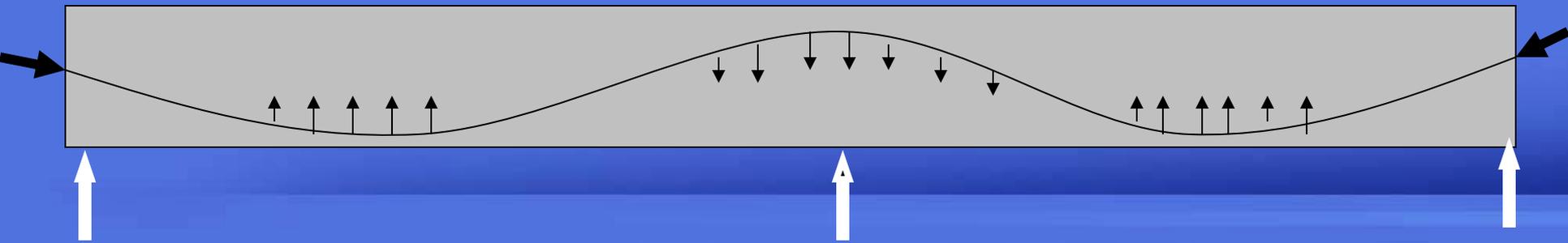


Post-tensioning Workshop

HQ Construction Office

Structural Mechanics

Tendon Path





Materials

Mill Certifications:

- Ducts
 - Area of Strands
 - Modulus of Elasticity (Max 3% variance)



5. 1. 2003 13:32



10.10.2003 08:54



10. 10. 2003 08:47

Standard Specs 9-07.10 Sampling & Testing





Pre-stressing Preparation

Before Post-tensioning

- Ram/gage Calibration Certs
- Ram Calibration Curve
- Strand Mill Certs
(Actual Strand Area and Modulus of Elasticity)
- Prepare The P.T. Record Form
- Study Plans, Approved Shop Drawings, Std. Specs, and Const. Manual
(See Handout)

INSTEEL WIRE PRODUCTS
1 Wiremill Road - Sanderson, FL 32087

MATERIAL CERTIFICATION

AVAR CONSTRUCTION SYSTEMS INC
C/O KIEWIT CONSTRUCTION
WOODINVILLE WA 98072

BILL OF LADING #: 122104

Date: 18-DEC-02

Insteel Wire Products hereby certifies that the specimens taken from strand package(s) consisting of one or more of the following Lot/serial numbers were tested in accordance with and met the requirements of ASTM A 416-99. The attached test report(s) represent the result of such test(s).

Material Description

.600 7W 270 LR ASTM A416 CAL WRAP W/TAILS Test Report Number 10009495

Lot/serial(s)	Heat #/Lot #
12012243450	41599
12012243473	
12012243475	
12012243476	
12012243477	
12012243485	
12012243486	

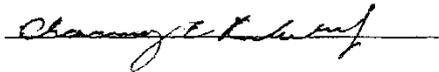
Insteel Wire Products hereby certifies that the material described above will bond to concrete of a normal strength and consistency in conformance with the prediction equations for transfer and development length given in the ACI / AASHTO specifications.

Insteel Wire Products Company certifies that the use of this product conforms with Buy America Requirements set forth in 23 CFR Subpart D, Section 635.410, Buy America Requirements and Title 49 Transportation, Chapter VI- Federal Transit Administration, Department of Transportation Part 661 - Buy America Requirements - Surface Transportation Assistance Act of 1982, As Amended.

ORDER NUMBER #: 146779

CUSTOMER PO #: 0109

Certification prepared by:



Verify Against Tested Samples

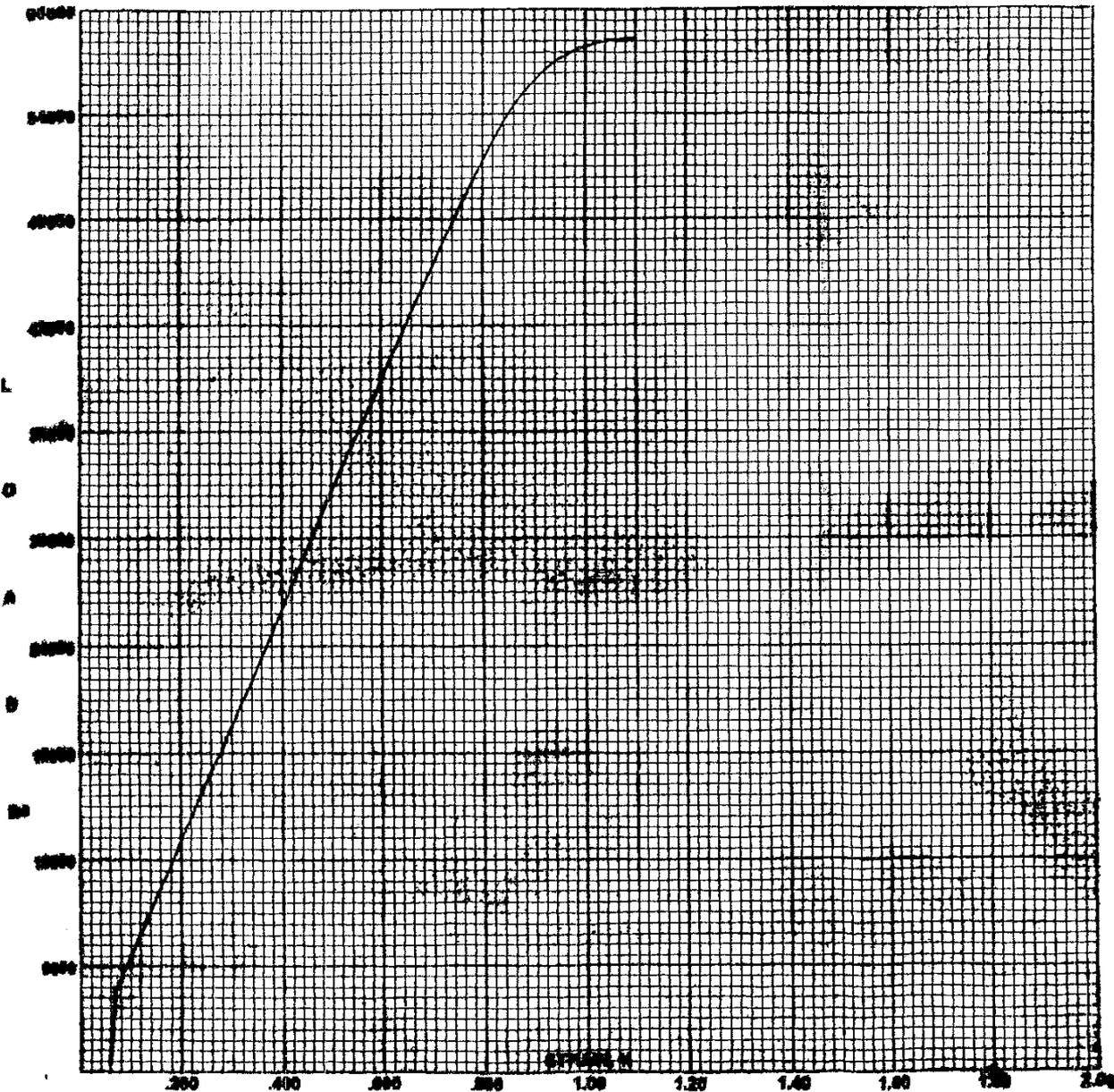
**Insteel Wire Products
Prestressed Concrete Strand**

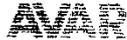
0.600 270 LOW RELAXATION

Team PC

Test Number:	10004486
Lot/Heat Number:	
Tested By:	CER
Ultimate Breaking Strength, lbs:	80200
Load @ 1% Extension, lbs:	57900
Ult. Elongation, %:	4.95
Representative Area, sq. in:	0.217
Actual Area, sq. in:	0.217
Avg Modulus of Elasticity, Mpa:	205

0.2168





AVAR Construction Systems, Inc.
 504 F. Vandell Way
 Campbell, CA 95008
 (408) 370-2100
 FAX (408) 370-2329

Chil. Contractors Lic. No. 448934

RAM CALIBRATION BY CALTRANS

RAM 6-8-7

December 12, 2002 OK UNTIL 6/10/03
comp.

Gauge # 6-8-7 A

Gauge # 6-8-7 B

<u>KIPS</u>	<u>PSI Average</u>	<u>KIPS</u>	<u>PSI Average</u>
200	1,450	200	1,500
400	2,850	400	2,900
600	4,300	600	4,350
800	5,700	800	5,750
1000	7,100	1000	7,150
1188	8,450	1188	8,500

U-XING 4,270

$20\% = 854 \text{ KN} = 192 \text{ Kips} = 1,390 \text{ ps.i} = 9.58 \text{ MPa}$
 $100\% = 4,270 \text{ " } = 960 \text{ Kips} = 6,820 \text{ " } = 47.02 \text{ MPa}$

HQ Construction will verify
 through CalTrans

RAM CALIBRATION CURVE

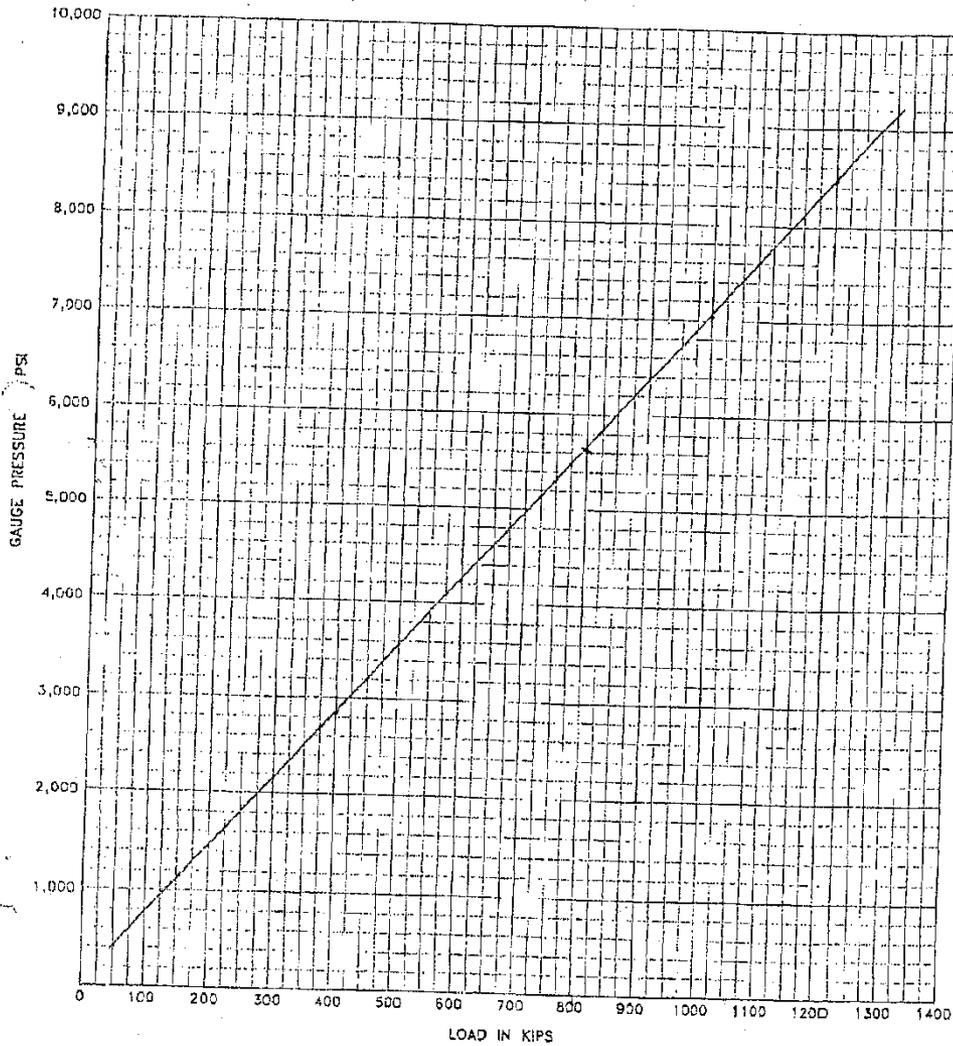
CALIBRATED BY: UNIVERSITY OF WASHINGTON

RAM NO: 6-8-8

DATE OF CALIBRATION: MAY 30 2000

GAUGE NO: 6-8-BB

LOAD CELL NO:



Shop Drawings

- Duct Diameter.& Strand Sizes and # / Duct
- Anchorage Type
- Tendon Geometry
- Verify Jack Size
- Stressing Sequence
- Vents & Drains
- Jacking Force & Seated Force
- Tendon Elongations

Elongation Adjustment

Delta = 0.8 X Elong. (From shop Plans)

Delta_(corrected) = Delta (A_(cal)/A_(act))(E_(cal)/E_(act))

Force Calculations

$$T_o = T_x e^{(KL + u \text{ Alpha})}$$

K = Wobble friction Coefficient

u = Angular Friction Coefficient

Alpha = Tendon Angle Change

Before Post-tensioning

- Min. Concrete Comp. Strength 4000 psi
(Unless Plans Specify)
- Remove Side Forms & Release Overhang Brackets Before Post-tensioning



Release Forms
Before Post-tensioning

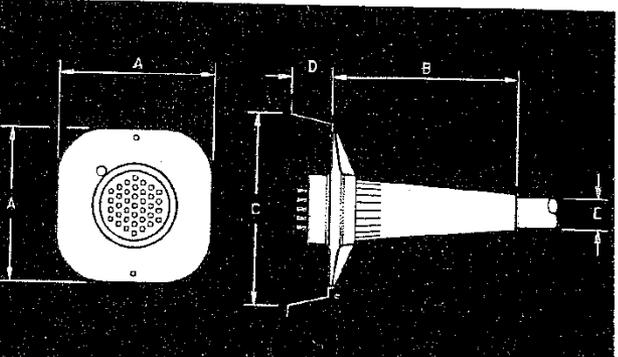




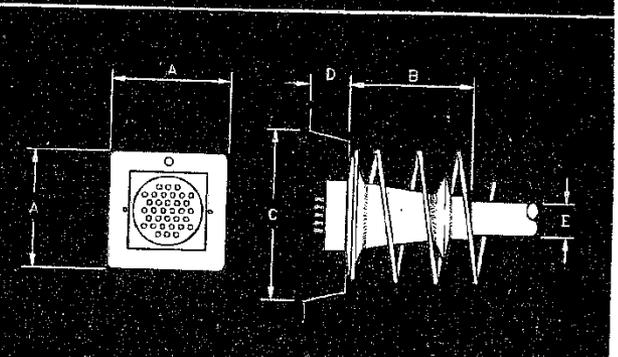


9. 4. 2003 11:48

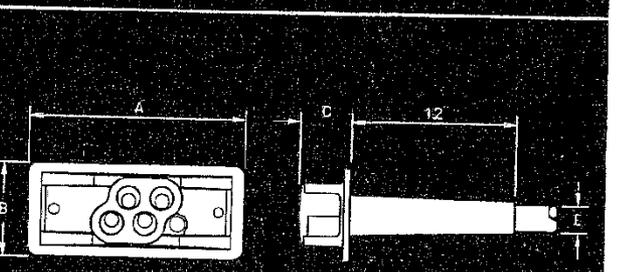
Anchorage	No. of Strands (1/2"-270K)	Ultimate Strength (Kips)	A	B	C	D	E Duct O.D.
SP 7.5	7	289	8 1/4	9	12	4 1/2	2 1/4
SP 12.5	12	496	11	14	14	4 1/2	2 7/8
SP 19.5	19	785	13 3/4	15 1/2	18	5	3 3/8
SP 27.5	27	1115	17 1/4	21 1/2	22	5 1/2	3 7/8
SP 37.5	37	1528	19 1/4	22 1/2	24	6	4 1/2
SP 47.5	47	1941	22	29	27	6 1/2	5
SP 61.5	61	2519	24 3/4	32	30	7	5 3/4



Anchorage	No. of Strands (1/2"-270K)	Ultimate Strength (Kips)	A	B	C	D	E Duct O.D.
MP 12.5	12	496	9	9	14	4 1/2	2 7/8
MP 22.5	22	909	12	12	18	5	3 3/4
MP 34.5	34	1304	15	15	24	6	4 1/2



Anchorage	No. of Strands (270K)	Ultimate Strength (Kips)	A	B	C	E Duct O.D.*
F 4.5	4	165	8 1/2	4 5/8	2 1/2	1 3/4
F 4.6	4	234	10 1/2	4 5/8	2 1/2	2

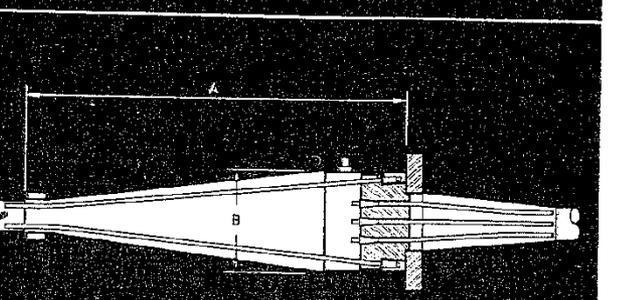


Strand Diameter for F 4.5: 1/2"

Strand Diameter for F 4.6: 0.6"

*As an option, 1" x 3" flat duct may be used

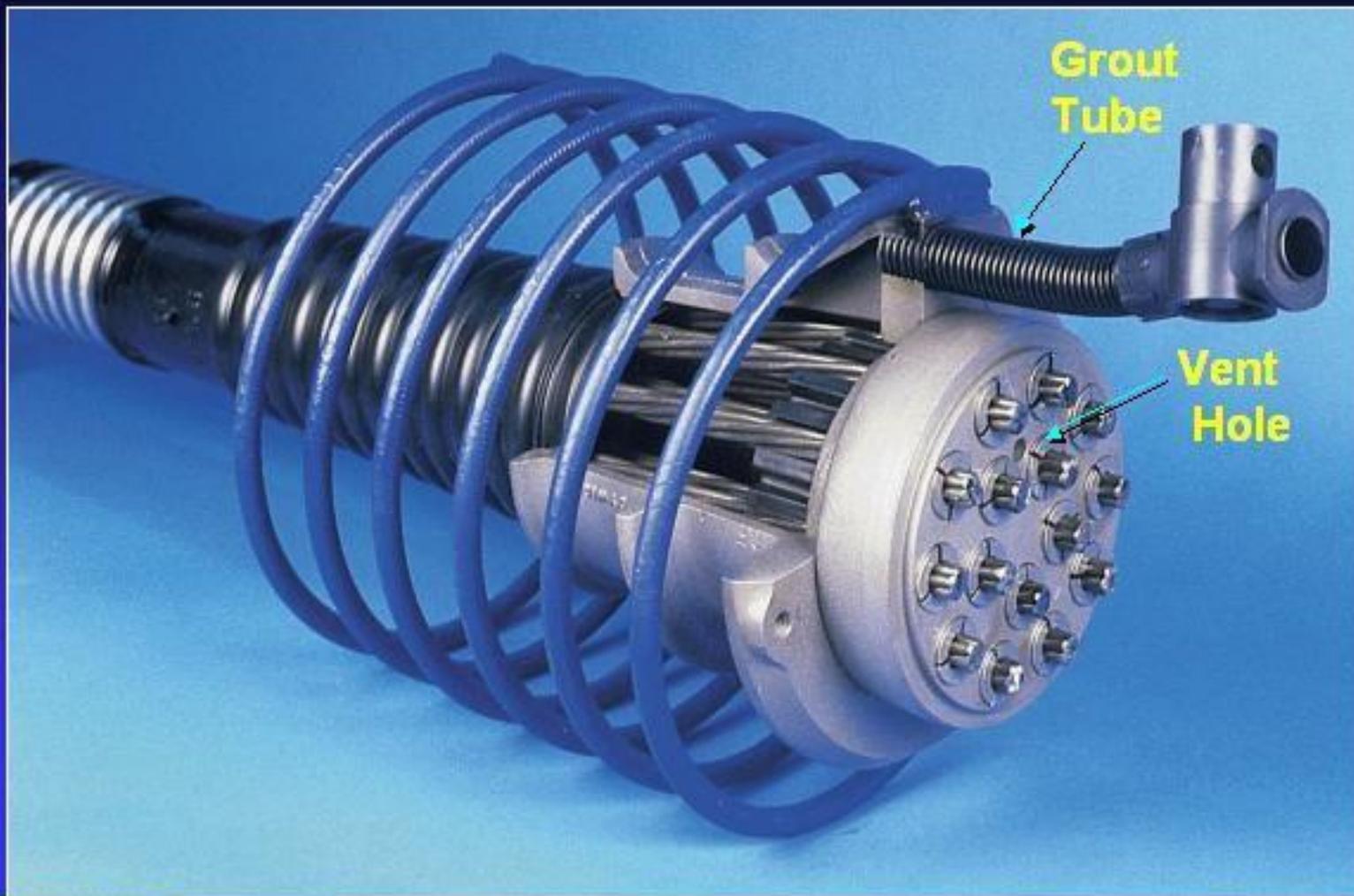
Anchorage	No. of Strands (1/2"-270K)	Ultimate Strength (Kips)	A	B		
C 12.5	12	496	30	9		
C 19.5	19	785	38	10 1/2		
C 27.5	27	1115	48	12		

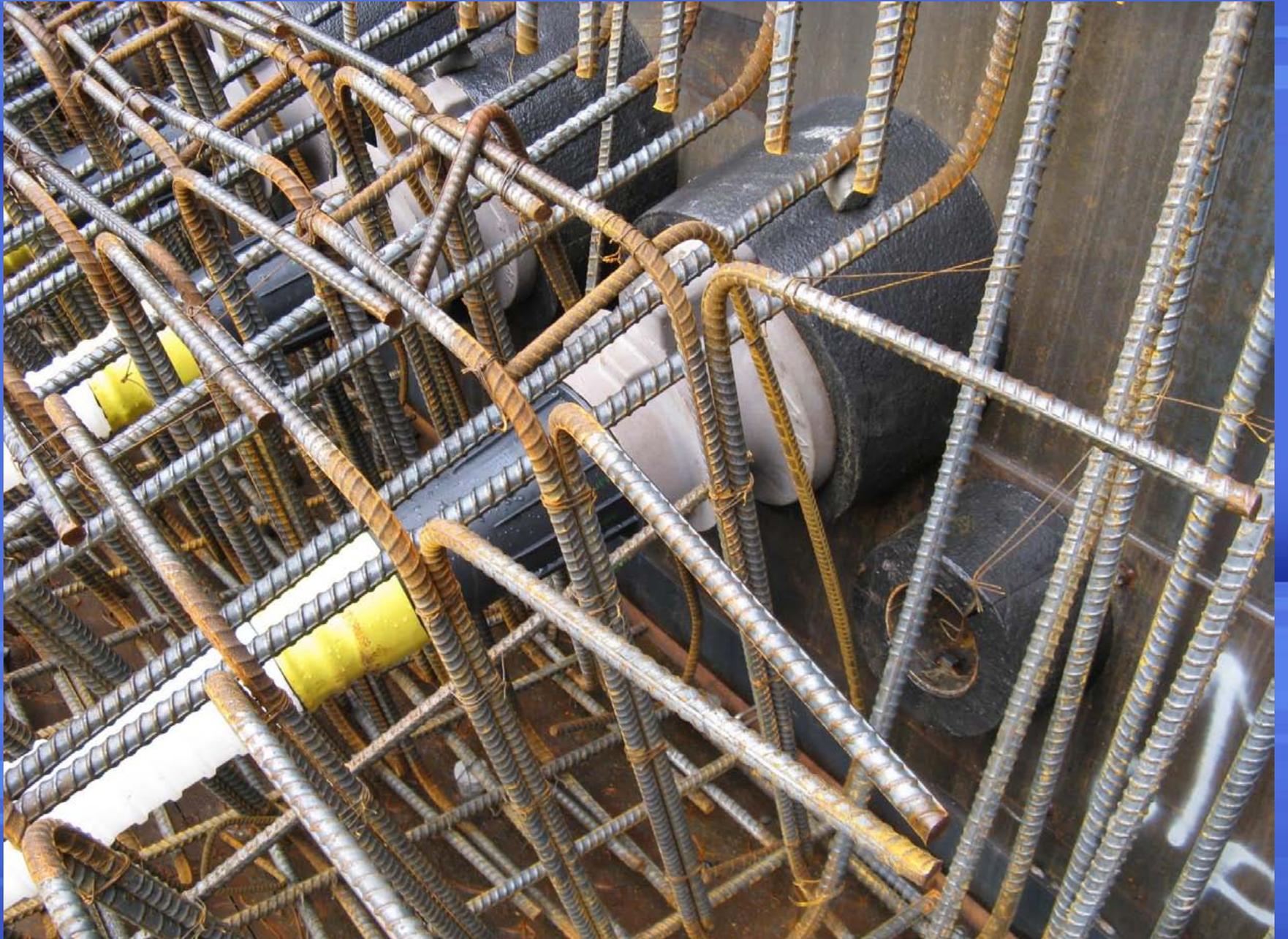


All dimensions are in inches

PRESTRESSING STRAND
ASTM A 416, Grade 270K; 1/2" Dia., Area 0.153 sq in

PT ANCHORAGE







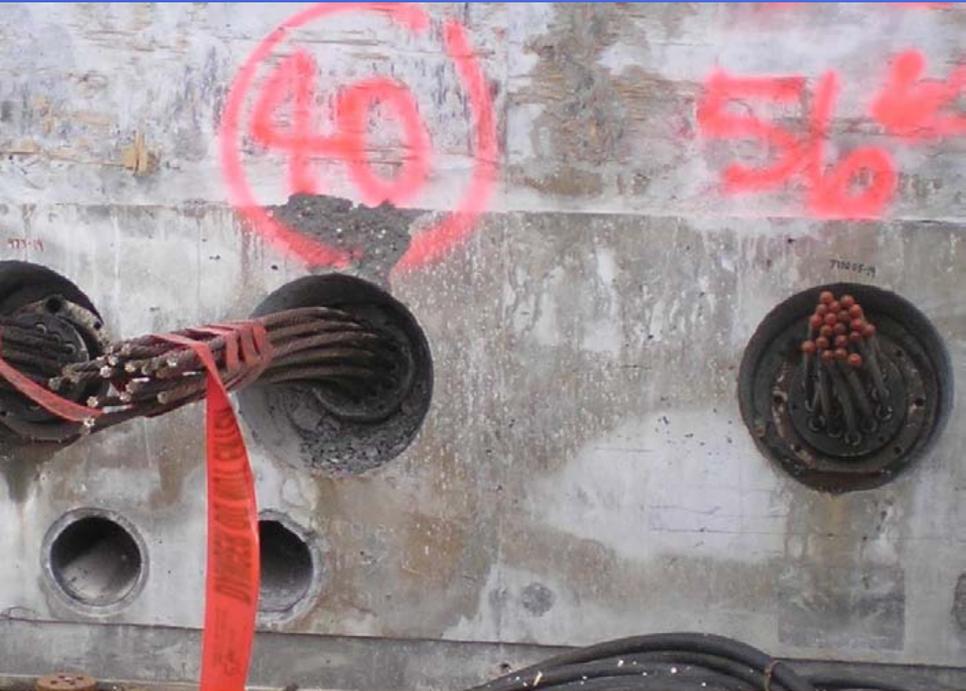






10.24.2003 09:23

Hood Canal Bridge





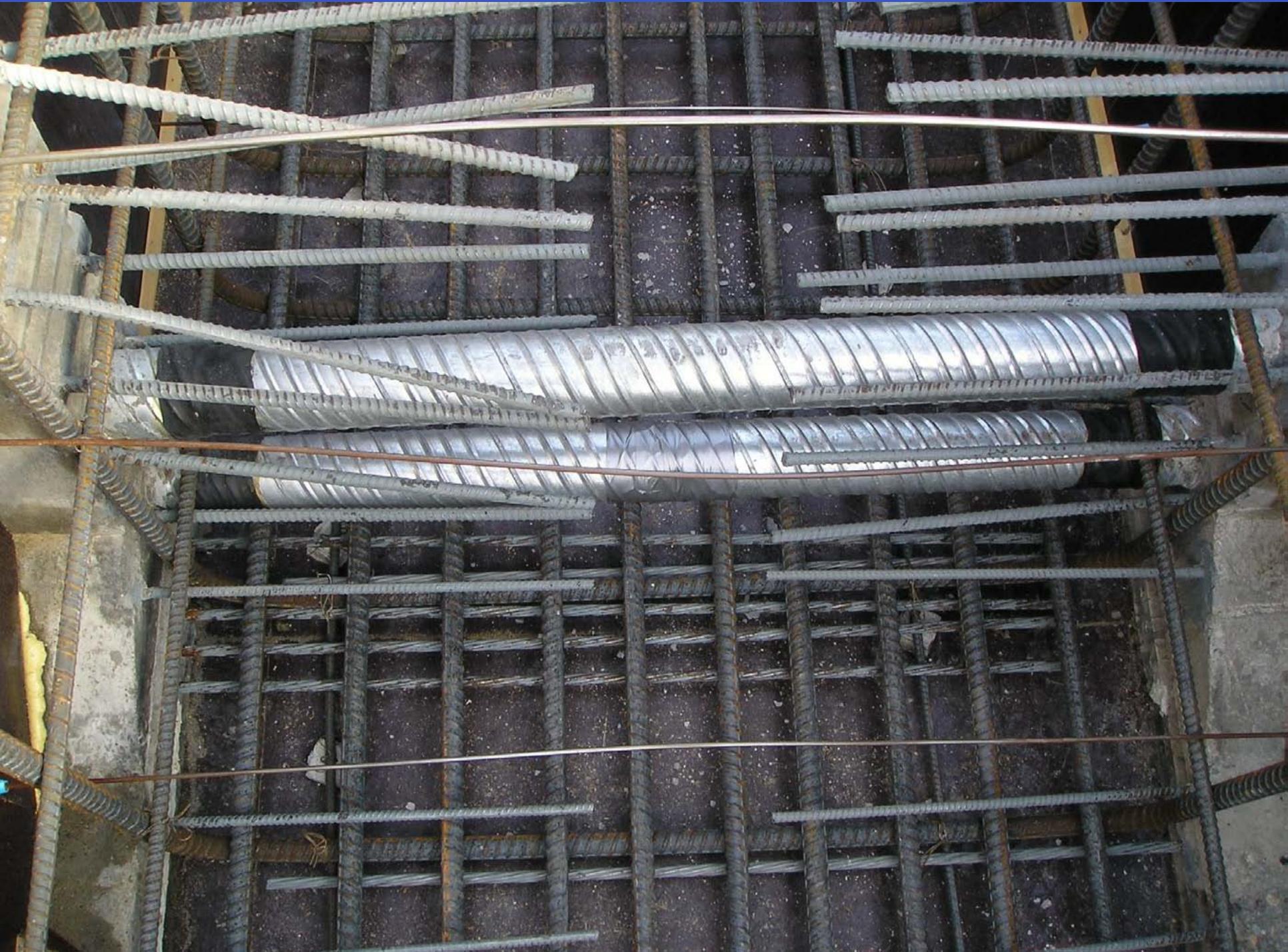
Excess Duct

Cracks

























Anchor Plate



Anchor Head



VPI Powder

- Needed when 7 days elapsed before grouting
- Highly toxic









Safety

- Do not stand in front of the tendons or ram at either end
- Avoid standing above the anchorages







10.28.2003 09:18



10.29.2003 08:48















Broken Strand – Eastern Region



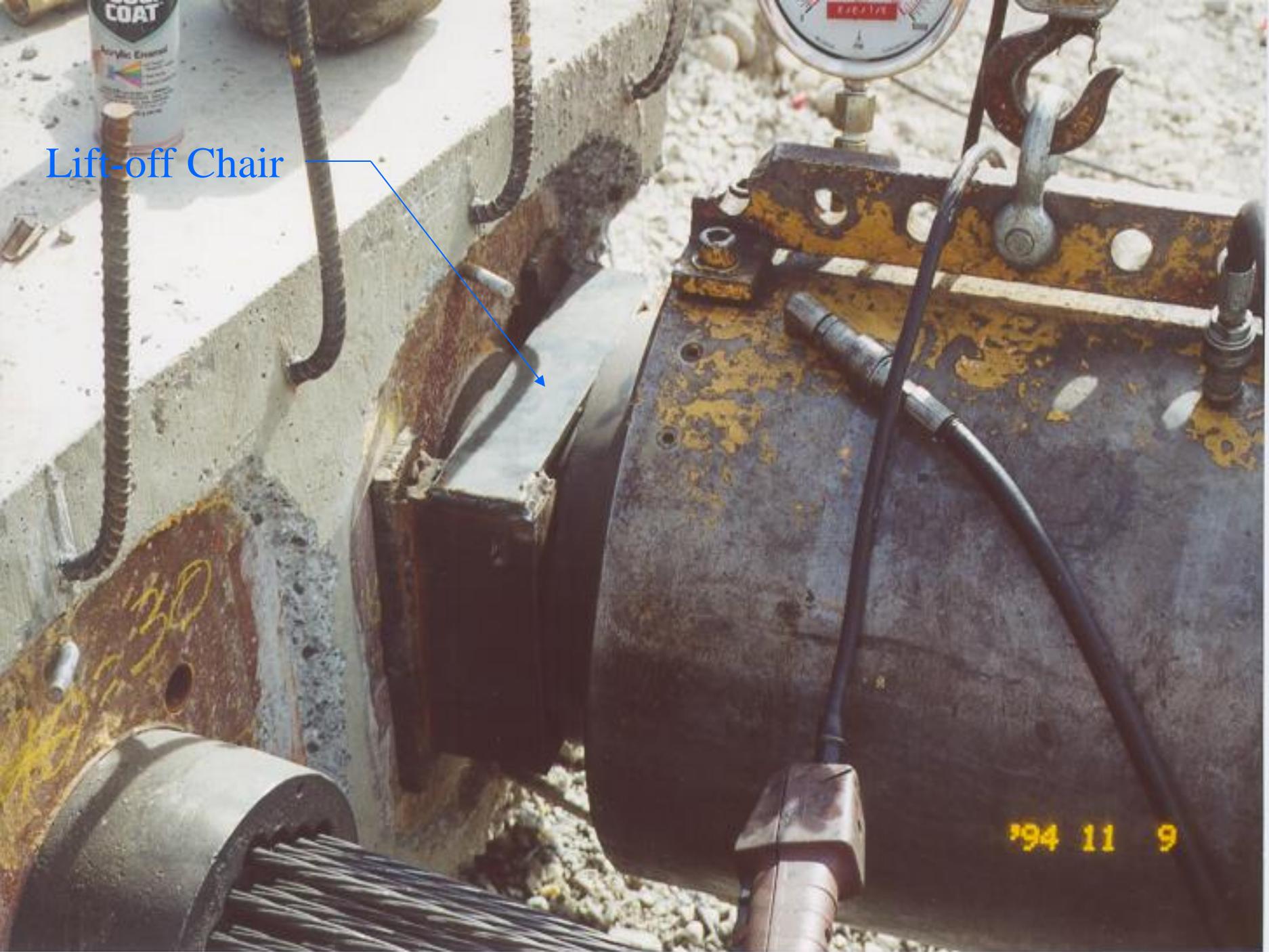


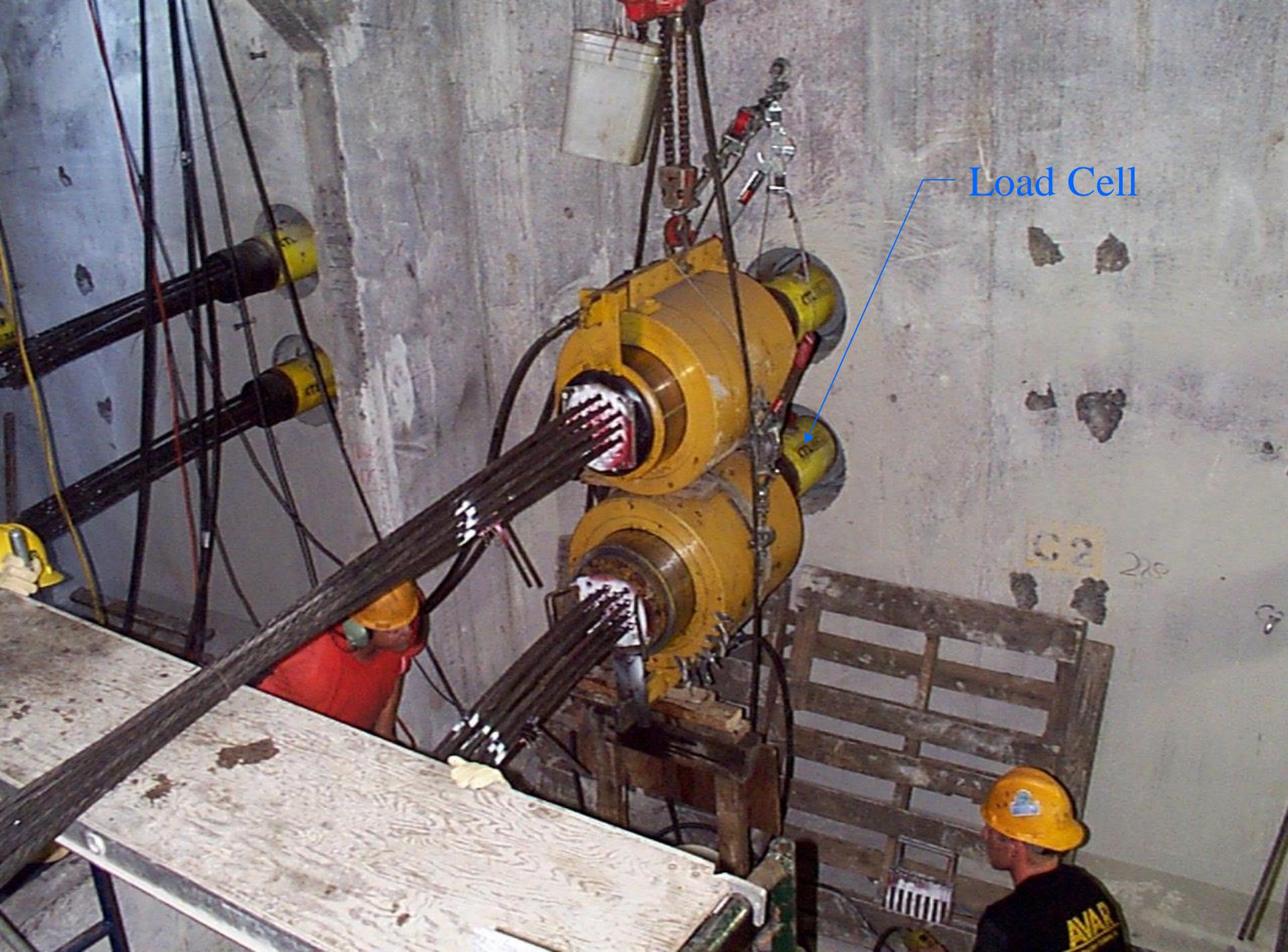


Lift-off Force Verification

- Elongation $> 107\%$ Calculated
- Elongation $< 93\%$ Calculated
- Lift-off Force $> 99\%$ Calculated $< 0.7 F's$

Lift-off Chair





Load Cell

Load Cell





High Strength Bar Tendons

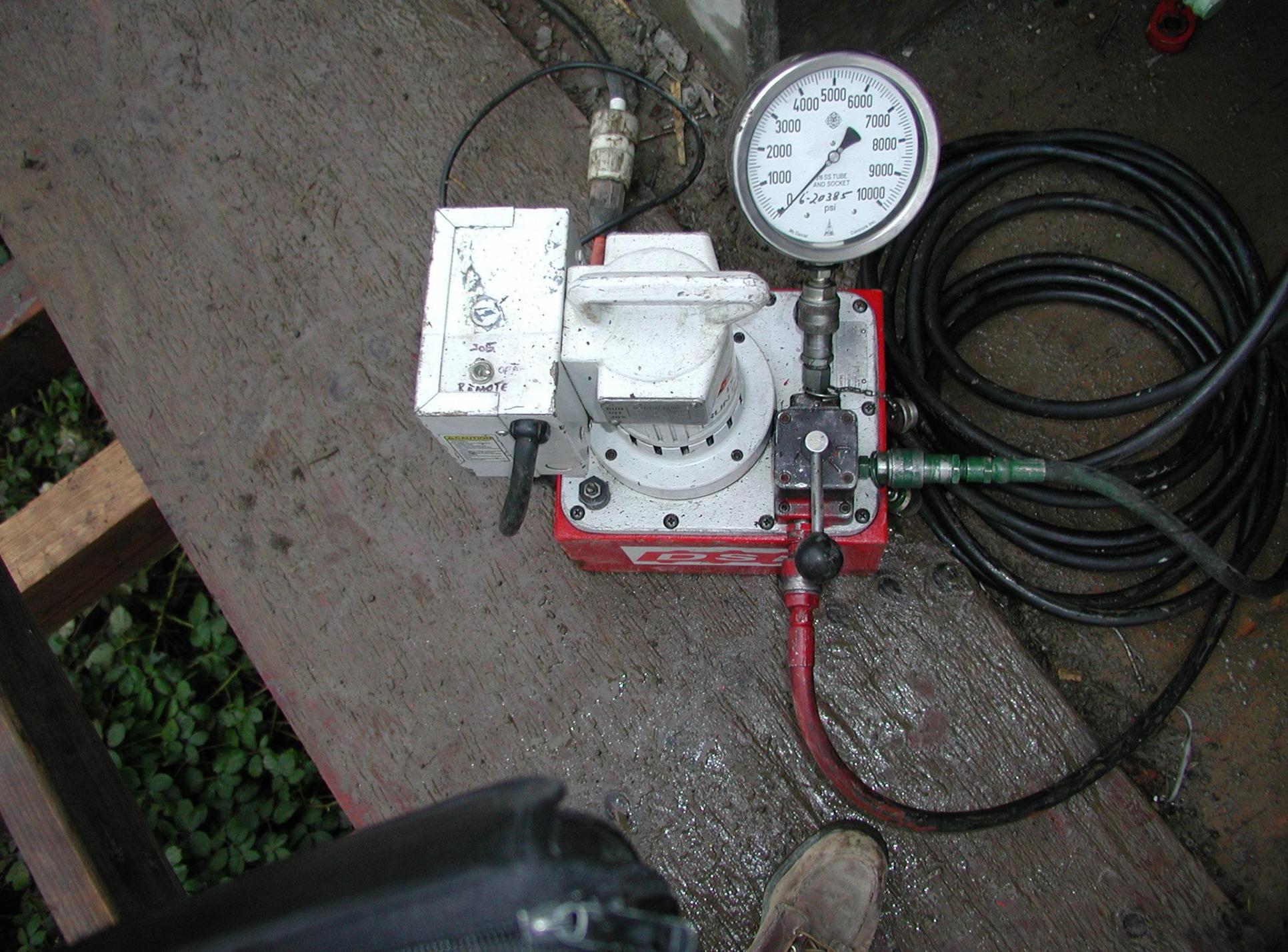




WARNING

DO NOT STAND WHEN STRESSING

75 A134
6-15



REMOTE

PSI



4.4.2003



4. 4. 2003

Grouting

- Non-segregating, thixotropic pre-packaged grout required.
- High-shear colloidal mixer (no paddle mixers)



Colloidal Mixers





ATTITUDE
WITH THE
RIGHT
ATTITUDE

SikaGrout 300 PT

SikaGrout



06/28/2012 08:20 AM





W.S.



Tendon Bleeding

- Allow the Air to Escape
- Drain Bleed Water
- Close Vents
- Maintain Pressure (100-200psi)
For min. 10 Sec.



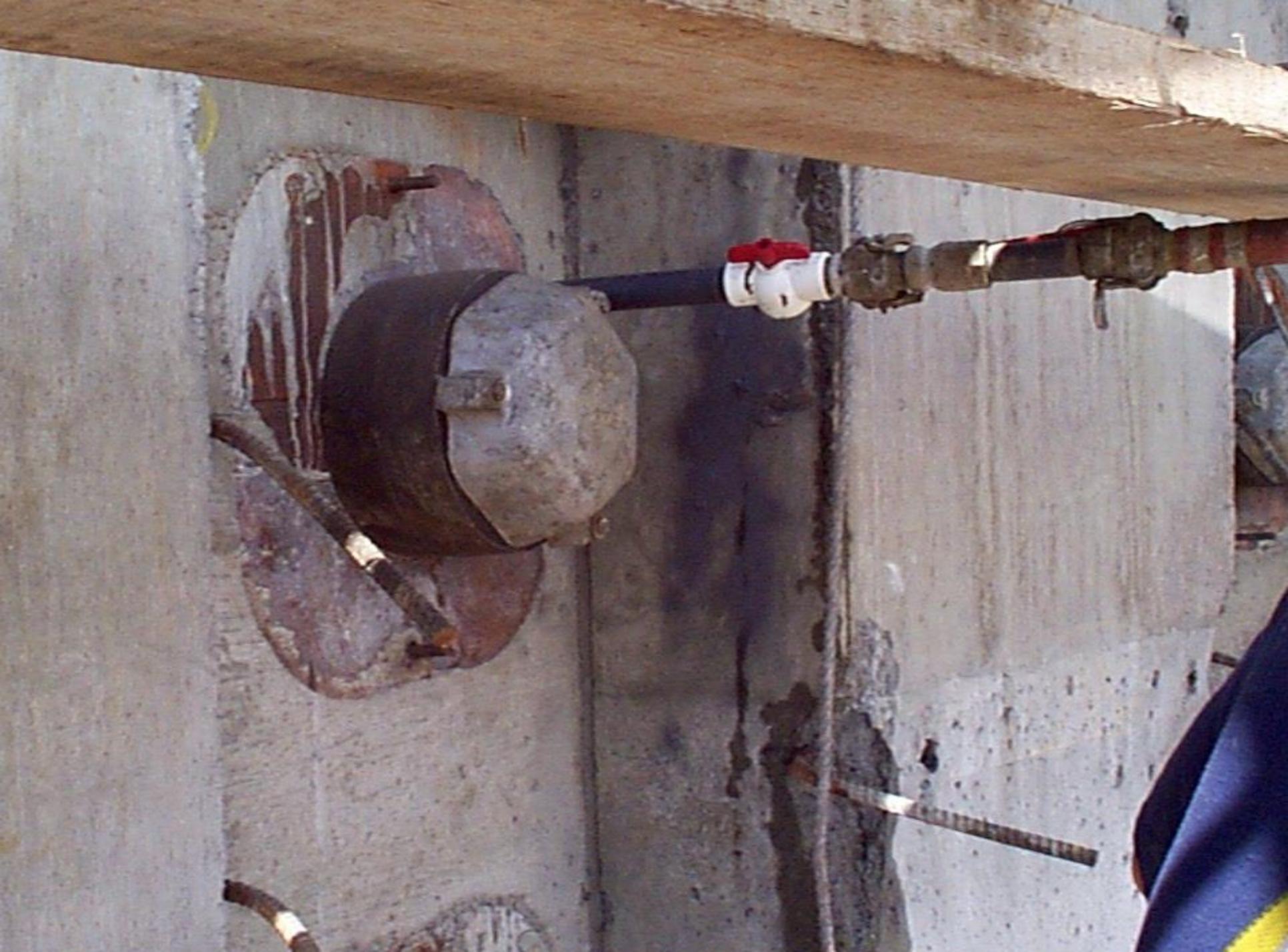
Latest specifications require three vents – one at high point, and a vent upstream and downstream of high point.

7. 1. 2003 13:51



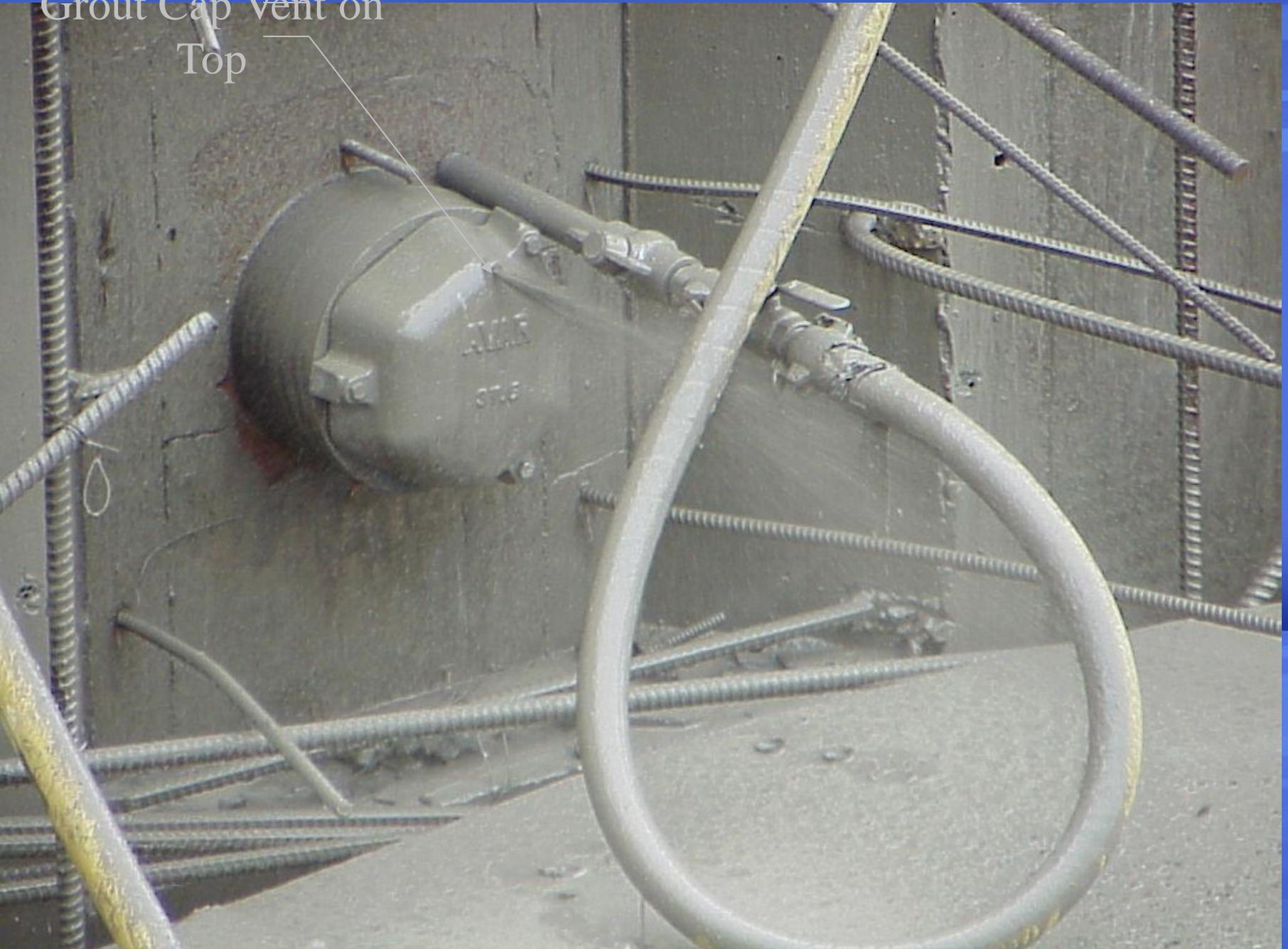


10.28.2003 13:20





Grout Cap Vent on
Top



Grout Voids



Falsework Release

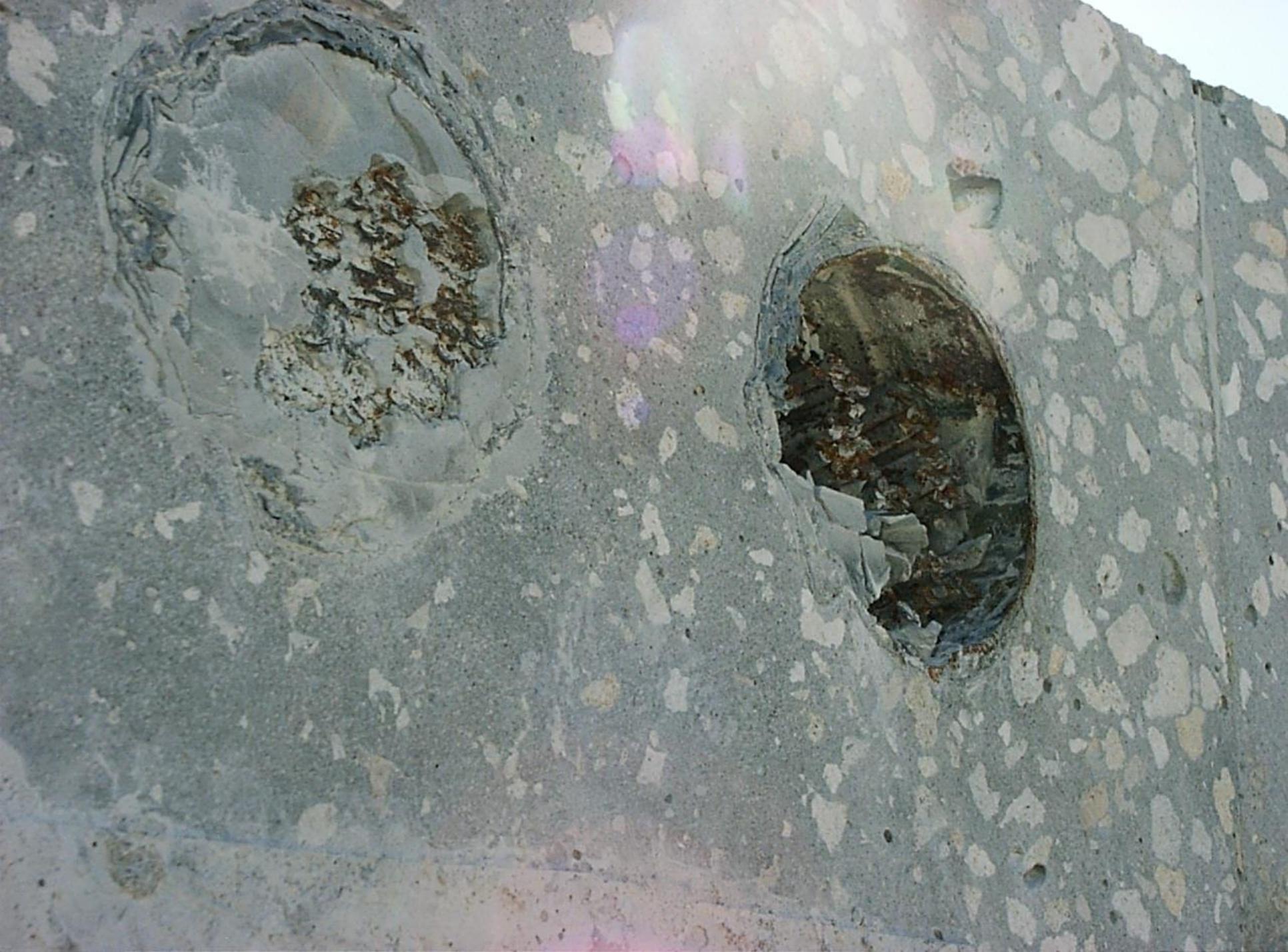
- No Vibration producing equipment on the the Bridge After Grouting
- Release Falsework a Min. Of Two Days After P.T. Duct Grouting

Segmental Bridge Removal



Unbonded Tendon





Segmental Bridge Removal

Corrosion of PT Tendons

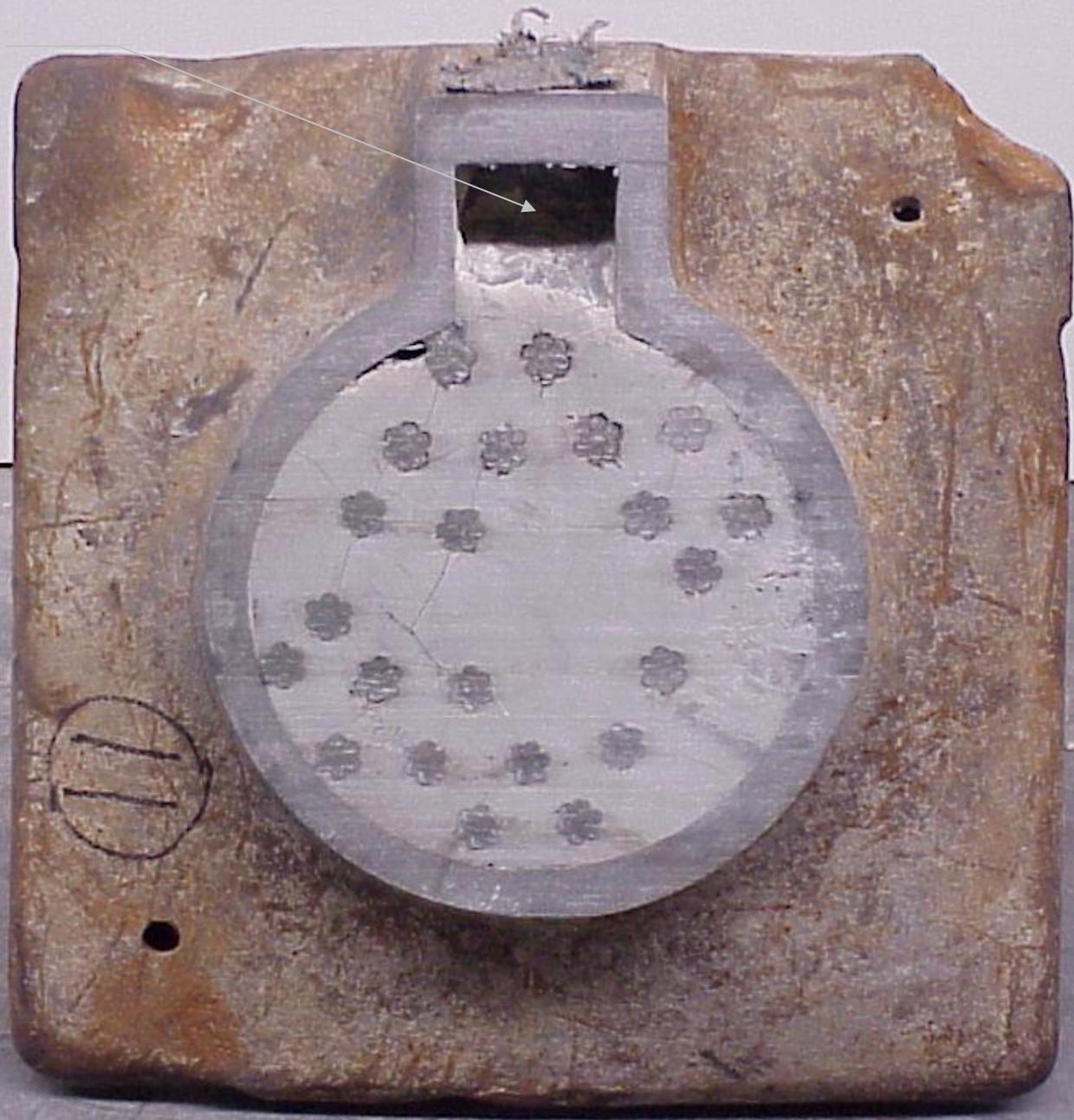
001279.JPG

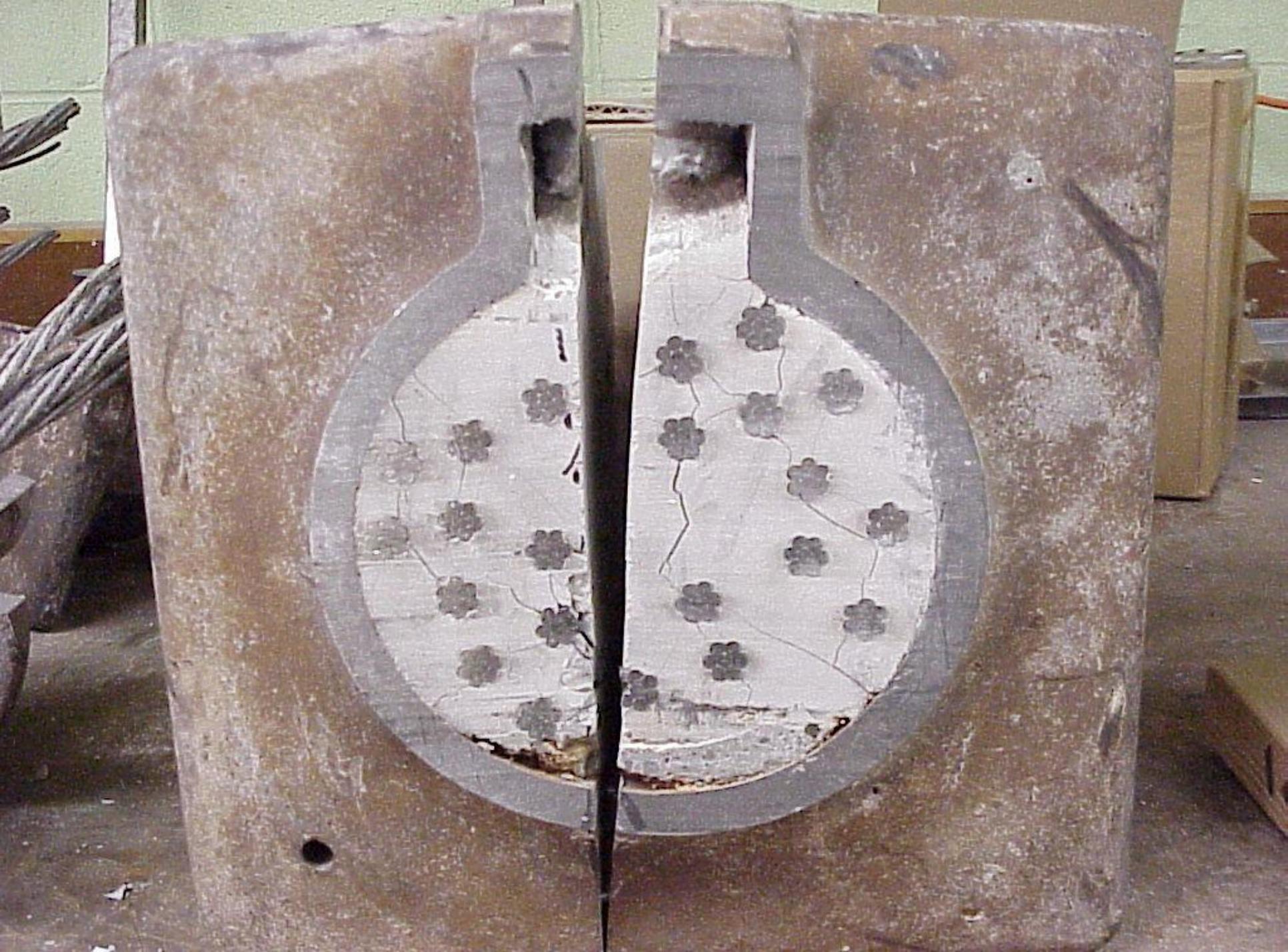


Washington State
Department of Transportation

www.wsdot.wa.gov/eesc/bridge

Void







Unsecured Duct Tape



Post-tensioning on Curved Structures

- **Ties are needed**
- **Minimum Cover of 2.5”**



6/10/2003 13:24

Field Problems

- Out of Tolerance Elongation
- Verification of Force (lift-off)
- Severed Strand Wires
- Uneven Strand Elongation
- Excessive Volume of Grout





1. 31. 2002



10.29.2003 11:26



**Send a Copy of p.t. Records to The
HQ Construction**

Sample Calculations

Approved Shop Drawings

PRESTRESSING CALCULATIONS - BARS

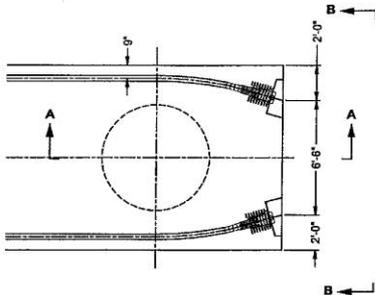
USE: Ø1 1/4", 150 ksi DEFORMED PRESTRESSING BAR (ASTM A722, TYPE II)

GUARANTEED MINIMUM ULTIMATE STRENGTH = 187.5 kips

PJACK: 150 kips / BAR
18 BARS TOTAL

ELONGATION:
$$\Delta = \frac{(150 \text{ kips})(13+1.5)(12")}{(1.25 \text{ in}^2)(29,500 \text{ ksi})} = 0.71" \quad \text{USE: } 11/16"$$

- NOTES: 1. BARS ARE TO BE STRESSED AND GROUTED PRIOR TO STRESSING OF STRAND TENDONS.
2. BARS & HARDWARE TO BE GALVANIZED.



BLOWUP @ RIGHT SIDE [JACKING END]

PRESTRESSING CALCULATIONS - STRANDS

USE: Ø0.6", 270 ksi, LOW RELAXATION, 7-WIRE STRAND (ASTM A416)

GUARANTEED MINIMUM ULTIMATE STRENGTH = 58.8 kips

GIVEN: ANCHOR SET 0.375"

INITIAL STRESS AT \square = 0.920 TIMES THE JACKING FORCE

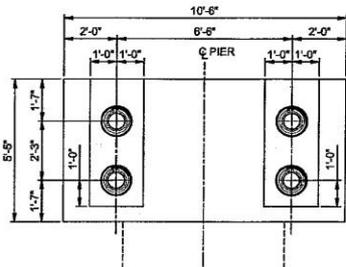
PJACK: USE: 4 - TENDONS W/ 19 STRANDS EACH PJACK = 835 kips EACH

ELONGATION: STRESSING FROM ONE END:
FROM THE RIGHT

$$\Delta 1 = \frac{(43.95 \text{ kips})(1+0.920)}{2} \times \frac{(80.25-(2 \cdot 0.375)+3.5)(12")}{(0.217 \text{ in}^2)(28,000 \text{ ksi})} = 6.87"$$

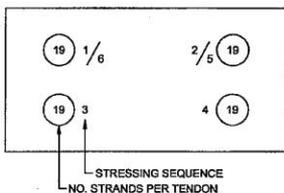
$$60\% \Delta = (0.8)(6.87) = 5.49" \quad \text{USE: } 5 \frac{1}{2}"$$

- NOTES: 1. BARS ARE TO BE STRESSED AND GROUTED PRIOR TO STRESSING OF STRAND TENDONS.
2. ASSUMED STRAND A = 0.217 in² AND E = 28,000 ksi USED FOR ELONGATION CALCULATIONS TO BE VERIFIED ON ACTUAL PRESTRESSING STEEL USED. THE FIGURES MAY VARY WHICH WOULD RESULT IN A VARIANCE OF THE CALCULATED ELONGATION.
3. CONCRETE: f_{cd} = 4000 Psi @ TIME OF STRESSING
4. SEE DRAWING NO.1 FOR GENERAL NOTES AND ANCHORAGE DETAILS



ELEVATION B-B

STRESSING SEQUENCE NOTES:
1. STRESS SEQ. #1-2 TO 50% PJACK.
2. STRESS SEQ. #3-6 TO 100% PJACK.



STRESSING SEQUENCE - STRAND [STRESS FROM RIGHT SIDE]

PRESTRESSING CALCULATIONS - BARS

USE: Ø1 1/4", 150 ksi DEFORMED PRESTRESSING BAR (ASTM A722, TYPE II)
GUARANTEED MINIMUM ULTIMATE STRENGTH = 187.5 kips

PJACK: 150 kips / BAR
18 BARS TOTAL

ELONGATION:
$$\Delta = \frac{(150 \text{ kips})(13+1.5)(12")}{(1.25 \text{ in}^2)(29,500 \text{ ksi})} = 0.71" \quad \text{USE: } 11/16"$$

- NOTES: 1. BARS ARE TO BE STRESSED AND GROUTED PRIOR TO STRESSING OF STRAND TENDONS.
2. BARS & HARDWARE TO BE GALVANIZED.

PRESTRESSING CALCULATIONS - STRANDS

USE: Ø0.6", 270 ksi, LOW RELAXATION, 7-WIRE STRAND (ASTM A416)
GUARANTEED MINIMUM ULTIMATE STRENGTH = 58.8 kips

GIVEN: ANCHOR SET 0.375"

INITIAL STRESS AT \square = 0.920 TIMES THE JACKING FORCE

PJACK: USE: 4 - TENDONS W/ 19 STRANDS EACH PJACK = 835 kips EACH

ELONGATION: STRESSING FROM ONE END:
FROM THE RIGHT

$$\Delta 1 = \frac{(43.95 \text{ kips})(1+0.920)}{2} \times \frac{(80.25-(2 \cdot 0.375)+3.5)(12")}{(0.217 \text{ in}^2)(28,000 \text{ ksi})} = 6.87"$$

$$60\% \Delta = (0.8)(6.87) = 5.49" \quad \text{USE: } 5 \frac{1}{2}"$$

- NOTES: 1. BARS ARE TO BE STRESSED AND GROUTED PRIOR TO STRESSING OF STRAND TENDONS.
2. ASSUMED STRAND A = 0.217 in² AND E = 28,000 ksi USED FOR ELONGATION CALCULATIONS TO BE VERIFIED ON ACTUAL PRESTRESSING STEEL USED. THE FIGURES MAY VARY WHICH WOULD RESULT IN A VARIANCE OF THE CALCULATED ELONGATION.
3. CONCRETE: f_{cd} = 4000 Psi @ TIME OF STRESSING
4. SEE DRAWING NO.1 FOR GENERAL NOTES AND ANCHORAGE DETAILS

ing
ility
11
3/29/07
Date

DYWIDAG SYSTEMS INTERNATIONAL, USA INC. DOES NOT ASSUME ANY LIABILITY FOR THE DESIGN OF THIS STRUCTURE. THIS SHOP DRAWING IS INTENDED TO PROVIDE POST TENSIONING DETAILS ONLY

I-5 EVERETT HOV - SR 526 TO US-2 VICINITY
5/638 E HWY 2 OC - PIER 2

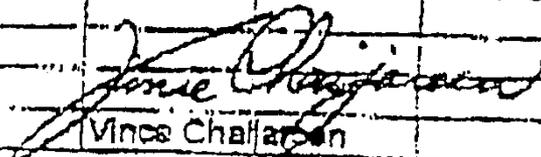
EVERETT	WASHINGTON
DIST. 15	CONTRACT NO.: C8981
CONTRACTOR: ATKINSON / CH2M HILL, J.V.	



DYWIDAG Systems International, USA, Inc.

POST TENSIONING / REINFORCEMENT				POST TENSIONING DETAILS			
REV.	DATE	ISSUE DESCRIPTION	NAME	CHKD.	SCALE	DRAWN	SKW
1	3/29/07	REVISED PER ENGINEER	BL		VARIES	CHKD.	
					DATE	APPD.	
					8/7/08	APPD.	
					JOB No.	420882	
					DWG. No.	3	

Ram Calibration (Raw Data)

University of Washington								
Ram Calibration Report								
Ram No.	6/8/8					Capacity	600 Tons	
Gauge No.	6/8/8/A	6/8/8/B				Ram Stroke:-	8"	
Actual Load (Kips)	Run 1	Run 1	Run 2	Run 2	Run 3	Run 3	Average	Average
	Gauge A (PSI)	Gauge B (PSI)	Gauge A (PSI)	Gauge B (PSI)	Gauge A (PSI)	Gauge B (PSI)	Gauge A (PSI)	Gauge B (PSI)
200	1400	1450	1400	1500	1400	1400	1400	1480
400	2800	2840	2800	2890	2800	2890	2800	2873
600	4200	4260	4190	4250	4200	4280	4197	4263
800	5650	5640	5650	5850	5600	5850	5633	5847
1000	7050	7000	7000	7020	7000	7050	7017	7023
1200	8450	8450	8400	8450	8425	8450	8425	8450
Calibrated Using Baldwin testing machine No. 224842								
Date:- 5/30/2000						by:-  Vince Chaffar		

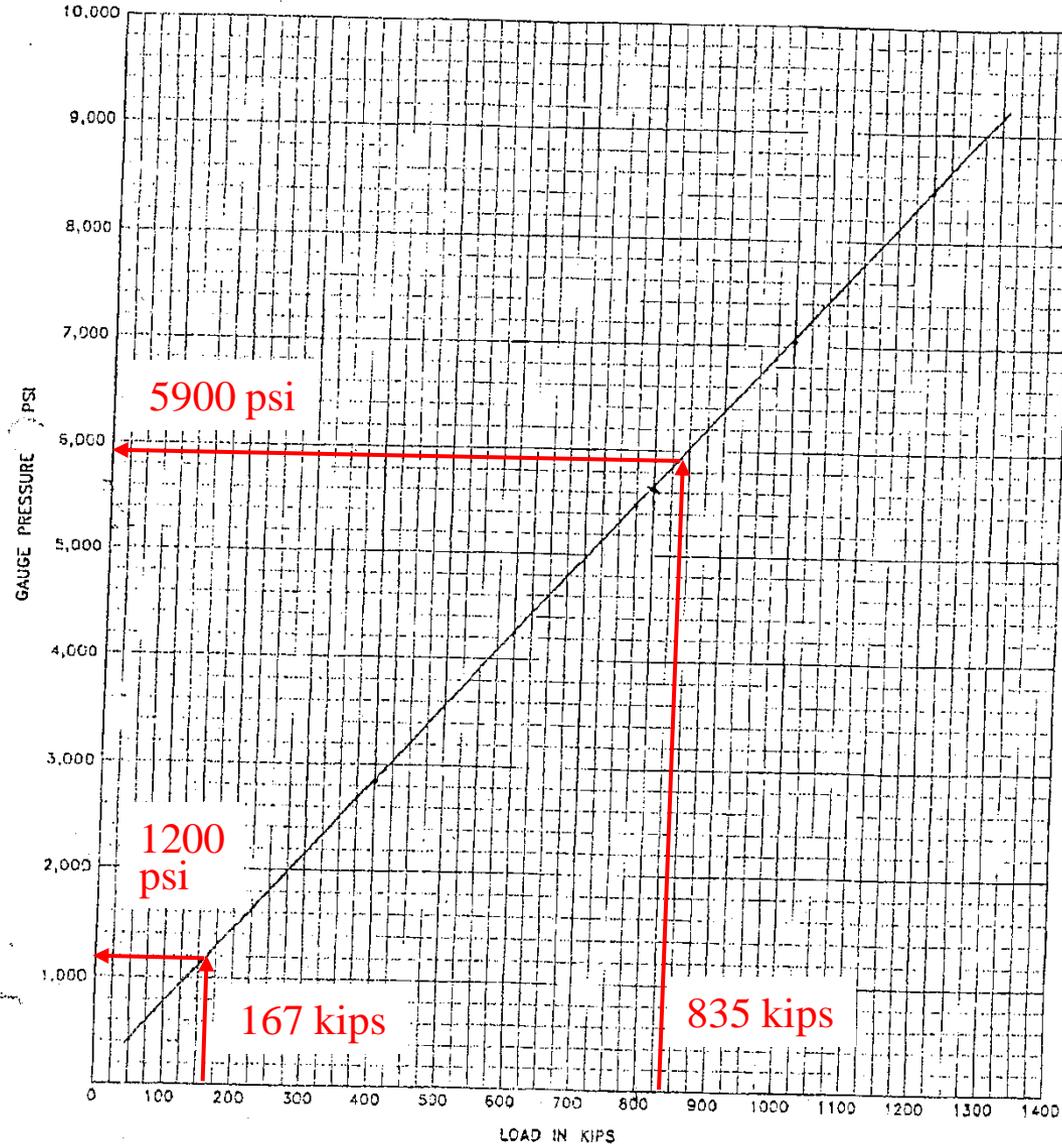
CALIBRATED BY: UNIVERSITY OF WASHINGTON

RAM NO: 6-8-8

DATE OF CALIBRATION: MAY 30 2000

GAUGE NO: 6-8-BB

LOAD CELL NO:



PRESTRESSING CALCULATIONS - BARS

USE: Ø1 1/4", 150 ksi DEFORMED PRESTRESSING BAR (ASTM A722, TYPE II)
GUARANTEED MINIMUM ULTIMATE STRENGTH = 187.5 kips

PJACK: 150 kips / BAR
18 BARS TOTAL

$$\text{ELONGATION: } \Delta = \frac{(150 \text{ kips})(13+1.5')(12")}{(1.25 \text{ in}^2)(29,500 \text{ ksi})} = 0.71" \quad \text{USE: } \underline{11/16"}$$

- NOTES: 1. BARS ARE TO BE STRESSED AND GROUTED PRIOR TO STRESSING OF STRAND TENDONS.
2. BARS & HARDWARE TO BE GALVANIZED.

PRESTRESSING CALCULATIONS - STRANDS

USE: Ø0.6", 270 ksi, LOW RELAXATION, 7-WIRE STRAND (ASTM A416)
GUARANTEED MINIMUM ULTIMATE STRENGTH = 58.8 kips

GIVEN: ANCHOR SET 0.375"
INITIAL STRESS AT \square = 0.920 TIMES THE JACKING FORCE

PJACK: USE: 4 - TENDONS W/ 19 STRANDS EACH PJACK = 835 kips EACH

ELONGATION: STRESSING FROM ONE END:
FROM THE RIGHT

$$\Delta_1 = \frac{(43.95 \text{ kips})(1+0.920)}{2} \times \frac{(80.25'-(2 \times 0.67')-3.5')(12")}{(0.217 \text{ in}^2)(28,000 \text{ ksi})} = 6.87"$$

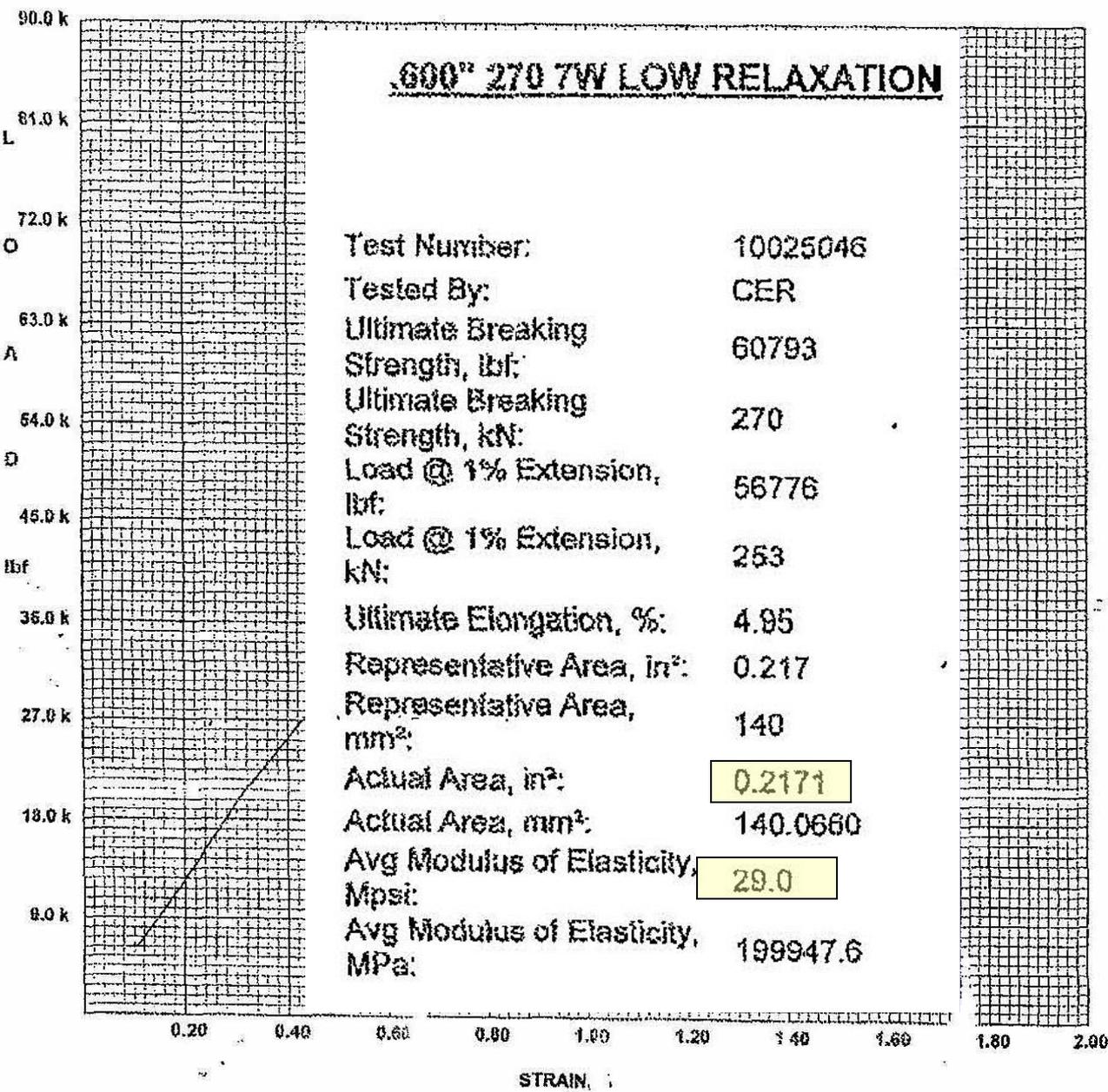
$$60\% \Delta = (0.6)(6.87") = 5.49" \quad \text{USE: } \underline{5 \ 1/2"}$$

- NOTES: 1. BARS ARE TO BE STRESSED AND GROUTED PRIOR TO STRESSING OF STRAND TENDONS.
2. ASSUMED STRAND $A = 0.217 \text{ in}^2$ AND $E = 28,000 \text{ ksi}$ USED FOR ELONGATION CALCULATIONS TO BE VERIFIED ON ACTUAL PRESTRESSING STEEL USED. THE FIGURES MAY VARY WHICH WOULD RESULT IN A VARIANCE OF THE CALCULATED ELONGATION.
3. CONCRETE: $f'c = 4000 \text{ Psi}$ @ TIME OF STRESSING
4. SEE DRAWING NO.1 FOR GENERAL NOTES AND ANCHORAGE DETAILS

Insteel Wire Products
 Prestressed Concrete Strand

.600" 270 7W LOW RELAXATION

.600" 270 7W LOW RELAXATION



Test Number: 10025046
 Tested By: CER
 Ultimate Breaking Strength, lbf: 60793
 Ultimate Breaking Strength, kN: 270
 Load @ 1% Extension, lbf: 56776
 Load @ 1% Extension, kN: 253
 Ultimate Elongation, %: 4.95
 Representative Area, in²: 0.217
 Representative Area, mm²: 140
 Actual Area, in²: 0.2171
 Actual Area, mm²: 140.0660
 Avg Modulus of Elasticity, Mpsi: 29.0
 Avg Modulus of Elasticity, MPa: 199947.6

Test Number: 10025046
 Tested By: CER
 Ultimate Breaking Strength, lbf: 60793
 Ultimate Breaking Strength, kN: 270
 Load @ 1% Extension, lbf: 56776
 Load @ 1% Extension, kN: 253
 Ultimate Elongation, %: 4.95
 Representative Area, in²: 0.217
 Representative Area, mm²: 140
 Actual Area, in²: 0.2171
 Actual Area, mm²: 140.0660
 Avg Modulus of Elasticity, Mpsi: 29.0
 Avg Modulus of Elasticity, MPa: 199947.6

RECEIVED TNC

APR 28 2005

Document Control

147770808 VEA 02.02.02 FEA 0440301741
 FEA WLRK SANDERS
 000

Adjust Elongation for actual strand area/modulus

$$\Delta_{(\text{corrected})} = \Delta_{(\text{shop})} (A_{(\text{shop})}/A_{(\text{act})}) (E_{(\text{shop})}/E_{(\text{act})})$$

$$A_{(\text{shop})} = 0.217 \text{ in}^2$$

$$A_{(\text{act})} = 0.2171 \text{ in}^2$$

$$E_{(\text{shop})} = 28,000 \text{ ksi}$$

$$E_{(\text{act})} = 29,000 \text{ ksi}$$

$$\Delta_{(\text{shop})} = 5 \frac{1}{2} \text{ in.}$$

$$\Delta_{(\text{corrected})} = (5 \frac{1}{2}'')(0.217/0.2171)(28000/29000)$$

$$\Delta_{(\text{corrected})} = 5.308 \text{ in} = 5 \frac{3}{8} \text{ in}$$





Contract No.		Page No 1
Section		
Structure Sample Calculations		
Project Engineer		Inspector

Post-Tensioning Record

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Date	Gir. No.	Tendon No.	Jack No.	Jack Location	Req'd. Jacking Force Per Tendon (Kips)	Strands Per Tendon	Gauge @ 20% Jacking Force (p.s.i.)	Gauge @ Req'd. Jacking Force (p.s.i.)	Gauge @ Actual Jacking Force (p.s.i.)	Actual Elong (in.)	(A) 100% Actual Elong. - 20% Actual Elong. (in.)	(B) Calc. 80% Elong. (in.)	% Elong. Per Tendon	100% Actual Elong. - Seated Elong. (in.) = (c)	(c) - Jack Elong. = Seating Take-up (in.)	Req'd. Seating Take-up (in.)
05/10	Pier 2	1	6-8-8	East	835	19	1200	5900	1200	1 1/2"						
									5900	7 1/4"	5 3/4"	5 3/8"	105%			3/8"
									1200	6 3/4"						
									Dead End Anchor Set		-1/8"					
											5 5/8"					

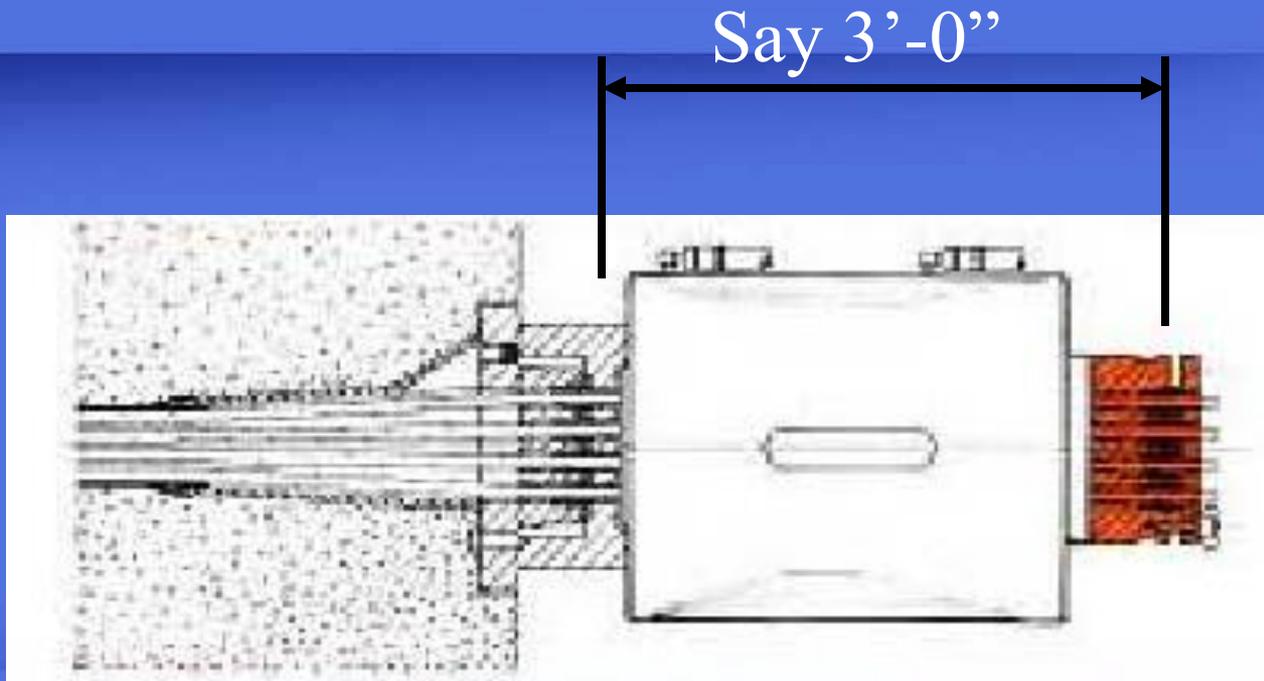
Verify Anchor Set



Contract No.		Page No 1
Section		
Structure Sample Calculations		
Project Engineer		Inspector

Post-Tensioning Record

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Date	Gir. No.	Tendon No.	Jack No.	Jack Location	Req'd. Jacking Force Per Tendon (Kips)	Strands Per Tendon	Gauge @ 20% Jacking Force (p.s.i.)	Gauge @ Req'd. Jacking Force (p.s.i.)	Gauge @ Actual Jacking Force (p.s.i.)	Actual Elong (in.)	(A) 100% Actual Elong. - 20% Actual Elong. (in.)	(B) Calc. 80% Elong. (in.)	% Elong. Per Tendon	100% Actual Elong. - Seated Elong. (in.) = (c)	(c) - Jack Elong. = Seating Take-up (in.)	Req'd. Seating Take-up (in.)
05/10	Pier 2	1	6-8-8	East	835	19	1200	5900	1200	1 1/2"						
									5900	7 1/4"	5 3/4"	5 3/8"	105%	1/2"		3/8"
									1200	6 3/4"						
							Dead End Anchor Set				-1/8"					
											5 5/8"					

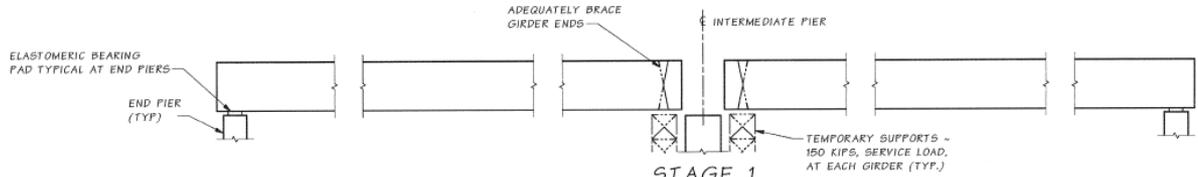


Jack Elongation = $1/16 \text{ in/ft} \times 3 \text{ ft} = 3/16 \text{ inch}$

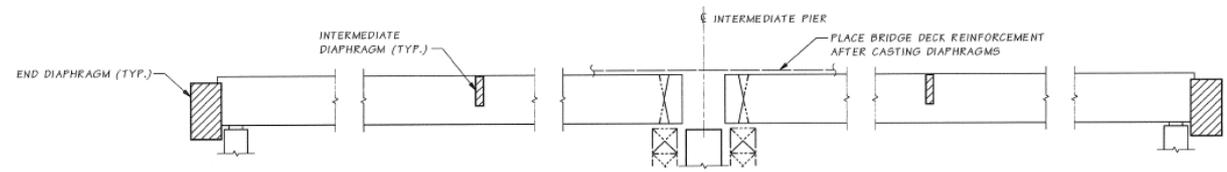
PT Record Keeping Complete

Project-Specific Details

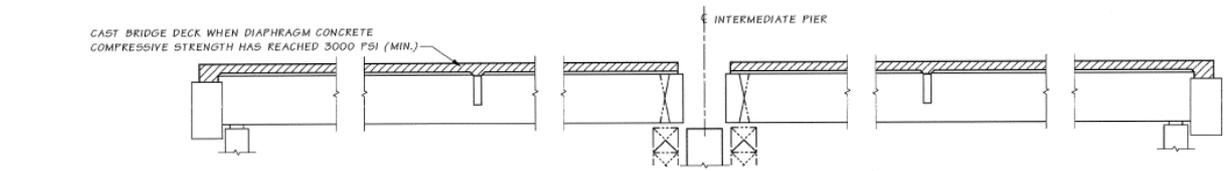
Construction Sequence



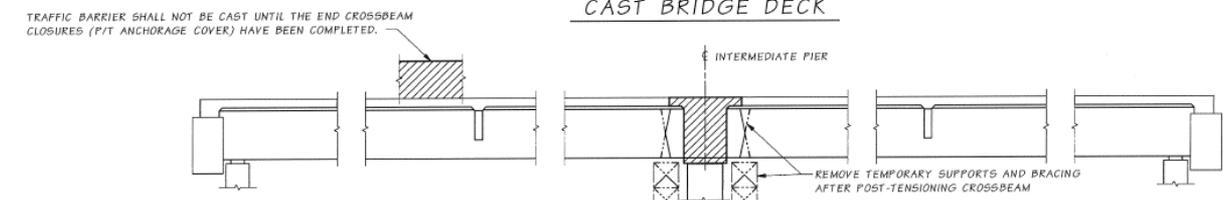
STAGE 1
SET GIRDERS ON TEMPORARY SUPPORT
 LOAD SHOWN FOR TEMPORARY GIRDER SUPPORT DOES NOT INCLUDE ALLOWANCE FOR
 CONSTRUCTING THE CROSSBEAM. FORMWORK AND SHORING FOR CROSSBEAM IS NOT SHOWN.



STAGE 2
CAST DIAPHRAGMS AND PLACE BRIDGE DECK REINFORCEMENT



STAGE 3
CAST BRIDGE DECK

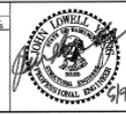


STAGE 4
CONSTRUCT CROSSBEAM WITH POST-TENSIONING
CONSTRUCTION SEQUENCE ~ SUPERSTRUCTURE

SR_16 FILE NO. 2383 SHEET BC5

Bridge Design Engr.	Kha Teigh1, B	M:V-Team/SR16 EB NV\WN Line\window Files\Const Seq-WING
Supervisor	Zsolt Horvath, RP	
Designed By	Young, JL	01/10
Checked By	NSB / NJR	04/11
Detalled By	Plesha, GM	03/10
Bridge Projects Engr.		
Presm. Plan By		
Architect/Specialist		
DATE	REVISION	BY APPD

PROJECT NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
30	WASH.			
JOB NUMBER	09C519			



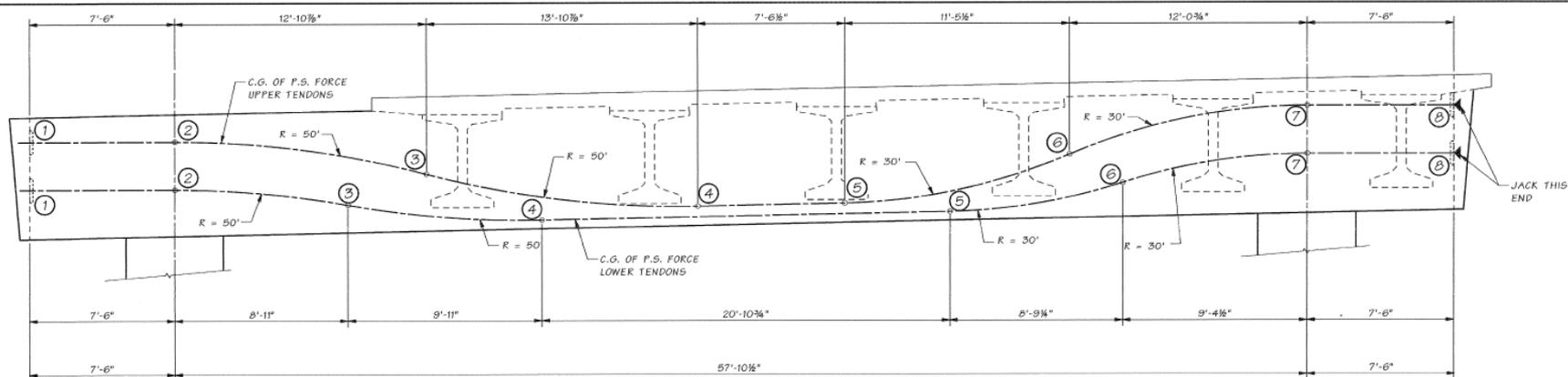
BRIDGE AND STRUCTURES OFFICE



Washington State Department of Transportation

I-5 / SR 16 EB NALLEY VALLEY - HOV	BRIDGE SHEET NO. BC5
WN LINE BRIDGE	SHEET 775
CONSTRUCTION SEQUENCE SUPERSTRUCTURE	OF 1341
	SHEETS

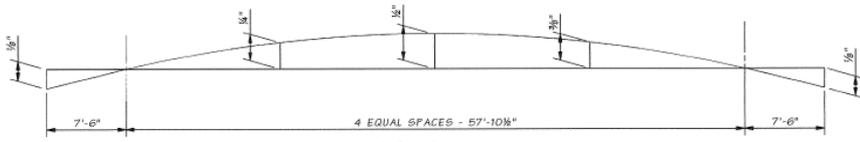
Post-tensioning profile and notes



CROSS BEAM ELEVATION

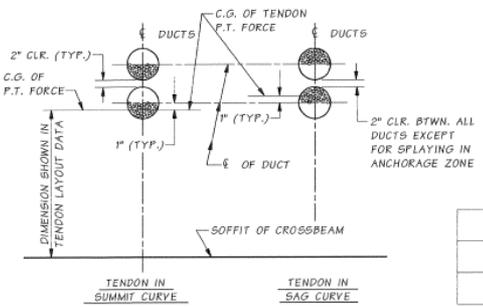
POST-TENSIONING NOTES

- THE CAST-IN-PLACE CONCRETE IN THE CROSSBEAM SHALL BE CLASS 5000. THE MINIMUM COMPRESSIVE STRENGTH OF THE CAST-IN-PLACE CONCRETE AT THE TIME OF POST-TENSIONING SHALL BE 4000 PSI.
- THE DESIGN IS BASED ON A TOTAL OF 8 TENDONS CONSISTING OF 0.6 INCH DIAMETER LOW RELAXATION STRANDS WITH A JACKING LOAD OF 1018 KIPS PER TENDON, AN ANCHOR SET OF 1/4 INCH. A CURVATURE FRICTION COEFFICIENT $\mu = 0.23$ AND THE WOBBLE FRICTION COEFFICIENT, $k = 0.0002$. THE ACTUAL ANCHOR SET USED BY THE CONTRACTOR SHALL BE SPECIFIED IN THE SHOP PLANS AND INCLUDED IN THE TRANSFER FORCE CALCULATIONS.
- THE MINIMUM PRESTRESSING LOAD AFTER SEATING FOR EACH TENDON SHALL BE 820 KIPS MEASURED AT THE JACKING END. EACH TENDON SHALL HAVE A MINIMUM OF 22 STRANDS.
- THE DESIGN IS BASED ON AN ESTIMATED PRESTRESS LOSS OF 32 KSI DUE TO STEEL RELAXATION, ELASTIC SHORTENING, CREEP AND SHRINKAGE OF CONCRETE.
- THE CONTRACTOR SHALL SUBMIT THE STRESSING SEQUENCE AND ELONGATION CALCULATIONS TO THE ENGINEER FOR APPROVAL. ALL LOSSES DUE TO TENDON VERTICAL AND HORIZONTAL CURVATURE MUST BE INCLUDED IN ELONGATION CALCULATIONS. THE STRESSING SEQUENCE SHALL MEET THE FOLLOWING CRITERIA:
 - A. EACH TENDON NEED BE STRESSED AT ONLY ONE END. THE SEQUENCE STRESSING SHALL BE AS SHOWN IN THE DIAGRAM BELOW. THE ESTIMATED ELONGATION IS 6 1/8" AND 6 1/2" FOR THE UPPER AND LOWER TENDONS, RESPECTIVELY. A STRAND EXTENSION OF 4 FT. IS ASSUMED WITHIN THE JACKS.
- THE MAXIMUM OUTSIDE DIAMETER OF THE DUCT SHALL BE 4 1/8 INCHES. THE AREA OF THE DUCT SHALL BE AT LEAST 2.5 TIMES THE NET AREA OF THE PRESTRESSING STEEL IN THE DUCT.



CAMBER DIAGRAM

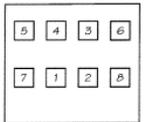
DIAGRAM SHOW DEAD LOAD PLUS PRESTRESS CAMBER ONLY AND SHALL BE MODIFIED BY THE AMOUNT OF TAKEUP ANTICIPATED IN FALSEWORK.



STRAND LOCATION DETAIL

CONTROL POINTS	①	②	③	④	⑤	⑥	⑦	⑧
UPPER TENDON	4'-11"	4'-10"	2'-11 1/2"	1'-1 1/2"	1'-1 1/2"	3'-3 1/2"	5'-6"	5'-5"
LOWER TENDON	2'-5"	2'-4"	1'-5"	6 1/8"	6 1/2"	1'-9"	3'-0"	2'-11"

TENDON LAYOUT DATA



SEQUENCE OF TENDON STRESSING

SR 16 FILE NO. 2583 SHEET BC16

Bridge Design Engr. khalighi, B	M:\Z-Team\SR16 EB NW\Win Line\Window Files\Pier 2 X-Beam Dtls.WND	REGION NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
Supervisor zelidrust, RP		10	WASH.			
Designed By Brown, NS 04/11		JOB NUMBER				
Checked By Rochon, M 05/11		002519				
Detailed By Plesha, GR 04/11						
Bridge Projects Engr. Pletim, Plan By						
Architect/ Specialist						
DATE	REVISION	BY	APPRO			



BRIDGE AND STRUCTURES OFFICE



I-5 / SR 16 EB NALLEY VALLEY - HOV	BRIDGE SHEET NO. BC16
WN LINE BRIDGE	SHEET 786 OF 1341
PIER 2 CROSSBEAM DETAILS 2 OF 2	DATE

Comments/thoughts?