IOWA ULTRA THIN WHITETOPPING AT TWO YEARS OF AGE

Interim Condition Report
Iowa Department of Transportation
Project HR-559

In Cooperation With The
Federal Highway Administration
as
Work Order #DTFH71-94-TBO-IA-37

November 1996

Project Development Division

Iowa Department of Transportation

Interim Condition Report
for
Iowa Department of Transportation
Project HR-559

IOWA ULTRA THIN WHITETOPPING RESEARCH AT TWO YEARS OF AGE

By
James D. Grove, P.E.
P. C. Concrete Engineer
515-239-1226
Office of Materials
Project Development Division
Iowa Department of Transportation
Ames, Iowa 50010

Dr. James Cable, P.E.
Associate Professor
515-294-2862
Civil and Construction Engineering
378 Town Engineering
Iowa State University
Ames, Iowa 50011

Melinda Heyer
Transportation Engineering Intern
515-239-1433
Office of Materials
Iowa Department of Transportation
Ames, Iowa 50010

November 1996

TECHNICAL REPORT TITLE PAGE

1. **REPORT NO.** HR-559	2. **REPORT DATE** November 1996
3. **TITLE AND SUBTITLE** Iowa Ultra Thin Whitetopping Research at Two Years of Age	4. **TYPE OF REPORT & PERIOD COVERED** Interim Report, 8-94 to 8-96
5. **AUTHOR(S)** James D. Grove, P.E. James K. Cable, P.E. Melinda Heyer	6. **PERFORMING ORGANIZATION ADDRESS** Iowa Department of Transportation Materials Department 800 Lincoln Way Ames, Iowa 50010

7. **ACKNOWLEDGEMENT OF COOPERATING ORGANIZATIONS**

Federal Highway Administration

8. **ABSTRACT**

An 11.6 km research project was constructed in 1994 on a portion of Iowa Highway 21 in Iowa County, from U.S. 6 to Iowa Highway 212. This research is intended to evaluate the effect of four primary variables on long term performances of the PCC concrete overlay, commonly called whitetopping. The variables are thickness (50 mm, 100 mm, 150 mm, and 200 mm), joint spacing (0.6 m squares, 1.2 m squares, 1.8 m squares, and 4.6 m spacing), fiber use (concrete with and without polypropolene fibers) and surface preparation (patch only, scarifying the surface, and cold-in-place recycling).

After two years, only two sections exhibit a small amount of debonding and distress cracking. Both sections are 50 mm thick. Within each of these two sections, only 2% of the area is affected. Two other 50 mm thick sections have a small number of cracks but no debonding has been found. No adverse effects of these cracks are evident. Three asphalt overlay sections were also constructed. In each asphalt section, transverse cracks have recently been found.

At two years of age, the research sections are performing very well. An insignificant number of cracks and no distressed areas have been found in any research sections thicker than 50 mm.

9. **KEY WORDS**
PCC Overlay
Fibrous
Concrete
Whitetopping
Ultra Thin Whitetopping

TABLE OF CONTENTS

INTRODUCTION

In 1994, the Iowa Department of Transportation (Iowa DOT) in conjunction with the Federal Highway Administration constructed an 11.6 km research project to evaluate portland cement concrete overlays over an existing asphalt roadway. This procedure is normally referred to as whitetopping.

The research was designed to evaluate long term performance of whitetopping. Four major variables were chosen for evaluation and 65 test sections were constructed, each 213 m long. Some of the sections were used to transition from one set of parameters to the next, therefore 41 test sections were designated for long term study.

Iowa State University contracted to perform the research. The field instrumentation was installed and the long term evaluation will be performed under this agreement.

This interim report presents the changes in condition of the test sections that have occurred following construction and up to the present time. The project is now two years old. The overall performance to date has been very good. Only two sections of the 41 have small areas that may need repair in the foreseeable future. Within those two sections, only 2% of each have areas showing significant deterioration.

THE PROJECT

This project is located on Iowa Highway 21 in Iowa County. It lies between the junction of U.S. 6 and the junction with Iowa Highway 212, a distance of 11.6 km. The existing pavement was constructed in 1961 of 150 mm of rolled stone base, 175 mm of cement treated base, and topped with a seal coat. In 1964, 75 mm of asphaltic cement concrete (ACC) pavement was placed. A seal coat was placed in 1987. The estimated ADT is 1350 vehicles with 13% trucks.

THE RESEARCH

The project was divided into 65 test sections. Some of the sections provided a transition between adjacent sections where changes in thickness or material occurred. Therefore, 41 test sections will be monitored over the life of the research. Table 1 lists each section of the 65 sections constructed and the variables within each section. Figure 1 shows the layout of the sections throughout the project. Table 2 lists the 41 sections which will be studied in this research and the variables within each.

Four major variables were incorporated into this project:

1. **Thickness**

Three thicknesses were used for the primary research: 50 mm, 100 mm, and 150 mm. Also three sections were constructed at 200 mm thickness, but of those, one was a reconstruction section, not an overlay, at the beginning of the project. The other two 200 mm sections were differentiated by one having load transfer dowels at the transverse contraction joints and the other did not.

Three sections of ACC resurfacing were also constructed. The design thickness for an ACC overlay for this roadway was 115 mm. That thickness was used on these three sections.

The actual measured depths of the pavement in each section are listed in Table 3.

2. **Joint Spacing**

Joint spacing is not an appropriate term to describe the joint pattern of some of the research sections. Conventional pavement normally has a longitudinal joint at the centerline of a two lane roadway. It also has contraction joints at specified intervals throughout the length of pavement.

In this research, the pavement was cut into small squares to evaluate panel size as it relates to thickness, particularly for very thin concrete pavement.

Pavement sections were cut into squares of 0.6 x 0.6 m, 1.2 m x 1.2 m, and 1.8 x 1.8 m. These were the primary panel sizes used in this research. Thicker pavement sections were jointed with a conventional scheme, that is, a centerline joint and transverse joints at 3.7 m spacing. The two 200 m thick sections had spacing of 4.6 m and the reconstruction section utilized spacing of 6.1 m.

3. **Fibers**

The Iowa DOT had not used polypropolene fibers in concrete pavement prior to this project. They were used in earlier research in the first ultra thin whitetopping project in Louisville, Kentucky and were thought to be beneficial. Iowa DOT has conducted a research project involving concrete overlays, not whitetopping, using steel fibers. It was built in 1973 and performed for over 15 years. Economic and construction problems with steel fibers in that project precluded future use.

This research included two types of polypropolene fibers - monofilament and fibrillated. Sections of each were placed as well as sections with no fibers. In sections where fibers are used, the rate of addition was 1.8 kg/m^3. This was twice the manufacturer's recommended rate but consistent with the rate used in the project in Kentucky. Table 4 identifies the sections which contained each type of fiber and those that contained no fibers.

4. Base Preparation

Three types of base preparation were utilized prior to the concrete and asphalt overlays. The project was divided approximately into thirds.

On one portion, the concrete was placed on the existing asphalt with nothing done other than broom cleaning of the surface. In this portion, areas of distress in the existing pavement were repaired by patching.

Another portion had areas of distress patched but also had the entire surface milled. This milling did not true the cross-section but merely roughened the surface. Research conducted in 1992 by the Iowa DOT found that a roughened surface enhances the bond between the new concrete and the old asphalt. A report entitled "Bond Contribution to Whitetopping Performance on Low Volume Roads" was prepared for this 1992 project as a part of Research Project HR-341.

In the third portion, a cold-in-place recycle process was applied to the 75 mm asphalt surface.

5. Other Variables

A hot pour type joint sealant was placed in the joints when the pavement thickness was greater than 100 mm. The 50 mm and 100 mm thick pavement sections did not have joint sealant placed in the joints, except for five sections.

This project was constructed with conventional concrete. A standard primary highway paving mixture was specified. Most ultra thin whitetopping projects built to date have utilized some form of early opening concrete, i.e. Fast Track. This project was specifically intended to evaluate ultra thin whitetopping performance where a conventional paving mixture was used. Therefore, the concrete mixture was not a variable. Table 5 lists the concrete proportions.

RESEARCH

Iowa State University conducted laboratory research, field test site development, and field evaluation prior to and during construction. The project will continue to be evaluated quarterly for the first five years. Evaluation will be conducted annually using a falling weight deflectometer (FWD) to monitor bond strength, pavement structure, and load transfer. Table 6 presents the information from this testing.

CONSTRUCTION

This project was constructed in 1994, beginning June 24. the concrete overlay was finished July 18 and the asphalt sections on July 27. A construction report for this research, designated Project HR-559, is entitled "Ultra Thin PCC Overlays" and is available from the Iowa DOT.

One feature became a variable inadvertently. The contractor began the project by having water from the ready mix delivery trucks sprayed on the surface of the asphalt immediately ahead of the paver. This is not the recommended practice. Wetting the grade ahead of paving is required on new construction, but not on overlays.

The practice was stopped when it was discovered, but this was not until Section 15 had been constructed. Therefore, approximately half of the sections with the base preparation type of patching and scarifying were constructed with a watered surface and half without.

There is a time when water may need to be sprayed on the surface for whitetopping projects, though. On extremely hot, sunny days, the surface can become extremely hot. A surface is probably too hot when it is uncomfortable for one to hold their hand on the surface for a short period of time. This heat can cause a rapid set in the concrete and lead to cracking. When this occurs, it is acceptable to spray a small amount of water on the surface well ahead of the paving operation. The water should be evaporated before the paver reaches these locations. The water can provide cooling.

INITIAL CONDITION

The construction in general went well. Some typical construction problems arose, as happens on many conventional projects. But, the only one that caused a significant detrimental effect on the final pavement happened on July 11 and 12. Sections 36 through 48 were constructed on those days. Of those, Sections 36, 39, 41, 43, and 45 experienced transverse cracking that was recorded in the first two condition surveys, listed in Table 7. Section 39 contained the most with 26 cracks found in the first survey.

The cracks are classic examples of those which form due to late sawing. In general, they begin at the transverse joint near the centerline and generally follow the joint to the edge. A second crack begins about 1 m from the other edge at the same transverse joint. This happens when one begins sawing about 1 m from the edge and as the saw passes across the centerline, enough pavement has been relieved to allow cracking to happen ahead of the saw and also the 1 m length behind the saw. Therefore, the author feels this cracking was construction related and is not an adverse effect of any of the research variables.

PERFORMANCE RELATED FACTORS

Two factors which affect the long term performance of the pavement are traffic loadings and environmental conditions. The following discusses each for the two year period.

1. Traffic Loading

The traffic estimates have been verified by the weigh-in-motion instrumentation. The volumes closely approximate the estimated 1350 Average Daily Traffic (ADT). The number of Equivalent Single Axle Loads (ESAL's) has also matched projections. Currently an average of 40 ESAL's per day are recorded northbound and 20 ESAL's per day southbound. It is estimated that approximately 22,000 ESAL's have been applied to the roadway since construction of overlay.

2. Environmental Factors

Iowa experiences great variations in climatic conditions between seasons. Summer temperatures can exceed 40 °C and winter low temperatures can reach -30 °C. The weather in January 1996 brought an extremely large temperature swing. In Des Moines, Iowa, approximately 100 km from the project, the high temperature on January 13 was 16 °C. The low temperature on January 31 was -29 °C. It is possible that these conditions may have played a role in the cracking and distress that first became evident during this past winter and spring.

CONDITION AFTER TWO YEARS

Of the 41 test sections being studied, only four concrete sections and the three asphalt sections show any significant cracking after two years. Of the four concrete sections, two have exhibited small areas of debonding and distress cracking. The other two have a small amount of cracking but no debonding. The cracks have exhibited no adverse effect to date. The three asphalt sections have exhibited transverse cracking.

The survey of the transverse, longitudinal, corner, and diagonal cracks is shown in Tables 7, 8, 9, and 10, respectively. Table 11 identifies spalls and Table 12 lists fractured slabs.

The specific sections are described in detail below, in order of increasing severity:

Section 10:

One longitudinal crack, running through many panels, was identified in May 1996. It is parallel to a longitudinal joint and very straight. The sawed joint makes a slight deviation to the west from the alignment south of this area. The crack begins at the jog where the deviation begins and runs very close to the sawed joint. No debond is detected and no adverse effect is evident.

This section is 50 mm thick, has 0.6 m panels, and contains fibers.

Section 39:

This section experienced a significant amount of transverse cracking due to construction problems, as described above. One small section of corner/longitudinal cracking became evident, beginning in February of this year. The cracking is typical of load related edge cracks. Testing indicates no debonding. There is no indication at this time that this cracking will adversely affect performance.

This section is 50 mm thick, has 1.2 m panels and contains fibers.

Section 23

The August 1996 survey revealed an area of distress in Section 23 approximately 6 m x 5 m. Differential vertical movement had occurred between panels of approximately 5 mm in one area. Partial debonding has occurred in this distressed area. The area represents approximately 2% of the area of the section.

This section is 50 mm thick, has 0.6 m panels, and contains no fibers.

Section 62:

The first section to exhibit distress was Section 62. Significant cracking was discovered in February 1996. By the August 1996 survey, the area of debonding and distress cracking was approximately 6 m x 2.4 m. Construction records reveal that a major problem with the paver, not fully described in the records, occurred in the exact location of this distress. How the construction problem affected the distress area is unknown.

Three other smaller areas of corner/longitudinal cracks were identified in the August 1996 survey. The total area of the four locations identified with cracking and distress is 2% of the area of the entire section. Partial debonding has been found at each of the areas.

This section is 50 mm thick, has 1.2 m panels, and contains no fibers.

SUMMARY OF THE CONDITION

- The only distress to date is found in sections of 50 mm thickness.
- Only two of the eight sections constructed 50 mm in depth exhibit debonding and distress cracking. Within those two sections, only in 2% of the area of each of the sections is this distress found.
- The two 50 mm thick sections exhibiting debonding and distress cracking contain no fibers. The two 50 mm thick sections exhibiting some cracking but no debonding or distress contain fibers. The other four 50 mm thick sections do contain fibers and show no cracking or debonding.
- One section of the two sections showing some debonding and distress cracking had a significant construction problem occur in the exact location where the distress has become evident.
- Transverse cracking has occurred in all three asphalt sections. The cracking began in late fall of 1995 and winter of 1996, approximately a year and a half after construction.

CONCLUSIONS

It is too early in the life of the pavement sections to find wide spread distress which would differentiate good and poor performance of any of the research variables. Since only two sections of the 41 test sections have exhibited any debonding and distress cracking, it can be concluded that at two years of age, the concrete overlay sections have all performed well.

Since the only distress has occurred in the 50 mm thick sections, there may be indications that 50 mm sections are more vulnerable to being adversely affected by construction practices or possible weaknesses in the base and old pavement below. It will be some time before this can be confirmed or invalidated.

The two sections showing some debonding and distress cracking have different sawing patterns. One is cut in 0.6 m squares and the other in 1.2 m squares. Joint spacing as it relates to thickness can not be evaluated at this time.

The two 50 mm sections exhibiting some debonding and distress cracking are the only two 50 mm sections containing no fibers. It may be premature to draw conclusions about the benefits of fibers. But, at two years of age, the thinnest sections with fiber have shown better performance.

FIGURE CAPTIONS

1. Figure 1: Test Section Layout

FIGURE 1: Test Section Layout

Section	Station	Surface Preparation	Pavement Thickness (mm)	Fibers	Joint Spacing (m)
1	2335+64 – 2340+00	RECONST	200	RECONST	6.1
2	2340+00 – 2342+00	PATCH AND SCARIFY			
3	2342+00 – 2349+00		150	FIBERS	3.7
4	2349+00 – 2356+00				1.8
5	2356+00 – 2357+00				
6	2357+00 – 2364+00	PATCH AND SCARIFY	100	FIBERS	
7	2364+00 – 2371+00				0.6
8	2371+00 – 2378+00				1.2
9	2378+00 – 2380+00	PATCH AND SCARIFY		FIBERS	0.6
10	2380+00 – 2387+00		50		

1 m = 3.28 ft   1 mm = 0.04 in

FIGURE 1: Test Section Layout

Section	Station	Surface Preparation	Pavement Thickness (mm)	Fibers	Joint Spacing (m)
11	2387+00				
			50		1.2
	2394+00	PATCH			
12					
	2396+00	AND		FIBERS	
13					
		SCARIFY			
					1.8
	2403+00				
14					
			150		
					3.7
				FIBERS	
	2414+00				
15	2415+00				
16		PATCH			
		AND			
		SCARIFY	110	AC	N/A
	2425+00				
17	2426+00				
18					
					3.7
	2433+00	PATCH	150	NO FIBERS	
19					
		AND			
		SCARIFY			1.8
	2440+00				
20	2441+00				

1 m = 3.28 ft 1 mm = 0.04 in

FIGURE 1: Test Section Layout

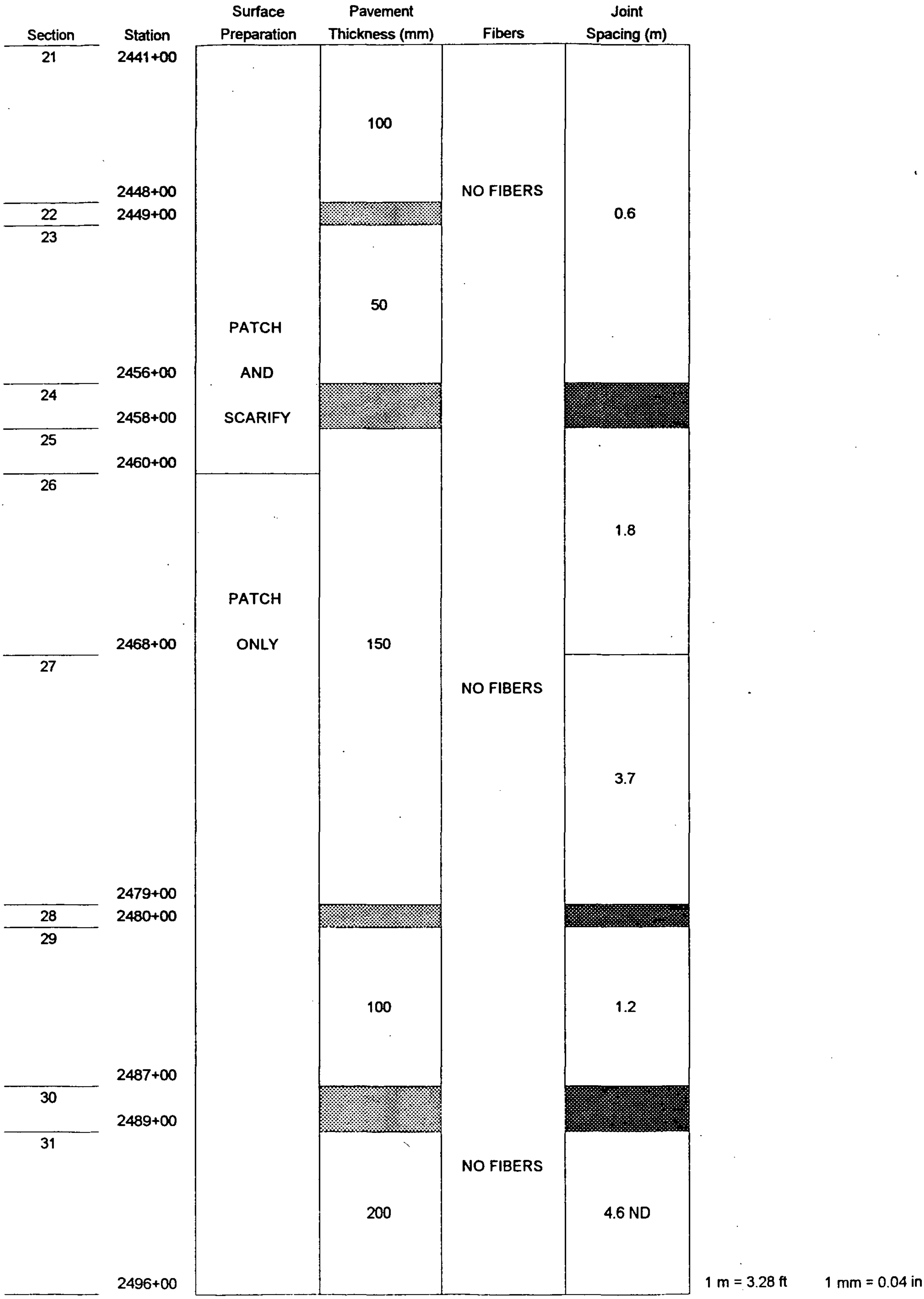
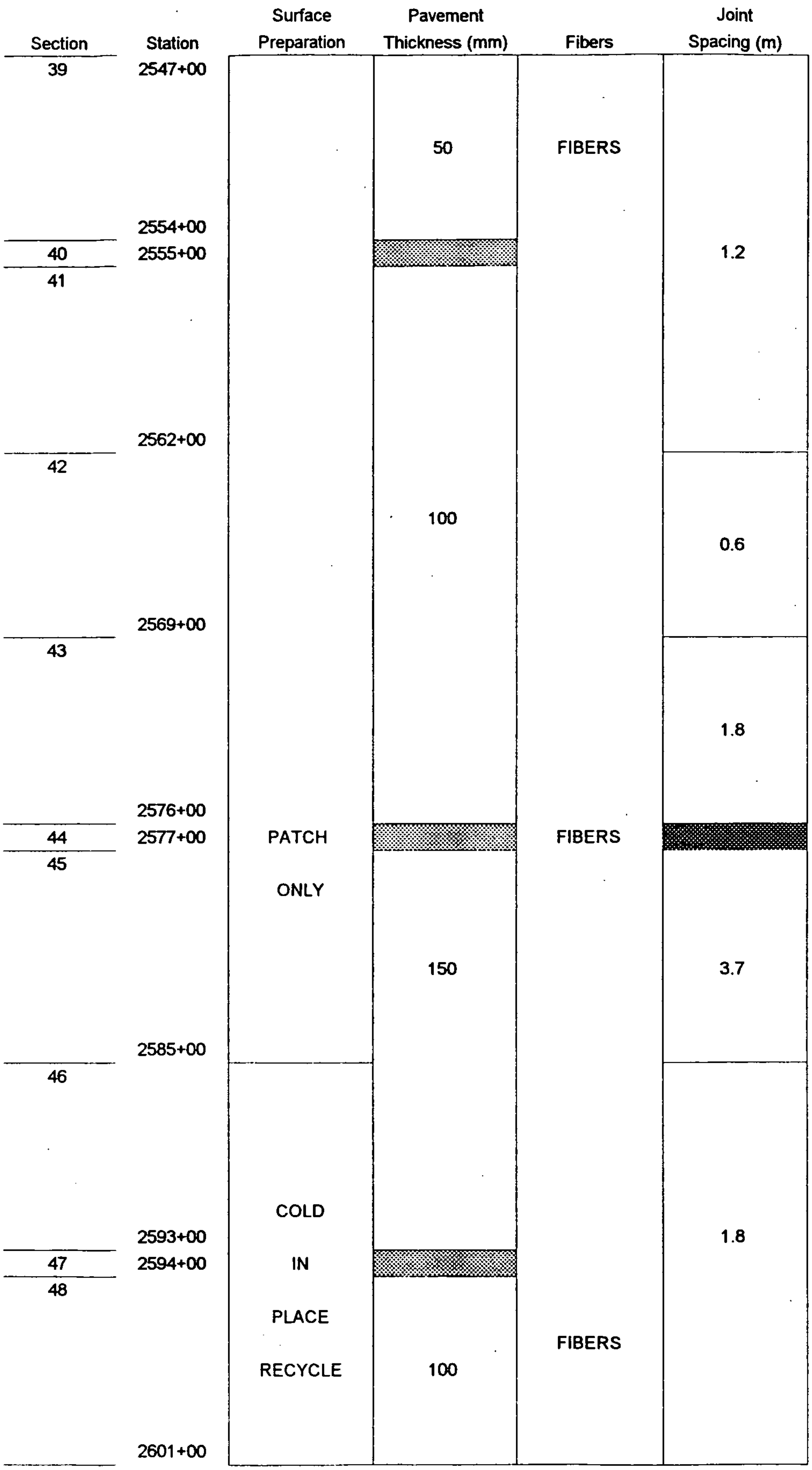


FIGURE 1: Test Section Layout

Section	Station	Surface Preparation	Pavement Thickness (mm)	Fibers	Joint Spacing (m)
32	2496+00		200	NO FIBERS	4.6 D
33	2503+00	PATCH			
34	2505+00	ONLY	110	AC	N/A
35	2515+00				
36	2516+00		150	NO FIBERS	1.8
				NO FIBERS	
37	2538+00	PATCH			
38	2540+00	ONLY	50	FIBERS	0.6
	2547+00				

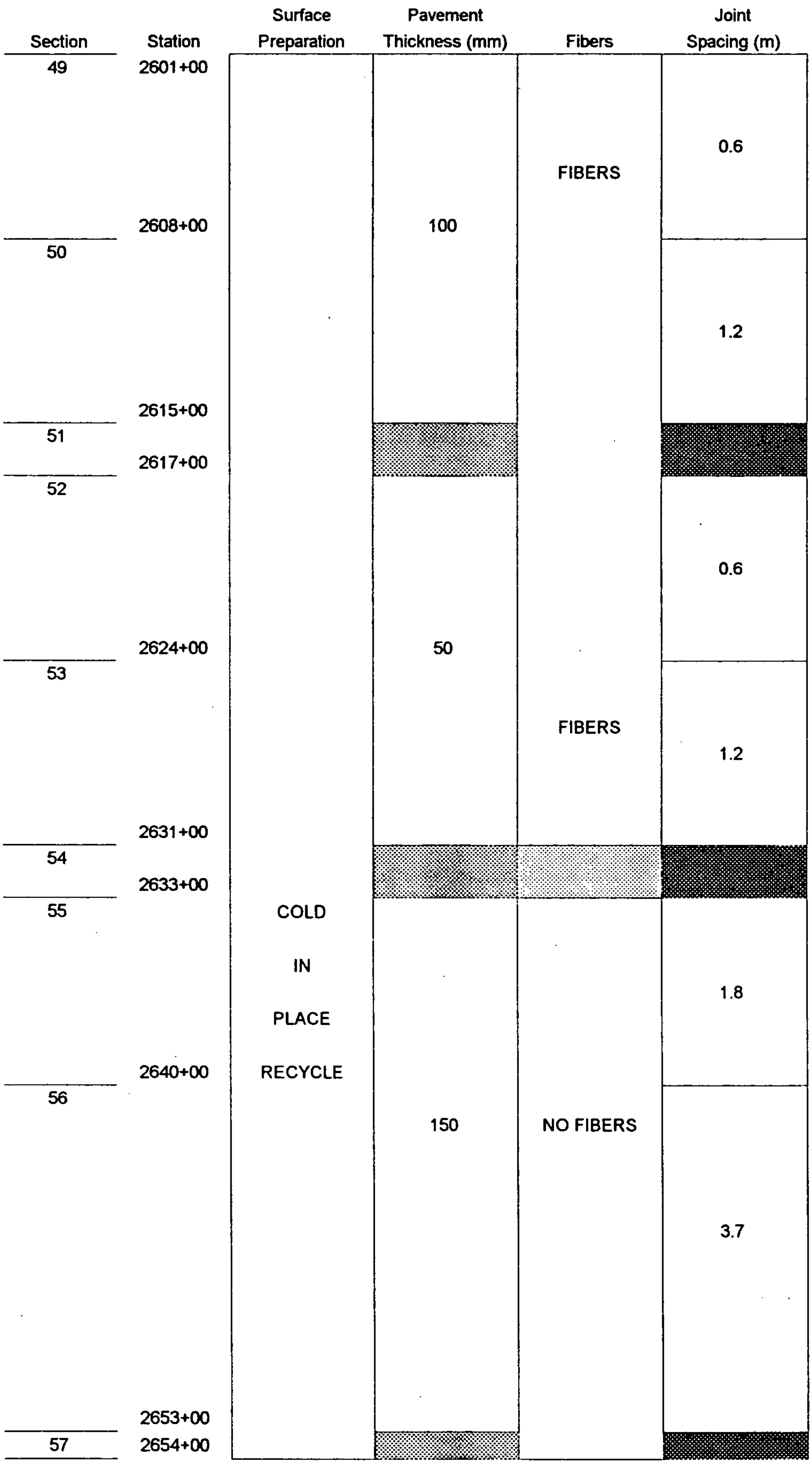
1 m = 3.28 ft 1 mm = 0.04 in

FIGURE 1: Test Section Layout



1 m = 3.28 ft 1 mm = 0.04 in

FIGURE 1: Test Section Layout



1 m = 3.28 ft   1 mm = 0.04 in

FIGURE 1: Test Section Layout

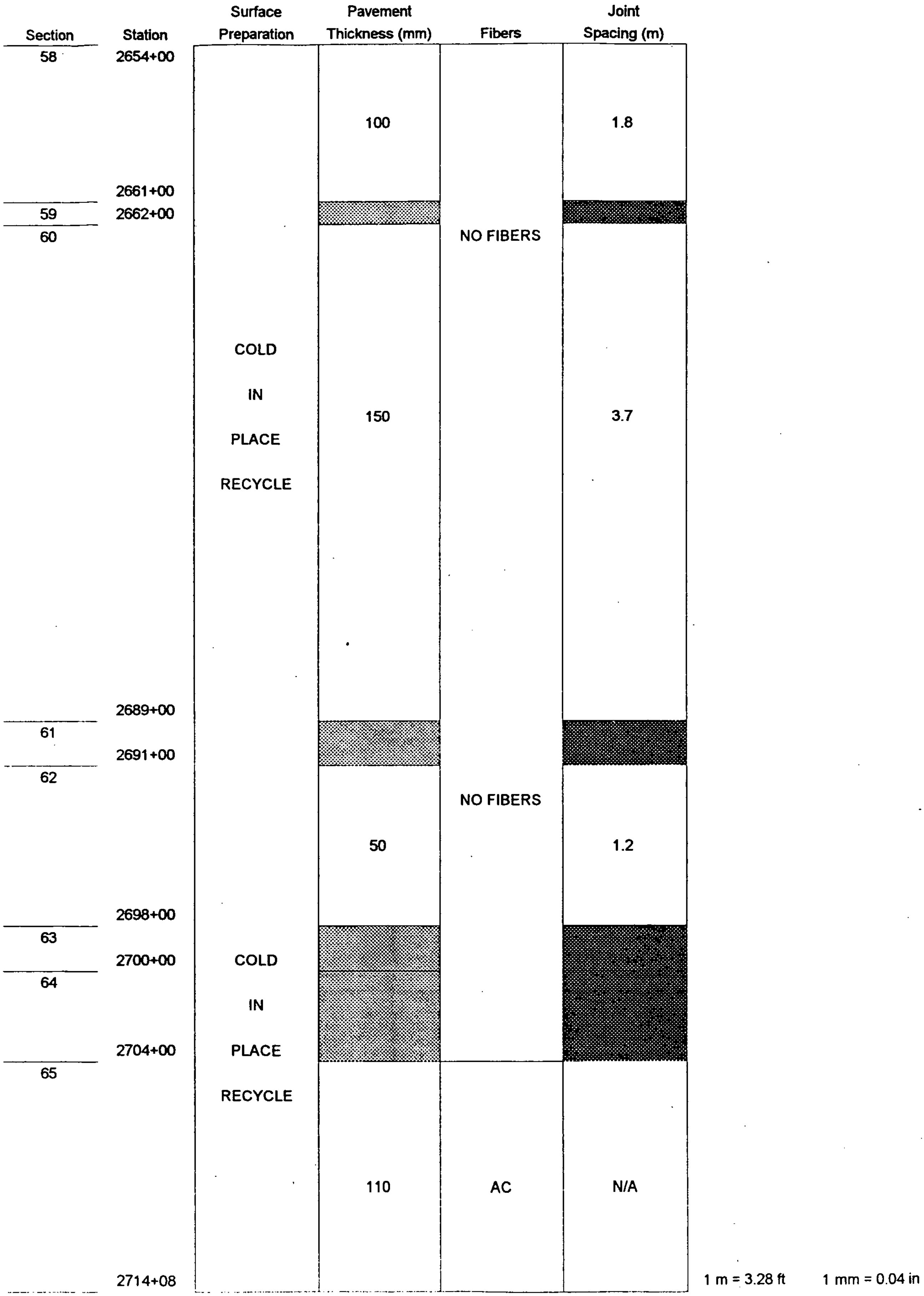


TABLE TITLES

Table 1: Project Layout

Section Number	Begin Station	Ending Station	Thickness (mm)	Fiber F & NF	Joint Spacing (m)	Surface Preparation
1	2335+64	2340+00	200	RECONSTR	6.1	***
2	2340+00	2342+00	200-150	NF-F	3.7	P&S
3	2342+00	2349+00	150	F	3.7	P&S
4	2349+00	2356+00	150	F	1.8	P&S
5	2356+00	2357+00	150-100	F	1.8	P&S
6	2357+00	2364+00	100	F	1.8	P&S
7	2364+00	2371+00	100	F	0.6	P&S
8	2371+00	2378+00	100	F	1.2	P&S
9	2378+00	2380+00	100-50	F	0.6	P&S
10	2380+00	2387+00	50	F	0.6	P&S
11	2387+00	2394+00	50	F	1.2	P&S
12	2394+00	2396+00	50-150	F	1.2-1.8	P&S
13	2396+00	2403+00	150	F	1.8	P&S
14	2403+00	2414+00	150	F	3.7	P&S
15	2414+00	2415+00	150-110	F	3.7-1.8	P&S
16	2415+00	2425+00	110	ACC	ACC	P&S
17	2425+00	2426+00	110-150	NF	1.8-3.7	P&S
18	2426+00	2433+00	150	NF	3.7	P&S
19	2433+00	2440+00	150	NF	1.8	P&S
20	2440+00	2441+00	150-200	NF	1.8-0.6	P&S
21	2441+00	2448+00	100	NF	0.6	P&S
22	2448+00	2449+00	100-50	NF	0.6	P&S
23	2449+00	2456+00	50	NF	0.6	P&S
24	2456+00	2458+00	50-150	NF	0.6-1.8	P&S
25	2458+00	2460+00	150	NF	1.8	P&S
26	2460+00	2468+00	150	NF	1.8	P ONLY
27	2468+00	2479+00	150	NF	3.7	P ONLY
28	2479+00	2480+00	150-100	NF	3.7-1.2	P ONLY
29	2480+00	2487+00	100	NF	1.2	P ONLY
30	2487+00	2489+00	100-200	NF	1.2-4.6	P ONLY
31	2489+00	2496+00	200	NF	4.6 ND	P ONLY
32	2496+00	2503+00	200	NF	4.6 D	P ONLY
33	2503+00	2505+00	200-110	NF	4.6-1.8	P ONLY
34	2505+00	2515+00	110	ACC	ACC	P ONLY
35	2515+00	2516+00	110-150	NF	1.2-1.8	P ONLY
36	2516+00	2538+00	150	NF	1.8	P ONLY
37	2438+00	2540+00	150-50	NF-F	1.8-0.6	P ONLY
38	2540+00	2547+00	50	F	0.6	P ONLY
39	2547+00	2554+00	50	F	1.2	P ONLY
40	2554+00	2555+00	50-100	F	1.2	P ONLY
41	2555+00	2562+00	100	F	1.2	P ONLY
42	2562+00	2569+00	100	F	0.6	P ONLY
43	2569+00	2576+00	100	F	1.8	P ONLY

1 m = 0.305 ft 1 mm = 0.04 in

Table 1: Project Layout

Section Number	Begin Station	Ending Station	Thickness (mm)	Fiber F & NF	Joint Spacing (m)	Surface Preparation
44	2576+00	2577+00	100-150	F	1.8-3.7	P ONLY
45	2577+00	2585+00	150	F	3.7	P ONLY
46	2585+00	2593+00	150	F	1.8	CIP
47	2593+00	2594+00	150-100	F	1.8	CIP
48	2594+00	2601+00	100	F	1.8	CIP
49	2601+00	2608+00	100	F	0.6	CIP
50	2608+00	2615+00	100	F	1.2	CIP
51	2615+00	2616+00	100-50	F	1.2-0.6	CIP
52	2616+00	2624+00	50	F	0.6	CIP
53	2624+00	2631+00	50	F	1.2	CIP
54	2631+00	2633+00	50-150	F-NF	1.2-1.8	CIP
55	2633+00	2640+00	150	NF	1.8	CIP
56	2640+00	2653+00	150	NF	3.7	CIP
57	2653+00	2654+00	150-100	NF	3.7-1.8	CIP
58	2654+00	2661+0	100	NF	1.8	CIP
59	2661+00	2662+00	100-150	NF	1.8-3.7	CIP
60	2662+00	2689+00	150	NF	3.7	CIP
61	2689+00	2691+00	150-50	NF	3.7-1.2	CIP
62	2691+00	2698+00	50	NF	1.2	CIP
63	2698+00	2700+00	50-150	NF	1.2-3.7	CIP
64	2700+00	2704+00	150-110	NF	3.7-1.2	CIP
65	2704+00	2714+08	110	ACC	ACC	CIP

NOTE: ALL INFORMATION WAS TAKEN FROM PLANS
D: DOWELLED
ND: NON-DOWELLED
****: SPECIAL BACKFILL*
P&S: PATCH AND SCARIFY
P ONLY: PATCH ONLY
CIP: COLD-IN-PLACE RECYCLE

1 m = 0.305 ft   1 mm = 0.04 in

Table 2: Project Research Study Sections

Section Number	Begin Station	Ending Station	Thickness (mm)	Fiber F & NF	Joint Spacing (m)	Surface Preparation
1	2335+64	2340+00	200	RECONSTR	6.1	***
3	2342+00	2349+00	150	F	3.7	P&S
4	2349+00	2356+00	150	F	1.8	P&S
6	2357+00	2364+00	100	F	1.8	P&S
7	2364+00	2371+00	100	F	0.6	P&S
8	2371+00	2378+00	100	F	1.2	P&S
10	2380+00	2387+00	50	F	0.6	P&S
11	2387+00	2394+00	50	F	1.2	P&S
13	2396+00	2403+00	150	F	1.8	P&S
14	2403+00	2414+00	150	F	3.7	P&S
16	2415+00	2425+00	110	ACC	ACC	P&S
18	2426+00	2433+00	150	NF	3.7	P&S
19	2433+00	2440+00	150	NF	1.8	P&S
21	2441+00	2448+00	100	NF	0.6	P&S
23	2449+00	2456+00	50	NF	0.6	P&S
25	2458+00	2460+00	150	NF	1.8	P&S
26	2460+00	2468+00	150	NF	1.8	P ONLY
27	2468+00	2479+00	150	NF	3.7	P ONLY
29	2480+00	2487+00	100	NF	1.2	P ONLY
31	2489+00	2496+00	200	NF	4.6 ND	P ONLY
32	2496+00	2503+00	200	NF	4.6 D	P ONLY
34	2505+00	2515+00	110	ACC	ACC	P ONLY
36	2516+00	2538+00	150	NF	1.8	P ONLY
38	2540+00	2547+00	50	F	0.6	P ONLY
39	2547+00	2554+00	50	F	1.2	P ONLY
41	2555+00	2562+00	100	F	1.2	P ONLY
42	2562+00	2569+00	100	F	0.6	P ONLY
43	2569+00	2576+00	100	F	1.8	P ONLY
45	2577+00	2585+00	150	F	3.7	P ONLY
46	2585+00	2593+00	150	F	1.8	CIP
48	2594+00	2601+00	100	F	1.8	CIP
49	2601+00	2608+00	100	F	0.6	CIP
50	2608+00	2615+00	100	F	1.2	CIP
52	2616+00	2624+00	50	F	0.6	CIP
53	2624+00	2631+00	50	F	1.2	CIP
55	2633+00	2640+00	150	NF	1.8	CIP
56	2640+00	2653+00	150	NF	3.7	CIP
58	2654+00	2661+0	100	NF	1.8	CIP
60	2662+00	2689+00	150	NF	3.7	CIP
62	2691+00	2698+00	50	NF	1.2	CIP
65	2704+00	2714+08	110	ACC	ACC	CIP

NOTE: ALL INFORMATION WAS TAKEN FROM PLANS
D: DOWELLED
ND: NON-DOWELLED
****: SPECIAL BACKFILL*
P&S: PATCH AND SCARIFY
P ONLY: PATCH ONLY
CIP: COLD-IN-PLACE RECYCLE

1 m = 0.305 ft

1 mm = 0.04 in

Table 3: Actual Depth of Slab

SECTION NUMBER	MINIMUM			MAXIMUM			AVERAGE			SAMPLE SIZE
	LT	CL	RT	LT	CL	RT	LT	CL	RT	
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
2	T	T	T	T	T	T	T	T	T	-
3	200	200	200	200	200	200	200	200	200	1
4	150	160	130	220	220	180	180	190	150	5
5	T	T	T	T	T	T	T	T	T	-
6	100	100	100	130	160	160	120	130	130	3
7	110	110	80	110	120	130	110	110	100	2
8	110	100	150	170	140	180	140	120	170	5
9	T	T	T	T	T	T	T	T	T	-
10	100	80	40	100	90	60	100	80	50	2
11	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
12	T	T	T	T	T	T	T	T	T	-
13	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
14	130	140	150	190	190	190	160	170	170	6
15	T	T	T	T	T	T	T	T	T	-
16	ACC	ACC	ACC	ACC	ACC	ACC	ACC	ACC	ACC	ACC
17	T	T	T	T	T	T	T	T	T	-
18	140	150	160	170	180	160	150	170	190	4
19	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
20	T	T	T	T	T	T	T	T	T	-
21	50	80	80	100	140	140	80	110	110	3
22	T	T	T	T	T	T	T	T	T	-
23	60	80	60	130	140	130	100	100	100	3
24	T	T	T	T	T	T	T	T	T	-
25	180	180	200	180	180	200	180	180	200	2
26	150	170	170	200	200	200	170	190	190	4
27	150	170	170	190	200	190	170	190	180	4
28	T	T	T	T	T	T	T	T	T	-
29	150	150	140	150	150	140	150	150	140	1
30	T	T	T	T	T	T	T	T	T	-
31	200	210	180	270	270	280	220	240	240	4
32	200	240	210	230	280	270	210	260	230	4
33	T	T	T	T	T	T	T	T	T	-
34	ACC	ACC	ACC	ACC	ACC	ACC	ACC	ACC	ACC	ACC
35	T	T	T	T	T	T	T	T	T	-
36	100	150	170	190	220	180	150	190	170	8
37	T	T	T	T	T	T	T	T	T	-
38	40	80	80	80	100	100	60	90	90	3
39	50	80	70	100	90	110	70	80	80	3
40	T	T	T	T	T	T	T	T	T	-
41	90	110	110	130	130	130	110	120	110	4
42	110	130	110	140	140	130	120	140	120	3
43	70	100	100	120	150	110	100	120	100	3
44	T	T	T	T	T	T	T	T	T	-
45	150	150	150	170	200	170	160	170	160	3
46	160	150	130	170	160	160	160	150	140	3

Table 3: Actual Depth of Slab

SECTION NUMBER	MINIMUM			MAXIMUM			AVERAGE			SAMPLE SIZE
	LT	CL	RT	LT	CL	RT	LT	CL	RT	
47	T	T	T	T	T	T	T	T	T	-
48	110	100	100	140	220	130	130	160	110	3
49	130	150	140	150	220	150	140	180	140	4
50	80	120	120	180	200	120	130	160	120	2
51	T	T	T	T	T	T	T	T	T	-
52	50	80	50	50	80	50	50	80	50	1
53	60	60	40	60	60	40	60	60	40	1
54	T	T	T	T	T	T	T	T	T	-
55	130	150	110	210	220	170	160	180	140	4
56	150	130	130	210	220	200	190	190	170	5
57	T	T	T	T	T	T	T	T	T	-
58	110	110	110	150	150	130	130	130	120	2
59	T	T	T	T	T	T	T	T	T	-
60	120	140	140	200	180	170	150	160	150	9
61	T	T	T	T	T	T	T	T	T	-
62	40	80	80	60	110	120	50	90	100	2
63	T	T	T	T	T	T	T	T	T	-
64	T	T	T	T	T	T	T	T	T	-
65	ACC	ACC	ACC	ACC	ACC	ACC	ACC	ACC	ACC	ACC

NOTE: T: TRANSITION SECTION
NA: NO INFORAMITON AVAILABLE FOR SECTION
ALL MEASUREMENTS IN mm

Table 4: Mixtures

Beginning Station	Ending Station	Mixture	Section Numbers
2335+64	2341+02	Standard	1-2
2341+02	2386+75	Fibrillated	2-10
2386+75	2412+75	Monofillament	10-14
2412+75	2415+00	Fibrillated	14-15
2415+00	2425+00	ACC	16
2425+00	2505+00	Standard	17-33
2505+00	2515+00	ACC	34
2515+00	2539+09	Standard	35-37
2539+09	2632+25	Fibrillated	37-54
2632+25	2703+95	Standard	54-64
2703+95	2714+00	ACC	65

Note: Information taken from plant reports

Table 5: Concrete Mixture Proportions Basic Absolute Volumes Per Unit Volumes

Concrete Mixture Class	Fine Aggregate	Coarse Aggregate	Cement Minimum	Water	Entrained Air	Flyash	Basic W/C	Maximum W/C
C-3WR-C	0.307	0.375	0.092	0.147	0.06	0.019	0.430	0.480
C-3WR	0.309	0.377	0.108	0.146	0.06	--	0.430	0.480

TABLE 6: Average Structual Ratings

Section Number	North Bound (4/28/94)	North Bound (10/13/94)	North Bound (6/06/95)	South Bound (4/28/94)	South Bound (10/13/94)	South Bound (6/06/95)	Combined (4/28/94)	Combined (10/13/94)	Combined (6/06/95)
1	2.76	4.82	4.20	2.73	5.53	4.32	2.75	5.18	4.26
2	2.14	5.14	4.25	2.24	4.99	4.02	2.19	5.07	4.13
3	1.78	5.04	5.66	1.99	5.31	4.96	1.89	5.18	5.31
4	1.93	3.98	2.82	1.97	5.60	3.90	1.95	4.79	3.36
5	2.20	4.73	3.91	1.76	3.89	2.92	1.98	4.31	3.41
6	1.82	3.95	3.54	1.75	3.17	2.80	1.78	3.56	3.17
7	1.83	2.50	1.83	1.81	3.00	2.16	1.82	2.75	2.00
8	2.07	4.83	3.93	2.23	3.60	3.65	2.15	4.22	3.79
9	1.89	3.35	2.62	2.61	3.04	2.84	2.25	3.20	2.73
10	2.15	2.23	1.66	2.18	2.86	1.94	2.17	2.55	1.80
11	-	2.30	1.86	2.14	2.23	1.51	-	2.27	1.69
12	2.20	3.61	2.63	1.89	4.37	3.15	2.05	3.99	2.89
13	1.50	7.02	5.20	2.35	5.12	5.10	1.93	6.07	5.15
14	2.14	4.66	4.03	2.02	4.65	4.23	2.08	4.66	4.13
15	2.33	4.51	3.59	2.07	3.74	2.93	2.20	4.13	3.26
16	1.60	2.59	3.77	2.13	2.45	3.95	1.87	2.52	3.86
17	1.43	4.56	3.08	2.19	4.56	3.32	1.81	4.56	3.20
18	1.83	5.63	4.57	3.61	4.79	4.22	2.72	5.21	4.39
19	2.59	5.86	4.76	2.94	5.02	3.98	2.77	5.44	4.37
20	2.85	4.70	3.14	2.04	3.81	3.00	2.45	4.26	3.07
21	1.62	4.43	3.19	2.08	4.16	2.99	1.85	4.30	3.09
22	2.60	3.16	2.12	2.23	2.62	1.85	2.42	2.89	1.98
23	2.64	3.02	2.06	2.23	2.40	2.00	2.44	2.71	2.03
24	2.83	4.42	3.47	2.47	4.47	3.33	2.65	4.45	3.40
25	2.47	5.98	5.32	1.91	5.69	5.51	2.19	5.84	5.41
26	1.47	6.21	5.32	2.12	4.80	4.36	1.79	5.51	4.84
27	1.89	5.51	4.58	2.38	5.24	4.37	2.14	5.38	4.47
28	2.08	4.45	2.88	2.35	4.26	3.04	2.21	4.36	2.96
29	2.77	6.17	3.68	2.29	4.53	3.59	2.53	5.35	3.63
30	2.07	6.64	4.73	2.18	5.07	4.70	2.13	5.86	4.71
31	1.78	7.74	6.81	2.34	6.74	5.71	2.06	7.24	6.26
32	2.27	7.31	6.43	2.28	7.58	6.12	2.28	7.45	6.27
33	2.37	6.13	5.33	2.91	6.35	5.98	2.64	6.24	5.65
34	2.37	3.93	4.92	2.30	2.44	4.26	2.34	3.18	4.59
35	2.44	5.79	4.23	2.57	5.02	4.51	2.51	5.41	4.37
36	2.18	6.47	-	2.87	6.40	5.04	2.53	6.44	2.52
37	2.21	5.25	3.72	2.47	4.61	4.09	2.34	4.93	3.90
38	3.23	4.45	3.34	3.35	3.79	3.13	3.29	4.12	3.23
39	1.97	2.41	2.13	2.39	2.63	2.29	2.18	2.52	2.21
40	2.52	3.99	2.94	2.42	3.45	2.73	2.47	3.72	2.83
41	2.63	4.26	3.12	2.21	4.71	3.21	2.42	4.49	3.16
42	1.98	3.42	2.34	1.75	3.57	2.97	1.86	3.50	2.66
43	1.65	3.52	2.53	2.86	4.10	3.11	2.26	3.81	2.82
44	2.16	3.72	2.25	2.26	3.96	3.07	2.21	3.84	2.66
45	2.42	4.35	3.59	2.51	5.28	4.41	2.47	4.82	4.00

TABLE 6: Average Structual Ratings

Section Number	North Bound (4/28/94)	North Bound (10/13/94)	North Bound (6/06/95)	South Bound (4/28/94)	South Bound (10/13/94)	South Bound (6/06/95)	Combined (4/28/94)	Combined (10/13/94)	Combined (6/06/95)
46	2.87	4.33	3.47	2.49	4.56	3.54	2.68	4.45	3.50
47	2.61	4.33	3.29	2.09	4.36	3.32	2.35	4.35	3.30
48	2.42	4.38	3.63	2.52	4.56	3.53	2.47	4.47	3.58
49	2.63	4.94	3.84	2.38	4.35	3.93	2.51	4.65	3.89
50	2.57	3.83	3.28	2.66	4.47	3.70	2.62	4.15	3.49
51	1.84	2.58	1.56	1.98	2.77	2.09	1.91	2.68	1.83
52	2.63	3.16	2.08	2.07	2.76	2.30	2.35	2.96	2.19
53	1.95	3.60	1.92	2.50	2.50	2.38	2.22	3.05	2.15
54	2.35	3.54	2.70	2.69	3.45	3.73	2.52	3.50	3.22
55	1.77	4.45	4.45	1.81	5.37	4.34	1.79	4.91	4.39
56	2.72	4.94	4.32	2.35	5.71	4.48	2.53	5.33	4.40
57	2.58	3.44	2.92	1.98	4.36	4.16	2.28	3.90	3.54
58	2.11	4.94	2.52	2.15	4.63	3.13	2.13	4.79	2.82
59	1.62	3.11	2.78	1.73	3.68	2.79	1.68	3.40	2.79
60	2.18	5.25	3.50	1.76	4.79	3.49	1.97	5.02	3.49
61	1.71	3.26	2.00	1.82	2.44	1.94	1.77	2.85	1.97
62	2.01	2.94	1.84	2.35	2.19	1.87	2.18	2.57	1.85
63	2.80	4.65	3.07	1.84	4.44	2.87	2.32	4.55	2.97
64	1.83	4.67	3.93	2.51	4.21	3.96	2.17	4.44	3.95
65	3.78	3.44	4.44	3.16	3.21	5.42	3.47	3.33	4.93

Table 7: Transverse Cracking

TEST SECTION	DEPTH (mm)	JOINTS (m)	FIBER	SURFACE PREP	NEW TRANSVERSE CRACKS 8/6/94	10/29/94	2/18/95	4/8/95	6/3/95	8/5/95	11/4/95	2/10/96	5/4/96	8/3/96
52	50	0.6	F	C	0	0	0	0	0	0	0	0	0	0
38	50	0.6	F	P	0	0	0	0	0	0	0	0	0	0
10	50	0.6	F	S	0	0	0	0	0	0	0	0	0	0
23	50	0.6	NF	S	0	0	0	0	0	0	0	0	0	4
53	50	1.2	F	C	0	0	0	0	0	0	0	0	1	0
39	50	1.2	F	P	26	5	1	0	0	0	0	1	0	0
11	50	1.2	F	S	0	0	0	0	0	0	0	0	0	0
62	50	1.2	NF	C	0	0	0	0	0	1	0	0	0	0
49	100	0.6	F	C	0	0	0	0	0	0	0	0	0	0
42	100	0.6	F	P	0	0	0	0	0	0	0	0	0	0
7	100	0.6	F	S	0	0	0	0	0	0	0	0	0	0
21	100	0.6	NF	S	0	0	0	0	0	0	0	0	0	0
50	100	1.2	F	C	0	0	0	0	0	0	0	0	0	0
41	100	1.2	F	P	5	1	0	0	0	0	0	0	0	1
8	100	1.2	F	S	0	0	0	0	0	0	0	0	0	0
29	100	1.2	NF	P	0	0	0	0	0	0	0	1	0	0
48	100	1.8	F	C	0	0	0	0	0	0	0	0	0	0
43	100	1.8	F	P	2	5	0	1	0	0	0	0	0	0
6	100	1.8	F	S	0	0	0	0	0	0	0	0	0	0
58	100	1.8	NF	C	0	0	0	0	0	0	0	0	0	0
46	150	1.8	F	C	0	0	0	0	0	0	0	0	0	0
4	150	1.8	F	S	0	0	0	0	0	0	0	0	0	0
13	150	1.8	F	S	0	0	0	0	0	0	0	0	0	0
55	150	1.8	NF	C	0	0	0	0	0	0	0	0	0	0
26	150	1.8	NF	P	0	0	0	0	0	0	0	0	0	0
36	150	1.8	NF	P	2	0	0	0	0	1	0	0	0	0
19	150	1.8	NF	S	0	0	0	0	0	0	0	0	0	0
25	150	1.8	NF	S	0	0	0	0	0	0	0	0	0	0
45	150	3.7	F	P	1	4	0	0	0	0	0	0	0	0
3	150	3.7	F	S	0	0	0	0	0	0	0	0	0	0
14	150	3.7	F	S	0	0	0	0	0	0	0	0	0	0
56	150	3.7	NF	C	0	0	0	0	0	0	0	0	0	0
60	150	3.7	NF	C	0	0	0	0	0	0	0	0	0	0
27	150	3.7	NF	P	0	0	0	0	0	0	0	0	0	0
18	150	3.7	NF	S	0	0	0	0	0	0	0	0	0	0
31	200	4.6	NF	P	0	0	0	0	0	0	0	0	0	0
32	200	4.6	NF	P	1	0	0	0	0	0	0	0	0	0
1	200	6.1	N/A	R	0	0	0	0	0	0	0	0	0	0
16	112.5	N/A	ACC	N/A	0	0	0	0	0	0	0	6	3	0
34	112.5	N/A	ACC	P	0	0	0	0	0	0	0	15	2	1
65	112.5	N/A	ACC	P	0	0	1	0	0	0	13	0	4	0

1 mm = 0.039 inches

1m = 3.28 ft

NOTES:

FIBERS: F = FIBERS PRESENT NF = NO FIBERS PRESENT

JOINTS: SQUARES: 0.6 m, 1.2 m, 1.8 m CONVENTIONAL JOINT SPACING: 3.7 m, 4.6 m, 6.1 m

SURFACE PREPARATION: C = COLD IN PLACE RECYCLE P = PATCH S =SCARIFY R = RECONSTRUCTION

N/A = NOT APPLICABLE

Table 8: Longitudinal Cracking

TEST SECTION	DEPTH (mm)	JOINTS (m)	FIBER	SURFACE PREP	NEW LONGITUDINAL CRACKS 8/6/94	10/29/94	2/18/95	4/8/95	6/3/95	8/5/95	11/4/95	2/10/96	5/4/96	8/3/96
52	50	0.6	F	C	0	0	0	0	0	0	0	0	0	0
38	50	0.6	F	P	0	0	0	0	0	0	0	0	0	0
10	50	0.6	F	S	0	0	0	0	0	0	0	0	8	0
23	50	0.6	NF	S	0	0	0	0	0	0	0	0	0	25
53	50	1.2	F	C	0	0	0	0	0	0	0	3	0	0
39	50	1.2	F	P	0	0	0	0	0	0	0	0	3	1
11	50	1.2	F	S	0	0	0	0	0	0	0	5	3	11
62	50	1.2	NF	C	0	0	0	0	0	0	0	0	2	0
49	100	0.6	F	C	0	0	0	0	0	0	0	0	0	0
42	100	0.6	F	P	0	0	0	0	0	0	0	0	0	0
7	100	0.6	F	S	0	0	0	0	0	0	0	0	0	0
21	100	0.6	NF	S	0	0	0	0	0	0	0	0	0	0
50	100	1.2	F	C	0	0	0	0	0	0	0	0	0	0
41	100	1.2	F	P	0	0	0	0	0	0	0	0	0	0
8	100	1.2	F	S	0	0	0	0	0	0	0	0	0	0
29	100	1.2	NF	P	0	0	0	0	0	0	0	0	0	0
48	100	1.8	F	C	0	0	0	0	0	0	0	0	0	0
43	100	1.8	F	P	0	0	0	0	0	0	0	0	0	0
6	100	1.8	F	S	0	0	0	0	0	0	0	0	0	0
58	100	1.8	NF	C	0	0	0	0	0	0	0	0	0	0
46	150	1.8	F	C	0	0	0	0	0	1	0	0	0	0
4	150	1.8	F	S	0	0	0	0	0	0	0	0	0	0
13	150	1.8	F	S	0	0	0	0	0	0	0	0	0	0
55	150	1.8	NF	C	0	0	0	0	0	0	0	0	0	0
26	150	1.8	NF	P	0	0	0	0	0	0	0	0	0	0
36	150	1.8	NF	P	0	0	0	0	0	0	0	0	0	0
19	150	1.8	NF	S	0	0	0	0	0	0	0	0	0	0
25	150	1.8	NF	S	0	0	0	0	0	0	0	0	0	0
45	150	3.7	F	P	0	0	0	0	0	0	0	0	1	0
3	150	3.7	F	S	0	0	0	0	0	0	0	0	0	0
14	150	3.7	F	S	0	0	0	0	0	0	0	0	4	0
56	150	3.7	NF	C	0	0	0	0	0	0	0	0	0	0
60	150	3.7	NF	C	0	0	0	0	0	0	0	0	1	0
27	150	3.7	NF	P	0	0	0	0	0	0	0	0	0	0
18	150	3.7	NF	S	0	0	0	0	0	0	0	0	0	0
31	200	4.6	NF	P	0	0	0	0	0	0	0	0	0	0
32	200	4.6	NF	P	0	0	0	0	0	0	0	0	0	0
1	200	6.1	N/A	R	1	0	0	1	0	0	0	0	1	0
16	112.5	N/A	NF	N/A	0	0	0	0	0	0	0	0	0	0
34	112.5	N/A	NF	P	0	0	0	0	0	0	0	0	0	0
65	112.5	N/A	NF	P	0	0	0	0	0	0	0	0	0	0

1 mm = 0.039 inches

1m = 3.28 ft

NOTES:

FIBERS: F = FIBERS PRESENT NF = NO FIBERS PRESENT

JOINTS: SQUARES: 0.6 m, 1.2 m, 1.8 m CONVENTIONAL JOINT SPACING: 3.7 m, 4.6 m, 6.1 m

SURFACE PREPARATION: C = COLD IN PLACE RECYCLE P = PATCH S =SCARIFY R = RECONSTRUCTION

N/A = NOT APPLICABLE

Table 9: Corner Cracking

TEST SECTION	DEPTH (mm)	JOINTS (m)	FIBER	SURFACE PREP	NEW CORNER CRACKS 8/6/94	10/29/94	2/18/95	4/8/95	6/3/95	8/5/95	11/4/95	2/10/96	5/4/96	8/3/96
52	50	0.6	F	C	0	0	0	0	0	0	0	0	0	0
38	50	0.6	F	P	0	0	0	0	0	0	0	0	0	0
10	50	0.6	F	S	0	0	0	0	0	0	0	0	0	0
23	50	0.6	NF	S	0	0	0	0	0	0	0	0	0	3
53	50	1.2	F	C	0	0	0	0	0	0	0	3	1	0
39	50	1.2	F	P	2	0	1	0	0	0	0	12	0	2
11	50	1.2	F	S	0	0	0	0	0	0	0	0	0	0
62	50	1.2	NF	C	0	0	0	0	0	0	0	30	0	0
49	100	0.6	F	C	0	0	0	0	0	0	0	0	0	0
42	100	0.6	F	P	0	0	0	0	0	0	0	0	0	0
7	100	0.6	F	S	0	0	0	0	0	0	0	0	0	0
21	100	0.6	NF	S	0	0	0	0	0	0	0	0	0	0
50	100	1.2	F	C	0	1	0	0	0	0	0	0	0	0
41	100	1.2	F	P	0	0	0	0	0	0	0	0	0	0
8	100	1.2	F	S	0	0	0	0	0	0	0	0	0	0
29	100	1.2	NF	P	1	0	0	0	0	0	0	0	0	0
48	100	1.8	F	C	0	0	0	0	0	0	0	0	0	0
43	100	1.8	F	P	0	0	0	0	0	0	0	0	0	0
6	100	1.8	F	S	0	0	0	0	0	0	0	0	0	0
58	100	1.8	NF	C	0	0	0	0	0	0	0	0	0	0
46	150	1.8	F	C	0	0	0	0	0	0	0	0	0	0
4	150	1.8	F	S	0	0	0	0	0	0	0	0	0	0
13	150	1.8	F	S	0	0	0	0	0	0	0	0	0	0
55	150	1.8	NF	C	0	0	0	0	0	0	0	0	0	0
26	150	1.8	NF	P	0	0	0	0	0	0	0	0	0	0
36	150	1.8	NF	P	0	0	0	0	0	0	0	0	0	0
19	150	1.8	NF	S	0	0	0	0	0	0	0	0	0	0
25	150	1.8	NF	S	0	0	0	0	0	0	0	0	0	0
45	150	3.7	F	P	0	0	0	0	0	0	0	0	0	1
3	150	3.7	F	S	0	0	0	0	0	1	0	0	0	0
14	150	3.7	F	S	0	0	0	0	0	0	0	0	0	0
56	150	3.7	NF	C	0	0	0	0	0	0	0	0	0	0
60	150	3.7	NF	C	0	1	0	0	1	0	0	0	0	0
27	150	3.7	NF	P	0	0	0	0	0	0	0	0	0	0
18	150	3.7	NF	S	0	0	0	0	0	0	0	0	0	0
31	200	4.6	NF	P	0	0	0	0	0	0	0	0	0	0
32	200	4.6	NF	P	0	0	0	1	0	0	1	0	0	0
1	200	6.1	N/A	R	4	0	0	0	0	0	0	0	0	0
16	112.5	N/A	ACC	N/A	0	0	0	0	0	0	0	0	0	0
34	112.5	N/A	ACC	P	0	0	0	0	0	0	0	0	0	0
65	112.5	N/A	ACC	P	0	0	0	0	0	0	0	0	0	0

1 mm = 0.039 inches

1m = 3.28 ft

NOTES:

FIBERS: F = FIBERS PRESENT NF = NO FIBERS PRESENT

JOINTS: SQUARES: 0.6 m, 1.2 m, 1.8 m CONVENTIONAL JOINT SPACING: 3.7 m, 4.6 m, 6.1 m

SURFACE PREPARATION: C = COLD IN PLACE RECYCLE P = PATCH S =SCARIFY R = RECONSTRUCTION

N/A = NOT APPLICABLE

Table 10: Diagonal Cracking

TEST SECTION	DEPTH (mm)	JOINT (m)	FIBER	SURFACE PREP	NEW DIAGONAL CRACKS 8/6/94	10/29/94	2/18/95	4/8/95	6/3/95	8/5/95	11/4/95	2/10/96	5/4/96	8/3/96
52	50	0.6	F	C	-	-	-	-	-	-	-	1	0	0
38	50	0.6	F	P	-	-	-	-	-	-	-	0	0	0
10	50	0.6	F	S	-	-	-	-	-	-	-	0	2	0
23	50	0.6	NF	S	-	-	-	-	-	-	-	0	0	0
53	50	1.2	F	C	-	-	-	-	-	-	-	0	0	0
39	50	1.2	F	P	-	-	-	-	-	-	-	0	0	0
11	50	1.2	F	S	-	-	-	-	-	-	-	0	0	0
62	50	1.2	NF	C	-	-	-	-	-	-	-	0	0	0
49	100	0.6	F	C	-	-	-	-	-	-	-	0	0	0
42	100	0.6	F	P	-	-	-	-	-	-	-	0	0	0
7	100	0.6	F	S	-	-	-	-	-	-	-	0	0	0
21	100	0.6	NF	S	-	-	-	-	-	-	-	0	0	0
50	100	1.2	F	C	-	-	-	-	-	-	-	0	0	0
41	100	1.2	F	P	-	-	-	-	-	-	-	0	0	0
8	100	1.2	F	S	-	-	-	-	-	-	-	0	0	0
29	100	1.2	NF	P	-	-	-	-	-	-	-	0	0	1
48	100	1.8	F	C	-	-	-	-	-	-	-	0	0	0
43	100	1.8	F	P	-	-	-	-	-	-	-	0	0	0
6	100	1.8	F	S	-	-	-	-	-	-	-	0	0	0
58	100	1.8	NF	C	-	-	-	-	-	-	-	0	0	0
46	150	1.8	F	C	-	-	-	-	-	-	-	0	0	0
4	150	1.8	F	S	-	-	-	-	-	-	-	0	0	0
13	150	1.8	F	S	-	-	-	-	-	-	-	0	0	0
55	150	1.8	NF	C	-	-	-	-	-	-	-	0	0	0
26	150	1.8	NF	P	-	-	-	-	-	-	-	0	0	0
36	150	1.8	NF	P	-	-	-	-	-	-	-	0	0	0
19	150	1.8	NF	S	-	-	-	-	-	-	-	0	0	0
25	150	1.8	NF	S	-	-	-	-	-	-	-	0	0	0
45	150	3.7	F	P	-	-	-	-	-	-	-	0	0	0
3	150	3.7	F	S	-	-	-	-	-	-	-	0	0	0
14	150	3.7	F	S	-	-	-	-	-	-	-	0	0	0
56	150	3.7	NF	C	-	-	-	-	-	-	-	0	0	0
60	150	3.7	NF	C	-	-	-	-	-	-	-	0	0	0
27	150	3.7	NF	P	-	-	-	-	-	-	-	0	0	0
18	150	3.7	NF	S	-	-	-	-	-	-	-	0	0	0
31	200	4.6	NF	P	-	-	-	-	-	-	-	0	0	0
32	200	4.6	NF	P	-	-	-	-	-	-	-	0	0	0
1	200	6.1	N/A	R	-	-	-	-	-	-	-	0	1	0
16	112.5	0.0	ACC	N/A	-	-	-	-	-	-	-	0	0	0
34	112.5	0.0	ACC	P	-	-	-	-	-	-	-	0	0	0
65	112.5	0.0	ACC	P	-	-	-	-	-	-	-	0	2	0

1 mm = 0.039 inches

1m = 3.28 ft

NOTES:

FIBERS: F = FIBERS PRESENT NF = NO FIBERS PRESENT

JOINTS: SQUARES: 0.6 m, 1.2 m, 1.8 m CONVENTIONAL JOINT SPACING: 3.7 m, 4.6 m, 6.1 m

SURFACE PREPARATION: C = COLD IN PLACE RECYCLE P = PATCH S =SCARIFY R = RECONSTRUCTION

N/A = NOT APPLICABLE

Table 11: Spalls

TEST SECTION	DEPTH (mm)	JOINTS (m)	FIBER	SURFACE PREP	NEW SPALLS 8/6/94	10/29/94	2/18/95	4/8/95	6/3/95	8/5/95	11/4/95	2/10/96	5/4/96	8/3/96
52	50	0.6	F	C	0	0	0	0	0	0	0	0	0	0
38	50	0.6	F	P	0	0	0	0	0	0	0	0	0	0
10	50	0.6	F	S	0	0	1	0	0	0	0	0	0	0
23	50	0.6	NF	S	0	0	0	0	0	0	0	0	0	0
53	50	1.2	F	C	0	0	0	0	0	0	0	0	0	0
39	50	1.2	F	P	0	0	0	0	0	0	0	0	0	0
11	50	1.2	F	S	0	0	0	0	0	0	0	0	0	0
62	50	1.2	NF	C	0	0	0	0	0	0	0	0	0	0
49	100	0.6	F	C	0	0	0	0	0	0	0	0	0	0
42	100	0.6	F	P	0	0	0	0	0	0	0	0	0	0
7	100	0.6	F	S	0	0	0	0	0	0	0	0	0	0
21	100	0.6	NF	S	1	0	0	0	0	0	0	0	0	0
50	100	1.2	F	C	0	0	0	0	0	0	0	0	0	0
41	100	1.2	F	P	0	0	0	0	0	0	0	0	0	0
8	100	1.2	F	S	0	0	0	0	0	0	0	0	0	0
29	100	1.2	NF	P	1	0	0	0	0	0	0	0	0	0
48	100	1.8	F	C	0	0	0	0	0	0	0	0	0	0
43	100	1.8	F	P	0	0	1	0	0	0	0	0	0	0
6	100	1.8	F	S	0	0	0	0	0	0	0	0	0	0
58	100	1.8	NF	C	0	0	0	0	0	0	0	0	0	0
46	150	1.8	F	C	0	0	0	0	0	0	0	0	0	0
4	150	1.8	F	S	0	0	0	0	0	0	0	0	0	0
13	150	1.8	F	S	0	0	0	0	0	0	0	0	0	0
55	150	1.8	NF	C	0	0	0	0	0	0	0	0	0	0
26	150	1.8	NF	P	0	0	0	0	0	0	0	0	0	0
36	150	1.8	NF	P	0	0	0	0	0	0	0	0	0	0
19	150	1.8	NF	S	0	1	0	0	0	1	0	0	0	0
25	150	1.8	NF	S	0	0	0	0	0	0	0	0	0	0
45	150	3.7	F	P	0	0	0	0	0	0	0	0	0	0
3	150	3.7	F	S	0	0	0	0	0	0	0	0	0	0
14	150	3.7	F	S	0	0	0	0	0	0	0	0	0	0
56	150	3.7	NF	C	0	0	0	0	0	0	0	0	0	0
60	150	3.7	NF	C	0	0	0	0	0	0	0	0	0	0
27	150	3.7	NF	P	0	0	0	1	0	0	0	0	0	0
18	150	3.7	NF	S	0	0	0	0	0	0	0	0	0	0
31	200	4.6	NF	P	1	1	0	0	0	0	0	0	0	0
32	200	4.6	NF	P	0	0	0	0	0	0	0	0	0	0
1	200	6.1	N/A	R	0	0	0	0	0	0	0	0	0	0
16	112.5	N/A	ACC	N/A	0	0	0	0	0	0	0	0	0	0
34	112.5	N/A	ACC	P	0	0	2	0	0	0	0	0	0	0
65	112.5	N/A	ACC	P	0	0	0	0	0	0	0	0	0	0

1 mm = 0.039 inches

1m = 3.28 ft

NOTES:

FIBERS: F = FIBERS PRESENT NF = NO FIBERS PRESENT

JOINTS: SQUARES: 0.6 m, 1.2 m, 1.8 m CONVENTIONAL JOINT SPACING: 3.7 m, 4.6 m, 6.1 m

SURFACE PREPARATION: C = COLD IN PLACE RECYCLE P = PATCH S =SCARIFY R = RECONSTRUCTION

N/A = NOT APPLICABLE

Table 12: Fractured Slabs

TEST SECTION	DEPTH (mm)	JOINTS (m)	FIBER	SURFACE PREP	NEW FRACTURED SLABS 8/6/94	10/29/94	2/18/95	4/8/95	6/3/95	8/5/95	11/4/95	2/10/96	5/4/96	8/3/96
52	50	0.6	F	C	-	-	-	-	-	-	-	-	0	0
38	50	0.6	F	P	-	-	-	-	-	-	-	-	0	0
10	50	0.6	F	S	-	-	-	-	-	-	-	-	0	0
23	50	0.6	NF	S	-	-	-	-	-	-	-	-	0	0
53	50	1.2	F	C	-	-	-	-	-	-	-	-	0	0
39	50	1.2	F	P	-	-	-	-	-	-	-	-	0	0
11	50	1.2	F	S	-	-	-	-	-	-	-	-	0	0
62	50	1.2	NF	C	-	-	-	-	-	-	-	-	12	14
49	100	0.6	F	C	-	-	-	-	-	-	-	-	0	0
42	100	0.6	F	P	-	-	-	-	-	-	-	-	0	0
7	100	0.6	F	S	-	-	-	-	-	-	-	-	0	0
21	100	0.6	NF	S	-	-	-	-	-	-	-	-	0	0
50	100	1.2	F	C	-	-	-	-	-	-	-	-	0	0
41	100	1.2	F	P	-	-	-	-	-	-	-	-	0	0
8	100	1.2	F	S	-	-	-	-	-	-	-	-	0	0
29	100	1.2	NF	P	-	-	-	-	-	-	-	-	0	0
48	100	1.8	F	C	-	-	-	-	-	-	-	-	0	0
43	100	1.8	F	P	-	-	-	-	-	-	-	-	0	0
6	100	1.8	F	S	-	-	-	-	-	-	-	-	0	0
58	100	1.8	NF	C	-	-	-	-	-	-	-	-	0	0
46	150	1.8	F	C	-	-	-	-	-	-	-	-	0	0
4	150	1.8	F	S	-	-	-	-	-	-	-	-	0	0
13	150	1.8	F	S	-	-	-	-	-	-	-	-	0	0
55	150	1.8	NF	C	-	-	-	-	-	-	-	-	0	0
26	150	1.8	NF	P	-	-	-	-	-	-	-	-	0	0
36	150	1.8	NF	P	-	-	-	-	-	-	-	-	0	0
19	150	1.8	NF	S	-	-	-	-	-	-	-	-	0	0
25	150	1.8	NF	S	-	-	-	-	-	-	-	-	0	0
45	150	3.7	F	P	-	-	-	-	-	-	-	-	0	0
3	150	3.7	F	S	-	-	-	-	-	-	-	-	0	0
14	150	3.7	F	S	-	-	-	-	-	-	-	-	0	0
56	150	3.7	NF	C	-	-	-	-	-	-	-	-	0	0
60	150	3.7	NF	C	-	-	-	-	-	-	-	-	0	0
27	150	3.7	NF	P	-	-	-	-	-	-	-	-	0	0
18	150	3.7	NF	S	-	-	-	-	-	-	-	-	0	0
31	200	4.6	NF	P	-	-	-	-	-	-	-	-	0	0
32	200	4.6	NF	P	-	-	-	-	-	-	-	-	0	0
1	200	6.1	N/A	R	-	-	-	-	-	-	-	-	0	0
16	112.5	0.0	ACC	N/A	-	-	-	-	-	-	-	-	0	0
34	112.5	0.0	ACC	P	-	-	-	-	-	-	-	-	0	0
65	112.5	0.0	ACC	P	-	-	-	-	-	-	-	-	0	0

1 mm = 0.039 inches

1m = 3.28 ft

NOTES:

FIBERS: F = FIBERS PRESENT NF = NO FIBERS PRESENT

JOINTS: SQUARES: 0.6 m, 1.2 m, 1.8 m CONVENTIONAL JOINT SPACING: 3.7 m, 4.6 m, 6.1 m

SURFACE PREPARATION: C = COLD IN PLACE RECYCLE P = PATCH S =SCARIFY R = RECONSTRUCTION

N/A = NOT APPLICABLE