APPENDIX E

Construction Records

Appendix E. Construction Records

This appendix highlights MDOT historical records for each selected project, including important construction information found in the inspector daily reports. This summary includes typical mix designs showing source of materials and batch weights. Additionally, the gradation type and the source of the base course materials is provided. The summaries also include information about any subgrade undercutting or swamp backfill used. Any other construction related problems that were noted are also mentioned in these summaries.

The data from the inspector's daily reports for each project combined to create spreadsheets that show the concrete placement temperatures and air temperatures during each day's pour. The concrete placement temperatures and air temperatures were then averaged. When possible a graph was made showing the variation of average concrete placement temperature vs. milepost or station.

Review of Historical Records

Control Section 11017-32516A EB and WB Sections A-D, I-94 Watervliet
Contractor for Paving: Interstate Highway Construction Inc.

- Typical Mix Design:

Strength: 35P
Slump: 0 to 3"
Air Content: 4.5 to 8%

Materials	Type	Supplier	Batch Weights
Cement	Type I	LaFarge	451 lbs
Fine Aggregate	2NS	Garavaglia Pit No. 14-48	1349 lbs
Coarse Aggregate	6AA	Levy Burns Harbor Slag Pit No. 92-11	1419 lbs
Water			246 lbs
Air Entrainer		Master Builders, VR	9 cwt
Water Reducer		Master Builders Pozzolith 220N	2 cwt
Fly Ash	Class F	U.S. Ash Schaeffer Station	113 lbs

- Base Course: 6A Limestone from Inland, which meets 3G specification 95% of the time. Also a 95% of Maximum Density was used for compaction testing (Michigan Cone). Base thickness was specified as 4"

- Class II Granular material from Alden White Pit used for subbase. Thickness was specified as minimum 8"

- Joint Spacing: Section A and D 16 ft, Section B Hinge Joint, Section C 15,16,17 ft Random

- Pavement is 12" thick non-reinforced

- Trouble with installation of edge drain on eastbound (filter fabric misplaced)

- Eastbound was opened to traffic on October 16, 1995

- Joints were observed working on eastbound 10 days after final pour

- Longitudinal cracking on section A from 1893+00 to 1880+00. Cross stitching was used to fix this problem.

Control Section# 11017-32516A

Concrete Temperature At Placment
Conctractor: Interstate Highway Construction Inc.
Sections Tested: **Section A 1790+10 to 1795+08**
Section C 1682+62 to 1690+15

Eastbound

	Poured			
Date	From	To	Concrete Temperature	Average
8/24/95	1865+95	1877+38	82	
	1879+78	1893+00	82	
			82	
			84	
			84	83
8/28/95	1846+44	1865+95	82	
			82	82
8/29/95	1805+28	1846+44	88	
			82	85
8/30/95	1766+28	1805+28	82	
			82	
			82	
			86	
			87	
			87	
			88	85
8/31/95	1747+40	1766+28	81	
			82	
			82	
			84	
			83	
			83	
			83	83
9/5/95	1707+45	1747+40	78	
			78	
			78	
			84	
			84	
			83	
			86	82
9/6/95	1667+27	1707+45	81	
			80	
			80	
			82	
			82	
			82	
			82	
			84	
			82	82
9/7/95	1665+65	1667+27	Rain	

Average	**83**

Control Section# 11017-32516A

Concrete Temperature At Placment
Conctractor: Interstate Highway Construction Inc.

Section Tested: **Section D 1793+08 to 1782+98**

Westbound

	Poured			
Date	From	To	Concrete Temperature	Average
5/13/96	1629+87	1658+64	50	
			56	
			64	
			66	
			66	
			67	
			66	62
5/14/96	1658+64	1693+10	57	
			57	
			60	
			63	
			63	
			64	
			65	
			63	62
5/16/97	1693+10	1733+14	61	
			62	
			64	
			64	
			65	
			65	
			70	
			70	
			70	
			65	66
5/17/95	1733+14	1771+00	65	
			65	
			67	
			70	
			70	
			70	
			71	
			74	
			75	
			75	70
5/20/96	1771+00	1792+61	80	
			73	
			74	
			75	
			74	
			74	75
5/21/96	1792+61	1794+50	65	65
5/22/96	1808+36	1810+12	68	
	1822+65	1824+25	72	
			72	71
5/23/96	1794+50	1808+36	72	
			71	
			75	73
5/28/97	1810+12	1822+65	65	
	1849+28	1824+25	66	
			67	
			68	
			70	
			70	
			69	
			66	
			68	
			70	68
5/29/97	1849+28	1877+47	64	
	1879+89	1893+00	63	
			66	
			67	
			70	
			72	
			72	
			70	68
6/3/97	1809+60	1795+72	73	
	1877+45	1878+00	72	
			74	
			73	
			73	
			73	
			72	73

Average	68

Review of Historical Records

Control Section 19042-24680A Section B EB, I-69 Lansing
Contractor for Paving: Tony Angelo Cement Construction Company

- Typical Mix Design:

Strength: 35P
Slump: 0 to 3"
Air Content: 5 to 8%

Materials	Type	Supplier	Batch Weights
Cement	Type I	Medusa (Charlevoix)	526 lbs
Fine Aggregate	2NS	Hall Pit 19-24	1574 lbs
Coarse Aggregate	6AA	Michigan Lime and Chemical Pit 71-3	1649 lbs
Water			158 lbs
Air Entrainer		Daravair, WR Grace	0.35 oz/sack
Water Reducer		WRDA-79, WR Grace	5 oz/sack

- Base Course: 8G from Pit No. 71-3 Michigan Lime and Chemical.

- Subgrade undercutting 273+00 to 277+50 EB.

- Expansion joints every 328 ft.

- Majority of EB was a cut section.

Concrete Temperature At Placement

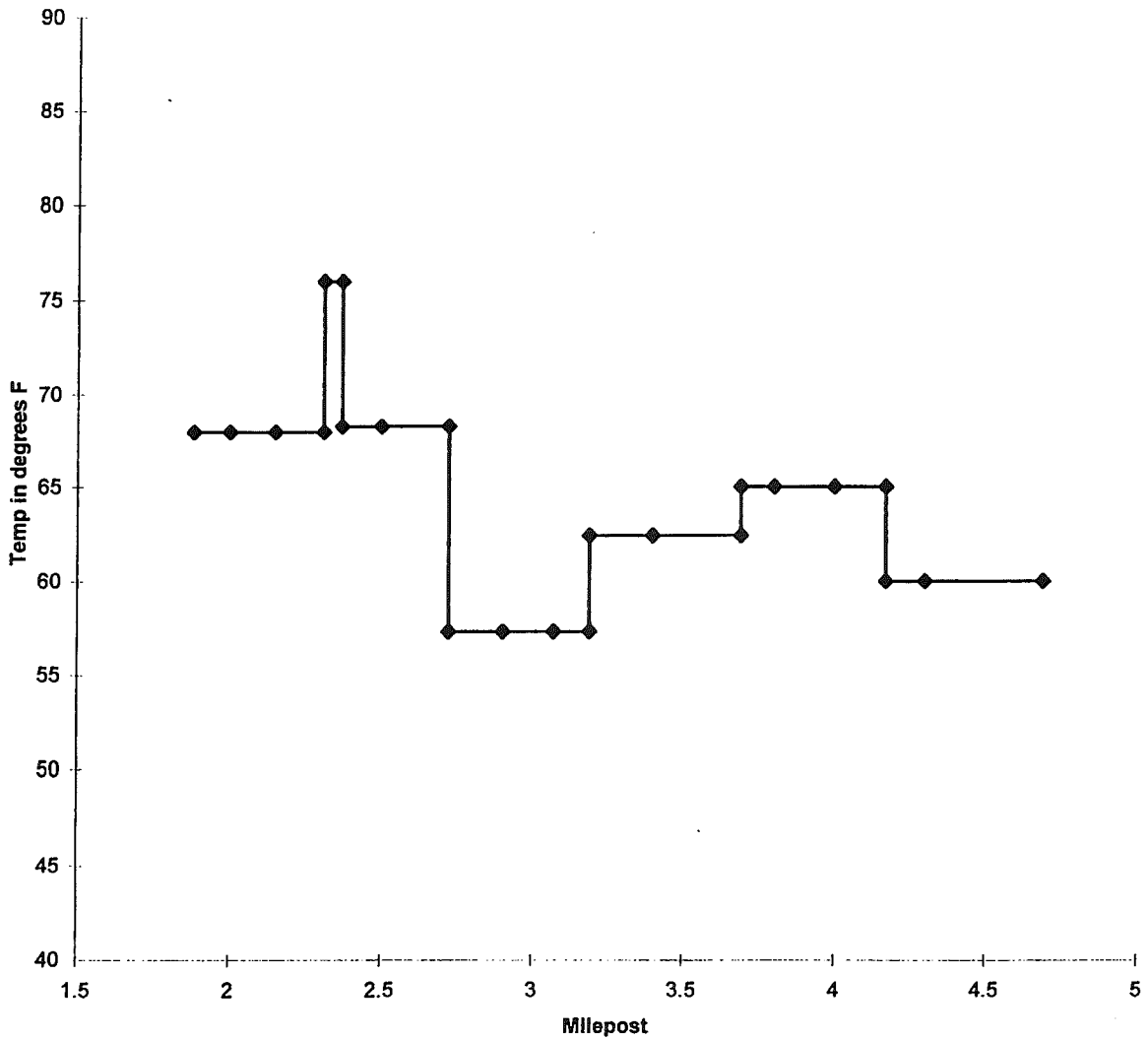
Control Section# 19042-24680A Section B EB
Contractor: Tony Angelo Cement Construction Company

Section Tested: 275+00 to 281+72

	Station		Milepost					
Date	From	To	From	To	Concrete Temp	Air Temp	Average Concrete Temp	Average Air Temp
9/24/86	265+00	272+31	1.888	2.026	68	77		
	Gap 272+31	278+45	2.026	2.086	68	78		
	278+45	290+70	2.086	2.318	68	76	68	77
9/26/86	290+76	294+04	2.318	2.380	76	72	76	72
10/2/86	294+04	312+49	2.380	2.729	68	60		
					69	61		
					68	56	68.3	59
10/6/86	312+49	330+82.45	2.729	3.076	56	38		
	330+31.76	337+28	3.067	3.199	58	44		
					58	48	57.3	43.3
10/7/86	337+28	363+47	3.199	3.695	58	42		
					62	52		
					64	60		
					64	63		
					64	64	62.4	56.2
10/8/86	363+47	388+79	3.695	4.174	62	58		
					66	62		
					66	66		
					66	62		
					65	62	65	62.0
10/9/86	388+79	411+75	4.174	4.609	60	40		
					60	44		
					60	44		
					60	52	60	45

Average	**65**	**59**

Average Concrete Placement Temperature vs. Milepost 19042-24680A Section B EB



Review of Historical Records

Control Section 19042-02233A Section C EB, I-69 Lansing
Contractor for Paving: Denton Construction

- Typical Mix Design:

Strength: 35P
Slump: 1 to 3"
Air Content: 5 to 8%

Materials	Type	Supplier	Batch Weights
Cement	Type I	Dundee	480 lbs
Fine Aggregate	2NS	Hall Pit 19-24	1493 lbs
Coarse Aggregate	6AA	Michigan Lime and Chemical Pit 71-3	1669 lbs
Water			187.1 lbs
Air Entrainer		Daravair WR Grace	0.35 oz/sack
Water Reducer		WRDA-79, WR Grace	5 oz/sack
Fly Ash			72 lbs/cyd

- Base Course: 8G from Pit No. 71-3 Michigan Lime and Chemical.

- Subgrade undercutting on both east and west bound, 518 to 530+50 WB, 530+50 to 538+50 EB, 423+50 to 426+50 WB, 527+50 to 530+50 EB, 522+50 to 527+50 EB, 399+50 to 405+50 EB.

- Peat excavation and swamp backfill 565+00 to 570+00 EB, 543+00 to 543+25 EB, 543+50 to 544+00 EB, 461+90 to 463+50 EB, 444+00 to 445+50, 442+00 to 446+00, 546+50 to 547+00 EB, 546+00 to 548 WB.

Concrete Temperature At Placement

Control Section# 19042-02233A Section C EB
Contractor: Holloway/Denton

Section Tested: 527+20 to 533+00

	Station		Milepost					
Date Placed &Time	From	To	From	To	Concrete Temp	Air Temp	Average Concrete Temp	Average Air Temp
7/30/87 10:30	411+67	430+61	4.713	5.072	78	74		
7/30/87 12:00					80	79		
7/30/87 14:30					86	84	81	79
7/31/87 8:30	430+61	468+61	5.072	5.753	72	70		
7/31/87 10:30					87	75		
7/31/87 14:30					92	87		
7/31/87 16:00					90	88	85	80
8/1/87 8:30	468+61	487+03	5.753	6.102	80	75		
8/1/87 12:00					82	78	81	77
8/4/87 8:00	520+64	557+51	6.739	7.437	88	74		
8/4/87 10:00					86	80		
8/4/87 12:00					86	84		
8/4/87 14:00						85		
8/4/87 16:00						84	87	81
8/5/87 8:00	557+51	590+05	7.437	8.053	80	68		
8/5/87 10:30						74		
8/5/87 13:00						76		
8/5/87 15:20						80	80	75
						Average	83	78

Review of Historical Records

Control Section 19043-02234A EB and WB (metric), I-69 Lansing
Contractor for Paving: Kegle Construction

- Typical Mix Design:

Strength: 35P
Slump: max 0.076 m
Air Content: 5 to 8%

Materials	Type	Supplier	Batch Weights
Cement	Type I	Dundee	526 lbs
Fine Aggregate	2NS	The Gravel Pit Pit 33-9	1515 lbs
Coarse Aggregate	6A	The Gravel Pit Pit 33-9	2040 lbs
Water			138 lbs
Air Entrainer		Darex, WR Grace	0.25 oz/sack
Water Reducer		WRDA, WR Grace	5.0 oz/sack

- Base Course: 22A from Pit No. 19-46 Smith, specified 4" thick

- Subbase: Class II granular sand subbase, specified minimum 10" thick.

- Econocrete shoulders.

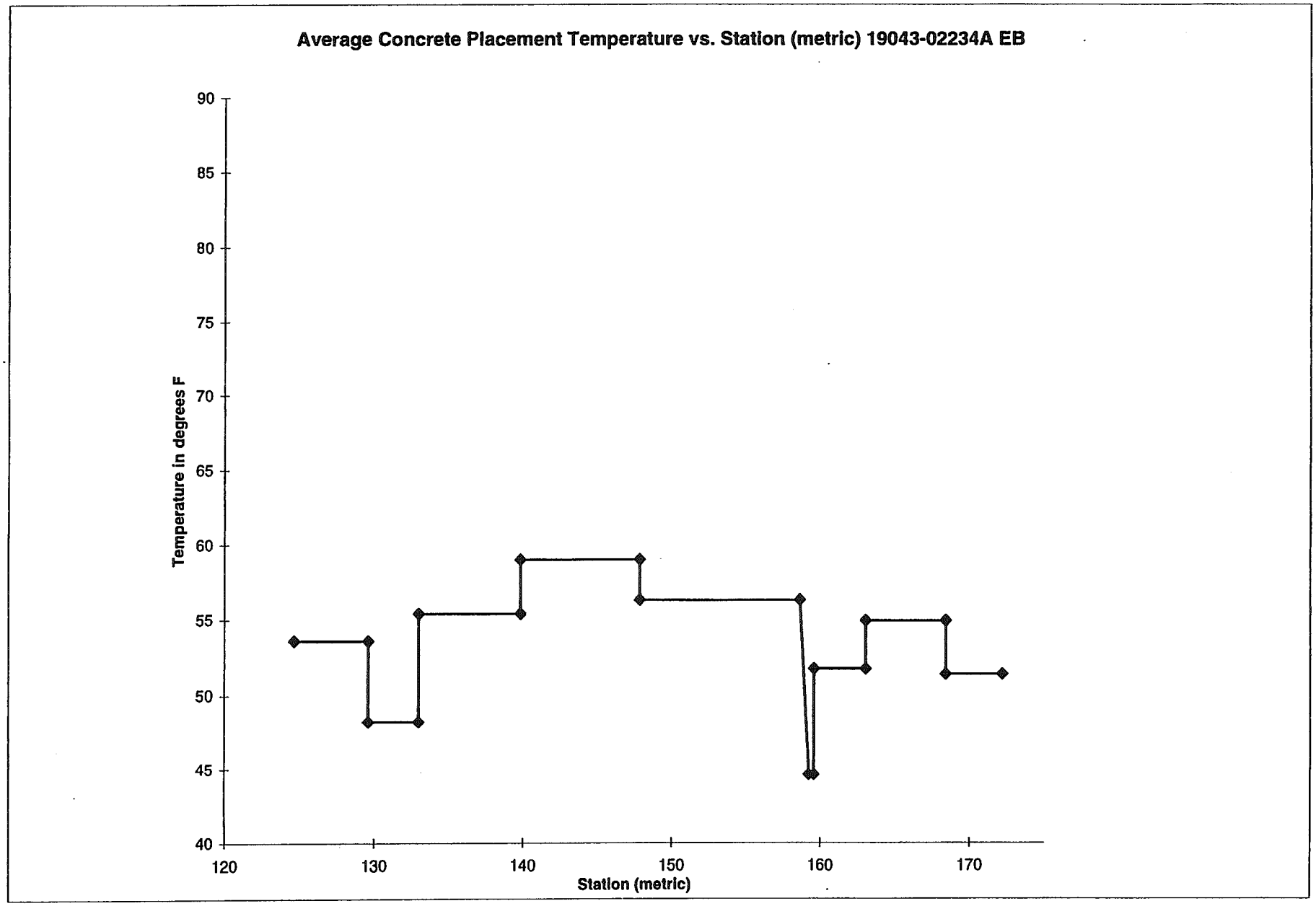
Control Section# 19043-02234A EB (metric)

Concrete Temperature At Placement
Contractor: Kegle Construction

Section Tested: 137+00 to 138+98

	Station							
Date Placed &Time	From	To	Concrete Temp F	Air Temp F	Concrete Temp C	Air Temp C	Average Concrete Temp F	Average Air Temp F
10/9/81 8:30	172+21	168+42	45	32	7	0		
10/9/81 10:00			48	34	9	1		
10/9/81 13:30			55	52	13	11		
10/9/81 15:00			54	50	12	10		
10/9/81 17:00			55	50	13	10	51	44
10/10/81 8:00	168+42	163+05	52	41	11	5		
10/10/81 10:00			54	41	12	5		
10/10/81 12:00			57	43	14	6		
10/10/81 14:00			57	50	14	10	55	44
10/12/81 9:40	163+05	159+59	52	44	11	6.5		
10/12/81 10:30			52	45	11	7.4	52	45
10/13/81 8:00	147+85	158+63	50	37	10	3.0		
10/13/81 10:00			55	50	13	10.0		
10/13/81 12:00			57	57	14	14.0		
10/13/81 14:00			57	57	14	14.0		
10/13/81 16:00			59	57	15	14.0		
10/13/81 17:30			59	59	15	15.0	56	53
10/14/81 8:00	147+85	139+84	59	45	15	7.0		
10/14/81 10:00			59	52	15	11.0		
10/14/81 11:30			59	54	15	12.0		
10/14/81 13:30			59	54	15	12.0		
10/14/81 15:30			59	52	15	11	59	51
10/17/81 8:00	132+99	139+84	54	41	12	5		
10/17/81 10:00			54	46	12	8		
10/17/81 11:30			57	55	14	13		
10/17/81 13:30			57	54	14	12	55	49
10/19/81 9:15	129+62	132+99	46	28	8	-2		
10/19/81 10:55			48	28	9	-2		
10/19/81 13:30			50	37	10	3	48	31
10/20/81 8:55	124+65	129+62	50	39	10	4		
10/20/81 11:00			50	45	10	7		
10/20/81 13:30			55	55	13	13		
10/20/81 16:25			59	57	15	14.0	54	49
11/3/81 8:00	159+59	159+25	45	41	7	5	45	41

Average	53	45


Average Concrete Placement Temperature vs. Station (metric) 19043-02234A EB
Temperature in degrees F
90
85
80
75
70
65
60
55
50
45
40
120
130
140
150
160
170
Station (metric)

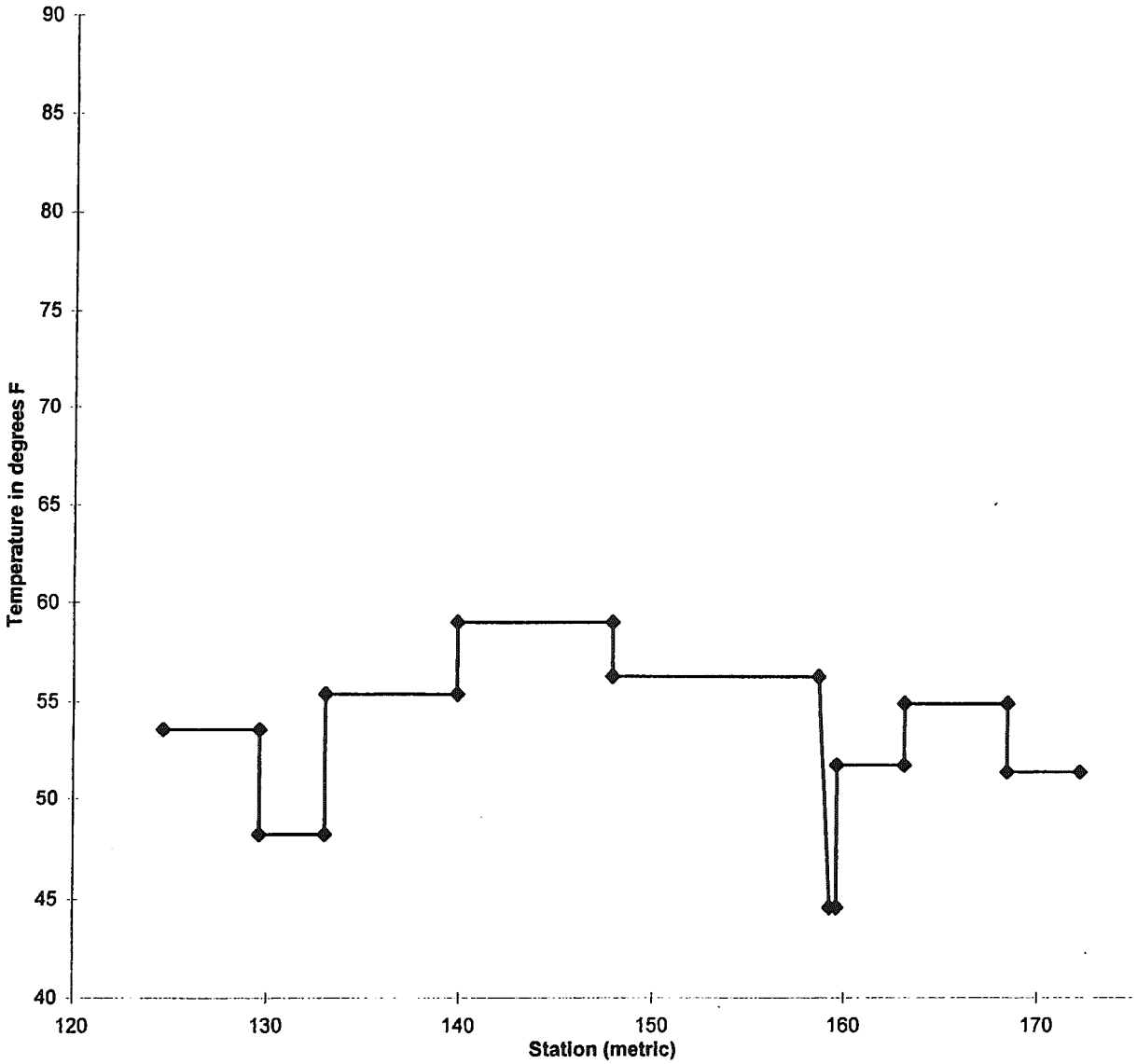
Control Section# **19043-02234A** **WB (metric)**

Concrete Temperature At Placement
Contractor: Kegle Construction

Section Tested: 147+83 to 150+00

	Station							
Date Placed &Time	From	To	Concrete Temp F	Air Temp F	Concrete Temp C	Air Temp C	Average Concrete Temp F	Average Air Temp F
9/29/81 10:30	153+18	158+42	53.6	53.6	12	12		
9/29/81 11:30			53.6	59	12	15		
9/29/81 13:00			59	57.2	15	14		
9/29/81 16:00			57.2	53.6	14	12	56	56
10/7/81 8:50	159+26	164+13	51.8	41	11	5		
10/7/81 9:30			53.6	41	12	5		
10/7/81 11:30			57.2	42.8	14	6		
10/7/81 13:30			57.2	50	14	10	55	44
10/8/81 8:50	164+13	170+47	44.6	32	7	0		
10/8/81 11:00			50	41	10	5		
10/8/81 13:10			55.4	50	13	10		
10/8/81 15:20			55.4	51.8	13	11.0	51	44
10/9/81 8:30	170+47	172+49	44.6	32	7	0.0		
10/9/81 10:00			48.2	33.8	9	1.0		
10/9/81 13:30			55.4	51.8	13	11.0		
10/9/81 15:00			53.6	50	12	10.0	50	42
10/20/81 8:55	124+65	125+90	50	39.2	10	4.0		
10/20/81 11:00			50	44.6	10	7.0		
10/20/81 13:30			55.4	55.4	13	13.0		
10/20/81 16:25			59	57.2	15	14	54	49
10/21/84 8:30	125+90	128+90	50	33.8	10	1		
10/21/81 8:45				33.8		1		
10/21/81 10:45			55.4	32.9	13	0.5		
10/26/81 10:00	128+90	137+79	44.6	32	7	0	50	33
10/26/81 11:00			51.8	42.8	11	6		
10/26/81 14:30			53.6	46.4	12	8		
10/26/81 15:30			53.6	50	12.0	10.0	53	46
10/28/81 7:30	137+79	148+83	44.6	24.8	7	-4		
10/28/81 9:25			48.2	41	9	5		
10/28/81 10:45			51.8	42.8	11	6		
10/28/81 12:30			50	46.4	10	8		
10/28/81 14:30			53.6	51.8	12	11		
10/28/81 16:00			51.8	42.8	11	6	50	42
10/29/81 7:15	148+83	153+13	44.6	30.2	7	-1.0		
10/29/81 9:30			50	32	10	0		
10/29/81 11:30			48.2	37.4	9	3	48	33
						Average	52	43

Average Concrete Placement Temperature vs. Station (metric) 19043-02234A WB



Review of Historical Records

Control Section 44044-18804A WB, I-69 Attica
Contractor for Paving: Denton Construction

- Typical Mix Design:

Strength: 35P
Slump: 2 to 3"
Air Content: 5 to 8%

Materials	Type	Supplier	Batch Weights
Cement	Type I	SME	480 lbs
Fine Aggregate	2NS	Vannini Pit 44-63	1515 lbs
Coarse Aggregate	6AA	Michigan Lime and Chemical Pit 71-3	1649 lbs
Water			168 lbs
Air Entrainer		MBVR Master Builders	1.5 oz/sack
Water Reducer		MBL-82 Master Builders	5.5 oz/sack

- Base Course: 8G from Pit No. 44-63 Vannini, Specified 4" thick.

- Westbound undercuts 690+00 to 692+00 for non-uniform textured material, 680+75 to 684+25 high water table and frost heave material, 687+00 to 696+50 high water table.

- Eastbound undercuts 676+00 to 677+00 non-uniform textured materials, 682+00 to 684+50 frost heave material, 690+00 to 699+00 high water table and frost heave material, 704+00 to 704+50 silt and clay in sandy subbase.

- At station 675+00 EB pavement cracked less than year after construction, "There are other frost heave locations, throughout project, stationing not recorded."

- Also transverse cracks in WB at 676+92, 678+45, 676+38, 649+33.

- Surcharges were used in Muck areas 582+75 to 584+75 WB, 584+50 to 586+00 EB, 706+75 to 707+00.

Control Section# **44044-18804A** **WB**

Concrete Temperature At Placement
Contractor: Denton Construction

Section Tested: 666+04 to 671+07

	Station		Milepost					
Date Placed &Time	From	To	From	To	Concrete Temp	Air Temp	Average Concrete Temp	Average Air Temp
8/7/84 10:00	737+39	768+23	3.083	3.667	82	76		
8/7/84 9:00					84	84		
8/7/84 11:00					83	87		
8/7/84 13:00					85	86	84	83
8/13/84 16:30	736+37	737+79	3.064	3.091	88	86	88	86
9/7/84 7:30	575+57	580+48	0.019	0.112	60	54	60	54
9/10/84 7:30	580+48	585+48	0.112	0.206	68	62		
9/10/84 10:30	588+30	622+42	0.260	0.906	68	64		
9/10/84 13:00					73	76		
9/10/84 15:45					76	76	71	70
9/14/84 7:30	681+99	734+40	2.034	3.027	70	60		
9/14/84 9:30					70	64		
9/14/84 12:30					72	76	71	67
9/12/84 8:30	681+99	624+98	2.034	0.954	73	62		
9/12/84 10:15					75	68		
9/12/84 12:10					74	76		
9/12/84 14:45					73	70		
9/12/84 17:15					74	72	74	70
9/17/84 0:00	585+48	586+29	0.206	0.222				
	588+30	587+49	0.260	0.244				
9/18/84 0:00	734+40	735+17	3.027	3.041				
9/19/84 0:00	575+57	574+37	0.019	-0.004				
10/2/84 10:00	622+53	623+14	0.908	0.920	60	60		
	624+07	624+66	0.926	0.937	60	63		
					62	66	61	63
10/3/84 10:45	735+58	738+00	3.049	3.095	60	55		
10/3/85 13:30					60	68	60	62
10/4/84 0:00	734+85	735+28	3.035	3.043				
	737+43	737+80	3.084	3.091				
	734+56	735+13	3.030	3.041				
	733+32	734+56	3.006	3.030				
	737+80	738+32	3.091	3.101				
	733+32	734+85	3.006	3.035				
						Average	71	69

Control Section# 44044-18804A EB

Concrete Temperature At Placement
Contractor: Denton Construction

Section Tested: none

	Station					
Date Placed &Time	From	To	Concrete Temp	Air Temp	Average Concrete Temp	Average Air Temp
8/17/84 7:00	737+60	747+67	80	62		
8/17/84 9:00	747+59	768+00	76	68		
8/17/84 11:00			80	70		
8/17/84 13:15			80	84		
8/17/84 14:40			78	78		
8/17/84 16:45			80	82	79	74
8/20/84 7:15	687+63	734+66	70	44		
8/20/84 9:00			70	60		
8/20/84 10:45			76	77		
8/20/84 13:00			76	75		
8/20/84 15:00			78	76		
8/20/84 17:00			80	77	75	66
8/21/84 7:15	687+63	654+06	70	56		
8/21/84 9:10	737+60 (OL)	736+81(OL)	70	66		
8/21/84 11:00	735+49 (OL)	734+66 (OL)	73	74		
8/21/84 12:50			76	82	72	70
8/22/84 7:15	626+65	654+06	74	70		
8/22/84 9:00	736+84 (IL)	737+66 (IL)	74	70		
8/22/84 11:15	734+66 (IL)	735+45 (IL)	76	76		
8/22/84 15:00			76	82	75	75
9/6/84 7:30	621+53	588+32	60	46		
9/6/84 9:45	585+48	575+64	64	64		
9/6/84 12:15			70	72		
9/6/84 14:45			72	78	67	65
9/13/84 9:30	588+32	587+50	70	70		
9/13/84 12:00	588+48	586+30	72	80		
9/13/84 14:00	575+64	574+36	74	80	72	77
9/17/84 0:00	622+42	623+22				
	624+20	624+98				
9/19/84 0:00	575+64	574+36				
	585+48	586+29				
	588+32	587+50				
9/21/84 13:00	585+48	586+29	66	72		
9/21/84 15:00	587+92	587+53	68	79		
	583+61	584+32			67	76
10/2/84 10:00	571+48	578+52	60	60		
10/2/84 12:00	622+80	623+39	60	63		
10/2/84 15:00	624+18	624+99	62	66	61	63
				Average	71	71

Review of Historical Records

Control Section 47065-28215A EB and WB, I-96 Howell
Contractor for Paving: Interstate Highway Construction Inc.

- Typical Mix Design:

Strength: 35P
Air Content: 6.5%

Materials	Type	Supplier	Batch Weights
Cement	Type I	Essroc (Windsor)	480 lbs
Fine Aggregate	2NS	Houghton Pit No. 47-6	1528 lbs
Coarse Aggregate	6AA	Levy (Dix) Slag Pit No. 82-19	1419 lbs
Water			246 lbs
Air Entrainer		N/A	
Water Reducer		N/A	
Fly Ash	Class C	U.S. Ash Bayshore	72 lbs

Base Course: Westbound 680+00 to 686+00 3G Slag, Westbound 785+55 to 796+00 350AA Limestone, 820+65 to 829+84 350AA Slag, Eastbound 3G slag from West end of job to I-96 Business Loop, and from I-96 Business Loop to East end of job 3G Limestone

Review of Historical Records

Control Section 77024-20821A Section A EB, I-69 Capac
Contractor for Paving: Denton Construction

- Typical Mix Design:

Strength: 35P
Slump: 1 to 3"
Air Content: 5 to 8%

Materials	Type	Supplier	Batch Weights
Cement	Type I	SME	526 lbs
Fine Aggregate	2NS	Vannini Pit 44-63	1628 lbs
Coarse Aggregate	6AA	Presque Isle Stone Pit 71-47	1649 lbs
Water			156 lbs
Air Entrainer		MBVR Master Builders	0.7 oz/sack
Water Reducer		MBL-82 Master Builders	5 oz/sack
Fly Ash			72 lb/cyd

- Base Course: 8G from Pit No. 58-8 Rockwood and Pit No. 71-3 Michigan Lime and Chemical, Specified 4" thick.

- Subbase: Class II Granular Sand , specified minimum 8" thick.

- RQI after construction: WBOL 42, WBIL 44, EBIL 39, EBOL 39.

- Some problems in adding fly ash at portable batch plant.

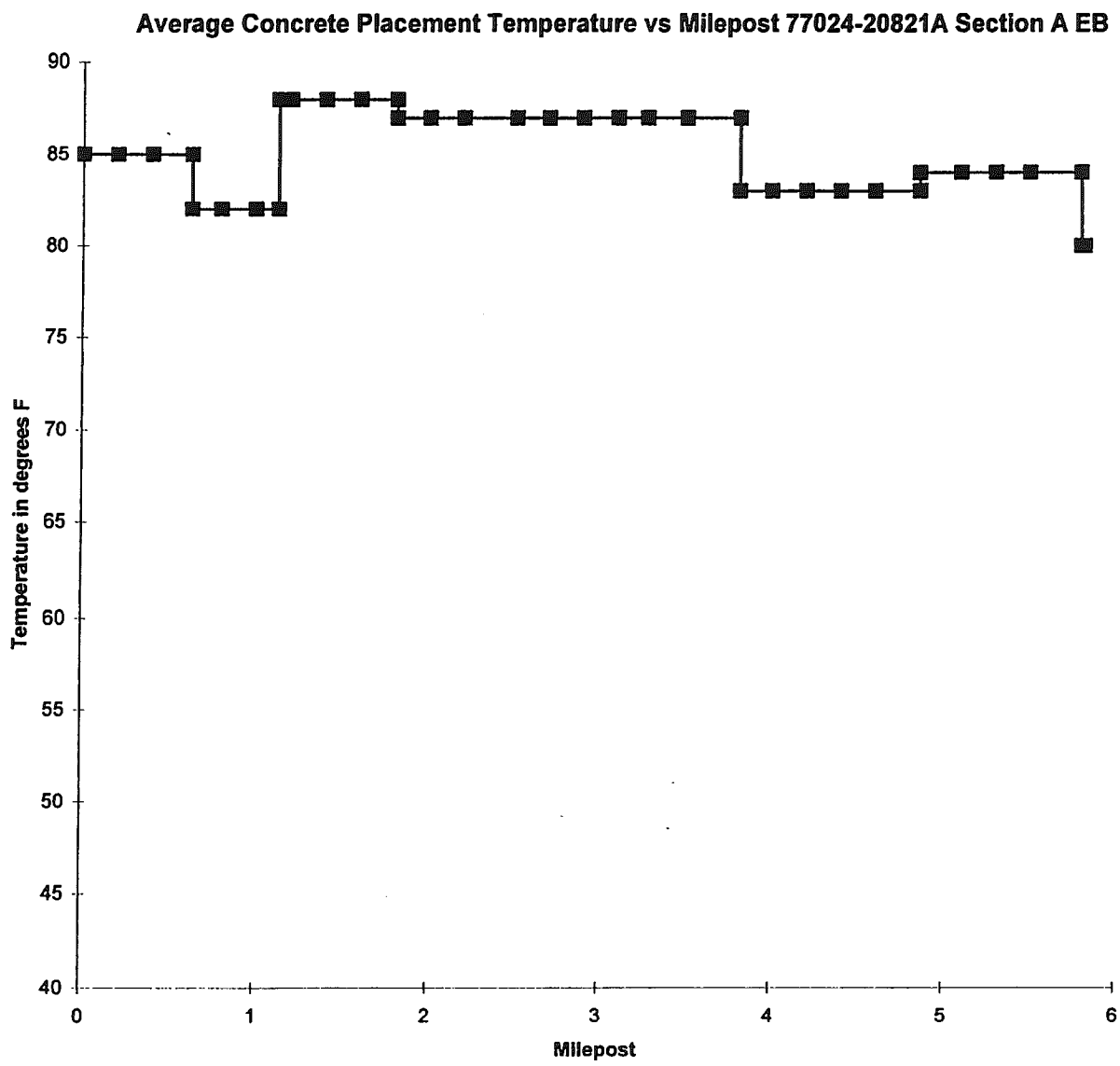
Concrete Temperature At Placement

Control Section# 77024-20821A Section A EB
Contractor: Denton Construction

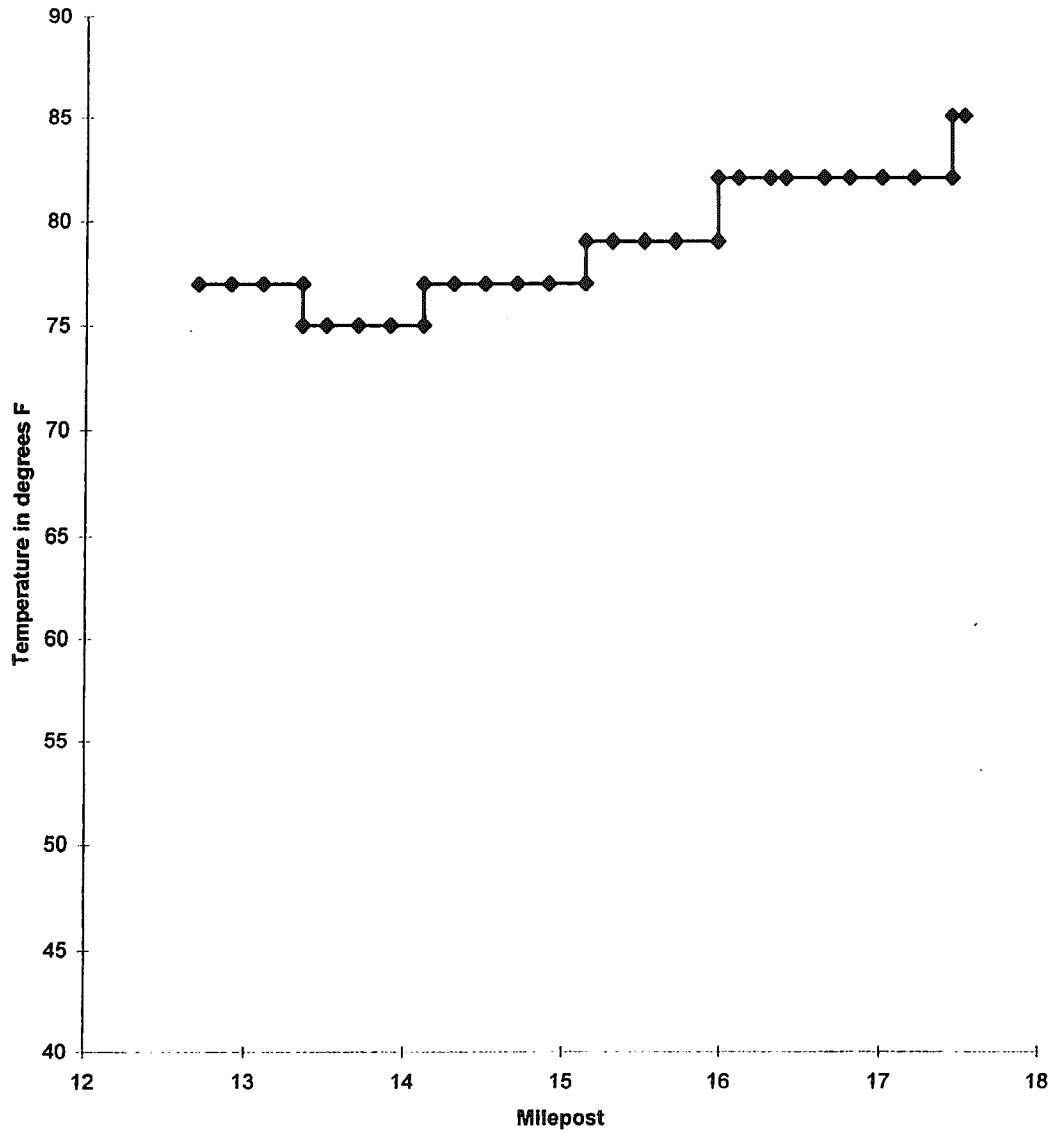
Section Tested: 83+90 to 90+12

	Station		Milepost					
Date Placed &Time	From	To	From	To	Concrete Temp	Air Temp	Average Concrete Temp	Average Air Temp
8/10/83 10:00	321+27	322+10	5.808	5.824	80	65	80	65
7/26/83 7:30	271+30	321+27	4.861	5.808	80	59		
7/26/83 8:20	1452+30	1453+51	16.620	16.643				
7/26/83 8:45	1450+16	1451+36	16.580	16.603				
7/26/83 12:30					85	85		
7/26/83 15:00					85	84		
7/26/83 17:00					86	85	84	78
7/25/83 7:00	215+93	271+30	3.813	4.861	80	61		
7/25/83 8:45					81	67		
7/25/83 10:00								
7/25/83 12:20					84	76		
7/25/83 15:30					85	83		
7/25/83 17:30					85	83	83	74
7/21/83 7:00	187+65	215+93	3.277	3.813	85	73		
7/21/83 10:00					88	80		
7/21/83 12:00					87	85	87	79
7/20/83 7:30	147+55	187+65	2.518	3.277	87	73		
7/20/83 10:00	1450+16	1451+36	16.580	16.603	88	80		
7/20/83 12:00					87	83		
7/20/83 14:00					87	88	87	81
7/19/83 7:30	110+25	147+55	1.811	2.518	83	69		
7/19/83 8:00	1452+30	1453+51	16.620	16.643				
7/19/83 9:30					87	80		
7/19/83 11:30					88	80		
7/19/83 13:30					88	89		
7/19/83 15:30					88	90		
7/19/83 17:30					89	92	87	83
7/18/83 7:30	74+57	110+25	1.135	1.811	87	70		
7/18/83 10:30					88	85		
7/18/83 12:30					88	81		
7/18/83 14:30					89	86	88	81

	Station		Milepost					
Date Placed &Time	From	To	From	To	Concrete Temp	Air Temp	Average Concrete Temp	Average Air Temp
7/13/83 7:30	47+92	74+57	0.631	1.135	80	65		
7/13/83 9:30					82	75		
7/13/83 11:30					83	82		
7/13/83 13:30					84	87	82	77
7/12/83 7:30	10+00	47+92	0.000	0.631	83	75		
7/12/83 8:00								
7/12/83 8:30	1495+73	1500+00	17.443	17.524	83	78		
7/12/83 10:30	**				85	83		
7/12/83 12:30					85	87		
7/12/83 14:30					88	88		
7/12/83 16:30					87	88	85	83
7/11/83 7:30	1453+51	1495+73	16.643	17.443	79	69		
7/11/83 9:30					79	72		
7/11/83 11:30					83	80		
7/11/83 13:30					84	88		
7/11/83 15:30					87	90	82	80
7/9/83 7:30	1414+98	1450+16	15.977	16.643	79	67		
7/9/83 8:30								
7/9/83 10:30					82	75		
7/9/83 12:30					84	80		
7/9/83 15:00					84	84	82	77
7/8/83 7:30	1370+34	1414+98	15.132	15.977	77	68		
7/8/83 9:30					77	70		
7/8/83 12:00					78	72		
7/8/83 14:00					81	80		
7/8/83 17:00					83	84	79	75
7/7/83 7:30	1316+62	1370+34	14.114	15.132	70	54		
7/7/83 9:30					77	73		
7/7/83 11:30					78	73		
7/7/83 12:00								
7/7/83 14:00					79	82		
7/7/83 14:30								
7/7/83 16:30					80	80	77	72
7/6/83 7:30	1276+44	1316+62	13.353	14.114	68	52		
7/6/83 10:30					77	61		
7/6/83 13:00					76	71		
7/6/83 15:30					77	70	75	64
7/5/83 8:30	1247+10	1276+44	12.734	13.353	77	63		
7/5/83 10:30					77	62		
7/5/83 12:30					80	64		
7/5/83 15:00					75	62	77	63
						Average	82	75


Average Concrete Placement Temperature vs Milepost 77024-20821A Section A EB
Temperature in degrees F
90
85
80
75
70
65
60
55
50
45
40
0
1
2
3
4
5
6
Milepost

Average Placement Concrete Temperature vs. Milepost 77024-20821A Section A EB



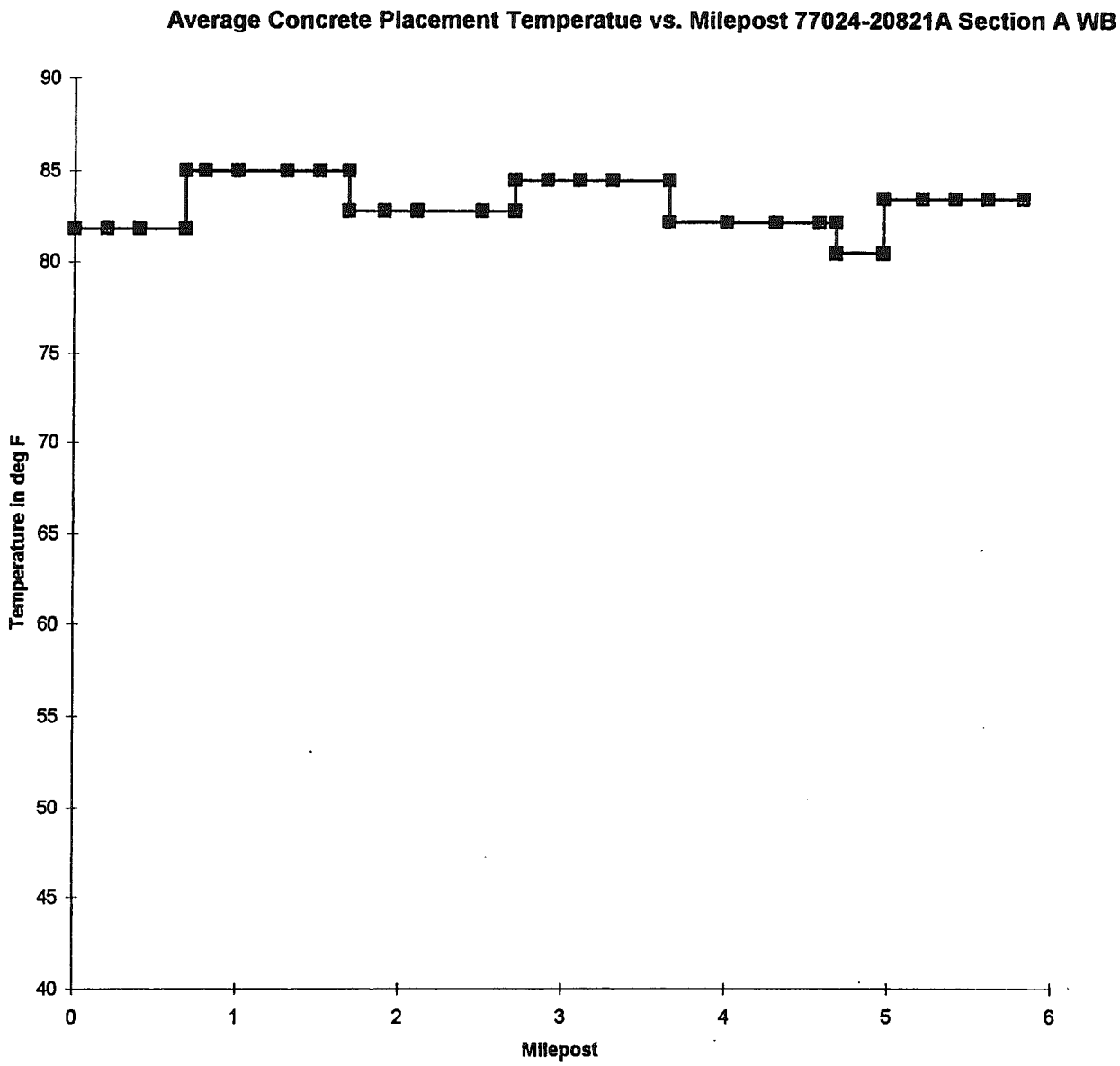
Concrete Temperature At Placement

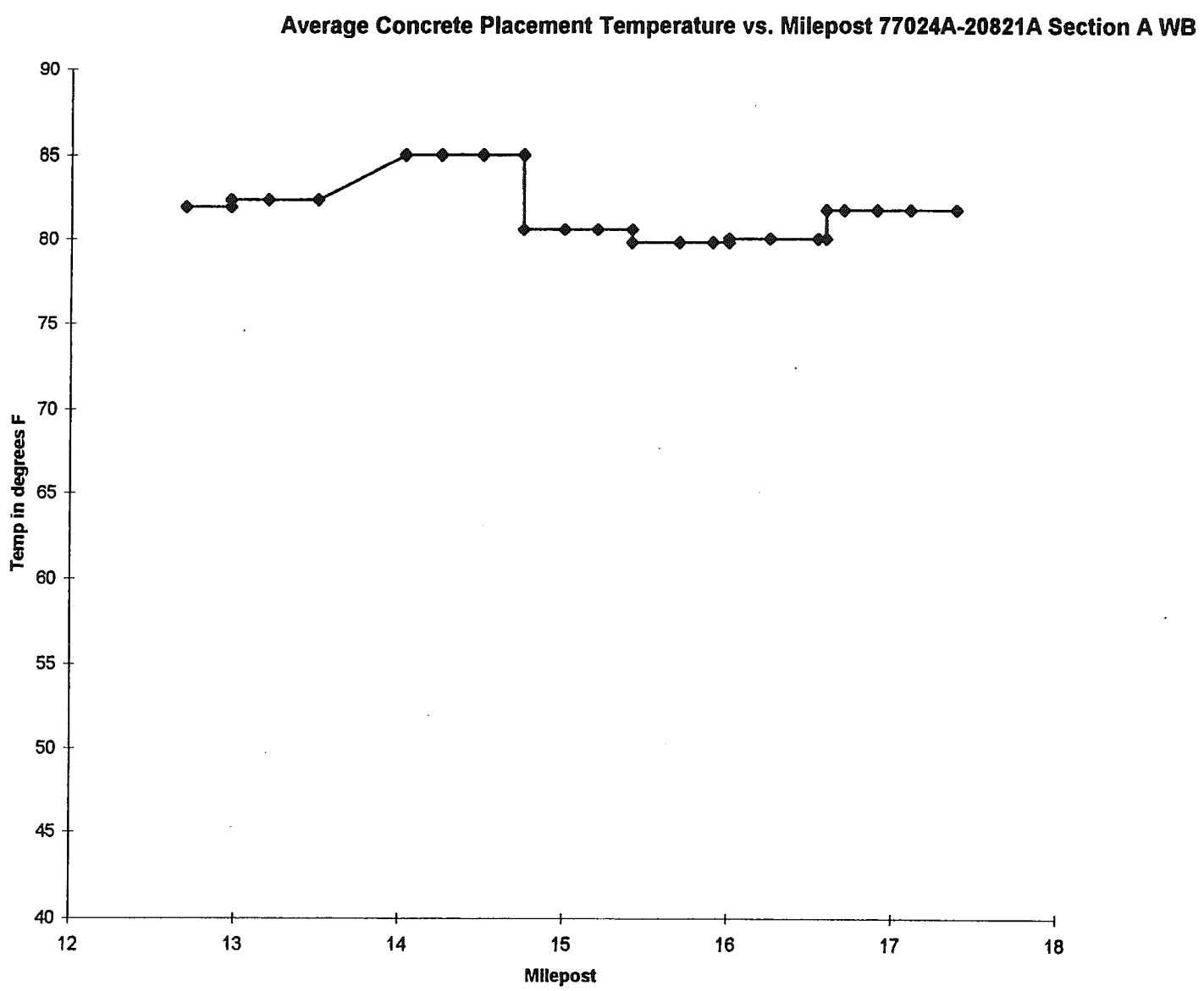
Control Section# 77024-20821A Section A WB
Contractor: Denton Construction

Section Tested: none

	Station		Milepost					
Date Placed	From	To	From	To	Concrete Temp	Air Temp	Average Concrete Temp	Average Air Temp
6/20/83	1247+10	1261+25	12.706	12.973992	82	75		
					82	80	82	77.5
6/21/83	1261+25	1289+11	12.97399	13.501644	80	60		
					80	76		
					81	84		
					85	90		
					86	92	82.4	80.4
6/23/83	1317+11	1355+25	14.03195	14.754295	80	65		
					85	84		
					85	88		
					87	90		
					88	90	85	83.4
6/24/83	1355+25	1390+30	14.7543	15.418121	80	64		
					79	75		
					82	83		
					81	84		
					81	84	80.6	78
6/25/83	1390+30	1421+53	15.41812	16.009598	77	64		
					80	76		
					81	80		
					81	86	79.8	76.5
6/30/83	1421+53	1450+00	16.0096	16.548803	77	68		
					79	78		
					82	85		
					82	88	80	79.8

	Station		Milepost					
Date Placed	From	To	From	To	Concrete Temp	Air Temp	Average Concrete Temp	Average Air Temp
7/1/83	1452+55	1494+12	16.5971	17.384409	80	76		
					80	79		
					82	83		
					84	88		
					83	85	81.8	82.2
7/7/83	1451+75	1452+55	16.58195	16.597098	70	54		
	1450+00	1450+80	16.5488	16.563955	77	73		
					78	73		
					79	82		
					80	80	76.8	72.4
7/19/83	1451+75	1452+55	16.58195	16.597098	83	69		
	1450+00	1450+80	16.5488	16.563955	87	80		
					88	80		
					88	89		
					89	90		
					89	92	87.3	83.3
7/27/83	321+81	276+70	5.817871	4.9635152	76	64		
					83	78		
					87	88		
					88	88	83.5	79.5
7/28/83	276+70	261+54	4.963515	4.676394	80	70		
					81	73	80.5	71.5
8/2/83	261+54	207+38	4.676394	3.650636	78	67		
					80	75		
					85	80		
					85	80		
					83	80	82.2	76.4
8/3/83	207+38	157+54	3.650636	2.706697	83	70		
					83	76		
					83	80		
					86	85		
					86	86		
					86	86	84.5	80.5
8/5/83	157+54	103+80	2.706697	1.688894	81	69		
					82	71		
					82	76		
					86	84		
					83	82		
					83	78	82.8	76.7
8/8/83	103+80	50+55	1.688894	0.6803712	78	70		
					84	82		
					87	90		
					88	91		
					88	92	85	85
8/9/83	50+55	1494+12	0.680371	17.384409	77	60		
					80	72		
					83	74		
					85	77		
					84	82	81.8	73
8/10/83	321+81	322+89	5.817871	5.839	80	65	80	65
						Average	82	78


Average Concrete Placement Temperatue vs. Milepost 77024-20821A Section A WB
Temperature in deg F
90
85
80
75
70
65
60
55
50
45
40
0
1
2
3
4
5
6
Milepost


Average Concrete Placement Temperature vs. Milepost 77024A-20821A Section A WB
Temp in degrees F
90
85
80
75
70
65
60
55
50
45
40
12
13
14
15
16
17
18
Milepost

Review of Historical Records

Control Section 77024-17988A Section B EB, I-69 Capac
Contractor for Paving: John Carlo Inc.

- Typical Mix Design:

Strength: 35P
Slump: 1 to 3"
Air Content: 5 to 8%

Materials	Type	Supplier	Batch Weights
Cement	Type I	Dundee and SME	526 lbs
Fine Aggregate	2NS	Holloway S&G Pit 44-67	1590lbs
Coarse Aggregate	6A	Michigan Lime and Chemical Pit 71-3	1650 lbs
Water			154 lbs
Air Entrainer		Daravair WR Grace	0.5 oz/sack
Water Reducer		WRDA, WR Grace	5 oz/sack

- Base Course: 8G from Pit No. 71-3 Michigan Lime and Chemical (shipped over from 77023-21586A). Base course specified 4" thick.

- Subbase: Class II granular material, specified minimum 9" thick.

- 1450 lineal feet of subbase on 433+00 to 447+50 WB did not meet specification and was removed.

- 1100 lineal feet of subbase on (484+00 to 495+00) EB did not meet specification (high loss on wash) bad areaas were removed and other areas were disked in with new good material.

- Some minor spalls needed patching on entire WB.

- Numerous drainage outlets were damaged during construction and needed repair.

Control Section# 77024-17988A Section B EB

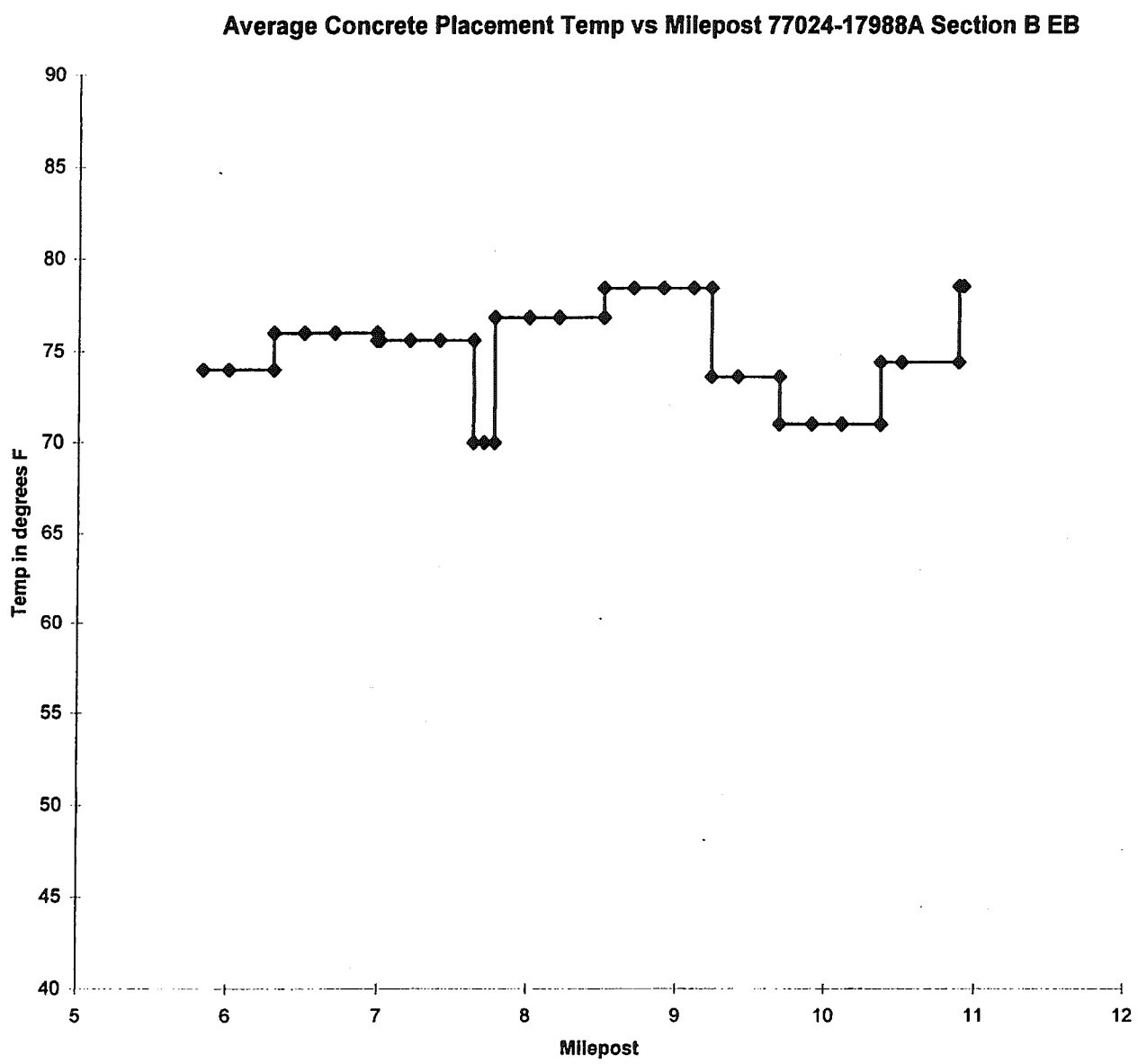
Concrete Temperature At Placement
Contractor: John Carlo Inc.

Section Tested: 408+06 to 418+29

	Station		Milepost					
Date	From	To	From	To	Concrete Placement Temp	Air Temp	Average Concrete Temp	Average Air Temp
6/11/84	1515+00	1505+58	11.480	11.291	72	70		
					74	74	73	73
6/13/84	1505+58	1486+00	11.291	10.920	78	72		
	591+21	589+49	10.920	10.887	78	74		
					78	80		
					78	84		
					79	86		
					80	88	79	81
6/14/84	589+49	562+03	10.887	10.368	74	66		
					76	72		
					76	72		
					72	68		
					74	66	74	69
6/15/84	562+03	526+00	10.368	9.686	67	52		
					68	60		
					68	60		
					68	70		
					71	70		
					75	73		
					74	70		
					74	70		
					74	66	71	66
6/16/84	526+00	501+80	9.686	9.227	68	52		
					71	68		
					74	68		
					76	73		
					79	80	74	68

	Station		Milepost					
Date	From	To	From	To	Concrete Placement Temp	Air Temp	Average Concrete Temp	Average Air Temp
6/20/84	501+80	465+75	9.227	8.545	75	63		
					75	70		
					75	70		
					82	75		
					82	75		
					80	78		
					80	75	78	72
6/21/84	465+75	425+25	8.545	7.778	69	56		
					74	72		
					80	74		
					82	82		
					78	78		
					78	78	77	73
6/22/84	425+25	417+47	7.778	7.630	70	60		
					70	62	70	61
6/25/84	417+47	383+46	7.630	6.986	70	58		
					75	68		
					77	77		
					78	80		
					78	77	76	72
6/26/84	383+46	347+48	6.986	6.305	68	56		
					76	70		
					76	71		
					78	74		
					78	74		
					80	78		
					76	74	76	71
6/27/84	347+48	322+90	6.305	5.839	74	64		
					74	68		
					72	68		
					76	74	74	69

Average	75	70


Average Concrete Placement Temp vs Milepost 77024-17988A Section B EB
Temp in degrees F
90
85
80
75
70
65
60
55
50
45
40
5
6
7
8
9
10
11
12
Milepost

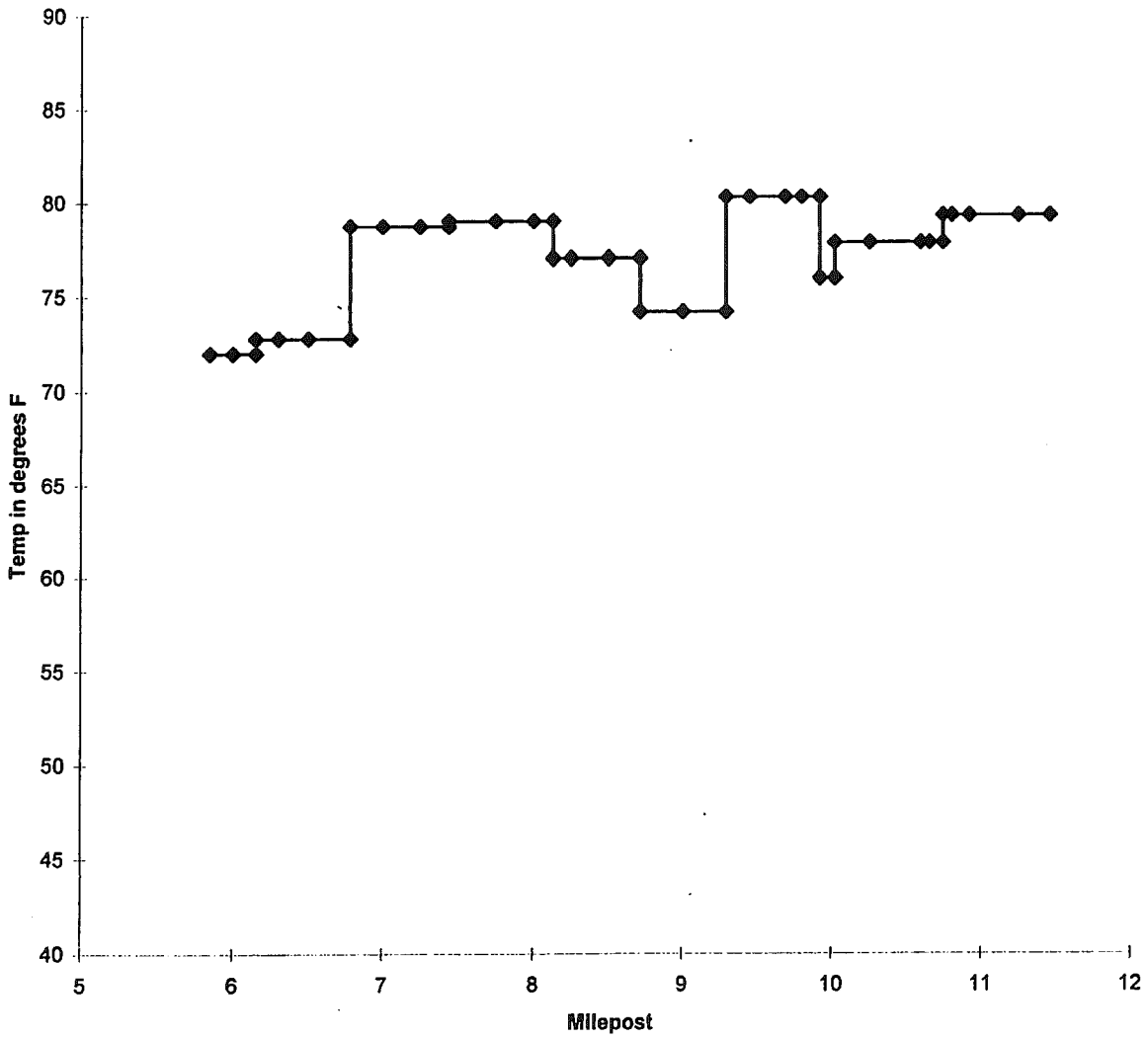
Control Section# 77024-17988A Section B WB

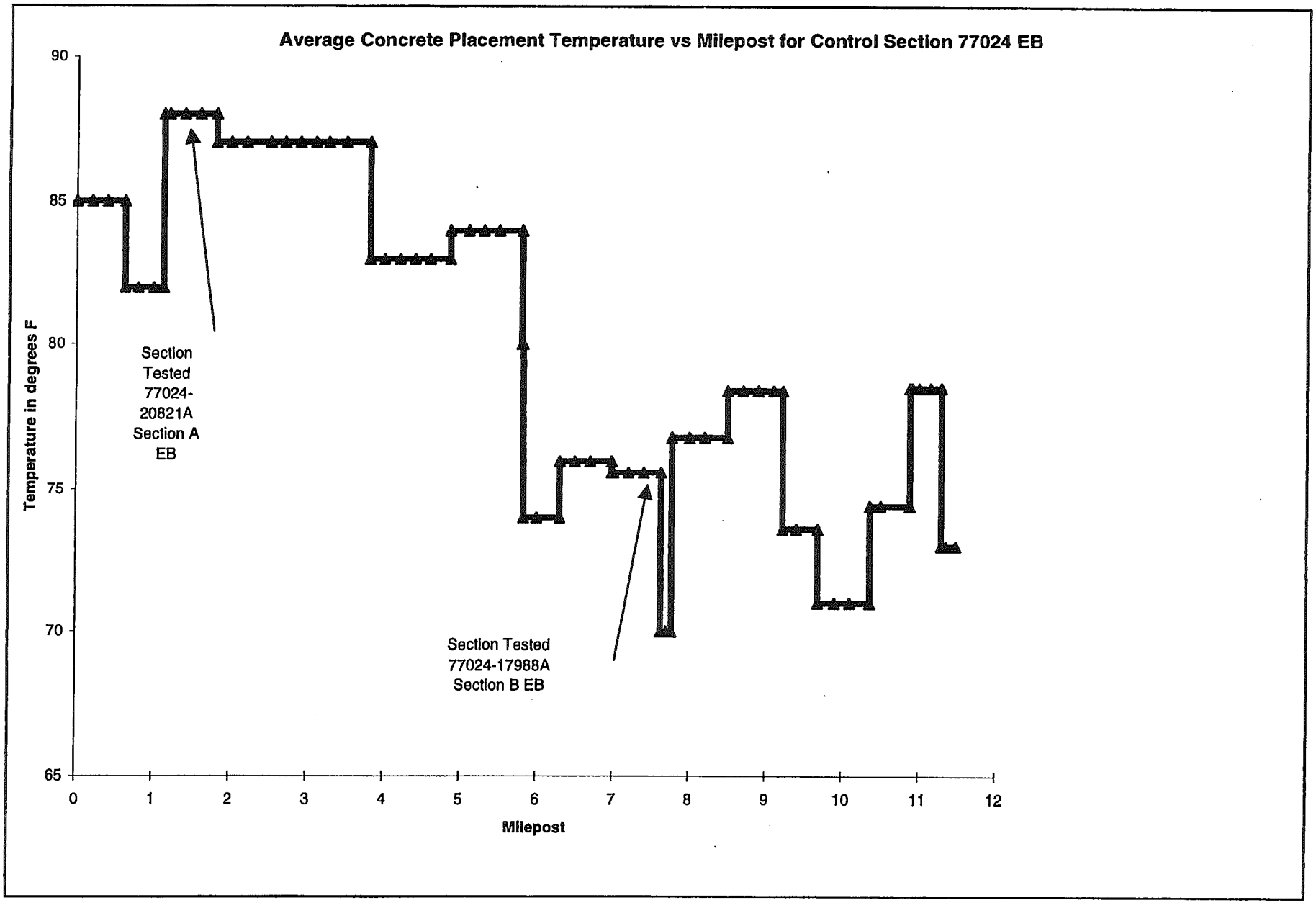
Concrete Temperature At Placement
Contractor: John Carlo Inc.

Section Tested: none

	Station		Milepost					
Date	From	To	From	To	Concrete Placement Temp	Air Temp	Average Concrete Temp	Avgerage Air Temp
6/28/84	323+55	339+52	5.852	6.154	66	62		
					74	70		
					76	73	72	68
6/29/84	339+52	372+63	6.154	6.782	69	60		
					71	64		
					71	64		
					75	66		
					76	66		
					75	69	73	65
7/2/84	372+63	407+55	6.782	7.442	75	66		
					75	74		
					76	75		
					81	82		
					82	85		
					82	82		
					80	78	79	77
7/3/84	407+55	444+36	7.442	8.140	75	65		
					77	74		
					77	82		
					82	85		
					82	85		
					81	84	79	79
7/5/84	444+36	474+66	8.140	8.713	75	64		
					76	70		
					80	82		
					78	75		
					75	75		
					78	72	77	73
7/9/84	474+66	505+40	8.713	9.296	72	68		
					73	72		
					72	74		
					76	74		
					76	74		
					76	74	74	73
7/10/84	505+40	526+37	9.296	9.693	74	67		
	527+15	538+55	9.707	9.923	76	74		
					82	76		
					82	83		
					82	91		
					86	91	80	80
7/11/84	538+55	543+88	9.923	10.024	76	67	76	67
7/12/84	543+88	574+05	10.024	10.596	72	64		
	574+17	582+10	10.598	10.748	75	71		
					78	76		
					82	80		
					80	84		
					80	82	78	76
7/13/84	582+10	591+21	10.748	10.921	73	65		
	1486+00	1515+00	10.921	11.470	78	72		
					82	84		
					84	90	79	78
						Average	77	74

Average Concrete Placement Temp vs. Milepost 77024-17988A Section B WB




Average Concrete Placement Temperature vs Milepost for Control Section 77024 EB
Temperature in degrees F
90
85
80
75
70
65
0
1
2
3
4
5
6
7
8
9
10
11
12
Milepost
Section Tested 77024-20821A Section A EB
Section Tested 77024-17988A Section B EB