SOUTH DAKOTA
I 29 Northbound

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SOUTH DAKOTA
I 29 Northbound

1. DESCRIPTION

Location:	Northbound I 29 over railroad in Minnehaha County Structure No. 50-181-155
Open to Traffic:	October 1999
Environment:	Normal over railroad
HPC Elements:	Girders, deck, and bent diaphragms
Total Length:	171 ft 9-5/8 in
Skew or Curve:	27^{o} skew
Girder Type:	AASHTO Type II
Span Lengths:	54 ft 0 in, 61 ft 0 in, and 54 ft 0 in
Girder Spacing:	11 ft 5 in
Girder Strand Grade:	270
Girder Strand Dia.:	0.5 in
Max. No. of Bottom Strands:	32
Deck Thickness:	9 in
Deck Panels:	None

2. BENEFITS OF HPC AND COSTS

A. Benefits of HPC

The high-strength concrete used in the girders allowed the number of girder lines to be reduced from five to four. This reduced both girder costs and construction time. The low permeability of the deck concrete should increase the service life of the deck and reduce future maintenance costs.

B. Costs

$48.03/ft^2 of deck surface area including width of barriers. Costs do not include bridge end items such as approach slabs. Total cost of the girders and bearing pads for excise tax purposes was $46,440. Girders were purchased by the State separate from the bridge contract. Bid cost of the girders and deck were $50,459 and $81,972, respectively.

3. STRUCTURAL DESIGN

Design Specifications:	AASHTO Standard Specifications for Highway Bridges 1996 with 1997 Interim
Design Live Loads:	HS 25-44 and alternate except HS 20-44 and alternate loading were used for bridge deck design and serviceability requirements
Seismic Requirements:	AASHTO Seismic Performance Category A
Flexural Design Method:	AASHTO Standard Specifications 9.17
Maximum Compressive Strain:	0.003
Shear Design Method:	AASHTO Standard Specifications
Fatigue Design Method:	AASHTO Standard Specifications 8.16.8
Lateral Stability Considerations:	Diaphragms at midspan and ends of each span
Allowable Tensile Stress	
—Top of Girder at Release:	$3\sqrt{f'_{ci}}$ = 277 psi
—Bottom of Girder after Losses:	$6\sqrt{f'_{c}}$ = 597 psi
Prestress Loss:	28%
Method Used for Loss:	AASHTO Standard Specifications 9.16.2.1
Calculated Camber:	1.5 in at release 2.75 in final
Concrete Cover	
—Girder:	1 in clear
—Top of Deck:	2-1/2 in clear
—Bottom of Deck:	1 in clear
—Other Locations:	2 in clear
Properties of Reinforcing Steel	
—Girder:	ASTM A 615 Grade 60, uncoated
—Deck:	ASTM A 615 Grade 60, epoxy coated
Properties of Strand	
—Grade and Type:	Grade 270, low relaxation
—Supplier:	—
—Surface Condition:	—
—Pattern:	Fourteen strands draped from 40% of span for both span lengths
—Transfer Length:	$1.5(f_{si}/f'_{ci})d_b$-4.6
—Development Length:	AASHTO Standard Specifications 9.28

4. SPECIFIED ITEMS

A. Concrete Properties

	Girders (1)	Deck (2)
Cementitious Materials Content:	—	684 lb/yd^3
Water/Cementitious Materials Ratio:	—	0.39
Min. Quantity of Fly Ash:	—	118 lb/yd^3
Max. Quantity of Fly Ash:	—	118 lb/yd^3
Min. Quantity of Silica Fume:	—	55 lb/yd^3
Max. Quantity of Silica Fume:	—	55 lb/yd^3
Min. Percentage of GGBFS:	—	—
Max. Percentage of GGBFS:	—	—
Maximum Aggregate Size:	—	—
Slump:	(3)	5-7 in
Air Content:	6.5 $\pm$ 1.0%	6.5 $\pm$ 1.0%

(1) In lieu of an approved mix design and trial batch, mix proportions were included in the special provisions. See Section 11 for details.
(2) Mix proportions included in the special provisions. See Section 11 for details.
(3) With silica fume, slump to be increased by 2 in from the normal slump.

Compressive Strength		
—Release of Strands:	8520 psi	—
—Design:	9900 psi at 28 days	4500 psi at 28 days
Chloride Permeability:	—	—
(AASHTO T 277)	—	—
ASR or DEF Prevention:	—	—
Freeze-Thaw Resistance:	—	—
Deicer Scaling:	—	—
Abrasion Resistance:	—	—
Other:	Type II cement	Type II cement

B. Specified QC Procedures

Girder Production	
Curing:	Steam or radiant heat at 100% relative humidity
Internal Concrete Temperature:	—
Cylinder Curing:	—
Cylinder Size:	4x8 in
Cylinder Capping Procedure:	—
Cylinder Testing Method:	—
Frequency of Testing:	—
Other QA/QC Requirements:	3-5 yd^3 concrete trial batch
Deck Construction	
Curing:	Wet burlap, soaker hoses, and polyethylene sheeting for 7 days. Curing compound prior to wet burlap allowed if fogging was ineffective. See Section 11 for details.
Cylinder Curing:	—
Cylinder Size:	6x12 in
Flexural Strength:	—
Other QA/QC Requirements:	40 ft x 36 ft x 9 in test pour

5. CONCRETE MATERIALS

A. Approved Concrete Mix Proportions

	Girders	CIP Deck (4)
Cement Brand:	South Dakota	—
Cement Type:	II	II
Cement Composition:	—	—
Cement Fineness:	—	—
Cement Quantity:	680 lb/yd^3	511 lb/yd^3
GGBFS Brand:	—	—
GGBFS Quantity:	—	—
Fly Ash Brand:	—	—
Fly Ash Type:	—	—
Fly Ash Quantity:	—	118 lb/yd^3
Silica Fume Brand:	Force 10,000	—
Silica Fume Quantity:	84 lb/yd^3	55 lb/yd^3
Fine Aggregate Type:	—	—
Fine Aggregate FM:	—	—
Fine Aggregate SG:	—	—
Fine Aggregate Quantity:	1200 lb/yd^3	1100 lb/yd^3
Coarse Aggregate, Max. Size:	3/4 in	—
Coarse Aggregate Type:	Quartzite	Quartzite
Coarse Aggregate SG:	—	—
Coarse Aggregate Quantity:	1825 lb/yd^3	1725 lb/yd^3
Water:	190 lb/yd^3	264 lb/yd^3
Water Reducer Brand:	Polyheed 997	Polyheed 997
Water Reducer Type:	A and F	A and F
Water Reducer Quantity:	45.8 fl oz/yd^3	40.9 fl oz/yd^3
High-Range Water-Reducer Brand:	Daracem 19	—
High-Range Water-Reducer Type:	A and F	—
High-Range Water-Reducer Quantity:	260 fl oz/yd^3	—
Retarder Brand:	—	—
Retarder Type:	—	—
Retarder Quantity:	—	—
Corrosion Inhibitor Brand:	—	—
Corrosion Inhibitor Type:	—	—
Corrosion Inhibitor Quantity:	—	—
Air Entrainment Brand:	Pave-air	MB-VR
Air Entrainment Type:	Neutralized vinsol resin	Neutralized vinsol resin
Air Entrainment Quantity:	6.0 fl oz/yd^3	As required
Water/Cementitious Materials Ratio:	0.25	0.39

(4) Concrete mix proportions included in the Special Provisions. Contractor was allowed to change the water reducer.

B. Measured Properties of Approved Mix

	Girders	Deck
Slump:	6 in	5-7 in
Air Content:	4% ± 1%	6.5 ± 1.0%
Unit Weight:	147.4 lb/ft^3	139.7 lb/ft^3
Compressive Strength:	12,280 psi at 7 days 14,065 psi at 28 days	5135 psi at 14 days 6140 psi at 28 days
Modulus of Elasticity:	6200 ksi at 7 days 7200 ksi at 28 days	4240 ksi at 7 days 4700 ksi at 28 days
Modulus of Rupture:	— —	660 psi at 7 days 800 psi at 28 days
Chloride Permeability: (AASHTO T 277)	158 coulombs at 2 days after curing at 100 ^{o}F	1207 coulombs at 90 days

6. CONCRETE MATERIAL PROPERTIES

A. Measured Properties from QC Tests of Production Concrete for Girders

Cement Composition: —
Actual Curing Procedure for Girders: Radiant heat
Maximum Girder Temperature: 140 ^{o}F

Air Content, Slump, and Compressive Strength:

Fabrication No.	Girder	Air Content, %	Slump, in	Concrete Age, days	Compressive Strength, psi
1	G2	4	8	28	16,400
				41	17,390
	G2	3	5.5	28	14,980
				41	15,880
2	G2	5	10.5	28	16,380
				37	17,030
	G2	5	6.5	28	16,220
				37	16,870
3	G1	6.5	9	28	16,390
	G3	4	9	28	16,390
4	G7	4	9	28	14,560
	G8	4.1	8.25	28	16,310
5	G6	3.5	8	28	15,910
	G5	3.5	8	28	14,800
6	G5	3	8	28	16,630
	G4	3	8.5	28	15,790
Average		4	8	28	15,900

Curing Procedure for Cylinders: —

B. Measured Properties from QC Tests of Production Concrete for Deck

Cement Composition: —
Actual Curing Procedure for Deck: Soaker hose under wet burlap and plastic cover
Compressive Strength: —
Curing Procedure for Cylinders: —

C. Measured Properties from Research Tests of Production Concrete for Girders

Compressive Strength:

All compressive strength values are in psi.

Fabric-aton/ Girder No.	Concrete Age, days							
	1	3	7	14	28	56	180	365
1/1	7200	9830	11,880	13,800	15,350	16,180	—	—
1/2	—	—	12,140	14,200	15,950	16,780	18,000	—
2/1	6120	8670	10,740	12,960 (5)	14,100	14,700	—	—
2/2	—	8950	11,350	13,300 (5)	14,860	15,400	—	—
3/1 (6)	6430	9510 (7)	11,020	12,800	13,200	14,200	14,300	15,680
3/1 (8)	6430	10,600 (7)	12,140	12,940	13,840	14,230	15,140	15,100
3/2 (6)	6060	10,400 (7)	11,770	13,790	14,630	15,660	16,530	17,200
3/2 (8)	6060	11,330 (7)	13,000	14,070	15,320	14,990	16,240	16,450
4/1	—	—	12,630	—	15,560	15,740	—	—
4/2	—	—	13,170	—	15,930	16,540	—	—
5/1	—	—	11,710	—	14,070	14,480	—	—
5/2	—	—	11,720	—	14,810	15,360	—	—
6/1	—	—	12,410	—	16,500	16,690	—	—
6/2	—	—	11,900	—	15,950	17,300	—	—
Average	—	—	11,970	—	15,005	15,590	—	—

All results are the average values from three 4x8-in cylinders.
(5) Tested at concrete age of 15 days.
(6) Moist cure.
(7) Tested at concrete age of 4 days.
(8) Companion cure in the field with the girders.

Modulus of Elasticity:
(ASTM C 469)

Concrete Age, days	4	7	14	28	56	181	365
Compressive Strength, psi	10,460	12,090	13,390	14,320	14,750	15,600	16,230
Modulus of Elasticity, ksi	6270	6600	6890	7280	7180	7010	7020

All results are the average values from four tests on 4x8-in cylinders.

Coefficient of Thermal Expansion (9): May to August 2000 – 7.53 and 7.41 millionths/^{o}F
May to July 2001 – 7.56 and 7.49 millionths/^{o}F

(9) Measured using vibrating wire strain gages in two 6x6x12-in prisms stored in an outdoor environment.

Chloride Permeability (10):
(AASHTO T 277)
All permeability values are in coulombs.

Fabrication No.	Truck No.				Average
	1		2		
	Sample No.				
	1	2	1	2	
1	43	41	41	42	42
2	66	76	74	82	75
3	72	68	64	70	69
4	57	57	74	56	61
5	108	64	71	79	81
6	58	51	71	65	61
Average					65

(10) Tested at 90 days.

D. Measured Properties from Research Tests of Production Concrete for Deck

Compressive Strength:
All values of compressive strength are in psi.

Sample No.	Concrete Age, days						
	3	7	14	28	90	191	365
1	4030	5300	6730	7530	8260	8140	8510
2	3740	5020	6100	6830	7560	7820	8080
3	3720	5040	5960	6960	7520	7900	8290
4	3640	4960	5970	6750	7430	7890	8280
5	3990	5290	6490	7290	8000	8410	8570
Average	3830	5120	6250	7070	7750	8030	8350

All results are the average values from three 6x12-in cylinders.

Modulus of Elasticity:
(ASTM C 469)

Concrete Age, days	3	7	14	28	91	191	365
Compressive Strength, psi	3750	5170	6090	7120	7840	7820	8150
Modulus of Elasticity, ksi	3840	4510	4900	5220	5140	5340	5370

All results are the average values from three tests on 6x12-in cylinders.

Modulus of Rupture:

Range	715-828 psi
Average	775 psi
Range MOR/$\sqrt{f'_c}$	8.50-9.85
Average MOR/$\sqrt{f'_c}$	9.22
Concrete Age	28 days

Coefficient of Thermal Expansion (11): May to August 2000 – 7.50 and 7.47 millionths/^{o}F
May to July 2001 – 7.68 and 7.59 millionths/^{o}F

(11) Measured using vibrating wire strain gages in two 6x6x12-in prisms stored in an outdoor environment.

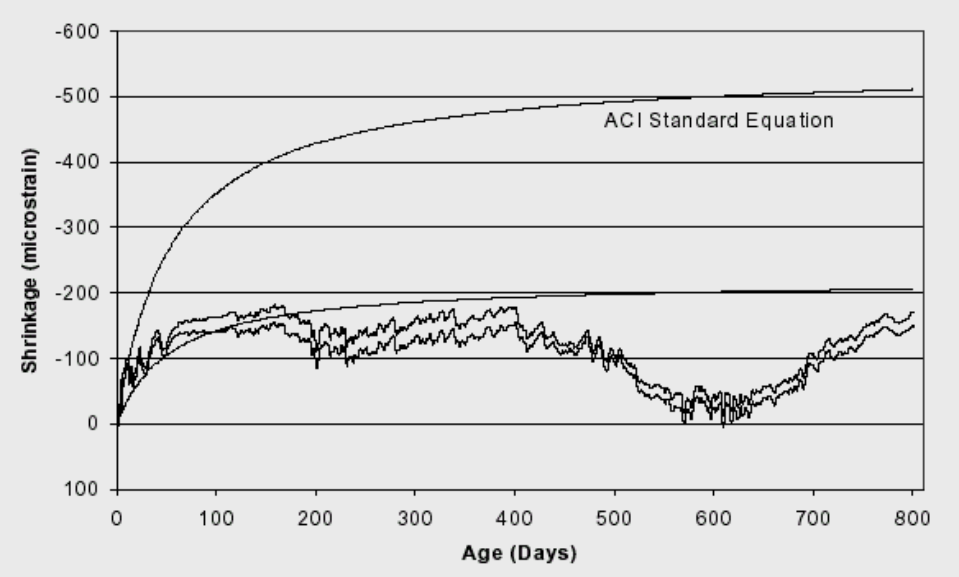
Chloride Permeability (12):
(AASHTO T 277)

Specimen No.	Chloride Permeability, coulombs			
D1	281	323	323	342
D2	359	414	535	534
D3	439	582	482	560
D4	625	654	581	622
D5	300	484	432	355
Average	461			

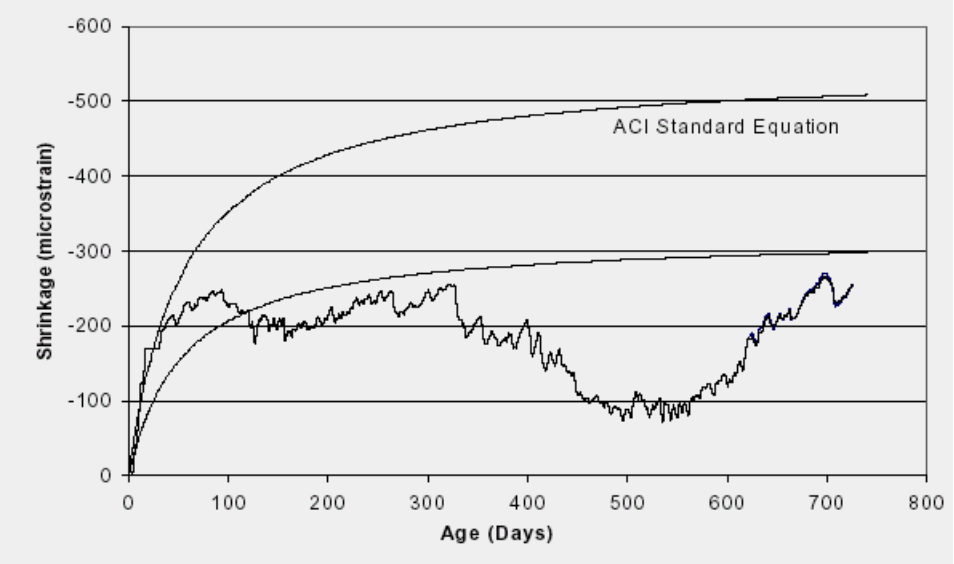
(12) Tested at 90 days.

7. OTHER RESEARCH DATA

Shrinkage (13):



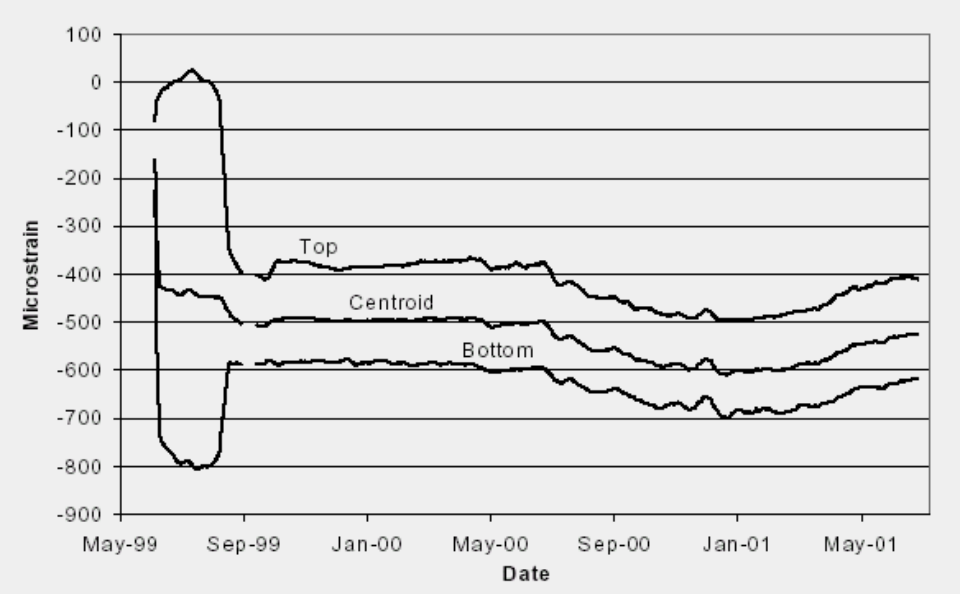
Girder Concrete



Deck Concrete

(13) Shrinkage strains measured using vibrating wire strain gages in two 6x6x12-in prisms in an outdoor environment.

Girder Strains (14):



(14) Strains were measured at four vertical locations at midspan of two girders. Values at top, centroid, and bottom were determined by linear regression analysis from each set of four readings. The strains for each day were then averaged and the results from each girder averaged. See section 10 for location of gages.

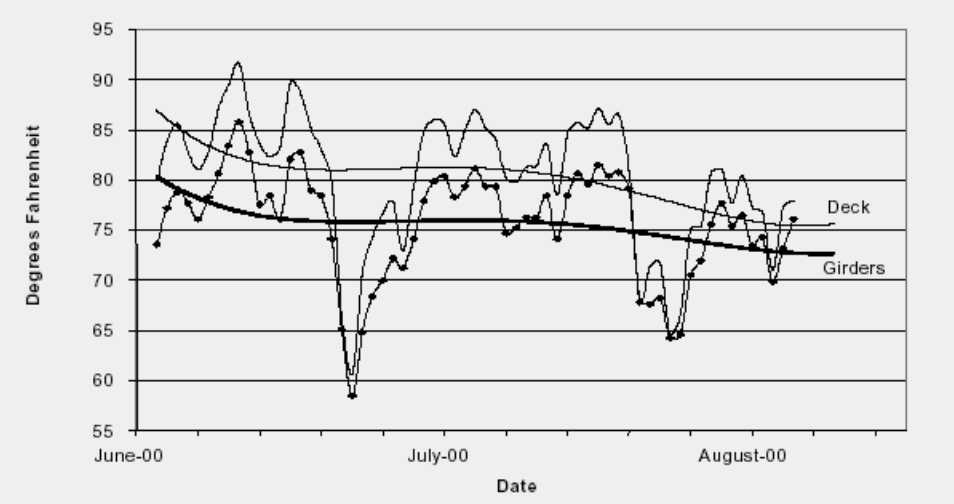
Deck Strains (15):

Middepth Deck Strains at Midspan

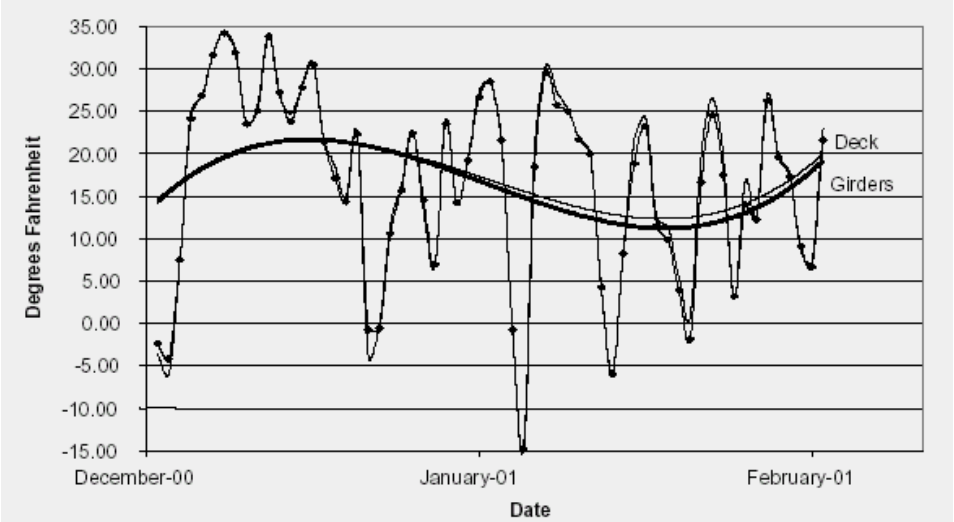
Middepth Deck Strains at the Bent

(15) Strains were measured at two vertical locations and then computed for the middepth locations. Bridge B1 is northbound. Bridge B2 is southbound. Strains are shown with and without shrinkage.

Temperatures:
Highest measured temperature of the deck during curing was 127 ^{o}F about 23 hours after concrete placement.



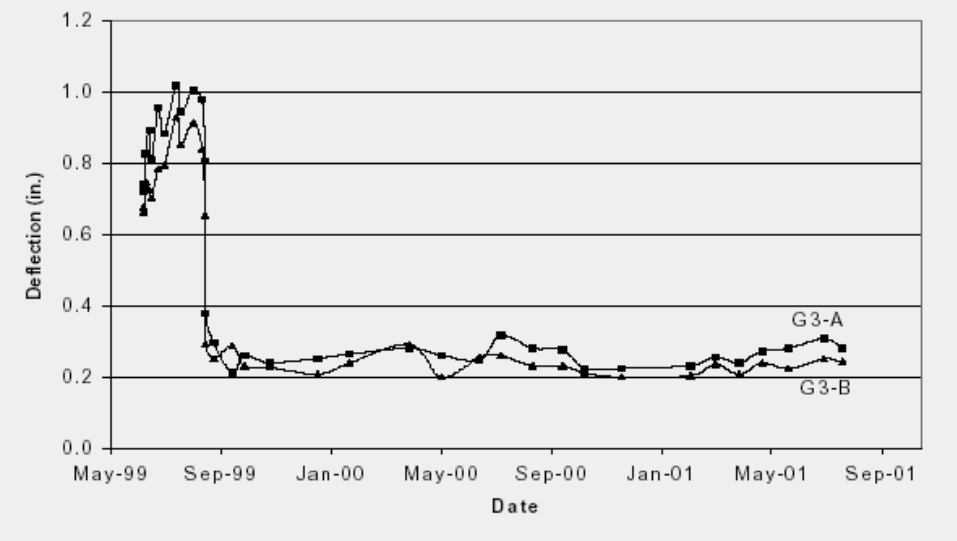
Average Girder and Deck Temperatures in Summer (16)



Average Girder and Deck Temperatures in Winter (16)

(16) Values are the daily averages of all temperature sensors. Smooth lines are trend lines.

Camber:



Midspan Deflection

Camber (17)	Girder	
	G3-A	G3-B
Instantaneous Camber	0.74	0.67
Maximum Camber	1.00	0.93
Deck Placement Deflection	-0.33	-0.36
Average Deflections		
Winter 1999	0.25	0.21
Summer 2000	0.29	0.25
Winter 2000	0.23	0.20
Summer 2001	0.29	0.24

(17) All values are in inches. Positive values are an upward deflection.

8. OTHER RELATED RESEARCH

For the high-strength concrete used in the bridge girders, 12 mixes were made with various percentage replacements of the cement with silica fume and various water-cementitious materials ratios.

For the HPC used in the deck, ten mixes were investigated for both quartzite and limestone aggregates. In each mix, the percentage of cement replaced by fly ash was varied while keeping the water-cementitious materials ratio approximately constant at 0.40.

All concretes were tested for slump, air content, unit weight, compressive strength, modulus of elasticity, modulus of rupture, and chloride permeability. Test results are given in the final report listed in section 9.

Crack Survey:

In August 2001, an underside crack survey was conducted from the ground. Transverse cracks were observed. Nearly all the cracks exhibited calcium carbonate precipitation.

Span	No. of Cracks	Spacing of Cracks, ft
North	38	6.0
Middle	82	3.3
South	43	5.5

9. SOURCES OF DATA

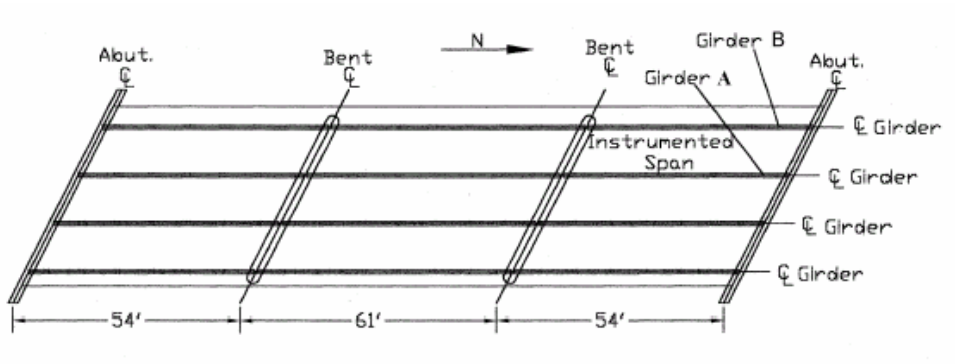
Ramakrishnan, V. and Sigl, A., "Evaluation of High Performance Concrete in Four Bridge Decks as well as Prestressed Girders for Two Bridges," Report No. SD1998-06-F, South Dakota Department of Transportation, December 31, 2001, 180 pp. plus Appendices.

Eisenbeisz, H. G., " South Dakota's First HPC Bridge," HPC Bridge Views, Issue No. 16, July/August 2001, p. 1.

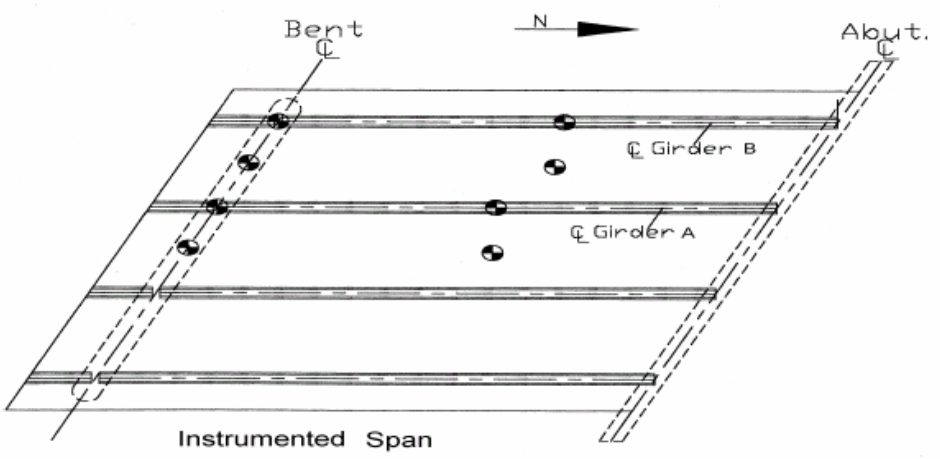
Hadly G. Eisenbeisz, State of South Dakota, Department of Transportation, Pierre, SD.

Daniel Strand, State of South Dakota, Department of Transportation, Pierre, SD.

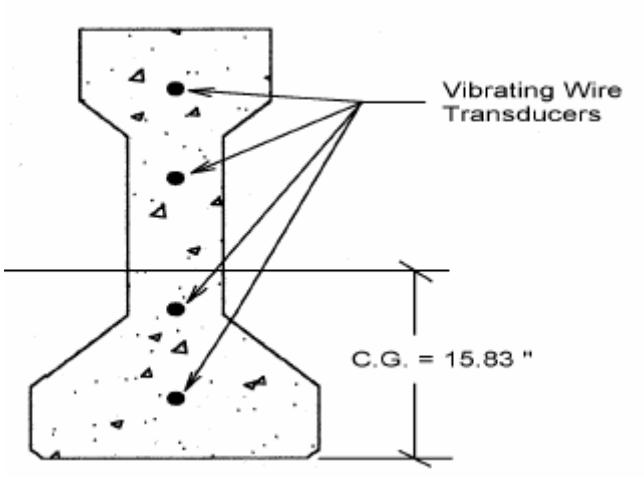
10. DRAWINGS



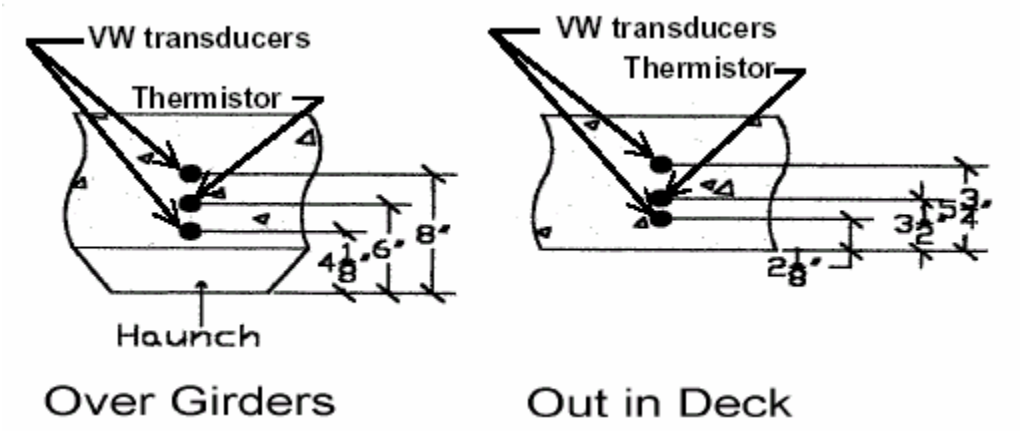
Girder Instrumentation Locations



Deck Instrumentation Locations



Location of Instrumentation in Girders



Location of Instrumentation in Decks

STATE OF SOUTH DAKOTA
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
HIGH STRENGTH PRESTRESSED BEAMS

IM 029-3(82)84, PCEMS 3784
MINNEHAHA COUNTY

OCTOBER 28, 1998

The following specified revisions shall be made to Section 490 of the South Dakota Department of Transportation Standard Specifications for Roads and Bridges.

Delete the first paragraph of Section 490.2 B.3. and replace it with the following.

3. The Contractor shall submit a concrete job mix design for approval and produce a trial batch of 3-5 cubic yards for testing by the Department thirty working days prior to fabrication. The trial batch can be used anywhere by the Contractor. Adequate notice shall be given to the Department prior to batching the trial mix so testing can be scheduled. The mix design shall include all admixtures proposed for use and shall contain a minimum of 58 percent coarse aggregate by weight.

In lieu of an approved mix design and trial batch, the contractor may use the following mix proportions:

Cement Type II	630lb/Cu. Yd.
Fine Aggregate	1200lb/Cu. Yd.
Course Aggregate (quartzite)	1825lb/Cu. Yd.
Water	189lb/Cu. Yd.
Silica Fume	70lb/Cu. Yd.
Air	6.5% ±1.0%

The air-entraining agent MB-VR Standard (Master Builders) shall be used.

For informational purposes - Trial mixes used a high range water reducer (RHEOBUILD 1000 Master Builders) at 26.7oz/cwt of cementitious material. The trial mixes had a 7-day strength of 12280 psi and a 28 day strength of 14065 psi.

For informational purposes – Silica fume concrete mixes typically require more air entraining agent than normal mixes to get the desired air content. Due to rapid slump loss in silica fume concrete mixes, slump should be increased approximately 2 inches from the normal slump used. Mixing times may need to be increased and the volume of concrete mixed in truck mixers may need to be decreased to achieve good uniformity.

Add the following to Section 490.2 B.

4. Silica Fume shall conform to the Special Provision for Silica Fume.

Delete the first paragraph of 490.3 F and replace it with the following.

F. Concrete Cure: The beams shall be cured by low pressure steam or radiant heat with 100% humidity maintained within the curing enclosure until the concrete has gained sufficient strength for prestress transfer.

The Department will supply instrumentation for and monitor the humidity.

Delete section 490.5 and replace it with the following.

BASIS OF PAYMENT: Prestressed beams will be paid for at the contract unit price per each. Payment will be full compensation for furnishing and transporting the beams to the project site. Payment includes reinforcing bars, prestressing steel, and all other accessories embedded in the beam.

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STATE OF SOUTH DAKOTA
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
HIGH PERFORMANCE CONCRETE BRIDGE DECK

IM 029-3(82)84, PCEMS 3784
MINNEHAHA COUNTY

DECEMBER 12, 1998

The following specified revisions shall be made to Section 460 of the South Dakota Department of Transportation Standard Specifications for Roads and Bridges.

Change the following in Section 460.2.

J. Fly Ash: See the Special Provision for Fly Ash.

Add the following to Section 460.2.

K. Silica Fume: See the Special Provision for Silica Fume.

L. Evaporation Retardant: The evaporation retardant shall be one of the following or an approved alternate:

SIKAFILM Sika Corporation Aurora, Colorado (303)337-1713	E-CON L&M Construction Chemicals, Inc. Omaha, Nebraska (402)453-6600
CONFILM Master builders, Inc. Cleveland, Ohio (800)MBT-9990	FINISHING AID Symons Corporation Des Plaines, Illinois (847)298-3200

Delete the second, third and fourth paragraph of Section 460.3 A and replace it with the following.

The concrete job mix design is based on 4500 psi 28 day compressive design strength and shall consist of the following mix proportions:

Cement Type II	511 lb/Cu. Yd.
Fine Aggregate	1100 lb/Cu. Yd.
Course Aggregate (quartzite)	1725 lb/Cu. Yd.

Water	264 lb/Cu. Yd.
Fly Ash	118 lb/Cu. Yd.
Silica Fume	55 lb/Cu. Yd.
Air	6.5% ±1.0%
Slump	5 to 7 inches

The air-entraining agent MB-VR Standard (Master Builders) shall be used.

A mid range water reducer shall be used conforming to ASTM C494, Type A or D.

For informational purposes - Trial mixes used a mid range water reducer (Polyheed-997 Master Builders) at 8.0 oz/cwt of cement. The trial mixes had a 14-day compressive strength of 5135 psi and a 28 day strength of 6140 psi.

A test pour, with the above mix, shall be conducted a minimum of 30 days prior to the deck pour. The location for the test pour will be coordinated through the Engineer and will be on the project if possible. The test pour shall consist of an unreinforced slab 40’ wide, 36’ long, and 9” thick. The test pour shall be set up, placed, finished, and cured – including the use of fogging equipment – in the same manner the bridge deck will be done. An exception is that the last 10’ of the test pour shall not be fogged but instead shall have an evaporation retardant applied immediately behind the carpet drag on the finish machine. Following the initial application of the evaporation retardant, the test pour slab shall be given a grooved finish using a metal tine as per Section 460.3.O(4). Following the metal tine grooving, the evaporation retardant shall be reapplied. Application of the evaporation retardant shall be in accordance with the manufacturer's instructions. Re-application of the retardant is necessary whenever the fugitive dye in the retardant is no longer visible. The evaporation retardant shall be reapplied as necessary until the concrete is covered with wet burlap. Placing High Performance Concrete in the bridge deck will not be allowed until successful completion of a test pour. Successful completion is defined as achieving concrete compressive strengths in excess of the minimum specified and demonstrating a successful fogging and curing operation with minimal cracking of the test pour. If it is necessary to adjust mix design or procedures, the Engineer will order a second test pour which will be paid for at the unit price bid. The Contractor may be required to dispose of the test pour slab(s). If required, test pour slab(s) shall be

removed and disposed of on a site obtained by the Contractor and approved by the Engineer in accordance with the WASTE DISPOSAL NOTES found in the grading plans. Payment shall be at the unit price bid for Remove Test Slab.

For informational purposes – Silica fume concrete mixes typically require more air entraining agent than normal mixes to obtain the desired air content. Slump requirements are higher due to rapid slump loss in silica fume concrete mixes. Mixing times may need to be increased and the volume of concrete mixed in truck mixers may need to be decreased to achieve uniformity in the mix.

Add the following to Section 460.3.B

4. Fogging Equipment: Fogging equipment shall be capable of applying a fine fog (maximum average water droplet size no larger than 75 microns), NOT A SPRAY, over the entire exposed concrete surface from immediately behind the finish machine to the closest point at which wet burlap has been placed on the deck.

The manufacturer’s literature, equipment specifications, and operating instructions for the fogging equipment shall be submitted to the Office of Bridge Design for approval prior to use on the test pour.

5. Deck Grooving Equipment: Deck grooving shall be done with a mechanized multi-blade saw capable of sawing 1/8″ wide by 3/16″ deep grooves at 1″ spacing in the concrete deck.

Add the following to Section 460.3 N.

High Performance Bridge Decks shall be cured as follows:

As soon as the bridge deck concrete has been struck off and finished by the finish machine, it shall be given carpet drag finish with the carpet drag attached to the finish machine. Fogging with approved fogging equipment shall begin immediately behind the finish machine and shall continuously fog the entire exposed surface until wet burlap is applied. Fogging will be considered inadequate when the relative humidity is less than 85% within 6″ above the deck surface, in which case fogging must be immediately applied or the area of coverage increased. The Engineer will monitor relative humidity. Wet burlap shall be placed as soon as the concrete surface will support it without deformation. The

burlap shall be kept continuously and thoroughly wet with soaker hoses for not less than seven days after placing the concrete. Polyethylene sheeting shall be placed over the wet burlap and soaker hoses as soon as the concrete can be walked on without damaging it. Bridge deck grooving shall be sawed into the surface at least 14 days after the deck pour. Grooving shall be cut transverse to the centerline of the roadway, succeeding passes shall not overlap and it shall terminate one foot from the barrier curb.

Curing compound will not be allowed unless fogging is ineffective due to high winds or equipment malfunction. Therefore, the Contractor shall have curing compound and equipment to apply it on the job site and ready for use as a backup to fogging. Because wind can cause fogging to be ineffective, the Contractor shall attempt to pour the bridge deck when light winds are forecast. The Contractor will not be allowed to pour when winds are in excess of 20 mph at the start of the pour.

Change the first sentence under bridge deck finishing machine minimum requirements in Section 460.3 O.4. to the following:

The finishing machine shall be a self-propelled rotating cylinder type with two or more rotating steel cylinders and augers.

Add the following to Section 460.4.

METHOD OF MEASUREMENT: The test pour and high performance concrete bridge deck will be measured with neat line dimensions computed to the nearest 0.1 cubic yard. Bridge Deck Grooving will be measured to the nearest 0.1 square yard.

Add the following to Section 460.5.

BASIS OF PAYMENT: The test pour and high performance concrete bridge deck will be paid for at the contract price per cubic yard. Payment will be full compensation for all labor, equipment, tools, materials, and other items required to furnish, place, finish and cure the High Performance Concrete.

Bridge Deck Grooving will be paid for at the contract unit price per square yard. Payment will be full compensation for all labor, equipment, tools, materials, and other items required to groove the bridge deck.

Remove Test Pour will be paid for at the lump sum contract price. Payment will be full compensation for all labor, equipment, tools, materials, and other items required to remove the test pour slab.

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