DEVELOPMENT OF A SIMPLE DEVICE FOR PREDICTING THE PERMISSIBLE SPRING AXLE LOADING OF ASPHALT PAVEMENTS

A Progress Report

RESEARCH PROJECT 30

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Materials Section
Surveys and Plans Division

State of Idaho
DEPARTMENT OF HIGHWAYS
Boise, Idaho

ACKNOWLEDGEMENTS

This project was assigned to the Materials Laboratory under Harry L. Day, Materials Engineer. The test beams were constructed by Joe Kennedy, Laboratory Equipment Repairman, of the Laboratory and the African Curvature Meter constructed by the District 3 Machine Shop. Field crews were supervised by Al Deonier, Engineering Technician III, and data was assembled and analyzed by Gene Wortham, Engineer in Training.

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SYNOPSIS

The measurement of pavement deflection can provide valuable information for predicting the load-carrying capacity of asphalt pavements. It is agreed by most states that deflection measurements are invaluable in evaluating existing pavements and will become equally important in the design of future flexible pavements.

The Benkelman Beam has been used by many Highway Departments to aid in the evaluation of flexible pavement performance. This device while extremely useful is large and cumbersome for use in the frequent and numerous pavement deflection tests as advocated by this project in measuring the pavement condition during the spring breakup period by maintenance personnel.

The Union of South Africa has developed a curvature meter 10 inches in length using a 0.0001-inch dial. Phase I of this research project consisted of the design and construction of similar devices 10-, 30-, and 48-inches in length, respectively. These devices were then correlated with the Benkelman Beam. The 30- and 48-inch beams proved much easier to operate and both correlated very well with the Benkelman Beam. The 10-inch curvature meter was more difficult to operate and was damaged before the series of tests were completed. Limited test data did show, however, that its correlation was satisfactory. The next phase of this project will be the collection of field data from roadway test sections throughout the state. This data will be analyzed to determine if load limits may be placed on highways during spring breakup with deflection measurements serving as the criterion.

I. INTRODUCTION

The Benkelman Beam was developed for the WASHO Road Test at Malad, Idaho, where it correlated very well with the performance of the pavements. It was also used at the AASHO Road Test at Ottawa, Illinois, where it also correlated with performance.

The Union of South Africa developed a device to measure the radius of curvature of the deflection basin measuring only 10 inches in length. This device was developed due to work performed at the road test sites and elsewhere indicates that performance of the pavements appears to correlate even better with the radius of curvature of the pavement. A 10-inch African radius of curvature device was constructed for correlation with the Benkelman Beam but also 30-inch and 48-inch beams were constructed and patterned after the South African device.

Several features of the 30-inch and 48-inch beams indicate that these devices would be simpler to use than either the Benkelman Beam or curvature meter. The purpose of developing a smaller instrument than the Benkelman Beam is to enable District maintenance personnel to take deflection measurements during the spring breakup period so that, if necessary, the application of load restrictions may be imposed on Idaho roads using some measurable deflection relationship rather than "rule of thumb" decisions. The next phase of this project will be the collection of deflection data by maintenance personnel and analyzing this data to develop relationships between fall and spring deflections to establish load limits by deflection readings.

Three deflection measuring beams 10-, 30-, and 48-inch in length respectively, were constructed and subsequently tested in the field. Figure 1 shows the four beams used in this project, i.e., the

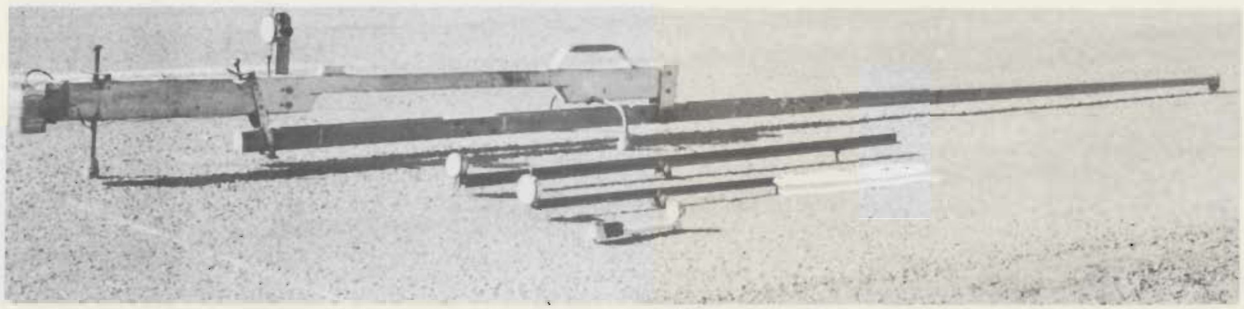

Figure 1 - Pavement deflection measuring equipment

Top - Benkelman Beam
2nd - 48-inch rigid beam
3rd - 30-inch rigid beam
Bottom - 10-inch African Curvature Meter

Benkelman Beam, 48-inch beam, 30-inch beam, and 10-inch African curvature meter. The 30- and 48-inch beam were equipped with 0.001-inch dials since readings were obtained with magnitudes in this range in lieu of the 0.0001-inch dial of the South African curvature meter.

It should be noted that the purpose of this research project was not to go into the theory behind the mechanics of the beams but only to compare the deflection values obtained to determine if a good correlation exists with the Benkelman Beam. However, a few comments will be made concerning the beams used to clarify the devices used.

The 30- and 48-inch beams are actually more of a curvature meter than a total deflection measuring instrument with the 10-inch beam or African curvature meter referred to as measuring the extreme curvature. The Benkelman Beam is in comparison measuring more nearly the total deflection. In the case of the 10-inch beam, it is believed that the differential deflection occurring over a short distance is related to the curvature of the surface over that distance. Whereas, with the Benkelman Beam, the instrument measures approximately the total deflection of the pavement. It has been shown that curvature is a more accurate measure of severity of flexure than is deflection, and that the sharpness of the basin of deflection has the most influence on flexible pavement breakup. The 30- and 48-inch beams are devices which occupy a position between the curvature meter and the Benkelman Beam be measuring the depth of the deflection basin over a greater span than the African curvature meter but not the approximate total deflection of the pavement as recorded by the Benkelman Beam.

In this study, the correlation and expression of results has been in deflection winches, rather than by radius of curvature.

Figure 2 represents the basic principles of the 10-, 30- and

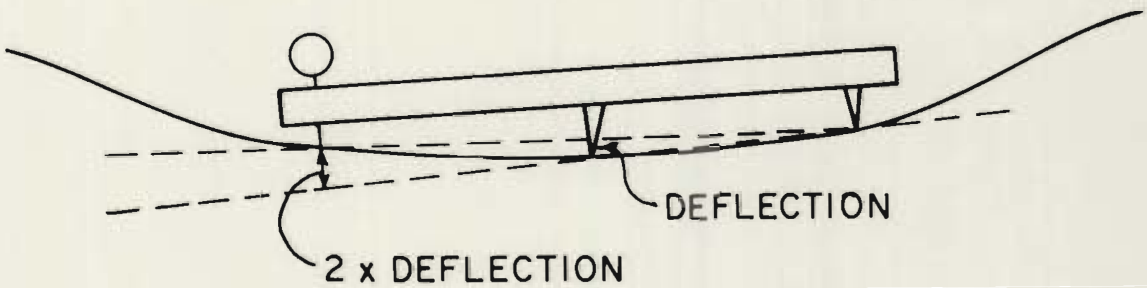

FIG. 2 - PRINCIPAL OF DESIGN OF 10" AFRICAN CURVATURE METER AND 30" & 48" RIGID BEAMS

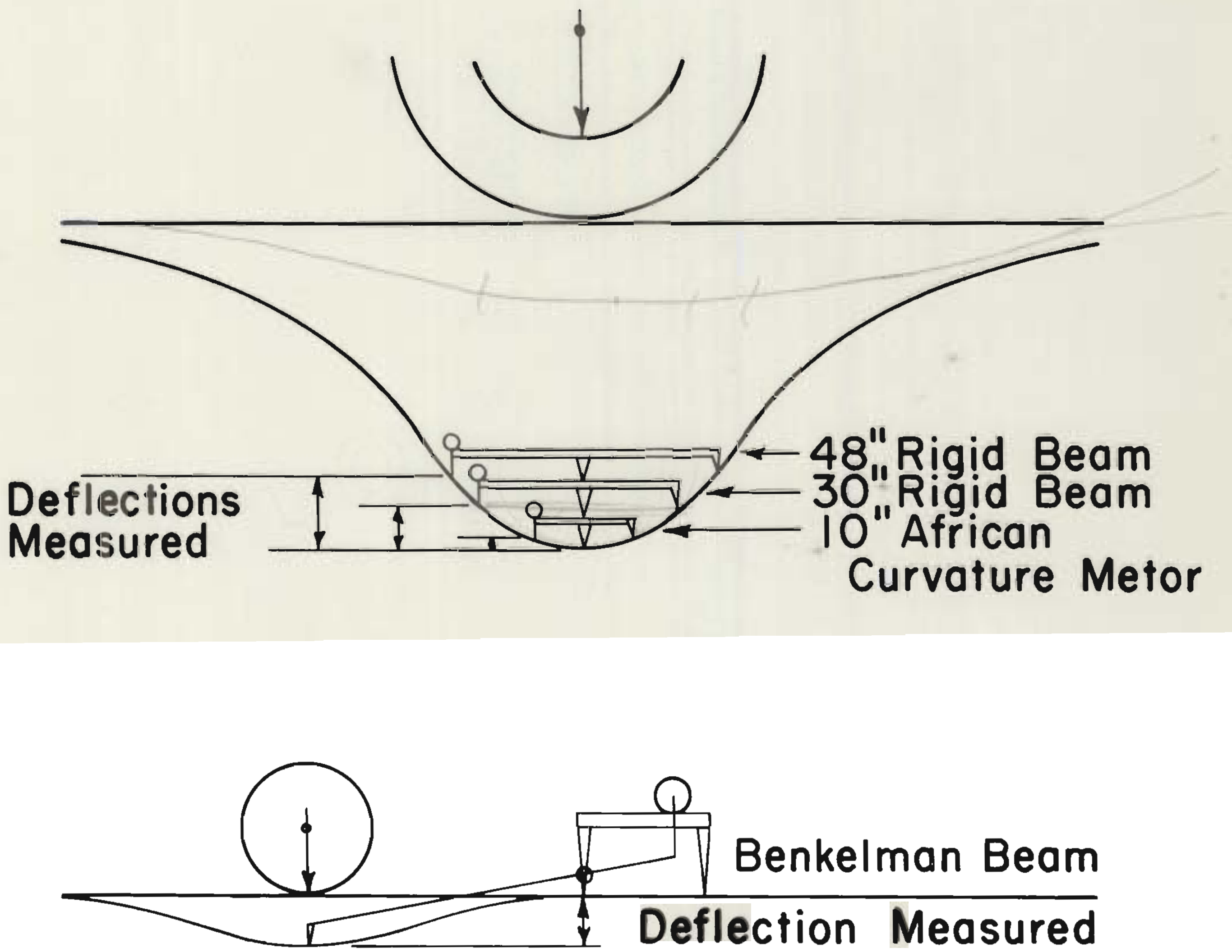

Fig. 3 - Longitudenal Profile of Deflection Basin and Relative Deflections Measured.

48-inch experimental beams used and the relationship of pavement surface to measurement.

Figure 3 represents a deflection basin and the relative location of the various instruments used in relationship to this basin. It should be noted that the minimum deflection is measured by the 10-inch beam, and the 30-inch, 48-inch and Benkelman Beams each giving greater deflections in that order. The point of inflection where the surface profile changes from concave to convex is not known. It is possible that the 48-inch and possibly the 30-inch beams measure the depth of depression from outside the point of inflection. The Benkelman Beam is outside the point of inflection. The African curvature meter is considered within the concave portion of the profile.

Test Procedure

Road test sections were selected in the vicinity of Boise on which to conduct the deflection measuring tests. Twenty-seven locations were chosen and at each location 10 deflection measuring positions were marked off 15 ft. apart. Deflections were always measured in the outer wheel path with each beam measuring the deflection at the same point on the highway. For each location, the mean of the ten readings was used as the deflection value for that test section. Therefore, in the analysis, 27 sampling values were used with each sample value being the mean of 10 readings. Appendix A, Table I, lists the location of the test site locations.

The loaded test vehicle consisted of a truck with single rear axle and dual wheels having a rear axle load of 15,000 pounds. For each measurement the right rear wheel of the truck was centered over the point, the instrument placed in position, the original reading taken and the truck moved forward to obtain the deflection reading. After a reading was taken with one device, the truck was backed to its original position and the next beam tested. A possible source of error of this sequence of measurements could arise from plastic deformation or slow elastic rebound. However, the Benkelman Beam was checked consistently over the same point and results did not seem to vary appreciably.

Observations on Ease of Use

The 10-inch beam was abandoned from use after damage of the device in the field. It was learned, however, that the 10-inch device required greater care in handling and consumed considerably more time in setting up and reading than did the 30- and 48-inch beams. It should be understood that the abandonment of the 10-inch beam is no reflection upon the accuracy of the instrument but only due to breakage.

The application of the 10-inch beam is shown in Figure 4. It can easily be seen that the placement of this instrument by maintenance personnel is not desirable from the standpoint of the objectives of this project. The testing of the 10-inch beam was discontinued about one-fourth of the way through this series of tests due to damage received by the dial during testing operations.

Application of the 30- and 48-inch beams is shown in Figure 5. Note that the person setting up and reading the instrument has to be down close to the pavement under the truck, but not in such an awkward position as that required by the 10-inch beam.

Figure 6 shows the Benkelman Beam in operation. Note the easier body position of the operator but the larger, more cumbersome size of beam to be aligned properly. Since a simple, rugged, easily portable and handled device was desired, the 30-inch beam was believed to fulfill this need best providing it appeared to give an equally good correlation with the Benkelman Beam.

Figure 4 - Placement between dual tires of the
10-inch African curvature meter.
(Note - Extreme care required.)

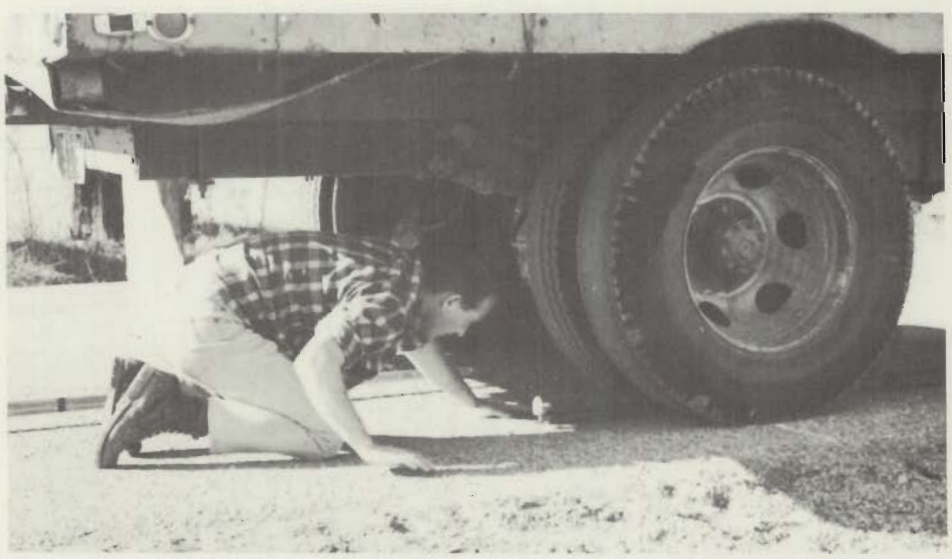

Figure 5 - Placement of 30- or 48-inch rigid
beam. (Note - Easier position of
operator.)

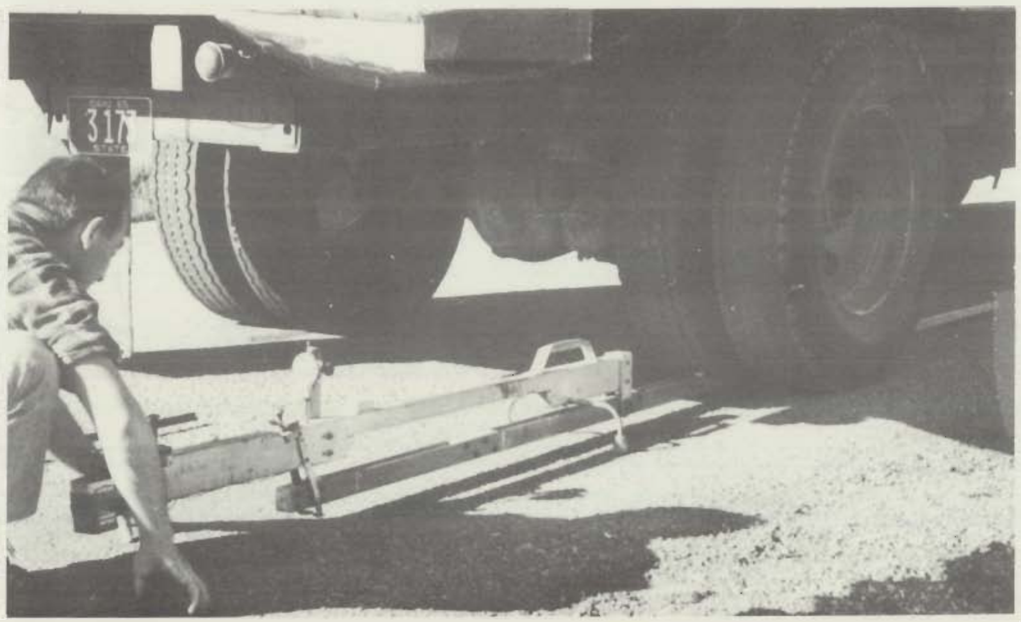

Figure 6 - Placement of Benkelman Beam in position (Note - The CGRA method requires placing end of the probe directly over the selected position rather than by and the position as indicated. These tests were made as indicated reading the maximum deflection as the truck drives ahead.)

Analysis of Results

The deflection readings were correlated with the Benkelman Beam readings for the 27 stations comparing each short beam individually with the Benkelman Beam results. However, the results of the correlation for the 30- and 48-inch beams will be discussed together so that a comparison of these two can be more readily seen.

The data were plotted on arithmetic graph paper and a least squares regression line computed for the data which is also shown. See Figures 7 and 8. The coefficient of correlation for the 30-inch beam is 0.950 and for the 48-inch beam, 0.977. This means we can say with more than 90 per cent certainty that a correlation exists. From the limited data available and analyzed, the correlation coefficient for the 10-inch beam was 0.842. We can say there is a correlation but since the data is considered too limited, possibilities exist this correlation may be inaccurate.

The estimate of error was computed for the 30- and 48-inch beams with the Benkelman Beam and in both instances the value is 0.004 inches. This means 68 per cent of the data is within ± 0.004 inches of the least squares line and 95 per cent is within ± 0.008 inches.

Since the beams are not measuring the deflection for the same span lengths and the shape of the deflection basins are different depending on the stiffness of the pavement, a perfect correlation should not be expected. Since the 30-inch beam is easier to use and more nearly measures the deflection within the concave portion of the basin, it was chosen as the device to be used for this project.

A careful review of the test data shows that in some instances the 30-inch beam indicated greater deflections than did the 48-inch beam and in a few instances greater than the Benkelman Beam. The 48-inch beam

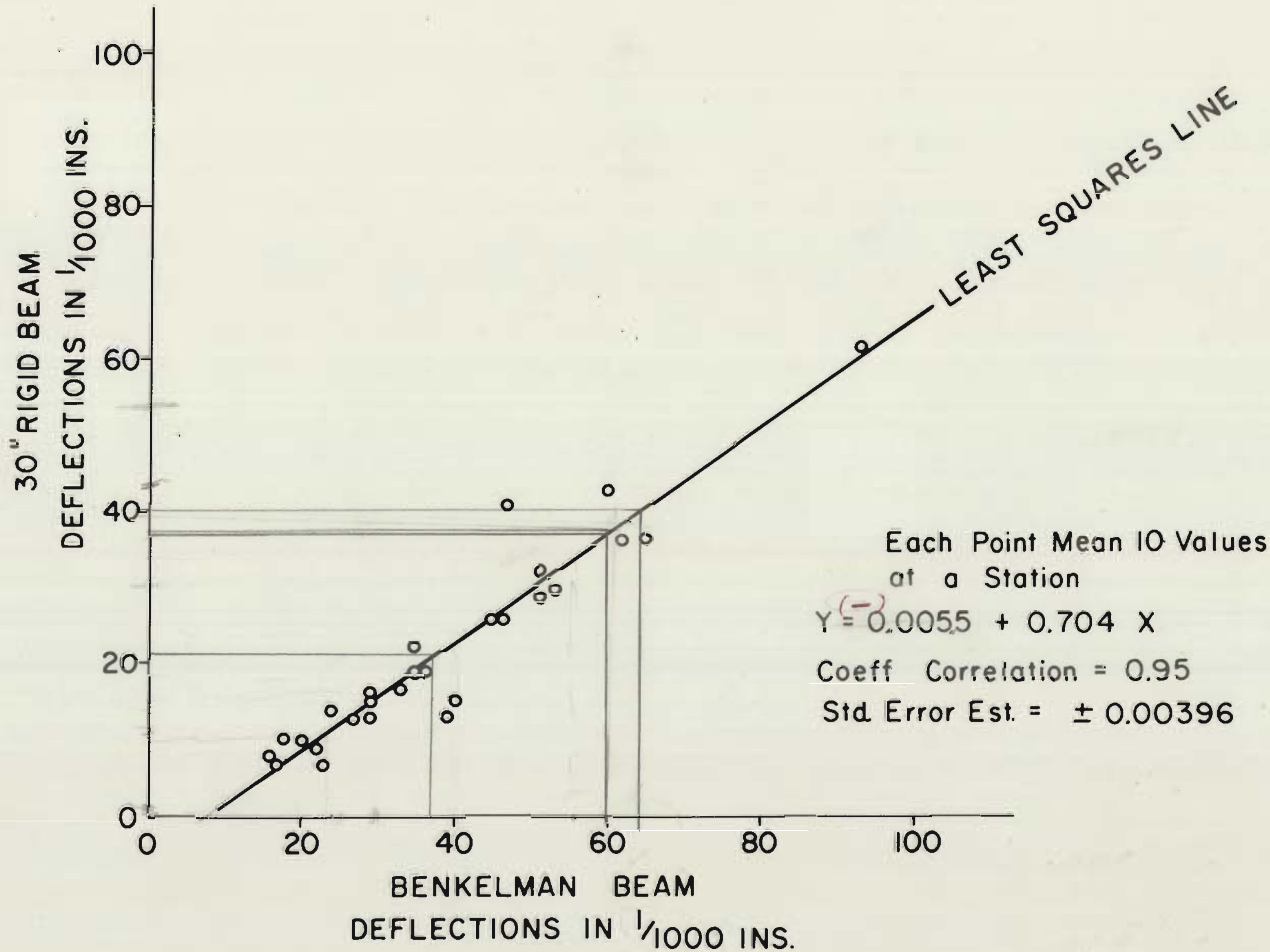

FIG. 7 - COMPARISON OF 30" RIGID BEAM WITH BENKELMAN BEAM

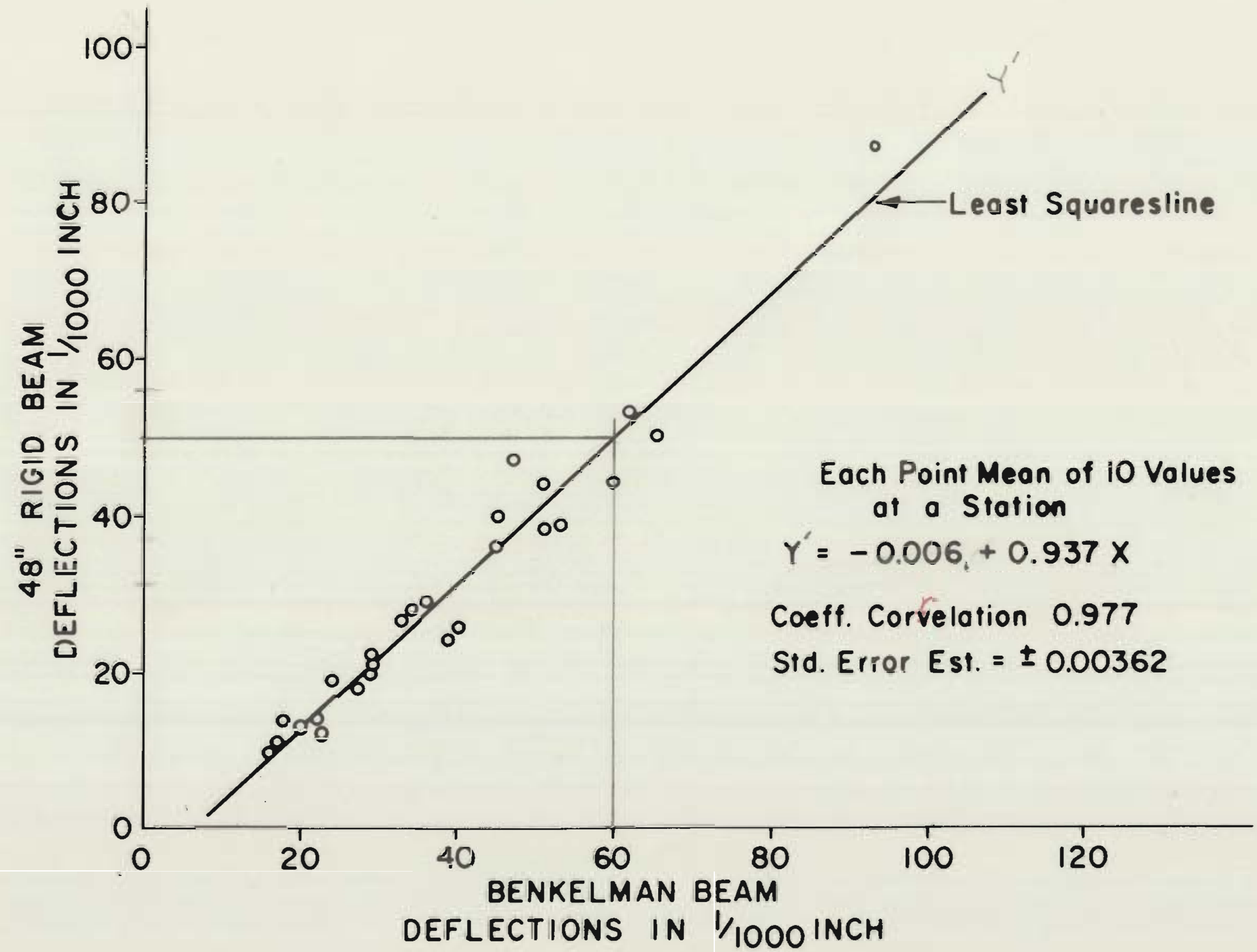

FIG. 8 - COMPARISON OF 48" RIGID BEAM WITH BENKLMAN BEAM

also indicated greater deflection values than the Benkelman Beam in a few instances.

Figure 3 indicates these values are in all probability reading or recording errors. This data was not omitted from the analysis as possibly compensating errors may also exist and a bias of unknown degree would therefore be introduced. The only alternative would be to redo parts of the experiment which obviously is impossible. Since the data did give a sufficiently good correlation to warrant the continuation of the study with the 30-inch beam during the spring breakup period by the districts, further correlation work was not undertaken.

Errors in reading the Benkelman Beam are very easy to make using the procedure followed by Idaho in the past. Use of the Canadian Good Roads procedure would eliminate taking a reading while the truck is moving and hence increase its accuracy as more time is available to read the dial.

Conclusions

The following conclusions are drawn from this study:

1. The 30- and 48-inch beams correlate with the Benkelman Beam with over 90 per cent of the results obtained by the short beams being explained by the Benkelman Beam.

2. A correlation between the 10-inch African curvature meter and the Benkelman Beam exists; however, data available is too limited to warrant any conclusions as to the accuracy of the correlation.

3. Personnel using the test devices were unanimous in their choice that the 30-inch beam was easiest of all to place in position and adjust to read with the 48-inch beam next easiest and the 10-inch African curvature meter most difficult.

Recommendations

1. It is recommended that the 30-inch beam be adopted as standard

for this study and that six of these beams be manufactured.

2. One 30-inch beam be assigned to each district for use during the fall and spring of the 1965-66 winter season.

3. Several sites be chosen near the district office for fall measurements of deflection and repeated at intervals during the spring of 1966 to determine the rate at which the pavement structure gains strength.

4. Data obtained from this data to be analyzed for purposes of evaluating the device as a means of measuring the load carrying capacity of flexible pavements during the spring breakup period.

5. Adopt the Canadian Good Roads procedure for obtaining deflections with the Benkelman Beam on any future work. See Appendix B.

6. Adopt the procedure outlined in Appendix C for measuring deflections with the 30-inch rigid beam.

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APPENDIX A

TABLE 1

LOCATION OF DEFLECTION TEST SECTIONS

Route	Area	Designated Test Location	No. of Stations
SH 21	Boise - Barber	1	1
FAS 3785	Barber - US 30	2	4
Airport Bypass	US 30 - FAS 3786	3	1
FAS 3786	Bypass - FAS 3783	4	1
FAS 3783	FAS 3786 - US 30	5	1
US 30	FAS 3783 - Meridian	6	1
SH 69	US 30 - US 20	7	1
US 20	SH 69 - FAS 3781	8	1
SH 69	US 20 - SH 44	9	4
SH 44	SH 69 - SH 16	10	1
SH 16	SH 44 - 4 Mi. N. SH 44	11	4
SH 15	3 Mi. N. SH 44 - 7 Mi. N. SH 44	12	7

1 - A station is 10 truck positions approximately 15 ft. apart.

TABLE 2

COMPARATIVE DEFLECTION MEASUREMENTS WITH FOUR DEFLECTION INSTRUMENTS

			Deflection 1/1000ths Inches										Mean
Route	Sta.	Instr.*	1	2	3	4	5	6	7	8	9	10	Deflection
SH 21	1	BB	36	30	44	40	40	50	32	40	44	44	40
		10"	1.6	1.8	0.7	0.9	3.0	3.0	2.6	2.8	2.8	2.9	2.2
		30"	12	12	14	14	16	16	12	16	16	20	15
		48"	21	22	23	28	24	28	28	28	24	30	26
FAS 3785	1	BB	82	56	60	62	56	42	90	88	56	60	65
		10"	0.9	8.7	4.7	6.6	6.7	74	80	15.6	4.9	9.8	7.3
		30"	52	12	36	35	32	15	48	48	46	36	36
		48"	58	50	18	50	41	50	60	68	53	49	50
FAS 3785	2	BB	52	44	40	46	48	34	42	48	42	58	45
		10"	-	-	-	-	-	-	-	-	-	-	-
		30"	22	28	28	28	26	24	24	24	24	32	26
		48"	46	37	42	37	38	37	37	32	44	47	40
FAS 3785	3	BB	38	52	50	56	46	31	44	54	62	50	51
		10"	-	-	-	-	-	-	-	-	-	-	-
		30"	22	26	26	31	25	38	38	30	42	38	32
		48"	28	38	32	41	34	46	42	40	48	34	39

* Instrument	Designation
Benkelman Beam	BB
African 10" Curvature Meter	10"
30" Rigid Beam	30"
48" Rigid Beam	48"

TABLE 2 CONT'D

Route	Sta.	Instr.	Deflection 1/1000ths Inches										Mean Deflection
			1	2	3	4	5	6	7	8	9	10	
FAS 3785	4	BB	40	44	60	42	52	48	48	54	74	52	51
		10"	-	-	-	-	-	-	-	-	-	-	-
		30"	21	26	35	22	26	24	26	30	54	25	29
		48"	32	36	46	30	32	27	37	45	70	86	44
Airport Bypass	1	BB	42	32	34	40	36	38	30	30	30	40	35
		10"	2.8	-	-	-	-	-	-	-	-	-	-
		30"	24	22	26	24	21	22	18	17	18	28	22
		48"	36	22	20	31	29	30	24	23	26	40	28
FAS 3786	1	BB	20	22	24	28	22	22	20	22	24	24	23
		10"	-	-	-	-	-	-	-	-	-	-	-
		30"	8	12	6	2	10	8	8	7	4	9	7
		48"	11	8	13	11	14	12	13	12	12	12	12
FAS 3783	1	BB	96	76	90	86	108	94	94	84	92	108	93
		10"	-	-	-	-	-	-	-	-	-	-	-
		30"	74	42	24	42	80	72	70	59	72	68	61
		48"	101	44	68	74	116	77	112	86	92	92	87
US 30	1	BB	18	22	20	20	22	30	26	22	22	22	22
		10"	-	-	-	-	-	-	-	-	-	-	-
		30"	8	10	7	6	10	7	10	8	10	10	9
		48"	12	13	14	14	20	12	13	13	13	12	14

TABLE 2 CONT'D

Route	Sta.	Instr.	Deflection 1/1000ths Inches										Mean
			1	2	3	4	5	6	7	8	9	10	Deflection
SH 69	1	BB	24	26	28	30	30	38	44	42	32	52	35
		10"	-	-	-	-	-	-	-	-	-	-	-
		30"	9	8	16	15	16	18	22	36	22	30	19
		48"	14	11	22	14	20	30	37	42	38	53	28
US 20	1	BB	40	12	12	12	16	14	10	16	12	16	16
		10"	-	-	-	-	-	-	-	-	-	-	-
		30"	7	7	7	6	8	7	8	9	8	10	8
		48"	10	10	8	9	10	10	11	11	11	12	10
SH 69	1	BB	36	38	32	28	40	38	42	42	42	20	36
		10"	1.9	2.8	2.1	1.6	1.0	1.0	0.6	4.7	5.0	2.1	2.3
		30"	16	21	14	13	16	18	24	33	28	6	19
		48"	29	30	24	21	28	30	33	36	37	21	29
SH 69	2	BB	14	20	18	22	20	18	18	16	16	16	18
		10"	2.1	3.0	2.3	2.4	2.2	2.2	1.7	2.8	2.2	2.6	2.4
		30"	10	11	8	12	10	12	8	7	11	10	10
		48"	11	16	14	16	16	15	12	11	11	12	14
SH 69	3	BB	28	24	26	24	32	22	34	34	28	34	29
		10"	3.2	36	2.8	0.9	33	46	3.9	2.8	3.8	4.0	3.3
		30"	16	10	12	14	16	19	18	14	14	16	15
		48"	23	15	17	18	23	29	22	21	17	24	21

TABLE 2 CONT'D

Route	Sta.	Inst.	Deflection 1/1000ths Inches 1	2	3	4	5	6	7	8	9	10	Mean Deflection
SH 69	4	BB	30	38	32	36	28	28	36	22	28	16	29
		10"	32	2.6	2.4	3.4	4.6	2.5	2.4	2.1	1.1	2.6	2.7
		30"	14	12	12	14	16	10	16	9	12	14	13
		48"	22	24	18	18	20	38	23	14	16	20	20
SH 44	1	BB	18	18	16	16	14	16	20	16	16	18	17
		10"	-	-	-	-	-	-	-	-	-	-	-
		30"	8	8	6	3	8	4	8	5	7	7	7
		48"	10	12	12	10	10	10	10	10	11	10	11
SH 16	1	BB	20	20	20	22	22	20	20	20	16	20	20
		10"	-	-	-	-	-	-	-	-	-	-	-
		30"	8	8	10	8	10	10	10	10	10	11	10
		48"	12	14	10	12	10	13	13	11	14	14	13
SH 16	2	BB	24	24	24	20	18	18	20	30	32	30	24
		10"	-	-	-	-	-	-	-	-	-	-	-
		30"	14	12	12	12	12	12	11	19	16	18	14
		48"	19	18	17	15	14	14	12	26	26	22	19
SH 16	3	BB	26	28	28	24	34	30	32	34	28	26	29
		10"	-	-	-	-	-	-	-	-	-	-	-
		30"	13	14	14	16	16	19	18	16	16	16	16
		48"	19	20	20	21	24	26	24	24	20	22	22

TABLE 2 CONT'D

Route	Sta.	Instr.	Deflection 1/1000ths Inches 1	2	3	4	5	6	7	8	9	10	Mean Deflection
SH 16	4	BB	32	34	28	26	20	24	30	24	28	26	27
		10"	-	-	-	-	-	-	-	-	-	-	-
		30"	12	15	13	10	12	12	12	14	14	8	13
		48"	14	16	15	14	17	15	20	21	22	20	18
SH 15	1	BB	32	28	30	32	32	40	36	40	30	26	33
		10"	-	-	-	-	-	-	-	-	-	-	-
		30"	14	14	15	18	16	20	19	20	14	16	17
		48"	24	24	27	34	24	32	26	30	26	22	27
SH 15	2	BB	72	58	54	60	58	64	54	64	64	56	60
		10"	-	-	-	-	-	-	-	-	-	-	-
		30"	32	40	40	42	36	43	42	38	46	68	43
		48"	20	56	46	53	26	55	35	52	44	40	44
SH 15	3	BB	54	42	44	40	46	46	42	48	54	50	47
		10"	-	-	-	-	-	-	-	-	-	-	-
		30"	44	40	37	32	37	44	44	45	46	37	41
		48"	58	48	45	39	38	50	48	47	52	44	47
SH 15	4	BB	40	46	54	48	44	42	44	42	50	40	45
		10"	-	-	-	-	-	-	-	-	-	-	-
		30"	22	23	22	34	24	29	26	24	30	24	26
		48"	26	38	30	46	32	40	37	32	40	36	36

TABLE 2 CONT'D

Route	Sta.	Instr.	Deflection 1/1000ths Inches 1	2	3	4	5	6	7	8	9	10	Mean Deflection
SH 15	5	BB	28	34	42	48	48	48	38	36	32	36	39
		10"	-	-	-	-	-	-	-	-	-	-	-
		30"	8	9	14	20	15	12	14	11	14	12	13
		48"	14	18	24	30	33	31	26	26	20	20	24
SH 15	6	BB	54	56	64	74	48	48	44	44	44	50	53
		10"	-	-	-	-	-	-	-	-	-	-	-
		30"	40	34	38	35	28	25	25	28	29	24	30
		48"	46	42	44	47	39	35	36	39	30	34	39
SH 15	7	BB	72	84	74	68	46	28	34	56	54	46	62
		10"	-	-	-	-	-	-	-	-	-	-	-
		30"	38	66	36	30	30	35	30	32	34	28	36
		48"	55	75	50	90	36	47	46	45	44	39	53

TABLE 3

RESULTS OF STATISTICAL ANALYSES OF DATA FROM DEFLECTION MEASUREMENTS - COMPARISON OF DATA FOR TEST DEVICES WITH BENKELMAN BEAM DATA

	30-inch beam	48-inch beam
Coefficient of Correlation	0.95	0.977
Slope of Least Squares Line	0.704	0.937
Equation of Line	$y = -.0055+0.704x$	$y = -.006+0.937x$
Standard Error of Estimate	0.00396	0.0042

APPENDIX B

THE CGRA DEFLECTION TEST PROCEDURE

Scope

This method of test covers a procedure for the determination of the static rebound deflection of a pavement under a standardized axle load, tire size, tire spacing and tire pressure.

Equipment

The equipment shall include the following:

1. U. S. Bureau of Public Roads type Benkelman Beam having the following dimensions:

mensions:	ft.	in.
a. Length of probe arm from pivot to probe point	8	0
b. Length of measurement arm from pivot to dial	4	0
c. Distance from pivot to front legs	0	10
d. Distance from pivot to rear legs	5	5½
e. Lateral spacing of front support legs	1	1

2. A 5-ton truck is recommended as the reaction. The vehicle shall have an 18,000-pound rear axle load equally distributed in two wheels, each equipped with dual tires. The tires shall be 10.00 x 20, 12-ply, inflated to a pressure of 80 psi. The use of tires with tubes and rib treads is recommended.
3. Tire pressure measuring gauge.
4. Thermometer (0 - 120°F) with 1° divisions.
5. A mandrel for making a 1.75-inch deep hole in the pavement for temperature measurement. The diameter of the hole at the surface shall be one-half inch and at the bottom three-eighths of an inch.

Procedure

1. The point on the pavement to be tested is selected and marked. For highways, the points are located at specified distances from the edge of the pavement according to the width of the lane, as follows:

Lane Width (feet)	Distance from Pavement Edge (feet)
9 or less	1.5
10	2.0
11	2.5
12 or more	3.0

2. The dual wheels of the truck are centered above the selected point.
3. The probe of the Benkelman Beam is inserted between the duals and placed on the selected point.
4. The locking pin is removed from the beam and the legs adjusted so that the plunger of the beam is in contact with the stem of the dial gauge.
5. The dial gauge is set at approximately 0.4 inch. The initial reading is recorded when the rate of deformation of the pavement is equal or less than 0.001 inch per minute, i.e., dial measurement rate is less than 0.0005 inches per minute.
6. The truck is slowly driven forward a distance of 8 feet 10 inches and stopped.
7. An intermediate reading is recorded when the rate of recovery of the pavement is equal to or less than 0.001 inch per minute.
8. The truck is driven forward a further 30 feet.
9. The final reading is recorded when the rate of recovery of the pavement is equal to or less than 0.001 inch per minute.
10. Pavement temperature is recorded at least once every hour, inserting the thermometer in the standard hole and filling up the hole with water. At the same time the air temperature is recorded.
11. The tire pressure is checked at two- to three-hour intervals during the day and adjusted to the standard if necessary.

Calculations

1. Subtract the final dial reading from the initial dial reading. Subtract the intermediate dial reading from the initial dial reading.

2. If the differential readings obtained compare within 0.001 inch, the actual pavement movement is twice the final differential reading.

3. If the differential readings obtained do not compare to 0.001 inch, twice the final differential dial reading represents the apparent pavement deflection.

Report

The report shall include the following:

1. Test location.
2. Differential movement of the pavement
3. Pavement temperature.
4. Air temperature.

APPENDIX C

TENTATIVE STANDARD TEST FOR MEASURING DEFLECTION OF AN ASPHALT PAVEMENT UNDER DUAL WHEEL LOADING USING A 30-INCH RIGID DEFLECTION BEAM

1. This method of test covers a procedure for the determination of the states rebound deflection of a pavement over a 30-inch span under a standarized axle load, tire size, tire spacing and tire pressure.

2. Equipment. The equipment shall include the following:

   a. Rigid 30-inch beam with 1/1000-inch indicator dial mounted 30 inches from the support at one end with an intermediate support midway between the dial and end support. The device shall be counterweighted to support the dial. (See attached drawing of beam.)

   b. A single axle truck having dual tires with tires of 10:00 x 20 size 12 ply, 26000 G.V.W. The tires shall be inflated to manufacturers recommended pressure. The truck shall be loaded uniformly such that the gross weight on the rear axle is 15000 lbs.

   c. Thermometer (1) for measuring air temperatures ^{o}F and thermometer for measuring pavement temperatures.

   d. Mandrel and hammer for making a 1½-2 in. deep hole in the pavement for temperature measurement. The diameter of the hole shall be about 3/8 in.

3. Procedure.

   a. Select the site location where the measurements can be taken with maximum safety to personnel.

   b. Mark pavement along outside wheelpath 3 ft. from land edge (9 ft. from centerline or inside lane marking.) Marks are to be spaced 20 ft. apart with 10 positions marked for reading. (Note - should evidence indicate that a variation in base or pavement thickness exists relocate positions so that a uniform set of readings can be obtained.)

   c. Check axle weight and tire pressure of truck.

   d. Determine air and pavement temperatures. The pavement temperature shall be determined by driving mandrel into pavement, filling hole with water inserting thermometer and reading after at least five minutes or when reading is static. Air temperature shall be measured in the shade.

e. The wheels of the truck are to be centered over the marked selected point.

f. The rigid beam is to be inserted between the dual tires with the center support placed on the selected point and aligned so the truck can drive ahead without touching the beam.

g. Adjust the dial (facing rearward) to give a reading on an even hundred marking and record.

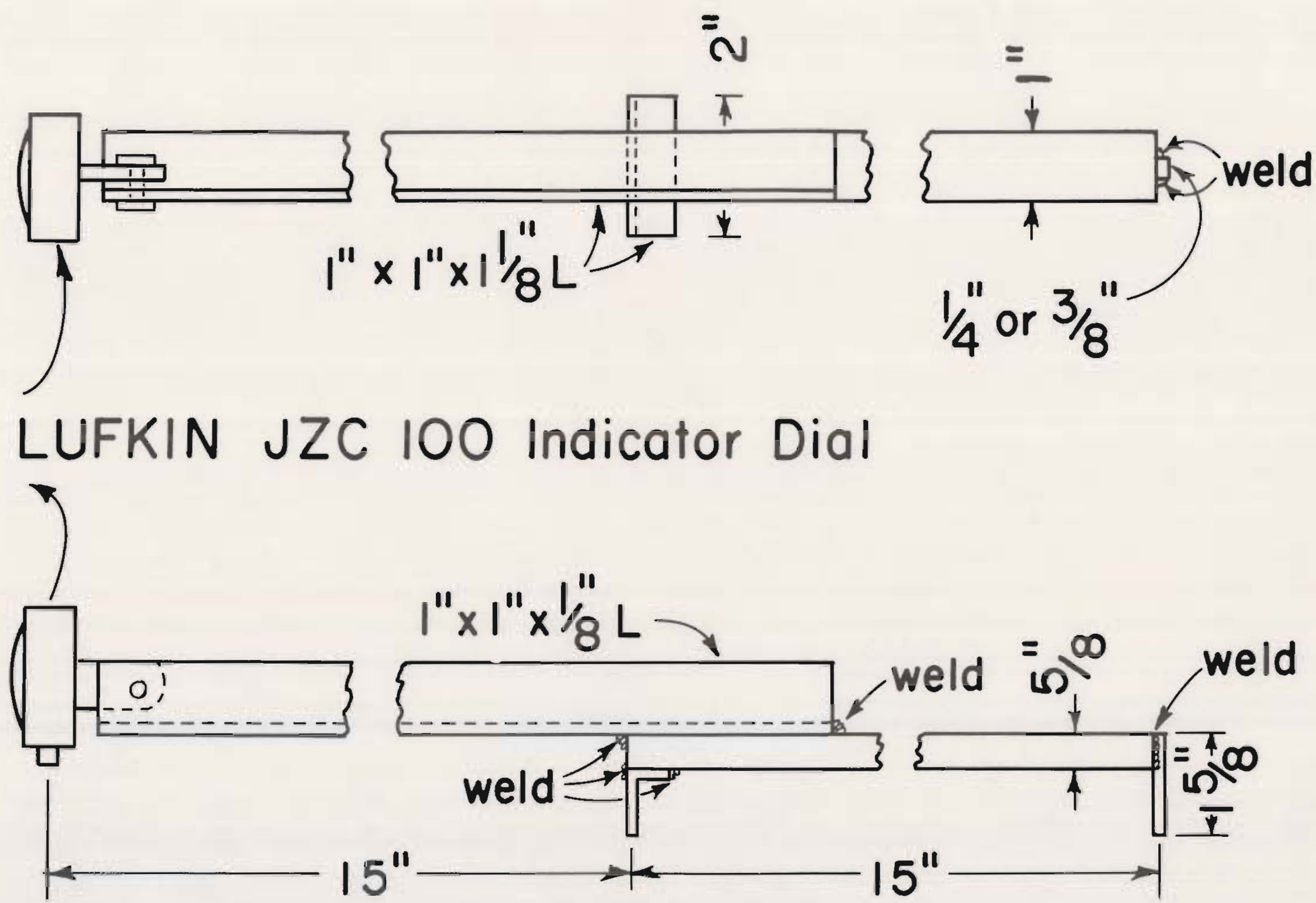
h. Drive truck ahead to the next marked selected point.

i. Wait until the dial reading becomes static (not more than 0.001 in. change in 60 seconds.) Record new reading.

j. Compute deflection indicated, divide by two and record both. (Note - deflection indicated is twice actual deflection.)

Report

1. Test location.
2. Deflections for each position - in sequence.
3. Pavement and air temperature.
4. Remarks regarding weather during the previous 24 hours.



30 Inch Rigid Beam For Measuring The Deflection Of Flexible Pavements For Radius Of Curvature