	13.6	9.6	6.9	5.0
400	154.5	50.7	34.6	25.2	18.5	12.8	7.9	5.1
450	143.8	61.2	38.3	29.1	21.8	13.8	8.9	6.1
500	141.9	63.7	38.5	30.3	22.4	14.4	9.7	6.5
$\bar{x}$	147.8	57.2	37.9	27.4	19.7	13.5	9.0	6.2
s	9.7	15.7	11.3	7.4	4.7	2.6	1.4	0.8

Table E21. SR 2, MP 159.6, FWD Data, 03/21/84, Surface Temperature = 49°F.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	56.3	33.4	21.6	14.0	8.2	4.5	2.7	1.9
50	64.7	28.8	21.5	15.2	10.4	6.6	4.2	2.9
100	64.3	27.8	19.1	13.4	8.5	5.2	3.6	2.5
150	65.3	26.2	17.4	12.3	8.4	5.3	3.6	2.5
200	69.1	20.2	13.7	9.8	6.5	4.4	3.0	2.2
250	68.8	18.3	12.6	8.3	6.2	4.2	2.9	2.2
300	69.2	16.5	10.9	7.3	4.9	3.5	2.7	2.0
350	71.7	16.7	10.2	7.1	4.8	3.4	2.6	1.9
400	68.5	21.9	15.4	10.4	7.2	4.8	3.1	2.2
450	64.3	26.9	17.3	12.4	8.4	5.4	3.4	2.4
500	64.2	25.2	17.7	11.3	8.1	5.2	3.5	2.5
$\bar{x}$	66.0	23.8	16.1	11.0	7.4	4.8	3.2	2.3
s	4.1	5.5	3.9	2.7	1.7	0.9	0.5	0.3

Table E21. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	77.0	47.5	30.9	21.5	12.8	6.8	3.9	2.6
50	90.6	40.3	30.0	21.9	15.2	9.8	6.3	4.3
100	91.8	39.5	27.3	19.4	12.4	7.6	5.2	3.6
150	90.4	36.1	24.4	17.8	12.2	7.8	5.2	3.6
200	99.0	28.9	19.5	14.5	9.8	6.6	4.5	3.3
250	100.4	25.7	17.4	12.1	9.1	6.2	4.3	3.2
300	100.2	23.0	15.2	10.7	7.4	5.2	3.9	3.0
350	100.4	24.0	14.2	10.5	6.9	4.9	3.7	2.7
400	97.0	31.0	21.0	15.1	10.3	6.9	4.5	3.0
450	89.9	37.4	24.5	17.8	12.2	7.8	4.9	3.3
500	89.6	35.4	24.8	14.4	11.9	7.8	5.2	3.6
$\bar{x}$	93.3	33.5	22.6	16.0	10.9	7.0	4.7	3.3
s								

Table E21. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	107.0	66.1	43.2	29.6	19.0	10.2	5.7	3.8
50	125.5	54.8	40.4	31.0	21.7	14.1	9.5	6.1
100	123.7	53.9	32.9	27.9	17.9	11.1	7.6	5.2
150	123.1	48.9	32.2	25.1	17.5	11.3	7.6	5.2
200	133.6	39.2	26.6	20.4	14.2	9.6	6.7	4.8
250	136.5	34.3	23.7	17.1	13.0	9.0	6.3	4.8
300	134.5	30.8	20.8	15.1	10.7	7.7	5.8	4.3
350	134.5	31.6	19.3	14.6	10.3	7.2	5.2	3.8
400	134.2	42.0	28.4	21.2	14.8	10.0	6.4	4.1
450	124.4	51.0	33.0	25.4	17.6	11.2	7.1	4.8
500	121.6	48.3	33.3	20.3	17.5	11.5	7.7	5.2
$\bar{x}$	127.1	45.5	30.3	22.5	15.8	10.3	6.9	4.7
s	8.7	11.0	7.5	5.7	3.6	1.9	1.2	0.7

Table E22. SR 172, MP 2.0, FWD Data, 08/17/83, Surface Temperature =75°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	82.0	37.7	23.0	14.8	8.6	5.0	3.3	2.5
50	79.8	32.8	21.9	15.7	9.4	5.0	3.5	2.4
100	73.6	59.4	38.3	24.6	13.4	6.3	3.9	3.0
150	75.3	48.1	31.1	20.4	11.7	6.3	4.2	3.2
200	72.8	45.0	29.9	19.9	11.8	6.7	4.0	3.0
250	72.3	53.9	35.9	24.4	14.5	7.4	4.3	3.0
300	72.4	52.7	36.6	24.7	14.6	8.1	4.9	3.4
350	74.3	57.2	38.2	25.5	15.0	7.4	4.6	3.4
400	73.1	67.0	43.7	29.1	16.3	8.3	4.5	3.0
450	74.1	55.0	37.7	26.5	15.9	8.5	5.1	3.6
500	72.0	43.1	31.9	24.7	17.2	10.8	6.9	5.0
$\bar{x}$	74.7	50.2	33.4	22.8	13.5	7.2	4.5	3.2
s	3.2	10.0	6.7	4.5	2.8	1.7	1.0	0.7

Table E22. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	111.8	48.0	30.7	20.4	12.1	7.0	4.7	3.7
50	108.0	45.0	30.9	22.1	13.8	7.6	5.0	3.5
100	105.7	82.0	53.7	34.3	19.1	9.1	5.8	4.5
150	107.6	66.2	44.3	28.9	17.4	9.6	6.5	4.9
200	104.4	61.1	42.3	27.7	17.7	10.1	6.2	4.5
250	103.7	75.0	50.9	33.8	21.4	11.0	6.3	4.3
300	101.4	71.9	51.5	35.0	23.4	11.9	7.1	4.8
350	105.0	77.8	53.3	36.5	20.5	10.7	6.3	4.2
400	105.9	91.0	60.7	40.9	23.6	11.8	6.3	4.2
450	107.4	76.6	52.5	37.1	22.3	11.5	6.8	4.8
500	103.1	54.3	40.3	31.0	21.6	13.6	8.8	6.6
$\bar{x}$	105.8	68.1	46.5	31.6	19.3	10.4	6.3	4.6
s	2.8	14.6	9.7	6.3	3.8	1.9	1.1	0.8

Table E23. SR 172, MP 2.0 - FWD Data, 01/10/84, Surface Temperature = 34°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	74.7	6.5	3.7	2.6	2.1	1.8	1.6	1.3
50	70.0	5.8	3.8	2.8	2.1	1.6	1.3	1.1
100	71.7	4.4	3.2	2.6	2.3	1.9	1.6	1.3
150	75.8	4.9	3.3	2.7	2.2	1.9	1.6	1.3
200	66.2	5.5	3.5	2.7	2.1	1.8	1.5	1.2
250	73.8	6.5	4.1	3.1	2.7	2.1	1.7	1.4
300	73.2	7.2	5.2	4.2	3.5	2.8	2.2	1.6
350	75.0	4.5	2.9	2.3	1.8	1.5	1.2	1.0
400	72.6	5.9	3.7	2.8	2.3	1.9	1.5	1.2
450	75.2	5.7	3.8	3.0	2.5	2.0	1.6	1.3
500	73.0	2.3	1.9	1.7	1.5	1.3	1.1	1.0
$\bar{x}$	72.8	5.4	3.6	2.8	2.3	1.9	1.5	1.2
s	2.8	1.3	0.8	0.6	0.5	0.4	0.3	0.2

Table E23. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	117.8	10.7	5.7	4.1	3.3	2.8	2.4	2.0
50	97.8	8.1	5.3	3.9	3.0	2.4	2.0	1.6
100	103.6	6.8	4.9	4.0	3.4	2.9	2.4	1.9
150	104.7	7.3	5.0	4.2	3.3	2.8	2.3	1.9
200	95.0	8.1	5.2	4.1	3.2	2.6	2.2	1.8
250	107.1	9.8	6.2	5.1	4.2	3.4	2.7	2.1
300	106.0	11.2	8.1	6.6	5.5	4.4	3.3	2.6
350	108.6	7.1	4.5	3.7	2.9	2.4	1.9	1.5
400	104.0	9.3	5.8	4.4	3.5	2.8	2.2	1.7
450	102.0	8.0	5.5	4.4	3.6	3.0	2.4	1.9
500	99.6	3.8	2.8	2.5	2.3	2.0	1.7	1.4
$\bar{x}$	104.2	8.2	5.4	4.3	3.4	2.9	2.3	1.8
s	6.1	2.1	1.3	1.0	0.8	0.6	0.4	0.3

Table E23. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	162.9	16.2	8.7	6.2	4.9	4.1	3.4	2.9
50	132.3	11.8	7.7	5.8	4.4	3.5	2.9	2.3
100	141.1	10.5	7.4	6.1	5.1	4.3	3.5	2.8
150	139.6	11.0	7.6	6.1	5.0	4.1	3.4	2.9
200	130.6	12.1	7.8	6.2	5.0	4.0	3.3	2.7
250	149.8	14.7	9.8	8.0	6.6	5.3	4.1	3.2
300	150.0	17.5	12.7	10.6	8.6	6.8	5.3	3.9
350	151.8	11.0	7.1	5.7	4.6	3.7	2.9	2.3
400	145.6	14.2	9.0	7.1	5.5	4.4	3.3	2.6
450	137.4	11.8	8.3	6.7	5.5	4.5	3.6	2.8
500	136.4	5.6	4.2	3.7	3.3	3.0	2.6	2.2
$\bar{x}$	143.5	12.4	8.2	6.6	5.3	4.3	3.5	2.8
s	9.7	3.2	2.0	1.7	1.3	1.0	0.7	0.5

Table 23. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	188.1	21.2	11.5	8.1	6.3	5.4	4.5	3.7
50	163.9	15.8	10.1	7.7	5.8	4.6	3.8	3.1
100	174.6	13.9	9.9	8.1	6.7	5.7	4.6	3.7
150	165.8	14.4	10.0	8.3	6.6	5.4	4.5	3.7
200	168.3	15.8	10.5	8.3	6.6	5.3	4.3	3.5
250	185.1	19.2	13.0	10.6	8.7	7.0	5.4	4.2
300	183.7	23.3	17.2	14.2	11.4	9.0	7.0	5.2
350	186.8	14.4	9.5	7.6	6.0	4.8	3.8	3.1
400	177.6	18.7	11.9	9.4	7.3	5.7	4.4	3.4
450	166.4	15.2	11.0	8.8	7.1	5.6	4.6	3.7
500	170.4	7.2	5.5	4.8	4.3	3.9	3.3	2.8
$\bar{x}$	175.5	16.3	10.9	8.7	7.0	5.7	4.6	3.6
s	9.2	4.3	2.8	2.3	1.8	1.4	1.0	0.6

Table E24. SR 172, MP 2.0 - FWD Data, 03/01/84, Surface Temperature = 46°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	62.0	39.9	24.6	16.2	8.7	4.4	3.1	2.6
50	61.7	28.0	21.1	16.8	11.6	6.6	3.3	2.0
100	57.2	52.1	38.3	29.9	19.9	10.1	4.3	2.8
150	54.3	74.7	55.5	42.6	27.8	13.4	5.2	3.5
200	56.5	43.5	29.9	21.8	13.2	6.3	3.3	2.3
250	56.0	57.7	40.1	28.7	16.7	7.4	3.7	3.0
300	52.6	89.7	70.9	52.4	36.5	18.8	7.6	4.4
350	49.8	89.9	68.3	51.2	32.2	14.2	4.3	2.9
400	54.3	72.7	56.6	44.1	27.9	12.8	4.1	2.3
450	57.3	46.0	31.9	22.4	12.6	5.6	3.6	2.4
500	63.3	37.1	26.4	20.5	13.9	8.0	4.8	3.5
$\bar{x}$	56.8	57.4	42.1	31.5	20.1	9.8	4.3	2.9
s	4.2	21.4	17.8	13.6	9.4	4.5	1.3	0.7

Table E24. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	83.7	50.6	32.0	21.0	11.5	5.9	4.1	3.5
50	76.4	37.1	28.3	22.1	15.3	8.9	4.6	2.8
100	77.5	66.2	48.3	37.5	25.1	13.2	6.1	4.1
150	78.2	90.4	67.0	51.3	33.5	16.4	6.9	4.8
200	79.4	56.2	39.1	28.7	17.8	9.0	4.8	3.6
250	78.3	73.3	51.5	36.6	22.0	10.1	5.0	4.0
300	75.4	99.1	84.1	65.9	46.2	24.7	10.5	6.0
350	72.3		80.9	64.5	40.8	18.5	6.0	4.0
400	75.4	89.7	66.9	54.3	35.4	16.3	5.4	3.0
450	77.5	58.7	39.9	28.5	16.1	6.9	4.4	4.1
500	89.0	46.7	34.7	25.6	17.2	9.8	6.1	4.4
$\bar{x}$	78.5	66.8	52.1	39.6	25.5	12.7	5.8	4.0
s	4.5	20.8	19.7	16.6	11.6	5.7	1.8	0.9

Table E24. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	109.0	64.9	40.8	27.6	16.1	8.5	5.9	5.1
50	104.7	51.6	40.8	30.8	21.3	12.4	6.6	4.1
100	111.1	88.1	74.3	51.6	33.2	17.8	8.6	5.8
150	112.4	88.0	68.8	58.0	42.8	21.2	9.7	6.9
200	112.7	75.0	52.4	36.3	24.6	13.0	7.0	5.6
250	110.0	97.3	69.8	47.7	30.9	14.2	7.2	5.7
300	108.8		111.1	87.5	60.7	33.0	14.4	8.5
350	104.6	113.9	95.2	79.3	52.0	23.4	7.5	4.9
400	104.8	115.5	101.7	83.6	45.7	21.3	7.1	4.1
450	112.4	76.7	53.5	32.4	20.8	8.6		5.5
500	119.8	58.6	49.9	31.9	21.3	12.2	7.6	5.5
$\bar{x}$	110.0	83.0	68.9	51.5	33.6	16.9	7.9	5.6
s	4.5	21.8	24.6	22.7	14.7	7.4	2.4	1.2

Table E24. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	132.9	78.3	47.5	33.5	20.2	10.9	7.8	6.7
50	135.5	65.5	48.0	41.7	27.1	15.8	8.6	5.3
100	143.6	88.0	78.6	60.9	40.5	21.9	10.9	7.5
150	144.7	83.3	72.6	56.4	51.1	25.6	12.5	8.8
200	144.1	92.0	67.2	44.9	30.7	16.4	9.3	7.3
250	140.9	93.1	84.4	59.5	39.1	17.9	9.1	7.2
300	140.6		89.5	80.7	73.9	40.2	18.2	10.1
350	137.7	126.5	90.0	74.3	60.7	27.0	8.5	6.1
400	132.9	118.3		86.9	54.9	25.2	7.8	4.7
450	148.4	94.3	64.4	44.7	24.6	9.9	6.4	6.1
500	145.8	69.0	49.1	48.1	25.4	14.3	8.9	6.7
$\bar{x}$	140.6	90.8	69.1	57.4	40.7	20.5	9.8	7.0
s	5.3	19.4	16.8	17.1	17.4	8.8	3.2	1.5

Table E25. SR 172, MP 2.0 - FWD Data, 03/07/84, Surface Temperature = 60°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	60.8	37.6	21.5	14.7	7.9	3.5	3.1	1.9
50	60.8	35.3	24.4	18.3	11.3	5.6	3.1	2.4
100	55.0	53.0	37.2	27.0	15.7	6.7	3.1	2.6
150	54.9	49.6	31.1	21.8	11.9	5.9	3.7	2.8
200	57.2	37.6	24.8	17.6	10.5	5.5	3.3	2.4
250	55.5	46.7	33.1	23.3	13.6	6.7	3.7	2.6
300	52.6	72.3	52.8	40.1	25.6	12.8	5.7	3.3
350	52.1	87.6	55.6	40.9	23.0	8.9	3.3	3.1
400	51.1	92.6	66.5	45.1	29.9	11.9		3.1
450	53.6	54.9	39.2	28.0	16.8	8.4	3.9	2.9
500	53.1	43.0	30.6	23.2	15.2	16.1	4.9	3.6
$\bar{x}$	55.2	55.5	37.9	27.3	16.5	8.4	3.8	2.8
s	3.3	20.0	14.5	10.3	6.9	3.8	0.9	0.5

Table E25. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	82.8	47.7	28.9	19.4	11.2	6.4	3.9	3.4
50	81.5	46.7	31.6	24.1	15.1	7.8	4.3	3.0
100	74.6	71.2	50.2	24.7	21.3	9.1	4.1	3.4
150	74.4	65.4	41.8	30.3	17.0	8.2	5.1	4.0
200	76.2	49.8	33.4	23.9	14.5	7.7	4.5	3.3
250	75.4	63.5	44.6	32.0	18.9	9.3	5.0	3.5
300	72.5	96.0	59.4	49.9	35.6	18.2	7.9	4.3
350	70.4	140.0	82.2	49.8	29.6	11.7	4.1	4.0
400	70.4	108.6	83.9	51.9	37.9	14.6		3.3
450	72.1	73.0	46.4	37.3	22.1	10.3	5.1	4.3
500	73.3	55.1	38.7	29.4	19.1	9.3	6.1	4.4
$\bar{x}$	74.9	74.3	49.2	34.8	22.0	10.2	5.0	3.7
s	4.1	29.3	18.9	11.3	8.7	3.4	1.2	0.5

Table E25. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	113.0	63.0	39.4	24.4	15.2	8.5	5.8	4.7
50	106.7	63.1	40.1	31.6	2.09	11.0	5.7	4.0
100	102.8	96.1	70.5	48.9	29.0	12.6	5.9	4.7
150	104.7	88.8	59.9	39.1	24.1	11.9	7.3	5.7
200	104.8	68.2	42.6	33.0	20.7	11.1	6.5	4.8
250	104.8	86.9	54.1	43.3	26.6	13.0	6.9	4.8
300	102.4	107.4		71.3	49.7	25.7	10.9	5.8
350	98.8	98.3	86.3	55.2	39.2	15.4	5.2	4.9
400	99.0	108.3	88.5	64.8	48.5	18.1	3.9	3.4
450	102.4	99.7	64.1	48.8	30.2	13.4	6.3	5.0
500	103.7	70.4	43.9	35.7	24.0	13.0	7.4	5.7
$\bar{x}$	103.9	86.4	58.9	45.1	29.8	14.0	6.5	4.9
s	3.8	17.3	18.4	14.4	11.3	4.6	1.8	0.7

Table E25. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	138.3	76.9	41.3	29.4	18.6	10.8	7.5	6.1
50	134.4	78.9	49.2	37.8	26.4	13.9	7.2	5.0
100	135.0	122.1	93.5	88.0	35.5	15.6	7.6	6.2
150	135.0	123.9	72.2	47.4	30.8	15.5	9.4	7.5
200	136.1	84.7	63.7	38.7	26.4	14.3	8.4	6.2
250	134.5	139.9	67.9	50.6	33.7	16.5	8.7	6.1
300	130.0	129.4	97.8	94.3	62.6	32.9	14.1	7.0
350	125.8	94.4	90.7	80.3	46.9	18.4	6.1	5.8
400	124.1	115.7	88.4	78.1	57.4	21.0	4.1	3.3
450	131.5	108.9	95.2	60.6	37.3	16.0	7.1	5.7
500	134.8	81.6	54.9	40.6	27.6	14.8	8.6	6.7
$\bar{x}$	132.7	105.1	74.0	58.7	36.6	17.2	8.1	6.0
s	4.4	22.7	20.2	22.8	13.7	5.8	2.5	1.1

Table E26. SR 172, MP 2.0 - FWD Data, 03/21/84, Surface Temperature = 50°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	58.9	38.6	23.8	16.9	9.4	4.8	3.2	2.6
50	60.4	28.8	20.7	16.1	10.4	5.6	3.1	2.1
100	56.5	47.8	34.5	26.7	16.9	8.3	3.9	2.8
150	56.9	41.3	27.8	20.7	12.3	6.3	3.8	2.9
200	59.4	34.9	23.1	16.6	10.2	5.6	3.3	2.3
250	57.2	48.6	33.0	24.6	15.2	7.8	4.3	3.0
300	55.9	59.1	41.9	31.9	20.4	10.2	4.8	3.0
350	54.7	59.0	41.6	30.9	18.6	8.6	3.9	2.9
400	55.0	59.4	42.5	32.6	20.4	9.7	4.4	2.9
450	55.5	45.0	33.1	25.9	16.9	9.2	4.8	3.0
500	57.3	35.1	28.6	21.7	15.6	9.7	4.8	3.7
$\bar{x}$	57.1	45.2	31.9	24.0	15.1	7.8	1 4.0	2.8
s	1.8	10.7	7.8	6.2	4.0	1.9	0.6	0.4

Table E26. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	82.0	51.5	30.9	22.5	12.7	6.7	4.4	3.6
50	81.8	40.5	28.1	22.6	14.6	7.9	4.2	2.8
100	76.6	70.0	48.5	38.5	24.3	11.7	5.2	3.8
150	75.2	57.6	38.0	29.2	17.6	9.1	5.5	4.1
200	80.2	48.7	31.9	23.4	14.6	8.1	4.6	3.3
250	76.9	69.8	45.6	36.6	21.7	11.1	5.9	3.9
300	76.2	85.2	61.8	46.3	29.6	14.5	6.6	4.0
350	75.6	85.0	56.6	44.4	26.4	11.9	5.0	3.8
400	75.6	86.8	61.4	47.5	29.5	13.5	5.5	3.7
450	76.4	65.0	46.5	36.8	23.6	12.5	6.2	3.9
500	77.6	46.3	35.0	28.2	20.0	12.2	6.9	4.6
$\bar{x}$	77.6	64.2	44.0	34.2	21.3	10.8	5.4	3.8
s	2.5	16.7	12.2	9.5	6.0	2.5	0.9	0.4

Table E26. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	112.4	68.3	52.5	29.3	17.6	9.5	6.4	5.1
50	111.8	58.5	39.9	33.3	21.0	11.3	5.9	3.7
100	104.1	96.9	69.6	65.4	35.0	16.3	7.1	5.2
150	108.0	81.0	54.7	39.8	25.2	13.2	8.0	6.2
200	110.0	68.5	44.6	33.2	21.1	11.7	6.7	5.0
250	104.0	99.5		60.1	31.0	15.9	8.0	5.2
300	103.7	105.4	81.5	54.0	43.2	20.8	9.0	5.0
350	103.7	101.2	81.5	58.4	37.8	16.1	6.2	4.6
400	103.1	107.2	92.5	80.2	41.7	18.5	6.7	4.3
450	108.5	91.5	88.0	52.0	32.4	16.6	7.8	4.9
500	108.2	60.2	44.1	36.5	25.2	14.7	8.6	5.9
$\bar{x}$	107.0	85.3	64.9	49.3	30.1	15.0	7.3	5.0
s	3.5	18.6	20.0	16.2	8.7	3.3	1.0	0.7

Table E27. SR 172, MP 21.4 - FWD Data, 08/17/83, Surface Temperature =75°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	91.4	24.8	16.7	11.3	6.9	4.4	3.2	2.4
50	93.7	24.7	17.1	11.7	7.6	4.6	3.1	2.6
100	93.8	26.3	17.5	11.2	7.2	4.7	3.3	2.3
150	93.7	24.4	16.1	11.0	7.1	4.6	3.1	1.9
200	81.4	24.1	16.5	11.7	7.1	4.1	2.8	2.1
250	90.1	19.6	14.6	11.1	7.8	5.1	3.4	2.5
300	85.4	19.4	13.3	10.0	7.0	4.8	3.3	2.3
350	86.6	15.0	10.1	7.3	5.0	3.2	2.2	1.7
400	76.3	26.3	17.8	11.9	7.1	3.8	2.5	2.0
450	89.1	31.3	20.8	13.5	7.7	4.0	2.6	2.0
500	87.0	33.2	20.7	13.3	7.5	4.2	3.0	2.6
$\bar{x}$	88.0	24.5	16.5	11.3	7.1	4.3	3.0	2.2
s	5.5	5.2	3.1	1.6	0.8	0.5	0.4	0.3

Table E27. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	124.5	32.6	22.6	15.6	10.0	6.3	4.3	3.3
50	126.8	30.8	22.0	15.0	11.3	6.1	3.9	3.8
100	128.9	33.4	21.9	14.6	9.0	5.8	4.2	3.1
150	132.6	32.9	22.3	15.4	10.0	6.3	4.3	2.6
200	110.9	32.2	22.3	15.7	9.8	5.6	3.8	2.8
250	126.0	25.8	19.0	14.3	10.2	6.7	4.5	3.1
300	119.2	25.6	17.6	13.3	9.6	6.5	4.4	3.1
350	119.9	19.5	13.1	9.4	6.5	4.3	2.9	2.2
400	106.3	35.7	24.4	16.5	10.1	5.5	3.6	2.8
450	121.2	40.5	27.1	17.9	10.3	5.2	3.5	3.0
500	120.2	44.9	28.8	18.5	10.6	6.1	4.3	3.6
$\bar{x}$	121.5	32.2	21.9	15.1	8.5	5.8	4.0	3.0
s	7.7	7.0	4.3	2.4	2.2	0.7	0.5	0.4

Table E28. SR 172, MP 21.4 - FWD Data, 01/10/84, Surface Temperature = 34°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	77.2	12.8	7.1	5.0	3.6	2.9	2.3	1.6
50	80.8	10.4	5.9	4.0	2.7	2.2	1.8	1.4
100	69.4	10.5	6.9	4.9	3.5	2.6	1.8	1.3
150	78.0	12.4	7.2	4.8	3.4	2.5	1.9	1.2
200	71.0	6.8	4.6	3.5	2.6	1.9	1.4	1.0
250	70.3	5.5	3.8	3.9	2.2	1.7	1.4	1.1
300	72.7	5.2	3.3	2.5	1.9	1.6	1.3	1.1
350	71.2	5.9	4.0	2.9	2.1	1.6	1.2	0.9
400	69.4	8.0	5.3	4.0	2.9	2.1	1.6	1.2
450	67.7	7.7	4.9	3.2	2.4	2.0	1.5	1.2
500	67.4	9.3	5.2	3.2	2.4	2.1	1.7	1.3
$\bar{x}$	72.3	8.6	5.3	3.7	2.7	2.1	1.6	1.2
s	4.4	2.7	1.4	0.9	0.6	0.4	0.3	0.4

Table E28. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	110.4	17.2	10.0	7.3	5.4	4.4	3.3	2.4
50	114.7	14.8	8.8	6.1	4.4	3.6	2.8	2.3
100	102.5	15.8	10.4	7.6	5.4	4.0	2.9	2.0
150	113.8	18.7	11.1	7.6	5.3	4.0	2.8	1.7
200	97.5	10.2	6.9	5.3	4.0	2.8	2.1	1.5
250	100.4	7.9	5.3	4.1	3.1	2.4	1.9	1.5
300	102.0	7.1	4.5	3.3	2.7	2.2	1.9	1.5
350	100.2	8.3	5.6	4.0	3.0	2.3	1.8	1.3
400	96.5	11.0	7.6	5.8	4.3	3.3	2.4	1.8
450	100.4	10.4	6.8	4.8	3.7	3.0	2.3	1.8
500	96.7	12.4	7.2	4.9	3.8	3.3	2.6	2.0
$\bar{x}$	102.3	12.2	7.7	5.5	4.1	3.2	2.4	1.8
s	8.0	3.9	2.2	1.5	1.0	0.7	0.5	0.3

Table E28. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	146.7	23.6	14.3	10.7	7.8	6.4	4.8	3.6
50	157.1	21.2	12.6	8.8	6.4	5.2	4.0	3.2
100	139.7	22.7	15.1	11.1	8.0	6.0	4.3	3.0
150	154.5	26.6	16.2	11.5	8.0	6.0	4.2	2.6
200	131.4	15.2		7.9	6.0	4.3	3.1	2.3
250	137.6	11.5	7.7	6.0	4.7	3.6	2.9	2.3
300	141.4	10.2	6.5	5.1	3.9	3.2	2.7	2.3
350	137.9	12.1	8.0	6.1	4.6	3.5	2.6	1.9
400	131.3	16.0	11.1	8.5	6.4	5.0	3.5	2.7
450	139.4	14.8	10.0	7.1	5.5	4.5	3.4	2.7
500	132.1	17.4	10.5	7.3	5.6	5.0	4.0	3.0
$\bar{x}$	140.8	17.4	11.2	8.2	6.1	4.8	3.6	2.7
s	8.7	5.4	3.3	2.2	1.4	1.1	0.7	0.5

Table E23. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	181.0	29.6	18.1	12.8	10.2	8.0	6.4	4.5
50	193.0	26.3	10.1	11.4	8.1	6.4	5.1	4.0
100	173.4	28.4	19.1	14.0	10.3	7.6	5.5	3.8
150	191.5	33.0	21.2	14.8	10.4	7.6	5.3	3.3
200	161.4	19.5	13.2	10.3	7.7	5.6	4.0	3.0
250	179.3	14.6	9.9	7.8	6.0	4.7	3.7	3.0
300	177.9	12.9	8.2	6.4	5.0	4.2	3.4	2.9
350	170.8	15.3	10.3	7.8	5.9	4.4	3.3	2.5
400	162.0	20.4	14.2	11.1	8.3	6.3	4.5	3.5
450	180.0	18.8	13.2	9.4	7.2	5.8	4.4	3.5
500	155.8	21.8	13.3	9.5	7.2	6.3	5.1	3.9
$\bar{x}$	175.1	21.9	14.3	10.5	7.9	6.1	4.6	3.4
s	12.0	6.6	4.0	2.7	1.9	1.3	1.0	0.6

Table E29. SR 172, MP 21.4 - FWD Data, 03/01/84, Surface Temperature = 38°F.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	62.0	41.2	27.0	18.8	10.9	5.7	3.9	3.0
50	67.0	35.9	24.4	17.5	10.2	5.0	3.1	2.8
100	63.1	41.1	27.5	19.3	10.6		3.1	2.2
150	64.7	41.9	26.7	17.4	9.2	4.3	2.6	1.7
200	63.7	37.6	26.1	19.4	12.0	5.9	2.8	2.1
250	68.4	17.8	13.2	10.5	7.0	4.3	2.8	1.9
300	63.7	22.7	17.1	13.3	9.1	5.4	3.0	2.0
350	64.6	15.7	11.4	8.9	6.1	3.6	2.1	1.6
400	58.5	39.1	28.7	21.4	13.4	5.7	2.0	1.7
450	58.6	69.0	46.1	30.3	13.1	1.5		
500	67.2	34.5	18.9	11.7	4.6	2.4	1.7	1.0
$\bar{x}$	63.8	36.0	24.3	17.1	9.6	4.4	2.7	2.0
s	3.2	14.5	9.4	6.0	2.8	1.5	0.6	0.6

Table E29. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	83.8	52.0	24.9	24.3	14.5	7.9	5.3	4.2
50	90.9	44.2	30.1	22.0	12.9	6.1	3.9	3.8
100	85.3	49.3	33.8	23.6	13.1	6.4	4.1	2.8
150	91.7	45.7	32.1	21.3	12.5	5.9	3.9	
200	84.8	44.9	31.3	23.3	14.8	7.5	3.7	3.0
250	91.1	22.2	16.3	12.9	8.9	5.6	3.5	2.6
300	88.0	28.1	20.4	16.0	11.0	6.6	3.8	2.4
350	88.6	20.9	14.8	11.7	8.0	4.8	2.8	1.9
400	79.5	47.2	24.5	25.9	16.5	7.4	2.8	2.4
450	81.1	75.3	52.4	34.1	17.4	2.6	2.2	
500	90.9	44.9	24.6	15.9	6.5	3.2	2.3	1.7
$\bar{x}$	86.9	43.2	29.6	21.0	12.4	5.8	3.5	2.8
s	4.3	15.3	10.5	6.5	3.5	1.7	0.9	0.8

Table E29. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	114.4	68.3	48.8	32.6	19.7	10.9	7.2	5.7
50	123.4	57.2	40.1	28.5	16.7	7.8	5.2	5.0
100	115.0	63.0	50.0	30.0	17.3	8.4	5.2	3.7
150	125.5	59.7	50.3		16.7	8.0	4.7	1.4
200	113.8	59.4	42.5	31.6	19.9	10.0	4.8	3.6
250	122.1	30.1	22.0	17.5	12.3	7.8	5.0	3.5
300	119.3	37.7	27.4	21.3	14.4	8.6	4.9	3.1
350	120.6	29.8	20.2	15.8	10.9	6.7	3.8	2.8
400	109.3	62.8	46.3	34.9	21.8	9.7	3.9	3.2
450	110.8	94.8	69.6	62.0	23.1	3.7	2.8	
500	124.7	60.2	34.4	21.8	10.3	4.4	2.7	1.9
$\bar{x}$	118.1	56.6	41.0	29.6	16.6	7.8	4.6	3.4
s	5.7	18.7	14.5	13.2	4.3	2.2	1.2	1.3

Table E29. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	147.1	83.7	54.5	39.5	24.1	13.2	8.7	6.6
50	150.4	69.1	49.1	32.7	20.5	9.5	6.5	6.3
100	147.7	75.7	59.1	45.3	21.1	10.4	6.1	4.3
150	153.2	71.9	49.4	38.6	20.7	10.3	5.6	2.8
200	46.5 1	71.7	52.5	38.7	24.3	12.1	6.0	4.5
250	148.0	37.2	27.3	21.7	15.3	9.7	6.3	4.4
300	146.5	46.0	33.2	25.6	17.3	10.2	5.8	3.8
350	149.6	36.0	25.7	19.9	13.8	8.5	5.0	3.7
400	143.6	77.5	57.4	43.0	26.8	11.9	4.9	3.9
450	142.5	102.0	80.1	69.1	28.1	4.8	3.4	
500	150.0	72.8	47.3	26.6	13.2	5.5	3.7	2.5
$\bar{x}$	147.7	67.6	48.7	36.4	20.5	9.6	5.6	4.3
s	3.0	20.2	15.6	13.9	5.1	2.6	1.4	1.3

Table E30. SR 172, MP 21.4 - FWD Data, 03/07/84, Surface Temperature = 40°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	58.4	32.4	21.3	14.8	8.8	5.0	3.3	2.8
50	61.2	27.7	18.8	13.5	8.4	4.9	3.1	2.5
100	62.4	27.5	17.7	12.4	7.4	4.3	3.3	2.4
150	67.3	25.6	17.7	12.6	7.8	4.8	3.1	1.7
200	59.7	23.7	16.9	12.6	7.7	4.3	2.6	1.9
250	60.2	15.6	11.6	9.0	6.1	3.8	2.6	1.9
300	65.2	18.3	13.2	10.2	7.1	4.5	3.0	1.9
350	65.2	14.6	10.4	7.9	5.4	3.2	2.0	1.5
400	58.5	29.7	21.1	15.7	9.5	4.4	2.3	1.9
450	66.6	37.3	25.1	16.8	8.5	3.0	2.0	1.9
500	64.0	40.4	25.2	15.0	7.8	2.8	2.2	
$\bar{x}$	62.6	26.6	18.1	12.8	7.7	4.1	2.7	2.1
s	3.2	8.3	5.0	2.8	1.2	0.8	0.5	0.4

Table E30. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	81.4	42.2	28.1	19.7	12.3	7.1	4.5	3.6
50	88.6	37.4	25.6	18.2	11.2	5.9	3.9	3.4
100	91.1	36.3	23.4	16.9	10.2	5.7	4.1	3.0
150	93.7	33.6	23.2	16.8	10.4	6.1	4.0	2.2
200	80.9	31.7	22.8	17.0	10.6	5.8	3.3	2.5
250	84.8	22.1	15.7	12.4	8.4	5.3	3.5	2.6
300	91.5	25.2	17.7	13.7	9.3	5.9	3.8	2.5
350	88.0	19.3	13.1	10.3	7.0	4.2	2.5	1.9
400	78.9	41.3	28.6	21.3	12.8	6.0	3.0	2.3
450	88.3	50.	34.4	22.6	11.3	3.8	3.0	2.3
500	87.5	54.2	33.9	20.2	10.1	3.9	3.2	3.0
$\bar{x}$	86.8	35.8	24.2	17.1	10.3	5.4	3.5	2.7
s	4.8	11.0	6.9	3.8	1.7	1.0	0.6	0.5

Table E30. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	111.6	56.3	40.7	24.9	16.9	9.5	6.3	5.0
50	121.1	49.4	35.6	22.7	14.8	8.2	5.2	4.8
100	124.7	48.4	31.4	22.8	13.5	7.6	5.2	3.8
150	124.5	45.9	33.0	23.0	14.6	8.5	5.0	2.8
200	109.0	43.1	31.3	23.4	14.5	7.9	4.5	3.4
250	114.2	29.6	21.3	16.8	11.5	7.4	5.0	3.6
300	124.0	34.1	23.8	18.2	12.4	7.9	5.0	3.4
350	118.3	26.3	18.2	13.9	9.5	5.8	3.6	2.6
400	111.4	56.1	39.6	29.4	17.7	8.2	4.0	3.7
450	117.3	75.6	46.0	30.8	15.7	5.0	4.0	2.8
500	117.6	71.4	45.9		14.2	4.9	4.6	3.9
$\bar{x}$	117.6	48.7	33.3	22.6	14.1	7.4	4.8	3.6
s	5.6	15.7	9.4	5.2	2.4	.5	0.7	0.8

Table E30. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	141.8	68.8	52.4	33.6	21.4	11.9	8.0	6.1
50	146.1	60.1	52.7	26.6	17.8	9.7	6.6	6.1
100	151.3	59.4	38.6	25.3	17.2	9.3	6.7	4.8
150	150.4	55.9	41.2	29.4	18.8	10.7	6.1	3.5
200	142.5	53.9	42.4	28.4	18.6	10.0	5.6	4.2
250	145.1	36.2	26.0	20.6	14.0	9.2	6.2	4.6
300	149.4	41.1	28.9	21.9	14.9	9.4	5.9	4.1
350	149.0	32.5	22.7	17.4	12.0	7.4	4.5	3.5
400	142.6	69.1	49.4	35.2	22.2	10.2	4.7	4.4
450	143.8	80.3	54.0	40.9	19.2	5.8	4.3	3.3
500	140.3	85.0	54.3	33.0	17.8	5.9	5.6	4.9
$\bar{x}$	145.7	58.4	42.0	28.4	17.6	9.0	5.8	4.5
s	3.8	17.0	11.8	7.0	3.0	1.9	1.1	1.0

Table E31. SR 172, MP 21.4 - FWD Data, 03/20/84, Surface Temperature = 34°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	61.2	31.5	21.9	15.7	9.2	5.2	3.7	3.0
50	64.9	29.1	19.3	14.1	8.2	4.4	3.0	2.6
100	62.7	30.9	18.1	14.7	9.0	4.6	3.4	3.2
150	64.0	28.5	19.6	13.8	8.2	4.9	3.1	1.9
200	61.5	20.0	15.0	11.7	7.6	4.4	2.5	1.8
250	68.9	17.0	12.9	10.5	7.4	4.7	2.9	2.2
300	64.4	16.9	12.5	10.2	7.3	4.8	3.1	2.1
350	60.1	13.0	9.3	7.4	4.8	2.8	1.8	1.3
400	63.9	24.9	14.8	13.7	8.7	3.9	2.9	1.7
450	57.0	44.0	20.8	14.5	7.4	2.8	2.2	2.1
500	60.2	42.4	25.6	17.3	8.1	2.4	2.2	2.1
$\bar{x}$	62.6	27.1	17.2	13.0	7.6	4.1	2.8	2.2
s	3.1	10.1	4.8	2.8	1.1	1.0	0.6	0.6

Tablt E31. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	86.7	41.9	28.3	20.5	11.9	6.9	5.0	4.0
50	88.8	38.3	25.2	18.5	10.7	5.6	3.8	3.6
100	88.2	40.7	26.5	19.6	11.2	5.8	3.9	3.3
150	90.4	40.0	26.7	19.2	11.5	6.7	4.0	2.4
200	86.4	29.1	20.6	16.4	10.6	6.1	3.5	2.5
250	96.0	22.8	17.2	13.7	9.7	6.1	3.9	2.8
300	90.4	23.0	16.8	13.5	9.7	6.3	4.0	2.7
350	90.4	17.3	12.2	9.8	6.6	4.1	2.6	1.8
400	83.8	32.0	22.4	17.6	11.3	5.9	3.3	2.5
450	79.2	40.7	26.9	19.5	10.5	4.3	2.7	
500	86.7	52.0	30.7	22.9	11.8	4.4	3.5	3.4
$\bar{x}$	87.9	34.3	23.0	17.4	10.5	5.6	3.6	2.9
s	4.3	10.4	5.7	3.8	1.5	1.0	0.7	0.7

Table E31. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	118.4	55.7	49.5	26.6	16.5	9.2	6.5	5.4
50	122.9	51.0	33.0	24.4	14.1	7.0	5.0	4.9
100	121.6	54.8	33.5	25.9	14.9	7.8	5.1	3.9
150	123.5	54.6	35.6	25.7	16.0	8.9	5.1	3.2
200	117.9	40.4	26.9	23.0	14.8	8.6	4.8	3.5
250	130.5	30.9	22.8	18.0	13.2	8.5	5.5	4.1
300	125.0	30.6	23.4	17.9	12.9	8.5	5.3	3.7
350	123.7	23.7	16.9	13.4	9.1	5.7	3.6	2.6
400	114.2	44.7	28.5	24.1	15.7	8.3	4.5	3.6
450	109.6	55.6	34.9	26.5	14.8	5.8	4.4	3.6
500	117.2	70.1	40.0	30.6	16.4	7.0	5.1	4.6
$\bar{x}$	120.4	46.4	31.4	23.3	14.7	7.8	5.0	3.9
s	5.7	13.9	9.0	4.9	2.6	1.2	0.7	0.8

Table E32. SR 174, FWD Data, 08/09/83, Surface Temperature = 76°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	50.25	14.0	9.5	6.2	3.8	2.0	1.1	0.7
50	42.27	19.8	12.6	7.1	5.2	2.6	1.8	1.2
100	43.15	15.4	9.5	6.4	4.2	2.6	1.8	1.3
150	42.57	17.5	11.3	8.0	5.2	3.3	2.2	1.2
200	41.85	14.4	8.0	4.8	2.6	1.6	1.2	0.9
250	41.56	15.3	9.3	5.5	3.9	2.2	1.2	0.7
300	40.98	16.7	10.3	6.9	4.4	2.2	1.2	0.6
350	57.20	17.2	9.1	5.6	3.7	2.4	1.7	1.2
400	51.84	12.9	9.0	6.1	3.2	2.0	1.4	1.0
450	51.84	13.9	9.5	5.8	3.6	2.2	1.6	1.2
500	52.86	14.2	9.0	5.6	3.4	2.0	1.5	1.1
$\bar{x}$	46.97	15.6	21.2	6.2	3.9	2.3	1.5	1.0
s	5.85	2.0	3.6	0.9	0.8	0.4	0.3	0.2

Table E32. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	76.31	17.7	12.4	8.6	5.6	3.1	1.7	1.0
50	78.34	28.1	19.1	13.1	8.7	4.9	2.8	1.7
100	79.21	22.8	15.2	11.1	7.6	4.8	3.1	2.1
150	73.13	25.6	18.0	13.8	9.4	6.2	3.8	2.2
200	73.71	19.9	11.9	7.9	4.7	2.9	2.0	1.5
250	75.45	22.2	14.8	10.5	7.1	4.1	2.1	1.2
300	75.74	24.2	16.9	12.1	8.0	4.3	2.2	1.1
350	85.00	18.9	11.5	7.6	5.3	3.5	2.4	1.7
400	75.88	17.4	11.7	7.8	5.0	3.3	2.2	1.6
450	86.45	19.0	13.8	9.6	6.1	3.9	2.7	1.9
500	85.58	11.5	11.5	7.9	5.1	3.3	2.3	1.7
$\bar{x}$	78.62	21.2	14.2	10.0	6.6	4.0	2.5	1.6
s	4.86	3.6	2.8	2.3	1.6	1.0	0.6	0.4

Table E32. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	122.36	24.5	17.3	12.2	8.1	4.7	2.7	1.5
50	126.71	41.9	30.8	20.6	14.1	8.1	4.4	2.6
100	128.45	36.5	25.5	19.7	14.3	9.3	6.0	3.9
150	118.31	41.2	30.2	23.9	17.6	12.0	7.4	4.1
200	114.40	31.5	20.8	13.8	9.0	5.7	3.8	2.7
250	131.06	35.3	24.3	17.4	11.8	6.8	3.3	1.6
300	122.51	35.5	27.4	17.5	13.4	6.9	3.5	1.7
350	133.80	28.5	18.8	13.3	10.4	6.2	4.2	2.9
400	118.74	25.1	18.1	12.2	8.7	5.7	4.1	3.0
450	126.56	27.0	20.0	13.7	9.9	6.6	4.5	3.3
500	125.84	24.6	17.0	12.4	8.3	5.4	3.7	2.6
$\bar{x}$	123.52	32.0	22.7	16.1	11.4	7.0	4.3	2.7
s	5.44	6.5	5.1	4.0	3.1	2.1	1.3	0.9

Table E32. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	138.58	26.5	18.8	13.3	8.9	5.2	3.0	1.6
50	143.51	47.5	35.3	23.0	16.7	9.6	5.2	3.0
100	147.85	41.8	39.6	23.0	17.0	11.3	7.3	4.8
150	133.80	47.4	35.4	28.1	21.1	14.5	9.1	5.0
200	135.11	36.1	23.3	15.0	10.9	7.0	4.7	3.3
250	137.86	39.8	27.0	20.3	14.1	8.1	4.1	1.8
300	137.57	39.4	30.3	20.4	14.5	7.9	3.9	1.9
350	151.62	31.9	21.3	15.3	11.0	7.6	5.2	3.7
400	136.27	28.9	20.6	14.9	10.4	7.1	5.0	3.7
450	144.81	30.8	22.9	16.3	11.8	7.9	5.5	3.9
500	143.80	27.8	19.6	14.5	10.0	6.7	4.5	3.2
$\bar{x}$	140.98	36.2	25.8	18.6	13.3	8.4	5.2	3.3
s	5.70	7.6	6.1	4.7	3.7	2.6	1.7	1.1

Table E33. SR 174, FWD Data, 01/10/84, Surface Temperature = 34°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	91.1	8.4	4.2	2.6	1.4	0.9	0.8	0.6
50	88.0	8.3	5.4	3.7	2.6	2.0	1.5	1.1
100	80.8	7.8	5.5	4.0	3.0	2.3	1.8	1.4
150	76.9	6.5	4.6	3.6	2.8	2.2	1.7	1.3
200	83.2	6.9	3.8	2.6	1.8	1.5	1.2	1.0
250	75.6	5.2	3.4	2.7	2.0	1.5	1.1	0.9
300	75.6	4.7	3.1	2.5	2.0	1.4	1.0	0.7
350	85.7	7.0	3.8	2.7	1.9	1.6	1.3	1.0
400	79.6	6.4	3.8	2.5	1.9	1.5	1.2	1.0
450	83.8	6.3	3.4	2.4	1.6	1.4	1.1	0.9
500	78.5	4.9	3.0	2.0	1.5	1.2	1.1	0.9
$\bar{x}$	81.7	6.6	4.0	2.9	2.0	1.6	1.2	1.0
s	5.1	1.3	0.9	0.6	0.6	0.4	0.3	0.2

Table E33. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	116.4	10.2	5.2	3.2	1.8	1.2	1.0	0.7
50	119.2	11.0	7.3	5.0	3.5	2.6	2.0	1.4
100	110.0	10.6	7.4	5.9	4.3	3.4	2.7	2.0
150	107.5	9.4	6.7	5.4	4.3	3.4	2.7	2.0
200	114.0	9.6	5.3	3.8	2.8	2.2	1.8	1.4
250	105.4	7.1	4.7	3.8	2.7	2.2	1.6	1.2
300	106.7	6.2	4.5	4.0	2.8	2.0	1.4	1.0
350	123.5	9.8	5.3	3.8	2.9	2.4	1.9	1.6
400	112.2	8.9	5.4	3.8	2.8	2.2	1.8	1.4
450	118.2	8.6	4.8	3.5	2.5	2.1	1.7	
500	112.3	7.2	4.3	3.1	2.3	1.9	1.6	1.3
$\bar{x}$	113.2	9.0	5.5	4.1	3.0	2.3	1.8	1.4
s	5.7	1.6	1.1	0.9	0.8	0.6	0.5	0.4

Table E33. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	159.9	14.0	7.0	4.4	2.4	2.0	1.5	1.0
50	159.7	15.7	10.4	7.4	5.3	3.8	2.9	2.0
100	151.3	15.4	10.6	8.4	6.4	5.0	4.1	3.0
150	148.4	13.7	9.7	8.0	6.4	5.1	4.0	3.0
200	149.2	13.7	7.6	5.4	4.1	3.4	2.7	2.1
250	145.9	11.3	7.3	5.5	4.2	3.2	2.3	1.5
300	145.2	9.3	6.4		3.8	2.8		1.3
350	171.1	14.1	7.6	5.5	4.3	3.6	3.0	2.3
400	153.8	12.7	7.7	5.6	4.1	3.3	2.8	2.2
450	162.4	12.4	7.0	5.1	3.8	3.2	2.6	2.2
500	157.2	10.4	6.2	4.7	3.6	3.0	2.4	2.0
$\bar{x}$	154.9	13.0	7.0	6.0	4.4	3.5	2.8	2.1
s	8.0	2.0	1.6	1.4	1.2	0.9	0.8	0.6

Table E33. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	196.4	17.0	8.4	5.1	2.8	2.3	1.6	1.1
50	198.3	19.8	13.0	9.4	6.8	5.1	3.7	2.7
100	190.3	19.1	13.4	10.6	8.2	6.4	5.0	3.8
150	183.2	17.4	12.5	10.2	8.3	6.6	5.2	3.9
200	183.5	17.0	9.4	7.0	5.4	4.4	3.5	2.8
250	178.0	14.6	9.5	7.1	5.6	4.1	3.4	2.0
300	179.8	12.1	8.0	6.6	4.9	3.5	2.7	1.6
350	208.1	17.3	9.5	7.1	5.6	4.6	3.9	2.8
400	198.0	15.4	8.8	6.5	5.0	4.1	3.4	2.7
450	194.6	13.2	8.0	6.0	4.7	3.8	3.2	2.6
500	192.2	15.9	9.8	7.2	5.4	4.4	3.6	2.8
$\bar{x}$	191.1	16.3	10.0	7.5	5.7	4.5	3.6	2.6
s	9.2	2.3	2.0	1.8	1.6	1.2	1.0	0.8

Table E34. SR 174, FWD Data, 03/01/84, Surface Temperature = 38°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	71.8	22.9	15.4	10.7	6.7	3.7	2.0	1.2
50	64.0	42.6	30.0	20.9	11.1	3.2		1.2
100	71.5	28.6	21.6	16.9	11.3	6.4	3.7	2.4
150	69.2	27.0	20.0	16.3	11.3	7.1	4.2	2.7
200	68.6	21.6	14.1	10.2	6.5	3.8	2.5	1.8
250	58.4	65.8	48.4	37.0	23.9	9.9	2.1	1.9
300	65.3	36.8	26.0	20.8	12.6	5.4	2.0	0.9
350	73.0	23.5	16.3	11.3	7.4	4.3	2.6	1.9
400	75.2	21.9	14.3	9.9	5.9	3.7	2.6	1.9
450	74.1	22.4	14.9	10.6	6.4	3.9	2.7	1.9
500	75.3	20.1	13.8	10.2	6.3	3.8	2.5	1.7
$\bar{x}$	69.7	30.3	21.3	15.9	9.9	5.0	2.7	1.7
s	5.3	13.7	10.4	8.2	5.3	2.0	0.7	0.5

Table E34. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	97.4	28.5	19.5	13.7	8.5	4.6	2.5	1.5
50	88.9	52.4	37.8	25.9	14.4	4.8		1.4
100	98.5	37.9	28.5	21.9	15.1	8.9	5.1	1.4
150	89.9	35.6	26.2	21.5	15.2	9.7	5.9	3.7
200	93.5	27.4	18.2	13.4	8.7	5.3	3.4	2.4
250	81.8	75.6	55.8	43.5	29.4	13.0	2.8	
300	91.2	46.4	28.5	26.0	16.0	7.0	2.6	1.1
350	100.6	30.7	21.5	15.6	10.2	6.3	4.0	2.6
400	101.8	27.9	18.5	13.3	8.2	5.2	3.5	2.5
450	94.9	29.3	19.0	13.9	8.6	5.2	3.5	2.5
500	101.2	26.1	17.5	13.2	8.1	5.1	3.2	2.4
$\bar{x}$	95.0	38.0	26.4	20.2	12.9	6.8	3.6	2.4
s	6.4	15.1	11.6	9.3	6.3	2.6	1.1	0.8

Table E34. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	128.3	35.7	27.6	17.1	10.2	5.5	2.8	1.6
50	114.4	66.6	50.2	32.6	17.4	6.3	2.0	1.3
100	133.5	50.5	38.1	31.5	20.6	12.3	7.2	4.9
150	120.6	48.3	36.1	29.3	21.0	13.7	8.6	5.5
200	125.6	37.5	25.3	18.7	23.4	7.6	4.8	3.5
250	108.0	93.0	69.1	57.7	36.5	16.9	3.6	1.3
300	124.7	58.7	25.1		20.6	9.1	3.3	1.3
350	136.0	40.9	28.5	20.7	14.1	8.9	5.8	3.7
400	137.0	36.9	24.9	18.7	11.5	7.5	5.0	3.6
450	136.8	37.3	25.6	18.8	12.0	7.6	5.0	3.7
500								
$\bar{x}$	126.5	50.5	25.0	27.2	18.7	9.5	4.8	3.0
s	9.9	18.2	14.5	13.0	7.8	3.6	2.0	1.6

Table E34. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	156.7	41.6	36.7	19.3	11.6	6.0	3.0	1.7
50	142.3	78.3	54.9	40.9	19.9	6.5	3.3	1.5
100	159.6	61.1	46.3	36.1	25.4	15.5	9.3	6.2
150	150.2	59.6	44.0	35.8	26.2	17.2	10.9	7.0
200	156.1	45.8	31.6	23.4		9.8	6.3	4.5
250	132.2	116.9	78.7		43.0	19.7	4.1	1.8
300	152.5	69.5	30.2		25.3	11.1	3.9	1.6
350	169.6	49.7	34.5	25.4	17.4	11.2	7.3	4.8
400	165.5	44.7	28.9	22.2	14.4	9.9	6.4	4.4
450	164.8	44.6	31.3	21.9	14.7	9.5	6.5	4.6
500								
$\bar{x}$	155.0	61.2	41.7	29.1	22.2	11.6	6.1	3.8
s	11.3	23.0	15.5	8.2	9.0	4.5	2.6	2.0

Table E35. SR 174, FWD Data, 03/07/84, Surface Temperature = 38°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	68.6	19.8	13.5	10.0	6.2	3.4	1.8	1.1
50	63.7	39.3	27.4	19.4	11.5	5.4	2.5	2.0
100	68.8	24.6	16.9	13.1	8.7	5.6	3.8	2.4
150	67.8	26.4	19.5	15.7	10.2	6.3	3.8	2.3
200	68.6	20.9	13.9	9.8	6.1	3.7	2.4	1.7
250	65.9	30.2	20.6	14.9	8.9	4.4	2.2	1.3
300	69.2	27.2	18.6	13.1	8.4	4.3	2.1	1.2
350	70.8	19.6	12.9	9.3	6.3	4.4	2.6	1.6
400	69.4	19.8	13.0	9.0	5.6	3.6	2.5	1.7
450	73.0	20.4	14.3	10.0	6.1	3.7	2.5	1.8
500	70.7	18.5	12.3	8.8	5.6	3.5	2.2	1.6
$\bar{x}$	68.8	24.2	16.6	12.1	7.6	4.4	2.6	1.7
s	2.4	6.3	4.6	3.4	2.0	1.0	0.6	0.4

Tabel E35. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	97.2	26.2	17.8	13.1	8.3	4.6	2.4	1.4
50	90.8	50.9	35.6	28.4	15.2	6.8	3.1	2.6
100	97.4	34.4	24.6	19.8	13.0	8.0	4.8	3.1
150	94.3	35.7	26.9	22.5	14.7	9.8	5.2	4.1
200	93.4	26.3	18.1	13.1	8.4	5.2	3.3	2.3
250	91.1	39.6	272.	19.6	12.1	6.1	2.9	1.7
300	95.7	34.6	24.0	17.4	10.9	5.6	2.6	1.4
350	101.8	25.8	17.9	13.3	8.9	5.6	3.7	2.5
400	95.6	25.1	16.5	11.9	7.6	4.9	3.3	2.3
450	90.8	24.7	17.6	12.8	8.0	5.0	3.3	2.3
500	96.6	23.4	15.4	11.3	7.4	4.8	3.1	2.2
$\bar{x}$	95.0	31.5	22.0	16.6	10.4	6.0	3.4	2.4
s	3.4	8.5	6.3	5.4	2.9	1.6	0.8	0.8

Table E35. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	132.4	33.0	22.0	16.7	10.5	5.7	3.0	1.7
50	122.2	66.9	46.4	39.4	20.5	8.5	3.6	3.1
100	135.1	47.3	35.0	23.6	18.2	12.2	7.6	4.7
150	127.9	49.1	37.3	26.3	21.0	13.8	7.4	5.6
200	128.6	35.7	24.9	18.5	21.1	7.6	4.8	3.3
250	125.5	53.4	37.2	25.0	16.8	8.3	3.7	1.9
300	129.9	44.4	34.7		14.1	7.1	3.1	1.5
350	138.7	35.4	24.5	18.5	12.7	8.5	5.4	3.5
400	131.9	33.5	22.9	16.5	10.9	7.1	4.9	3.4
450	125.4	32.8	23.6	17.4	11.2	7.1	4.7	3.4
500	126.1	30.9	20.6	15.2	10.2	6.6	4.3	3.2
$\bar{x}$	129.4	42.0	29.9	21.7	14.4	8.4	4.8	3.2
s	4.8	11.3	8.5	7.3	4.0	2.4	1.5	1.2

Table E35. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	160.4	37.8	26.6	22.8	11.6	6.3	3.1	1.7
50	148.4	81.6	56.2	42.1	24.9	10.2	4.0	3.6
100	165.1	58.5	42.7	28.8	21.8	15.5	9.8	6.0
150	158.0	61.1	46.9	32.0	26.3	16.7	10.4	7.0
200	159.0	43.9	30.4	23.1	15.5	9.7	6.3	4.3
250	152.2	65.1	44.3	33.0	21.9	10.4	4.5	2.2
300	156.0	55.2	35.2	29.0	17.1	8.5	3.3	1.6
350	166.8	42.8	30.4	22.2	15.8	10.9	6.9	4.4
400	162.0	40.4	29.0	19.8	13.7	9.1	6.3	4.4
450	150.4	39.8	29.3	21.3	14.0	9.1	6.1	4.3
500	154.1	37.6	25.0	18.7	12.8	8.5	5.7	4.0
$\bar{x}$	157.5	51.2	36.0	26.6	17.8	10.4	6.0	4.0
s	5.9	14.2	10.0	7.1	5.1	3.1	24.	1.7

Table E36. SR 174, FWD Data, 03/20/84, Surface Temperature = 40°F.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	71.1	20.6	13.4	10.0	6.2	3.4	1.9	1.1
50	61.1	32.0	21.7	16.1	10.0	5.5	2.8	1.7
100	69.8	19.4	14.1	10.9	7.5	5.0	3.2	2.2
150	66.6	20.4	16.8	12.7	9.5	6.1	3.5	2.4
200	70.4	18.1	12.7	9.6	6.1	3.6	2.3	1.6
250	65.4	21.6	16.2	11.7	8.0	6.8	2.4	1.3
300	66.2	21.9	14.6	10.7	6.7	4.2	2.2	1.2
350	68.8	20.0	13.7	10.0	6.4	3.9	2.6	1.8
400	68.4	17.8	11.1	8.1	5.0	3.3	2.3	1.6
450	66.9	18.7	10.5	8.5	5.3	3.4	2.3	1.7
500	68.2	17.4	12.0	8.8	5.7	3.5	2.3	1.6
$\bar{x}$	67.5	20.7	14.2	10.6	6.9	4.4	2.5	1.6
s	2.8	4.0	3.1	2.3	1.6	1.2	0.5	0.4

Table E36. Continued.

Station	Load (psi)	δ_1 ($\times 10^{-3}$ in)	δ_2 ($\times 10^{-3}$ in)	δ_3 ($\times 10^{-3}$ in)	δ_4 ($\times 10^{-3}$ in)	δ_5 ($\times 10^{-3}$ in)	δ_6 ($\times 10^{-3}$ in)	δ_7 ($\times 10^{-3}$ in)
1	99.0	26.4	16.8	13.1	8.1	4.4	2.5	1.5
50	85.6	42.0	27.6	20.4	13.5	7.2	3.5	2.3
100	99.0	28.3	20.6	16.9	11.3	7.6	4.8	3.2
150	95.3	29.4	23.2	18.5	13.6	9.1	6.0	3.8
200	98.9	23.7	17.3	12.8	8.4	5.0	3.2	2.2
250	94.8	29.9	22.0	16.6	11.2	6.3	3.3	1.5
300	95.0	29.2	19.6	14.9	9.5	5.7	3.1	1.4
350	98.8	30.0	18.8	13.7	9.1	5.6	3.7	2.5
400	96.6	23.3	15.4	11.1	7.2	4.7	3.2	2.4
450	94.7	24.6	16.3	11.8	7.8	4.9	3.3	2.3
500	97.3	23.4	16.2	11.9	7.8	5.0	3.2	2.2
$\bar{x}$	95.9	29.2	19.4	14.7	9.8	6.0	3.6	2.3
s	3.8	5.3	3.7	3.0	2.3	1.5	1.0	0.7

Table E36. Continued.

Station	Load (psi)	δ_1 (x 10^{-3} in)	δ_2 (x 10^{-3} in)	δ_3 (x 10^{-3} in)	δ_4 (x 10^{-3} in)	δ_5 (x 10^{-3} in)	δ_6 (x 10^{-3} in)	δ_7 (x 10^{-3} in)
1	136.8	33.0	20.5	16.7	10.3	5.6	3.1	1.8
50	117.9	55.5	36.7	26.5	18.1	9.4	4.6	3.0
100	135.5	38.6	26.1	22.4	16.3	11.1	7.1	4.6
150	131.8	41.3	28.7	15.3	19.4	13.2	8.4	5.4
200	137.0	32.6	21.7	18.9	12.3	7.6	4.9	3.4
250	132.1	41.3	28.6	23.5	15.5	8.6	4.3	1.9
300	131.0	38.7	25.6	20.9	12.3	7.5	3.8	1.9
350	135.8	37.4	22.8	19.5	12.8	8.2	5.4	3.6
400	135.1	31.2	19.8	15.9	10.5	6.9	4.8	3.5
450	132.6	32.4	22.0	15.3	11.1	7.2	4.8	3.4
500	135.4	31.3	20.1	16.1	10.9	7.1	4.6	3.3
$\bar{x}$	132.8	37.6	24.8	20.1	13.6	8.4	5.1	3.2
s	5.4	7.1	5.1	3.9	3.2	2.1	1.5	1.1

APPENDIX F

TEMPERATURE DATA SUMMARIES

Table F1. Temperature Data Summary for SR 97 (MP 183.48) for Winter 1982-83 (Source: Blewett WSDOT Facility).

Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days	Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days
Nov. 1, 1982	36	4	4	Dec. 1, 1982	30	- 2	-116
2	39	7	11	2	29	- 3	-119
3	38	6	17	3	32	0	-119
4	35	3	20	4	35	3	-116
5	36	4	24	5	29	- 3	-119
6	32	0	24	6	28	- 4	-123
7	33	1	25	7	23	- 9	-132
8	37	5	30	8	20	-12	-144
9	34	2	32	9	18	-14	-158
10	23	- 9	23	10	20	-12	-170
11	30	- 2	21	11	16	-16	-186
12	29	- 3	18	12	21	-11	-197
13	28	- 4	14	13	22	-10	-207
14	26	- 6	8	14	28	- 4	-211
15	27	- 5	3	15	27	- 5	-216
16	32	0	3	16	32	0	-216
17	32	0	3	17	33	1	-215
18	29	- 3	0	18	30	- 2	-217
19	31	- 1	- 1	19	28	- 4	-221
20	30	- 2	- 3	20	29	- 3	-224
21	24	- 8	- 11	21	26	- 6	-230
22	18	-14	- 25	22	26	- 6	-236
23	17	-15	- 40	23	23	- 9	-245
24	12	-20	- 60	24	22	-10	-255
25	14	-18	- 78	25	22	-10	-265
26	12	-20	- 98	26	24	- 8	-273
27	19	-13	-111	27	20	-12	-285
28	24	- 8	-119	28	17	-15	-300
29	32	0	-119	29	17	-15	-315
30	36	+ 4	-115	30	20	-12	-327
				31	8	-24	-351

Table F1. Temperature Data Summary for SR 97 (MP 183.48) for Winter 1982-83 (Source: Blewett WSDOT Facility). (Cont.)

Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days	Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days
Jan. 1, 1983	8	-24	375	Feb. 1, 1983	30	- 2	-389
2	15	-17	392	2	26	- 6	-395
3	22	-10	402	3	27	- 5	-400
4	27	- 5	407	4	24	- 8	-408
5	32	0	407	5	24	- 8	-416
6	33	1	406	6	25	- 7	-423
7	32	0	406	7	22	-10	-433
8	40	8	398	8	28	- 4	-437
9	29	- 3	401	9	26	- 6	-443
10	41	9	392	10	32	0	-443
11	34	2	390	11	34	2	-441
12	40	8	382	12	35	3	-438
13	41	9	373	13	35	3	-435
14	35	3	370	14	36	4	-431
15	32	0	370	15	30	- 2	-433
16	28	- 4	374	16	29	- 3	-436
17	30	- 2	376	17	38	6	-430
18	32	0	376	18	38	6	-424
19	29	- 3	379	19	32	0	-424
20	31	- 1	380	20	32	0	-424
21	29	- 3	383	21	32	0	-424
22	32	0	383	22	32	0	-424
23	30	- 2	385	23	38	6	-418
24	35	3	382	24	36	4	-414
25	37	5	377	25	32	0	-414
26	32	0	377	26	30	- 2	-416
27	32	0	377	27	31	- 1	-417
28	26	- 6	383	28	31	- 1	-418
29	28	- 4	387				
30	30	- 2	389				
31	34	2	387				

Table Fl. Temperature Data Summary for SR 97 (MP 183.48) for Winter 1982-83 (Source: Blewett WSDOT Facility). (Cont.)

Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days	Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days
Mar. 1, 1983	32	0	-418	Apr. 1, 1983	34	2	-337
2	32	0	-418	2	31	- 1	-338
3	34	2	-416	3	29	- 3	-341
4	37	5	-411	4	31	- 1	-342
5	36	4	-407	5	36	4	-338
6	32	0	-407	6	39	9	-331
7	36	4	-403	7	42	10	-321
8	35	3	-400	8	47	15	-306
9	35	3	-397	9	42	10	-396
10	39	7	-390	10	42	10	-286
11	37	5	-385	11	37	5	-281
12	38	6	-370	12	31	- 1	-282
13	37	5	-374	13	31	- 1	-283
14	32	0	-374	14	34	2	-281
15	30	-2	-376	15	39	7	-274
16	32	0	-376	16	41	9	-265
17	34	2	-374	17	44	12	-253
18	36	4	-370	18	45	13	-240
19	33	1	-369	19	49	17	-223
20	34	2	-367	20	49	17	-206
21	36	4	-363	21	44	12	-194
22	37	5	-358	22	42	10	-184
23	36	4	-354	23		10	-174
24	34	2	-352	24		10	-164
25	34	2	-350	25	42	10	-154
26	33	1	-349	26	37	5	-149
27	36	4	-345	27	36	4	-145
28	32	0	-345	28	39	7	-138
29	31	1	-346	29	39	7	-131
30	35	3	-343	30		7	-124
31	36	4	-339				

Winter 1982-83 FI = 32 -(-443) = 475°F - days

Table F2. Temperature Data Summary for SR 97 (MP 183.48) for Winter 1983-84 (Source: Blewett WSDOT Facility).

Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days	Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days
Nov. 1, 1983	50	18	18	Dec. 1, 1983	16	-16	33
2	44	12	30	2	18	-14	19
3	44	12	42	3	20	-12	7
4	39	7	49	4	15	-17	- 10
5	31	- 1	48	5	19	-13	- 23
6	31	- 1	47	6	18	-14	- 37
7	35	3	50	7	16	-16	- 53
8	33	1	51	8	19	-13	- 66
9	34	2	53	9	29	- 3	- 69
10	33	1	54	10	29	- 3	- 72
11	33	1	55	11	30	- 2	- 74
12	36	4	59	12	26	- 6	- 80
13	35	3	62	13	27	- 5	- 85
14	33	1	63	14	32	- 0	- 85
15	36	4	67	15	25	- 7	- 92
16	35	3	70	16	18	-14	-106
17	37	5	75	17	16	-16	-122
18	37	5	80	18	12	-20	-142
19	33	1	81	19	14	-18	-160
20	31	- 1	80	20	11	-21	-181
21	32	0	80	21	- 1	-33	-214
22	28	- 4	76	22	- 6	-38	-252
23	29	- 3	73	23	- 9	-41	-293
24	29	- 3	70	24	-10	-42	-335
25	30	- 2	68	25	0	-32	-367
26	30	- 2	66	26	10	-22	-389
27	31	- 1	65	27	16	-16	-405
28	32	0	65	28	13	-19	-424
29	24	- 8	57	29	15	-17	-441
30	24	- 8	49	30	18	-14	-455
				31	29	- 3	-458

Table F2. Temperature Data Summary for SR 97 (MP 183.48) for Winter 1983-84 (Source: Blewett WSDOT Facility). (Cont.)

Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days	Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days
Jan. 1, 1984	27	- 5	-463	Feb. 1, 1984	31	-1	-575
2	30	- 2	-465	2	34	2	-573
3	34	2	-463	3	34	2	-571
4	43	11	-452	4	39	7	-564
5	41	9	-443	5	35	3	-561
6	38	6	-437	6	38	6	-555
7	39	7	-430	7	35	3	-552
8	33	1	-429	8	29	-3	-555
9	32	0	-429	9	34	2	-553
10	30	- 2	-431	10	30	-2	-555
11	32	0	-431	11	30	-2	-557
12	30	- 2	-433	12	32	0	-557
13	30	- 2	-435	13	33	1	-556
14	23	- 9	-444	14	36	4	-552
15	12	-20	-464	15	30	-2	-554
16	17	-15	-479	16	33	1	-553
17	18	-14	-493	17	28	-4	-557
18	10	-22	-515	18	26	-6	-563
19	8	-24	-539	19	27	-5	-568
20	10	-22	-581	20	30	-2	-570
21	11	-21	-582	21	32	0	-570
22	24	- 8	-590	22	28	-4	-574
23	27	- 5	-595	23	29	-3	-577
24	35	3	-592	24	30	-2	-579
25	38	5	-587	25	27	-5	-584
26	33	1	-586	26	26	-6	-590
27	33	1	-585	27	25	-7	-597
28	39	7	-578	28	28	-4	-601
29	36	4	-574	29	32	0	-601
30	32	0	-574				
31	32	0	-574				

Table F2. Temperature Data Summary for SR 97 (MP 183.48) for Winter 1983-84 (Source: Blewett WSDOT Facility). (Cont.)

Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days
Mar. 1, 1984	36	4	-597
2	33	1	-596
3	29	- 3	-599
4	36	4	-595
5	34	2	-593
6	39	7	-586
7	42	10	-576
8	46	14	-562
9	46	14	-548
10	45	13	-535
11	39	7	-528
12	41	9	-519
13	35	3	-516
14	35	3	-513
15	41	9	-504
16	38	6	-498
17	38	6	-492
18	38	6	-486
19	39	7	-479
20	40	8	-471
21	37	5	-466
22	36	4	-462
23	44	12	-450
24	38	6	-444
25	39	7	-437
26	34	2	-435
27	35	3	-432
28	42	10	-422
29	37	5	-417
30	36	4	-413
31	36	4	-409

Winter 1983-84 FI = 81 -(-595) = 676 °F - days

Table F3. Temperature Data Summary for SR 2 (MP 117.38) for Winter 1983-84 (Source: Wenatchee WSDOT Facility).

Month/Date	Daily Mean Temp.	Degree Days	Cumulative Degree Days	Month/Date	Daily Mean Temp.	Degree Days	Cumulative Degree-Days
Nov. 1, 1983	54	22	22	Dec. 1, 1983	24	8	234
2	47	15	37	2	22	10	224
3	48	16	53	3	23	9	215
4	48	16	69	4	23	9	206
5	45	13	82	5	24	8	198
6	45	13	95	6	23	9	189
7	42	10	105	7	24	8	181
8	41	9	114	8	20	12	169
9	40	8	122	9	22	10	159
10	40	8	130	10	26	6	153
11	39	7	137	11	26	6	147
12	39	7	144	12	30	2	145
13	39	7	151	13	24	8	137
14	38	6	157	14	28	4	133
15	41	9	166	15	28	4	129
16	40	8	174	16	24	8	121
17	46	14	188	17	20	12	109
18	43	11	199	18	20	12	97
19	41	9	208	19	16	16	81
20	40	8	216	20	11	21	60
21	38	6	222	21	6	26	- 34
22	37	5	227	22	2	34	- 0
23	36	4	231	23	2	34	- 34
24	36	4	235	24	8	24	- 58
25	36	4	239	25	8	24	- 82
26	35	3	242	26	9	23	-105
27	35	3	245	27	19	13	-118
28	35	3	248	28	18	14	-132
29	31	- 1	247	29	18	14	-146
30	27	- 5	242	30	18	14	-160
				31	23	9	-169

Table F3. Temperature Data Summary for SR 2 (MP 117.38) for Winter 1983-84 (Source: Wenatchee WSDOT Facility). (Cont.)

Month/Date	Daily Mean Temp.	Degree Days	Cumulative Degree-Days	Month/Date	Daily Mean Temp.	Degree Days	Cumulative Degree-Days
Jan. 1, 1984	23	- 9	-178	Feb. 1, 1984	34	2	-214
2	23	- 9	-187	2	30	- 2	-216
3	28	- 4	-191	3	30	- 2	-218
4	30	- 2	-193	4	30	- 2	-220
5	44	12	-181	5	31	- 1	-221
6	44	12	-169	6	31	- 1	-222
7	39	7	-162	7	32	0	-222
8	38	6	-156	8	34	2	-220
9	33	1	-155	9	34	2	-218
10	33	1	-154	10	36	4	-214
11	32	0	-154	11	36	4	-210
12	32	0	-154	12	36	4	-206
13	32	0	-154	13	36	4	-202
14	27	- 5	-159	14	36	4	-198
15	26	- 6	-165	15	40	8	-190
16	21	-11	-176	16	39	7	-183
17	20	-12	-188	17	37	5	-178
18	17	-15	-203	18	36	4	-174
19	15	-17	-220	19	35	3	-171
20	15	-17	-237	20	35	3	-168
21	21	-11	-248	21	34	2	-166
22	22	-10	-258	22	42	10	-156
23	28	- 4	-262	23	36	4	-152
24	36	4	-258	24	38	6	-146
25	42	10	-248	25	35	3	-143
26	40	8	-240	26	35	3	-140
27	37	5	-235	27	32	0	-140
28	37	5	-230	28	38	6	-134
29	38	6	-224	29	42	10	-124
30	38	6	-218				
31	34	2	-216				

Winter 1983-84 FI = 248 -(-262) = 510°F - days

Table F4. Temperature Data Summary for SR 2 (MP 159.6) for Winter 1982-83 (Source: Waterville WSDOT Facility).

Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days	Month/Date	Daily Mean Temp.	Degree Days	Cumulative Degree-Days
Nov. 1, 1982	40	8	8	Dec. 1, 1982	33	1	- 37
2	42	10	18	2	32	0	- 37
3	38	6	24	3	30	- 2	- 39
4	37	5	29	4	38	6	- 33
5	42	10	39	5	35	3	- 30
6	38	6	45	6	32	0	- 30
7	38	6	51	7	23	- 9	- 39
8	35	3	54	8	17	-15	- 54
9	32	0	54	9	17	-15	- 69
10	32	0	54	10	18	-14	- 84
11	32	0	54	11	22	-10	- 93
12	33	1	55	12	20	-12	-105
13	31	- 1	54	13	18	-14	-119
14	31	- 1	53	14	26	- 6	-125
15	30	- 2	51	15	26	- 6	-131
16	29	- 3	48	16	31	- 1	-132
17	29	- 3	45	17	37	5	-127
18	31	- 1	44	18	30	- 2	-129
19	29	- 3	41	19	28	- 4	-133
20	32	0	41	20	31	- 1	-134
21	28	- 4	37	21	28	- 4	-138
22	24	- 8	29	22	25	- 7	-145
23	14	-18	11	23	28	- 4	-149
24	15	-17	- 6	24	23	- 9	-158
25	20	-12	-18	25	25	- 7	-165
26	20	-12	-30	26	24	- 8	-173
27	24	- 8	-38	27	22	-10	-183
28	28	- 4	-42	28	18	-14	-197
29	31	- 1	-43	29	14	-18	-215
30	35	3	-40	30	21	-11	-226
31	34	2	-38	31	20	-12	-238

Table F4. Temperature Data Summary for SR 2 (MP 159.6) for Winter 1982-83 (Source: Watervill WSDOT Facility). (Cont.)

Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days	Month/Date	Daily Mean Temp.	Degree Days	Cumulative Degree-Days
Jan. 1, 1983	14	-18	-256	Feb. 1, 1983	35	3	-287
2	18	-14	-270	2	34	2	-285
3	14	-18	-288	3	30	- 2	-287
4	14	-18	-306	4	28	- 4	-291
5	22	-10	-316	5	26	- 6	-297
6	31	- 1	-317	6	28	- 4	-301
7	27	- 5	-322	7	22	-10	-311
8	35	3	-319	8	30	- 2	-313
9	35	3	-316	9	27	- 5	-318
10	39	7	-309	10	25	- 7	-325
11	45	13	-296	11	28	- 4	-329
12	37	5	-291	12	35	3	-326
13	37	5	-286	13	37	5	-321
14	30	- 2	-288	14	37	5	-316
15	30	- 2	-290	15	32	0	-316
16	29	- 3	-293	16	28	- 4	-320
17	30	- 2	-295	17	36	4	-316
18	29	- 3	-298	18	39	7	-309
19	33	1	-297	19	36	4	-305
20	34	2	-295	20	35	3	-302
21	36	4	-291	21	36	4	-298
22	32	0	-291	22	37	5	-293
23	28	- 4	-295	23	38	6	-287
24	30	- 2	-297	24	39	7	-280
25	34	2	-295	25	35	3	-277
26	31	- 1	-296	26	34	2	-275
27	35	3	-293	27	36	4	-271
28	32	0	-293	28	38	6	-265
29	34	2	-291				
30	32	0	-291				
31	33	1	-290				

Winter 1982-83 FI = 55 -(-329) = 384 °F - days

Table F5. Temperature Data Summary for SR 2 (MP 159.6) for Winter 1983-84 (Source: Waterville WSDOT Facility). (Cont.)

Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days	Month/Date	Daily Mean Temp.	Degree Days	Cumulative Degree-Days
ɔv. 1, 1983	51	19	19	Dec. 1, 1983	15	-17	144
2	43	11	30	2	18	-14	130
3	46	14	44	3	18	-14	116
4	45	13	57	4	19	-13	103
5	42	10	67	5	18	-14	89
6	42	10	77	6	21	-11	78
7	40	8	85	7	21	-11	67
8	37	5	90	8	16	-16	51
9	34	2	92	9	20	-12	39
10	35	3	95	10	29	- 3	36
11	38	6	101	11	34	2	38
12	38	6	107	12	22	-10	28
13	38	6	113	13	18	-14	14
14	42	10	123	14	27	- 5	9
15	37	5	128	15	24	- 8	1
16	42	10	138	16	22	-10	- 9
17	45	13	151	17	21	-11	- 20
18	40	8	159	18	15	-17	- 37
19	39	7	166	19	15	-17	- 54
20	39	7	173	20	11	-21	- 75
21	39	7	180	21	- 1	-33	-108
22	34	2	182	22	- 4	-36	-144
23	31	- 1	181	23	- 8	-40	-184
24	32	0	181	24	- 9	-41	-225
25	31	- 1	180	25	3	-29	-254
26	32	0	180	26	15	-17	-271
27	34	2	182	27	14	-18	-289
28	27	- 5	177	28	8	-24	-313
29	26	- 6	171	29	15	-17	-330
30	22	-10	161	30	13	-19	-349
				31	14	-18	-367

Table F5. Temperature Data Summary for SR 2 (MP 159.6) for Winter 1983-84 (Source: Waterville WSDOT Facility). (Cont.)

Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days	Month/Date	Daily Mean Temp.	Degree Days	Cumulative Degree-Days
Jan. 1, 1984	20	-12	-379	Feb. 1, 1984	34	2	-484
2	25	- 7	-386	2	32	0	-484
3	26	- 6	-392	3	35	3	-481
4	30	- 2	-394	4	32	0	-481
5	42	10	-384	5	31	-1	-482
6	35	3	-381	6	32	0	-482
7	33	1	-380	7	27	-5	-487
8	32	0	-380	8	29	-3	-490
9	31	- 1	-381	9	32	0	-490
10	29	- 3	-384	10	30	-2	-492
11	32	0	-384	11	35	3	-489
12	34	2	-382	12	31	-1	-490
13	32	0	-382	13	33	1	-489
14	24	- 8	-390	14	34	2	-487
15	12	-20	-410	15	38	6	-481
16	13	-19	-429	16	36	4	-477
17	15	-17	-446	17	30	-2	-479
18	10	-22	-468	18	30	-2	-481
19	11	21	-489	19	30	-2	-483
20	12	-20	-509	20	33	1	-482
21	11	-21	-530	21	32	0	-482
22	17	-15	-545	22	36	4	-478
23	27	- 5	-550	23	34	2	-476
24	40	8	-542	24	36	4	-472
25	43	11	-531	25	32	0	-472
26	40	8	-523	26	31	-1	-473
27	39	7	-516	27	26	-6	-479
28	45	13	-503	28	30	-2	-481
29	40	8	-495	29	38	6	-475
30	41	9	-486				
31	32	0	-486				

Table F5. Temperature Data Summary for SR 2 (MP 159.6) for Winter 1983-84 (Source: Waterville WSDOT Facility). (Cont.)

Month/Date	Daily Mean Temp.	Degree-Days	Cumulativie Degree-Days
Mar. 1, 1984	35	3	-472
2	35	3	-469
3	37	5	-464
4	37	5	-459
5	39	7	-452
6	38	6	-446
7	41	9	-437
8	42	10	-427
9	40	8	-419
10	40	8	-411
11	40	8	-403
12	40	8	-395
13	40	8	-387
14	35	3	-384
15	39	7	-377
16	38	6	-371
17	40	8	-363
18	40	8	-355
19	41	9	-346
20	43	11	-335
21	40	8	-327
22	44	12	-315
23	48	16	-299
24	44	12	-287
25	44	12	-275
26	41	9	-266
27	43	11	-255
28	47	15	-240
29	40	8	-232
30	41	9	-223
31	41	9	-214

Winter 1983-84 FI = 182 -(-550) = 732 °F - days

Table F6. Temperature Data Summary for SR 172 for Winter 1982-83 (Source: Mansfield WSDOT Facility).

Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days	Month/Date	Daily Mean Temp.	Degree Days	Cumulative Degree Days
Nov. 1, 1982	39	7	7	Dec. 1, 1982	34	2	- 89
2	39	7	14	2	35	3	- 86
3	39	7	21	3	32	0	- 86
4	40	8	29	4	31	- 1	- 87
5	42	10	39	5	31	- 1	- 87
6	38	6	45	6	30	- 2	- 89
7	38	6	51	7	26	- 6	- 95
8	34	2	53	8	16	-16	-111
9	36	4	57	9	16	-16	-127
10	32	0	57	10	20	-12	-139
11	32	0	58	11	23	- 9	-148
12	33	1	58	12	23	- 9	-157
13	31	- 1	57	13	26	- 6	-163
14	30	- 2	55	14	22	-10	-173
15	28	- 4	51	15	27	- 5	-178
16	26	- 6	45	16	36	4	-174
17	28	- 2	43	17	38	6	-168
18	28	- 2	41	18	34	2	-166
19	29	- 3	38	19	34	2	-164
20	26	- 6	32	20	30	- 2	-166
21	26	- 6	26	21	28	- 4	-170
22	23	- 9	17	22	28	- 4	-174
23	14	-18	- 1	23	26	- 6	-180
24	13	-19	-20	24	21	-11	-191
25	16	-16	-36	25	20	-12	-203
26	16	-16	-52	26	20	-12	-215
27	17	-15	-67	27	15	-19	-232
28	17	-15	-82	28	16	-16	-248
29	20	-12	-94	29	12	-20	-268
30	35	- 3	-91	30	11	-21	-289
				31	15	-17	-306

Table F6. Temperature Data Summary for SR 172 for Winter 1982-83 (Source: Mansfield WSDOT Facility). (Cont.)

Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days	Month/Date	Daily Mean Temp.	Degree Days	Cumulative Degree-Days
Jan. 1, 1983	15	-17	-323	Feb. 1, 1983	34	2	-367
2	15	-17	-349	2	34	2	-365
3	15	-17	-357	3	32	0	-365
4	13	-19	-376	4	26	- 6	-371
5	26	- 6	-382	5	23	- 9	-380
6	32	0	-382	6	20	-12	-392
7	25	- 7	-389	7	28	- 4	-396
8	30	- 2	-391	8	28	- 4	-400
9	30	- 2	-393	9	28	- 4	-404
10	35	3	-390	10	30	- 2	-406
11	28	- 4	-394	11	30	- 2	-408
12	37	5	-389	12	30	- 2	-410
13	36	4	-385	13	30	- 2	-412
14	38	6	-370	14	30	- 2	-414
15	32	0	-379	15	30	- 2	-416
16	31	- 1	-380	16	34	+ 2	-414
17	25	- 7	-387	17	33	1	-413
18	30	- 2	-389	18	40	8	-405
19	36	4	-385	19	40	8	-397
20	34	2	-383	20	40	8	-389
21	35	3	-380	21	40	8	-381
22	33	1	-379	22	40	8	-373
23	32	0	-370	23	40	8	-365
24	30	- 2	-381	24	40	8	-357
25	33	1	-380	25	40	8	-349
26	35	3	-377	26	40	8	-341
27	34	2	-375	27	39	7	-334
28	33	1	-374	28	39	7	-327
29	33	1	-373				
30	34	2	-371				
31	34	2	-369				

Winter 1982-83 FI = 58 -(-416) = 474 °F - days

Table F7. Temperature Data Summary for SR 172 for Winter 1983-84 (Source: Mansfield WSDOT Facility).

Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days	Month/Date	Daily Mean Temp.	Degree Days	Cumulative Degree Days
ıv. 1, 1983	48	16	16	Dec. 1, 1983	17	-15	170
2	46	14	30	2	17	-15	155
3	48	16	46	3	16	-16	139
4	46	14	60	4	15	-17	122
5	44	12	72	5	14	-18	104
6	43	11	83	6	22	-10	94
7	41	9	92	7	22	-10	84
8	37	5	97	8	17	-15	69
9	41	9	106	9	22	-10	59
10	35	3	109	10	24	- 8	51
11	35	6	115	11	24	- 8	43
12	38	6	121	12	26	- 6	38
13	38	6	127	13	23	- 9	28
14	41	9	136	14	25	- 7	21
15	40	8	144	15	24	- 8	13
16	40	8	152	16	19	-13	0
17	45	13	163	17	15	-17	- 17
18	41	9	172	18	14	-18	- 35
19	40	8	180	19	10	-22	- 57
20	39	7	187	20	7	-25	- 82
21	38	6	193	21	1	-31	-113
22	37	5	198	22	8	-24	-137
23	34	2	200	23	5	-27	-164
24	33	1	201	24	5	-27	-191
25	33	1	202	25	6	-26	-217
26	32	0	202	26	5	-27	-244
27	32	0	202	27	16	-16	-260
28	31	- 1	201	28	18	-14	-274
29	26	- 6	195	29	13	-19	-293
30	22	-10	185	30	16	-16	-309
				31	11	-11	-320

Table F7. Temperature Data Summary for SR 172 for Winter 1983-84 (Source: Mansfield WSDOT Facility). (Cont.)

Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days	Month/Date	Daily Mean Temp.	Degree Day	Cumulative Degree Days
Jan. 1, 1984	21	-11	-331	Feb. 1, 1984	34	2	-483
2	21	-11	-342	2	30	-2	-485
3	26	- 6	-348	3	32	0	-485
4	32	0	-348	4	31	-1	-486
5	42	10	-338	5	30	-2	-488
6	36	4	-334	6	29	-3	-491
7	33	1	-333	7	28	-4	-495
8	33	1	-332	8	30	-2	-497
9	30	- 2	-334	9	32	0	-497
10	30	- 2	-336	10	31	-1	-498
11	29	- 3	-339	11	31	-1	-499
12	23	- 9	-348	12	30	-2	-501
13	28	- 4	-352	13	30	-2	-503
14	20	-12	-364	14	30	-2	-505
15	20	-12	-376	15	34	2	-503
16	12	-20	-396	16	36	4	-499
17	18	-14	-410	17	32	0	-499
18	10	-22	-432	18	32	0	-499
19	9	-23	-455	19	32	0	-499
20	9	-23	-478	20	32	0	-499
21	16	-16	-494	21	32	0	-499
22	17	-15	-509	22	37	5	-494
23	24	- 8	-517	23	34	2	-492
24	36	4	-513	24	34	2	-490
25	37	5	-508	25	32	0	-490
26	38	6	-502	26	32	0	-490
27	36	4	-498	27	30	- 2	-492
28	36	4	-494	28	34	2	-490
29	36	4	-490	29	36	4	-486
30	36	4	-486				
31	33	1	-485				

Winter 1983-84 FI = 202 -(-517) = 719°F - days

Table F8. Temperature Data Summary for SR 174 for Winter 1982-83 (Source: Electric City WSDOT Facility).

Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days	Month/Date	Daily Mean Temp.	Degree Days	Cumulative Degree-Days
Nov. 1, 1982	42	10	10	Dec. 1, 1982	39	7	75
2	42	10	20	2	39	7	82
3	45	13	33	3	38	6	88
4	43	11	44	4	40	8	96
5	44	12	56	5	40	8	104
6	41	9	65	6	42	10	114
7	40	8	73	7	29	- 3	111
8	39	7	80	8	25	- 7	104
9	37	5	85	9	24	- 8	96
10	38	6	91	10	15	-17	79
11	38	6	97	11	19	-13	66
12	37	5	102	12	20	-12	54
13	35	3	105	13	24	- 8	46
14	34	2	107	14	20	-12	34
15	32	0	107	15	37	5	37
16	33	1	108	16	44	12	49
17	37	5	113	17	39	7	56
18	42	10	123	18	38	6	62
19	37	5	128	19	37	5	67
20	33	1	129	20	36	4	71
21	33	1	130	21	32	0	71
22	29	- 3	127	22	38	6	77
23	19	-13	114	23	28	- 4	73
24	20	-12	102	24	26	- 6	67
25	23	- 9	93	25	26	- 6	61
26	23	- 9	84	26	26	- 6	55
27	24	- 8	76	27	24	- 8	47
28	24	- 8	68	28	18	-14	33
29	27	- 5	63	29	20	-12	21
30	35	3	66	30	22	-10	11
				31	20	-12	-1

Table F8. Temperature Data Summary for SR 174 for Winter 1982-83 (Source: Electric City WSDOT Facility). (Cont.)

Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days	Month/Date	Daily Mean Temp.	Degree Days	Cumulative Degree-Days
Jan. 1, 1983	21	-11	-13	Feb. 1, 1983	36	4	75
2	21	-11	-24	2	34	2	88
3	22	-10	-34	3	32	0	88
4	26	- 6	-40	4	30	- 2	75
5	30	- 2	-42	5	29	- 3	72
6	34	2	-40	6	28	- 4	68
7	33	1	-39	7	30	- 2	66
8	37	5	-34	8	32	0	66
9	38	6	-28	9	30	- 2	64
10	42	10	-18	10	29	- 3	61
11	42	10	- 8	11	35	3	64
12	41	9	1	12	35	3	67
13	36	4	5	13	36	4	71
14	34	2	7	14	42	10	81
15	31	- 1	6	15	39	7	88
16	31	- 1	5	16	41	9	97
17	28	- 4	1	17	42	10	107
18	28	- 4	- 3	18	40	8	115
19	33	1	- 2	19	40	8	123
20	36	4	2	20	40	8	131
21	36	4	6	21	40	8	148
22	36	4	10	22	40	8	156
23	37	5	15	23	45	13	169
24	37	5	20	24	46	14	183
25	38	6	26	25	41	9	192
26	45	13	39	26	42	10	202
27	40	8	47	27	42	10	212
28	40	8	55	28	43	11	223
29	38	6	61				
30	38	6	67				
31	36	4	71				

Winter 1982-83 FI = 130 -(-42) = 172 °F - days

Table F9. Temperature Data Summary for SR 174 for Winter 1983-84 (Source: Electric City WSDOT Facility). (Cont.)

Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days	Month/Date	Daily Mean Temp.	Degree Days	Cumulative Degree-Days
Nov. 1, 1983	51	19	19	Dec.1, 1983	22	-10	327
2	51	19	38	2	25	- 7	320
3	52	20	58	3	24	- 8	312
4	52	20	78	4	23	- 9	303
5	49	17	95	5	22	-10	293
6	49	17	112	6	28	- 6	287
7	46	14	126	7	24	- 8	279
8	38	6	132	8	24	- 8	271
9	40	8	140	9	27	- 5	266
10	40	8	148	10	31	- 1	265
11	43	11	159	11	31	- 1	264
12	43	11	170	12	35	4	268
13	43	11	181	13	31	- 1	267
14	46	14	195	14	33	1	268
15	44	12	207	15	33	1	269
16	49	17	224	16	28	- 4	265
17	48	16	240	17	22	-10	255
18	44	12	252	18	21	-11	244
19	44	12	264	19	15	-17	227
20	44	12	276	20	14	-18	209
21	44	12	288	21	5	-27	182
22	41	9	297	22	1	-31	151
23	38	6	303	23	-1	-33	118
24	38	6	309	24	10	-22	96
25	38	6	315	25	10	-22	74
26	39	7	322	26	10	-22	52
27	39	7	329	27	21	-11	41
28	39	7	336	28	16	-16	25
29	35	3	339	29	16	-16	9
30	30	-2	337	30	19	-13	-4
				31	.23	- 9	-13

Table F9. Temperature Data Summary for SR 174 for Winter 1983-84 (Source: Electric City WSDOT Facility). (Cont.)

Month/Date	Daily Mean Temp.	Degree-Days	Cumulative Degree-Days	Month/Date	Daily Mean Temp.	Degree Days	Cumulative Degree Days
Jan. 1, 1984	23	- 9	- 22	Feb. 1, 1984	30	-2	-100
2	24	- 8	- 30	2	32	0	-100
3	28	- 6	- 36	3	32	0	-100
4	35	3	- 33	4	31	-1	-101
5	37	5	- 28	5	31	-1	-102
6	37	5	- 23	6	30	-2	-104
7	36	4	- 19	7	31	-1	-105
8	36	4	- 15	8	32	0	-105
9	35	3	- 12	9	35	3	-102
10	34	2	- 10	10	34	2	-100
11	33	1	- 9	11	34	2	- 98
12	30	- 2	- 11	12	34	2	- 96
13	28	- 4	- 15	13	34	2	- 94
14	26	- 6	- 21	14	34	2	- 92
15	26	- 6	- 27	15	37	5	- 87
16	24	- 8	- 35	16	38	6	- 81
17	20	-12	- 47	17	35	3	- 78
18	20	-12	- 59	18	35	3	- 75
19	18	-14	- 73	19	35	3	- 72
20	12	-20	- 93	20	35	3	- 69
21	17	-15	-108	21	35	3	- 66
22	18	-14	-122	22	36	4	- 62
23	23	- 9	-131	23	37	5	- 57
24	32	0	-131	24	38	4	- 53
25	40	9	-123	25	35	3	- 50
26	39	7	-116	26	35	3	- 47
27	34	2	-114	27	34	2	- 45
28	35	3	-111	28	40	8	- 37
29	36	4	-107	29	41	9	- 29
30	37	5	-102				
31	36	4	- 98				

Winter 1983-84 FI = 339 -(-131) = 470°F - days.