



**FORM DQP 2.01-1  
LEVEL 1 CHECK PRINT SIGN-OFF SHEET**

Client Name: Ohio Department of Transportation  
 Job Title: Cleveland Innerbelt Design-Build Contract  
 Job Number: CUY-90-14.90  
 Document Title: Seismic Pedestal Change

Check Level (Mark One):  1A 100% Document Check  
 1B 100% Input Check

Enter description below:  
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	Print Name	Signature	Date
<input checked="" type="checkbox"/> Originator	<u>Jacob Wroten</u>	<u>J. Wroten</u>	<u>7/21/11</u>
<input checked="" type="checkbox"/> Checker	<u>RICHARD S. BLOCH</u>	<u>Richard S. Bloch</u>	<u>7/21/11</u>
<input checked="" type="checkbox"/> Backchecker	<u>Jacob Wroten</u>	<u>J. Wroten</u>	<u>7/21/11</u>
<input checked="" type="checkbox"/> Updater	<u>Jacob Wroten</u>	<u>J. Wroten</u>	<u>7/21/11</u>
<input checked="" type="checkbox"/> Validator	<u>RICHARD S. BLOCH</u>	<u>Richard S. Bloch</u>	<u>7/21/11</u>

Insert an "X" in the box to indicate a required QC activity.

Form DQP 2.01-1

For CUY-90-1490L

Job no. 49633

Sheet no. 1/6

Made by JTW

Checked by RSB

Backchecked by JTW

Date 7/21/11

Date 7/21/11

Date 7/21/11

HNTB

Determine the number of Pedestals needed due to a reduced capacity at each pedestal.

$$\text{Total Seismic} = 455.2^k \checkmark$$

Due to end crossframe interference only 3 of the 5 #9 bars can be placed. Assume a  $\frac{3}{5}$  capacity of the seismic pedestal.

$$\text{Full Pedestal} = 294^k \text{ Resistance } \checkmark$$

$$294 \left(\frac{3}{5}\right) = 176.4^k \checkmark$$

$$455.2^k / 176.4^k = 2.58 \text{ peds } \checkmark$$

Say 3 peds per direction  $\checkmark$

- See Marked up plan sheets for Pedestal locations  $\checkmark$

Check thermal contraction to ensure end crossframe angle clears seismic Pedestal.

See included expansion joint calcs.

Assume bearing set at  $60^\circ$

$$\text{Max Contraction} = 0.81" \checkmark$$

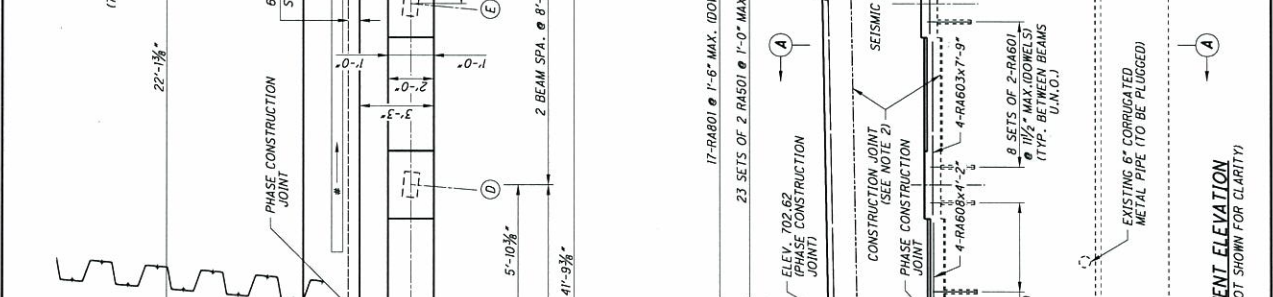
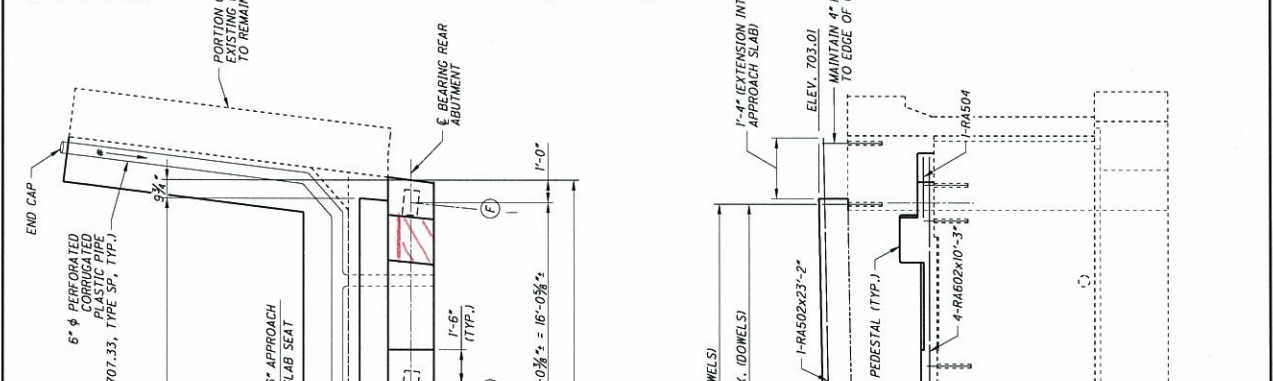
provide 1" clr  $\checkmark$

	DATE REVISIONS NO.	DATE REVISIONS NO.	DATE REVISIONS NO.

HNTB  
 DESIGN AGENCY  
 BRIDGE NO. CUY-90-1490  
 1-90 W.B. OVER STARKWEATHER AVE.  
 REAR ABUTMENT PLAN AND ELEVATION  
 BRIDGE 1

GIRDER	PROPOSED	EXISTING
A	698.13	697.47
B	698.26	697.59
C	698.39	697.70
D	698.51	697.80
E	698.64	697.91
F	698.77	698.02

\* LENGTH OF REBAR DOES NOT INCLUDE ANY LAP LENGTHS. CONTRACTOR SHALL DETERMINE TOTAL REBAR LENGTH REQUIRED. SEE TABLE FOR MINIMUM LAP LENGTHS.  
 \*\* OTHER APPROACH SLAB REBAR NOT SHOWN FOR CLARITY.



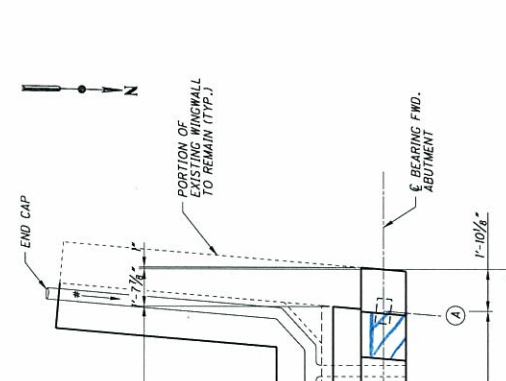
NOTES:  
 1. EXISTING REAR ABUTMENT IS NOW LABELED FORWARD.  
 2. FOR SECTION A-A, REINFORCING BAR BEND DIAGRAMS, DRAINAGE PIPE OUTLET DETAIL, AND LEGEND SEE SHEET 12/28.  
 3. FOR SEISMIC PEDESTAL DETAILS, SEE SHEET 13/28.  
 4. CLARIFY THE TOP OF EXISTING SURFACES TO A DEPTH OF 1/4\"/>

REAR ABUTMENT ELEVATION  
 (EXISTING PILES NOT SHOWN FOR CLARITY)

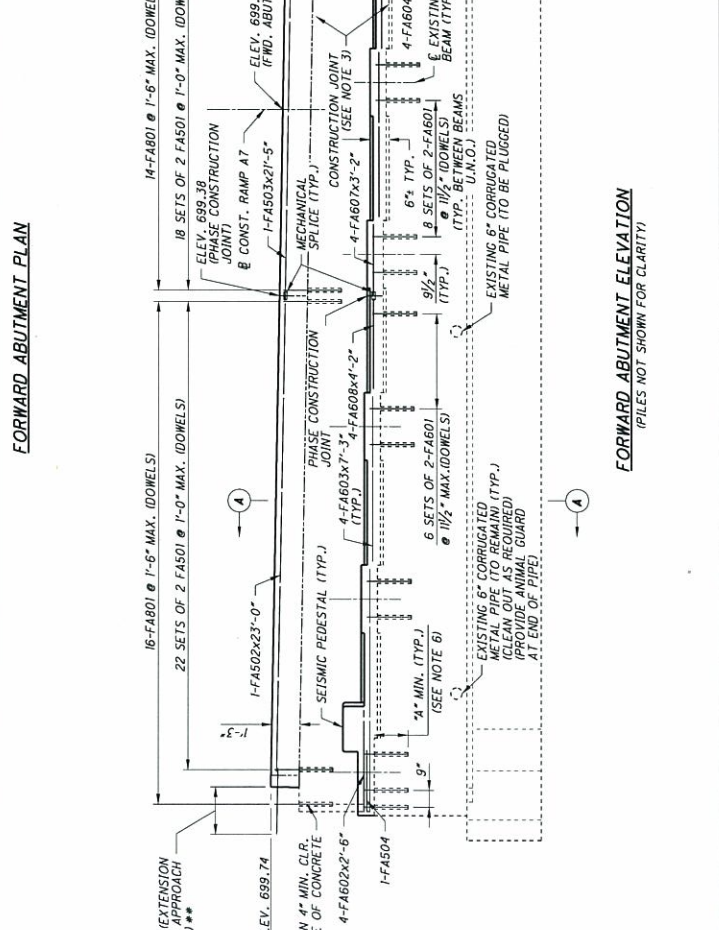
- Partial Pedestal - Restraint to the Left  
 - Partial Pedestal - Restraint to the Right

	<b>WILSH HNTB</b> <small>DESIGN ADVISORS</small>		<b>BRIDGE 1</b> FORWARD ABUTMENT PLAN AND ELEVATION	BRIDGE NO. CUY-90-1490 1.90 W.B. OVER STARKWEATHER AVE.	PID NO. 77332/8531 CUY-90-14.90
DATE REVISIONS	NO. A FINAL SUBMISSION REVIEW B INTERIM REVIEW SIGNATURE C APPROVED FOR CONSTRUCTION 03-17-11	DATE REVISIONS	DATE REVISIONS	DATE REVISIONS	DATE REVISIONS

GIRDER	GIRDER SEAT ELEVATIONS	
	PROPOSED	EXISTING
A	694.87	694.45
B	695.01	694.57
C	695.13	694.67
D	695.26	694.78
E	695.39	694.89
F	695.53	695.01



**FORWARD ABUTMENT PLAN**



**FORWARD ABUTMENT ELEVATION**  
(PILES NOT SHOWN FOR CLARITY)

- \* SLOPE 1/4"/FT.
- NOTES:**
- EXISTING REAR ABUTMENT IS NOW LABELED FORWARD.
  - FOR SECTIONS A-A, REINFORCING BAR BEND DIAGRAMS, DRAINAGE PIPE OUTLET DETAILS, AND LEGEND SEE SHEET [12/28].
  - FOR SEISMIC PEDESTAL DETAILS, SEE SHEET [13/28].
  - SCARIFY THE TOP OF EXISTING SURFACES TO A DEPTH OF 1/4". OF THE DOWEL HOLES SHALL BE LOCATED WITH THE AID OF A REINFORCING BAR LOCATOR. IF AN EXISTING BAR IS ENCOUNTERED AT THE SAME LOCATION AS A PROPOSED DOWEL HOLE, THE DOWEL SHALL BE MOVED TO EITHER SIDE OF THE EXISTING BAR.
  - FOR TABLE OF DIMENSION "A", SEE SHEET [12/28].

- LENGTH OF REBAR DOES NOT INCLUDE ANY LAP LENGTHS. CONTRACTOR SHALL DETERMINE TOTAL REBAR LENGTH REQUIRED. SEE TABLE FOR MINIMUM LAP LENGTHS.
- OTHER APPROACH SLAB REBAR NOT SHOWN FOR CLARITY

▨ - Partial Pedestal - Restraint to the Left

▨ - Partial Pedestal - Restraint to the Right

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<b>HNTB</b>	Made by AKS	Date 02/14/11	Job No. 49633
	Checked by DBT	Date 02/18/11	Sheet No.
	Backchecked by AKS	Date 02/18/11	
Calculations For <b>I-90 - Cleveland Innerbelt, BL-1</b>			

File: c:\caddlib\pw\asteff\db\dms72707\CUY090 1490L - Seismic Pedestal.xls\SEISMIC PEDESTAL 2/18/2011 11:23

**CUY-090-1490L - BRIDGE 1  
SEISMIC PEDESTAL DESIGN**

Per ODOT BDM 301.4.3, use Seismic Zone A Requirements  
 Per AASHTO Standard Specifications (LFD), Division I-A, Section 5 (Seismic Performance Category A):  
 Section 5.2: the mechanical device used to connect the superstructure to the substructure shall be designed to resist a horizontal seismic force in each direction equal to 20% of the tributary dead load.  
 Section 5.6: only the superstructure to substructure connection needs to be designed for seismic forces.

**HEIGHT OF PEDESTAL (h)**  
 $h = \text{Max Brg Ht} + 2 \frac{3}{4}"$  ODOT Std. Drwg. A-1-69

LOCATION	Beams A - F		h (in.)
	Brg. Ht. (in.)	2 3/4 (in.)	
Rear Abut	4.25	2.75	7.00
Pier 1	4.67	2.75	7.42
Pier 2	4.67	2.75	7.42
Fwd Abut	4.25	2.75	7.00

PRELIMINARY BEARING HEIGHTS, VERIFY WITH FINAL DESIGN THAT  $h \leq 14$  in.

**HORIZONTAL SEISMIC FORCE**  
 skew = 4.622 degrees (Max. skew at Rear Abutment)  
 skew = 0.08 rad

LOCATION	GIRDER	Unfactored DL (kip)	DL Factor AASHTO T 3.22.1.A	Factored DL (kip)	F <sub>SEISMIC</sub> (kip)
Rear Abut	A & F	31.2	1.3	40.6	45.1
	B - E	27.6	1.3	35.8	
Pier 1	A & F	126.6	1.3	164.5	182.8
	B - E	111.9	1.3	145.5	
Pier 2	A & F	126.2	1.3	164.0	182.2
	B - E	111.6	1.3	145.0	
Fwd Abut	A & F	31.3	1.3	40.7	45.1
	B - E	27.6	1.3	35.9	
<b>Total =</b>					<b>455.2</b>

$F_{\text{seismic}} = 20\% * (\text{No. of Beams} * \text{Fact. DL}) / \cos(\text{skew})$

**CHECK FOR REQUIRED QUANTITY OF PEDESTALS**  
 Max Pedestal Ht. = 7.42 in.  
 Allowable Pedestal Force = 294 kips ODOT Std. Drwg. A-1-69, Table A

$QTY_{REQD} = F_{SEISMIC} / \text{Allowable}$   
 $QTY_{REQD} = 1.55$   
**USE: 2** Pedestals minimum on bridge per direction of seismic movement  
 Place at Rear & Forward Abutments

Place 2 pedestals at each abutment to resist transverse movements in either direction

<b>HNTB</b>	Made by AKS	Date 02/15/11	Job No. 49663
	Checked by DBT	Date 02/17/11	Sheet No.
Calculations For CUY-90-1490L (BRIDGE 1)	Backchecked by AKS	Date 02/18/11	

File: c:\caddlib\pw\asteff\db\dms72707\CUY090 1490L - StripSealExpJoint.xls Rear Abutment

2/18/2011 7:49

**STRIP SEAL EXPANSION JOINT (REAR ABUTMENT)**

**INPUT**

L = 47.72916667 FT (LENGTH FROM JOINT TO THERMAL NEUTRAL POINT)  
(MEASURED ALONG CL BRIDGE)  
d steel = 0.0000065 PER DEGREE FAHRENHEIT  
SKEW = 4.622222222 DEGREE

**DIMENSION "A"**

(ODOT STANDARD EXJ-4-87)

**A60 = 1.70 IN** (DIMENSION "A" AT 60 DEGREES)

$$A90 = A60 - (d \cdot DT \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

DT = 30 F

**A90 = 1.59 IN**

$$A80 = A60 - (d \cdot DT \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

DT = 20 F

**A80 = 1.63 IN**

$$A70 = A60 - (d \cdot DT \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

DT = 10 F

**A70 = 1.66 IN**

$$A50 = A60 + (d \cdot DT \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

DT = 10 F

**A50 = 1.74 IN**

$$A40 = A60 + (d \cdot DT \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

DT = 20 F

**A40 = 1.77 IN**

$$A30 = A60 + (d \cdot DT \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

DT = 30 F

**A30 = 1.81 IN**

Max Contraction from 60° to -30°  
 $\Delta T = 90^\circ$   
 $6.5E-6(90)(47.73 \times 12)(\cos 4.62) = 0.33 \checkmark$

Note: See ODOT Std. EXJ-4-87 Page 4 of 5 Legend 4. Minimum joint opening of 1.5" at time of installation.

<b>HNTB</b>	Made by AKS	Date 02/15/11	Job No. 49663
	Checked by DBT	Date 02/17/11	Sheet No.
Calculations For CUY-90-1490L (BRIDGE 1)	Backchecked by AKS	Date 02/18/11	

File: c:\caddlib\pw\asteff\db\dms72707\CUY090 1490L - StripSealExpJoint.xls\Forward Abutment

2/18/2011 7:49

STRIP SEAL EXPANSION JOINT (FORWARD ABUTMENT)

INPUT

L = 114.90625 FT (LENGTH FROM JOINT TO THERMAL NEUTRAL POINT)  
(MEASURED ALONG CL BRIDGE)

d steel = 0.0000065 PER DEGREE FAHRENHEIT

SKEW = 4.136944444 DEGREE

DIMENSION "A"

(ODOT STANDARD EXJ-4-87)

**A60 = 1.60 IN** (DIMENSION "A" AT 60 DEGREES)

$$A90 = A60 - (d \cdot DT \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

DT = 30 F

**A90 = 1.33 IN**

$$A80 = A60 - (d \cdot DT \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

DT = 20 F

**A80 = 1.42 IN**

$$A70 = A60 - (d \cdot DT \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

DT = 10 F

**A70 = 1.51 IN**

$$A50 = A60 + (d \cdot DT \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

DT = 10 F

**A50 = 1.69 IN**

$$A40 = A60 + (d \cdot DT \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

DT = 20 F

**A40 = 1.78 IN**

$$A30 = A60 + (d \cdot DT \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

DT = 30 F

**A30 = 1.87 IN**

*Max Contraction from 60° to -30°  
Movement = 0.81" ✓*

Note: See ODOT Std. EXJ-4-87 Page 4 of 5 Legend 4. Minimum joint opening of 1.5" at time of installation.

Determine the number of Pedestals needed due to a reduced capacity at each pedestal.

$$\text{Total } F_{\text{seismic}} = 537.3^k \quad \checkmark$$

(See Previous attached Calc)

Due to End Crossframe interference only 3 of the 5 #9 bars can be placed. Assume  $\frac{3}{5}$  capacity of each seismic pedestal

$$\text{Full Pedestal} = 294^k \text{ Resistance} \quad \checkmark$$

$$294^k \left(\frac{3}{5}\right) = 176.4^k \quad \checkmark$$

Note, due to Addition of Beam line to this structure, 2 full Pedestals restraining to the Right can be Placed

⇒ Restraint to the Right

$$537.3^k - (2 \times 294) = -50.7^k \quad \checkmark$$

Right Restraint is OK as shown  $\checkmark$

⇒ Restraint to the Left

$$537.3^k / 176.4^k = 3.05 \text{ peds} \quad \checkmark$$

Say 4 partial pedestals  $\checkmark$

- See attached marked up plans for pedestal locations.

Check Thermal Contraction to ensure angle clearance with Pedestal

See included expansion Joint Calcs

Assume Bearing Set at  $60^\circ$   $\checkmark$

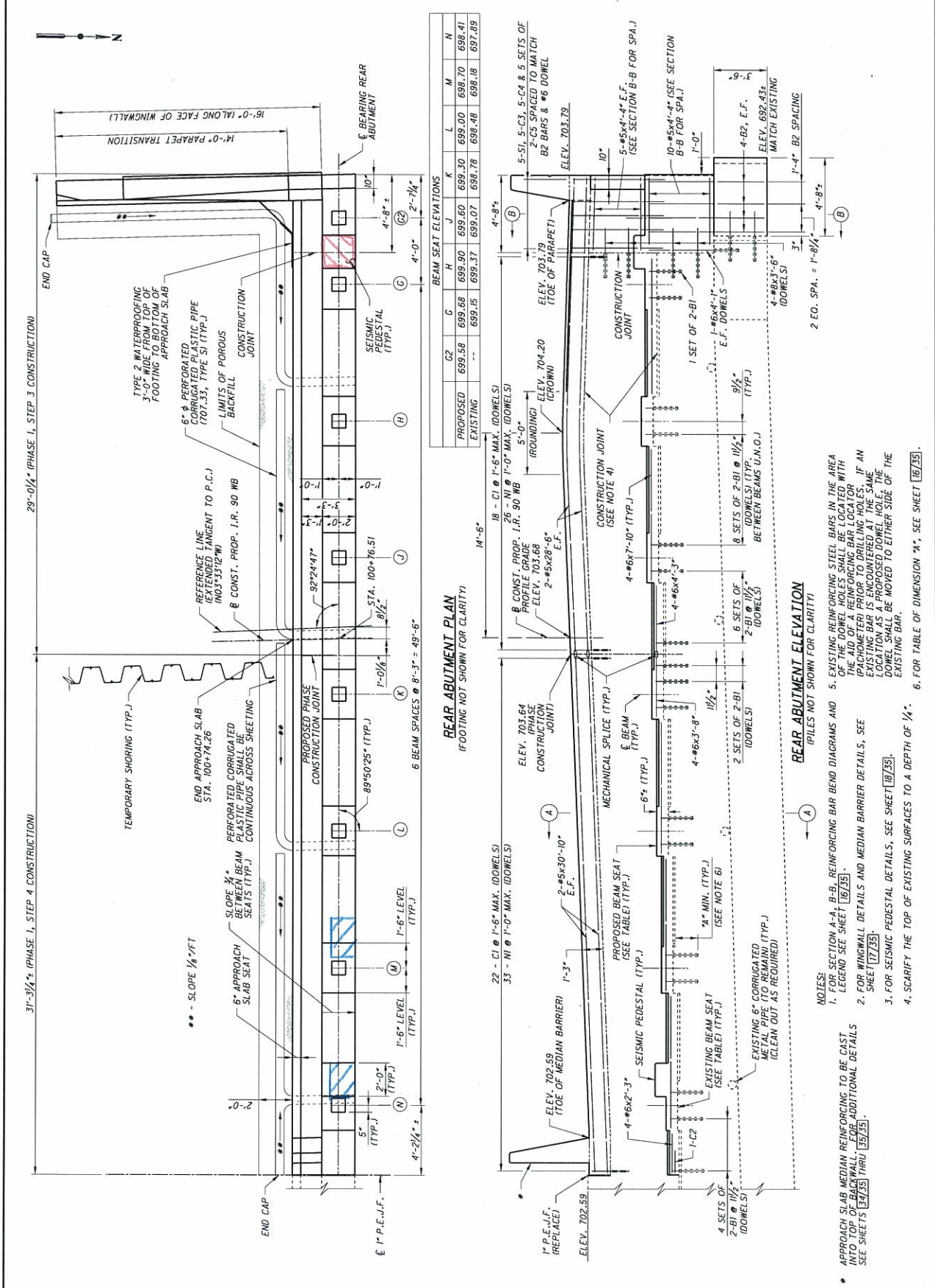
$$\text{Max Contraction} = 0.80" \quad \checkmark$$

provide 1" clr.  $\checkmark$



2/6

	BRIDGE NO. CUY-90-149R 1-71-90 OVER STARKWEATHER AVENUE	PID No. 77322 / 0531	14 / 35	
	<b>REAR ABUTMENT PLAN AND ELEVATION</b> <b>BRIDGE 2</b>	CUY-90-14.90 STRUCTURE FILE NUMBER 1807625	DBT 01-28-11	DBT 1807625



31'-3/4" (PHASE 1, STEP 4 CONSTRUCTION)

29'-0 1/4" (PHASE 1, STEP 3 CONSTRUCTION)

REAR ABUTMENT PLAN (FOOTING NOT SHOWN FOR CLARITY)

REAR ABUTMENT ELEVATION (PILES NOT SHOWN FOR CLARITY)

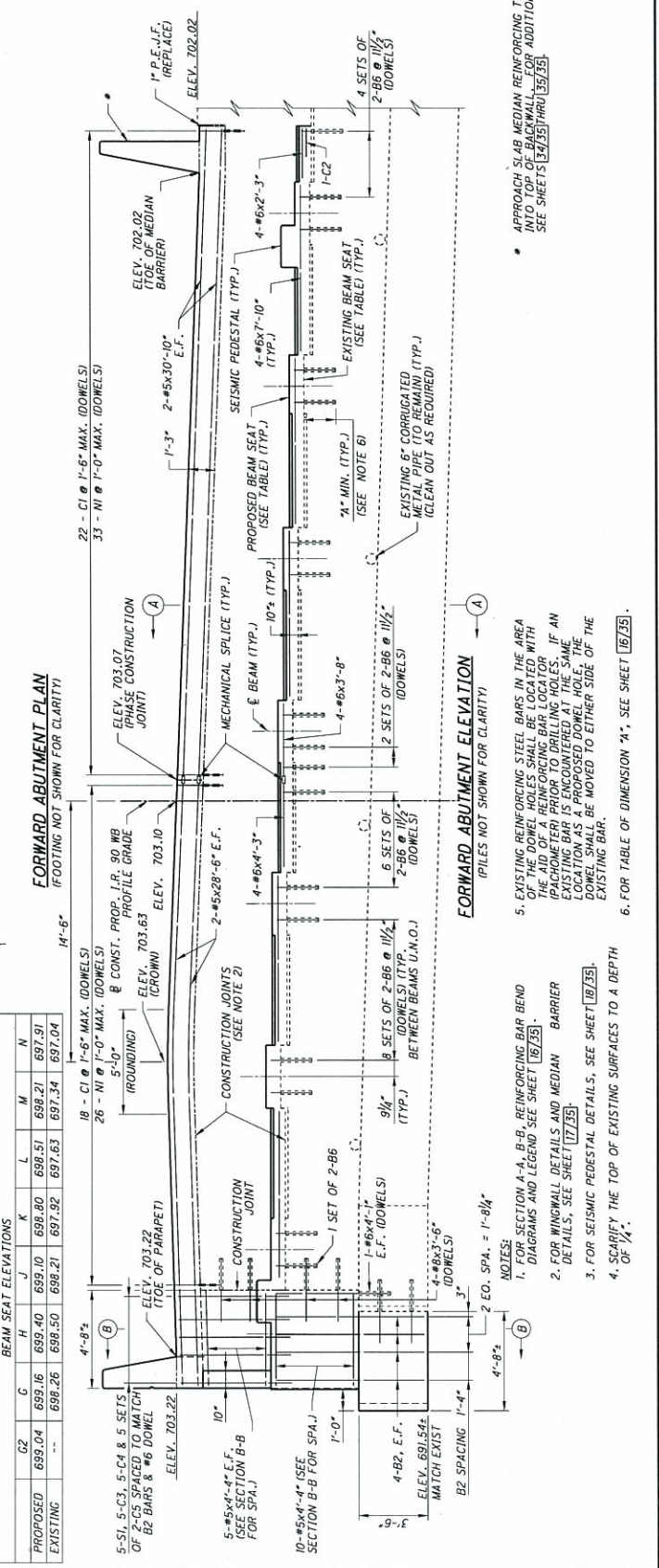
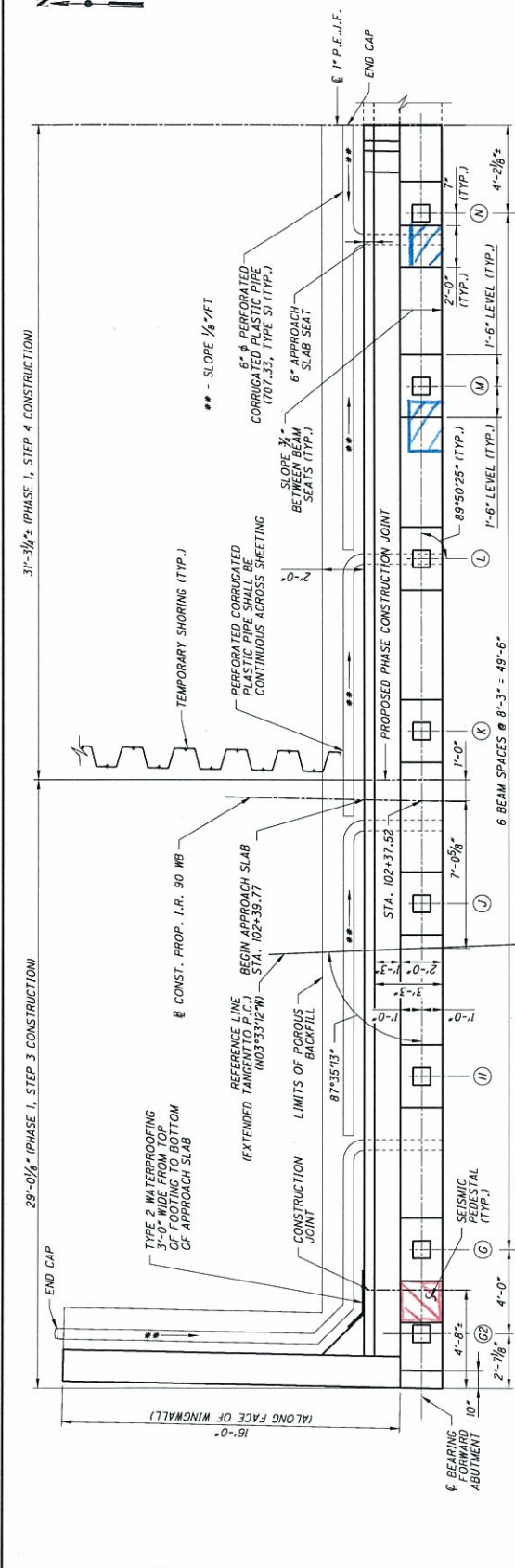
NOTES:

- FOR SECTION A-A, B-B, REINFORCING BAR BEND DIAGRAMS AND LEGEND SEE SHEET [16/35].
- FOR WINGWALL DETAILS AND MEDIAN BARRIER DETAILS, SEE SHEET [17/35].
- FOR SEISMIC PEDESTAL DETAILS, SEE SHEET [19/35].
- SCARIFY THE TOP OF EXISTING SURFACES TO A DEPTH OF 1/4".
- EXISTING REINFORCING STEEL BARS IN THE AREA OF THE DOWEL HOLES SHALL BE LOCATED WITH THE MID OTHER REINFORCING BARS. IF AN EXISTING BAR IS ENCOUNTERED AT THE SAME LOCATION AS A PROPOSED DOWEL HOLE, THE DOWEL SHALL BE MOVED TO EITHER SIDE OF THE EXISTING BAR.
- FOR TABLE OF DIMENSION 'A', SEE SHEET [15/35].

*Partial Pedestal - Restraint to the Left*

*Full Pedestal - Restraint to the Right*

	<b>FORWARD ABUTMENT PLAN AND ELEVATION</b> BRIDGE NO. CUY-90-1490 BRIDGE NO. CUY-90-1490R 1-71-90 OVER STARKWEATHER AVENUE	<b>BRIDGE 2</b>	PID No. 7732/85531 CUY-90-14.90	15/35 0
DATE: _____ REVISIONS: _____ NO. _____	APPROVED FOR CONSTRUCTION: _____ FINAL SUBMISSION REVIEW: _____ INTERIM REVIEW SUBMITTAL: _____	DESIGNED: _____ WDR: _____ CHECKED: _____ STRUCTURE FILE NUMBER: _____ 01-28-11	REVIEWED: _____ DATE: _____ 01-28-11	DBT: _____ 1801625



APPROACH SLAB MEDIAN REINFORCING TO BE CAST INTO TOP OF BACKWALL FOR ADDITIONAL DETAILS SEE SHEETS [34/35] THRU [35/35].

5. EXISTING REINFORCING STEEL BARS IN THE AREA OF THE DOWEL HOLES SHALL BE LOCATED WITH THE AID OF A REINFORCING BAR LOCATOR IF AN IPACHOMETER PRIOR TO DRILLING HOLES. IF AN IPACHOMETER IS A PROPOSED DOWEL HOLE, THE DOWEL SHALL BE MOVED TO EITHER SIDE OF THE EXISTING BAR.

6. FOR TABLE OF DIMENSION 'A', SEE SHEET [16/35].

- Partial Pedestal - Restraint to the Left

- Full Pedestal - Restraint to the Right

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<b>HNTB</b>	Made by VWR	Date 12/14/10	Job No. 49633
	Checked by DBT	Date 12/15/10	Sheet No.
Calculations For <b>I-90 - Cleveland Innerbelt</b>	Backchecked by VWR	Date 12/17/10	

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**CUY-090-1490R - BRIDGE 2  
SEISMIC PEDESTAL DESIGN**

Per ODOT BDM 301.4.3, use Seismic Zone A Requirements  
 Per AASHTO Standard Specifications (LFD), Division I-A, Section 5 (Seismic Performance Category A):  
 Section 5.2: the mechanical device used to connect the superstructure to the substructure shall be designed to resist a horizontal seismic force in each direction equal to 20% of the tributary dead load.  
 Section 5.6: only the superstructure to substructure connection needs to be designed for seismic forces.

**HEIGHT OF PEDESTAL (h)**

$h = \text{Max Brg Ht} + 2 \frac{3}{4}''$  ODOT Std. Drwg. A-1-69

LOCATION	Beam G2	Beams G -		h (in.)
	Brg. Ht. (in.)	N Brg. Ht. (in.)	2 3/4 (in.)	
Rear Abut	5.16	4.25	2.75	7.91
Pier 1	6.15	4.67	2.75	8.90
Pier 2	6.15	4.67	2.75	8.90
Fwd Abut	5.16	4.25	2.75	7.91

PRELIMINARY BEARING HEIGHTS, VERIFY WITH FINAL DESIGN THAT  $h \leq 14$  in.

**HORIZONTAL SEISMIC FORCE**

skew = 0.000 degrees (ignore small skew)  
 skew = 0.00 rad

LOCATION	GIRDER	Unfactored DL	DL Factor	Factored DL	$F_{SEISMIC}$ (kip)
		(kip)	AASHTO T 3.22.1.A	(kip)	
Rear Abut	G2	20.9	1.3	27.2	53.4
	H - M	28.1	1.3	36.5	
	G & N	22.1	1.3	28.7	
Pier 1	G2	80.1	1.3	104.2	215.2
	H - M	113.7	1.3	147.8	
	G & N	89.4	1.3	116.3	
Pier 2	G2	80.1	1.3	104.2	215.5
	H - M	113.9	1.3	148.1	
	G & N	89.6	1.3	116.5	
Fwd Abut	G2	20.9	1.3	27.2	53.3
	H - M	28.0	1.3	36.4	
	G & N	22.0	1.3	28.6	
<b>Total =</b>					<b>537.3</b> *

$F_{seismic} = 20\% * (\text{No. of Beams} * \text{Fact. DL}) / \cos(\text{skew})$

Existing exterior beam reactions reduced by tributary slab width.

	Tributary Slab Width	
Beams G & N	6.49	ft (avg.)
Beams H-M	8.25	ft

**CHECK FOR REQUIRED QUANTITY OF PEDESTALS**

Max Pedestal Ht. = 8.90 in.  
 Allowable Pedestal Force = 294 kips ODOT Std. Drwg. A-1-69, Table A

$QTY_{REQD} = F_{SEISMIC} / \text{Allowable}$

$QTY_{REQD} = 1.83$

USE: 2 Pedestals minimum on bridge per direction of seismic movement

Place at Rear & Forward Abutments

Place 2 pedestals at each abutment to resist transverse movements in either direction

<b>HNTB</b>	Made by NJK	Date 12/02/10	Job No. 49663
	Checked by DBT	Date 12/06/10	Sheet No.
Calculations For CUY-90-1490R (BRIDGE 2)	Backchecked by NJK	Date 12/08/10	

File: c:\cadd\lib\pwnkoche\rd\ids72711\CUY090\_1490R\_StripSealExpJoint.xls\Rear Abutment 12/8/2010 10:04

**STRIP SEAL EXPANSION JOINT (REAR ABUTMENT)**

**INPUT**

L = 114 FT (LENGTH FROM JOINT TO THERMAL NEUTRAL POINT)  
(MEASURED ALONG CL BRIDGE)  
d steel = 0.0000065 PER DEGREE FAHRENHEIT  
SKEW = 0 DEGREE

**DIMENSION "A"**

(ODOT STANDARD EXJ-4-87)

**A60 = 1.60 IN** (DIMENSION "A" AT 60 DEGREES)

$$A90 = A60 - (d \cdot DT \cdot (L \cdot 12) \cdot \cos(SKEW))$$

DT = 30 F

**A90 = 1.33 IN**

$$A80 = A60 - (d \cdot DT \cdot (L \cdot 12) \cdot \cos(SKEW))$$

DT = 20 F

**A80 = 1.42 IN**

$$A70 = A60 - (d \cdot DT \cdot (L \cdot 12) \cdot \cos(SKEW))$$

DT = 10 F

**A70 = 1.51 IN**

$$A50 = A60 + (d \cdot DT \cdot (L \cdot 12) \cdot \cos(SKEW))$$

DT = 10 F

**A50 = 1.69 IN**

$$A40 = A60 + (d \cdot DT \cdot (L \cdot 12) \cdot \cos(SKEW))$$

DT = 20 F

**A40 = 1.78 IN**

$$A30 = A60 + (d \cdot DT \cdot (L \cdot 12) \cdot \cos(SKEW))$$

DT = 30 F

**A30 = 1.87 IN**

*Max contraction from 60° to 30°*  
*ΔT = 90°*  
*Movement = 6.5E-6(90)(114 x 12)(cos 0)*  
*= 0.80" ✓*

Note: See ODOT Std. EXJ-4-87 Page 4 of 5 Legend 4. Minimum joint opening of 1.5" at time of installation.

<b>HNTB</b>	Made by NJK	Date 12/02/10	Job No. 49663
	Checked by DBT	Date 12/06/10	Sheet No.
Calculations For <b>CUY-90-1490R (BRIDGE 2)</b>	Backchecked by NJK	Date 12/08/10	

File: c:\caddlib\pwr\koche\ndb\dms72711\CUY090\_1490R\_StripSealExpJoint.xls\Forward Abutme 12/8/2010 10:04

**STRIP SEAL EXPANSION JOINT (FORWARD ABUTMENT)**

**INPUT**

L = 47 FT (LENGTH FROM JOINT TO THERMAL NEUTRAL POINT)  
(MEASURED ALONG CL BRIDGE)  
d steel = 0.0000065 PER DEGREE FAHRENHEIT  
SKEW = 0 DEGREE

**DIMENSION "A"**

(ODOT STANDARD EXJ-4-87)

**A60 = 1.70 IN** (DIMENSION "A" AT 60 DEGREES)

$$A90 = A60 - \left( \frac{d \cdot DT}{DT} \cdot (L \cdot 12) \cdot \cos(\text{SKEW}) \right)$$

**A90 = 1.59 IN**

$$A80 = A60 - \left( \frac{d \cdot DT}{DT} \cdot (L \cdot 12) \cdot \cos(\text{SKEW}) \right)$$

**A80 = 1.63 IN**

$$A70 = A60 - \left( \frac{d \cdot DT}{DT} \cdot (L \cdot 12) \cdot \cos(\text{SKEW}) \right)$$

**A70 = 1.66 IN**

$$A50 = A60 + \left( \frac{d \cdot DT}{DT} \cdot (L \cdot 12) \cdot \cos(\text{SKEW}) \right)$$

**A50 = 1.74 IN**

$$A40 = A60 + \left( \frac{d \cdot DT}{DT} \cdot (L \cdot 12) \cdot \cos(\text{SKEW}) \right)$$

**A40 = 1.77 IN**

$$A30 = A60 + \left( \frac{d \cdot DT}{DT} \cdot (L \cdot 12) \cdot \cos(\text{SKEW}) \right)$$

**A30 = 1.81 IN**

Max Contraction from 60° to -30°  
ΔT = 90°  
Movement = 0.33 ✓

Note: See ODOT Std. EXJ-4-87 Page 4 of 5 Legend 4. Minimum joint opening of 1.5" at time of installation.

Determine the number of Seismic Pedestals needed due to a reduced Capacity at each Pedestal.

$$\text{Total } F_{\text{seismic}} = 1713.8^k \quad \checkmark$$

(See Previous attached Calc)

Due to End Crossframe interference only 3 of the 5 #9 bars can be placed. Assume  $\frac{3}{5}$  Capacity of the seismic pedestal

$$294^k \left(\frac{3}{5}\right) = 176.4^k \quad \checkmark$$

note For left Structure 4 full Pedestals have already been placed, Restraining in the Right direction. Forward abutment can receive full Pedestals due to all end Crossframes being replaced.

⇒ For Right Restraint

- 4 full placed
- 2 additional full to be built at fwd abut
- Make Remaining 2 at Rear abut partial pedestals

$$\text{Total Restraint} = 4(294) + 2(294) + 2(176.4)$$

$$= 2116.8^k \quad \checkmark$$

$$2116.8^k > 1713.8^k$$

sy OK ✓

⇒ For Left Restraint

- 4- full pedestals at fwd abut,
- 4- partial pedestals at Rear abut

$$\text{Total Restraint} = 4(294) + 4(176.4)$$

$$= 1883.6^k$$

1881.6 ✓

$$1883.6^k > 1713.8^k \quad \text{sy OK} \quad \checkmark$$

1881.6 ✓

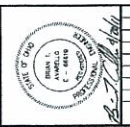
Check Thermal Contraction to ensure angle clearance w/ pedestals

See included expansion joint calcs.

Assume bearing set at  $60^\circ$

$$\text{Max Contraction} = 0.99'' \quad \checkmark$$

provide 1" clr ✓

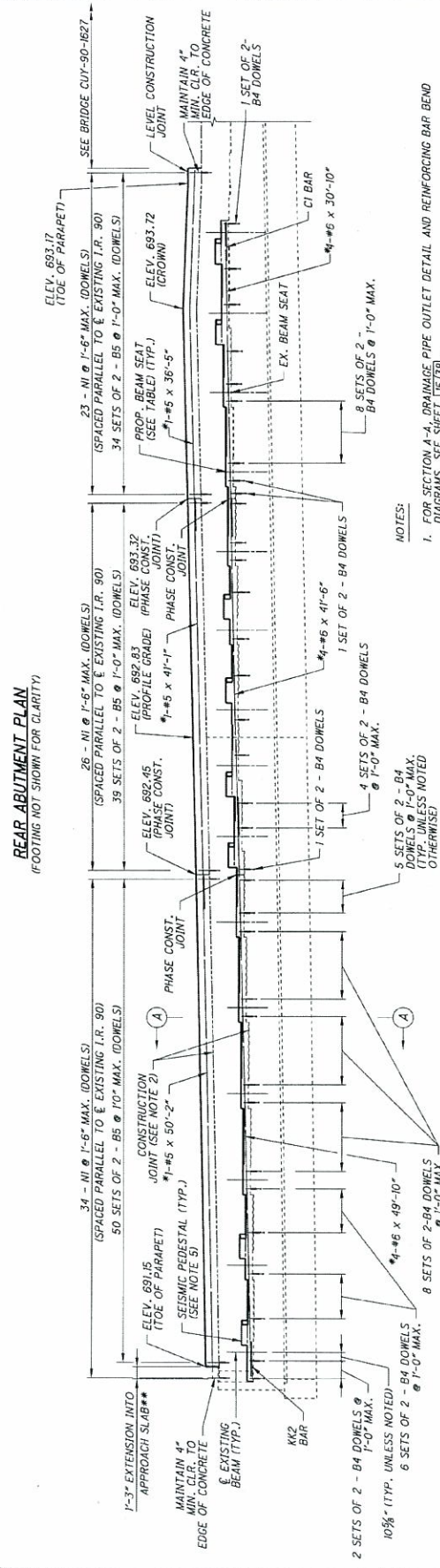
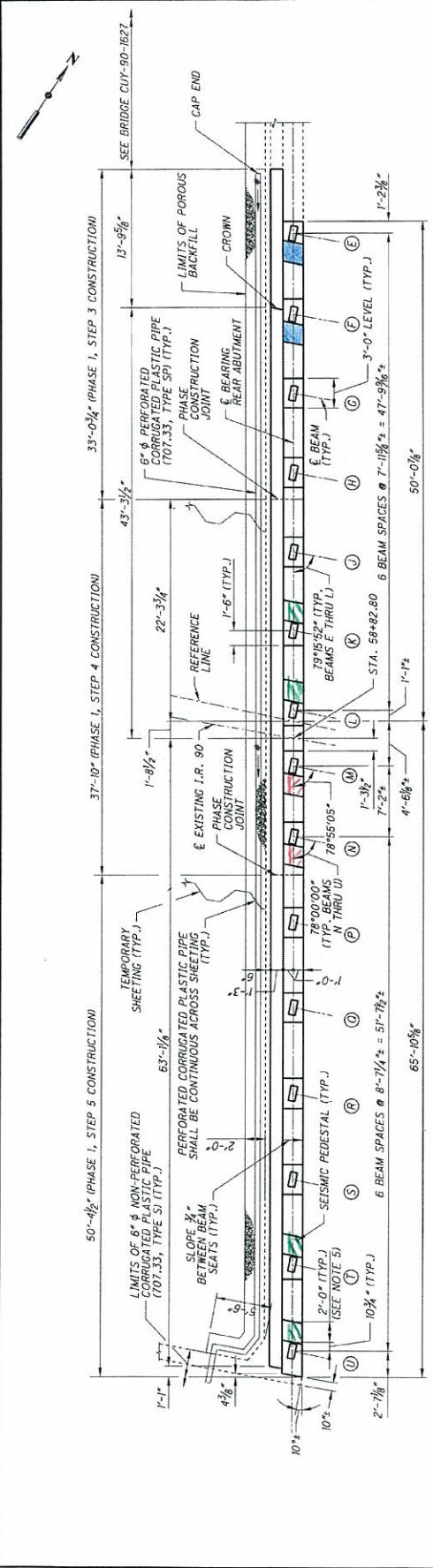


NO.	DATE	REVISIONS
1	04-28-11	APPROVED FOR CONSTRUCTION
2	04-28-11	FINAL SUBMITTAL REVIEW
3	04-28-11	
4	04-28-11	INTERIM REVIEW SIGNATURE

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**REAR ABUTMENT PLAN AND ELEVATION**  
 BRIDGES 7 & 8  
 BRIDGE NO. CUY-90-1628 L/R  
 1-90 WESTBOUND AND EASTBOUND OVER E 9TH STREET  
 PID NO. 77332 / 85631  
 CUY-90-14.90  
 03-29-11  
 1807 9th Street, Suite 200, San Francisco, CA 94107  
 03-29-11  
 1807 9th Street, Suite 200, San Francisco, CA 94107



**NOTES:**

- FOR SECTION A-A, DRAINAGE PIPE OUTLET DETAIL AND REINFORCING BAR BEND DIAGRAMS, SEE SHEET 15/23B.
- OF STRUCTURE REMOVED OVER 20 FOOT SPAN, AS PER PLAN.
- EXISTING REINFORCING STEEL BARS IN THE AREA OF THE DOWEL HOLES SHALL BE REINFORCED WITH #5 BARS. THE REINFORCING BARS SHALL BE FACED AT THE SAME LOCATION AS A PROPOSED DOWEL HOLE. THE DOWEL HOLE SHALL BE MOVED TO EITHER SIDE OF THE EXISTING BAR.
- POROUS BACKFILL WITH FILTER FABRIC, 2 FEET THICK SHALL EXTEND UP TO THE PLANE OF THE SUBGRADE AND LATERALLY TO THE LIMITS SHOWN IN THE PLANS.
- FOR SEISMIC PEDESTAL DETAILS, SEE SHEET 16/28B.
- FOR APPROACH SLAB DETAILS, SEE SHEET 35/28B THRU 38/28B.

**REAR ABUTMENT ELEVATION**  
 (PILES NOT SHOWN FOR CLARITY)

**MINIMUM LAP LENGTH TABLE**

BAR SIZE	MINIMUM LAP LENGTH
#5	3'-3"
#6	3'-10"

**BEAM SEAT ELEVATIONS**

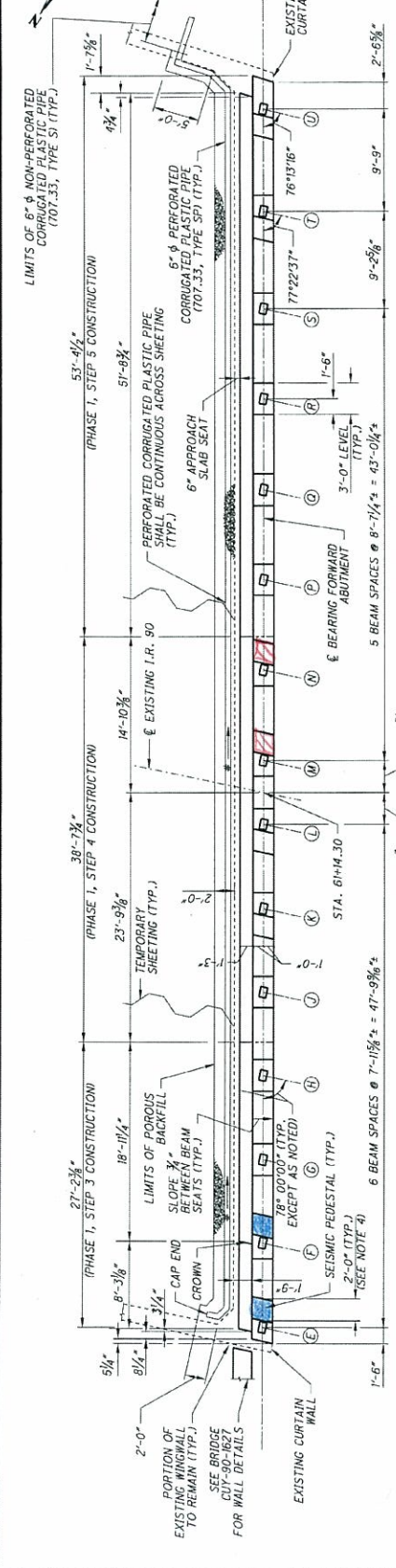
PROPOSED	E	F	G	H	J	K	L	M	N	P	O	R	S	T	U	EXISTING
699.27	699.38	699.22	699.02	699.02	699.52	699.62	699.40	699.34	699.14	699.95	699.71	699.49	699.28	699.04	699.63	699.27
699.5	699.5	699.3	699.1	699.1	699.9	699.8	699.7	699.6	699.1	699.9	699.7	699.5	699.2	699.6	699.1	699.5

\* SLOPE 1/8" / FT.  
 \* LENGTH OF REBAR DOES NOT INCLUDE ANY LAP LENGTHS (SEE MINIMUM LAP LENGTH TABLE). CONTRACTOR SHALL DETERMINE TOTAL REBAR LENGTH REQUIRED.  
 \*\* OTHER APPROACH SLAB REBAR NOT SHOWN FOR CLARITY.

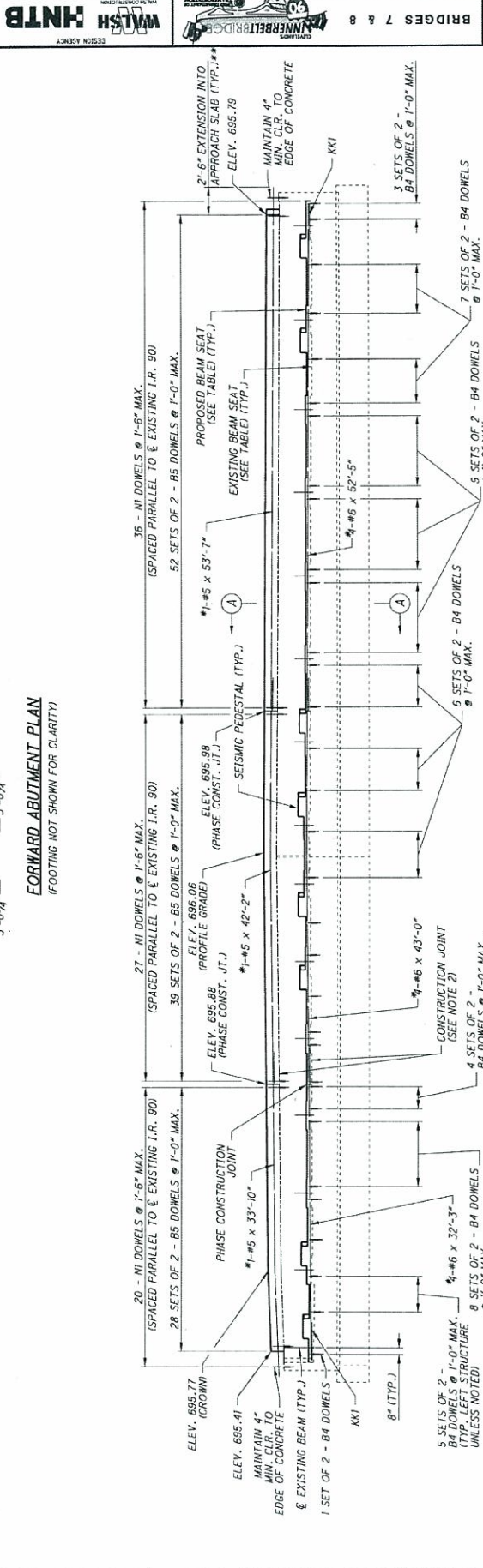
Partial Pedestal (already placed) - Restraint in the Right  
 Partial Pedestal - Restraint in the Left

NO.	DATE	REVISIONS
1	04-24-11	APPROVED FOR CONSTRUCTION
2	03-25-11	FINAL SUBMITTAL REVIEWED
3	03-25-11	FINAL SUBMITTAL
4	03-25-11	INTERIM REVIEW SUBMITTAL

BRIDGES 7 & 8  
**WILSH HNTB**  
 CIVIL ENGINEERING  
 190 WESTBOND AND EASTBOND OVER E 9TH STREET  
 PID NO. 77332/85631



**FORWARD ABUTMENT PLAN**  
 (FOOTING NOT SHOWN FOR CLARITY)



**NOTES:**

- FOR SECTION A-A, SEE SHEET 18238.
- SCARIFY THE TOP OF EXISTING SURFACES TO A DEPTH OF 1/4\"/>

**FORWARD ABUTMENT ELEVATION**  
 (PILES NOT SHOWN FOR CLARITY)

BEAM SEAT ELEVATIONS															
	E	F	G	H	J	K	L	M	N	P	O	R	S	T	U
PROPOSED	691.14	691.40	691.42	691.44	691.47	691.54	691.59	691.59	691.58	691.55	691.48	691.50	691.45	691.34	691.23
EXISTING	690.5	690.7	690.8	690.8	690.8	690.9	691.0	691.0	690.9	690.9	690.8	690.8	690.8	690.7	690.7

**MINIMUM LAP LENGTH TABLE**

#5	3'-3"
#6	3'-10"

\* SLOPE 1/8" / FT.  
 \* LENGTH OF REBAR DOES NOT INCLUDE ANY LAP LENGTHS (SEE MINIMUM LAP LENGTH TABLE). CONTRACTOR SHALL DETERMINE TOTAL REBAR LENGTH REQUIRED.  
 \*\* OTHER APPROACH SLAB REBAR NOT SHOWN FOR CLARITY.

Full Pedestal (already placed) - Restraint in the Right

Full Pedestal - Restraint in the Left

Full Pedestal - Restraint in the Right

Full Pedestal - Restraint in the Left



4/8

<b>HNTB</b>	Made by NJ	Date 11/30/10	Job No. 49633
	Checked by JTW	Date 12/1/10	Sheet No.
Calculations For <b>CUY-90-1628L&amp;R - Seismic Pedestal</b>	Backchecked by NJ	Date 12/1/10	

File: C:\Documents and Settings\nojain\Desktop\[CUY-90-1628\_Seismic Pedestal.xlsm]SEISMIC PEDESTAL 12/1/2010 15:18

Updated: NJ 12/1/10

**SEISMIC PEDESTAL - DESIGN  
ZONE A REQUIREMENTS (ODOT BDM 301.4.3)**

Verify! JTW 12/1/10

**HEIGHT OF PEDESTAL (h)**

$$h = T_h + 2 \text{ 3/4"}$$

$$(T_h = T_e + T_t, \text{ from bearing design})$$

Girders A-G	LOCATION	Te (IN)	Tt (IN)	Th (IN)	2 3/4 (IN)	h (IN)
	RA	1.89	1.60	3.49	2.75	6.24
	PIER 1	2.92	2.10	5.02	2.75	7.77
	PIER 2	2.92	1.60	4.52	2.75	7.27
	FA	2.68	1.60	4.28	2.75	7.03

**MINIMUM HORIZONTAL SEISMIC FORCE**

skew = 12.000 degrees  
skew = 0.21 rad

$$F_{seismic} = (0.20 * (\text{No. of Girders} * \text{Fact DL})) / (\cos(\text{skew}))$$

LOCATION	GIRDER	Non Comp DL (K)	Comp DL (K)	TOTAL DL (K)	F <sub>SEISMIC</sub> (K)
RA	P	58.43	27.23	85.66	262.7
PIER 1	P	172.25	81.03	253.28	776.8
PIER 2	P	117.39	60.89	178.28	546.8
FA	P	26.87	14.69	41.56	127.5
<b>Total =</b>					<b>1713.8</b>

**Total = 1713.8** \*

**CHECK FOR REQUIRED QUANTITY OF PEDESTALS**

(ODOT STANDARD A-1-69, TABLE A)

$$h(\text{MAX}) = 7.8 \text{ IN}$$

(ALLOWABLE FORCE PER PEDESTAL BASED ON TABLE A IS 294)

$$QTY_{REQD} = F_{SEISMIC} / 294$$

$$F_{SEISMIC} = 1714 \text{ K}$$

$$QTY_{REQD} = 5.83$$

USE: 8 PEDESTALS MINIMUM ACROSS LENGTH OF BRIDGE

**PLACE AT RA & FA - Place 8 pedestals at each RA and FA**

**8 pedestals provided to allow even distribution betwn L & R bridges.**

<b>HNTB</b>	Made by jrs	Date 11/04/10	Job No. 49663
	Checked by JTW	Date 11/8/10	Sheet No.
Calculations For CUY-90-1628L/R (BRIDGES 7 & 8)	Backchecked by JTS	Date 11/8/10	

File: C:\Documents and Settings\jstock\My Documents\I-90 Innerbelt Project\Bridge No. CUY-90-1 11/4/2010 16:35

JTW 11/8/10

**STRIP SEAL EXPANSION JOINT ( LEFT REAR ABUTMENT)**

**INPUT**

L = 87.7 FT (LENGTH FROM JOINT TO THERMAL NEUTRAL POINT  
(MEASURED ALONG CL BRIDGE))  
 $\delta$  steel = 0.0000065 PER DEGREE FAHRENHEIT  
 SKEW = 10.7356 DEGREE

**DIMENSION "A"**

(ODOT STANDARD EXJ-4-87)

**A60 = 1.79 IN** (DIMENSION "A" AT 60 DEGREES)

$$A90 = A60 - (\delta \cdot \Delta T \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

$\Delta T = 30 \text{ F}$

**A90 = 1.59 IN**

$$A80 = A60 - (\delta \cdot \Delta T \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

$\Delta T = 20 \text{ F}$

**A80 = 1.66 IN**

$$A70 = A60 - (\delta \cdot \Delta T \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

$\Delta T = 10 \text{ F}$

**A70 = 1.72 IN**

$$A50 = A60 + (\delta \cdot \Delta T \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

$\Delta T = 10 \text{ F}$

**A50 = 1.86 IN**

$$A40 = A60 + (\delta \cdot \Delta T \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

$\Delta T = 20 \text{ F}$

**A40 = 1.92 IN**

$$A30 = A60 + (\delta \cdot \Delta T \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

$\Delta T = 30 \text{ F}$

**A30 = 1.99 IN**

Max Contraction from 60° to -30°  
 @ -30°  $\Delta T = 90^\circ$

$$\text{Movement} = 6.5E-6(90)(87.7 \times 12)(\cos 10.74)$$

$$= 0.60'' \checkmark$$

<b>HNTB</b>	Made by jrs	Date 11/04/10	Job No. 49663
	Checked by JTW	Date 11/2/10	Sheet No.
Calculations For CUY-90-1628L/R (BRIDGES 7 & 8)	Backchecked by JRS	Date 11/2/10	

File: C:\Documents and Settings\stock\My Documents\I-90 Innerbelt Project\Bridge No. CUY-90-1 11/4/2010 16:35

JTW 11/2/10

**STRIP SEAL EXPANSION JOINT (LEFT FORWARD ABUTMENT)**

**INPUT**

L = 143.8 FT (LENGTH FROM JOINT TO THERMAL NEUTRAL POINT)  
(MEASURED ALONG CL BRIDGE)

$\delta$  steel = 0.0000065 PER DEGREE FAHRENHEIT

SKEW = 12.0000 DEGREE

**DIMENSION "A"**

(ODOT STANDARD EXJ-4-87)

A60 = 1.68 IN	(DIMENSION "A" AT 60 DEGREES)
---------------	-------------------------------

$A90 = A60 - (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$   
 $\Delta T = 30 \text{ F}$

A90 = 1.35 IN
---------------

$A80 = A60 - (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$   
 $\Delta T = 20 \text{ F}$

A80 = 1.46 IN
---------------

$A70 = A60 - (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$   
 $\Delta T = 10 \text{ F}$

A70 = 1.57 IN
---------------

$A50 = A60 + (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$   
 $\Delta T = 10 \text{ F}$

A50 = 1.79 IN
---------------

$A40 = A60 + (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$   
 $\Delta T = 20 \text{ F}$

A40 = 1.90 IN
---------------

$A30 = A60 + (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$   
 $\Delta T = 30 \text{ F}$

A30 = 2.01 IN
---------------

Max Contraction from 60° to -30°

Movement = 0.99" ✓

7/8

<b>HNTB</b>	Made by jrs	Date 11/04/10	Job No. 49663
	Checked by JTW	Date 11/8/10	Sheet No.
Calculations For CUY-90-1628L/R (BRIDGES 7 & 8)	Backchecked by JTW	Date 11/8/10	

File: C:\Documents and Settings\stock\My Documents\I-90 Innerbelt Project\Bridge No. CUY-90-1 11/4/2010 16:35

JTW 11/8/10

**STRIP SEAL EXPANSION JOINT (RIGHT REAR ABUTMENT)**

**INPUT**

L = 88 FT (LENGTH FROM JOINT TO THERMAL NEUTRAL POINT)  
(MEASURED ALONG CL BRIDGE)

$\delta$  steel = 0.0000065 PER DEGREE FAHRENHEIT

SKEW = 12.0000 DEGREE

**DIMENSION "A"**

(ODOT STANDARD EXJ-4-87)

**A60 = 1.79 IN** (DIMENSION "A" AT 60 DEGREES)

$$A90 = A60 - (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$$

$\Delta T = 30 \text{ F}$

**A90 = 1.59 IN**

$$A80 = A60 - (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$$

$\Delta T = 20 \text{ F}$

**A80 = 1.66 IN**

$$A70 = A60 - (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$$

$\Delta T = 10 \text{ F}$

**A70 = 1.72 IN**

$$A50 = A60 + (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$$

$\Delta T = 10 \text{ F}$

**A50 = 1.86 IN**

$$A40 = A60 + (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$$

$\Delta T = 20 \text{ F}$

**A40 = 1.92 IN**

$$A30 = A60 + (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$$

$\Delta T = 30 \text{ F}$

**A30 = 1.99 IN**

Max contraction from 60° to -30°  
Movement = 0.6" ✓

8/8

<b>HNTB</b>	Made by jrs	Date 11/04/10	Job No. 49663
	Checked by JTW	Date 11/8/10	Sheet No.
Calculations For CUY-90-1628L/R (BRIDGES 7 & 8)	Backchecked by JTW	Date 11/8/10	

File: C:\Documents and Settings\jstock\My Documents\I-90 Innerbelt Project\Bridge No. CUY-90-1 11/4/2010 16:35

JTW 11/8/10

**STRIP SEAL EXPANSION JOINT (RIGHT FORWARD ABUTMENT)**

**INPUT**

L = 143.8 FT (LENGTH FROM JOINT TO THERMAL NEUTRAL POINT)  
(MEASURED ALONG CL BRIDGE)

$\delta$  steel = 0.0000065 PER DEGREE FAHRENHEIT

SKEW = 12.0000 DEGREE

**DIMENSION "A"**

(ODOT STANDARD EXJ-4-87)

A60 = 1.68 IN	(DIMENSION "A" AT 60 DEGREES)
---------------	-------------------------------

$$A90 = A60 - (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$$

$\Delta T = 30 \text{ F}$

A90 = 1.35 IN
---------------

$$A80 = A60 - (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$$

$\Delta T = 20 \text{ F}$

A80 = 1.46 IN
---------------

$$A70 = A60 - (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$$

$\Delta T = 10 \text{ F}$

A70 = 1.57 IN
---------------

$$A50 = A60 + (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$$

$\Delta T = 10 \text{ F}$

A50 = 1.79 IN
---------------

$$A40 = A60 + (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$$

$\Delta T = 20 \text{ F}$

A40 = 1.90 IN
---------------

$$A30 = A60 + (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$$

$\Delta T = 30 \text{ F}$

A30 = 2.01 IN
---------------

Max Contraction From 60° to -30°

Movement = 0.99" ✓

Determine the Number of Pedestals needed due to a reduced capacity at each Pedestal. ✓

$$\text{Total F seismic} = 2321.7 \text{ k} \quad \checkmark$$

(See Previous attached Calc)

Due to End Cross frame interference only 4 of the 5 #9 bars can be placed. Assume  $\frac{4}{5}$  Capacity of the seismic pedestal.

$$\text{Full Pedestal} = 294 \text{ k Resistance} \quad \checkmark$$

$$294 \text{ k} \left(\frac{4}{5}\right) = 235.2 \text{ k} \quad \checkmark$$

$$2321.7 \text{ k} / 235.2 \text{ k} = 9.87 \text{ peds} \quad \checkmark$$

Say 10 Peds for each direction  
(5 for each Bridge) ✓

- See attached Marked up plan sheets for pedestal Placement.

Check Thermal Contraction to ensure angle Clearance w/ Pedestal

See Included Expansion Joint Calcs.

Assume Bearing Set at  $60^\circ$

$$\text{Max Contraction} = \frac{1.59 \text{ "}}{0.53 \text{ "}} \quad \checkmark$$

provide  $\frac{1}{2} \text{ "}$  clr for unknowns ✓



3/9

**FORWARD ABUTMENT PLAN AND ELEVATION - 1**

BRIDGE NO. CUY-90-1490  
1-90 EASTBOUND AND WESTBOUND OVER I-77 SOUTHBOUND

**DESIGNED** J.T.M. 03-14-11  
**DATE**

**CHECKED** J.T.M. 03-14-11  
**DATE**

**NO.** 14/42  
**PID NO.** 77332/85531

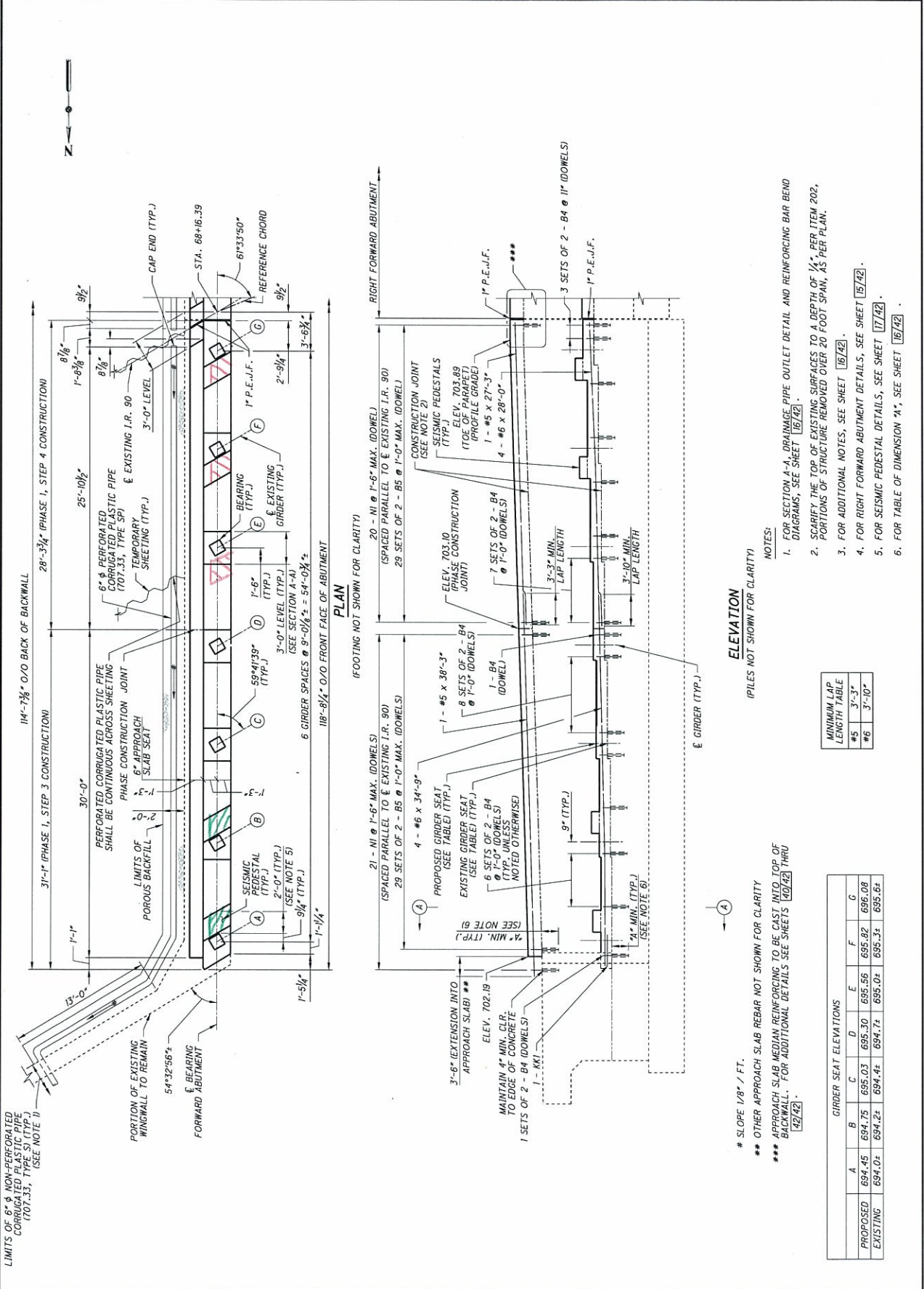
**BRIDGE 9**

**NO.** 1  
**APPROVED FOR CONSTRUCTION**

**NO.** 2  
**FINAL SUBMITTAL**

**NO.** 3  
**INTERIM REVIEW SUBMITTAL**

**NO.** 4  
**DATE**



**MINIMUM LAP LENGTH TABLE**

BAR SIZE	MIN. LAP LENGTH
#5	3'-3"
#6	3'-10"

**GIRDER SEAT ELEVATIONS**

	A	B	C	D	E	F	G
PROPOSED	694.45	694.75	695.03	695.30	695.56	695.82	696.08
EXISTING	694.0x	694.2x	694.4x	694.7x	695.0x	695.3x	695.6x

- Restraint to the Left - Partial Pedestal

- Restraint to the Right - Partial Pedestal





5/9

<b>HNTB</b>	Made by NJ	Date 11/30/10	Job No. 49633
	Checked by JTW	Date 12/1/10	Sheet No.
Calculations For <b>CUY-90-1640 - Seismic Pedestal</b>	Backchecked by NJ	Date 12/1/10	

File: C:\Documents and Settings\nojain\Desktop\CUY-90-1640\_Seismic Pedestal.xls]SEISMIC PEDESTAL 12/1/2010 15:14

Updated: JTW 12/1/10  
Verify: JTW 12/1/10

**SEISMIC PEDESTAL - DESIGN  
ZONE A REQUIREMENTS (ODOT BDM 301.4.3)**

**HEIGHT OF PEDESTAL (h)**

$h = T_h + 2\ 3/4"$

$(T_h = T_e + T_t, \text{ from bearing design})$

<b>Girders A-G</b>	LOCATION	Te (IN)	Tt (IN)	Th (IN)	2 3/4 (IN)	h (IN)
	RA	4.23	1.50	5.73	2.75	<b>8.48</b>
	PIER 1	4.57	2.50	7.07	2.75	<b>9.82</b>
	PIER 2	4.78	2.50	7.28	2.75	<b>10.03</b>
	FA	4.28	1.50	5.78	2.75	<b>8.53</b>

<b>Girders H-P</b>	LOCATION	Te (IN)	Tt (IN)	Th (IN)	2 3/4 (IN)	h (IN)
	RA	4.28	1.50	5.78	2.75	<b>8.53</b>
	PIER 1	4.32	2.50	6.82	2.75	<b>9.57</b>
	PIER 2	4.37	2.50	6.87	2.75	<b>9.62</b>
	FA	4.28	1.50	5.78	2.75	<b>8.53</b>

**MINIMUM HORIZONTAL SEISMIC FORCE**

skew = 29.500 degrees (max skew @ FA)  
skew = 0.51 rad

$F_{seismic} = (0.20 * (\text{No. of Girders} * \text{Fact DL})) / (\cos(\text{skew}))$

LOCATION	GIRDER	Non Comp DL (K)	Comp DL (K)	TOTAL DL (K)	F <sub>SEISMIC</sub> (K)
RA	B	43.36	22.94	66.3	<b>231.4</b>
	N	55.65	28.34	83.99	
PIER 1	B	236.28	110.61	346.89	<b>929.3</b>
	N	171.46	85.22	256.68	
PIER 2	B	238.47	110.68	349.15	<b>930.5</b>
	N	170.48	84.73	255.21	
FA	B	43.67	22.91	66.58	<b>230.6</b>
	N	55.13	28.07	83.2	

Average reaction used for internal girders

Average reaction for internal girders is reduced by a factor of 0.85 for external girders.

**Total = 2321.7**

**CHECK FOR REQUIRED QUANTITY OF PEDESTALS  
(ODOT STANDARD A-1-69, TABLE A)**

$h(\text{MAX}) = 10.0 \text{ IN}$

(ALLOWABLE FORCE PER PEDESTAL BASED ON TABLE A IS 294)

$QTY_{REQ'D} = F_{SEISMIC} / 294$

$F_{SEISMIC} = 2322 \text{ K}$

$QTY_{REQ'D} = 7.90$

USE: 8 PEDESTALS MINIMUM ACROSS LENGTH OF BRIDGE

**PLACE AT RA & FA**

**Place 8 pedestals at each RA and FA**

6/9

<b>HNTB</b>	Made by JTW	Date 11/03/10	Job No. 49663
	Checked by RSB	Date 11/4/10	Sheet No.
Calculations For CUY-77-1640C (BRIDGE 9)	Backchecked by JTW	Date 11/4/10	

File: c:\caddlib\pw\jwrote\bd\vdms72484\Strip Seal Exp Joint.xls\Left Rear Abutment 11/4/2010 11:16

RSB 11/4/10

**STRIP SEAL EXPANSION JOINT ( LEFT REAR ABUTMENT)**

**INPUT**

L = 228 FT (LENGTH FROM JOINT TO THERMAL NEUTRAL POINT)  
(MEASURED ALONG CL BRIDGE)

$\delta$  steel = 0.0000065 PER DEGREE FAHRENHEIT

SKEW = 0.63 DEGREE

**DIMENSION "A"**

(ODOT STANDARD EXJ-4-87)

**A60 = 1.50 IN** (DIMENSION "A" AT 60 DEGREES)

$$A90 = A60 - (\delta \cdot \Delta T \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

$\Delta T = 30 \text{ F}$

**A90 = 0.97 IN**

$$A80 = A60 - (\delta \cdot \Delta T \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

$\Delta T = 20 \text{ F}$

**A80 = 1.14 IN**

$$A70 = A60 - (\delta \cdot \Delta T \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

$\Delta T = 10 \text{ F}$

**A70 = 1.32 IN**

$$A50 = A60 + (\delta \cdot \Delta T \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

$\Delta T = 10 \text{ F}$

**A50 = 1.68 IN**

$$A40 = A60 + (\delta \cdot \Delta T \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

$\Delta T = 20 \text{ F}$

**A40 = 1.86 IN**

$$A30 = A60 + (\delta \cdot \Delta T \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

$\Delta T = 30 \text{ F}$

**A30 = 2.03 IN**

Max Contraction from 60°  
2.03" - 1.5" = 0.53"

CALCULATE "A" @ -30°F (AASHTO 3.16) RSB  
7/21/11

$A(-30) = 3.09"$  ✓

$\Delta A = 3.09" - 1.5" = 1.59"$  ✓ ← CONTROLS

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Calculations For CUY-77-1640C (BRIDGE 9)	Backchecked by JTW	Date 11/4/10	

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RSB 11/4/10

**STRIP SEAL EXPANSION JOINT (LEFT FORWARD ABUTMENT)**

**INPUT**

L = 90 FT (LENGTH FROM JOINT TO THERMAL NEUTRAL POINT)  
(MEASURED ALONG CL BRIDGE)  
 $\delta$  steel = 0.0000065 PER DEGREE FAHRENHEIT  
SKEW = 30.712 DEGREE

**DIMENSION "A"**

(ODOT STANDARD EXJ-4-87)

**A60 = 1.65 IN** (DIMENSION "A" AT 60 DEGREES)

$$A90 = A60 - (\delta \cdot \Delta T \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

$\Delta T = 30 \text{ F}$

**A90 = 1.47 IN**

$$A80 = A60 - (\delta \cdot \Delta T \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

$\Delta T = 20 \text{ F}$

**A80 = 1.53 IN**

$$A70 = A60 - (\delta \cdot \Delta T \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

$\Delta T = 10 \text{ F}$

**A70 = 1.59 IN**

$$A50 = A60 + (\delta \cdot \Delta T \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

$\Delta T = 10 \text{ F}$

**A50 = 1.71 IN**

$$A40 = A60 + (\delta \cdot \Delta T \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

$\Delta T = 20 \text{ F}$

**A40 = 1.77 IN**

$$A30 = A60 + (\delta \cdot \Delta T \cdot (L \cdot 12) \cdot \cos(\text{SKEW}))$$

$\Delta T = 30 \text{ F}$

**A30 = 1.83 IN**

Max Contraction from 60°  
 $1.83 - 1.65" = 0.18"$

CALCULATE "A" @ -30° F (AASHTO 3.16) RSB 7/21/10

$$A(-30) = 2.19"$$

$$AA = 2.19" - 1.65" = \underline{\underline{0.54"}}$$

<b>HNTB</b>	Made by JTW	Date 11/03/10	Job No. 49663
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Calculations For CUY-77-1640C (BRIDGE 9)	Backchecked by JTW	Date 11/4/10	

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**STRIP SEAL EXPANSION JOINT (RIGHT REAR ABUTMENT)**

**INPUT**

L = 90 FT (LENGTH FROM JOINT TO THERMAL NEUTRAL POINT)  
 (MEASURED ALONG CL BRIDGE)  
 $\delta$  steel = 0.0000065 PER DEGREE FAHRENHEIT  
 SKEW = 0.63 DEGREE

**DIMENSION "A"**  
 (ODOT STANDARD EXJ-4-87)

**A60 = 1.65 IN** (DIMENSION "A" AT 60 DEGREES)

$A90 = A60 - (\delta * \Delta T * (L * 12) * \cos(SKEW))$   
 $\Delta T = 30 \text{ F}$

**A90 = 1.44 IN**

$A80 = A60 - (\delta * \Delta T * (L * 12) * \cos(SKEW))$   
 $\Delta T = 20 \text{ F}$

**A80 = 1.51 IN**

$A70 = A60 - (\delta * \Delta T * (L * 12) * \cos(SKEW))$   
 $\Delta T = 10 \text{ F}$

**A70 = 1.58 IN**

$A50 = A60 + (\delta * \Delta T * (L * 12) * \cos(SKEW))$   
 $\Delta T = 10 \text{ F}$

**A50 = 1.72 IN**

$A40 = A60 + (\delta * \Delta T * (L * 12) * \cos(SKEW))$   
 $\Delta T = 20 \text{ F}$

**A40 = 1.79 IN**

$A30 = A60 + (\delta * \Delta T * (L * 12) * \cos(SKEW))$   
 $\Delta T = 30 \text{ F}$

**A30 = 1.86 IN**

Max Contraction from 60°  
 $1.86" - 1.65" = 0.21"$

CALCULATE DIMENSION "A" @ -30°F (AASHTO 3.16) RSB 7/21/11

$A(-30) = A60 + (\delta * \Delta T * (L * 12) * \cos(SKEW))$

$A(-30) = 2.28"$

MAX CONTRACTION FROM 60° =  $2.28" - 1.65" = \underline{0.63}"$

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<b>HNTB</b>	Made by JTW	Date 11/03/10	Job No. 49663
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Calculations For CUY-77-1640C (BRIDGE 9)	Backchecked by JTW	Date 11/4/10	

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RSB 11/4/10

**STRIP SEAL EXPANSION JOINT (RIGHT FORWARD ABUTMENT)**

**INPUT**

L = 200 FT (LENGTH FROM JOINT TO THERMAL NEUTRAL POINT)  
(MEASURED ALONG CL BRIDGE)  
 $\delta$  steel = 0.0000065 PER DEGREE FAHRENHEIT  
 SKEW = 30.712 DEGREE

**DIMENSION "A"**

(ODOT STANDARD EXJ-4-87)

**A60 = 1.50 IN** (DIMENSION "A" AT 60 DEGREES)

$$A90 = A60 - (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$$

$\Delta T = 30 \text{ F}$

**A90 = 1.10 IN**

$$A80 = A60 - (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$$

$\Delta T = 20 \text{ F}$

**A80 = 1.23 IN**

$$A70 = A60 - (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$$

$\Delta T = 10 \text{ F}$

**A70 = 1.37 IN**

$$A50 = A60 + (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$$

$\Delta T = 10 \text{ F}$

**A50 = 1.63 IN**

$$A40 = A60 + (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$$

$\Delta T = 20 \text{ F}$

**A40 = 1.77 IN**

$$A30 = A60 + (\delta * \Delta T * (L * 12) * \cos(\text{SKEW}))$$

$\Delta T = 30 \text{ F}$

**A30 = 1.90 IN**

Max Contraction from 60°  
 $1.90" - 1.5" = 0.4"$

CALCULATE "A" @ -30° F (AASHTO 3.16) RSB 7/25/11

A(-30) =

$$A A = 2.7" - 1.5" = 1.2"$$