

Ohio/SHRP Test Road

SPS-2 Tech Day

LTPP SPS-2 Experiment and Construction

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RUSS COLLEGE OF ENGINEERING AND TECHNOLOGY

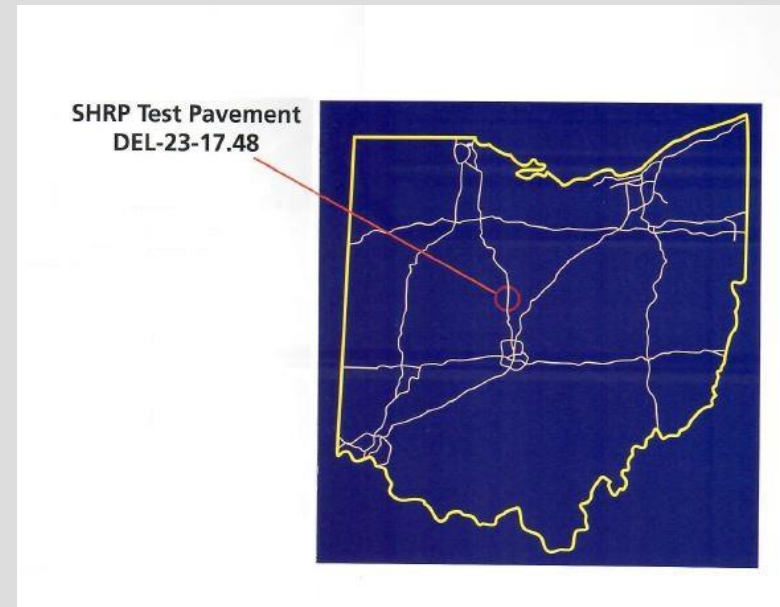
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OHIO
UNIVERSITY

Ohio/SHRP Test Road

- DEL-23-17.48
- Project 380(94)
- Sold June 21, 1994
- S. E. Johnson
 - Highway Paving
- \$10,281,263.55 bid
- 40 test sections
- Incorporated four SHRP SPS experiments



SHRP Specific Pavement Studies (SPS)

- **SPS-1: Strategic Study of Structural Factors for Flexible Pavements**
- **SPS-2: Strategic Study of Structural Factors for Rigid Pavement**
- SPS-3: Preventive Maintenance Effectiveness of Flexible Pavements
- SPS-4: Preventive Maintenance Effectiveness of Rigid Pavements
- SPS-5: Rehabilitation of Asphalt Concrete Pavements

SHRP Specific Pavement Studies (SPS)

- SPS-6: Rehabilitation of Jointed PCC Pavements
- SPS-7: Bonded PCC Overlays on Concrete Pavements
- **SPS-8: Study of Environmental Effects in the Absence of Heavy Loads**
- **SPS-9: Validation of SHRP Asphalt Specifications and Mix Design (Superpave)**
- SPS-10: Warm Mix Asphalt Overlay of Asphalt Pavement

Ohio SPS-2 Core Sections As Proposed

Pavement Structure					SPS-2 Site Designation															
					J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
Edge Drain	Base Type	PCC		Lane Width	Climate Zones, Subgrade															
					Wet								Dry							
		Slab Thickness	Flexural Strength		Freeze		No-Freeze		Freeze		No-Freeze									
					Fine	Coarse	Fine	Coarse	Fine	Coarse	Fine	Coarse								
No	DGAB		550 psi	12 ft	01		01		01		01		01		01		01			
				14 ft		13		13		13		13		13		13				
			900 psi	12 ft		14		14		14			14		14		14			
		14 ft		02		02		02		02		02		02		02				
			550 psi	12 ft		15		15		15		15		15		15		15		
				14 ft	03		03		03		03		03		03		03			
	900 psi		12 ft	04		04		04		04		04		04		04		04		
		14 ft		16		16		16		16		16		16		16				
	No	LCB		550 psi	12 ft	05		05		05		05		05		05		05		
					14 ft		17		17		17		17		17		17			
				900 psi	12 ft		18		18		18		18		18		18		18	
			14 ft		06		06		06		06		06		06		06			
			550 psi	12 ft		19		19		19		19		19		19		19		
				14 ft	07		07		07		07		07		07		07			
	900 psi	12 ft	08		08		08		08		08		08		08		08			
14 ft			20		20		20		20		20		20		20					
Yes	PATB		550 psi	12 ft	09		09		09		09		09		09		09			
				14 ft		21		21		21		21		21		21				
			900 psi	12 ft		22		22		22		22		22		22		22		
				14 ft	10		10		10		10		10		10		10			
			550 psi	12 ft		23		23		23		23		23		23		23		
				14 ft	11		11		11		11		11		11		11			
			900 psi	12 ft	12		12		12		12		12		12		12		12	
				14 ft		24		24		24		24		24		24		24		24

Ohio SPS-2 Core Sections As Built

Pavement Structure					SPS-2 Site Designation															
					J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
Edge Drain	Base Type	PCC		Lane Width	Climate Zones, Subgrade															
					Wet								Dry							
		Slab Thickness	Flexural Strength		Freeze		No-Freeze		Freeze		No-Freeze									
					Fine	Coarse	Fine	Coarse	Fine	Coarse	Fine	Coarse								
No	DGAB	8 inches	780 psi	12 ft	01	01	01	01	01	01	01	01	01	01	01	01	01	01		
				14 ft	13	13	13	13	13	13	13	13	13	13	13	13				
			900 psi	12 ft	14	14	14	14	14	14	14	14	14	14	14	14				
				14 ft	02	02	02	02	02	02	02	02	02	02	02	02				
		11 inches	780 psi	12 ft	15	15	15	15	15	15	15	15	15	15	15	15				
				14 ft	03	03	03	03	03	03	03	03	03	03	03	03				
			900 psi	12 ft	04	04	04	04	04	04	04	04	04	04	04	04				
				14 ft	16	16	16	16	16	16	16	16	16	16	16	16				
		No	LCB	8 inches	780 psi	12 ft	05	05	05	05	05	05	05	05	05	05	05	05		
						14 ft	17	17	17	17	17	17	17	17	17	17	17			
					900 psi	12 ft	18	18	18	18	18	18	18	18	18	18	18			
						14 ft	06	06	06	06	06	06	06	06	06	06	06			
11 inches	780 psi			12 ft	19	19	19	19	19	19	19	19	19	19	19					
				14 ft	07	07	07	07	07	07	07	07	07	07	07					
	900 psi			12 ft	08	08	08	08	08	08	08	08	08	08	08					
				14 ft	20	20	20	20	20	20	20	20	20	20	20					
Yes	PATB	8 inches	780 psi	12 ft	09	09	09	09	09	09	09	09	09	09	09	09				
				14 ft	21	21	21	21	21	21	21	21	21	21	21					
			900 psi	12 ft	22	22	22	22	22	22	22	22	22	22	22					
				14 ft	10	10	10	10	10	10	10	10	10	10	10					
		11 inches	780 psi	12 ft	23	23	23	23	23	23	23	23	23	23	23					
				14 ft	11	11	11	11	11	11	11	11	11	11	11					
			900 psi	12 ft	12	12	12	12	12	12	12	12	12	12	12					
				14 ft	24	24	24	24	24	24	24	24	24	24	24					

SPS-2 Supplemental Sections

SPS 2 Supplemental Test Sections Pavement Structure						
Edge Drain	PCC		Base Type	Lane Width	Section ID	Notes
	Slab Thickness	Flexural Strength				
Yes	11 inches	900 psi	6" DGAB	12 ft	390259	390204 with edge drains
		780 psi	4" PATB/ 4"DGAB	12 ft	390260	390212 with ODOT Class C Concrete
		780 psi	4" PCTB/ 4"DGAB	14 ft	390261	390212 with ODOT Class C Concrete, PCTB, and 14 ft lane
		780 psi	4" PCTB/ 4"DGAB	12 ft	390262	390212 with ODOT Class C Concrete and PCTB
		780 psi	6" DGAB	14 ft	390263	390204 with ODOT Class C Concrete, edge drains, and 14 ft lane
		780 psi	6" DGAB	12 ft	390264	390204 with ODOT Class C Concrete and edge drains
		780 psi	4" PATB/ 4"DGAB	12 ft	390265	Duplicate of 390260

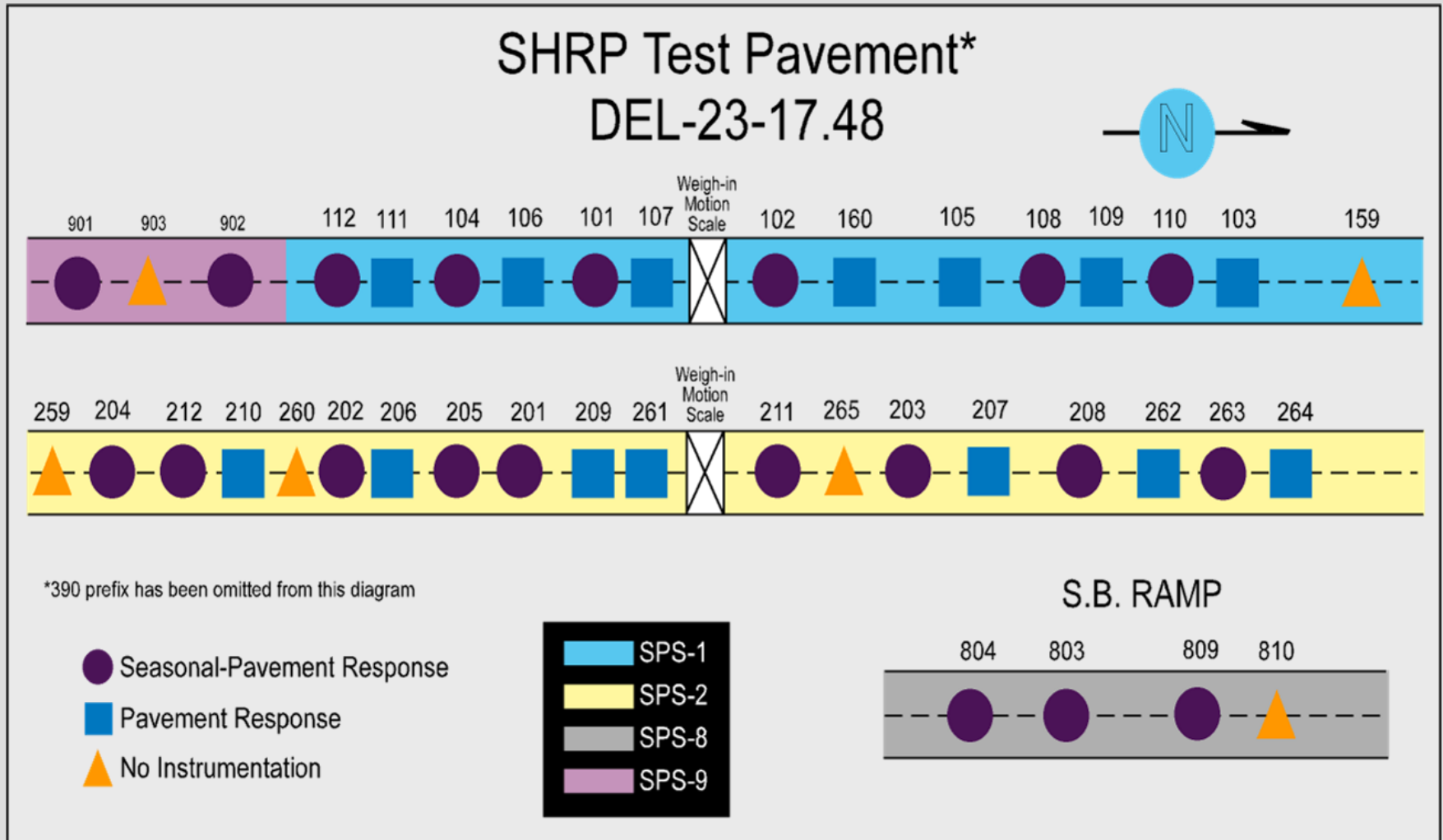
Ohio SPS-8 Test Sections

Pavement Structure			SPS-8 Site Designation																							
Pavement Type	Surface Thickness	Base Thickness	Factors for Moisture, Temperature, and Subgrade Type																							
			Wet												Dry											
			Freeze						No-Freeze						Freeze						No-Freeze					
			Active	Fine	Coarse	Active	Fine	Coarse	Active	Fine	Coarse	Active	Fine	Coarse	Active	Fine	Coarse									
Flexible	4 inches	8 inches	01		03		03		01		03		05		01		03		03		01		03		03	
	7 inches	12 inches	02		04		06		02		04		06		02		04		06		02		04		06	
Rigid	8 inches	6 inches		07		09		11		07		09		11		07		09		11		07		09		11
	11 inches	6 inches		08		10		12		08		10		12		08		10		12		08		10		12

550 psi design flexural strength

2018 ADT = 133, 8% trucks

Ohio SHRP Test Road



Ohio SHRP Test Road

SPS-1, SPS-8 & SPS-9

Asphalt Concrete Studies				
SPS-1				
Section	Thickness (in)		Base Type	Drain
	AC	Base		
390101	7	8	DGAB	NO
390102	4	12	DGAB	NO
390103	4	8	ATB	NO
390104	7	12	ATB	NO
390105	4	8	4" ATB/4" DGAB	NO
390106	7	12	8" ATB/4" DGAB	NO
390107	4	8	4" PATB/4" DGAB	YES
390108	7	12	4" PATB/8" DGAB	YES
390109	7	16	4" PATB/12" DGAB	YES
390110	7	8	4" ATB/4" PATB	YES
390111	4	12	8" ATB/4" PATB	YES
390112	4	16	12" ATB/4" PATB	YES
390159	4	25	15" ATB/4" PCTB/6" DGAB	YES
390160	4	15	11" ATB/4" DGAB	YES
SPS-8				
390803	4	8	DGAB	NO
390804	7	12	DGAB	NO
SPS-9				
390901	4	22	AC-20 12" ATB/4" PATB/6" DGAB	YES
390903	4	22	PG-64-28 12" ATB/4" PATB/6" DGAB	YES
390902	4	22	PG 58-28 12" ATB/4" PATB/6" DGAB	YES



Ohio SHRP Test Road

SPS-2

Portland Cement Concrete Studies						
SPS-2						
Section	Lane Width	Strength (PSI)	Thickness (in)		Base Type	Drain
390201	12	ODOT	8	6	DGAB	NO
390202	14	900	8	6	DGAB	NO
390203	14	ODOT	11	6	DGAB	NO
390204	12	900	11	6	DGAB	NO
390205	12	ODOT	8	6	LCB	NO
390206	14	900	8	6	LCB	NO
390207	14	ODOT	11	6	LCB	NO
390208	12	900	11	6	LCB	NO
390209	12	ODOT	8	8	4" PATB/4" DGAB	YES
390210	14	900	8	8	4" PATB/4" DGAB	YES
390211	14	ODOT	11	8	4" PATB/4" DGAB	YES
390212	12	900	11	8	4" PATB/4" DGAB	YES
390259	12	900	11	6	DGAB	YES
390260	12	ODOT	11	8	4" PATB/4" DGAB	YES
390261	14	ODOT	11	8	4" PCTB/4" DGAB	YES
390262	12	ODOT	11	8	4" PCTB/4" DGAB	YES
390263	14	ODOT	11	6	DGAB	YES
390264	12	ODOT	11	6	DGAB	YES
390265	12	ODOT	11	8	4" PATB/4" DGAB	YES
SPS-8						
390809	11	550	8	6	DGAB	NO
390810	11	550	11	6	DGAB	NO



Ohio SHRP Test Road

SPS-8

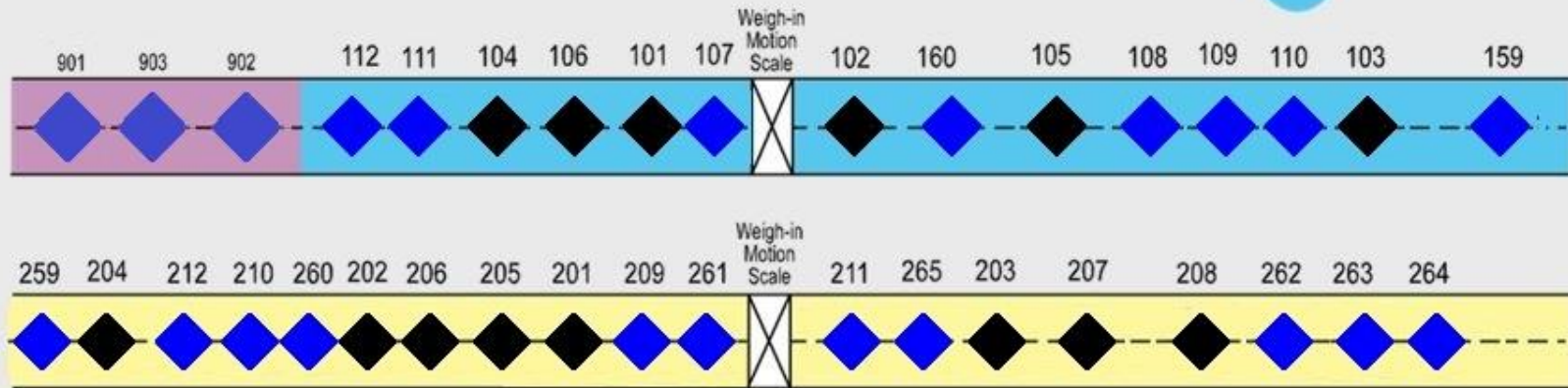


Construction

- 15' joint spacing
- Dowel bars (epoxy coated)
 - 1.25" for 8" thick pavement
 - 1.5" for 11" thick pavement
 - On baskets

Construction

SHRP Test Pavement* DEL-23-17.48

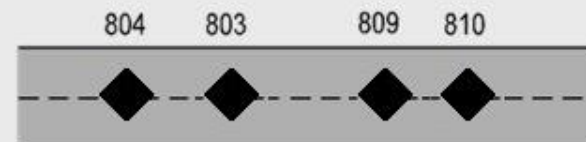


*390 prefix has been omitted from this diagram

-  **No Drainage**
-  **Longitudinal Drains**

-  SPS-1
-  SPS-2
-  SPS-8
-  SPS-9

S.B. RAMP



Concrete Mix Designs

- Lean Concrete Base
 - Compressive strength 500 psi, 700 psi maximum at 7 days

JMF	C290003			
Design Cf	27			
% air	6.0			
design slump	1.0			
Name	Source	Sp. Gr.	Abs.	Quantity/CY (lbs)
sand, natural	Shelly, Prospect	2.59	1.70	1465
57 crushed stone	National, Carey	2.62	1.73	2000
cement type 1 701.04	Cemex, Fairborn	3.15	0.01	160
water				235
admixture, AEA	Grace, Dublin			24 oz
admixture, type A	Grace, Dublin			3 oz.

Concrete Mix Designs

- Permeable Cement Treated Base (PCTB)

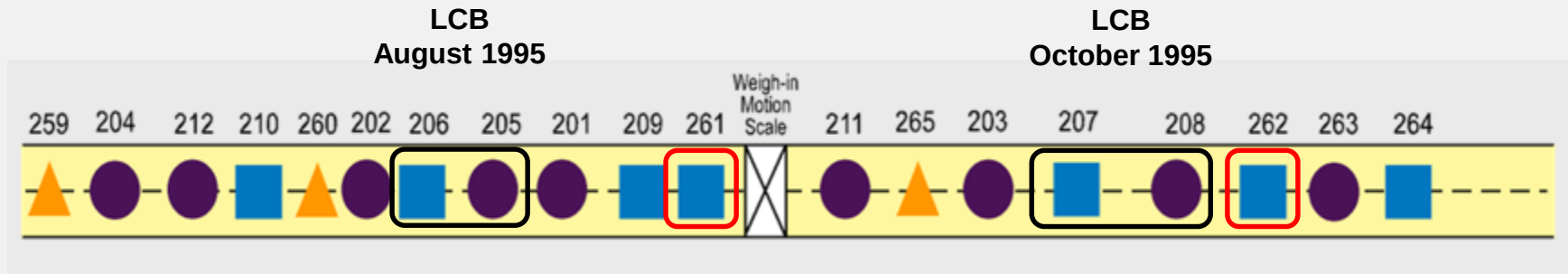
JMF		C290005		
Design Cf	27			
% air				
design slump				
Name	Source	Sp. Gr.	Abs.	Quanty/CY (lbs)
57 crushed stone	National, Carey	2.62	1.73	2515
cement type 1 701.04	Cemex, Fairborn	3.15	0.01	250
water				85

Construction



Lean Concrete Base

Concrete Mix Designs



CTFDB: September 1995

- Seasonal-Pavement Response
- Pavement Response
- ▲ No Instrumentation

- SPS-1
- SPS-2
- SPS-8
- SPS-9



Concrete Mix Designs

- Low Strength, 550 psi third point at 14 days

JMF	C290001			
Design Cf	27			
% air	6.5			
design slump	1.3			
Name	Source	Sp. Gr.	Abs.	Quanty/CY (lbs)
fly ash, class F	Mountaineer, W. Va.	2.30	0.01	120
sand, natural	Union, Prospect	2.58	3.20	1335
57 crushed stone	National, Carey	2.62	2.90	1800
cement type 1 701.04	Southwestern, Fairborn	3.15	0.01	350
water				235
admixture, type A	Grace, Dublin			14.10 oz

Concrete Mix Designs

- ODOT Mix

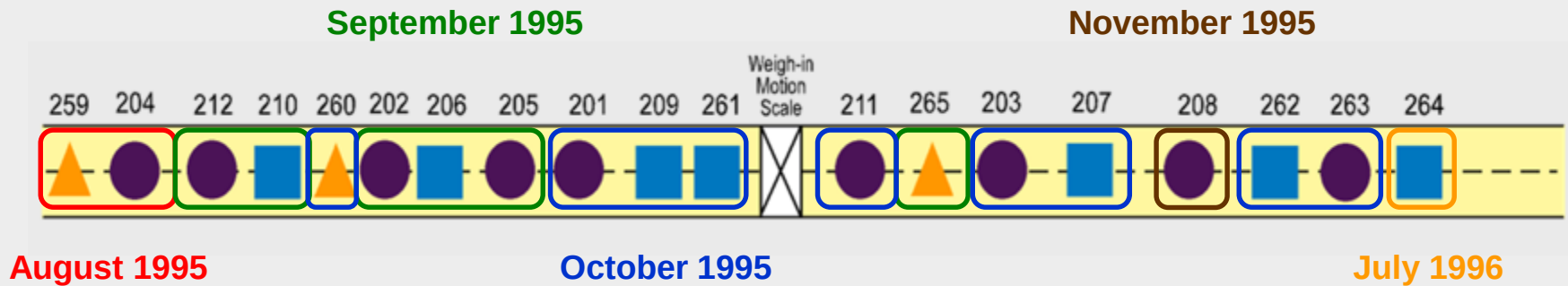
JMF		C290002		
Design Cf	27			
% air	6.0			
design slump	4.0			
Name	Source	Sp. Gr.	Abs.	Quantity/CY (lbs)
fly ash, class F	Mountaineer, W. Va.	2.30	0.01	90
sand, natural	Shelly, Prospect	2.54	1.78	1260
57 crushed stone	National, Carey	2.60	1.63	1680
cement type 1 701.04	Cemex, Fairborn	3.15	0.01	510
water				240
admixture, AEA	Grace, Dublin			24 oz

Concrete Mix Designs

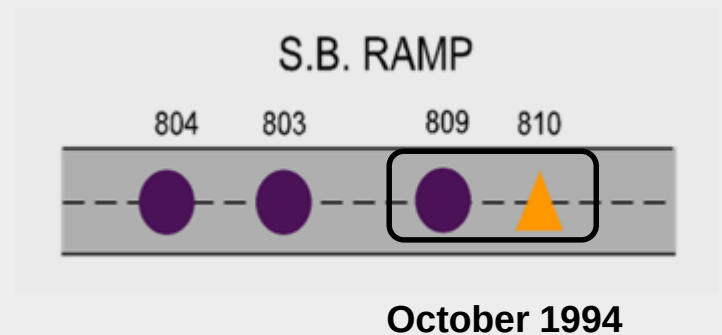
- High strength, 900 psi third point at 14 days

JMF		C290004		
Design Cf	27			
% air	6.0			
design slump	4.0			
Name	Source	Sp. Gr.	Abs.	Quantity/CY (lbs)
fly ash, class C	Elec Energy, Joppa	2.30	0.01	113
sand, natural	Shelly, Prospect	2.59	1.70	950
57 crushed stone	National, Carey	2.62	1.73	1850
cement type 1 701.04	Cemex, Fairborn	3.15	0.01	750
water				270
admixture, AEA	Grace, Dublin			24 oz
admixture, type A	Grace, Dublin			5 oz

Paving



- Seasonal-Pavement Response
- Pavement Response
- ▲ No Instrumentation



Paving



Concrete Surface

Construction

- Opened to Traffic:
 - SPS-8: November 1, 1994
 - SPS 2: August 14, 1996

SPS-2

Instrumentation

- Instrumentation
 - WIM
 - Weather Station
 - Seasonal Instrumentation
 - Load Response Instrumentation

Weather Station



- **Weather Station**
 - Precipitation
 - Wind Speed and Direction
 - Air Temperature
 - Humidity
 - Solar Radiation



Weigh in Motion



- 2018 ADT 28,599, 16% trucks
- Average approximately 600,000 ESAL/year

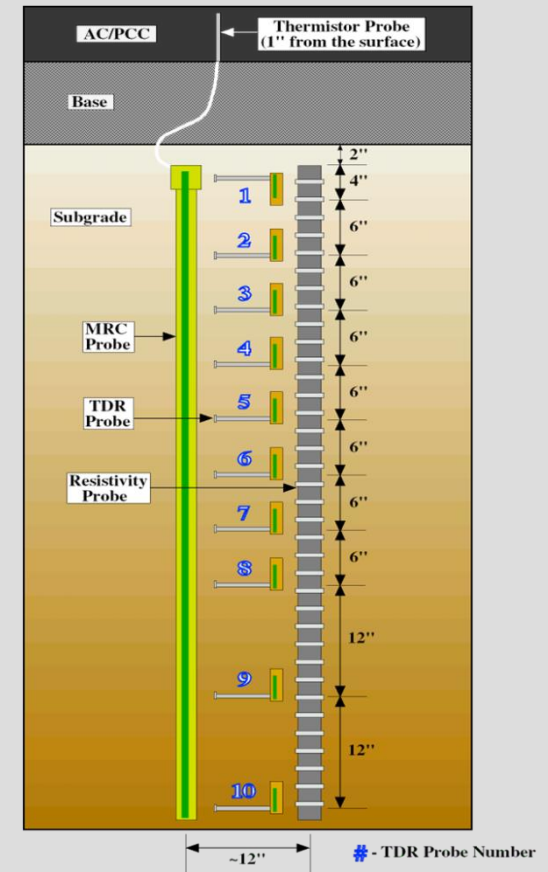


SPS-2

Pavement Instrumentation

- Seasonal Instrumentation
 - Temperature
 - Moisture
 - Frost Depth
 - Soil Suction

Nine SPS-2 sections instrumented

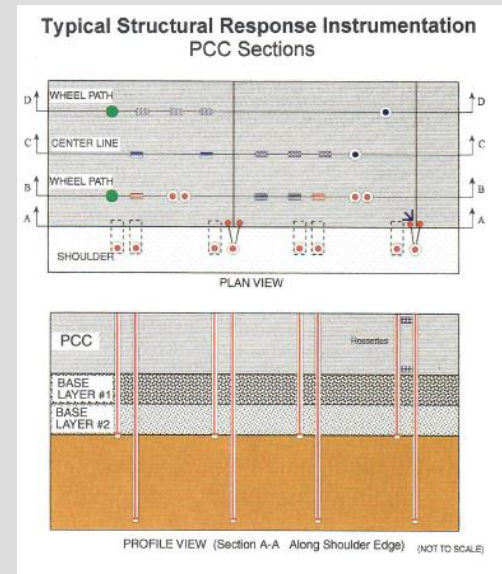


SPS-2

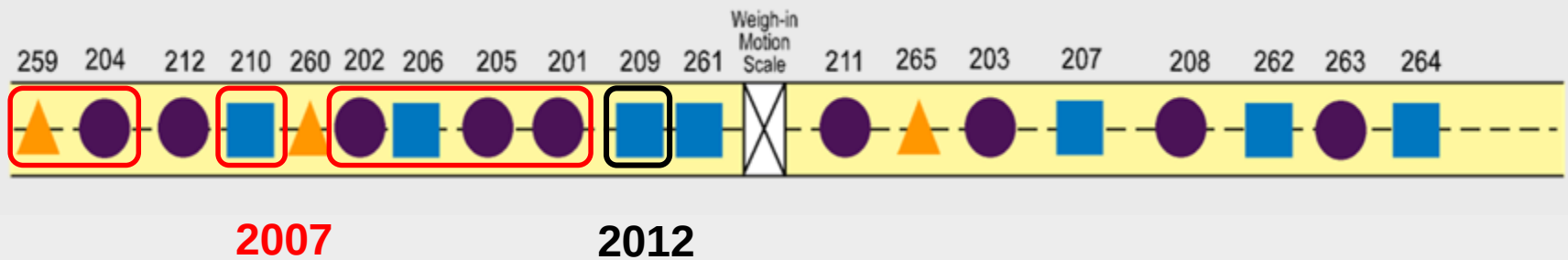
Pavement Instrumentation

- Load Response Instrumentation
 - Strain (gages)
 - Deflection (LVDT)
 - Base and Subgrade Pressure (pressure cells)

Sixteen SPS-2 sections instrumented



Replaced Sections



- Seasonal-Pavement Response
- Pavement Response
- ▲ No Instrumentation

■	SPS-1
■	SPS-2
■	SPS-8
■	SPS-9



SPS-2 Replacement Sections									
construction limits		pavement thickness	lane width	joint spacing	aggregate size	Concrete Mix	Base Type		Subgrade
begin station	end station						301	304	
256.0863	274.0000	11"	12	15	467	APP A	4"	4"	16" lime stabilized subgrade
274.0000	286.8500		12	15	467	APP A		8"	
302.3000	309.3013		14	14	467	APP A	4"	4"	
318.0000	325.6700		14	13	57	APP C	4"	4"	
325.6700	333.3200		14	15	57	APP C	4"	4"	
333.3200	341.1600		14	14	57	APP C	4"	4"	
341.1600	349.2500		14	14	357	APP B	4"	4"	

Maximize unit weight using Shilstone or equivalent procedure

Coarse aggregate from National Lime & Stone, Carey

Minimum cementitious content of 500 lbs

Maximum pozzolan content of 25 %

Proportion in accordance with SS 888.03, Portland Cement Concrete Pavement using QC/QA



Questions?

<https://www.ohio.edu/engineering/orite/>

Create for Good.

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