2022

Arizona US 93 NB Silicone Joint Sealant Evaluation (040160)

On January 20, 2022, a cursory field evaluation of the 29-year-old LTPP concrete pavement test section was conducted. The evaluation consisted of taking pictures of 17 consecutive transverse joints sealed with silicone and estimating the percent of missing sealant from the photos in the office. The results indicated that almost 100% of the joint seal still existed in the joints although it was not always bonded to both joint faces. It appears that the concrete may be experiencing joint associated distress resulting in concrete disintegrating at the joint. The sealant continues to survive, but the concrete is now missing at some joint locations.

IGGA

International Grooving & Grinding Association

Your Pavement Preservation Resource® since 1972

ACPA

IGGA/ACPA
Larry Scofield, P.E.
6/2/2022

Introduction

On Thursday, January 20, 2022, a cursory evaluation of the silicone joint seal condition on LTPP Test Section 040160 was conducted. The evaluation consisted of parking on the shoulder and taking photos of 17 consecutive joints. The sun angle was low on the horizon, and it was difficult to see the joint condition coupled with significant truck traffic volumes. The decision was made to photograph each of the joints and then estimate the percent of sealant missing from the photos back in the office.

This section of US93 was part of the LTPP SPS-1 and SPS-9 project. However, it was a concrete section installed to evaluate the performance of concrete pavement as well as host the bending plate weigh in motion system. The section was constructed during May 1993 and has had no maintenance on it. This section is near Santa Claus, Arizona at approximately MP 52.6 (elev. 3400 ft).

The pavement structure consists of 11.2” of PCCP on 4” of aggregate base. This LTPP test section was in the dry-freeze zone with coarse grained soils. Between 1993 and 2020, this location averaged 8.5 inches of annual rainfall (ranging from 2” to 14”) with an annual average temperature of 66 degrees (ranging from 62 to 67). The freezing index over this same period was 1.3-degree F degree day. Annual ESALs averaged 531,000 with AADTT averaging 563.

Excerpts from the LTPP Construction report are provided in Appendix 5. That report indicates the test section was paved using a Bidwell and ready-mix concrete. The slump ranged widely during construction (2.5” to 6”) and curing compound was applied by hand and appeared inadequate. From the report, it appears consolidation of the mix was also an issue. One construction joint was noted.

Although the concrete pavement test section is still in good condition after 29 years, this LTPP site went out of service in 2006 as the adjacent SPS-1 & 9 AC test sections had been overlaid. Test section 040160, the concrete test section, remained in service with the WIM system continuing traffic data collection for several more years.

Pavement Evaluation

As indicated in Figure 1, the roughness (IRI-in/mi) increased approximately 11 inches per mile over time (i.e., one inch per year). However, the data scatter suggests that diurnal curl was occurring as indicated by the abnormally high readings in 1999 and 2001. Since LTPP only collected single time of day measurements, and the time of day was a function of the schedule, this may be the reason for the data scatter.

The distress and deflection data are indicated in Tables 2-3 and 2-4, respectively in Appendix 2. During the period between construction (1993) and going out of service (2006), no faulting was reported and only 2-3 transverse cracks recorded. The FWD maximum deflection ranged between 3-4 mils. Load transfer efficiency (LTE) was surprisingly low from original construction and remained in the 60% for both the leave and approach sides throughout the 29 years. Although the relative deflections between the two approaches is not indicated in the LTPP section summary data, it is believed that the deflection may be small which can provide a misleading LTE. No corner breaks were recorded during the monitoring period, but 10 to 12 spalled joints were recorded.

During this 2022 field review, transverse joint spalling was observed. However, the author believes that the spalling is a result of joint associated distress. Further information needs to be collected to refine this assessment, but at this time, it is not believed that the spalling is a result of incompressibles.

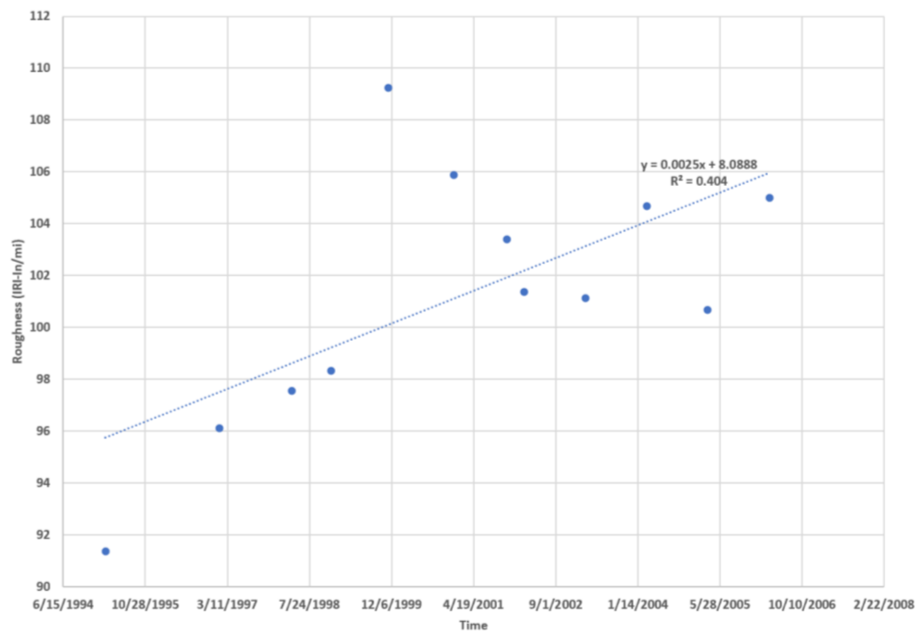

Figure 1 LTPP 040160 Roughness Over Time

Joint Sealant Evaluation

The original joint sealant still exists and has had no maintenance. Although not measured at the time of the field review, it was estimated that the transverse joint widths were ½ inch. On January 20th, seventeen consecutive transverse joints were photographed, beginning three joints south of the LTPP sign indicated in Figure 1-4. The joint photos were used for this evaluation. On January 18th, several joints were previously photographed. Joint 18, indicated with an asterisk in Table 1, is from the earlier photos and was used in the evaluation.

Table 1 Percent of Silicone Joint Sealant Missing from Transverse Joint (Travel Lane Only)

Joint Number	Percent of Missing Joint Sealant	Joint Number	Percent of Missing Joint Sealant
1	5	10	0
2	5	11	0
3	0	12	5
4	0	13	0
5	0	14	5
6	0	15	5
7	0	16	0
8	0	17	0
9	0	18*	90

The criteria of missing sealant can be somewhat misleading as in many cases the sealant still exists in the joint, but the concrete has deteriorated away from the silicone and is no longer in contact. As such, the sealant cannot function as intended in terms of preventing water and incompressible ingress. Hopefully, a future effort will attempt to verify whether the concrete has joint associated distress. As indicated in Table 1, most of the silicone sealant still exists in the joint after 29 years. Joint 18, observed on January 18th, appeared wider than the other joints. Further investigation is needed to determine why this joint performed differently or whether it was a construction joint.

Appendix 1 Photos of Joint Sealants

Figure 1-1 (Joint 1)

Appendix 1 Photos of Joint Sealants

Figure 1-2 (Joint 2)

Appendix 1 Photos of Joint Sealants

Figure 1-3 (Joint 3)

Appendix 1 Photos of Joint Sealants

Figure 1-4 (Note the Sign Test Section Number Should be 040160)

Appendix 1 Photos of Joint Sealants

Figure 1-5 (Joint 4)

Appendix 1 Photos of Joint Sealants

Figure 1-6 (Joint 5)

Appendix 1 Photos of Joint Sealants

Figure 1-7 (Joint 6)

Appendix 1 Photos of Joint Sealants

Figure 1-8 (Joint 7)

Appendix 1 Photos of Joint Sealants

Figure 1-9 (Joint 8)

Appendix 1 Photos of Joint Sealants

Figure 1-10 (Joint 9)

Appendix 1 Photos of Joint Sealants

Figure 1-11 (Joint 10)

Appendix 1 Photos of Joint Sealants

Figure 1-12 (Joint 11)

Appendix 1 Photos of Joint Sealants

Figure 1-13 (Joint 12)

Appendix 1 Photos of Joint Sealants

Figure 1-14 (Joint 13)

Appendix 1 Photos of Joint Sealants

Figure 1-15 (Joint 14)

Appendix 1 Photos of Joint Sealants

Figure 1-16 (Joint 15)

Appendix 1 Photos of Joint Sealants

Figure 1-17 (Joint 16)

Appendix 1 Photos of Joint Sealants

Figure 1-18 (Joint 17)

Appendix 1 Photos of Joint Sealants

Figure 1-19 (Joint 18)

Appendix 2 LTPP Information

Table 2-1 Basic Section Data

Basic Section Overview (04-0160)

State/ Province	Arizona	**GPS- Lat., Long. (Degrees)**	35.39879, -114.26049	**Date of Construction**	01-Aug-1993
County	MOHAVE	**Functional Class**	Rural Principal Arterial - Other	**Date Included in LTPP**	01-Jan-1993
Route, Direction	U. S.-93 , Northbound	**No. of Lanes**	2	**LTPP Monitoring Status (Date Inactive)**	Out-of-study (06/01/2006)
Mile Post	52.6	**Climatic Zone**	Dry, No-Freeze	**Region (Code and Description)**	4- Western

LTPP Section History and Pavement Structure

LTPP Section M&R History				Layer Information				Strength or Stiffness Measures (Multiple)	
Experiment Number	**Construction Number (CN) and Max Layer Number**	**CN Event (M&R) Date**	**CN Event (Code and Description)**	**Layer Number**	**Layer Type**	**Thickness (in.)**	**Material Code Description**	**Test Results (Abbr,Unit)**	**Other (Abbr,Unit)**
SPS-1	CN1 (Layer Max =3)	01-01-1993	Date test section initially accepted for study into LTPP program.	1	Subgrade (untreated)		261-Coarse-Grained Soil: Well-Graded Gravel with Silt and Sand		
				2	Unbound (granular) base	4	304-Crushed Gravel		
				3	Portland cement concrete layer	11.2	4-Portland Cement Concrete (JPCP)		

Table 2-2 Climate and Traffic Data

Climate and Traffic

Time (Year)	Climate (MERRA Data)				Traffic					
					SHA Data			Monitored Data	Derived Data	Computed Data
	Annual Average Precipitation (in)	Annual Average Temperature (deg F)	Annual Average Freeze Index (deg F deg days)	Annual Average Humidity Min-Max (%)	Annual Average Daily Traffic (AADT)	Annual Average Daily Truck Traffic (AADTT)	18-Kip ESAL (KESAL)	Annual Average Daily Truck Traffic (AADTT)	Annual Average Daily Truck Traffic (AADTT)	18-Kip ESAL (KESAL)
1993	14	62.6	0	3-117	2600	400	230		400	
1994	6.3	64.8	0	4-106	5950	1190	300	629	629	328
1995	6.7	65.3	0	4-110	5950	1190	300	657	657	324
1996	8.8	66	0	3-110				714	712	359
1997	9	65.1	0.2	2-113				770	770	335
1998	8.9	63	0	4-114				835	835	358
1999	5.1	65.1	0	3-103				875	875	359
2000	4	66.2	0	2-114				950	947	443
2001	6.9	66.2	0	3-108	7175	1787	523	1006	1006	464
2002	2.1	66.2	0	2-105	7567	1885	552		1885	
2003	8.7	66.7	0	3-110				214	214	63
2004	11.5	65.3	0	4-110				221	220	76
2005	16.4	64.9	0	4-109				220	220	76
2006	4.9	65.3	0	3-116				219	219	69
Jun-2006	Out of Study									
2007	7.2	65.8	10.8	2-101				413		
2008	7.5	64.9	0	2-110				237		
2009	6.8	65.3	0	4-109				286		
2010	12.6	64.6	3.6	3-111				379		
2011	7	64	5.4	3-102				942		
2012	7.4	66.7	0	3-108						
2013	11.5	64.8	16.2	2-107						
2014	8	67.1	0	2-103						
2015	8.6	66.7	0	3-114						
2016	11.7	66.9	0	4-120						
2017	14.1	67.5	0	3-107						
2018	8	66.9	0	3-104						
2019	12.6	64.8	0	3-112						
2020	2.7	67.3	0	3-115						

Appendix 2 LTPP Information

Table 2-3 Performance Data- Distress

Performance

Survey Date and CN Event Date	CN Event Description	AC Distress (Sum of all severity - Low, Medium, High)				JPCP Distress (Sum of all severity - Low, Medium, High)			
		Fatigue-Alligator Cracking (ft^2)	Longitudinal Cracking (WP, NWP) (Length,ft)	Transverse Cracking (Count)	Rutting (in)	Faulting (in)	Spalling of Trans. Joints (Count)	Transverse Cracking (Count)	Corner Breaks (Count)
Jan-1993	Date test section initially accepted for study into LTPP program								
02-15-1995						0	1	1	0
03-30-1995							1	0	0
01-06-1998						0	10	1	0
02-10-1999						0	12	1	0
10-04-1999							0	0	0
01-12-2000						0	20	1	0
01-09-2001							0	0	0
05-01-2001						0	18	1	0
11-09-2001							0	1	0
03-26-2002						0	29	2	0
10-27-2002							0	1	0
04-14-2003						0	12	2	0
11-04-2003							0	1	0
04-06-2005						0	13	2	0
03-30-2006						0	10	3	0

Table 2-4 Performance Data- Roughness and Deflection

Survey Date and CN Event Date	CN Event Descriptio n	Profile		Deflection			
		International Roughness Index (IRI) Section Average (in/mile)	Texture Mean Profile Depth MPD Section Average (in)- Collected After 2013	Avg Deflection (9-Kip, wheel load) at 0" from Load Plate (mils)	Avg Deflection (9-kip, wheel load) farthest sensor (60" or 72") from Load Plate (mils)	Load Transfer Efficiency of Transverse Joints (%)	
						Approach	Leave
Jan-1993	Date test section initially accepted for study into LTPP program						
01-27-1994		92.44					
02-15-1994				4.20	1.70	68	70
02-16-1995						65	65
02-22-1995				3.60	1.60		
02-27-1995		91.37					
01-23-1997		96.12					
01-06-1998				3.60	1.60	62	65
04-08-1998		97.57					
12-04-1998		98.33					
02-10-1999				3.30	1.50	67	65
11-17-1999		109.23					
12-19-2000		105.87					
05-01-2001				3.10	1.40	63	69
11-06-2001		103.40					
02-20-2002		101.38					
03-02-2003		101.12					
03-10-2004		104.67					
03-15-2005		100.68					
04-06-2005				3.10	1.40	63	69
03-27-2006		104.99					

Appendix 3 Construction Information

Figure 3-1 Bidwell Paving of PCCP

Figure 3-2 Indicates Dowel Baskets and Tie Bar Stands and Concrete Spotting to Hold Them in Place

Appendix 3 Construction Information

Figure 3-3 Hand Applied Curing Compound

Figure 3-4 Photo of Inadequate Coverage of Hand Sprayed Curing Compound

Appendix 3 Construction Information

Figure 3-5 Sawing Transverse Joints

Figure 3-6 Power Washing Longitudinal Joints

Appendix 3 Construction Information

Figure 3-7 Abrasive Blasting of Joints

Figure 3-8 Backer Rod and Sealant Installation

Appendix 4 PCCP Mix Design

Coronado Engineering & Consulting

127 South Weber Drive, Suite B-1, Chandler, AZ 85226 Phone: 602-940-0276 Fax: 602-940-0263

TECHNICAL REPORT

CONCRETE MIX DESIGN

CLIENT: FNF CONSTRUCTION, INC.

PROJECT: HOOVER DAM - KINGMAN HWY; F-039-1-509

ADDRESS: P.O. BOX 5005; TEMPE, AZ 85280

MIX DESIGN DATE: 3/2/93

CODE: ADOT CLASS P CONCRETE (PCCP)

STRENGTH: 4000 PSI @ 28 DAYS

CEMENT TYPE: TYPE IP PORTLAND-POZZOLAN CEMENT

SOURCE: PHOENIX CEMENT COMPANY

FINE AGGREGATE % = 45.00

SOURCE: FNF

COARSE AGG. #1 % = 100.00

SOURCE: CANYON SAND

COARSE AGG. #2 % = 0.00

MAX SIZE = 1 INCH ASTM C-33 # 57

AIR ENTRAINING AGENT: DAREX II AEA

SOURCE: W.R. GRACE RATE: 1.5 OZ./CWT.

WATER REDUCING AGENT: WRDA-64

SOURCE: W.R. GRACE RATE: 4.0 OZ./CWT.

THER ADMIXTURE TYPE:

SOURCE: RATE: OZ./CWT.

WATER CEMENT RATIO: 0.44

MATERIALS	WEIGHT/CU YD		SPECIFIC GRAVITY	VOLUME/CU YD (CU FT)
CEMENT	611	LB.	3.00	3.26
POZZOLAN	0	LB.	2.30	0.00
WATER	268	LB.	1.00	4.29
FINE AGGREGATE	1346	LB.	2.63	8.20
COARSE AGGREGATE # 1	1601	LB.	2.56	10.02
COARSE AGGREGATE # 2	0	LB.	0.00	0.00
AIR CONTENT	4.50	%		1.22
AIR ENTRAINING AGENT:	9.165	OZS/YD		
WATER REDUCING AGENT:	24.44	OZS/YD		
TOTAL =	3826	LBS.		27.00

SLUMP = 2.50 INCHES

Figure 4-1 PCCP Mix Design

Appendix 4 PCCP Mix Design

Coronado Engineering & Consulting

127 South Weber Drive, Suite B-1, Chandler, AZ 85226 Phone: 602-940-0276 Fax: 602-940-0263

TECHNICAL REPORT

COMPRESSIVE STRENGTH OF CONCRETE CYLINDERS

CLIENT: FNF CONSTRUCTION, INC.

PROJECT: HOOVER DAM - KINGMAN HWY (US 93)

PROJECT NO: F-039-1-509

LOCATION: COTTONWOOD RD - MP 59

SAMPLE SOURCE: LAB MIXER

SLUMP: 2.75 in.

SLUMP ORDERED: 2.5 in.

TRUCK NO: N/A

MAX AGG SIZE: 1"

TIME BATCHED: 15:00

TIME SAMPLED: 15:15

CYLINDER SIZE: 4" x 8"

CONVERSION FACTOR: 12.566

PLASTIC UNIT WEIGHT (pcf): 139.7

REPORT DATE: 4/1/93

DATE MADE: 3/2/93

PRODUCT CODE: ADOT CLASS P

TICKET NO: N/A

BATCH SIZE: 2.0 CU FT

DESIGN STRENGTH: 4000 @ 28 DAYS

NO. OF CYLINDERS MADE: 12

CONCRETE TEMPERATURE: 68 °F

AMBIENT TEMPERATURE: 69 °F

WATER ADDED: 0

SAMPLED BY: KEC

REQUESTED BY: CLIENT

DATE RECEIVED: N/A

PERCENT AIR: 4.5

LAB NO	TEST DATE	AGE	FORCE (LBS)	PSI	AVG	TESTED BY
93078	3/3/93	1	23592	1880		
	3/3/93	1	23889	1900	1890	FV
	3/5/93	3	45333	3610		
	3/5/93	3	45693	3640	3630	DW
	3/9/93	7	55179	4390		
	3/9/93	7	56137	4470	4430	DW
	3/16/93	14	58230	4630		
	3/16/93	14	59541	4740	4690	DW
	3/30/93	28	66612	5300		
	3/30/93	28	69156	5500	5400	DW

REMARKS:
ALL TESTING PERFORMED IN ACCORDANCE WITH APPROPRIATE ADOT & AASHTO PROCEDURES.

Figure 4-2 PCCP Cylinder Breaks

Appendix 5 Excerpts from PCCP Construction Report

CONCRETE SECTION 040160

This section consisted of 10" of portland cement concrete pavement (PCCP) over 4" of aggregate base (AB). Within the section, a weigh-in-motion (WIM) system was installed. The system includes equipment and software for collecting, processing, storing, transmitting and manipulating information related to the counting, classifying and speed monitoring of all vehicles and the weighing of trucks and buses. The WIM station was located at the leave end of Section 040160, from Station 5+40 to 6+00. The function of this PCCP section was to allow traffic a smooth ride before crossing the WIM station and, therefore, preventing false readings from traffic dynamics across the WIM station. The WIM station was placed following PCCP construction. Photos of the in-place WIM station and cabinet are shown in Appendix A. The details of the PCCP construction are discussed in the following sections.

PCC Construction

Placement of the PCC surface layer occurred in two stages. The leave end, Stations 1005+00 to 1009+50, was paved on May 19, and the remainder on May 24.

The concrete was a jointed plain concrete with joints spaced at 15'/13'/15'/17' intervals. Table 26 shows the location of the transverse joints in this section. Skewed joints were not used.

Table 26. Location of Transverse Joints, PCC Section 040160

Joint No.	Distance from South End of Slab	Joint No.	Distance from South End of Slab
1	10'4"	27	392'8"*
2	27'4"	28	401'11"
3	42'3"	29	414'11"
4	55'3"	30	429'9"
5	70'3"	31	446'9"
6	87'3"	32	462'
7	102'3"	33	474'10"
8	115'2"	34	489'9"
9	130'3"	35	506'8"
10	147'3"	36	521'8"
11	162'3"	37	534'9"
12	175'2"	38	549'8"
13	190'2"	39	565'8"
14	207'2"	40	581'6"
15	222'1"	41	594'7"
16	235'1"	42	609'6"
17	250'1"	43	626'5"
18	267'	44	641'5"
19	282'	45	654'6"
20	295'	46	669'6"
21	310'1"	47	686'5"
22	327'	48	701'5"
23	342'	49	714'5"
24	355'	50	729'3"
25	369'11"	51	746'4"
26	387'	52	761'3"

Appendix 5 Excerpts from LTPP PCCP Construction Report

Joint No.	Distance from South End of Slab	Joint No.	Distance from South End of Slab
53	774'3"	56	821'3"
54	789'3"	57	834'3"
55	806'4"	58	849'3"**

* Construction Joint
** North End of Slab

Epoxy coated 1.25" dowel bars 18" long and spaced 12" apart were placed using transverse dowel baskets which were nailed down to the AB (Appendix A). Longitudinal tie bars were placed using baskets fabricated with #3 longitudinal and #4 transverse bars with wire chairs. The tie bars were 1/2" diameter and spaced 18" apart (Appendix A).

A Bidwell twin auger side form paver with heavy duty 10" forms was used (Appendix A). The paver consisted of two rubber rollers, a 4 foot spinning finishing drum, a burlap drag and a tinning bar (Appendix A). Two hand pan floats were also used for finishing.

The PCC concrete was brought to the site in standard rotating drum 9 and 12 yd^3 concrete trucks (Appendix A). The concrete was batched at a plant approximately one mile (five minutes) away. Travel time from batching to site to departure was recorded by ADOT personnel with a low of ten minutes to a high of twenty minutes.

The concrete occasionally had to be moved down the concrete truck chute using a vibrator. Vibration of the placed PCC was done with a hand vibrator. The vibrator was not always inserted perpendicular to the placement plane, and was occasionally drug through the mix for consolidation. The vibrator was also used to move concrete around instead of shoveling it. Several times during vibration work, the workers stepped on the longitudinal dowel baskets pushing them down or collapsing them.

Following placement, a curing compound, was placed by hand from the Bidwell paver finishing deck (Appendix A). The compound was a WR Meadows, "Sealtight" 1600 water based white pigmented solution, meeting ASTM C-309, Type II, Class A specifications. Fifty-five gallon drums of the curing compound were emptied into a 250 gallon trailer mounted tank and a pump and hose brought the compound to the finishing deck for application.

Tining of the PCC surface was done twice transversely to obtain 7/8" deep cuts (Appendix A). Sawing of longitudinal and transverse joints was done eight to ten hours following placement by Blade Runners Contracting (Appendix A). Two saws were used, one longitudinally and one transversely to obtain approximately 3" cuts. Following the primary cut, a 1.5" reservoir cut was sawn. Both longitudinal and transverse joints, as well as the top of the slab, were then water jetted (Appendix A). The jetting removed excess cuttings from the joints and the surface. (This ensured that the profilometer would have a clean surface to take readings on.) The joints were allowed to air dry and were then sandblasted and air blow clean (Appendix A).

A 1/2" backer rod (Hot Rod XL made in Canada, lot #C2934), was placed in all longitudinal and transverse joints (Appendix A). A Crafco non-slump grey silicone sealant was then placed on top of the backer rod (Appendix A). It was fairly windy during placement and some fines were blown onto the sealant prior to its skinning over, but not a significant amount to cause problems. Arizona DOT personnel measured all reservoir cuts before and after backer rod installation and found the depths to be all within specifications.

Materials

A type 1P Portland-Pozzolan cement was used with a 1" maximum size aggregate for the mix design on this project. A 4000 psi, 28 day design strength with a 2.5" slump was specified. Table 27 summarizes the mix design. Table 28 lists the measured on site slumps and entrained air contents and the 28 day average compressive strengths obtained from lab tests. The complete mix design and concrete compressive strengths obtained are shown in Appendix E.

Detailed Construction

Construction problems occurred during both days of PCC placement and will be discussed in the following sections.

May 19th

The slump value from the first truck at the site measured 1 to 2". The second truck had a 2.5" slump. Approximately 20% into the pour, the slump had increased to the 3 to 3.5" range. As the pour progressed, the slump continued to increase and a slump of 6" was measured at 11:30 a.m. at Station 1007+85.

There were several instances where concrete on one side of the forms had a 1.5 to 2" slump, while the adjacent load was 4". The placement went slowly, taking from 7:40 a.m. until 5:25 p.m.

The majority of the concrete was placed at the upper end of the slump specification and some was placed over the specification. At the conclusion of the pour, the construction supervisor from F-N-F informed LTPP personnel that varying cement temperatures at the plant caused the fluctuation in slump values. The cement was hot at the plant so the aggregate stockpiles were being soaked with water to bring the concrete temperatures down. A second area of concern was the vibration was not performed perpendicular to the surface, and the vibrator was usually drug through the section.

At the end of the pour, #9 tie bars on 30" centers were placed in the perpendicular face of the slab at the construction joint. No one checked to make sure that the bars were square with the slab vertically and horizontally. Following placement of the tie bars, the third bar from the left was cracked in a "V" shape upwards to the surface. No expansion material was used on the construction joint.

Several of the longitudinal dowel baskets collapsed during placement due to the weight of the concrete and instability of the baskets. After the forms were stripped from the slab, there was a large amount of honeycombing along the edges, possibly due to the poor vibrating techniques used.

Table 27. Concrete Mix Design Summary

Cement Type:	Type 1P Portland-Pozzolan
Fine Aggregate:	45%
Air Content:	4.5%
Air Entraining Agent:	9.1 oz/yd
Water Reducing Agent:	24.4 oz/yd
Specified Strength:	4000 psi @ 28 days
Specified Slump:	2.5"

Table 28. Concrete Slumps, Air Contents, Compressive Strengths

Date	Time	Station	Measured Slump (in)	Slump Specification (in)	Entrained Air Content (%)	Entrained Air Specification (%)	Average 28-Day Strength (psi)	Required Strength (psi)
5/19/93	8 38 am	1009+20	2.5	0.5-4.5	5.5	4-7	5166	4000
5/19/93	11:30 am	1007+85	6.0	0.5-4.5	6.5	4-7	3887	4000
5/24/93	7:20 am	1004+50	4.5	0.5-4.5	6	4-7	4077	4000
5/24/93	8:50 am	1003+00	4.3	0.5-4.5	5.2	4-7	5096	4000

May 24th

Concrete placement started at 6:40 a.m. The contractor placed concrete over the longitudinal dowel baskets about 50' in front of placement so that the basket would be "encased" as the pour progressed, preventing collapsing as occurred on the first pour (Appendix A). The contractors were being more careful about collapsing the longitudinal baskets, but still occasionally stepped on the baskets during spreading and vibrating of the concrete.

For this pour, the aggregate stockpiles were pre-wet to try to stabilize the concrete temperatures and slump. There was not as much variability in slump from truck to truck as on May 19, but the concrete was generally wetter. The first sample taken by ADOT had a 5.5" slump and the second a 3.5" slump. The 5.5" slump sample looked typical of the PCC placed on this day.

Vibrating on this day was still inadequate. The vibrating head was tossed into the PCC mix and drug back, and was also used to move the concrete around in the forms. Sometimes the vibrator was left in one spot for a minute or more, and other times it was drug quickly through the mix.

The curing compound was applied using a "watering the yard" technique and appeared to be applied more heavily on this second pour.

Following construction, the Arizona Transportation Research Center required that the section be ground and reprofiled as specified in the specifications, to ensure that the entire section met the 3" per mile Profile Index requirement. This was done and the section met the Profile Index requirement upon reprofiling.