EVALUATION OF CONTINUOUSLY REINFORCED CONCRETE PAVEMENT

FINAL REPORT

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Research Report No. 86

Conducted by
LOUISIANA DEPARTMENT OF HIGHWAYS
Research and Development Section

February 1975

ABSTRACT

This report provides a review of the performance and structural characteristics exhibited on five continuously reinforced concrete pavement projects in the State of Louisiana. The performance characteristics were evaluated by means of the Mays Ride Meter. The structural characteristics were determined by means of the Dynamic Deflection Determination System (Dynaflect). Physical characteristics of cracking and deterioration were visually observed.

In general the overall performance of CRCP appears to be as good as jointed concrete pavement, particularly from a deflection and smoothness standpoint. Detrimental deflection is generally acknowledged when Dynaflect deflection values exceed 0.75 milli-inches. The average deflection value is presently 0.63 milli-inches or less for each of the five CRCP projects. Early pavement deterioration experienced on several of the projects should be noted, however. For the most part this heavy deterioration is a recent development within the past three years. The performance of CRCP from a deterioration standpoint is considered very unpredictable at this time.

The Louisiana Department of Highways as of June, 1974, made the decision to utilize plain concrete pavement with 20-foot joint spacing in lieu of CRCP. The factors contributing to this decision were the non-availability and high price of steel.

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INTRODUCTION

Approximately seven years ago the Department completed construction of its first highway project comprised of continuously reinforced concrete pavement (CRCP) on Interstate Highway 10 between Kenner and New Orleans. That segment of highway performed well intially, and the CRCP concept was extended to four other interstate highway projects. A research project (P-8) was initiated in early 1968 to evaluate the CRCP concept and its performance in the State of Louisiana. The five CRCP projects consisted of a uniform eight-inch thick pavement with 0.55 percent longitudinal steel and No. 4 bars spaced 30 inches apart as transverse reinforcement. Last year one jointed pavement project was included in the study for evaluation and comparison purposes. This project consisted of a uniform 10-inch thick pavement with wire mesh reinforcement and joints spaced 58.5 feet apart. Figures 8 through 13 of the Appendix illustrate the location of all the test sections. Figure 14 of the Appendix shows the CRCP typical section.

The pavement evaluation data presented in this report represents only the outside lane of each project, since the outside lanes represent the worst conditions of the entire roadway. Another consideration, as well as one of the aims of this project, was non destructive type testing which was exercised throughout the seven annual evaluations.

METHODOLOGY

The following highway projects were evaluated:

1. State Project No. 740-00-35, Interstate Highway 10 between Kenner and New Orleans (Veterans Highway - Causeway Boulevard), 2.4 miles in length.

2. State Project No. 450-15-15, Interstate Highway 10 between Kenner and New Orleans (Williams Boulevard - Veterans Highway), 1.5 miles in length.

3. State Project No. 451-07-04, Interstate Highway 20 between Rayville and Holly Ridge (Rayville - Bee Bayou), 3.4 miles in length.

4. State Project No. 451-07-05, Interstate Highway 20 between Delhi and Tallulah (Delhi - Bayou Macon), 0.9 miles in length.

5. State Project No. 454-01-05, Interstate Highway 12 between Baton Rouge and Walker (Sherwood Forest Boulevard - O'Neal Lane), 3.8 miles in length.

6. State Project No. 454-01-07, Interstate Highway 12 between Baton Rouge
6. and Denham Springs (O'Neal Lane - Amite River), 1.6 miles in length (jointed pavement).

On each CRCP project two 20-foot test sections were randomly located in each roadway. On two of the projects (State Project No. 454-01-05, Interstate Highway 12 between Baton Rouge and Walker, and State Project No. 450-15-15, Interstate Highway 10 between Williams Boulevard - Veterans Highway), two additional CRCP test sections were selected to further enhance the evaluation. The addition of a jointed pavement project on I-12 provided a comparison to CRCP. Two 80-foot test sections were selected for evaluation. Also on each project a 1000-foot section was designated to provide a comparison to average crack spacing data obtained from the 20-foot sections. In addition to average crack spacing, each CRCP project was evaluated with particular attention paid to crack patterns, spalling, and any other signs of deterioration.

Each of the 20-foot sections was tested as follows:

Dynaflect readings were obtained at two arbitrarily selected locations in the outside lane without regard to crack location. Dynaflect measurements were taken at the smallest opening of the tightest crack in each section. Dynaflect measurements were also taken at the widest opening of the widest crack in each section. For both measurements, the Dynaflect readings were taken with the first sensor placed on the forward side of the crack and the other four sensors placed on the back side of the crack. The sensors were placed in this manner to determine the degree of load transfer obtained.

Mays Ride Meter values and Present Serviceability Index values were obtained for the entire length of each project.

A crack survey was conducted and a scale map was drawn of the spacing. From this survey the average crack spacing was determined.

Evaluation of the jointed pavement project was conducted in the same manner as the CRCP projects except that Dynaflect Sensors I and II straddled a joint instead of a crack for analysis of load transfer.

The Dynamic Deflection Determination System (Dynaflect) played an important part in this study. It is a trailer-mounted device which induces a dynamic load on the pavement and measures the resulting slab deflections by use of geophones (usually five) spaced under the trailer at approximately one-foot intervals from the application of the load. The pavement is subjected to a 1000-pound dynamic load at a frequency of eight cycles per second, which is produced by the counter-rotation of two unbalanced flywheels. The generated cyclic force is transmitted vertically to the pavement through two steel wheels spaced 20 inches center to center. Any horizontal reactions will cancel each other due to the opposing rotations. The dynamic force varies in sine wave fashion from 500 pounds upward to 500 pounds downward during each rotation. The entire force transmitted to the pavement, however, consists of the weight of the trailer (about 1600 pounds) and the dynamic force which alternately adds to and subtracts from the static weight. Thus, the dynamic force during each rotation of the flywheels at the proper speed varies from 1100 to 2100 pounds.

The deflection measurements induced by the system are expressed in terms of milli-inches (thousandths of an inch). In order to convert these Dynaflect readings to the more widely used Benkleman Beam values, it is necessary to multiply the Dynaflect readings by a factor of approximately 11.

The Mays Ride Meter is used to evaluate the pavement roughness by recording the mechanical vertical displacement created by the relative motion between the rear axle and the body of the vehicle. This mechanical movement is converted into electrical impulse through a photo electric cell. The electrical signal is transmitted back into a mechanical movement which is recorded on graph paper. The Mays Ride Meter when installed in a passenger vehicle and operated at traffic velocities supplies a permanent graphical log of roughness summation. All roughness measurements are expressed in units of inches per mile.

DISCUSSION OF RESULTS

The Dynaflect was a primary tool in this study. It was used in conjunction with information obtained from the Texas Transportation Institute. According to the Institute, first sensor Dynaflect deflection values for satisfactorily performing CRCP average in the vicinity of 0.57 milli-inches. Detrimental deflection was generally acknowledged whey Dynaflect deflection values exceeded 0.75 milli-inches. Of course, the terminal Dynaflect deflection value may vary from state to state due to difference in material and designs. Table 1 is a summary of the performance and structural characteristics of each project evaluated. Table 2 illustrates the date of construction, the temperature at the time of construction and average crack spacing for each project evaluated.

Load Transfer

The Dynaflect was used to evaluate the structural quality of the continuously reinforced concrete pavements. Figure 1 illustrates how the sensors of the Dynaflect are straddled across a crack to determine what deflections are experienced on each side of the crack (or the joint on regular jointed pavement). A comparison was made of the magnitude of deflections on opposite sides of a crack to determine whether the load transfer characteristics of the pavement have been adversely affected by the occurrence of the crack. The numerical difference in deflections detected by sensors Number I and Number II is referred to as the surface curvature index (SCI). The fact that this index was less than 0.1 milli-inches for each of the cracks evaluated in this study (See tables 3 through 7 of the Appendix) indicates that the load transfer capabilities of the pavements have not been significantly reduced by the transverse cracking. Even near locations experiencing deflections as high as 1.68 milli-inches, no surface curvature index value exceeded 0.08 milli-inches. (See table 4 of the Appendix). The surface curvature index for the jointed pavement was an average of 0.22 milli-inches indicating a loss in load transfer across the joint. It is felt that acceptable load transfer across joints on PCC is 0.15 milli-inches or less. The 0.22 milli-inch value is high for PCC pavement of this age (4 years), which is indicative of an inadequate load transfer device system.

TABLE 1

PERFORMANCE AND STRUCTURAL CHARACTERISTICS
WITHIN THE TEST SECTIONS

Project Number and Name	Average Crack Spacing, ft.	Average Deflection, Mils	Average Roughness In./Mi.	Average Present Serviceability Index (PSI)	Years Open to Traffic
740-00-35 I-10 Veterans Hwy-Causeway Blvd.	4.6	0.63	121	3.12	7
450-15-15 I-10 Williams Blvd-Veterans Hwy.	5.4	0.62	87	3.66	6 1/2
451-07-04 I-20 Rayville- Bee Bayou	3.1	0.54	58	4.58	4
451-07-05 I-20 Delhi-Bayou Macon	4.6	0.61	72	4.06	3
454-01-05 I-12 Sherwood Forest-O'Neal Lane	3.3	0.60	68	4.14	4 1/2
454-01-07 I-12* O'Neal Lane-Amite River	----	0.53	88	3.63	4 1/2

* Baton Rouge-Denham Springs project is jointed pavement.

TABLE 2

CRACK SPACING EVALUATION

Project Number and Name	Date Constructed	First Evaluation	Construction Temperature°F		Average Crack Spacing	
			Low	High	Random 1000 ft.	20 ft. Section
740-00-35 I-10 Veterans Hwy-Causeway Blvd.	8-7-67	2-7-68	69	91	4.3	4.6
450-15-15 I-10 Williams Blvd-Veterans Hwy.	2-29-68	4-22-68	37	47	4.7	5.4
451-07-04 I-20 Rayville-Bee Bayou	8-5-68	2-11-69	75	95	3.0	3.1
451-07-05 I-20 Delhi-Bayou Macon	5-6-70	1-29-71	62	86	4.9	4.6
454-01-05 I-12 Sherwood Forest-O'Neal Lane	8-6-69	11-22-69	75	95	3.3	3.3

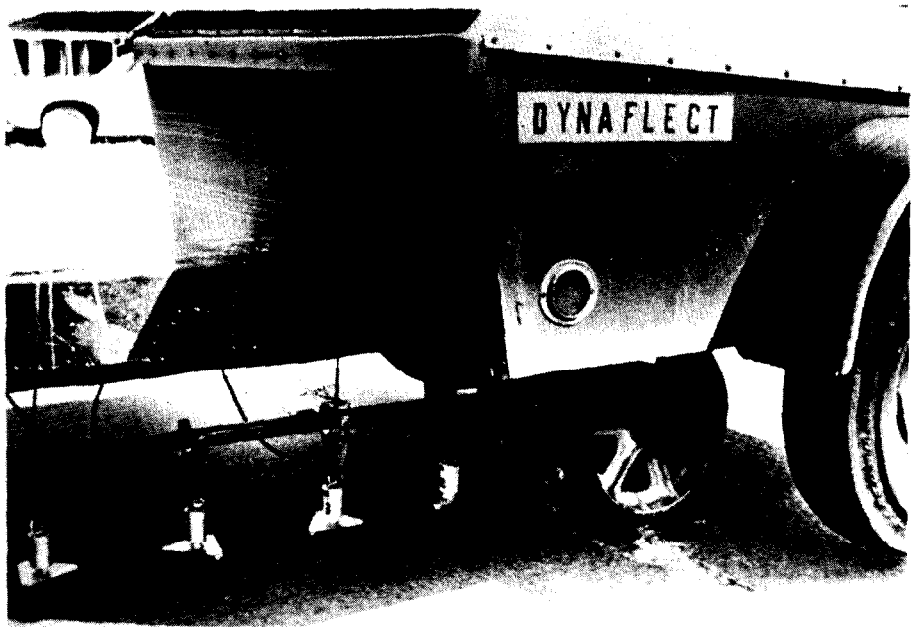


FIGURE 1
Determination of Load Transfer Capability

Deflection Values

The average deflection value for each of the five CRCP projects was 0.63 milli-inches or less and 0.55 milli-inches for the jointed pavement project. Although these average deflection values remain below the critical 0.75 milli-inch value, it may be seen in Figure 2 that they have consistently increased over the years. This increase ranged from an average of 5 percent per year on I-12 (Baton Rouge to Walker) to an average of 10 percent per year on I-20 (Delhi to Tallulah). On most projects the most dramatic increases in average deflection have occurred during the 1973-1974 period. It is impossible to predict how rapidly deflections will increase in the future. If, however, the present deflection trends continue, the two projects on I-10 in New Orleans and the Delhi-Tallulah project on I-20 will probably reach the critical deflection value in the next few years.

High maximum deflections of 0.88 and 1.68 milli-inches were recorded on the two projects on I-10 at New Orleans. Heavy spalling on I-10 is shown in Figure 3. The CRCP project on I-20 between Delhi and Tallulah experienced an isolated deflection of 0.90 milli-inches on section "C". Deflection data are represented in tables 3 through 8 of the Appendix.

Cracking and Deterioration

As can be seen in Figure 3, the large crack divides into two or more cracks thereby creating small islands. As pavement ages and is subjected to heavy traffic loads, the pavement in these islands tends to crush and dislodge, creating heavy spalls. On most of the CRCP projects evaluated this condition was more pronounced in the outside lane and became worse with age. The division of cracks in this manner creates an unpredictable factor in the deterioration pattern of CRCP.

For the five CRCP projects, a trend was established relating larger average crack spacing with heavier spalling and higher maximum deflections. Crack spacing data are presented in tables 3 through 7 of the Appendix.

Two adjacent projects, Veterans Highway-Causeway Boulevard and Williams Boulevard-Veterans Highway, have experienced transverse cracks on the average of every 4.6

FIGURE 2

INCREASE IN AVERAGE DEFLECTIONS

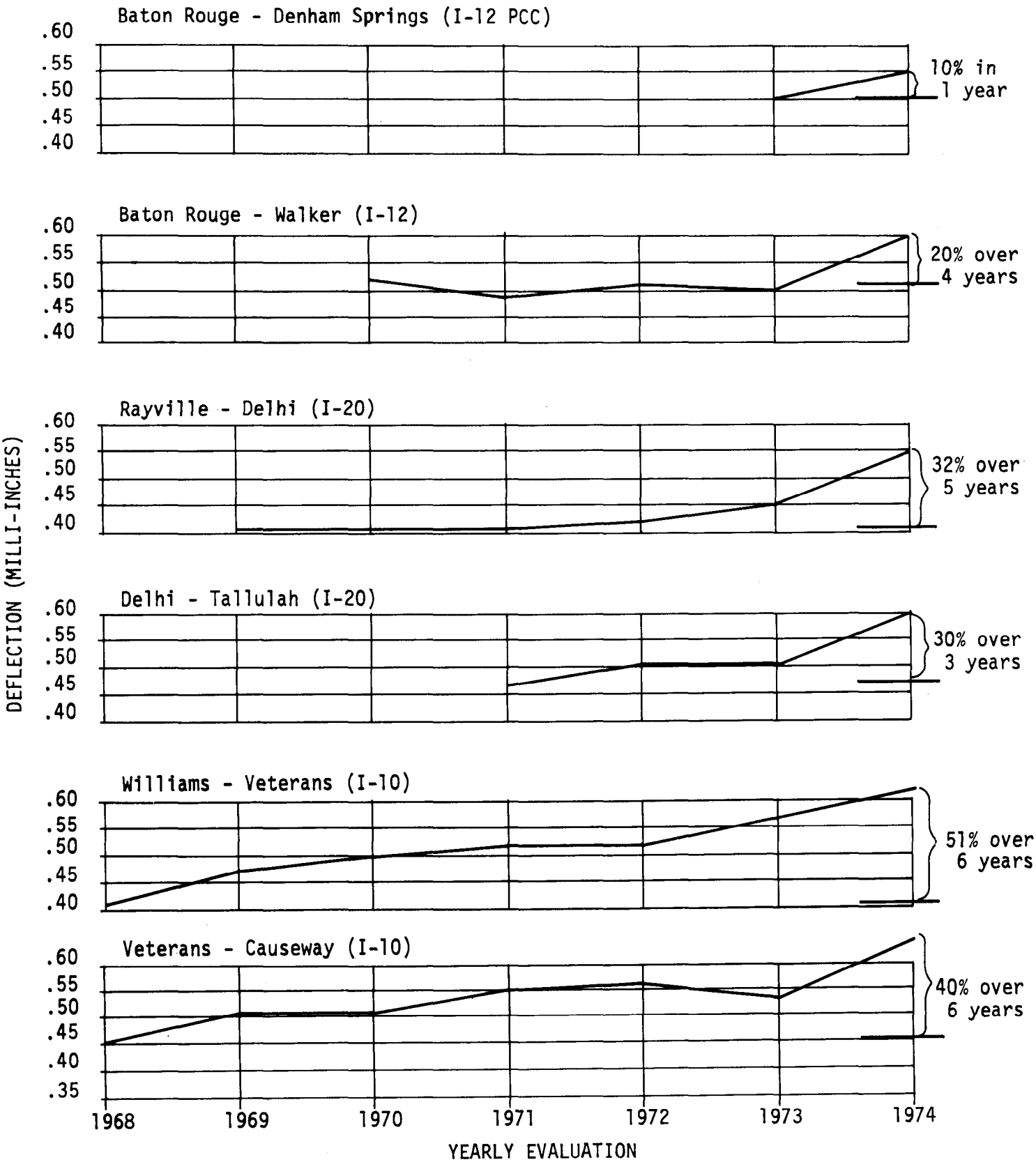


FIGURE 3
Spalling Experienced on State Project 740-00-35
Between Kenner and New Orleans
(Veterans Highway-Causeway Boulevard)

FIGURE 4
Spalling Experienced Within Test Section
on State Project 740-00-35 between Kenner and New Orleans
(Veterans Highway - Causeway Boulevard)

and 5.4 feet, respectively. These highways are deteiorating at a much faster rate than is desired. The large crack depicted in Figure 4 occurred within one of the 20-foot test sections on the Veterans Highway-Causeway Boulevard project. Deterioration similar to that shown in Figure 4 has been described in Highway Board Special Report No. 113* as spalling-a "breakdown or disintegration of slab edges at joints or cracks or directly over reinforcing steel, usually resulting in removal of sound concrete." A second type of deficiency defined as "crazing" in HRB Special Report No. 113, was discovered in test section "A" of the Veterans Highway-Causeway Boulevard project. Crazing was defined as the occurrence of "fine, hairline cracks apparently extending only through the surface layer and tending to intersect at an angle of approximately 120°, forming a chicken-wire pattern." A probable cause is weak surface of the slab caused by excessive finishing. Heavy spalling also accompanied the transverse cracks in the test section "A" of that project. It should be noted that both CRCP projects on I-10 at New Orleans have been overlaid to improve the skid resistance. The thin overlay will not contribute to the strength of the CRCP and hence will not affect future deflection analysis.

The two CRCP projects on I-20, Rayville-Delhi and Delhi-Tallulah, have experienced transverse cracks on the average every 3.1 and 4.6 feet, respectively. The Rayville-Delhi project is experiencing isolated heavy spalling with several randomly located "pop-outs" (places where closely spaced cracks have connected and pavement is crushed). Heavily deteriorated CRCP on I-20, Bayou Macon east to Parish Road is shown in Figure 5.

The Baton Rouge-Walker project on I-12 is experiencing transverse cracks on the average of every 3.3 feet. Maximum deflections in test sections ranged from 0.52 to 0.84 milli-inches with medium spalling. In March, 1974, three large concrete patches were constructed near the test sections due to heavy pavement deterioration as shown in Figures 6 and 7. Although deflection readings in these failure areas

* Standard Nomenclature and Definitions for Pavement Components and Deficiencies, HRB No. 113, (Washington, Highway Research Board, 1970), pp. 19-27.

FIGURE 5
Heavily Deteriorated CRCP on I-20, Bayou Macon East to Parish Road

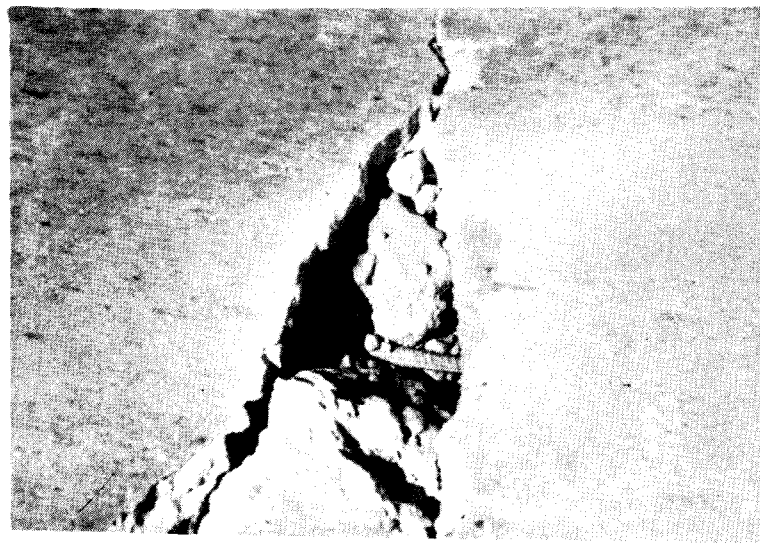


FIGURE 6
Heavily Deteriorated CRCP on I-20, Delhi-Tallulah
(State Project No. 454-01-05)

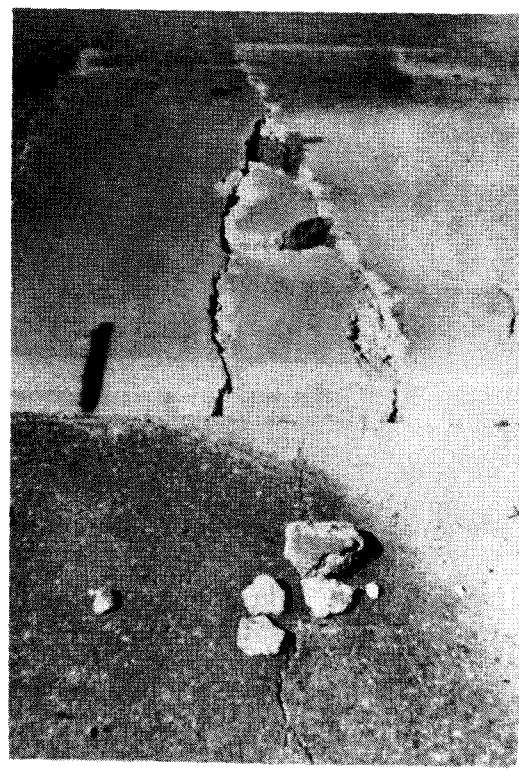


FIGURE 7
Heavily Deteriorated CRCP on I-12, Baton Rouge-Walker
(State Project No. 454-01-05)

were high (1.53 milli-inches), tests indicated a good soil-cement base and good subgrade support. Concrete cores taken at the patch locations indicated a sound concrete with an average compressive strength of 7450 psi, splitting tensile strength of 403 psi to 606 psi, and unit weight of 142.7 pounds per cubic foot. Typical signs of pumping, such as water carrying material through the shoulder joint, may not necessarily be the result of the wear of the supporting layer beneath the CRCP pavement. However, because sections of I-12 with a sound stabilized base course were showing signs of pumping at the shoulder joints, a section of the shoulder was removed to determine the cause. A small quantity of shoulder base course material at the bottom edge of the slab was found to be uncompacted. This loose material was being forced out by the action of water in the shoulder joint. This explains why locations which displayed signs of pumping did not accept a slab jacking mixture of soil, cement, and water. Therefore, it may be concluded that much of the heavy pavement deteioration experienced on this segment of CRCP is due to characteristics inherent in the reinforced pavement layer itself, irrespective of the condition of the supporting layers. A report entitled, "Deterioration of CRCP in Louisiana" is currently being prepared.

A survey was made of the number of cracks in a 1000-foot section on each of the projects. The average crack spacing determined from this data was numerically very near the average values determined from the 20-foot sections. At locations where there were crack spacings of less than a foot and where cracks intersected in the roadway, heavy spalling occurred creating conditions that required repair. It should be noted that the condition of all test sections evaluated are representative of the entire project in which they are located.

Serviceability

Roughness measurements were made over the full length of each of the six projects with the Mays Ride Meter. The Present Serviceability Indices ranged from a low of 3.12 on the Veterans Highway-Causeway Boulevard project to a high of 4.58 on the Rayville-Delhi project. Similarly, the Mays Ride Meter average values ranged from 121 to 58 inches per mile. Serviceability on the Veterans Highway-Causeway Boulevard project can be rated only as "good," whereas serviceability on the other four CRCP projects may be classified as "very good." These values are presented in Table 1.

SUMMARY OF RESULTS

The findings of this report indicate the following:

1. Good load transfer is being obtained across all cracks measured on CRCP. Deflection values obtained across joints in jointed pavement (average SCI=0.22) indicated less load transfer capability than those measured across cracks in CRCP (average SCI=0.06).

2. The average deflection values for each project remain below the detrimental deflection level. However, high isolated deflections were obtained on the two adjacent CRCP projects on Interstate Highway 10 between Kenner and New Orleans (6 years old) and the Delhi-Tallulah project on I-20 (3 years old). Average deflection values on these three projects will reach the detrimental deflection level in two to three years if the current rate of increase continues.

3. The CRCP projects with the smaller average crack spacing (approximately 3 feet) contained less spalling and narrower crack widths. Projects with the larger average crack spacing (approximately 5 feet) contained heavier and more frequent spalling, wider crack widths, and generally more deterioration. Where cracks intersected and had a spacing of one foot or less, spalling extended from one crack to another, creating a condition requiring repair. As cracks divide creating small islands, the action of heavy traffic tends to crush and dislodge the pavement in these islands. The division of cracks in this manner creates an unpredictable factor in the deterioration pattern of CRCP.

4. Several heavily deteriorated areas on I-12 in Baton Rouge and on I-20 near Bayou Macon were found to have good soil-cement bases and adequate subgrade support. It may be concluded that much of the heavy pavement deterioration experienced on CRCP is due to characteristics inherent in the reinforced pavement layer itself, irrespective of the condition of the supporting layers.

5. Mays Ride Meter values ranged from 58 to 121 inches per mile on the five CRCP projects. These values would generally be classified as "very good" to "good."

6. In general the overall performance (rideability, deflection, and deterioration) of CRCP pavement appears to be as good as jointed concrete pavement of the same age. However, because heavy pavement deterioration on the CRCP projects is a fairly recent development, the rate of continued deterioration remains unpredictable at this time.

APPENDIX

TABLE 3

SUMMARY - CRCP PERFORMANCE

VETERANS HIGHWAY-CAUSEWAY BOULEVARD

(State Project No. 740-00-35)

	TEST SECTION	A	B	C	D	E	F	Project Avg.
	Year							
Σ - Load (18 Kip)	1968	Completed 3/5/68						382,170
	1969							848,610
	1970							1,307,700
	1971							1,736,060
	1972							2,232,240
	1973							2,606,070
	1974							3,215,380
	1975							
	1976							
	1977							
Age (Years)	1968							1
	1969							2
	1970							3
	1971							4
	1972							5
	1973							6
	1974							7
	1975							
	1976							
	1977							
Average Deflection (Milli-Inches)	1968	0.44	0.50	0.51	0.36			0.45
	1969	0.48	0.54	0.59	0.44			0.51
	1970	0.52	0.52	0.56	0.44			0.51
	1971	0.68	0.49	0.60	0.43			0.55
	1972	0.64	0.48	0.58	0.53			0.56
	1973	0.54	0.48	0.55	0.56			0.53
	1974	0.61	0.50	0.69	0.62			0.68
	1975							
	1976							
	1977							
Maximum Deflection (Milli-Inches)	1968	0.48	0.54	0.54	0.40			0.49
	1969	0.52	0.57	0.77	0.48			0.58
	1970	0.52	0.55	0.69	0.49			0.56
	1971	0.78	0.50	0.70	0.45			0.61
	1972	0.76	0.50	0.80	0.56			0.66
	1973	0.68	0.51	0.70	0.62			0.63
	1974	0.65	0.66	0.88	0.68			0.72
	1975							
	1976							
	1977							
Minimum Deflection (Milli-Inches)	1968	0.38	0.44	0.42	0.34			0.40
	1969	0.42	0.52	0.44	0.40			0.44
	1970	0.51	0.47	0.41	0.38			0.44
	1971	0.58	0.49	0.37	0.41			0.46
	1972	0.58	0.46	0.40	0.49			0.48
	1973	0.43	0.45	0.38	0.48			0.44
	1974	0.58	0.53	0.52	0.55			0.54

TABLE 3 (CONTINUED)

SUMMARY - CRCP PERFORMANCE

VETERANS HIGHWAY-CAUSEWAY BOULEVARD

(State Project No. 740-00-35)

	TEST SECTION	A	B	C	D	E	F	Project Avg.
	Year							
Average Deflection At Cracks (Milli-Inches)	1968	0.44	0.54	0.52	0.40			0.48
	1969	0.52	0.57	0.64	0.48			0.55
	1970	0.51	0.55	0.57	0.49			0.53
	1971	0.68	0.49	0.64	0.45			0.56
	1972	0.61	0.50	0.57	0.56			0.56
	1973	0.56	0.47	0.54	0.57			0.54
	1974	0.62	0.62	0.72	0.67			0.66
	1975							
	1976							
	1977							
Average Surface Curvature Index (Milli-Inches)	1968	0.02	0.04	0.06	0.04			0.04
	1969	0.04	0.04	0.06	0.04			0.04
	1970	0.02	0.07	0.04	0.06			0.05
	1971	0.06	0.05	0.06	0.06			0.06
	1972	0.04	0.03	0.04	0.04			0.04
	1973	0.04	0.02	0.03	0.04			0.04
	1974	0.07	0.06	0.04	0.08			0.06
	1975							
	1976							
	1977							
Present Serviceability Index	1968	-	-	-	-			-
	1969	3.46	3.46	3.46	3.46			3.46
	1970	3.32	3.32	3.34	3.34			3.33
	1971	3.79	3.79	3.79	3.79			3.79
	1972	3.72	3.72	3.71	3.71			3.72
	1973	3.54	3.54	3.50	3.50			3.52
	1974	3.22	3.22	3.03	3.03			3.12
	1975							
	1976							
	1977							
Crack Spacing (Feet) 20 Foot Section	1968	3.1	8.5	6.2	3.1			5.2
	1969	3.1	8.5	6.2	3.1			5.2
	1970	3.1	8.5	6.2	3.1			5.2
	1971	3.1	8.5	6.2	3.1			5.2
	1972	3.1	8.0	6.2	3.1			5.1
	1973	3.1	8.0	4.0	3.1			4.6
	1974	3.1	8.0	4.0	3.1			4.6
	1975							
	1976							
	1977							
Mays Ride Meter Roughness (In/Mile)	1968	-	-	-	-			-
	1969	73	73	73	73			73
	1970	73	73	73	73			73
	1971	-	-	-	-			-
	1972	92	92	101	101			96
	1973	85	85	98	98			92
	1974	114	114	128	128			121

SUMMARY - [illegible] PERFORMANCE
[illegible] BOU[illegible] [illegible] HIGH[illegible]
([illegible])

	TEST SECTION Year	A	B	C	D	E	F	Project Avg.
Σ - Load (18 Kip)	1968	[illegible] leted [illegible]						116,760
	1969							309,320
	1970							496,690
	1971							739,350
	1972							952,860
	1973							1,273,840
	1974							1,623,460
	1975							
	1976							
	1977							
Age (Years)	1968							1/2
	1969							1 1/2
	1970							2 1/2
	1971							3 1/2
	1972							4 1/2
	1973							[illegible]
	1974							6 1/2
	1975							
	1976							
	1977							
Average Deflection (Milli-Inches)	1968	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.40	0.41
	1969	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.47
	1970	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	1971	[illegible]	[illegible]	[illegible]	[illegible]	0.75	[illegible]	[illegible]
	1972	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.42	[illegible]
	1973	0.46	[illegible]	[illegible]	0.50	[illegible]	0.48	0.57
	1974	[illegible]	[illegible]	[illegible]	0.56	[illegible]	[illegible]	[illegible]
	1975							
	1976							
	1977							
Maximum Deflection (Milli-Inches)	1968	0.42	[illegible]	[illegible]	[illegible]	0.48	0.40	0.43
	1969	0.50	[illegible]	[illegible]	[illegible]	0.53	0.52	0.50
	1970	0.44	[illegible]	0.59	0.48	0.66	0.61	0.53
	1971	[illegible]	[illegible]	0.59	0.56	0.84	0.44	0.59
	1972	0.42	[illegible]	[illegible]	0.62	0.96	0.47	0.60
	1973	[illegible]	[illegible]	[illegible]	0.70	[illegible]	0.55	0.77
	1974	0.51	[illegible]	[illegible]	0.84	[illegible]	0.71	0.77
	1975							
	1976							
	1977							
Minimum Deflection (Milli-Inches)	1968	0.41	[illegible]	[illegible]	[illegible]	0.48	0.40	0.40
	1969	0.43	[illegible]	[illegible]	[illegible]	0.46	0.44	0.43
	1970	[illegible]	[illegible]	[illegible]	[illegible]	0.58	0.48	0.45
	1971	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.32	0.45
	1972	0.37	[illegible]	[illegible]	[illegible]	0.66	0.38	0.44
	1973	0.42	[illegible]	[illegible]	[illegible]	0.62	0.43	0.45
	1974	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.70	0.52

TABLE 4 (CONTINUED)

SUMMARY - CROP PERFORMANCE

WILLIAMS BOULEVARD-VETERANS HIGHWAY

(State Project No. 450-15-15)

	TEST SECTION	A	B	C	D	E	F	Project Avg..
	Year							
Average Deflection At Cracks (Milli-Inches)	1968	0.43	[illegible]	0.36	0.41	-	-	0.40
	1969	0.46	0.53	0.47	0.48	0.50	0.50	0.48
	1970	0.43	[illegible]	[illegible]	0.48	0.63	0.56	0.51
	1971	0.60	0.46	0.51	0.43	0.78	0.40	0.53
	1972	[illegible]	[illegible]	[illegible]	0.44	0.80	0.42	0.52
	1973	[illegible]	[illegible]	[illegible]	[illegible]	0.96	0.44	0.55
	1974	[illegible]	[illegible]	[illegible]	[illegible]	1.03	0.49	0.61
	1975							
	1976							
	1977							
Average Surface Curvature Index (Milli-Inches)	1968					-	-	
	1969	[illegible]			[illegible]	0.02	0.04	0.03
	1970	0.03				0.05	0.06	0.04
	1971	0.04				0.06	0.04	0.04
	1972	0.03				0.04	0.03	0.03
	1973	[illegible]			[illegible]	0.06	0.04	0.04
	1974	[illegible]			0.04	0.04	0.04	0.04
	1975							
	1976							
	1977							
Present Serviceability Index	1968					-	-	-
	1969	[illegible]			[illegible]	3.53	3.49	3.51
	1970	[illegible]			[illegible]	3.68	3.72	3.70
	1971	[illegible]	[illegible]	[illegible]	[illegible]	4.43	4.32	4.38
	1972	[illegible]			[illegible]	4.37	4.15	4.26
	1973	[illegible]			[illegible]	4.13	3.98	4.06
	1974	[illegible]	[illegible]	[illegible]	3.54	3.79	3.54	3.66
	1975							
	1976							
	1977							
Crack Spacing (Feet) 20 Foot Section	1968	[illegible]		[illegible]	8.0	7.2	8.8	7.3
	1969	[illegible]	[illegible]	[illegible]	8.0	4.8	8.8	6.6
	1970	8.0	[illegible]	[illegible]	8.0	4.8	8.8	6.6
	1971	[illegible]	[illegible]	[illegible]	5.3	3.6	8.8	5.9
	1972	8.0	[illegible]	[illegible]	[illegible]	3.6	8.8	5.9
	1973	[illegible]	[illegible]	[illegible]	[illegible]	3.6	8.8	5.4
	1974	[illegible]	[illegible]	[illegible]	[illegible]	3.2	8.8	5.4
	1975							
	1976							
	1977							
Mays Ride Meter Roughness (In/Mile)	1968	[illegible]	[illegible]	[illegible]	[illegible]	39	41	40
	1969	[illegible]	[illegible]	[illegible]	40	40	40	40
	1970	[illegible]	[illegible]	[illegible]	40	40	40	40
	1971	[illegible]	[illegible]	[illegible]	-	-	-	-
	1972	[illegible]	[illegible]	[illegible]	72	66	72	69
	1973	[illegible]	[illegible]	[illegible]	[illegible]	59	67	63
	1974	[illegible]	[illegible]	[illegible]	[illegible]	81	93	87

TABLE 5

SUMMARY - CRCP PERFORMANCE

RAVILLE-BEE BAYOU
(State Project No. 451-07-04)

	TEST SECTION	A	B	C	D	E	F	Project A
	Year							
Σ - Load (18 Kip)	1968							
	1969							---
	1970	Completed 11/9/70						22,900
	1971							226,610
	1972							436,570
	1973							646,660
	1974							886,570
	1975							
	1976							
	1977							
Age (Years)	1968							
	1969							---
	1970							---
	1971							1
	1972							2
	1973							3
	1974							4
	1975							
	1976							
	1977							
Average Deflection (Milli-Inches)	1968							
	1969	0.41	0.38	0.37	0.48			0.41
	1970	0.43	0.40	0.35	0.46			0.41
	1971	0.43	0.40	0.34	0.46			0.41
	1972	0.48	0.38	0.34	0.48			0.42
	1973	0.47	0.47	0.39	0.48			0.45
	1974	0.58	0.54	0.45	0.57			0.54
	1975							
	1976							
	1977							
Maximum Deflection (Milli-Inches)	1968							
	1969	0.44	0.40	0.40	0.49			0.43
	1970	0.44	0.42	0.37	0.50			0.43
	1971	0.46	0.42	0.36	0.50			0.44
	1972	0.52	0.38	0.36	0.52			0.44
	1973	0.50	0.56	0.43	0.51			0.50
	1974	0.63	0.61	0.47	0.61			0.58
	1975							
	1976							
	1977							
Minimum Deflection (Milli-Inches)	1968							
	1969	0.39	0.37	0.35	0.45			0.39
	1970	0.40	0.37	0.33	0.44			0.38
	1971	0.40	0.40	0.32	0.44			0.39
	1972	0.45	0.37	0.32	0.46			0.40
	1973	0.42	0.42	0.36	0.44			0.41
	1974	0.54	0.47	0.41	0.52			0.49

TABLE 5 (CONTINUED)

SUMMARY - CRCP PERFORMANCE
RAYVILLE-BEE BAYOU
(State Project No. 451-07-04)

	TEST SECTION	A	B	C	D	E	F	Project Avg.
	Year							
Average Deflection At Cracks (Milli-Inches)	1968							
	1969	0.43	0.38	0.37	0.45			0.41
	1970	0.44	0.41	0.36	0.44			0.41
	1971	0.46	0.40	0.36	0.44			0.42
	1972	0.48	0.37	0.36	0.46			0.42
	1973	0.49	0.49	0.40	0.47			0.46
	1974	0.59	0.56	0.44	0.55			0.54
	1975							
	1976							
	1977							
Average Surface Curvature Index (Milli-Inches)	1968							
	1969	0.03	0.03	0.02	0.02			0.02
	1970	0.05	0.04	0.04	0.04			0.04
	1971	0.04	0.04	0.04	0.04			0.04
	1972	0.05	0.03	0.03	0.03			0.04
	1973	0.04	0.04	0.04	0.02			0.04
	1974	0.05	0.06	0.04	0.04			0.05
	1975							
	1976							
	1977							
Present Serviceability Index	1968							
	1969	3.92	3.92	3.80	3.80			3.86
	1970	4.16	4.16	3.94	3.94			4.05
	1971	4.76	4.76	4.78	4.78			4.77
	1972	4.83	4.83	4.57	4.57			4.70
	1973	4.06	4.06	3.84	3.84			3.95
	1974	4.65	4.65	4.50	4.50			4.58
	1975							
	1976							
	1977							
Crack Spacing (Feet) 20 Foot Section	1968							
	1969	2.9	2.5	5.3	3.3			3.5
	1970	2.9	2.2	5.3	3.3			3.4
	1971	2.9	2.2	5.3	2.4			3.2
	1972	2.9	2.2	5.0	2.4			3.1
	1973	2.9	2.2	5.0	2.4			3.1
	1974	2.9	2.2	5.0	2.4			3.1
	1975							
	1976							
	1977							
Mays Ride Meter Roughness (In/Mile)	1968							
	1969	42	42	42	42			42
	1970	42	42	42	42			42
	1971	36	36	39	39			38
	1972	47	47	50	50			48
	1973	44	44	48	48			46
	1974	57	57	60	60			58

TABLE 6

SUMMARY - CRCP PERFORMANCE

DELHI-BAYOU MACON
(State Project No. 451-07-05)

	TEST SECTION	A	B	C	D	E	F	Project A
	Year							
Σ - Load (18 Kip)	1968							
	1969							
	1970							
	1971	Completed 10/22/71						34,030
	1972							217,300
	1973							416,040
	1974							592,420
	1975							
	1976							
	1977							
Age (Years)	1968							
	1969							
	1970							
	1971							
	1972							1
	1973							2
	1974							3
	1975							
	1976							
	1977							
Average Deflection (Milli-Inches)	1968							
	1969							
	1970							
	1971	0.44	0.45	0.58	0.41			0.47
	1972	0.48	0.46	0.59	0.48			0.50
	1973	0.49	0.50	0.57	0.45			0.50
	1974	0.59	0.64	0.66	0.54			0.61
	1975							
	1976							
	1977							
Maximum Deflection (Milli-Inches)	1968							
	1969							
	1970							
	1971	0.50	0.47	0.64	0.44			0.51
	1972	0.53	0.48	0.66	0.50			0.54
	1973	0.51	0.59	0.78	0.48			0.59
	1974	0.61	0.74	0.90	0.56			0.70
	1975							
	1976							
	1977							
Minimum Deflection (Milli-Inches)	1968							
	1969							
	1970							
	1971	0.40	0.43	0.51	0.36			0.42
	1972	0.43	0.44	0.53	0.43			0.46
	1973	0.46	0.47	0.52	0.42			0.47
	1974	0.57	0.61	0.56	0.52			0.57

TABLE 6 (CONTINUED)

SUMMARY - CRCP PERFORMANCE
DELHI-BAYOU MACON
(State Project No. 451-07-05)

	TEST SECTION	A	B	C	D	E	F	Project Avg.
	Year							
Average Deflection At Cracks (Milli-Inches)	1968							
	1969							
	1970							
	1971	0.47	0.46	0.58	0.41			0.48
	1972	0.53	0.55	0.59	0.48			0.54
	1973	0.50	0.48	0.53	0.46			0.49
	1974	0.58	0.61	0.63	0.54			0.59
	1975							
	1976							
	1977							
Average Surface Curvature Index (Milli-Inches)	1968							
	1969							
	1970							
	1971	0.03	0.01	0.05	0.03			0.03
	1972	0.04	0.03	0.05	0.02			0.04
	1973	0.06	0.04	0.05	0.06			0.05
	1974	0.05	0.04	0.04	0.04			0.04
	1975							
	1976							
	1977							
Present Serviceability Index	1968							
	1969							
	1970							
	1971	4.30	4.30	4.37	4.37			4.34
	1972	4.38	4.38	4.23	4.23			4.30
	1973	3.80	3.80	3.85	3.85			3.82
	1974	4.08	4.08	4.05	4.05			4.06
	1975							
	1976							
	1977							
Crack Spacing (Feet) 20 Foot Section	1968							
	1969							
	1970							
	1971	10.7	2.7	6.4	5.8			6.4
	1972	10.7	2.7	6.4	4.4			6.0
	1973	10.7	2.7	6.4	4.4			6.0
	1974	5.0	2.7	6.4	4.4			4.6
	1975							
	1976							
	1977							
Mays Ride Meter Roughness (In/Mile)	1968							
	1969							
	1970							
	1971	45	45	49	49			47
	1972	61	61	68	68			64
	1973	59	59	63	63			61
	1974	71	71	72	72			72

TABLE 7

SUMMARY - CRCP PERFORMANCE
SHERWOOD FOREST BLVD. - O'NEAL LANE
(State Project No. 454-01-05)

	TEST SECTION	A	B	C	D	E	F	Project A
	Year							
Σ - Load (18 Kip)	1968							
	1969							
	1970	Completed 6/24/70						75,580
	1971							221,810
	1972							463,480
	1973							665,420
	1974							940,230
	1975							
	1976							
	1977							
Age (Years)	1968							
	1969							
	1970							1/2
	1971							1 1/2
	1972							2 1/2
	1973							3 1/2
	1974							4 1/2
	1975							
	1976							
	1977							
Average Deflection (Milli-Inches)	1968							
	1969							
	1970	0.60	0.49	0.53	0.52	0.44	0.51	0.52
	1971	0.57	0.44	0.49	0.42	0.40	0.55	0.48
	1972	0.62	0.48	0.52	0.47	0.41	0.58	0.51
	1973	0.56	0.48	0.48	0.46	0.40	0.60	0.50
	1974	0.65	0.60	0.59	0.59	0.49	0.70	0.68
	1975							
	1976							
	1977							
Maximum Deflection (Milli-Inches)	1968							
	1969							
	1970	0.64	0.53	0.56	0.60	0.45	0.52	0.55
	1971	0.58	0.46	0.51	0.47	0.42	0.58	0.50
	1972	0.64	0.50	0.55	0.50	0.44	0.60	0.54
	1973	0.63	0.59	0.52	0.47	0.43	0.65	0.55
	1974	0.73	0.84	0.66	0.62	0.52	0.70	0.68
	1975							
	1976							
	1977							
Minimum Deflection (Milli-Inches)	1968							
	1969							
	1970	0.58	0.47	0.49	0.38	0.41	0.40	0.46
	1971	0.53	0.42	0.46	0.34	0.37	0.53	0.44
	1972	0.60	0.46	0.49	0.44	0.40	0.54	0.49
	1973	0.52	0.43	0.47	0.44	0.38	0.53	0.46
	1974	0.60	0.52	0.55	0.53	0.44	0.64	0.55

TABLE 7 (CONTINUED)
SUMMARY - CRCP PERFORMANCE
SHERWOOD FOREST BLVD. - O'NEAL LANE
(State Project No. 454-01-05)

	TEST SECTION	A	B	C	D	E	F	Project Avg.
	Year							
Average Deflection At Cracks (Milli-Inches)	1968							
	1969							
	1970	0.61	0.48	0.56	0.59	0.45	0.52	0.54
	1971	0.58	0.44	0.50	0.45	0.42	0.58	0.50
	1972	0.60	0.48	0.55	0.50	0.40	0.60	0.52
	1973	0.53	0.43	0.50	0.46	0.41	0.61	0.49
	1974	0.62	0.52	0.60	0.58	0.48	0.66	0.58
	1975							
	1976							
	1977							
Average Surface Curvature Index (Milli-Inches)	1968							
	1969							
	1970	0.05	0.06	0.05	0.04	0.04	0.03	0.04
	1971	0.02	0.01	0.03	0.02	0.04	0.02	0.02
	1972	0.04	0.03	0.05	0.04	0.04	0.04	0.04
	1973	0.04	0.04	0.05	0.03	0.04	0.04	0.04
	1974	0.04	0.04	0.04	0.06	0.05	0.05	0.05
	1975							
	1976							
	1977							
Present Serviceability Index	1968							
	1969							
	1970	--	--	--	--	--	--	--
	1971	4.92	4.92	4.92	4.84	4.84	4.84	4.88
	1972	4.52	4.52	4.52	4.58	4.58	4.58	4.55
	1973	4.49	4.49	4.49	4.58	4.58	4.58	4.54
	1974	4.16	4.16	4.16	4.11	4.11	4.11	4.14
	1975							
	1976							
	1977							
Crack Spacing (Feet) 20 Foot Section	1968							
	1969							
	1970	3.4	2.4	4.6	3.8	3.2	3.6	3.5
	1971	3.4	2.4	4.6	3.8	3.2	3.6	3.5
	1972	3.4	2.4	3.6	3.8	3.2	3.6	3.3
	1973	3.4	2.4	3.6	3.8	3.2	3.6	3.3
	1974	3.4	2.4	3.6	3.8	3.2	3.6	3.3
	1975							
	1976							
	1977							
Mays Ride Meter Roughness (In/Mile)	1968							
	1969							
	1970	--	--	--	--	--	--	--
	1971	--	--	--	--	--	--	--
	1972	54	54	54	56	56	56	55
	1973	46	46	46	50	50	50	48
	1974	67	67	67	70	70	70	68

TABLE 8
SUMMARY - PCC PERFORMANCE
O'NEAL LANE - AMITE RIVER
(State Project No. 454-01-07)

	Test Section			Project Average		Test Section			Project Average
	Year	A	B			Year	A	B	
Σ- 18 Kip Load	1970	6/24/70		65,110	Average Deflection At Joints	1973	0.60	0.65	0.62
	1971			191,100		1974	0.66	0.74	0.70
	1972			322,470		1975			
	1973			466,120		1976			
	1974			622,280		1977			
	1975								
Age (Years)	1970			1/2	Average Surface Curvature Index (Mill-Inches) At Cracks	1973	0.01	-	0.01
	1971			1 1/2		1974	0.03	-	0.03
	1972			2 1/2		1975			
	1973			3 1/2		1976			
	1974			4 1/2		1977			
	1975								
Average Deflection (Milli-Inches)	1973	0.48	0.51	0.50	Average Surface Curvature Index (Milli-Inches) At Joints	1973	0.12	0.30	0.21
	1974	0.52	0.58	0.55		1974	0.14	0.30	0.22
	1975					1975			
	1976					1976			
	1977					1977			
Maximum Deflection (Milli-Inches)	1973	0.66	0.70	0.68	Present Serviceability Index	1973	4.20	4.20	4.20
	1974	0.74	0.80	0.77		1974	3.65	3.65	3.65
	1975					1975			
	1976					1976			
	1977					1977			
Minimum Deflection (Milli-Inches)	1973	0.34	0.35	0.34	Crack Spacing (Feet)	1973			
	1974	0.36	0.33	0.34		1974			
	1975					1975			
	1976					1976			
	1977					1977			
Average Deflection At Cracks	1973	0.34	---	0.34	Mays Ride Meter Roughness (Inches per Mile)	1973	67	67	67
	1974	0.36	---	0.36		1974	88	88	88
	1975					1975			
	1976					1976			
	1977					1977			

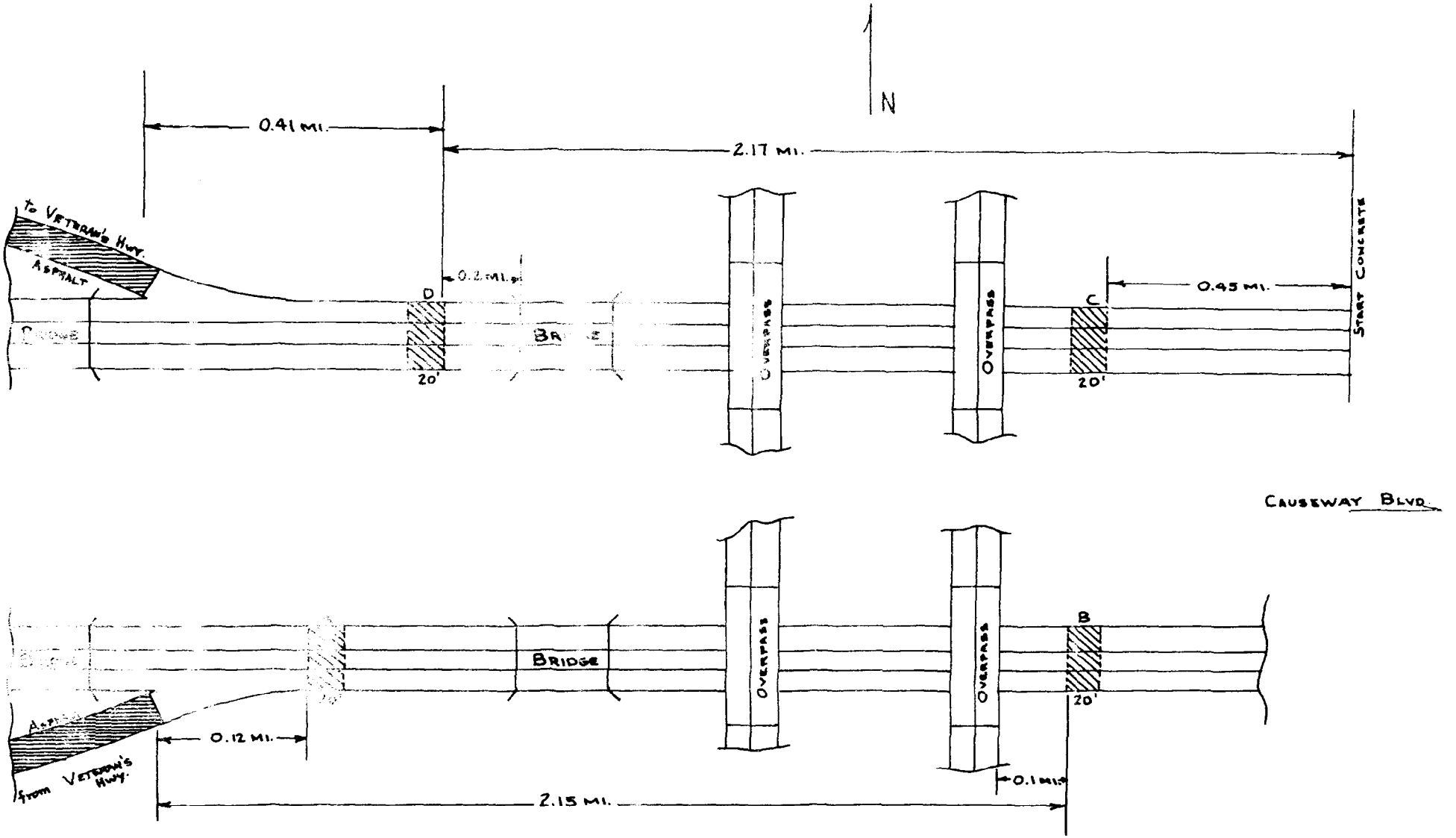


FIGURE 8

Continuously Reinforced Concrete Pavement
740-00-35
KENNER to N.O. I-10
(Veteran's Hwy. - N. Causeway Blvd.)

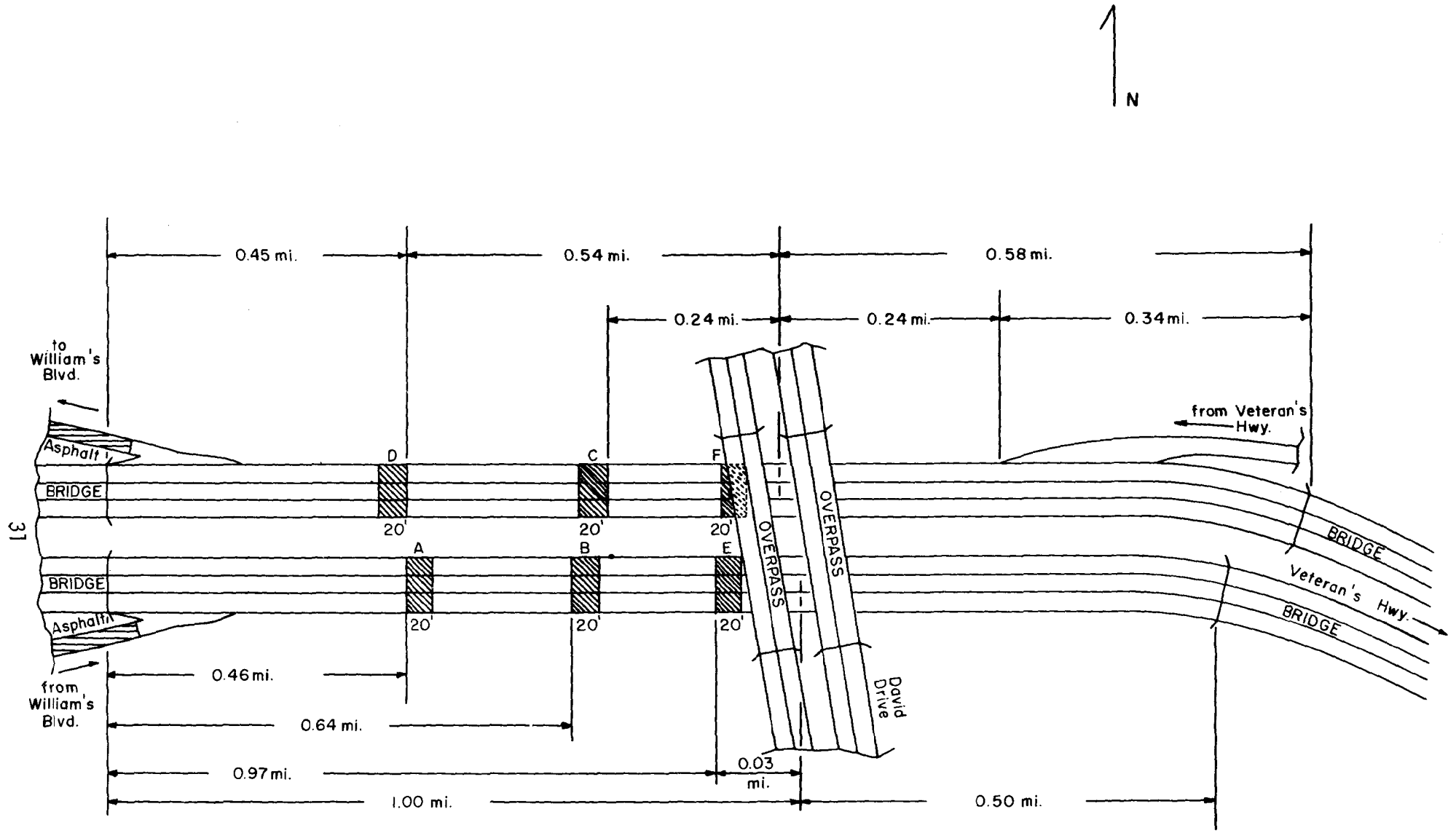


FIGURE 9

Continuously Reinforced Concrete Pavement
450-15-15
Kenner to N. O. I-10
(William's Blvd. - Veteran's Hwy.)

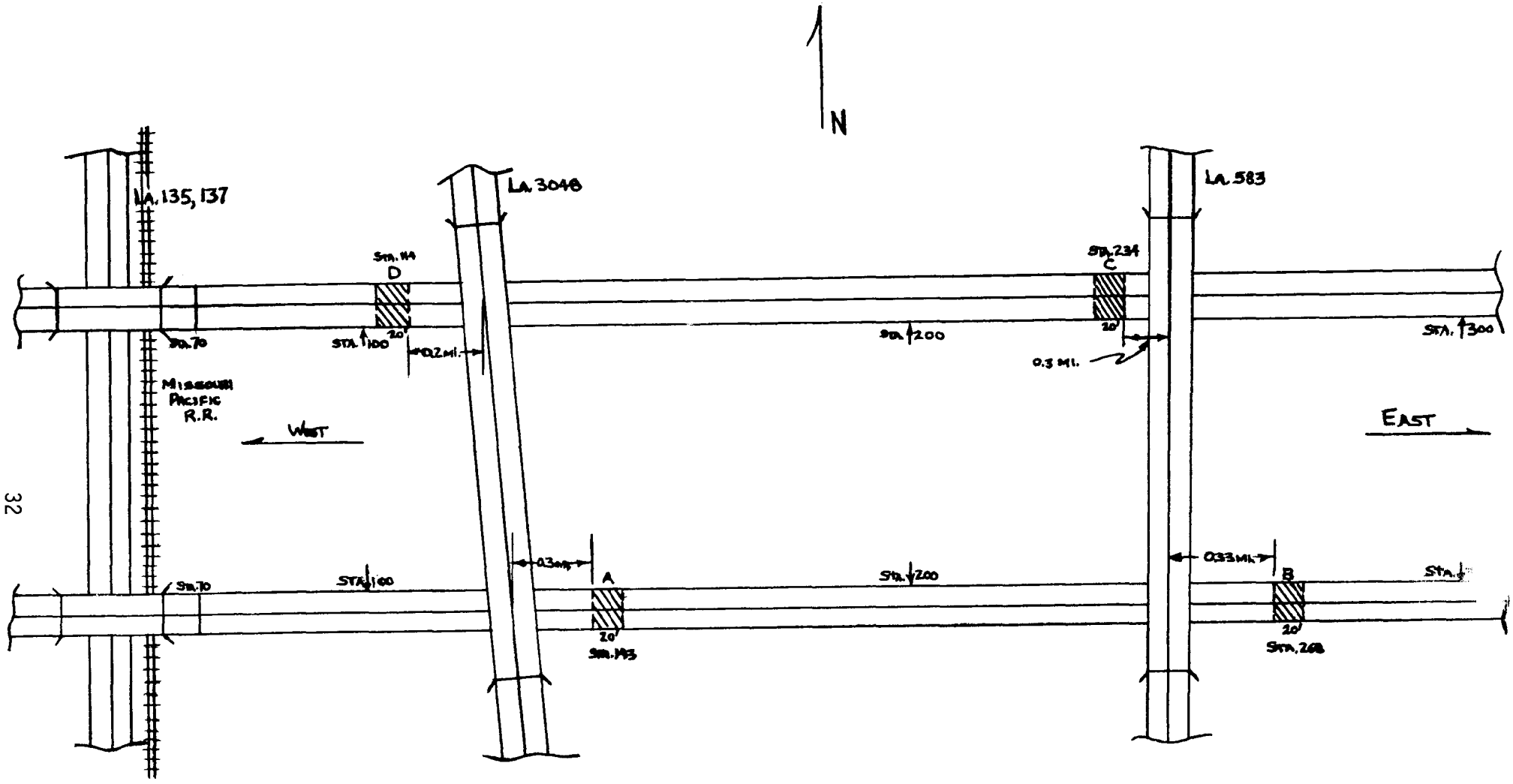


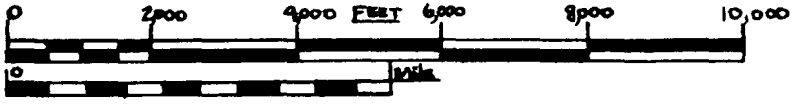
FIGURE 10

CONTINUOUSLY REINFORCED CONCRETE PAVEMENT

451-07-04

RAYVILLE - DELHI I-20

(RAYVILLE - HOLLY RIDGE)



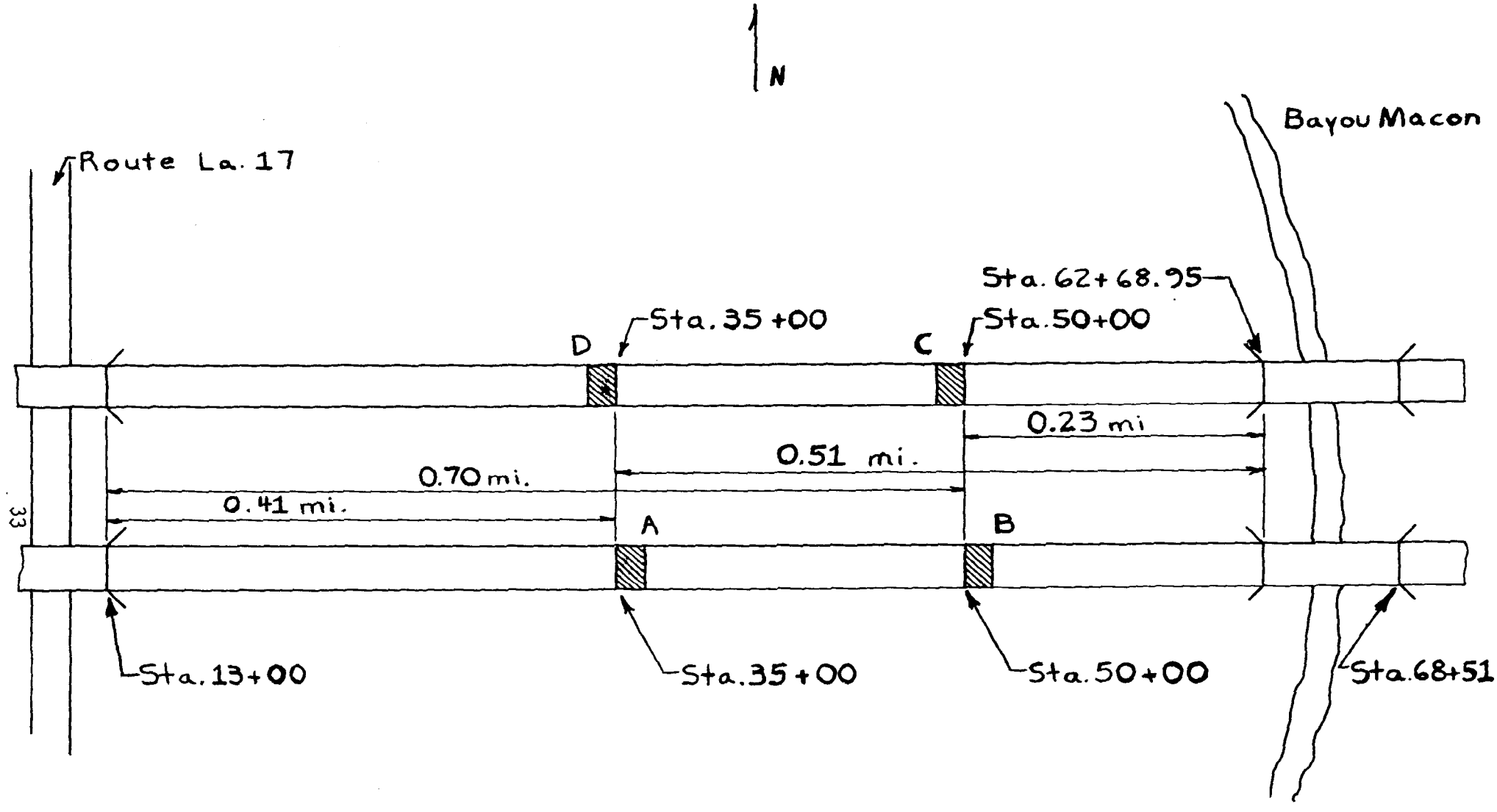


FIGURE 11

Continuously Reinforced Concrete Pavement
451-07-05
Delhi - Tallulah I-20
(Delhi-Bayou Macon)

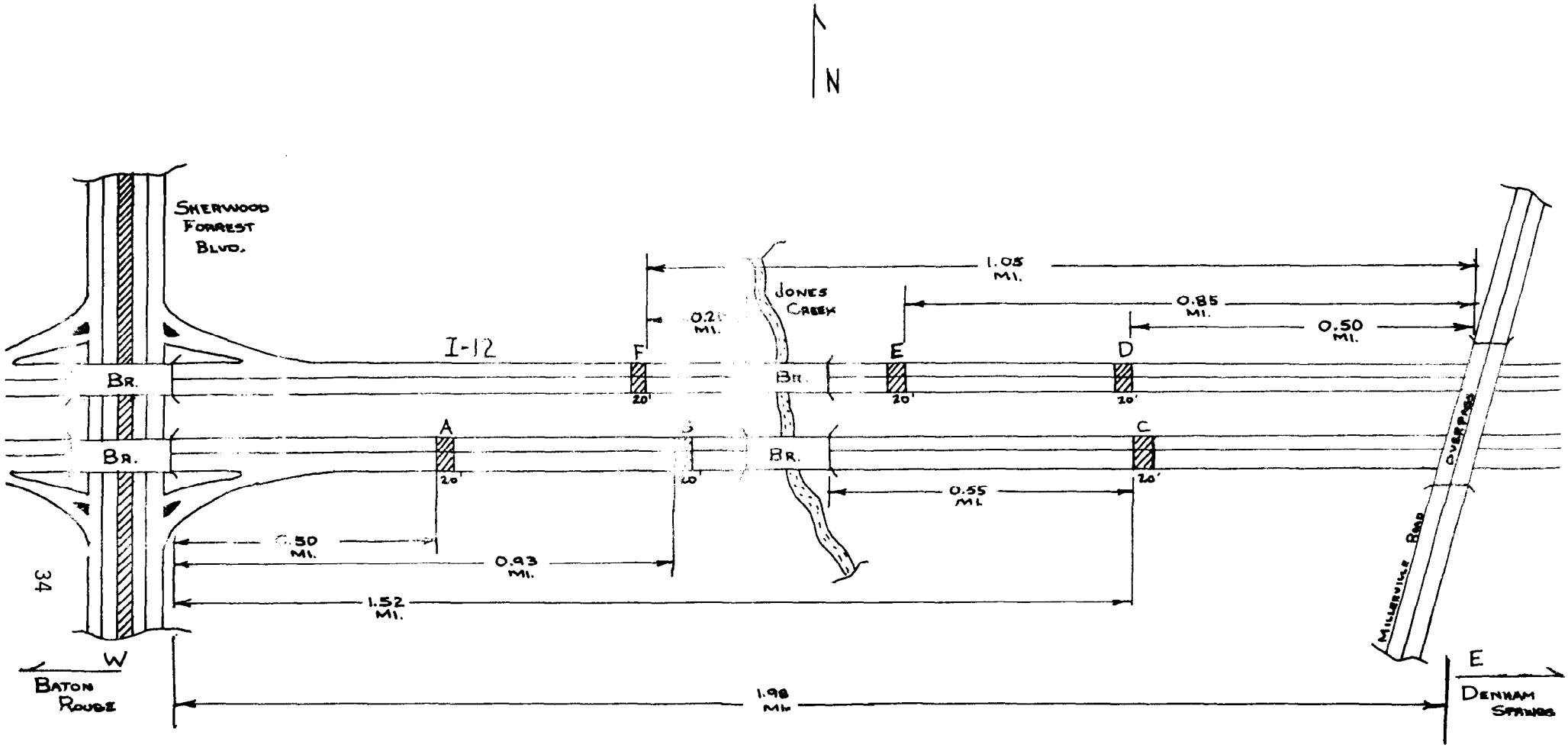


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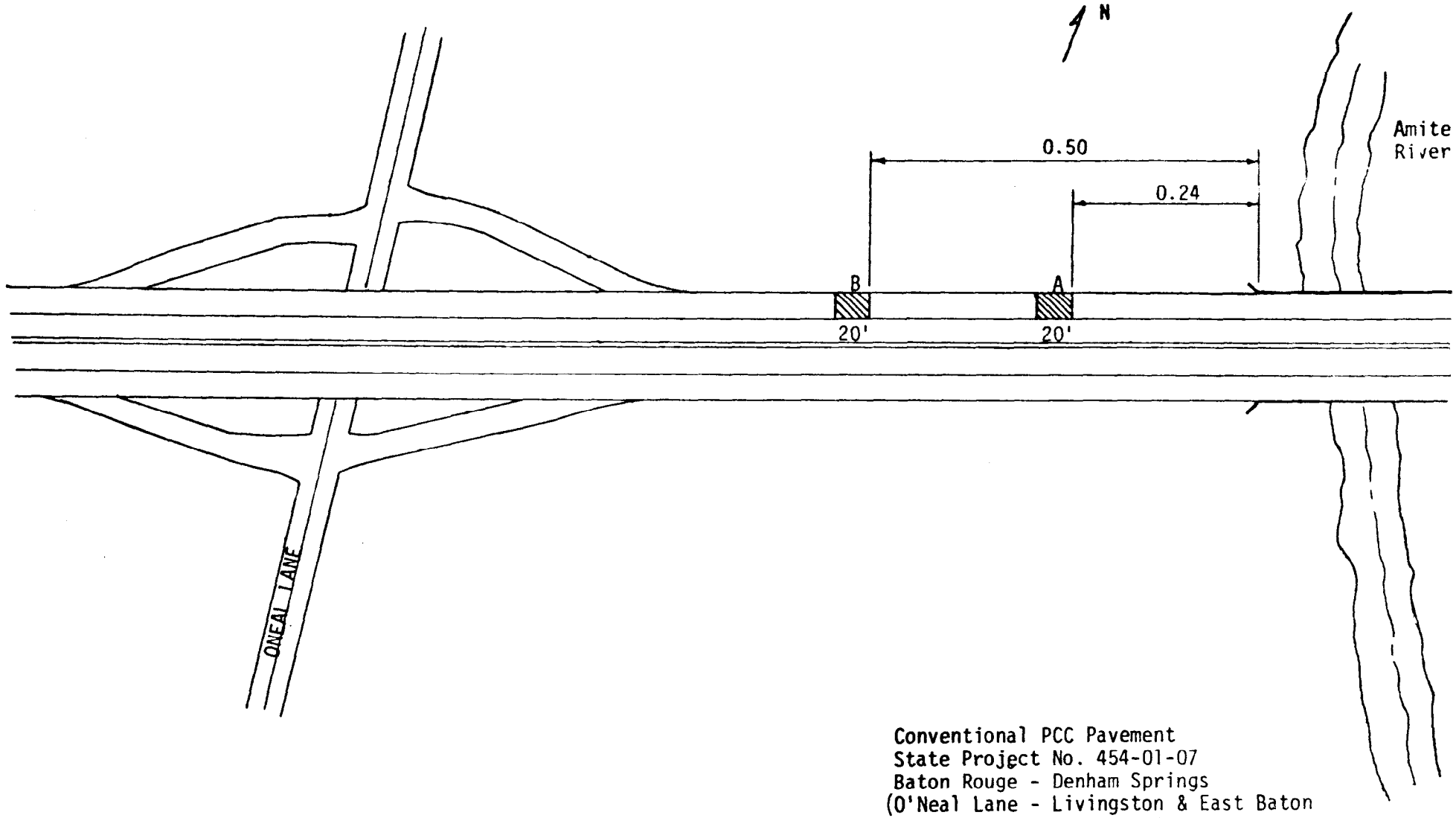
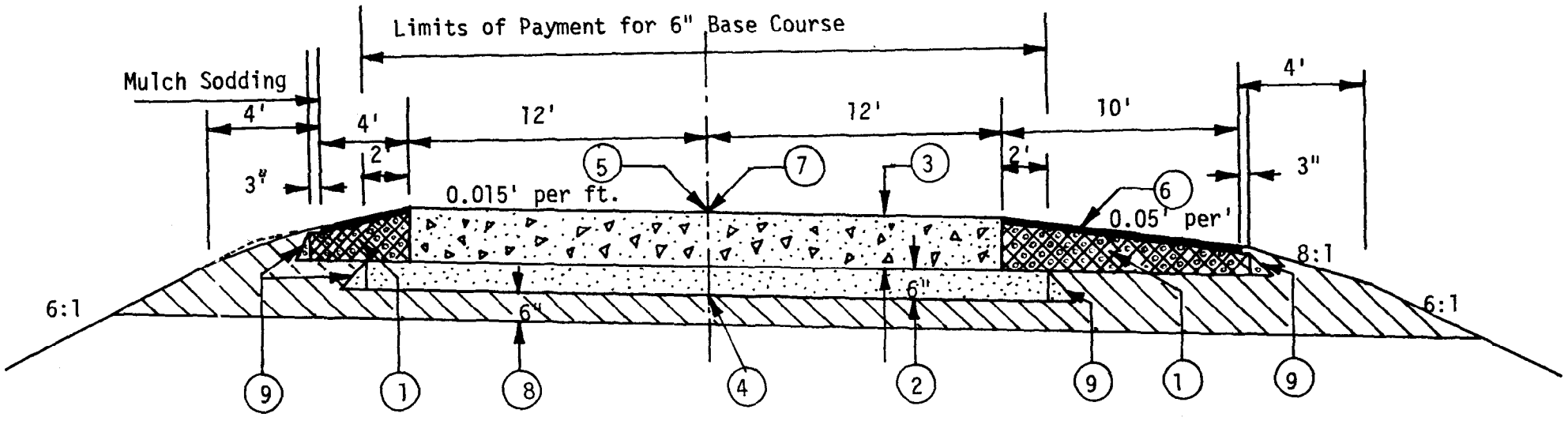
FIGURE 12

Continuously Reinforced Concrete Pavement
454-01-05
Baton Rouge - Walker I-12
(Sherwood Forest Boulevard-Millerville Road Overpass)



Conventional PCC Pavement
State Project No. 454-01-07
Baton Rouge - Denham Springs
(O'Neal Lane - Livingston & East Baton Rouge Parish Line)

FIGURE 13



TYPICAL FINISHED SECTION ON TANGENTS

Right Roadway-Left Roadway Identical But Opposite Hand

① Soil Cement Base Course (shoulder)

② Soil Cement Base Course (roadway)

③ 8" Continuously Reinforced Concrete Pavement

④ Subgrade Elevation

⑤ Grade Shown on Profile

⑥ 1" Asphaltic Concrete Pavement (wearing course) (shoulder mix) (Type 1 or 2 with AC-5)

⑦ Longitudinal Joint

⑧ Select Material

⑨ Limits and slopes of this line to be determined by the contractor with the approval of Engineer, according to the latest construction procedures.

FIGURE 14