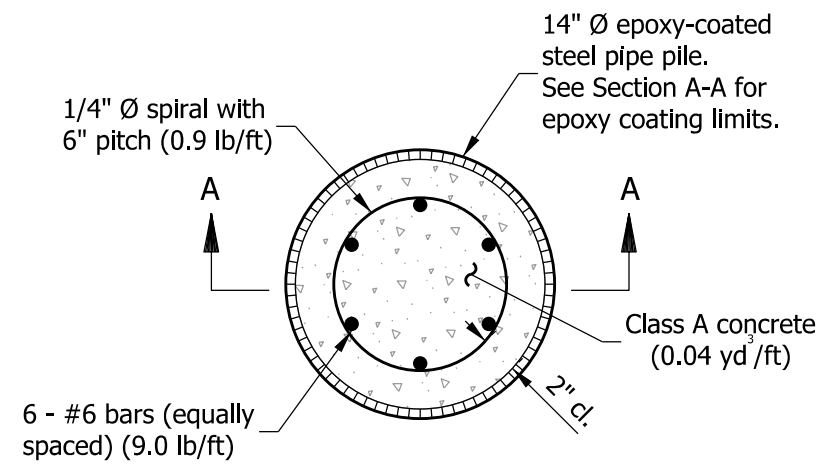
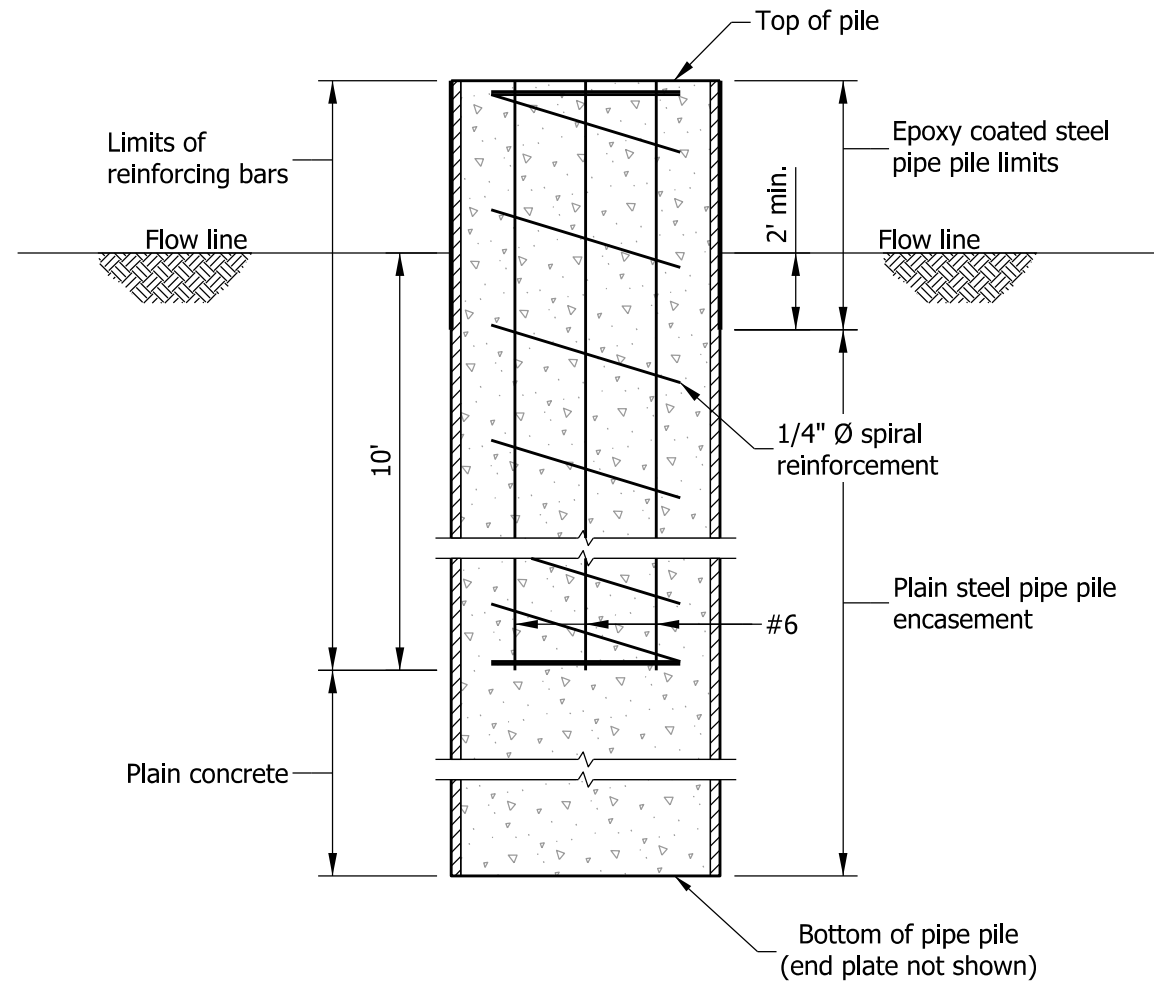
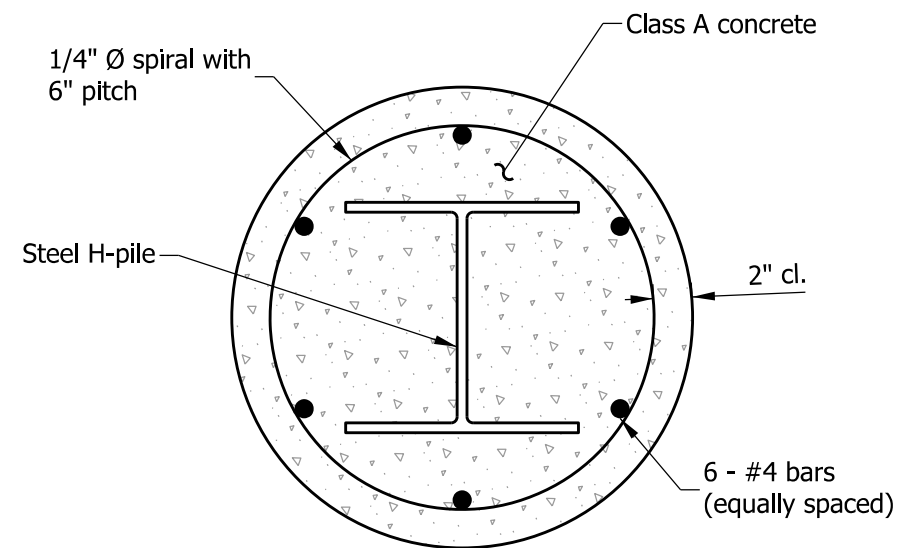




**REINFORCED-CONCRETE FILLED EPOXY-COATED  
STEEL PIPE PILE ENCASEMENT PLAN VIEW**



**SECTION A-A**



**STEEL H - PILES  
REINFORCED-CONCRETE ENCASEMENT PLAN VIEW**

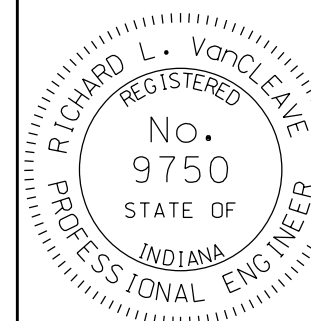
| TABLE OF MATERIALS       |                       |                         |                          |
|--------------------------|-----------------------|-------------------------|--------------------------|
| Steel H-Pile designation | Minimum pile diameter | Reinforcing bars, lb/ft | Class A concrete, yd³/ft |
| HP 14                    | 2'-3"                 | 5.8                     | 0.12                     |
| HP 12                    | 2'-0"                 | 5.6                     | 0.10                     |
| HP 10                    | 1'-9"                 | 5.4                     | 0.08                     |

**INDIANA DEPARTMENT OF TRANSPORTATION**

**REINFORCED-CONCRETE  
ENCASEMENT FOR PILES**

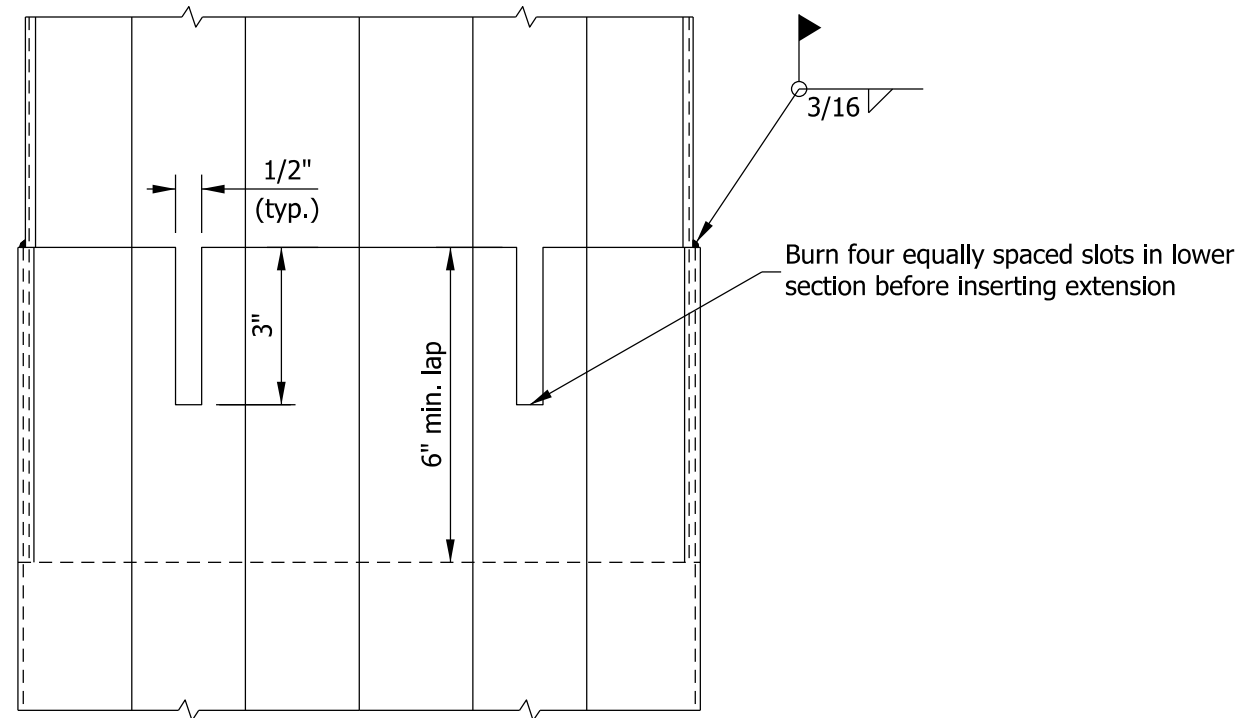
**SEPTEMBER 2012**

**STANDARD DRAWING NO. E 701-BPIL-01**

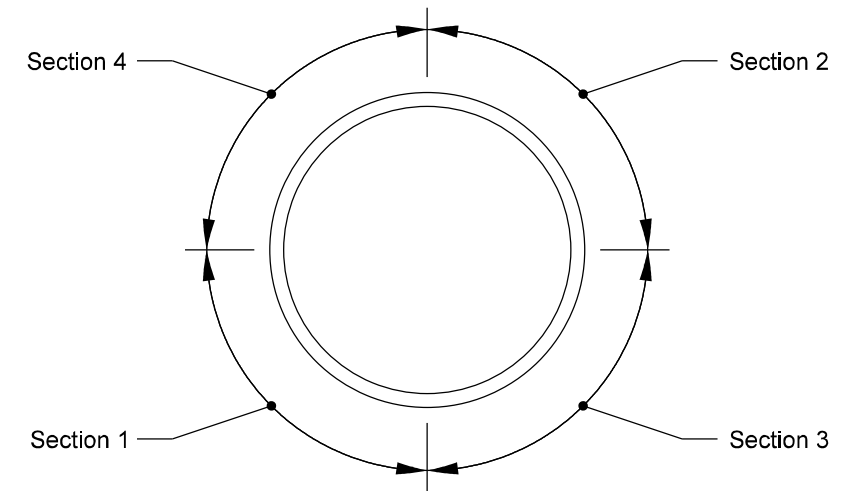


/s/ Richard L. VanCleave 09/04/12  
SUPERVISOR, ROADWAY STANDARDS DATE

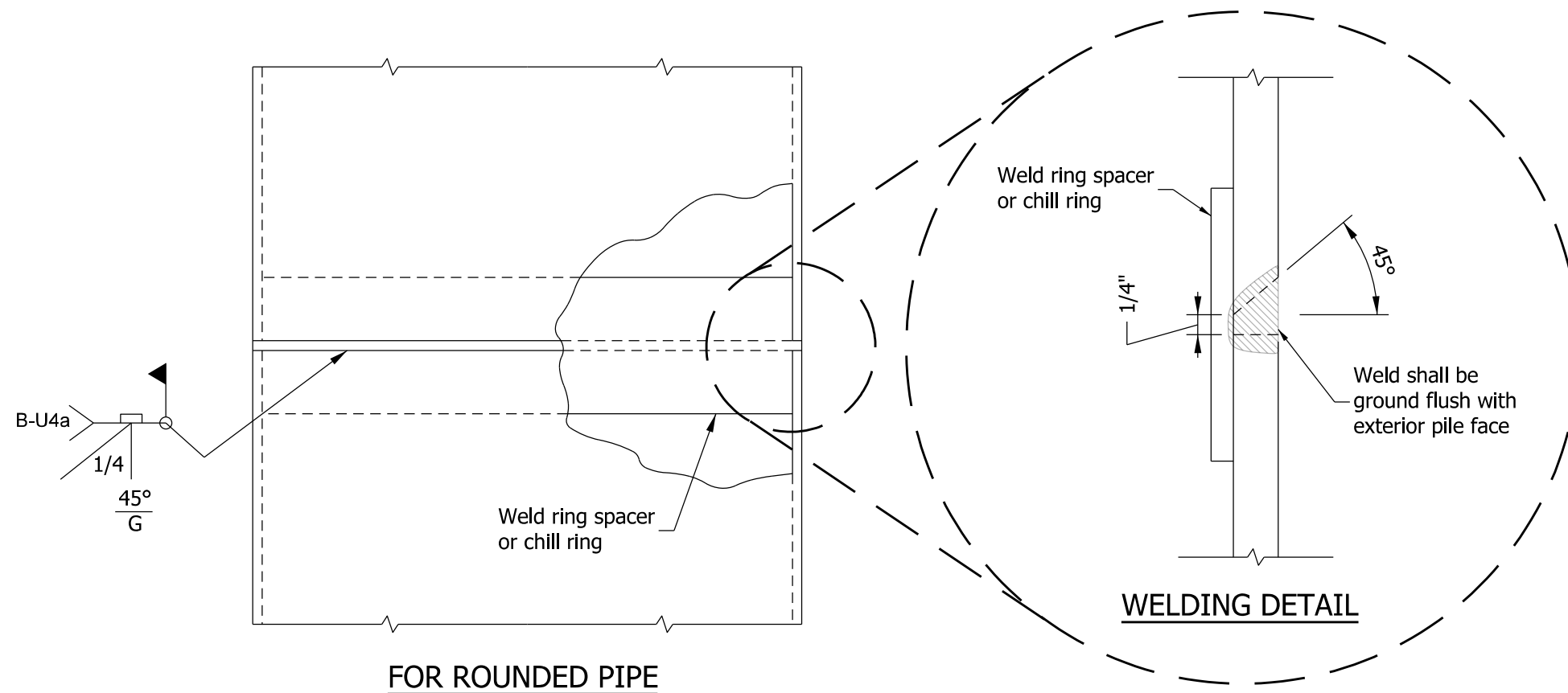
/s/ Mark A. Miller 09/04/12  
CHIEF ENGINEER DATE



FOR FLUTED PIPE



WELDING SEQUENCE



FOR ROUNDED PIPE

WELDING DETAIL

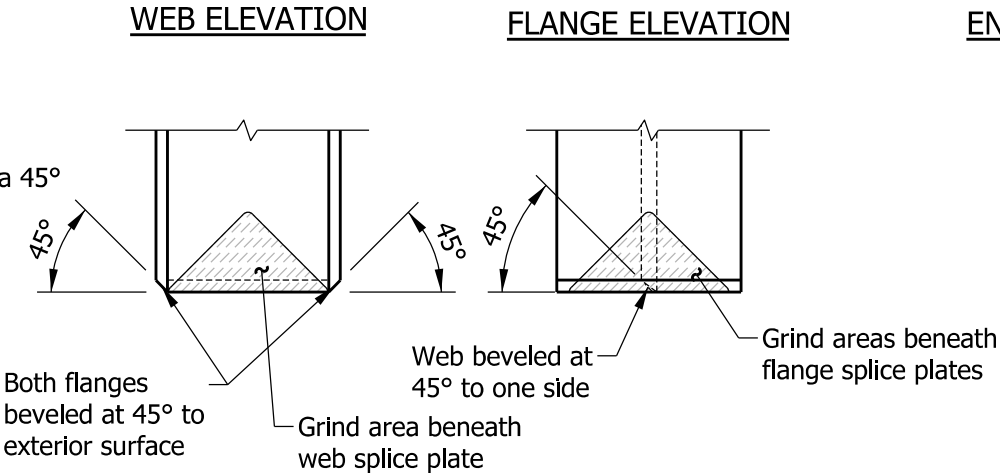
| INDIANA DEPARTMENT OF TRANSPORTATION |                                                                                |
|--------------------------------------|--------------------------------------------------------------------------------|
| FIELD SPLICING PIPE PILES            |                                                                                |
| SEPTEMBER 2012                       |                                                                                |
| STANDARD DRAWING NO. E 701-BPIL-02   |                                                                                |
|                                      | /s/ <i>Richard L. VanCleave</i> 09/04/12<br>SUPERVISOR, ROADWAY STANDARDS DATE |
|                                      | /s/ <i>Mark A. Miller</i> 09/04/12<br>CHIEF ENGINEER DATE                      |



PROCEDURE FOR SPLICING PARTIALLY DRIVEN PILING

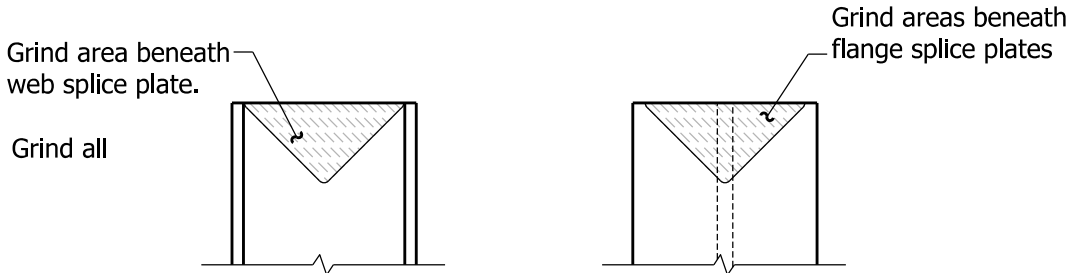
1. Upper Pile Section

Prepare outside of both flanges and one side of web by beveling to a 45° angle. Prepare all surfaces to be welded by grinding.



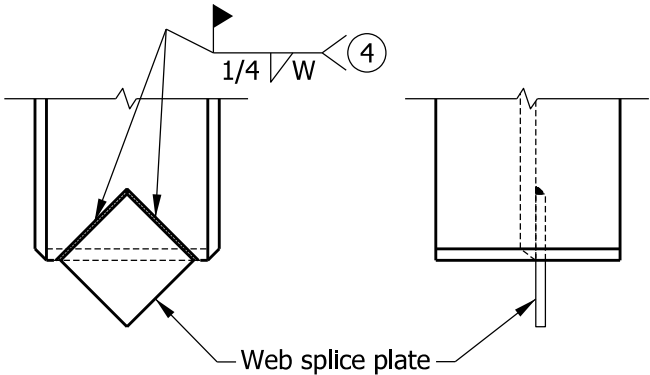
2. Lower Pile Section

Prepare top of pile by restoring it to its original cross section. Grind all surfaces to be welded, extending 1/2" beyond weld area(s).



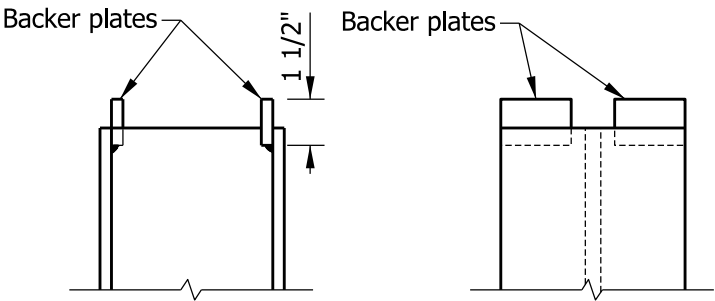
3. Upper Pile Section

Fillet weld web splice plate to upper pile section at two locations.



4. Lower Pile Section

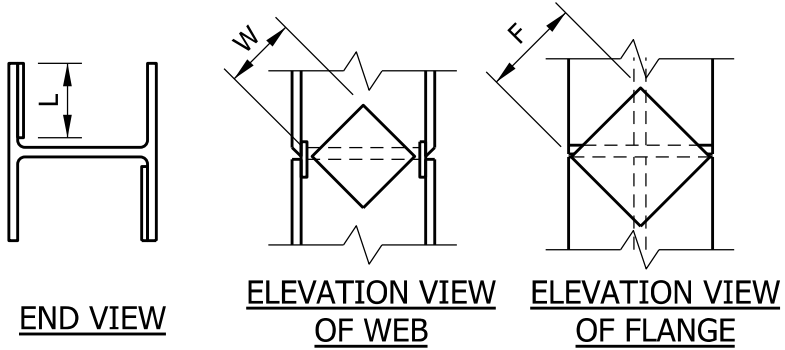
Tack weld two backer plates to inside of flange.



NOTES

- Steel H piling may be spliced in a horizontal position prior to driving, using splice plates and web and flange welds as shown.
- Two flange splice plates, one web splice plate, and four backer plates will be required per splice.
- All fillet welds shall be single pass.
- See table for splice plate dimensions W and F.

SPLICE PLATE AND BACKER PLATE DIMENSIONS



| H-PILE SIZE            | HP 10  | HP 12  | HP 14   |
|------------------------|--------|--------|---------|
| Flange Splice Plate, F | 7"     | 8 1/4" | 10 1/4" |
| Web Splice Plate, W    | 5 3/8" | 6 3/4" | 8"      |
| Backer Plate Length, L | 4 1/8" | 5"     | 6 1/4"  |

NOTE: Splice plate thickness = 3/8"  
Backer plate thickness = 1/4"

INDIANA DEPARTMENT OF TRANSPORTATION

STEEL H-PILE  
SPLICE

SEPTEMBER 2012

STANDARD DRAWING NO. E 701-BPIL-03



/s/ Richard L. VanCleave 09/04/12

SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE

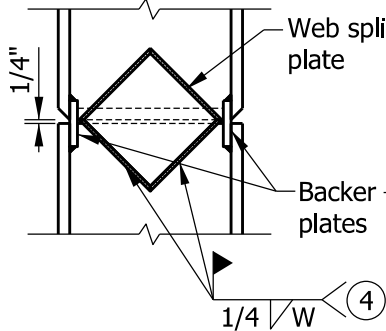
Procedure continued on Standard Drawing E 701-BPIL-04.

PROCEDURE FOR SPLICING PARTIALLY DRIVEN PILING (cont.)

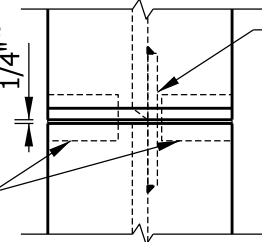
5. Combine Pile Sections

Lift and hold upper pile section into place, maintaining 1/4" gap between upper and lower pile sections by using the remaining two backer plates as a spacing guide. Plumb the pile. Tack weld the untacked side of the two backer plates to the inside upper flange. Remove the backer plate spacers and tack weld them to the inside flange portion of the upper and lower sections of the pile. Fillet weld the remaining two sides of the web splice plate to the lower section.

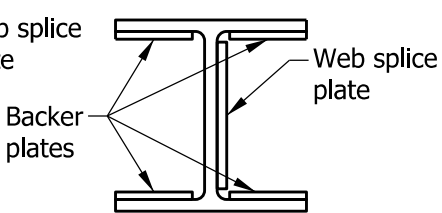
WEB ELEVATION



FLANGE ELEVATION



END VIEW

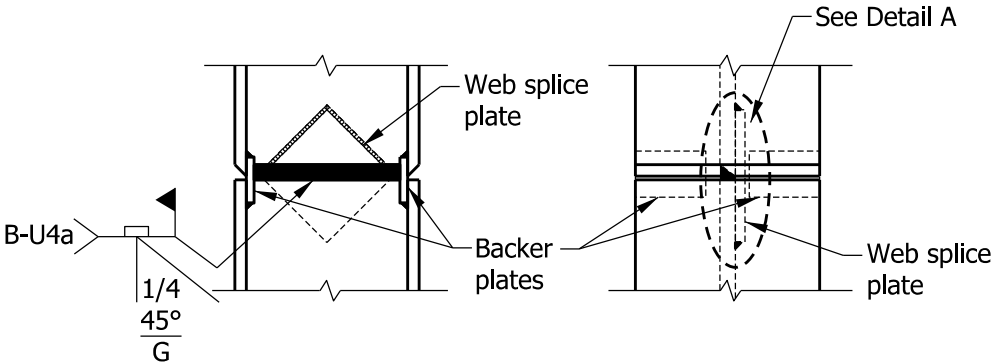


NOTES

- 1. Steel H piling may be spliced in a horizontal position prior to driving, using splice plates and web and flange welds as shown.
- 2. Two flange splice plates, one web splice plate, and four backer plates will be required per splice.
- 3. All fillet welds shall be single pass.
- ④ See Standard Drawing E 701-BPIL-03 table for splice plate dimensions W and F.

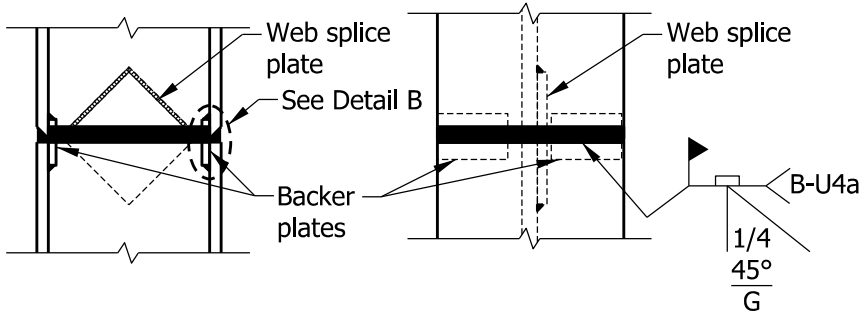
6. Combined Pile Section

Complete Joint Penetration (CJP) weld the web. See Detail A.



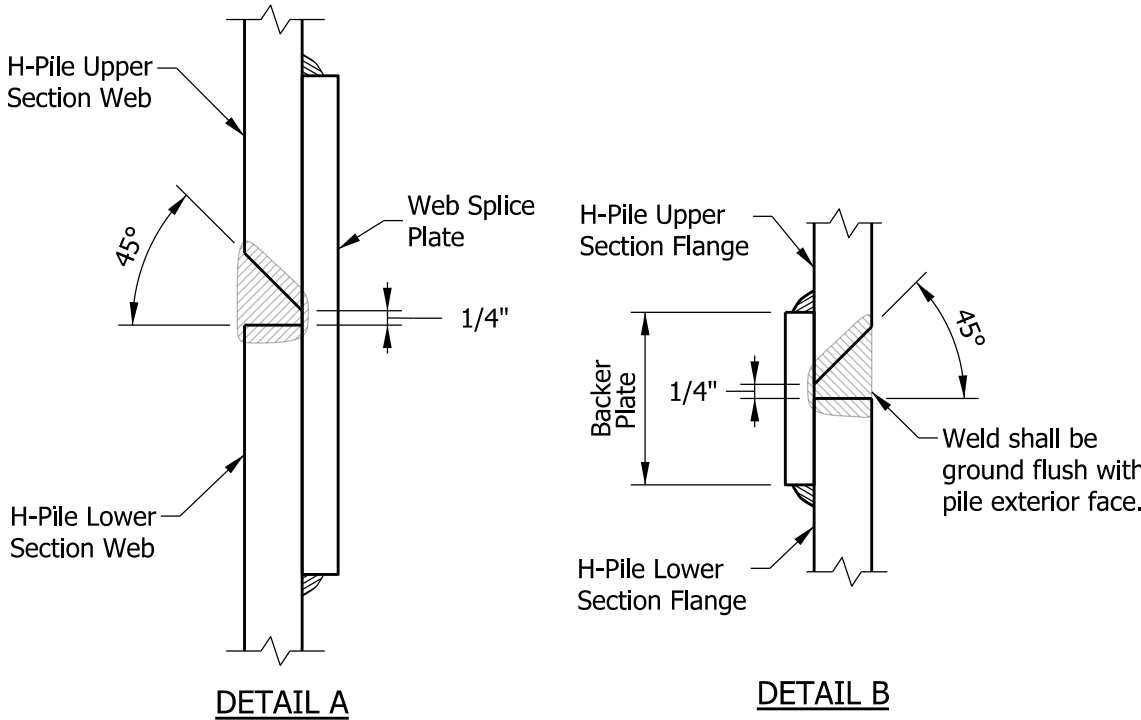
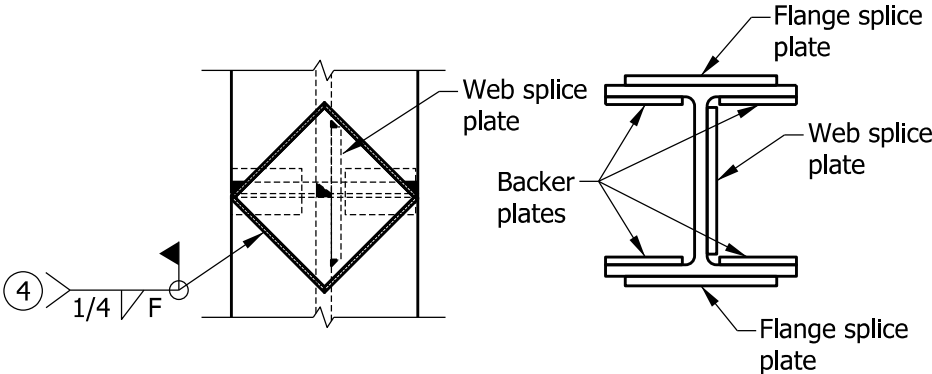
7. Combined Pile Section

Complete Joint Penetration (CJP) weld both flanges. Grind weld smooth with the pile exterior face. See Detail B.

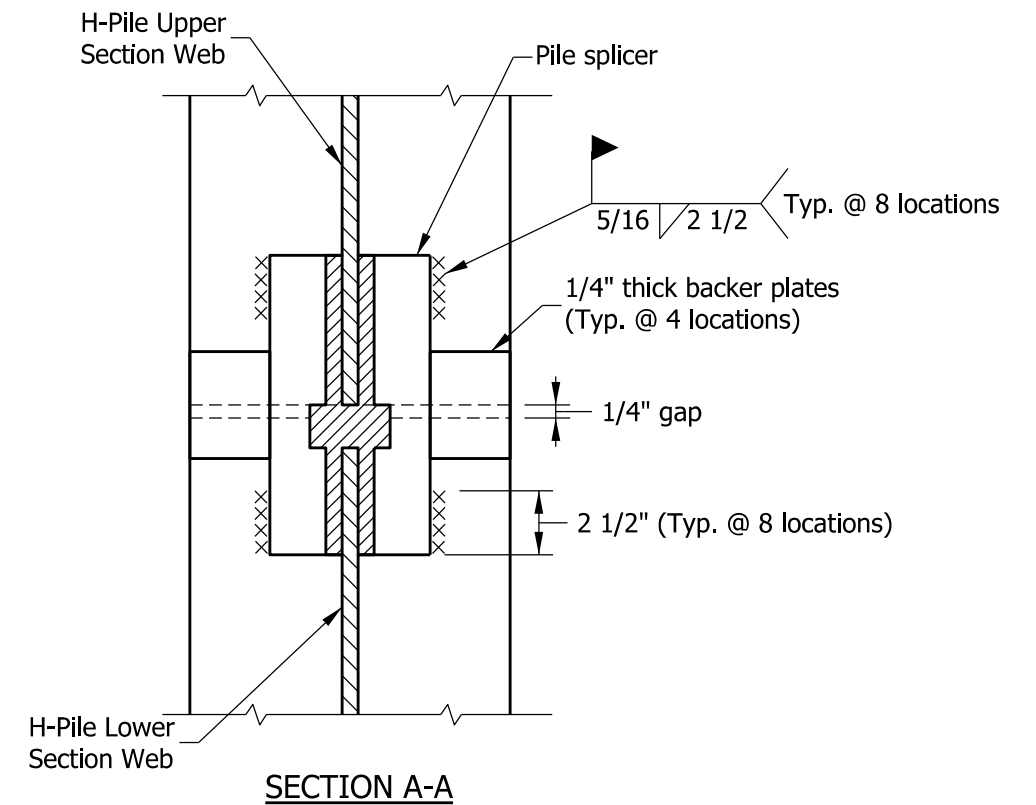
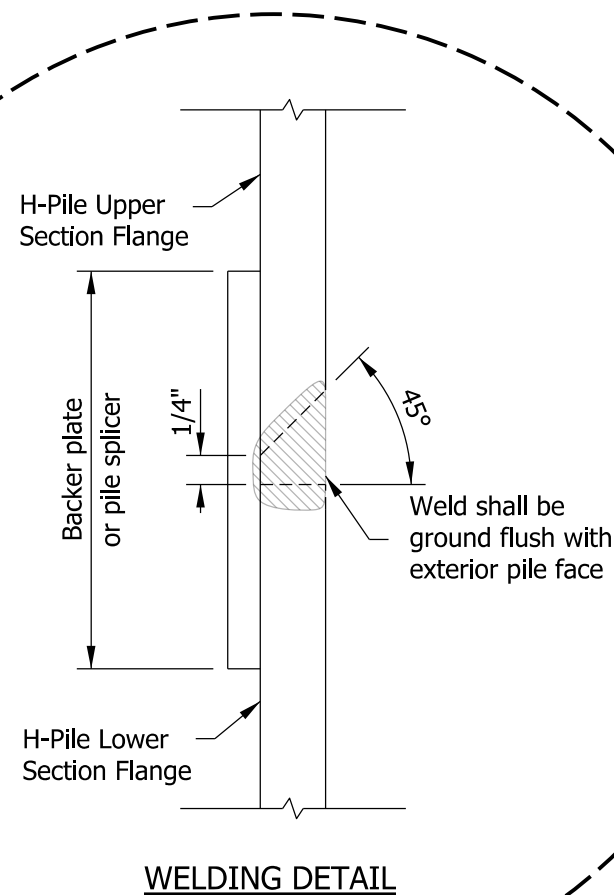
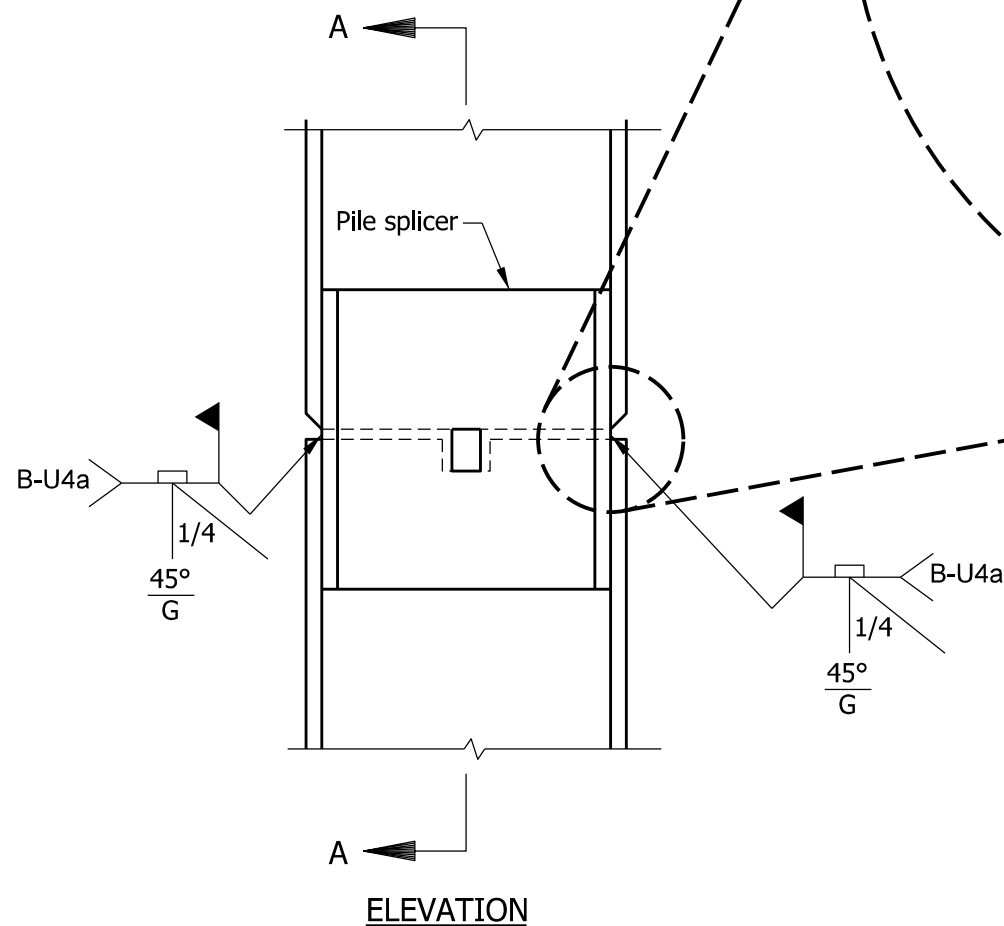
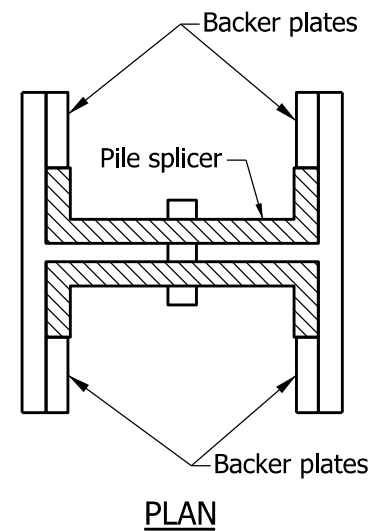


8. Combined Pile Section

Fillet weld the flange splice plates to the flanges.

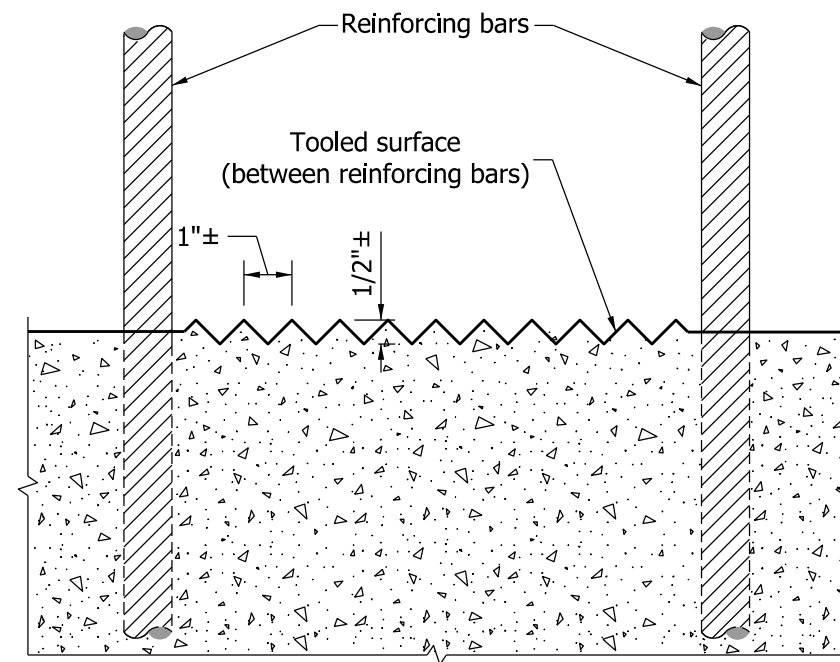


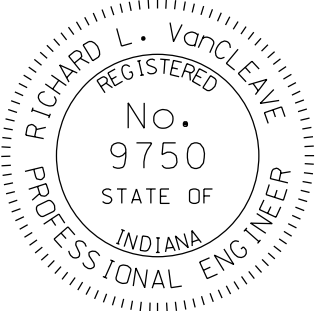
| INDIANA DEPARTMENT OF TRANSPORTATION                    |                               |               |          |
|---------------------------------------------------------|-------------------------------|---------------|----------|
| STEEL H-PILE<br>SPLICE<br>(CONTINUED)<br>SEPTEMBER 2012 |                               |               |          |
| STANDARD DRAWING NO.                                    |                               | E 701-BPIL-04 |          |
|                                                         | /s/ Richard L. VanCleave      |               | 09/04/12 |
|                                                         | SUPERVISOR, ROADWAY STANDARDS |               | DATE     |
|                                                         | /s/ Mark A. Miller            |               | 09/04/12 |
|                                                         | CHIEF ENGINEER                |               | DATE     |

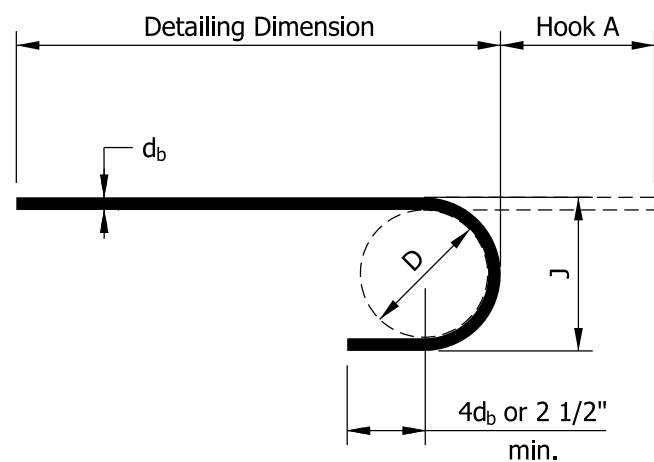


**ALTERNATE STEEL H-PILE SPLICE  
USING MECHANICAL PILE SPLICER**

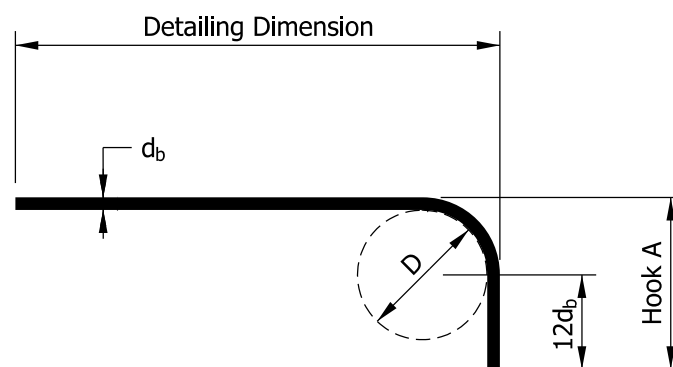
| INDIANA DEPARTMENT OF TRANSPORTATION        |                                          |
|---------------------------------------------|------------------------------------------|
| ALTERNATE STEEL<br>H-PILE MECHANICAL SPLICE |                                          |
| SEPTEMBER 2012                              |                                          |
| STANDARD DRAWING NO. E 701-BPIL-05          |                                          |
|                                             |                                          |
|                                             | /s/ <i>Richard L. VanCleave</i> 09/04/12 |
|                                             | SUPERVISOR, ROADWAY STANDARDS DATE       |
|                                             | /s/ <i>Mark A. Miller</i> 09/04/12       |
|                                             | CHIEF ENGINEER DATE                      |



| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                 |               |          |
|---------------------------------------------------------------------------------------|---------------------------------|---------------|----------|
| TYPE A<br>CONSTRUCTION JOINT<br><br>MARCH 2003                                        |                                 |               |          |
| STANDARD DRAWING NO.                                                                  |                                 | E 702-CJTA-01 |          |
|  | DETAILS PLACED IN THIS FORMAT   |               | 09/04/12 |
|                                                                                       | <i>/s/ Richard L. VanCleave</i> |               | 09/04/12 |
|                                                                                       | SUPERVISOR, ROADWAY STANDARDS   |               | DATE     |
|                                                                                       | <i>/s/ Mark A. Miller</i>       |               | 09/04/12 |
|                                                                                       | CHIEF ENGINEER                  |               | DATE     |



180° HOOK



90° HOOK

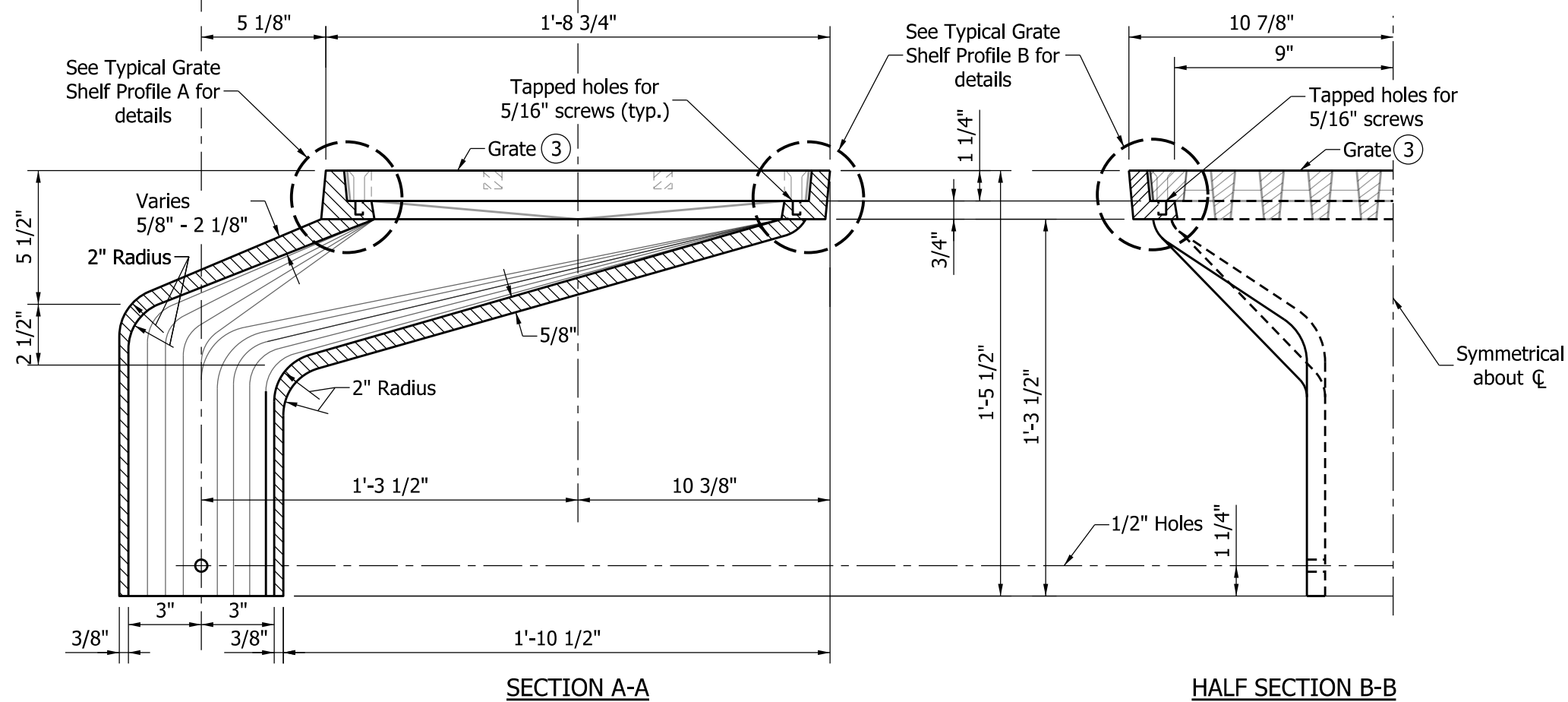
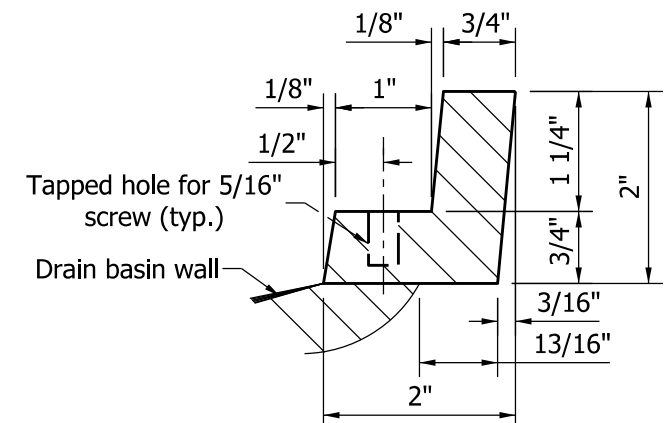
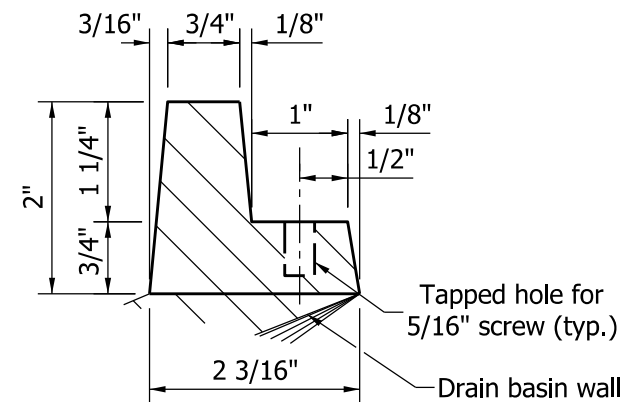
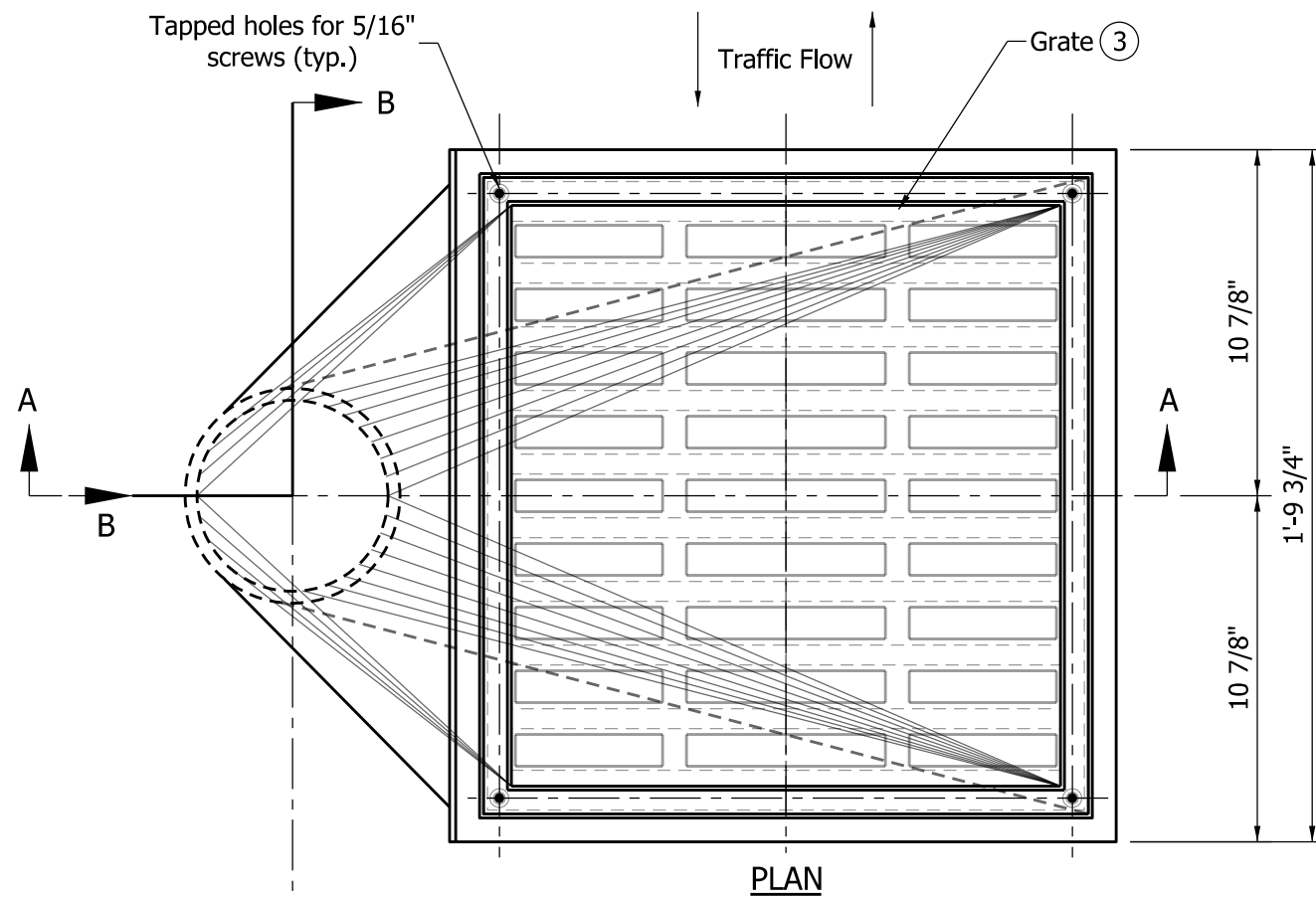
NOTES:

1. All dimensions on reinforcing bar bending diagrams shall be measured out-to-out of bars.
2. All dimensions on reinforcing bar details shall be measured on centerlines of bars, except where cover or cl. is indicated.
3. Bent bars will be given a numeric bar mark, e.g., 588. The last two digits, e.g., 88, indicate the mark. The characters preceding the last two digits, e.g., 5, indicate the size of the bar.
4. Bent reinforcing bar marks on standard drawings will consist of the first digit as the bar size; the second digit, 7, indicating that it shall be placed in a bridge railing, or 8, indicating that it shall be placed in a bridge-railing transition, or 9, indicating that it shall be placed elsewhere; and the third and fourth digits as the serial number for that bar size.
5. Straight bars will be designated by size and length.
6. Standard size hooks shown shall be used on all hooked bars unless noted.
7. See the plans for lap and embedment lengths.
8. This drawing is consistent with the ACI 318 and CRSI *Manual of Standard Practice*.

ACI = American Concrete Institute  
CRSI = Concrete Reinforcing Steel Institute

| STANDARD END HOOKS |         |           |           |          |
|--------------------|---------|-----------|-----------|----------|
|                    |         | 180° HOOK |           | 90° HOOK |
| BAR SIZE           | D       | HOOK A    | J         | HOOK A   |
| #3                 | 2 1/4"  | 5"        | 3"        | 6"       |
| #4                 | 3"      | 6"        | 4"        | 8"       |
| #5                 | 3 3/4"  | 7"        | 5"        | 10"      |
| #6                 | 4 1/2"  | 8"        | 6"        | 1'-0"    |
| #7                 | 5 1/4"  | 10"       | 7"        | 1'-2"    |
| #8                 | 6"      | 11"       | 8"        | 1'-4"    |
| #9                 | 9 1/2"  | 1'-3"     | 11 3/4"   | 1'-7"    |
| #10                | 10 3/4" | 1'-5"     | 1'-1 1/4" | 1'-10"   |
| #11                | 12"     | 1'-7"     | 1'-2 3/4" | 2'-0"    |
| #14                | 18 1/4" | 2'-3"     | 1'-9 3/4" | 2'-7"    |
| #18                | 24"     | 3'-0"     | 2'-4 1/2" | 3'-5"    |

| INDIANA DEPARTMENT OF TRANSPORTATION |                                                                                                                                                                                                                                     |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| BAR BENDING DETAILS                  |                                                                                                                                                                                                                                     |
| SEPTEMBER 2015                       |                                                                                                                                                                                                                                     |
| STANDARD DRAWING NO. E 703-BRST-01   |                                                                                                                                                                                                                                     |
|                                      | <div> <div>/s/ Elizabeth W. Phillips</div> <div>DESIGN STANDARDS ENGINEER</div> <div>12/31/14</div> <div>DATE</div> </div> <div> <div>/s/ Mark A. Miller</div> <div>CHIEF ENGINEER</div> <div>01/05/15</div> <div>DATE</div> </div> |



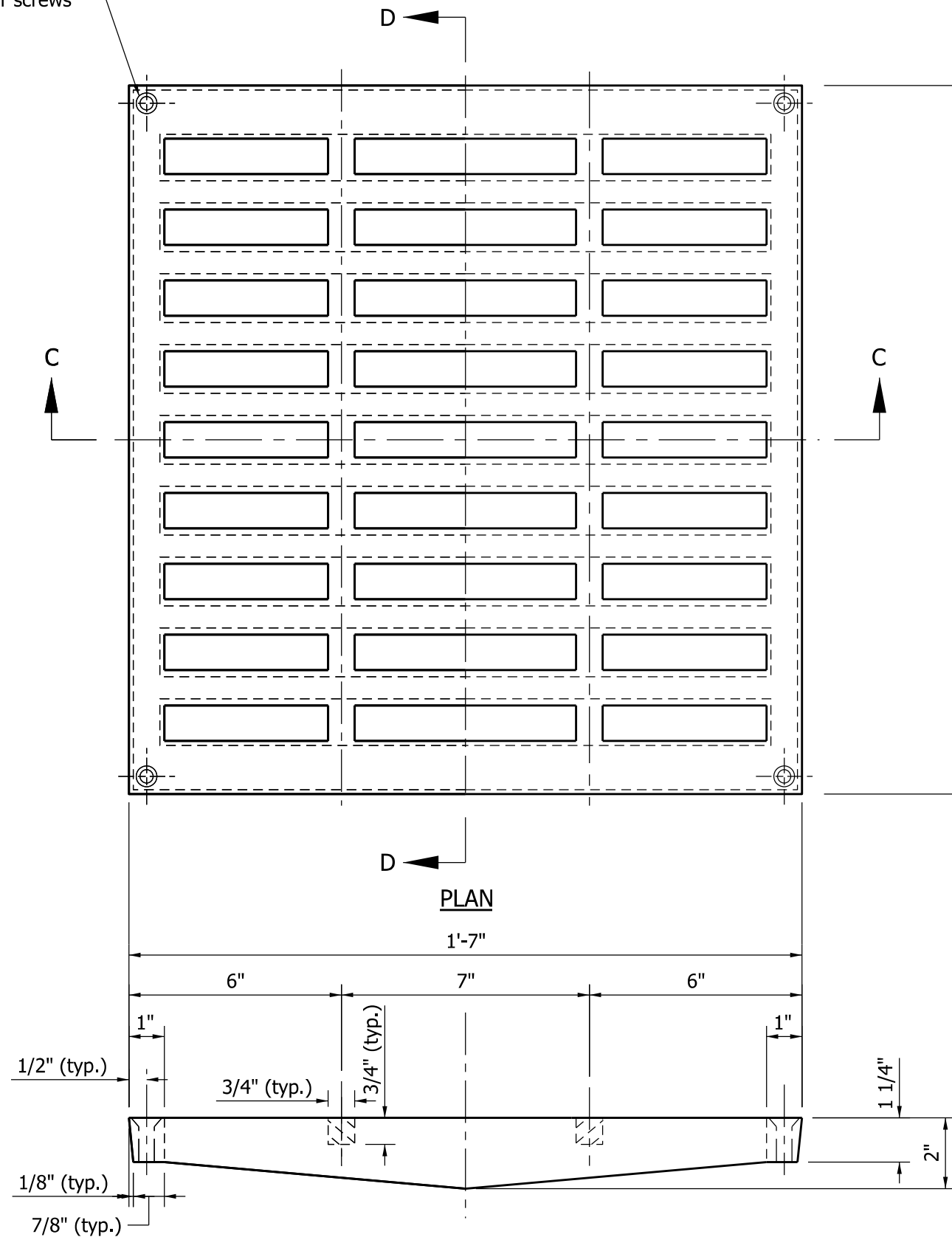
## NOTES

- See Standard Drawing E 715-BDCG-01 for deck drain casting extension pipe details.
- See Standard Drawing E 704-BDCG-05 for adjusting frame details.
- See Standard Drawing E 704-BDCG-02 for grate details.

| INDIANA DEPARTMENT OF TRANSPORTATION |                                 |               |          |
|--------------------------------------|---------------------------------|---------------|----------|
| DECK DRAIN<br>TYPE OS                |                                 |               |          |
| SEPTEMBER 2012                       |                                 |               |          |
| STANDARD DRAWING NO.                 |                                 | E 704-BDCG-01 |          |
|                                      | /s/ <i>Richard L. VanCleave</i> |               | 09/04/12 |
|                                      | SUPERVISOR, ROADWAY STANDARDS   |               | DATE     |
|                                      | /s/ <i>Mark A. Miller</i>       |               | 09/04/12 |
|                                      | CHIEF ENGINEER                  |               | DATE     |



② 3/8" countersunk  
holes for screws  
(typ.)



PLAN

D

D

C

C

SECTION C-C

Varies (2" @  $\phi$ )

1 1/4"

1/2" (typ.)

1 1/2"

1" (typ.)

1" (typ.)

1 1/2"

SECTION D-D

## NOTES

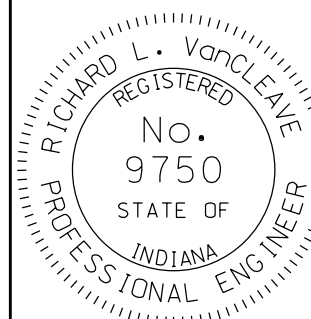
1. This grate used with Type OS deck drain. See Standard Drawing E 704-BDCG-01 for deck drain details.
- ② 4 - 5/16" x 1 3/4" flat-head stainless steel screws required for each grate.

INDIANA DEPARTMENT OF TRANSPORTATION

DECK DRAIN TYPE OS  
GRATE

SEPTEMBER 2012

STANDARD DRAWING NO. E 704-BDCG-02



/s/ Richard L. VanCleave 09/04/12

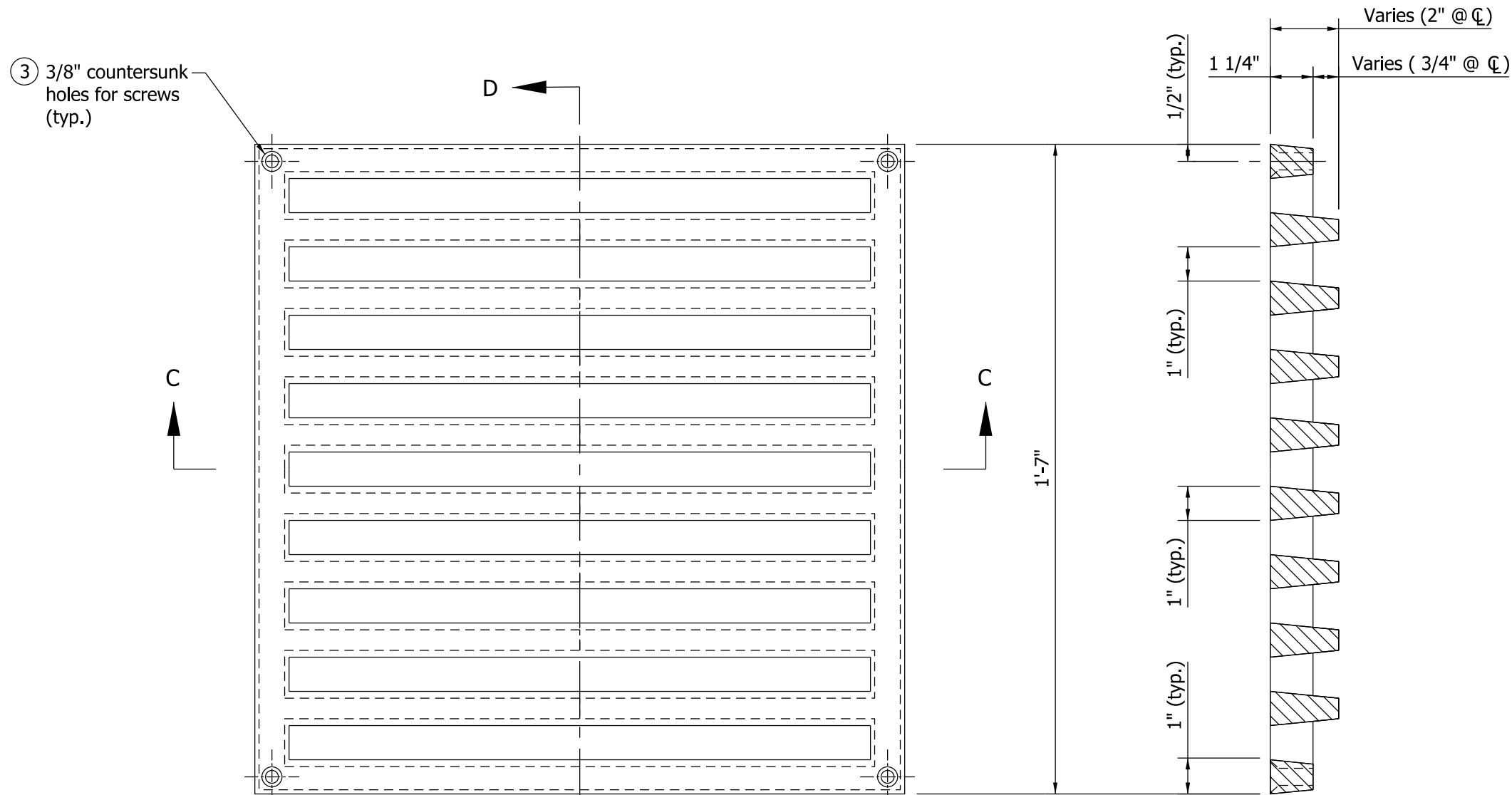
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE

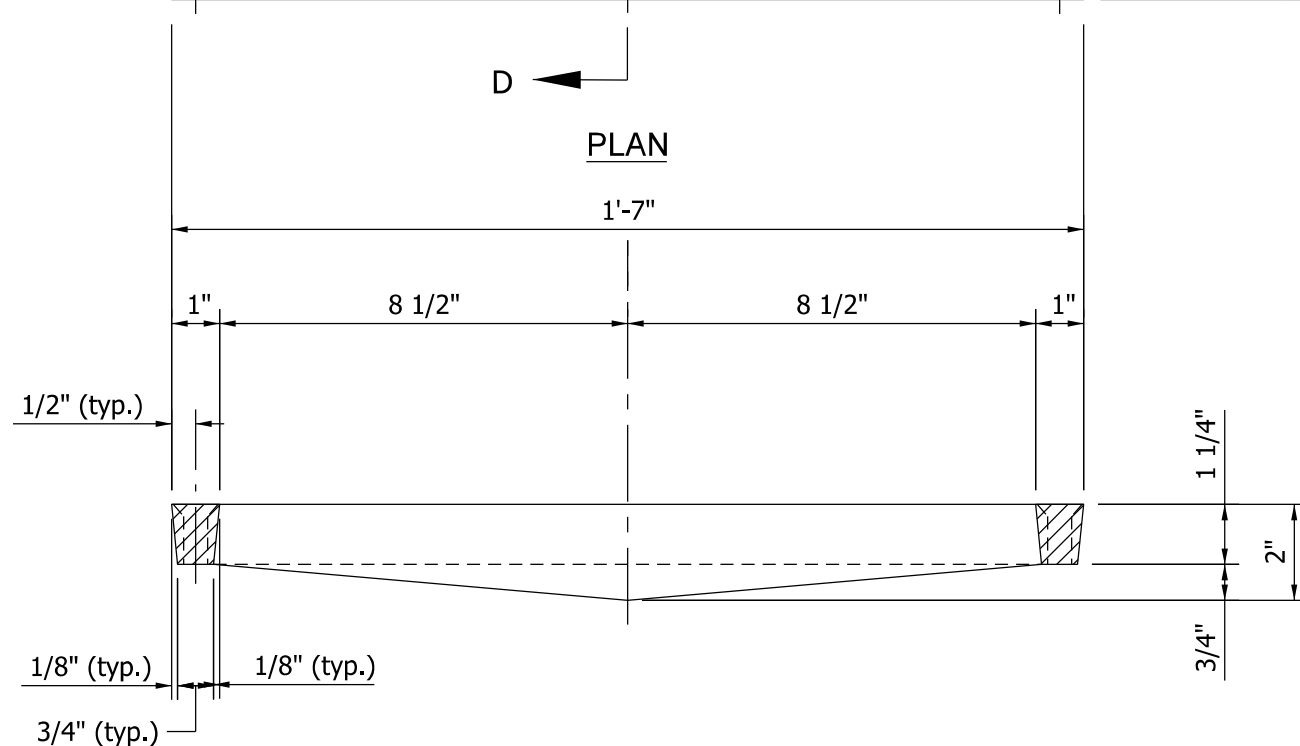






PLAN

SECTION D-D



SECTION C-C

NOTES

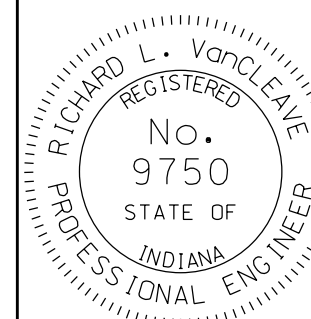
1. See the floor details on the plans for orientation of the grate.
2. This grate used with Type SQ deck drain. See Standard Drawing E 704-BDCG-03 for deck drain details.
- ③ 4 - 5/16" x 1 3/4" flat-head stainless steel screws required for each grate.

INDIANA DEPARTMENT OF TRANSPORTATION

DECK DRAIN TYPE SQ  
GRATE

SEPTEMBER 2012

STANDARD DRAWING NO. E 704-BDCG-04

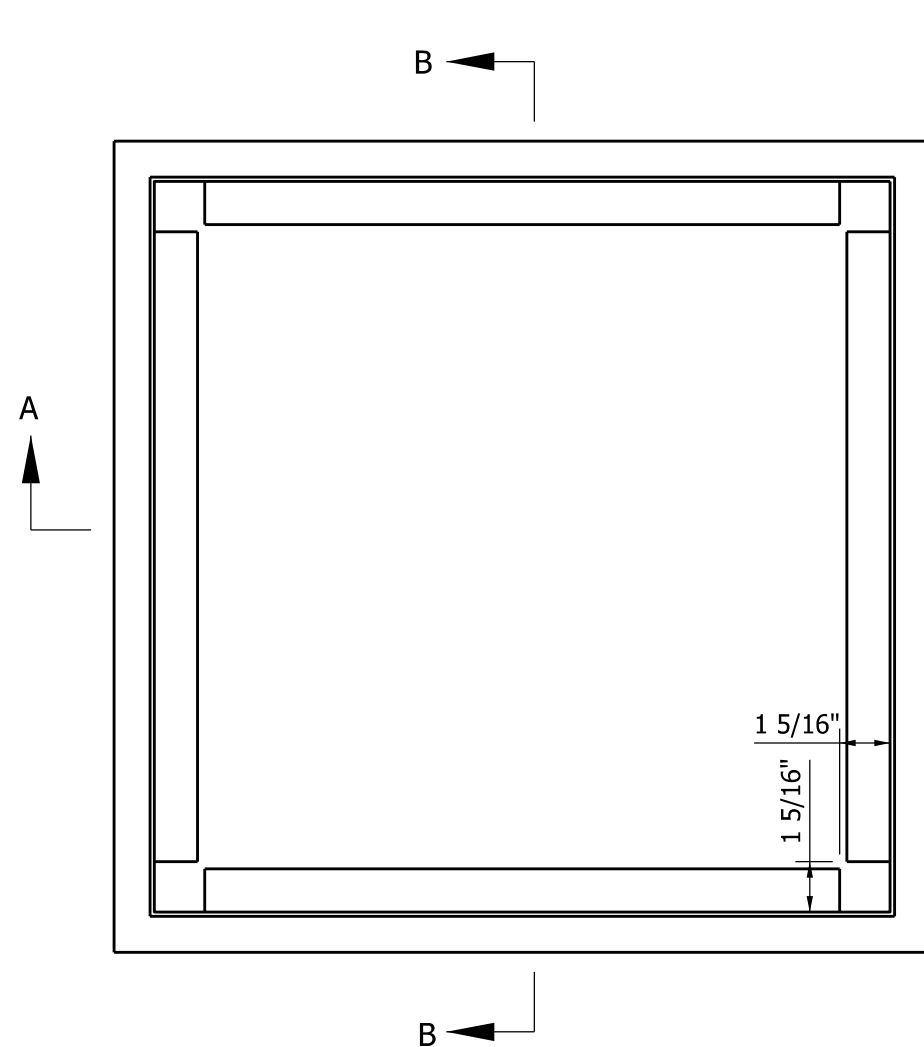


/s/ Richard L. VanCleave 09/04/12

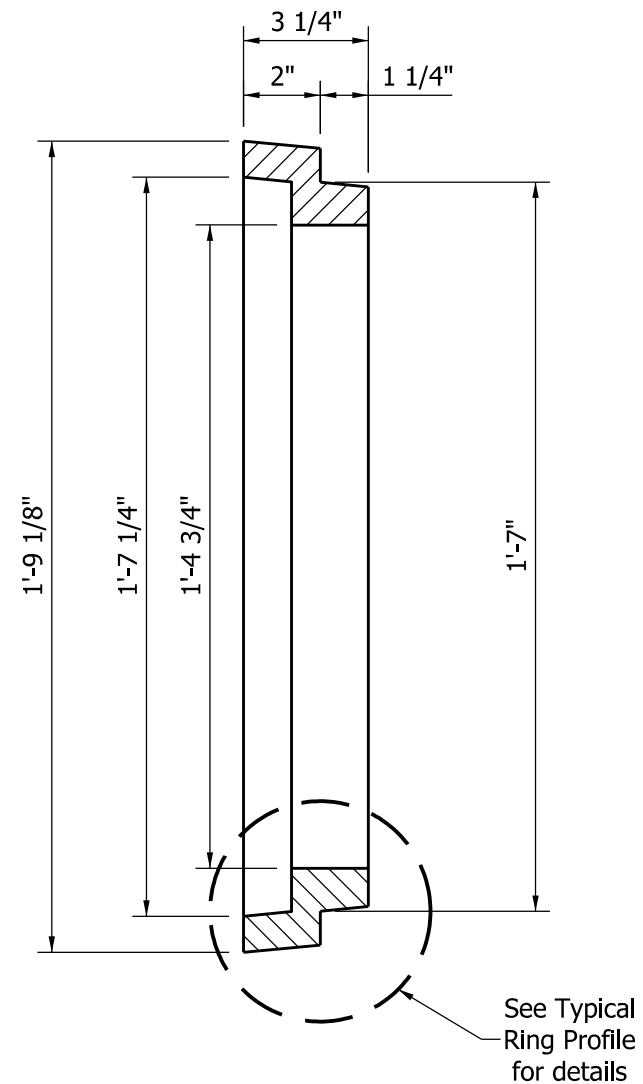
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

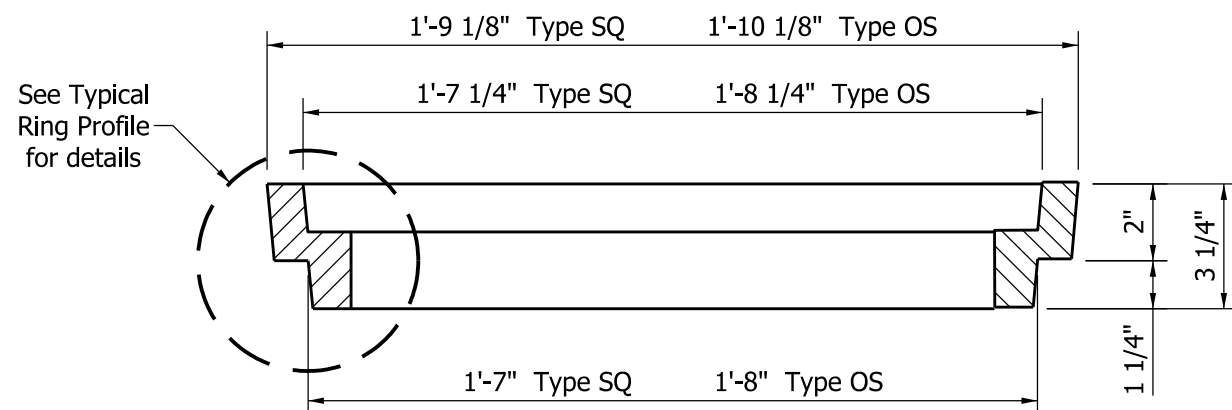
CHIEF ENGINEER DATE



PLAN VIEW



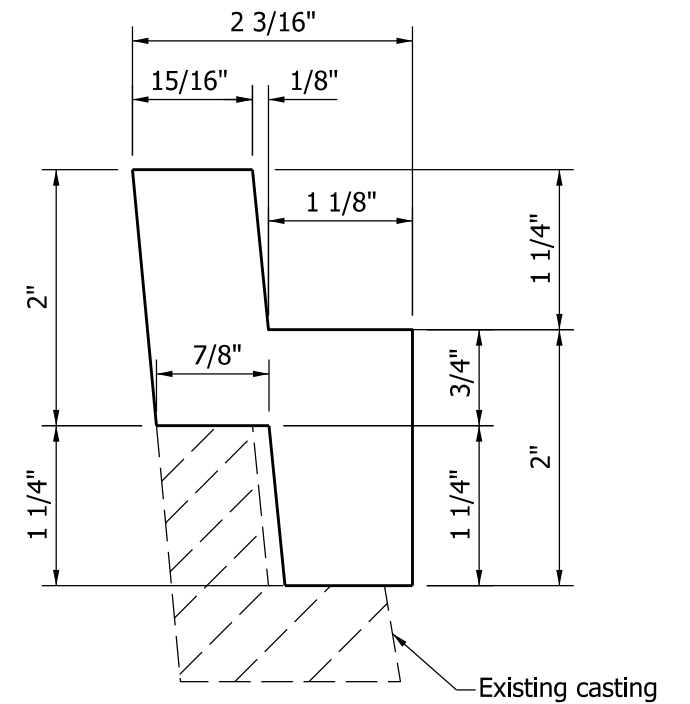
SECTION B-B



SECTION A-A

NOTES

1. 4 - 5/16" x 3 3/4" flat-head stainless steel screws required when frame is used.

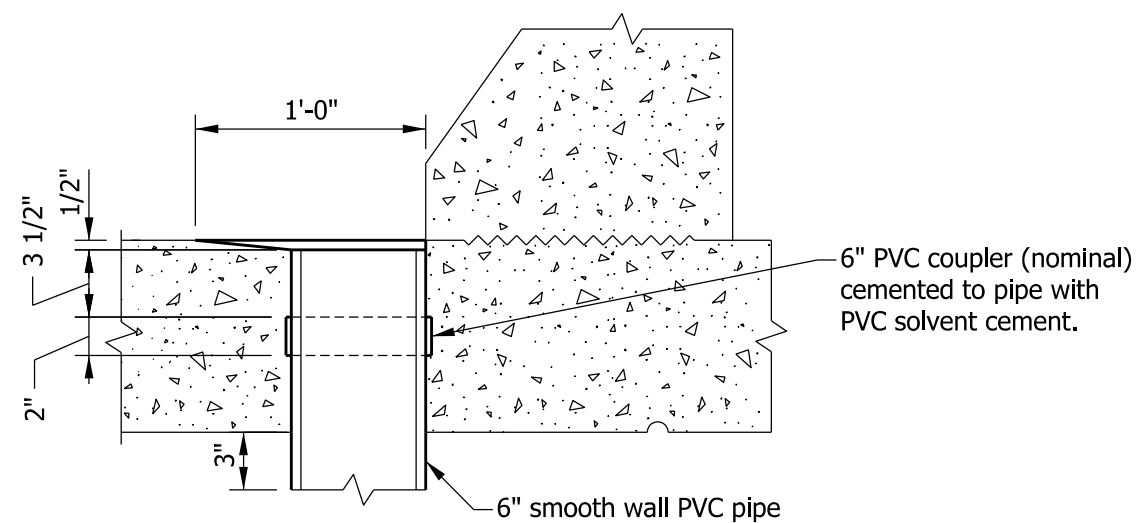
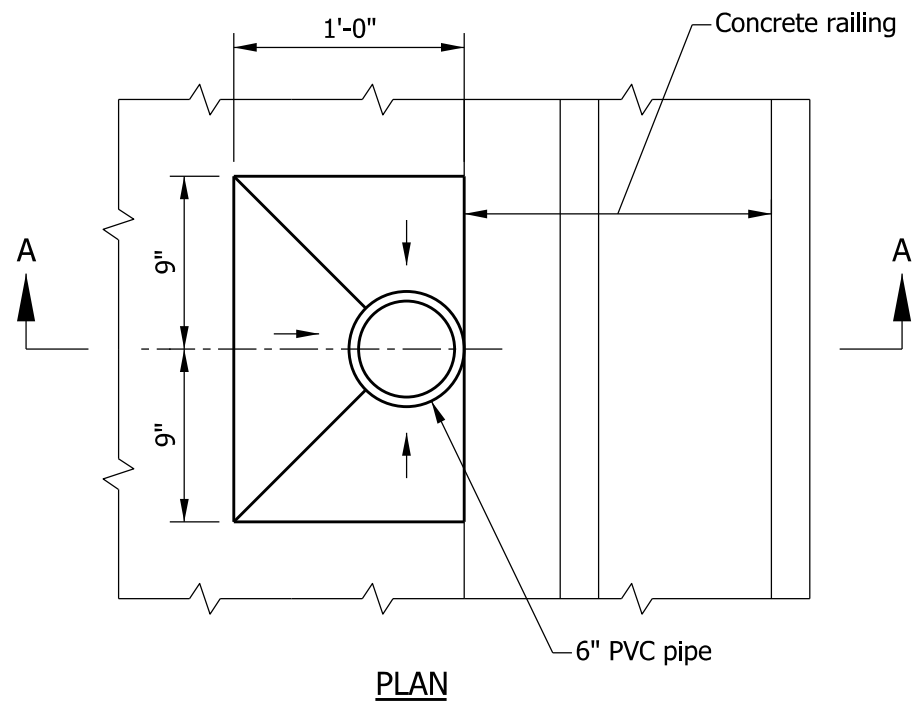


TYPICAL RING PROFILE

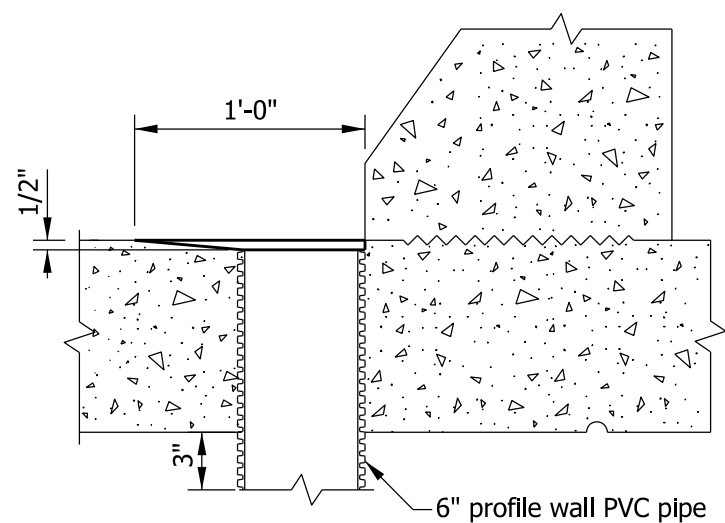
| INDIANA DEPARTMENT OF TRANSPORTATION        |                                 |               |          |
|---------------------------------------------|---------------------------------|---------------|----------|
| DECK DRAIN TYPE OS OR SQ<br>ADJUSTING FRAME |                                 |               |          |
| SEPTEMBER 2012                              |                                 |               |          |
| STANDARD DRAWING NO.                        |                                 | E 704-BDCG-05 |          |
|                                             | /s/ <i>Richard L. VanCleave</i> |               | 09/04/12 |
|                                             | SUPERVISOR, ROADWAY STANDARDS   |               | DATE     |
|                                             | /s/ <i>Mark A. Miller</i>       |               | 09/04/12 |
|                                             | CHIEF ENGINEER                  |               | DATE     |

NOTE

1. See plans for drain spacing.



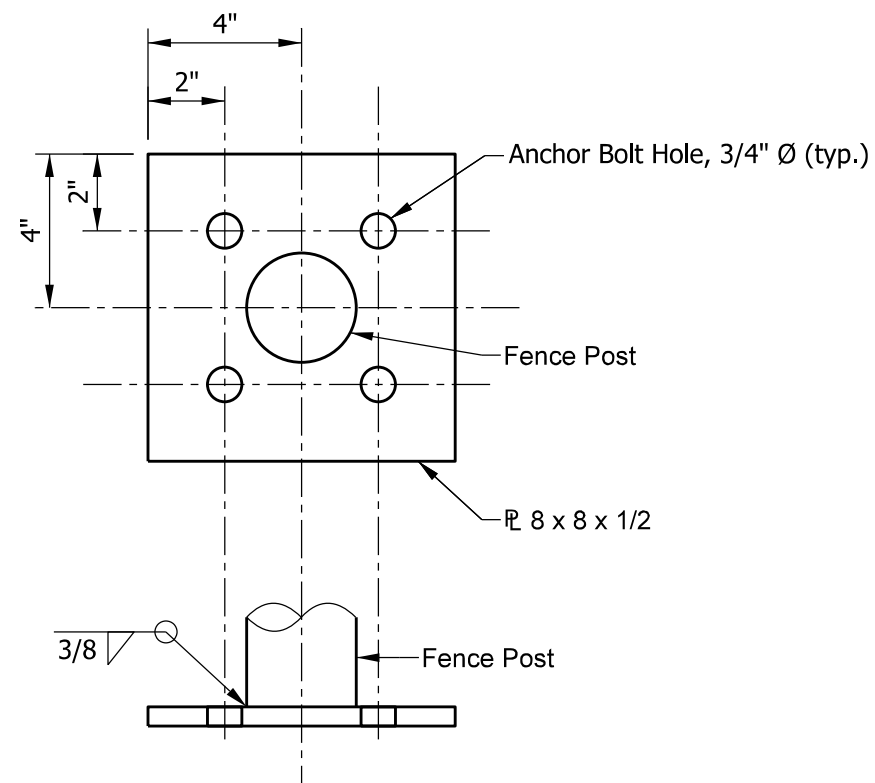
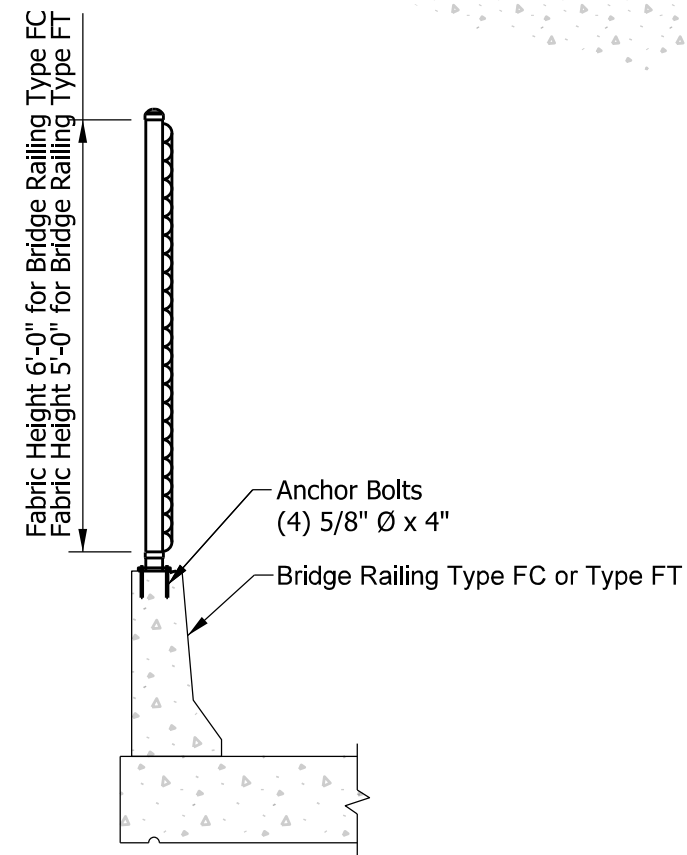
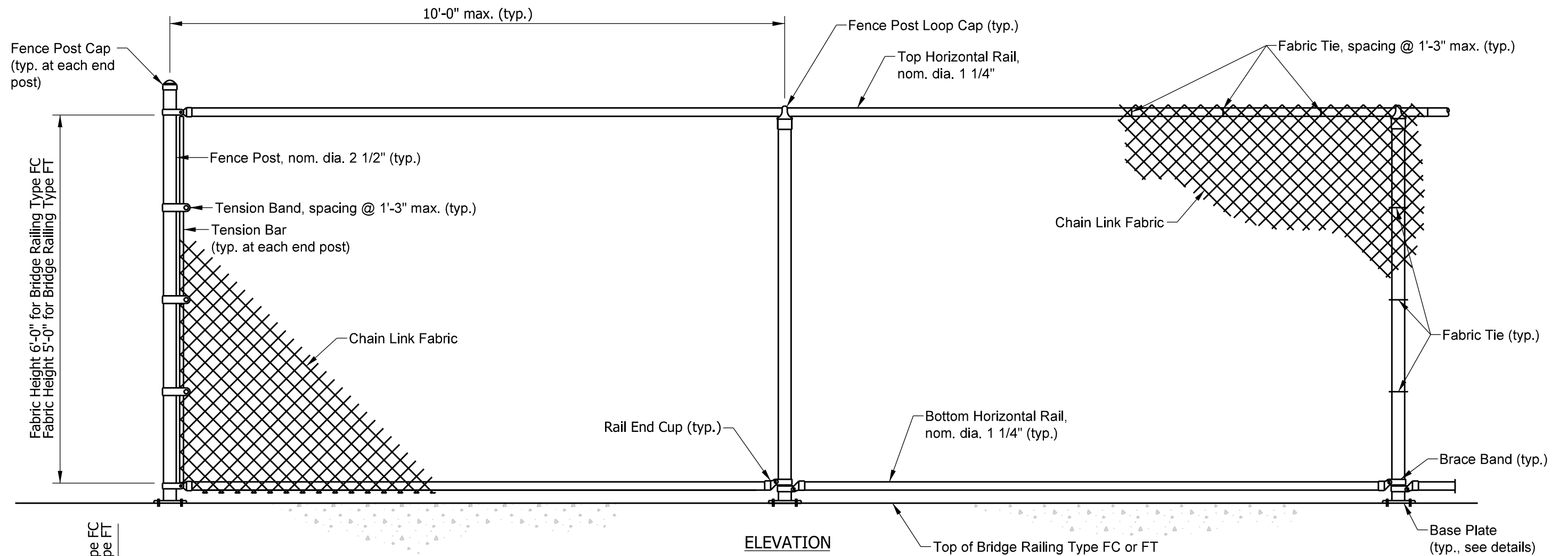
6" SMOOTH WALL PVC PIPE



6" PROFILE WALL PVC PIPE

SECTION A-A

| INDIANA DEPARTMENT OF TRANSPORTATION |                                 |               |          |
|--------------------------------------|---------------------------------|---------------|----------|
| SLAB BRIDGE FLOOR DRAIN<br>DETAIL    |                                 |               |          |
| SEPTEMBER 2012                       |                                 |               |          |
| STANDARD DRAWING NO.                 |                                 | E 704-SBFD-01 |          |
|                                      | /s/ <i>Richard L. VanCleave</i> |               | 09/04/12 |
|                                      | SUPERVISOR, ROADWAY STANDARDS   |               | DATE     |
|                                      | /s/ <i>Mark A. Miller</i>       |               | 09/04/12 |
|                                      | CHIEF ENGINEER                  |               | DATE     |

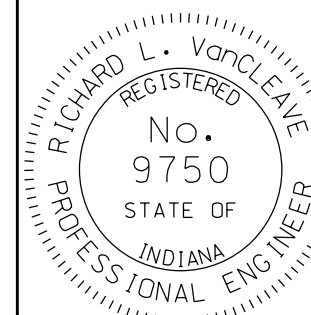


INDIANA DEPARTMENT OF TRANSPORTATION

BRIDGE RAILING  
PEDESTRIAN FENCE

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-BRPF-01

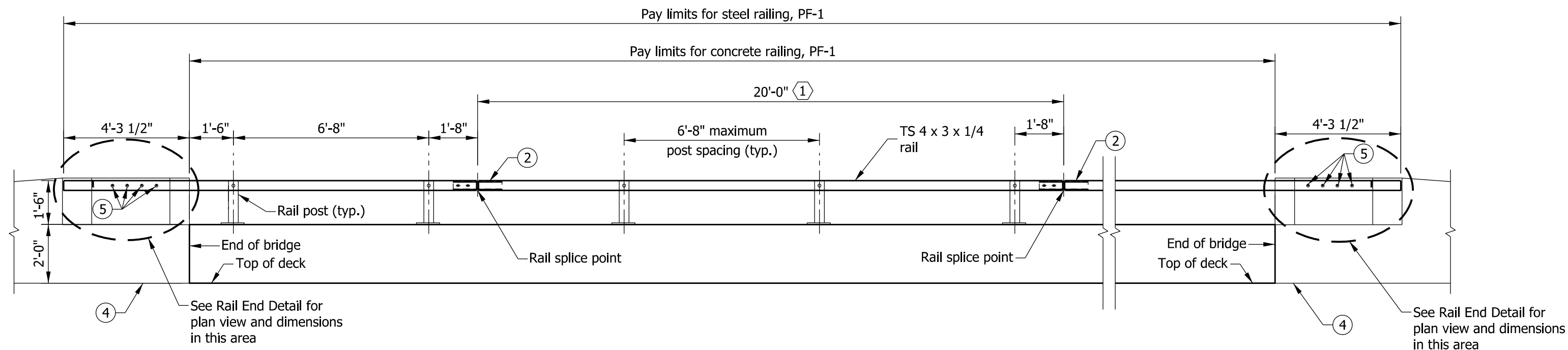


/s/ Richard L. VanCleave 09/04/12

SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

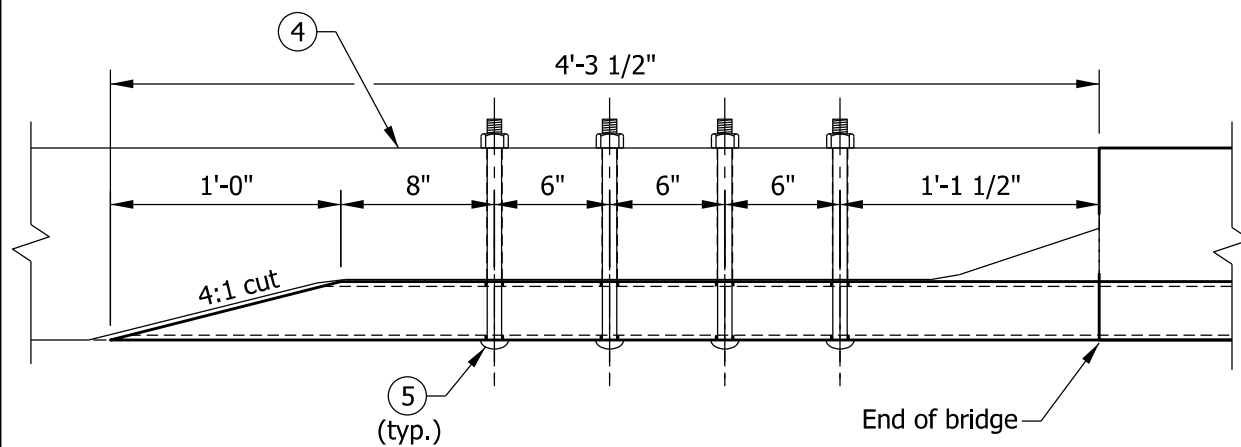
CHIEF ENGINEER DATE



**ELEVATION**

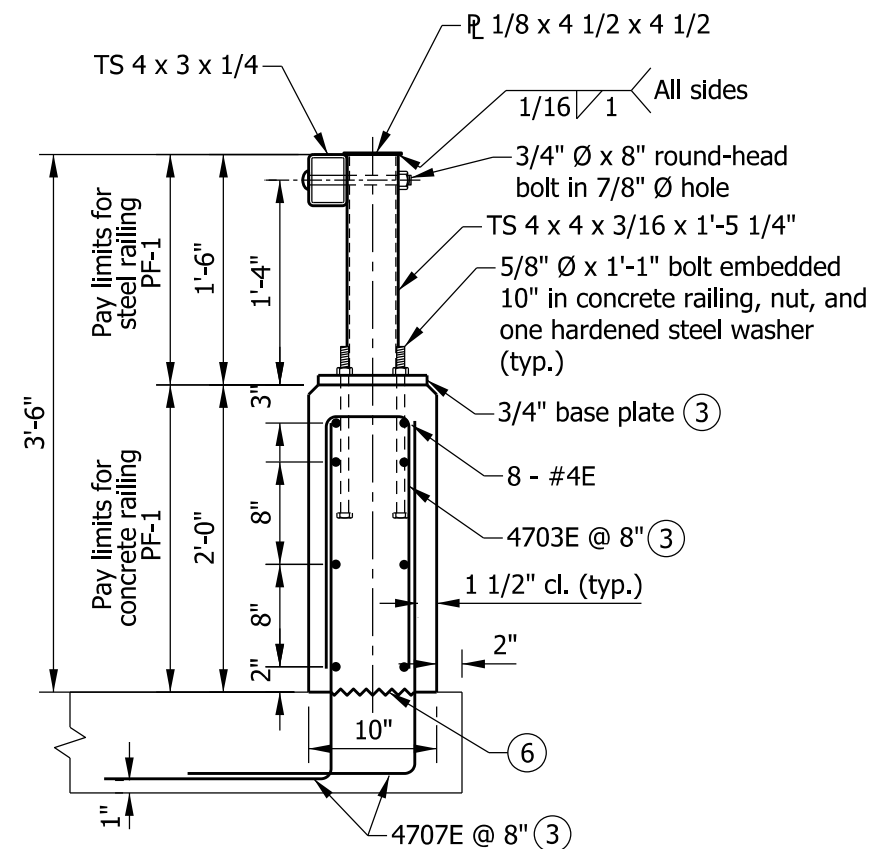
**NOTES**

1. See Standard Drawing E 706-BRPP-06 for General Notes (1).
- 2 See Standard Drawing E 706-BRPP-05 for rail tube details and rail splice details.
- 3 See Standard Drawing E 706-BRPP-06 for base plate detail and reinforcing-bar bends.
- 4 Concrete bridge railing transition, TPF-1. See Standard Drawings E 706-TTPP-01 and -02 for details.
- 5 3/4" Ø x 11 1/2" round-head bolt in 7/8" Ø hole. Hole shall be slotted as required for expansion.
- 6 Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.



**Plan view of TS 4 x 3 x 1/4**

**RAIL END DETAIL**



**TYPICAL SECTION**

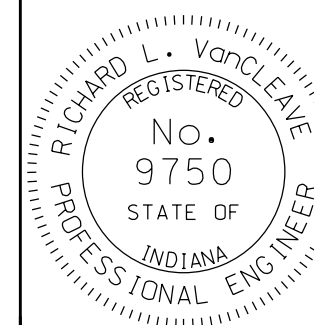
| QUANTITIES FOR ONE RUNNING FOOT OF RAILING |          |
|--------------------------------------------|----------|
| Concrete, class C                          | 1.66 CFT |
| Reinforcing bars                           | 17.0 LBS |

**INDIANA DEPARTMENT OF TRANSPORTATION**

**RAILING, PF-1**

**SEPTEMBER 2012**

**STANDARD DRAWING NO. E 706-BRPP-01**

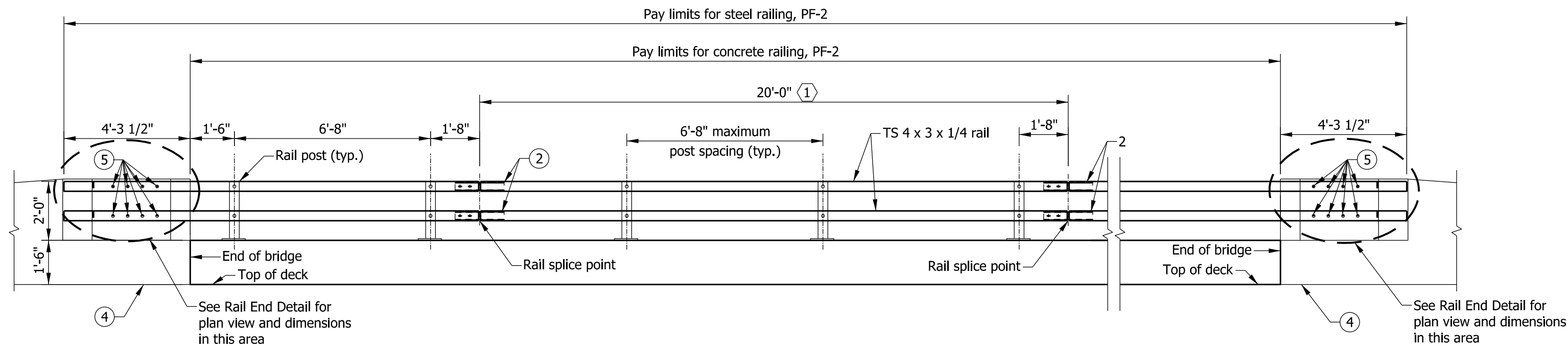


/s/ Richard L. VanCleave 09/04/12

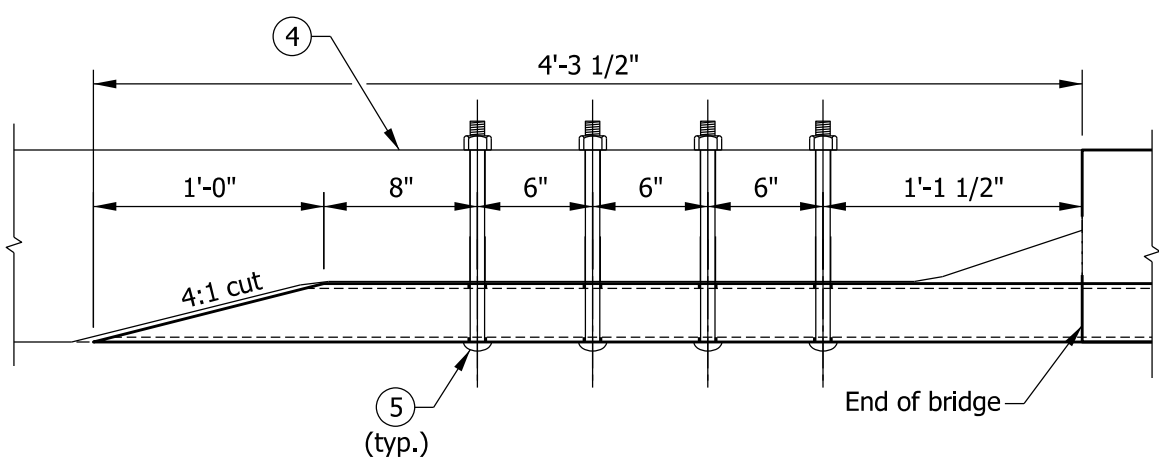
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE

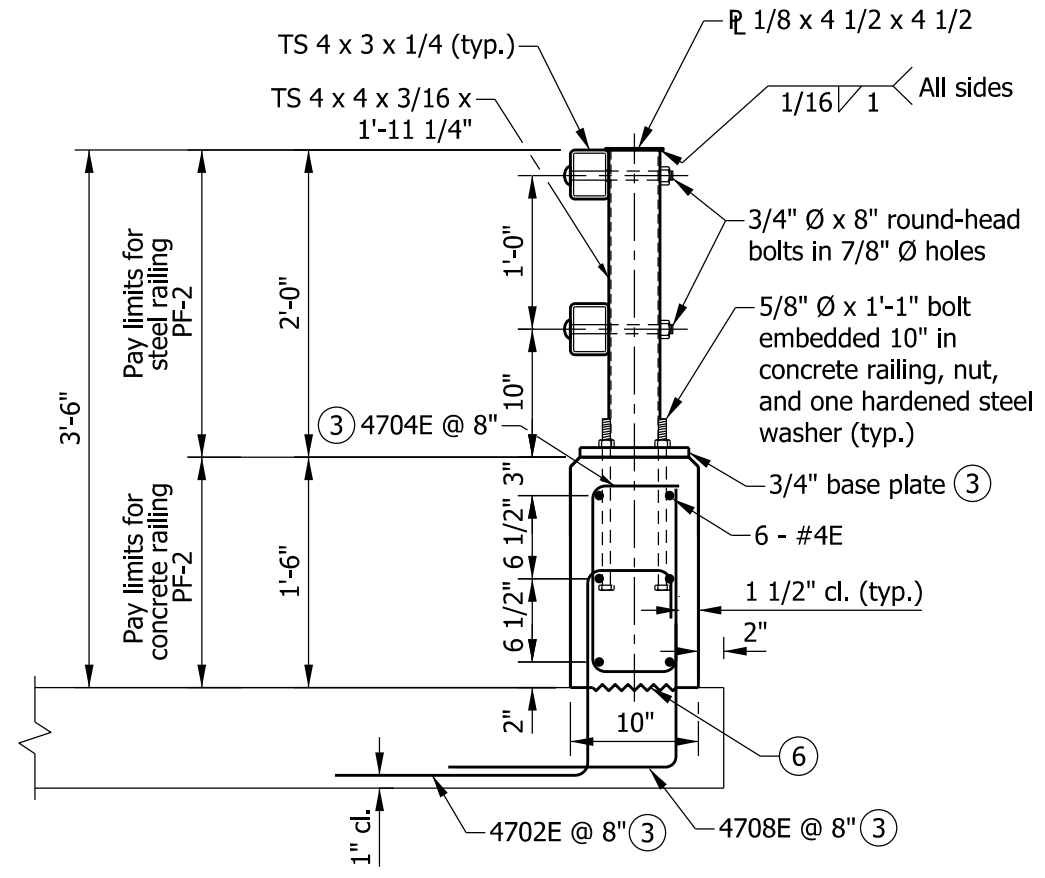


### ELEVATION



Plan view of TS 4 x 3 x 1/4

### RAIL END DETAIL



### TYPICAL SECTION

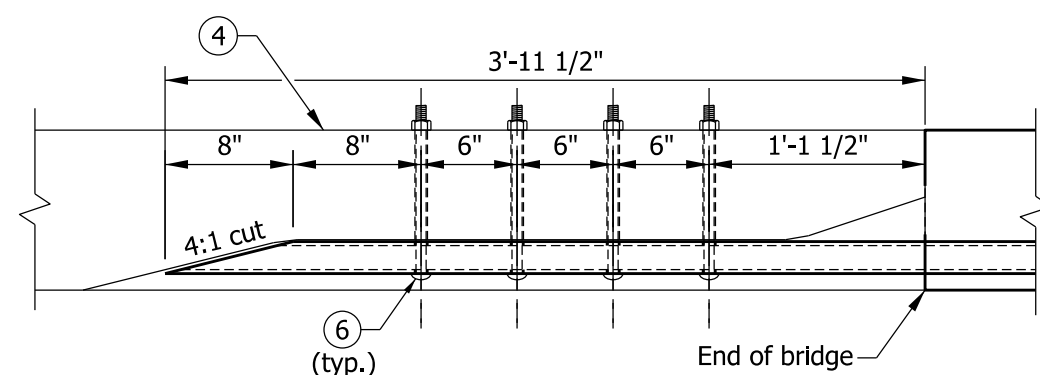
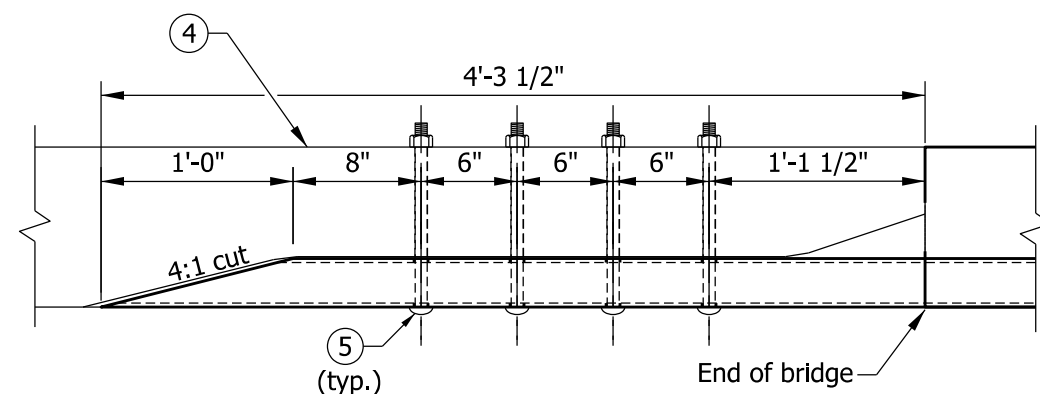
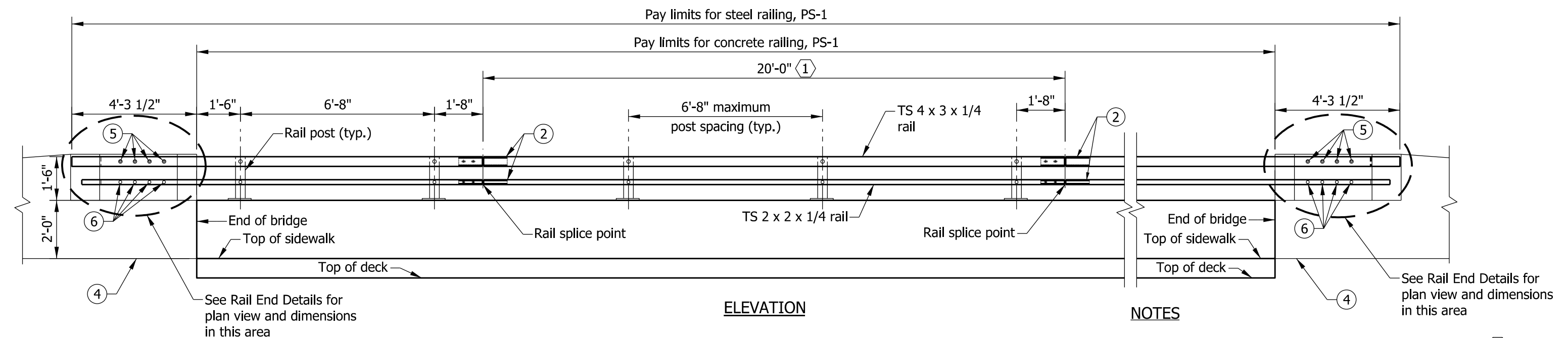
### NOTES

1. See Standard Drawing E 706-BRPP-06 for General Notes 1.
2. See Standard Drawing E 706-BRPP-05 for rail tube details and rail splice details.
3. See Standard Drawing E 706-BRPP-06 for base plate detail and reinforcing-bar bends.
4. Concrete bridge railing transition, TPF-2. See Standard Drawings E 706-TTPP-03 and -04 for details.
5. 3/4" Ø x 11 1/2" round-head bolt in 7/8" Ø hole. Hole shall be slotted as required for expansion.
6. Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.

|                                      |                                                                                                                                   |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION |                                                                                                                                   |
| RAILING, PF-2                        |                                                                                                                                   |
| SEPTEMBER 2012                       |                                                                                                                                   |
| STANDARD DRAWING NO.                 | E 706-BRPP-02                                                                                                                     |
|                                      | /s/ Richard L. VanCleave 09/04/12<br>SUPERVISOR, ROADWAY STANDARDS DATE<br><br>/s/ Mark A. Miller 09/04/12<br>CHIEF ENGINEER DATE |

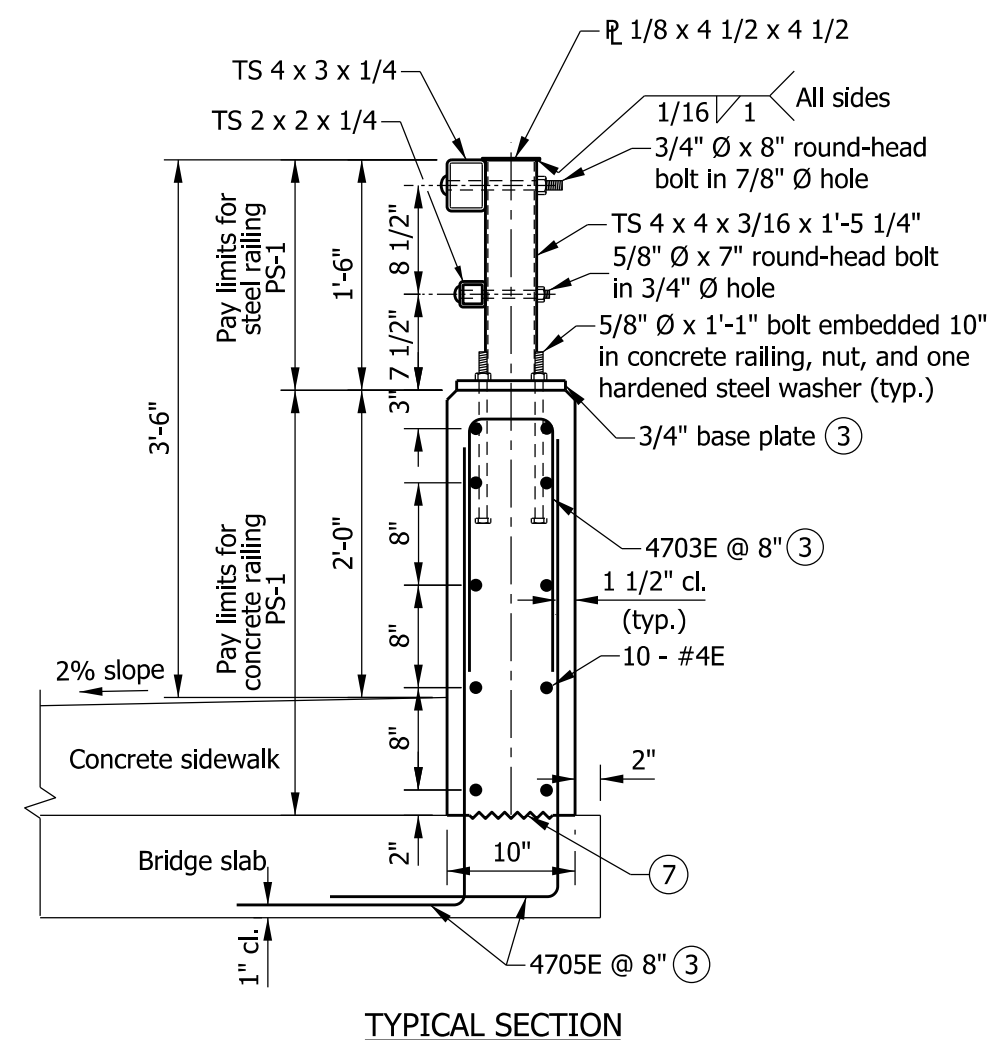
| QUANTITIES FOR ONE RUNNING FOOT OF RAILING |          |
|--------------------------------------------|----------|
| Concrete, class C                          | 1.25 CFT |
| Reinforcing bars                           | 14.1 LBS |





#### RAIL END DETAILS

| QUANTITIES FOR ONE RUNNING FOOT OF RAILING |          |
|--------------------------------------------|----------|
| Concrete, class C                          | 2.30 CFT |
| Reinforcing bars                           | 19.6 LBS |



#### NOTES

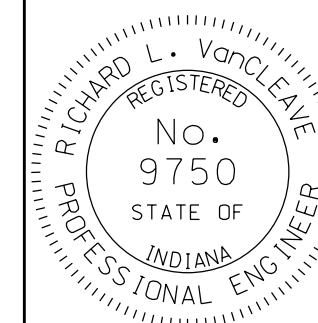
- See Standard Drawing E 706-BRPP-06 for General Notes (1).
- See Standard Drawing E 706-BRPP-05 for rail tube details and rail splice details.
- See Standard Drawing E 706-BRPP-06 for base plate detail and reinforcing-bar bends.
- Concrete bridge railing transition, TPS-1. See Standard Drawings E 706-TTPP-05 and -06 for details.
- 3/4" Ø x 11 1/2" round-head bolt in 7/8" Ø hole. Hole shall be slotted as required for expansion.
- 5/8" Ø x 10 1/2" round-head bolt in 3/4" Ø hole. Hole shall be slotted as required for expansion.
- Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.

#### INDIANA DEPARTMENT OF TRANSPORTATION

RAILING, PS-1

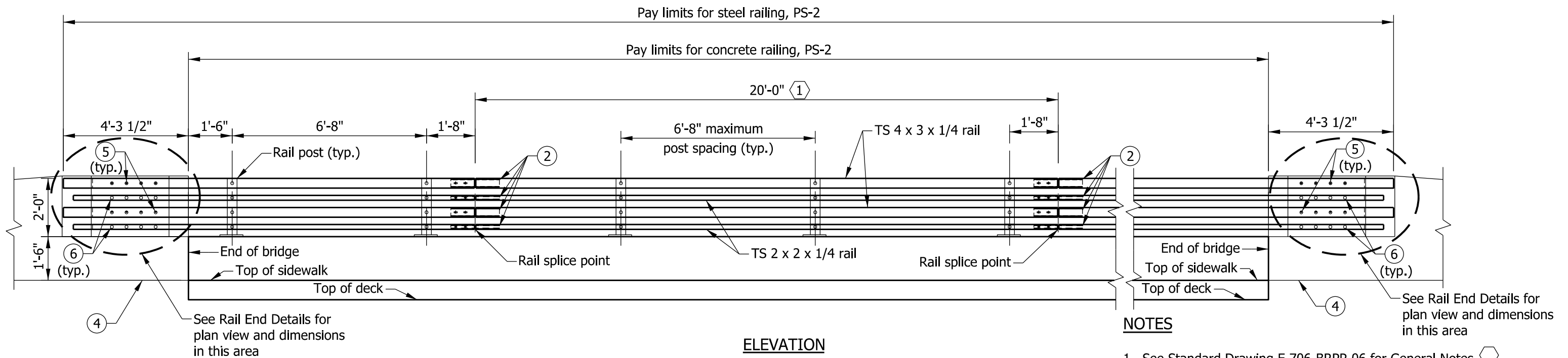
SEPTEMBER 2012

STANDARD DRAWING NO. E 706-BRPP-03



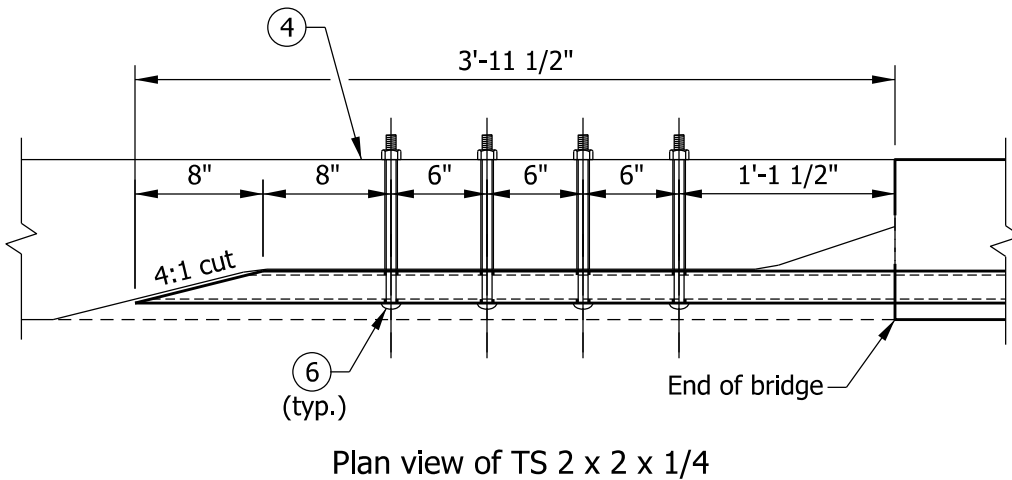
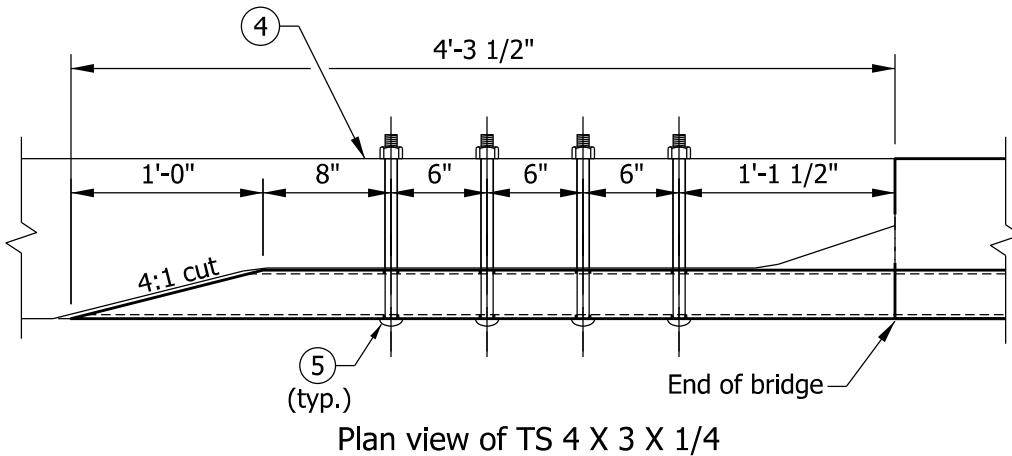
/s/ Richard L. VanCleave 09/04/12  
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12  
CHIEF ENGINEER DATE



### NOTES

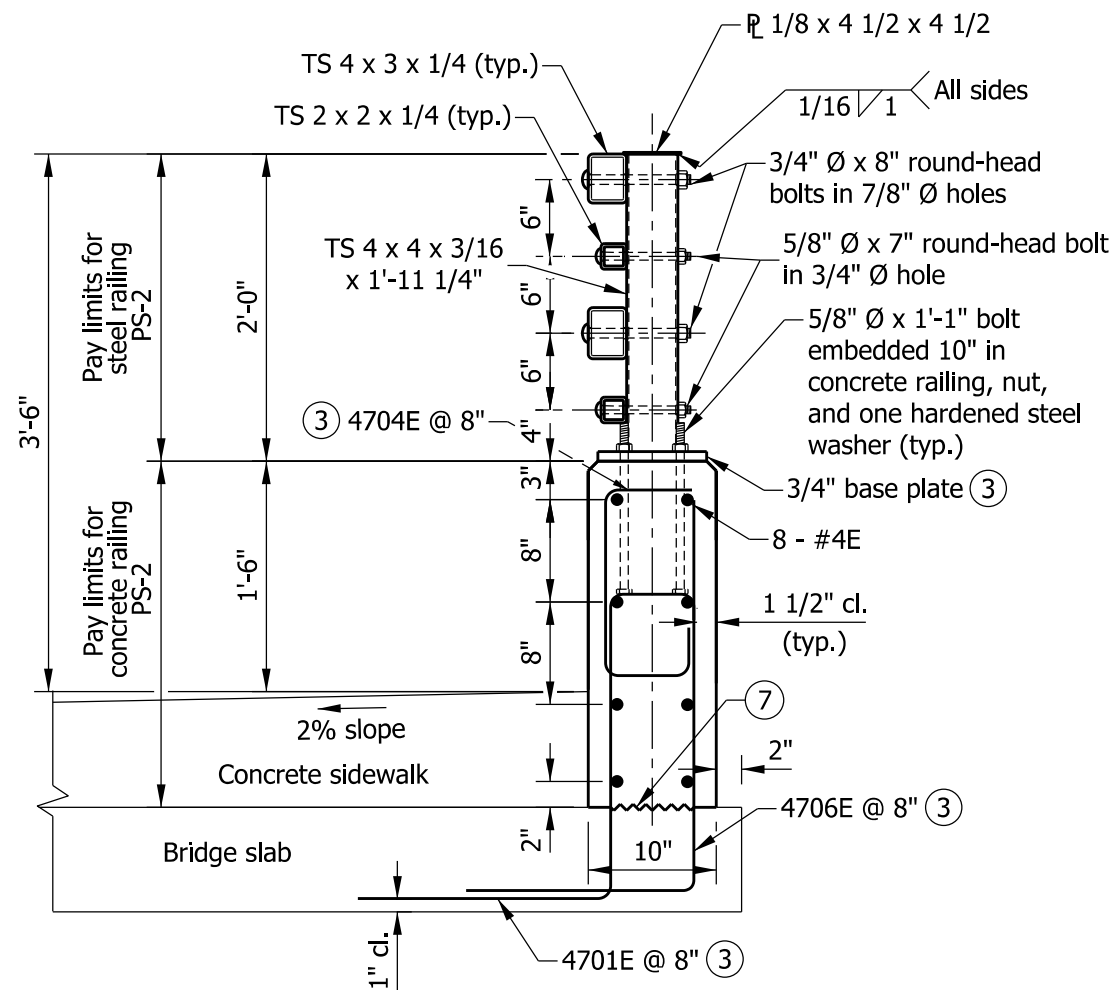
1. See Standard Drawing E 706-BRPP-06 for General Notes (1).
2. See Standard Drawing E 706-BRPP-05 for rail tube details and rail splice details.
3. See Standard Drawing E 706-BRPP-06 for base plate detail and reinforcing-bar bends.
4. Concrete bridge railing transition, TPS-2. See Standard Drawings E 706-TTPP-07 and -08 for details.
5. 3/4" Ø x 11 1/2" round-head bolt in 7/8" Ø hole. Hole shall be slotted as required for expansion.
6. 5/8" Ø x 10 1/2" round-head bolt in 3/4" Ø hole. Hole shall be slotted as required for expansion.
7. Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.



### RAIL END DETAILS

#### QUANTITIES FOR ONE RUNNING FOOT OF RAILING

|                   |          |
|-------------------|----------|
| Concrete, class C | 1.89 CFT |
| Reinforcing bars  | 16.8 LBS |

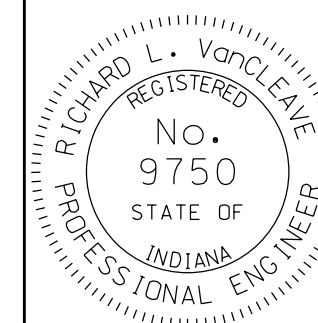


### INDIANA DEPARTMENT OF TRANSPORTATION

#### RAILING, PS-2

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-BRPP-04



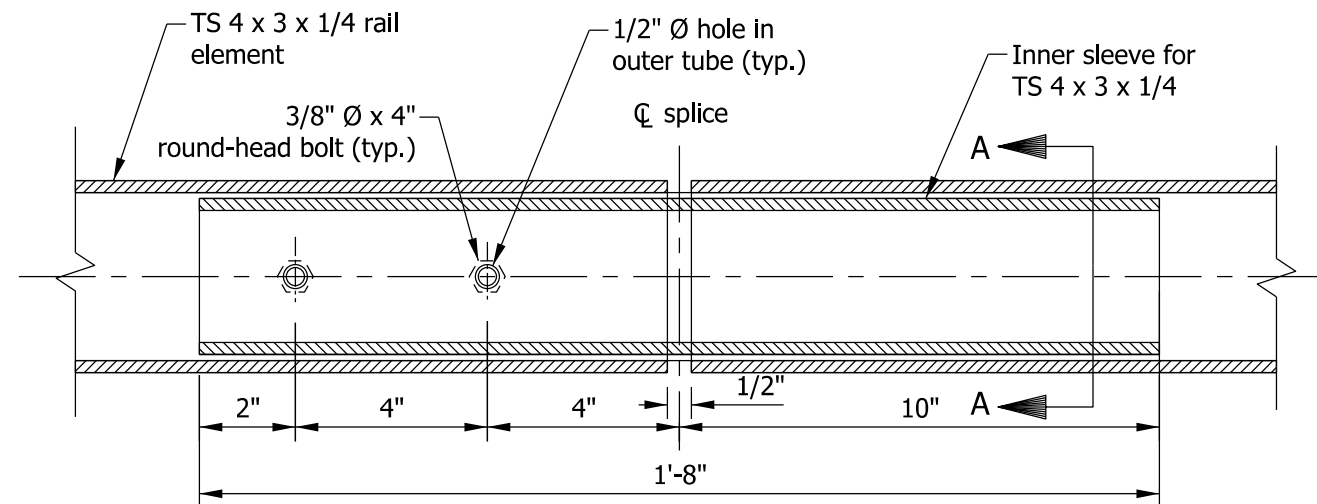
/s/ Richard L. VanCleave 09/04/12

SUPERVISOR, ROADWAY STANDARDS DATE

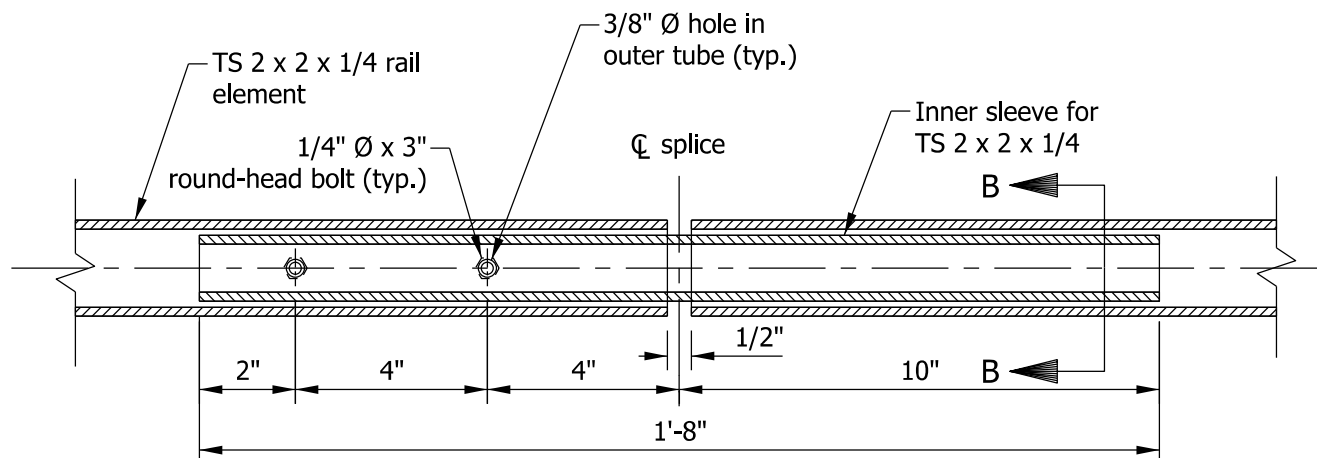
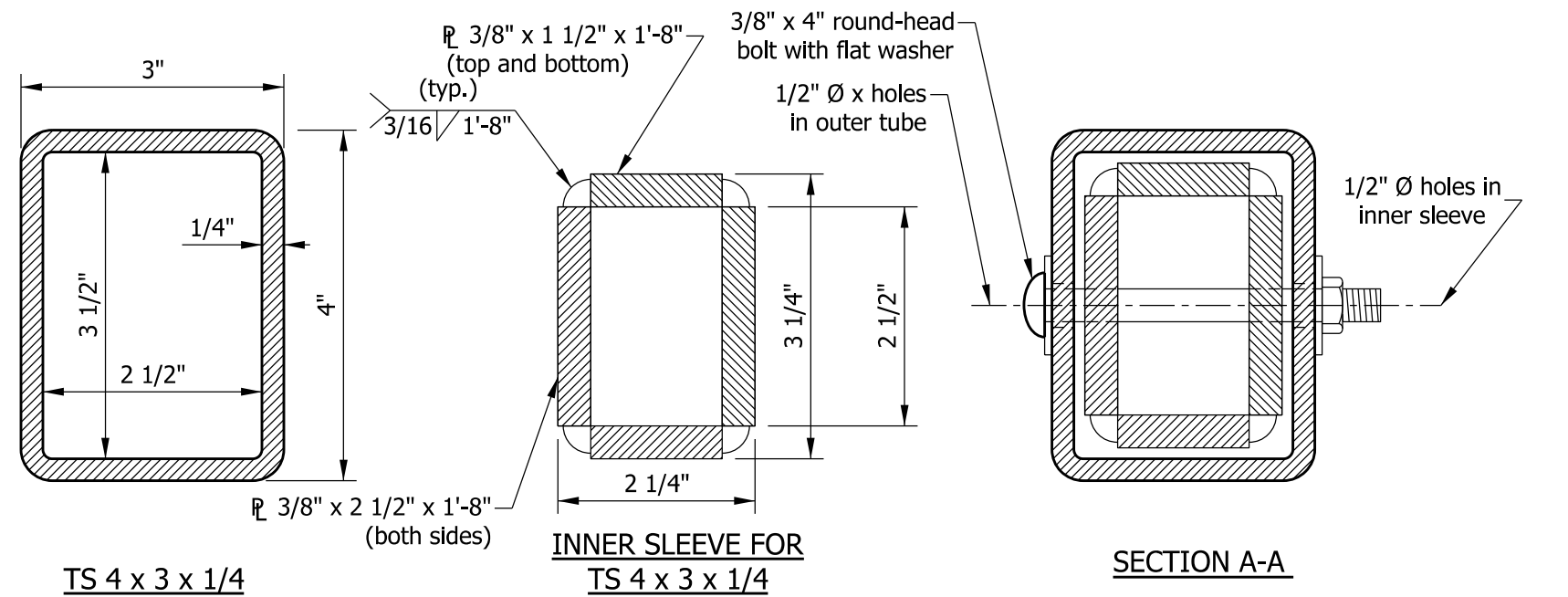
/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE

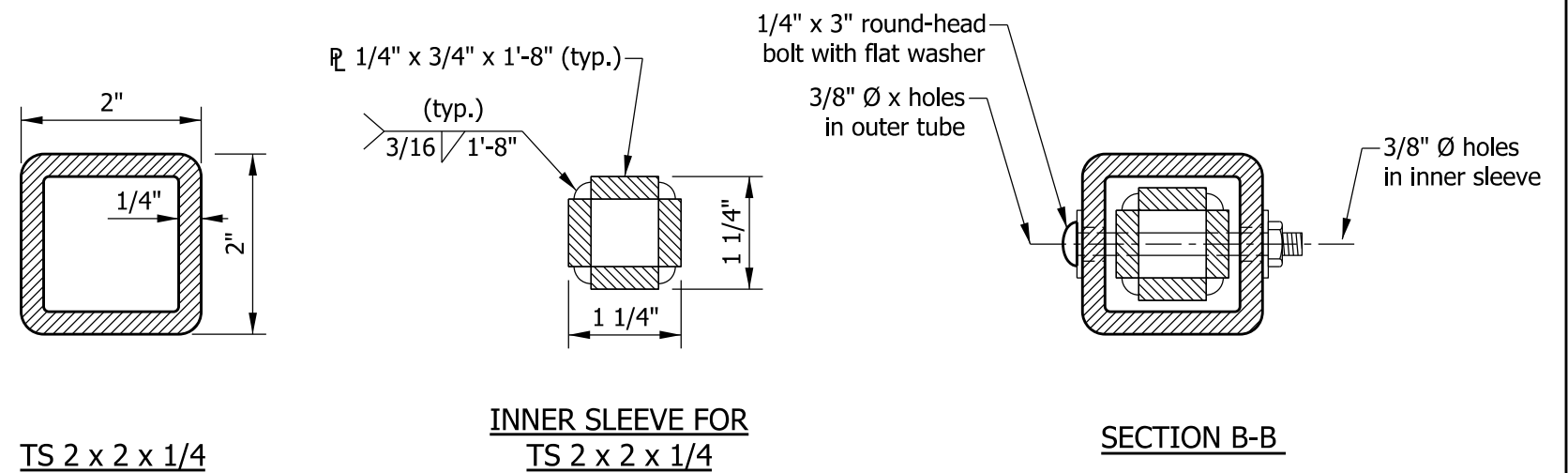




**SPLICE ASSEMBLY  
FOR TS 4 X 3 X 1/4 RAIL**



**SPLICE ASSEMBLY  
FOR TS 2 X 2 X 1/4 RAIL**

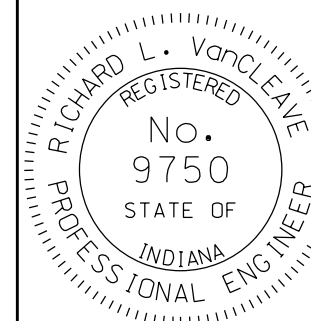


INDIANA DEPARTMENT OF TRANSPORTATION

RAILING, PF AND PS  
RAIL SPLICE DETAILS

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-BRPP-05

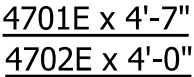
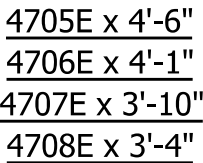


/s/ Richard L. VanCleave 09/04/12

SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE



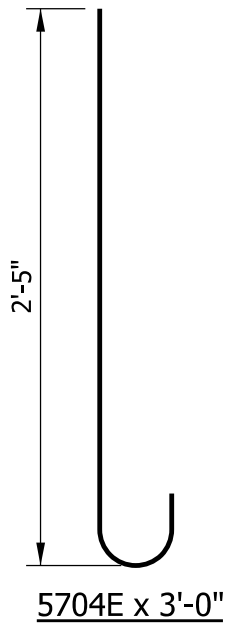
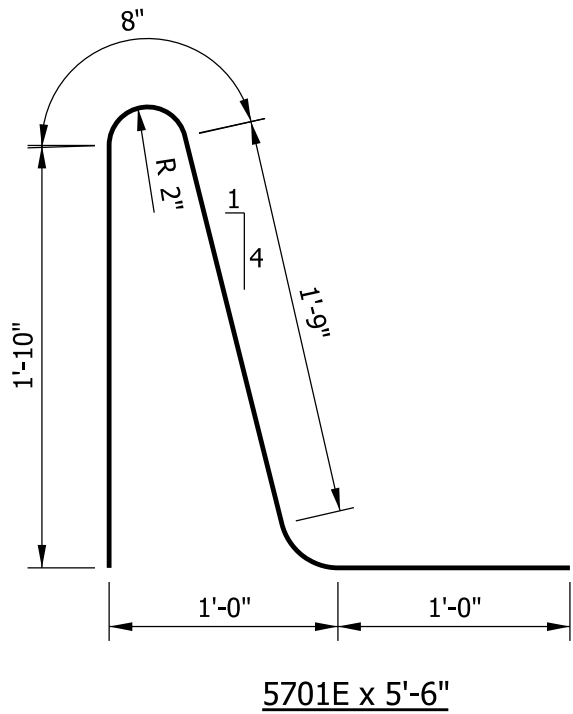
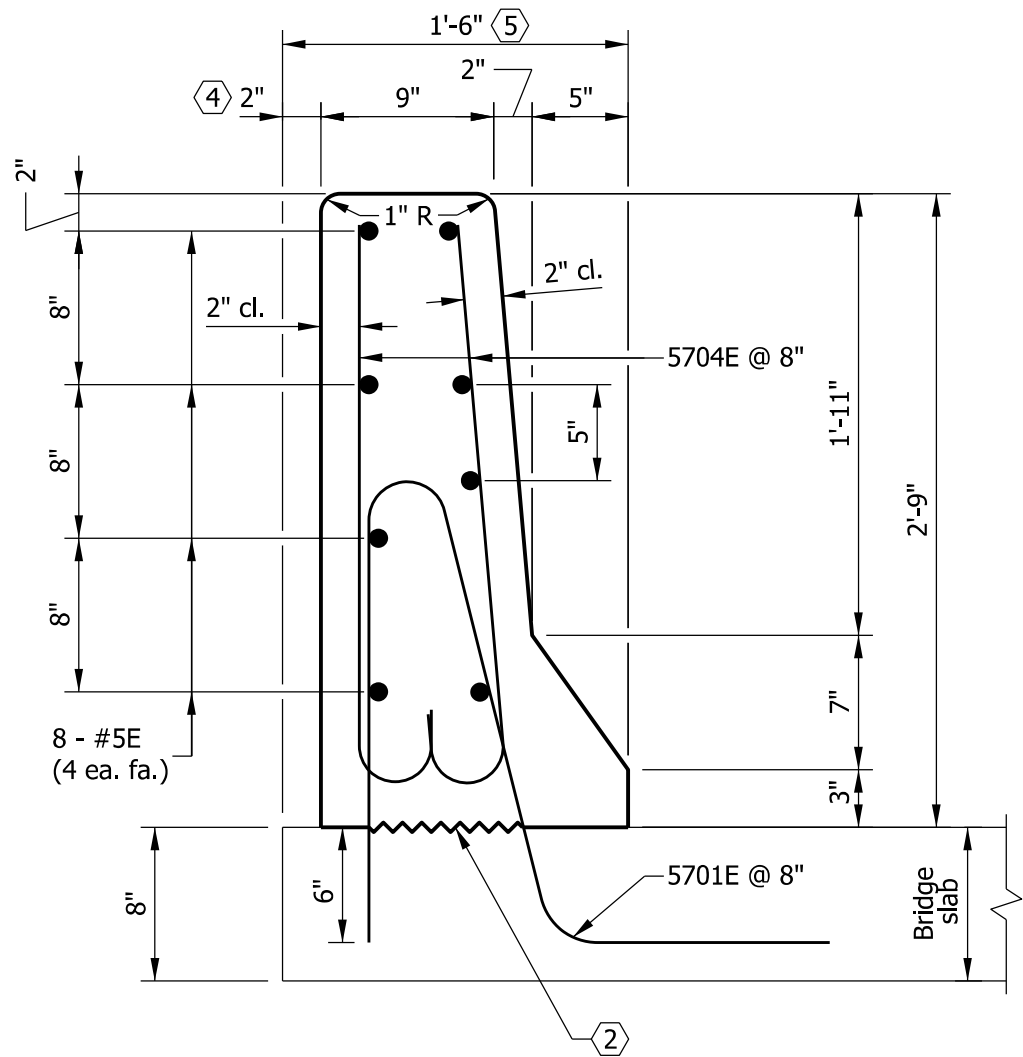
## GENERAL NOTES

- ① Intermediate railing splices shall be placed every 20 ft.
2. See Standard Drawing E 703-BRST-01 for reinforcing-bar bending details and notes.
3. All chamfered edges shall be 3/4".
4. All reinforcing bars designated E shall be epoxy coated.

|                                                                                       |                                                                                           |
|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                           |
| RAILING, PF & PS<br>DETAILS<br><br>SEPTEMBER 2012                                     |                                                                                           |
| STANDARD DRAWING NO.      E 706-BRPP-06                                               |                                                                                           |
|  | /s/ <i>Richard L. VanCleave</i> 09/04/12<br><hr/> SUPERVISOR, ROADWAY STANDARDS      DATE |
|                                                                                       | /s/ <i>Mark A. Miller</i> 09/04/12<br><hr/> CHIEF ENGINEER      DATE                      |

NOTES

1. See Standard Drawing E 706-BRSF-03 for General Notes
2. See Standard Drawing E 703-BRST-01 for reinforcing-bar bending details and notes.

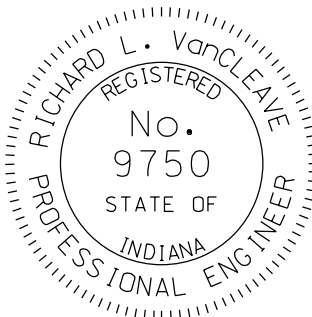


INDIANA DEPARTMENT OF TRANSPORTATION

BRIDGE RAILING  
TYPE FC

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-BRSF-01



/s/ Richard L. VanCleave 09/04/12

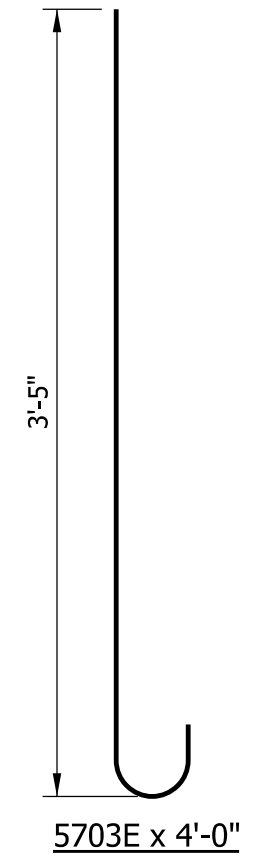
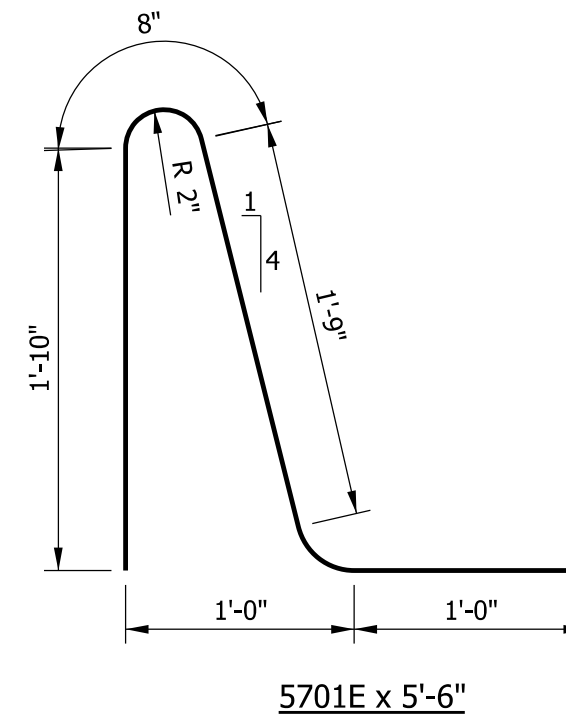
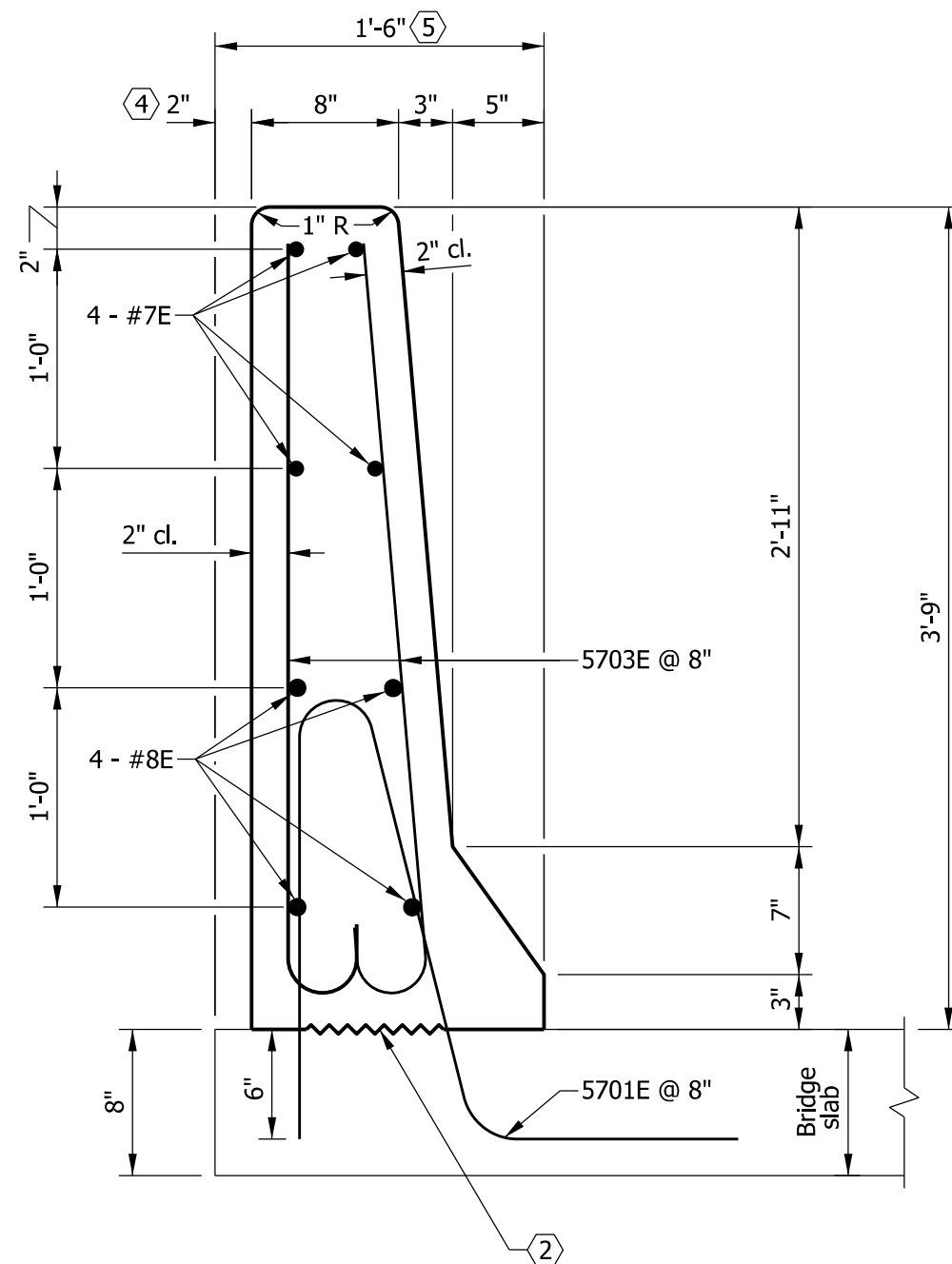
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE

QUANTITIES FOR ONE RUNNING  
FOOT OF RAILING

|                   |          |
|-------------------|----------|
| Concrete, class C | 2.58 CFT |
| Reinforcing bars  | 26.3 LBS |



## NOTES

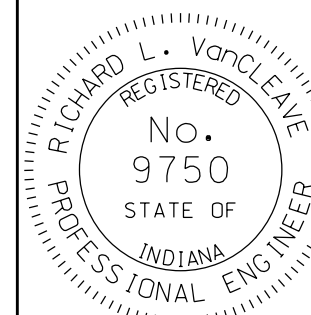
- See Standard Drawing E 706-BRSF-03 for General Notes .
- See Standard Drawing E 703-BRST-01 for reinforcing-bar bending details and notes.

INDIANA DEPARTMENT OF TRANSPORTATION

BRIDGE RAILING  
TYPE FT

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-BRSF-02



/s/ *Richard L. VanCleave* 09/04/12

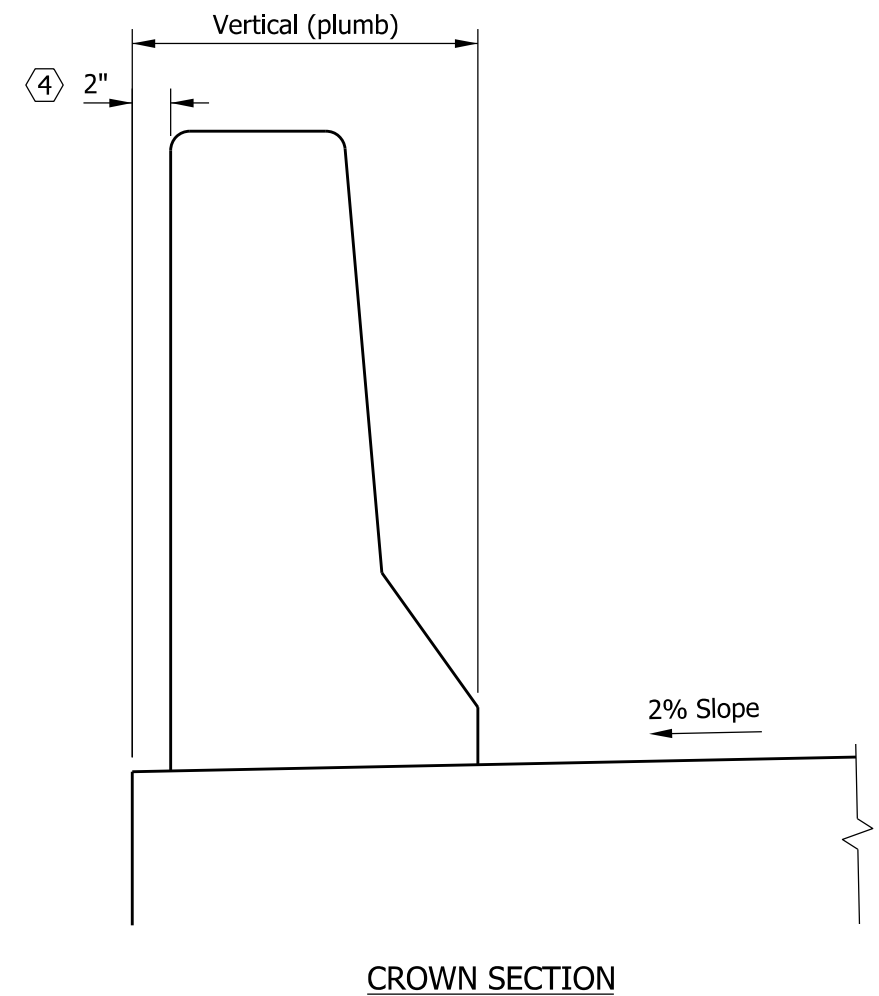
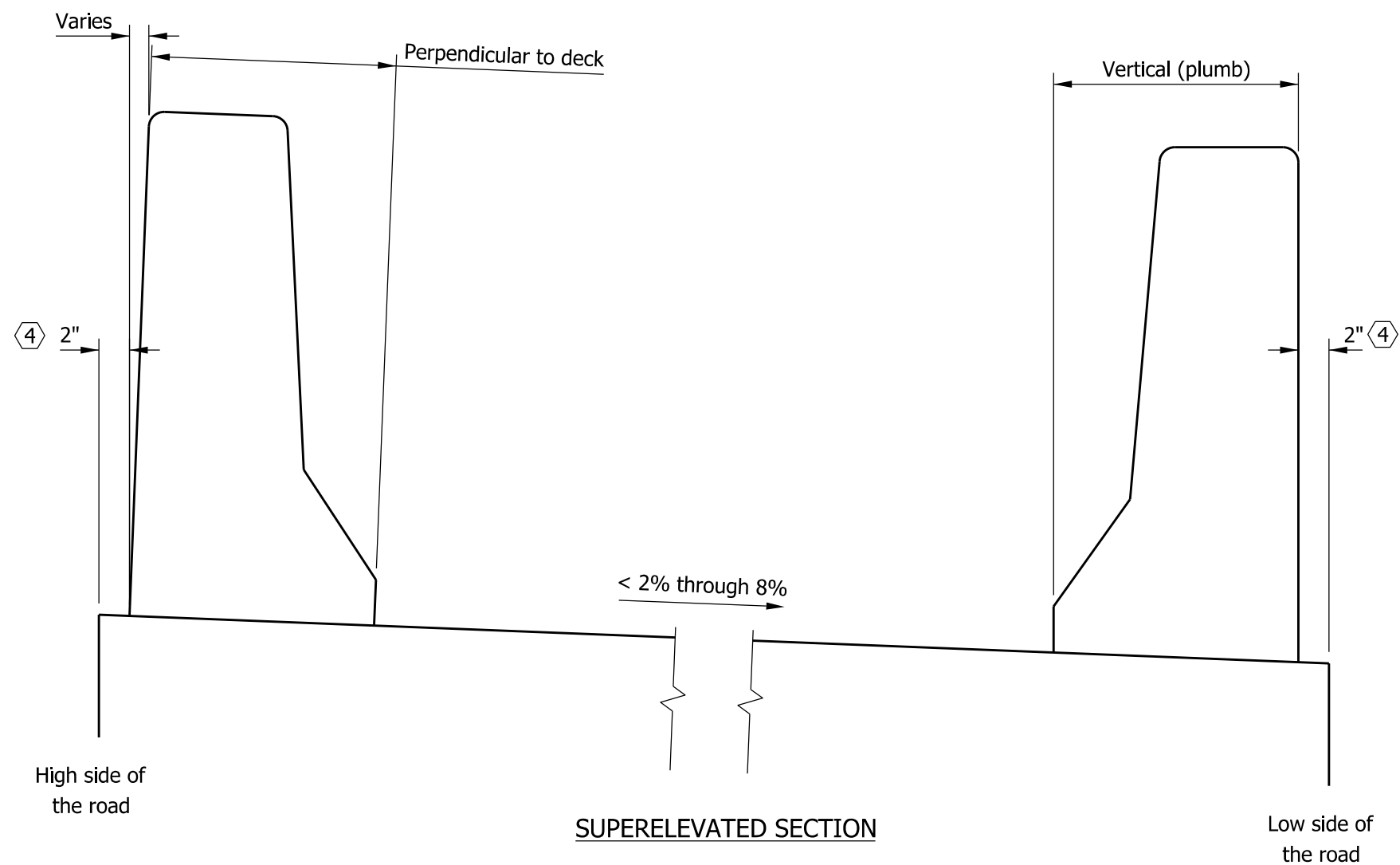
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ *Mark A. Miller* 09/04/12

CHIEF ENGINEER DATE

## QUANTITIES FOR ONE RUNNING FOOT OF RAILING

|                   |          |
|-------------------|----------|
| Concrete, class C | 3.29 CFT |
| Reinforcing bars  | 40.0 LBS |



### GENERAL NOTES

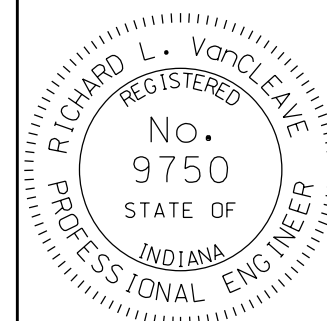
- Minimum lap for #5 bars shall be 1'-11".
- Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.
- A joint shall be provided between the bridge railing and railing transition at the end of the bridge slab as shown on Standard Drawing E 706-CBRT-01.
- For twin structures or other structures which are placed side by side, this dimension shall be reduced to 0 on the median side.
- For twin structures or other structures which are placed side by side, this dimension shall be reduced to 1'-4" on the median side.
- All reinforcing bars designated E shall be epoxy coated.

INDIANA DEPARTMENT OF TRANSPORTATION

CONCRETE BRIDGE RAILING  
PLACEMENT

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-BRSF-03



/s/ *Richard L. VanCleave* 09/04/12

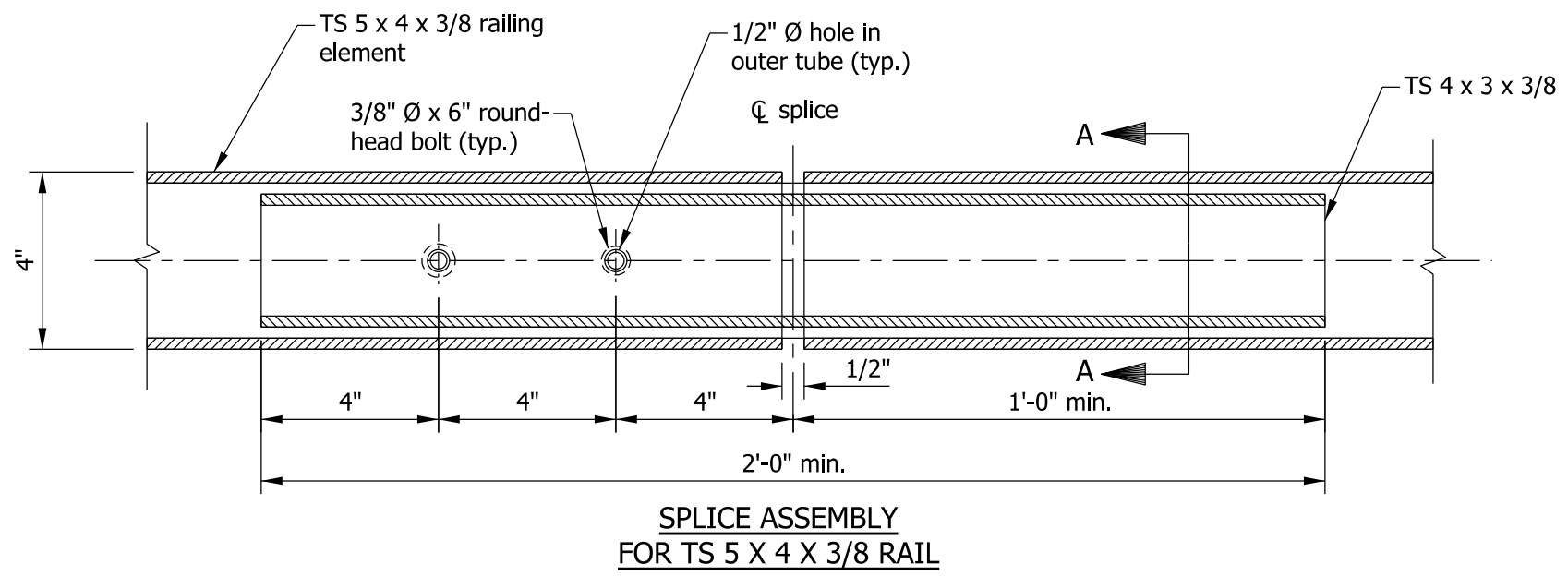
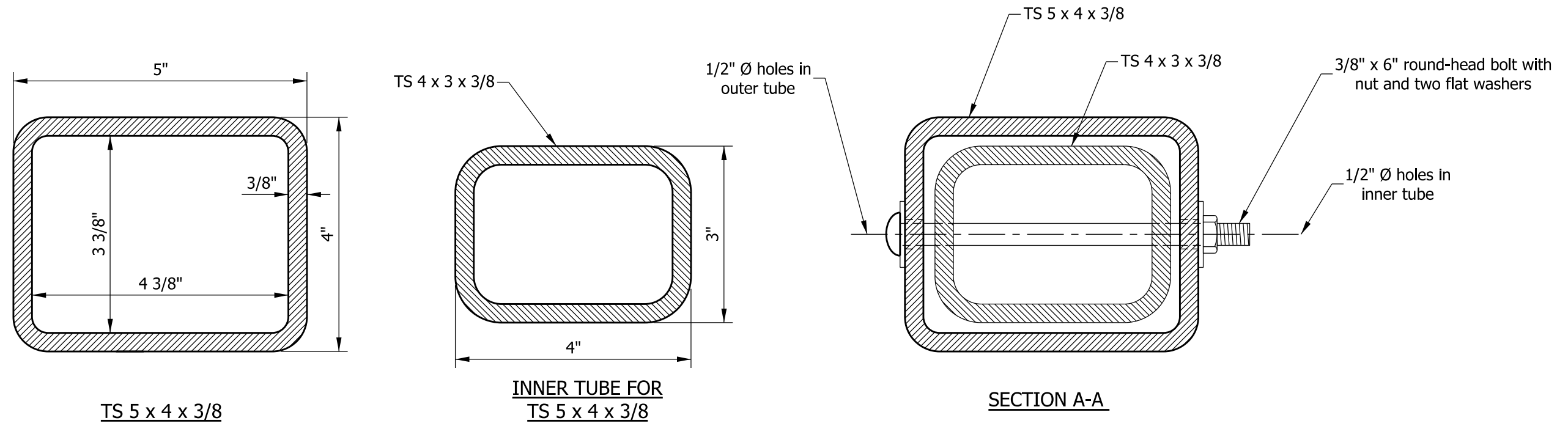
SUPERVISOR, ROADWAY STANDARDS DATE

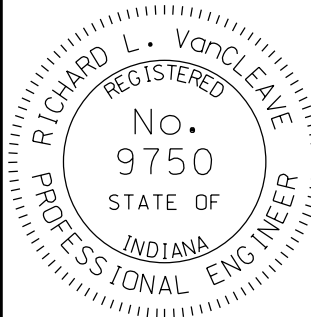
/s/ *Mark A. Miller* 09/04/12

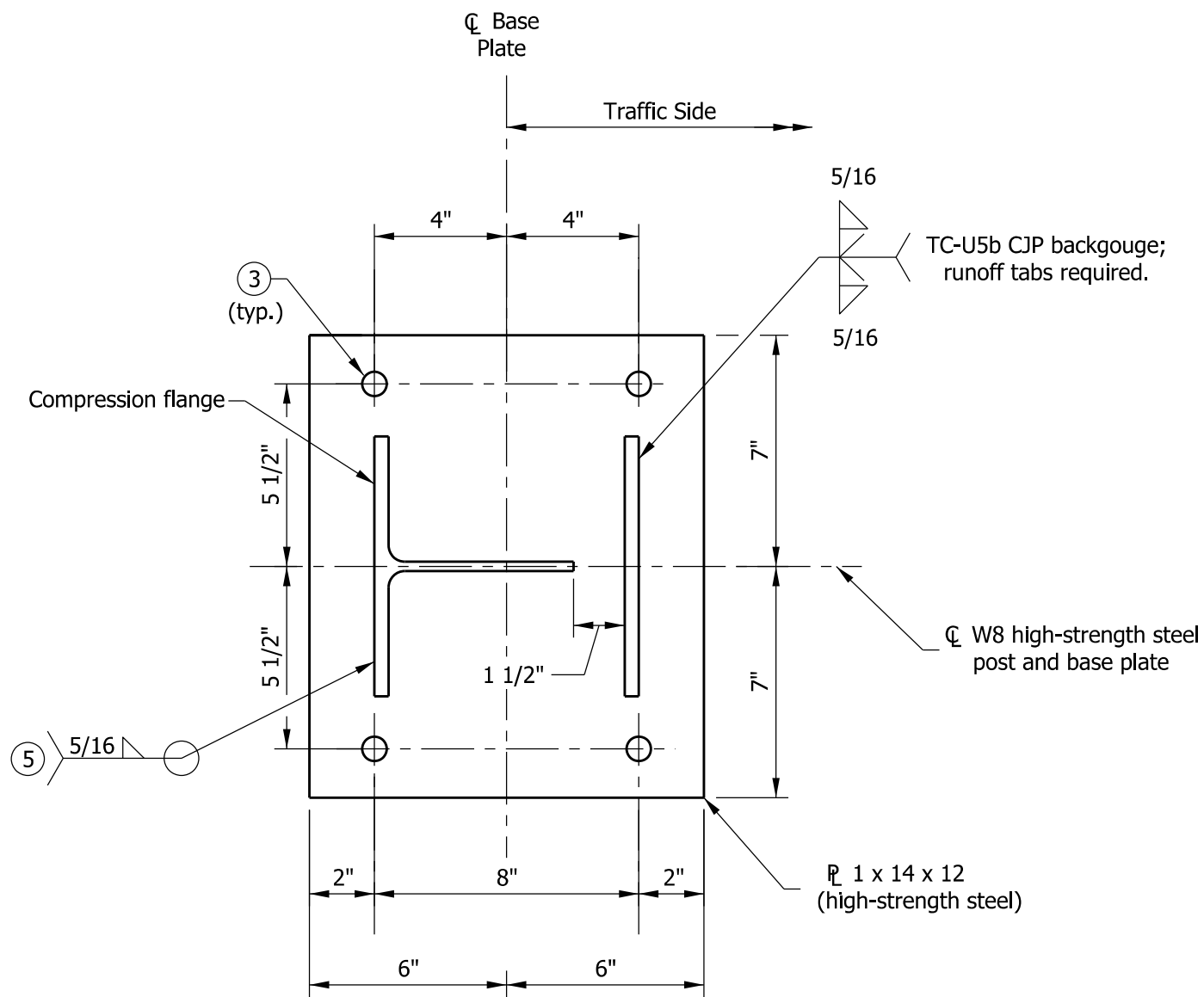
CHIEF ENGINEER DATE



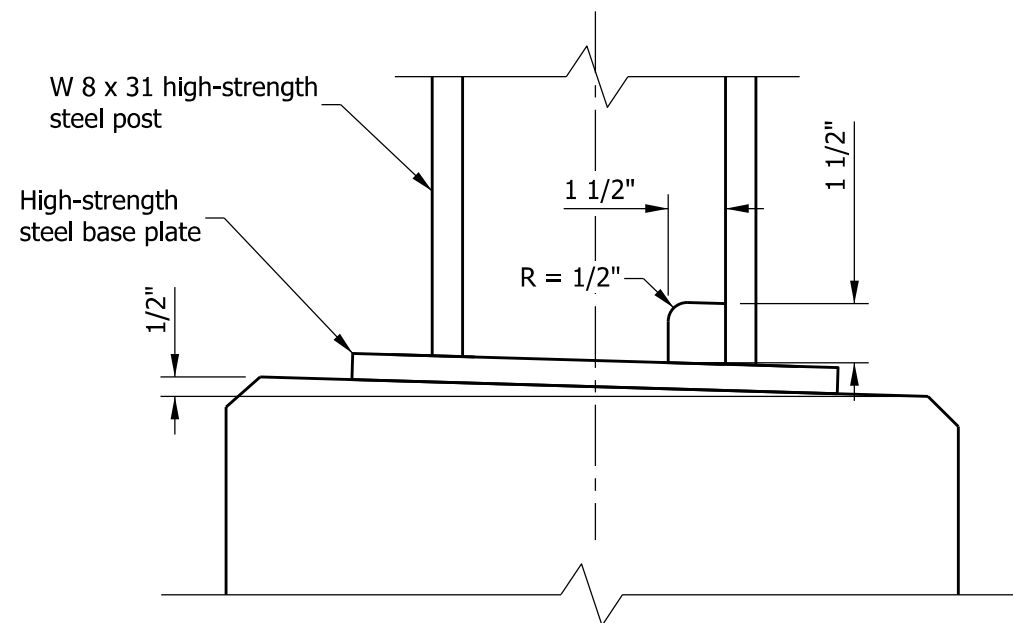




| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                 |               |
|---------------------------------------------------------------------------------------|---------------------------------|---------------|
| RAILING, TF-2<br>RAIL SPLICE DETAILS<br>SEPTEMBER 2012                                |                                 |               |
| STANDARD DRAWING NO.                                                                  |                                 | E 706-BRTF-02 |
|  | /s/ <i>Richard L. VanCleave</i> | 09/04/12      |
|                                                                                       | SUPERVISOR, ROADWAY STANDARDS   | DATE          |
|                                                                                       | /s/ <i>Mark A. Miller</i>       | 09/04/12      |
|                                                                                       | CHIEF ENGINEER                  | DATE          |



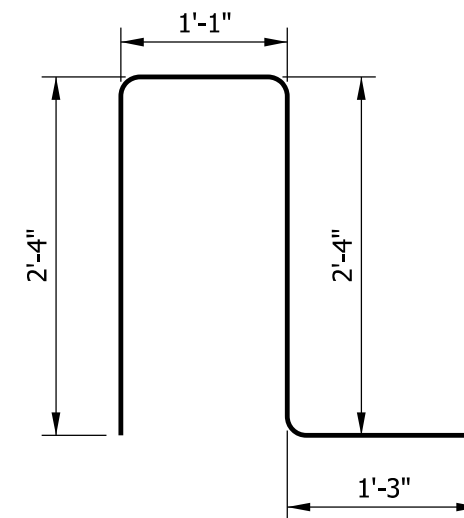
BASE PLATE DETAIL



WELD-ACCESS HOLE DETAIL

NOTES

1. See Standard Drawing E 703-BRST-01 for reinforcing-bar bending details and notes.
2. All chamfered edges shall be 3/4".
- 3 1 3/8" Ø holes for 1 1/8" anchor bolts.
4. All reinforcing bars designated E shall be epoxy coated.
- 5 Mill to bear flush with base plate prior to welding to ensure that the final position of the post is vertical.



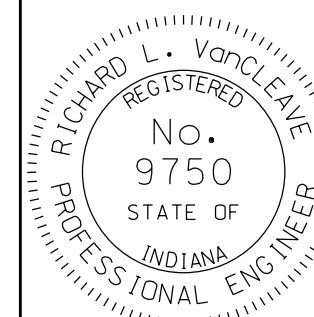
4700E x 7'-0"

INDIANA DEPARTMENT OF TRANSPORTATION

RAILING, TF-2  
DETAILS

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-BRTF-03



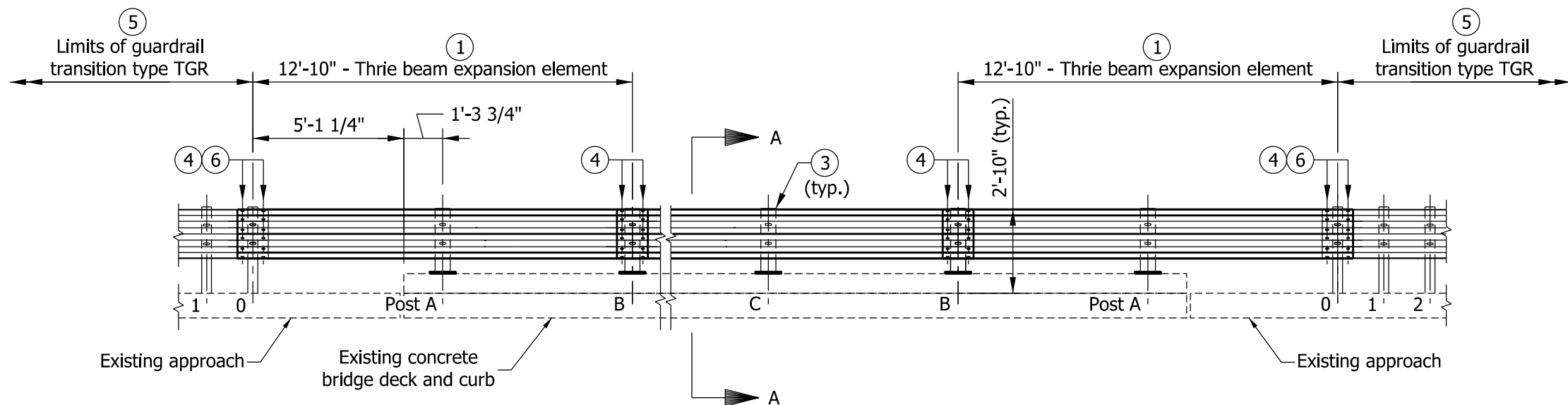
/s/ Richard L. VanCleave 09/04/12

SUPERVISOR, ROADWAY STANDARDS DATE

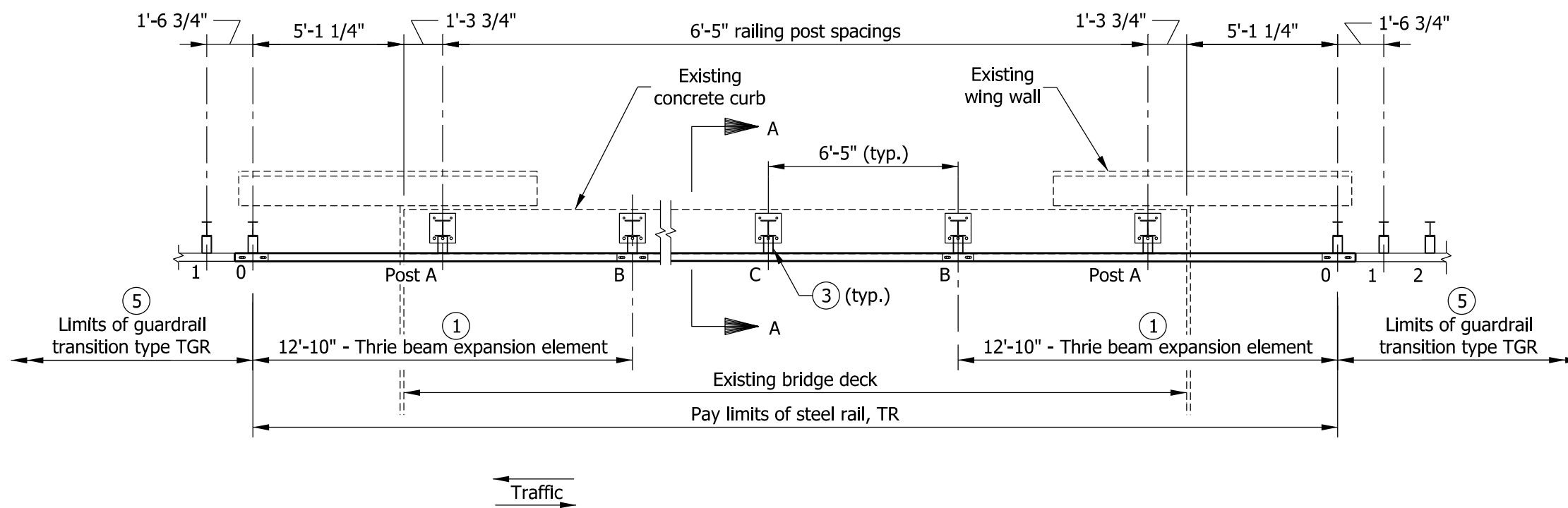
/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE





ELEVATION VIEW



PLAN VIEW

## NOTES

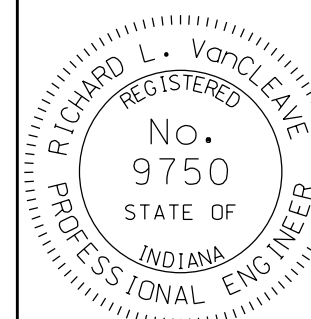
- ① See Standard Drawing E 706-BRTR-04 for thrie beam expansion element.
2. See Standard Drawing E 706-BRTR-02 for Section A-A.
- ③ Bridge railing post/blockout assembly. See Standard Drawing E 706-BRTR-03 for post and blockout details. Attach rail using two 5/8" Ø x 2" std. button head bolts with rectangular plate washers, round washers, and recess nuts.
- ④ Twelve 5/8" Ø std. button head bolts with round washers and recess nuts.
- ⑤ See Standard Drawing E 706-BRTR-05 for thrie beam guardrail transition type TGR.
- ⑥ Hand tighten post bolts on thrie beam expansion element and burr bolt threads.

INDIANA DEPARTMENT OF TRANSPORTATION

RETROFIT THRIE BEAM  
BRIDGE RAILING TR

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-BRTR-01

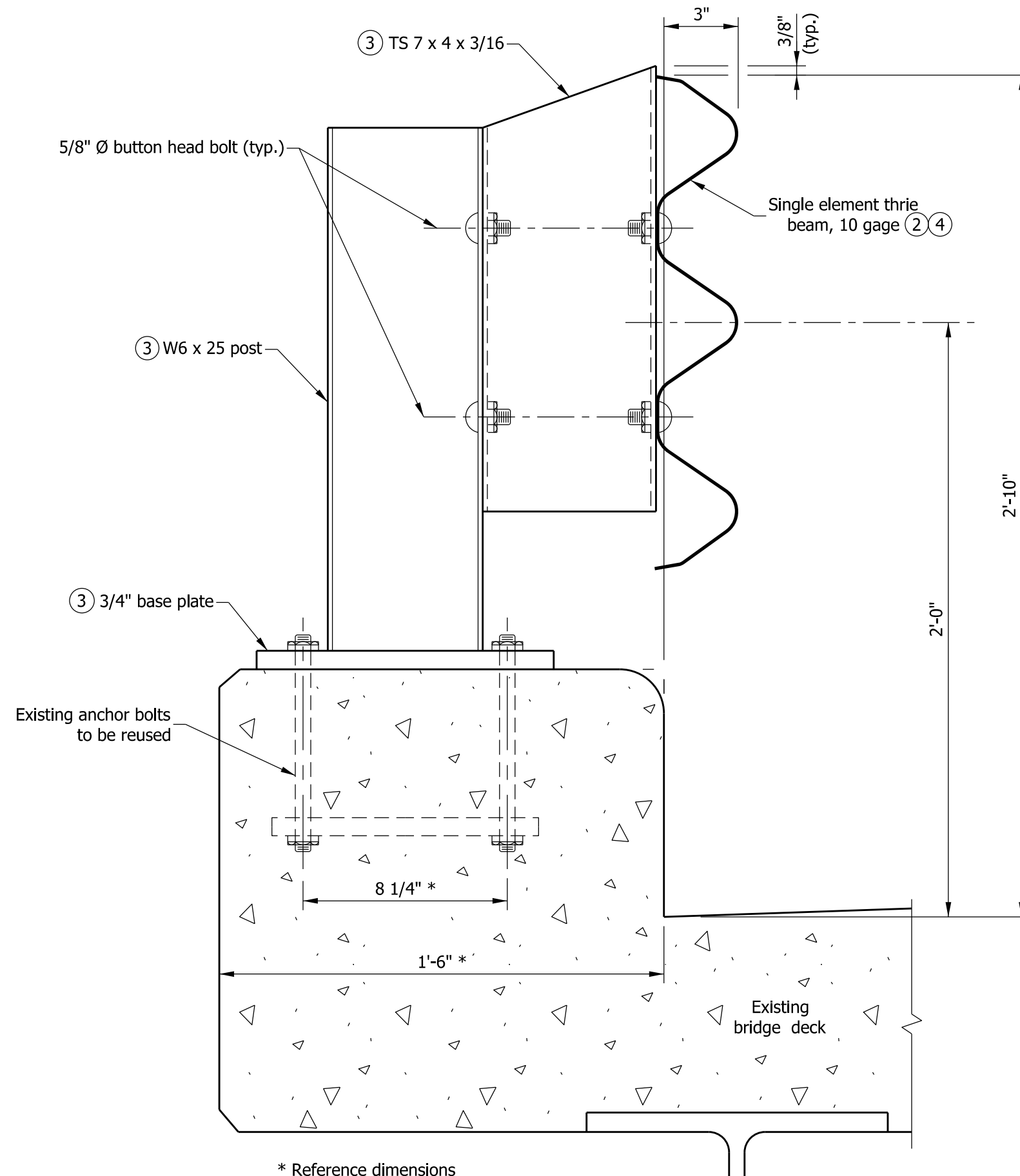


/s/ Richard L. VanCleave 09/04/12

SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE



**SECTION A-A**

**NOTES**

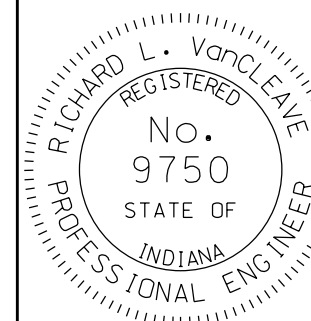
1. See Standard Drawing E 706-BRTR-01 for plan view.
- (2) See Standard Drawing E 601-TBGC-01 for thrie beam section.
- (3) See Standard Drawing E 706-BRTR-03 for post, blockout, and base plate details.
- (4) See Standard Drawing E 706-BRTR-04 for thrie beam bridge railing elements.

INDIANA DEPARTMENT OF TRANSPORTATION

RETROFIT THRIE BEAM  
BRIDGE RAILING TR

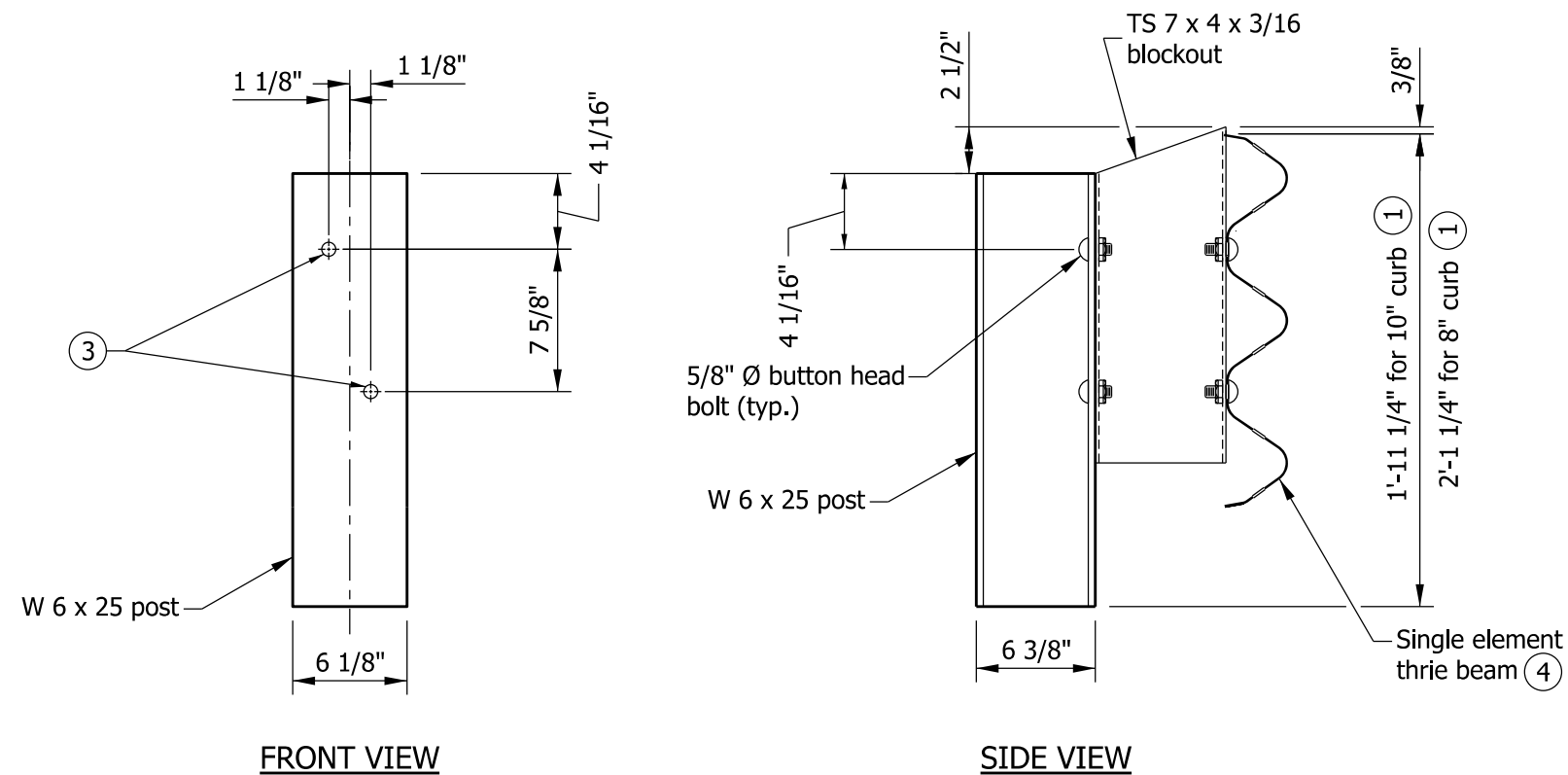
SEPTEMBER 2012

STANDARD DRAWING NO. E 706-BRTR-02

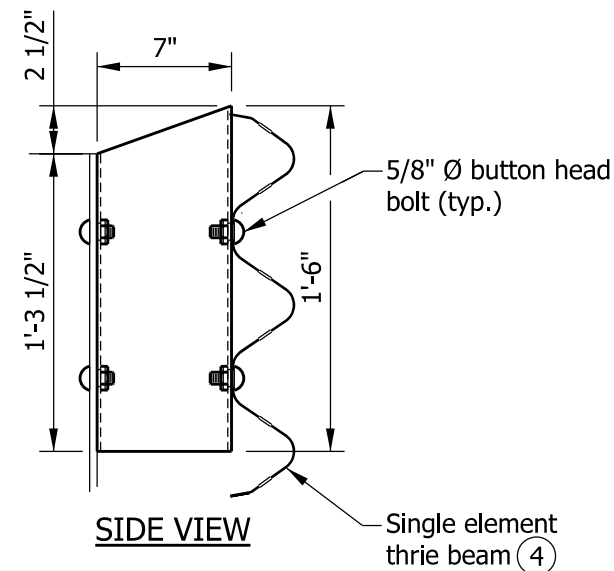
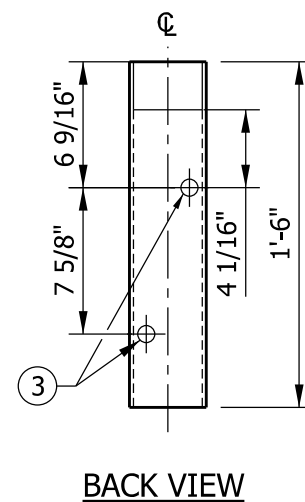
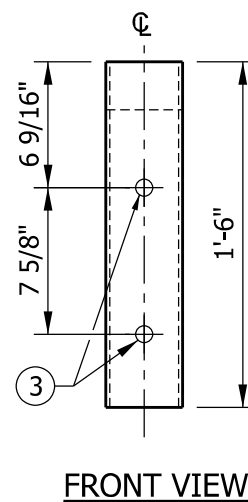
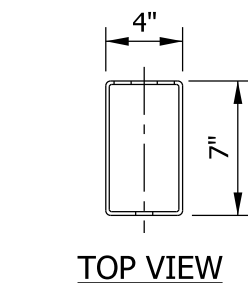


/s/ Richard L. VanCleave 09/04/12  
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12  
CHIEF ENGINEER DATE



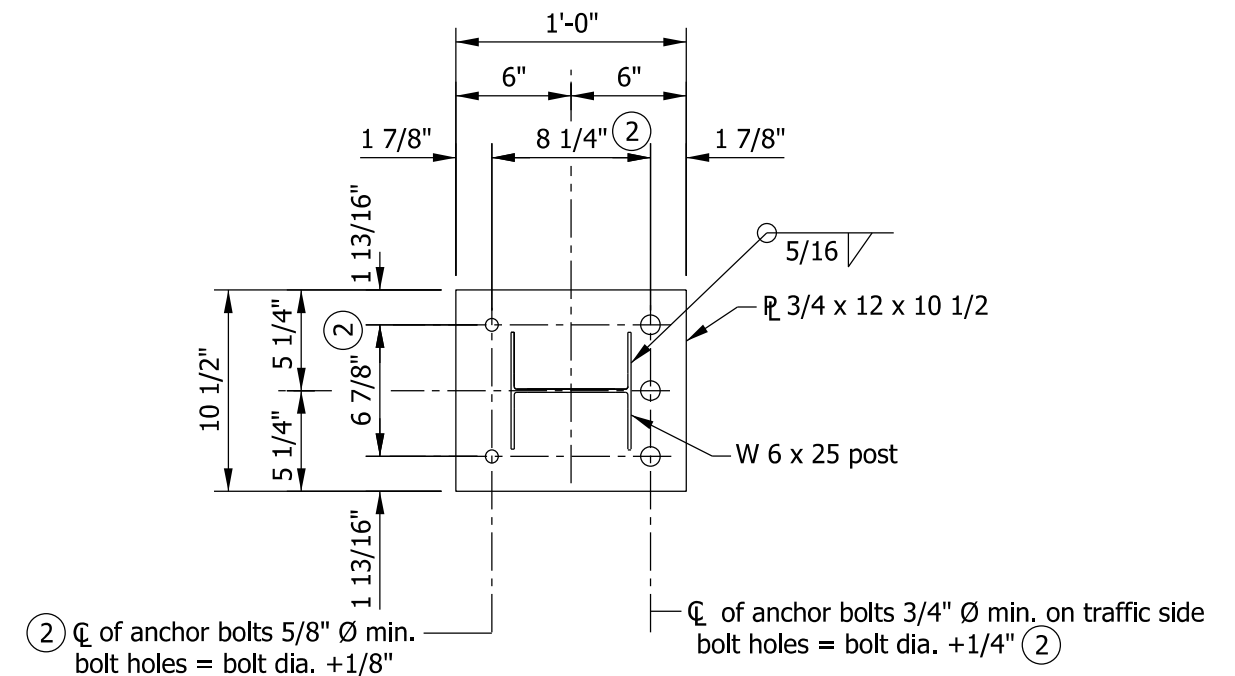
W 6 x 25 POST DETAILS FOR CURB MOUNTED POSTS



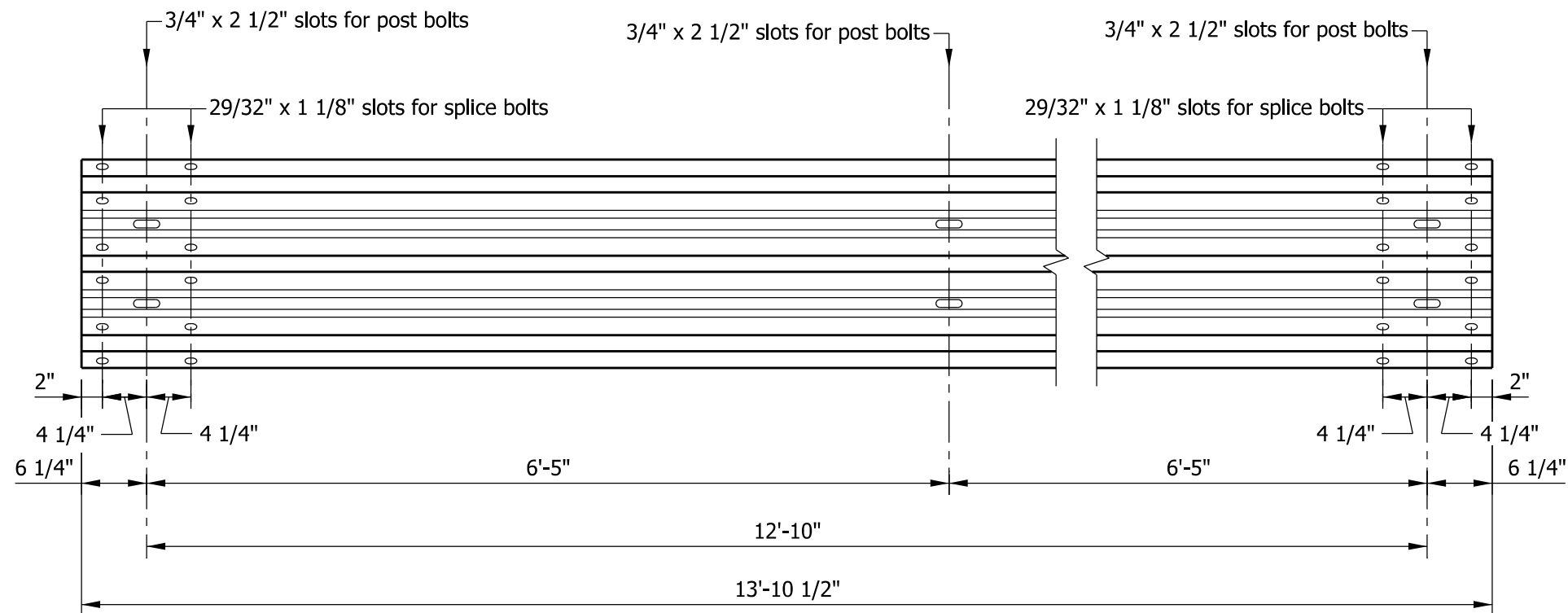
TS 7 x 4 x 3/16 BLOCKOUT DETAILS  
FOR CURB MOUNTED POSTS

## NOTES

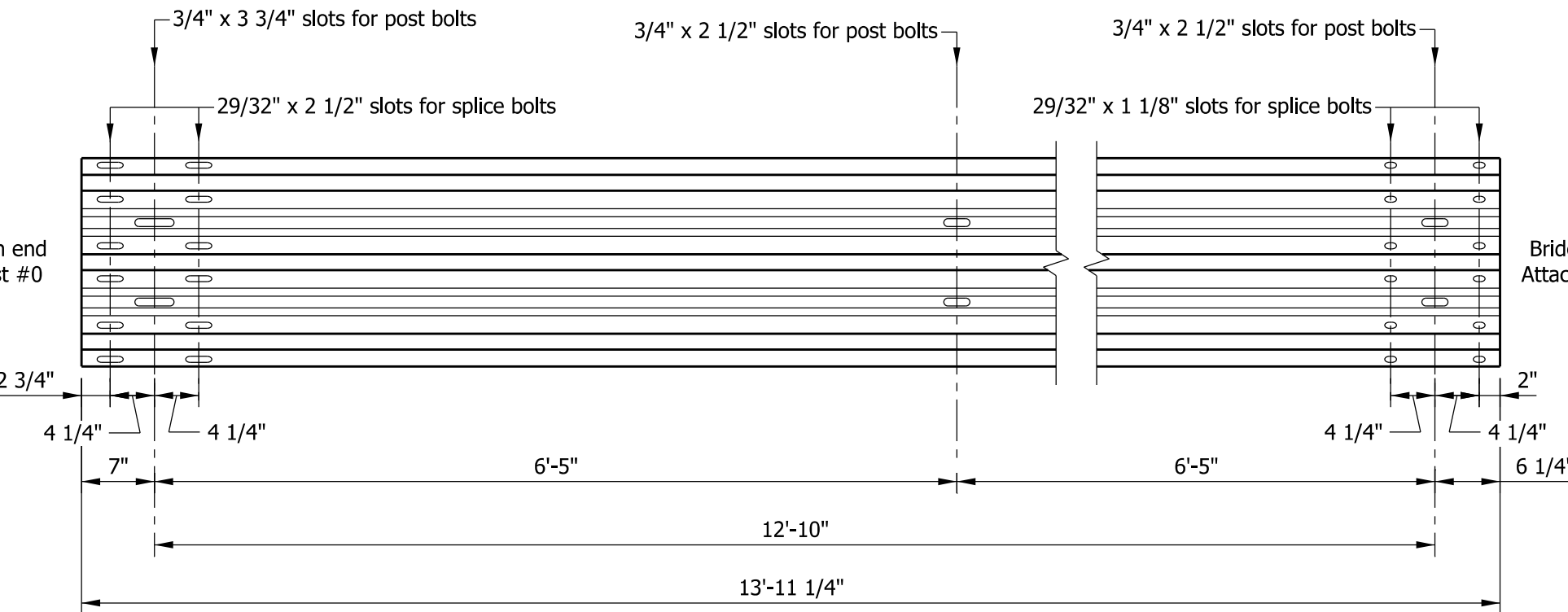
- Adjust the post length for thrie beam height above the deck.
- Locations of bolt holes on base plate shall match locations of existing anchor bolts.
- All holes drilled or punched to 3/4" Ø.
- See Standard Drawing E 706-BRTR-04 for thrie beam elements. See Standard Drawing E 601-TBGC-01 for thrie beam rail section.



| INDIANA DEPARTMENT OF TRANSPORTATION                                     |                               |               |          |
|--------------------------------------------------------------------------|-------------------------------|---------------|----------|
| RETROFIT THRIE BEAM<br>BRIDGE RAILING TR<br>COMPONENTS<br>SEPTEMBER 2012 |                               |               |          |
| STANDARD DRAWING NO.                                                     |                               | E 706-BRTR-03 |          |
|                                                                          | /s/ Richard L. VanCleave      |               | 09/04/12 |
|                                                                          | SUPERVISOR, ROADWAY STANDARDS |               | DATE     |
|                                                                          | /s/ Mark A. Miller            |               | 09/04/12 |
|                                                                          | CHIEF ENGINEER                |               | DATE     |



THRIE BEAM ELEVATION



THRIE BEAM EXPANSION ELEMENT ELEVATION

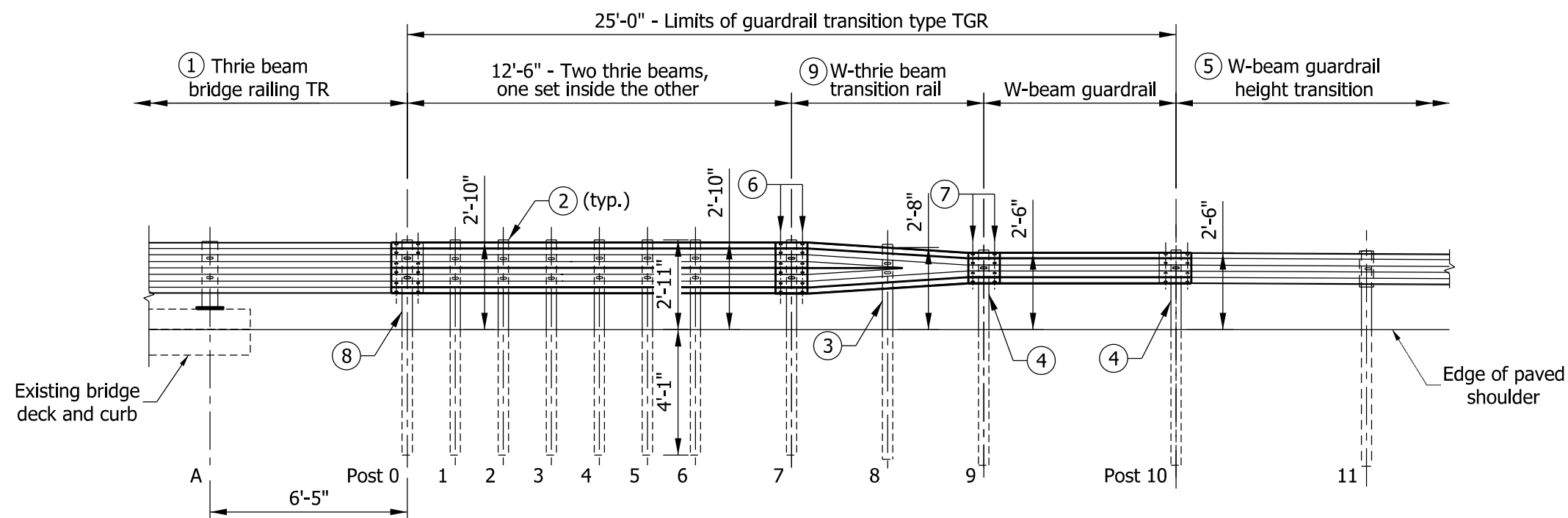
NOTES

- ① See Standard Drawing E 706-BRTR-01 for post locations.

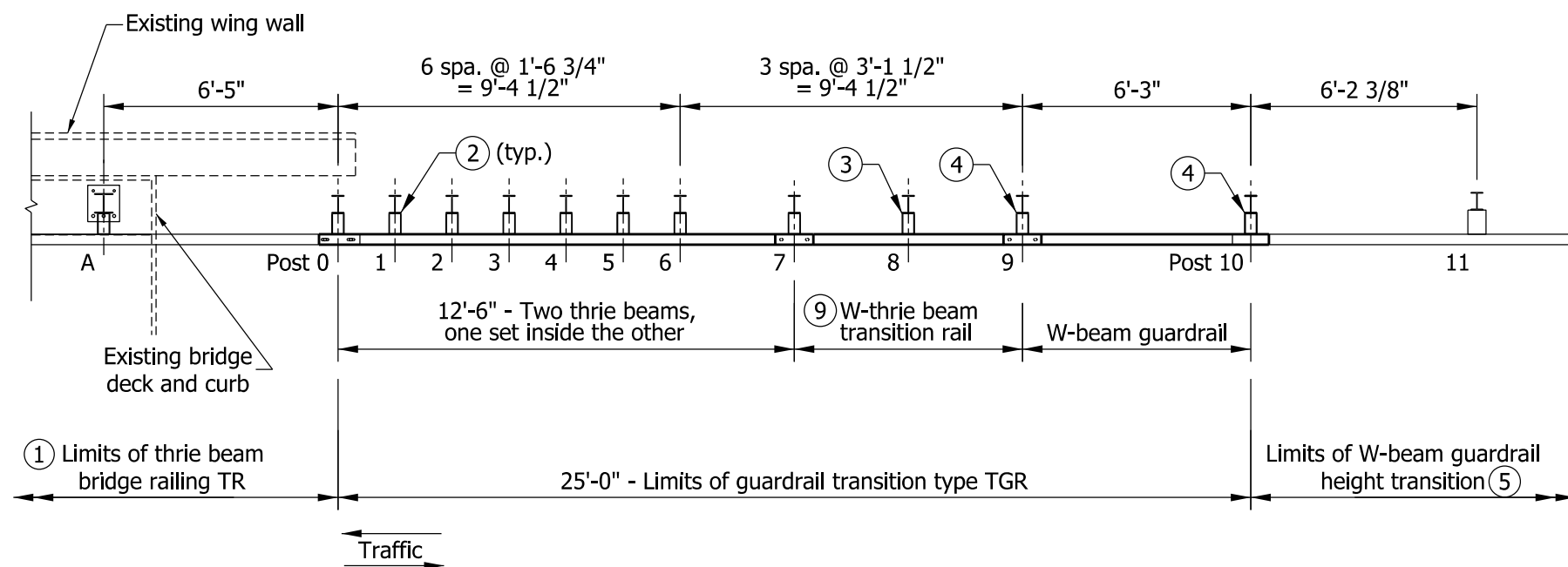
R.C. approach end  
Attach to Post #0  
①

Bridge deck end  
Attach to Post #B  
①

| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                 |               |          |
|---------------------------------------------------------------------------------------|---------------------------------|---------------|----------|
| RETROFIT THRIE BEAM<br>BRIDGE RAILING TR<br>COMPONENTS<br>SEPTEMBER 2012              |                                 |               |          |
| STANDARD DRAWING NO.                                                                  |                                 | E 706-BRTR-04 |          |
|  | /s/ <i>Richard L. VanCleave</i> |               | 09/04/12 |
|                                                                                       | SUPERVISOR, ROADWAY STANDARDS   |               | DATE     |
|                                                                                       | /s/ <i>Mark A. Miller</i>       |               | 09/04/12 |
|                                                                                       | CHIEF ENGINEER                  |               | DATE     |



ELEVATION



PLAN VIEW

## NOTES

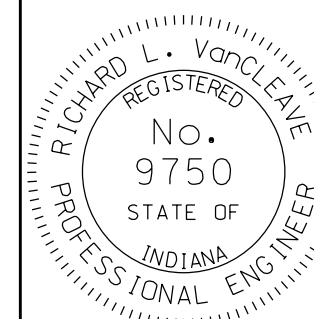
- See Standard Drawing E 706-BRTR-01 for thrie beam bridge railing TR.
- TGB transition post/blockout assembly. See Standard Drawing E 601-TTGB-03 for post and blockout details. Adjust post height to accommodate guardrail heights indicated on this sheet. Attach rail using two 5/8" Ø x 2" std. button head bolts with rectangular plate washers, round washers, and recess nuts.
- W-thrie beam transition post/blockout assembly. See Standard Drawing E 601-TTGB-04 for post and blockout details. Adjust post height to accommodate guardrail heights indicated on this sheet. Attach rail using two 5/8" Ø x 2" std. button head bolts with rectangular plate washers, round washers, and recess nuts.
- W-beam post/blockout assembly. See Standard Drawing E 601-TTGB-05 for post and blockout details. Adjust post height to accommodate guardrail heights indicated on this sheet. Attach rail using one 5/8" Ø x 1 1/4" std. button head bolt with rectangular plate washer, round washer, and recess nut.
- See Standard Drawing E 706-BRTR-06 for W-beam guardrail height transition.
- Twelve 5/8" Ø x 2" std. button head bolts with round washers and recess nuts, through rail sections.
- Eight 5/8" Ø x 1 1/4" std. button head bolts with round washers and recess nuts.
- Hand tighten post bolts on thrie beam expansion element and burr bolt threads.
- See Standard Drawing E 601-TBGC-01 for W-thrie beam transition rail.

## INDIANA DEPARTMENT OF TRANSPORTATION

### RETROFIT THRIE BEAM GUARDRAIL TRANSITION TYPE TGR

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-BRTR-05

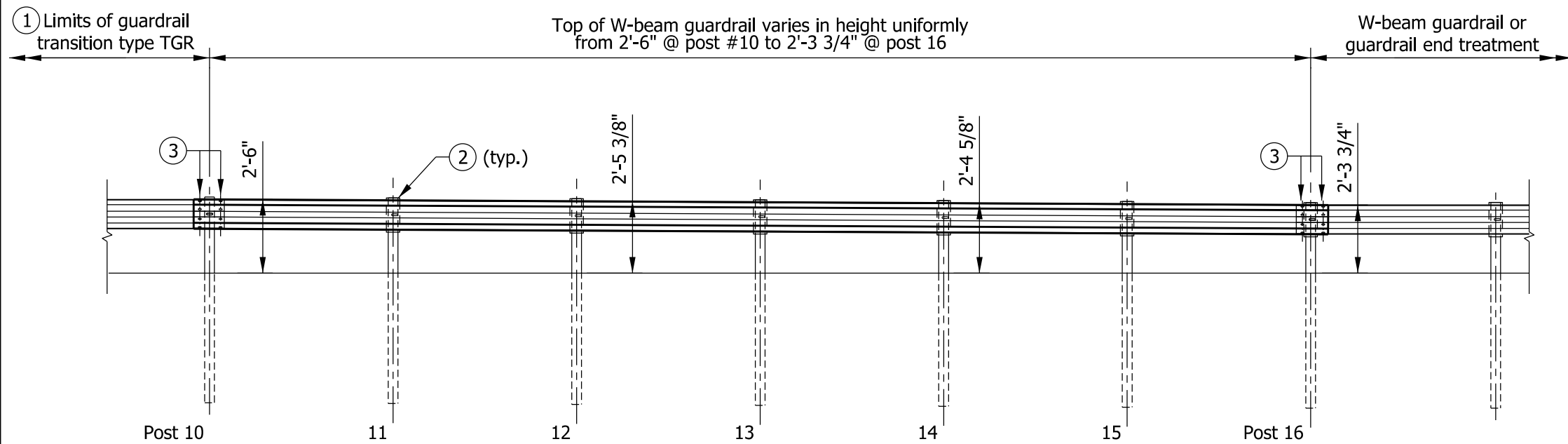


/s/ Richard L. VanCleave 09/04/12

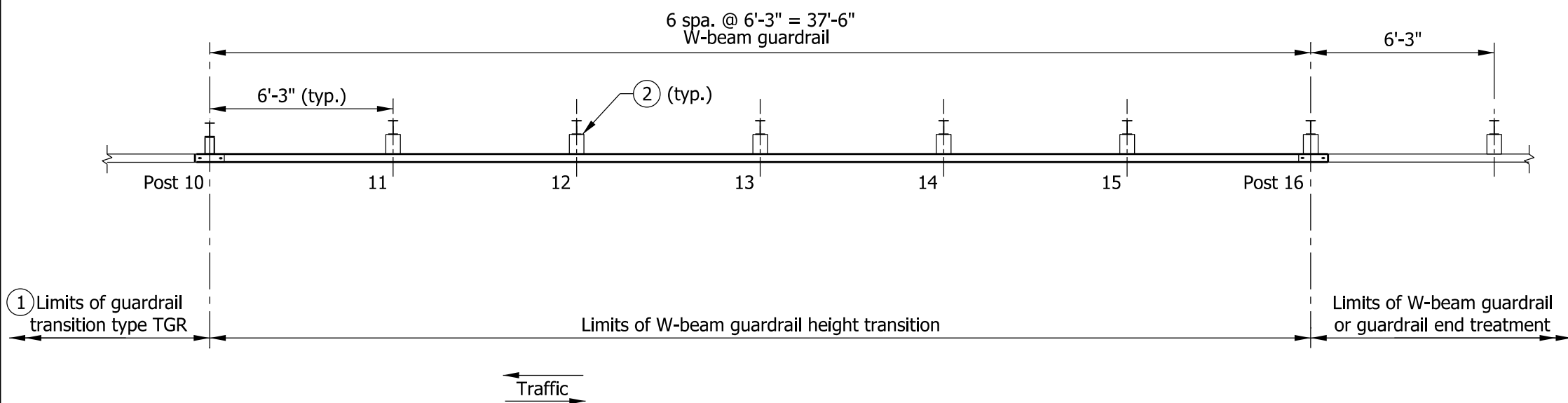
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE



ELEVATION



PLAN VIEW

NOTES

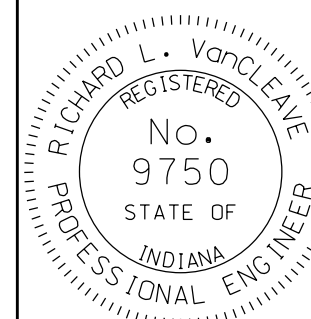
- ① See Standard Drawing E 706-BRTR-05 for thrie beam guardrail transition type TGR.
- ② W-beam post/blockout assembly. See Standard Drawing E 601-WGBA-01 for post and blockout details. Adjust post height to accommodate guardrail heights indicated on this sheet. Attach rail using one 5/8" Ø x 1 1/4" std. button head bolt with rectangular plate washer, round washer, and recess nut.
- ③ Eight 5/8" Ø x 1 1/4" std. button head bolts with round washers and recess nuts.

INDIANA DEPARTMENT OF TRANSPORTATION

RETROFIT THRIE BEAM  
GUARDRAIL HEIGHT TRANSITION

SEPTEMBER 2012

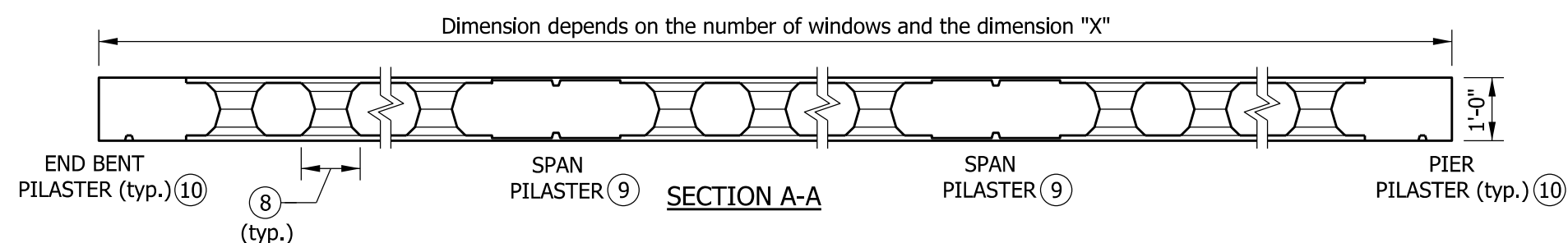
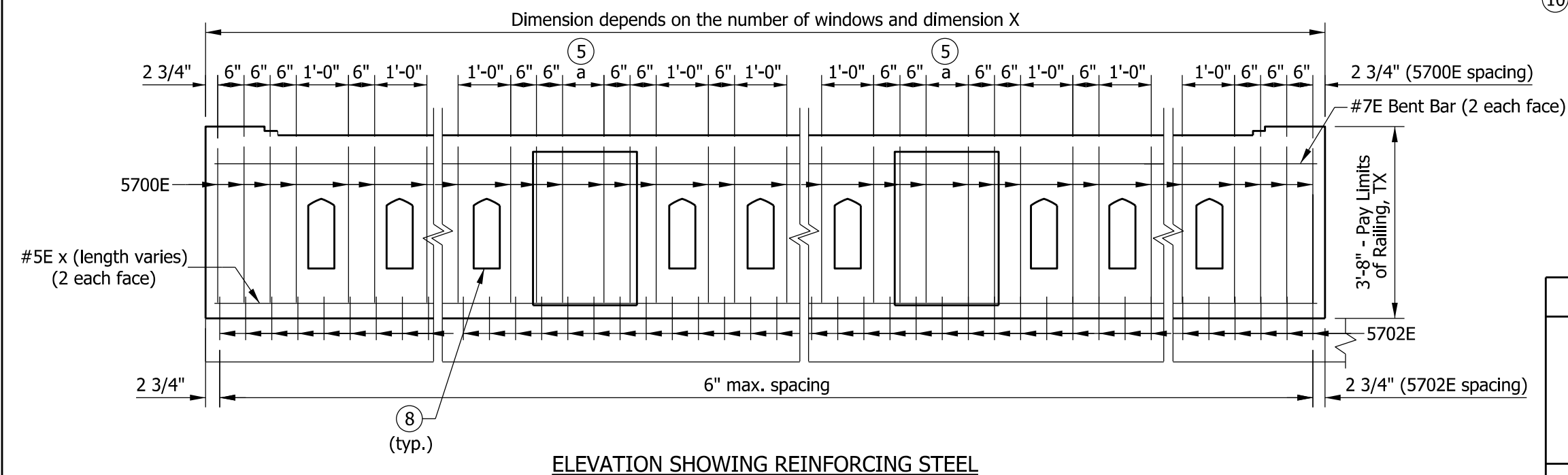
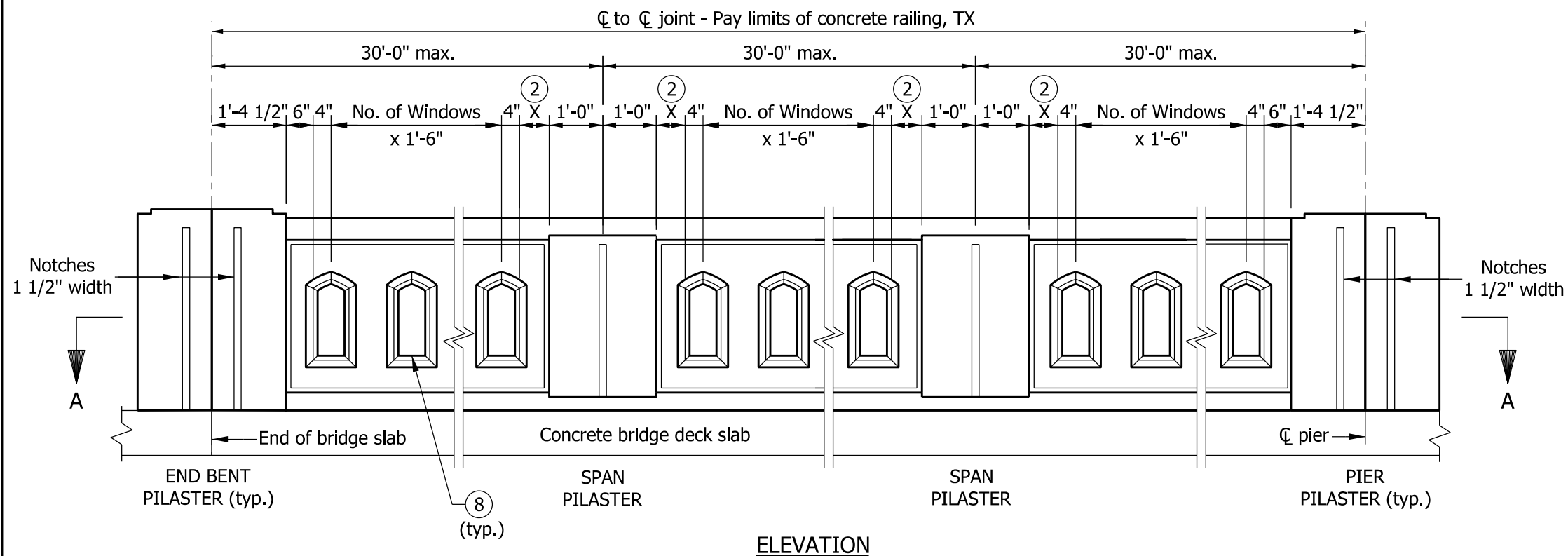
STANDARD DRAWING NO. E 706-BRTR-06



/s/ Richard L. VanCleave 09/04/12  
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12  
CHIEF ENGINEER DATE





## NOTES

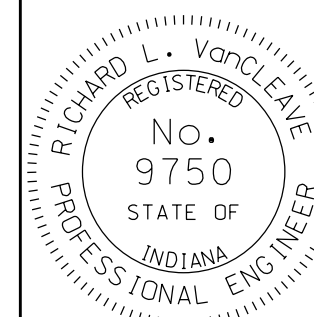
- See Standard Drawing E 706-BRTX-02, -03, and -04 for sections.
- Select the number of windows and adjust dimension X to fit the span length.
- Span pilasters may be omitted for a short span with  $X \leq 2'-0"$ .
- Span pilasters are for aesthetic purposes only. Omitting span pilasters does not decrease the integrity of the railing.
- Dimension  $a = 2X + 3 \frac{1}{2}"$ . Space bars within dimension  $a$  equally  $\leq 6"$ .
- See Standard Drawing E 706-TTXX-01 for Concrete Bridge Railing Transition, TTXX.
- All reinforcing bars designated E shall be epoxy coated.
- Window opening. See Standard Drawing E 706-BRTX-02 for details.
- See Standard Drawing E 706-BRTX-03 for span pilaster details.
- See Standard Drawing E 706-BRTX-04 for pier and end bent pilaster details.

INDIANA DEPARTMENT OF TRANSPORTATION

RAILING, TX  
TYPICAL PANEL

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-BRTX-01

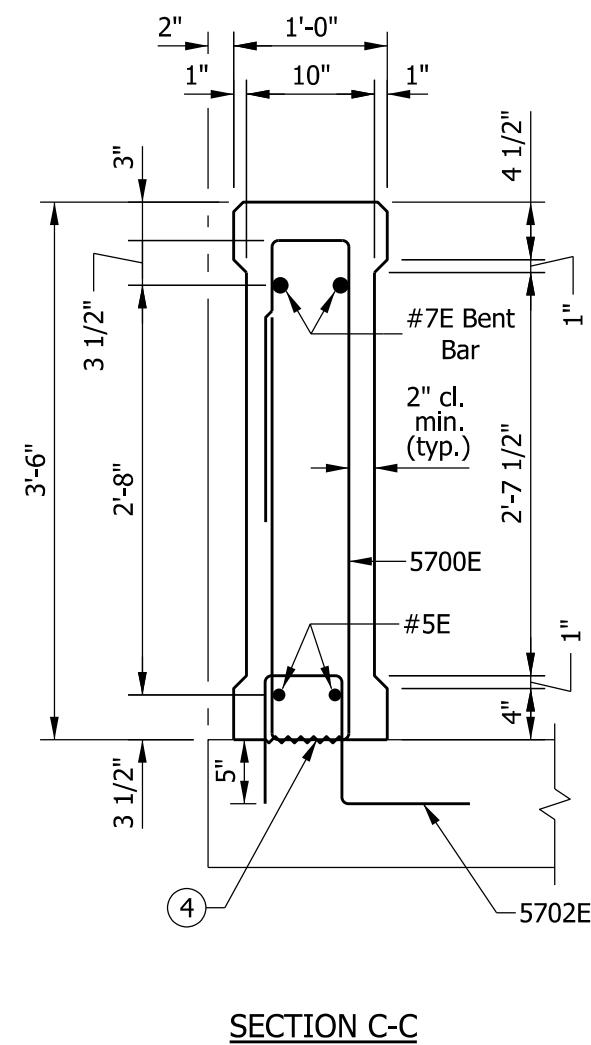
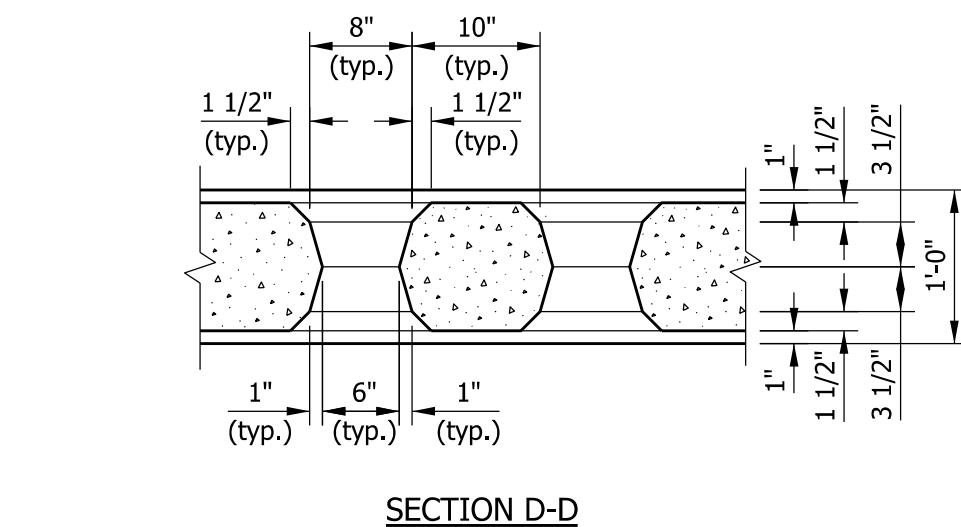


/s/ Richard L. VanCleave 09/04/12

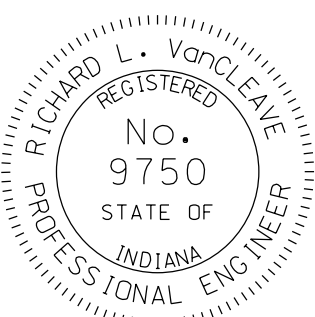
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

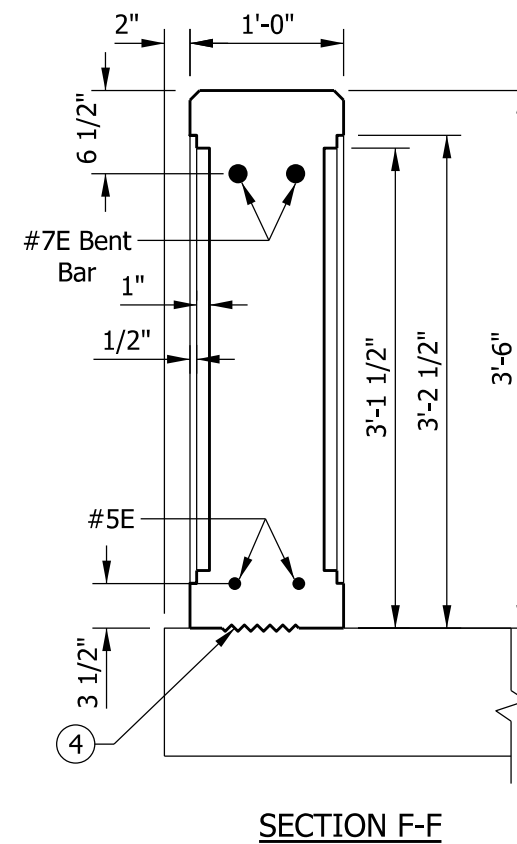
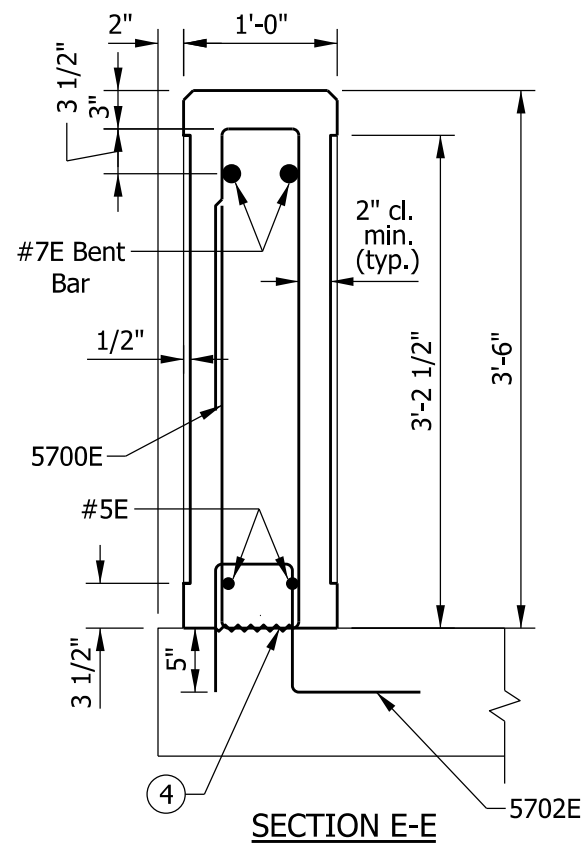
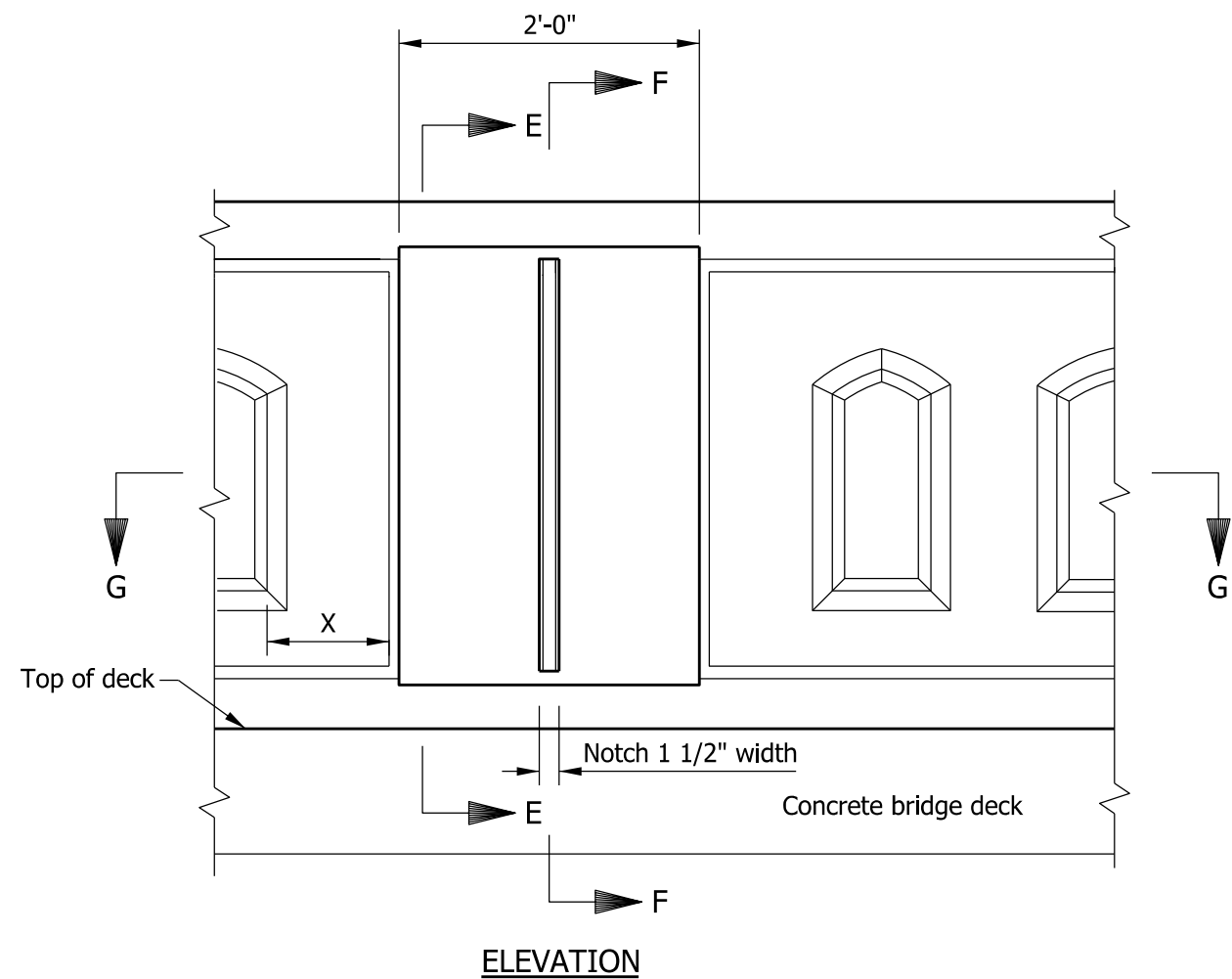
CHIEF ENGINEER DATE



- ## NOTES
1. All reinforcing bars designated E shall be epoxy coated.
  2. All chamfered edges shall be 3/4".
  3. See Standard Drawing E 706-BRTX-04 for reinforcing-bar diagrams.
  - ④ 4. Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.

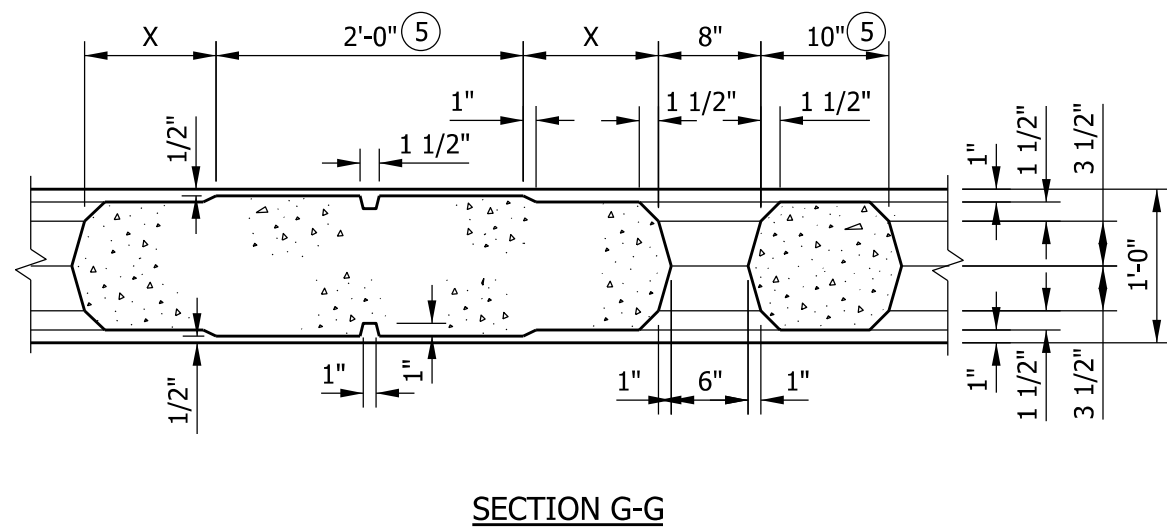
|                                                                                       |                                                                                                                                                                                                   |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                                                   |
| <p>RAILING, TX<br/>WINDOW DETAILS</p> <p>SEPTEMBER 2012</p>                           |                                                                                                                                                                                                   |
| STANDARD DRAWING NO.                                                                  | E 706-BRTX-02                                                                                                                                                                                     |
|  | <p><i>/s/ Richard L. VanCleave</i>      09/04/12</p> <hr/> <p>SUPERVISOR, ROADWAY STANDARDS      DATE</p><br><p><i>/s/ Mark A. Miller</i>      09/04/12</p> <hr/> <p>CHIEF ENGINEER      DATE</p> |



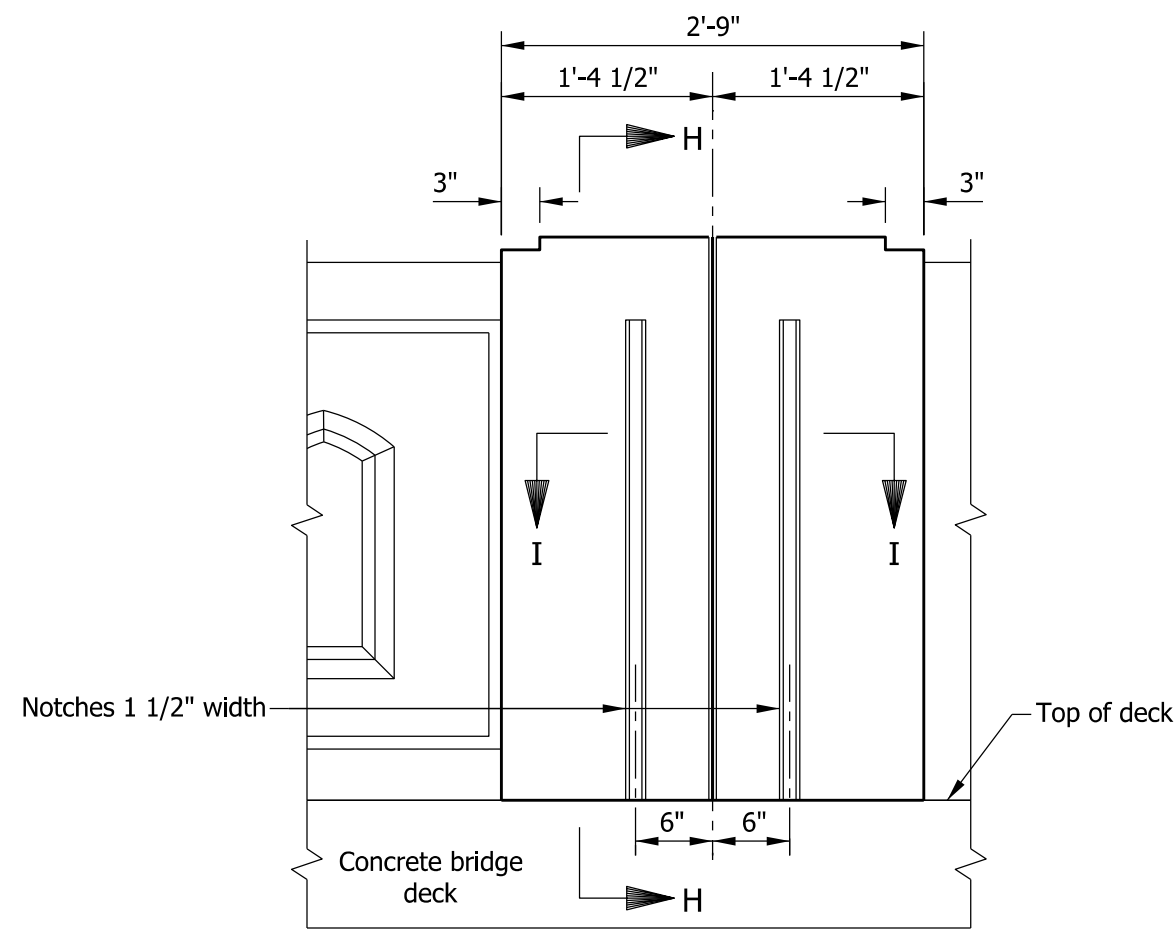


## NOTES

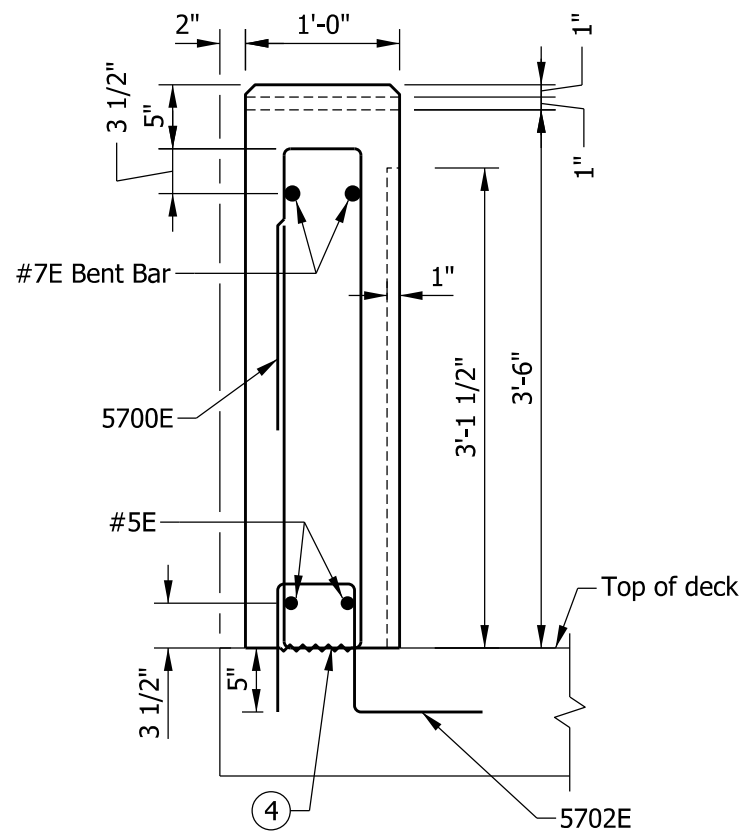
1. All reinforcing bars designated E shall be epoxy coated.
2. All chamfered edges shall be 3/4".
3. See Standard Drawing E 706-BRTX-04 for reinforcing-bar diagrams.
- ④ Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.
- ⑤ Adjust dimension X to fit the span length, depending upon the number of window openings.



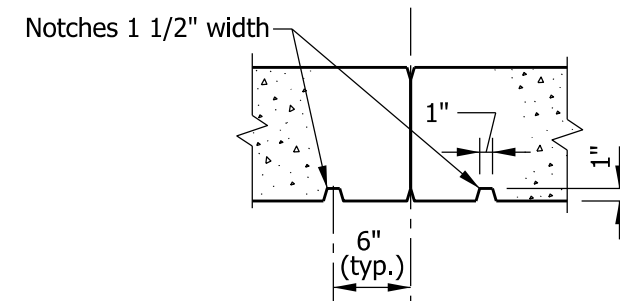
| INDIANA DEPARTMENT OF TRANSPORTATION |                                 |               |          |
|--------------------------------------|---------------------------------|---------------|----------|
| RAILING, TX<br>SPAN PILASTER         |                                 |               |          |
| SEPTEMBER 2012                       |                                 |               |          |
| STANDARD DRAWING NO.                 |                                 | E 706-BRTX-03 |          |
|                                      | /s/ <i>Richard L. VanCleave</i> |               | 09/04/12 |
|                                      | SUPERVISOR, ROADWAY STANDARDS   |               | DATE     |
|                                      | /s/ <i>Mark A. Miller</i>       |               | 09/04/12 |
|                                      | CHIEF ENGINEER                  |               | DATE     |



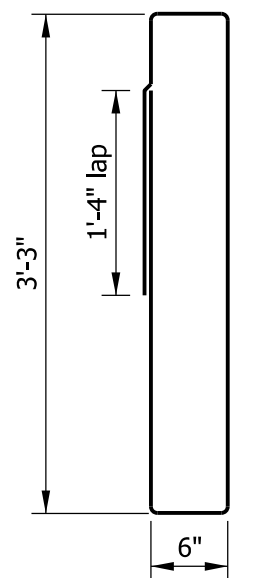
ELEVATION



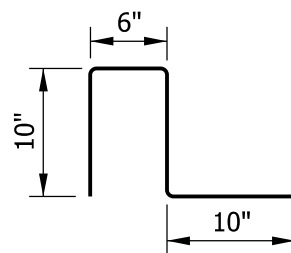
SECTION H-H



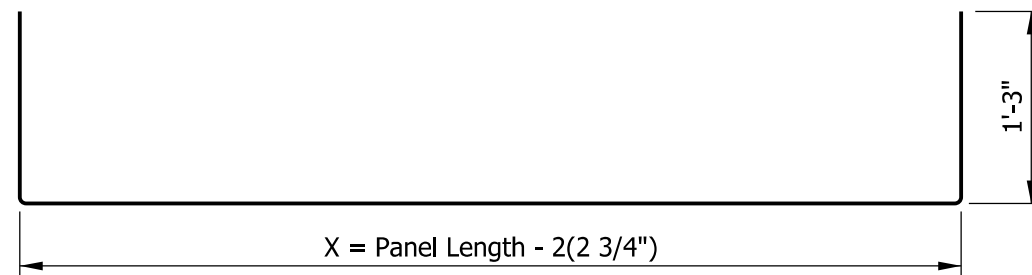
SECTION I-I



5700E x 8'-10"



5702E x 2'-2"



#7E BENT BAR x (X + 2'-6")

NOTES

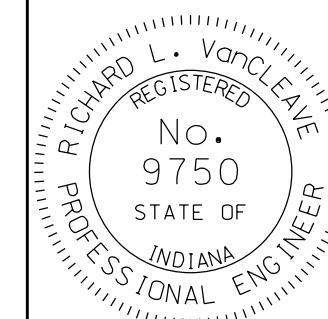
1. All reinforcing bars designated E shall be epoxy coated.
2. See Standard Drawing E 703-BRST-01 for reinforcing-bar bending details and notes.
3. All chamfered edges shall be 3/4".
- ④ Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.

INDIANA DEPARTMENT OF TRANSPORTATION

RAILING, TX  
PIER OR END BENT PILASTER

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-BRTX-04

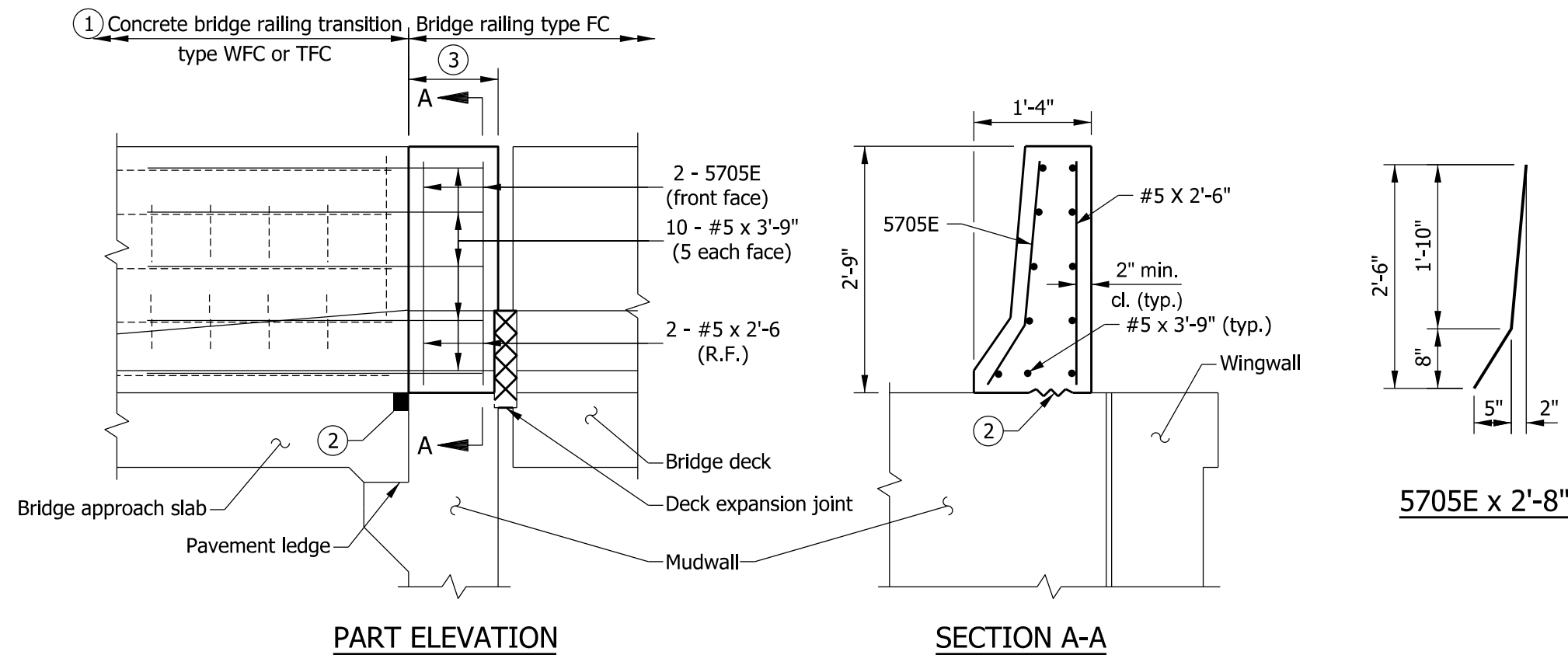


/s/ *Richard L. VanCleave* 09/04/12

SUPERVISOR, ROADWAY STANDARDS DATE

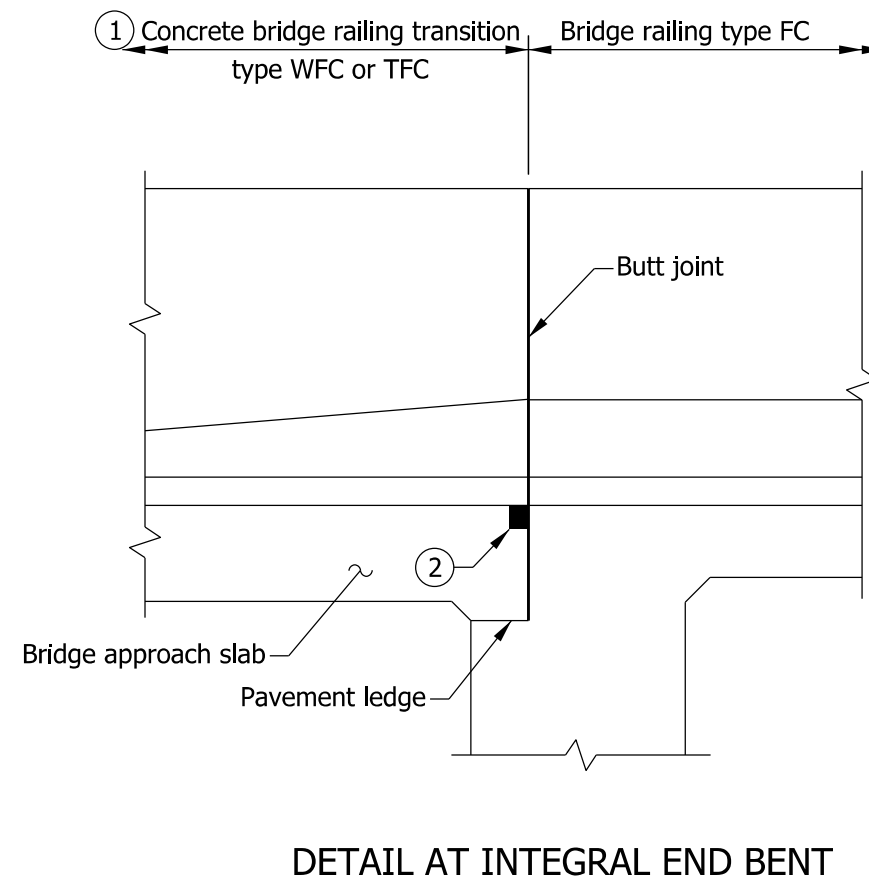
/s/ *Mark A. Miller* 09/04/12

CHIEF ENGINEER DATE



## NOTES

- ① See Standard Drawings E 706-TWFC-01 through -03 for concrete bridge railing transition type WFC. See Standard Drawings E 706-TTFC-01 through -03 for concrete bridge railing transition type TFC.
- ② See Standard Drawing E 609-BRJT-01 for joint type I-A.
- ③ This shall be part of the concrete bridge railing, but it shall be poured with the concrete bridge-railing transition. The minimum length shall be equal to the width of the mudwall. See Standard Drawing E 706-BRSF-01 for bridge railing type FC dimensions.
4. See Standard Drawing E 703-BRST-01 for reinforcing-bar bending details and notes.

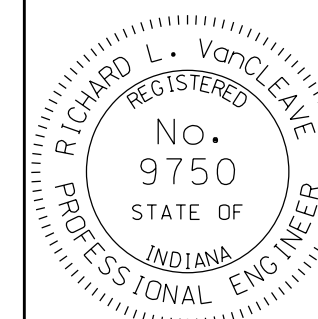


INDIANA DEPARTMENT OF TRANSPORTATION

BRIDGE RAILING TRANSITION WFC  
OR TFC DETAILS AT END BENT

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-CBRT-01

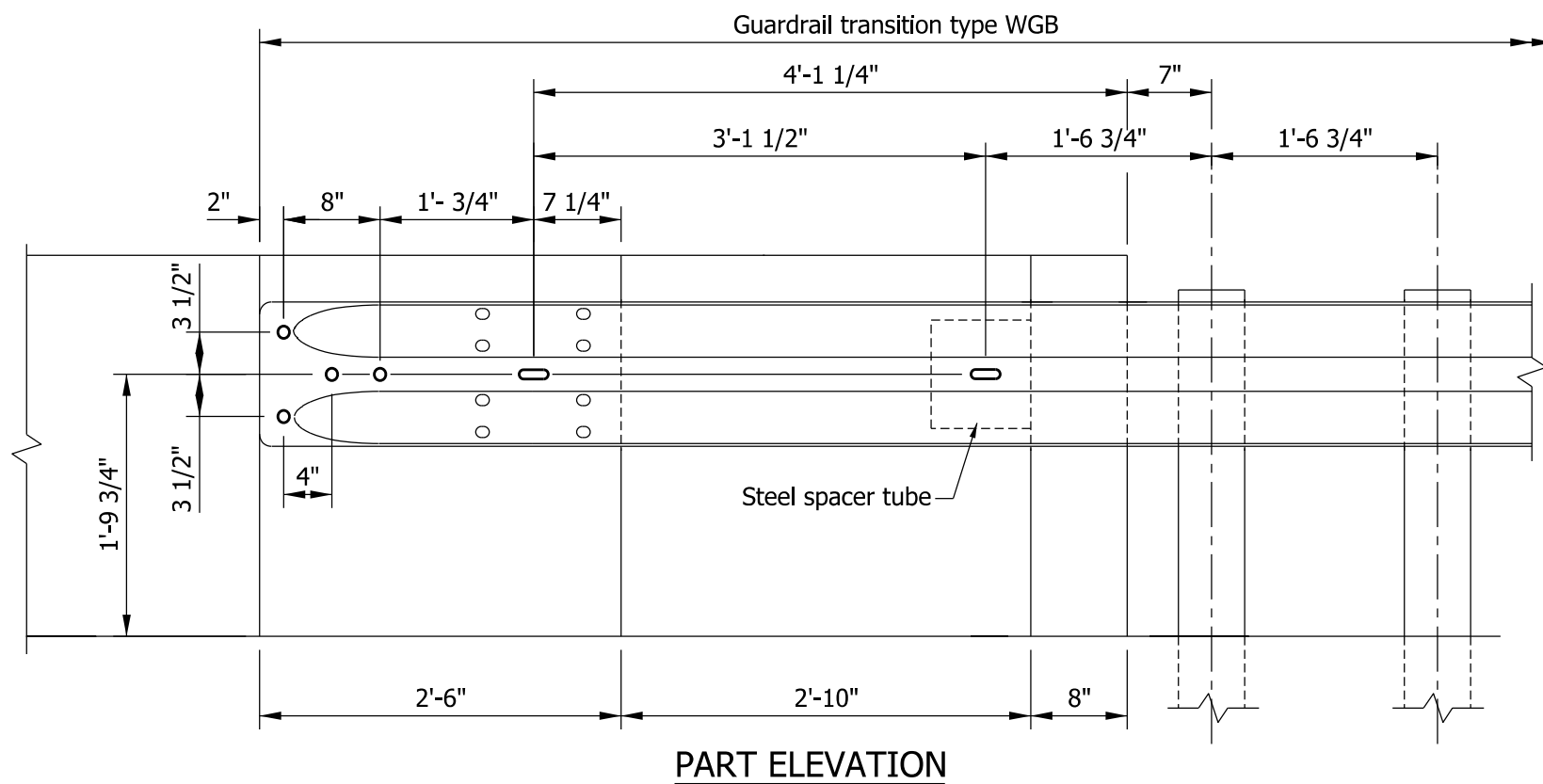
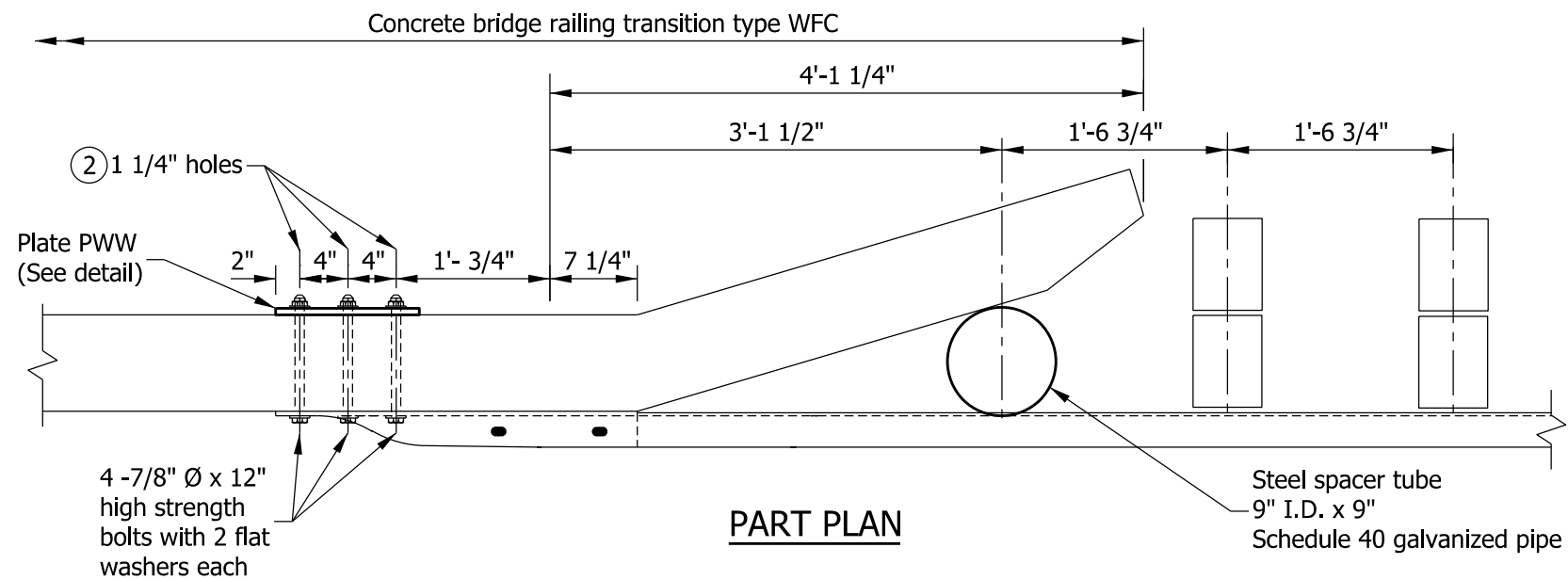


/s/ Richard L. VanCleave 09/04/12

SUPERVISOR, ROADWAY STANDARDS DATE

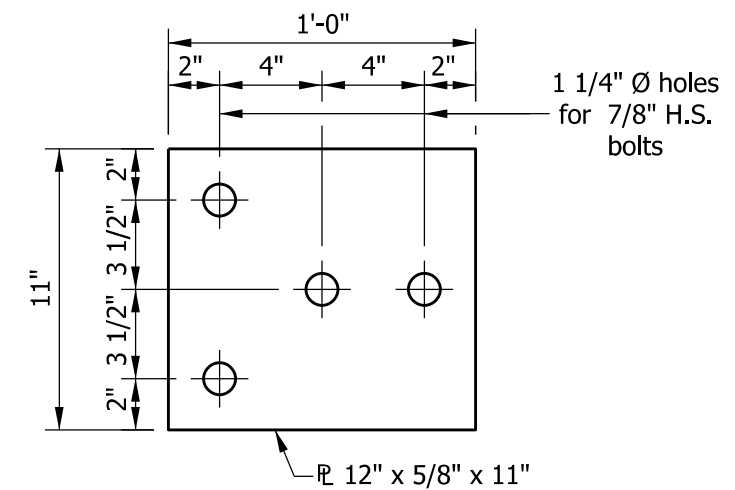
/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE



## NOTES

- See Standard Drawing E 706-TWFC-01 through -03 for concrete bridge railing transition type WFC. See Standard Drawings E 601-TWGB-01 through -03 for guardrail transition type WGB .
- Preformed holes, for connection of the guardrail transition type WGB to the end of the concrete bridge railing transition type WFC.

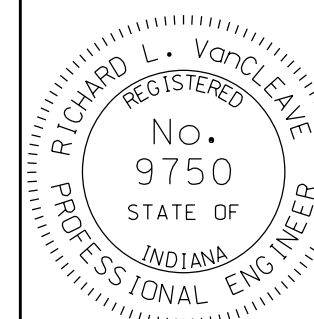


INDIANA DEPARTMENT OF TRANSPORTATION

BRIDGE RAILING TRANSITION WFC  
ATTACHMENT OF GUARDRAIL

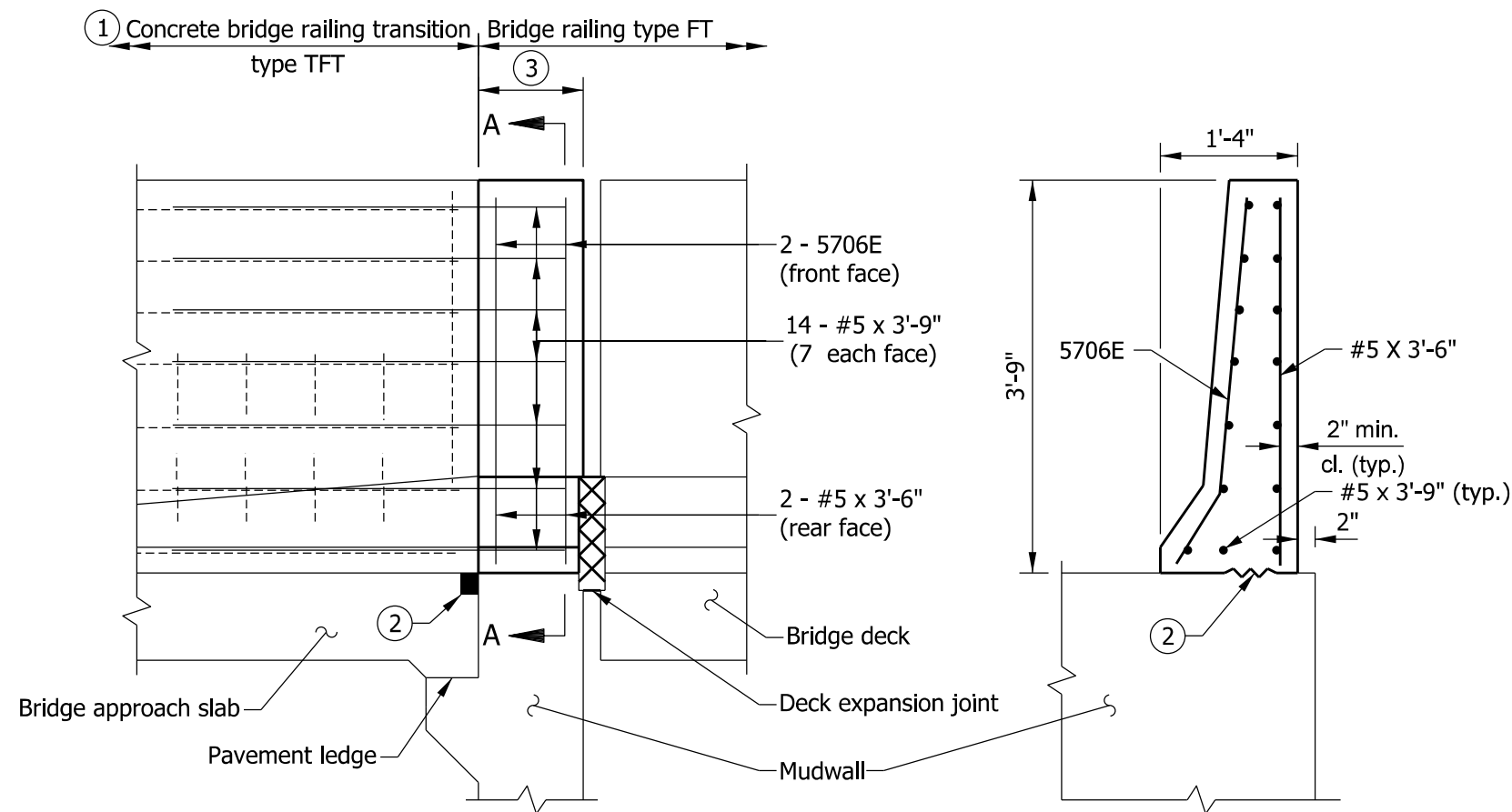
SEPTEMBER 2012

STANDARD DRAWING NO. E 706-CBRT-02



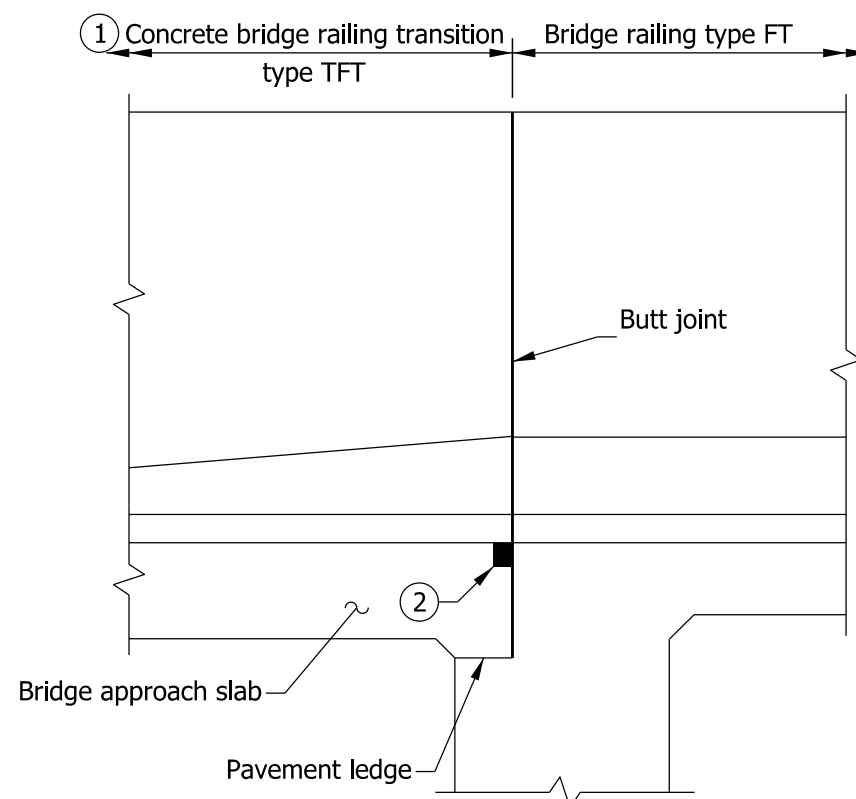
/s/ Richard L. VanCleave 09/04/12  
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12  
CHIEF ENGINEER DATE



**PART ELEVATION**

**SECTION A-A**



**DETAIL AT INTEGRAL END BENT**

**NOTES**

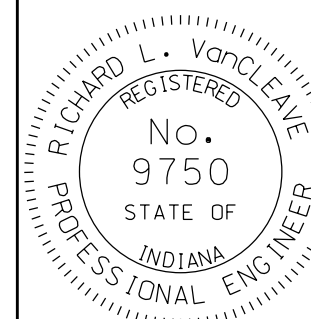
- ① See Standard Drawings E 706-TTFT-01 through -03 for concrete bridge railing transition type TFT details.
- ② See Standard Drawing E 609-BRJT-01 for joint type I-A.
- ③ This shall be part of the concrete bridge railing, but it shall be poured with the concrete bridge-railing transition. The minimum length shall be equal to the width of the mudwall. See Standard Drawing E 706-BRSF-02 for bridge railing type FT dimensions.
4. See Standard Drawing E 703-BRST-01 for reinforcing-bar bending diagrams and notes.

INDIANA DEPARTMENT OF TRANSPORTATION

BRIDGE RAILING TRANSITION TFT  
DETAILS AT END BENT

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-CBRT-03

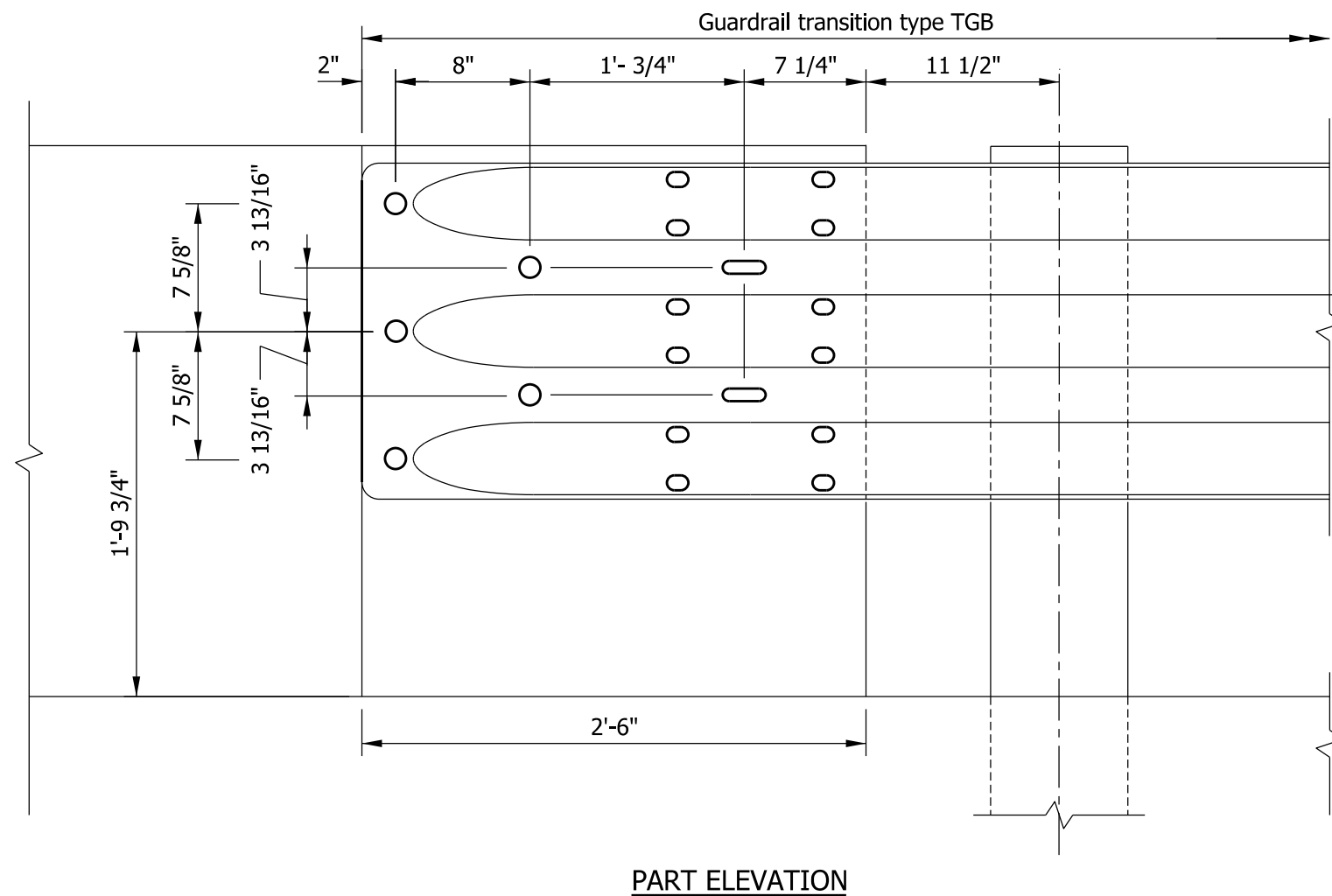
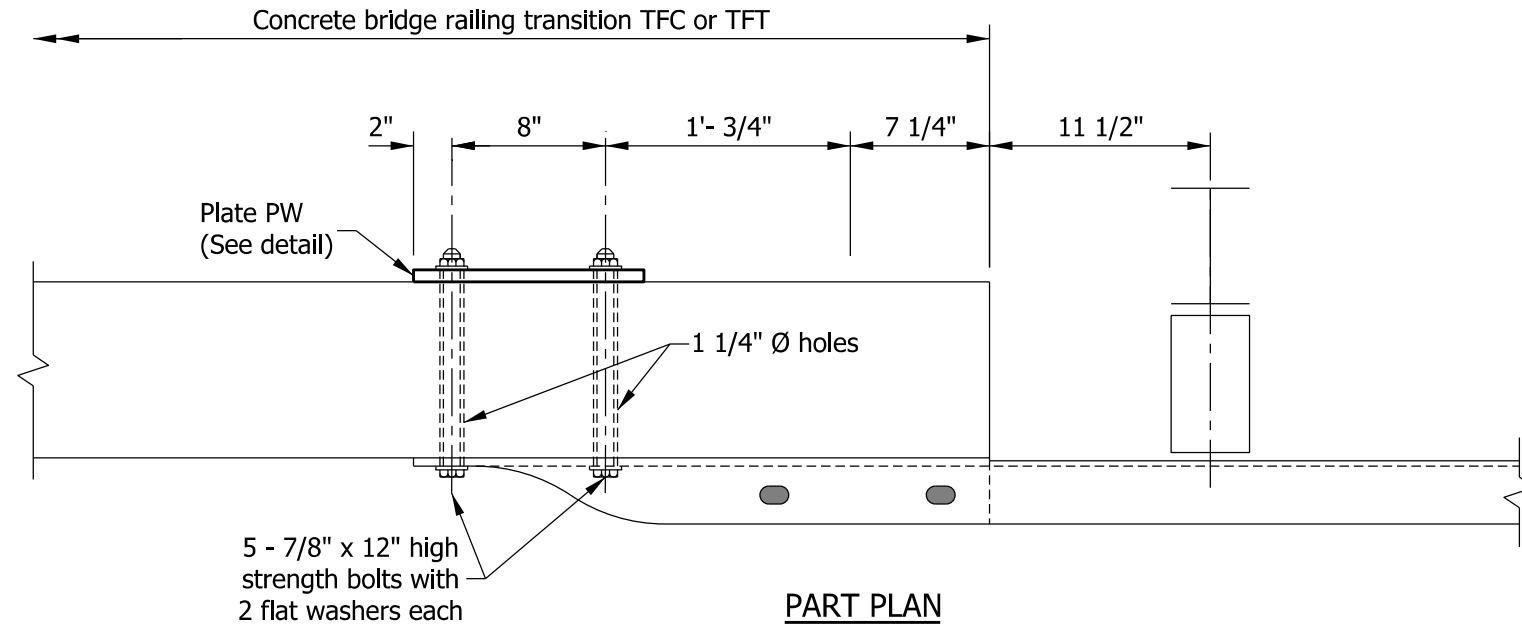


/s/ *Richard L. VanCleave* 09/04/12

SUPERVISOR, ROADWAY STANDARDS DATE

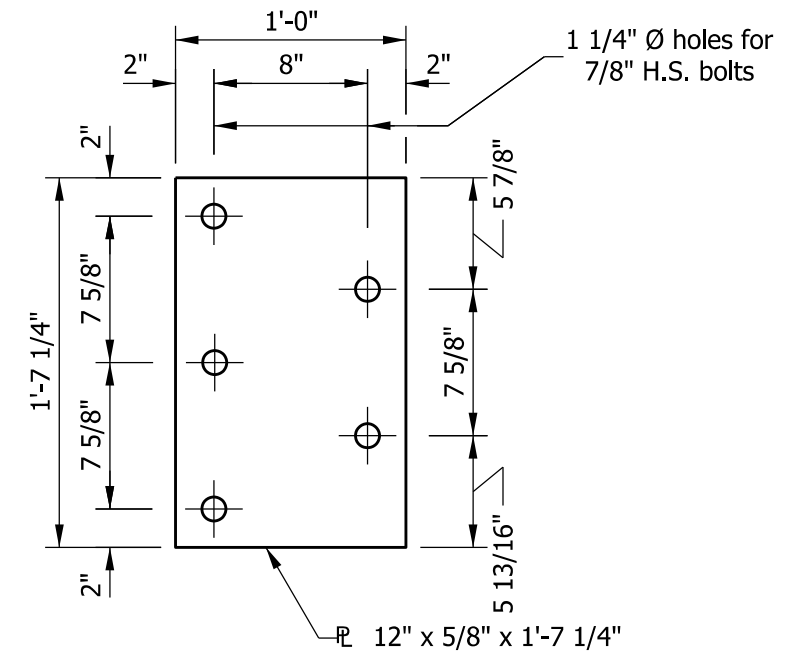
/s/ *Mark A. Miller* 09/04/12

CHIEF ENGINEER DATE



## NOTES

- See Standard Drawings E 706-TTFC-01 through -03 for concrete bridge railing transition type TFC. See Standard Drawings E 706-TTFT-01 through -03 for concrete bridge railing transition type TFT. See Standard Drawings E 601-TTGB-01 through -05 for guardrail transition type TGB.
- Preformed holes, for connection of the guardrail transition type TGB to the end of the concrete bridge railing transition type TFC or TFT.



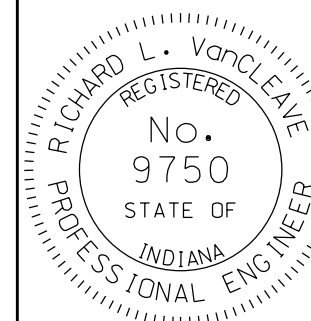
**PLATE PW**

INDIANA DEPARTMENT OF TRANSPORTATION

BRIDGE RAILING TRANSITION TFC OR  
TFT ATTACHMENT OF GUARDRAIL

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-CBRT-04



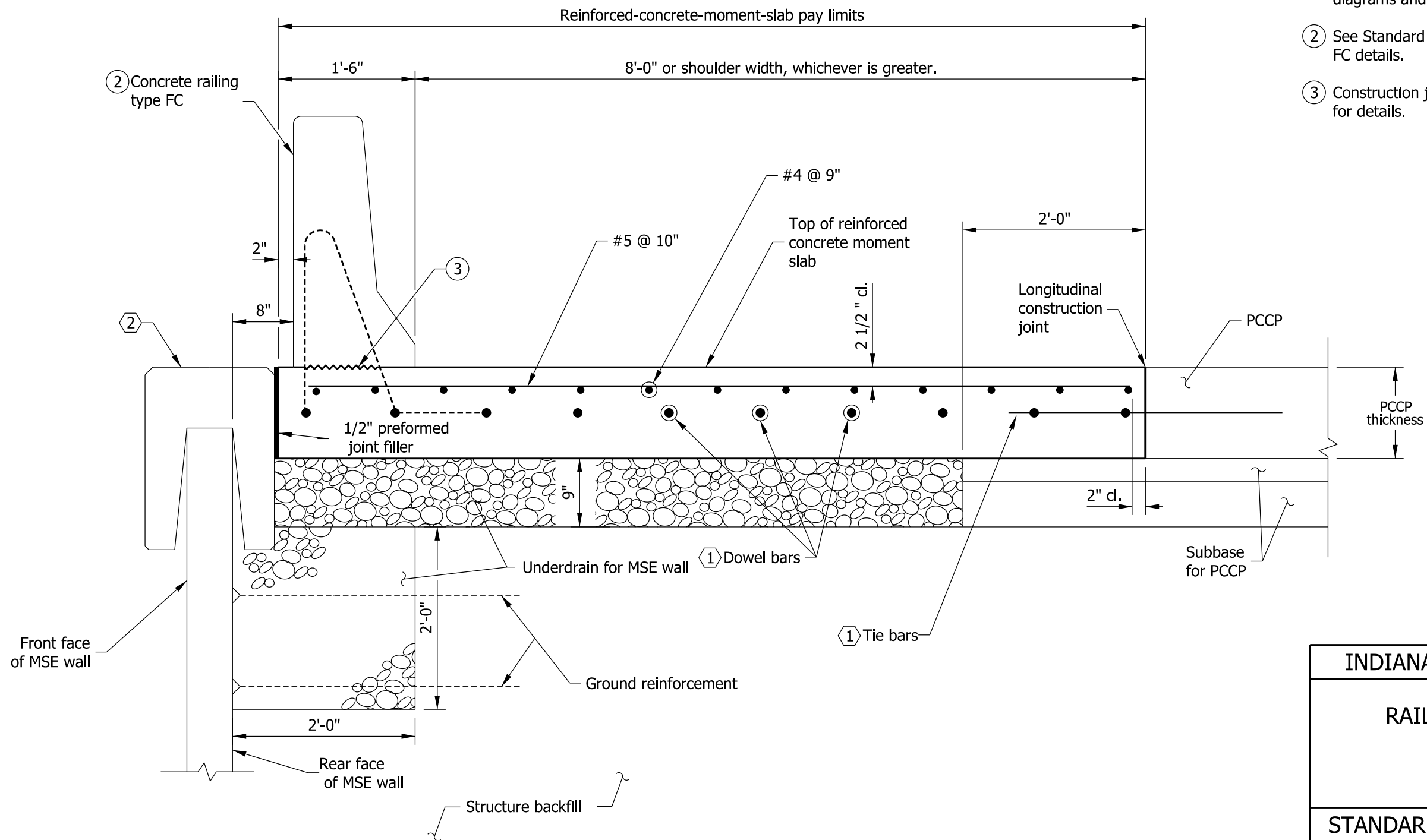
/s/ Richard L. VanCleave 09/04/12

SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE





## NOTES

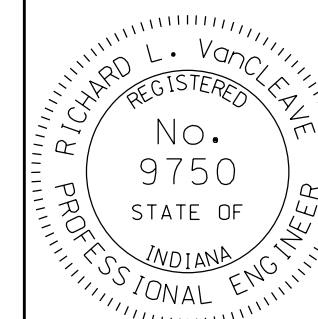
- See Standard Drawing E 706-MSRW-10 for reinforcing-bar diagrams and General Notes .
- See Standard Drawing E 706-BRSF-01 for concrete railing type FC details.
- Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.

INDIANA DEPARTMENT OF TRANSPORTATION

RAILING TYPE FC AND MOMENT SLAB  
ASIDE MSE WALL - PCCP

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-MSRW-01



/s/ Richard L. VanCleave 09/04/12

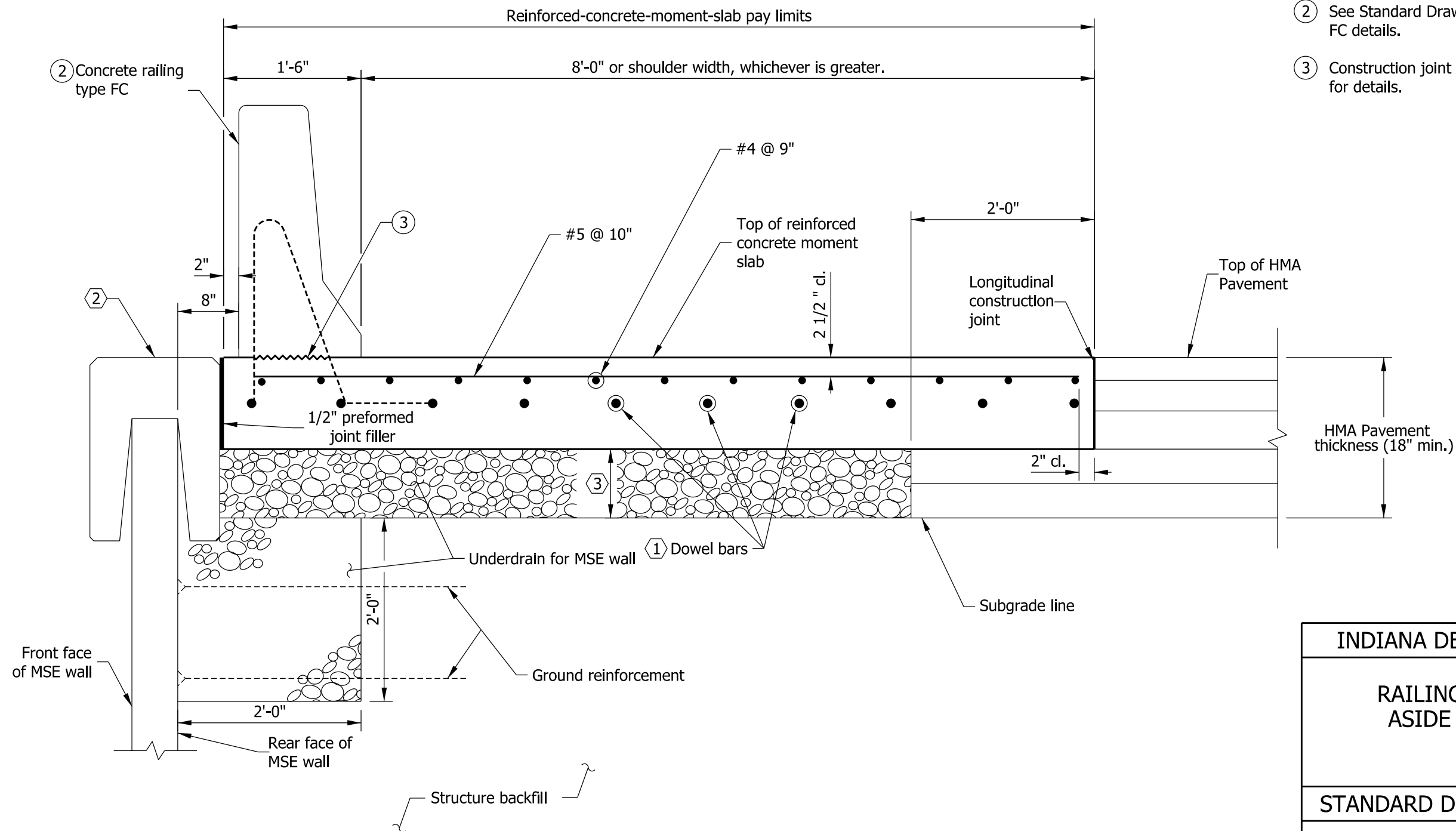
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE







## NOTES

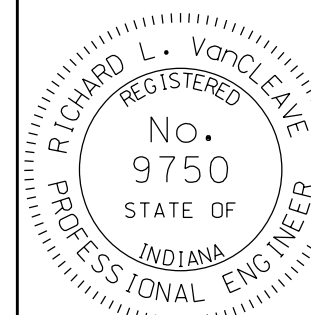
- See Standard Drawing E 706-MSRW-10 for reinforcing-bar diagrams and General Notes.
- See Standard Drawing E 706-BRSF-01 for concrete railing type FC details.
- Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.

INDIANA DEPARTMENT OF TRANSPORTATION

RAILING TYPE FC AND MOMENT SLAB  
ASIDE MSE WALL - HMA PAVEMENT

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-MSRW-03

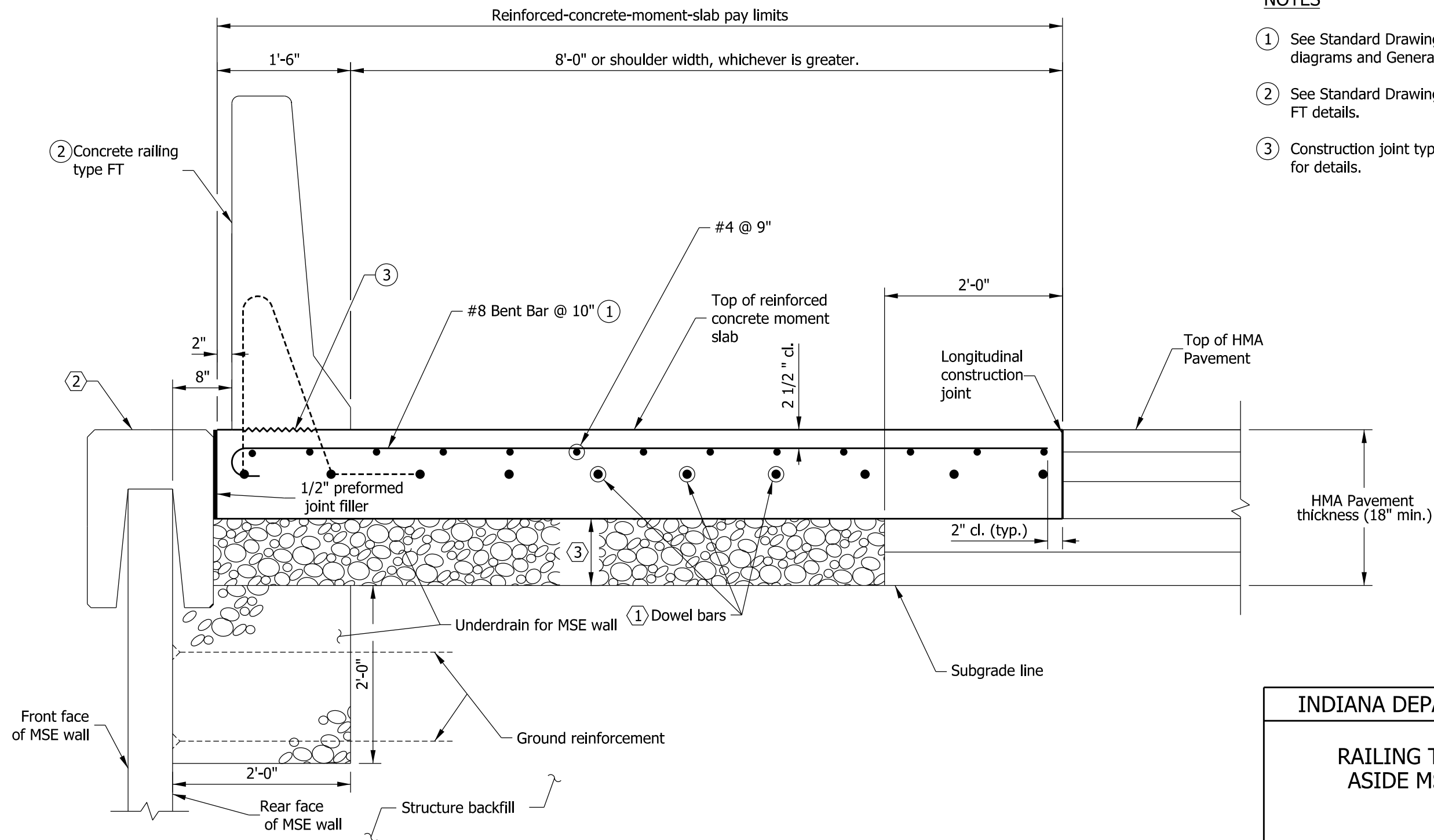


/s/ Richard L. VanCleave 09/04/12

SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE



## NOTES

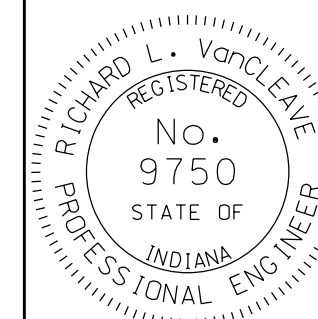
- See Standard Drawing E 706-MSRW-10 for reinforcing-bar diagrams and General Notes.
- See Standard Drawing E 706-BRSF-02 for concrete railing type FT details.
- Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.

INDIANA DEPARTMENT OF TRANSPORTATION

RAILING TYPE FT AND MOMENT SLAB  
ASIDE MSE WALL - HMA PAVEMENT

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-MSRW-04

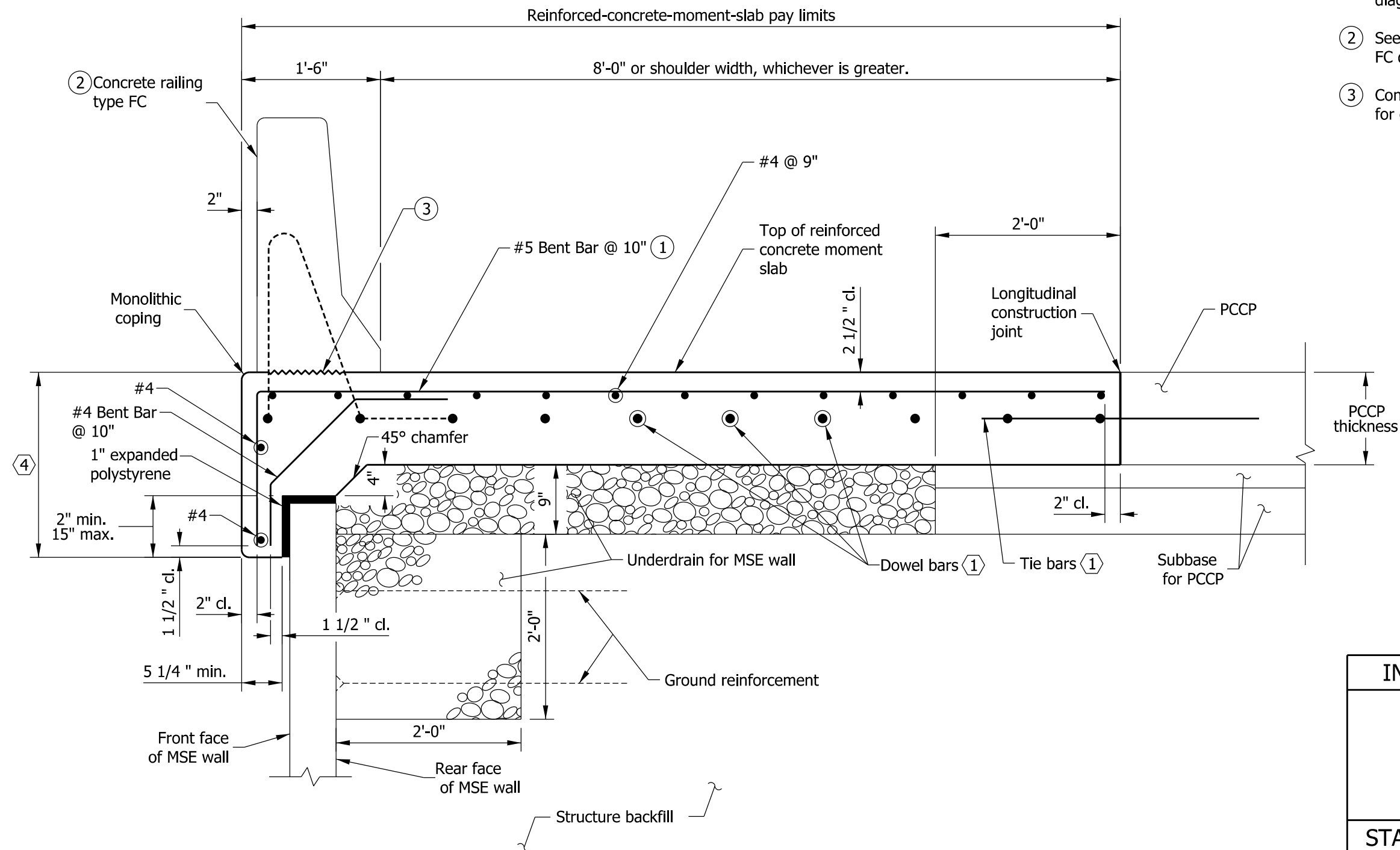


/s/ Richard L. VanCleave 09/04/12

SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE



## NOTES

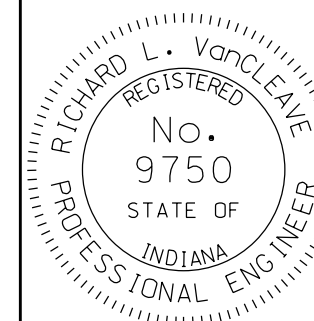
- ① See Standard Drawing E 706-MSRW-10 for reinforcing-bar diagrams and General Notes .
- ② See Standard Drawing E 706-BRSF-01 for concrete railing type FC details.
- ③ Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.

INDIANA DEPARTMENT OF TRANSPORTATION

RAILING TYPE FC AND MOMENT SLAB  
ATOP MSE WALL - PCCP

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-MSRW-05

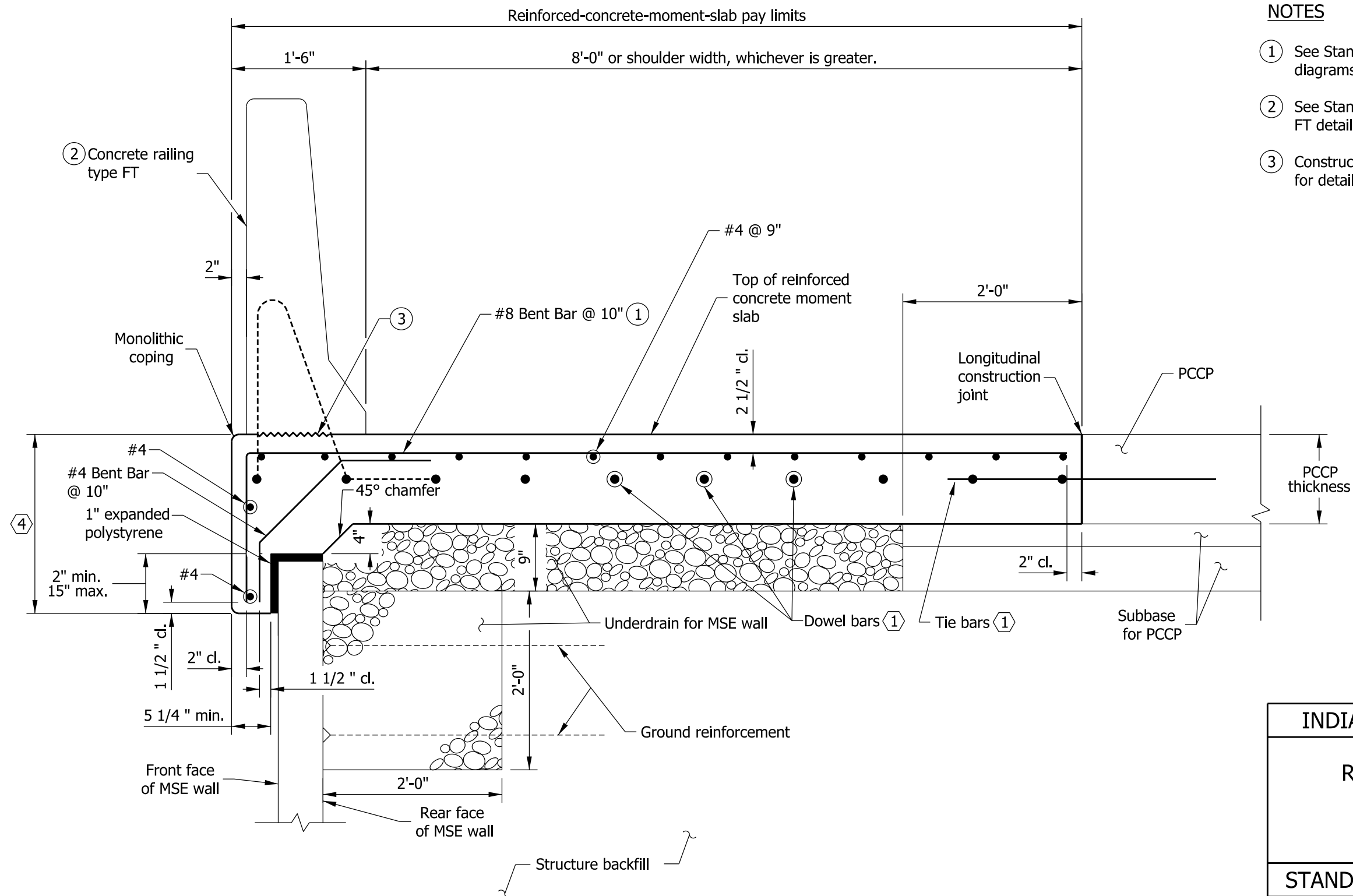


/s/ *Richard L. VanCleave* 09/04/12

SUPERVISOR, ROADWAY STANDARDS DATE

/s/ *Mark A. Miller* 09/04/12

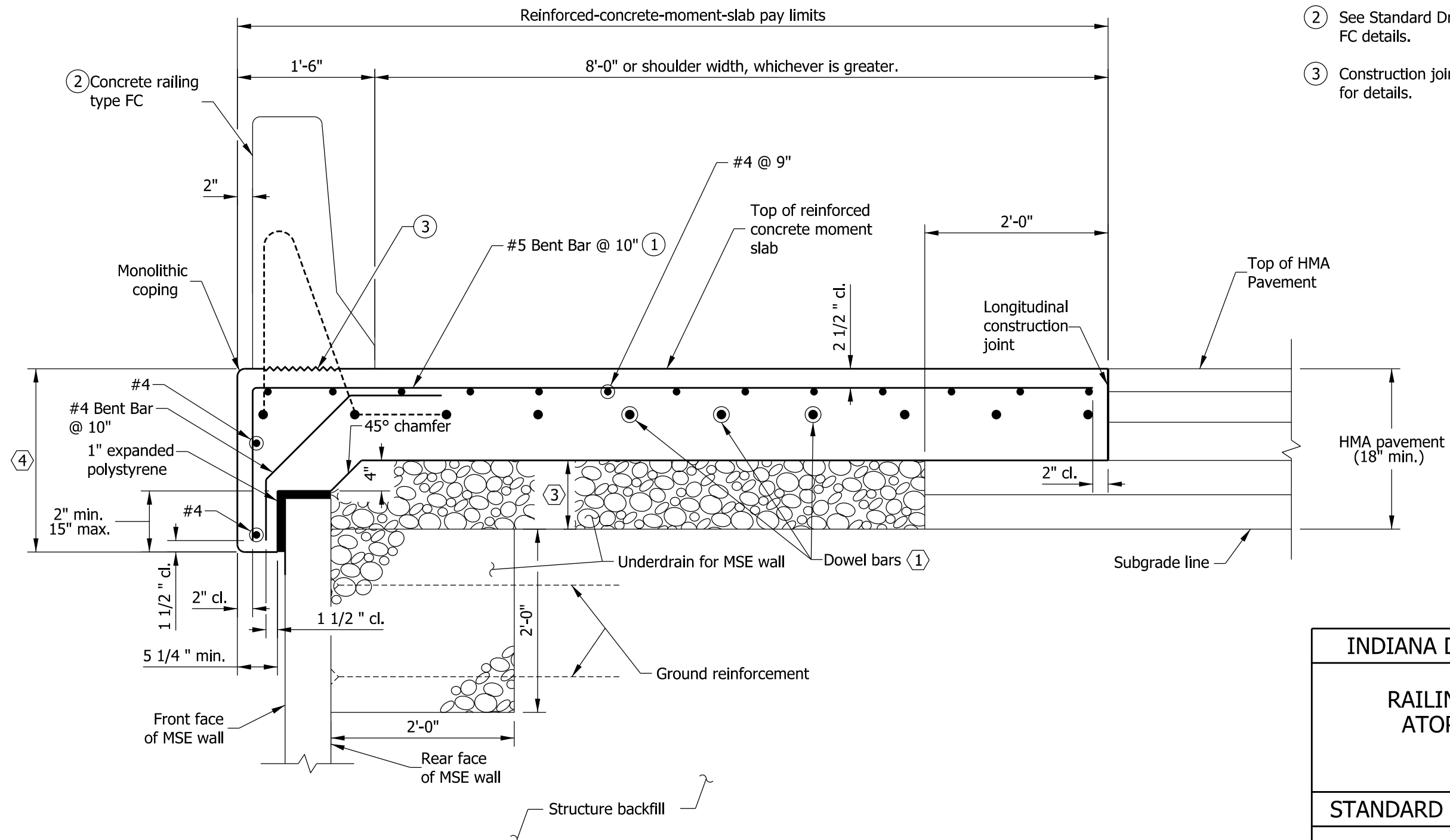
CHIEF ENGINEER DATE



|                                                                                       |                                                                                           |
|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                           |
| RAILING TYPE FT AND MOMENT SLAB<br>ATOP MSE WALL - PCCP<br><br>SEPTEMBER 2012         |                                                                                           |
| STANDARD DRAWING NO.      E 706-MSRW-06                                               |                                                                                           |
|  | /s/ <i>Richard L. VanCleave</i> 09/04/12<br><hr/> SUPERVISOR, ROADWAY STANDARDS      DATE |
|                                                                                       | /s/ <i>Mark A. Miller</i> 09/04/12<br><hr/> CHIEF ENGINEER      DATE                      |

## NOTES

- ① See Standard Drawing E 706-MSRW-10 for reinforcing-bar diagrams and General Notes .
- ② See Standard Drawing E 706-BRSF-01 for concrete railing type FC details.
- ③ Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.

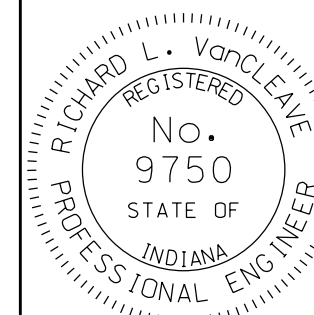


INDIANA DEPARTMENT OF TRANSPORTATION

### RAILING TYPE FC AND MOMENT SLAB ATOP MSE WALL - HMA PAVEMENT

SEPTEMBER 2012

|                      |               |
|----------------------|---------------|
| STANDARD DRAWING NO. | E 706-MSRW-07 |
|----------------------|---------------|



/s/ Richard L. VanCleave 09/04/12

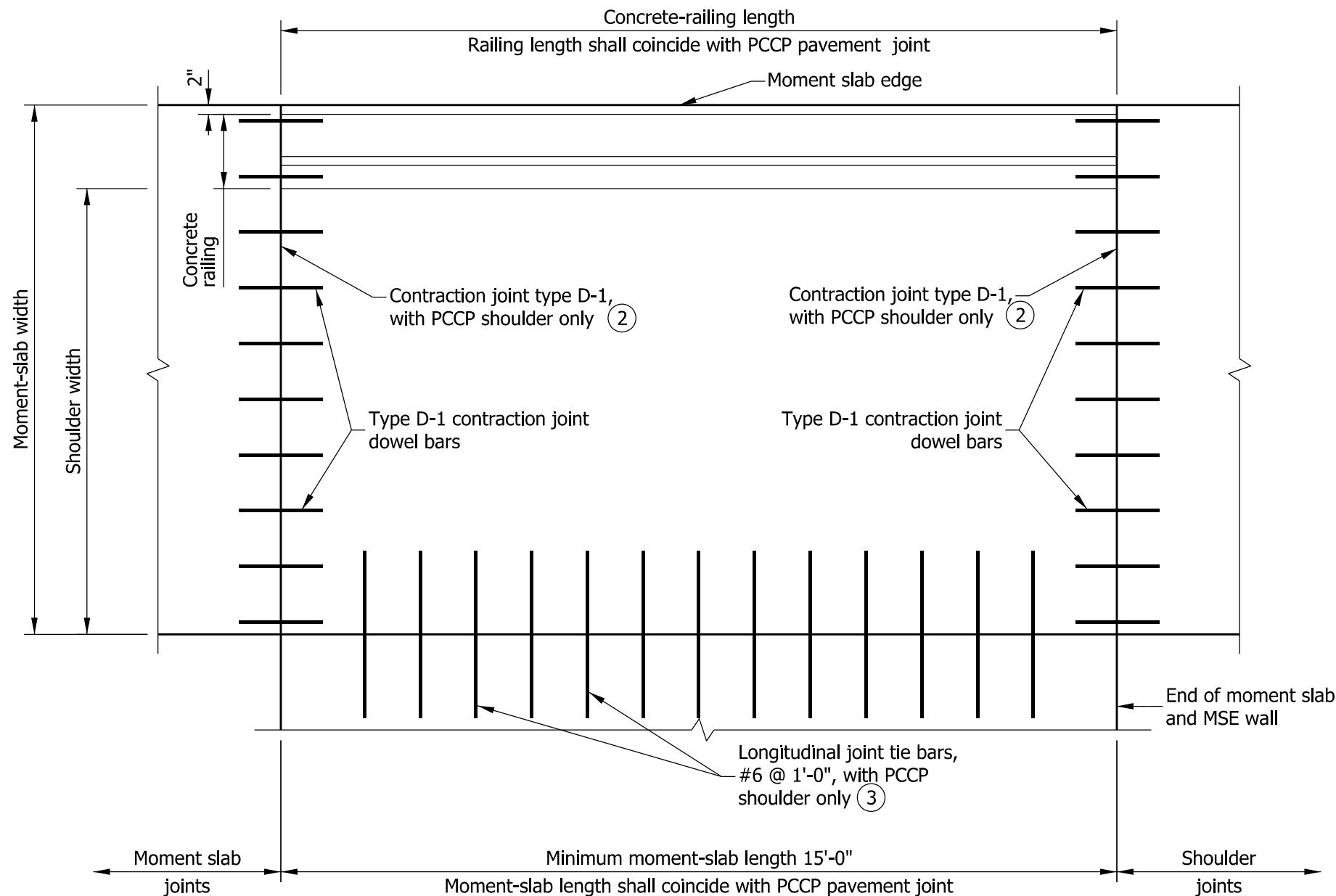
SUPERVISOR, ROADWAY STANDARDS      DATE

/s/ Mark A. Miller 09/04/12

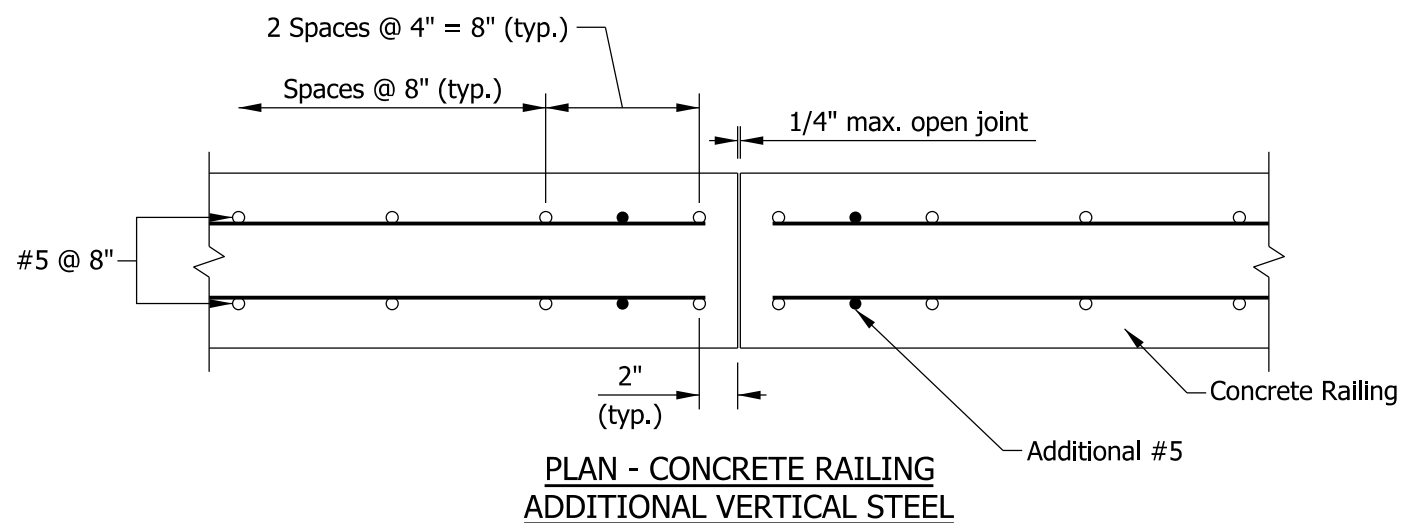
|                |      |
|----------------|------|
| CHIEF ENGINEER | DATE |
|----------------|------|







**PLAN - REINFORCED CONCRETE MOMENT SLAB JOINTS**



**NOTES**

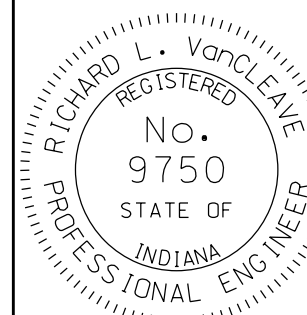
1. Where used with HMA mainline pavement, concrete railing and moment-slab lengths shall coincide and be spaced at 18'-0".
- ② See Standard Drawing E 503-CCPJ-01 for contraction joint type D-1 details.
- ③ See Standard Drawing E 503-CCPJ-02 for joint tie bars details.

INDIANA DEPARTMENT OF TRANSPORTATION

MOMENT SLAB JOINTS

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-MSRW-09



/s/ Richard L. VanCleave 09/04/12

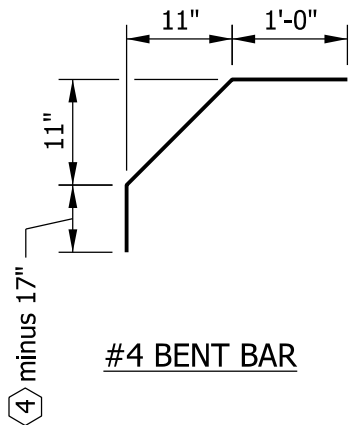
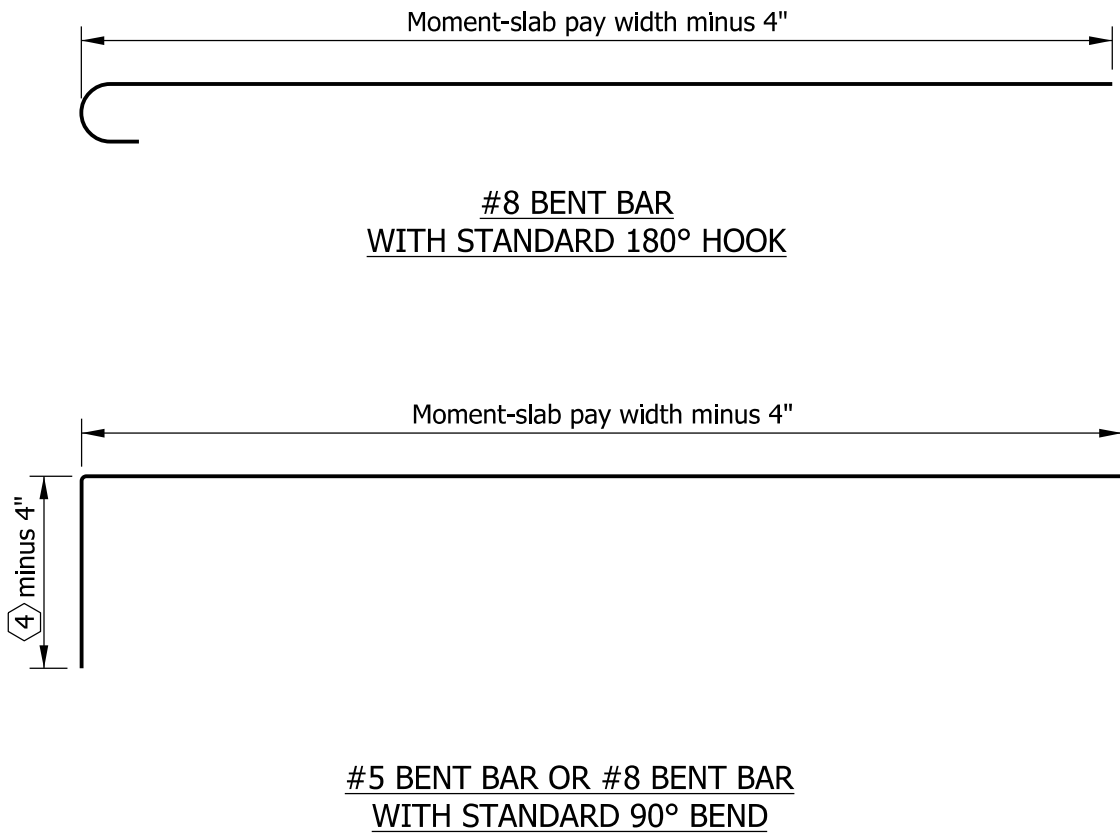
SUPERVISOR, ROADWAY STANDARDS DATE

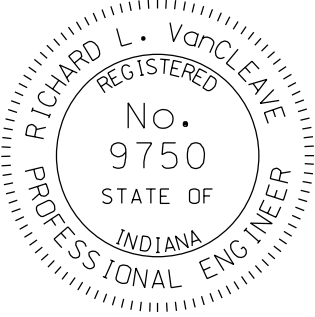
/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE

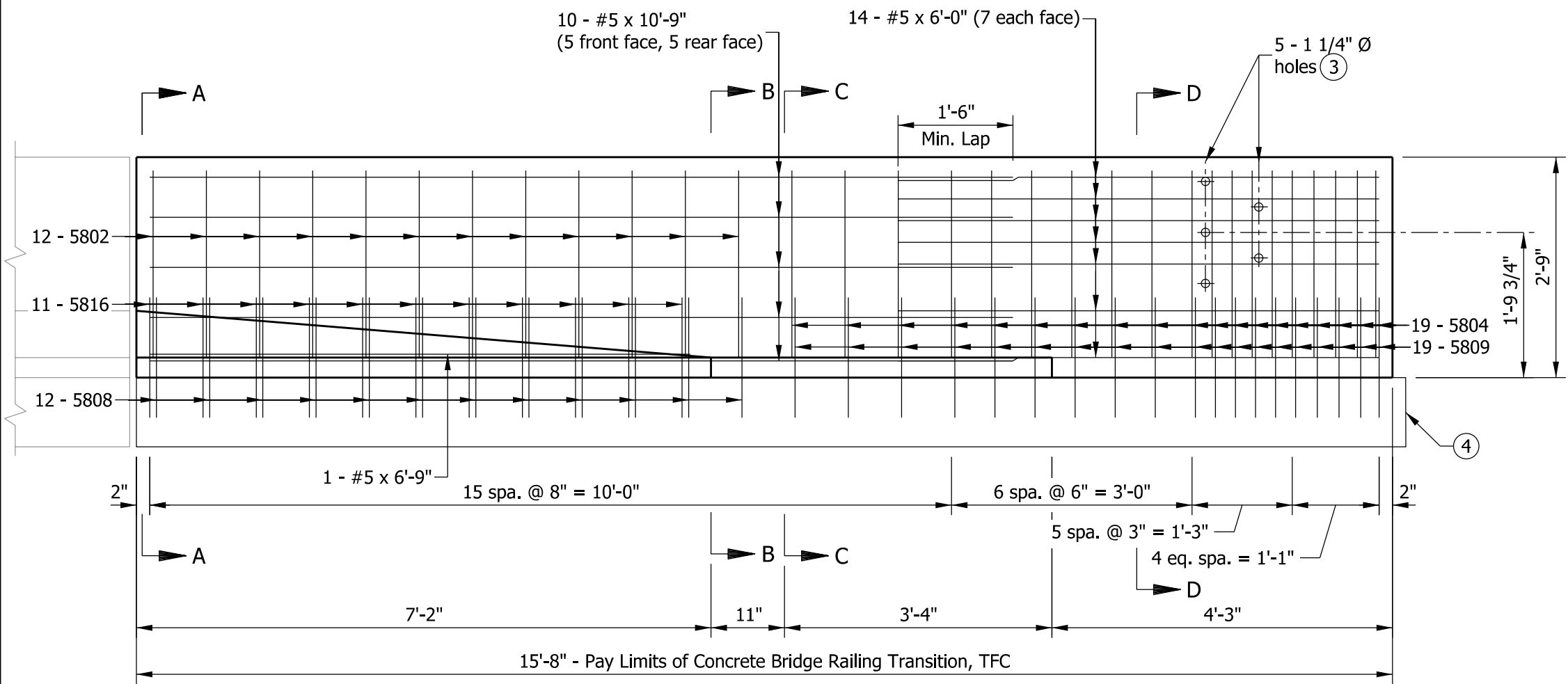
GENERAL NOTES

- ① See Standard Drawing E 706-MSRW-09 for plan view and additional reinforcing bars in the railing at the railing joints.
- ② See Standard Drawing E 731-MSEW-01 for coping details.
- ③ The thickness of the coarse aggregate No. 8 shall be equal to the combined thicknesses of the first two lifts of HMA, but not less than 6 in.
- ④ For moment slab thickness  $\leq 15$  in., this shall be 2'-0".  
For moment slab thickness  $> 15$  in., this shall be moment-slab thickness plus 12 in.
5. The moment slab shall be used only within the limits of the MSE wall.
6. Reinforcing bars in the moment slab shall be epoxy coated.
7. See Standard Drawing E 703-BRST-01 for reinforcing-bar bending diagrams and notes.

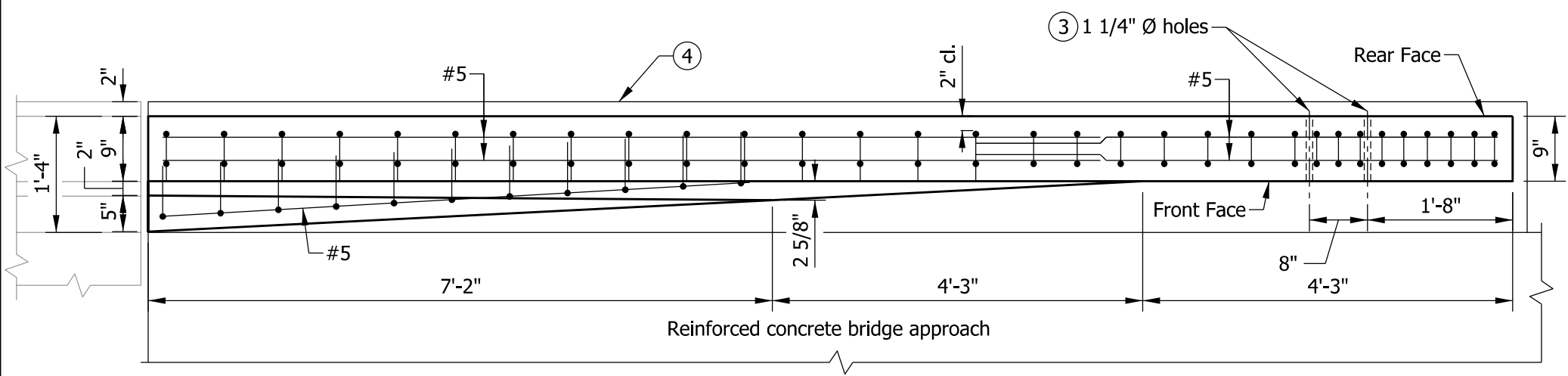


| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                 |               |                 |
|---------------------------------------------------------------------------------------|---------------------------------|---------------|-----------------|
| RAILING AND MOMENT SLAB<br>AT MSE WALL                                                |                                 |               |                 |
| SEPTEMBER 2012                                                                        |                                 |               |                 |
| STANDARD DRAWING NO.                                                                  |                                 | E 706-MSRW-10 |                 |
|  | <u>/s/ Richard L. VanCleave</u> |               | <u>09/04/12</u> |
|                                                                                       | SUPERVISOR, ROADWAY STANDARDS   |               | DATE            |
|                                                                                       | <u>/s/ Mark A. Miller</u>       |               | <u>09/04/12</u> |
|                                                                                       | CHIEF ENGINEER                  |               | DATE            |





**ELEVATION**



**PLAN**

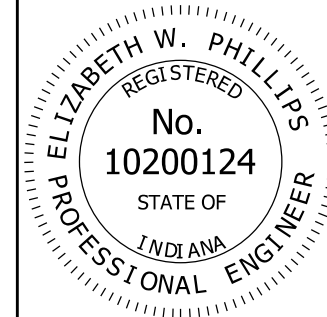
**NOTES**

1. See Standard Drawing E 706-TTFC-02 for sections.
2. See Standard Drawing E 706-TTFC-03 for reinforcing-bar diagrams and bill of materials.
- ③ Holes for attachment of guardrail transition type TGB. See Standard Drawing E 706-CBRT-04 for details.
- ④ RCBA extension for bridge railing transition type TFC. See Standard Drawing E 609-TBAE-01 for details.

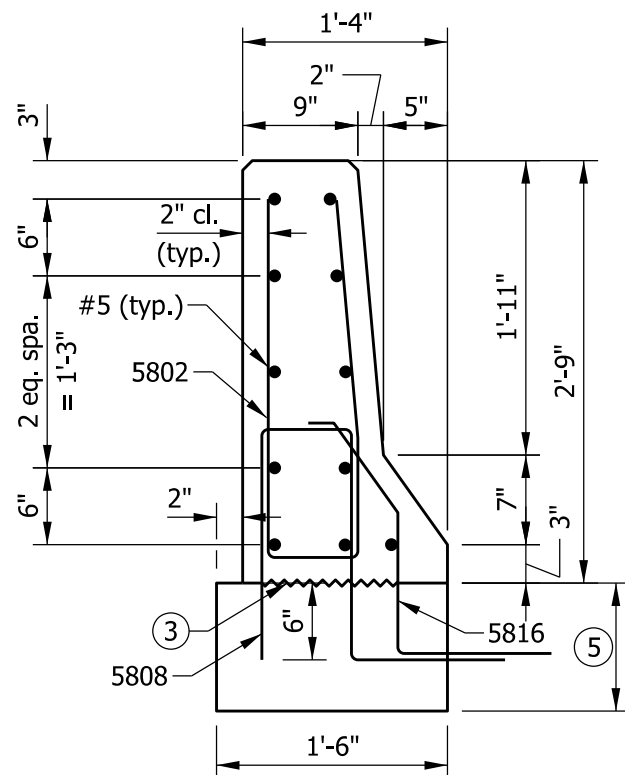
INDIANA DEPARTMENT OF TRANSPORTATION

CONCRETE BRIDGE RAILING  
TRANSITION TFC  
PLAN AND ELEVATION  
SEPTEMBER 2013

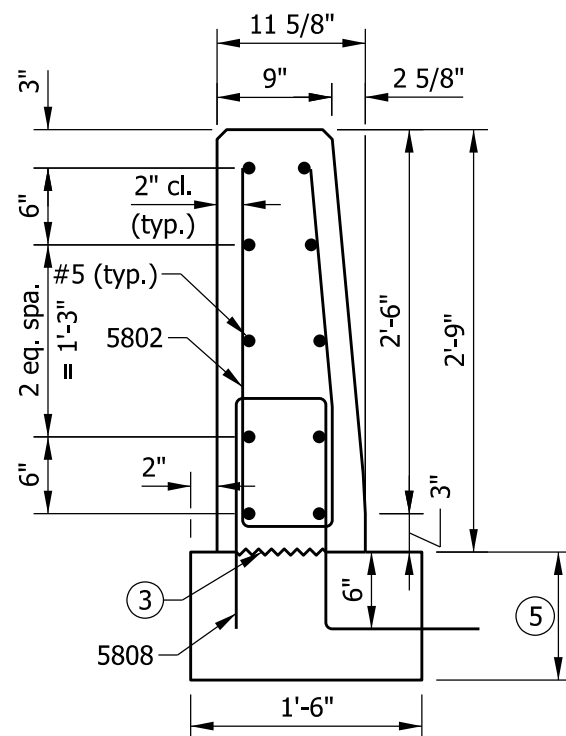
STANDARD DRAWING NO. E 706-TTFC-01



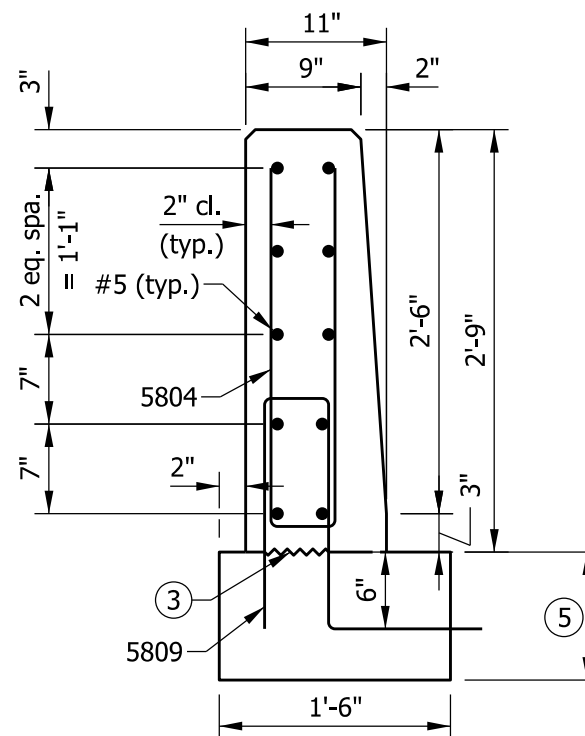
|                           |          |
|---------------------------|----------|
| /s/ Elizabeth W. Phillips | 02/04/13 |
| DESIGN STANDARDS ENGINEER | DATE     |
| /s/ Mark A. Miller        | 03/27/13 |
| CHIEF ENGINEER            | DATE     |



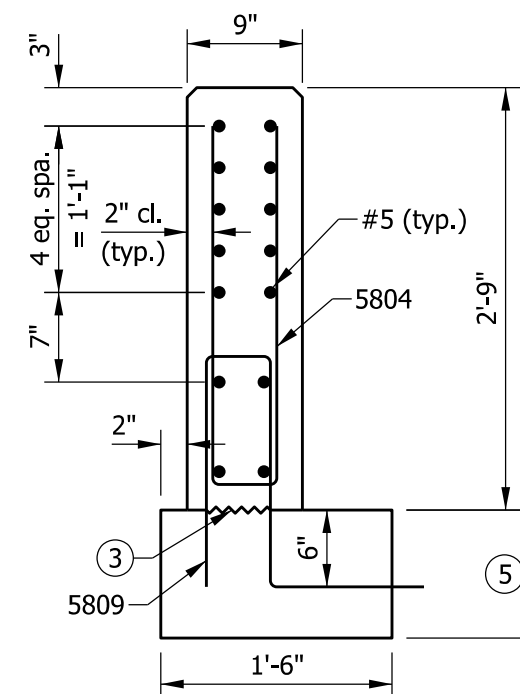
SECTION A-A



SECTION B-B



SECTION C-C



SECTION D-D

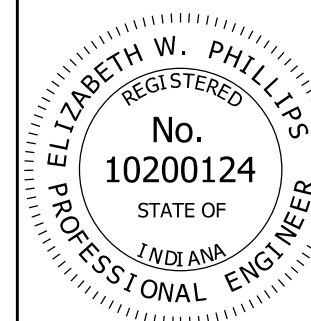
NOTES

1. See Standard Drawing E 706-TTFC-01 for elevation and plan.
2. All chamfered edges shall be 3/4".
- ③ Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.
4. See Standard Drawing E 706-TTFC-03 for reinforcing-bar diagrams.
- ⑤ RCBA extension for bridge railing type TFC. See Standard Drawing E 609-TBAE-01 for details.

INDIANA DEPARTMENT OF TRANSPORTATION

CONCRETE BRIDGE RAILING  
TRANSITION, TFC  
SECTIONS  
SEPTEMBER 2013

STANDARD DRAWING NO. E 706-TTFC-02

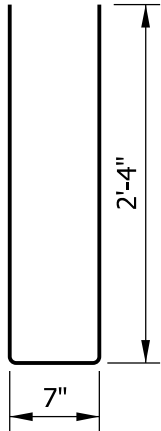


/s/ Elizabeth W. Phillips 02/04/13

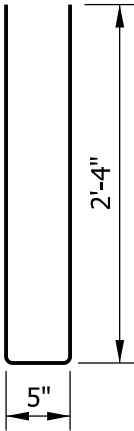
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller 03/27/13

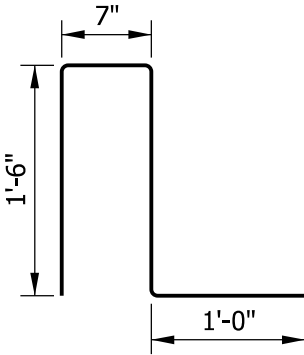
CHIEF ENGINEER DATE



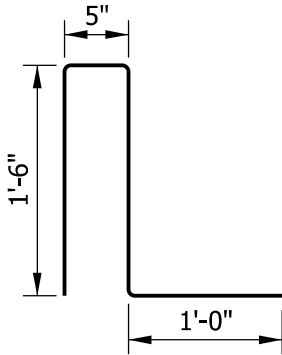
5802 x 5'-3"



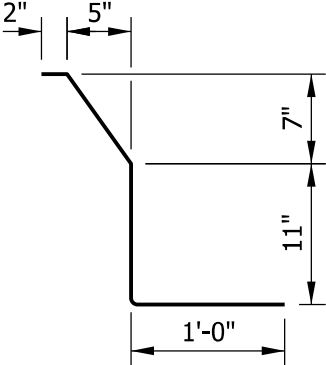
5804 x 5'-1"



5808 x 4'-7"



5809 x 4'-5"

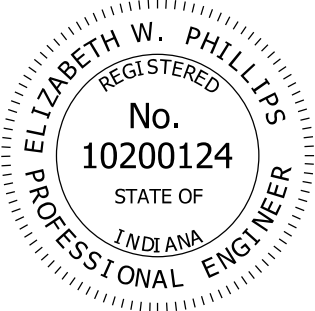


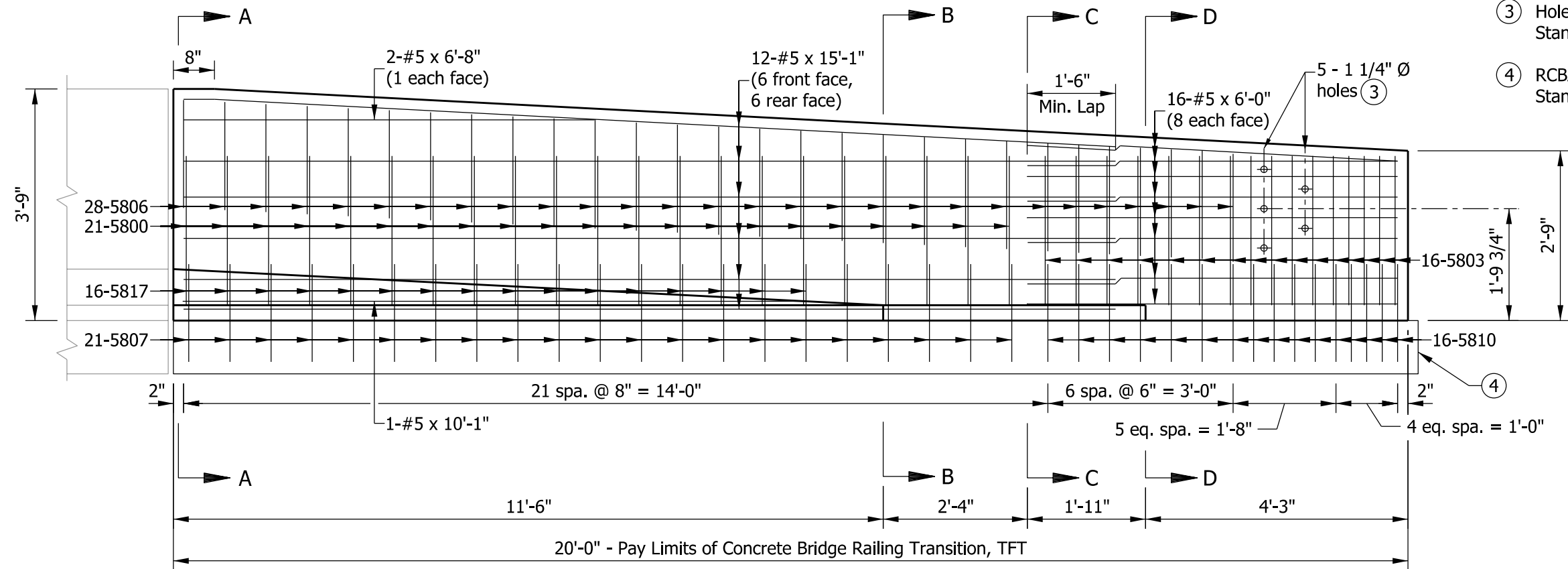
5816 x 2'-10"

NOTE

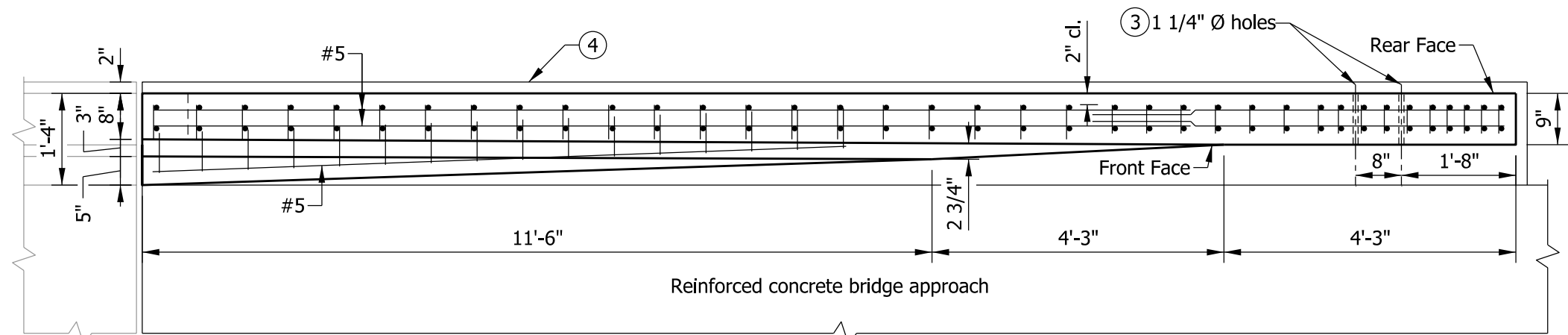
1. See Standard Drawing E 703-BRST-01 for reinforcing-bar bending details and notes.

| BILL OF MATERIALS                                                  |             |        |         |
|--------------------------------------------------------------------|-------------|--------|---------|
| Quantities are for one concrete bridge railing transition type TFC |             |        |         |
| EPOXY-COATED REINFORCING STEEL                                     |             |        |         |
| MARK OR SIZE                                                       | NO. OF BARS | LENGTH | WEIGHT  |
| 5802                                                               | 12          | 5'-3"  |         |
| 5804                                                               | 19          | 5'-1"  |         |
| 5808                                                               | 12          | 4'-7"  |         |
| 5809                                                               | 19          | 4'-5"  |         |
| 5816                                                               | 11          | 2'-10" |         |
| #5                                                                 | 10          | 10'-9" |         |
| #5                                                                 | 1           | 6'-9"  |         |
| #5                                                                 | 14          | 6'-0"  |         |
| Total Epoxy-Coated Reinforcing Steel                               |             |        | 551 LBS |
| MISCELLANEOUS                                                      |             |        |         |
| Concrete, Class C                                                  |             |        | 1.2 CYS |
| Surface Seal                                                       |             |        | 100 SFT |

| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                   |
|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CONCRETE BRIDGE RAILING<br>TRANSITION, TFC                                            |                                                                                                                                                                   |
| SEPTEMBER 2013                                                                        |                                                                                                                                                                   |
| STANDARD DRAWING NO. E 706-TTFC-03                                                    |                                                                                                                                                                   |
|  | <div><div>/s/ Elizabeth W. Phillips02/04/13</div><div>DESIGN STANDARDS ENGINEERDATE</div><div>/s/ Mark A. Miller03/27/13</div><div>CHIEF ENGINEERDATE</div></div> |



**ELEVATION**



**PLAN**

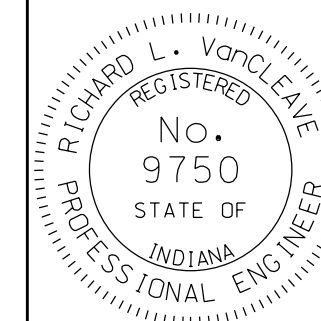
**NOTES**

- See Standard Drawing E 706-TTFT-02 for sections.
- See Standard Drawing E 706-TTFT-03 for reinforcing-bar diagrams and bill of materials.
- Holes for attachment of guardrail transition type TGB. See Standard Drawing E 601-TTGB-01 for details.
- RCBA extension for bridge railing transition type TFT. See Standard Drawing E 609-TBAE-02 for details.

INDIANA DEPARTMENT OF TRANSPORTATION

CONCRETE BRIDGE RAILING  
TRANSITION TFT  
PLAN AND ELEVATION  
SEPTEMBER 2012

STANDARD DRAWING NO. E 706-TTFT-01

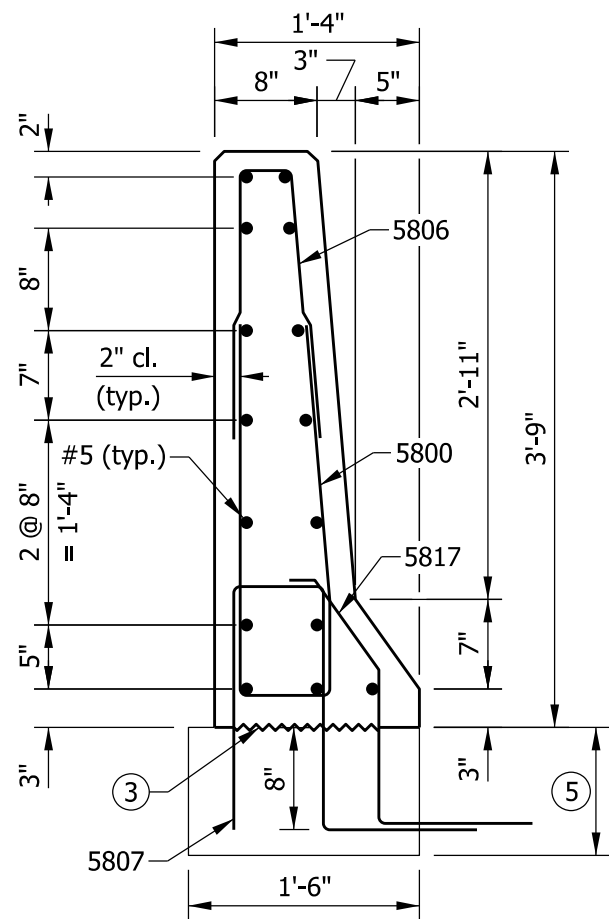


/s/ Richard L. VanCleave 09/04/12

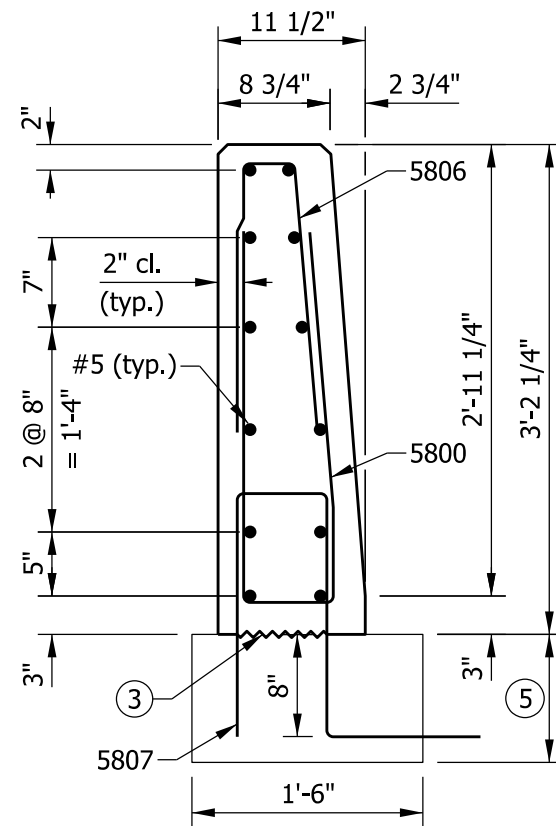
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

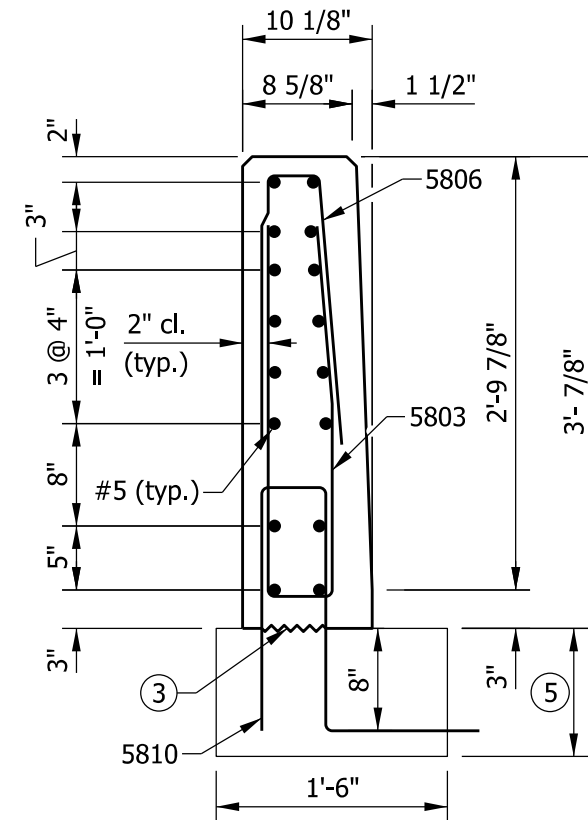
CHIEF ENGINEER DATE



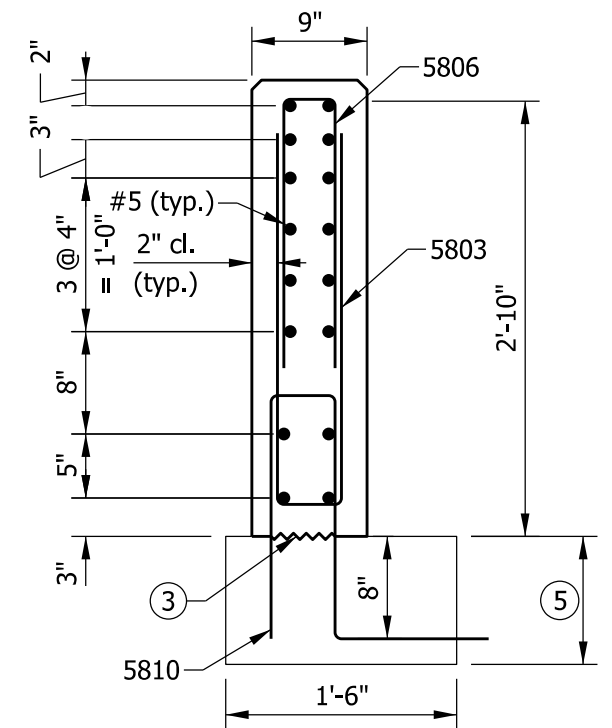
SECTION A-A



SECTION B-B



SECTION C-C



SECTION D-D

NOTES

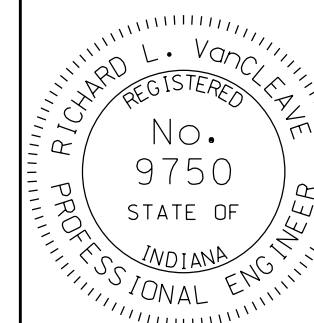
1. See Standard Drawing E 706-TTFT-01 for elevation and plan.
2. All chamfered edges shall be 3/4".
- ③ Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.
4. See Standard Drawing E 706-TTFT-03 for reinforcing-bar diagrams.
- ⑤ RCBA extension for bridge railing transition type TFT. See Standard Drawing E 609-TBAE-02 for details.

INDIANA DEPARTMENT OF TRANSPORTATION

CONCRETE BRIDGE RAILING  
TRANSITION, TFT

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-TTFT-02

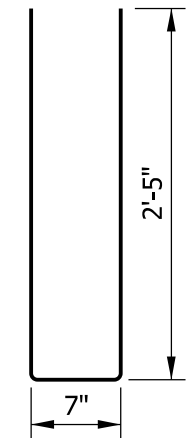


/s/ *Richard L. VanCleave* 09/04/12

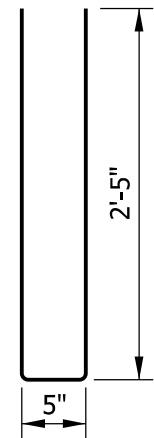
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ *Mark A. Miller* 09/04/12

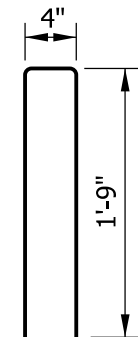
CHIEF ENGINEER DATE



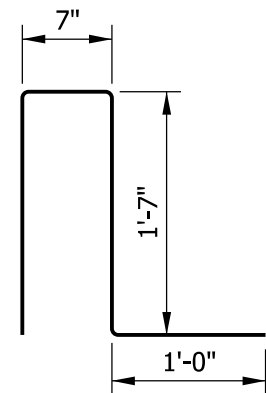
5800 x 5'-5"



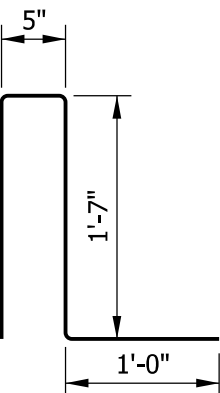
5803 x 5'-3"



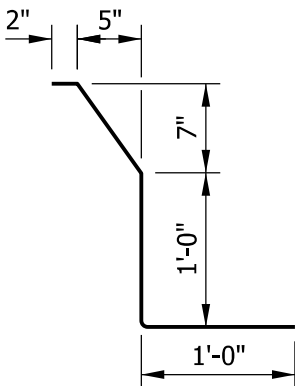
5806 x 3'-10"



5807 x 4'-9"



5810 x 4'-7"



5817 x 3'-0"

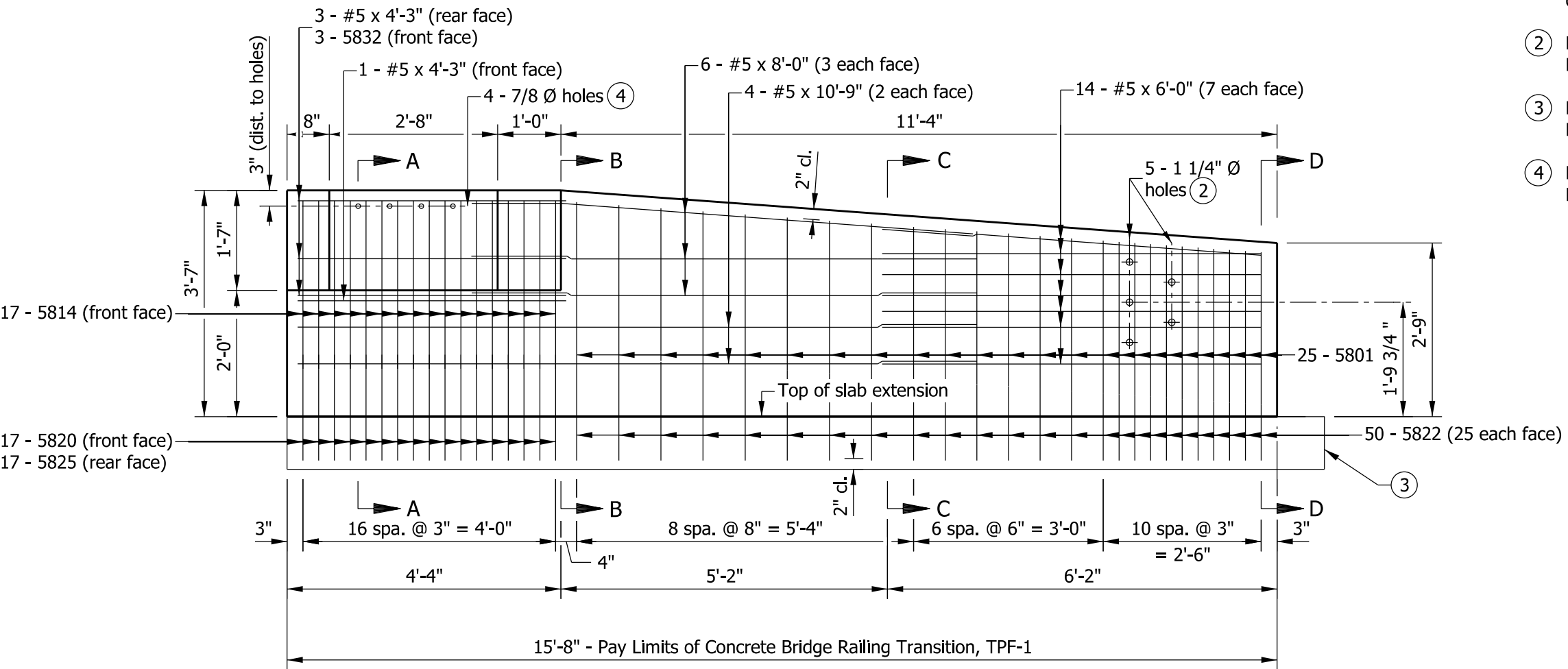
NOTE

1. See Standard Drawing E 703-BRST-01 for reinforcing-bar bending details and notes.

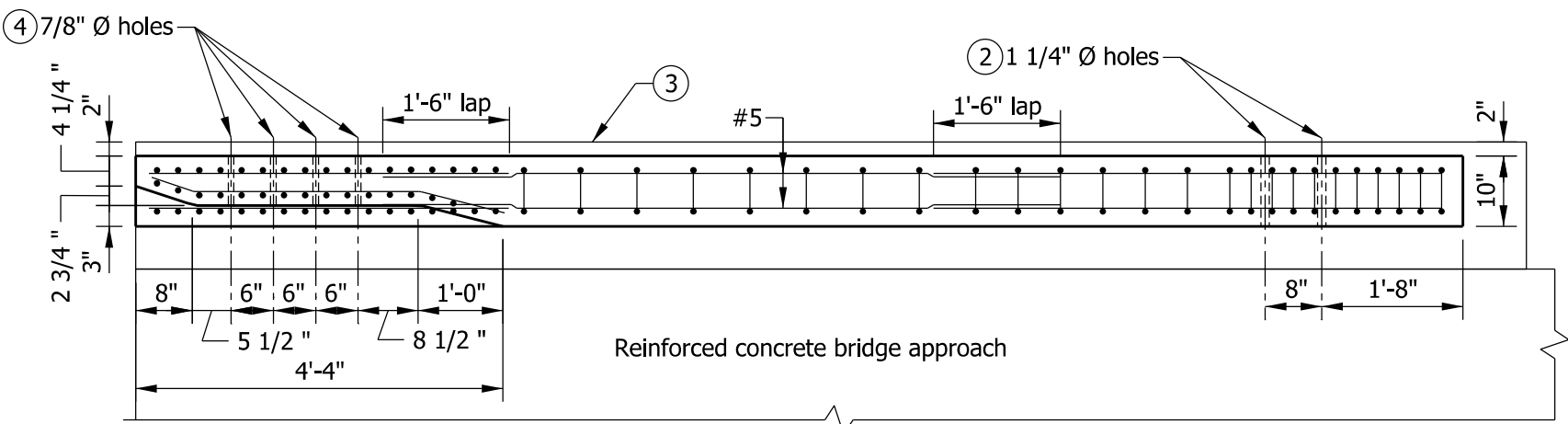
| BILL OF MATERIALS                                                  |             |        |          |
|--------------------------------------------------------------------|-------------|--------|----------|
| Quantities are for one concrete bridge railing transition type TFT |             |        |          |
| EPOXY-COATED REINFORCING STEEL                                     |             |        |          |
| MARK OR SIZE                                                       | NO. OF BARS | LENGTH | WEIGHT   |
| 5800                                                               | 21          | 5'-5"  |          |
| 5803                                                               | 16          | 5'-3"  |          |
| 5806                                                               | 28          | 3'-10" |          |
| 5807                                                               | 21          | 4'-9"  |          |
| 5810                                                               | 16          | 4'-7"  |          |
| 5817                                                               | 16          | 3'-0"  |          |
| #5                                                                 | 12          | 15'-1" |          |
| #5                                                                 | 1           | 10'-1" |          |
| #5                                                                 | 2           | 6'-8"  |          |
| #5                                                                 | 16          | 6'-0"  |          |
| Total Epoxy-Coated Reinforcing Steel                               |             |        | 862 LBS  |
| MISCELLANEOUS                                                      |             |        |          |
| Concrete, Class C                                                  |             |        | 2.0 CYS  |
| Surface Seal                                                       |             |        | 13.4 SYS |

| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                      |
|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CONCRETE BRIDGE RAILING<br>TRANSITION TYPE TFT                                        |                                                                                                                                                                      |
| SEPTEMBER 2012                                                                        |                                                                                                                                                                      |
| STANDARD DRAWING NO. E 706-TTFT-03                                                    |                                                                                                                                                                      |
|  | <div><div>/s/ Richard L. VanCleave09/04/12</div><div>SUPERVISOR, ROADWAY STANDARDSDATE</div><div>/s/ Mark A. Miller09/04/12</div><div>CHIEF ENGINEERDATE</div></div> |





ELEVATION



PLAN

NOTES

1. See Standard Drawing E 706-TTPP-02 for sections and reinforcing bar diagrams.
2. Holes for attachment of guardrail transition type TGB. See Standard Drawing E 706-CBRT-04 for details.
3. RCBA extension for bridge railing transition type TPF-1. See Standard Drawing E 609-TBAE-01 for details.
4. Holes for attachment of steel bridge railing type PF-1. See Standard Drawing E 706-BRPP-01 for details.

| BILL OF MATERIALS                                                     |             |        |         |
|-----------------------------------------------------------------------|-------------|--------|---------|
| Quantities are for one concrete bridge railing transition type TPF-1. |             |        |         |
| EPOXY-COATED REINFORCING STEEL                                        |             |        |         |
| MARK OR SIZE                                                          | NO. OF BARS | LENGTH | WEIGHT  |
| 5801                                                                  | 25          | 5'-4"  |         |
| 5814                                                                  | 17          | 3'-0"  |         |
| 5820                                                                  | 17          | 3'-1"  |         |
| 5822                                                                  | 50          | 3'-7"  |         |
| 5825                                                                  | 17          | 4'-8"  |         |
| 5832                                                                  | 3           | 4'-3"  |         |
| #5                                                                    | 4           | 10'-9" |         |
| #5                                                                    | 6           | 8'-0"  |         |
| #5                                                                    | 14          | 6'-0"  |         |
| #5                                                                    | 4           | 4'-3"  |         |
| Total Epoxy-Coated Reinforcing Steel                                  |             |        | 730 LBS |
| MISCELLANEOUS                                                         |             |        |         |
| Concrete, Class C                                                     |             |        | 1.5 CYS |
| Surface Seal                                                          |             |        | 119 SFT |

INDIANA DEPARTMENT OF TRANSPORTATION

CONCRETE BRIDGE RAILING  
TRANSITION, TPF-1

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-TTPP-01

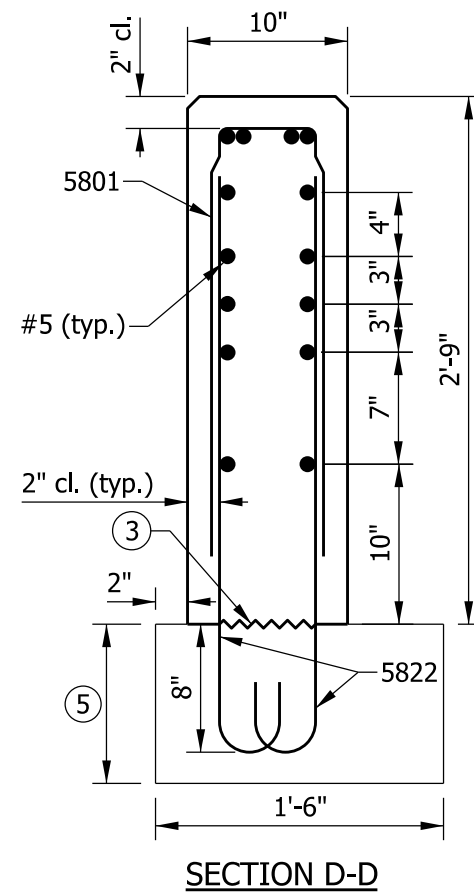
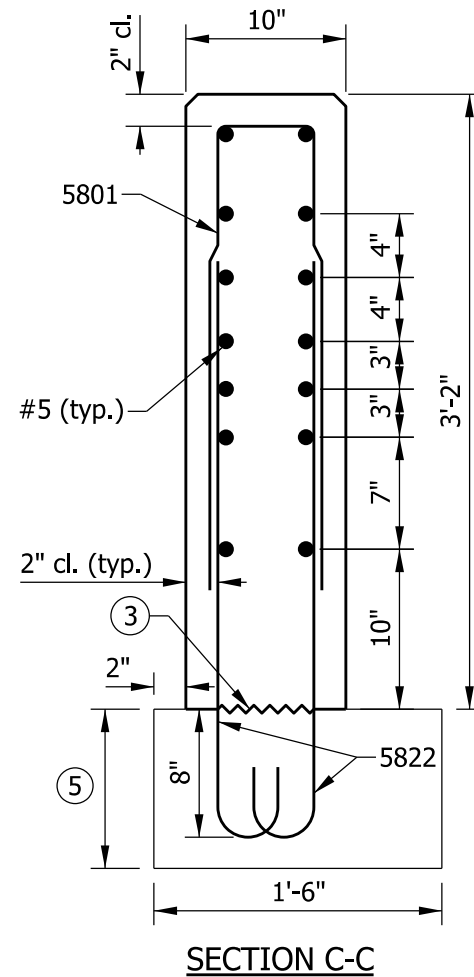
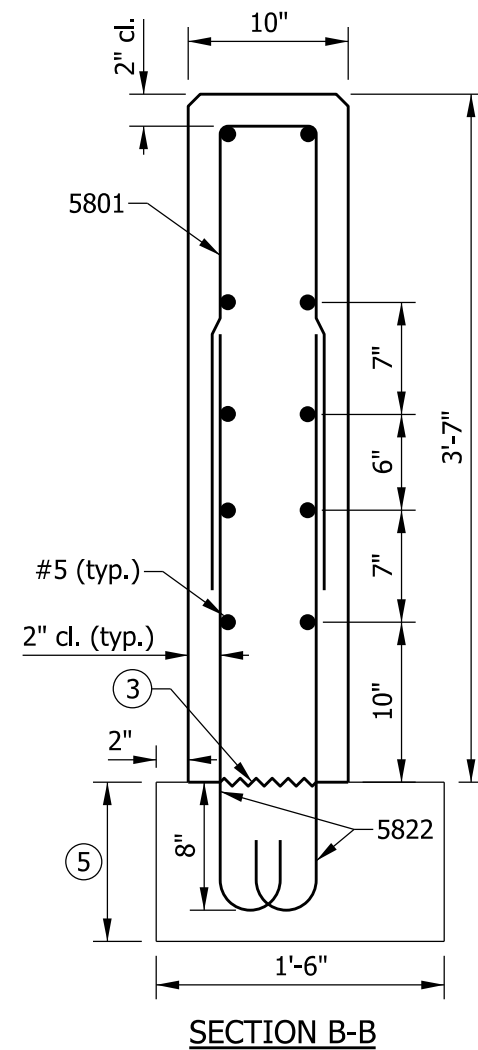
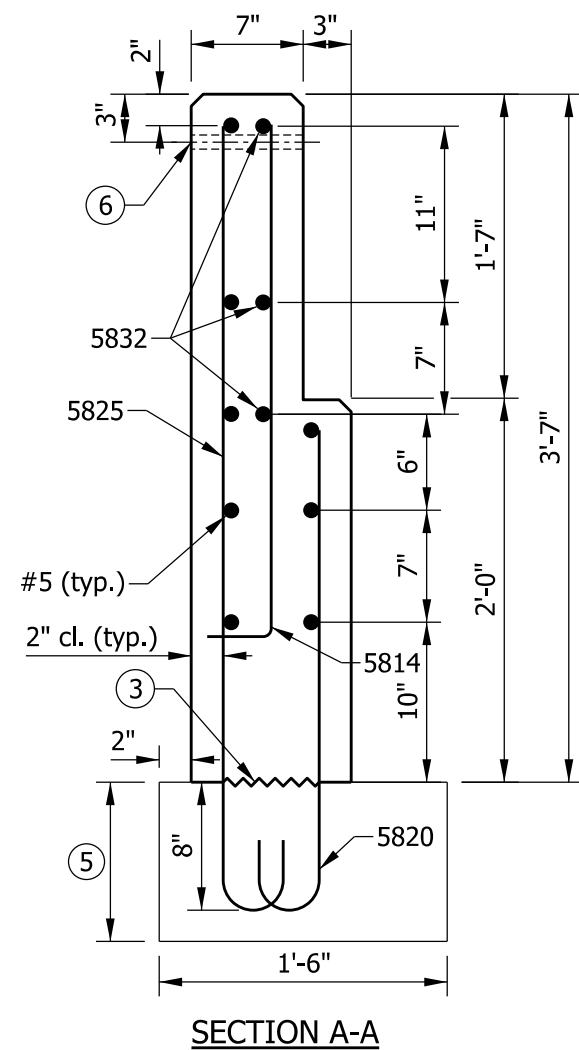


/s/ Richard L. VanCleave 09/04/12

SUPERVISOR, ROADWAY STANDARDS DATE

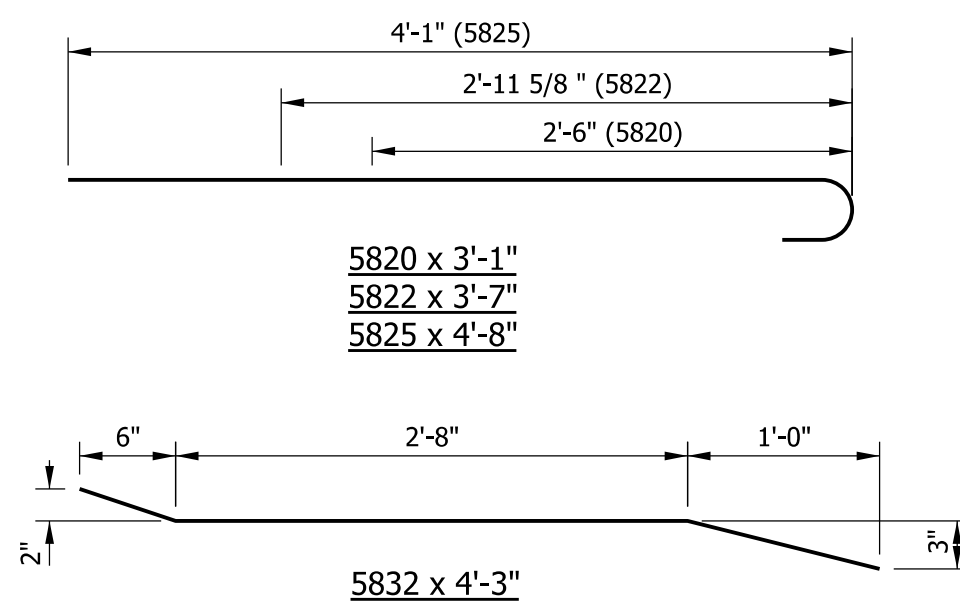
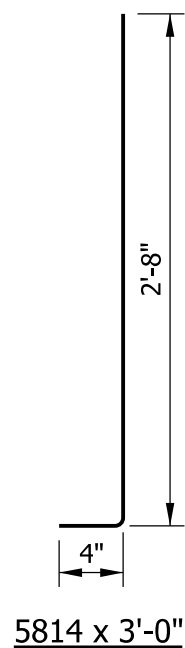
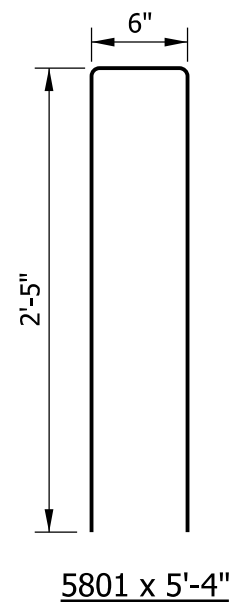
/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE



## NOTES

1. See Standard Drawing E 706-TTPP-01 for elevation and plan.
2. All chamfered edges shall be 3/4".
3. Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.
4. See Standard Drawing E 703-BRST-01 for reinforcing-bar bending details and notes.
5. RCBA extension for bridge railing transition type TPF-1. See Standard Drawing E 609-TBAE-01 details.
6. 7/8" Ø hole for attachment of steel bridge railing type PF-1. See Standard Drawing E 706-BRPP-01 for details.

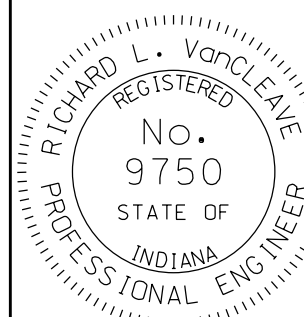


INDIANA DEPARTMENT OF TRANSPORTATION

CONCRETE BRIDGE RAILING  
TRANSITION, TPF-1

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-TTPP-02



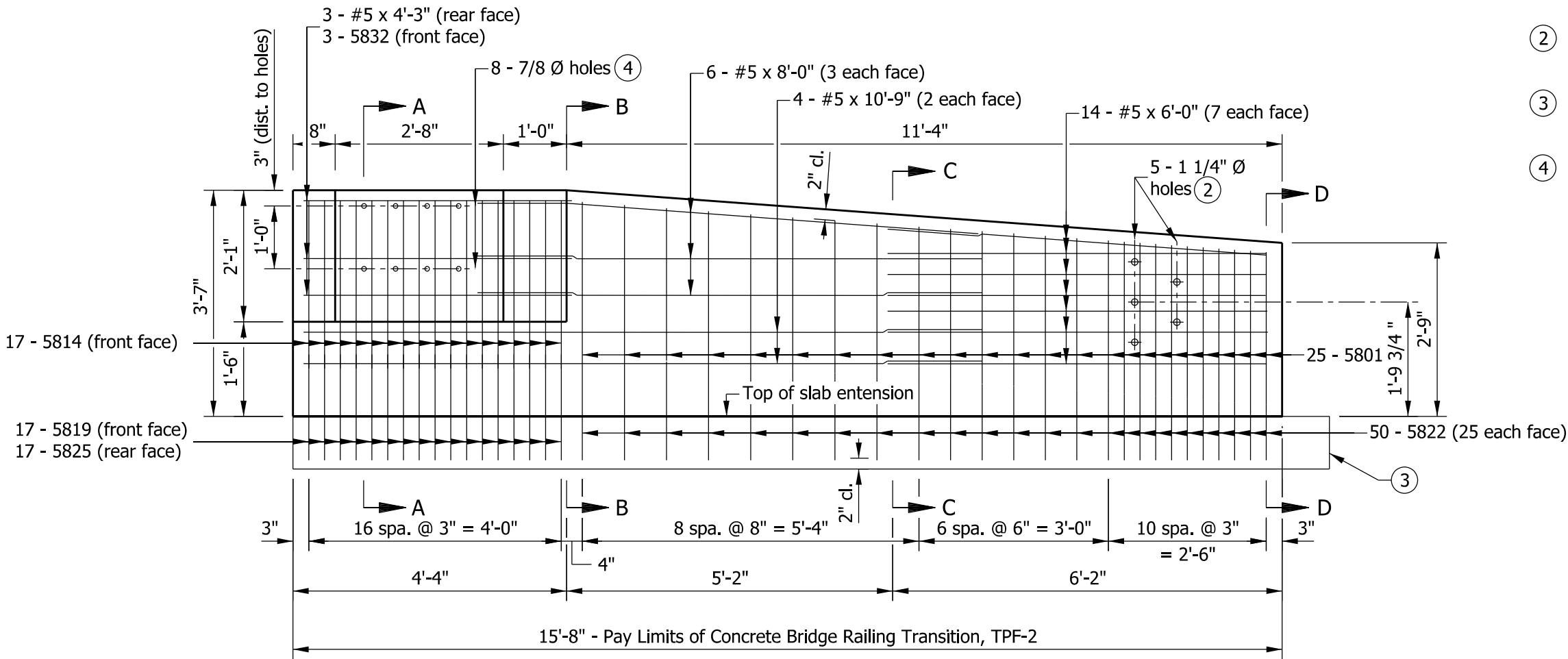
/s/ *Richard L. VanCleave* 09/04/12  
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ *Mark A. Miller* 09/04/12  
CHIEF ENGINEER DATE

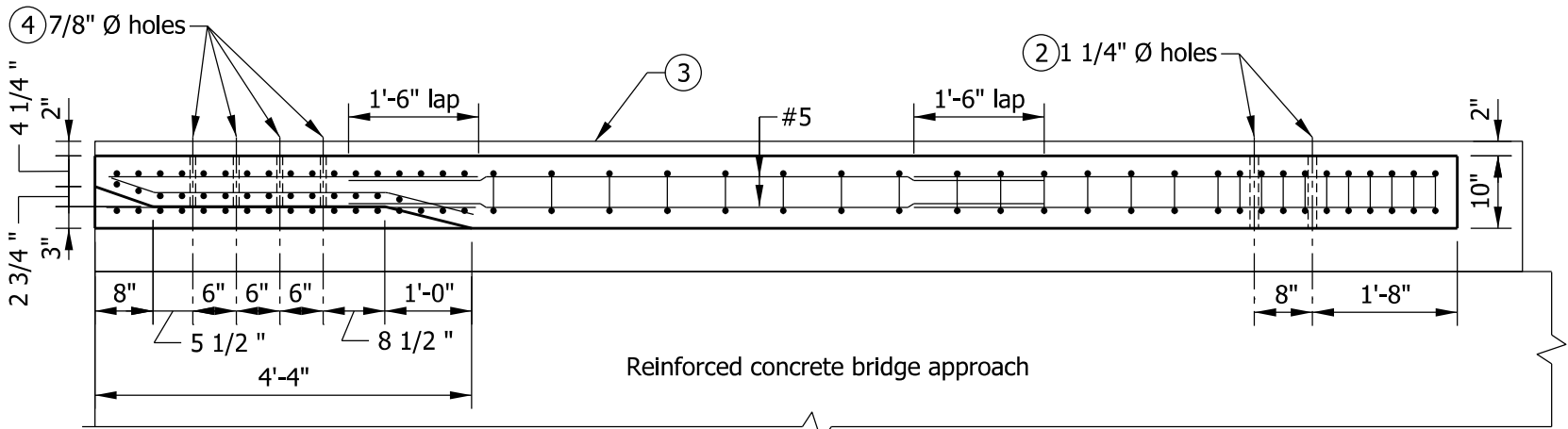


NOTES

1. See Standard Drawing E 706-TTPP-04 for sections and reinforcing bar diagrams.
2. Holes for attachment of guardrail transition type TGB. See Standard Drawing E 706-CBRT-04 for details.
3. RCBA extension for bridge railing transition type TPF-2. See Standard Drawing E 609-TBAE-01 for details.
4. Holes for attachment of steel bridge railing type PF-2. See Standard Drawing E 706-BRPP-02 for details.



ELEVATION



PLAN

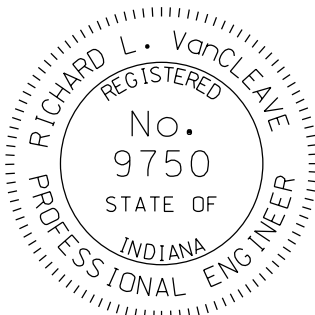
| BILL OF MATERIALS                                                     |             |        |         |
|-----------------------------------------------------------------------|-------------|--------|---------|
| Quantities are for one concrete bridge railing transition type TPF-2. |             |        |         |
| EPOXY-COATED REINFORCING STEEL                                        |             |        |         |
| MARK OR SIZE                                                          | NO. OF BARS | LENGTH | WEIGHT  |
| 5801                                                                  | 25          | 5'-4"  |         |
| 5814                                                                  | 17          | 3'-0"  |         |
| 5819                                                                  | 17          | 2'-7"  |         |
| 5822                                                                  | 50          | 3'-7"  |         |
| 5825                                                                  | 17          | 4'-8"  |         |
| 5832                                                                  | 3           | 4'-3"  |         |
| #5                                                                    | 4           | 10'-9" |         |
| #5                                                                    | 6           | 8'-0"  |         |
| #5                                                                    | 14          | 6'-0"  |         |
| #5                                                                    | 3           | 4'-3"  |         |
| Total Epoxy-Coated Reinforcing Steel                                  |             |        | 717 LBS |
| MISCELLANEOUS                                                         |             |        |         |
| Concrete, Class C                                                     |             |        | 1.5 CYS |
| Surface Seal                                                          |             |        | 119 SFT |

INDIANA DEPARTMENT OF TRANSPORTATION

CONCRETE BRIDGE RAILING  
TRANSITION, TPF-2

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-TTPP-03

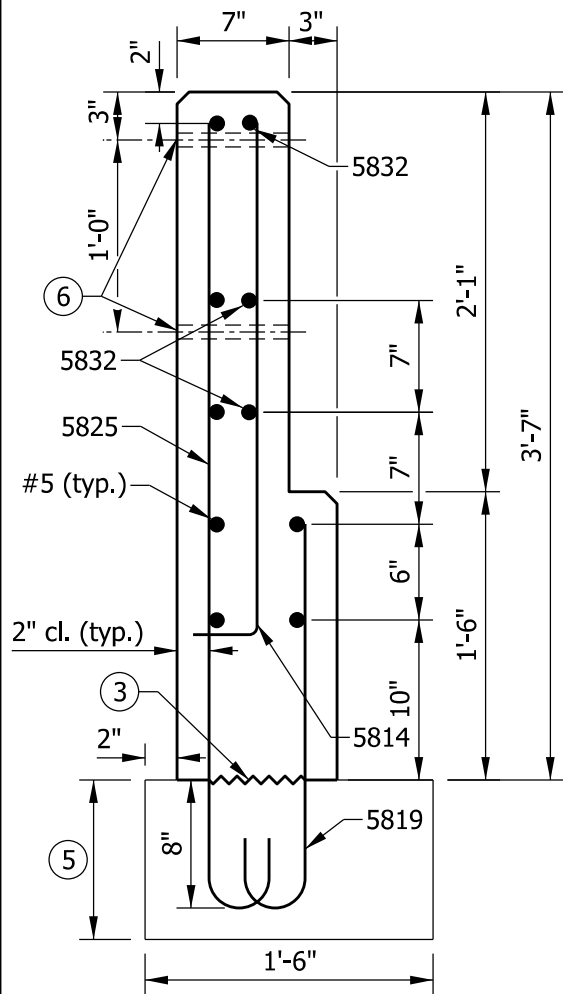


/s/ Richard L. VanCleave 09/04/12

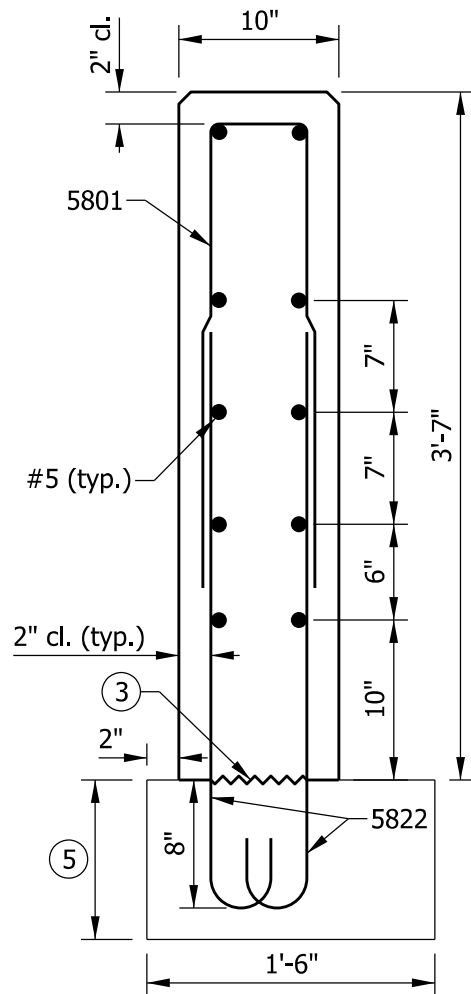
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

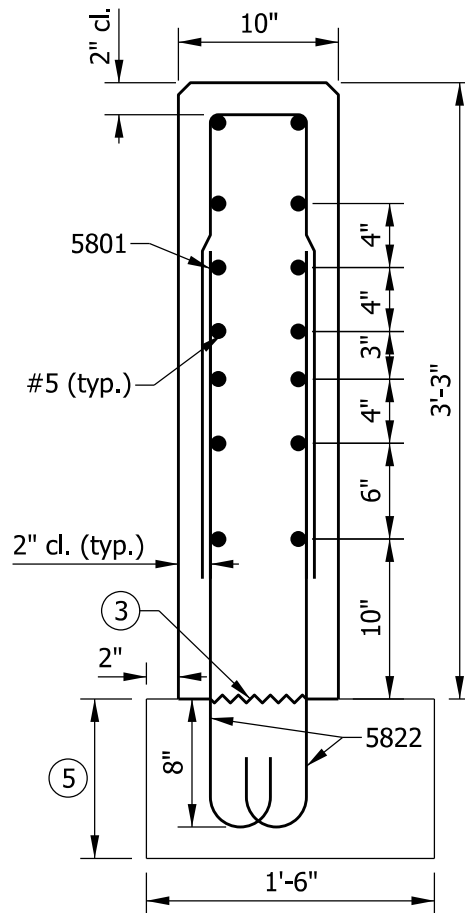
CHIEF ENGINEER DATE



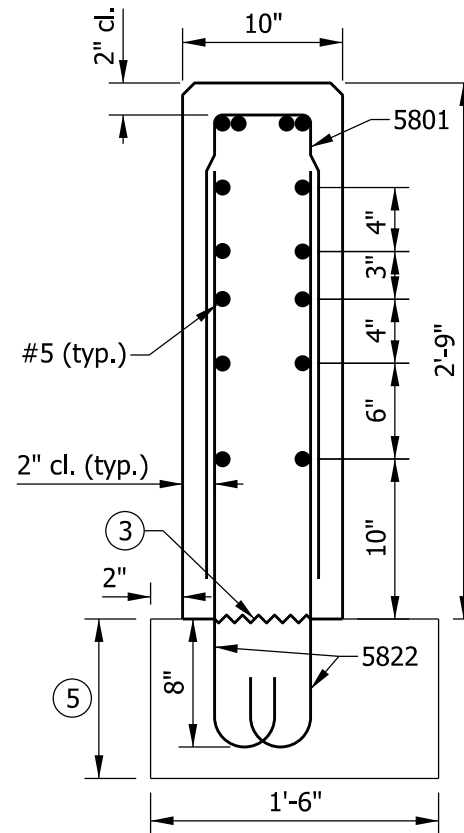
SECTION A-A



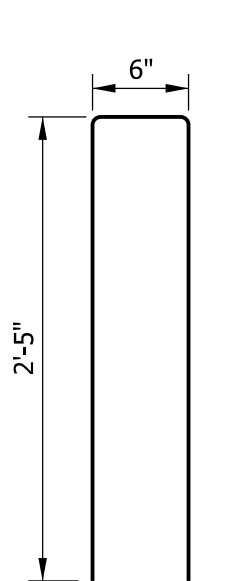
SECTION B-B



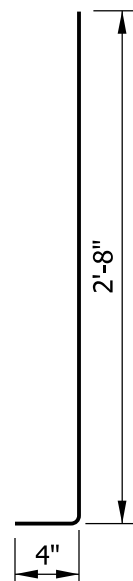
SECTION C-C



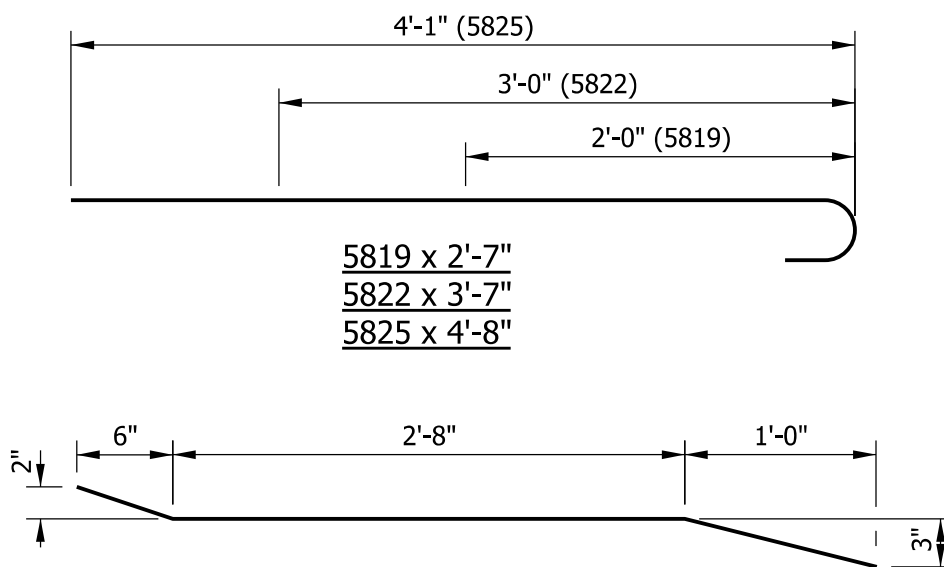
SECTION D-D



5801 x 5'-4"



5814 x 3'-0"



5832 x 4'-3"

## NOTES

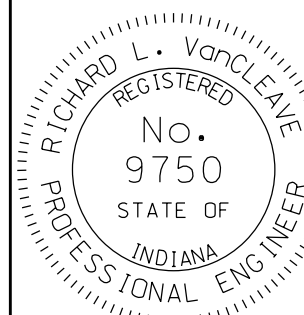
1. See Standard Drawing E 706-TTPP-03 for elevation and plan.
2. All chamfered edges shall be 3/4".
3. Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.
4. See Standard Drawing E 703-BRST-01 for reinforcing-bar bending details and notes.
5. RCBA extension for bridge railing transition type TPF-2. See Standard Drawing E 609-TBAE-01 for details.
6. 7/8" Ø hole for attachment of steel bridge railing type PF-2. See Standard Drawing E 706-BRPP-02 for details.

INDIANA DEPARTMENT OF TRANSPORTATION

CONCRETE BRIDGE RAILING  
TRANSITION, TPF-2

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-TTPP-04

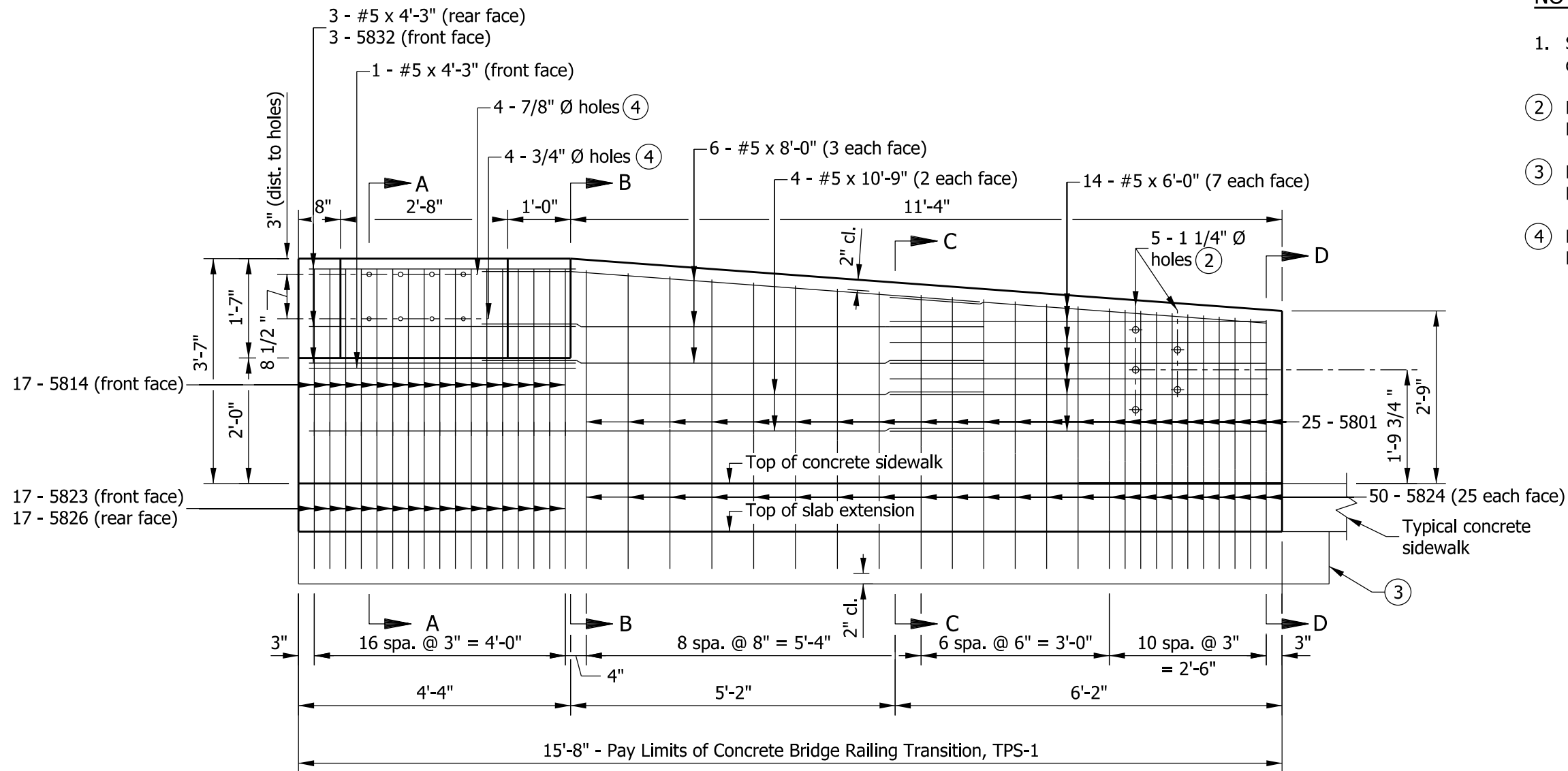


/s/ Richard L. VanCleave 09/04/12

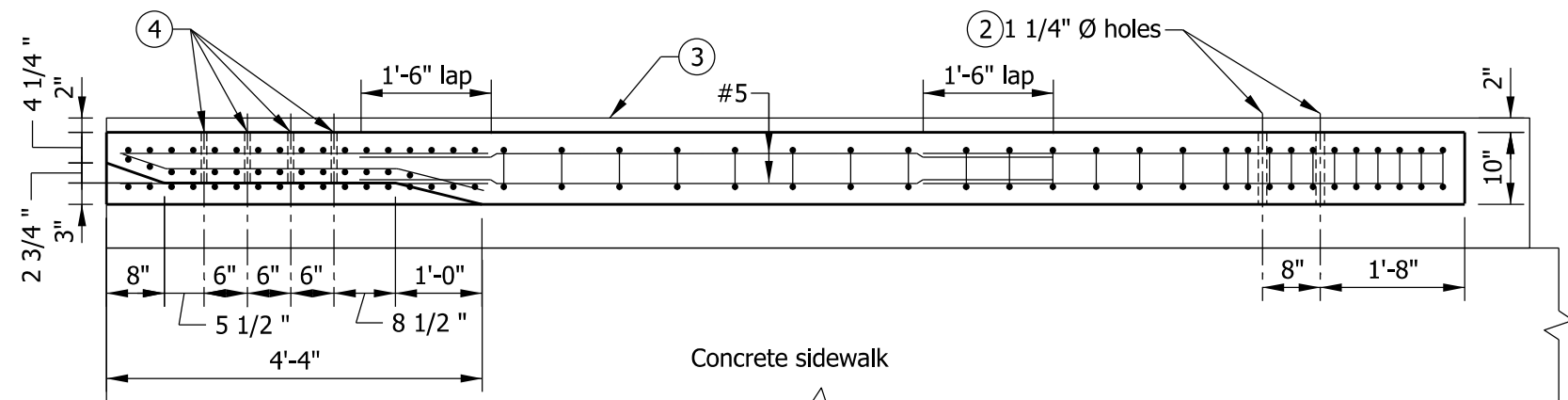
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE



ELEVATION



PLAN

NOTES

- See Standard Drawing E 706-TTPP-06 for sections and reinforcing bar diagrams.
- Holes for attachment of guardrail transition type TGB. See Standard Drawing E 706-CBRT-04 for details.
- RCBA extension for bridge railing transition type TPS-1. See Standard Drawing E 609-TBAE-01 for details.
- Holes for attachment of steel bridge railing type PS-1. See Standard Drawing E 706-BRPP-03 for details.

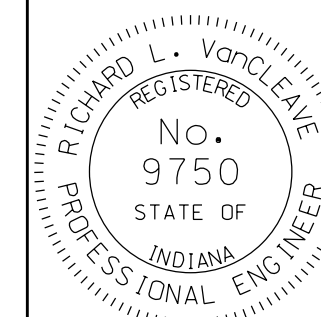
| BILL OF MATERIALS                                                     |             |        |         |
|-----------------------------------------------------------------------|-------------|--------|---------|
| Quantities are for one concrete bridge railing transition type TPS-1. |             |        |         |
| EPOXY-COATED REINFORCING STEEL                                        |             |        |         |
| MARK OR SIZE                                                          | NO. OF BARS | LENGTH | WEIGHT  |
| 5801                                                                  | 25          | 5'-4"  |         |
| 5814                                                                  | 17          | 3'-0"  |         |
| 5823                                                                  | 17          | 3'-9"  |         |
| 5824                                                                  | 50          | 4'-3"  |         |
| 5826                                                                  | 17          | 5'-4"  |         |
| 5832                                                                  | 3           | 4'-3"  |         |
| #5                                                                    | 4           | 10'-9" |         |
| #5                                                                    | 6           | 8'-0"  |         |
| #5                                                                    | 14          | 6'-0"  |         |
| #5                                                                    | 4           | 4'-3"  |         |
| Total Epoxy-Coated Reinforcing Steel                                  |             |        | 789 LBS |
| MISCELLANEOUS                                                         |             |        |         |
| Concrete, Class C                                                     |             |        | 1.9 CYS |
| Surface Seal                                                          |             |        | 131 SFT |

INDIANA DEPARTMENT OF TRANSPORTATION

CONCRETE BRIDGE RAILING  
TRANSITION, TPS-1

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-TTPP-05

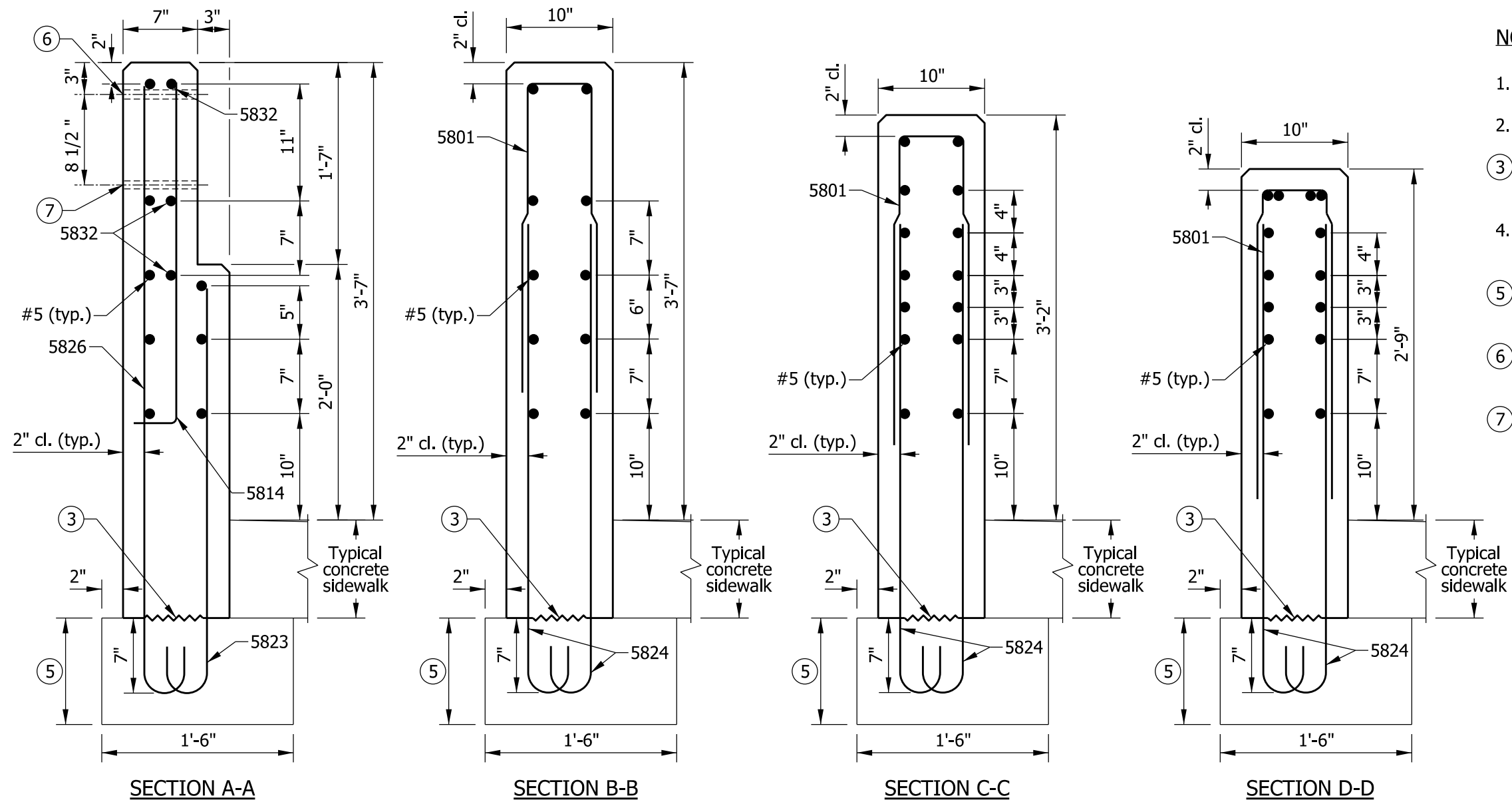


/s/ Richard L. VanCleave 09/04/12

SUPERVISOR, ROADWAY STANDARDS DATE

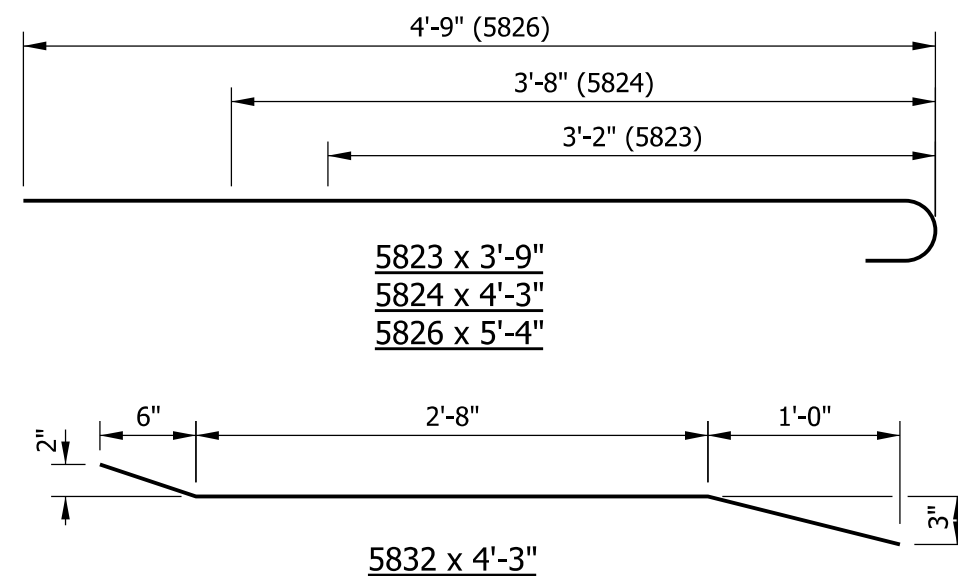
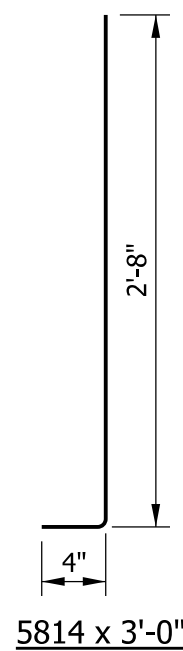
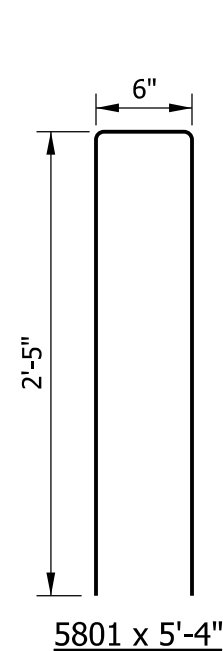
/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE



## NOTES

1. See Standard Drawing E 706-TTPP-05 for elevation and plan.
2. All chamfered edges shall be 3/4".
- 3 Construction joing type A. See Standard Drawing E 702-CJTA-01 for details.
4. See Standard Drawing E 703-BRST-01 for reinforcing-bar bending details and notes.
- 5 RCBA extension for bridge railing transition type TPS-1. See Standard Drawing E 609-TBAE-01 for details.
- 6 7/8" Ø hole for attachment of steel bridge railing type PS-1, large rail. See Standard Drawing E 706-BRPP-03 for details.
- 7 3/4" Ø hole for attachment of steel bridge railing type PS-1, small rail. See Standard Drawing E 706-BRPP-03 for details.

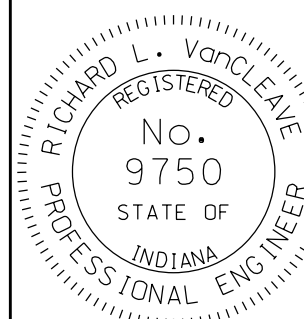


INDIANA DEPARTMENT OF TRANSPORTATION

CONCRETE BRIDGE RAILING  
TRANSITION, TPS-1

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-TTPP-06



/s/ Richard L. VanCleave 09/04/12

SUPERVISOR, ROADWAY STANDARDS DATE

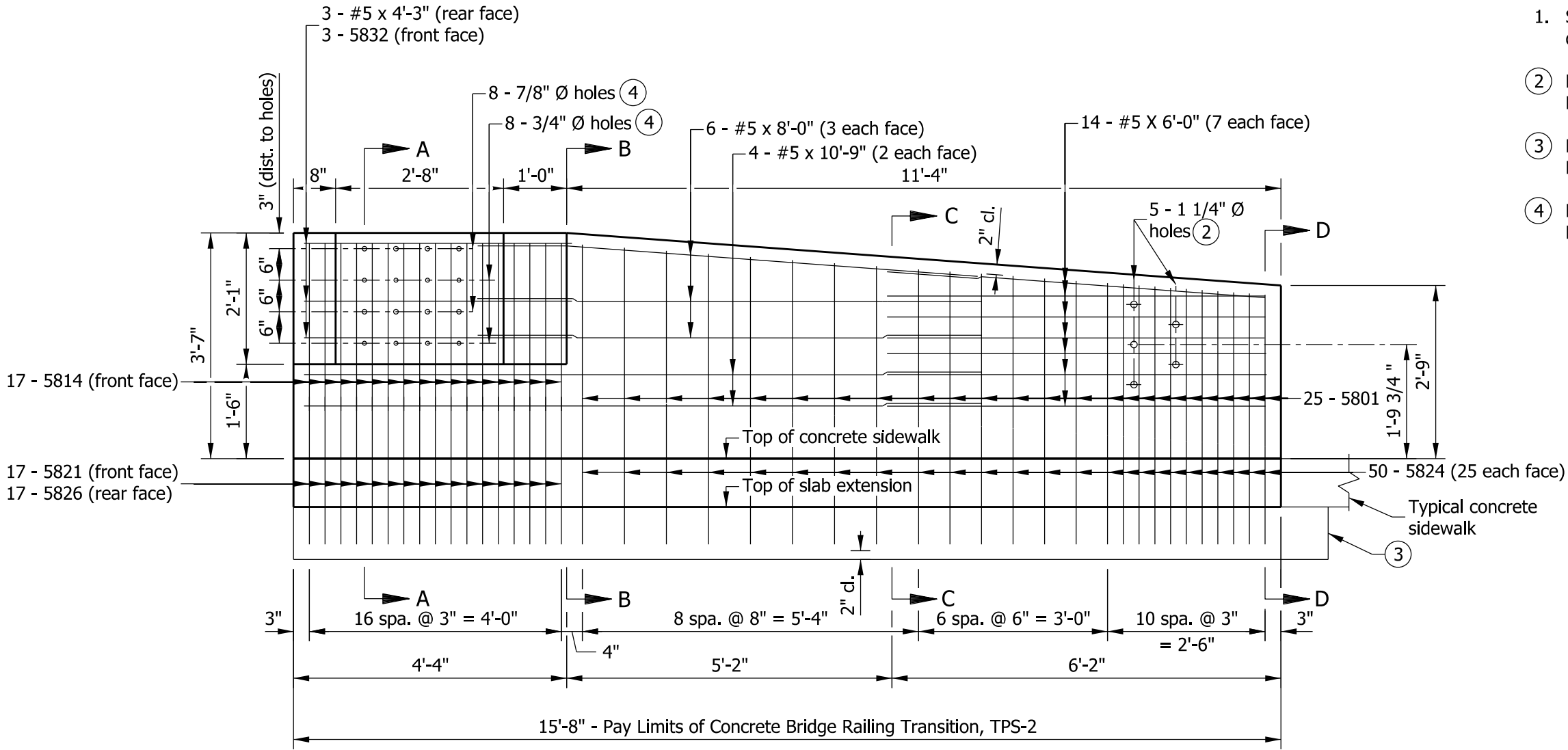
/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE

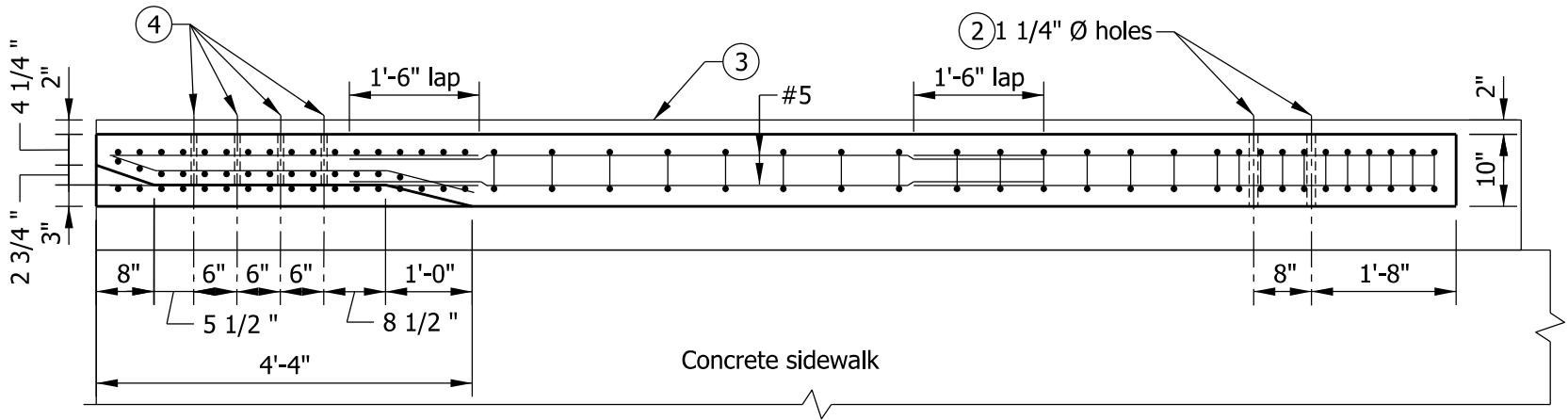
NOTES

1. See Standard Drawing E 706-TTPP-08 for sections and reinforcing bar diagrams.
2. Holes for attachment of guardrail transition type TGB. See Standard Drawing E 706-CBRT-04 for details.
3. RCBA extension for bridge railing transition type TPS-2. See Standard Drawing E 609-TBAE-01 for details.
4. Holes for attachment of steel bridge railing type PS-2. See Standard Drawing E 706-BRPP-04 for details.

| BILL OF MATERIALS                                                     |             |        |         |
|-----------------------------------------------------------------------|-------------|--------|---------|
| Quantities are for one concrete bridge railing transition type TPS-2. |             |        |         |
| EPOXY-COATED REINFORCING STEEL                                        |             |        |         |
| MARK OR SIZE                                                          | NO. OF BARS | LENGTH | WEIGHT  |
| 5801                                                                  | 25          | 5'-4"  |         |
| 5814                                                                  | 17          | 3'-0"  |         |
| 5821                                                                  | 17          | 3'-3"  |         |
| 5824                                                                  | 50          | 4'-3"  |         |
| 5826                                                                  | 17          | 5'-4"  |         |
| 5832                                                                  | 3           | 4'-3"  |         |
| #5                                                                    | 4           | 10'-9" |         |
| #5                                                                    | 6           | 8'-0"  |         |
| #5                                                                    | 14          | 6'-0"  |         |
| #5                                                                    | 3           | 4'-3"  |         |
| Total Epoxy-Coated Reinforcing Steel                                  |             |        | 775 LBS |
| MISCELLANEOUS                                                         |             |        |         |
| Concrete, Class C                                                     |             |        | 1.9 CYS |
| Surface Seal                                                          |             |        | 131 SFT |



ELEVATION



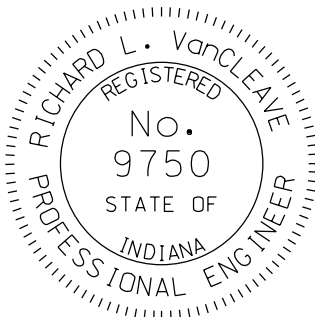
PLAN

INDIANA DEPARTMENT OF TRANSPORTATION

CONCRETE BRIDGE RAILING  
TRANSITION, TPS-2

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-TTPP-07

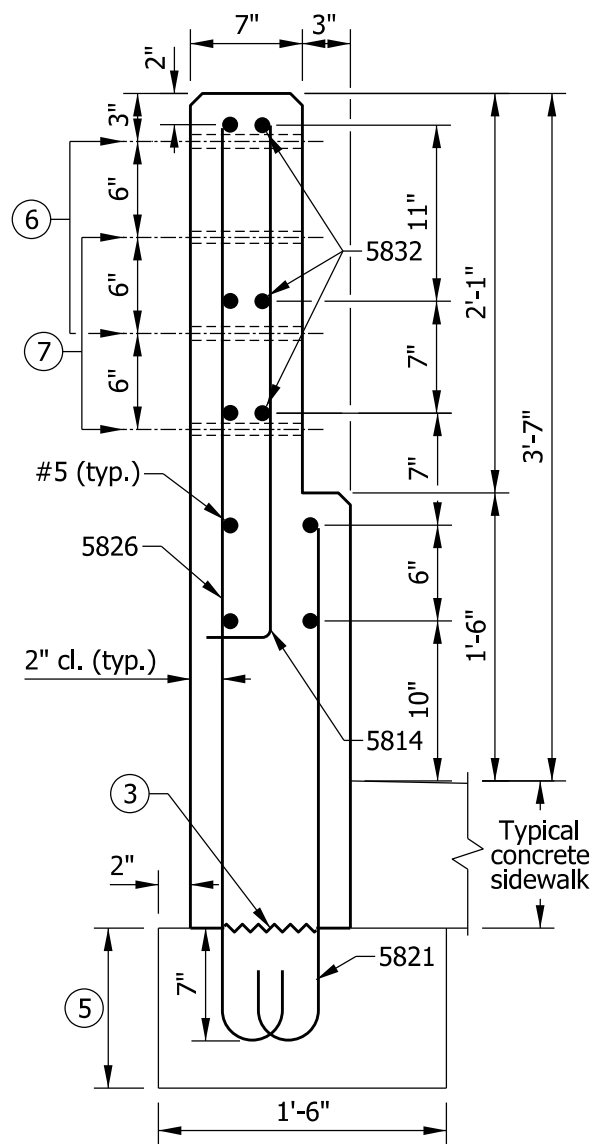


/s/ Richard L. VanCleave 09/04/12

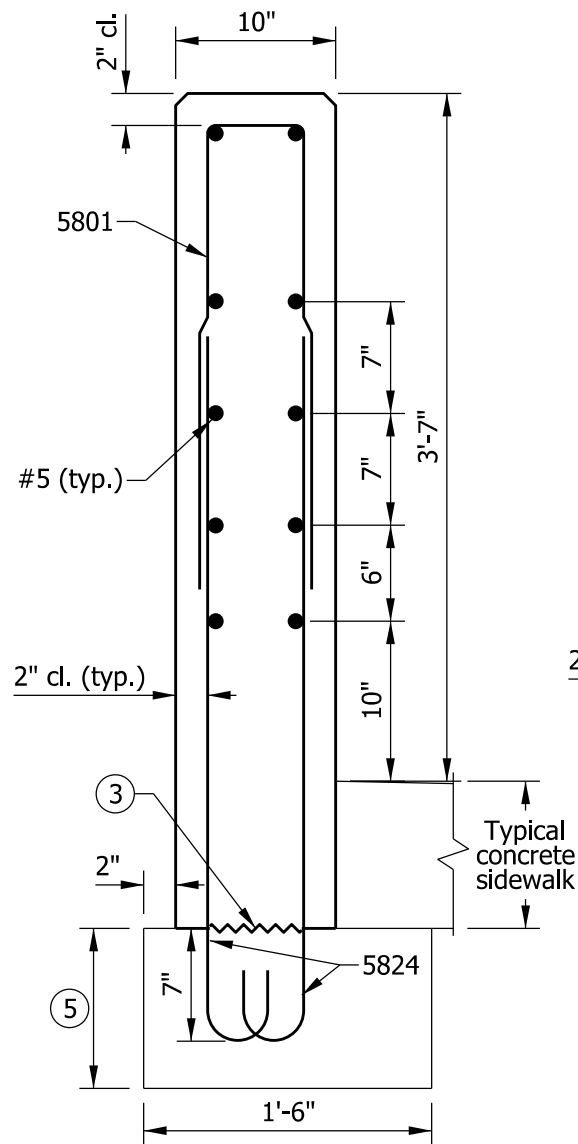
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

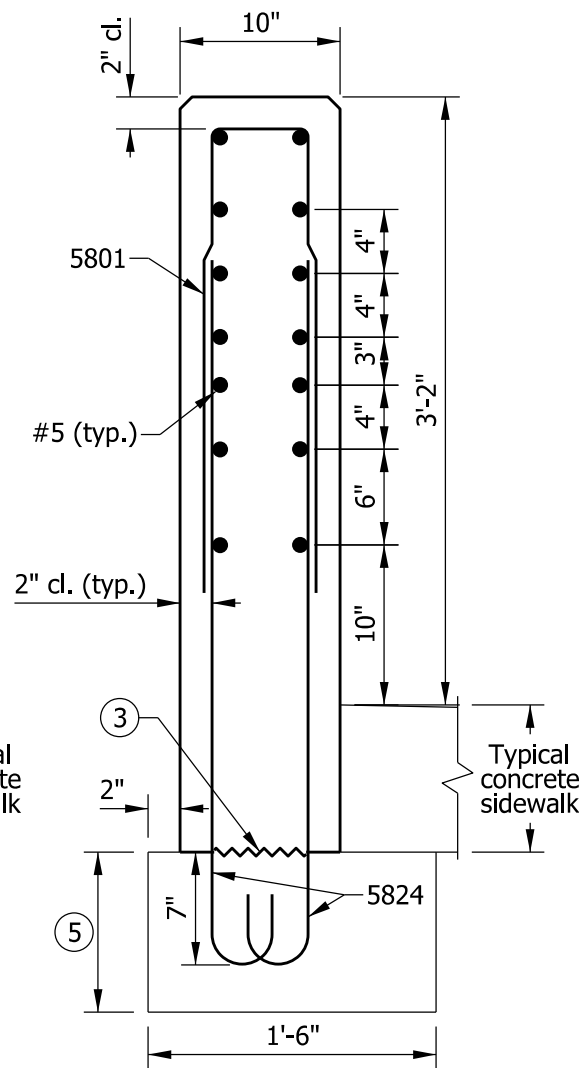
CHIEF ENGINEER DATE



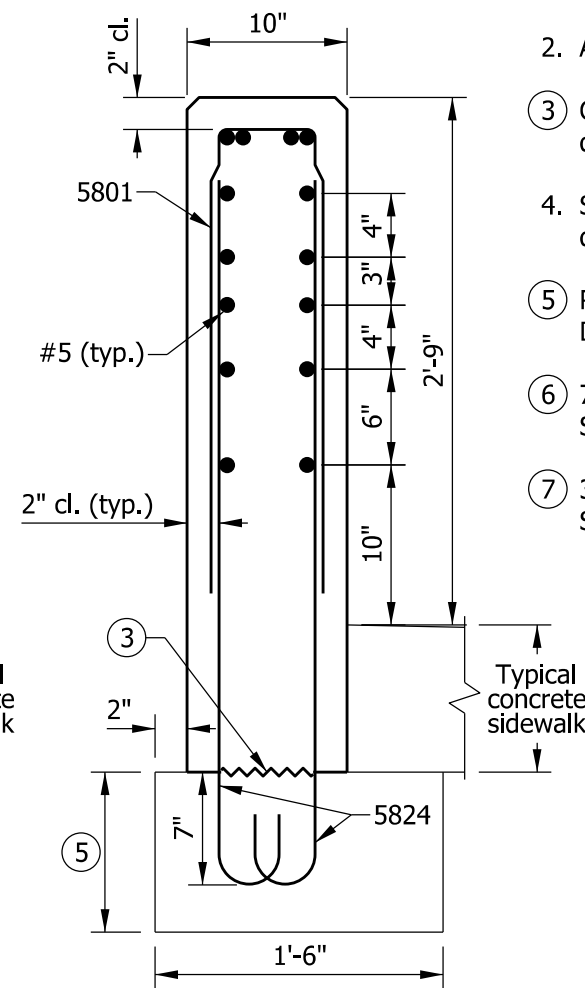
SECTION A-A



SECTION B-B



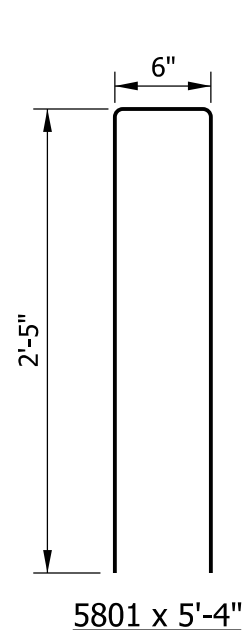
SECTION C-C



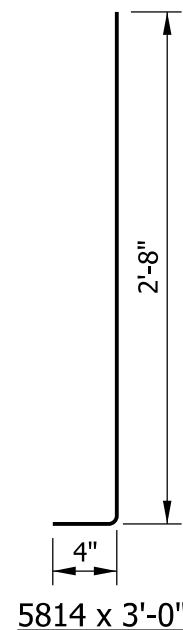
SECTION D-D

## NOTES

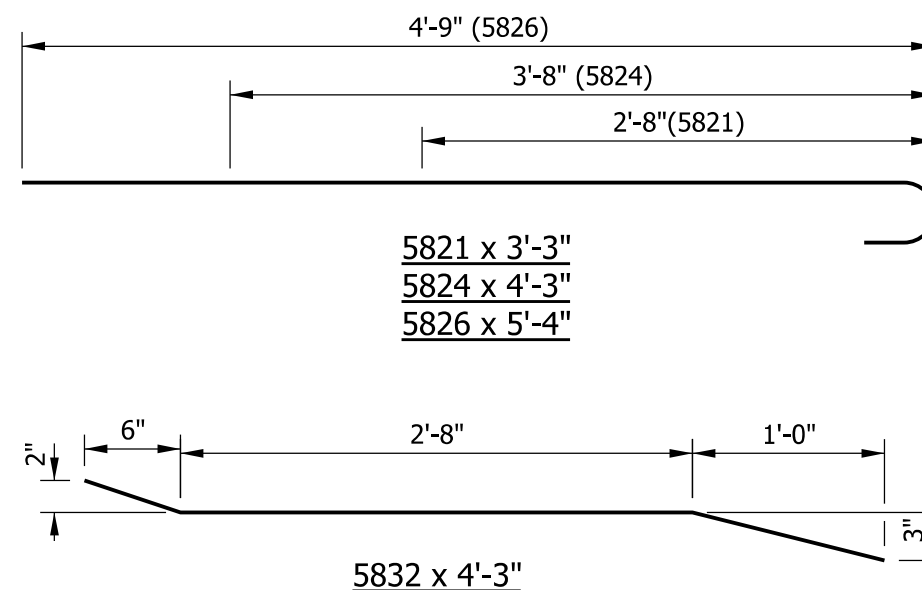
1. See Standard Drawing E 706-TTPP-07 for elevation and plan.
2. All chamfered edges shall be 3/4".
- 3 Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.
4. See Standard Drawing E 703-BRST-01 for reinforcing-bar bending details and notes.
- 5 RCBA extension for bridge railing transition type TPS-2. See Standard Drawing E 609-TBAE-01 for details.
- 6 7/8" Ø hole for attachment of steel bridge railing type PS-2, large rail. See Standard Drawing E 706-BRPP-04 for details.
- 7 3/4" Ø hole for attachment of steel bridge railing type PS-2, small rail. See Standard Drawing E 706-BRPP-04 for details.



5801 x 5'-4"



5814 x 3'-0"



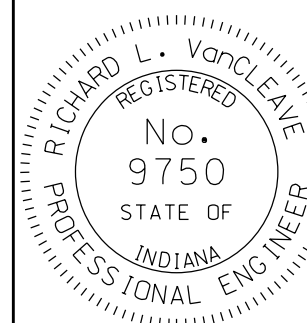
5832 x 4'-3"

INDIANA DEPARTMENT OF TRANSPORTATION

CONCRETE BRIDGE RAILING  
TRANSITION, TPS-2

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-TTPP-08



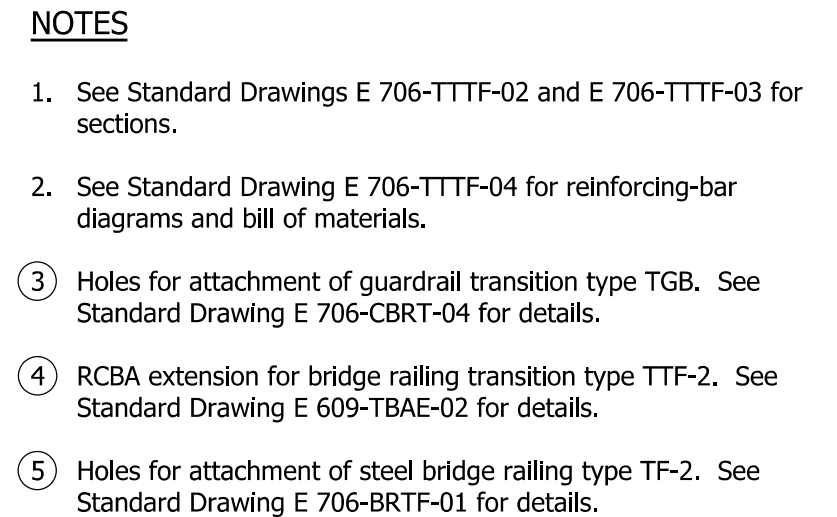
/s/ Richard L. VanCleave 09/04/12

SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE

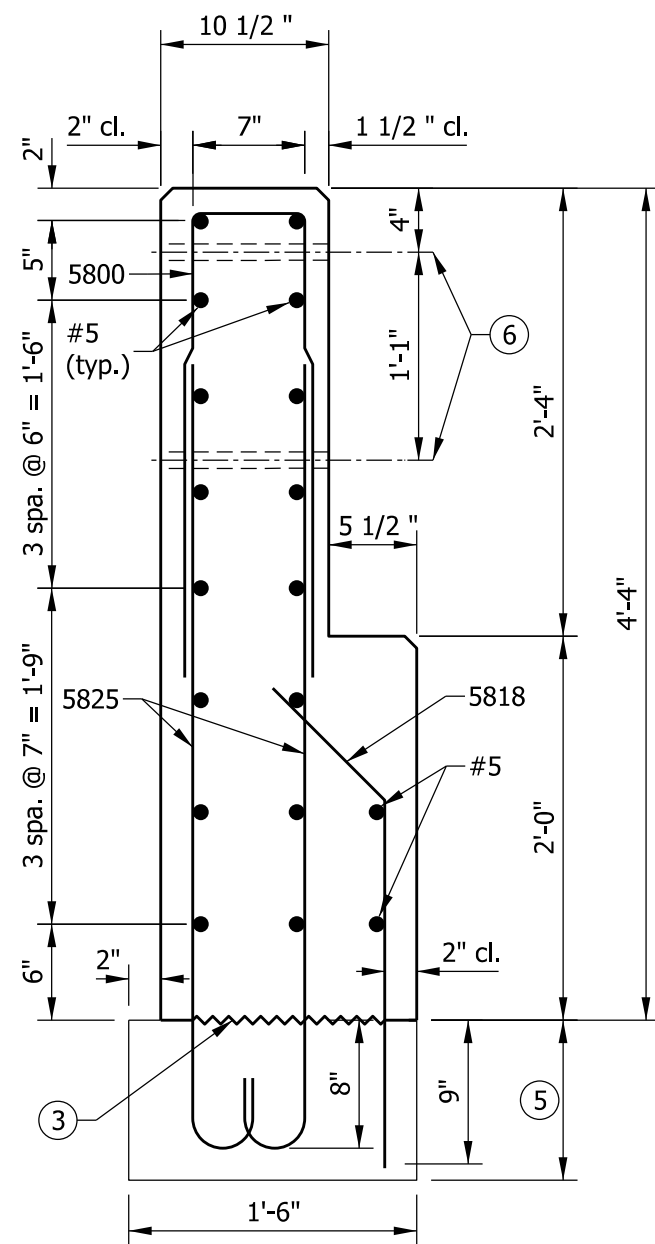




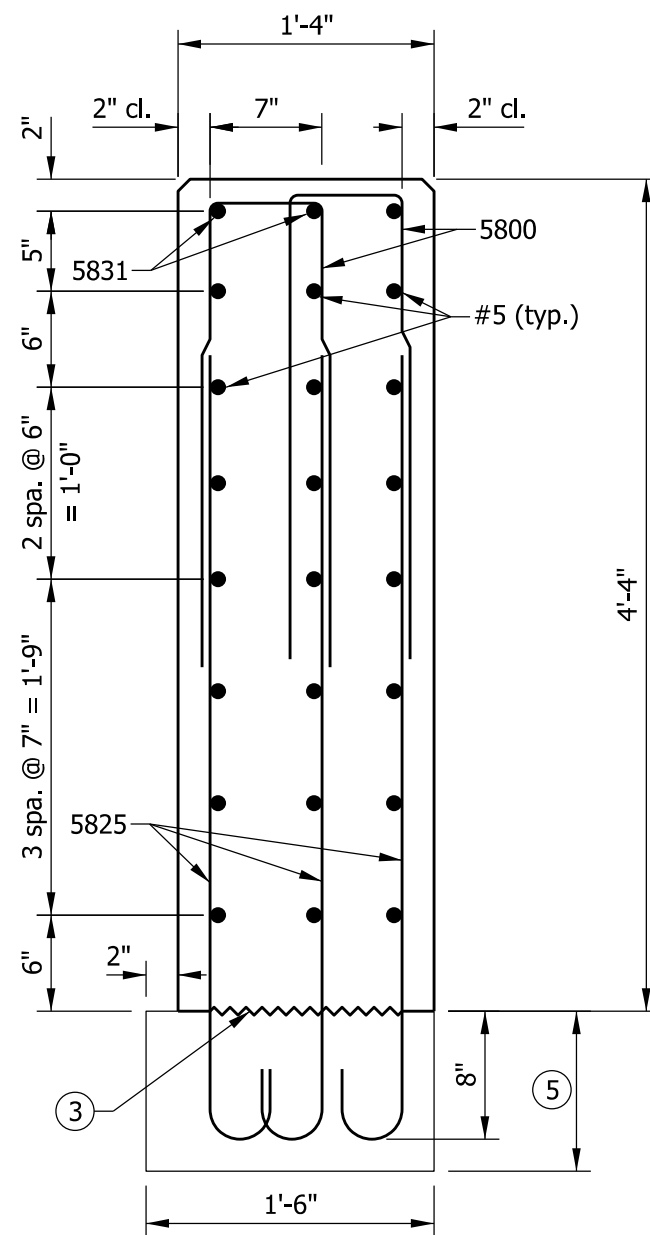
PLAN VIEW

A circular professional engineer seal for Richard L. VanCleave. The outer ring contains the text "RICHARD L. VANCLEAVE" at the top and "PROFESSIONAL ENGINEER" at the bottom, separated by small vertical lines. The inner circle contains the text "REGISTERED" at the top, "No. 9750" in the center, "STATE OF" below the number, and "INDIANA" at the bottom. The seal is surrounded by a dashed circular border.

CHIEF ENGINEER \_\_\_\_\_ DATE \_\_\_\_\_



SECTION A-A



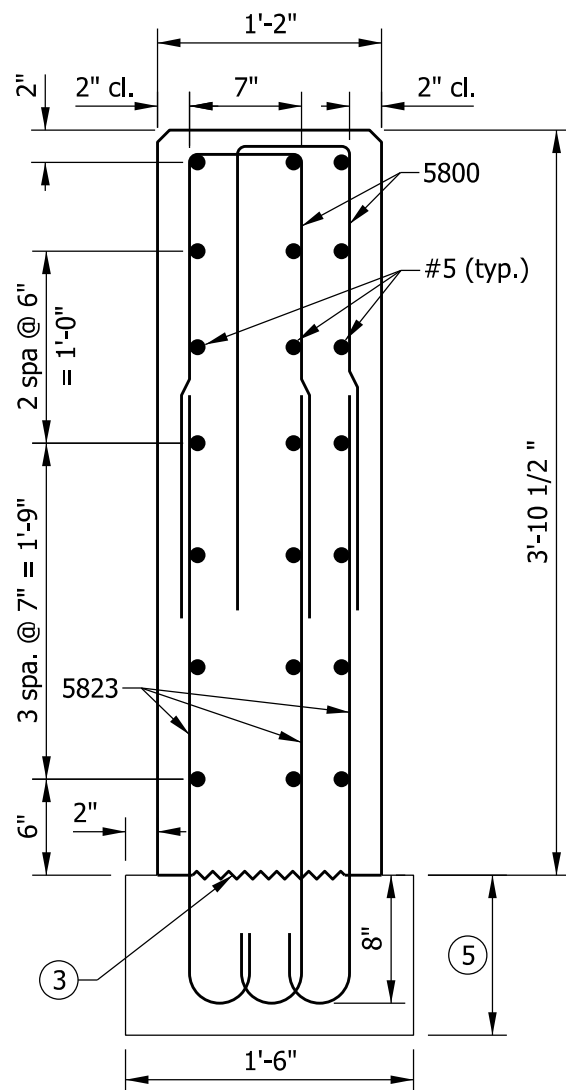
SECTION B-B

## NOTES

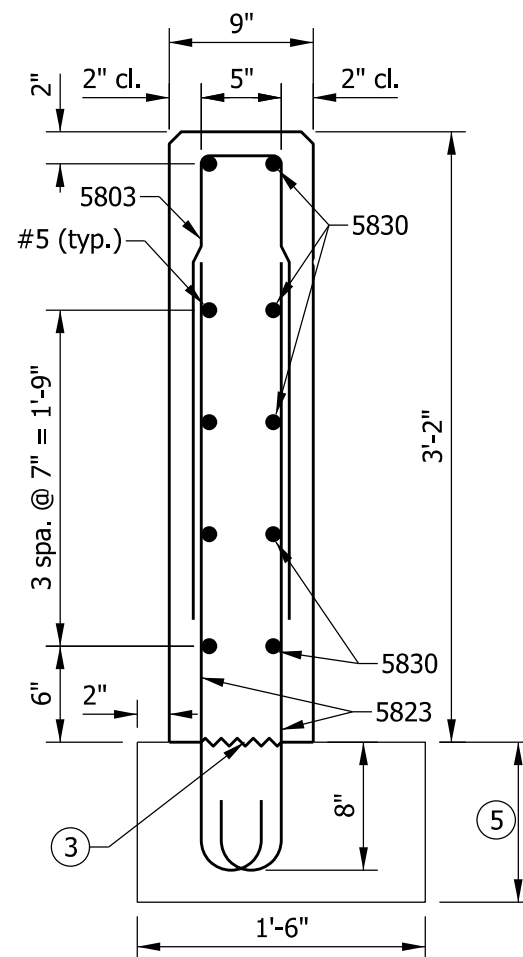
1. See Standard Drawing E 706-TTTF-01 for elevation and plan.
2. All chamfered edges shall be 3/4".
- ③ 3. Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.
4. See Standard Drawing E 706-TTTF-04 for reinforcing-bar diagrams.
- ⑤ 5. RCBA extension for bridge railing transition type TTF-2. See Standard Drawing E 609-TBAE-02 for details.
- ⑥ 6. 1" Ø hole for attachment of steel bridge railing type TF-2. See Standard Drawing E 706-BRTF-01 for details.

|                                                                                       |                                                                                                                                                                                                                                                                      |                                 |                 |                               |      |                           |                 |                |      |
|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-----------------|-------------------------------|------|---------------------------|-----------------|----------------|------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                                                                                                                      |                                 |                 |                               |      |                           |                 |                |      |
| CONCRETE BRIDGE RAILING<br>TRANSITION, TTF-2                                          |                                                                                                                                                                                                                                                                      |                                 |                 |                               |      |                           |                 |                |      |
| SEPTEMBER 2012                                                                        |                                                                                                                                                                                                                                                                      |                                 |                 |                               |      |                           |                 |                |      |
| STANDARD DRAWING NO. E 706-TTTF-02                                                    |                                                                                                                                                                                                                                                                      |                                 |                 |                               |      |                           |                 |                |      |
|  | <table><tr><td><i>/s/ Richard L. VanCleave</i></td><td><i>09/04/12</i></td></tr><tr><td>SUPERVISOR, ROADWAY STANDARDS</td><td>DATE</td></tr><tr><td><i>/s/ Mark A. Miller</i></td><td><i>09/04/12</i></td></tr><tr><td>CHIEF ENGINEER</td><td>DATE</td></tr></table> | <i>/s/ Richard L. VanCleave</i> | <i>09/04/12</i> | SUPERVISOR, ROADWAY STANDARDS | DATE | <i>/s/ Mark A. Miller</i> | <i>09/04/12</i> | CHIEF ENGINEER | DATE |
| <i>/s/ Richard L. VanCleave</i>                                                       | <i>09/04/12</i>                                                                                                                                                                                                                                                      |                                 |                 |                               |      |                           |                 |                |      |
| SUPERVISOR, ROADWAY STANDARDS                                                         | DATE                                                                                                                                                                                                                                                                 |                                 |                 |                               |      |                           |                 |                |      |
| <i>/s/ Mark A. Miller</i>                                                             | <i>09/04/12</i>                                                                                                                                                                                                                                                      |                                 |                 |                               |      |                           |                 |                |      |
| CHIEF ENGINEER                                                                        | DATE                                                                                                                                                                                                                                                                 |                                 |                 |                               |      |                           |                 |                |      |

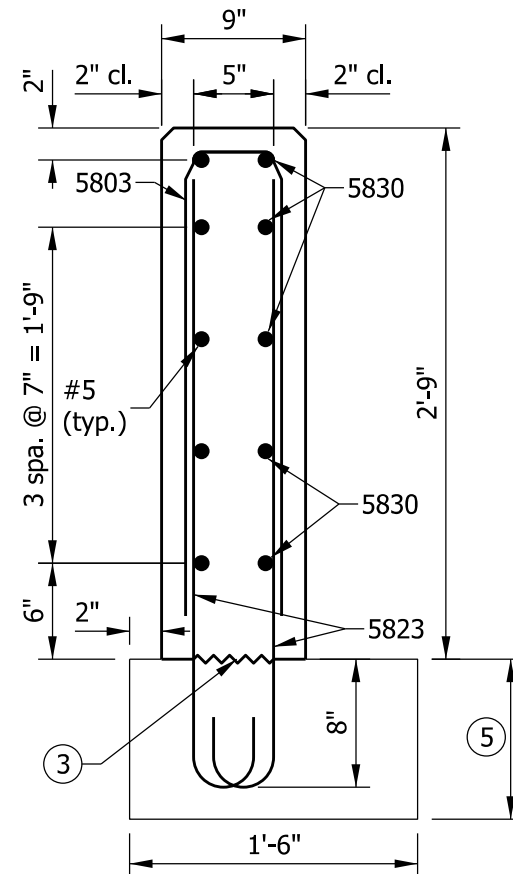




SECTION C-C



SECTION D-D



SECTION E-E

NOTES

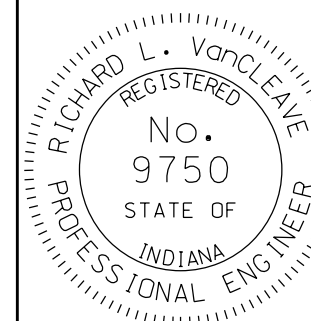
1. See Standard Drawing E 706-TTTF-01 for elevation and plan.
2. All chamfered edges shall be 3/4".
- ③ Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.
4. See Standard Drawing E 706-TTTF-04 for reinforcing-bar diagrams.
- ⑤ RCBA extension for bridge railing transition type TTF-2. See Standard Drawing E 609-TBAE-02 for details.

INDIANA DEPARTMENT OF TRANSPORTATION

CONCRETE BRIDGE RAILING  
TRANSITION, TTF-2

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-TTTF-03

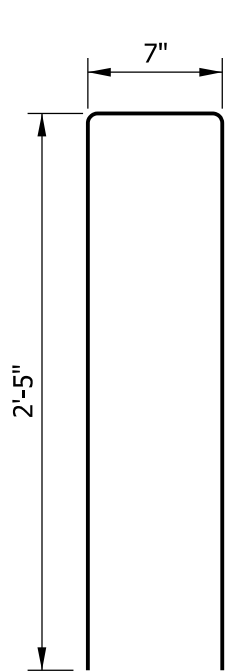


/s/ *Richard L. VanCleave* 09/04/12

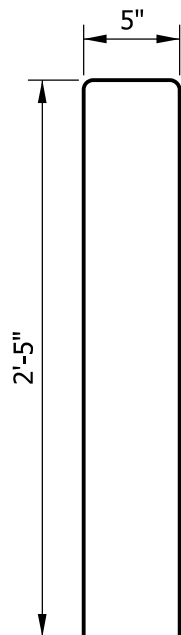
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ *Mark A. Miller* 09/04/12

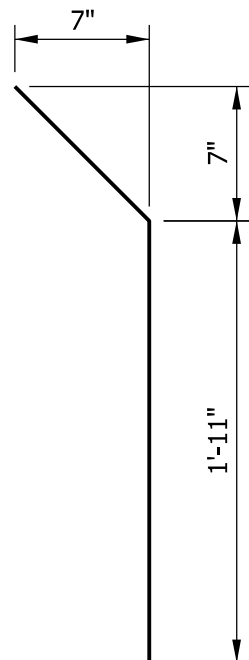
CHIEF ENGINEER DATE



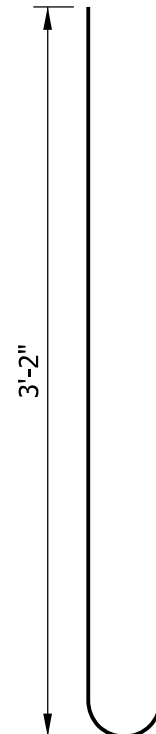
5800 x 5'-5"



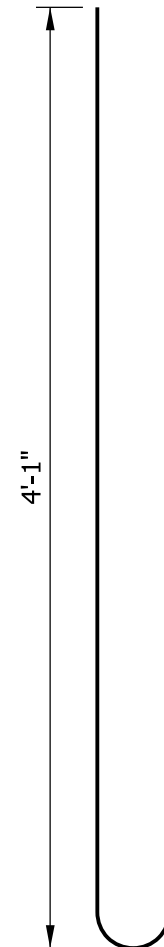
5803 x 5'-3"



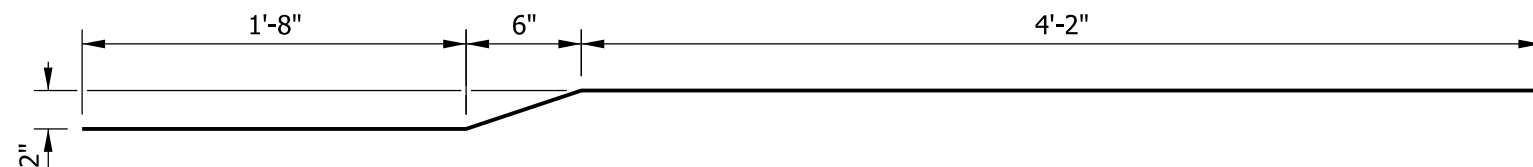
5818 x 2'-9"



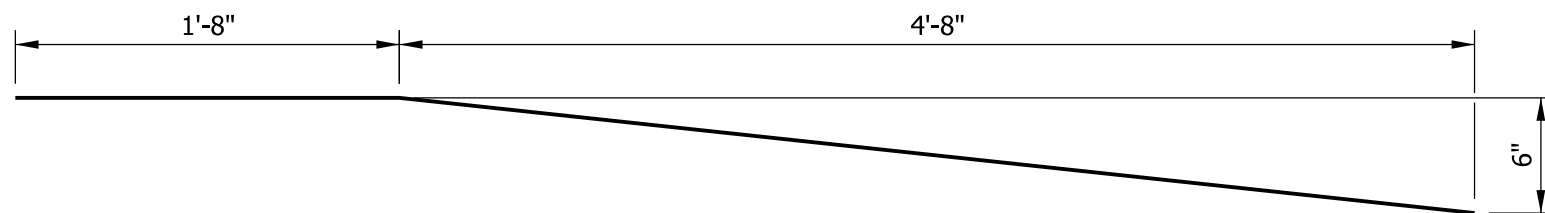
5823 x 3'-9"



5825 x 4'-8"



5830 x 6'-4"



5831 x 6'-4"

NOTE

1. See Standard Drawing E 703-BRST-01 for reinforcing-bar bending details and notes.

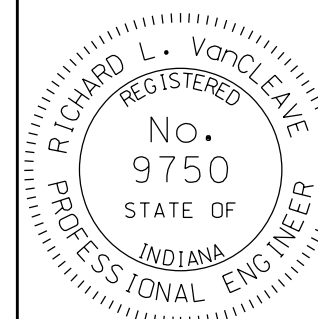
| BILL OF MATERIALS                                                    |             |        |          |
|----------------------------------------------------------------------|-------------|--------|----------|
| Quantities are for one concrete bridge railing transition type TTF-2 |             |        |          |
| EPOXY-COATED REINFORCING STEEL                                       |             |        |          |
| MARK OR SIZE                                                         | NO. OF BARS | LENGTH | WEIGHT   |
| 5800                                                                 | 38          | 5'-5"  |          |
| 5803                                                                 | 13          | 5'-3"  |          |
| 5818                                                                 | 7           | 2'-9"  |          |
| 5823                                                                 | 54          | 3'-9"  |          |
| 5825                                                                 | 35          | 4'-8"  |          |
| 5830                                                                 | 5           | 6'-4"  |          |
| 5831                                                                 | 2           | 6'-4"  |          |
| #5                                                                   | 10          | 15'-0" |          |
| #5                                                                   | 2           | 13'-1" |          |
| #5                                                                   | 6           | 11'-0" |          |
| #5                                                                   | 4           | 8'-0"  |          |
| #5                                                                   | 5           | 6'-4"  |          |
| #5                                                                   | 4           | 4'-0"  |          |
| Total Epoxy-Coated Reinforcing Steel                                 |             |        | 1072 LBS |
| MISCELLANEOUS                                                        |             |        |          |
| Concrete, Class C                                                    |             |        | 2.9 CYS  |
| Surface Seal                                                         |             |        | 182 SFT  |

INDIANA DEPARTMENT OF TRANSPORTATION

CONCRETE BRIDGE RAILING  
TRANSITION, TTF-2

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-TTTF-04

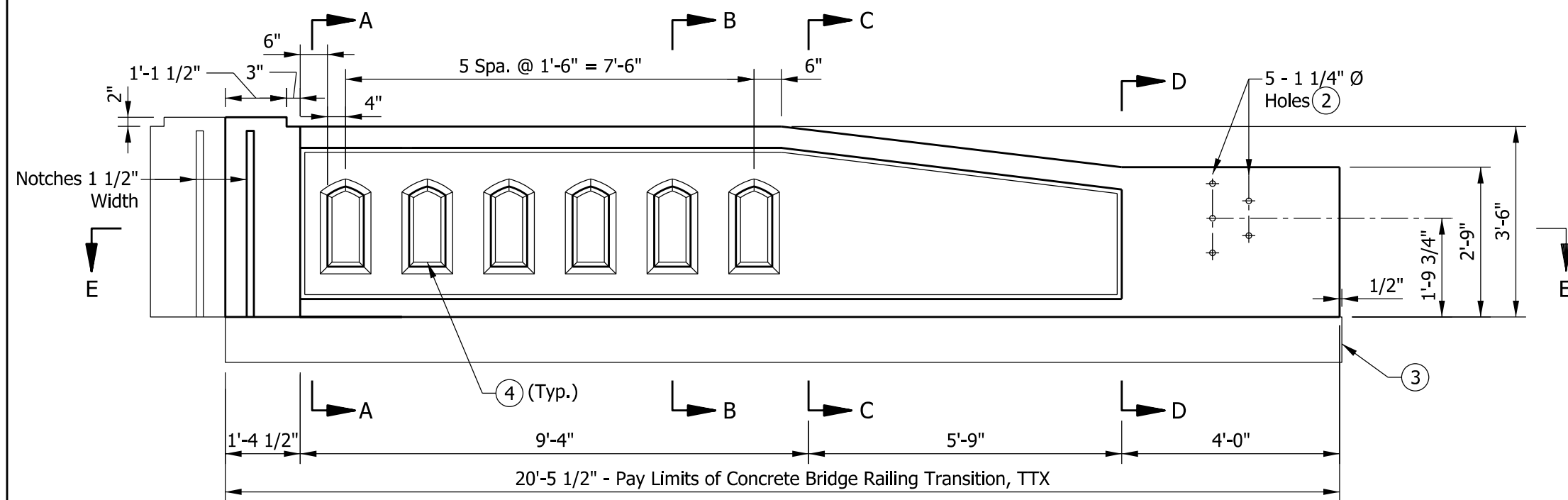


/s/ Richard L. VanCleave 09/04/12

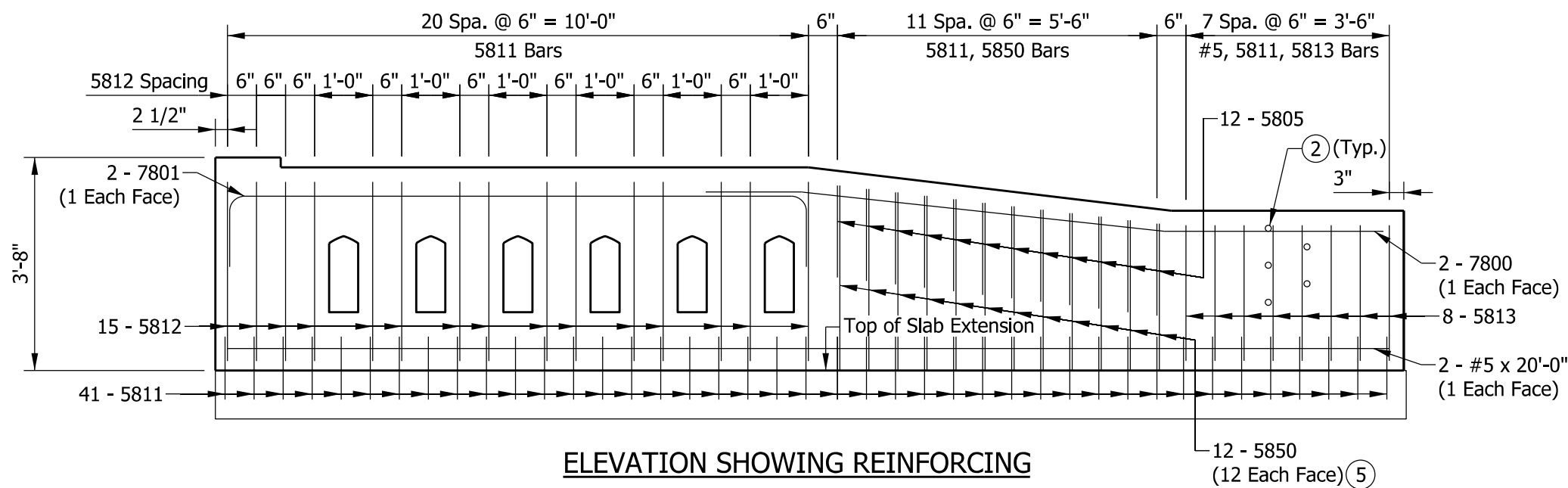
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

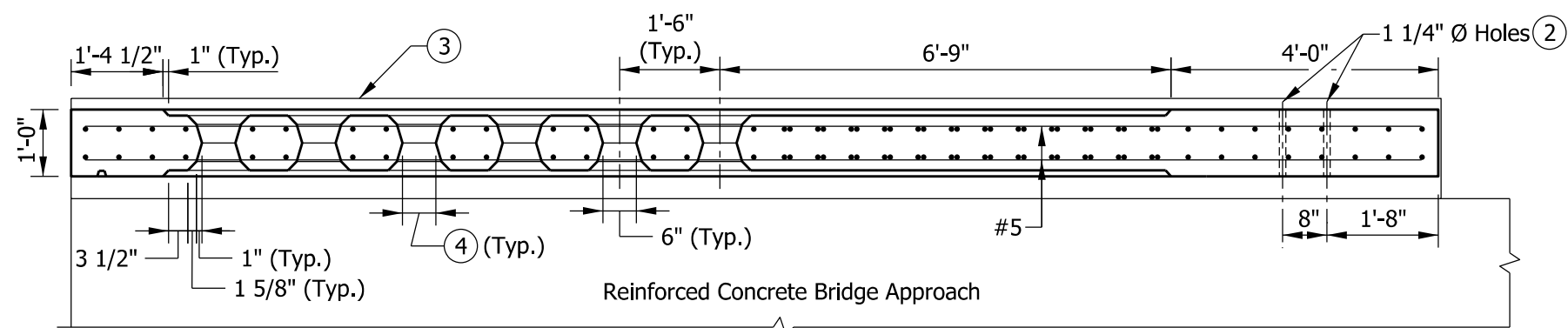
CHIEF ENGINEER DATE



**ELEVATION**



**ELEVATION SHOWING REINFORCING**



**SECTION E-E**

**NOTES:**

- See Standard Drawing E 706-TTXX-02 for sections and reinforcing-bar diagrams.
- Holes for attachment of guardrail transition type TGB. See Standard Drawing E 706-CBRT-04 for details.
- RCBA extension for bridge railing transition type TTX. See Standard Drawing E 609-TBAE-02 for details.
- Window opening. See Standard Drawing E 706-BRTX-02 for details.
- See Standard Drawing E 706-TTXX-02 for reinforcing-bar cutting diagram.

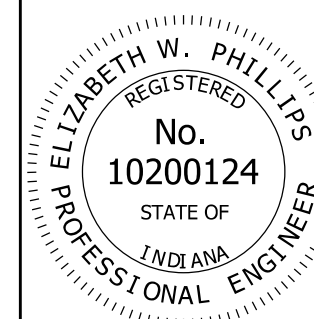
| BILL OF MATERIALS                                                  |             |        |         |
|--------------------------------------------------------------------|-------------|--------|---------|
| Quantities are for one concrete bridge railing transition type TTX |             |        |         |
| EPOXY-COATED REINFORCING BARS                                      |             |        |         |
| MARK OR SIZE                                                       | NO. OF BARS | LENGTH | WEIGHT  |
| 7800                                                               | 2           | 11'-9" |         |
| 7801                                                               | 2           | 12'-4" |         |
| Total #7                                                           |             |        | 98 LBS  |
| 5805                                                               | 12          | 4'-8"  |         |
| 5811                                                               | 41          | 4'-0"  |         |
| 5812                                                               | 15          | 8'-6"  |         |
| 5813                                                               | 8           | 7'-0"  |         |
| 5850                                                               | 12          | 5'-8"  |         |
| #5                                                                 | 2           | 20'-0" |         |
| Total #5                                                           |             |        | 538 LBS |
| Total Epoxy-Coated Reinforcing Bars                                |             |        | 636 LBS |
| MISCELLANEOUS                                                      |             |        |         |
| Concrete, Class C                                                  |             |        | 2.0 CYS |
| Surface Seal                                                       |             |        | 149 SFT |

**INDIANA DEPARTMENT OF TRANSPORTATION**

**CONCRETE BRIDGE RAILING  
TRANSITION, TTX**

**SEPTEMBER 2014**

**STANDARD DRAWING NO. E 706-TTXX-01**

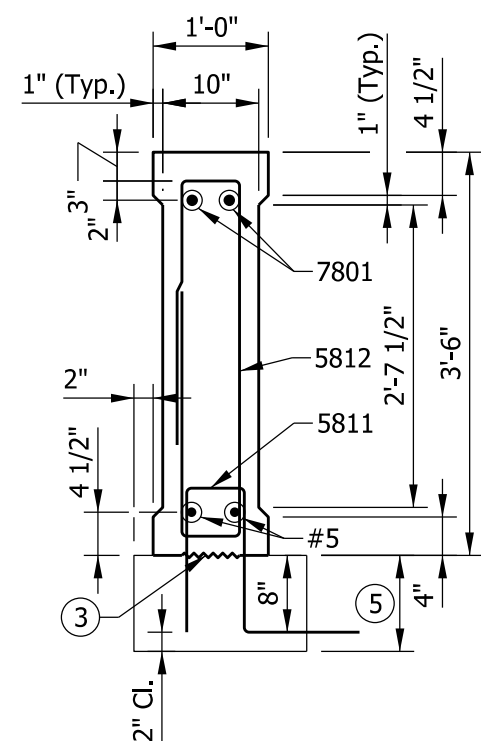


/s/ Elizabeth W. Phillips 09/23/13

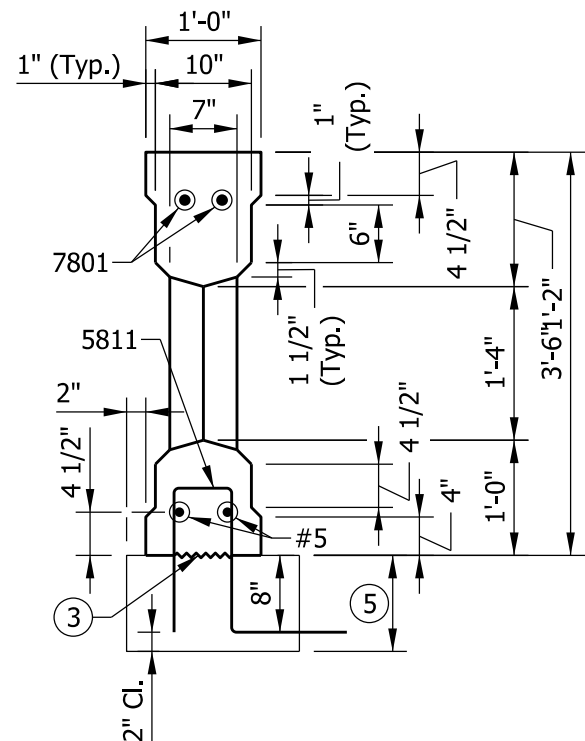
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller 09/26/13

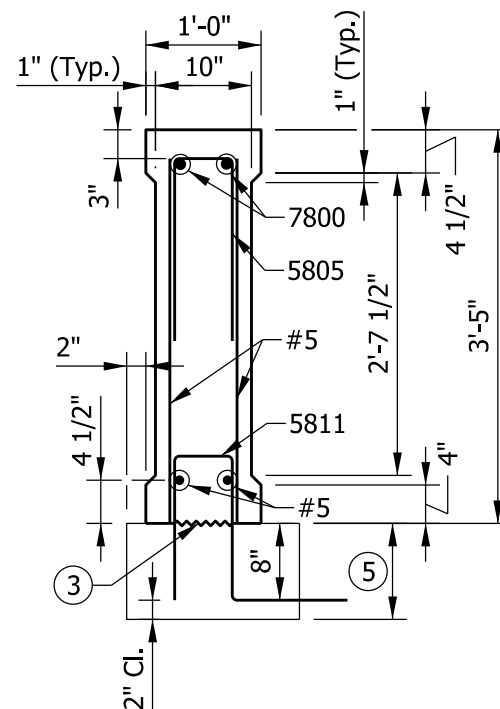
CHIEF ENGINEER DATE



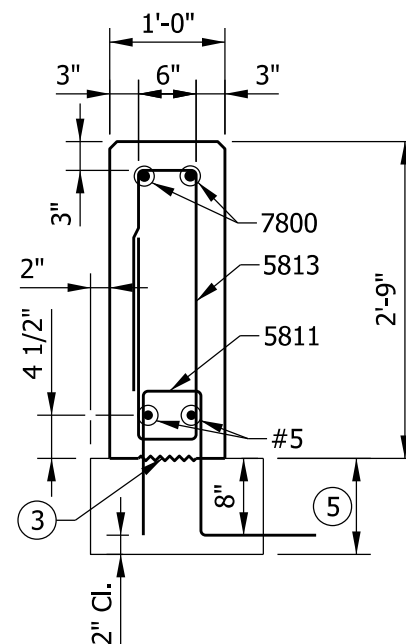
**SECTION A-A**



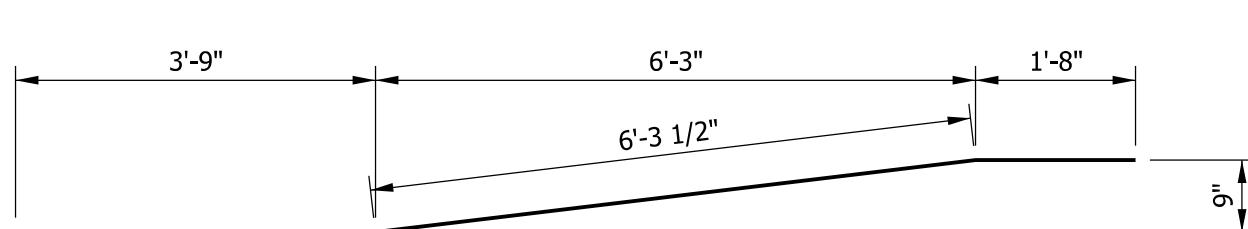
**SECTION B-B**



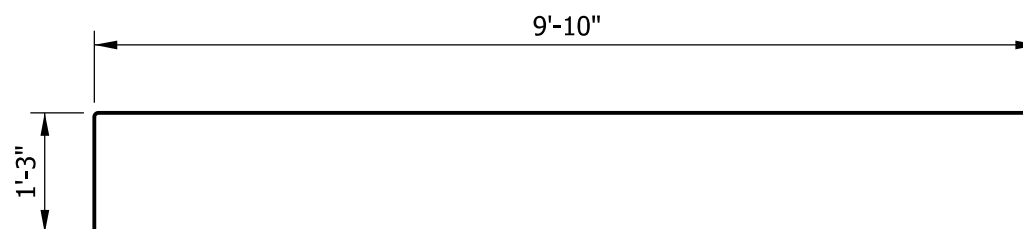
**SECTION C-C**



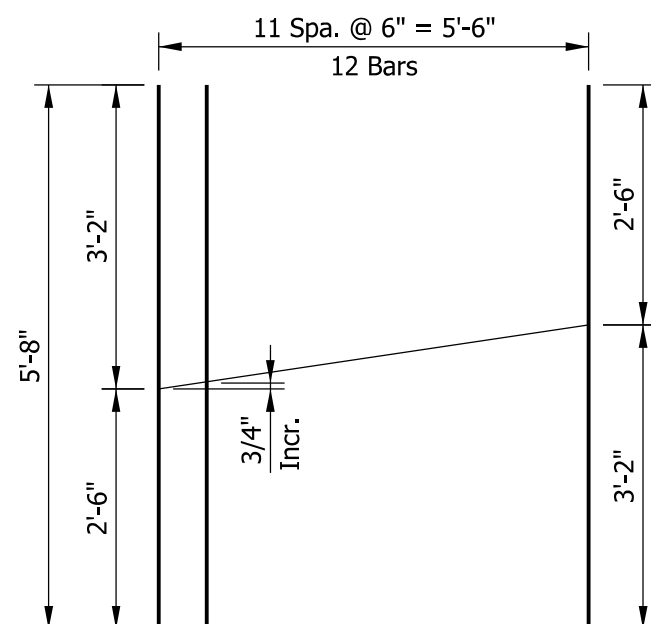
**SECTION D-D**



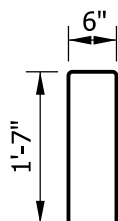
**7800 x 11'-9"**



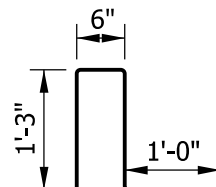
**7801 x 12'-4"**



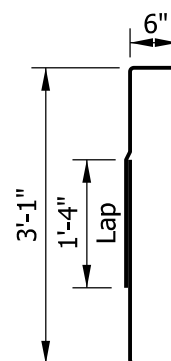
**5850 x 5'-8"**  
(1 Bar Cuts 2)



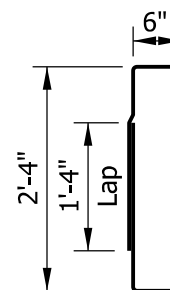
**5805 x 4'-8"**



**5811 x 4'-0"**



**5812 x 8'-6"**



**5813 x 7'-0"**

## NOTES:

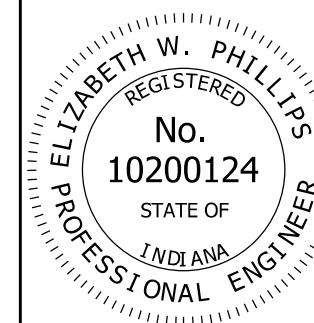
1. See Standard Drawing E 706-TTXX-01 for elevations and plan.
2. All chamfered edges shall be 3/4".
3. Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.
4. See Standard Drawing E 703-BRST-01 for reinforcing-bar bending details and notes.
5. RCBA extension for bridge railing transition type TTX. See Standard Drawing E 609-TBAE-02 for details.

INDIANA DEPARTMENT OF TRANSPORTATION

CONCRETE BRIDGE RAILING  
TRANSITION, TTX

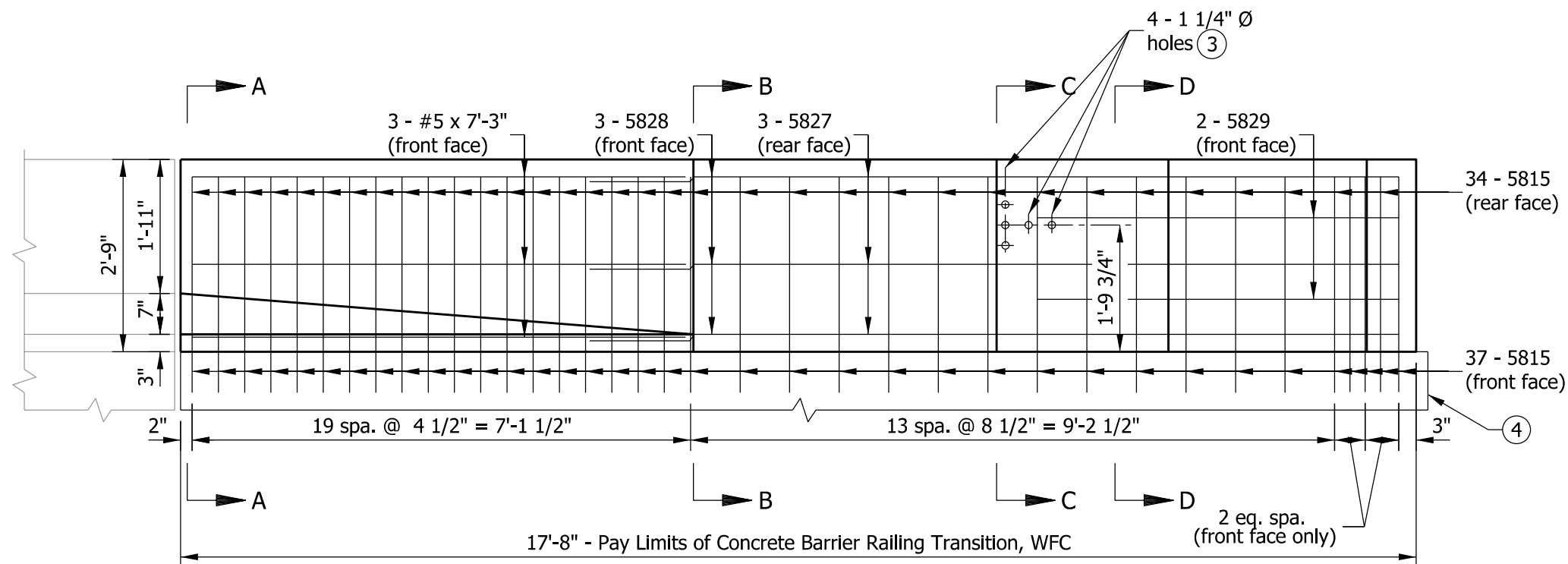
SEPTEMBER 2014

STANDARD DRAWING NO. E 706-TTXX-02

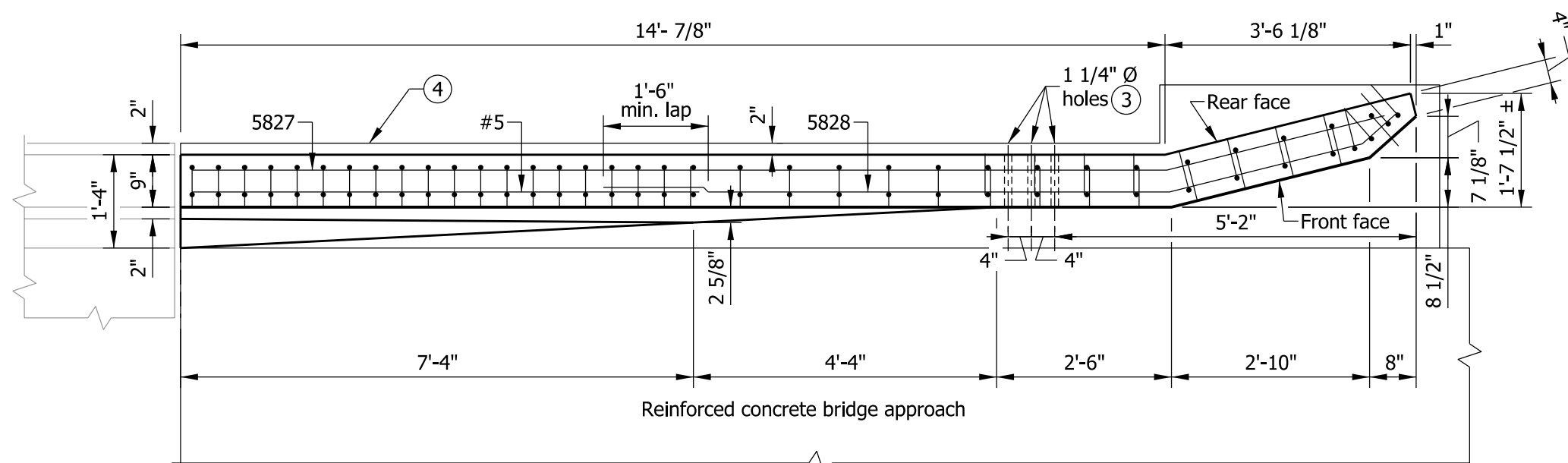


/s/ Elizabeth W. Phillips 09/23/13  
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller 09/26/13  
CHIEF ENGINEER DATE



**ELEVATION**



**PLAN**

**NOTES**

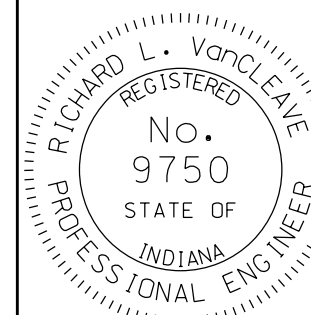
1. See Standard Drawing E 706-TWFC-02 for sections.
2. See Standard Drawing E 706-TWFC-03 for reinforcing-bar diagrams and bill of materials.
- ③ Holes for attachment of guardrail transition type WGB. See Standard Drawing E 706-CBRT-02 for details.
- ④ RCBA extension for bridge railing transition type WFC. See Standard Drawing E 609-TBAE-03 for details.

INDIANA DEPARTMENT OF TRANSPORTATION

CONCRETE BRIDGE RAILING  
TRANSITION TYPE WFC

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-TWFC-01

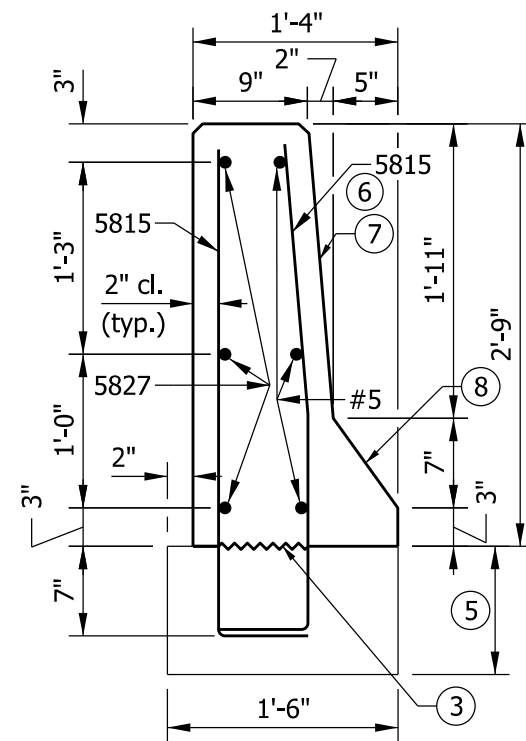


/s/ *Richard L. VanCleave* 09/04/12

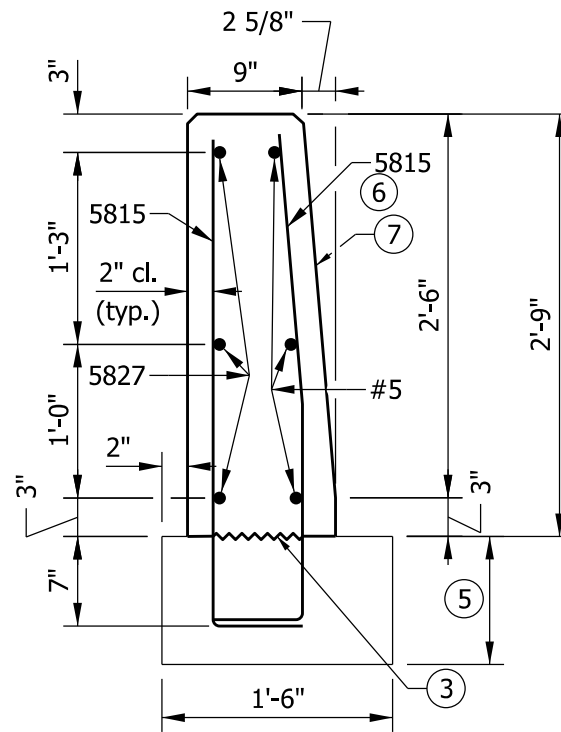
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ *Mark A. Miller* 09/04/12

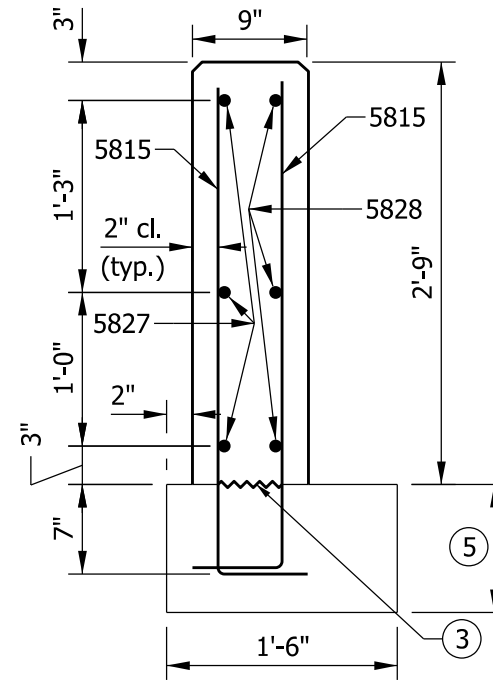
CHIEF ENGINEER DATE



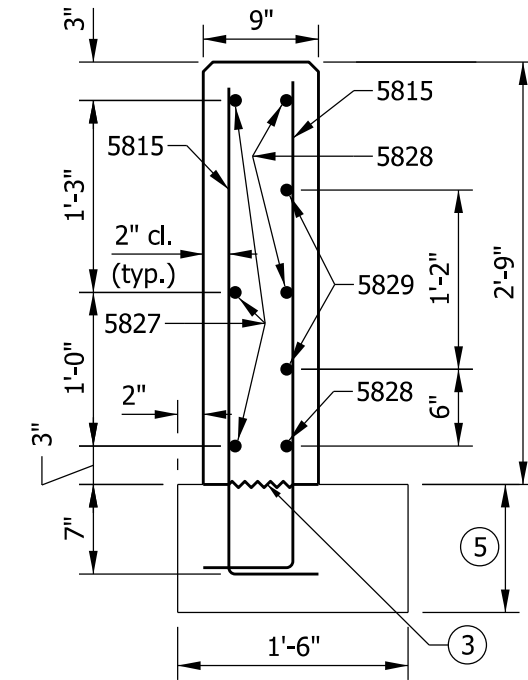
SECTION A-A



SECTION B-B



SECTION C-C



SECTION D-D

## NOTES

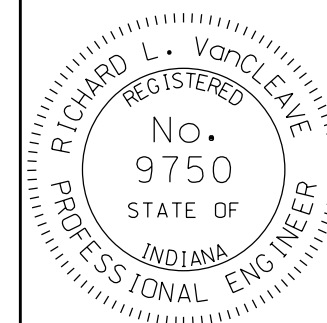
- See Standard Drawing E 706-TWFC-01 for elevation and plan.
- All chamfered edges shall be 3/4".
- Construction joint type A. See Standard Drawing E 702-CJTA-01 for details.
- See Standard Drawing E 706-TWFC-03 for reinforcing-bar diagrams.
- RCBA extension for bridge railing transition type WFC. See Standard Drawing E 609-TBAE-03 for details.
- These bars shall be field bent to provide 2" clearance along the front face batter.
- Constant 1:11 batter.
- Constant 5:7 batter.

INDIANA DEPARTMENT OF TRANSPORTATION

CONCRETE BRIDGE RAILING  
TRANSITION TYPE WFC

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-TWFC-02



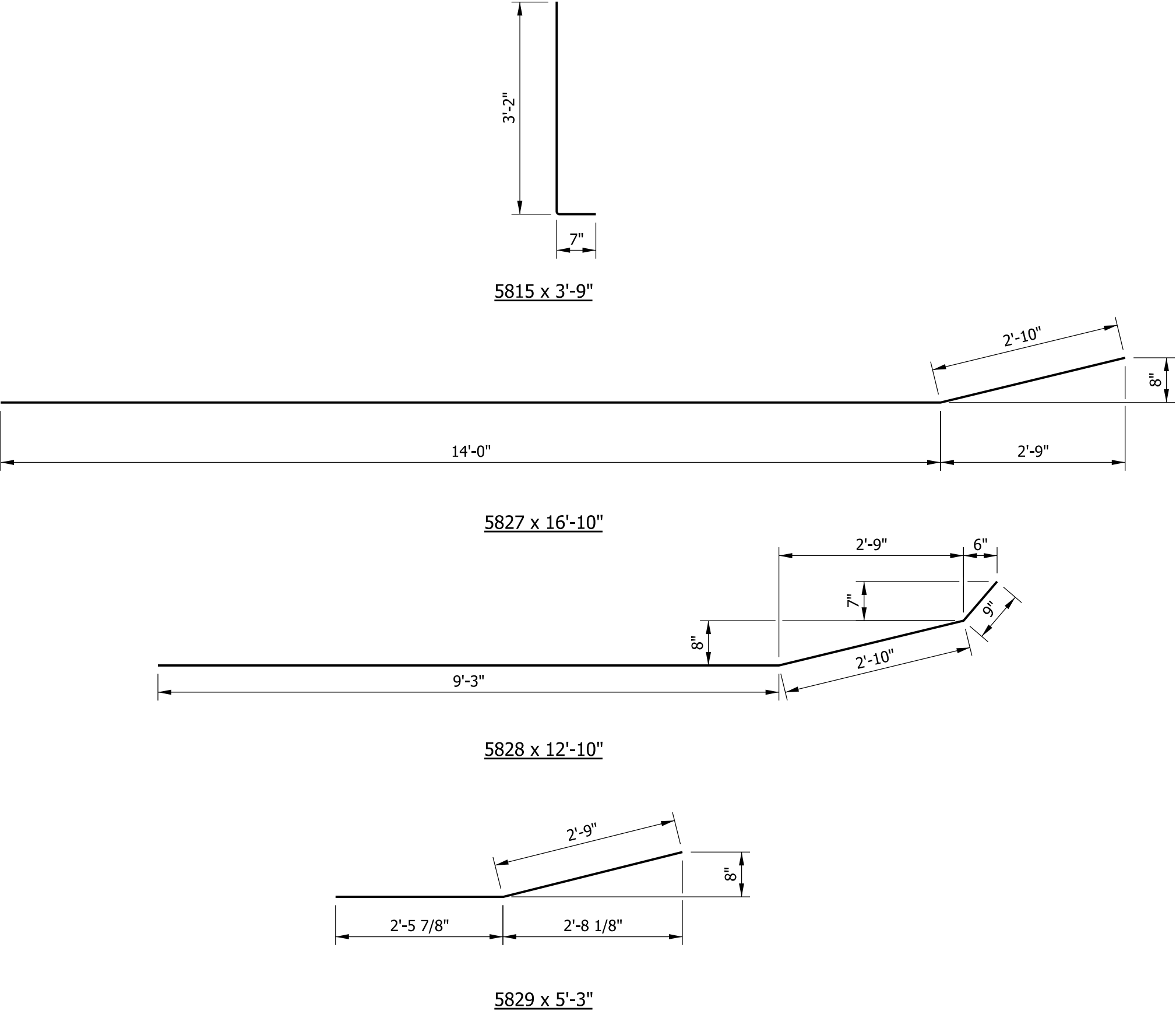
/s/ Richard L. VanCleave 09/04/12

SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE





NOTE

1. See Standard Drawing E 703-BRST-01 for reinforcing-bar bending details and notes.

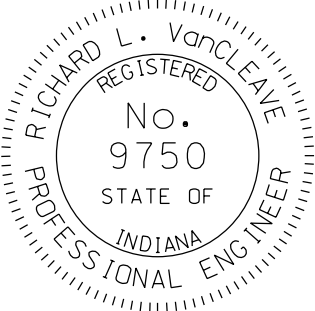
| BILL OF MATERIALS                                                  |             |         |         |
|--------------------------------------------------------------------|-------------|---------|---------|
| Quantities are for one concrete bridge railing transition type WFC |             |         |         |
| EPOXY-COATED REINFORCING STEEL                                     |             |         |         |
| MARK OR SIZE                                                       | NO. OF BARS | LENGTH  | WEIGHT  |
| 5815                                                               | 71          | 3'-9"   |         |
| 5827                                                               | 3           | 16'-10" |         |
| 5828                                                               | 3           | 12'-10" |         |
| 5829                                                               | 2           | 5'-3"   |         |
| #5                                                                 | 3           | 7'-3"   |         |
| Total Epoxy-Coated Reinforcing Steel                               |             |         | 404 LBS |
| MISCELLANEOUS                                                      |             |         |         |
| Concrete, Class C                                                  |             |         | 1.6 CYS |
| Surface Seal                                                       |             |         | 113 SYS |

INDIANA DEPARTMENT OF TRANSPORTATION

CONCRETE BRIDGE RAILING  
TRANSITION TYPE WFC

SEPTEMBER 2012

STANDARD DRAWING NO. E 706-TWFC-03

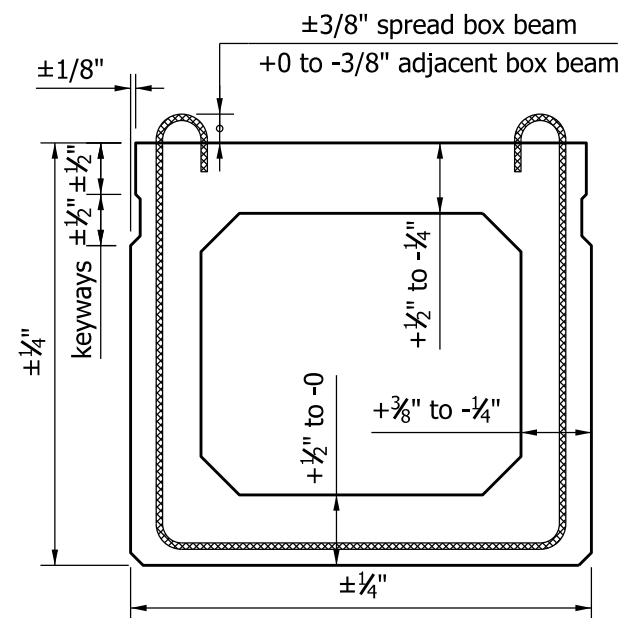
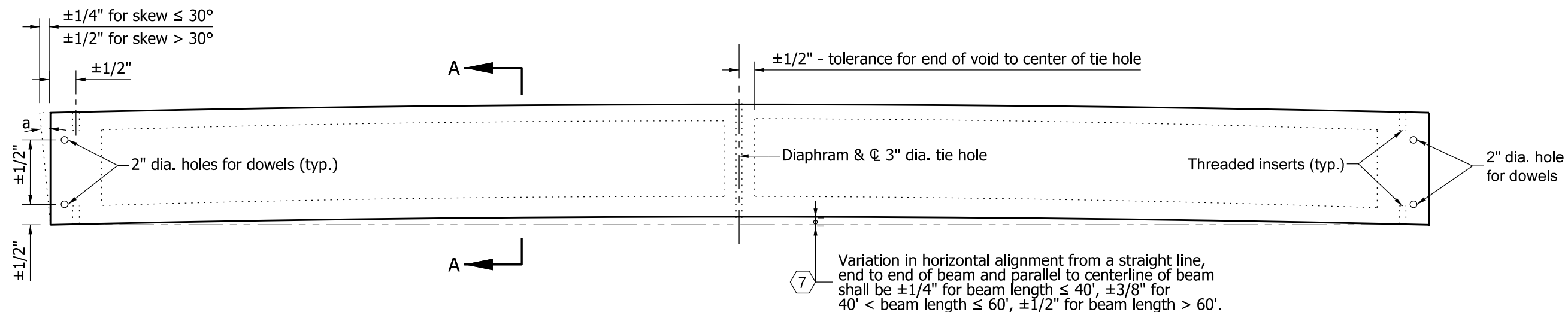
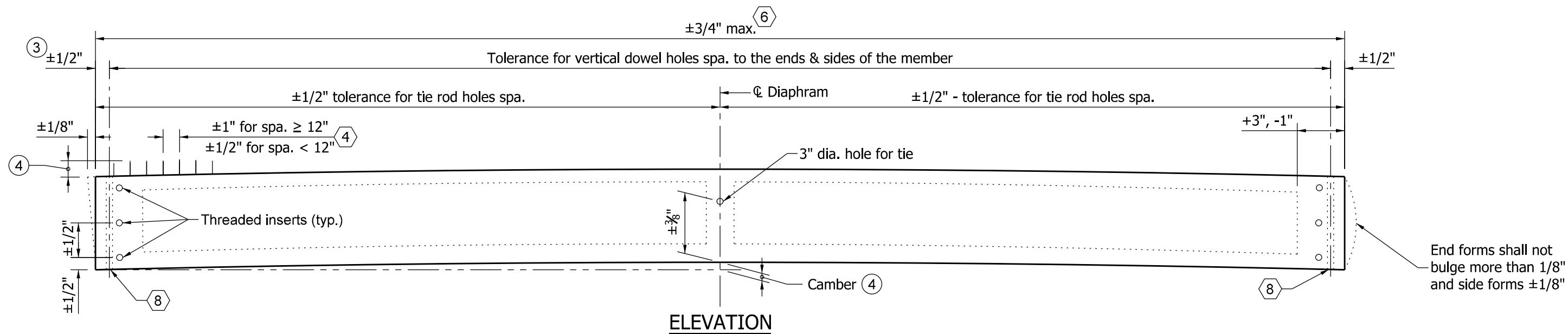


/s/ *Richard L. VanCleave*09/04/12

SUPERVISOR, ROADWAY STANDARDSDATE

/s/ *Mark A. Miller*09/04/12

CHIEF ENGINEERDATE



#### NOTES:

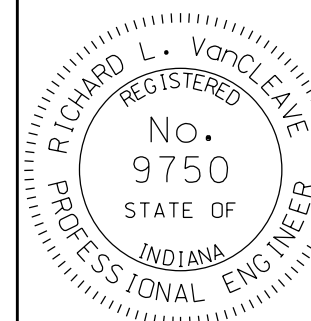
- See Standard Drawing E 707-BPBF-04 for General Notes.
- The top surface of the beam shall not vary more than 1/8" in 10' as measured from a straightedge.
- (3) Tolerance of beam ends for deviation from a true vertical with respect to top and bottom surfaces.
- (4) Projection above top of spread box beam shall be ±3/8". Projection above top of adjacent box beam +0 to -3/8".

INDIANA DEPARTMENT OF TRANSPORTATION

FABRICATION TOLERANCES  
PRESTRESSED BOX BEAM

SEPTEMBER 2012

STANDARD DRAWING NO. E 707-BPBF-01



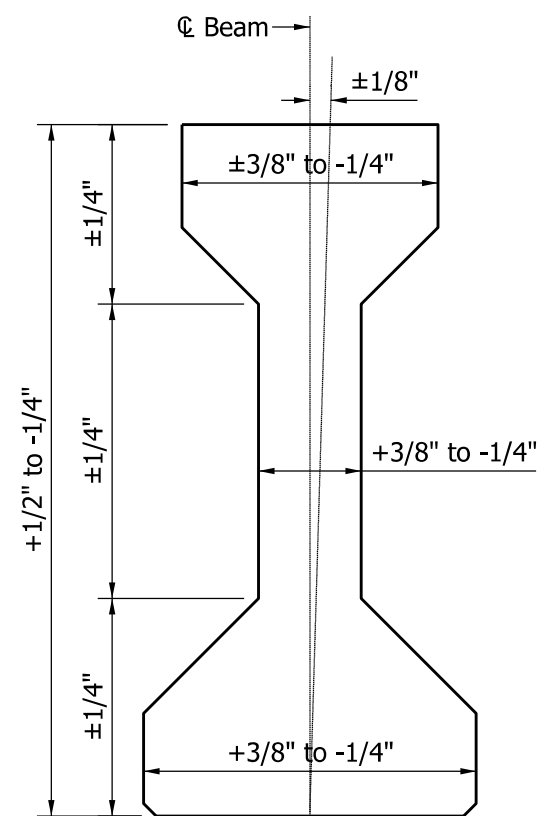
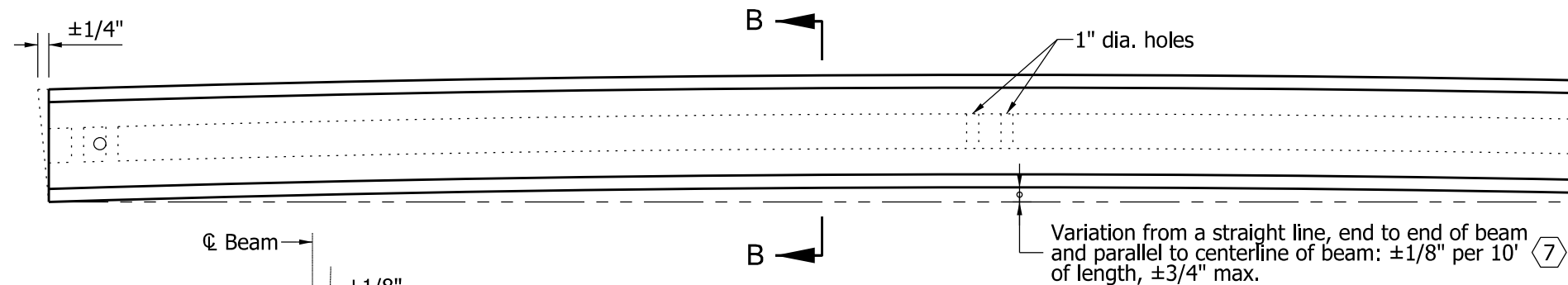
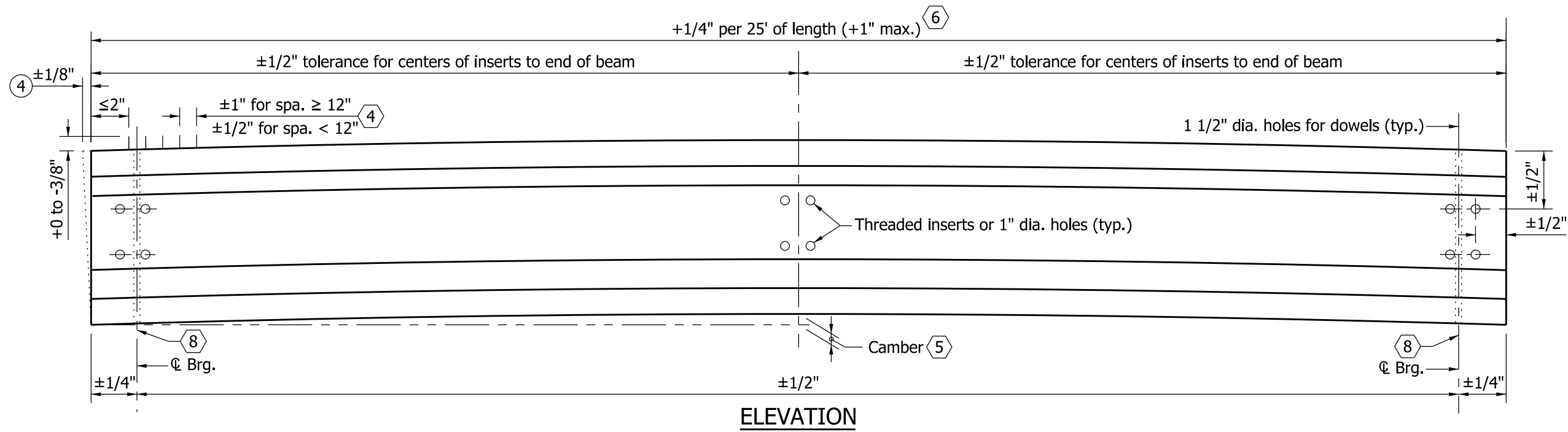
/s/ Richard L. VanCleave 09/04/12

SUPERVISOR, ROADWAY STANDARDS DATE

/s/ Mark A. Miller 09/04/12

CHIEF ENGINEER DATE

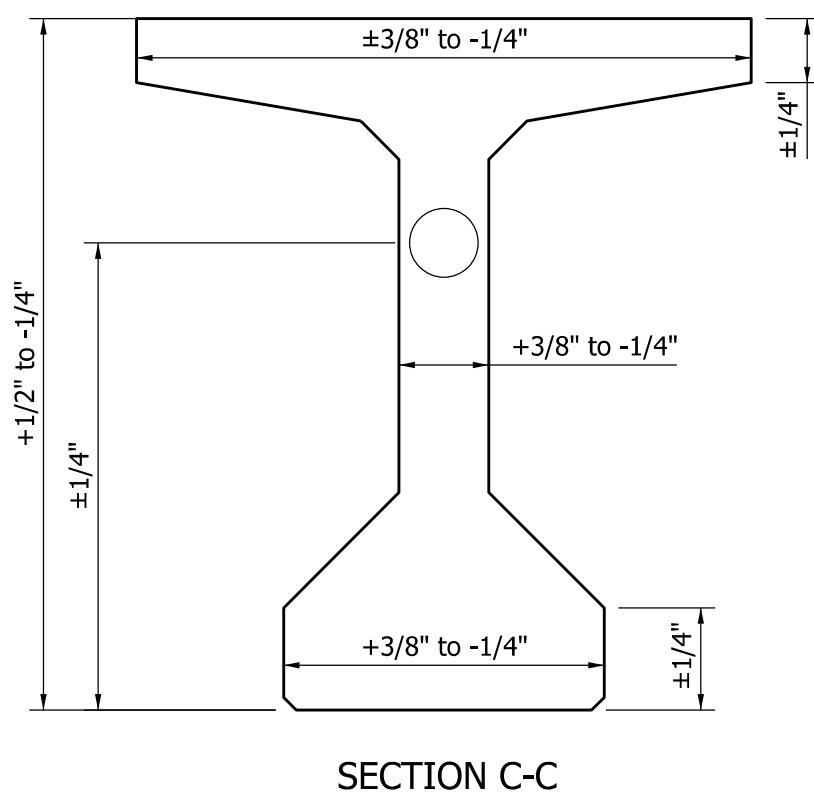
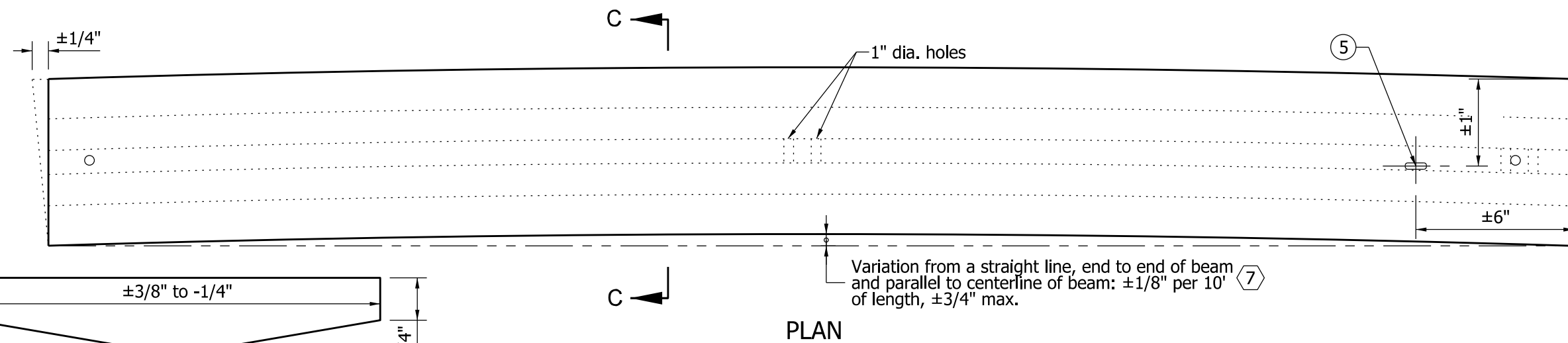
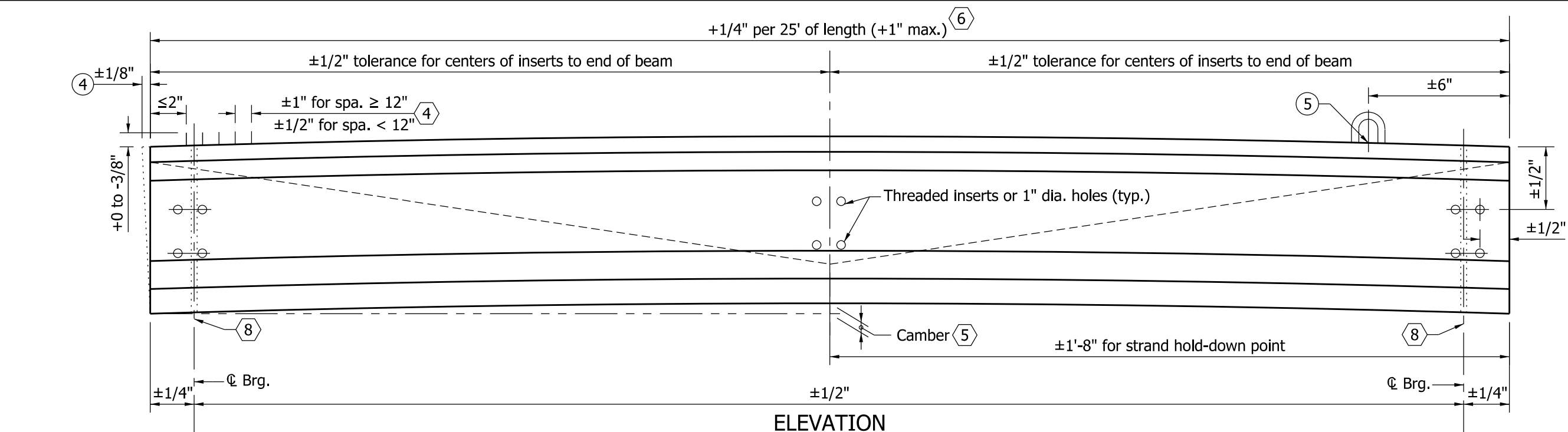




**NOTES:**

1. See Standard Drawing E 707-BPBF-04 for General Notes.
2. Center of gravity of depressed-strands group at the end of beam shall not be more than  $\pm 1/2"$ .
3. Tolerance of position of post-tensioning duct shall be  $\pm 1/4"$ .
4. Horizontal tolerance of beam ends for deviation from a true vertical with respect to top and bottom surfaces. Vertical tolerance shall be  $\pm 1/8"$  per 12" of beam height.

| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                 |               |          |
|---------------------------------------------------------------------------------------|---------------------------------|---------------|----------|
| FABRICATION TOLERANCES<br>PRESTRESSED I BEAM                                          |                                 |               |          |
| SEPTEMBER 2012                                                                        |                                 |               |          |
| STANDARD DRAWING NO.                                                                  |                                 | E 707-BPBF-02 |          |
|  | /s/ <i>Richard L. VanCleave</i> |               | 09/04/12 |
|                                                                                       | SUPERVISOR, ROADWAY STANDARDS   |               | DATE     |
|                                                                                       | /s/ <i>Mark A. Miller</i>       |               | 09/04/12 |
| CHIEF ENGINEER                                                                        |                                 | DATE          |          |



**NOTES:**

1. See Standard Drawing E 707-BPBF-04 for General Notes.
2. Center of gravity of depressed-strands group at the end of beam shall not be more than  $\pm 1/2"$ .
3. Tolerance of position of post-tensioning duct shall be  $\pm 1/4"$ .
- (4) Horizontal tolerance of beam ends for deviation from a true vertical with respect to top and bottom surfaces. Vertical tolerance shall be  $\pm 1/8"$  per 12" of beam height.
- (5) Location of handling device.

|                                                                                       |                                                                                                                                                                      |
|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                      |
| FABRICATION TOLERANCES<br>PRESTRESSED BULB-TEE BEAM                                   |                                                                                                                                                                      |
| SEPTEMBER 2012                                                                        |                                                                                                                                                                      |
| STANDARD DRAWING NO. E 707-BPBF-03                                                    |                                                                                                                                                                      |
|  | <div><div>/s/ Richard L. VanCleave09/04/12</div><div>SUPERVISOR, ROADWAY STANDARDSDATE</div><div>/s/ Mark A. Miller09/04/12</div><div>CHIEF ENGINEERDATE</div></div> |

GENERAL NOTES :

1. Tolerances shown are maximum permissible variations from the dimensions shown on the plans or shop drawings. Tolerances shall not be considered cumulative. Longitudinal tolerances are based on design length. Casting length shall be adjusted to compensate for shrinkage and plastic flow.
2. End stirrup bars shall not be more than 2" from the end of the beam.
3. Mild reinforcing steel concrete cover tolerance shall be 1/8" to +3/8".

4 Tolerances for reinforcing bars for composite beam.

5 Variation of camber shall not be more than 1" on one span nor more than 1/2" between adjacent members to be measured at time of erection.

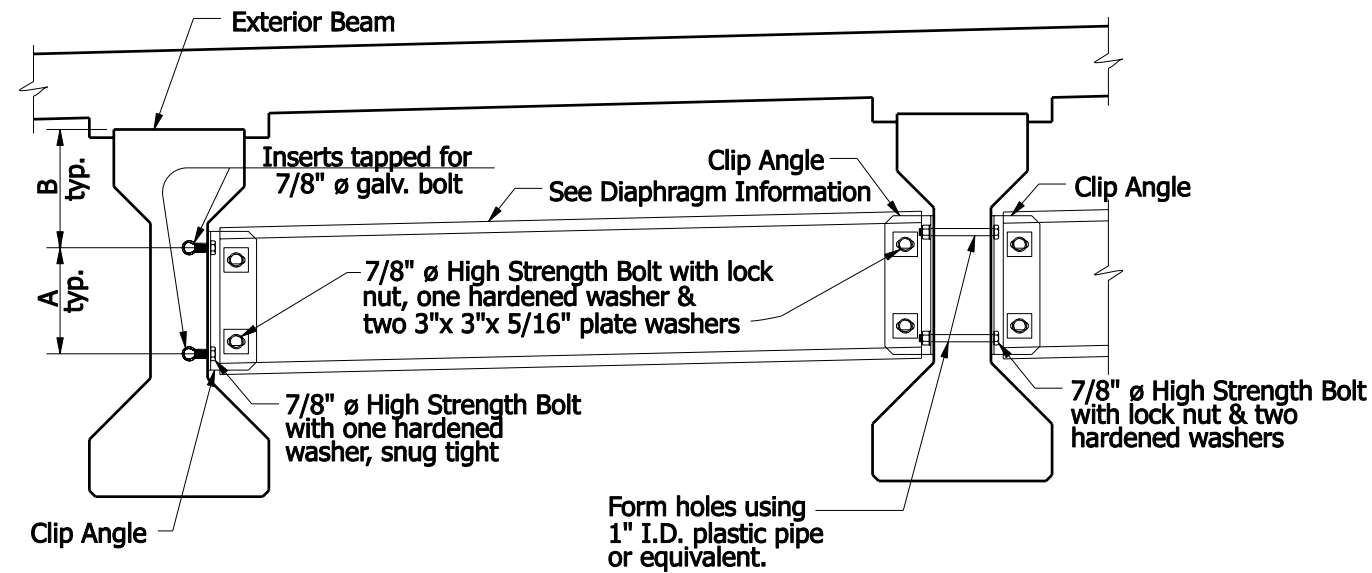
Permitted camber variation from design camber is as follows:

I-beam or bulb-tee beam:  $\pm 1/8"$  per 10'-0" length with  $\pm 1/2"$  maximum for member length of 80'-0" or less  
 $\pm 1"$  maximum for member length of greater than 80'-0"

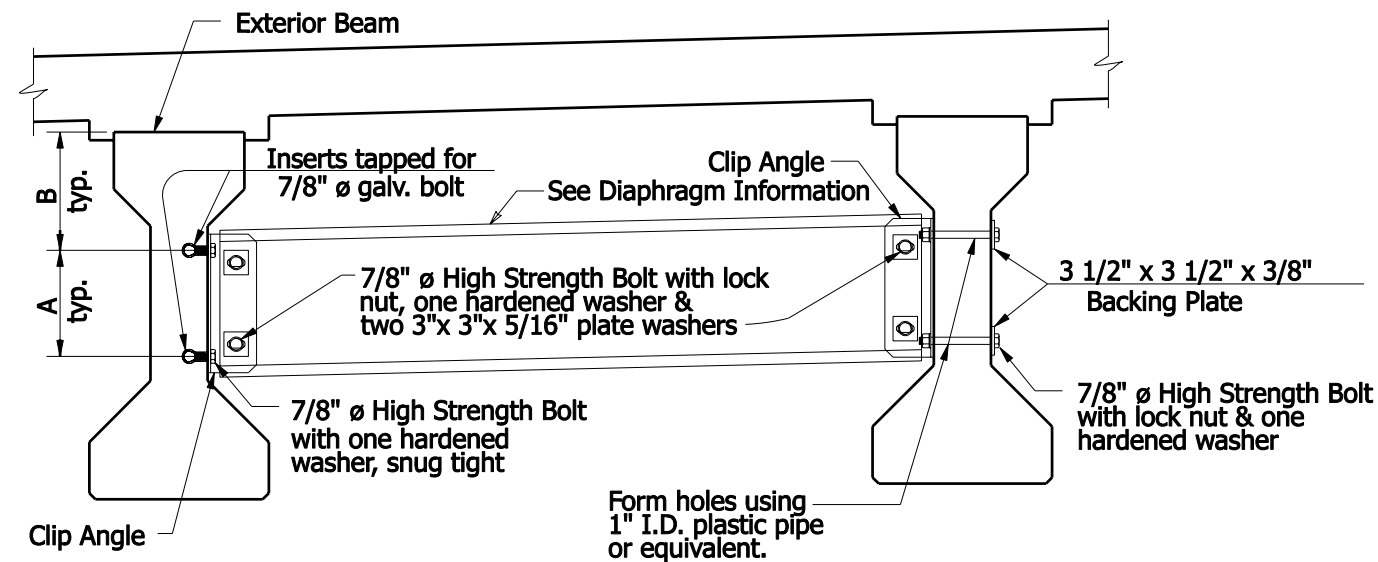
Box beam:  $\pm 1/8"$  per 10'-0" length with  $\pm 1/2"$  mm maximum

- 6 Tolerance in length of beam shall be checked after the final curing phase and within three days prior to shipping.
- 7 Horizontal-alignment tolerance shall be checked immediately after removal of forms and strand release, and prior to removal from bed.
- 8 At concrete bearing area, deviation from plane surface when tested in all directions of the plane surface with a steel straightedge shall not be more than  $\pm 1/16"$ .

|                                                                                       |                                                                                                                                                                                                                                                                          |                                 |                 |                           |      |                           |                 |                        |      |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-----------------|---------------------------|------|---------------------------|-----------------|------------------------|------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                                                                                                                          |                                 |                 |                           |      |                           |                 |                        |      |
| FABRICATION TOLERANCES<br>GENERAL NOTES                                               |                                                                                                                                                                                                                                                                          |                                 |                 |                           |      |                           |                 |                        |      |
| SEPTEMBER 2011                                                                        |                                                                                                                                                                                                                                                                          |                                 |                 |                           |      |                           |                 |                        |      |
| STANDARD DRAWING NO.      E 707-BPBF-04                                               |                                                                                                                                                                                                                                                                          |                                 |                 |                           |      |                           |                 |                        |      |
|  | <table><tr><td><u>/s/ Richard L. VanCleave</u></td><td><u>09/01/11</u></td></tr><tr><td>DESIGN STANDARDS ENGINEER</td><td>DATE</td></tr><tr><td><u>/s/ Mark A. Miller</u></td><td><u>09/01/11</u></td></tr><tr><td>CHIEF HIGHWAY ENGINEER</td><td>DATE</td></tr></table> | <u>/s/ Richard L. VanCleave</u> | <u>09/01/11</u> | DESIGN STANDARDS ENGINEER | DATE | <u>/s/ Mark A. Miller</u> | <u>09/01/11</u> | CHIEF HIGHWAY ENGINEER | DATE |
| <u>/s/ Richard L. VanCleave</u>                                                       | <u>09/01/11</u>                                                                                                                                                                                                                                                          |                                 |                 |                           |      |                           |                 |                        |      |
| DESIGN STANDARDS ENGINEER                                                             | DATE                                                                                                                                                                                                                                                                     |                                 |                 |                           |      |                           |                 |                        |      |
| <u>/s/ Mark A. Miller</u>                                                             | <u>09/01/11</u>                                                                                                                                                                                                                                                          |                                 |                 |                           |      |                           |                 |                        |      |
| CHIEF HIGHWAY ENGINEER                                                                | DATE                                                                                                                                                                                                                                                                     |                                 |                 |                           |      |                           |                 |                        |      |
| DESIGN STANDARDS ENGINEER                                                             |                                                                                                                                                                                                                                                                          |                                 |                 |                           |      |                           |                 |                        |      |



**INTERMEDIATE DIAPHRAGM**  
*Typical for Square Structure*



**INTERMEDIATE DIAPHRAGM**  
*Typical for Skewed Structure*

| Diaphragm Information |           |           |       |     |        |    |              |
|-----------------------|-----------|-----------|-------|-----|--------|----|--------------|
| Beam Type             | Dimension |           |       |     |        |    | Channel Type |
|                       | A         | B         | C     | D   | E      | F  |              |
| Type II               | 9"        | 1'-0"     | 1'-1" | 6"  | 3 1/2" | 3" | C 12 x 20.7  |
| Type III              | 1'-1"     | 1'-2 1/2" | 1'-5" | 10" | 3 1/2" | 4" | MC 18 x 42.7 |
| Type IV               | 1'-4"     | 1'-5 1/2" | 1'-8" | 10" | 5"     | 4" | MC 18 x 42.7 |

**NOTES:**

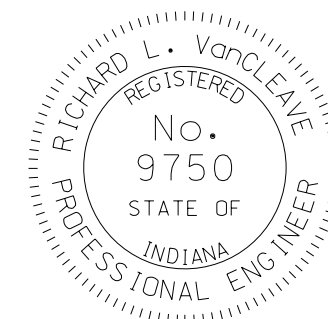
1. See Standard Drawing E 707-SDPC-02 for connection details.

INDIANA DEPARTMENT OF TRANSPORTATION

**STEEL DIAPHRAGMS  
AASHTO I-BEAMS**

**SEPTEMBER 2007**

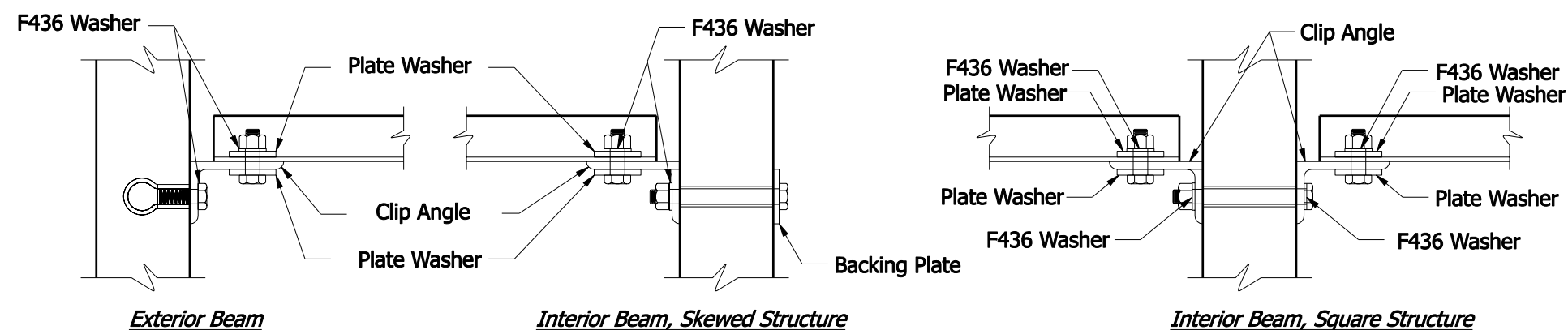
**STANDARD DRAWING NO. E 707-SDPC-01**



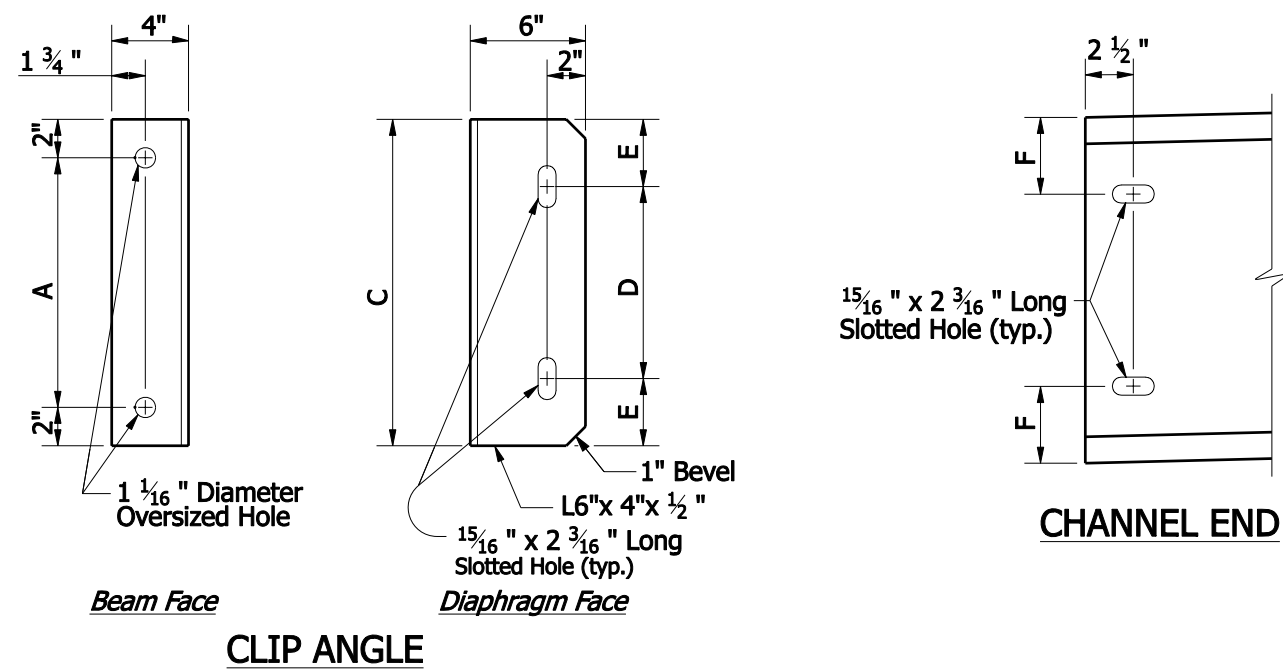
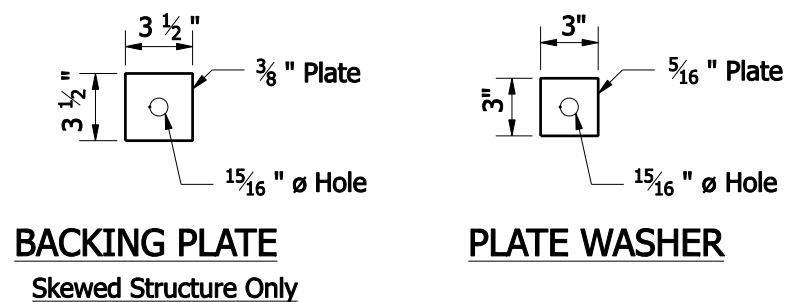
DESIGN STANDARDS ENGINEER

*/s/ Richard L. VanCleave* 09/04/07  
DESIGN STANDARDS ENGINEER DATE

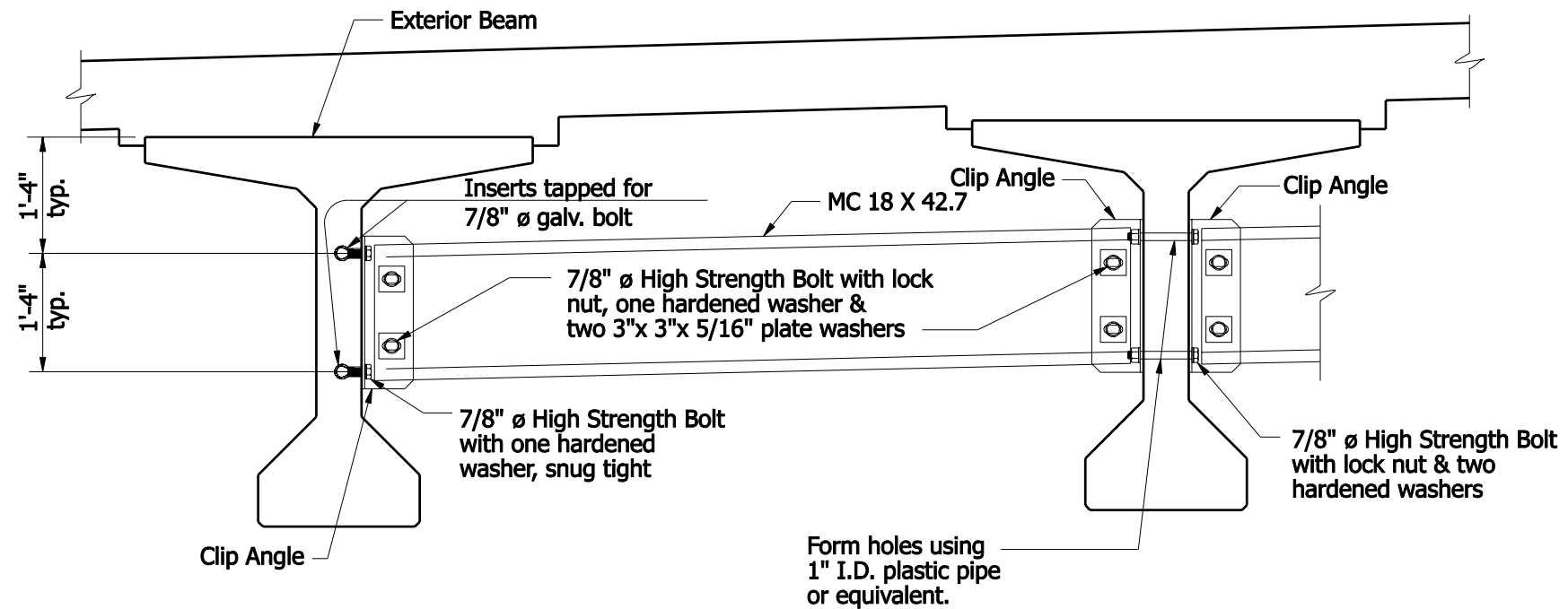
*/s/ Mark A. Miller* 09/04/07  
CHIEF HIGHWAY ENGINEER DATE



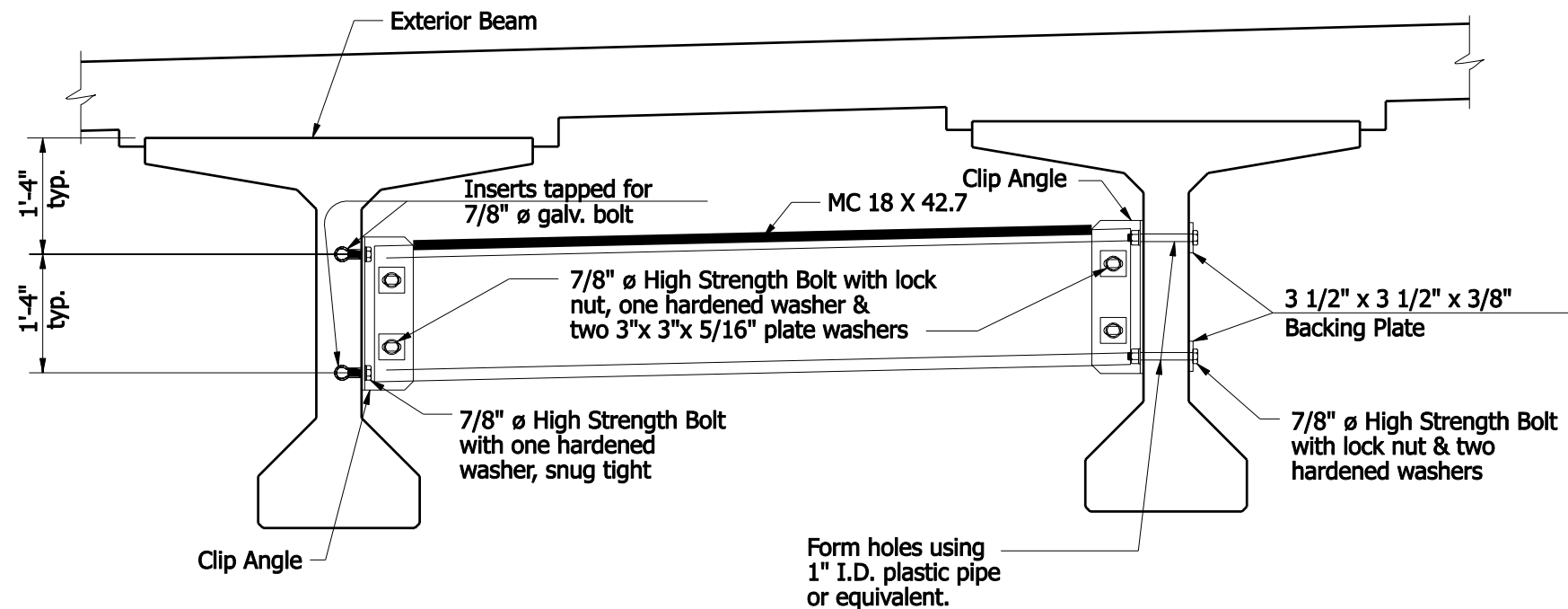
### CONNECTION DETAILS



|                                      |                                 |          |
|--------------------------------------|---------------------------------|----------|
| INDIANA DEPARTMENT OF TRANSPORTATION |                                 |          |
| STEEL DIAPHRAGMS<br>AASHTO I-BEAMS   |                                 |          |
| SEPTEMBER 2007                       |                                 |          |
| STANDARD DRAWING NO. E 707-SDPC-02   |                                 |          |
|                                      | /s/ <i>Richard L. vanCleave</i> | 09/04/07 |
|                                      | DESIGN STANDARDS ENGINEER       | DATE     |
| DESIGN STANDARDS ENGINEER            | /s/ <i>Mark A. Miller</i>       | 09/04/07 |
|                                      | CHIEF HIGHWAY ENGINEER          | DATE     |



**INTERMEDIATE DIAPHRAGM**  
*Typical for Square Structure*



**INTERMEDIATE DIAPHRAGM**  
*Typical for Skewed Structure*

**NOTES:**

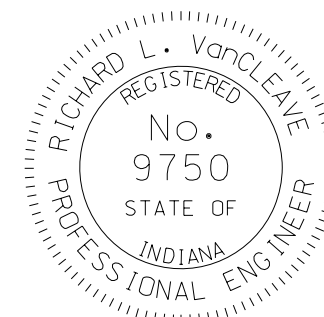
1. See Standard Drawing E 707-SDPC-04 for connection details.

INDIANA DEPARTMENT OF TRANSPORTATION

STEEL DIAPHRAGMS  
INDIANA BULB-TEES, 54-IN. DEPTH

SEPTEMBER 2007

STANDARD DRAWING NO. E 707-SDPC-03

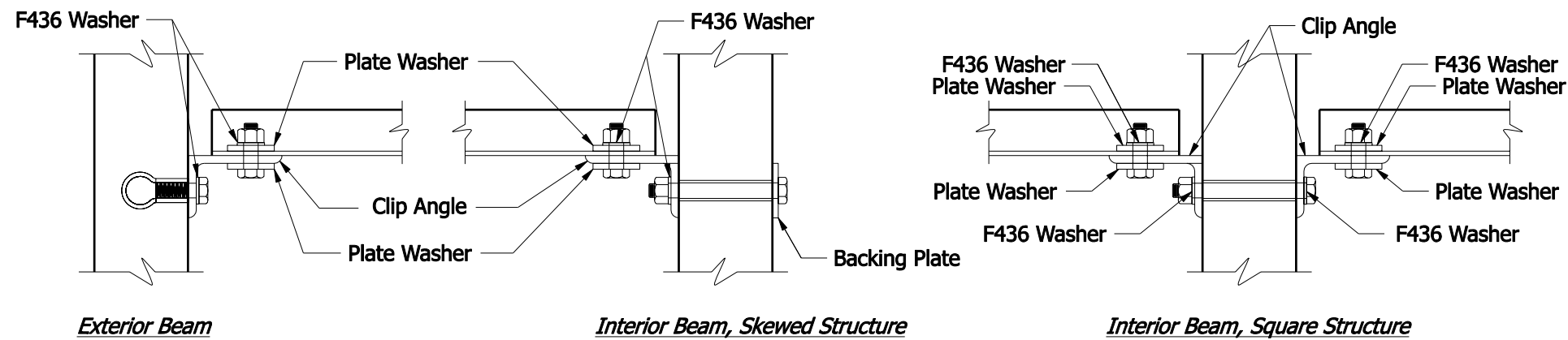


DESIGN STANDARDS ENGINEER

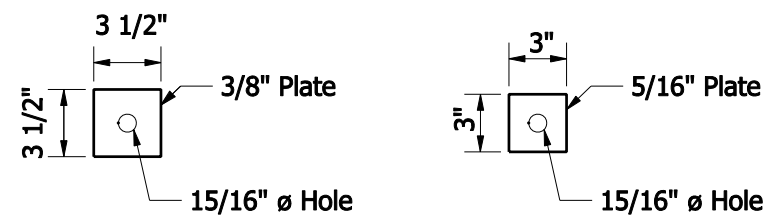
*/s/ Richard L. VanCleave* 09/04/07  
DESIGN STANDARDS ENGINEER DATE

*/s/ Mark A. Miller* 09/04/07  
CHIEF HIGHWAY ENGINEER DATE



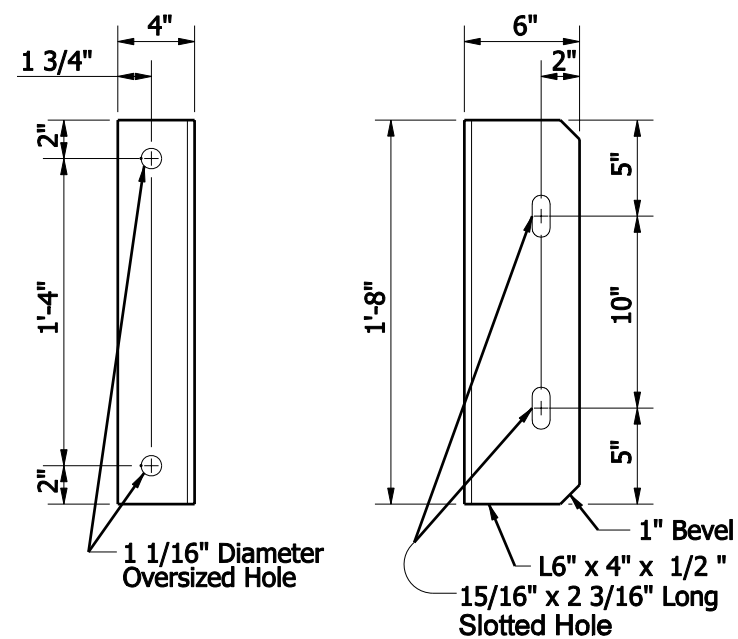


### CONNECTION DETAILS



**BACKING PLATE**  
*Skewed Structure Only*

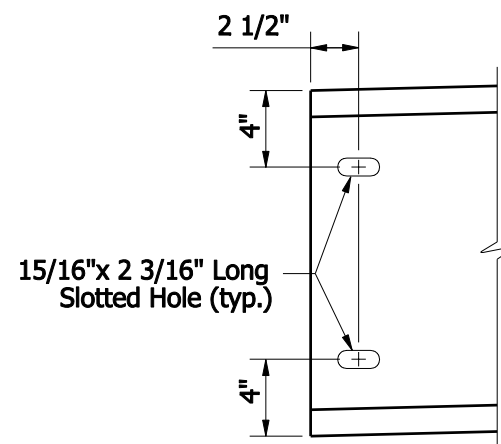
**PLATE WASHER**



*Beam Face*

*Diaphragm Face*

**CLIP ANGLE**



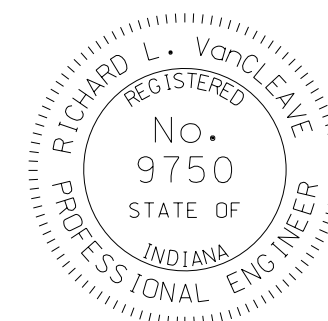
**CHANNEL END**

INDIANA DEPARTMENT OF TRANSPORTATION

STEEL DIAPHRAGMS  
INDIANA BULB-TEES, 54-IN. DEPTH

SEPTEMBER 2007

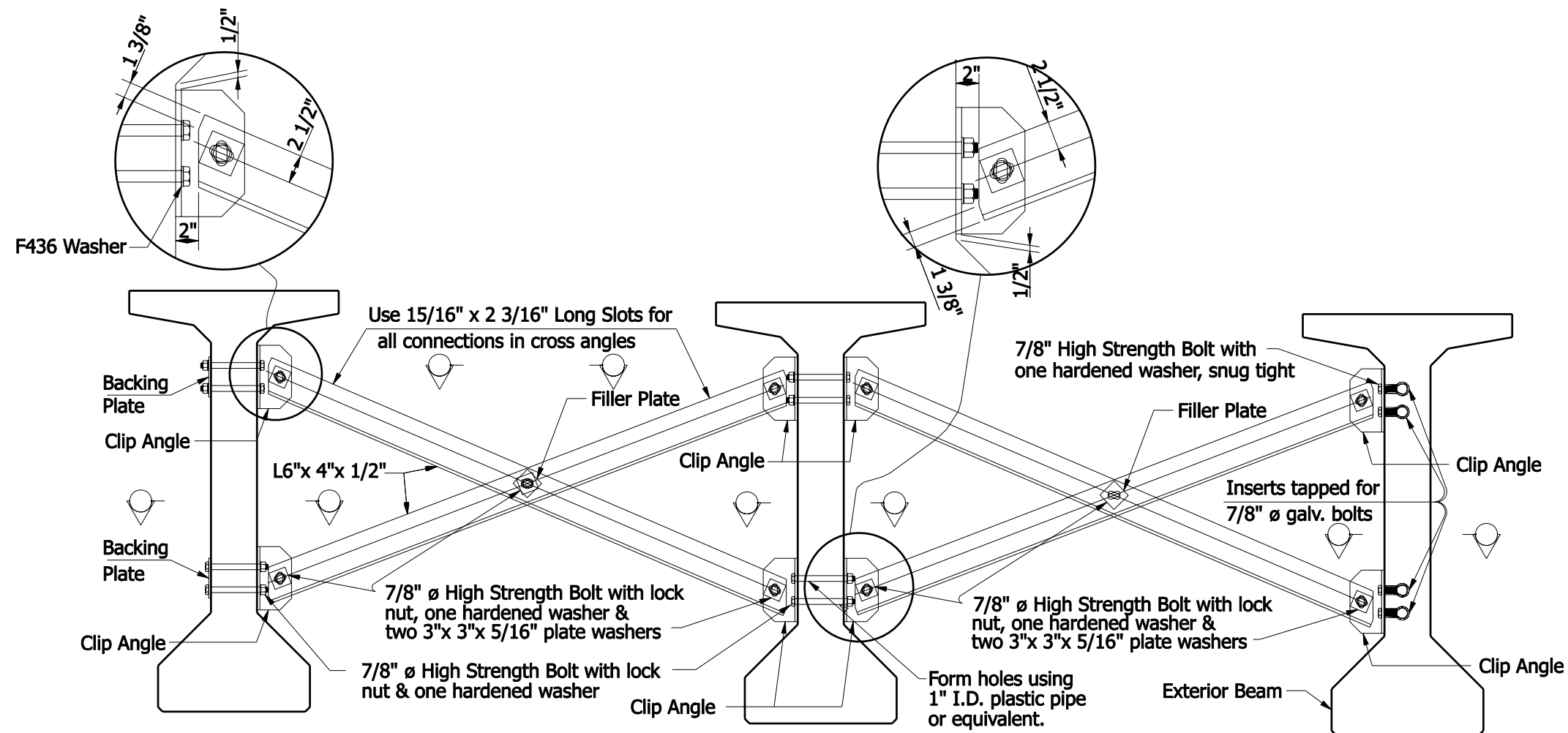
STANDARD DRAWING NO. E 707-SDPC-04



DESIGN STANDARDS ENGINEER

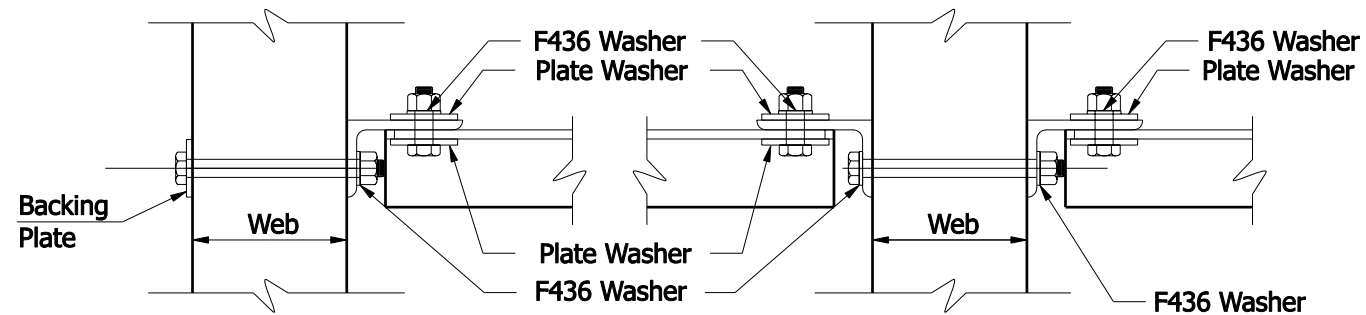
/s/ Richard L. VanCleave 09/04/07  
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller 09/04/07  
CHIEF HIGHWAY ENGINEER DATE



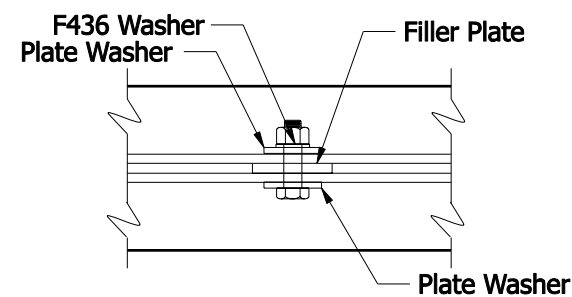
## INTERMEDIATE DIAPHRAGM DETAILS



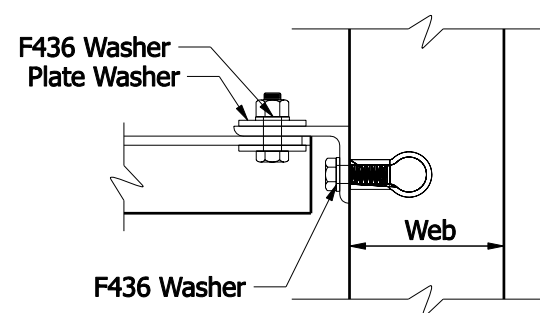


**SECTION T-T**  
*Interior Beam, Skewed Structure*

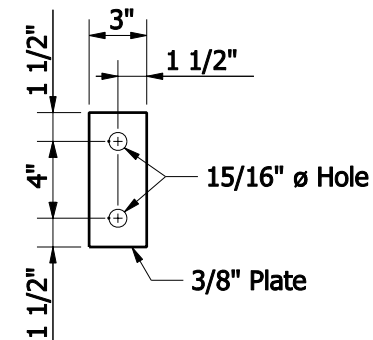
**SECTION B-B**  
*Interior Beam, Square Structure*



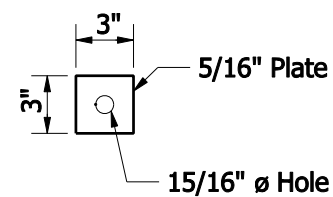
**SECTION X-X**



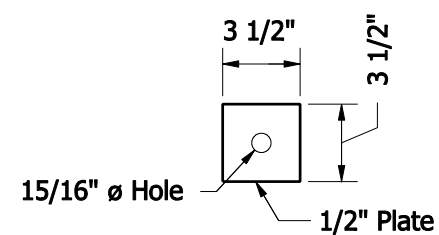
**SECTION E-E**  
*Exterior Beam*



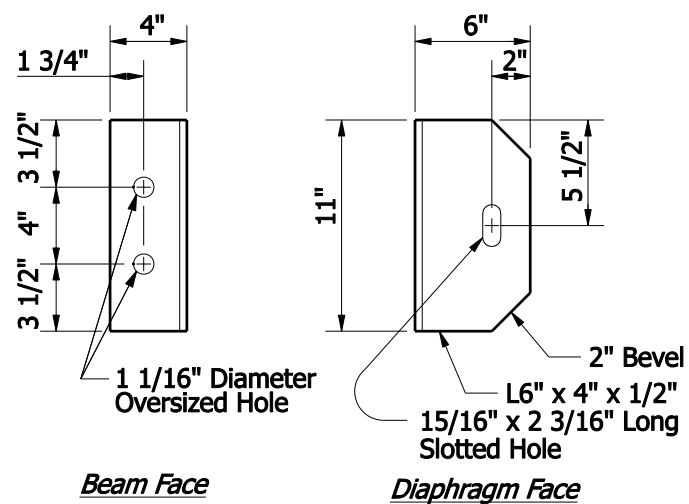
**BACKING PLATE**



**PLATE WASHER**

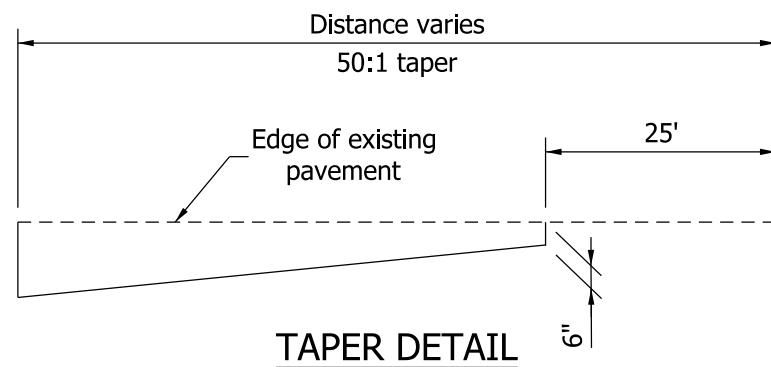
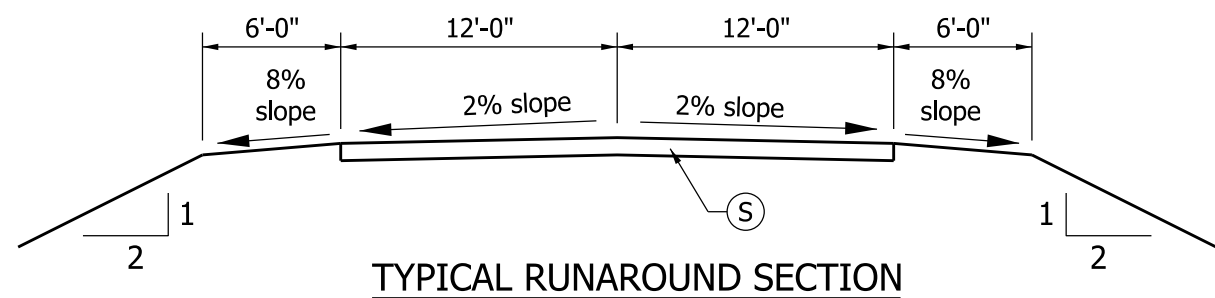
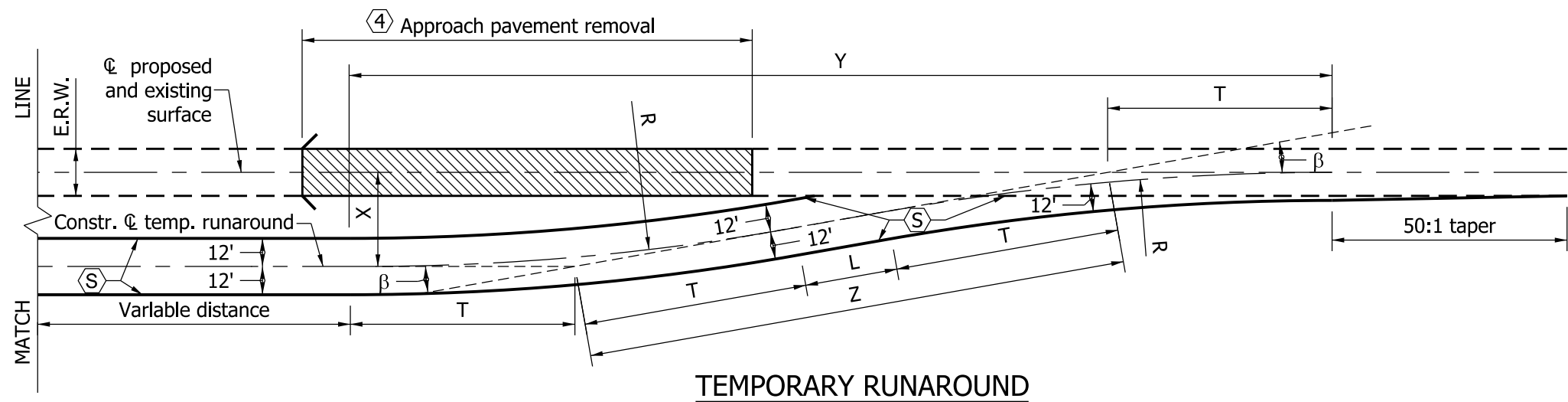
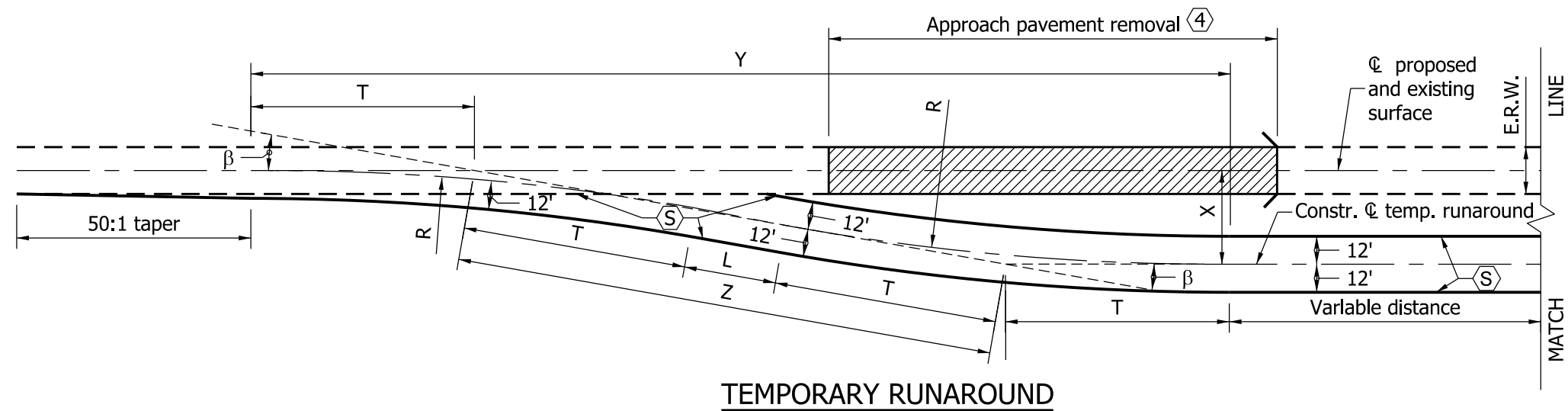


**FILLER PLATE**



**CLIP ANGLE**

|                                                         |                                                                            |
|---------------------------------------------------------|----------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                    |                                                                            |
| STEEL DIAPHRAGMS<br>INDIANA BULB-TEES, 60 IN. OR DEEPER |                                                                            |
| SEPTEMBER 2007                                          |                                                                            |
| STANDARD DRAWING NO. E 707-SDPC-06                      |                                                                            |
|                                                         | /s/ <i>Richard L. VanCleave</i> 09/04/07<br>DESIGN STANDARDS ENGINEER DATE |
|                                                         | /s/ <i>Mark A. Miller</i> 09/04/07<br>CHIEF HIGHWAY ENGINEER DATE          |
| DESIGN STANDARDS ENGINEER                               |                                                                            |



### NOTES:

1. See Standard Drawing E 713-TCTR-04 for general notes with numbered hexagon frame that apply to this sheet.
2. See Standard Drawings E 713-TCTR-02 for runaround geometrics and -02A for surface areas.
3. See Standard Drawing E 801-TCLG-01 for standard notes and legend.

### LEGEND:

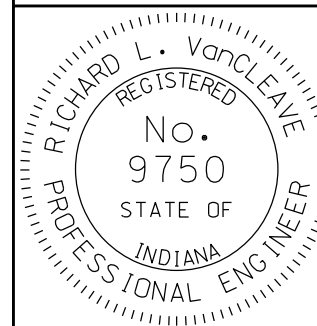
Work Area

INDIANA DEPARTMENT OF TRANSPORTATION

TEMPORARY RUNAROUND  
GEOMETRICS

SEPTEMBER 2011

STANDARD DRAWING NO. E 713-TCTR-01



DESIGN STANDARDS ENGINEER

DETAILS PLACED IN THIS FORMAT 9/1/2011

/s/ *Richard L. VanCleave* 09/01/11  
DESIGN STANDARDS ENGINEER DATE

/s/ *Mark A. Miller* 09/01/11  
CHIEF HIGHWAY ENGINEER DATE

ORIGINALLY APPROVAL ON SEPTEMBER 9/1/06

| RUNAROUND GEOMETRICS AND SURFACE AREAS |                                                                    |        |        |        |        |        |                  |        |        |        |        |        |
|----------------------------------------|--------------------------------------------------------------------|--------|--------|--------|--------|--------|------------------|--------|--------|--------|--------|--------|
| TYPE A, ≥ 50 MPH                       |                                                                    |        |        |        |        |        | TYPE B, ≤ 45 MPH |        |        |        |        |        |
| X (ft)                                 | 40                                                                 | 45     | 50     | 55     | 60     | 65     | 40               | 45     | 50     | 55     | 60     | 65     |
| β                                      | 10°                                                                | 10°    | 10°    | 10°    | 10°    | 10°    | 13°              | 13°    | 13°    | 13°    | 13°    | 13°    |
| Z (ft)                                 | 230.35                                                             | 259.14 | 287.94 | 316.73 | 345.53 | 374.32 | 177.82           | 200.04 | 222.27 | 244.50 | 266.72 | 288.95 |
| R (ft)                                 | 1070                                                               | 1070   | 1070   | 1070   | 1070   | 1070   | 720              | 720    | 720    | 720    | 720    | 720    |
| T (ft)                                 | 93.61                                                              | 93.61  | 93.61  | 93.61  | 93.61  | 93.61  | 82.03            | 82.03  | 82.03  | 82.03  | 82.03  | 82.03  |
| L (ft)                                 | 43.13                                                              | 71.92  | 100.72 | 129.51 | 158.31 | 187.10 | 13.76            | 35.98  | 58.21  | 80.44  | 102.66 | 124.89 |
| Y (ft)                                 | 414.07                                                             | 442.42 | 470.79 | 499.14 | 527.50 | 555.85 | 337.32           | 358.97 | 380.63 | 402.29 | 423.94 | 445.60 |
| E.R.W.<br>(ft)                         | SURFACE AREA OF RUNAROUND IN SYS. (VARIABLE DISTANCE NOT INCLUDED) |        |        |        |        |        |                  |        |        |        |        |        |
| 18                                     | 1555                                                               | 1751   | 1950   | 2148   | 2347   | 2545   | 1280             | 1433   | 1586   | 1739   | 1892   | 2045   |
| 20                                     | 1493                                                               | 1691   | 1890   | 2088   | 2287   | 2585   | 1225             | 1378   | 1531   | 1684   | 1837   | 1990   |
| 22                                     | 1428                                                               | 1627   | 1825   | 2024   | 2222   | 2420   | 1170             | 1323   | 1476   | 1629   | 1783   | 1935   |
| 24                                     | 1375                                                               | 1574   | 1773   | 1971   | 2170   | 2368   | 1127             | 1280   | 1432   | 1586   | 1739   | 1892   |

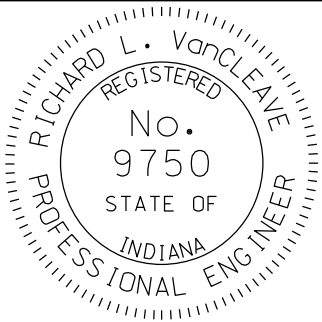
ERW - Existing Roadway Width

INDIANA DEPARTMENT OF TRANSPORTATION

TEMPORARY RUNAROUND  
GEOMETRICS

SEPTEMBER 2011

STANDARD DRAWING NO. E 713-TCTR-02



DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave09/01/11

DESIGN STANDARDS ENGINEERDATE

/s/ Mark A. Miller09/01/11

CHIEF HIGHWAY ENGINEERDATE

ORIGINALLY APPROVAL ON SEPTEMBER 9/1/06

ERW - Existing Roadway Width

INDIANA DEPARTMENT OF TRANSPORTATION

# SEPTEMBER 2011

The seal is circular with a double-line border. The outer ring contains the text "RICHARD L. VanCLEAVE" at the top and "PROFESSIONAL ENGINEER" at the bottom, separated by tick marks. The inner circle contains the text "REGISTERED" at the top, "No. 9750" in the center, "STATE OF" below the number, and "INDIANA" at the bottom, also separated by tick marks.

DETAILS PLACED IN THIS FORMAT 9/1/2011

/s/ Richard L. VanCleave 09/01/11

|                           |      |
|---------------------------|------|
| DESIGN STANDARDS ENGINEER | DATE |
|---------------------------|------|

/s/ Mark A. Miller 09/01/11

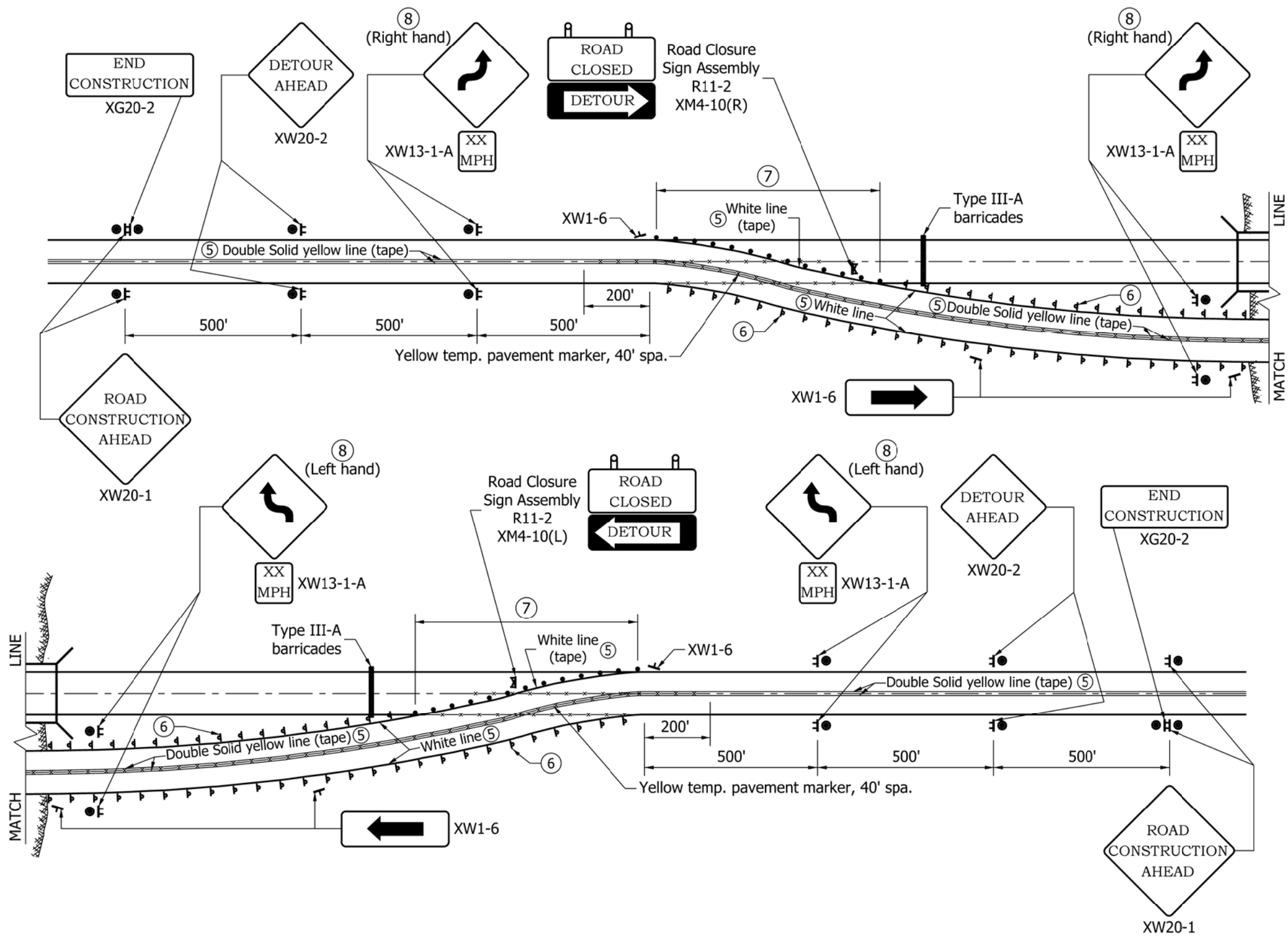
CHIEF HIGHWAY ENGINEER \_\_\_\_\_ DATE \_\_\_\_\_

DESIGN STANDARDS ENGINEER

ORIGINALLY APPROVAL ON SEPTEMBER 9/1/06

NOTES:

- 1. See Standard Drawing E 713-TCTR-04 for notes that apply to this sheet.
- 2. See Standard Drawing E 801-TCLG-01 for standard notes and legend.



|                                                                                       |                                                                           |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                           |
| TEMPORARY RUNAROUND<br>SIGNING AND MARKING                                            |                                                                           |
| SEPTEMBER 2011                                                                        |                                                                           |
| STANDARD DRAWING NO. E 713-TCTR-03                                                    |                                                                           |
| DETAILS PLACED IN THIS FORMAT 9/1/2011                                                |                                                                           |
|  | <i>/s/ Richard L. VanCleave</i> 9/01/11<br>DESIGN STANDARDS ENGINEER DATE |
|                                                                                       | <i>/s/ Mark A. Miller</i> 9/01/11<br>CHIEF HIGHWAY ENGINEER DATE          |
| DESIGN STANDARDS ENGINEER                                                             | ORIGINALLY APPROVAL ON SEPTEMBER 9/1/97                                   |

GENERAL NOTES:

1. The pavement section for trucks count exceeding the values shown in (S) in the Legend shall be as shown elsewhere in the plans.
3. A temporary bridge or temporary pipe shall be used as specified. A 28'-0 clear roadway width shall be provided on a temporary bridge.
- ④ The connection of the temporary runaround to the existing pavement shall be outside the limits of the approach pavement removal.
- ⑤ Temporary pavement markings will be required as shown. The contractor shall have the option of using temporary tape or paint for all temporary pavement markings except where otherwise specified.
- ⑥ Delineators type D-2 (white) shall be placed at 30 ft maximum spacing on both sides throughout the length of the temporary runaround, including across the temporary structure. If a temporary bridge is used, type 3 object markers shall be placed at all four corners in accordance with the MUTCD.
- ⑦ Spacing of drums at this location shall be 20 ft.
- ⑧ If the runaround posted speed limit is greater than 30 mph the reverse curve sign, XW1-4 (36" x 36"), shall be used at this location.  
If the runaround posted advisory speed limit is 30 mph or less, the reverse turn sign, XW1-3 (36" x 36") shall be used.

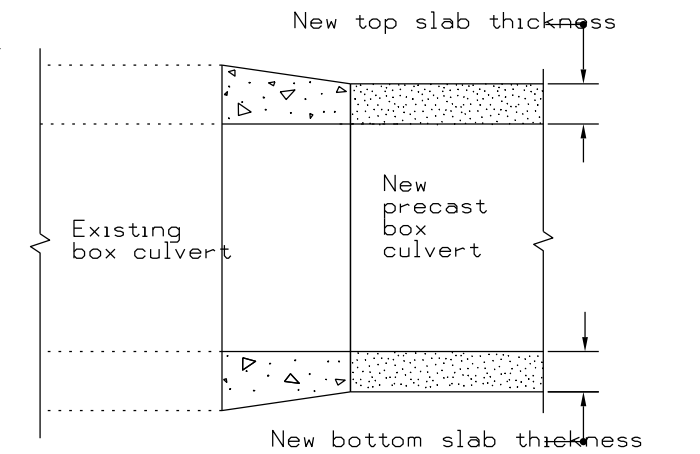
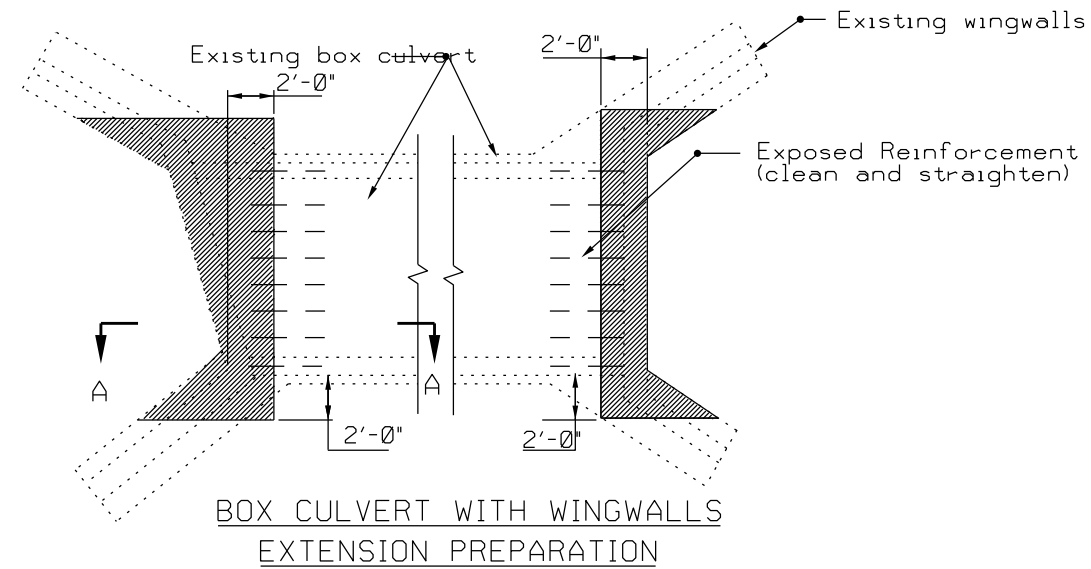
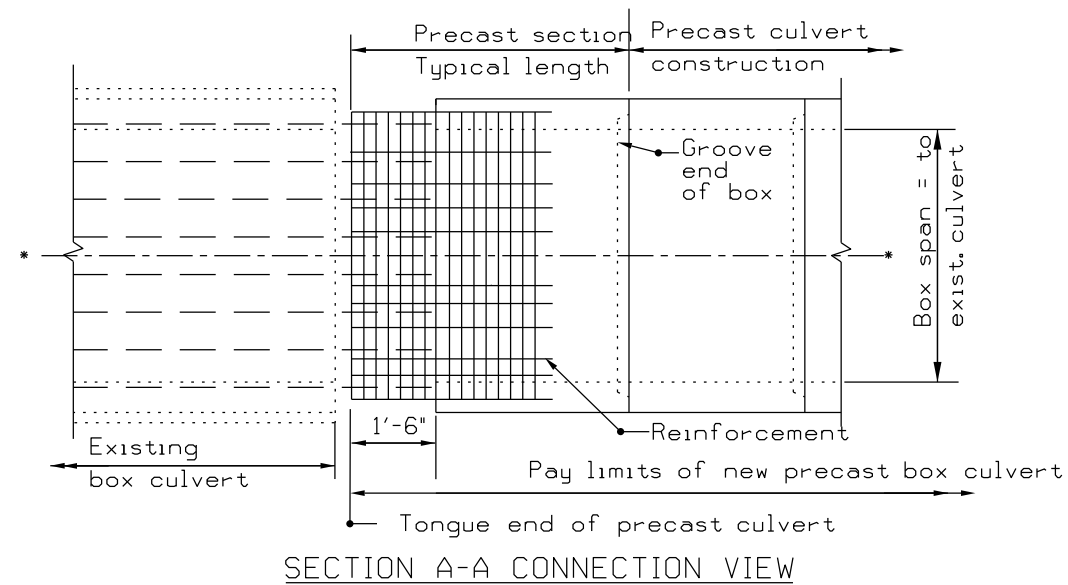
LEGEND:

- Delineator type D-2 (white)
- Ⓢ

Pavement section for truck count, AADTT < 500, shall be:  
  
165 #/yd<sup>2</sup> HMA Surface, Type A, on  
275 #/yd<sup>2</sup> HMA Intermediate, Type A, on  
6 in. compacted aggregate, size No. 53, Base, on  
Type III Subgrade Treatment  
(See Genaral Note #1)

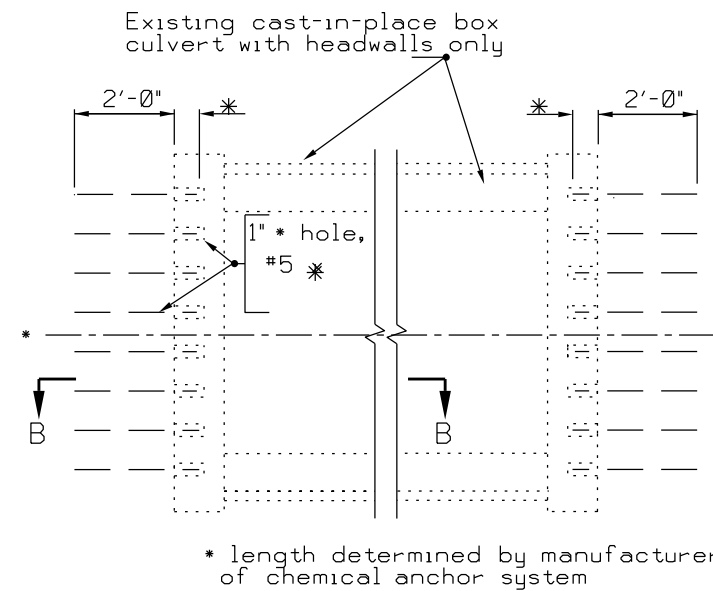
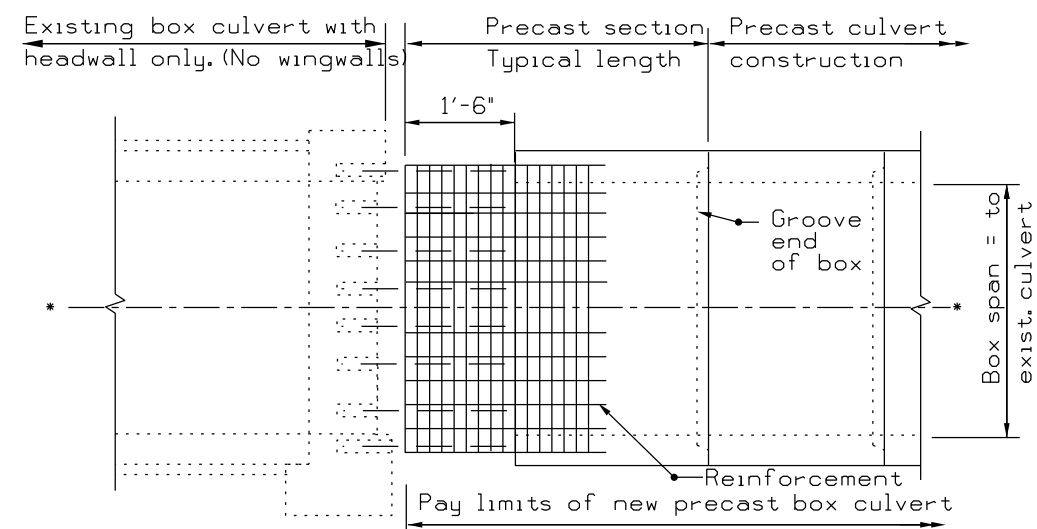
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                 |                        |                 |
|---------------------------------------------------------------------------------------|---------------------------------|------------------------|-----------------|
| TEMPORARY RUNAROUND<br>GENERAL NOTES                                                  |                                 |                        |                 |
| SEPTEMBER 2010                                                                        |                                 |                        |                 |
| STANDARD DRAWING NO.                                                                  |                                 | E 713-TCTR-04          |                 |
|  | <i>/s/ Richard L. VanCleave</i> |                        | <i>09/01/10</i> |
|                                                                                       | DESIGN STANDARDS ENGINEER       |                        | DATE            |
|                                                                                       | <i>/s/ Mark A. Miller</i>       |                        | <i>09/01/10</i> |
| DESIGN STANDARDS ENGINEER                                                             |                                 | CHIEF HIGHWAY ENGINEER |                 |
|                                                                                       |                                 | DATE                   |                 |





LEGEND :

-  Removal
-  Existing structure
-  New element or structure



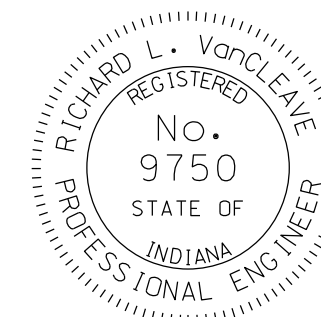
\* length determined by manufacturer of chemical anchor system

INDIANA DEPARTMENT OF TRANSPORTATION

PRECAST BOX-CULVERT EXTENSION

SEPTEMBER 2010

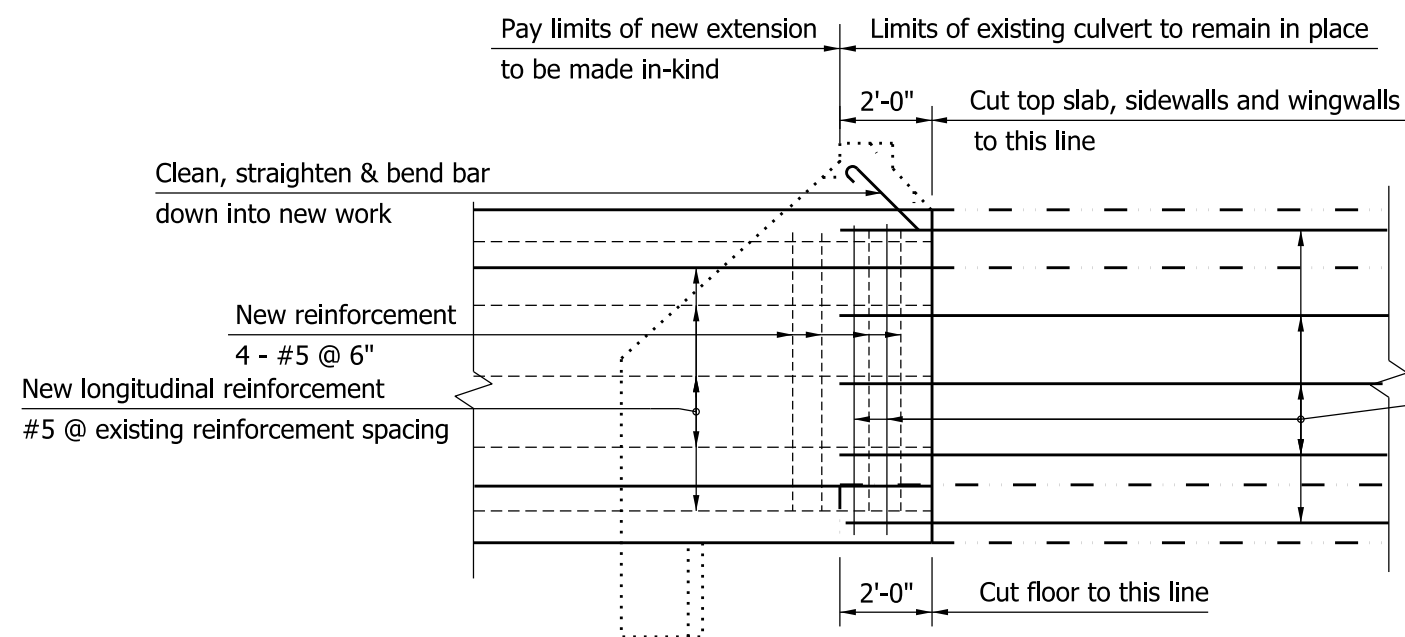
STANDARD DRAWING NO. E 714-BCEX-01



DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave 09/01/10  
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller 09/01/10  
CHIEF HIGHWAY ENGINEER DATE



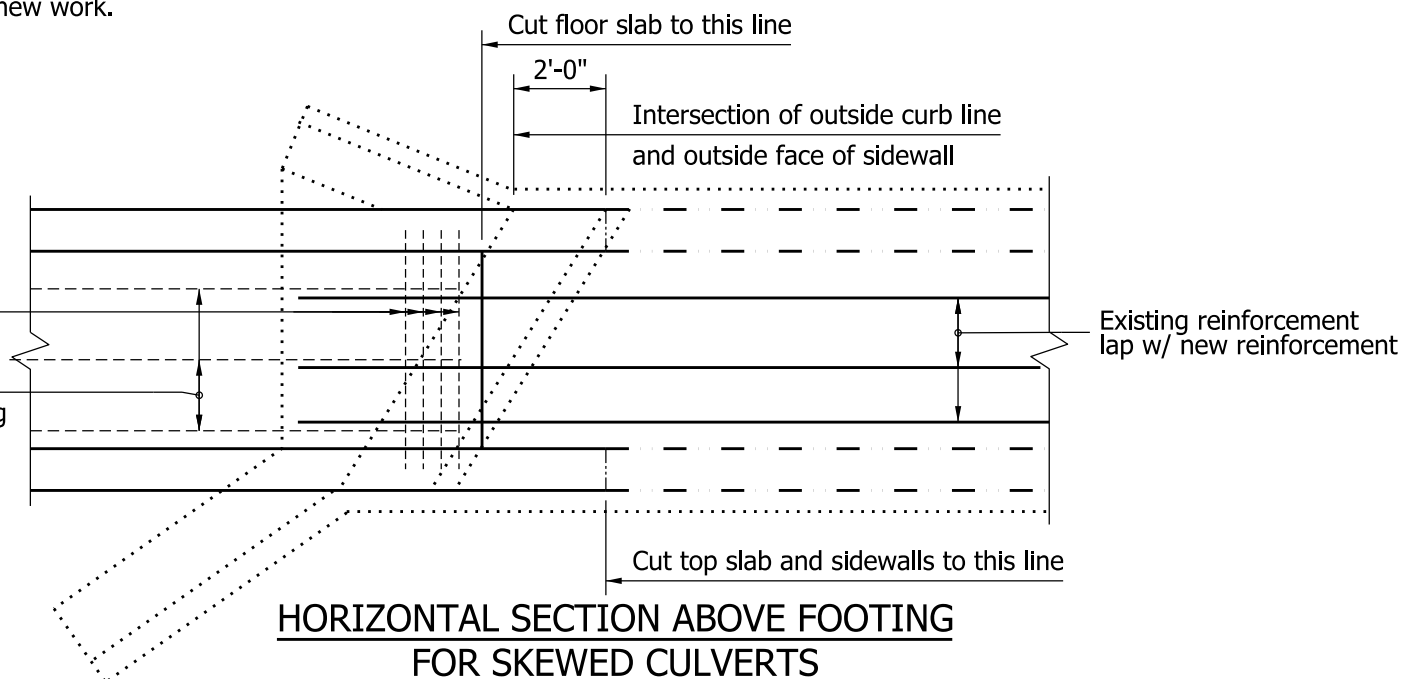
**LONGITUDINAL SECTION  
FOR ALL CULVERTS**

All existing exposed longitudinal reinforcing and wall reinforcement shall remain in place and project into new work.

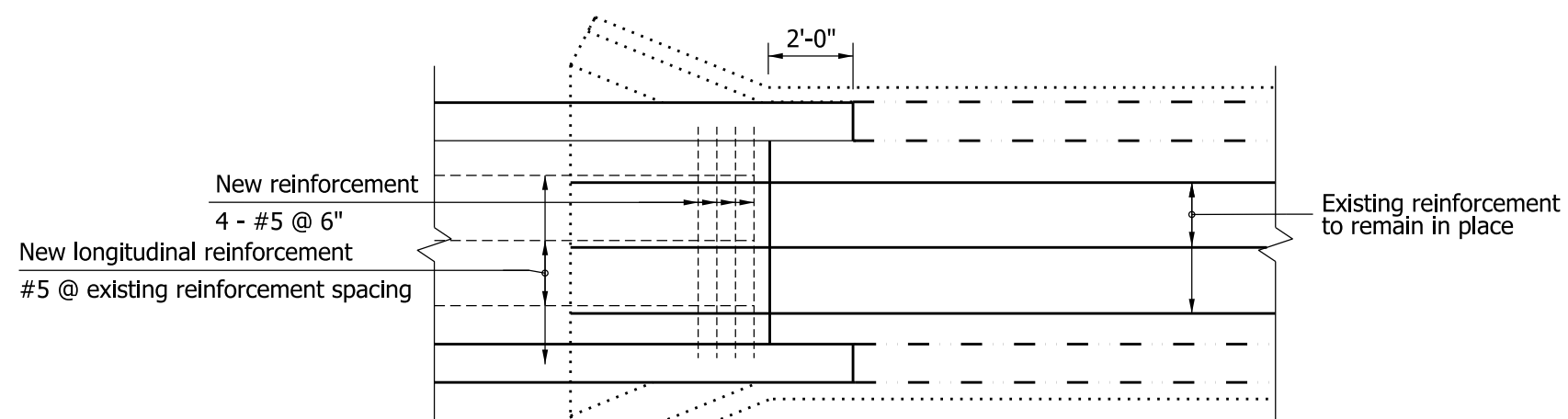
New reinforcement  
4 - #5 @ 6"  
New longitudinal reinforcement  
#5 @ existing reinforcement spacing

**NOTES:**

1. Before removing existing concrete, saw around the perimeter of the removal areas on the interior and exterior of the culvert to a depth of 1".
2. New horizontal reinforcement shall be anchored into the culvert walls with bar hooks.



**HORIZONTAL SECTION ABOVE FOOTING  
FOR SKEWED CULVERTS**



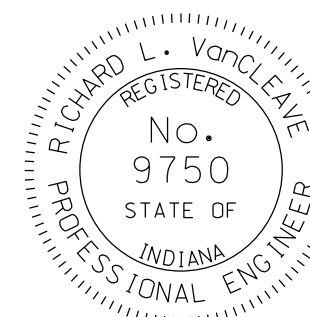
**HORIZONTAL SECTION ABOVE FOOTING  
FOR SQUARE CULVERTS**

INDIANA DEPARTMENT OF TRANSPORTATION

CAST-IN-PLACE  
BOX-CULVERT EXTENSION

SEPTEMBER 2010

STANDARD DRAWING NO. E 714-BCEX-02

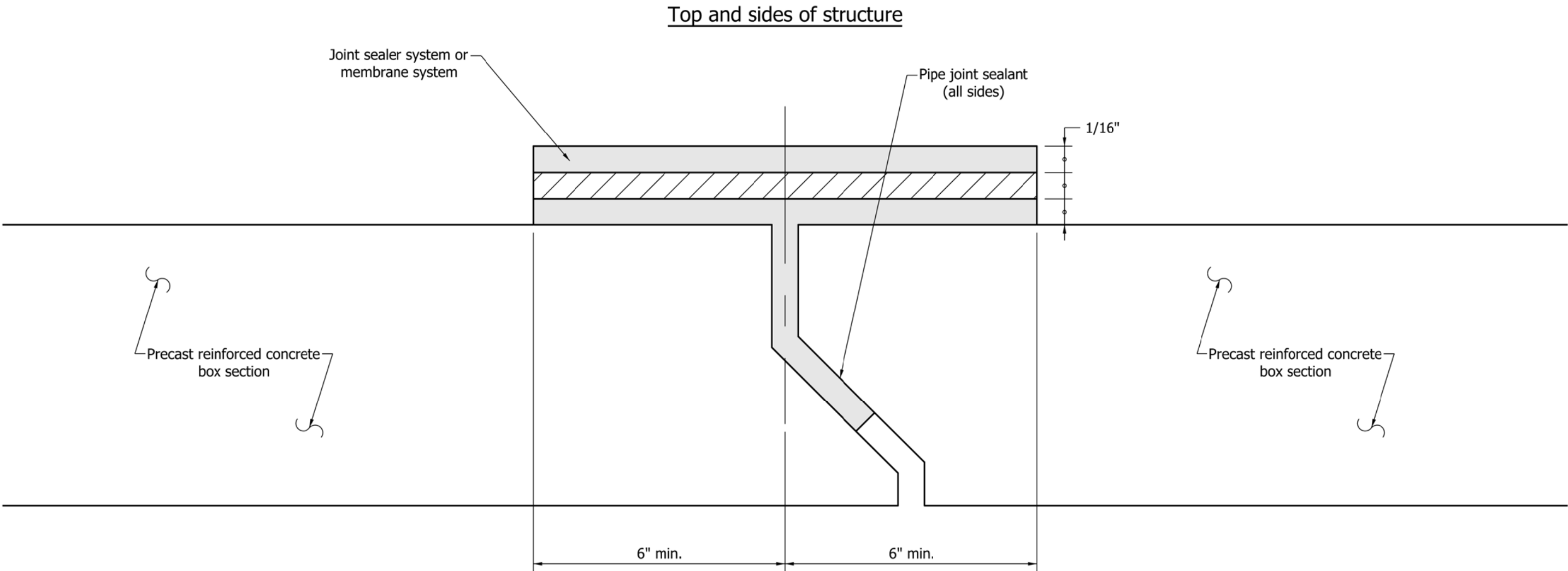


DESIGN STANDARDS ENGINEER

/s/ *Richard L. VanCleave* 09/01/10  
DESIGN STANDARDS ENGINEER DATE

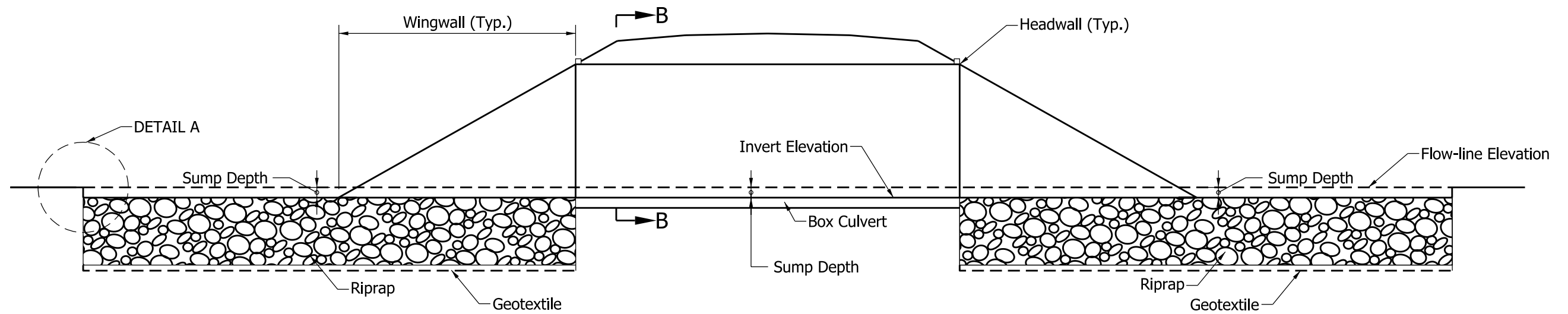
/s/ *Mark A. Miller* 09/01/10  
CHIEF HIGHWAY ENGINEER DATE



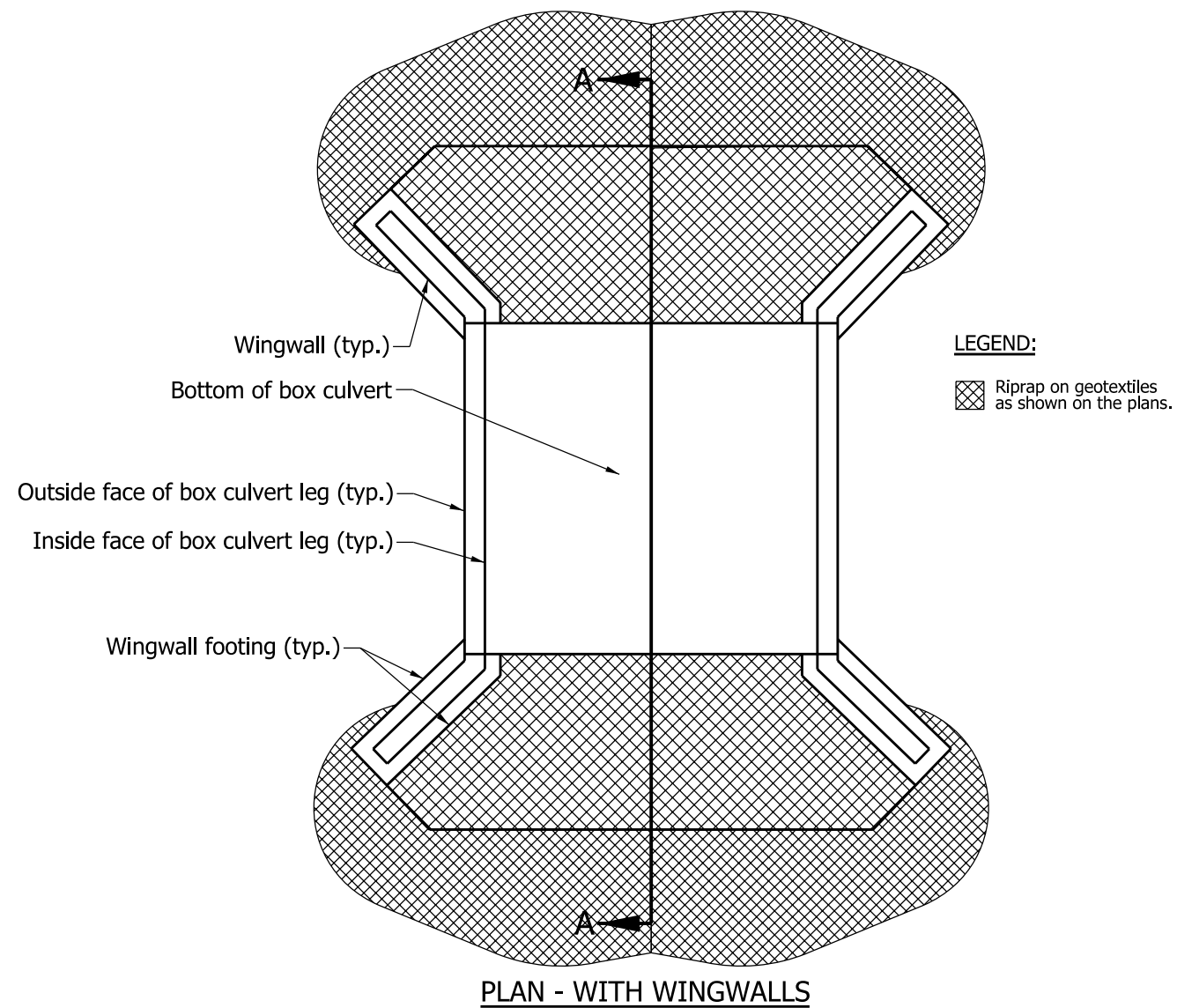


Inside of structure

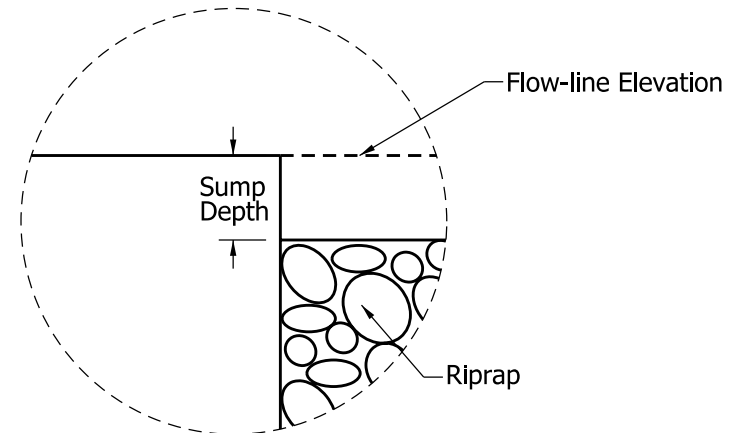
|                                                                                       |                                 |               |
|---------------------------------------------------------------------------------------|---------------------------------|---------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                 |               |
| PRECAST REINFORCED CONCRETE<br>BOX SECTION JOINT                                      |                                 |               |
| SEPTEMBER 2011                                                                        |                                 |               |
| STANDARD DRAWING NO.                                                                  |                                 | E 714-BCJT-01 |
|  | /s/ <i>Richard L. VanCleave</i> | 09/01/11      |
|                                                                                       | DESIGN STANDARDS ENGINEER       | DATE          |
|                                                                                       | /s/ <i>Mark A. Miller</i>       | 09/01/11      |
|                                                                                       | CHIEF HIGHWAY ENGINEER          | DATE          |
| DESIGN STANDARDS ENGINEER                                                             |                                 |               |



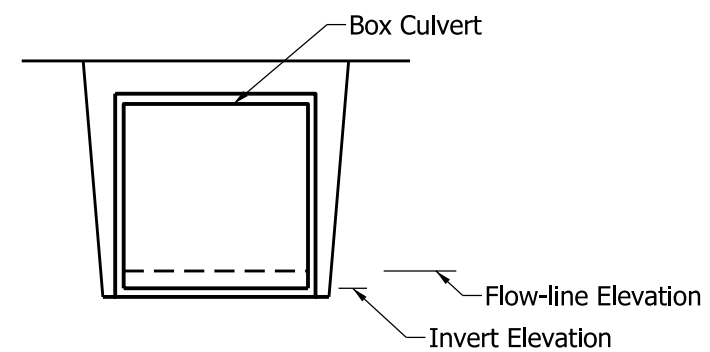
**SECTION A-A ELEVATION**



**PLAN - WITH WINGWALLS**



**DETAIL A**



**SECTION B-B**

| INDIANA DEPARTMENT OF TRANSPORTATION     |                                 |               |
|------------------------------------------|---------------------------------|---------------|
| BOX CULVERT SUMPING AND SCOUR PROTECTION |                                 |               |
| SEPTEMBER 2011                           |                                 |               |
| STANDARD DRAWING NO.                     |                                 | E 714-BCSP-01 |
|                                          | /s/ <i>Richard L. VanCleave</i> | 09/01/11      |
|                                          | DESIGN STANDARDS ENGINEER       | DATE          |
|                                          | /s/ <i>Mark A. Miller</i>       | 09/01/11      |
|                                          | CHIEF HIGHWAY ENGINEER          | DATE          |
| DESIGN STANDARDS ENGINEER                |                                 |               |

| REINFORCED CONCRETE PIPE |       |         |        |             |                           |             |                           |             |                           |
|--------------------------|-------|---------|--------|-------------|---------------------------|-------------|---------------------------|-------------|---------------------------|
| D                        | H     | R       | S      | SINGLE PIPE |                           | DOUBLE PIPE |                           | TRIPLE PIPE |                           |
|                          |       |         |        | G           | CU.YDS.CONC.<br>2 ANCHORS | G           | CU.YDS.CONC.<br>2 ANCHORS | G           | CU.YDS.CONC.<br>2 ANCHORS |
| 42"                      | 3'-3  | 2'-7½"  | 6'-3   | 5'-3        | 2.5                       | 11'-6       | 5.5                       | 17'-9       | 8.6                       |
| 48"                      | 3'-5  | 2'-11   | 6'-10  | 5'-10       | 2.8                       | 12'-8       | 6.2                       | 19'-6       | 9.6                       |
| 54"                      | 3'-7  | 3'-2½"  | 7'-8   | 6'-5        | 3.2                       | 14'-1       | 7.1                       | 21'-9       | 11.1                      |
| 60"                      | 3'-9  | 3'-6    | 8'-6   | 7'-0        | 3.5                       | 15'-6       | 8.0                       | 24'-0       | 12.5                      |
| 66"                      | 3'-11 | 3'-9½"  | 9'-4   | 7'-7        | 3.9                       | 16'-11      | 9.0                       | 26'-3       | 14.1                      |
| 72"                      | 4'-1  | 4'-1    | 10'-2  | 8'-2        | 4.3                       | 18'-4       | 10.0                      | 28'-6       | 15.7                      |
| 78"                      | 4'-3  | 4'-4½"  | 11'-0  | 8'-9        | 4.7                       | 19'-9       | 11.0                      | 30'-9       | 17.3                      |
| 84"                      | 4'-5  | 4'-8    | 11'-10 | 9'-4        | 5.1                       | 21'-2       | 12.1                      | 33'-0       | 19.0                      |
| 90"                      | 4'-7  | 4'-11½" | 12'-8  | 9'-11       | 5.5                       | 22'-7       | 13.2                      | 35'-3       | 20.8                      |
| 96"                      | 4'-9  | 5'-3    | 13'-6  | 10'-6       | 6.0                       | 24'-0       | 14.3                      | 37'-6       | 22.7                      |
| 102"                     | 4'-11 | 5'-6½"  | 14'-1  | 11'-1       | 6.4                       | 25'-2       | 15.3                      | 39'-3       | 24.2                      |
| 108"                     | 5'-1  | 5'-10   | 14'-8  | 11'-8       | 6.9                       | 26'-4       | 16.3                      | 41'-0       | 25.7                      |
| 114"                     | 5'-3  | 6'-1½"  | 15'-3  | 12'-3       | 7.4                       | 27'-6       | 17.3                      | 42'-9       | 27.3                      |
| 120"                     | 5'-5  | 6'-5    | 15'-10 | 12'-10      | 7.8                       | 28'-8       | 18.4                      | 44'-6       | 28.9                      |
| 126"                     | 5'-7  | 6'-8½"  | 16'-5  | 13'-5       | 8.3                       | 29'-10      | 19.4                      | 46'-3       | 30.5                      |
| 132"                     | 5'-9  | 7'-0    | 17'-0  | 14'-0       | 8.8                       | 31'-0       | 20.5                      | 48'-0       | 32.2                      |
| 138"                     | 5'-11 | 7'-3½"  | 17'-7  | 14'-7       | 9.4                       | 32'-2       | 21.6                      | 49'-9       | 33.9                      |
| 144"                     | 6'-1  | 7'-7    | 18'-2  | 15'-2       | 9.9                       | 33'-4       | 22.8                      | 51'-6       | 35.6                      |

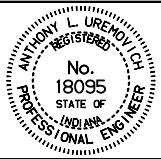
### GENERAL NOTES

1. Refer to Standard Drawings E 715-SPCA-01 and E 715-SPCA-02 for single pipe anchor details.
2. Refer to Standard Drawings E 715-MPCA-01 and E 715-MPCA-02 for multiple pipe anchor details.

### LEGEND

- D - Pipe diameter  
H - Anchor height  
R - Dimension from anchor edge to  $\phi$  of pipe  
S - Dimension between  $\phi$  of adjacent pipes  
G - Overall anchor length

| CORRUGATED ALUMINUM ALLOY OR STEEL PIPE |       |       |       |             |                           |             |                           |             |                           |
|-----------------------------------------|-------|-------|-------|-------------|---------------------------|-------------|---------------------------|-------------|---------------------------|
| D                                       | H     | R     | S     | SINGLE PIPE |                           | DOUBLE PIPE |                           | TRIPLE PIPE |                           |
|                                         |       |       |       | G           | CU.YDS.CONC.<br>2 ANCHORS | G           | CU.YDS.CONC.<br>2 ANCHORS | G           | CU.YDS.CONC.<br>2 ANCHORS |
| 42"                                     | 2'-11 | 2'-4  | 5'-8  | 4'-8        | 2.1                       | 10'-4       | 4.7                       | 16'-0       | 7.3                       |
| 48"                                     | 3'-1  | 2'-7  | 6'-2  | 5'-2        | 2.4                       | 11'-4       | 5.3                       | 17'-6       | 8.2                       |
| 54"                                     | 3'-3  | 2'-10 | 6'-11 | 5'-8        | 2.7                       | 12'-7       | 6.1                       | 19'-6       | 9.5                       |
| 60"                                     | 3'-4  | 3'-1  | 7'-8  | 6'-2        | 3.0                       | 13'-10      | 6.7                       | 21'-6       | 10.5                      |
| 66"                                     | 3'-5  | 3'-4  | 8'-5  | 6'-8        | 3.2                       | 15'-1       | 7.5                       | 23'-6       | 11.6                      |
| 72"                                     | 3'-7  | 3'-7  | 9'-2  | 7'-2        | 3.6                       | 16'-4       | 8.3                       | 25'-6       | 13.0                      |
| 78"                                     | 3'-9  | 3'-10 | 9'-11 | 7'-8        | 3.9                       | 17'-7       | 9.1                       | 27'-6       | 14.4                      |
| 84"                                     | 3'-10 | 4'-1  | 10'-8 | 8'-2        | 4.2                       | 18'-10      | 9.9                       | 29'-6       | 15.6                      |
| 90"                                     | 3'-11 | 4'-4  | 11'-5 | 8'-8        | 4.5                       | 20'-1       | 10.7                      | 31'-6       | 16.8                      |
| 96"                                     | 4'-1  | 4'-7  | 12'-2 | 9'-2        | 4.8                       | 21'-4       | 11.6                      | 33'-6       | 18.4                      |
| 102"                                    | 4'-2  | 4'-10 | 12'-8 | 9'-8        | 5.1                       | 22'-4       | 12.2                      | 35'-0       | 19.3                      |
| 108"                                    | 4'-4  | 5'-1  | 13'-2 | 10'-2       | 5.5                       | 23'-4       | 13.0                      | 36'-6       | 20.6                      |
| 114"                                    | 4'-5  | 5'-4  | 13'-8 | 10'-8       | 5.8                       | 24'-4       | 13.7                      | 38'-0       | 21.6                      |
| 120"                                    | 4'-7  | 5'-7  | 14'-2 | 11'-2       | 6.2                       | 25'-4       | 14.6                      | 39'-6       | 22.9                      |
| 126"                                    | 4'-8  | 5'-10 | 14'-8 | 11'-8       | 6.5                       | 26'-4       | 15.2                      | 41'-0       | 23.9                      |
| 132"                                    | 4'-10 | 6'-1  | 15'-2 | 12'-2       | 6.9                       | 27'-4       | 16.1                      | 42'-6       | 25.3                      |
| 138"                                    | 4'-11 | 6'-4  | 15'-8 | 12'-8       | 7.3                       | 28'-4       | 16.8                      | 44'-0       | 26.4                      |
| 144"                                    | 5'-1  | 6'-7  | 16'-2 | 13'-2       | 7.7                       | 29'-4       | 17.8                      | 45'-6       | 27.8                      |

|                                                                                       |                                                                     |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                     |
| <b>CONCRETE ANCHOR<br/>TABLE</b>                                                      |                                                                     |
| JANUARY 1998                                                                          |                                                                     |
| STANDARD DRAWING NO. <b>E 715-ANCH-01</b>                                             |                                                                     |
|  | DETAILS PLACED IN THIS FORMAT 11-15-99                              |
|                                                                                       | /s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE |
|                                                                                       | /s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE            |
|                                                                                       | DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 1-02-98               |

### REINFORCED CONCRETE HORIZONTAL ELLIPTICAL PIPE

| SPAN | RISE | H     | R      | S      | SINGLE PIPE |                            | DOUBLE PIPE |                            | TRIPLE PIPE |                            |
|------|------|-------|--------|--------|-------------|----------------------------|-------------|----------------------------|-------------|----------------------------|
|      |      |       |        |        | G           | CU.YDS.CONC.,<br>2 ANCHORS | G           | CU.YDS.CONC.,<br>2 ANCHORS | G           | CU.YDS.CONC.,<br>2 ANCHORS |
| 45"  | 29"  | 3'-0  | 2'-9   | 6'-6   | 5'-6        | 2.5                        | 12'-0       | 5.5                        | 18'-6       | 8.5                        |
| 49"  | 32"  | 3'-1  | 2'-11½ | 6'-11  | 5'-11       | 2.7                        | 12'-10      | 5.9                        | 19'-9       | 9.2                        |
| 53"  | 34"  | 3'-2  | 3'-1½  | 7'-6   | 6'-3        | 2.9                        | 13'-9       | 6.4                        | 21'-3       | 10.0                       |
| 60"  | 38"  | 3'-3  | 3'-5½  | 8'-5   | 6'-11       | 3.2                        | 13'-4       | 7.3                        | 23'-9       | 11.3                       |
| 68"  | 43"  | 3'-5  | 3'-10  | 9'-6   | 7'-8        | 3.6                        | 17'-2       | 8.3                        | 26'-8       | 13.0                       |
| 76"  | 48"  | 3'-7  | 4'-2½  | 10'-7  | 8'-5        | 4.1                        | 19'-0       | 9.4                        | 29'-7       | 14.8                       |
| 83"  | 53"  | 3'-8  | 4'-6½  | 11'-7  | 9'-1        | 4.5                        | 20'-8       | 10.5                       | 32'-3       | 16.5                       |
| 91"  | 58"  | 3'-10 | 4'-11  | 12'-8  | 9'-10       | 4.9                        | 22'-6       | 11.7                       | 35'-2       | 18.4                       |
| 98"  | 63"  | 4'-0  | 5'-3   | 13'-6  | 10'-6       | 5.3                        | 24'-0       | 12.7                       | 37'-6       | 20.1                       |
| 106" | 68"  | 4'-2  | 5'-7½  | 14'-3  | 11'-3       | 5.8                        | 25'-6       | 13.7                       | 39'-9       | 21.7                       |
| 113" | 72"  | 4'-3  | 5'-11½ | 14'-11 | 11'-11      | 6.2                        | 26'-10      | 14.6                       | 41'-9       | 23.0                       |
| 121" | 77"  | 4'-5  | 6'-4   | 15'-8  | 12'-8       | 6.7                        | 28'-4       | 15.7                       | 44'-0       | 24.6                       |
| 128" | 82"  | 4'-6  | 6'-8   | 16'-4  | 13'-4       | 7.2                        | 29'-8       | 16.6                       | 46'-0       | 26.1                       |
| 136" | 87"  | 4'-8  | 7'-0   | 17'-0  | 14'-0       | 7.6                        | 31'-0       | 17.6                       | 48'-0       | 27.6                       |
| 143" | 92"  | 4'-10 | 7'-4   | 17'-8  | 14'-8       | 8.1                        | 32'-4       | 18.7                       | 50'-0       | 29.2                       |
| 151" | 97"  | 5'-0  | 7'-8½  | 18'-5  | 15'-5       | 8.7                        | 33'-10      | 19.9                       | 52'-3       | 31.0                       |
| 166" | 106" | 5'-3  | 8'-5   | 19'-10 | 16'-10      | 9.7                        | 36'-8       | 22.0                       | 56'-6       | 34.4                       |
| 180" | 116" | 5'-6  | 9'-1   | 21'-2  | 18'-2       | 10.8                       | 39'-4       | 24.3                       | 60'-6       | 37.8                       |

### GENERAL NOTES

1. Refer to Standard Drawings E 715-SPCA-01 and E 715-SPCA-02 for single anchor details.
2. Refer to Standard Drawing E 715-MPCA-02 for multiple anchor details.

### LEGEND

- H - Anchor height  
R - Dimension from anchor edge to  $\phi$  exterior pipe  
S - Dimension between  $\phi$  of adjacent pipes  
G - Overall anchor length

### CORRUGATED ALUMINUM ALLOY OR STEEL PIPE-ARCH

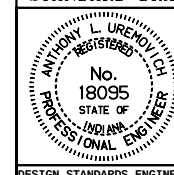
| SPAN | RISE | H     | R      | S      | SINGLE PIPE |                            | DOUBLE PIPE |                            | TRIPLE PIPE |                            |
|------|------|-------|--------|--------|-------------|----------------------------|-------------|----------------------------|-------------|----------------------------|
|      |      |       |        |        | G           | CU.YDS.CONC.,<br>2 ANCHORS | G           | CU.YDS.CONC.,<br>2 ANCHORS | G           | CU.YDS.CONC.,<br>2 ANCHORS |
| 49"  | 33"  | 3'-0  | 2'-7   | 6'-3   | 5'-2        | 2.2                        | 11'-5       | 4.9                        | 17'-8       | 7.7                        |
| 57"  | 38"  | 3'-1  | 2'-11  | 7'-3   | 5'-10       | 2.5                        | 13'-1       | 5.7                        | 20'-4       | 8.9                        |
| 64"  | 43"  | 3'-3  | 3'-2½  | 8'-1   | 6'-5        | 2.8                        | 14'-6       | 6.4                        | 22'-7       | 10.1                       |
| 71"  | 47"  | 3'-4  | 3'-6   | 9'-0   | 7'-0        | 3.0                        | 16'-0       | 7.2                        | 25'-0       | 11.3                       |
| 77"  | 52"  | 3'-6  | 3'-9   | 9'-9   | 7'-6        | 3.3                        | 17'-3       | 7.9                        | 27'-0       | 12.5                       |
| 83"  | 57"  | 3'-8  | 4'-0   | 10'-6  | 8'-0        | 3.5                        | 18'-6       | 8.6                        | 29'-0       | 13.6                       |
| 60"  | 46"  | 3'-9  | 3'-1   | 7'-8   | 6'-2        | 2.9                        | 13'-10      | 6.7                        | 21'-6       | 10.5                       |
| 66"  | 51"  | 3'-10 | 3'-4   | 8'-5   | 6'-8        | 3.1                        | 15'-1       | 7.4                        | 23'-6       | 11.6                       |
| 73"  | 55"  | 4'-0  | 3'-7½  | 9'-4   | 7'-3        | 3.4                        | 16'-7       | 8.3                        | 25'-11      | 13.1                       |
| 81"  | 59"  | 4'-2  | 3'-11½ | 10'-4  | 7'-11       | 3.7                        | 18'-3       | 9.1                        | 28'-7       | 14.5                       |
| 87"  | 63"  | 4'-2  | 4'-2½  | 11'-1  | 8'-5        | 4.0                        | 19'-6       | 9.8                        | 30'-7       | 15.6                       |
| 95"  | 67"  | 4'-4  | 4'-6½  | 12'-1  | 9'-1        | 4.3                        | 21'-2       | 10.8                       | 33'-3       | 17.2                       |
| 103" | 71"  | 4'-6  | 4'-10½ | 12'-9  | 9'-9        | 4.7                        | 22'-6       | 11.6                       | 35'-3       | 18.5                       |
| 112" | 75"  | 4'-8  | 5'-3   | 13'-6  | 10'-6       | 5.1                        | 24'-0       | 12.5                       | 37'-6       | 19.8                       |
| 117" | 79"  | 4'-9  | 5'-5½  | 13'-11 | 10'-11      | 5.3                        | 24'-10      | 12.9                       | 38'-9       | 20.6                       |
| 128" | 83"  | 5'-0  | 5'-11  | 14'-10 | 11'-10      | 5.8                        | 26'-8       | 14.1                       | 41'-6       | 22.4                       |
| 137" | 87"  | 5'-2  | 6'-3   | 15'-7  | 12'-7       | 6.1                        | 28'-1       | 14.8                       | 43'-8       | 23.5                       |
| 142" | 91"  | 5'-4  | 6'-6   | 16'-0  | 13'-0       | 6.5                        | 29'-0       | 15.7                       | 45'-0       | 24.9                       |

INDIANA DEPARTMENT OF TRANSPORTATION

### CONCRETE ANCHOR TABLES

JANUARY 1998

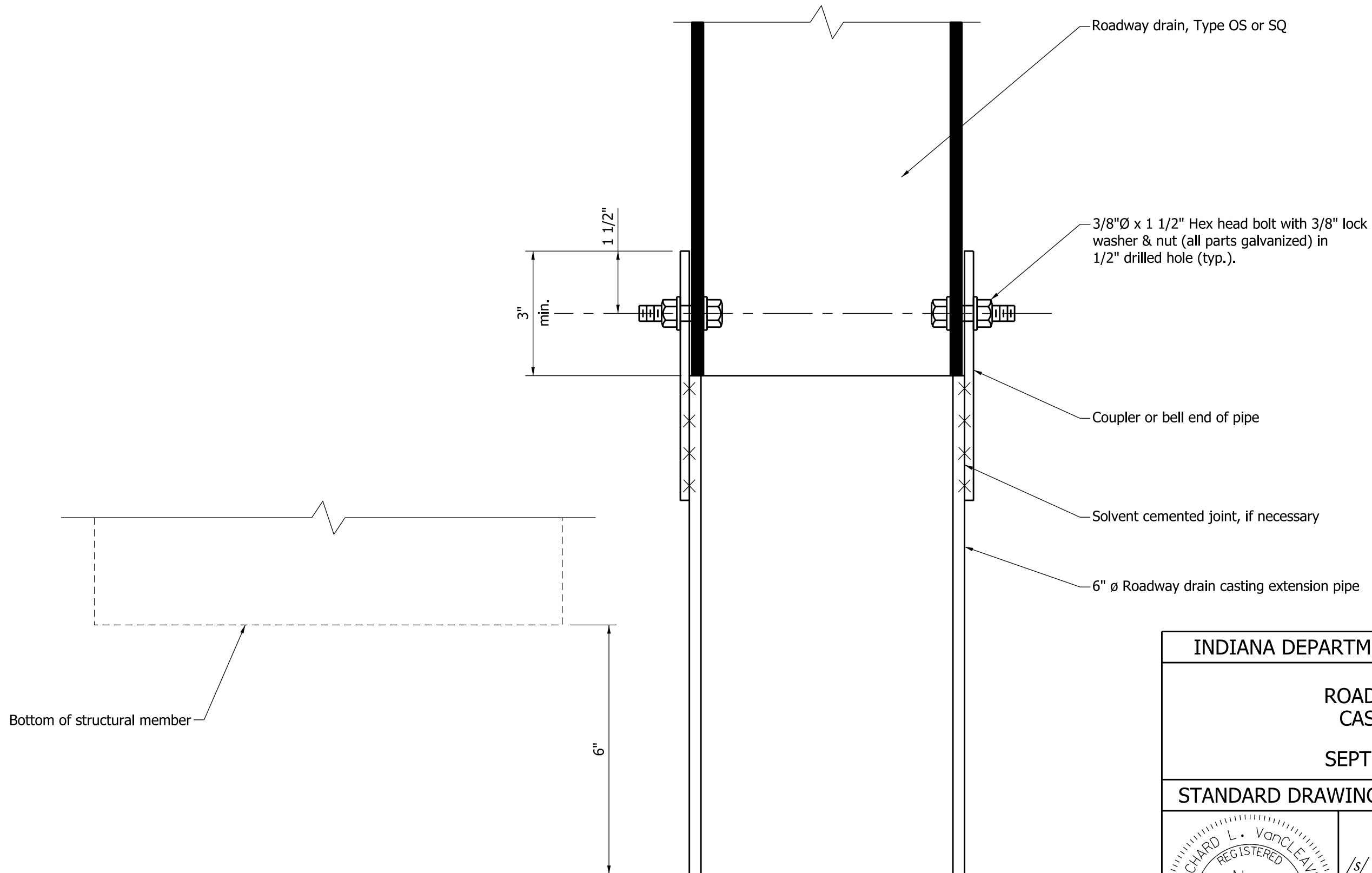
STANDARD DRAWING NO. E 715-ANCH-02



DETAILS PLACED IN THIS FORMAT 11-15-99

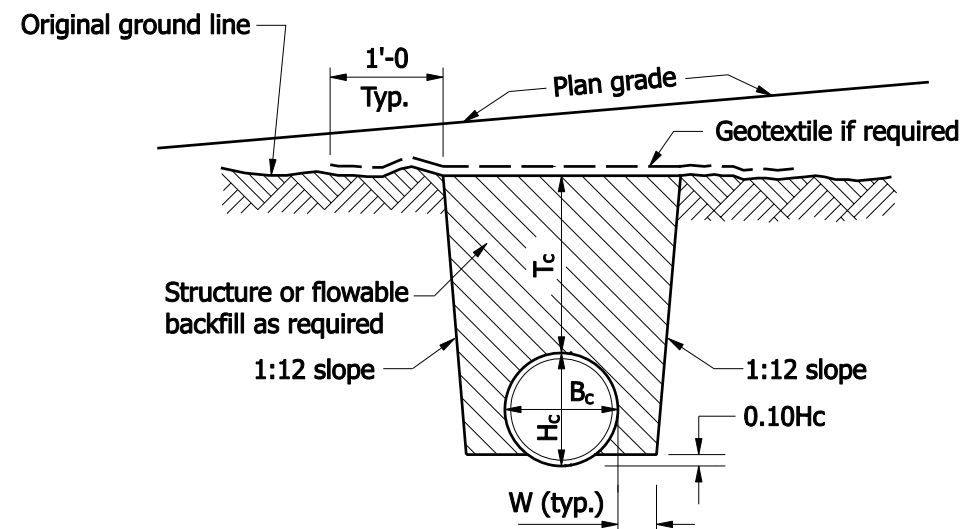
/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE  
ORIGINALLY APPROVED 1-02-98



Note: Pipe support brackets not shown for clarity.

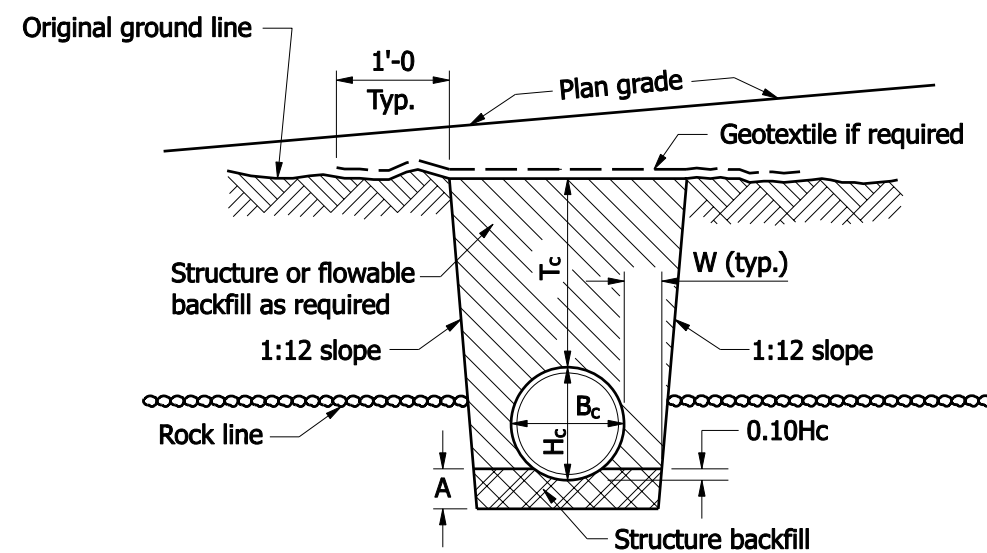
| INDIANA DEPARTMENT OF TRANSPORTATION |                                 |               |
|--------------------------------------|---------------------------------|---------------|
| ROADWAY DRAIN<br>CASTING PIPE        |                                 |               |
| SEPTEMBER 2011                       |                                 |               |
| STANDARD DRAWING NO.                 |                                 | E 715-BDCG-01 |
|                                      | /s/ <i>Richard L. VanCleave</i> | 09/01/11      |
|                                      | DESIGN STANDARDS ENGINEER       | DATE          |
|                                      | /s/ <i>Mark A. Miller</i>       | 09/01/11      |
|                                      | CHIEF HIGHWAY ENGINEER          | DATE          |
| DESIGN STANDARDS ENGINEER            |                                 |               |



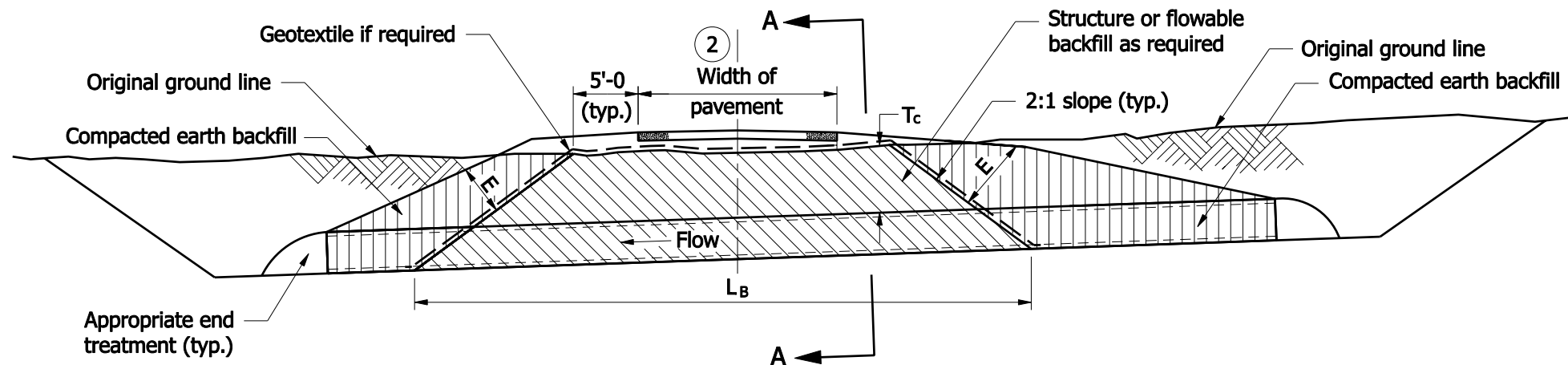
SECTION A-A

# LEGEND

$H_c$  = Overall diameter or rise (typ.)  
 $B_c$  = Overall diameter or span  
 $A$  = 8" min. for fill height less than 16'  
           = 12" min. for fill height of 16' or more  
 $T_c$  = Trench cover depth over pipe  
 $W$  =  $0.3 B_c$  or 9", whichever is greater  
 $E$  = Encasement  
 $L_B$  = Backfill length measured from toe to toe of the 2:1 slopes.



SECTION A-A  
ROCK FOUNDATION



ELEVATION

## NOTES :

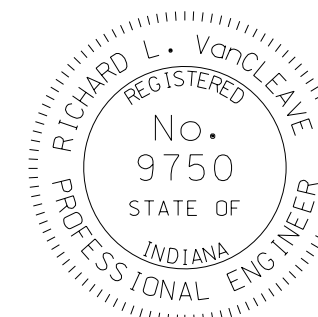
- Protective cover shall be constructed prior to running heavy equipment over installed pipes. The minimum covers are listed below:
  - 1.5' for  $B_c \leq 18"$
  - 3' for  $18" < B_c \leq 54"$
  - 4' for  $B_c > 54"$
- For backfill purposes, paved shoulders, curbs, and sidewalks are considered pavement. See Standard Drawing E 715-BKFL-10 for pavement limits when curbs, paved shoulders, or sidewalks are present.
- Flowable or structure backfill shall be encased by compacted earth backfill. The minimum encasement shall be 2 ft. If necessary, the 2:1 slope between the flowable or structure backfill and the encasement shall be modified to maintain the minimum 2 ft encasement.

INDIANA DEPARTMENT OF TRANSPORTATION

PIPE BACKFILL METHOD 1  
NEW ROADWAY, TRENCH

SEPTEMBER 2008

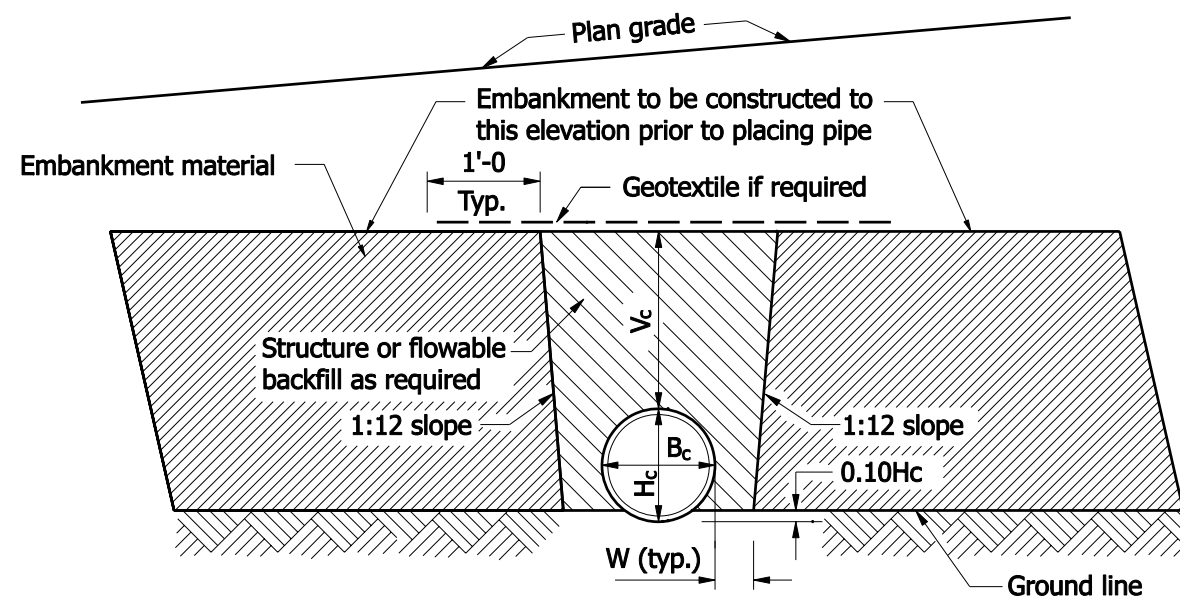
STANDARD DRAWING NO. E 715-BKFL-01



DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave 09/02/08  
DESIGN STANDARDS ENGINEER DATE

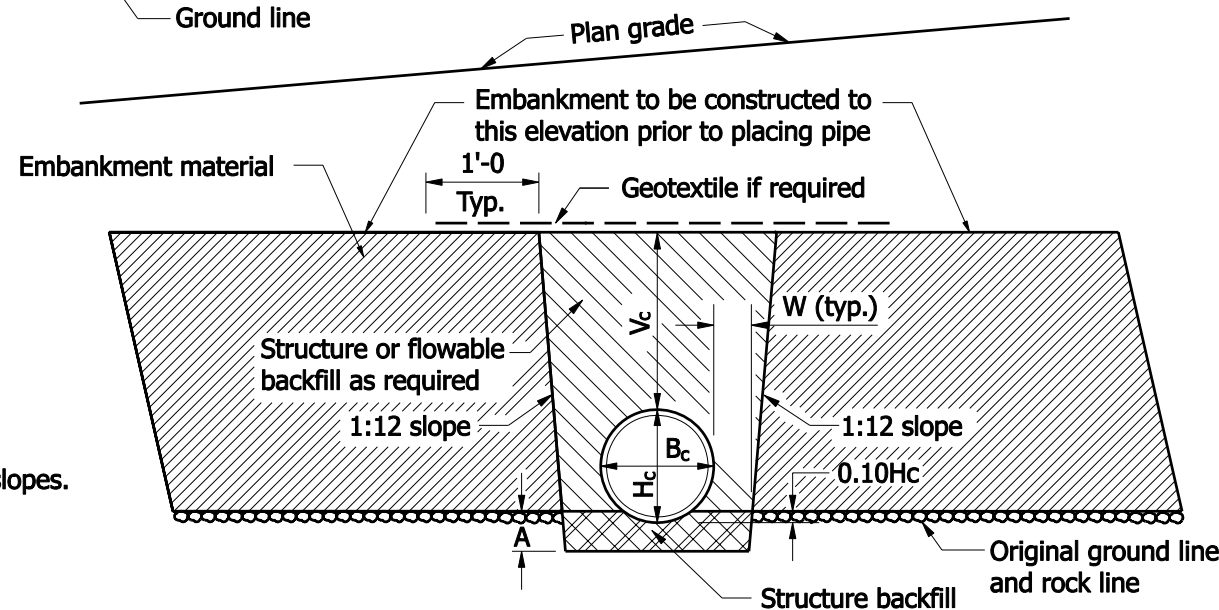
/s/ Mark A. Miller 09/02/08  
CHIEF HIGHWAY ENGINEER DATE



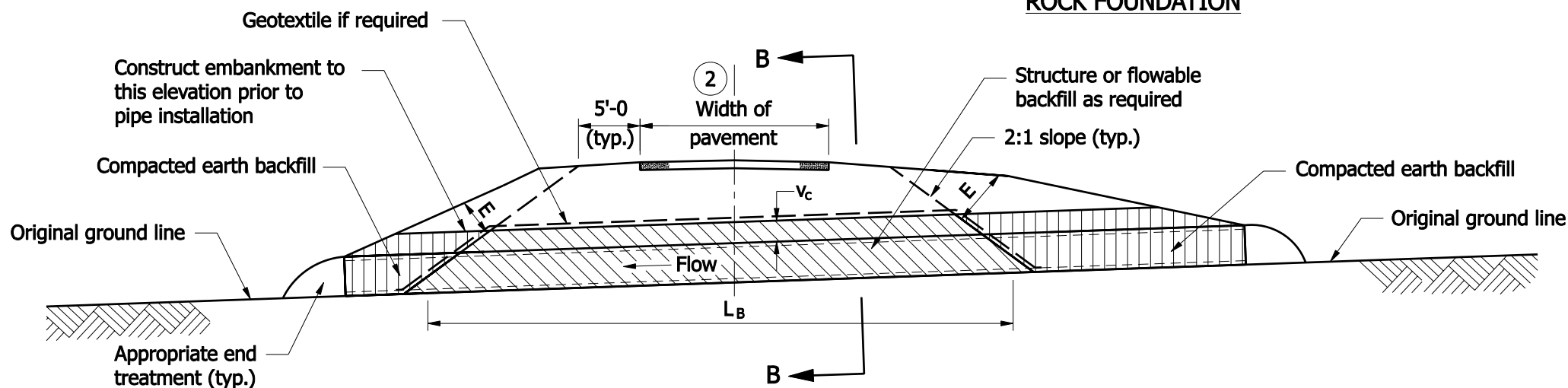
SECTION B-B

# LEGEND

$H_c$  = Overall diameter or rise (typ.)  
 $B_c$  = Overall diameter or span  
 $A$  = 8" min. for fill height less than 16'  
= 12" min. for fill height of 16' or more  
 $V_c$  = 12" for  $B_c \leq 18"$   
= 18" for  $B_c > 18"$   
 $W$  =  $0.3 B_c$  or 9", whichever is greater  
 $L_B$  = Backfill length measured from toe to toe of the 2:1 slopes.



SECTION B-B  
ROCK FOUNDATION



ELEVATION

## NOTES :

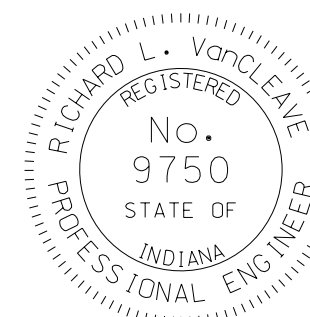
- Protective cover shall be constructed prior to running heavy equipment over installed pipes. The minimum covers are listed below:
  - 1.5' for  $B_c \leq 18"$
  - 3' for  $18" < B_c \leq 54"$
  - 4' for  $B_c > 54"$
- For backfill purposes, paved shoulders, curbs, and sidewalks are considered pavement. See Standard Drawing E 715-BKFL-10 for pavement limits when curbs, paved shoulders, or sidewalks are present.
- Flowable or structure backfill shall be encased by compacted earth backfill. The minimum encasement shall be 2 ft. If necessary, the 2:1 slope between the flowable or structure backfill and the encasement shall be modified to maintain the minimum 2 ft encasement.

INDIANA DEPARTMENT OF TRANSPORTATION

PIPE BACKFILL METHOD 1  
NEW ROADWAY, EMBANKMENT

SEPTEMBER 2008

STANDARD DRAWING NO. E 715-BKFL-02

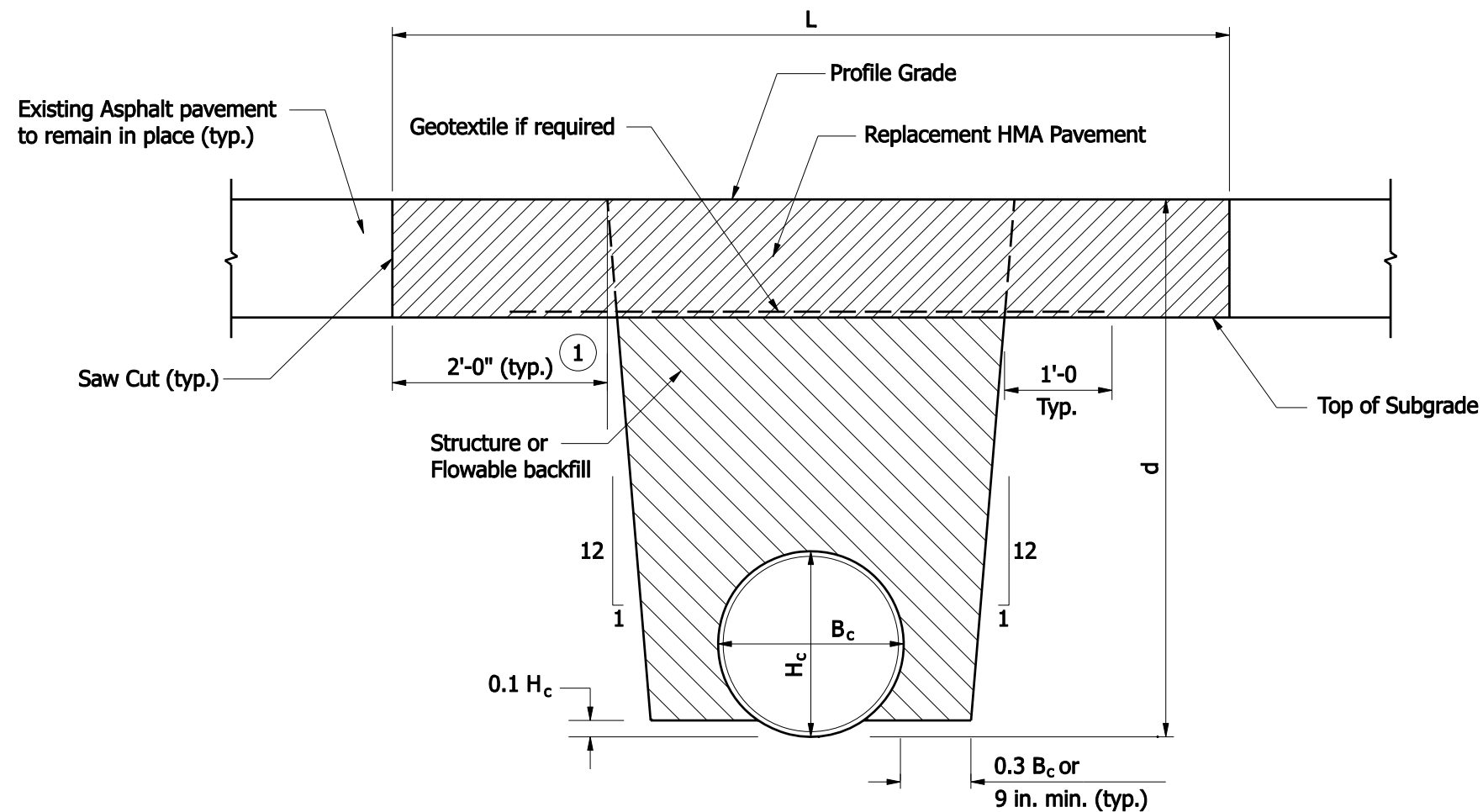


/s/ Richard L. VanCleave 09/02/08  
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller 09/02/08  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER





- $L$  = Pay limits of pavement removal and pavement replacement (ft); for cross pipe, measured along roadway centerline; for pipe parallel to roadway centerline, measured perpendicular to pipe centerline.
- $B_c$  = Overall diameter or span (in.)
- $H_c$  = Overall diameter or rise (in.)
- $d$  = Vertical distance from flowline to profile grade (ft)

#### ASPHALT REPLACEMENT PAVEMENT

#### NOTES :

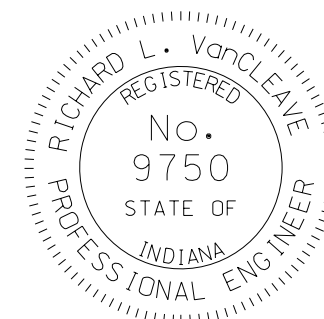
- Existing subgrade over this distance shall remain in place.
- The minimum pavement sections shall be as follows:  
HMA: 165 #/syd HMA Surface, Type A,B,C or D on variable HMA Intermediate, Type A, B, C or D
- If underdrains are present, they shall be perpetuated in accordance with the details shown on Standard Drawing E 718-UNDR-01.
- See Standard Drawing E 715-BKFL-01 for pipe backfill trench elevation view.

INDIANA DEPARTMENT OF TRANSPORTATION

PIPE BACKFILL METHOD 1  
EXISTING ROADWAY, TRENCH

SEPTEMBER 2008

STANDARD DRAWING NO. E 715-BKFL-03

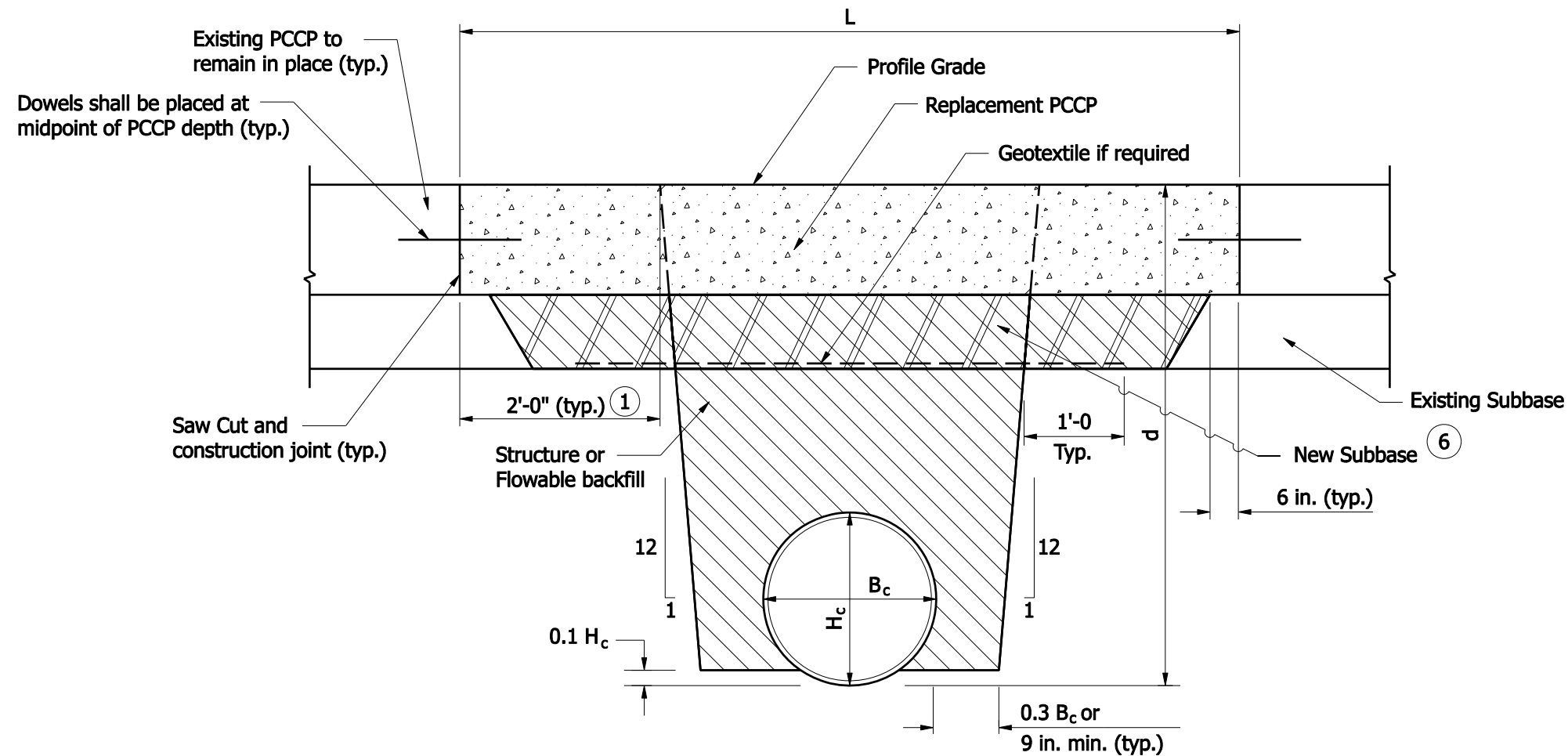


DESIGN STANDARDS ENGINEER

/s/ *Richard L. VanCleave* 09/02/08  
DESIGN STANDARDS ENGINEER DATE

/s/ *Mark A. Miller* 09/02/08  
CHIEF HIGHWAY ENGINEER DATE





- $L$  = Pay limits of pavement removal and pavement replacement (ft);  
for cross pipe, measured along roadway centerline; for pipe parallel to  
roadway centerline, measured perpendicular to pipe centerline.
- $B_c$  = Overall diameter or span (in.)
- $H_c$  = Overall diameter or rise (in.)
- $d$  = Vertical distance from flowline to profile grade (ft)

#### PCCP REPLACEMENT PAVEMENT

#### NOTES :

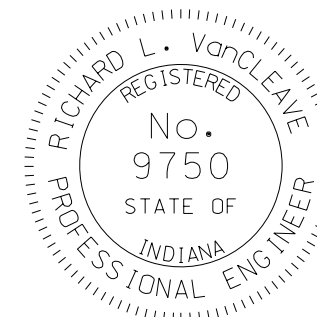
- ① Existing subgrade over this longitudinal distance shall remain in place.
2. The thickness of the replacement PCCP shall match that of the existing concrete pavement.
3. See Standard Drawing E 506-CCPP-01 for subbase, dowels, and construction joint details.
4. If underdrains are present, they shall be perpetuated in accordance with the details shown on Standard Drawing E 718-UNDR-01.
5. See Standard Drawing E 715-BKFL-01 for pipe backfill trench elevation view.
- ⑥ New subbase type shall match the existing subbase type and thickness.

INDIANA DEPARTMENT OF TRANSPORTATION

### PIPE BACKFILL METHOD 1 EXISTING ROADWAY, TRENCH

SEPTEMBER 2008

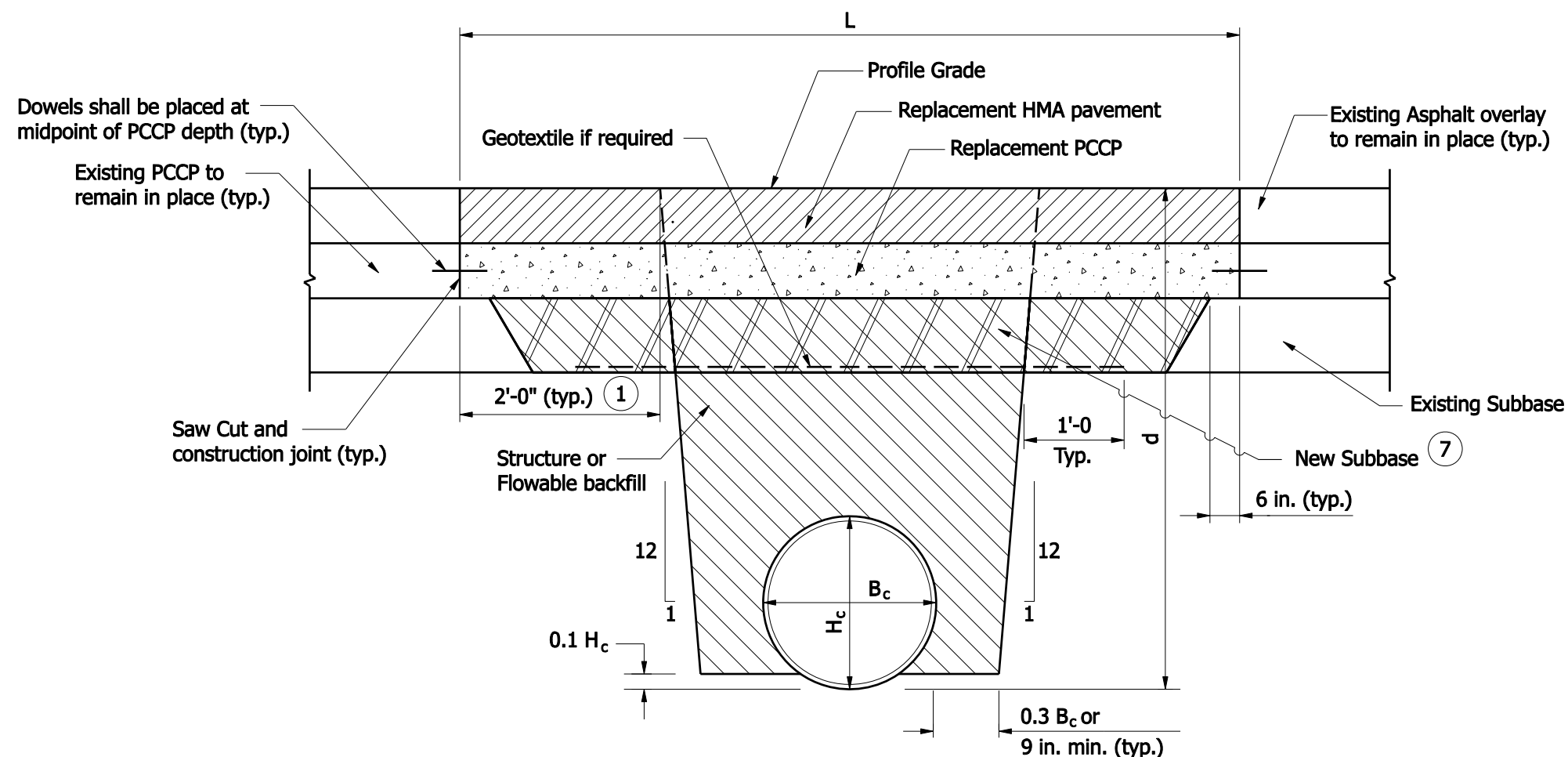
STANDARD DRAWING NO. E 715-BKFL-04



DESIGN STANDARDS ENGINEER

*/s/ Richard L. VanCleave* 09/02/08  
DESIGN STANDARDS ENGINEER DATE

*/s/ Mark A. Miller* 09/02/08  
CHIEF HIGHWAY ENGINEER DATE



- L = Pay limits of pavement removal and pavement replacement (ft);  
for cross pipe, measured along roadway centerline; for pipe parallel to  
roadway centerline, measured perpendicular to pipe centerline.
- $B_c$  = Overall diameter or span (in.)
- $H_c$  = Overall diameter or rise (in.)
- d = Vertical distance from flowline to profile grade (ft)

### COMPOSITE REPLACEMENT PAVEMENT

### NOTES :

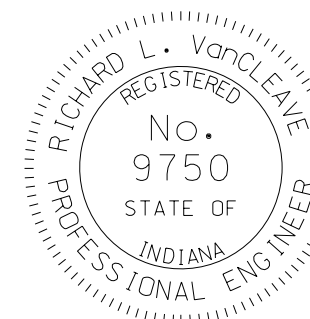
- Existing subgrade over this distance shall remain in place.
- The thickness of the replacement PCCP shall match that of the existing concrete pavement.
- The minimum pavement sections shall be as follows:  
HMA: 165 #/syd HMA Surface, Type A,B,C or D on  
variable HMA Intermediate, Type A, B, C or D
- See Standard Drawing E 506-CCPP-01 for subbase, dowels, and construction joint details.
- If underdrains are present, they shall be perpetuated in accordance with the details shown on Standard Drawing E 718-UNDR-01.
- See Standard Drawing E 715-BKFL-01 for pipe backfill trench elevation view.
- New subbase type shall match the existing subbase type and thickness.

INDIANA DEPARTMENT OF TRANSPORTATION

PIPE BACKFILL METHOD 1  
EXISTING ROADWAY, TRENCH

SEPTEMBER 2008

STANDARD DRAWING NO. E 715-BKFL-05



DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave 09/02/08  
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller 09/02/08  
CHIEF HIGHWAY ENGINEER DATE

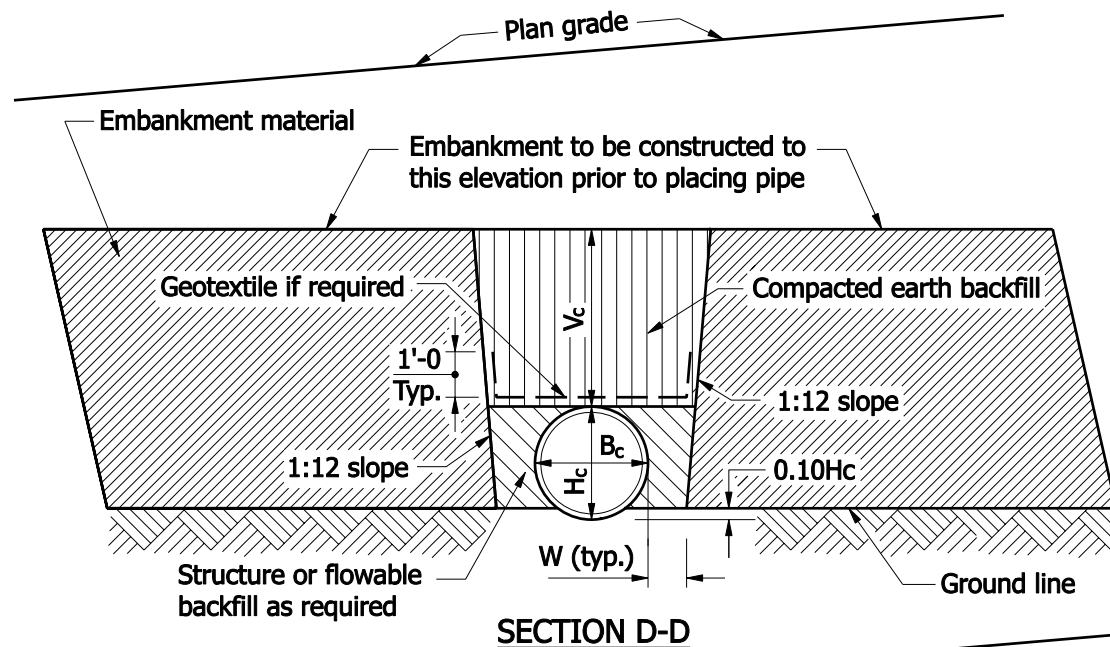


$H_c$  = Overall diameter or rise (typ.)  
 $B_c$  = Overall diameter or span  
 $A$  = 8" min. for fill height less than 16'  
       = 12" min. for fill height of 16' or more  
 $T_c$  = Trench cover depth over pipe  
 $W$  = 0.3  $B_c$  or 9", whichever is greater  
 $E$  = Encasement  
 $L_B$  = Backfill length measured from toe to toe of the 2:1 slopes.



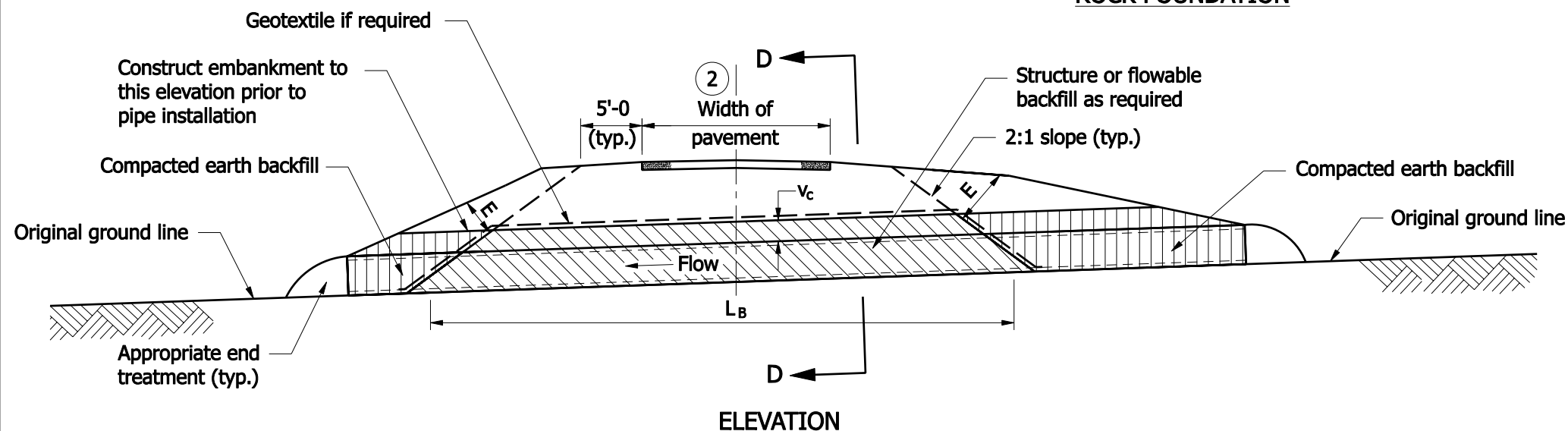
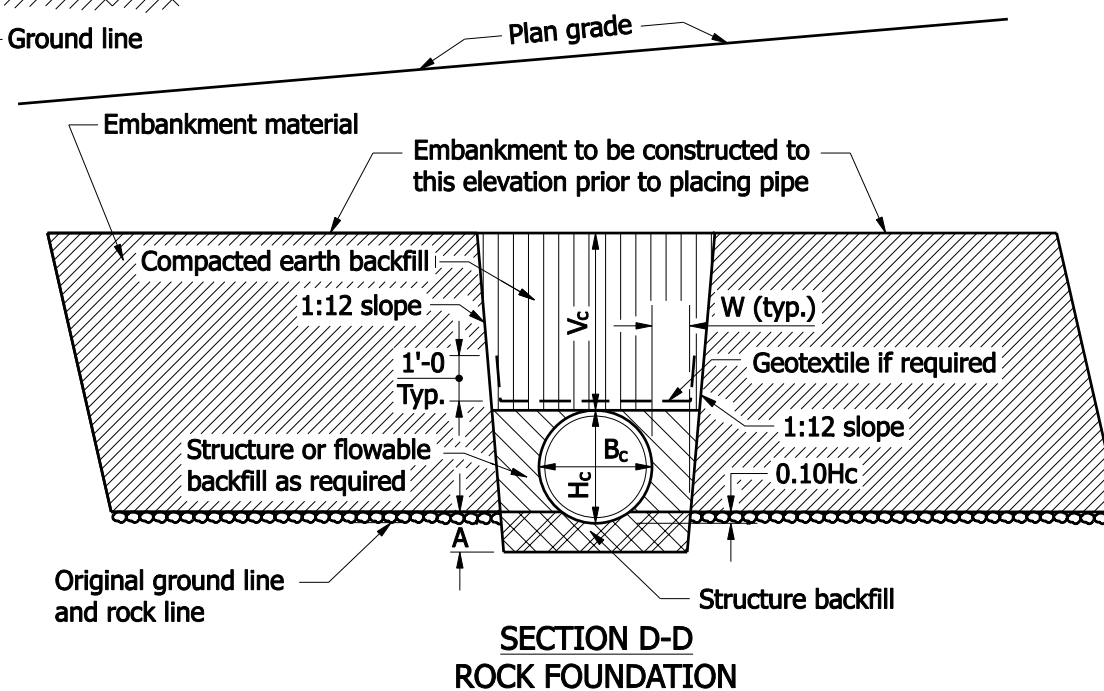
1. Protective cover shall be constructed prior to running heavy equipment over installed pipes. The minimum covers are listed below:
  - a.) 1.5' for  $B_c \leq 18"$
  - b.) 3' for  $18" < B_c \leq 54"$
  - c.) 4' for  $B_c > 54"$
2. For backfill purposes, paved shoulders, curbs, and sidewalks are considered pavement. See Standard Drawing E 715-BKFL-10 for pavement limits when curbs, paved shoulders, or sidewalks are present.
3. Flowable or structure backfill shall be encased by compacted earth backfill. The minimum encasement shall be 2 ft. If necessary, the 2:1 slope between the flowable or structure backfill and the encasement shall be modified to maintain the minimum 2 ft encasement.

|                                                                                       |                                                                                                                                                                                                                                                                          |                                 |                 |                           |      |                           |                 |                        |      |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-----------------|---------------------------|------|---------------------------|-----------------|------------------------|------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                                                                                                                          |                                 |                 |                           |      |                           |                 |                        |      |
| PIPE BACKFILL METHOD 2<br>NEW OR EXISTING DRIVE                                       |                                                                                                                                                                                                                                                                          |                                 |                 |                           |      |                           |                 |                        |      |
| SEPTEMBER 2008                                                                        |                                                                                                                                                                                                                                                                          |                                 |                 |                           |      |                           |                 |                        |      |
| STANDARD DRAWING NO. E 715-BKFL-06                                                    |                                                                                                                                                                                                                                                                          |                                 |                 |                           |      |                           |                 |                        |      |
|  | <table><tr><td><u>/s/ Richard L. VanCleave</u></td><td><u>09/02/08</u></td></tr><tr><td>DESIGN STANDARDS ENGINEER</td><td>DATE</td></tr><tr><td><u>/s/ Mark A. Miller</u></td><td><u>09/02/08</u></td></tr><tr><td>CHIEF HIGHWAY ENGINEER</td><td>DATE</td></tr></table> | <u>/s/ Richard L. VanCleave</u> | <u>09/02/08</u> | DESIGN STANDARDS ENGINEER | DATE | <u>/s/ Mark A. Miller</u> | <u>09/02/08</u> | CHIEF HIGHWAY ENGINEER | DATE |
| <u>/s/ Richard L. VanCleave</u>                                                       | <u>09/02/08</u>                                                                                                                                                                                                                                                          |                                 |                 |                           |      |                           |                 |                        |      |
| DESIGN STANDARDS ENGINEER                                                             | DATE                                                                                                                                                                                                                                                                     |                                 |                 |                           |      |                           |                 |                        |      |
| <u>/s/ Mark A. Miller</u>                                                             | <u>09/02/08</u>                                                                                                                                                                                                                                                          |                                 |                 |                           |      |                           |                 |                        |      |
| CHIEF HIGHWAY ENGINEER                                                                | DATE                                                                                                                                                                                                                                                                     |                                 |                 |                           |      |                           |                 |                        |      |
| DESIGN STANDARDS ENGINEER                                                             |                                                                                                                                                                                                                                                                          |                                 |                 |                           |      |                           |                 |                        |      |



## LEGEND

$H_c$  = Overall diameter or rise (typ.)  
 $B_c$  = Overall diameter or span  
 $A$  = 8" min. for fill height less than 16'  
       = 12" min. for fill height of 16' or more  
 $V_c$  = 12" for  $B_c \leq 18"$   
       18" for  $B_c > 18"$   
 $W$  = 0.3  $B_c$  or 9", whichever is greater  
 $E$  = Encasement  
 $L_B$  = Backfill length measured from toe to toe



**NOTES :**

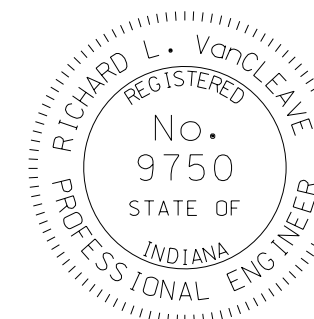
1. Protective cover shall be constructed prior to running heavy equipment over installed pipes. The minimum covers are listed below:
  - a.) 1.5' for  $B_c \leq 18"$
  - b.) 3' for  $18" < B_c \leq 54"$
  - c.) 4' for  $B_c > 54"$
2. For backfill purposes, paved shoulders, curbs, and sidewalks are considered pavement. See Standard Drawing E 715-BKFL-10 for pavement limits when curbs, paved shoulders, or sidewalks are present.
3. Flowable or structure backfill shall be encased by compacted earth backfill. The minimum encasement shall be 2 ft. If necessary, the 2:1 slope between the flowable or structure backfill and the encasement shall be modified to maintain the minimum 2 ft encasement.

INDIANA DEPARTMENT OF TRANSPORTATION

## PIPE BACKFILL METHOD 2 NEW OR EXISTING DRIVE

SEPTEMBER 2008

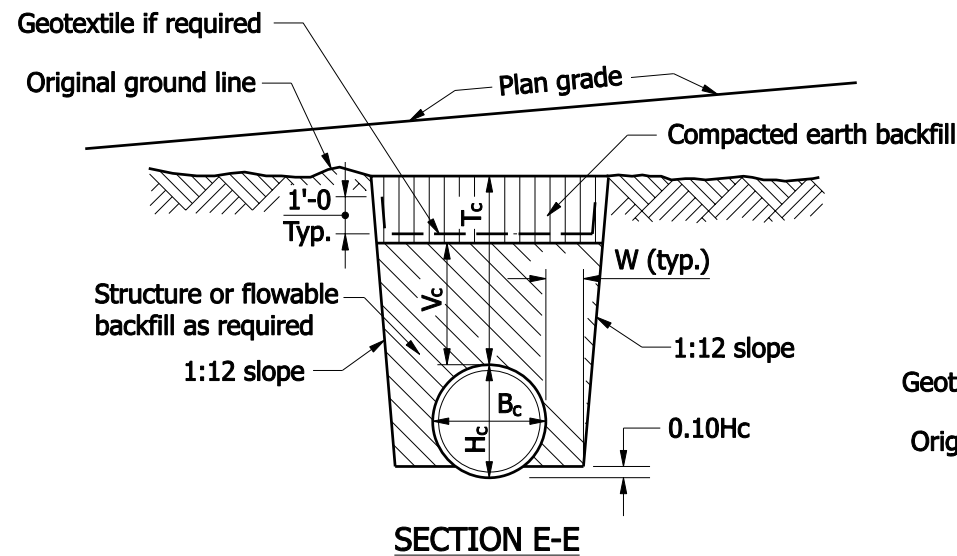
**STANDARD DRAWING NO. E 715-BKFL-07**



|                                 |                 |
|---------------------------------|-----------------|
| <u>/s/ Richard L. VanCleave</u> | <u>09/02/08</u> |
| DESIGN STANDARDS ENGINEER       | DATE            |

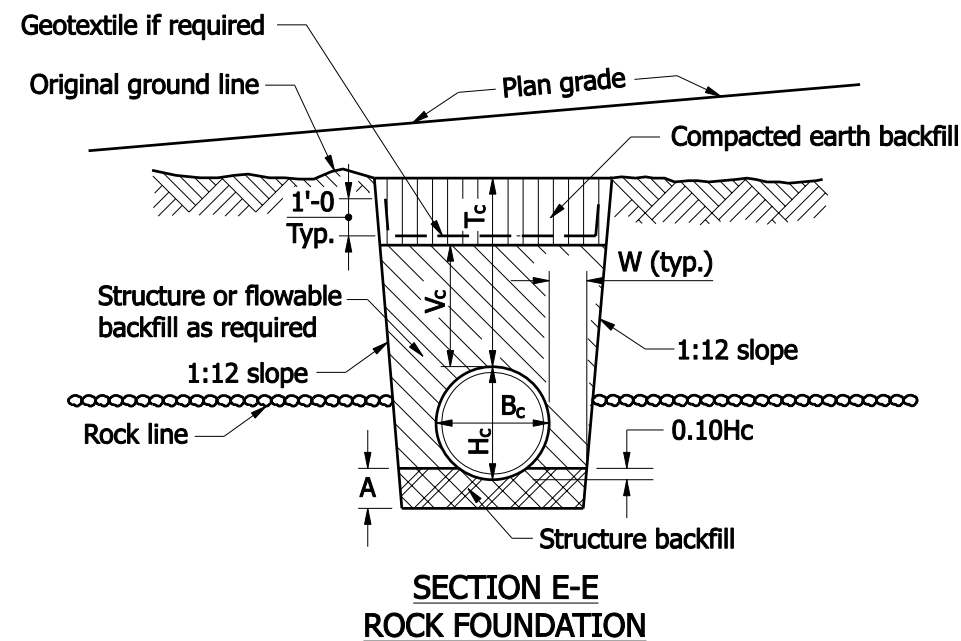
|                           |          |
|---------------------------|----------|
| <i>/s/ Mark A. Miller</i> | 09/02/08 |
| CHIEF HIGHWAY ENGINEER    | DATE     |

DESIGN STANDARDS ENGINEER



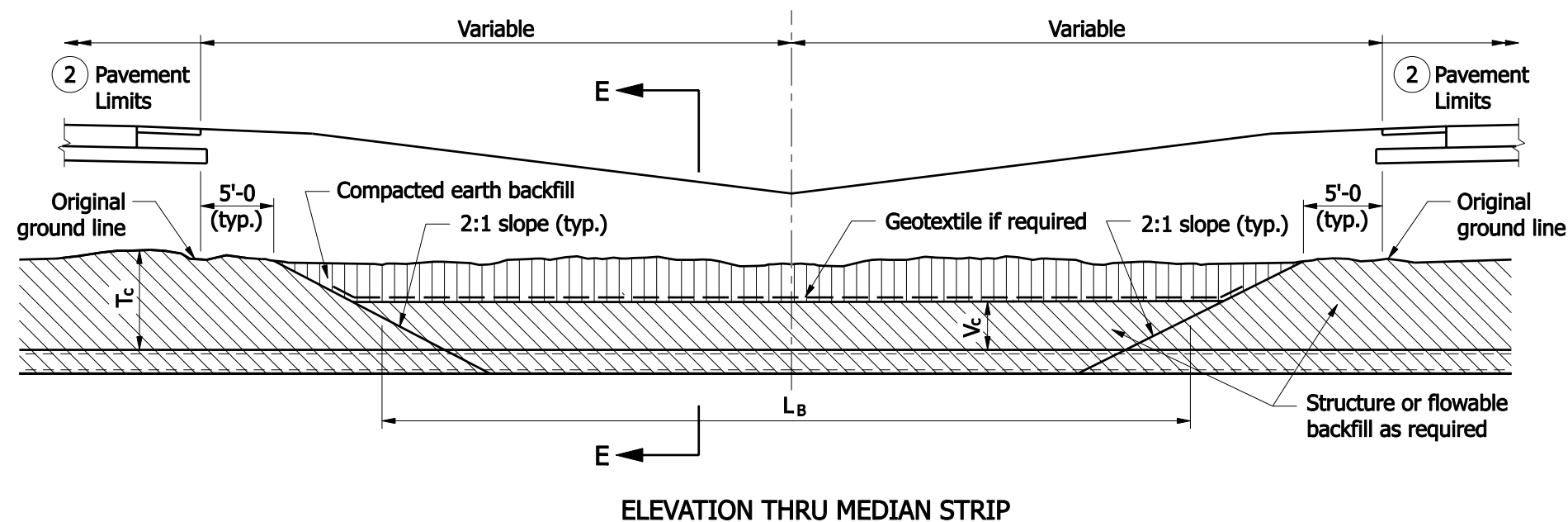
#### LEGEND

$H_c$  = Overall diameter or rise (typ.)  
 $B_c$  = Overall diameter or span  
 $A$  = 8" min. for fill height less than 16'  
           = 12" min. for fill height of 16' or more  
 $V_c$  = 12" for  $B_c \leq 18"$   
           = 18" for  $B_c > 18"$   
 $T_c$  = Trench cover depth over pipe  
 $W$  =  $0.3 B_c$  or 9", whichever is greater  
 $L_B$  = Backfill length measured from toe to toe of the 2:1 slopes.



#### NOTES :

1. Protective cover shall be constructed prior to running heavy equipment over installed pipes. The minimum covers are listed below:
  - a.) 1.5' for  $B_c \leq 18"$
  - b.) 3' for  $18" < B_c \leq 54"$
  - c.) 4' for  $B_c > 54"$
2. For backfill purposes, paved shoulders, curbs, and sidewalks are considered pavement. See Standard Drawing E 715-BKFL-10 for pavement limits when curbs, paved shoulders, or sidewalks are present.

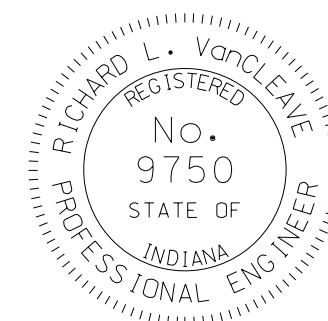


INDIANA DEPARTMENT OF TRANSPORTATION

### PIPE BACKFILL METHOD 3 MEDIAN INSTALLATION, TRENCH

SEPTEMBER 2008

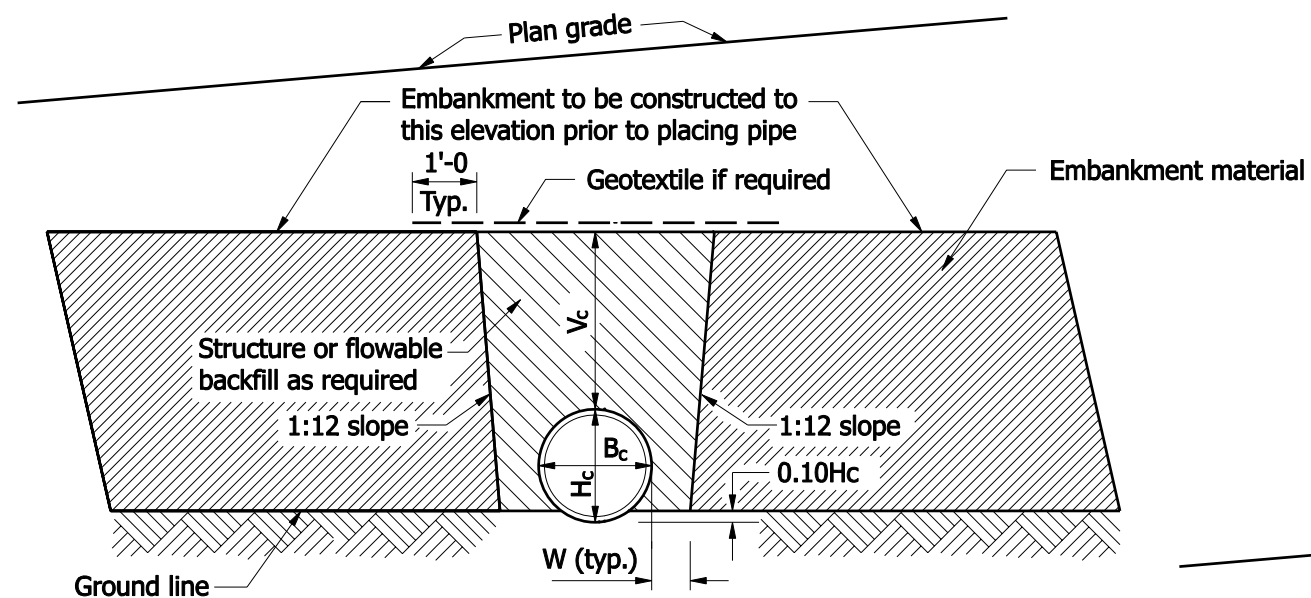
STANDARD DRAWING NO. E 715-BKFL-08



DESIGN STANDARDS ENGINEER

*/s/ Richard L. VanCleave* 09/02/08  
 DESIGN STANDARDS ENGINEER DATE

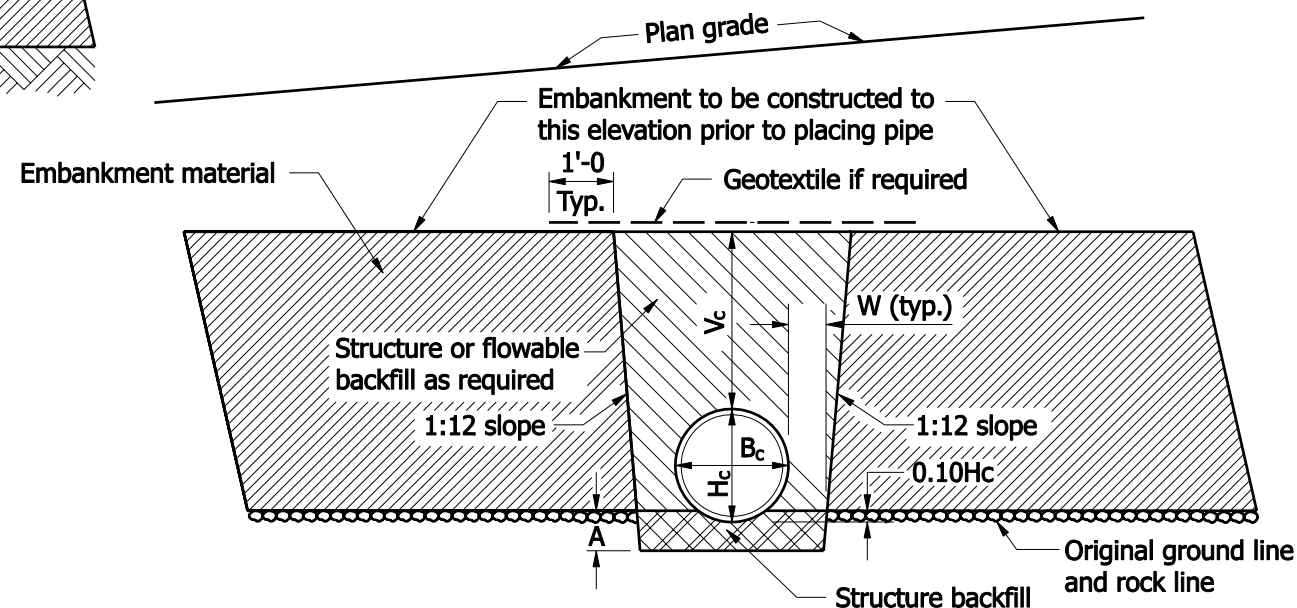
*/s/ Mark A. Miller* 09/02/08  
 CHIEF HIGHWAY ENGINEER DATE



SECTION F-F

# LEGEND

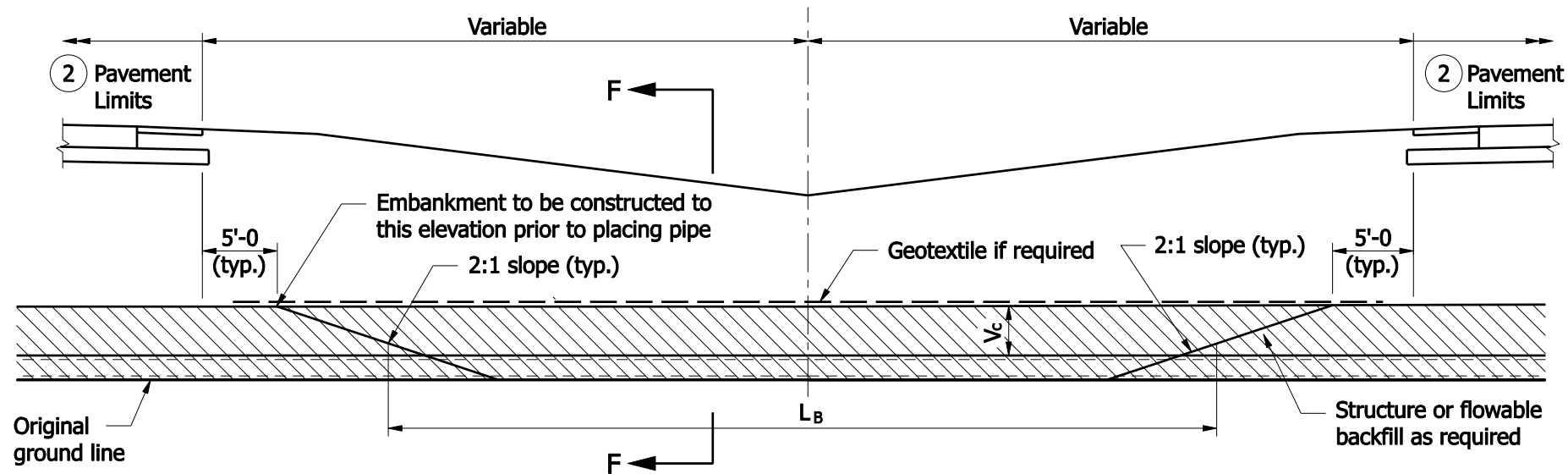
$H_c$  = Overall diameter or rise (typ.)  
 $B_c$  = Overall diameter or span  
 $A$  = 8" min. for fill height less than 16'  
           = 12" min. for fill height of 16' or more  
 $V_c$  = 12" for  $B_c \leq 18"$   
           = 18" for  $B_c > 18"$   
 $W$  =  $0.3 B_c$  or 9", whichever is greater  
 $L_B$  = Backfill length measured from toe to toe of the 2:1 slopes.



SECTION F-F  
ROCK FOUNDATION

## NOTES :

- Protective cover shall be constructed prior to running heavy equipment over installed pipes. The minimum covers are listed below:
  - 1.5' for  $B_c \leq 18"$
  - 3' for  $18" < B_c \leq 54"$
  - 4' for  $B_c > 54"$
- For backfill purposes, paved shoulders, curbs, and sidewalks are considered pavement. See Standard Drawing E 715-BKFL-10 for pavement limits when curbs, paved shoulders, or sidewalks are present.



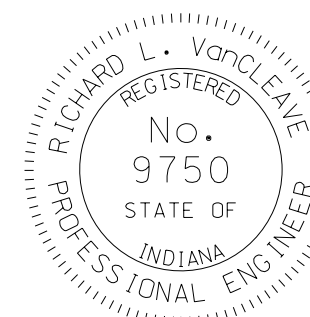
ELEVATION THRU MEDIAN STRIP

INDIANA DEPARTMENT OF TRANSPORTATION

PIPE BACKFILL METHOD 1  
MEDIAN INSTALLATION, EMBANKMENT

SEPTEMBER 2008

STANDARD DRAWING NO. E 715-BKFL-09



DESIGN STANDARDS ENGINEER

/s/ Richard L. Van Cleave 09/02/08  
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller 09/02/08  
CHIEF HIGHWAY ENGINEER DATE

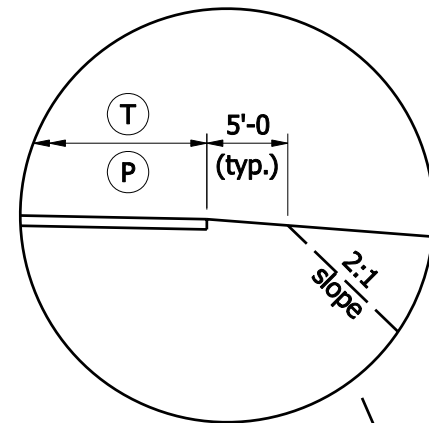


**LEGEND**

- (C) Curb
- (P) Pavement Limits \*
- (S) Sidewalk
- (T) Travel Lane
- (U) Utility Strip
- (V) Paved Shoulder

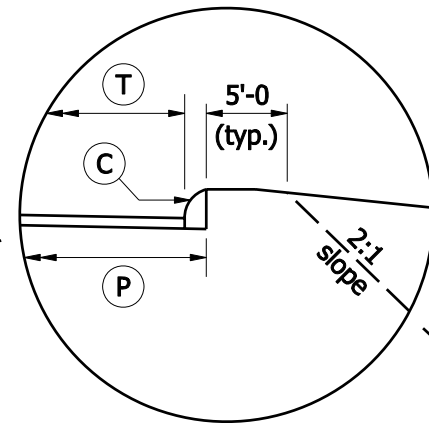
\* For backfill placement and computation

**EDGE OF TRAVELWAY**



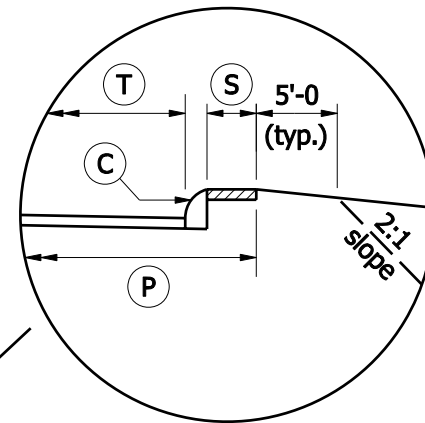
or

**BACK OF CURB**

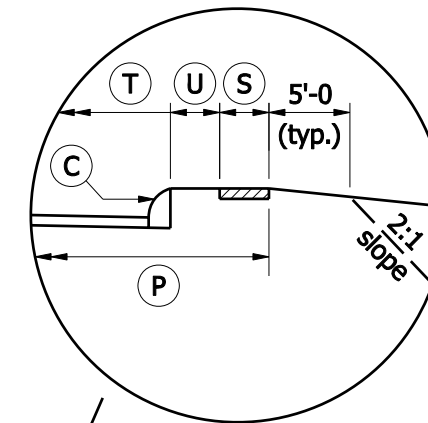


or

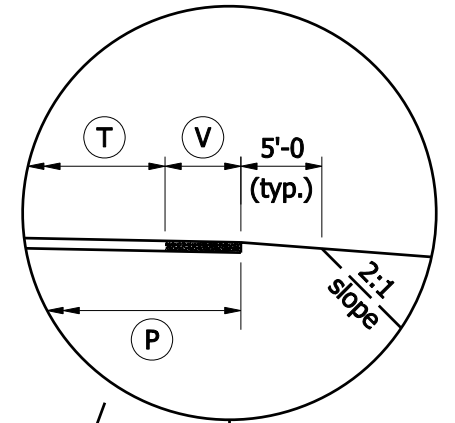
**EDGE OF SIDEWALK  
ADJACENT TO CURB**



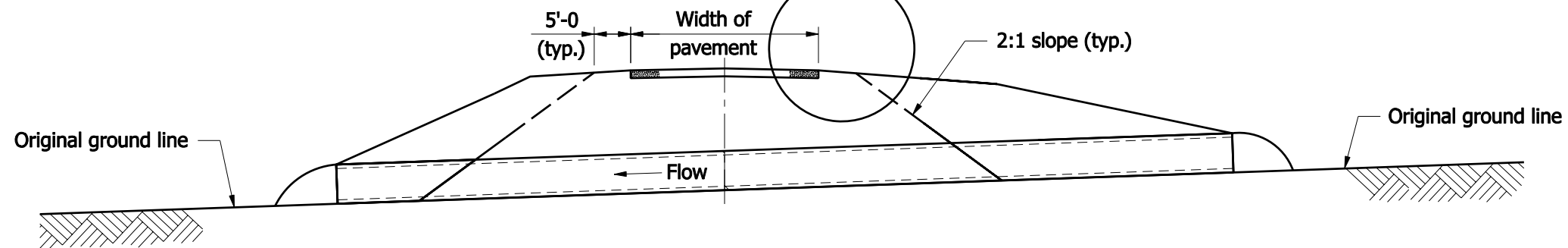
**EDGE OF SIDEWALK  
ADJACENT TO UTILITY  
STRIP**



**EDGE OF PAVED  
SHOULDER**



or



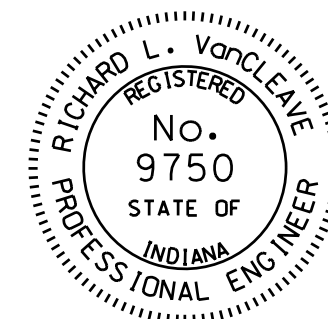
**ELEVATION**

INDIANA DEPARTMENT OF TRANSPORTATION

**PIPE BACKFILL  
LIMIT DETERMINATION**

SEPTEMBER 2007

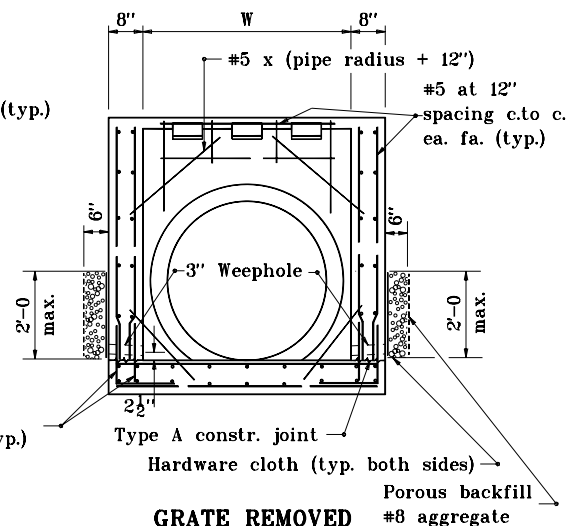
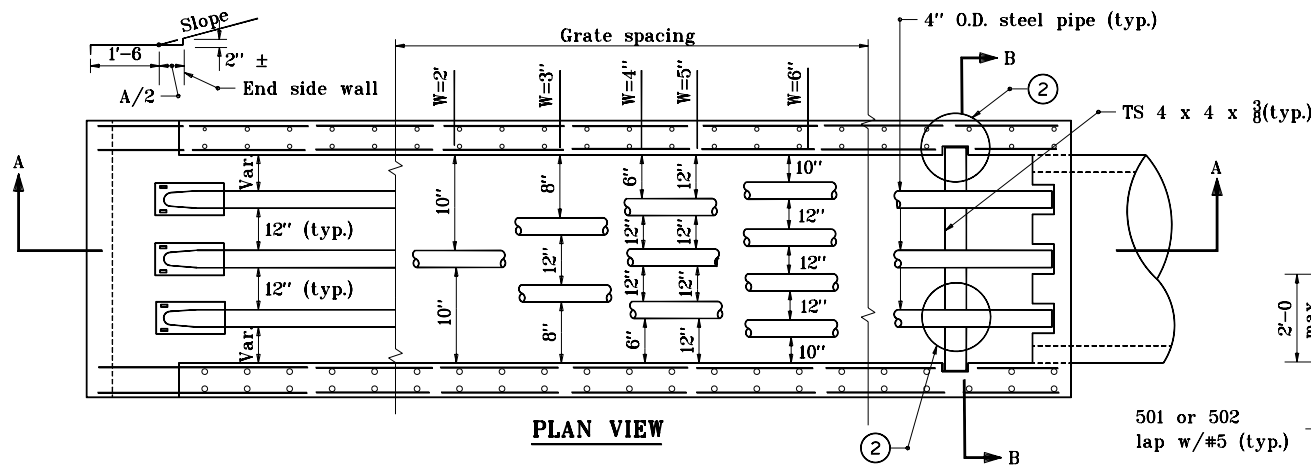
STANDARD DRAWING NO. E 715-BKFL-10



DESIGN STANDARDS ENGINEER

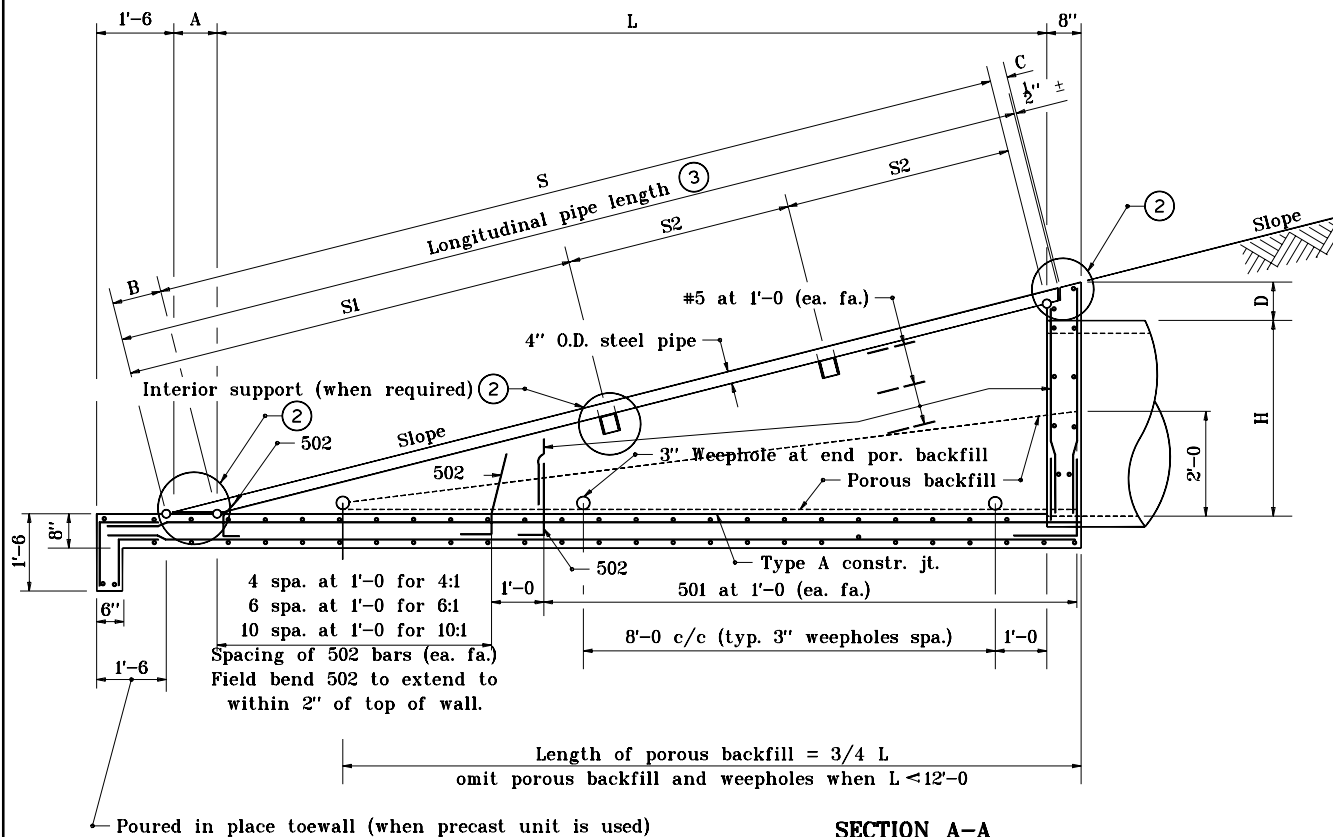
/s/ Richard L. VanCleave 09/04/07  
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller 09/04/07  
CHIEF HIGHWAY ENGINEER DATE



#### GENERAL NOTES

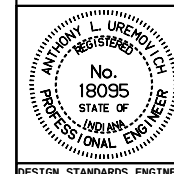
1. The invert grade of the grated box end section shall be the same as that of the pipe.
2. See Standard Drawing E 715-GBTO-04 for Details A, B, C, and D.
3. See Standard Drawings E 715-GBTO-05 through -08 for tables.
4. Type I grated box end section shall be used for mainline cross-culverts, outlet pipes within the clear zone.
5. See Standard Drawing E 715-GBTO-02 for bending diagrams.



INDIANA DEPARTMENT OF TRANSPORTATION

#### GRATED BOX END SECTION TYPE I JANUARY 1999

STANDARD DRAWING NO. E 715-GBTO-01

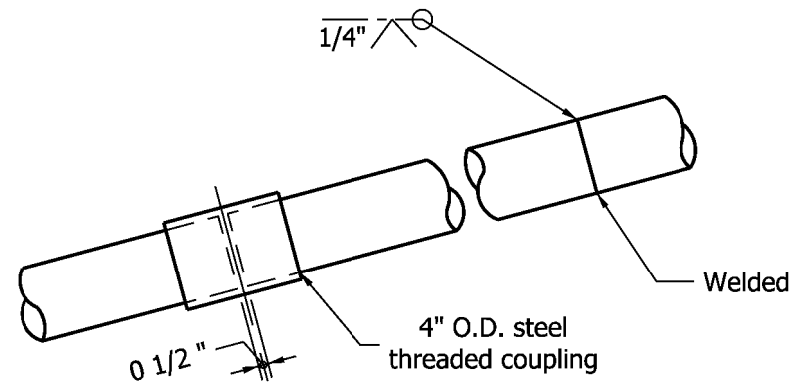


DETAILS PLACED IN THIS FORMAT 11-15-99

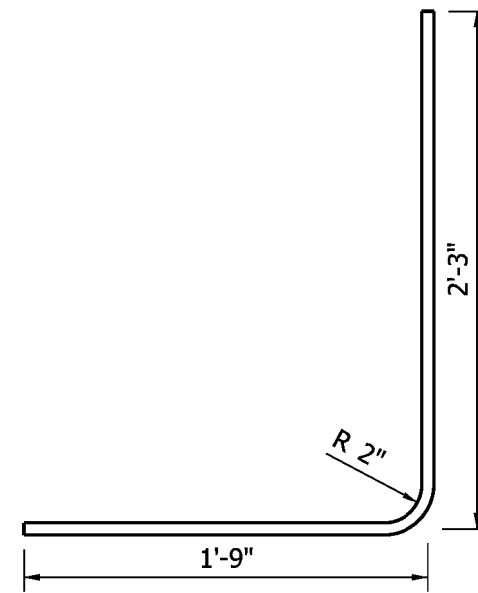
/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE  
ORIGINALLY APPROVED 1-04-99

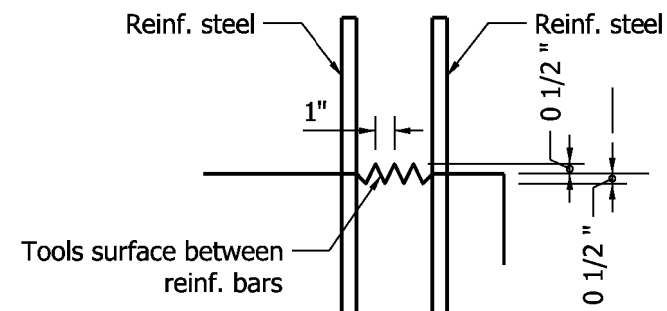




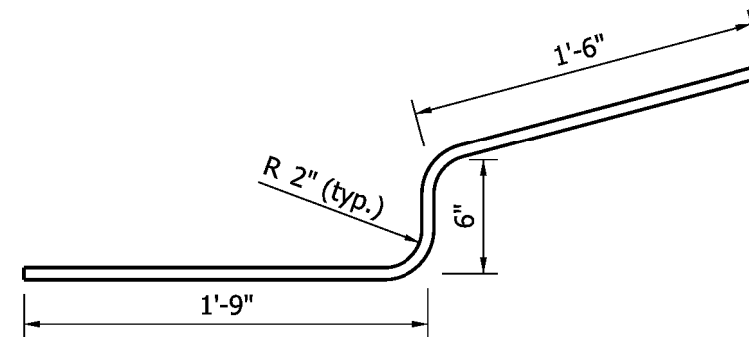
OPTIONAL COUPLING



501 x 4'-0"



TYPE A CONSTRUCTION JOINT



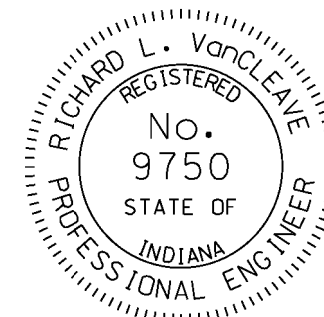
502 x 3'-9"

INDIANA DEPARTMENT OF TRANSPORTATION

GRATED BOX END SECTION  
TYPE 1

SEPTEMBER 2009

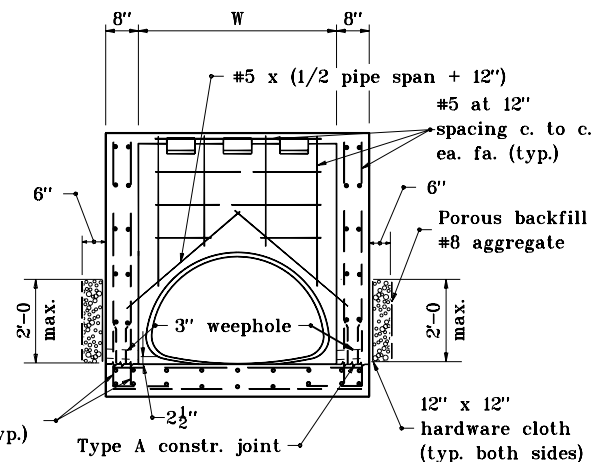
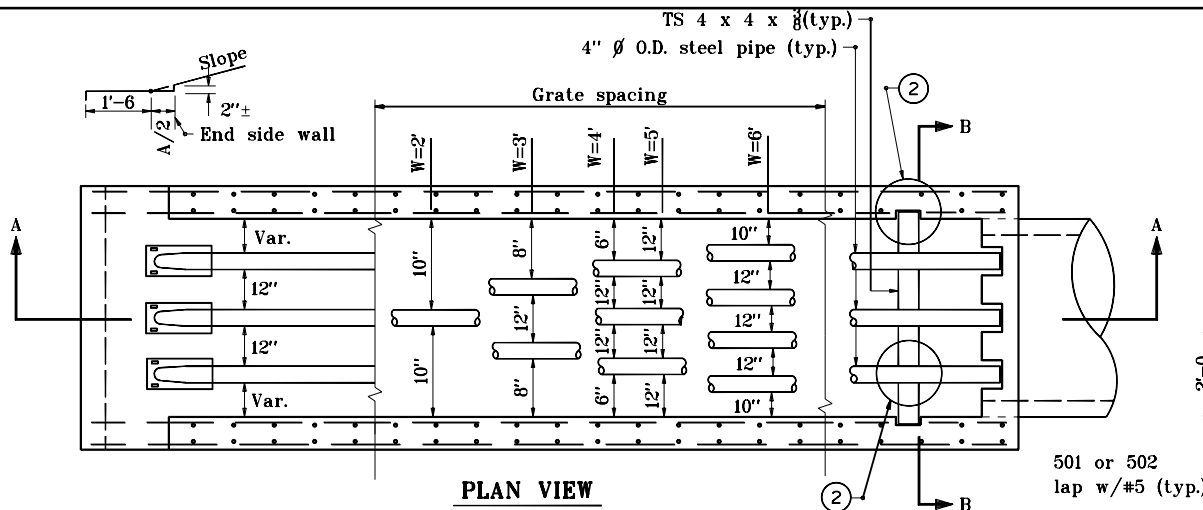
STANDARD DRAWING NO. E 715-GBTO-02



DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave 09/01/09  
DESIGN STANDARDS ENGINEER DATE

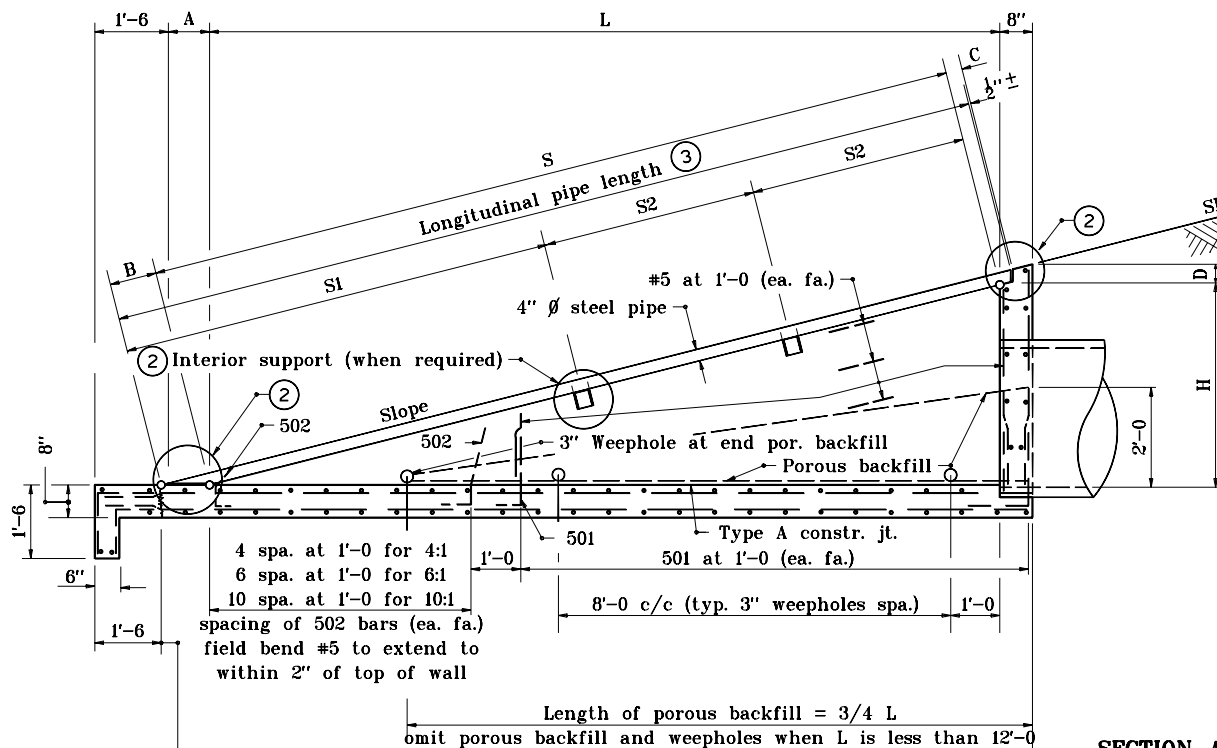
/s/ Mark A. Miller 09/01/09  
CHIEF HIGHWAY ENGINEER DATE



### GRATE REMOVED SECTION B-B

#### GENERAL NOTES

1. The invert grade of the grated box end section shall be the same as that of the pipe.
2. See Standard Drawing E 715-GBT0-04 for Details A, B, C, and D.
3. See Standard Drawings E 715-GBT0-05 through -08 for tables.
4. Type I grated box end sections shall be used for mainline cross-culverts' outlet pipes within the clear zone.
5. See Standard Drawing E 715-GBT0-02 for bending diagrams.

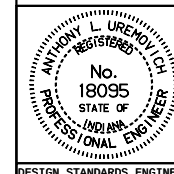


INDIANA DEPARTMENT OF TRANSPORTATION

### GRATED BOX END SECTION TYPE I

JANUARY 1999

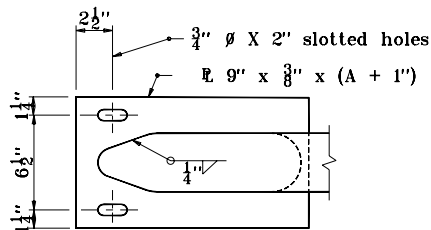
STANDARD DRAWING NO. E 715-GBT0-03



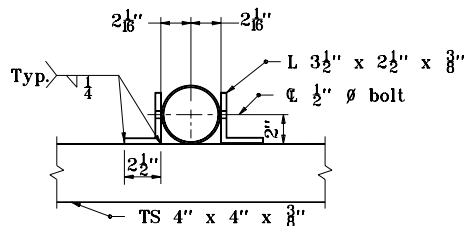
DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

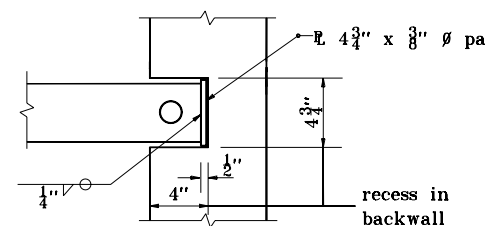
/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE  
ORIGINALLY APPROVED 1-04-99



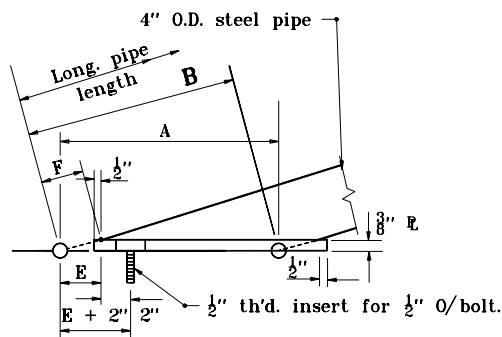
**PLAN**



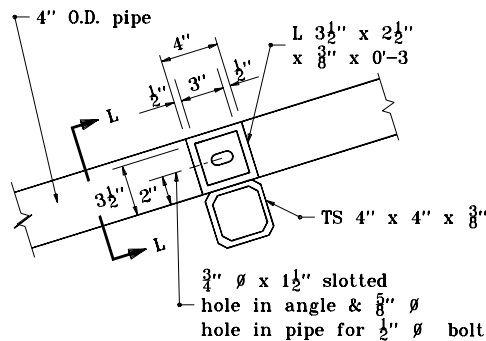
**SECTION L-L**



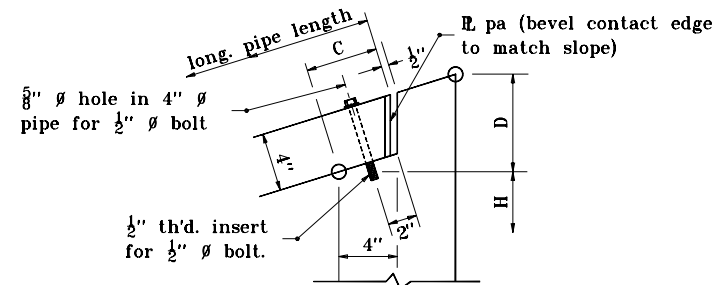
**PLAN**



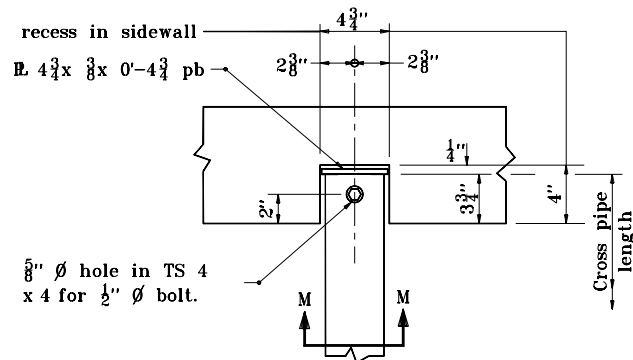
**DETAIL A**



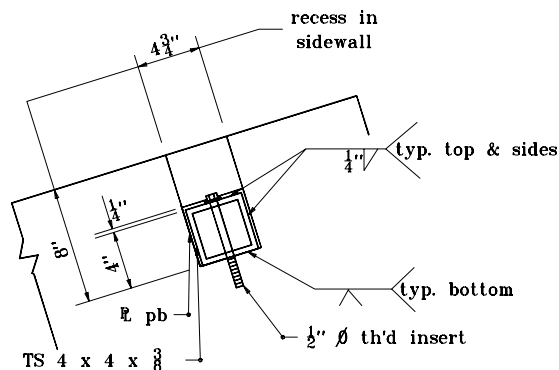
**DETAIL B**



**DETAIL C**



**DETAIL D**



**SECTION M-M**

|                                      |                                                                                                               |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION |                                                                                                               |
| GRATED BOX END SECTION               |                                                                                                               |
| TYPE I                               |                                                                                                               |
| JANUARY 1999                         |                                                                                                               |
| STANDARD DRAWING NO.E 715-GBT0-04    |                                                                                                               |
|                                      | DETAILS PLACED IN THIS FORMAT 11-15-99<br>/s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE |
| DESIGN STANDARDS ENGINEER            | /s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE<br>ORIGINALLY APPROVED 1-04-99                       |

| 2 : 1 SLOPE     |       |        |       |                       |     |                        |            |                      |                        |       |
|-----------------|-------|--------|-------|-----------------------|-----|------------------------|------------|----------------------|------------------------|-------|
| CULVERT<br>SIZE | H     | L      | W     | Longitudinal Pipe     |     |                        | Cross Tube |                      |                        |       |
|                 |       |        |       | S                     | No. | Length                 | No.        | Length               | SI                     | S2    |
| 12              | 2'-0" | 4'-0"  | 2'-0" | 4'-5 $\frac{1}{2}$ "  | 1   | 5'-7 $\frac{1}{2}$ "   | -          | -                    | 5'-1 $\frac{1}{2}$ "   | -     |
| 15 & 18         | 2'-6" | 5'-0"  | 2'-0" | 5'-7"                 | 1   | 6'-9"                  | 1          | 2'-7 $\frac{1}{2}$ " | 4'-9 $\frac{1}{2}$ "   | 1'-6" |
| 21 & 24         | 3'-0" | 6'-0"  | 3'-0" | 6'-8 $\frac{1}{2}$ "  | 2   | 7'-10 $\frac{1}{2}$ "  | -          | -                    | 7'-4 $\frac{1}{2}$ "   | -     |
| 27 & 30         | 3'-6" | 7'-0"  | 3'-0" | 7'-9 $\frac{1}{2}$ "  | 2   | 10'-1 $\frac{1}{2}$ "  | -          | -                    | 8'-5 $\frac{1}{2}$ "   | -     |
| 33 & 36         | 4'-0" | 8'-0"  | 4'-0" | 8'-11 $\frac{1}{2}$ " | 3   | 10'-11 $\frac{1}{2}$ " | -          | -                    | 9'-7 $\frac{1}{2}$ "   | -     |
| 42              | 4'-6" | 9'-0"  | 4'-0" | 10'-0 $\frac{1}{2}$ " | 3   | 11'-1 $\frac{1}{2}$ "  | -          | -                    | 10'-8 $\frac{1}{2}$ "  | -     |
| 48              | 5'-0" | 10'-0" | 5'-0" | 11'-2 $\frac{1}{2}$ " | 3   | 12'-4 $\frac{1}{2}$ "  | -          | -                    | 11'-10 $\frac{1}{2}$ " | -     |
| 54              | 5'-6" | 11'-0" | 6'-0" | 12'-3 $\frac{1}{2}$ " | 4   | 13'-5 $\frac{1}{2}$ "  | 1          | 6'-7 $\frac{1}{2}$ " | 9'-11 $\frac{1}{2}$ "  | 3'-0" |
| 60              | 6'-0" | 12'-0" | 6'-0" | 13'-5"                | 4   | 14'-7"                 | 1          | 6'-7 $\frac{1}{2}$ " | 11'-1"                 | 3'-0" |

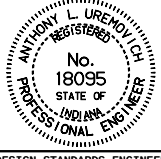
| 3 : 1 SLOPE     |       |        |       |                        |     |                        |            |                      |                        |       |
|-----------------|-------|--------|-------|------------------------|-----|------------------------|------------|----------------------|------------------------|-------|
| CULVERT<br>SIZE | H     | L      | W     | Longitudinal Pipe      |     |                        | Cross Tube |                      |                        |       |
|                 |       |        |       | S                      | No. | Length                 | No.        | Length               | SI                     | S2    |
| 12              | 2'-0" | 6'-0"  | 2'-0" | 6'-3 $\frac{1}{2}$ "   | 1   | 7'-9"                  | 1          | 2'-7 $\frac{1}{2}$ " | 5'-3 $\frac{1}{2}$ "   | 2'-0" |
| 15 & 18         | 2'-6" | 7'-6"  | 2'-0" | 7'-10 $\frac{1}{2}$ "  | 1   | 9'-3 $\frac{1}{2}$ "   | 1          | 2'-7 $\frac{1}{2}$ " | 5'-4 $\frac{1}{2}$ "   | 3'-6" |
| 21 & 24         | 3'-0" | 9'-0"  | 3'-0" | 9'-5 $\frac{1}{2}$ "   | 2   | 10'-10 $\frac{1}{2}$ " | 1          | 3'-7 $\frac{1}{2}$ " | 6'-11 $\frac{1}{2}$ "  | 3'-6" |
| 27 & 30         | 3'-6" | 10'-6" | 3'-0" | 11'-0 $\frac{1}{2}$ "  | 2   | 12'-5 $\frac{1}{2}$ "  | 1          | 3'-7 $\frac{1}{2}$ " | 8'-6 $\frac{1}{2}$ "   | 3'-6" |
| 33 & 36         | 4'-0" | 12'-0" | 4'-0" | 12'-7 $\frac{1}{2}$ "  | 3   | 14'-0 $\frac{1}{2}$ "  | 1          | 4'-7 $\frac{1}{2}$ " | 10'-1 $\frac{1}{2}$ "  | 3'-6" |
| 42              | 4'-6" | 13'-6" | 4'-0" | 14'-2 $\frac{1}{2}$ "  | 3   | 15'-7 $\frac{1}{2}$ "  | 1          | 4'-7 $\frac{1}{2}$ " | 10'-8 $\frac{1}{2}$ "  | 4'-6" |
| 48              | 5'-0" | 15'-0" | 5'-0" | 15'-9 $\frac{1}{2}$ "  | 3   | 17'-2 $\frac{1}{2}$ "  | 1          | 5'-7 $\frac{1}{2}$ " | 12'-3 $\frac{1}{2}$ "  | 4'-6" |
| 54              | 5'-6" | 16'-6" | 6'-0" | 17'-4 $\frac{1}{2}$ "  | 4   | 18'-9 $\frac{1}{2}$ "  | 1          | 6'-7 $\frac{1}{2}$ " | 10'-4 $\frac{1}{2}$ "  | 8'-0" |
| 60              | 6'-0" | 18'-0" | 6'-0" | 18'-11 $\frac{1}{2}$ " | 4   | 20'-4 $\frac{1}{2}$ "  | 1          | 6'-7 $\frac{1}{2}$ " | 11'-11 $\frac{1}{2}$ " | 8'-0" |

| 4 : 1 SLOPE     |       |        |       |                       |     |                       |            |                      |                       |        |
|-----------------|-------|--------|-------|-----------------------|-----|-----------------------|------------|----------------------|-----------------------|--------|
| CULVERT<br>SIZE | H     | L      | W     | Longitudinal Pipe     |     |                       | Cross Tube |                      |                       |        |
|                 |       |        |       | S                     | No. | Length                | No.        | Length               | SI                    | S2     |
| 12              | 2'-0" | 8'-0"  | 2'-0" | 8'-3"                 | 1   | 9'-11 $\frac{1}{2}$ " | 1          | 2'-7 $\frac{1}{2}$ " | 5'-7"                 | 4'-0"  |
| 15 & 18         | 2'-6" | 10'-0" | 2'-0" | 10'-3 $\frac{1}{2}$ " | 1   | 12'-0 $\frac{1}{2}$ " | 2          | 2'-7 $\frac{1}{2}$ " | 5'-7 $\frac{1}{2}$ "  | 3'-0"  |
| 21 & 24         | 3'-0" | 12'-0" | 3'-0" | 12'-4 $\frac{1}{2}$ " | 2   | 14'-1"                | 1          | 3'-7 $\frac{1}{2}$ " | 9'-2 $\frac{1}{2}$ "  | 4'-6"  |
| 27 & 30         | 3'-6" | 14'-0" | 3'-0" | 14'-5 $\frac{1}{2}$ " | 2   | 16'-1 $\frac{1}{2}$ " | 1          | 3'-7 $\frac{1}{2}$ " | 9'-3 $\frac{1}{2}$ "  | 6'-6"  |
| 33 & 36         | 4'-0" | 16'-0" | 4'-0" | 16'-5 $\frac{1}{2}$ " | 3   | 18'-2 $\frac{1}{2}$ " | 1          | 4'-7 $\frac{1}{2}$ " | 11'-3 $\frac{1}{2}$ " | 6'-6"  |
| 42              | 4'-6" | 18'-0" | 4'-0" | 18'-6 $\frac{1}{2}$ " | 3   | 20'-3 $\frac{1}{2}$ " | 1          | 4'-7 $\frac{1}{2}$ " | 12'-4 $\frac{1}{2}$ " | 7'-6"  |
| 48              | 5'-0" | 20'-0" | 5'-0" | 20'-7 $\frac{1}{2}$ " | 3   | 22'-4 $\frac{1}{2}$ " | 1          | 5'-7 $\frac{1}{2}$ " | 11'-5 $\frac{1}{2}$ " | 10'-6" |
| 54              | 5'-6" | 22'-0" | 6'-0" | 22'-8 $\frac{1}{2}$ " | 4   | 24'-4 $\frac{1}{2}$ " | 1          | 6'-7 $\frac{1}{2}$ " | 12'-6 $\frac{1}{2}$ " | 11'-6" |
| 60              | 6'-0" | 24'-0" | 6'-0" | 24'-8 $\frac{1}{2}$ " | 4   | 26'-5 $\frac{1}{2}$ " | 2          | 6'-7 $\frac{1}{2}$ " | 12'-6 $\frac{1}{2}$ " | 6'-9"  |

| 5 : 1 SLOPE     |       |        |       |                        |     |                        |            |                      |                       |        |
|-----------------|-------|--------|-------|------------------------|-----|------------------------|------------|----------------------|-----------------------|--------|
| CULVERT<br>SIZE | H     | L      | W     | Longitudinal Pipe      |     |                        | Cross Tube |                      |                       |        |
|                 |       |        |       | S                      | No. | Length                 | No.        | Length               | SI                    | S2     |
| 12              | 2'-0" | 10'-0" | 2'-0" | 10'-2 $\frac{1}{2}$ "  | 1   | 12'-2 $\frac{1}{2}$ "  | 2          | 2'-7 $\frac{1}{2}$ " | 6'-2 $\frac{1}{2}$ "  | 2'-10" |
| 15 & 18         | 2'-6" | 12'-6" | 2'-0" | 12'-9"                 | 1   | 14'-9 $\frac{1}{2}$ "  | 2          | 2'-7 $\frac{1}{2}$ " | 5'-11"                | 4'-3"  |
| 21 & 24         | 3'-0" | 15'-0" | 3'-0" | 15'-3 $\frac{1}{2}$ "  | 2   | 17'-4"                 | 1          | 3'-7 $\frac{1}{2}$ " | 9'-2 $\frac{1}{2}$ "  | 7'-9"  |
| 27 & 30         | 3'-6" | 17'-6" | 3'-0" | 17'-10 $\frac{1}{2}$ " | 2   | 19'-10 $\frac{1}{2}$ " | 2          | 3'-7 $\frac{1}{2}$ " | 9'-6 $\frac{1}{2}$ "  | 5'-0"  |
| 33 & 36         | 4'-0" | 20'-0" | 4'-0" | 20'-4 $\frac{1}{2}$ "  | 3   | 22'-5 $\frac{1}{2}$ "  | 1          | 4'-7 $\frac{1}{2}$ " | 13'-0 $\frac{1}{2}$ " | 9'-0"  |
| 42              | 4'-6" | 22'-6" | 4'-0" | 22'-11 $\frac{1}{2}$ " | 3   | 24'-11 $\frac{1}{2}$ " | 1          | 4'-7 $\frac{1}{2}$ " | 13'-1 $\frac{1}{2}$ " | 11'-6" |
| 48              | 5'-0" | 25'-0" | 5'-0" | 25'-6"                 | 3   | 27'-6 $\frac{1}{2}$ "  | 2          | 5'-7 $\frac{1}{2}$ " | 13'-2"                | 7'-0"  |
| 54              | 5'-6" | 27'-6" | 6'-0" | 28'-0 $\frac{1}{2}$ "  | 4   | 30'-0 $\frac{1}{2}$ "  | 2          | 6'-7 $\frac{1}{2}$ " | 13'-2 $\frac{1}{2}$ " | 8'-3"  |
| 60              | 6'-0" | 30'-0" | 6'-0" | 30'-7 $\frac{1}{2}$ "  | 4   | 32'-7 $\frac{1}{2}$ "  | 2          | 6'-7 $\frac{1}{2}$ " | 11'-9 $\frac{1}{2}$ " | 10'-3" |

| 6 : 1 SLOPE     |       |        |       |                       |     |                        |            |                      |                        |        |
|-----------------|-------|--------|-------|-----------------------|-----|------------------------|------------|----------------------|------------------------|--------|
| CULVERT<br>SIZE | H     | L      | W     | Longitudinal Pipe     |     |                        | Cross Tube |                      |                        |        |
|                 |       |        |       | S                     | No. | Length                 | No.        | Length               | SI                     | S2     |
| 12              | 2'-0" | 12'-0" | 2'-0" | 12'-2"                | 1   | 14'-6 $\frac{1}{2}$ "  | 2          | 2'-7 $\frac{1}{2}$ " | 6'-2"                  | 4'-0"  |
| 15 & 18         | 2'-6" | 15'-0" | 2'-0" | 15'-2 $\frac{1}{2}$ " | 1   | 17'-6 $\frac{1}{2}$ "  | 2          | 2'-7 $\frac{1}{2}$ " | 6'-8 $\frac{1}{2}$ "   | 5'-3"  |
| 21 & 24         | 3'-0" | 18'-0" | 3'-0" | 18'-3"                | 2   | 20'-7 $\frac{1}{2}$ "  | 2          | 3'-7 $\frac{1}{2}$ " | 9'-9"                  | 5'-3"  |
| 27 & 30         | 3'-6" | 21'-0" | 3'-0" | 21'-3 $\frac{1}{2}$ " | 2   | 23'-7 $\frac{1}{2}$ "  | 2          | 3'-7 $\frac{1}{2}$ " | 9'-9 $\frac{1}{2}$ "   | 6'-9"  |
| 33 & 36         | 4'-0" | 24'-0" | 4'-0" | 24'-4"                | 3   | 26'-8 $\frac{1}{2}$ "  | 2          | 4'-7 $\frac{1}{2}$ " | 13'-4"                 | 6'-6"  |
| 42              | 4'-6" | 27'-0" | 4'-0" | 27'-4 $\frac{1}{2}$ " | 3   | 29'-8 $\frac{1}{2}$ "  | 2          | 4'-7 $\frac{1}{2}$ " | 13'-4 $\frac{1}{2}$ "  | 8'-0"  |
| 48              | 5'-0" | 30'-0" | 5'-0" | 30'-5"                | 3   | 32'-9 $\frac{1}{2}$ "  | 2          | 5'-7 $\frac{1}{2}$ " | 13'-5"                 | 9'-6"  |
| 54              | 5'-6" | 33'-0" | 6'-0" | 33'-5 $\frac{1}{2}$ " | 4   | 35'-9 $\frac{1}{2}$ "  | 2          | 6'-7 $\frac{1}{2}$ " | 12'-11 $\frac{1}{2}$ " | 11'-3" |
| 60              | 6'-0" | 36'-0" | 6'-0" | 36'-6"                | 4   | 38'-10 $\frac{1}{2}$ " | 3          | 6'-7 $\frac{1}{2}$ " | 13'-0"                 | 8'-6"  |

| APPROXIMATE QUANTITIES |                       |              |                         |                       |                       |              |                         |                       |                       |              |                         |                       |                       |              |                         |                       |                       |              |                         |                       |
|------------------------|-----------------------|--------------|-------------------------|-----------------------|-----------------------|--------------|-------------------------|-----------------------|-----------------------|--------------|-------------------------|-----------------------|-----------------------|--------------|-------------------------|-----------------------|-----------------------|--------------|-------------------------|-----------------------|
| PIPE<br>DIAMETER       | 2 : 1 SLOPE           |              |                         |                       | 3 : 1 SLOPE           |              |                         |                       | 4 : 1 SLOPE           |              |                         |                       | 5 : 1 SLOPE           |              |                         |                       | 6 : 1 SLOPE           |              |                         |                       |
|                        | Concrete,<br>Cu. Yds. |              | Reinf.<br>Steel,<br>lb. | Str.<br>Steel,<br>lb. | Concrete,<br>Cu. Yds. |              | Reinf.<br>Steel,<br>lb. | Str.<br>Steel,<br>lb. | Concrete,<br>Cu. Yds. |              | Reinf.<br>Steel,<br>lb. | Str.<br>Steel,<br>lb. | Concrete,<br>Cu. Yds. |              | Reinf.<br>Steel,<br>lb. | Str.<br>Steel,<br>lb. | Concrete,<br>Cu. Yds. |              | Reinf.<br>Steel,<br>lb. | Str.<br>Steel,<br>lb. |
|                        | Conc.<br>Pipe         | C.M.<br>Pipe |                         |                       | Conc.<br>Pipe         | C.M.<br>Pipe |                         |                       | Conc.<br>Pipe         | C.M.<br>Pipe |                         |                       | Conc.<br>Pipe         | C.M.<br>Pipe |                         |                       | Conc.<br>Pipe         | C.M.<br>Pipe |                         |                       |
| 12                     | 1.1                   | 1.1          | 290                     | 80                    | 1.4                   | 1.4          | 375                     | 160                   | 1.7                   | 1.7          | 465                     | 195                   | 2.1                   | 2.1          | 555                     | 275                   | 2.4                   | 2.4          | 645                     | 305                   |
| 15 & 18                | 1.3                   | 1.3          | 345                     | 145                   | 1.8                   | 1.8          | 460                     | 180                   | 2.2                   | 2.2          | 575                     | 270                   | 2.8                   | 2.8          | 690                     | 305                   | 3.0                   | 3.0          | 805                     | 345                   |
| 21 & 24                | 1.9                   | 1.9          | 460                     | 215                   | 2.5                   | 2.5          | 620                     | 370                   | 3.1                   | 3.1          | 775                     | 460                   | 3.7                   | 3.8          | 935                     | 545                   | 4.3                   | 4.4          | 1090                    | 705                   |
| 27 & 30                | 2.1                   | 2.2          | 525                     | 245                   | 2.9                   | 3.0          | 715                     | 410                   | 3.6                   | 3.7          | 905                     | 510                   | 4.4                   | 4.5          | 1095                    | 680                   | 5.2                   | 5.3          | 1285                    | 780                   |
| 33 & 36                | 2.8                   | 2.9          | 670                     | 410                   | 3.8                   | 3.9          | 910                     | 660                   | 4.8                   | 4.9          | 1150                    | 825                   | 5.9                   | 6.0          | 1395                    | 995                   | 6.9                   | 7.0          | 1640                    | 1255                  |
| 42                     | 3.2                   | 3.3          | 745                     | 450                   | 4.4                   | 4.5          | 1025                    | 720                   | 5.6                   | 5.7          | 1305                    | 905                   | 6.8                   | 6.9          | 1585                    | 1090                  | 8.0                   | 8.1          | 1870                    | 1370                  |
| 48                     | 4.0                   | 4.1          | 1.1                     | 910                   | 5.5                   | 5.6          | 1250                    | 80                    | 8.5                   | 8.7          | 1940                    | 1310                  | 10.1                  | 10.2         | 1940                    | 1310                  | 10.1                  | 10.2         | 2285                    | 1515                  |
| 54                     | 4.9                   | 5.1          | 1090                    | 845                   | 6.8                   | 6.9          | 1500                    | 1125                  | 8.6                   | 8.8          | 1915                    | 1415                  | 10.5                  | 10.7         | 2330                    | 1845                  | 12.4                  | 12.6         | 2745                    | 2145                  |
| 60                     | 5.4                   | 5.8          | 1180                    | 900                   | 7.8                   | 7.7          | 1640                    | 1205                  | 9.8                   | 9.8          | 2105                    | 1850                  | 11.7                  | 11.9         | 2570                    | 1970                  | 13.8                  | 14.0         | 3035                    | 2425                  |

|                                                                                       |                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                                                                                        |
| GRADED BOX END SECTION TYPE I                                                         |                                                                                                                                                                                                                                        |
| DIMENSIONS AND QUANTITIES                                                             |                                                                                                                                                                                                                                        |
| JANUARY 1999                                                                          |                                                                                                                                                                                                                                        |
| STANDARD DRAWING NO.E 715-GBT0-05                                                     |                                                                                                                                                                                                                                        |
|  | DETAILS PLACED IN THIS FORMAT 11-15-99<br>/s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE<br><br>/s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE<br>DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 1-04-99 |

| 2:1 SLOPE |        |        |       |                       |     |                      |            |        |                       |     |
|-----------|--------|--------|-------|-----------------------|-----|----------------------|------------|--------|-----------------------|-----|
| Pipe Size | H      | L      | W     | Longitudinal Pipe     |     |                      | Cross Tube |        |                       |     |
|           |        |        |       | S                     | No. | Length               | No.        | Length | S 1                   | S 2 |
| 17 x 13   | 1'-9"  | 3'-6"  | 2'-0" | 3'-11"                | 1   | 5'-0 $\frac{7}{8}$ " | -          | -      | 4'-7"                 | -   |
| 21 x 15   | 1'-11" | 3'-10" | 2'-0" | 4'-3 $\frac{1}{2}$ "  | 1   | 5'-5 $\frac{3}{8}$ " | -          | -      | 4'-11 $\frac{3}{8}$ " | -   |
| 24 x 18   | 2'-2"  | 4'-4"  | 3'-0" | 4'-10 $\frac{1}{8}$ " | 2   | 6'-0 $\frac{1}{8}$ " | -          | -      | 5'-6 $\frac{1}{8}$ "  | -   |
| 28 x 20   | 2'-4"  | 4'-8"  | 3'-0" | 5'-2 $\frac{1}{2}$ "  | 2   | 6'-4 $\frac{3}{8}$ " | -          | -      | 5'-10 $\frac{3}{8}$ " | -   |
| 35 x 24   | 2'-8"  | 5'-4"  | 4'-0" | 5'-11 $\frac{1}{2}$ " | 3   | 7'-1 $\frac{1}{2}$ " | -          | -      | 6'-7 $\frac{1}{2}$ "  | -   |
| 42 x 29   | 3'-1"  | 6'-2"  | 4'-0" | 6'-10 $\frac{3}{4}$ " | 3   | 8'-0 $\frac{3}{4}$ " | -          | -      | 7'-6 $\frac{3}{4}$ "  | -   |
| 49 x 33   | 3'-5"  | 6'-10" | 5'-0" | 7'-7 $\frac{3}{8}$ "  | 3   | 8'-9 $\frac{3}{8}$ " | -          | -      | 8'-3 $\frac{3}{8}$ "  | -   |
| 57 x 38   | 3'-10" | 7'-8"  | 5'-0" | 8'-6 $\frac{1}{8}$ "  | 3   | 9'-8 $\frac{1}{8}$ " | -          | -      | 9'-2 $\frac{1}{8}$ "  | -   |
| 64 x 43   | 4'-3"  | 8'-6"  | 6'-0" | 9'-6"                 | 4   | 10'-8"               | -          | -      | 10'-2"                | -   |
| 71 x 47   | 4'-7"  | 9'-2"  | 6'-0" | 10'-3"                | 4   | 11'-5"               | -          | -      | 10'-11"               | -   |
|           |        |        |       |                       |     |                      |            |        |                       |     |

| 3:1 SLOPE |        |        |       |                       |     |                        |            |                      |                       |       |
|-----------|--------|--------|-------|-----------------------|-----|------------------------|------------|----------------------|-----------------------|-------|
| Pipe Size | H      | L      | W     | Longitudinal Pipe     |     |                        | Cross Tube |                      |                       |       |
|           |        |        |       | S                     | No. | Length                 | No.        | Length               | S 1                   | S 2   |
| 17 x 13   | 1'-9"  | 5'-3"  | 2'-0" | 5'-6 $\frac{3}{8}$ "  | 1   | 6'-11 $\frac{1}{8}$ "  | 1          | 2'-7 $\frac{1}{2}$ " | 5'-0 $\frac{3}{8}$ "  | 1'-6" |
| 21 x 15   | 1'-11" | 5'-9"  | 2'-0" | 6'-0 $\frac{3}{8}$ "  | 1   | 7'-5 $\frac{3}{8}$ "   | 1          | 2'-7 $\frac{1}{2}$ " | 5'-0 $\frac{3}{8}$ "  | 2'-0" |
| 24 x 18   | 2'-2"  | 6'-6"  | 3'-0" | 6'-10 $\frac{1}{4}$ " | 2   | 8'-3 $\frac{1}{4}$ "   | -          | -                    | 7'-10 $\frac{1}{4}$ " | -     |
| 28 x 20   | 2'-4"  | 7'-0"  | 3'-0" | 7'-4 $\frac{1}{2}$ "  | 2   | 8'-9 $\frac{3}{8}$ "   | -          | -                    | 8'-4 $\frac{1}{2}$ "  | -     |
| 35 x 24   | 2'-8"  | 8'-0"  | 4'-0" | 8'-5 $\frac{1}{4}$ "  | 3   | 9'-10 $\frac{1}{4}$ "  | -          | -                    | 9'-5 $\frac{1}{4}$ "  | -     |
| 42 x 29   | 3'-1"  | 9'-3"  | 4'-0" | 9'-9"                 | 3   | 11'-2"                 | -          | -                    | 10'-9"                | -     |
| 49 x 33   | 3'-5"  | 10'-3" | 5'-0" | 10'-9 $\frac{5}{8}$ " | 3   | 12'-2 $\frac{3}{8}$ "  | -          | -                    | 11'-9 $\frac{5}{8}$ " | -     |
| 57 x 38   | 3'-10" | 11'-6" | 5'-0" | 12'-1 $\frac{1}{2}$ " | 3   | 13'-6 $\frac{1}{2}$ "  | 1          | 5'-7 $\frac{1}{2}$ " | 10'-1 $\frac{1}{2}$ " | 3'-0" |
| 64 x 43   | 4'-3"  | 12'-9" | 6'-0" | 13'-5 $\frac{1}{4}$ " | 4   | 14'-10 $\frac{3}{8}$ " | 1          | 6'-7 $\frac{1}{2}$ " | 11'-5 $\frac{1}{4}$ " | 3'-0" |
| 71 x 47   | 4'-7"  | 13'-9" | 6'-0" | 14'-5 $\frac{5}{8}$ " | 4   | 15'-11"                | 1          | 6'-7 $\frac{1}{2}$ " | 12'-5 $\frac{5}{8}$ " | 3'-0" |
|           |        |        |       |                       |     |                        |            |                      |                       |       |

| 4:1 SLOPE |        |        |       |                        |     |                       |            |                      |                       |       |
|-----------|--------|--------|-------|------------------------|-----|-----------------------|------------|----------------------|-----------------------|-------|
| Pipe Size | H      | L      | W     | Longitudinal Pipe      |     |                       | Cross Tube |                      |                       |       |
|           |        |        |       | S                      | No. | Length                | No.        | Length               | S 1                   | S 2   |
| 17 x 13   | 1'-9"  | 7'-0"  | 2'-0" | 7'-2 $\frac{5}{8}$ "   | 1   | 8'-11 $\frac{1}{4}$ " | 1          | 2'-7 $\frac{1}{2}$ " | 5'-9 $\frac{5}{8}$ "  | 2'-9" |
| 21 x 15   | 1'-11" | 7'-8"  | 2'-0" | 7'-10 $\frac{1}{4}$ "  | 1   | 9'-7 $\frac{1}{2}$ "  | 1          | 2'-7 $\frac{1}{2}$ " | 5'-8 $\frac{1}{4}$ "  | 3'-6" |
| 24 x 18   | 2'-2"  | 8'-8"  | 3'-0" | 8'-11 $\frac{1}{4}$ "  | 2   | 10'-7 $\frac{3}{8}$ " | 1          | 3'-7 $\frac{1}{2}$ " | 8'-3 $\frac{1}{4}$ "  | 2'-0" |
| 28 x 20   | 2'-4"  | 9'-4"  | 3'-0" | 9'-7 $\frac{1}{2}$ "   | 2   | 11'-4"                | 1          | 3'-7 $\frac{1}{2}$ " | 8'-11 $\frac{1}{2}$ " | 2'-0" |
| 35 x 24   | 2'-8"  | 10'-8" | 4'-0" | 11'-0"                 | 3   | 12'-8 $\frac{1}{2}$ " | -          | -                    | 12'-4"                | -     |
| 42 x 29   | 3'-1"  | 12'-4" | 4'-0" | 12'-8 $\frac{1}{2}$ "  | 3   | 14'-5 $\frac{5}{8}$ " | 1          | 4'-7 $\frac{1}{2}$ " | 11'-0 $\frac{1}{2}$ " | 3'-0" |
| 49 x 33   | 3'-5"  | 13'-8" | 5'-0" | 14'-1"                 | 3   | 15'-9 $\frac{3}{8}$ " | 1          | 5'-7 $\frac{1}{2}$ " | 12'-5"                | 3'-0" |
| 57 x 38   | 3'-10" | 15'-4" | 5'-0" | 15'-9 $\frac{3}{8}$ "  | 3   | 17'-6 $\frac{1}{4}$ " | 1          | 5'-7 $\frac{1}{2}$ " | 12'-7 $\frac{3}{8}$ " | 4'-6" |
| 64 x 43   | 4'-3"  | 17'-0" | 6'-0" | 17'-6 $\frac{1}{4}$ "  | 4   | 19'-2 $\frac{1}{4}$ " | 1          | 6'-7 $\frac{1}{2}$ " | 12'-4 $\frac{1}{4}$ " | 6'-6" |
| 71 x 47   | 4'-7"  | 18'-4" | 6'-0" | 18'-10 $\frac{1}{4}$ " | 4   | 20'-7 $\frac{3}{8}$ " | 1          | 6'-7 $\frac{1}{2}$ " | 12'-8 $\frac{3}{4}$ " | 7'-6" |
|           |        |        |       |                        |     |                       |            |                      |                       |       |

|                                                                                       |                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                                                                                        |
| <b>GRATED BOX END SECTION</b><br><b>TYPE I DIMENSIONS</b><br>JANUARY 1999             |                                                                                                                                                                                                                                        |
| STANDARD DRAWING NO. <b>E 715-GBT0-06</b>                                             |                                                                                                                                                                                                                                        |
|  | DETAILS PLACED IN THIS FORMAT 11-15-99<br>/s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE<br><br>/s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE<br>DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 1-04-99 |

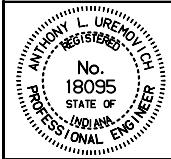
| 5:1 SLOPE |        |         |       |                       |     |                        |            |                      |                        |        |
|-----------|--------|---------|-------|-----------------------|-----|------------------------|------------|----------------------|------------------------|--------|
| Pipe Size | H      | L       | W     | Longitudinal Pipe     |     |                        | Cross Tube |                      |                        |        |
|           |        |         |       | S                     | No. | Length                 | No.        | Length               | S 1                    | S 2    |
| 17 x 13   | 1'-9"  | 8'-9"   | 2'-0" | 8'-11 $\frac{1}{2}$ " | 1   | 10'-11 $\frac{1}{2}$ " | 1          | 2'-7 $\frac{1}{2}$ " | 6'-1 $\frac{1}{2}$ "   | 4'-6"  |
| 21 x 15   | 1'-11" | 9'-7"   | 2'-0" | 9'-9 $\frac{1}{4}$ "  | 1   | 11'-9 $\frac{3}{4}$ "  | 1          | 2'-7 $\frac{1}{2}$ " | 6'-8 $\frac{1}{4}$ "   | 4'-9"  |
| 24 x 18   | 2'-2"  | 10'-10" | 3'-0" | 11'-0 $\frac{3}{8}$ " | 2   | 13'-1"                 | 1          | 3'-7 $\frac{1}{2}$ " | 8'-8 $\frac{3}{8}$ "   | 4'-0"  |
| 28 x 20   | 2'-4"  | 11'-6"  | 3'-0" | 11'-0 $\frac{3}{4}$ " | 2   | 13'-11 $\frac{1}{8}$ " | 1          | 3'-7 $\frac{1}{2}$ " | 9'-6 $\frac{3}{4}$ "   | 4'-0"  |
| 35 x 24   | 2'-8"  | 13'-4"  | 4'-0" | 13'-7 $\frac{1}{8}$ " | 3   | 15'-7 $\frac{1}{2}$ "  | 1          | 4'-7 $\frac{1}{2}$ " | 12'-3 $\frac{1}{8}$ "  | 3'-0"  |
| 42 x 29   | 3'-1"  | 15'-5"  | 4'-0" | 15'-8 $\frac{8}{8}$ " | 3   | 17'-9"                 | 1          | 4'-7 $\frac{1}{2}$ " | 12'-10 $\frac{8}{8}$ " | 4'-6"  |
| 49 x 33   | 3'-5"  | 17'-1"  | 5'-0" | 17'-5"                | 3   | 19'-5 $\frac{1}{2}$ "  | 1          | 5'-7 $\frac{1}{2}$ " | 13'-1"                 | 6'-0"  |
| 57 x 38   | 3'-10" | 19'-2"  | 5'-0" | 19'-6 $\frac{1}{2}$ " | 3   | 21'-6 $\frac{1}{2}$ "  | 1          | 5'-7 $\frac{1}{2}$ " | 13'-2 $\frac{1}{2}$ "  | 8'-0"  |
| 64 x 43   | 4'-3"  | 21'-3"  | 6'-0" | 21'-8"                | 4   | 23'-8 $\frac{3}{8}$ "  | 1          | 6'-7 $\frac{1}{2}$ " | 12'-10"                | 10'-6" |
| 71 x 47   | 4'-7"  | 22'-11" | 6'-0" | 23'-4 $\frac{3}{8}$ " | 4   | 25'-4 $\frac{3}{4}$ "  | 1          | 6'-7 $\frac{1}{2}$ " | 13'-6 $\frac{3}{8}$ "  | 11'-6" |
|           |        |         |       |                       |     |                        |            |                      |                        |        |

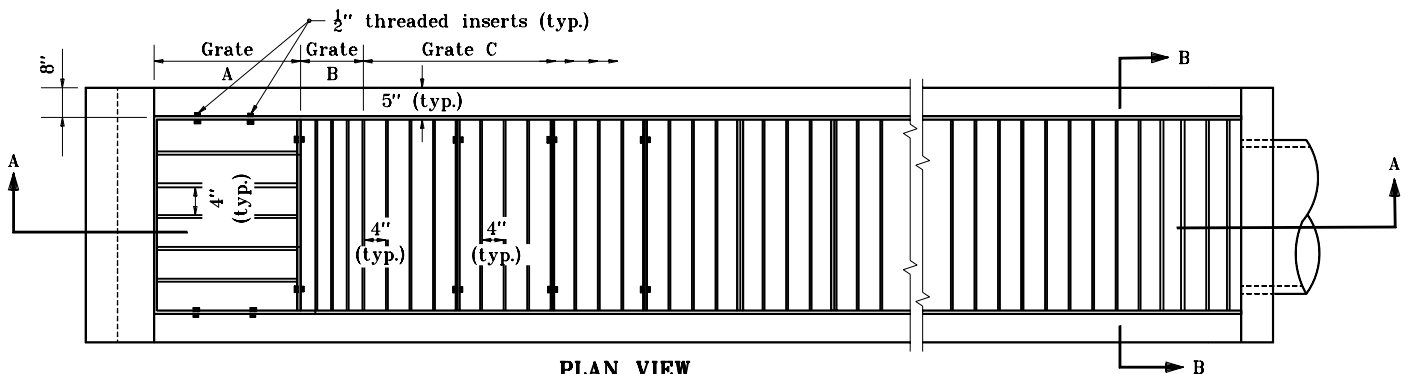
| 6:1 SLOPE |        |        |       |                        |     |                       |            |                      |                       |        |
|-----------|--------|--------|-------|------------------------|-----|-----------------------|------------|----------------------|-----------------------|--------|
| Pipe Size | H      | L      | W     | Longitudinal Pipe      |     |                       | Cross Tube |                      |                       |        |
|           |        |        |       | S                      | No. | Length                | No.        | Length               | S 1                   | S 2    |
| 17 x 13   | 1'-9"  | 10'-6" | 2'-0" | 10'-7 $\frac{3}{4}$ "  | 1   | 13'-0"                | 2          | 2'-7 $\frac{1}{2}$ " | 6'-7 $\frac{3}{4}$ "  | 3'-0"  |
| 21 x 15   | 1'-11" | 11'-6" | 2'-0" | 11'-7 $\frac{1}{8}$ "  | 1   | 14'-0 $\frac{1}{8}$ " | 2          | 2'-7 $\frac{1}{2}$ " | 6'-1 $\frac{1}{8}$ "  | 3'-9"  |
| 24 x 18   | 2'-2"  | 13'-0" | 3'-0" | 13'-2 $\frac{1}{4}$ "  | 2   | 15'-6 $\frac{1}{8}$ " | 1          | 3'-7 $\frac{1}{2}$ " | 9'-8 $\frac{1}{4}$ "  | 5'-6"  |
| 28 x 20   | 2'-4"  | 14'-0" | 3'-0" | 14'-2 $\frac{1}{4}$ "  | 2   | 16'-6 $\frac{1}{2}$ " | 1          | 3'-7 $\frac{1}{2}$ " | 9'-8 $\frac{1}{4}$ "  | 6'-6"  |
| 35 x 24   | 2'-5"  | 16'-0" | 4'-0" | 16'-2 $\frac{3}{8}$ "  | 3   | 18'-6 $\frac{1}{8}$ " | 1          | 4'-7 $\frac{1}{2}$ " | 13'-2 $\frac{3}{8}$ " | 5'-0"  |
| 42 x 29   | 3'-1"  | 18'-6" | 4'-0" | 18'-9"                 | 3   | 21'-1 $\frac{1}{4}$ " | 1          | 4'-7 $\frac{1}{2}$ " | 13'-6"                | 7'-3"  |
| 49 x 33   | 3'-5"  | 20'-6" | 5'-0" | 20'-9 $\frac{3}{8}$ "  | 3   | 23'-1 $\frac{3}{8}$ " | 1          | 5'-7 $\frac{1}{2}$ " | 13'-3 $\frac{3}{8}$ " | 9'-6"  |
| 57 x 38   | 3'-10" | 23'-0" | 5'-0" | 23'-3 $\frac{1}{2}$ "  | 3   | 25'-8"                | 1          | 5'-7 $\frac{1}{2}$ " | 13'-9 $\frac{1}{2}$ " | 11'-6" |
| 64 x 43   | 4'-3"  | 25'-6" | 6'-0" | 25'-10 $\frac{1}{4}$ " | 4   | 28'-2 $\frac{1}{2}$ " | 2          | 6'-7 $\frac{1}{2}$ " | 13'-4 $\frac{1}{4}$ " | 7'-3"  |
| 71 x 47   | 4'-7"  | 27'-6" | 6'-0" | 27'-10 $\frac{1}{2}$ " | 4   | 30'-2 $\frac{3}{4}$ " | 2          | 6'-7 $\frac{1}{2}$ " | 13'-4 $\frac{1}{2}$ " | 8'-3"  |
|           |        |        |       |                        |     |                       |            |                      |                       |        |

|                                                                                       |                                                                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                                                                                            |
| <b>GRATED BOX END SECTION</b><br><b>TYPE I DIMENSIONS</b><br>JANUARY 1999             |                                                                                                                                                                                                                                            |
| STANDARD DRAWING NO.E 715-GBT0-07                                                     |                                                                                                                                                                                                                                            |
|  | DETAILS PLACED IN THIS FORMAT 11-15-99<br><br>/s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE<br><br>/s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE<br>DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 1-04-99 |

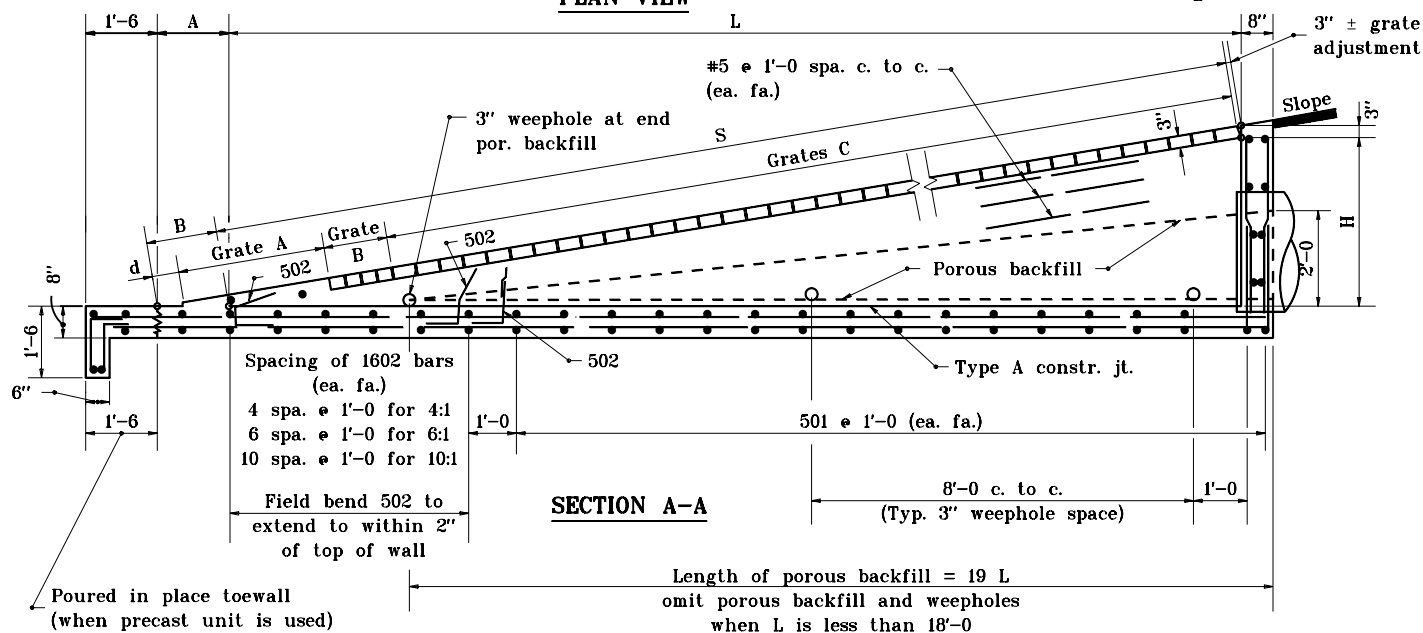
| APPROXIMATE QUANTITIES |                       |              |                         |                       |                       |              |                         |                       |                       |              |                         |                       |                       |              |                         |                       |                       |              |                         |                       |
|------------------------|-----------------------|--------------|-------------------------|-----------------------|-----------------------|--------------|-------------------------|-----------------------|-----------------------|--------------|-------------------------|-----------------------|-----------------------|--------------|-------------------------|-----------------------|-----------------------|--------------|-------------------------|-----------------------|
| PIPE<br>SIZE           | 2:1 SLOPE             |              |                         |                       | 3:1 SLOPE             |              |                         |                       | 4:1 SLOPE             |              |                         |                       | 5:1 SLOPE             |              |                         |                       | 6:1 SLOPE             |              |                         |                       |
|                        | Concrete,<br>Cu. Yds. |              | Reinf.<br>Steel,<br>lb. | Str.<br>Steel,<br>lb. | Concrete,<br>Cu. Yds. |              | Reinf.<br>Steel,<br>lb. | Str.<br>Steel,<br>lb. | Concrete,<br>Cu. Yds. |              | Reinf.<br>Steel,<br>lb. | Str.<br>Steel,<br>lb. | Concrete,<br>Cu. Yds. |              | Reinf.<br>Steel,<br>lb. | Str.<br>Steel,<br>lb. | Concrete,<br>Cu. Yds. |              | Reinf.<br>Steel,<br>lb. | Str.<br>Steel,<br>lb. |
|                        | Conc.<br>Pipe         | C.M.<br>Pipe |                         |                       | Conc.<br>Pipe         | C.M.<br>Pipe |                         |                       | Conc.<br>Pipe         | C.M.<br>Pipe |                         |                       | Conc.<br>Pipe         | C.M.<br>Pipe |                         |                       | Conc.<br>Pipe         | C.M.<br>Pipe |                         |                       |
| 17 x 13                | —                     | 1.0          | 260                     | 75                    | —                     | 1.2          | 335                     | 150                   | —                     | 1.5          | 415                     | 180                   | —                     | 1.8          | 490                     | 210                   | —                     | 2.1          | 565                     | 290                   |
| 21 x 15                | —                     | 1.1          | 280                     | 80                    | —                     | 1.3          | 360                     | 160                   | —                     | 1.6          | 445                     | 190                   | —                     | 1.9          | 530                     | 220                   | —                     | 2.3          | 615                     | 300                   |
| 24 x 18                | —                     | 1.4          | 360                     | 170                   | —                     | 1.8          | 465                     | 235                   | —                     | 2.2          | 570                     | 370                   | —                     | 2.6          | 680                     | 440                   | —                     | 3.1          | 790                     | 505                   |
| 28 x 20                | —                     | 1.5          | 375                     | 180                   | —                     | 1.9          | 495                     | 245                   | —                     | 2.4          | 610                     | 390                   | —                     | 2.8          | 730                     | 460                   | —                     | 3.3          | 845                     | 530                   |
| 35 x 24                | —                     | 2.0          | 475                     | 300                   | —                     | 2.6          | 625                     | 410                   | —                     | 3.2          | 775                     | 525                   | —                     | 3.8          | 925                     | 740                   | —                     | 4.4          | 1075                    | 860                   |
| 42 x 29                | —                     | 2.2          | 535                     | 335                   | —                     | 2.9          | 710                     | 460                   | —                     | 3.6          | 885                     | 685                   | —                     | 4.4          | 1060                    | 820                   | —                     | 5.1          | 1240                    | 955                   |
| 49 x 33                | —                     | 2.8          | 645                     | 360                   | —                     | 3.7          | 860                     | 500                   | —                     | 4.6          | 1075                    | 750                   | —                     | 5.5          | 1290                    | 900                   | —                     | 6.4          | 1505                    | 1045                  |
| 57 x 38                | —                     | 3.0          | 710                     | 395                   | —                     | 4.1          | 955                     | 655                   | —                     | 5.2          | 1205                    | 815                   | —                     | 6.2          | 1450                    | 980                   | —                     | 7.3          | 1700                    | 1140                  |
| 64 x 43                | —                     | 3.8          | 855                     | 575                   | —                     | 5.1          | 1155                    | 925                   | —                     | 6.4          | 1450                    | 1160                  | —                     | 7.8          | 1755                    | 1400                  | —                     | 9.1          | 2055                    | 1760                  |
| 71 x 47                | —                     | 4.0          | 910                     | 610                   | —                     | 5.5          | 1235                    | 980                   | —                     | 7.0          | 1565                    | 1225                  | —                     | 8.4          | 1895                    | 1480                  | —                     | 9.9          | 2225                    | 1865                  |
|                        |                       |              |                         |                       |                       |              |                         |                       |                       |              |                         |                       |                       |              |                         |                       |                       |              |                         |                       |

| DIMENSIONS |                      |       |                      |                      |                      |                      |
|------------|----------------------|-------|----------------------|----------------------|----------------------|----------------------|
| Slope      | A                    | B     | C                    | D                    | E                    | F                    |
| 2:1        | 0'-9"                | 0'-8" | 0'-6 $\frac{1}{2}$ " | 0'-8 $\frac{1}{2}$ " | 0'-0 $\frac{3}{4}$ " | 0'-0 $\frac{7}{8}$ " |
| 3:1        | 1'-0 $\frac{3}{8}$ " | 1'-0" | 0'-5 $\frac{1}{2}$ " | 0'-6 $\frac{1}{8}$ " | 0'-1 $\frac{1}{8}$ " | 0'-1 $\frac{1}{8}$ " |
| 4:1        | 1'-4 $\frac{1}{2}$ " | 1'-4" | 0'-5 $\frac{1}{8}$ " | 0'-6 $\frac{1}{8}$ " | 0'-1 $\frac{1}{2}$ " | 0'-1 $\frac{1}{2}$ " |
| 5:1        | 1'-8 $\frac{3}{8}$ " | 1'-8" | 0'-4 $\frac{7}{8}$ " | 0'-5 $\frac{3}{8}$ " | 0'-1 $\frac{1}{8}$ " | 0'-1 $\frac{1}{8}$ " |
| 6:1        | 2'-0 $\frac{3}{8}$ " | 2'-0" | 0'-4 $\frac{3}{4}$ " | 0'-5 $\frac{3}{8}$ " | 0'-2 $\frac{1}{4}$ " | 0'-2 $\frac{1}{4}$ " |
|            |                      |       |                      |                      |                      |                      |

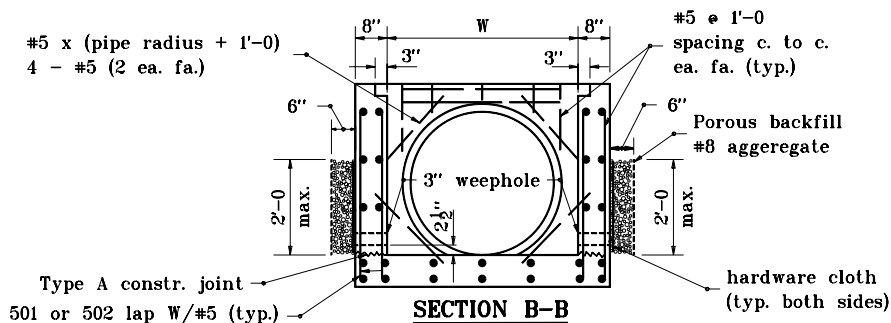
|                                                                                       |                                                                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                                                                                            |
| GRADED BOX END SECTION TYPE I                                                         |                                                                                                                                                                                                                                            |
| DIMENSIONS AND QUANTITIES                                                             |                                                                                                                                                                                                                                            |
| JANUARY 1999                                                                          |                                                                                                                                                                                                                                            |
| STANDARD DRAWING NO. <b>E 715-GBT0-08</b>                                             |                                                                                                                                                                                                                                            |
|  | DETAILS PLACED IN THIS FORMAT 11-15-99<br><br>/s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE<br><br>/s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE<br>DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 1-04-99 |



**PLAN VIEW**



**SECTION A-A**



**SECTION B-B**

## GENERAL NOTES

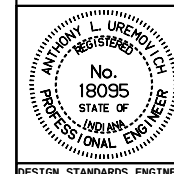
1. The invert grade of the grated box end section shall be the same as that of the pipe.
2. See Standard Drawings E 715-GBTT-05 and -06 for dimensions tables.
3. Type II grated box end sections shall be used for culverts parallel to the mainline within the clear zone.
4. See Standard Drawing E 715-GBTT-02 for bending diagrams.

INDIANA DEPARTMENT OF TRANSPORTATION

## GRATED BOX END SECTION TYPE II

JANUARY 1999

STANDARD DRAWING NO. E 715-GBTT-01

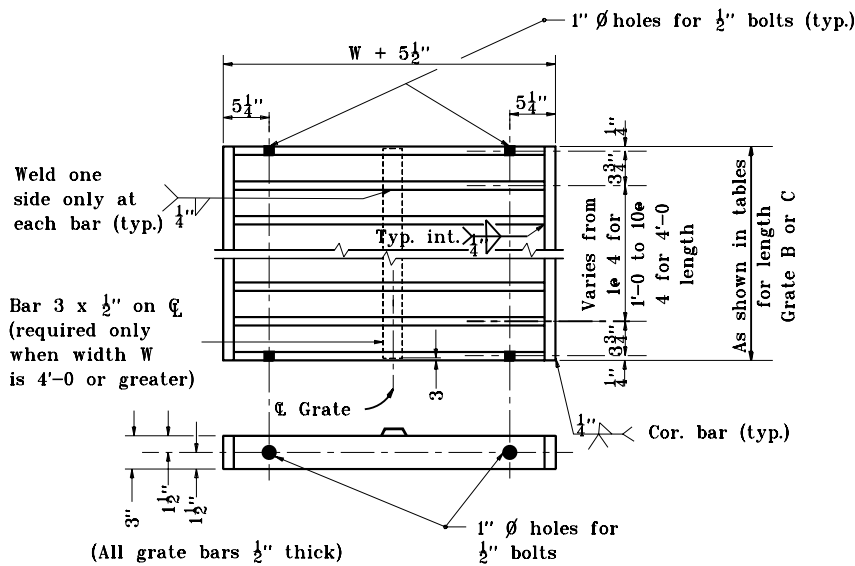


DETAILS PLACED IN THIS FORMAT 11-15-99

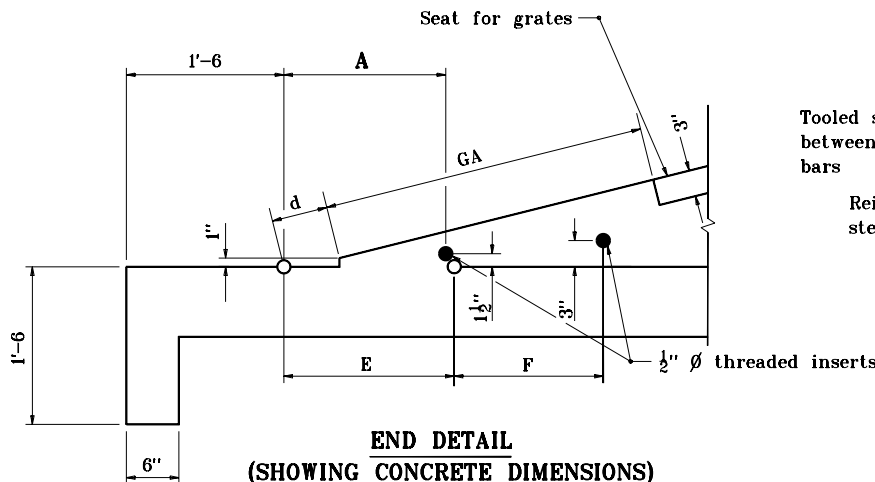
/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE  
DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 1-04-99

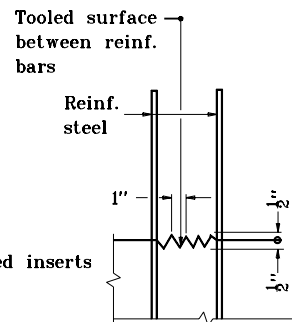




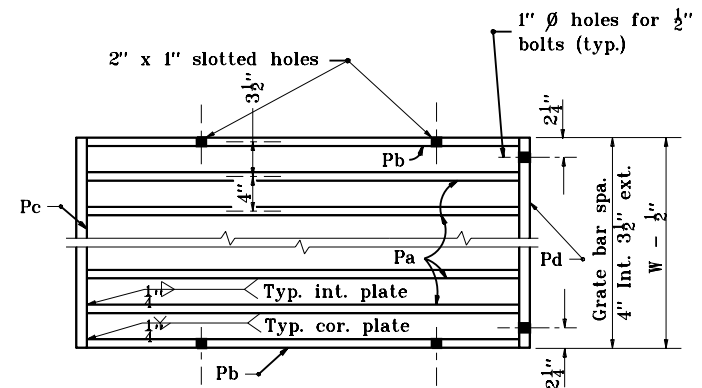
**GRATE B & C**



**END DETAIL  
(SHOWING CONCRETE DIMENSIONS)**

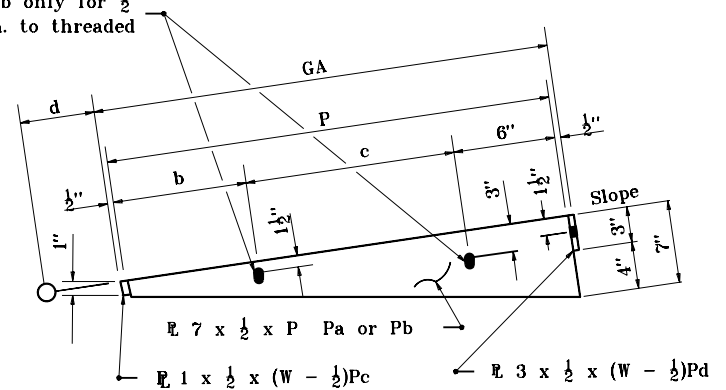


**TYPE A CONSTR.  
JOINT**

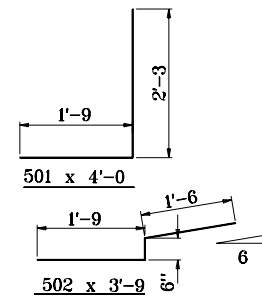


**PLAN VIEW**

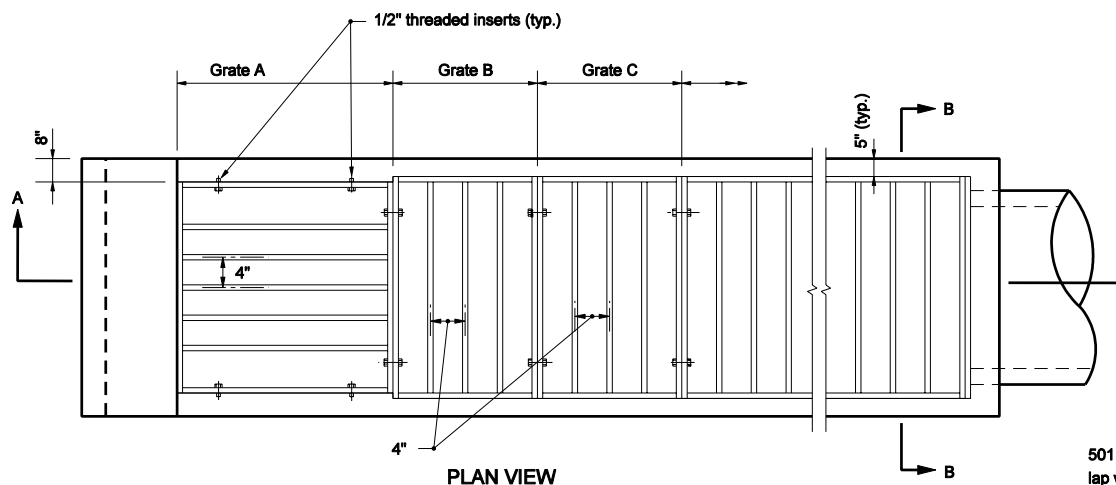
1" x 2" slotted hole in R. Pb only for  $\frac{1}{2}$ " bolt conn. to threaded inserts.



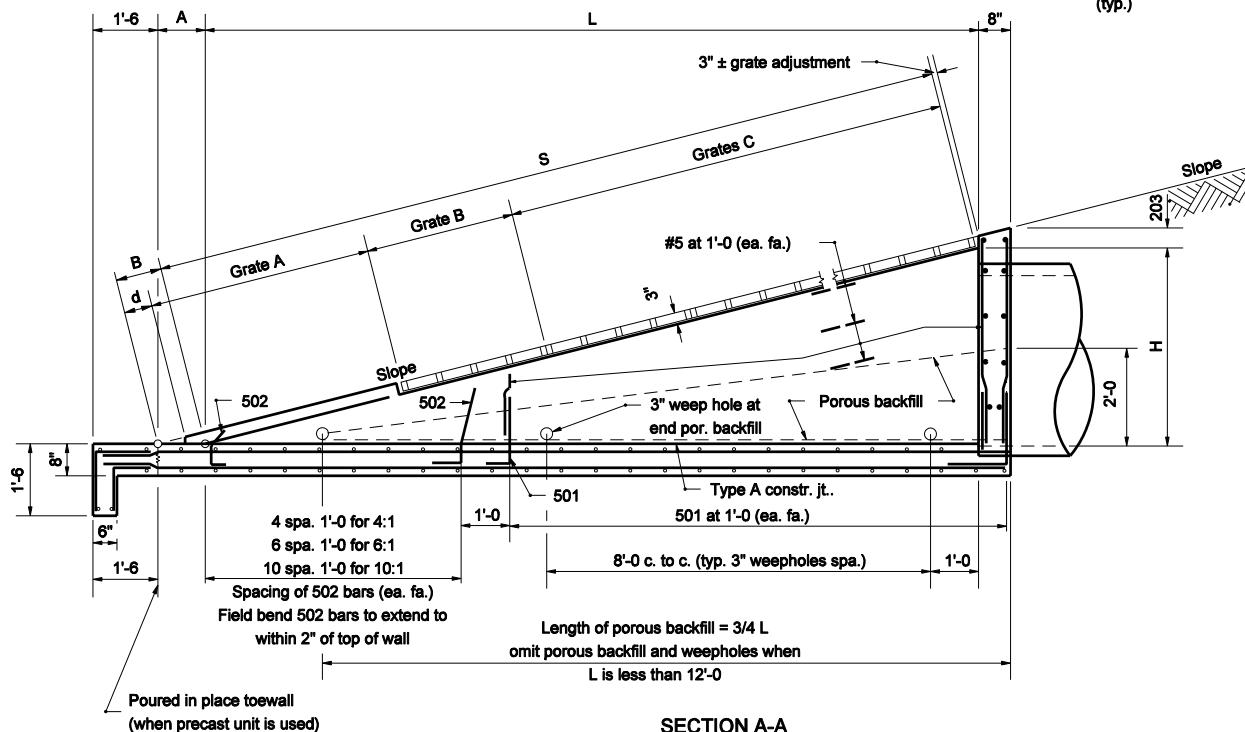
**ELEVATION  
GRATE A**



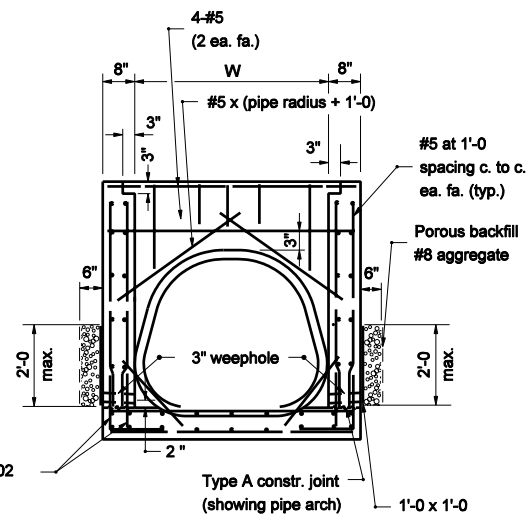
|                                           |                                                                    |
|-------------------------------------------|--------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION      |                                                                    |
| <b>GRATED BOX END<br/>SECTION TYPE II</b> |                                                                    |
| JANUARY 1999                              |                                                                    |
| <b>STANDARD DRAWING NO. E 715-GBTT-02</b> |                                                                    |
| DETAILS PLACED IN THIS FORMAT 11-15-99    |                                                                    |
|                                           | s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE |
|                                           | s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE            |
|                                           | DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 1-04-99              |



PLAN VIEW



SECTION A-A



GRATE REMOVED  
SECTION B-B

#### GENERAL NOTES

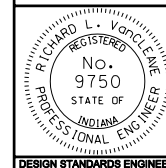
1. The invert grade of the grated box end section shall be the same as that of the pipe.
2. See Standard Drawings E 715-GBTT-05 and -06 for dimensions tables.
3. See Standard Drawing E 715-GBTT-02 for bending diagrams.
4. Type II grated box end sections shall be used for culverts parallel to the mainline within the clear zone.

INDIANA DEPARTMENT OF TRANSPORTATION

#### GRATED BOX END SECTION TYPE II

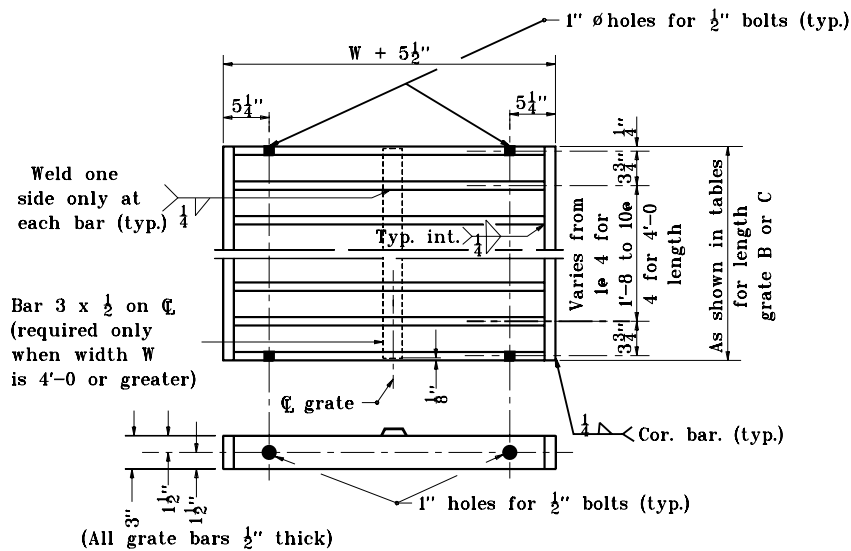
MARCH 2006

STANDARD DRAWING NO. E 715-GBTT-03

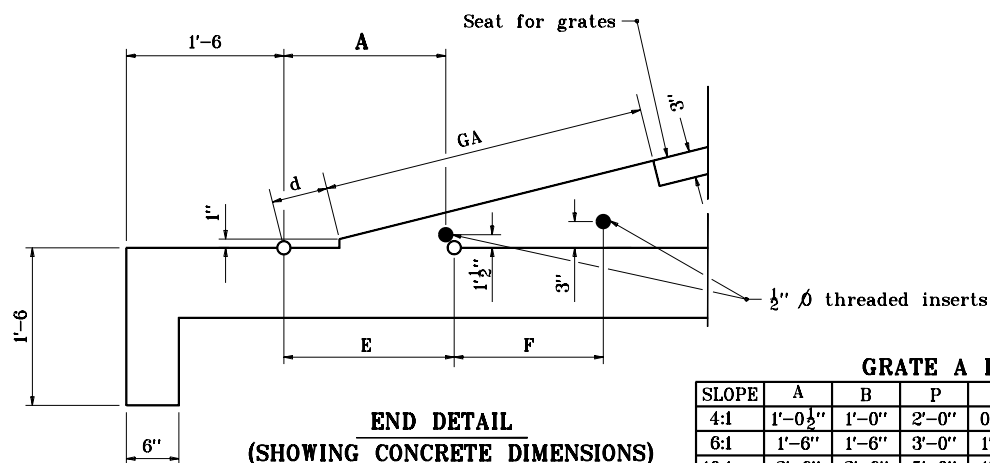


/s/ Richard L. VanCleave 3-01-06  
DESIGN STANDARDS ENGINEER DATE

/s/ Richard K. Smutzer 3-01-06  
CHIEF HIGHWAY ENGINEER DATE



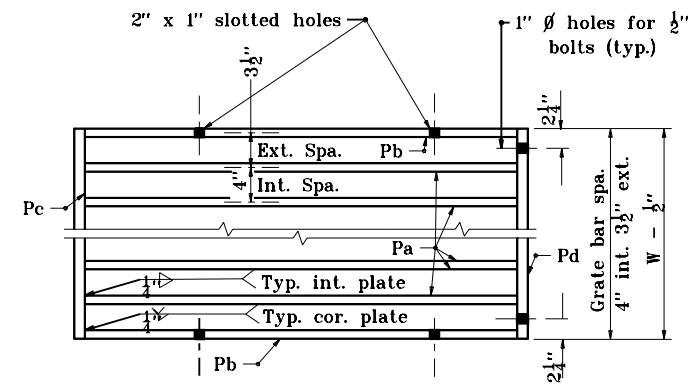
**GRATE B & C**



**END DETAIL  
(SHOWING CONCRETE DIMENSIONS)**

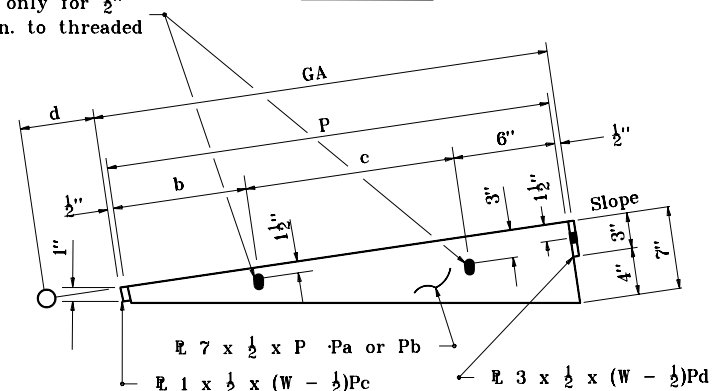
**GRATE A DIMENSIONS TABLE**

| SLOPE | A         | B     | P     | b     | c      | d   | E         | F      | G     |
|-------|-----------|-------|-------|-------|--------|-----|-----------|--------|-------|
| 4:1   | 1'-0 1/2" | 1'-0" | 2'-0" | 0'-8" | 0'-10" | 4"  | 1'-0 1/2" | 0'-10" | 2'-1" |
| 6:1   | 1'-6"     | 1'-6" | 3'-0" | 1'-0" | 1'-6"  | 6"  | 1'-6 1/2" | 1'-6"  | 3'-1" |
| 10:1  | 2'-6"     | 2'-6" | 5'-0" | 1'-8" | 2'-10" | 10" | 2'-6 1/2" | 2'-10" | 5'-1" |



**PLAN VIEW**

1" x 2" slotted hole in R Pb only for 1/2" bolt conn. to threaded inserts.



**ELEVATION  
GRATE A**

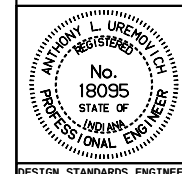
INDIANA DEPARTMENT OF TRANSPORTATION

**GRATED BOX END SECTION**

**TYPE II**

JANUARY 1999

**STANDARD DRAWING NO. E 715-GBTT-04**



DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE  
ORIGINALLY APPROVED 1-04-99

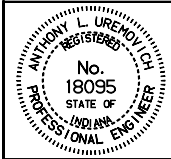
| 4:1 Slope     |      |       |      |       |         |        |         |
|---------------|------|-------|------|-------|---------|--------|---------|
| Pipe Diameter | H    | L     | W    | S     | Grate C |        | Grate B |
|               |      |       |      |       | No.     | Length | Length  |
| 12            | 1'-5 | 5'-8  | 2'-0 | 5'-9  | 1       | 3'-4   | 1'-0    |
| 15 & 18       | 2'-0 | 8'-0  | 2'-0 | 8'-1  | 1       | 4'-0   | 2'-8    |
| 21 & 24       | 2'-6 | 10'-0 | 3'-0 | 10'-1 | 2       | 3'-0   | 2'-8    |
| 27 & 30       | 3'-1 | 12'-4 | 3'-0 | 12'-5 | 3       | 3'-0   | 2'-0    |
| 33 & 36       | 3'-7 | 14'-4 | 4'-0 | 14'-5 | 5       | 2'-4   | 1'-4    |
| 42            | 4'-2 | 16'-5 | 4'-0 | 17'-1 | 6       | 2'-4   | 1'-8    |
| 48            | 4'-8 | 18'-8 | 5'-0 | 19'-1 | 8       | 2'-0   | 1'-8    |
| 54            | 5'-3 | 21'-0 | 6'-0 | 21'-5 | 12      | 1'-8   | -       |
| 60            | 5'-9 | 23'-0 | 6'-0 | 23'-5 | 12      | 1'-8   | 2'-0    |

| 10:1 Slope    |      |        |      |       |         |        |         |
|---------------|------|--------|------|-------|---------|--------|---------|
| Pipe Diameter | H    | L      | W    | S     | Grate C |        | Grate B |
|               |      |        |      |       | No.     | Length | Length  |
| 12            | 1'-5 | 14'-2  | 2'-0 | 14'-1 | 2       | 4'-0   | 2'-8    |
| 15 & 18       | 2'-0 | 20'-0  | 2'-0 | 19'-9 | 4       | 3-8    | 1'-8    |
| 21 & 24       | 2'-6 | 25'-0  | 3'-0 | 24'-9 | 8       | 2'-8   | -       |
| 27 & 30       | 3'-1 | 30'-10 | 3'-0 | 30'-5 | 9       | 3'-0   | -       |
| 33 & 36       | 3'-7 | 35'-10 | 4'-0 | 35'-9 | 13      | 2'-4   | 2'-0    |
| 42            | 4'-2 | 41'-8  | 4'-0 | 41'-9 | 16      | 2'-4   | 1'-0    |
| 48            | 4'-8 | 46'-8  | 5'-0 | 46'-9 | 21      | 2'-0   | 1'-4    |
| 54            | 5'-3 | 52'-6  | 6'-0 | 52'-5 | 36      | 1'-4   | 1'-0    |
| 60            | 5'-9 | 57'-6  | 6'-0 | 57'-9 | 40      | 1'-4   | 1'-0    |

| 6:1 Slope     |      |       |      |       |         |        |         |
|---------------|------|-------|------|-------|---------|--------|---------|
| Pipe Diameter | H    | L     | W    | S     | Grate C |        | Grate B |
|               |      |       |      |       | No.     | Length | Length  |
| 12            | 1'-5 | 8'-6  | 2'-0 | 8'-5  | 1       | 4'-0   | 2'-4    |
| 15 & 18       | 2'-0 | 12'-0 | 2'-0 | 11'-9 | 2       | 4'-0   | 1'-8    |
| 21 & 24       | 2'-6 | 15'-0 | 3'-0 | 15'-1 | 4       | 3'-0   | 1'-0    |
| 27 & 30       | 3'-1 | 18'-6 | 3'-0 | 18'-5 | 5       | 3'-0   | 1'-4    |
| 33 & 36       | 3'-7 | 21'-6 | 4'-0 | 21'-5 | 9       | 2'-0   | 1'-4    |
| 42            | 4'-2 | 25'-0 | 4'-0 | 25'-1 | 9       | 2'-4   | 2'-0    |
| 48            | 4'-8 | 28'-0 | 5'-0 | 28'-1 | 13      | 2'-0   | -       |
| 54            | 5'-3 | 31'-6 | 6'-0 | 31'-9 | 17      | 1'-8   | 1'-4    |
| 60            | 5'-9 | 34'-6 | 6'-0 | 34'-9 | 19      | 1'-8   | 1'-0    |

| GRATE A DIMENSIONS TABLE |        |      |      |      |       |     |        |            |
|--------------------------|--------|------|------|------|-------|-----|--------|------------|
| Slope                    | A      | B    | P    | b    | c     | d   | E      | F GA       |
| 4:1                      | 1'-0½" | 1'-0 | 2'-0 | 0'-8 | 0'-10 | 4"  | 1'-0½" | 0'-10 2'-1 |
| 6:1                      | 1'-6   | 1'-6 | 3'-0 | 1'-0 | 1'-6  | 6"  | 1'-6½" | 1'-6 3'-1  |
| 10:1                     | 2'-6   | 2'-6 | 5'-0 | 1'-8 | 2'-10 | 10" | 2'-6½" | 2'-10 5'-1 |

| APPROXIMATE QUANTITIES |               |              |                         |                       |               |              |                         |                       |               |              |                         |                       |
|------------------------|---------------|--------------|-------------------------|-----------------------|---------------|--------------|-------------------------|-----------------------|---------------|--------------|-------------------------|-----------------------|
| Pipe<br>Diameter       | 4:1 Slope     |              |                         |                       | 6:1 Slope     |              |                         |                       | 10:1 Slope    |              |                         |                       |
|                        | Conc., cys    |              | Reinf.<br>Steel,<br>lb. | Str.<br>Steel,<br>lb. | Conc., cys    |              | Reinf.<br>Steel,<br>lb. | Str.<br>Steel,<br>lb. | Conc., cys    |              | Reinf.<br>Steel,<br>lb. | Str.<br>Steel,<br>lb. |
|                        | Conc.<br>Pipe | C.M.<br>Pipe |                         |                       | Conc.<br>Pipe | C.M.<br>Pipe |                         |                       | Conc.<br>Pipe | C.M.<br>Pipe |                         |                       |
| 12                     | 1.1           | 1.1          | 295                     | 335                   | 1.5           | 1.5          | 400                     | 480                   | 2.3           | 2.4          | 605                     | 790                   |
| 15 & 18                | 1.6           | 1.6          | 395                     | 445                   | 2.2           | 2.2          | 550                     | 645                   | 3.4           | 3.4          | 865                     | 1080                  |
| 21 & 24                | 2.4           | 2.4          | 565                     | 750                   | 3.3           | 3.3          | 790                     | 1130                  | 5.2           | 5.2          | 1245                    | 1830                  |
| 27 & 30                | 2.9           | 3.0          | 695                     | 910                   | 4.2           | 4.3          | 980                     | 1345                  | 6.6           | 6.7          | 1580                    | 2195                  |
| 33 & 36                | 4.0           | 4.1          | 910                     | 1415                  | 5.7           | 5.8          | 1290                    | 2115                  | 9.1           | 9.2          | 2075                    | 3455                  |
| 42                     | 4.8           | 4.9          | 1085                    | 1655                  | 6.9           | 7.0          | 1545                    | 2415                  | 11.0          | 11.2         | 2490                    | 4015                  |
| 48                     | 6.2           | 6.3          | 1350                    | 2230                  | 8.8           | 9.0          | 1925                    | 3265                  | 14.2          | 14.4         | 3100                    | 5425                  |
| 54                     | 7.8           | 8.0          | 1665                    | 2955                  | 11.3          | 11.4         | 2400                    | 4375                  | 18.1          | 18.3         | 3855                    | 7440                  |
| 60                     | 8.7           | 8.9          | 1850                    | 3215                  | 12.6          | 12.8         | 2675                    | 4780                  | 20.4          | 20.4         | 4310                    | 8175                  |

|                                                                                             |                                                                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                        |                                                                                                                                                                                                                                            |
| <b>GRATED BOX END SECTION</b><br><b>DIMENSIONS &amp; QUANTITIES TYPE II</b><br>JANUARY 1999 |                                                                                                                                                                                                                                            |
| STANDARD DRAWING NO.E 715-GBTT-05                                                           |                                                                                                                                                                                                                                            |
|        | DETAILS PLACED IN THIS FORMAT 11-15-99<br><br>/s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE<br><br>/s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE<br>DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 1-04-99 |

| 4:1 SLOPE    |       |       |      |       |         |        |         |
|--------------|-------|-------|------|-------|---------|--------|---------|
| PIPE<br>SIZE | H     | L     | W    | S     | GRATE C |        | GRATE B |
|              |       |       |      |       | No.     | LENGTH | LENGTH  |
| 17 x 13      | 1'-6  | 6'-0  | 2'-0 | 6'-1  | 1       | 3'-8   | 1'-0    |
| 21 x 15      | 1'-8  | 6'-8  | 2'-0 | 6'-9  | 1       | 4'-0   | 1'-4    |
| 24 x 18      | 1'-11 | 7'-8  | 3'-0 | 7'-9  | 2       | 2'-8   | 1'-0    |
| 28 x 20      | 2'-1  | 8'-4  | 3'-0 | 8'-5  | 2       | 3'-0   | 1'-0    |
| 35 x 24      | 2'-5  | 9'-8  | 4'-0 | 9'-9  | 3       | 2'-4   | 1'-4    |
| 42 x 29      | 2'-10 | 11'-4 | 4'-0 | 11'-5 | 5       | 2'-0   | -       |
| 49 x 33      | 3'-2  | 12'-8 | 5'-0 | 12'-9 | 5       | 2'-0   | 1'-4    |
| 57 x 38      | 3'-7  | 14'-4 | 5'-0 | 14'-5 | 6       | 2'-0   | 1'-0    |
| 64 x 43      | 4'-0  | 16'-0 | 6'-0 | 16'-5 | 9       | 1'-8   | -       |
| 71 x 47      | 4'-4  | 17'-4 | 6'-0 | 17'-9 | 9       | 1'-8   | 1'-4    |

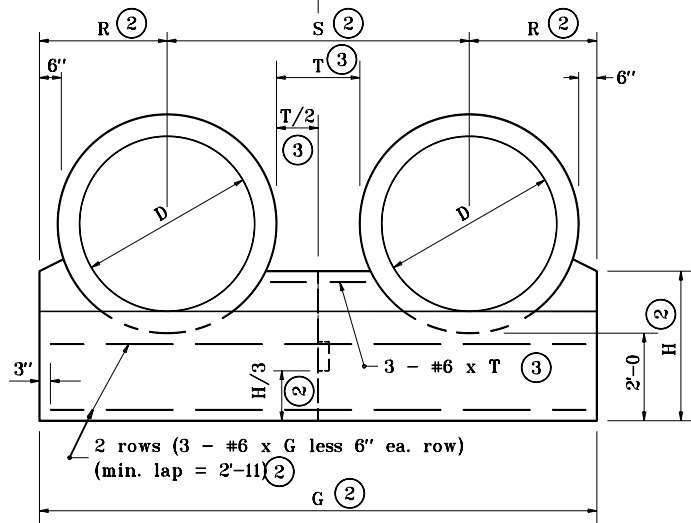
| 10:1 SLOPE   |       |        |      |       |         |        |         |
|--------------|-------|--------|------|-------|---------|--------|---------|
| PIPE<br>SIZE | H     | L      | W    | S     | GRATE C |        | GRATE B |
|              |       |        |      |       | No.     | LENGTH | LENGTH  |
| 17 x 13      | 1'-6  | 15'-0  | 2'-0 | 14'-9 | 2       | 4'-0   | 3'-4    |
| 21 x 15      | 1'-8  | 16'-8  | 2'-0 | 16'-5 | 3       | 4'-0   | 1'-0    |
| 24 x 18      | 1'-11 | 19'-2  | 3'-0 | 19'-1 | 5       | 2'-6   | 2'-4    |
| 28 x 20      | 2'-1  | 20'-10 | 3'-0 | 20'-9 | 5       | 3'-0   | 2'-4    |
| 35 x 24      | 2'-5  | 24'-2  | 4'-0 | 24'-1 | 8       | 2'-4   | 2'-0    |
| 42 x 29      | 2'-10 | 28'-4  | 4'-0 | 28'-1 | 10      | 2'-4   | 1'-4    |
| 49 x 33      | 3'-2  | 31'-8  | 5'-0 | 31'-9 | 17      | 1'-8   | -       |
| 57 x 38      | 3'-7  | 35'-10 | 5'-0 | 35'-9 | 23      | 1'-4   | 1'-8    |
| 64 x 43      | 4'-0  | 40'-0  | 6'-0 | 40'-1 | 22      | 1'-8   | -       |
| 71 x 47      | 4'-4  | 43'-4  | 6'-0 | 43'-5 | 24      | 1'-8   | -       |

| 6:1 SLOPE    |       |       |      |       |         |        |         |
|--------------|-------|-------|------|-------|---------|--------|---------|
| PIPE<br>SIZE | H     | L     | W    | S     | GRATE C |        | GRATE B |
|              |       |       |      |       | No.     | LENGTH | LENGTH  |
| 17 x 13      | 1'-6  | 9'-0  | 2'-0 | 8'-9  | 1       | 4'-0   | 2'-8    |
| 21 x 15      | 1'-8  | 10'-0 | 2'-0 | 9'-9  | 1       | 4'-0   | 3'-8    |
| 24 x 18      | 1'-11 | 11'-6 | 3'-0 | 11'-5 | 3       | 2'-8   | 1'-4    |
| 28 x 20      | 2'-1  | 12'-6 | 3'-0 | 12'-5 | 3       | 3'-0   | 1'-4    |
| 35 x 24      | 2'-5  | 14'-6 | 4'-0 | 14'-5 | 5       | 2'-0   | 2'-4    |
| 42 x 29      | 2'-10 | 17'-0 | 4'-0 | 17'-1 | 7       | 2'-0   | 1'-0    |
| 49 x 33      | 3'-2  | 19'-0 | 5'-0 | 19'-1 | 8       | 2'-0   | 1'-0    |
| 57 x 38      | 3'-7  | 21'-6 | 5'-0 | 21'-5 | 9       | 2'-0   | 1'-4    |
| 64 x 43      | 4'-0  | 24'-0 | 6'-0 | 24'-1 | 12      | 1'-8   | 2'-0    |
| 71 x 47      | 4'-4  | 26'-0 | 6'-0 | 26'-1 | 18      | 1'-4   | -       |

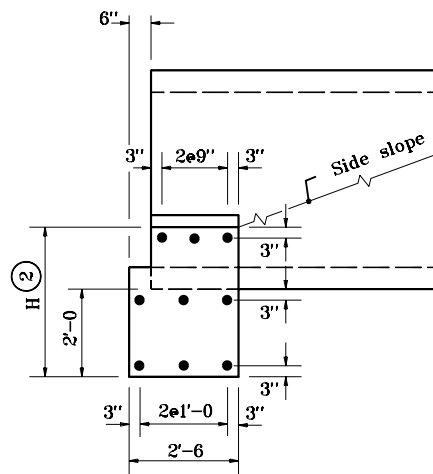
| APPROXIMATE QUANTITIES |                       |               |                         |                       |               |                         |                       |               |                         |
|------------------------|-----------------------|---------------|-------------------------|-----------------------|---------------|-------------------------|-----------------------|---------------|-------------------------|
| PIPE<br>Size           | 4:1 SLOPE             |               |                         | 6:1 SLOPE             |               |                         | 10:1 SLOPE            |               |                         |
|                        | Str.<br>Steel,<br>lb. | Conc.,<br>cys | Reinf.<br>Steel,<br>lb. | Str.<br>Steel,<br>lb. | Conc.,<br>cys | Reinf.<br>Steel,<br>lb. | Str.<br>Steel,<br>lb. | Conc.,<br>cys | Reinf.<br>Steel,<br>lb. |
| 17 x 13                | 355                   | 1.2           | 305                     | 495                   | 1.6           | 415                     | 820                   | 2.5           | 640                     |
| 21 x 15                | 385                   | 1.3           | 335                     | 540                   | 1.8           | 460                     | 910                   | 2.8           | 715                     |
| 24 x 18                | 605                   | 1.8           | 440                     | 875                   | 2.5           | 610                     | 1445                  | 3.9           | 935                     |
| 28 x 20                | 645                   | 2.0           | 465                     | 940                   | 2.7           | 645                     | 1545                  | 4.2           | 1020                    |
| 35 x 24                | 975                   | 2.7           | 615                     | 1435                  | 3.7           | 855                     | 2375                  | 5.8           | 1325                    |
| 42 x 29                | 1145                  | 3.1           | 700                     | 1710                  | 4.4           | 995                     | 2750                  | 6.9           | 1570                    |
| 49 x 33                | 1520                  | 4.0           | 880                     | 2270                  | 5.6           | 1230                    | 3825                  | 8.9           | 1960                    |
| 57 x 38                | 1715                  | 4.5           | 985                     | 2525                  | 6.4           | 1400                    | 4400                  | 10.2          | 2245                    |
| 64 x 43                | 2295                  | 5.7           | 1210                    | 3335                  | 8.1           | 1725                    | 5560                  | 12.9          | 2755                    |
| 71 x 47                | 2470                  | 6.2           | 1310                    | 3735                  | 8.9           | 1880                    | 6005                  | 14.2          | 3015                    |

|                                                                                       |                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                                                                                        |
| GRADED BOX END SECTION TYPE II                                                        |                                                                                                                                                                                                                                        |
| DIMENSIONS AND QUANTITIES                                                             |                                                                                                                                                                                                                                        |
| JANUARY 1999                                                                          |                                                                                                                                                                                                                                        |
| STANDARD DRAWING NO.E 715-GBTT-06                                                     |                                                                                                                                                                                                                                        |
|  | DETAILS PLACED IN THIS FORMAT 11-15-99<br>/s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE<br><br>/s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE<br>DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 1-04-99 |

④ 3' x 8' x H/3 keyway constr. jt.



**ANCHOR FOR DOUBLE PIPE INSTALLATION**  
**FRONT ELEVATION**



**SECTION THROUGH**  
**ANCHOR**

# **GENERAL NOTES**

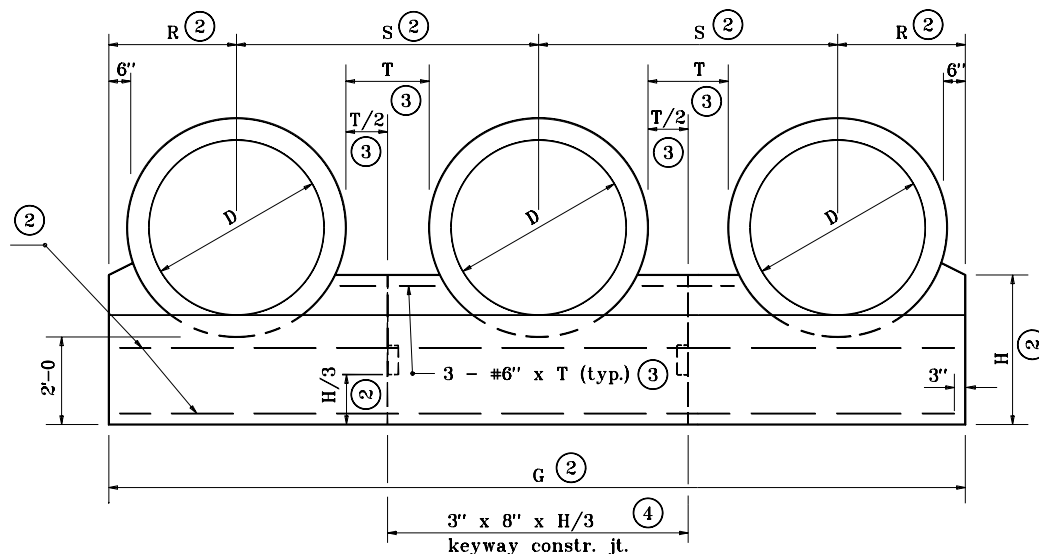
1. Circular reinforced concrete pipes shown. For details of other pipe alternates, see partial elevations on Standard Drawing E 715-MPCA-02.

② For dimension enter chart on Standard Drawing E 715-ANCH-01 with known dimension D.

③ T = Clear distance between pipes.  
For D less than 48", T = 2'-0.  
For D of 48" to 96", T = 1/2 D  
For D greater than 96", T = 4'-0.

④ No joint required if G is less than or equal to 30'. One joint required if G is greater than 30' but less than or equal to 42'. Two joints required if G is greater than 42'.

2 rows (3 - #6 x G less 6" ea. row) (min. lap = 2'-11")

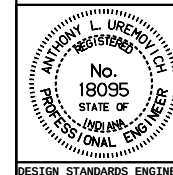


**ANCHOR FOR TRIPLE PIPE INSTALLATION**  
**FRONT ELEVATION**

INDIANA DEPARTMENT OF TRANSPORTATION

## **MULTIPLE PIPE** **CONCRETE ANCHORS** JANUARY 1998

STANDARD DRAWING NO. **E 715-MPCA-01**



DETAILS PLACED IN THIS FORMAT 7-27-99

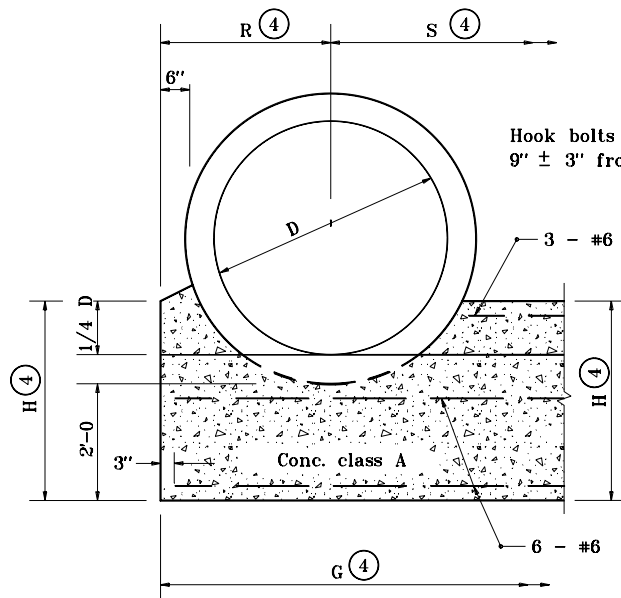
/s/ Anthony L. Uremovich 7-27-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 7-27-99  
CHIEF HIGHWAY ENGINEER DATE

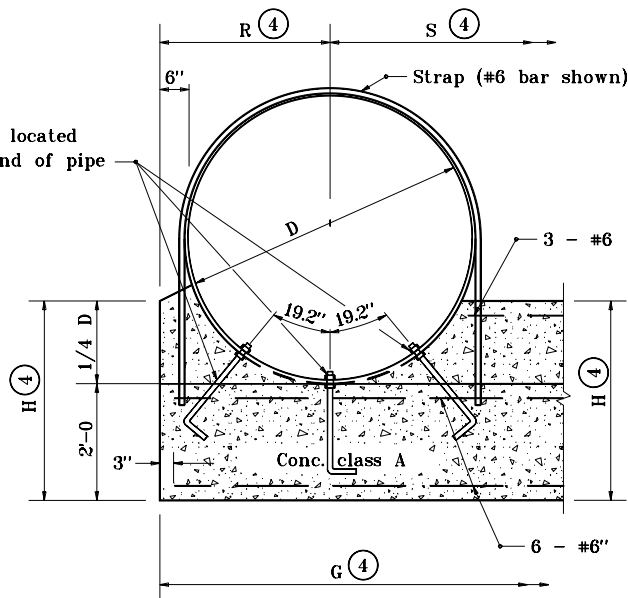
DESIGN STANDARDS ENGINEER

ORIGINALLY APPROVED

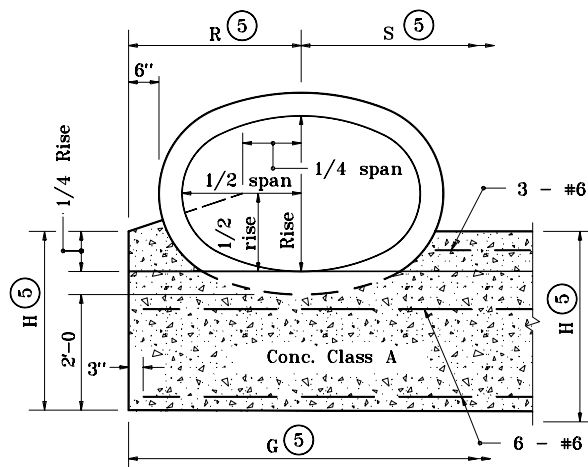
1-02-98



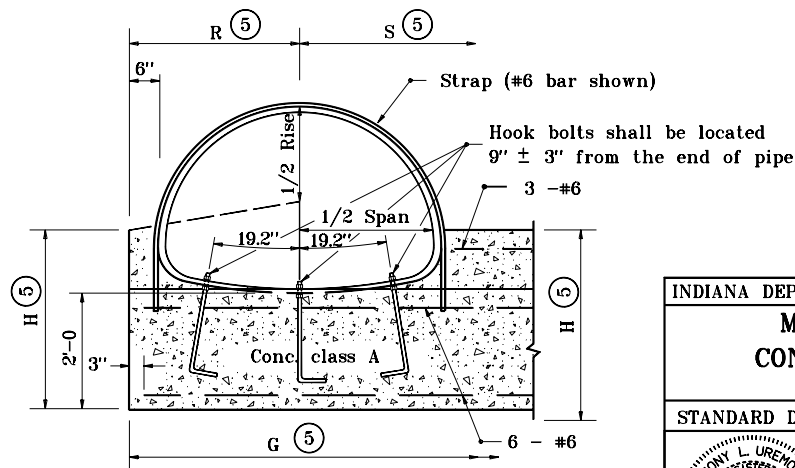
**ANCHOR FOR  
REINFORCED CONCRETE PIPE  
PARTIAL ELEVATION**



**ANCHOR FOR  
CORRUGATED METAL PIPE  
PARTIAL ELEVATION**



**ANCHOR FOR  
REINFORCED CONCRETE HORIZONTAL ELLIPTICAL PIPE  
PARTIAL ELEVATION**



**ANCHOR FOR CORRUGATED METAL PIPE-ARCH  
PARTIAL ELEVATION**

## GENERAL NOTES

1. Anchor straps shall be used at both upstream and downstream ends of all C.M. pipes with a diameter or span of 42" or greater.
2. Hook bolts and anchor straps shall be used for all C.M. pipes with a diameter or span of 84" or greater.
3. Riprap shall be placed at the ends of pipe structures when shown on the plans.
- ④ For dimension, enter chart on Standard Drawing E 715-ANCH-01 with known dimension D.
- ⑤ For dimension, enter chart on Standard Drawing E 715-ANCH-02 with known span and rise.

## LEGEND

C.M. = Corrugated Metal

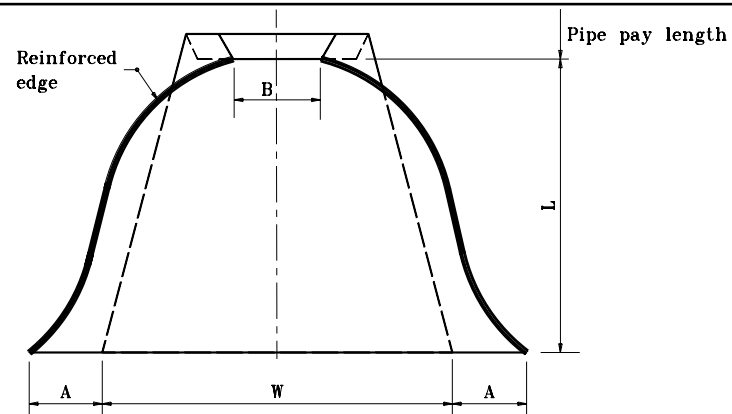
INDIANA DEPARTMENT OF TRANSPORTATION

## MULTIPLE PIPE CONCRETE ANCHOR JANUARY 1998

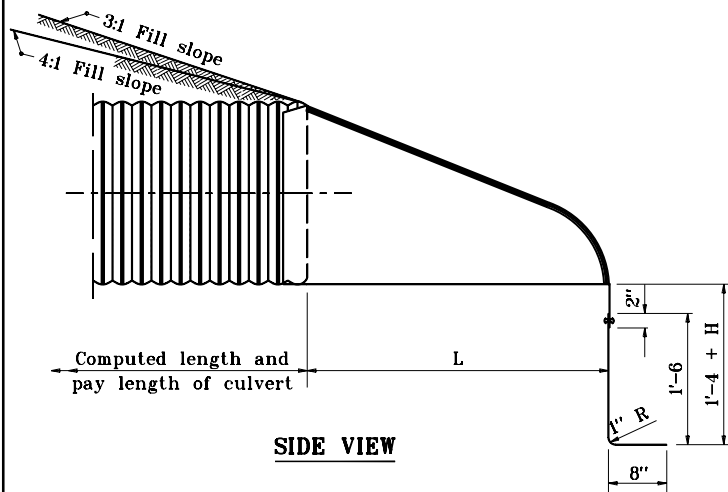
STANDARD DRAWING NO. E 715-MPCA-02

|  |                                                                    |         |
|--|--------------------------------------------------------------------|---------|
|  | DETAILS PLACED IN THIS FORMAT                                      | 7-27-99 |
|  | /s/ Anthony L. Uremovich 7-27-99<br>DESIGN STANDARDS ENGINEER DATE |         |
|  | /s/ Firooz Zandi 7-27-99<br>CHIEF HIGHWAY ENGINEER DATE            |         |
|  | DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 1-02-98              |         |

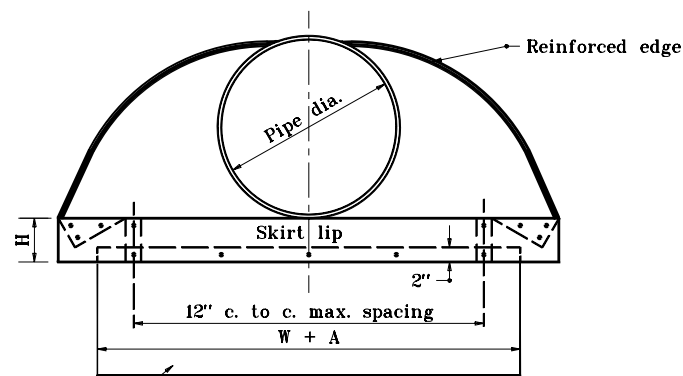
| PIPE DIA. | END SECTION THICK. (in.) | DIMENSIONS         |             |                    |                               |                    | APPROX. SLOPE    | BODY  |
|-----------|--------------------------|--------------------|-------------|--------------------|-------------------------------|--------------------|------------------|-------|
|           |                          | A<br>( $\pm 1''$ ) | B<br>(Max.) | H<br>( $\pm 1''$ ) | L<br>( $\pm 1\frac{1}{2}''$ ) | W<br>( $\pm 2''$ ) |                  |       |
| 12        | .064                     | 6                  | 6           | 6                  | 21                            | 24                 | $2\frac{1}{2}:1$ | 1 Pc. |
| 15        | .064                     | 7                  | 8           | 6                  | 26                            | 30                 | $2\frac{1}{2}:1$ | 1 Pc. |
| 18        | .064                     | 8                  | 10          | 6                  | 31                            | 36                 | $2\frac{1}{2}:1$ | 1 Pc. |
| 21        | .064                     | 9                  | 12          | 6                  | 36                            | 42                 | $2\frac{1}{2}:1$ | 1 Pc. |
| 24        | .064                     | 10                 | 13          | 6                  | 41                            | 48                 | $2\frac{1}{2}:1$ | 1 Pc. |
| 30        | .079                     | 12                 | 16          | 8                  | 51                            | 60                 | $2\frac{1}{2}:1$ | 1 Pc. |
| 36        | .079                     | 14                 | 19          | 9                  | 60                            | 72                 | $2\frac{1}{2}:1$ | 2 Pc. |



**PLAN VIEW**



**SIDE VIEW**



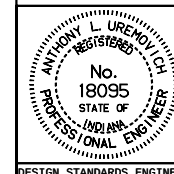
**END VIEW**

INDIANA DEPARTMENT OF TRANSPORTATION

## METAL PIPE END SECTION

JANUARY 1998

STANDARD DRAWING NO. **E 715-MPES-01**



DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

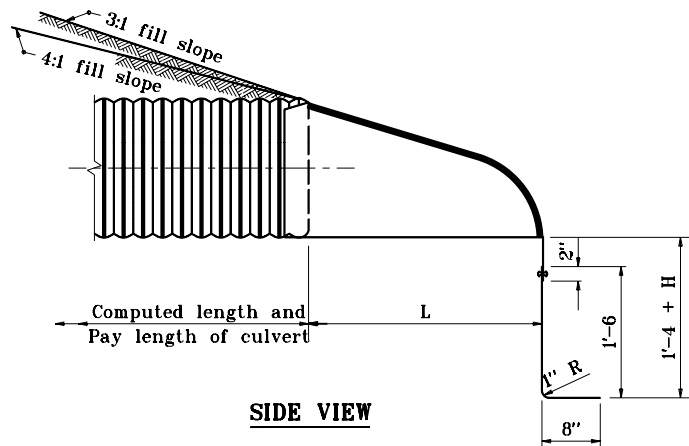
/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

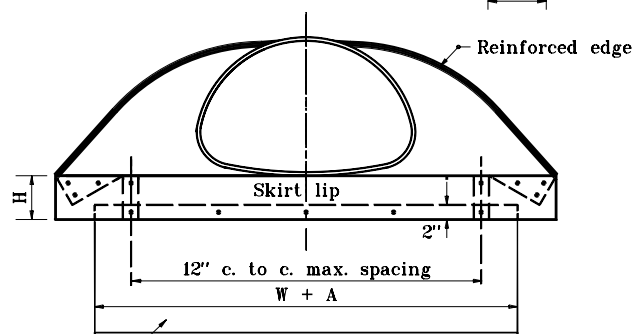
ORIGINALLY APPROVED 1-02-98



| PIPE-ARCH<br>DIMENSIONS |      | END<br>SECTION<br>THICK.<br>(in.) | DIMENSIONS |             |            |             |            | APPROX.<br>SLOPE | BODY  |
|-------------------------|------|-----------------------------------|------------|-------------|------------|-------------|------------|------------------|-------|
| SPAN                    | RISE |                                   | A<br>(±1") | B<br>(Max.) | H<br>(±1") | L<br>(±1½") | W<br>(±2") |                  |       |
| 17                      | 13   | .064                              | 7          | 9           | 6          | 19          | 30         | 2½:1             | 1 Pc. |
| 21                      | 15   | .064                              | 7          | 10          | 6          | 23          | 36         | 2½:1             | 1 Pc. |
| 24                      | 18   | .064                              | 8          | 12          | 6          | 28          | 42         | 2½:1             | 1 Pc. |
| 28                      | 20   | .064                              | 9          | 14          | 6          | 32          | 48         | 2½:1             | 1 Pc. |
| 35                      | 24   | .079                              | 10         | 16          | 8          | 39          | 60         | 2½:1             | 1 Pc. |
| 42                      | 29   | .079                              | 12         | 18          | 9          | 46          | 75         | 2½:1             | 1 Pc. |

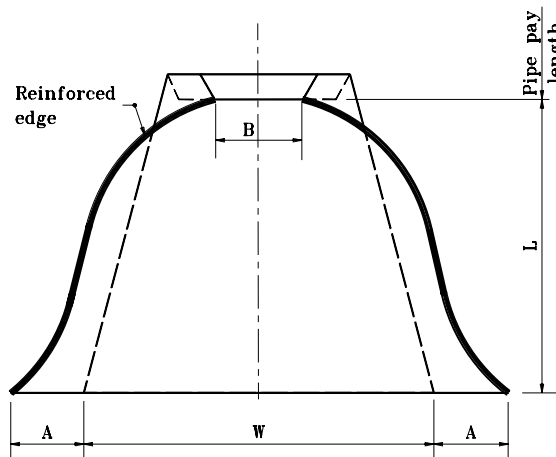


**SIDE VIEW**



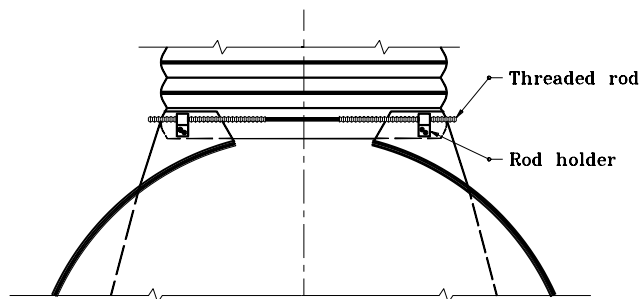
**END VIEW**

Toe plate anchor

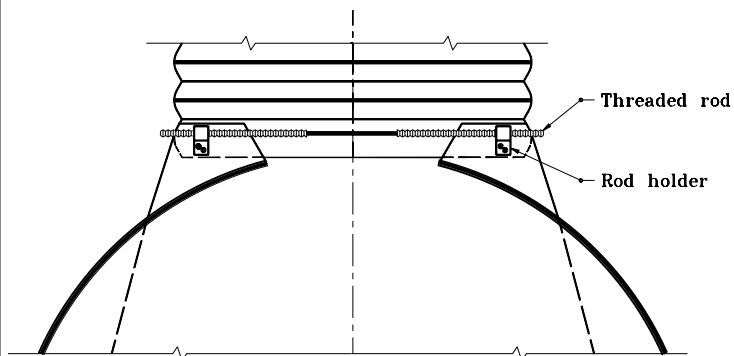


**PLAN VIEW**

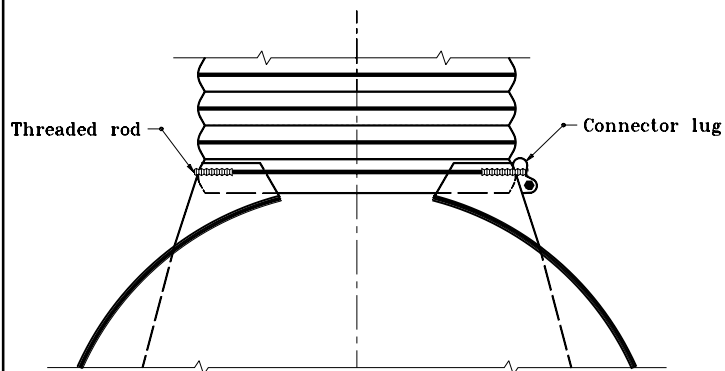
|                                                                                              |                                                                                                                                                                                                                                    |
|----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                         |                                                                                                                                                                                                                                    |
| METAL PIPE ARCH<br>END SECTION<br>JANUARY 1998                                               |                                                                                                                                                                                                                                    |
| STANDARD DRAWING NO. E 715-MPES-02                                                           |                                                                                                                                                                                                                                    |
| ANTHONY L. UREMOWICH<br>REGISTERED<br>No. 18095<br>STATE OF INDIANA<br>PROFESSIONAL ENGINEER | DETAILS PLACED IN THIS FORMAT 11-15-99<br>/s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE<br>/s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE<br>DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 1-02-98 |



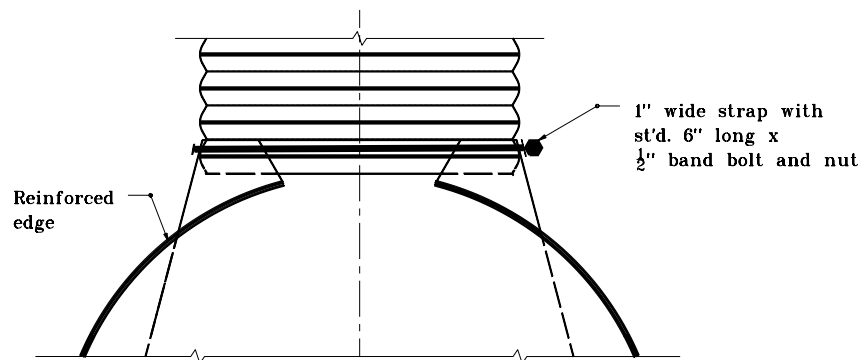
**TYPE 1**  
**FOR 17" x 13" THROUGH 42" x 29" ONLY**



**TYPE 4**  
**FOR 30" THROUGH 36" ONLY**



**TYPE 3**  
**FOR 12" THROUGH 24" ONLY**

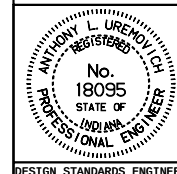


**ALTERNATE TYPE 3**  
**FOR 12" THROUGH 24" ONLY**

INDIANA DEPARTMENT OF TRANSPORTATION

**METAL PIPE**  
**END SECTION CONNECTIONS**  
JANUARY 1998

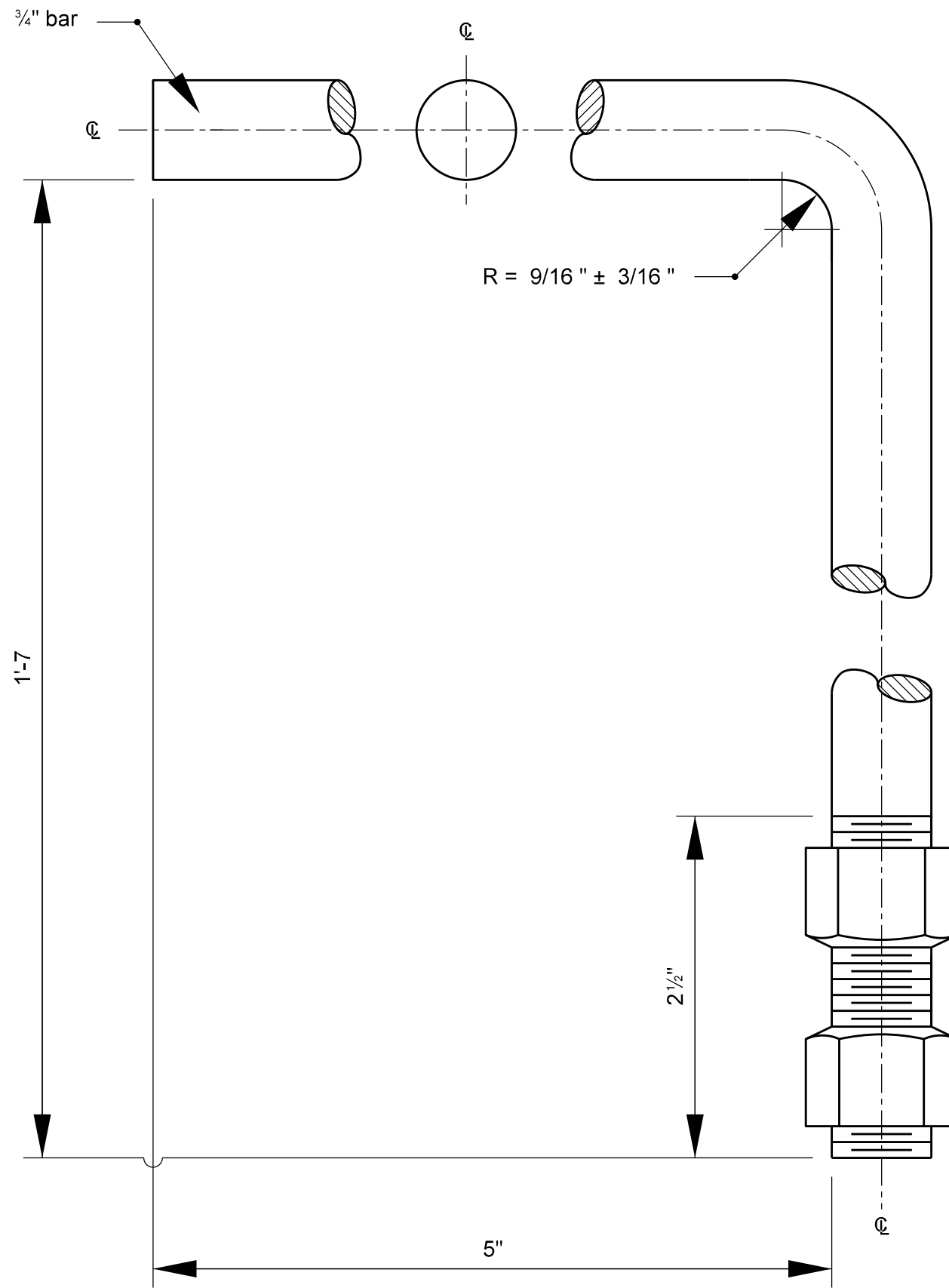
STANDARD DRAWING NO. **E 715-MPES-03**



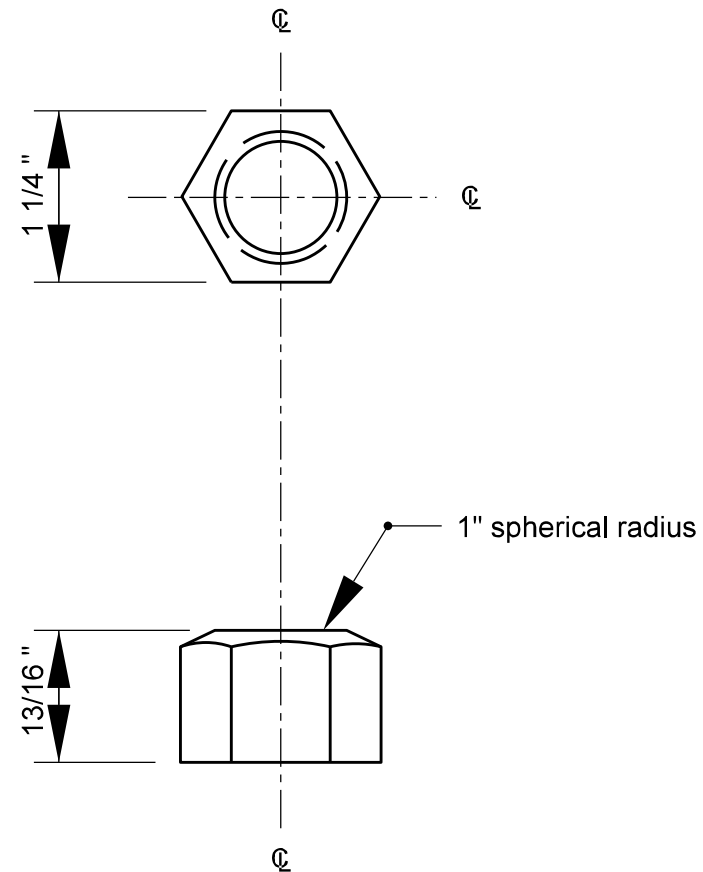
DETAILS PLACED IN THIS FORMAT 7-27-99

/s/ Anthony L. Uremovich 7-27-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 7-27-99  
CHIEF HIGHWAY ENGINEER DATE  
ORIGINALLY APPROVED 1-02-98



GALVANIZED  
HOOK BOLT AND NUTS

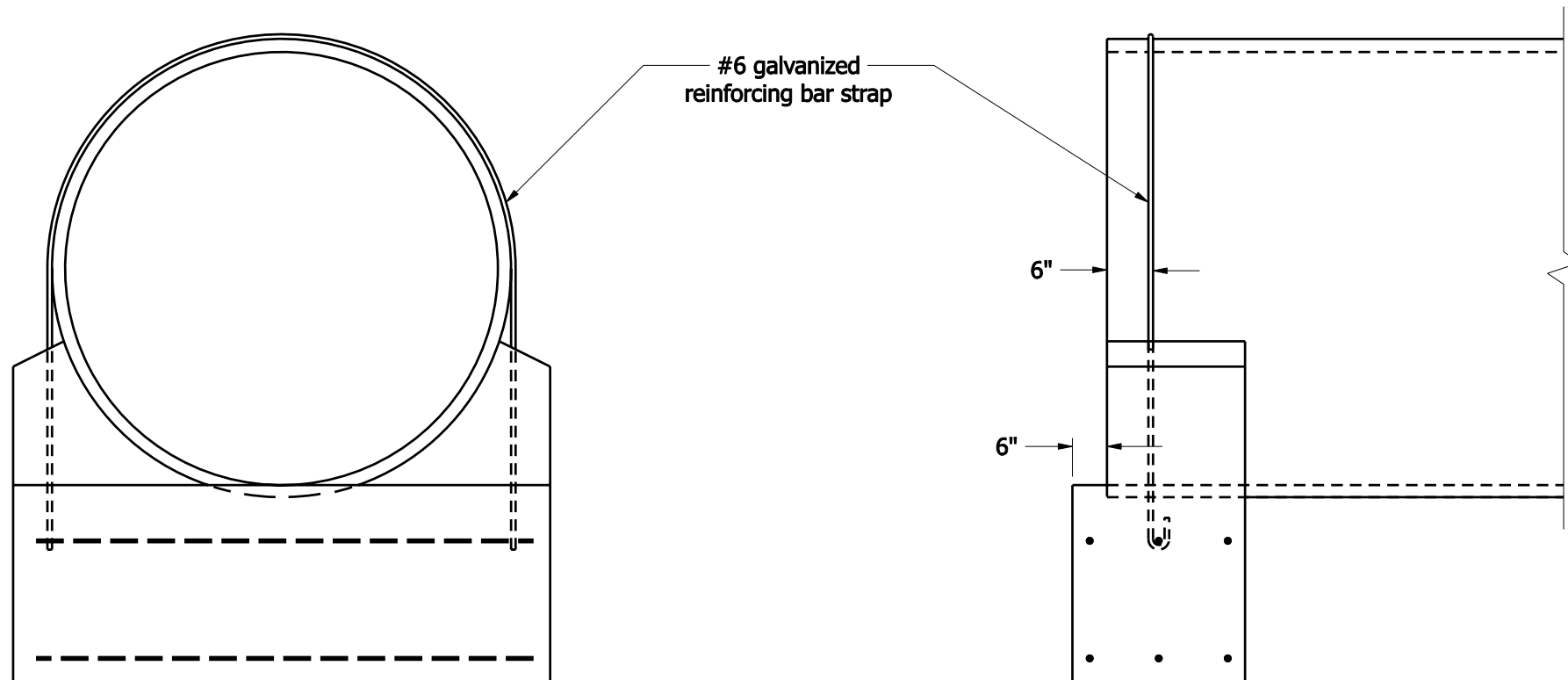


### GENERAL NOTES

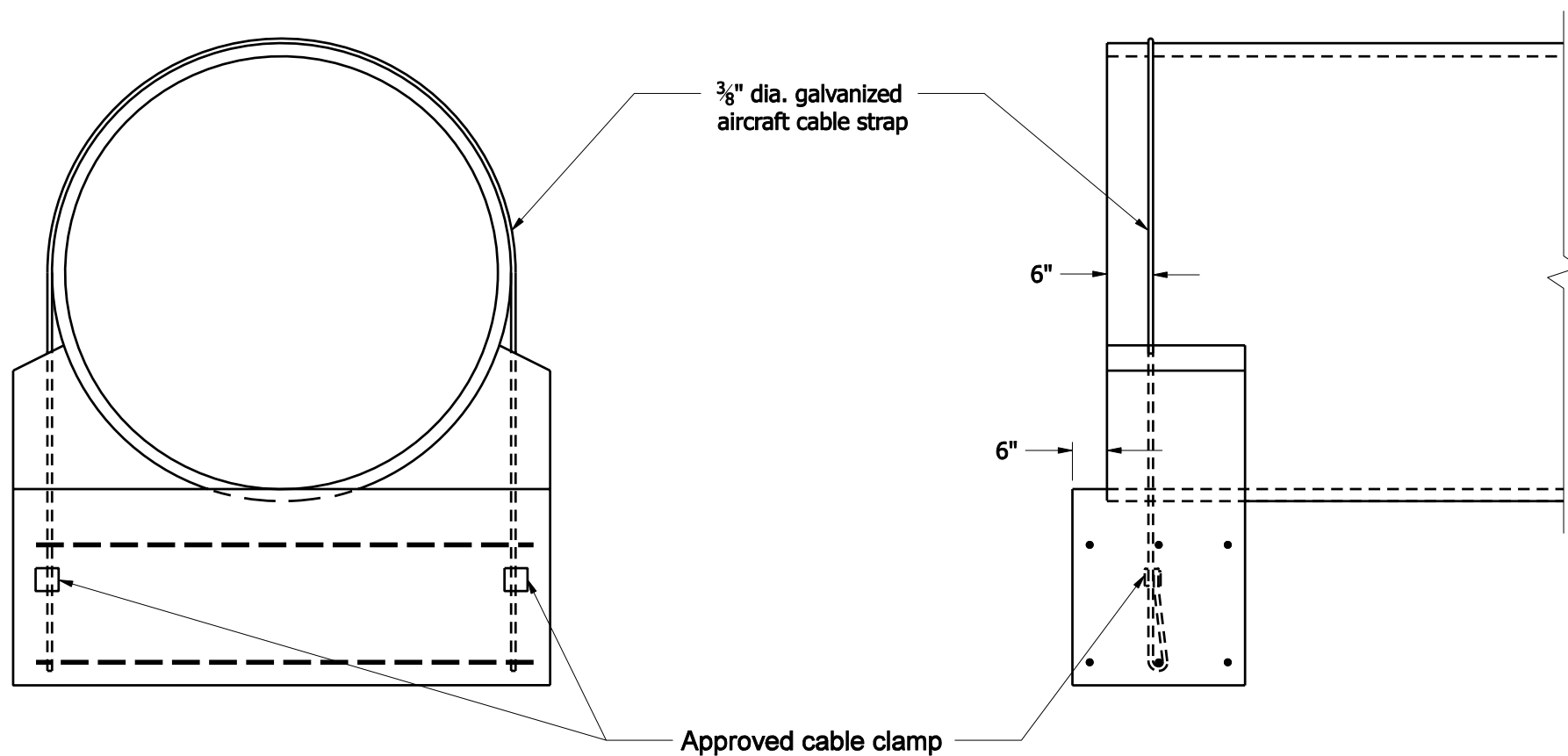
1. Hook bolts and anchor straps shall be used at both upstream and downstream ends of all C.A., C.S., and structural plate pipes and pipe diameter or span of 84" or greater.
2. See Standard Drawing E 715-PASD-01 for anchor strap details.

| INDIANA DEPARTMENT OF TRANSPORTATION |  |                                          |         |
|--------------------------------------|--|------------------------------------------|---------|
| PIPE ANCHOR HOOK BOLT DETAILS        |  |                                          |         |
| STANDARD DRAWING NO.                 |  | E 715-PAHB-01                            |         |
|                                      |  | APRIL 1995                               |         |
|                                      |  | DETAILS PLACED IN THIS FORMAT ON 7-27-95 |         |
|                                      |  | /s/ <i>Anthony L. Uremovich</i>          | 7-27-99 |
|                                      |  | DESIGN STANDARDS ENGINEER                | DATE    |
| DESIGN STANDARDS ENGINEER            |  | /s/ <i>Firooz Zandi</i>                  | 7-27-99 |
|                                      |  | CHIEF HIGHWAY ENGINEER                   | DATE    |

ORIGINALLY APPROVED 4-01-95



**#6 REINFORCING BAR STRAP DETAILS**



**3/8" AIRCRAFT CABLE STRAP DETAILS**

**GENERAL NOTES**

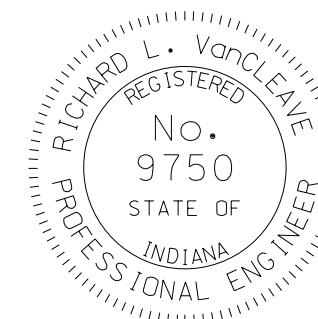
1. See Standard Drawing E 715-PAHB-01 for hook bolt details.

INDIANA DEPARTMENT OF TRANSPORTATION

PIPE ANCHOR  
STRAP DETAILS

SEPTEMBER 2008

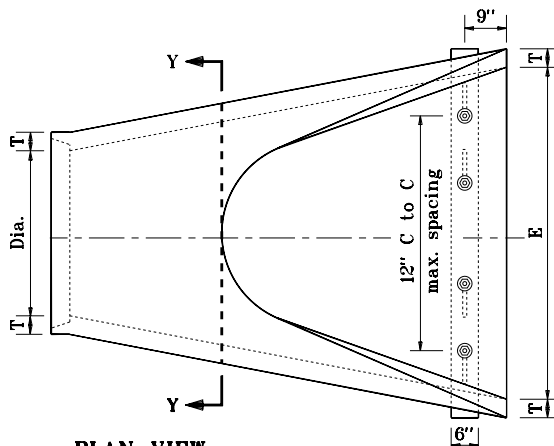
STANDARD DRAWING NO. E 715- PASD-01



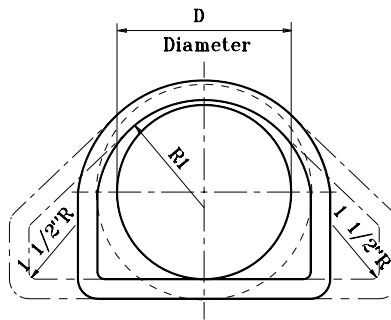
DESIGN STANDARDS ENGINEER

*/s/ Richard L. VanCleave* 09/02/08  
DESIGN STANDARDS ENGINEER DATE

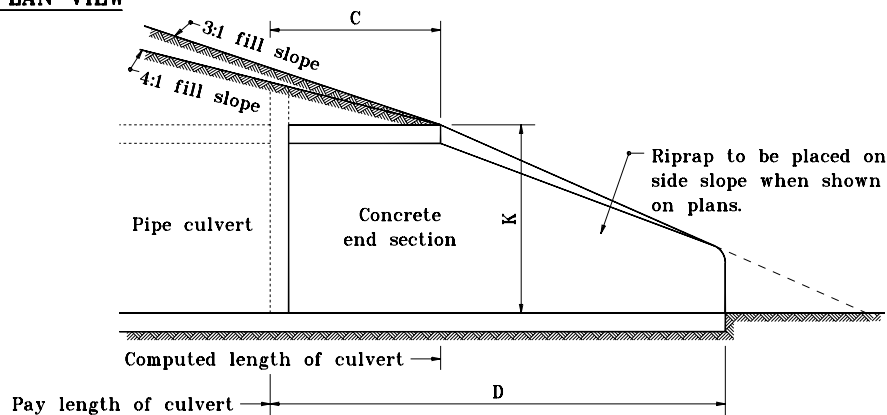
*/s/ Mark A. Miller* 09/02/08  
CHIEF HIGHWAY ENGINEER DATE



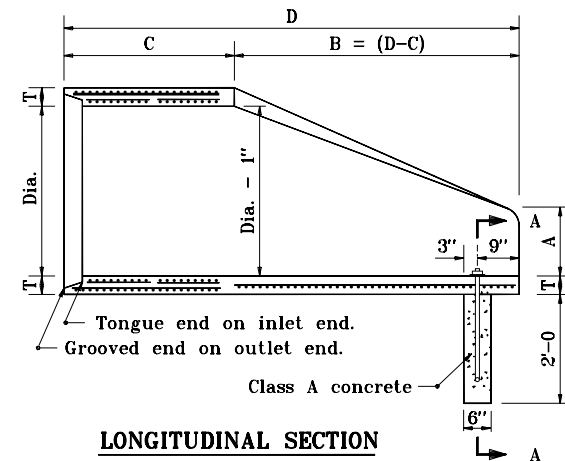
**PLAN VIEW**



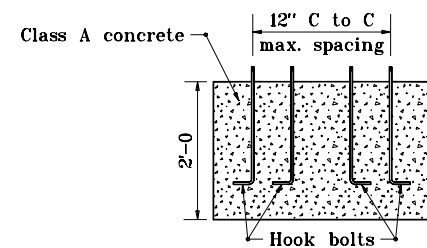
**SECTION Y-Y**



**SLOPE DETAIL**



**LONGITUDINAL SECTION**



**SECTION A-A**

Concrete Pipe Toe Anchor

**TABLE OF DIMENSIONS**

| DIA. | T<br>(min.) | A<br>(±1") | C<br>(±1") | D<br>(±1") | E<br>(±1") | K   | R1       | R2      | APPROX.<br>WEIGHT, lb. |
|------|-------------|------------|------------|------------|------------|-----|----------|---------|------------------------|
| 12"  | 2"          | 5"         | 4'-3       | 6'-2       | 2'-0       | 1.3 | 10 1/8"  | 9"      | 800                    |
| 15"  | 2 1/4"      | 7"         | 4'-0       | 6'-3       | 2'-6       | 1.5 | 12 1/2"  | 11"     | 1100                   |
| 18"  | 2 1/2"      | 11"        | 4'-1       | 6'-2       | 3'-0       | 1.8 | 15 1/2"  | 12"     | 1300                   |
| 21"  | 2 3/4"      | 11"        | 3'-6       | 6'-3       | 3'-6       | 2.1 | 16 1/8"  | 13"     | 1500                   |
| 24"  | 3"          | 1'-0       | 2'-8       | 6'-3       | 4'-0       | 2.3 | 16 3/16" | 14"     | 1800                   |
| 27"  | 3 1/4"      | 1'-1       | 2'-5       | 6'-3       | 4'-6       | 2.6 | 18 3/16" | 14 1/2" | 2100                   |
| 30"  | 3 1/2"      | 1'-2       | 1'-10      | 6'-3       | 5'-0       | 2.9 | 18 1/2"  | 15"     | 2400                   |
| 33"  | 3 3/4"      | 1'-3       | 3'-6       | 8'-3       | 5'-6       | 3.1 | 23 3/4"  | 17 1/2" | 4100                   |
| 36"  | 4"          | 1'-5       | 3'-1       | 8'-3       | 6'-0       | 3.4 | 24 5/8"  | 20"     | 4200                   |

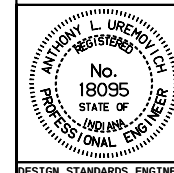
INDIANA DEPARTMENT OF TRANSPORTATION

**PRECAST CONCRETE**

**END SECTION**

MAY 1998

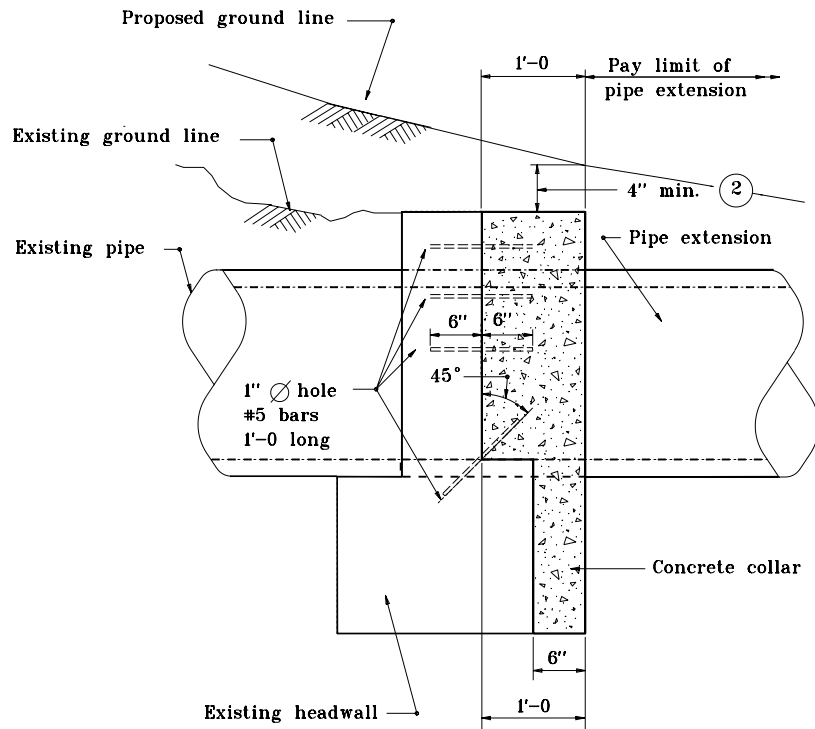
STANDARD DRAWING NO. **E 715-PCES-01**



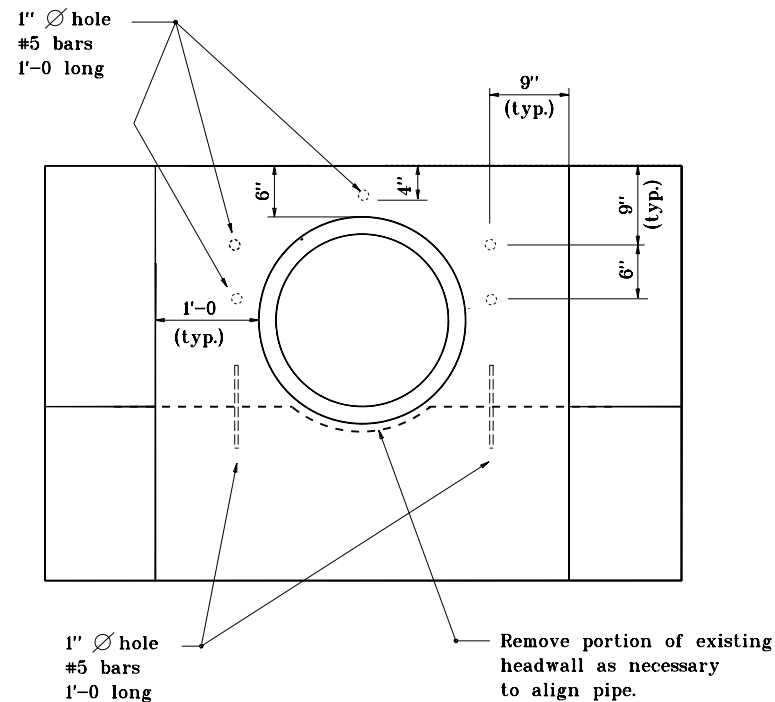
DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE  
ORIGINALLY APPROVED 5-01-98



**SIDE VIEW**

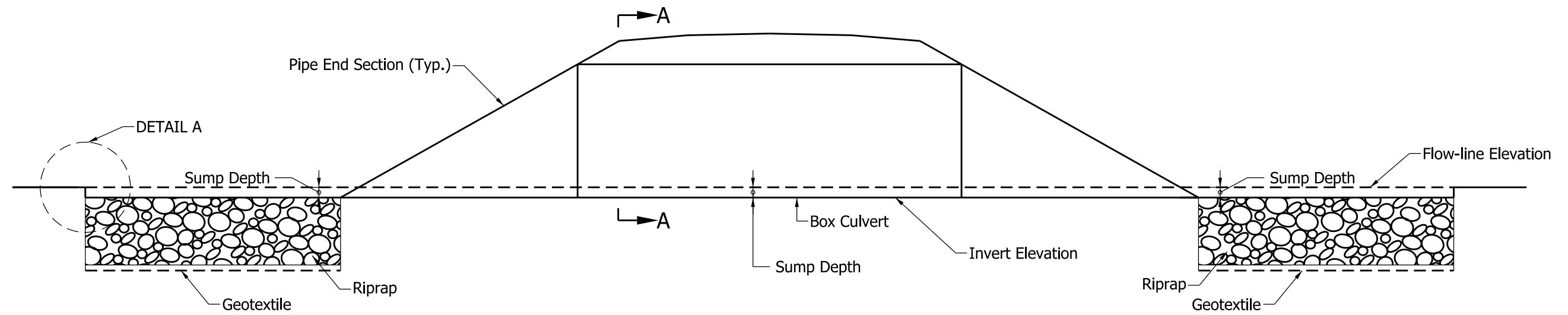


**END VIEW**

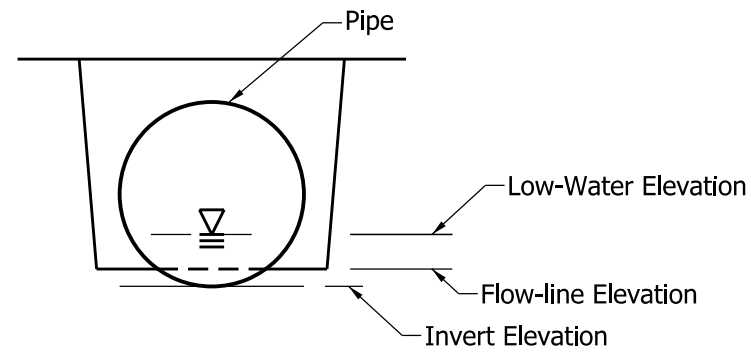
**NOTES:**

1. For other types of pipe end structures and pipes larger than 33"  $\varnothing$ , collar details are shown on the plans.
- (2) Remove portions of existing headwall if required to maintain 4" ground cover.

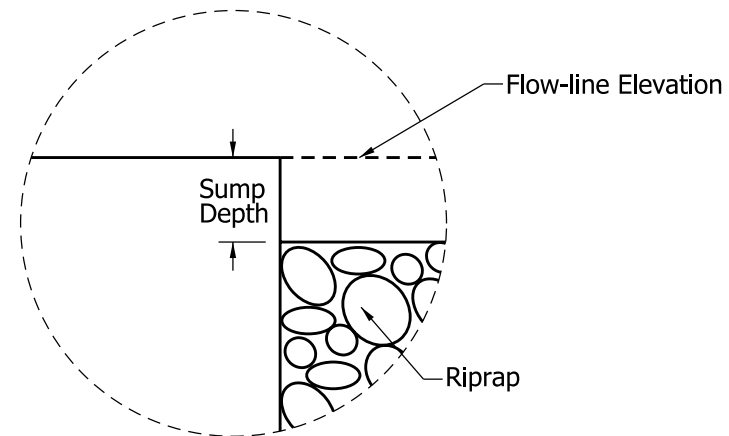
|                                               |                                                                    |
|-----------------------------------------------|--------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION          |                                                                    |
| <b>CONCRETE COLLAR<br/>FOR PIPE EXTENSION</b> |                                                                    |
| JANUARY 1998                                  |                                                                    |
| <b>STANDARD DRAWING NO. E 715-PCEX-01</b>     |                                                                    |
| DETAILS PLACED IN THIS FORMAT                 | 7-27-99                                                            |
|                                               | /s/ Anthony L. Uremovich 7-27-99<br>DESIGN STANDARDS ENGINEER DATE |
|                                               | /s/ Firooz Zandi 7-27-99<br>CHIEF HIGHWAY ENGINEER DATE            |
| DESIGN STANDARDS ENGINEER                     | ORIGINALLY APPROVED 1-02-98                                        |



ELEVATION



SECTION A-A



DETAIL A

| INDIANA DEPARTMENT OF TRANSPORTATION |                                 |               |
|--------------------------------------|---------------------------------|---------------|
| PIPE SUMPING PROTECTION              |                                 |               |
| SEPTEMBER 2011                       |                                 |               |
| STANDARD DRAWING NO.                 |                                 | E 715-PCSP-01 |
|                                      | /s/ <i>Richard L. VanCleave</i> | 09/01/11      |
|                                      | DESIGN STANDARDS ENGINEER       | DATE          |
|                                      | /s/ <i>Mark A. Miller</i>       | 09/01/11      |
|                                      | CHIEF HIGHWAY ENGINEER          | DATE          |
| DESIGN STANDARDS ENGINEER            |                                 |               |

**2  $\frac{2}{3}$ " x 1" CORRUGATED ALUMINUM ALLOY PIPE (LOCK SEAM)**  
**HEIGHT OF COVER LIMITS (ft.)**

[illegible]

**NOTE:**

1. The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.

|                                                                                       |                                                                                                                                                         |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                         |
| <h1 style="text-align: center;">PIPE HEIGHT OF<br/>COVER LIMITS</h1>                  |                                                                                                                                                         |
| JANUARY 1998                                                                          |                                                                                                                                                         |
| STANDARD DRAWING NO. <b>E 715-PHCL-01</b>                                             |                                                                                                                                                         |
|  | DETAILS PLACED IN THIS FORMAT <span style="float: right;">11-15-99</span>                                                                               |
|                                                                                       | <u>/s/ Anthony L. Uremovich</u> <span style="float: right;"><u>11-15-99</u></span><br>DESIGN STANDARDS ENGINEER <span style="float: right;">DATE</span> |
|                                                                                       | <u>/s/ Firooz Zandi</u> <span style="float: right;"><u>11-15-99</u></span><br>CHIEF HIGHWAY ENGINEER <span style="float: right;">DATE</span>            |
|                                                                                       | ORIGINALLY APPROVED <span style="float: right;">1-02-98</span>                                                                                          |
| DESIGN STANDARDS ENGINEER                                                             |                                                                                                                                                         |



| 2 $\frac{2}{3}$ " x $\frac{1}{2}$ " CORRUGATED ALUMINUM ALLOY PIPE (RIVETED)<br>HEIGHT OF COVER LIMITS (ft.) |       |
|--------------------------------------------------------------------------------------------------------------|-------|
| 1                                                                                                            | 1.5   |
| 2                                                                                                            | 2.5   |
| 3                                                                                                            | 3.5   |
| 4                                                                                                            | 4.5   |
| 5                                                                                                            | 5.5   |
| 6                                                                                                            | 6.5   |
| 7                                                                                                            | 7.5   |
| 8                                                                                                            | 8.5   |
| 9                                                                                                            | 9.5   |
| 10                                                                                                           | 10.5  |
| 11                                                                                                           | 11.5  |
| 12                                                                                                           | 12.5  |
| 13                                                                                                           | 13.5  |
| 14                                                                                                           | 14.5  |
| 15                                                                                                           | 15.5  |
| 16                                                                                                           | 16.5  |
| 17                                                                                                           | 17.5  |
| 18                                                                                                           | 18.5  |
| 19                                                                                                           | 19.5  |
| 20                                                                                                           | 20.5  |
| 21                                                                                                           | 21.5  |
| 22                                                                                                           | 22.5  |
| 23                                                                                                           | 23.5  |
| 24                                                                                                           | 24.5  |
| 25                                                                                                           | 25.5  |
| 26                                                                                                           | 26.5  |
| 27                                                                                                           | 27.5  |
| 28                                                                                                           | 28.5  |
| 29                                                                                                           | 29.5  |
| 30                                                                                                           | 30.5  |
| 31                                                                                                           | 31.5  |
| 32                                                                                                           | 32.5  |
| 33                                                                                                           | 33.5  |
| 34                                                                                                           | 34.5  |
| 35                                                                                                           | 35.5  |
| 36                                                                                                           | 36.5  |
| 37                                                                                                           | 37.5  |
| 38                                                                                                           | 38.5  |
| 39                                                                                                           | 39.5  |
| 40                                                                                                           | 40.5  |
| 41                                                                                                           | 41.5  |
| 42                                                                                                           | 42.5  |
| 43                                                                                                           | 43.5  |
| 44                                                                                                           | 44.5  |
| 45                                                                                                           | 45.5  |
| 46                                                                                                           | 46.5  |
| 47                                                                                                           | 47.5  |
| 48                                                                                                           | 48.5  |
| 49                                                                                                           | 49.5  |
| 50                                                                                                           | 50.5  |
| 51                                                                                                           | 51.5  |
| 52                                                                                                           | 52.5  |
| 53                                                                                                           | 53.5  |
| 54                                                                                                           | 54.5  |
| 55                                                                                                           | 55.5  |
| 56                                                                                                           | 56.5  |
| 57                                                                                                           | 57.5  |
| 58                                                                                                           | 58.5  |
| 59                                                                                                           | 59.5  |
| 60                                                                                                           | 60.5  |
| 61                                                                                                           | 61.5  |
| 62                                                                                                           | 62.5  |
| 63                                                                                                           | 63.5  |
| 64                                                                                                           | 64.5  |
| 65                                                                                                           | 65.5  |
| 66                                                                                                           | 66.5  |
| 67                                                                                                           | 67.5  |
| 68                                                                                                           | 68.5  |
| 69                                                                                                           | 69.5  |
| 70                                                                                                           | 70.5  |
| 71                                                                                                           | 71.5  |
| 72                                                                                                           | 72.5  |
| 73                                                                                                           | 73.5  |
| 74                                                                                                           | 74.5  |
| 75                                                                                                           | 75.5  |
| 76                                                                                                           | 76.5  |
| 77                                                                                                           | 77.5  |
| 78                                                                                                           | 78.5  |
| 79                                                                                                           | 79.5  |
| 80                                                                                                           | 80.5  |
| 81                                                                                                           | 81.5  |
| 82                                                                                                           | 82.5  |
| 83                                                                                                           | 83.5  |
| 84                                                                                                           | 84.5  |
| 85                                                                                                           | 85.5  |
| 86                                                                                                           | 86.5  |
| 87                                                                                                           | 87.5  |
| 88                                                                                                           | 88.5  |
| 89                                                                                                           | 89.5  |
| 90                                                                                                           | 90.5  |
| 91                                                                                                           | 91.5  |
| 92                                                                                                           | 92.5  |
| 93                                                                                                           | 93.5  |
| 94                                                                                                           | 94.5  |
| 95                                                                                                           | 95.5  |
| 96                                                                                                           | 96.5  |
| 97                                                                                                           | 97.5  |
| 98                                                                                                           | 98.5  |
| 99                                                                                                           | 99.5  |
| 100                                                                                                          | 100.5 |

[illegible]

**NOTE:**

1. The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.

|                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                               |          |                                                                                    |  |                           |      |                                                                            |  |                        |      |                     |         |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------|------------------------------------------------------------------------------------|--|---------------------------|------|----------------------------------------------------------------------------|--|------------------------|------|---------------------|---------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                               |          |                                                                                    |  |                           |      |                                                                            |  |                        |      |                     |         |
| <h1 style="margin: 0;">PIPE HEIGHT OF<br/>COVER LIMITS</h1>                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                               |          |                                                                                    |  |                           |      |                                                                            |  |                        |      |                     |         |
| JANUARY 1998                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                               |          |                                                                                    |  |                           |      |                                                                            |  |                        |      |                     |         |
| STANDARD DRAWING NO. <b>E 715-PHCL-02</b>                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                               |          |                                                                                    |  |                           |      |                                                                            |  |                        |      |                     |         |
|  | <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border-bottom: 1px solid black; width: 60%;">DETAILS PLACED IN THIS FORMAT</td> <td style="width: 40%; text-align: right;">11-15-99</td> </tr> <tr> <td colspan="2" style="padding-top: 10px;"> <i>/s/ Anthony L. Uremovich</i> <span style="float: right;"><i>11-15-99</i></span> </td> </tr> <tr> <td style="border-bottom: 1px solid black;">DESIGN STANDARDS ENGINEER</td> <td style="border-bottom: 1px solid black; text-align: right;">DATE</td> </tr> <tr> <td colspan="2" style="padding-top: 10px;"> <i>/s/ Firooz Zandi</i> <span style="float: right;"><i>11-15-99</i></span> </td> </tr> <tr> <td style="border-bottom: 1px solid black;">CHIEF HIGHWAY ENGINEER</td> <td style="border-bottom: 1px solid black; text-align: right;">DATE</td> </tr> <tr> <td style="text-align: center;">ORIGINALLY APPROVED</td> <td style="text-align: right;">1-02-98</td> </tr> </table> | DETAILS PLACED IN THIS FORMAT | 11-15-99 | <i>/s/ Anthony L. Uremovich</i> <span style="float: right;"><i>11-15-99</i></span> |  | DESIGN STANDARDS ENGINEER | DATE | <i>/s/ Firooz Zandi</i> <span style="float: right;"><i>11-15-99</i></span> |  | CHIEF HIGHWAY ENGINEER | DATE | ORIGINALLY APPROVED | 1-02-98 |
| DETAILS PLACED IN THIS FORMAT                                                         | 11-15-99                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                               |          |                                                                                    |  |                           |      |                                                                            |  |                        |      |                     |         |
| <i>/s/ Anthony L. Uremovich</i> <span style="float: right;"><i>11-15-99</i></span>    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                               |          |                                                                                    |  |                           |      |                                                                            |  |                        |      |                     |         |
| DESIGN STANDARDS ENGINEER                                                             | DATE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                               |          |                                                                                    |  |                           |      |                                                                            |  |                        |      |                     |         |
| <i>/s/ Firooz Zandi</i> <span style="float: right;"><i>11-15-99</i></span>            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                               |          |                                                                                    |  |                           |      |                                                                            |  |                        |      |                     |         |
| CHIEF HIGHWAY ENGINEER                                                                | DATE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                               |          |                                                                                    |  |                           |      |                                                                            |  |                        |      |                     |         |
| ORIGINALLY APPROVED                                                                   | 1-02-98                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |          |                                                                                    |  |                           |      |                                                                            |  |                        |      |                     |         |
| DESIGN STANDARDS ENGINEER                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                               |          |                                                                                    |  |                           |      |                                                                            |  |                        |      |                     |         |

**2 $\frac{2}{3}$ " x 1 $\frac{1}{2}$ " CORRUGATED ALUMINUM ALLOY PIPE-ARCH (RIVETED OR LOCK SEAM)  
HEIGHT OF COVER LIMITS (ft.)**

[illegible]

**NOTE:**

1. The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.
2. Dual entries in the "Corner Radius" column, such as  $3/3\frac{1}{2}$ , represent the following:
  - 3 - minimum corner radius allowed by AASHTO M 196.
  - $3\frac{1}{2}$  - corner radius typically available.
3. The tabulated cover heights reflect pipe-arches with typically available corner radii. If a pipe-arch with corner radii other than what is typically available is to be used, a specific design shall be performed to verify structural adequacy.

|                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                               |          |                                                                                                                                                                                                                                                                                             |  |                                                                                                                                                                                                                                                                                  |  |                     |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------|--|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                               |          |                                                                                                                                                                                                                                                                                             |  |                                                                                                                                                                                                                                                                                  |  |                     |  |
| <h1 style="margin: 0;">PIPE HEIGHT OF<br/>COVER LIMITS</h1>                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                               |          |                                                                                                                                                                                                                                                                                             |  |                                                                                                                                                                                                                                                                                  |  |                     |  |
| JANUARY 1998                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                               |          |                                                                                                                                                                                                                                                                                             |  |                                                                                                                                                                                                                                                                                  |  |                     |  |
| STANDARD DRAWING NO. <b>E 715-PHCL-03</b>                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                               |          |                                                                                                                                                                                                                                                                                             |  |                                                                                                                                                                                                                                                                                  |  |                     |  |
|                                                                                                                                                                                                        | <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 70%;">DETAILS PLACED IN THIS FORMAT</td> <td style="width: 30%; text-align: right;">11-15-99</td> </tr> <tr> <td colspan="2" style="padding-top: 10px;"> <div style="display: flex; justify-content: space-between;"> <span><i>/s/ Anthony L. Uremovich</i></span> <span><i>11-15-99</i></span> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <span>DESIGN STANDARDS ENGINEER</span> <span>DATE</span> </div> </td> </tr> <tr> <td colspan="2" style="padding-top: 10px;"> <div style="display: flex; justify-content: space-between;"> <span><i>/s/ Firooz Zandi</i></span> <span><i>11-15-99</i></span> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <span>CHIEF HIGHWAY ENGINEER</span> <span>DATE</span> </div> </td> </tr> <tr> <td colspan="2" style="text-align: center; padding-top: 10px;">           ORIGINALLY APPROVED         </td> </tr> </table> | DETAILS PLACED IN THIS FORMAT | 11-15-99 | <div style="display: flex; justify-content: space-between;"> <span><i>/s/ Anthony L. Uremovich</i></span> <span><i>11-15-99</i></span> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <span>DESIGN STANDARDS ENGINEER</span> <span>DATE</span> </div> |  | <div style="display: flex; justify-content: space-between;"> <span><i>/s/ Firooz Zandi</i></span> <span><i>11-15-99</i></span> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <span>CHIEF HIGHWAY ENGINEER</span> <span>DATE</span> </div> |  | ORIGINALLY APPROVED |  |
| DETAILS PLACED IN THIS FORMAT                                                                                                                                                                                                                                                               | 11-15-99                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                               |          |                                                                                                                                                                                                                                                                                             |  |                                                                                                                                                                                                                                                                                  |  |                     |  |
| <div style="display: flex; justify-content: space-between;"> <span><i>/s/ Anthony L. Uremovich</i></span> <span><i>11-15-99</i></span> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <span>DESIGN STANDARDS ENGINEER</span> <span>DATE</span> </div> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                               |          |                                                                                                                                                                                                                                                                                             |  |                                                                                                                                                                                                                                                                                  |  |                     |  |
| <div style="display: flex; justify-content: space-between;"> <span><i>/s/ Firooz Zandi</i></span> <span><i>11-15-99</i></span> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <span>CHIEF HIGHWAY ENGINEER</span> <span>DATE</span> </div>            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                               |          |                                                                                                                                                                                                                                                                                             |  |                                                                                                                                                                                                                                                                                  |  |                     |  |
| ORIGINALLY APPROVED                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                               |          |                                                                                                                                                                                                                                                                                             |  |                                                                                                                                                                                                                                                                                  |  |                     |  |
| DESIGN STANDARDS ENGINEER                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                               |          |                                                                                                                                                                                                                                                                                             |  |                                                                                                                                                                                                                                                                                  |  |                     |  |

NOTE:

1. The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.

| 3" x 1" CORRUGATED ALUMINUM ALLOY PIPE (LOCK SEAM)<br>HEIGHT OF COVER LIMITS (ft.) |                   |                 |      |       |      |       |       |       |       |       |       |
|------------------------------------------------------------------------------------|-------------------|-----------------|------|-------|------|-------|-------|-------|-------|-------|-------|
| AREA<br>(sft)                                                                      | DIAMETER<br>(in.) | THICKNESS (in.) |      |       |      |       |       |       |       |       |       |
|                                                                                    |                   | 0.060           |      | 0.075 |      | 0.105 |       | 0.135 |       | 0.164 |       |
|                                                                                    |                   | MIN.            | MAX. | MIN.  | MAX. | MIN.  | MAX.  | MIN.  | MAX.  | MIN.  | MAX.  |
| 4.9                                                                                | 30                | 1.0             | 71.2 | 1.0   | 89.4 | 1.0   | 100.0 | 1.0   | 100.0 |       |       |
| 5.9                                                                                | 33                | 1.0             | 59.3 | 1.0   | 74.5 | 1.0   | 100.0 | 1.0   | 100.0 |       |       |
| 7.1                                                                                | 36                | 1.0             | 59.3 | 1.0   | 74.5 | 1.0   | 100.0 | 1.0   | 100.0 |       |       |
| 9.6                                                                                | 42                | 1.0             | 50.8 | 1.0   | 63.8 | 1.0   | 89.1  | 1.0   | 100.0 |       |       |
| 12.6                                                                               | 48                | 1.0             | 44.5 | 1.0   | 55.9 | 1.0   | 78.0  | 1.0   | 100.0 | 1.0   | 100.0 |
| 15.9                                                                               | 54                | 1.0             | 39.5 | 1.0   | 49.6 | 1.0   | 69.3  | 1.0   | 92.8  | 1.0   | 90.7  |
| 19.6                                                                               | 60                | 1.0             | 35.6 | 1.0   | 44.7 | 1.0   | 62.4  | 1.0   | 83.5  | 1.0   | 81.6  |
| 23.8                                                                               | 66                | 1.0             | 32.3 | 1.0   | 40.6 | 1.0   | 56.7  | 1.0   | 75.9  | 1.0   | 74.2  |
| 28.3                                                                               | 72                |                 |      | 1.0   | 37.2 | 1.0   | 52.0  | 1.0   | 69.6  | 1.0   | 68.0  |
| 33.2                                                                               | 78                |                 |      | 1.0   | 34.4 | 1.0   | 48.0  | 1.0   | 64.2  | 1.0   | 62.8  |
| 38.5                                                                               | 84                |                 |      |       |      | 1.0   | 44.5  | 1.0   | 59.6  | 1.0   | 58.3  |
| 44.2                                                                               | 90                |                 |      |       |      | 1.0   | 41.6  | 1.0   | 55.6  | 1.0   | 54.4  |
| 50.3                                                                               | 96                |                 |      |       |      | 1.0   | 38.1  | 1.0   | 51.3  | 1.0   | 51.0  |
| 56.7                                                                               | 102               |                 |      |       |      |       |       | 1.1   | 46.3  | 1.1   | 48.0  |
| 63.6                                                                               | 108               |                 |      |       |      |       |       | 1.1   | 41.8  | 1.1   | 45.3  |
| 70.9                                                                               | 114               |                 |      |       |      |       |       |       |       | 1.2   | 42.9  |
| 78.5                                                                               | 120               |                 |      |       |      |       |       |       |       | 1.3   | 40.1  |

|                                                                                       |                                           |
|---------------------------------------------------------------------------------------|-------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                           |
| PIPE HEIGHT OF<br>COVER LIMITS                                                        |                                           |
| STANDARD DRAWING NO.     E 715-PHCL-04                                                |                                           |
|  | JANUARY 1998                              |
|                                                                                       | DETAILS PLACED IN THIS FORMAT ON 11/15/99 |
|                                                                                       | /s/ Anthony L. Uremovich     11/15/99     |
|                                                                                       | DESIGN STANDARDS ENGINEER     DATE        |
| DESIGN STANDARDS ENGINEER                                                             | /s/ Firooz Zandi     11/15/99             |
|                                                                                       | CHIEF HIGHWAY ENGINEER     DATE           |

| 3" x 1" CORRUGATED ALUMINUM ALLOY PIPE (RIVETED)<br>HEIGHT OF COVER LIMITS (ft.) |      |
|----------------------------------------------------------------------------------|------|
| 1                                                                                | 1.5  |
| 2                                                                                | 2.0  |
| 3                                                                                | 2.5  |
| 4                                                                                | 3.0  |
| 5                                                                                | 3.5  |
| 6                                                                                | 4.0  |
| 7                                                                                | 4.5  |
| 8                                                                                | 5.0  |
| 9                                                                                | 5.5  |
| 10                                                                               | 6.0  |
| 11                                                                               | 6.5  |
| 12                                                                               | 7.0  |
| 13                                                                               | 7.5  |
| 14                                                                               | 8.0  |
| 15                                                                               | 8.5  |
| 16                                                                               | 9.0  |
| 17                                                                               | 9.5  |
| 18                                                                               | 10.0 |
| 19                                                                               | 10.5 |
| 20                                                                               | 11.0 |
| 21                                                                               | 11.5 |
| 22                                                                               | 12.0 |
| 23                                                                               | 12.5 |
| 24                                                                               | 13.0 |
| 25                                                                               | 13.5 |
| 26                                                                               | 14.0 |
| 27                                                                               | 14.5 |
| 28                                                                               | 15.0 |
| 29                                                                               | 15.5 |
| 30                                                                               | 16.0 |
| 31                                                                               | 16.5 |
| 32                                                                               | 17.0 |
| 33                                                                               | 17.5 |
| 34                                                                               | 18.0 |
| 35                                                                               | 18.5 |
| 36                                                                               | 19.0 |
| 37                                                                               | 19.5 |
| 38                                                                               | 20.0 |
| 39                                                                               | 20.5 |
| 40                                                                               | 21.0 |
| 41                                                                               | 21.5 |
| 42                                                                               | 22.0 |
| 43                                                                               | 22.5 |
| 44                                                                               | 23.0 |
| 45                                                                               | 23.5 |
| 46                                                                               | 24.0 |
| 47                                                                               | 24.5 |
| 48                                                                               | 25.0 |
| 49                                                                               | 25.5 |
| 50                                                                               | 26.0 |
| 51                                                                               | 26.5 |
| 52                                                                               | 27.0 |
| 53                                                                               | 27.5 |
| 54                                                                               | 28.0 |
| 55                                                                               | 28.5 |
| 56                                                                               | 29.0 |
| 57                                                                               | 29.5 |
| 58                                                                               | 30.0 |
| 59                                                                               | 30.5 |
| 60                                                                               | 31.0 |
| 61                                                                               | 31.5 |
| 62                                                                               | 32.0 |
| 63                                                                               | 32.5 |
| 64                                                                               | 33.0 |
| 65                                                                               | 33.5 |
| 66                                                                               | 34.0 |
| 67                                                                               | 34.5 |
| 68                                                                               | 35.0 |
| 69                                                                               | 35.5 |
| 70                                                                               | 36.0 |
| 71                                                                               | 36.5 |
| 72                                                                               | 37.0 |
| 73                                                                               | 37.5 |
| 74                                                                               | 38.0 |
| 75                                                                               | 38.5 |
| 76                                                                               | 39.0 |
| 77                                                                               | 39.5 |
| 78                                                                               | 40.0 |
| 79                                                                               | 40.5 |
| 80                                                                               | 41.0 |
| 81                                                                               | 41.5 |
| 82                                                                               | 42.0 |
| 83                                                                               | 42.5 |
| 84                                                                               | 43.0 |
| 85                                                                               | 43.5 |
| 86                                                                               | 44.0 |
| 87                                                                               | 44.5 |
| 88                                                                               | 45.0 |
| 89                                                                               | 45.5 |
| 90                                                                               | 46.0 |
| 91                                                                               | 46.5 |
| 92                                                                               | 47.0 |
| 93                                                                               | 47.5 |
| 94                                                                               | 48.0 |
| 95                                                                               | 48.5 |
| 96                                                                               | 49.0 |
| 97                                                                               | 49.5 |
| 98                                                                               | 50.0 |
| 99                                                                               | 50.5 |
| 100                                                                              | 51.0 |

[illegible]

**NOTE:**

1. The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.

|                                                                                       |                                          |
|---------------------------------------------------------------------------------------|------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                          |
| <h1 style="text-align: center;">PIPE HEIGHT OF<br/>COVER LIMITS</h1>                  |                                          |
| JANUARY 1998                                                                          |                                          |
| STANDARD DRAWING NO. <b>E 715-PHCL-05</b>                                             |                                          |
|  | DETAILS PLACED IN THIS FORMAT 11-15-99   |
|                                                                                       | <i>/s/ Anthony L. Uremovich</i> 11-15-99 |
|                                                                                       | DESIGN STANDARDS ENGINEER DATE           |
|                                                                                       | <i>/s/ Firooz Zandi</i> 11-15-99         |
| DESIGN STANDARDS ENGINEER                                                             | CHIEF HIGHWAY ENGINEER DATE              |
|                                                                                       | ORIGINALLY APPROVED 1-02-98              |

**3" x 1" CORRUGATED ALUMINUM ALLOY PIPE-ARCH (RIVETED OR LOCK SEAM)  
HEIGHT OF COVER LIMITS (ft.)**

| CORNER<br>RADIUS<br>(in.) | SPAN<br>(in.) | RISE<br>(in.) | AREA<br>(sft) | THICKNESS (in.) |      |       |      |       |      |       |      |       |      |
|---------------------------|---------------|---------------|---------------|-----------------|------|-------|------|-------|------|-------|------|-------|------|
|                           |               |               |               | 0.060           |      | 0.075 |      | 0.105 |      | 0.135 |      | 0.164 |      |
|                           |               |               |               | MIN.            | MAX. | MIN.  | MAX. | MIN.  | MAX. | MIN.  | MAX. | MIN.  | MAX. |
| 8/18 $\frac{3}{4}$        | 60            | 46            | 15.6          |                 |      | 1.1   | 20.8 | 1.1   | 20.8 | 1.1   | 20.8 | 1.1   | 20.8 |
| 9/20 $\frac{3}{4}$        | 66            | 51            | 19.3          |                 |      | 1.1   | 20.9 | 1.1   | 20.9 | 1.1   | 20.9 | 1.1   | 20.9 |
| 12/22 $\frac{3}{4}$       | 73            | 55            | 23.2          |                 |      | 1.1   | 20.8 | 1.1   | 20.8 | 1.1   | 20.8 | 1.1   | 20.8 |
| 14/20 $\frac{3}{4}$       | 81            | 59            | 27.4          |                 |      |       |      | 1.2   | 17.1 | 1.2   | 17.1 | 1.2   | 17.1 |
| 14/22 $\frac{3}{4}$       | 87            | 63            | 32.1          |                 |      |       |      | 1.2   | 17.3 | 1.2   | 17.3 | 1.2   | 17.3 |
| 16/24 $\frac{3}{4}$       | 95            | 67            | 37.0          |                 |      |       |      |       |      | 1.2   | 17.1 | 1.2   | 17.1 |
| 16/26 $\frac{3}{4}$       | 103           | 71            | 42.4          |                 |      |       |      |       |      | 1.2   | 16.9 | 1.2   | 16.9 |
| 18/27 $\frac{3}{4}$       | 112           | 75            | 48.0          |                 |      |       |      |       |      |       |      | 1.3   | 16.5 |
|                           |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                           |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                           |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                           |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                           |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                           |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                           |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                           |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                           |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                           |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                           |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                           |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                           |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                           |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                           |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                           |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                           |               |               |               |                 |      |       |      |       |      |       |      |       |      |

**NOTE:**

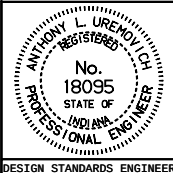
- The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.
- Dual entries in the "Corner Radius" column, such as 8/18 $\frac{3}{4}$  represent the following:  
8 - minimum corner radius allowed by AASHTO M 196.  
18 $\frac{3}{4}$  - corner radius typically available.
- The tabulated cover heights reflect pipe-arches with typically available corner radii. If a pipe-arch with corner radii other than what is typically available is to be used, a specific design shall be performed to verify structural adequacy.

INDIANA DEPARTMENT OF TRANSPORTATION

**PIPE HEIGHT OF  
COVER LIMITS**

JANUARY 1998

**STANDARD DRAWING NO. E 715-PHCL-06**



DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 1-02-98

| 6" x 1" CORRUGATED ALUMINUM ALLOY PIPE (LOCK SEAM) |  |
|----------------------------------------------------|--|
| HEIGHT OF COVER LIMITS (ft.)                       |  |

[illegible]

**NOTE:**

1. The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.

|                                                                                       |                                          |
|---------------------------------------------------------------------------------------|------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                          |
| <h1 style="text-align: center;">PIPE HEIGHT OF<br/>COVER LIMITS</h1>                  |                                          |
| JANUARY 1998                                                                          |                                          |
| STANDARD DRAWING NO. <b>E 715-PHCL-07</b>                                             |                                          |
|  | DETAILS PLACED IN THIS FORMAT 11-15-99   |
|                                                                                       | <i>/s/ Anthony L. Uremovich</i> 11-15-99 |
|                                                                                       | DESIGN STANDARDS ENGINEER DATE           |
|                                                                                       | <i>/s/ Firooz Zandi</i> 11-15-99         |
| DESIGN STANDARDS ENGINEER                                                             | CHIEF HIGHWAY ENGINEER DATE              |
|                                                                                       | ORIGINALLY APPROVED 1-02-98              |

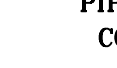
| 6" x 1" CORRUGATED ALUMINUM ALLOY PIPE (RIVETED)<br>HEIGHT OF COVER LIMITS (ft.) |      |
|----------------------------------------------------------------------------------|------|
| 1                                                                                | 1.0  |
| 2                                                                                | 1.5  |
| 3                                                                                | 2.0  |
| 4                                                                                | 2.5  |
| 5                                                                                | 3.0  |
| 6                                                                                | 3.5  |
| 7                                                                                | 4.0  |
| 8                                                                                | 4.5  |
| 9                                                                                | 5.0  |
| 10                                                                               | 5.5  |
| 11                                                                               | 6.0  |
| 12                                                                               | 6.5  |
| 13                                                                               | 7.0  |
| 14                                                                               | 7.5  |
| 15                                                                               | 8.0  |
| 16                                                                               | 8.5  |
| 17                                                                               | 9.0  |
| 18                                                                               | 9.5  |
| 19                                                                               | 10.0 |
| 20                                                                               | 10.5 |
| 21                                                                               | 11.0 |
| 22                                                                               | 11.5 |
| 23                                                                               | 12.0 |
| 24                                                                               | 12.5 |
| 25                                                                               | 13.0 |
| 26                                                                               | 13.5 |
| 27                                                                               | 14.0 |
| 28                                                                               | 14.5 |
| 29                                                                               | 15.0 |
| 30                                                                               | 15.5 |
| 31                                                                               | 16.0 |
| 32                                                                               | 16.5 |
| 33                                                                               | 17.0 |
| 34                                                                               | 17.5 |
| 35                                                                               | 18.0 |
| 36                                                                               | 18.5 |
| 37                                                                               | 19.0 |
| 38                                                                               | 19.5 |
| 39                                                                               | 20.0 |
| 40                                                                               | 20.5 |
| 41                                                                               | 21.0 |
| 42                                                                               | 21.5 |
| 43                                                                               | 22.0 |
| 44                                                                               | 22.5 |
| 45                                                                               | 23.0 |
| 46                                                                               | 23.5 |
| 47                                                                               | 24.0 |
| 48                                                                               | 24.5 |
| 49                                                                               | 25.0 |
| 50                                                                               | 25.5 |
| 51                                                                               | 26.0 |
| 52                                                                               | 26.5 |
| 53                                                                               | 27.0 |
| 54                                                                               | 27.5 |
| 55                                                                               | 28.0 |
| 56                                                                               | 28.5 |
| 57                                                                               | 29.0 |
| 58                                                                               | 29.5 |
| 59                                                                               | 30.0 |
| 60                                                                               | 30.5 |
| 61                                                                               | 31.0 |
| 62                                                                               | 31.5 |
| 63                                                                               | 32.0 |
| 64                                                                               | 32.5 |
| 65                                                                               | 33.0 |
| 66                                                                               | 33.5 |
| 67                                                                               | 34.0 |
| 68                                                                               | 34.5 |
| 69                                                                               | 35.0 |
| 70                                                                               | 35.5 |
| 71                                                                               | 36.0 |
| 72                                                                               | 36.5 |
| 73                                                                               | 37.0 |
| 74                                                                               | 37.5 |
| 75                                                                               | 38.0 |
| 76                                                                               | 38.5 |
| 77                                                                               | 39.0 |
| 78                                                                               | 39.5 |
| 79                                                                               | 40.0 |
| 80                                                                               | 40.5 |
| 81                                                                               | 41.0 |
| 82                                                                               | 41.5 |
| 83                                                                               | 42.0 |
| 84                                                                               | 42.5 |
| 85                                                                               | 43.0 |
| 86                                                                               | 43.5 |
| 87                                                                               | 44.0 |
| 88                                                                               | 44.5 |
| 89                                                                               | 45.0 |
| 90                                                                               | 45.5 |
| 91                                                                               | 46.0 |
| 92                                                                               | 46.5 |
| 93                                                                               | 47.0 |
| 94                                                                               | 47.5 |
| 95                                                                               | 48.0 |
| 96                                                                               | 48.5 |
| 97                                                                               | 49.0 |
| 98                                                                               | 49.5 |
| 99                                                                               | 50.0 |
| 100                                                                              | 50.5 |

[illegible]

**NOTE:**

1. The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.

|                                                             |  |
|-------------------------------------------------------------|--|
| INDIANA DEPARTMENT OF TRANSPORTATION                        |  |
| <h1 style="margin: 0;">PIPE HEIGHT OF<br/>COVER LIMITS</h1> |  |
| JANUARY 1998                                                |  |
| STANDARD DRAWING NO. <b>E 715-PHCL-08</b>                   |  |

|                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                               |          |                                 |          |                           |      |                         |          |                        |      |
|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------|---------------------------------|----------|---------------------------|------|-------------------------|----------|------------------------|------|
|  | <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border-bottom: 1px solid black; width: 60%;">DETAILS PLACED IN THIS FORMAT</td> <td style="width: 40%; text-align: right; border-bottom: 1px solid black;">11-15-99</td> </tr> <tr> <td style="border-bottom: 1px solid black; padding-top: 10px;">/s/ <i>Anthony L. Uremovich</i></td> <td style="text-align: right; border-bottom: 1px solid black; padding-top: 10px;">11-15-99</td> </tr> <tr> <td style="padding-top: 10px;">DESIGN STANDARDS ENGINEER</td> <td style="text-align: right; padding-top: 10px;">DATE</td> </tr> </table><br><table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border-bottom: 1px solid black; width: 60%; padding-top: 10px;">/s/ <i>Firooz Zandi</i></td> <td style="width: 40%; text-align: right; border-bottom: 1px solid black; padding-top: 10px;">11-15-99</td> </tr> <tr> <td style="padding-top: 10px;">CHIEF HIGHWAY ENGINEER</td> <td style="text-align: right; padding-top: 10px;">DATE</td> </tr> </table> | DETAILS PLACED IN THIS FORMAT | 11-15-99 | /s/ <i>Anthony L. Uremovich</i> | 11-15-99 | DESIGN STANDARDS ENGINEER | DATE | /s/ <i>Firooz Zandi</i> | 11-15-99 | CHIEF HIGHWAY ENGINEER | DATE |
| DETAILS PLACED IN THIS FORMAT                                                         | 11-15-99                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                               |          |                                 |          |                           |      |                         |          |                        |      |
| /s/ <i>Anthony L. Uremovich</i>                                                       | 11-15-99                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                               |          |                                 |          |                           |      |                         |          |                        |      |
| DESIGN STANDARDS ENGINEER                                                             | DATE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                               |          |                                 |          |                           |      |                         |          |                        |      |
| /s/ <i>Firooz Zandi</i>                                                               | 11-15-99                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                               |          |                                 |          |                           |      |                         |          |                        |      |
| CHIEF HIGHWAY ENGINEER                                                                | DATE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                               |          |                                 |          |                           |      |                         |          |                        |      |
| DESIGN STANDARDS ENGINEER                                                             | ORIGINALLY APPROVED<br>1-02-98                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                               |          |                                 |          |                           |      |                         |          |                        |      |

| 2 $\frac{2}{3}$ " x $\frac{1}{2}$ " CORRUGATED STEEL PIPE (LOCK SEAM) |       |
|-----------------------------------------------------------------------|-------|
| HEIGHT OF COVER LIMITS (ft.)                                          |       |
| 1                                                                     | 1.5   |
| 2                                                                     | 2.5   |
| 3                                                                     | 3.5   |
| 4                                                                     | 4.5   |
| 5                                                                     | 5.5   |
| 6                                                                     | 6.5   |
| 7                                                                     | 7.5   |
| 8                                                                     | 8.5   |
| 9                                                                     | 9.5   |
| 10                                                                    | 10.5  |
| 11                                                                    | 11.5  |
| 12                                                                    | 12.5  |
| 13                                                                    | 13.5  |
| 14                                                                    | 14.5  |
| 15                                                                    | 15.5  |
| 16                                                                    | 16.5  |
| 17                                                                    | 17.5  |
| 18                                                                    | 18.5  |
| 19                                                                    | 19.5  |
| 20                                                                    | 20.5  |
| 21                                                                    | 21.5  |
| 22                                                                    | 22.5  |
| 23                                                                    | 23.5  |
| 24                                                                    | 24.5  |
| 25                                                                    | 25.5  |
| 26                                                                    | 26.5  |
| 27                                                                    | 27.5  |
| 28                                                                    | 28.5  |
| 29                                                                    | 29.5  |
| 30                                                                    | 30.5  |
| 31                                                                    | 31.5  |
| 32                                                                    | 32.5  |
| 33                                                                    | 33.5  |
| 34                                                                    | 34.5  |
| 35                                                                    | 35.5  |
| 36                                                                    | 36.5  |
| 37                                                                    | 37.5  |
| 38                                                                    | 38.5  |
| 39                                                                    | 39.5  |
| 40                                                                    | 40.5  |
| 41                                                                    | 41.5  |
| 42                                                                    | 42.5  |
| 43                                                                    | 43.5  |
| 44                                                                    | 44.5  |
| 45                                                                    | 45.5  |
| 46                                                                    | 46.5  |
| 47                                                                    | 47.5  |
| 48                                                                    | 48.5  |
| 49                                                                    | 49.5  |
| 50                                                                    | 50.5  |
| 51                                                                    | 51.5  |
| 52                                                                    | 52.5  |
| 53                                                                    | 53.5  |
| 54                                                                    | 54.5  |
| 55                                                                    | 55.5  |
| 56                                                                    | 56.5  |
| 57                                                                    | 57.5  |
| 58                                                                    | 58.5  |
| 59                                                                    | 59.5  |
| 60                                                                    | 60.5  |
| 61                                                                    | 61.5  |
| 62                                                                    | 62.5  |
| 63                                                                    | 63.5  |
| 64                                                                    | 64.5  |
| 65                                                                    | 65.5  |
| 66                                                                    | 66.5  |
| 67                                                                    | 67.5  |
| 68                                                                    | 68.5  |
| 69                                                                    | 69.5  |
| 70                                                                    | 70.5  |
| 71                                                                    | 71.5  |
| 72                                                                    | 72.5  |
| 73                                                                    | 73.5  |
| 74                                                                    | 74.5  |
| 75                                                                    | 75.5  |
| 76                                                                    | 76.5  |
| 77                                                                    | 77.5  |
| 78                                                                    | 78.5  |
| 79                                                                    | 79.5  |
| 80                                                                    | 80.5  |
| 81                                                                    | 81.5  |
| 82                                                                    | 82.5  |
| 83                                                                    | 83.5  |
| 84                                                                    | 84.5  |
| 85                                                                    | 85.5  |
| 86                                                                    | 86.5  |
| 87                                                                    | 87.5  |
| 88                                                                    | 88.5  |
| 89                                                                    | 89.5  |
| 90                                                                    | 90.5  |
| 91                                                                    | 91.5  |
| 92                                                                    | 92.5  |
| 93                                                                    | 93.5  |
| 94                                                                    | 94.5  |
| 95                                                                    | 95.5  |
| 96                                                                    | 96.5  |
| 97                                                                    | 97.5  |
| 98                                                                    | 98.5  |
| 99                                                                    | 99.5  |
| 100                                                                   | 100.5 |

[illegible]

**NOTE:**

1. The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.

|                                                             |  |
|-------------------------------------------------------------|--|
| INDIANA DEPARTMENT OF TRANSPORTATION                        |  |
| <h1 style="margin: 0;">PIPE HEIGHT OF<br/>COVER LIMITS</h1> |  |
| JANUARY 1998                                                |  |
| STANDARD DRAWING NO. <b>E 715-PHCL-09</b>                   |  |



**ANTHONY L. UREMOWICH**  
REGISTERED  
**No. 18095**  
STATE OF  
**INDIANA**  
PROFESSIONAL ENGINEER

|                                                              |                         |
|--------------------------------------------------------------|-------------------------|
| DETAILS PLACED IN THIS FORMAT                                | 11-15-99                |
| <u>/s/ Anthony L. Uremovich</u><br>DESIGN STANDARDS ENGINEER | <u>11-15-99</u><br>DATE |
| <u>/s/ Firooz Zandi</u><br>CHIEF HIGHWAY ENGINEER            | <u>11-15-99</u><br>DATE |
| ORIGINALLY APPROVED                                          |                         |



**FIROOZ ZANDI**  
REGISTERED  
**No. 18095**  
STATE OF  
**INDIANA**  
PROFESSIONAL ENGINEER

|                                                              |                         |
|--------------------------------------------------------------|-------------------------|
| DETAILS PLACED IN THIS FORMAT                                | 11-15-99                |
| <u>/s/ Anthony L. Uremovich</u><br>DESIGN STANDARDS ENGINEER | <u>11-15-99</u><br>DATE |
| <u>/s/ Firooz Zandi</u><br>CHIEF HIGHWAY ENGINEER            | <u>11-15-99</u><br>DATE |
| ORIGINALLY APPROVED                                          |                         |



2 $\frac{2}{3}$ " x  $\frac{1}{2}$ " CORRUGATED STEEL PIPE (RIVETED)  
HEIGHT OF COVER LIMITS (ft.)

[illegible]

**NOTE:**

1. The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.

|                                                                                       |                                                                                                                                                         |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                         |
| <h1 style="text-align: center;">PIPE HEIGHT OF<br/>COVER LIMITS</h1>                  |                                                                                                                                                         |
| JANUARY 1998                                                                          |                                                                                                                                                         |
| STANDARD DRAWING NO. <b>E 715-PHCL-10</b>                                             |                                                                                                                                                         |
|  | DETAILS PLACED IN THIS FORMAT <span style="float: right;">11-15-99</span>                                                                               |
|                                                                                       | <u>/s/ Anthony L. Uremovich</u> <span style="float: right;"><u>11-15-99</u></span><br>DESIGN STANDARDS ENGINEER <span style="float: right;">DATE</span> |
|                                                                                       | <u>/s/ Firooz Zandi</u> <span style="float: right;"><u>11-15-99</u></span><br>CHIEF HIGHWAY ENGINEER <span style="float: right;">DATE</span>            |
|                                                                                       | ORIGINALLY APPROVED <span style="float: right;">1-02-99</span>                                                                                          |
| DESIGN STANDARDS ENGINEER                                                             |                                                                                                                                                         |

| $2\frac{2}{3}$ " x $\frac{1}{2}$ " CORRUGATED STEEL PIPE—ARCH (RIVETED OR LOCK SEAM)<br>HEIGHT OF COVER LIMITS (ft.) |       |
|----------------------------------------------------------------------------------------------------------------------|-------|
| 1                                                                                                                    | 1.5   |
| 2                                                                                                                    | 2.5   |
| 3                                                                                                                    | 3.5   |
| 4                                                                                                                    | 4.5   |
| 5                                                                                                                    | 5.5   |
| 6                                                                                                                    | 6.5   |
| 7                                                                                                                    | 7.5   |
| 8                                                                                                                    | 8.5   |
| 9                                                                                                                    | 9.5   |
| 10                                                                                                                   | 10.5  |
| 11                                                                                                                   | 11.5  |
| 12                                                                                                                   | 12.5  |
| 13                                                                                                                   | 13.5  |
| 14                                                                                                                   | 14.5  |
| 15                                                                                                                   | 15.5  |
| 16                                                                                                                   | 16.5  |
| 17                                                                                                                   | 17.5  |
| 18                                                                                                                   | 18.5  |
| 19                                                                                                                   | 19.5  |
| 20                                                                                                                   | 20.5  |
| 21                                                                                                                   | 21.5  |
| 22                                                                                                                   | 22.5  |
| 23                                                                                                                   | 23.5  |
| 24                                                                                                                   | 24.5  |
| 25                                                                                                                   | 25.5  |
| 26                                                                                                                   | 26.5  |
| 27                                                                                                                   | 27.5  |
| 28                                                                                                                   | 28.5  |
| 29                                                                                                                   | 29.5  |
| 30                                                                                                                   | 30.5  |
| 31                                                                                                                   | 31.5  |
| 32                                                                                                                   | 32.5  |
| 33                                                                                                                   | 33.5  |
| 34                                                                                                                   | 34.5  |
| 35                                                                                                                   | 35.5  |
| 36                                                                                                                   | 36.5  |
| 37                                                                                                                   | 37.5  |
| 38                                                                                                                   | 38.5  |
| 39                                                                                                                   | 39.5  |
| 40                                                                                                                   | 40.5  |
| 41                                                                                                                   | 41.5  |
| 42                                                                                                                   | 42.5  |
| 43                                                                                                                   | 43.5  |
| 44                                                                                                                   | 44.5  |
| 45                                                                                                                   | 45.5  |
| 46                                                                                                                   | 46.5  |
| 47                                                                                                                   | 47.5  |
| 48                                                                                                                   | 48.5  |
| 49                                                                                                                   | 49.5  |
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| 51                                                                                                                   | 51.5  |
| 52                                                                                                                   | 52.5  |
| 53                                                                                                                   | 53.5  |
| 54                                                                                                                   | 54.5  |
| 55                                                                                                                   | 55.5  |
| 56                                                                                                                   | 56.5  |
| 57                                                                                                                   | 57.5  |
| 58                                                                                                                   | 58.5  |
| 59                                                                                                                   | 59.5  |
| 60                                                                                                                   | 60.5  |
| 61                                                                                                                   | 61.5  |
| 62                                                                                                                   | 62.5  |
| 63                                                                                                                   | 63.5  |
| 64                                                                                                                   | 64.5  |
| 65                                                                                                                   | 65.5  |
| 66                                                                                                                   | 66.5  |
| 67                                                                                                                   | 67.5  |
| 68                                                                                                                   | 68.5  |
| 69                                                                                                                   | 69.5  |
| 70                                                                                                                   | 70.5  |
| 71                                                                                                                   | 71.5  |
| 72                                                                                                                   | 72.5  |
| 73                                                                                                                   | 73.5  |
| 74                                                                                                                   | 74.5  |
| 75                                                                                                                   | 75.5  |
| 76                                                                                                                   | 76.5  |
| 77                                                                                                                   | 77.5  |
| 78                                                                                                                   | 78.5  |
| 79                                                                                                                   | 79.5  |
| 80                                                                                                                   | 80.5  |
| 81                                                                                                                   | 81.5  |
| 82                                                                                                                   | 82.5  |
| 83                                                                                                                   | 83.5  |
| 84                                                                                                                   | 84.5  |
| 85                                                                                                                   | 85.5  |
| 86                                                                                                                   | 86.5  |
| 87                                                                                                                   | 87.5  |
| 88                                                                                                                   | 88.5  |
| 89                                                                                                                   | 89.5  |
| 90                                                                                                                   | 90.5  |
| 91                                                                                                                   | 91.5  |
| 92                                                                                                                   | 92.5  |
| 93                                                                                                                   | 93.5  |
| 94                                                                                                                   | 94.5  |
| 95                                                                                                                   | 95.5  |
| 96                                                                                                                   | 96.5  |
| 97                                                                                                                   | 97.5  |
| 98                                                                                                                   | 98.5  |
| 99                                                                                                                   | 99.5  |
| 100                                                                                                                  | 100.5 |

[illegible]

**NOTE:**

1. The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.
2. Dual entries in the "Corner Radius" column, such as  $3/3\frac{1}{2}$ , represent the following:
  - 3 - minimum corner radius allowed by AASHTO M 36.
  - $3\frac{1}{2}$  - corner radius typically available.
3. The tabulated cover heights reflect pipe-arches with typically available corner radii. If a pipe-arch with corner radii other than what is typically available is to be used, a specific design shall be performed to verify structural adequacy.

|                                                             |  |
|-------------------------------------------------------------|--|
| INDIANA DEPARTMENT OF TRANSPORTATION                        |  |
| <h1 style="margin: 0;">PIPE HEIGHT OF<br/>COVER LIMITS</h1> |  |
| JANUARY 1998                                                |  |
| STANDARD DRAWING NO. <b>E 715-PHCL-11</b>                   |  |



ANTHONY L. UREMOWICH  
REGISTERED  
No. 18095  
STATE OF INDIANA  
PROFESSIONAL ENGINEER

|                                                              |                         |
|--------------------------------------------------------------|-------------------------|
| DETAILS PLACED IN THIS FORMAT                                | 11-15-99                |
| <u>/s/ Anthony L. Uremovich</u><br>DESIGN STANDARDS ENGINEER | <u>11-15-99</u><br>DATE |
| <u>/s/ Firooz Zandi</u><br>CHIEF HIGHWAY ENGINEER            | <u>11-15-99</u><br>DATE |
| ORIGINALLY APPROVED                                          |                         |



FIROOZ ZANDI  
REGISTERED  
No. 18095  
STATE OF INDIANA  
PROFESSIONAL ENGINEER

|                                                      |                         |
|------------------------------------------------------|-------------------------|
| DETAILS PLACED IN THIS FORMAT                        | 11-15-99                |
| <u>/s/ Firooz Zandi</u><br>DESIGN STANDARDS ENGINEER | <u>11-15-99</u><br>DATE |
| <u>/s/ Firooz Zandi</u><br>CHIEF HIGHWAY ENGINEER    | <u>11-15-99</u><br>DATE |
| ORIGINALLY APPROVED                                  |                         |

| 3" x 1" CORRUGATED STEEL PIPE (LOCK SEAM) |      |
|-------------------------------------------|------|
| HEIGHT OF COVER LIMITS (ft.)              |      |
| 1                                         | 1.0  |
| 2                                         | 1.5  |
| 3                                         | 2.0  |
| 4                                         | 2.5  |
| 5                                         | 3.0  |
| 6                                         | 3.5  |
| 7                                         | 4.0  |
| 8                                         | 4.5  |
| 9                                         | 5.0  |
| 10                                        | 5.5  |
| 11                                        | 6.0  |
| 12                                        | 6.5  |
| 13                                        | 7.0  |
| 14                                        | 7.5  |
| 15                                        | 8.0  |
| 16                                        | 8.5  |
| 17                                        | 9.0  |
| 18                                        | 9.5  |
| 19                                        | 10.0 |
| 20                                        | 10.5 |
| 21                                        | 11.0 |
| 22                                        | 11.5 |
| 23                                        | 12.0 |
| 24                                        | 12.5 |
| 25                                        | 13.0 |
| 26                                        | 13.5 |
| 27                                        | 14.0 |
| 28                                        | 14.5 |
| 29                                        | 15.0 |
| 30                                        | 15.5 |
| 31                                        | 16.0 |
| 32                                        | 16.5 |
| 33                                        | 17.0 |
| 34                                        | 17.5 |
| 35                                        | 18.0 |
| 36                                        | 18.5 |
| 37                                        | 19.0 |
| 38                                        | 19.5 |
| 39                                        | 20.0 |
| 40                                        | 20.5 |
| 41                                        | 21.0 |
| 42                                        | 21.5 |
| 43                                        | 22.0 |
| 44                                        | 22.5 |
| 45                                        | 23.0 |
| 46                                        | 23.5 |
| 47                                        | 24.0 |
| 48                                        | 24.5 |
| 49                                        | 25.0 |
| 50                                        | 25.5 |
| 51                                        | 26.0 |
| 52                                        | 26.5 |
| 53                                        | 27.0 |
| 54                                        | 27.5 |
| 55                                        | 28.0 |
| 56                                        | 28.5 |
| 57                                        | 29.0 |
| 58                                        | 29.5 |
| 59                                        | 30.0 |
| 60                                        | 30.5 |
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| 62                                        | 31.5 |
| 63                                        | 32.0 |
| 64                                        | 32.5 |
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| 68                                        | 34.5 |
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| 72                                        | 36.5 |
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| 74                                        | 37.5 |
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| 76                                        | 38.5 |
| 77                                        | 39.0 |
| 78                                        | 39.5 |
| 79                                        | 40.0 |
| 80                                        | 40.5 |
| 81                                        | 41.0 |
| 82                                        | 41.5 |
| 83                                        | 42.0 |
| 84                                        | 42.5 |
| 85                                        | 43.0 |
| 86                                        | 43.5 |
| 87                                        | 44.0 |
| 88                                        | 44.5 |
| 89                                        | 45.0 |
| 90                                        | 45.5 |
| 91                                        | 46.0 |
| 92                                        | 46.5 |
| 93                                        | 47.0 |
| 94                                        | 47.5 |
| 95                                        | 48.0 |
| 96                                        | 48.5 |
| 97                                        | 49.0 |
| 98                                        | 49.5 |
| 99                                        | 50.0 |
| 100                                       | 50.5 |
| 101                                       | 51.0 |
| 102                                       | 51.5 |
| 103                                       | 52.0 |
| 104                                       | 52.5 |
| 105                                       | 53.0 |
| 106                                       | 53.5 |
| 107                                       | 54.0 |
| 108                                       | 54.5 |
| 109                                       | 55.0 |
| 110                                       | 55.5 |
| 111                                       | 56.0 |
| 112                                       | 56.5 |
| 113                                       | 57.0 |
| 114                                       | 57.5 |
| 115                                       | 58.0 |
| 116                                       | 58.5 |
| 117                                       | 59.0 |
| 118                                       | 59.5 |
| 119                                       | 60.0 |
| 120                                       | 60.5 |
| 121                                       | 61.0 |
| 122                                       | 61.5 |
| 123                                       | 62.0 |
| 124                                       | 62.5 |
| 125                                       | 63.0 |
| 126                                       | 63.5 |
| 127                                       | 64.0 |
| 128                                       | 64.5 |
| 129                                       | 65.0 |
| 130                                       | 65.5 |
| 131                                       | 66.0 |
| 132                                       | 66.5 |
| 133                                       | 67.0 |
| 134                                       | 67.5 |
| 135                                       | 68.0 |
| 136                                       | 68.5 |
| 137                                       | 69.0 |
| 138                                       | 69.5 |
| 139                                       | 70.0 |
| 140                                       | 70.5 |
| 141                                       | 71.0 |
| 142                                       | 71.5 |
| 143                                       | 72.0 |
| 144                                       | 72.5 |
| 145                                       | 73.0 |
| 146                                       | 73.5 |
| 147                                       | 74.0 |
| 148                                       | 74.5 |
| 149                                       | 75.0 |
| 150                                       | 75.5 |
| 151                                       | 76.0 |
| 152                                       | 76.5 |
| 153                                       | 77.0 |
| 154                                       | 77.5 |
| 155                                       | 78.0 |
| 156                                       | 78.5 |
| 157                                       | 79.0 |
| 158                                       | 79.5 |
| 159                                       | 80.0 |
| 160                                       | 80   |

[illegible]

**NOTE:**

1. The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.

|                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                               |          |                                 |          |                           |      |  |  |                         |          |                        |      |                     |         |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------|---------------------------------|----------|---------------------------|------|--|--|-------------------------|----------|------------------------|------|---------------------|---------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                               |          |                                 |          |                           |      |  |  |                         |          |                        |      |                     |         |
| <h1 style="margin: 0;">PIPE HEIGHT OF<br/>COVER LIMITS</h1>                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                               |          |                                 |          |                           |      |  |  |                         |          |                        |      |                     |         |
| JANUARY 1998                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                               |          |                                 |          |                           |      |  |  |                         |          |                        |      |                     |         |
| STANDARD DRAWING NO. <b>E 715-PHCL-12</b>                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                               |          |                                 |          |                           |      |  |  |                         |          |                        |      |                     |         |
|  | <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border-bottom: 1px solid black; width: 80%;">DETAILS PLACED IN THIS FORMAT</td> <td style="width: 20%; text-align: right; border-bottom: 1px solid black;">11-15-99</td> </tr> <tr> <td style="border-bottom: 1px solid black; width: 80%;">/s/ <i>Anthony L. Uremovich</i></td> <td style="width: 20%; text-align: right; border-bottom: 1px solid black;">11-15-99</td> </tr> <tr> <td style="width: 80%;">DESIGN STANDARDS ENGINEER</td> <td style="width: 20%; text-align: right;">DATE</td> </tr> <tr> <td colspan="2" style="height: 20px;"></td> </tr> <tr> <td style="border-bottom: 1px solid black; width: 80%;">/s/ <i>Firooz Zandi</i></td> <td style="width: 20%; text-align: right; border-bottom: 1px solid black;">11-15-99</td> </tr> <tr> <td style="width: 80%;">CHIEF HIGHWAY ENGINEER</td> <td style="width: 20%; text-align: right;">DATE</td> </tr> <tr> <td style="width: 80%;">ORIGINALLY APPROVED</td> <td style="width: 20%; text-align: right;">1-02-98</td> </tr> </table> | DETAILS PLACED IN THIS FORMAT | 11-15-99 | /s/ <i>Anthony L. Uremovich</i> | 11-15-99 | DESIGN STANDARDS ENGINEER | DATE |  |  | /s/ <i>Firooz Zandi</i> | 11-15-99 | CHIEF HIGHWAY ENGINEER | DATE | ORIGINALLY APPROVED | 1-02-98 |
| DETAILS PLACED IN THIS FORMAT                                                         | 11-15-99                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                               |          |                                 |          |                           |      |  |  |                         |          |                        |      |                     |         |
| /s/ <i>Anthony L. Uremovich</i>                                                       | 11-15-99                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                               |          |                                 |          |                           |      |  |  |                         |          |                        |      |                     |         |
| DESIGN STANDARDS ENGINEER                                                             | DATE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |          |                                 |          |                           |      |  |  |                         |          |                        |      |                     |         |
|                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                               |          |                                 |          |                           |      |  |  |                         |          |                        |      |                     |         |
| /s/ <i>Firooz Zandi</i>                                                               | 11-15-99                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                               |          |                                 |          |                           |      |  |  |                         |          |                        |      |                     |         |
| CHIEF HIGHWAY ENGINEER                                                                | DATE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |          |                                 |          |                           |      |  |  |                         |          |                        |      |                     |         |
| ORIGINALLY APPROVED                                                                   | 1-02-98                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                               |          |                                 |          |                           |      |  |  |                         |          |                        |      |                     |         |
| DESIGN STANDARDS ENGINEER                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                               |          |                                 |          |                           |      |  |  |                         |          |                        |      |                     |         |

| 3" x 1" CORRUGATED STEEL PIPE (RIVETED) |      |
|-----------------------------------------|------|
| HEIGHT OF COVER LIMITS (ft.)            |      |
| 1                                       | 1.5  |
| 2                                       | 2.0  |
| 3                                       | 2.5  |
| 4                                       | 3.0  |
| 5                                       | 3.5  |
| 6                                       | 4.0  |
| 7                                       | 4.5  |
| 8                                       | 5.0  |
| 9                                       | 5.5  |
| 10                                      | 6.0  |
| 11                                      | 6.5  |
| 12                                      | 7.0  |
| 13                                      | 7.5  |
| 14                                      | 8.0  |
| 15                                      | 8.5  |
| 16                                      | 9.0  |
| 17                                      | 9.5  |
| 18                                      | 10.0 |
| 19                                      | 10.5 |
| 20                                      | 11.0 |
| 21                                      | 11.5 |
| 22                                      | 12.0 |
| 23                                      | 12.5 |
| 24                                      | 13.0 |
| 25                                      | 13.5 |
| 26                                      | 14.0 |
| 27                                      | 14.5 |
| 28                                      | 15.0 |
| 29                                      | 15.5 |
| 30                                      | 16.0 |
| 31                                      | 16.5 |
| 32                                      | 17.0 |
| 33                                      | 17.5 |
| 34                                      | 18.0 |
| 35                                      | 18.5 |
| 36                                      | 19.0 |
| 37                                      | 19.5 |
| 38                                      | 20.0 |
| 39                                      | 20.5 |
| 40                                      | 21.0 |
| 41                                      | 21.5 |
| 42                                      | 22.0 |
| 43                                      | 22.5 |
| 44                                      | 23.0 |
| 45                                      | 23.5 |
| 46                                      | 24.0 |
| 47                                      | 24.5 |
| 48                                      | 25.0 |
| 49                                      | 25.5 |
| 50                                      | 26.0 |
| 51                                      | 26.5 |
| 52                                      | 27.0 |
| 53                                      | 27.5 |
| 54                                      | 28.0 |
| 55                                      | 28.5 |
| 56                                      | 29.0 |
| 57                                      | 29.5 |
| 58                                      | 30.0 |
| 59                                      | 30.5 |
| 60                                      | 31.0 |
| 61                                      | 31.5 |
| 62                                      | 32.0 |
| 63                                      | 32.5 |
| 64                                      | 33.0 |
| 65                                      | 33.5 |
| 66                                      | 34.0 |
| 67                                      | 34.5 |
| 68                                      | 35.0 |
| 69                                      | 35.5 |
| 70                                      | 36.0 |
| 71                                      | 36.5 |
| 72                                      | 37.0 |
| 73                                      | 37.5 |
| 74                                      | 38.0 |
| 75                                      | 38.5 |
| 76                                      | 39.0 |
| 77                                      | 39.5 |
| 78                                      | 40.0 |
| 79                                      | 40.5 |
| 80                                      | 41.0 |
| 81                                      | 41.5 |
| 82                                      | 42.0 |
| 83                                      | 42.5 |
| 84                                      | 43.0 |
| 85                                      | 43.5 |
| 86                                      | 44.0 |
| 87                                      | 44.5 |
| 88                                      | 45.0 |
| 89                                      | 45.5 |
| 90                                      | 46.0 |
| 91                                      | 46.5 |
| 92                                      | 47.0 |
| 93                                      | 47.5 |
| 94                                      | 48.0 |
| 95                                      | 48.5 |
| 96                                      | 49.0 |
| 97                                      | 49.5 |
| 98                                      | 50.0 |
| 99                                      | 50.5 |
| 100                                     | 51.0 |

[illegible]

**NOTE:**

1. The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.

|                                                                                       |                                          |
|---------------------------------------------------------------------------------------|------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                          |
| <h1 style="text-align: center;">PIPE HEIGHT OF<br/>COVER LIMITS</h1>                  |                                          |
| JANUARY 1998                                                                          |                                          |
| STANDARD DRAWING NO. <b>E 715-PHCL-13</b>                                             |                                          |
|  | DETAILS PLACED IN THIS FORMAT 11-15-99   |
|                                                                                       | <i>/s/ Anthony L. Uremovich</i> 11-15-99 |
|                                                                                       | DESIGN STANDARDS ENGINEER DATE           |
|                                                                                       | <i>/s/ Firooz Zandi</i> 11-15-99         |
| DESIGN STANDARDS ENGINEER                                                             | CHIEF HIGHWAY ENGINEER DATE              |
|                                                                                       | ORIGINALLY APPROVED 1-02-98              |

| 3" x 1" CORRUGATED STEEL PIPE-ARCH (RIVETED OR LOCK SEAM)<br>HEIGHT OF COVER LIMITS (ft.) |
|-------------------------------------------------------------------------------------------|
|-------------------------------------------------------------------------------------------|

[illegible]

**NOTE:**

1. The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.
2. 2. Dual entries in the ,Corner Radius, column, such as  $8/18\frac{3}{4}$ , represent the following:  
8 - minimum corner radius allowed by AASHTO M 36.  
 $18\frac{3}{4}$  - corner radius typically available.
3. The tabulated cover heights reflect pipe-arches with typically available corner radii. If a pipe-arch with corner radii other than what is typically available is to be used, a specific design shall be performed to verify structural adequacy.

|                                                                                       |                                                                                                                                                         |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                         |
| <h1 style="text-align: center;">PIPE HEIGHT OF<br/>COVER LIMITS</h1>                  |                                                                                                                                                         |
| JANUARY 1998                                                                          |                                                                                                                                                         |
| STANDARD DRAWING NO. <b>E 715-PHCL-14</b>                                             |                                                                                                                                                         |
|  | DETAILS PLACED IN THIS FORMAT <span style="float: right;">11-15-99</span>                                                                               |
|                                                                                       | <u>/s/ Anthony L. Uremovich</u> <span style="float: right;"><u>11-15-99</u></span><br>DESIGN STANDARDS ENGINEER <span style="float: right;">DATE</span> |
|                                                                                       | <u>/s/ Firooz Zandi</u> <span style="float: right;"><u>11-15-99</u></span><br>CHIEF HIGHWAY ENGINEER <span style="float: right;">DATE</span>            |
| DESIGN STANDARDS ENGINEER                                                             | ORIGINALLY APPROVED <span style="float: right;">1-02-98</span>                                                                                          |

| 5" x 1" CORRUGATED STEEL PIPE (LOCK SEAM) |      |
|-------------------------------------------|------|
| HEIGHT OF COVER LIMITS (ft.)              |      |
| 1                                         | 1.0  |
| 2                                         | 1.5  |
| 3                                         | 2.0  |
| 4                                         | 2.5  |
| 5                                         | 3.0  |
| 6                                         | 3.5  |
| 7                                         | 4.0  |
| 8                                         | 4.5  |
| 9                                         | 5.0  |
| 10                                        | 5.5  |
| 11                                        | 6.0  |
| 12                                        | 6.5  |
| 13                                        | 7.0  |
| 14                                        | 7.5  |
| 15                                        | 8.0  |
| 16                                        | 8.5  |
| 17                                        | 9.0  |
| 18                                        | 9.5  |
| 19                                        | 10.0 |
| 20                                        | 10.5 |
| 21                                        | 11.0 |
| 22                                        | 11.5 |
| 23                                        | 12.0 |
| 24                                        | 12.5 |
| 25                                        | 13.0 |
| 26                                        | 13.5 |
| 27                                        | 14.0 |
| 28                                        | 14.5 |
| 29                                        | 15.0 |
| 30                                        | 15.5 |
| 31                                        | 16.0 |
| 32                                        | 16.5 |
| 33                                        | 17.0 |
| 34                                        | 17.5 |
| 35                                        | 18.0 |
| 36                                        | 18.5 |
| 37                                        | 19.0 |
| 38                                        | 19.5 |
| 39                                        | 20.0 |
| 40                                        | 20.5 |
| 41                                        | 21.0 |
| 42                                        | 21.5 |
| 43                                        | 22.0 |
| 44                                        | 22.5 |
| 45                                        | 23.0 |
| 46                                        | 23.5 |
| 47                                        | 24.0 |
| 48                                        | 24.5 |
| 49                                        | 25.0 |
| 50                                        | 25.5 |
| 51                                        | 26.0 |
| 52                                        | 26.5 |
| 53                                        | 27.0 |
| 54                                        | 27.5 |
| 55                                        | 28.0 |
| 56                                        | 28.5 |
| 57                                        | 29.0 |
| 58                                        | 29.5 |
| 59                                        | 30.0 |
| 60                                        | 30.5 |
| 61                                        | 31.0 |
| 62                                        | 31.5 |
| 63                                        | 32.0 |
| 64                                        | 32.5 |
| 65                                        | 33.0 |
| 66                                        | 33.5 |
| 67                                        | 34.0 |
| 68                                        | 34.5 |
| 69                                        | 35.0 |
| 70                                        | 35.5 |
| 71                                        | 36.0 |
| 72                                        | 36.5 |
| 73                                        | 37.0 |
| 74                                        | 37.5 |
| 75                                        | 38.0 |
| 76                                        | 38.5 |
| 77                                        | 39.0 |
| 78                                        | 39.5 |
| 79                                        | 40.0 |
| 80                                        | 40.5 |
| 81                                        | 41.0 |
| 82                                        | 41.5 |
| 83                                        | 42.0 |
| 84                                        | 42.5 |
| 85                                        | 43.0 |
| 86                                        | 43.5 |
| 87                                        | 44.0 |
| 88                                        | 44.5 |
| 89                                        | 45.0 |
| 90                                        | 45.5 |
| 91                                        | 46.0 |
| 92                                        | 46.5 |
| 93                                        | 47.0 |
| 94                                        | 47.5 |
| 95                                        | 48.0 |
| 96                                        | 48.5 |
| 97                                        | 49.0 |
| 98                                        | 49.5 |
| 99                                        | 50.0 |
| 100                                       | 50.5 |
| 101                                       | 51.0 |
| 102                                       | 51.5 |
| 103                                       | 52.0 |
| 104                                       | 52.5 |
| 105                                       | 53.0 |
| 106                                       | 53.5 |
| 107                                       | 54.0 |
| 108                                       | 54.5 |
| 109                                       | 55.0 |
| 110                                       | 55.5 |
| 111                                       | 56.0 |
| 112                                       | 56.5 |
| 113                                       | 57.0 |
| 114                                       | 57.5 |
| 115                                       | 58.0 |
| 116                                       | 58.5 |
| 117                                       | 59.0 |
| 118                                       | 59.5 |
| 119                                       | 60.0 |
| 120                                       | 60.5 |
| 121                                       | 61.0 |
| 122                                       | 61.5 |
| 123                                       | 62.0 |
| 124                                       | 62.5 |
| 125                                       | 63.0 |
| 126                                       | 63.5 |
| 127                                       | 64.0 |
| 128                                       | 64.5 |
| 129                                       | 65.0 |
| 130                                       | 65.5 |
| 131                                       | 66.0 |
| 132                                       | 66.5 |
| 133                                       | 67.0 |
| 134                                       | 67.5 |
| 135                                       | 68.0 |
| 136                                       | 68.5 |
| 137                                       | 69.0 |
| 138                                       | 69.5 |
| 139                                       | 70.0 |
| 140                                       | 70.5 |
| 141                                       | 71.0 |
| 142                                       | 71.5 |
| 143                                       | 72.0 |
| 144                                       | 72.5 |
| 145                                       | 73.0 |
| 146                                       | 73.5 |
| 147                                       | 74.0 |
| 148                                       | 74.5 |
| 149                                       | 75.0 |
| 150                                       | 75.5 |
| 151                                       | 76.0 |
| 152                                       | 76.5 |
| 153                                       | 77.0 |
| 154                                       | 77.5 |
| 155                                       | 78.0 |
| 156                                       | 78.5 |
| 157                                       | 79.0 |
| 158                                       | 79.5 |
| 159                                       | 80.0 |
| 160                                       | 80   |

[illegible]

**NOTE:**

1. The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.

|                                                             |  |
|-------------------------------------------------------------|--|
| INDIANA DEPARTMENT OF TRANSPORTATION                        |  |
| <h1 style="margin: 0;">PIPE HEIGHT OF<br/>COVER LIMITS</h1> |  |
| JANUARY 1998                                                |  |
| STANDARD DRAWING NO. <b>E 715-PHCL-15</b>                   |  |



**ANTHONY L. UREMOWICH**  
REGISTERED  
**No. 18095**  
STATE OF  
**INDIANA**  
PROFESSIONAL ENGINEER

|                                 |                 |
|---------------------------------|-----------------|
| DETAILS PLACED IN THIS FORMAT   | 11-15-99        |
| <i>/s/ Anthony L. Uremovich</i> | <i>11-15-99</i> |
| DESIGN STANDARDS ENGINEER       | DATE            |
|                                 |                 |
| <i>/s/ Firooz Zandi</i>         | <i>11-15-99</i> |
| CHIEF HIGHWAY ENGINEER          | DATE            |
| ORIGINALLY APPROVED             | 1-02-98         |

DESIGN STANDARDS ENGINEER

**5" x 1" CORRUGATED STEEL PIPE-ARCH (LOCK SEAM)  
HEIGHT OF COVER LIMITS (ft.)**

| Rc<br>(in.)                       | SPAN<br>(in.) | RISE<br>(in.) | AREA<br>(sft) | THICKNESS (in.) |      |       |      |       |      |       |      |       |      |
|-----------------------------------|---------------|---------------|---------------|-----------------|------|-------|------|-------|------|-------|------|-------|------|
|                                   |               |               |               | 0.064           |      | 0.079 |      | 0.109 |      | 0.138 |      | 0.168 |      |
|                                   |               |               |               | MIN.            | MAX. | MIN.  | MAX. | MIN.  | MAX. | MIN.  | MAX. | MIN.  | MAX. |
| 8/18 <sup>3</sup> / <sub>4</sub>  | 60            | 46            | 15.6          |                 |      |       |      | 1.1   | 20.8 | 1.1   | 20.8 |       |      |
| 9/20 <sup>3</sup> / <sub>4</sub>  | 66            | 51            | 19.3          |                 |      |       |      | 1.1   | 20.9 | 1.1   | 20.9 |       |      |
| 12/22 <sup>3</sup> / <sub>4</sub> | 73            | 55            | 23.2          |                 |      |       |      | 1.1   | 20.8 | 1.1   | 20.8 |       |      |
| 14/20 <sup>3</sup> / <sub>4</sub> | 81            | 59            | 27.4          |                 |      |       |      | 1.2   | 17.1 | 1.2   | 17.1 | 1.2   | 17.1 |
| 14/22 <sup>3</sup> / <sub>4</sub> | 87            | 63            | 32.1          |                 |      |       |      | 1.2   | 17.3 | 1.2   | 17.3 | 1.2   | 17.3 |
| 16/24 <sup>3</sup> / <sub>4</sub> | 95            | 67            | 37.0          |                 |      |       |      | 1.2   | 17.1 | 1.2   | 17.1 | 1.2   | 17.1 |
| 16/26 <sup>3</sup> / <sub>4</sub> | 103           | 71            | 42.4          |                 |      |       |      | 1.2   | 16.9 | 1.2   | 16.9 | 1.2   | 16.9 |
| 18/27 <sup>3</sup> / <sub>4</sub> | 112           | 75            | 48.0          |                 |      |       |      | 1.3   | 16.5 | 1.3   | 16.5 | 1.3   | 16.5 |
| 18/29 <sup>3</sup> / <sub>4</sub> | 117           | 79            | 54.2          |                 |      |       |      | 1.2   | 16.8 | 1.2   | 16.8 | 1.2   | 16.8 |
| 18/31 <sup>3</sup> / <sub>4</sub> | 128           | 83            | 60.5          |                 |      |       |      |       |      | 1.3   | 16.2 | 1.3   | 16.2 |
| 18/33                             | 137           | 87            | 67.4          |                 |      |       |      |       |      | 1.3   | 16.0 | 1.3   | 16.0 |
| 18/34 <sup>3</sup> / <sub>4</sub> | 142           | 91            | 74.5          |                 |      |       |      |       |      |       |      | 1.3   | 16.3 |
|                                   |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                                   |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                                   |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                                   |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                                   |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                                   |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                                   |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                                   |               |               |               |                 |      |       |      |       |      |       |      |       |      |
|                                   |               |               |               |                 |      |       |      |       |      |       |      |       |      |

**NOTES:**

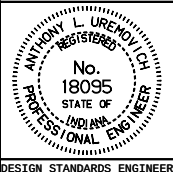
- The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.
- Dual entries in the "Corner Radius" column, such as 8/18 $\frac{3}{4}$ , represent the following:  
8 - minimum corner raduis allowed by AASHTO M 36.  
18 $\frac{3}{4}$ - corner radius typically available.
- The tabulated cover heights reflect pipe-arches with typically available corner radii. If a pipe-arch with corner radii other than what is typically available is to be used, a specific design shall be performed to verify structural adequacy.

INDIANA DEPARTMENT OF TRANSPORTATION

**PIPE HEIGHT OF  
COVER LIMITS**

JANUARY 1998

**STANDARD DRAWING NO. E 715-PHCL-16**



DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

ORIGINALLY APPROVED 1-02-98

**NON-REINFORCED CONCRETE PIPE  
CLASS 3  
HEIGHT OF COVER LIMITS (ft.)**

| DIAMETER<br>(in.) | MINIMUM<br>(ft.) | MAXIMUM<br>(ft.) |
|-------------------|------------------|------------------|
| 12                | 1.3              | 14.1             |
| 15                | 1.4              | 13.1             |
| 18                | 1.5              | 12.8             |
| 21                | 1.5              | 13.4             |
| 24                | 1.5              | 13.5             |
| 27                | 1.6              | 12.1             |
| 30                | 1.8              | 10.7             |
| 33                | 1.9              | 9.8              |
| 36                | 2.1              | 9.0              |

**NOTE:**

1. The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.

|                                                                                       |                                                                                                                          |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                          |
| <b>PIPE HEIGHT OF<br/>COVER LIMITS</b><br>JANUARY 1998                                |                                                                                                                          |
| STANDARD DRAWING NO. <b>E 715-PHCL-17</b>                                             |                                                                                                                          |
|  | DETAILS PLACED IN THIS FORMAT 11-15-99<br><br>/s/ <i>Anthony L. Uremovich</i> 11-15-99<br>DESIGN STANDARDS ENGINEER DATE |
|                                                                                       | /s/ <i>Firooz Zandi</i> 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE                                                          |
|                                                                                       | DESIGN STANDARDS ENGINEER                                                                                                |
|                                                                                       | ORIGINALLY APPROVED 1-02-98                                                                                              |



**CORRUGATED POLYETHYLENE PIPE, TYPES  
HEIGHT OF COVER LIMITS (ft.)**

| PAY ITEM<br>DIAMETER<br>(in.) | NOMINAL<br>DIAMETER<br>(in.) | MINIMUM<br>(ft.) | MAXIMUM<br>(ft.) |
|-------------------------------|------------------------------|------------------|------------------|
| 12                            | 12                           | 2.0              | 11.0             |
| 15                            | 15                           | 2.0              | 11.0             |
| 18                            | 18                           | 2.0              | 11.0             |
| 21                            | 21                           | 2.0              | 11.0             |
| 24                            | 24                           | 2.0              | 11.0             |
| 30                            | 30                           | 2.0              | 11.0             |
| 36                            | 36                           | 2.0              | 11.0             |

**RIBBED POLYETHYLENE PIPE  
HEIGHT OF COVER LIMITS (ft.)**

| PAY ITEM<br>DIAMETER<br>(in.) | NOMINAL<br>DIAMETER<br>(in.) | MINIMUM<br>(ft.) | MAXIMUM<br>(ft.) |
|-------------------------------|------------------------------|------------------|------------------|
| 18                            | 18                           | 2.0              | 18.0             |
| 21                            | 21                           | 2.0              | 22.0             |
| 24                            | 24                           | 2.0              | 21.0             |
| 27                            | 27                           | 2.0              | 24.0             |
| 30                            | 30                           | 2.0              | 22.0             |
| 33                            | 33                           | 2.0              | 23.0             |
| 36                            | 36                           | 2.0              | 25.0             |

**SMOOTH WALL POLYETHYLENE PIPE  
HEIGHT OF COVER LIMITS (ft.)**

| PAY<br>ITEM<br>DIA.<br>(in.) | NOMINAL<br>DIA.<br>(in.) | DIMENSION RATIO (NOM. DIA./WALL THICKNESS) |               |               |               |               |               |               |               |
|------------------------------|--------------------------|--------------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
|                              |                          | 26                                         |               | 21            |               | 17            |               | 11            |               |
|                              |                          | MIN.                                       | MAX.<br>(ft.) | MIN.<br>(ft.) | MAX.<br>(ft.) | MIN.<br>(ft.) | MAX.<br>(ft.) | MIN.<br>(ft.) | MAX.<br>(ft.) |
| 12                           | 13                       | 2.0                                        | 40.0          | 2.0           | 57.0          |               |               |               |               |
| 12                           | 14                       |                                            |               |               |               | 2.0           | 81.0          |               |               |
| 15                           | 18                       | 2.0                                        | 40.0          | 2.0           | 57.0          | 2.0           | 81.0          |               |               |
| 18                           | 20                       | 2.0                                        | 40.0          | 2.0           | 57.0          | 2.0           | 81.0          |               |               |
| 18                           | 22                       |                                            |               |               |               | 2.0           | 81.0          | 2.0           | 100.0         |
| 21                           | 24                       | 2.0                                        | 40.0          | 2.0           | 57.0          | 2.0           | 81.0          |               |               |
| 24                           | 28                       | 2.0                                        | 40.0          | 2.0           | 57.0          | 2.0           | 81.0          |               |               |
| 27                           | 32                       | 2.0                                        | 40.0          | 2.0           | 57.0          | 2.0           | 81.0          |               |               |
| 30                           | 34                       | 2.0                                        | 40.0          | 2.0           | 57.0          | 2.0           | 81.0          |               |               |
| 36                           | 42                       | 2.0                                        | 40.0          | 2.0           | 57.0          | 2.0           | 81.0          |               |               |

**NOTE:**

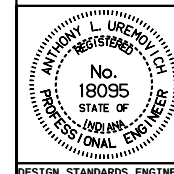
1. The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.
2. The pay item diameter reflects the minimum required inside diameter.
3. Because the nominal size of smooth wall polyethylene pipe is based on the outside diameter, different dimension ratios may require different nominal diameters to satisfy the pay item diameter requirements.

INDIANA DEPARTMENT OF TRANSPORTATION

**PIPE HEIGHT OF  
COVER LIMITS**

JANUARY 1998

**STANDARD DRAWING NO. E 715-PHCL-18**



DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

ORIGINALLY APPROVED 1-02-98

**PROFILE WALL POLYVINYL CHLORIDE PIPE  
HEIGHT OF COVER LIMITS (ft.)**

| DIAMETER<br>(in.) | MINIMUM<br>(ft.) | MAXIMUM<br>(ft.) |
|-------------------|------------------|------------------|
| 12                | 2.0              | 35.3             |
| 15                | 2.0              | 34.2             |
| 18                | 2.0              | 34.0             |
| 21                | 2.0              | 33.0             |
| 24                | 2.0              | 31.0             |
| 27                | 2.0              | 30.0             |
| 30                | 2.0              | 29.0             |
| 36                | 2.0              | 27.0             |

**SMOOTH WALL POLYVINYL CHLORIDE PIPE  
HEIGHT OF COVER LIMITS (ft.)**

| PAY ITEM<br>DIAMETER<br>(in.) | NOMINAL<br>DIAMETER<br>(in.) | MINIMUM<br>(ft.) | MAXIMUM<br>(ft.) |
|-------------------------------|------------------------------|------------------|------------------|
| 12                            | 12                           | 2.0              | 64.0             |
| 15                            | 15                           | 2.0              | 64.0             |
| 18                            | 18                           | 2.0              | 61.0             |
| 21                            | 21                           | 2.0              | 61.0             |
| 24                            | 24                           | 2.0              | 61.0             |
| 27                            | 27                           | 2.0              | 61.0             |

**NOTE:**

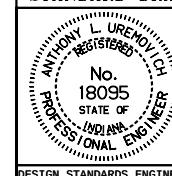
1. The tabulated cover depths shall be measured from the bottom of the concrete or asphalt pavement to the top of the pipe.
2. The pay item diameter reflects the minimum required inside diameter.

INDIANA DEPARTMENT OF TRANSPORTATION

**PIPE HEIGHT OF  
COVER LIMITS**

MAY 1999

**STANDARD DRAWING NO. E 715-PHCL-19**



DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

ORIGINALLY APPROVED

5-03-99

| VITRIFIED CLAY PIPE, EXTRA STRENGTH<br>HEIGHT OF COVER LIMITS (ft.) |                  |                  |
|---------------------------------------------------------------------|------------------|------------------|
| DIAMETER<br>(in)                                                    | MINIMUM<br>(ft.) | MAXIMUM<br>(ft.) |
| 12                                                                  | 1.2              | 16.0             |
| 15                                                                  | 1.4              | 14.0             |
| 18                                                                  | 1.4              | 13.0             |
| 21                                                                  | 1.4              | 14.0             |
| 24                                                                  | 1.4              | 15.0             |
| 27                                                                  | 1.5              | 14.0             |
| 30                                                                  | 1.6              | 13.0             |
| 33                                                                  | 1.5              | 13.0             |
| 36                                                                  | 1.5              | 14.0             |

**NOTE:**

1. The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.

|                                                                                       |                                                                                        |  |
|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|--|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                        |  |
| <b>PIPE HEIGHT OF<br/>COVER LIMITS</b><br>JANUARY 1998                                |                                                                                        |  |
| STANDARD DRAWING NO. <b>E 715-PHCL-20</b>                                             |                                                                                        |  |
|  | DETAILS PLACED IN THIS FORMAT 11-15-99                                                 |  |
|                                                                                       | <i>/s/ Anthony L. Uremovich</i> <i>11-15-99</i><br>DESIGN STANDARDS ENGINEER      DATE |  |
|                                                                                       | <i>/s/ Firooz Zandi</i> <i>11-15-99</i><br>CHIEF HIGHWAY ENGINEER      DATE            |  |
|                                                                                       | DESIGN STANDARDS ENGINEER      ORIGINALLY APPROVED      1-02-98                        |  |

- NOTE:
1. The tabulated cover depths shall be measured from the bottom of the bituminous or concrete pavement to the top of the pipe.

| REINFORCED CONCRETE CIRCULAR PIPE<br>HEIGHT OF COVER LIMITS (ft.) |                                    |      |                                     |      |                                     |      |                                    |      |                                    |      |                                    |       |
|-------------------------------------------------------------------|------------------------------------|------|-------------------------------------|------|-------------------------------------|------|------------------------------------|------|------------------------------------|------|------------------------------------|-------|
| DIAMETER<br>(in.)                                                 | Strength Class/D-load Rating       |      |                                     |      |                                     |      |                                    |      |                                    |      |                                    |       |
|                                                                   | Class II: D <sub>0.01</sub> = 1000 |      | Class III: D <sub>0.01</sub> = 1250 |      | Class III: D <sub>0.01</sub> = 1350 |      | Class IV: D <sub>0.01</sub> = 1500 |      | Class IV: D <sub>0.01</sub> = 1750 |      | Class IV: D <sub>0.01</sub> = 2000 |       |
|                                                                   | MIN.                               | MAX. | MIN.                                | MAX. | MIN.                                | MAX. | MIN.                               | MAX. | MIN.                               | MAX. | MIN.                               | MAX.  |
| 12                                                                | 1.4                                | 6.0  | 1.1                                 | 10.0 | 1.1                                 | 12.0 | 1.0                                | 15.0 | 1.0                                | 24.0 | 1.0                                | 100.0 |
| 15                                                                | 1.1                                | 8.0  | 1.0                                 | 12.0 | 1.0                                 | 14.0 | 1.0                                | 19.0 | 1.0                                | 35.0 | 1.0                                | 100.0 |
| 18                                                                | 1.0                                | 9.0  | 1.0                                 | 14.0 | 1.0                                 | 17.0 | 1.0                                | 22.0 | 1.0                                | 52.0 | 1.0                                | 100.0 |
| 21                                                                | 1.0                                | 10.0 | 1.0                                 | 15.0 | 1.0                                 | 18.0 | 1.0                                | 24.0 | 1.0                                | 84.0 | 1.0                                | 100.0 |
| 24                                                                | 1.0                                | 11.0 | 1.0                                 | 17.0 | 1.0                                 | 20.0 | 1.0                                | 26.0 | 1.0                                | 85.0 | 1.0                                | 100.0 |
| 27                                                                | 1.0                                | 10.0 | 1.0                                 | 13.0 | 1.0                                 | 15.0 | 1.0                                | 19.0 | 1.0                                | 26.0 | 1.0                                | 42.0  |
| 30                                                                | 1.0                                | 10.0 | 1.0                                 | 14.0 | 1.0                                 | 16.0 | 1.0                                | 20.0 | 1.0                                | 28.0 | 1.0                                | 44.0  |
| 33                                                                | 1.0                                | 10.0 | 1.0                                 | 15.0 | 1.0                                 | 17.0 | 1.0                                | 20.0 | 1.0                                | 29.0 | 1.0                                | 45.0  |
| 36                                                                | 1.0                                | 11.0 | 1.0                                 | 15.0 | 1.0                                 | 17.0 | 1.0                                | 21.0 | 1.0                                | 29.0 | 1.0                                | 45.0  |
| 42                                                                | 1.0                                | 11.0 | 1.0                                 | 16.0 | 1.0                                 | 18.0 | 1.0                                | 22.0 | 1.0                                | 30.0 | 1.0                                | 44.0  |
| 48                                                                | 1.0                                | 12.0 | 1.0                                 | 17.0 | 1.0                                 | 19.0 | 1.0                                | 22.0 | 1.0                                | 30.0 | 1.0                                | 43.0  |
| 54                                                                | 1.0                                | 12.0 | 1.0                                 | 17.0 | 1.0                                 | 19.0 | 1.0                                | 23.0 | 1.0                                | 31.0 | 1.0                                | 42.0  |
| 60                                                                | 1.0                                | 10.0 | 1.0                                 | 13.0 | 1.0                                 | 14.0 | 1.0                                | 17.0 | 1.0                                | 21.0 | 1.0                                | 26.0  |
| 66                                                                | 1.0                                | 10.0 | 1.0                                 | 14.0 | 1.0                                 | 15.0 | 1.0                                | 17.0 | 1.0                                | 21.0 | 1.0                                | 26.0  |
| 72                                                                | 1.0                                | 11.0 | 1.0                                 | 14.0 | 1.0                                 | 15.0 | 1.0                                | 18.0 | 1.0                                | 22.0 | 1.0                                | 27.0  |
| 78                                                                | 1.0                                | 11.0 | 1.0                                 | 14.0 | 1.0                                 | 16.0 | 1.0                                | 18.0 | 1.0                                | 22.0 | 1.0                                | 27.0  |
| 84                                                                | 1.0                                | 11.0 | 1.0                                 | 15.0 | 1.0                                 | 16.0 | 1.0                                | 19.0 | 1.0                                | 23.0 | 1.0                                | 28.0  |
| 90                                                                | 1.0                                | 11.0 | 1.0                                 | 15.0 | 1.0                                 | 16.0 | 1.0                                | 19.0 | 1.0                                | 23.0 | 1.0                                | 28.0  |
| 96                                                                | 1.0                                | 11.0 | 1.0                                 | 15.0 | 1.0                                 | 17.0 | 1.0                                | 19.0 | 1.0                                | 23.0 | 1.0                                | 28.0  |
| 102                                                               | 1.1                                | 12.0 | 1.1                                 | 15.0 | 1.1                                 | 17.0 | 1.1                                | 19.0 | 1.1                                | 24.0 | 1.1                                | 29.0  |
| 108                                                               | 1.2                                | 12.0 | 1.2                                 | 15.0 | 1.2                                 | 17.0 | 1.2                                | 20.0 | 1.2                                | 24.0 | 1.2                                | 29.0  |
| 114                                                               | 1.2                                | 12.0 | 1.2                                 | 16.0 | 1.2                                 | 17.0 | 1.2                                | 20.0 | 1.2                                | 24.0 | 1.2                                | 29.0  |
| 120                                                               | 1.3                                | 12.0 | 1.3                                 | 16.0 | 1.3                                 | 17.0 | 1.3                                | 20.0 | 1.3                                | 24.0 | 1.3                                | 29.0  |
| 126                                                               | 1.4                                | 12.0 | 1.4                                 | 16.0 | 1.4                                 | 18.0 | 1.4                                | 20.0 | 1.4                                | 24.0 | 1.4                                | 29.0  |
| 132                                                               | 1.4                                | 12.0 | 1.4                                 | 16.0 | 1.4                                 | 18.0 | 1.4                                | 20.0 | 1.4                                | 25.0 | 1.4                                | 29.0  |
| 138                                                               | 1.5                                | 12.0 | 1.5                                 | 16.0 | 1.5                                 | 18.0 | 1.5                                | 20.0 | 1.5                                | 25.0 | 1.5                                | 29.0  |
| 144                                                               | 1.5                                | 12.0 | 1.5                                 | 16.0 | 1.5                                 | 18.0 | 1.5                                | 20.0 | 1.5                                | 25.0 | 1.5                                | 29.0  |

INDIANA DEPARTMENT OF TRANSPORTATION

PIPE HEIGHT OF  
COVER LIMITS  
SEPTEMBER 2009

STANDARD DRAWING NO. E 715-PHCL-21



DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave09/01/09

DESIGN STANDARDS ENGINEERDATE

/s/ Mark A. Miller09/01/09

CHIEF HIGHWAY ENGINEERDATE

| REINFORCED CONCRETE CIRCULAR PIPE<br>HEIGHT OF COVER LIMITS (ft.) |                                   |       |                                   |       |                                   |       |                                   |       |                                         |       |
|-------------------------------------------------------------------|-----------------------------------|-------|-----------------------------------|-------|-----------------------------------|-------|-----------------------------------|-------|-----------------------------------------|-------|
| DIAMETER<br>(in.)                                                 | Strength Class/D-load Rating      |       |                                   |       |                                   |       |                                   |       |                                         |       |
|                                                                   | Class V: D <sub>0.01</sub> = 2250 |       | Class V: D <sub>0.01</sub> = 2500 |       | Class V: D <sub>0.01</sub> = 2750 |       | Class V: D <sub>0.01</sub> = 3000 |       | Class Special: D <sub>0.01</sub> = 3250 |       |
|                                                                   | MIN.                              | MAX.  | MIN.                              | MAX.  | MIN.                              | MAX.  | MIN.                              | MAX.  | MIN.                                    | MAX.  |
| 12                                                                | 1.0                               | 100.0 | 1.0                               | 100.0 | 1.0                               | 100.5 | 1.0                               | 100.5 | 1.0                                     | 100.5 |
| 15                                                                | 1.0                               | 100.0 | 1.0                               | 100.0 | 1.0                               | 100.5 | 1.0                               | 100.5 | 1.0                                     | 100.5 |
| 18                                                                | 1.0                               | 100.0 | 1.0                               | 100.0 | 1.0                               | 100.5 | 1.0                               | 100.5 | 1.0                                     | 100.5 |
| 21                                                                | 1.0                               | 100.0 | 1.0                               | 100.0 | 1.0                               | 100.5 | 1.0                               | 100.5 | 1.0                                     | 100.5 |
| 24                                                                | 1.0                               | 100.0 | 1.0                               | 100.0 | 1.0                               | 100.5 | 1.0                               | 100.5 | 1.0                                     | 100.5 |
| 27                                                                | 1.0                               | 92.0  | 1.0                               | 100.0 | 1.0                               | 100.5 | 1.0                               | 100.5 | 1.0                                     | 100.5 |
| 30                                                                | 1.0                               | 100.0 | 1.0                               | 100.0 | 1.0                               | 100.5 | 1.0                               | 100.5 | 1.0                                     | 100.5 |
| 33                                                                | 1.0                               | 89.0  | 1.0                               | 100.0 | 1.0                               | 100.5 | 1.0                               | 100.5 | 1.0                                     | 100.5 |
| 36                                                                | 1.0                               | 79.0  | 1.0                               | 100.0 | 1.0                               | 100.5 | 1.0                               | 100.5 | 1.0                                     | 100.5 |
| 42                                                                | 1.0                               | 68.0  | 1.0                               | 100.0 | 1.0                               | 100.5 | 1.0                               | 100.5 | 1.0                                     | 100.5 |
| 48                                                                | 1.0                               | 61.0  | 1.0                               | 100.0 | 1.0                               | 100.5 | 1.0                               | 100.5 | 1.0                                     | 100.5 |
| 54                                                                | 1.0                               | 57.0  | 1.0                               | 100.0 | 1.0                               | 100.5 | 1.0                               | 100.5 | 1.0                                     | 100.5 |
| 60                                                                | 1.0                               | 30.0  | 1.0                               | 100.0 | 1.0                               | 45.0  | 1.0                               | 57.0  | 1.0                                     | 75.0  |
| 66                                                                | 1.0                               | 31.0  | 1.0                               | 100.0 | 1.0                               | 46.0  | 1.0                               | 57.0  | 1.0                                     | 74.0  |
| 72                                                                | 1.0                               | 32.0  | 1.0                               | 37.0  | 1.0                               | 47.0  | 1.0                               | 57.0  | 1.0                                     | 73.0  |
| 78                                                                | 1.0                               | 32.0  | 1.0                               | 39.0  | 1.0                               | 47.0  | 1.0                               | 57.0  | 1.0                                     | 72.0  |
| 84                                                                | 1.0                               | 33.0  | 1.0                               | 39.0  | 1.0                               | 47.0  | 1.0                               | 57.0  | 1.0                                     | 70.0  |
| 90                                                                | 1.0                               | 33.0  | 1.0                               | 40.0  | 1.0                               | 47.0  | 1.0                               | 57.0  | 1.0                                     | 69.0  |
| 96                                                                | 1.0                               | 33.0  | 1.0                               | 40.0  | 1.0                               | 47.0  | 1.0                               | 57.0  | 1.0                                     | 68.0  |
| 102                                                               | 1.1                               | 34.0  | 1.1                               | 40.0  | 1.1                               | 47.0  | 1.1                               | 57.0  | 1.1                                     | 67.0  |
| 108                                                               | 1.2                               | 34.0  | 1.2                               | 40.0  | 1.2                               | 47.0  | 1.2                               | 55.0  | 1.2                                     | 66.0  |
| 114                                                               | 1.2                               | 34.0  | 1.2                               | 40.0  | 1.2                               | 47.0  | 1.2                               | 55.0  | 1.2                                     | 65.0  |
| 120                                                               | 1.3                               | 34.0  | 1.3                               | 40.0  | 1.3                               | 47.0  | 1.3                               | 55.0  | 1.3                                     | 64.0  |
| 126                                                               | 1.4                               | 34.0  | 1.4                               | 40.0  | 1.4                               | 47.0  | 1.4                               | 54.0  | 1.4                                     | 63.0  |
| 132                                                               | 1.4                               | 34.0  | 1.4                               | 40.0  | 1.4                               | 46.0  | 1.4                               | 54.0  | 1.4                                     | 63.0  |
| 138                                                               | 1.5                               | 34.0  | 1.5                               | 40.0  | 1.5                               | 46.0  | 1.5                               | 54.0  | 1.5                                     | 62.0  |
| 144                                                               | 1.5                               | 34.0  | 1.5                               | 40.0  | 1.5                               | 46.0  | 1.5                               | 53.0  | 1.5                                     | 61.0  |
|                                                                   |                                   |       |                                   |       |                                   |       |                                   |       |                                         |       |
|                                                                   |                                   |       |                                   |       |                                   |       |                                   |       |                                         |       |

NOTE:

1. The tabulated cover depths shall be measured from the bottom of the bituminous or concrete pavement to the top of the pipe.

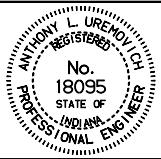
|                                                                                       |                                                                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                                                                                            |
| PIPE HEIGHT OF COVER LIMITS                                                           |                                                                                                                                                                                                                                            |
| SEPTEMBER 2009                                                                        |                                                                                                                                                                                                                                            |
| STANDARD DRAWING NO. E 715- PHCL-22                                                   |                                                                                                                                                                                                                                            |
|  | <div> <div>/s/ Richard L. VanCleave</div> <div>DESIGN STANDARDS ENGINEER</div> <div>09/01/09</div> <div>DATE</div> </div> <div> <div>/s/ Mark A. Miller</div> <div>CHIEF HIGHWAY ENGINEER</div> <div>09/01/09</div> <div>DATE</div> </div> |
| DESIGN STANDARDS ENGINEER                                                             |                                                                                                                                                                                                                                            |

**REINFORCED CONCRETE HORIZONTAL ELLIPICAL PIPE  
HEIGHT OF COVER LIMITS (ft.)**

| SPAN<br>(in.) | RISE<br>(in.) | AREA<br>(sft) | Strength Class/D-load Rating        |      |                                     |      |                                       |      |                                        |      |                                       |       |
|---------------|---------------|---------------|-------------------------------------|------|-------------------------------------|------|---------------------------------------|------|----------------------------------------|------|---------------------------------------|-------|
|               |               |               | Class HE-A: D <sub>0.01</sub> = 600 |      | Class HE-I: D <sub>0.01</sub> = 800 |      | Class HE-II: D <sub>0.01</sub> = 1000 |      | Class HE-III: D <sub>0.01</sub> = 1350 |      | Class HE-IV: D <sub>0.01</sub> = 2000 |       |
|               |               |               | MIN.                                | MAX. | MIN.                                | MAX. | MIN.                                  | MAX. | MIN.                                   | MAX. | MIN.                                  | MAX.  |
| 23            | 14            | 1.8           | 1.3                                 | 4.0  | 1.0                                 | 8.0  | 1.0                                   | 11.0 | 1.0                                    | 20.0 | 1.0                                   | 100.0 |
| 30            | 19            | 3.3           | 1.1                                 | 5.0  | 1.0                                 | 7.0  | 1.0                                   | 10.0 | 1.0                                    | 16.0 | 1.0                                   | 47.0  |
| 34            | 22            | 4.1           | 1.0                                 | 5.0  | 1.0                                 | 8.0  | 1.0                                   | 11.0 | 1.0                                    | 17.0 | 1.0                                   | 48.0  |
| 38            | 24            | 5.1           | 1.0                                 | 5.0  | 1.0                                 | 8.0  | 1.0                                   | 11.0 | 1.0                                    | 18.0 | 1.0                                   | 49.0  |
| 42            | 27            | 6.3           | 1.0                                 | 6.0  | 1.0                                 | 9.0  | 1.0                                   | 12.0 | 1.0                                    | 19.0 | 1.0                                   | 50.0  |
| 45            | 29            | 7.4           | 1.0                                 | 6.0  | 1.0                                 | 9.0  | 1.0                                   | 12.0 | 1.0                                    | 19.0 | 1.0                                   | 45.0  |
| 49            | 32            | 8.8           | 1.0                                 | 6.0  | 1.0                                 | 9.0  | 1.0                                   | 12.0 | 1.0                                    | 19.0 | 1.0                                   | 45.0  |
| 53            | 34            | 10.2          | 1.0                                 | 6.0  | 1.0                                 | 9.0  | 1.0                                   | 12.0 | 1.0                                    | 20.0 | 1.0                                   | 44.0  |
| 60            | 38            | 12.9          | 1.0                                 | 5.0  | 1.0                                 | 8.0  | 1.0                                   | 10.0 | 1.0                                    | 15.0 | 1.0                                   | 26.0  |
| 68            | 43            | 16.6          | 1.0                                 | 6.0  | 1.0                                 | 8.0  | 1.0                                   | 10.0 | 1.0                                    | 15.0 | 1.0                                   | 27.0  |
| 76            | 48            | 20.5          | 1.0                                 | 6.0  | 1.0                                 | 8.0  | 1.0                                   | 11.0 | 1.0                                    | 16.0 | 1.0                                   | 28.0  |
| 83            | 53            | 24.8          | 1.0                                 | 6.0  | 1.0                                 | 9.0  | 1.0                                   | 11.0 | 1.0                                    | 16.0 | 1.0                                   | 29.0  |
| 91            | 58            | 29.5          | 1.0                                 | 6.0  | 1.0                                 | 9.0  | 1.0                                   | 12.0 | 1.0                                    | 17.0 | 1.0                                   | 29.0  |
| 98            | 63            | 34.6          | 1.1                                 | 6.0  | 1.1                                 | 9.0  | 1.1                                   | 12.0 | 1.1                                    | 17.0 | 1.1                                   | 29.0  |
| 106           | 68            | 40.1          | 1.2                                 | 6.0  | 1.2                                 | 9.0  | 1.2                                   | 12.0 | 1.2                                    | 17.0 | 1.2                                   | 30.0  |
| 113           | 72            | 46.1          | 1.2                                 | 7.0  | 1.2                                 | 9.0  | 1.2                                   | 12.0 | 1.2                                    | 18.0 | 1.2                                   | 30.0  |
| 121           | 77            | 52.4          | 1.3                                 | 7.0  | 1.3                                 | 9.0  | 1.3                                   | 12.0 | 1.3                                    | 18.0 | 1.3                                   | 30.0  |
| 128           | 82            | 59.2          | 1.4                                 | 7.0  | 1.4                                 | 10.0 | 1.4                                   | 13.0 | 1.4                                    | 18.0 | 1.4                                   | 30.0  |
| 136           | 87            | 66.4          | 1.5                                 | 7.0  | 1.5                                 | 10.0 | 1.5                                   | 13.0 | 1.5                                    | 18.0 | 1.5                                   | 31.0  |
| 143           | 92            | 74.0          | 1.5                                 | 7.0  | 1.5                                 | 10.0 | 1.5                                   | 13.0 | 1.5                                    | 18.0 | 1.5                                   | 31.0  |
| 151           | 97            | 82.0          | 1.6                                 | 7.0  | 1.6                                 | 10.0 | 1.6                                   | 13.0 | 1.6                                    | 19.0 | 1.6                                   | 31.0  |
| 166           | 106           | 99.2          | 1.7                                 | 7.0  | 1.8                                 | 10.0 | 1.8                                   | 13.0 | 1.8                                    | 19.0 | 1.8                                   | 31.0  |
| 180           | 116           | 118.6         | 1.8                                 | 7.0  | 1.9                                 | 10.0 | 1.9                                   | 13.0 | 1.9                                    | 19.0 | 1.9                                   | 31.0  |
|               |               |               |                                     |      |                                     |      |                                       |      |                                        |      |                                       |       |
|               |               |               |                                     |      |                                     |      |                                       |      |                                        |      |                                       |       |
|               |               |               |                                     |      |                                     |      |                                       |      |                                        |      |                                       |       |
|               |               |               |                                     |      |                                     |      |                                       |      |                                        |      |                                       |       |
|               |               |               |                                     |      |                                     |      |                                       |      |                                        |      |                                       |       |
|               |               |               |                                     |      |                                     |      |                                       |      |                                        |      |                                       |       |
|               |               |               |                                     |      |                                     |      |                                       |      |                                        |      |                                       |       |

**NOTE:**

1. The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.

|                                                                                       |                                                                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                                                                                            |
| <b>PIPE HEIGHT OF<br/>COVER LIMITS</b><br>JANUARY 1998                                |                                                                                                                                                                                                                                            |
| STANDARD DRAWING NO. <b>E 715-PHCL-23</b>                                             |                                                                                                                                                                                                                                            |
|  | DETAILS PLACED IN THIS FORMAT 11-15-99<br><br>/s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE<br><br>/s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE<br>DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 1-02-98 |

| MATERIAL                                                         | PIPE TYPE |   |   |   |   |
|------------------------------------------------------------------|-----------|---|---|---|---|
|                                                                  | 1         | 2 | 3 | 4 | 5 |
| Non-Reinforced Concrete Pipe                                     |           |   |   | X |   |
| Non-Reinforced Concrete Pipe, Class 3 (S)                        | X         | X | X |   |   |
| Reinforced Concrete Pipe (S)                                     | X         | X | X |   |   |
| Reinforced Concrete Horizontal Elliptical Pipe (S)               | X         | X | X |   |   |
| Corrugated Steel Pipe (C)                                        | X         |   | X |   | X |
| Corrugated Steel Pipe-Arch (C)                                   | X         |   | X |   | X |
| Polymer Precoated Galvanized Corrugated Steel Pipe (C)           | X         |   | X |   | X |
| Polymer Precoated Galvanized Corrugated Steel Pipe Type 1A (S)   | X         | X | X |   | X |
| Fully Bituminous Coated and Lined Corrugated Steel Pipe (S)      |           | X |   |   | X |
| Polymer Precoated Galvanized Corr. Steel Pipe Arch Type IIA (S)  | X         | X | X |   | X |
| Fully Bituminous Coated and Lined Corrugated Steel Pipe-Arch (S) |           | X |   |   | X |
| Corrugated Aluminum Alloy Pipe (C)                               | X         |   | X |   | X |
| Corrugated Aluminum Alloy Pipe-Arch (C)                          | X         |   | X |   | X |
| Structural Plate Steel Pipe (C)                                  | X         |   | X |   |   |
| Polymer Precoated Galvanized Corrugated Steel Pipe-Arch (C)      | X         |   | X |   | X |

| MATERIAL                                      | PIPE TYPE |   |   |   |   |
|-----------------------------------------------|-----------|---|---|---|---|
|                                               | 1         | 2 | 3 | 4 | 5 |
| Structural Plate Steel Pipe-Arch (C)          | X         |   | X |   |   |
| Structural Plate Aluminum Alloy Pipe (C)      | X         |   | X |   |   |
| Structural Plate Aluminum Alloy Pipe-Arch (C) | X         |   | X |   |   |
| Clay Pipe, Extra Strength (S)                 | X         | X | X |   |   |
| Clay Pipe                                     |           |   |   | X |   |
| Perforated Clay Pipe                          |           |   |   | X |   |
| Corrugated Polyethylene Pipe, Type SP         |           |   |   | X |   |
| Corrugated Polyethylene Pipe, Type (S)        | X         | X | X | X | X |
| Ribbed Polyethylene Pipe (S)                  | X         | X | X |   | X |
| Smooth Wall Polyethylene Pipe (S)             | X         | X | X |   | X |
| Corrugated Polyethylene Drainage Tubing       |           |   |   | X |   |
| Perforated PVC Semicircular Pipe              |           |   |   | X |   |
| Profile Wall PVC Pipe (S)                     | X         | X | X | X | X |
| Smooth Wall PVC Pipe (S)                      | X         | X | X |   | X |
| Concrete Drain Tile                           |           |   |   | X |   |
| Clay Drain Tile                               |           |   |   | X |   |

## GENERAL NOTES

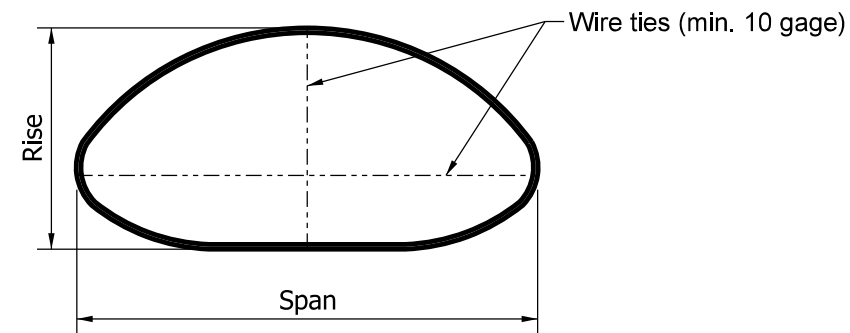
1. The prescribed uses for the pipe types are as follows:
  - a. Type 1 Pipe - Culverts under mainline pavement and public road approaches.
  - b. Type 2 Pipe - Storm sewer pipe.
  - c. Type 3 Pipe - Culverts under driveways and field entrances.
  - d. Type 4 Pipe - Drain tile and longitudinal underdrains.
  - e. Type 5 Pipe - Broken back and other installations requiring coupled pipe.
2. Refer to Standard Drawings E 715-PHCL-01 through E 715-PHCL-23 and E 717-PHCL-01 through E 717-PHCL-10 for allowable heights of cover for various pipe materials (except Type 4 pipes).
3. Refer to Standard Drawings E 715-PSLC-01 through E 715-PSLC-03 for required pipe service life criteria.
4. Any pipe material which is in accordance with the designated pipe type, acceptable for cover conditions, and conforms to service life criteria may be installed.

### LEGEND

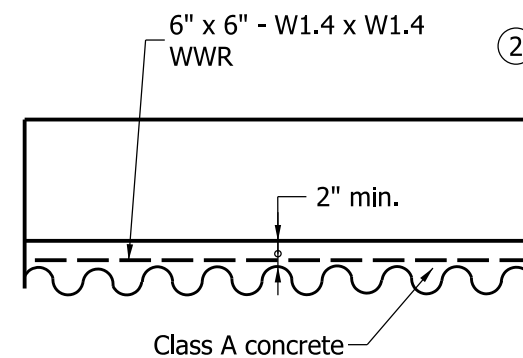
(C)- Corrugated Interior Culvert Pipe.

(S)- Smooth Interior Culvert or Storm Sewer Pipe.

|                                                                                       |                                          |
|---------------------------------------------------------------------------------------|------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                          |
| PIPE CLASSIFICATION TABLES                                                            |                                          |
| SEPTEMBER 2010                                                                        |                                          |
| STANDARD DRAWING NO. E 715-PIPE-01                                                    |                                          |
|  | <i>/s/ Richard L. VanCleave</i> 09/01/10 |
|                                                                                       | DESIGN STANDARDS ENGINEER      DATE      |
|                                                                                       | <i>/s/ Mark A. Miller</i> 09/01/10       |
|                                                                                       | CHIEF HIGHWAY ENGINEER      DATE         |
| DESIGN STANDARDS ENGINEER                                                             |                                          |



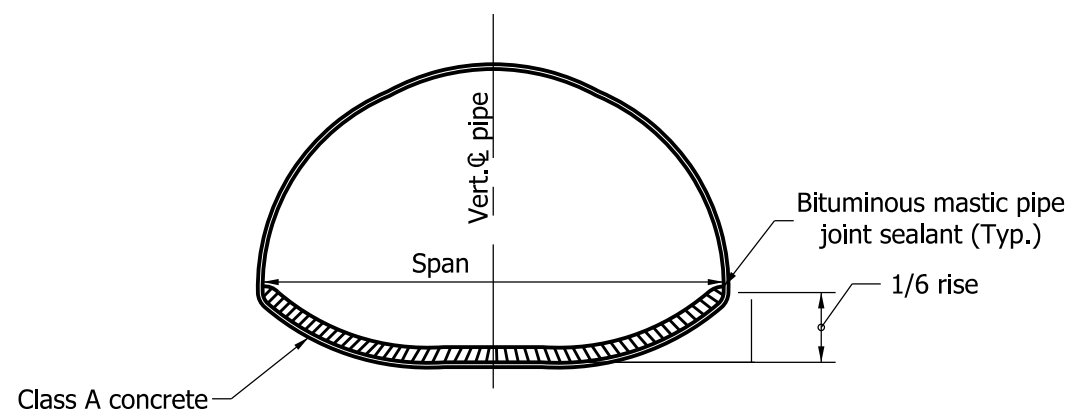
**STEEL PIPE-ARCH SECTIONS  
END STABILIZATION OF 3" x 1" CORRUGATED** ①



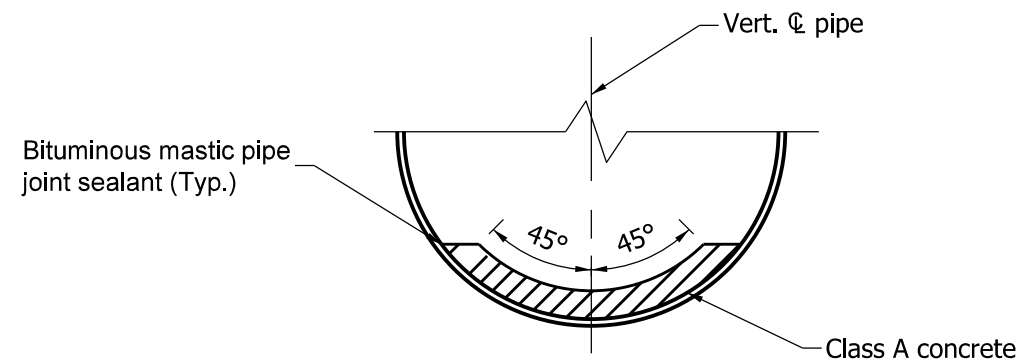
**TYPICAL LONGITUDINAL SECTION**

**NOTES:**

- ① In order to maintain their manufactured shape, all 3" x 1" corrugated steel pipe-arch sections shall have wire ties attached at each end as shown in the detail. The wire ties shall be attached across the largest vertical and horizontal dimension of the pipe-arch. The wire ties shall be installed by the manufacturer and shall remain in place until the on-site installation is complete.
- ② WWR shall be wired to every second circumferential bolt and every twelfth longitudinal bolt.

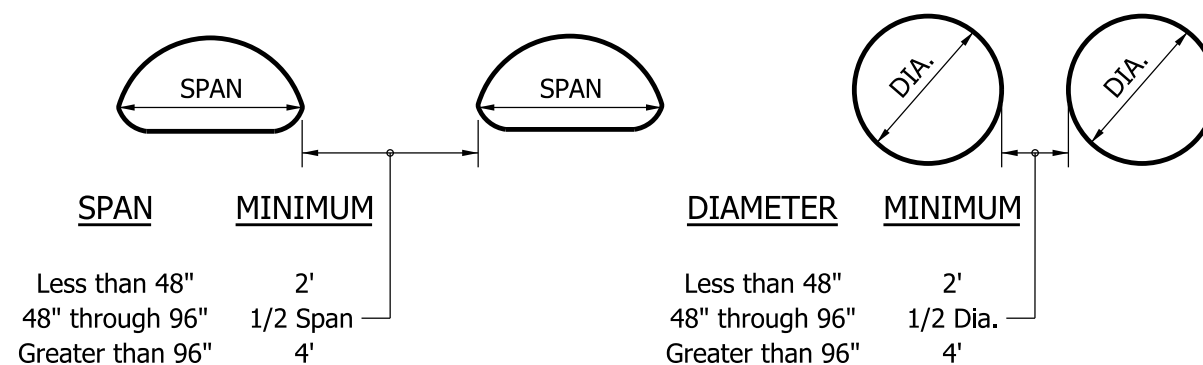


**STRUCTURAL PLATE  
PIPE-ARCH CULVERT  
ELEVATION**



**STRUCTURAL PLATE  
PIPE CULVERT**

**CONCRETE FIELD PAVED INVERT DETAILS**



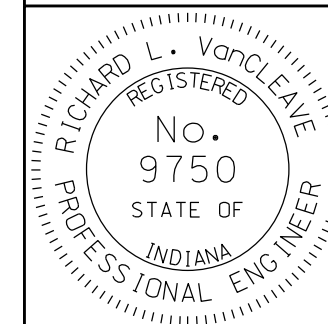
**MULTIPLE INSTALLATIONS**

**INDIANA DEPARTMENT OF TRANSPORTATION**

**MISCELLANEOUS PIPE  
DETAILS**

**SEPTEMBER 2011**

**STANDARD DRAWING NO. E 715-PIPE-02**



**DESIGN STANDARDS ENGINEER**

*/s/ Richard L. Vancleave* 09/01/11  
DESIGN STANDARDS ENGINEER DATE

*/s/ Mark A. Miller* 09/01/11  
CHIEF HIGHWAY ENGINEER DATE



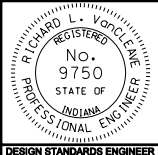
**REQUIREMENTS FOR CORRUGATED STEEL PIPE THICKNESS  
AND PROTECTION AT NON-ABRASIVE SITES**

| pH                                                                | ≤ 4.0  | 4.5    | 5.0    | 5.5   | 6.0   | 6.5   | ≥ 7.0 | Steel Conduit Type                                           |
|-------------------------------------------------------------------|--------|--------|--------|-------|-------|-------|-------|--------------------------------------------------------------|
| Thickness<br>required<br>for 50 year<br>Design<br>Service<br>Life |        |        |        | 0.168 | 0.168 | 0.138 | 0.109 | Zinc Coated Corrugated Steel Pipe                            |
|                                                                   |        |        |        |       |       |       |       | Zinc Coated Corrugated Steel Pipe-Arch                       |
|                                                                   |        |        |        |       |       |       |       | Zinc Coated Corrugated Steel Pipe w/Paved Invert             |
|                                                                   |        |        | 0.138  | 0.109 | 0.109 | 0.079 | 0.064 | Zinc Coated Corrugated Steel Pipe-Arch w/Paved Invert        |
|                                                                   |        |        |        |       |       |       |       | Fully Bituminous Coated and Lined Corrugated Steel Pipe      |
|                                                                   |        |        |        |       |       |       |       | Fully Bituminous Coated and Lined Corrugated Steel Pipe-Arch |
|                                                                   |        |        | 0.138  | 0.109 | 0.109 | 0.079 | 0.064 | Aluminum Coated Type 2 Corrugated Steel Pipe                 |
|                                                                   |        |        |        |       |       |       |       | Aluminum Coated Type 2 Corrugated Steel Pipe-Arch            |
|                                                                   | 0.109  | 0.109  | 0.079  | 0.064 | 0.064 | 0.064 | 0.064 | Polymer Precoated Galvanized Corrugated Steel Pipe           |
|                                                                   |        |        |        |       |       |       |       | Polymer Precoated Galvanized Corrugated Steel Pipe-Arch      |
|                                                                   | 0.111* | 0.111* | 0.111* | 0.170 | 0.111 | 0.111 | 0.111 | Structural Plate Steel Pipe                                  |
|                                                                   |        |        |        |       |       |       |       | Structural Plate Steel Pipe-Arch                             |

\* -- Concrete field paving required

| pH                                                                | ≤ 4.0  | 4.5    | 5.0    | 5.5   | 6.0   | 6.5   | ≥ 7.0 | Steel Conduit Type                                           |
|-------------------------------------------------------------------|--------|--------|--------|-------|-------|-------|-------|--------------------------------------------------------------|
| Thickness<br>required<br>for 75 year<br>Design<br>Service<br>Life |        |        |        |       |       | 0.168 | 0.138 | Zinc Coated Corrugated Steel Pipe                            |
|                                                                   |        |        |        |       |       |       |       | Zinc Coated Corrugated Steel Pipe-Arch                       |
|                                                                   |        |        |        |       |       |       |       | Zinc Coated Corrugated Steel Pipe w/Paved Invert             |
|                                                                   |        |        |        | 0.168 | 0.168 | 0.138 | 0.109 | Zinc Coated Corrugated Steel Pipe-Arch w/Paved Invert        |
|                                                                   |        |        |        |       |       |       |       | Fully Bituminous Coated and Lined Corrugated Steel Pipe      |
|                                                                   |        |        |        |       |       |       |       | Fully Bituminous Coated and Lined Corrugated Steel Pipe-Arch |
|                                                                   |        |        |        |       |       | 0.138 | 0.109 | Aluminum Coated Type 2 Corrugated Steel Pipe                 |
|                                                                   |        |        |        |       |       |       |       | Aluminum Coated Type 2 Corrugated Steel Pipe-Arch            |
|                                                                   |        |        |        | 0.138 | 0.138 | 0.109 | 0.109 | Polymer Precoated Galvanized Corrugated Steel Pipe           |
|                                                                   |        |        |        |       |       |       |       | Polymer Precoated Galvanized Corrugated Steel Pipe-Arch      |
|                                                                   | 0.111* | 0.111* | 0.111* | 0.218 | 0.111 | 0.111 | 0.111 | Structural Plate Steel Pipe                                  |
|                                                                   |        |        |        |       |       |       |       | Structural Plate Steel Pipe-Arch                             |

\* -- Concrete field paving required  
Refer to Standard Drawing E 715-PSLC-03 for General Notes.

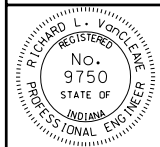
|                                                                                       |                                                                                                                                                             |
|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                             |
| PIPE SERVICE<br>LIFE CRITERIA                                                         |                                                                                                                                                             |
| MARCH 2006                                                                            |                                                                                                                                                             |
| STANDARD DRAWING NO. E 715-PSLC-01                                                    |                                                                                                                                                             |
|  | /s/ Richard L. VanCleave      3-01-06<br>DESIGN STANDARDS ENGINEER      DATE<br><br>/s/ Richard K. Smutzer      3-01-06<br>CHIEF HIGHWAY ENGINEER      DATE |

**REQUIREMENTS FOR CORRUGATED STEEL PIPE THICKNESS  
AND PROTECTION AT ABRASIVE SITES**

| pH                                                 | ≤ 4.0 | 4.5   | 5.0   | 5.5   | 6.0   | 6.5   | ≥ 7.0 | Steel Conduit Type                                                                                                                                                                                                                   |
|----------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Thickness required for 50 year Design Service Life |       |       |       | 0.168 | 0.168 | 0.138 | 0.109 | Zinc Coated Corrugated Steel Pipe w/Paved Invert<br>Zinc Coated Corrugated Steel Pipe-Arch w/Paved Invert<br>Fully Bituminous Coated and Lined Corrugated Steel Pipe<br>Fully Bituminous Coated and Lined Corrugated Steel Pipe-Arch |
|                                                    |       |       | 0.138 | 0.109 | 0.109 | 0.079 | 0.064 | Aluminum Coated Type 2 Corrugated Steel Pipe w/Paved Invert<br>Aluminum Coated Type 2 Corrugated Steel Pipe-Arch w/Paved Invert                                                                                                      |
|                                                    | 0.109 | 0.109 | 0.079 | 0.064 | 0.064 | 0.064 | 0.064 | Polymer Precoated Galvanized Corrugated Steel Pipe<br>Polymer Precoated Galvanized Corrugated Steel Pipe Arch                                                                                                                        |
|                                                    |       |       |       | 0.170 | 0.111 | 0.111 | 0.111 | Structural Plate Steel Pipe w/Concrete Field Paving<br>Structural Plate Steel Pipe-Arch w/Concrete Field Paving                                                                                                                      |

| pH                                                 | ≤ 4.0 | 4.5 | 5.0 | 5.5   | 6.0   | 6.5   | ≥ 7.0 | Steel Conduit Type                                                                                                                                                                                                                   |
|----------------------------------------------------|-------|-----|-----|-------|-------|-------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Thickness required for 75 year Design Service Life |       |     |     |       |       | 0.168 | 0.138 | Zinc Coated Corrugated Steel Pipe w/Paved Invert<br>Zinc Coated Corrugated Steel Pipe-Arch w/Paved Invert<br>Fully Bituminous Coated and Lined Corrugated Steel Pipe<br>Fully Bituminous Coated and Lined Corrugated Steel Pipe-Arch |
|                                                    |       |     |     |       |       | 0.138 | 0.109 | Aluminum Coated Type 2 Corrugated Steel Pipe w/Paved Invert<br>Aluminum Coated Type 2 Corrugated Steel Pipe-Arch w/Paved Invert                                                                                                      |
|                                                    |       |     |     | 0.138 | 0.138 | 0.109 | 0.109 | Polymer Precoated Galvanized Corrugated Steel Pipe<br>Polymer Precoated Galvanized Corrugated Steel Pipe Arch                                                                                                                        |
|                                                    |       |     |     | 0.218 | 0.111 | 0.111 | 0.111 | Structural Plate Steel Pipe w/Concrete Field Paving<br>Structural Plate Steel Pipe-Arch w/Concrete Field Paving                                                                                                                      |

Refer to Standard Drawing E 715-PSLC-03 for General Notes.

|                                                                                       |                                                                              |
|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                              |
| <b>PIPE SERVICE<br/>LIFE CRITERIA</b>                                                 |                                                                              |
| MARCH 2006                                                                            |                                                                              |
| STANDARD DRAWING NO. E 715-PSLC-02                                                    |                                                                              |
|  | /s/ Richard L. VanCleave      3-01-06<br>DESIGN STANDARDS ENGINEER      DATE |
| DESIGN STANDARDS ENGINEER                                                             | /s/ Richard K. Smutzer      3-01-06<br>CHIEF HIGHWAY ENGINEER      DATE      |

### GENERAL NOTES

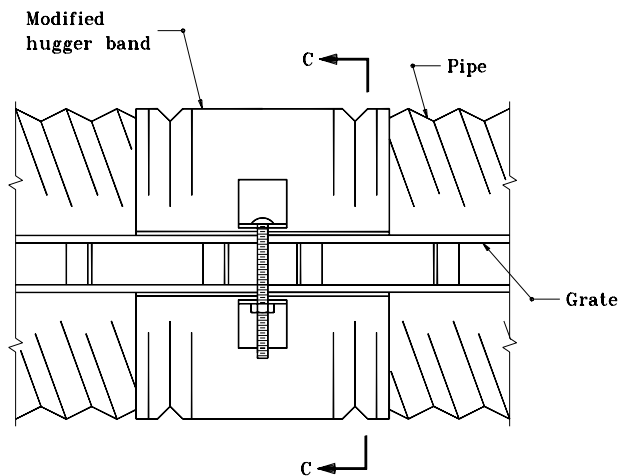
1. "X" entries in the table indicate that a thickness which satisfies the required design service life is not available.
2. The tabulated plate thickness for Structural Plate Steel Pipe and Pipe-Arches reflects the required thickness for the top and side plates. If the tabulated plate thickness is less than 0.280 in. the bottom plates shall be of the next greater available thickness.
3. Corrugated Aluminum Alloy Pipe and Pipe-Arches and Aluminum Alloy Structural Plate Pipe and Pipe-Arches are acceptable with the minimum thickness required to satisfy cover conditions for all non-abrasive sites with a structure pH  $\geq$  5.0.
4. Corrugated Aluminum Alloy Pipe and Pipe-Arches with bituminous paved invert and Aluminum Alloy Structural Plate Pipe and Pipe-Arches with concrete field paving are acceptable with the minimum thickness required to satisfy cover conditions for all abrasive sites with a structure pH  $\geq$  5.0.
5. Service life criteria apply to only reinforced concrete, corrugated metal, and structural plate metal pipe. Other materials which conform to the designated pipe type and height of cover parameters are acceptable for installation.
6. Service life criteria do not apply to Type 4 pipe.

### **REQUIREMENTS FOR REINFORCED CONCRETE PIPE PROTECTION**

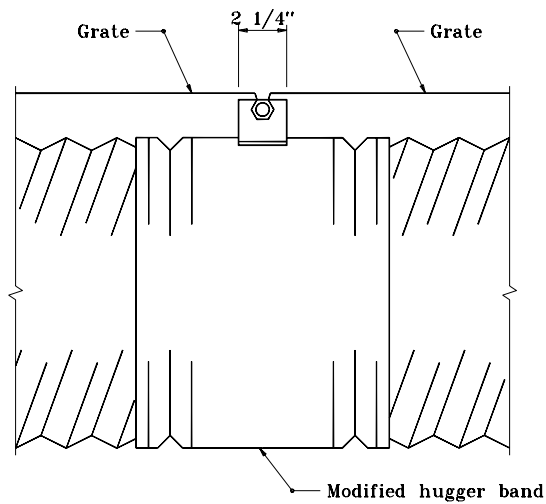
| Pipe Slope       | Minimum pH to Attain<br>Design Service Life |         |
|------------------|---------------------------------------------|---------|
|                  | 50 Year                                     | 75 Year |
| Less than 3%     | 4.0                                         | 4.5     |
| 3% to 10%        | 4.5                                         | 5.0     |
| Greater than 10% | 5.0                                         | 5.5     |

For a structure pH lower than the minimums listed above, reinforced concrete pipe shall not be used.

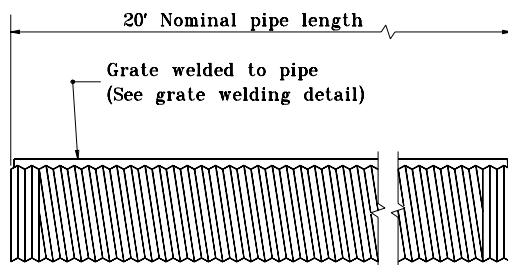
|                                                                                       |                                       |
|---------------------------------------------------------------------------------------|---------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                       |
| <b>PIPE SERVICE<br/>LIFE CRITERIA</b>                                                 |                                       |
| JANUARY 1998                                                                          |                                       |
| <b>STANDARD DRAWING NO. E 715-PSLC-03</b>                                             |                                       |
|  | DETAILS PLACED IN THIS FORMAT 7-27-99 |
| /s/ Anthony L. Uremovich<br>DESIGN STANDARDS ENGINEER                                 | 7-27-99<br>DATE                       |
| /s/ Firooz Zandi<br>CHIEF HIGHWAY ENGINEER                                            | 7-27-99<br>DATE                       |
| DESIGN STANDARDS ENGINEER                                                             | ORIGINALLY APPROVED 1-02-98           |



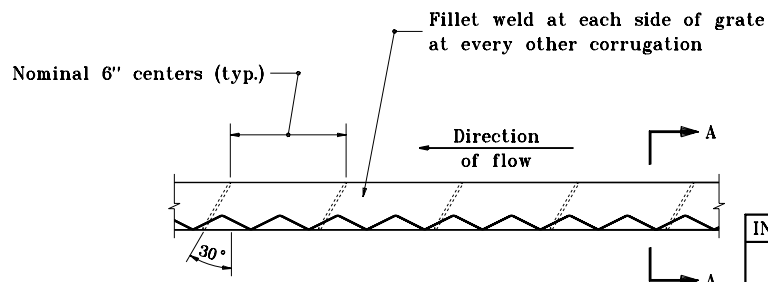
**MODIFIED HUGGER BAND**  
**TOP VIEW**



**MODIFIED HUGGER BAND**  
**SIDE VIEW**



**TYPICAL PIPE SECTION**



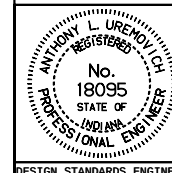
**GRATE WELDING DETAIL**

INDIANA DEPARTMENT OF TRANSPORTATION

**SLOTTED DRAIN PIPE**

APRIL 1995

STANDARD DRAWING NO. **E 715-SDLR-01**



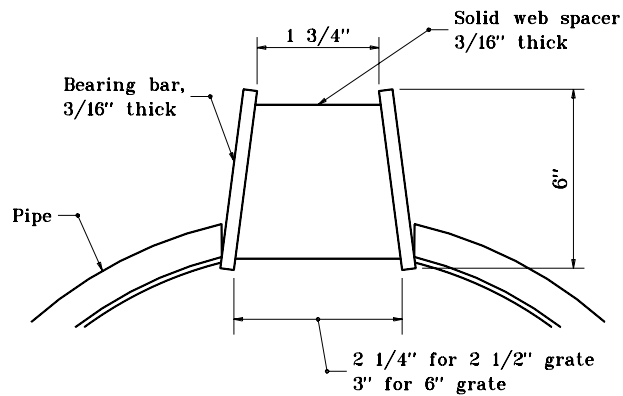
DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

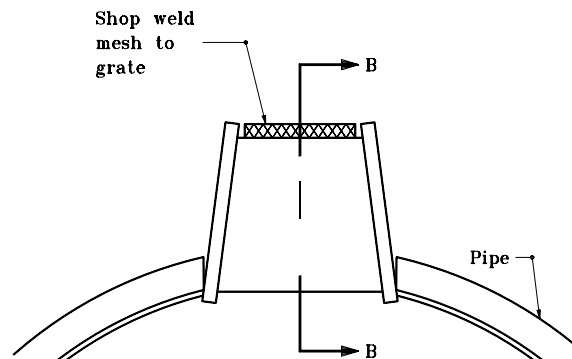
/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

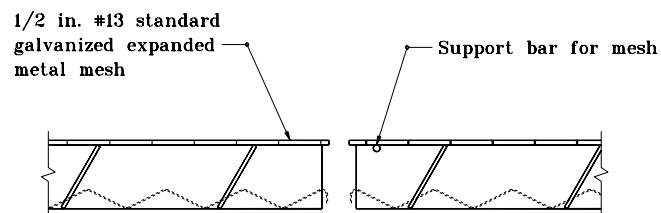
ORIGINALLY APPROVED 4-04-95



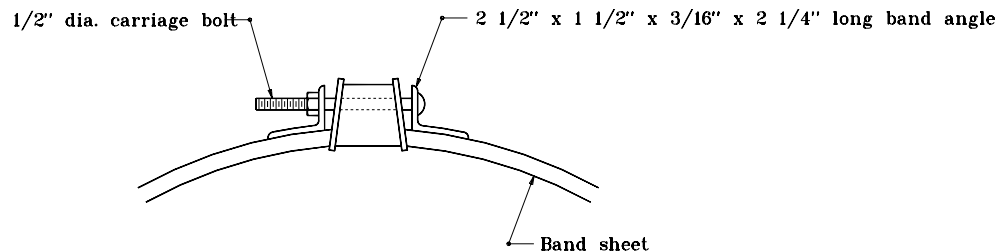
**SECTION A-A**  
**STANDARD GRATE DETAIL**



**SECTION A-A**  
**GRATE DETAIL WITH MESH**



**SECTION B-B**



**SECTION C-C**

| STANDARD SIZES       |                        |      |      |      |    |    |
|----------------------|------------------------|------|------|------|----|----|
| PIPE THICKNESS (IN.) | DIAMETER OF PIPE (IN.) |      |      |      |    |    |
|                      | 12                     | 15   | 18   | 24   | 30 | 36 |
| 0.064                | X                      | X    | X    | X    | X  | X  |
| 0.079                | X                      | X    | X    | X    | X  | X  |
| 0.109                | N.A.                   | N.A. | N.A. | N.A. | X  | X  |

X - Size available for designated thickness

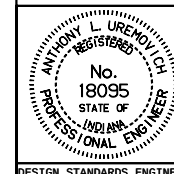
N.A. - Size not available for designated thickness

INDIANA DEPARTMENT OF TRANSPORTATION

**SLOTTED DRAIN PIPE**

JANUARY 1998

STANDARD DRAWING NO. **E 715-SLDR-02**



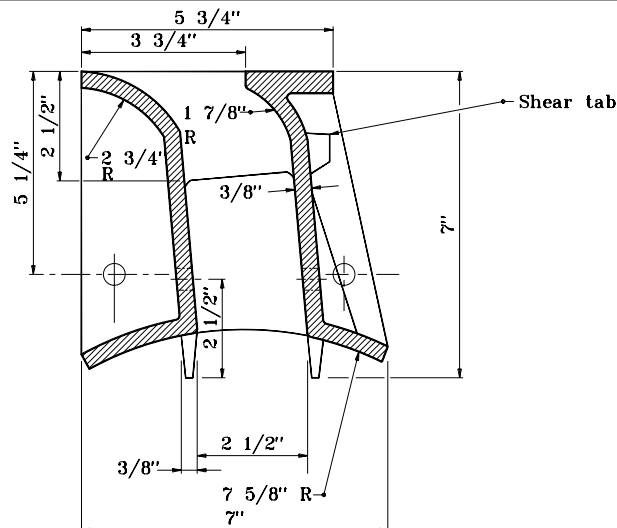
DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

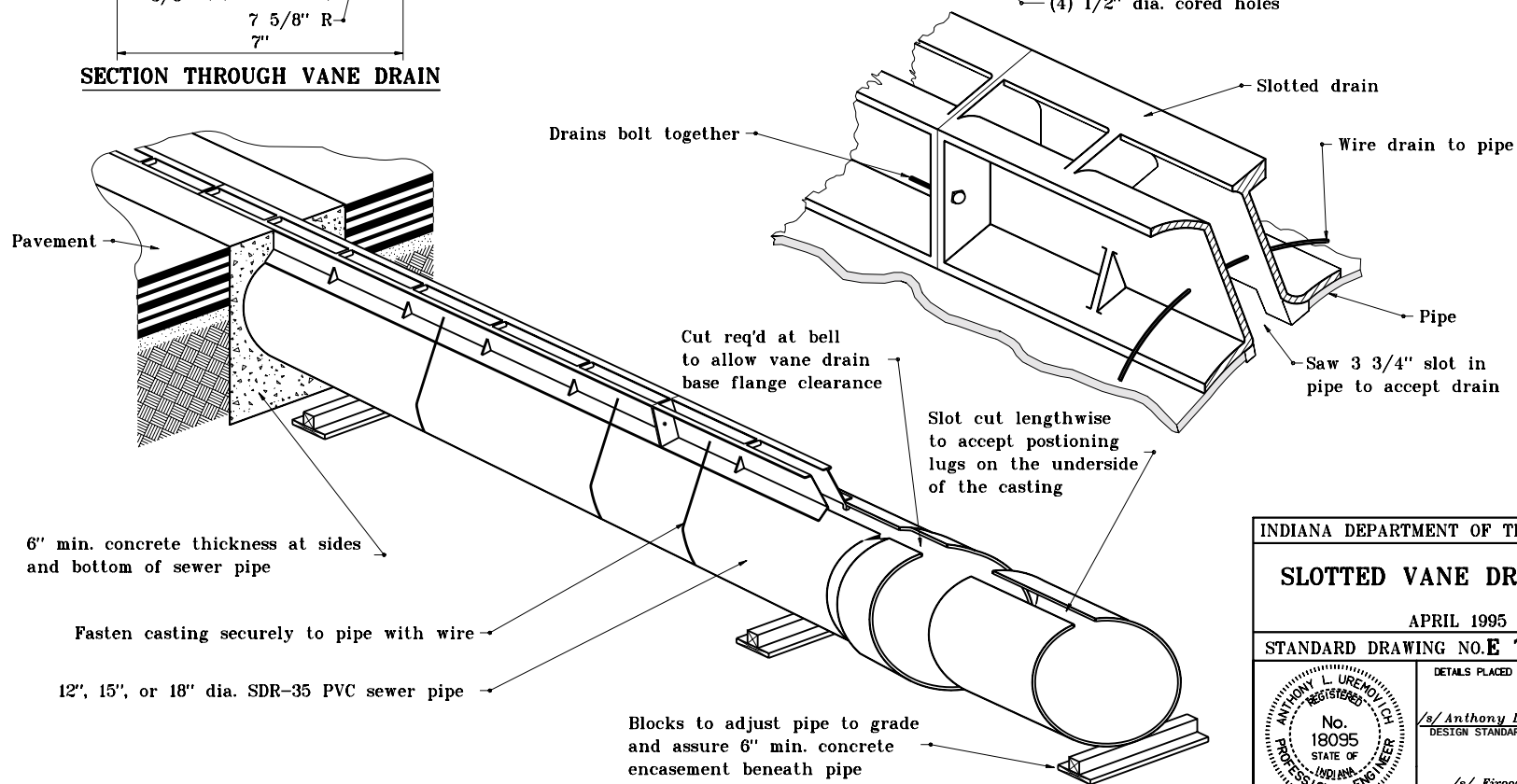
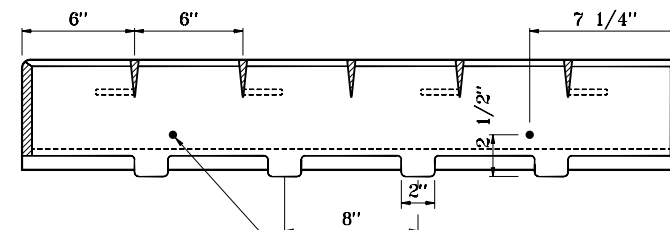
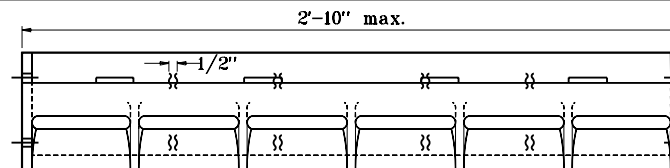
/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

ORIGINALLY APPROVED 1-02-98



**SECTION THROUGH VANE DRAIN**

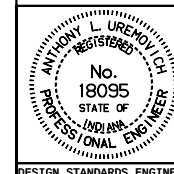


INDIANA DEPARTMENT OF TRANSPORTATION

# **SLOTTED VANE DRAIN PIPE**

APRIL 1995

STANDARD DRAWING NO. **E 715-SLDR-03**



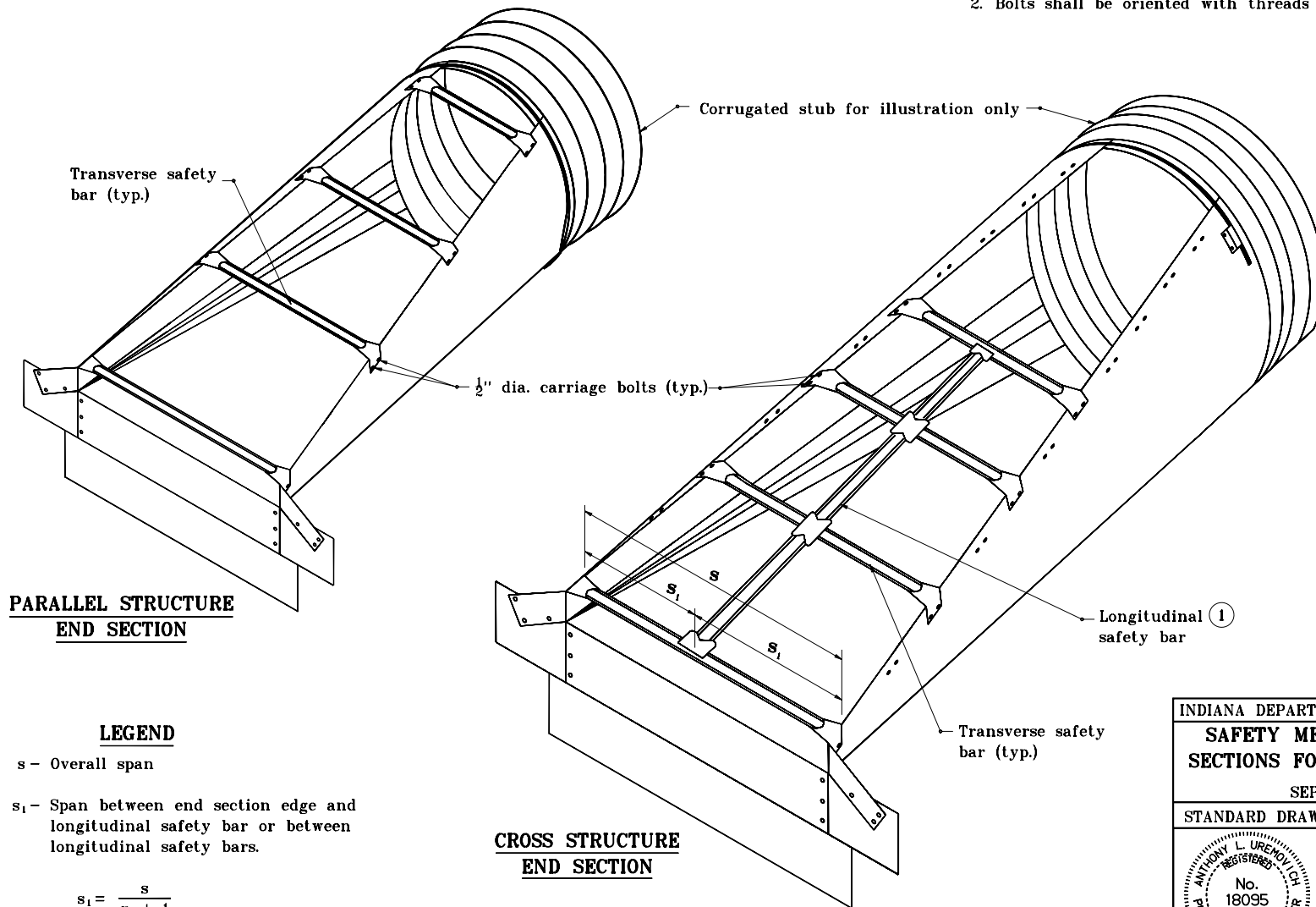
DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

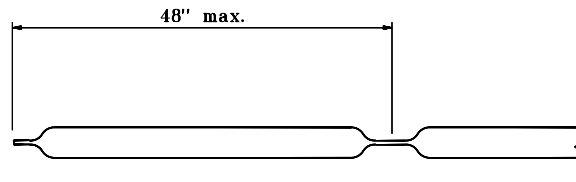
/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE  
ORIGINALLY APPROVED 4-03-95

## GENERAL NOTES

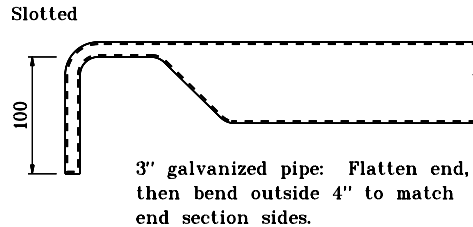
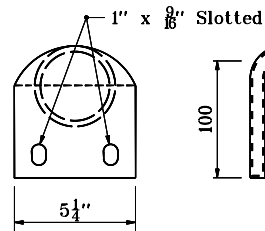
- ① Longitudinal safety bar shall be welded to transverse bars. For cross structure and section, if  $S < 2'-6"$ , no longitudinal safety bar is required. If  $S > 2'-6"$ , longitudinal safety bar(s) shall be provided so  $S_1 < 2'-6"$ .
2. Bolts shall be oriented with threads to inside of end section.



|                                                                  |                                                                    |
|------------------------------------------------------------------|--------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                             |                                                                    |
| <b>SAFETY METAL CULVERT END<br/>SECTIONS FOR CORRUGATED PIPE</b> |                                                                    |
| SEPTEMBER 2000                                                   |                                                                    |
| STANDARD DRAWING NO. <b>E 715-SMES-01</b>                        |                                                                    |
|                                                                  | /s/ Anthony L. Uremovich 9-01-00<br>DESIGN STANDARDS ENGINEER DATE |
|                                                                  | /s/ Firooz Zandi 9-01-00<br>CHIEF HIGHWAY ENGINEER DATE            |
| DESIGN STANDARDS ENGINEER                                        |                                                                    |

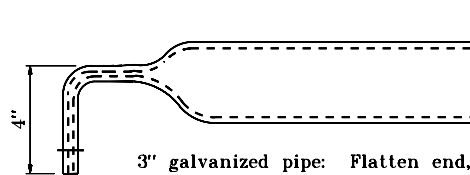
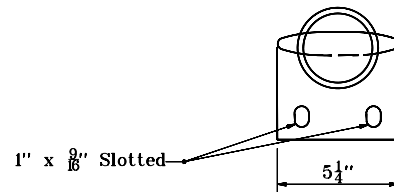


**LONGITUDINAL SAFETY BAR DETAIL**



3" galvanized pipe: Flatten end, then bend outside 4" to match end section sides.

OR



3" galvanized pipe: Flatten end, then bend outside 4" to match end section sides.

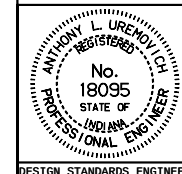
**TRANSVERSE SAFETY BAR DETAILS**

INDIANA DEPARTMENT OF TRANSPORTATION

**SAFETY METAL CULVERT END  
SECTIONS FOR CORRUGATED PIPE**

JANUARY 1998

STANDARD DRAWING NO. **E 715-SMES-02**



DETAILS PLACED IN THIS FORMAT 7-27-99

/s/ Anthony L. Uremovich 7-27-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 7-27-99  
CHIEF HIGHWAY ENGINEER DATE

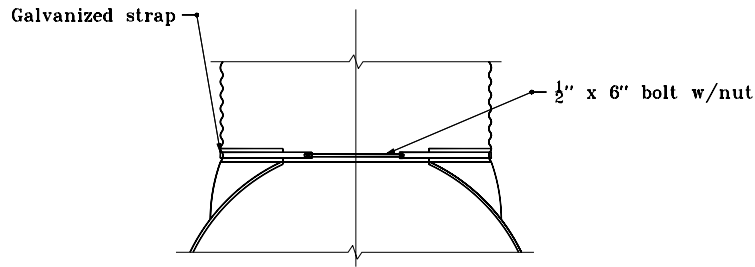
DESIGN STANDARDS ENGINEER

ORIGINALLY APPROVED 1-02-98



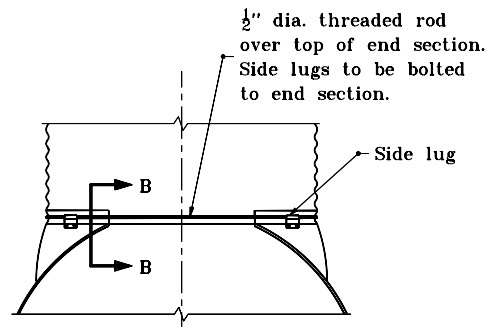
## GENERAL NOTES

1. For circular pipe diameters through 24", attach end section to pipe with type 1 connector. For all other sizes, attach end section to pipe with type 2 connector.



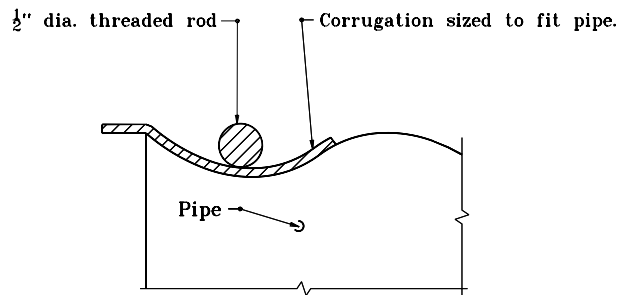
### TYPE 1 CONNECTOR DETAIL

Through 24" dia.



### TYPE 2 CONNECTOR DETAIL

For all circular pipes larger than 24"  
and all pipe-arches



### SECTION B-B

INDIANA DEPARTMENT OF TRANSPORTATION

**SAFETY METAL CULVERT END  
SECTIONS FOR CORRUGATED PIPE**

JANUARY 1998

STANDARD DRAWING NO. **E 715-SMES-03**

DETAILS PLACED IN THIS FORMAT 7-27-99

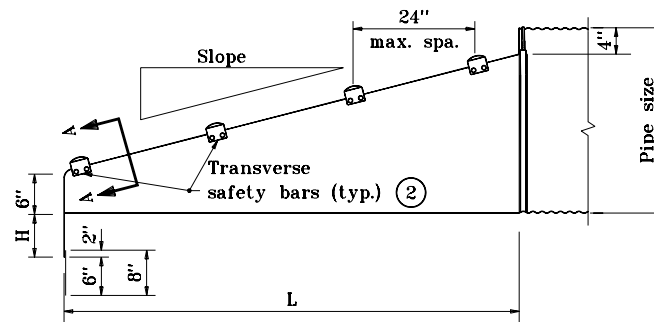


/s/ Anthony L. Uremovich 7-27-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 7-27-99  
CHIEF HIGHWAY ENGINEER DATE

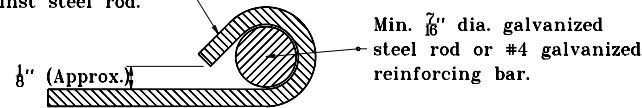
DESIGN STANDARDS ENGINEER

ORIGINALLY APPROVED 1-02-98

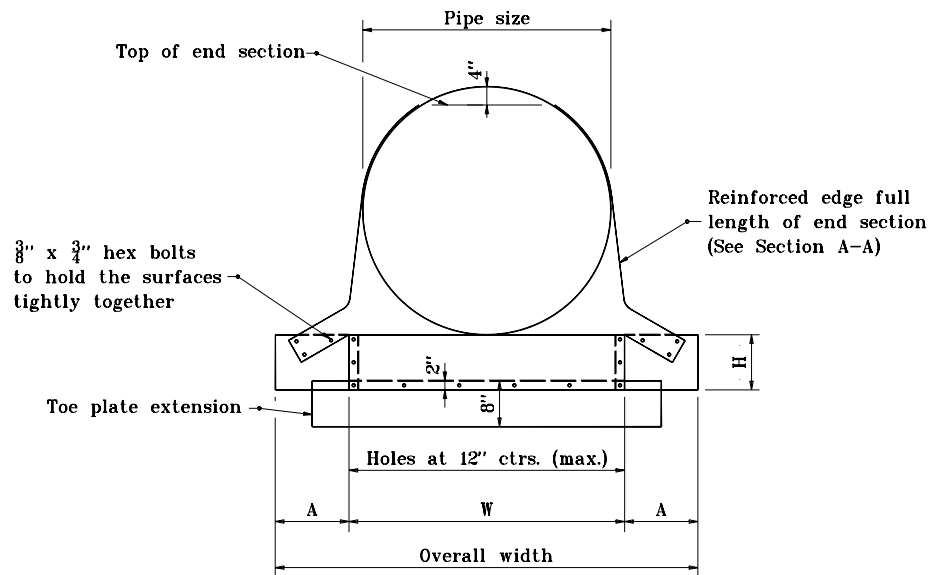


**SIDE ELEVATION OF PARALLEL STRUCTURE END SECTION**

Edge of sidewall sheet rolled snugly against steel rod.



**SECTION A-A**



**FRONT VIEW**

## GENERAL NOTES

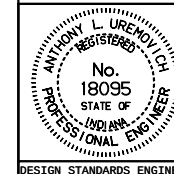
1. See Standard Drawing E 715-SMES-06 for variable dimensions.
2. Transverse safety bars shall be schedule 40 galvanized steel pipe. Pipe shall be galvanized after forming. Number of bars required will vary depending on the length of the end sections.
3. The toe plate extension shall be the same thickness as the end section. The dimension shall be the end section overall width less 6".

INDIANA DEPARTMENT OF TRANSPORTATION

**SAFETY METAL CULVERT END  
SECTIONS FOR CORRUGATED PIPE**

JANUARY 1998

STANDARD DRAWING NO. **E 715-SMES-04**



DETAILS PLACED IN THIS FORMAT 7-27-99

/s/ Anthony L. Uremovich 7-27-99  
DESIGN STANDARDS ENGINEER DATE

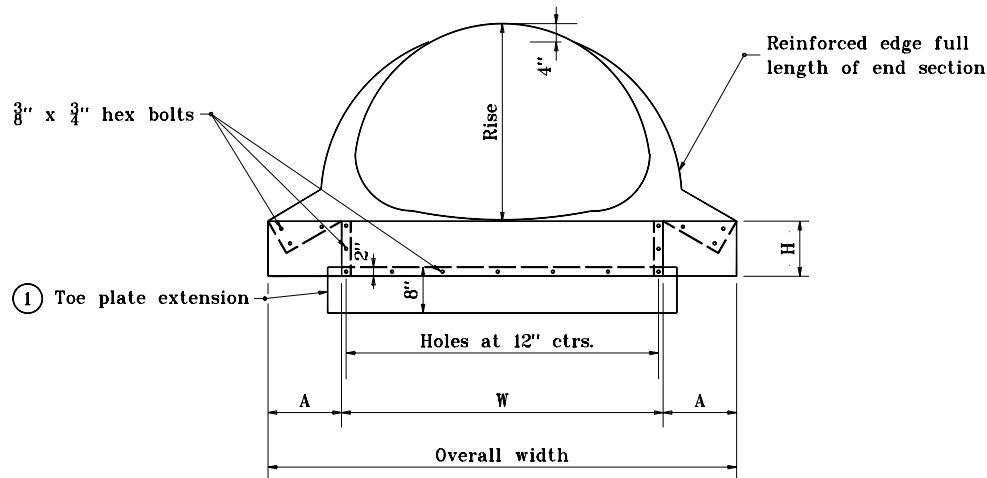
/s/ Firooz Zandi 7-27-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

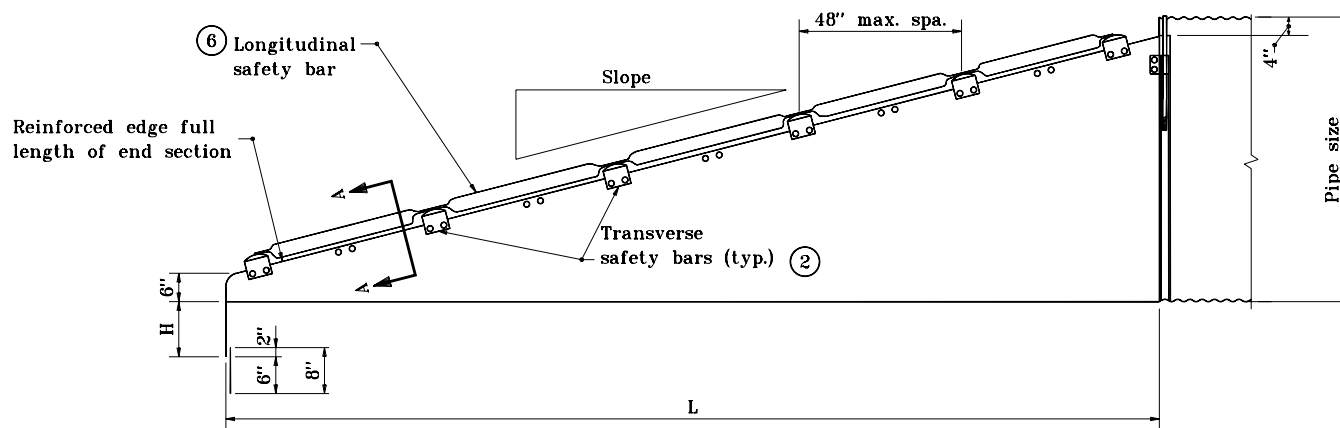
ORIGINALLY APPROVED 1-02-98

## GENERAL NOTES

- ① Toe plate extension shall be the same thickness as the end section. Dimension shall be overall width less 6".
- ② Transverse safety bars shall be Schedule 40 galvanized steel pipe. Pipe shall be galvanized after forming. Number of bars required will vary depending on the length of the end sections.
3. Slotted holes for safety bar attachment shall be provided for all end sections.
4. See Standard Drawing E 715-SMES-04 for Section A-A.
5. See Standard Drawing E 715-SMES-06 for variable dimensions.
- ⑥ See Standard Drawing E 715-SMES-01 for warrant of longitudinal safety bar.



**FRONT VIEW**



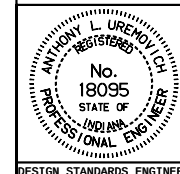
**SIDE ELEVATION FOR CROSS STRUCTURE END SECTION**

INDIANA DEPARTMENT OF TRANSPORTATION

### SAFETY METAL CULVERT END SECTIONS FOR CORRUGATED PIPE

JANUARY 1998

STANDARD DRAWING NO.E 715-SMES-05



DETAILS PLACED IN THIS FORMAT 7-27-99

/s/ Anthony L. Uremovich 7-27-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 7-27-99  
CHIEF HIGHWAY ENGINEER DATE  
ORIGINALLY APPROVED 1-02-98

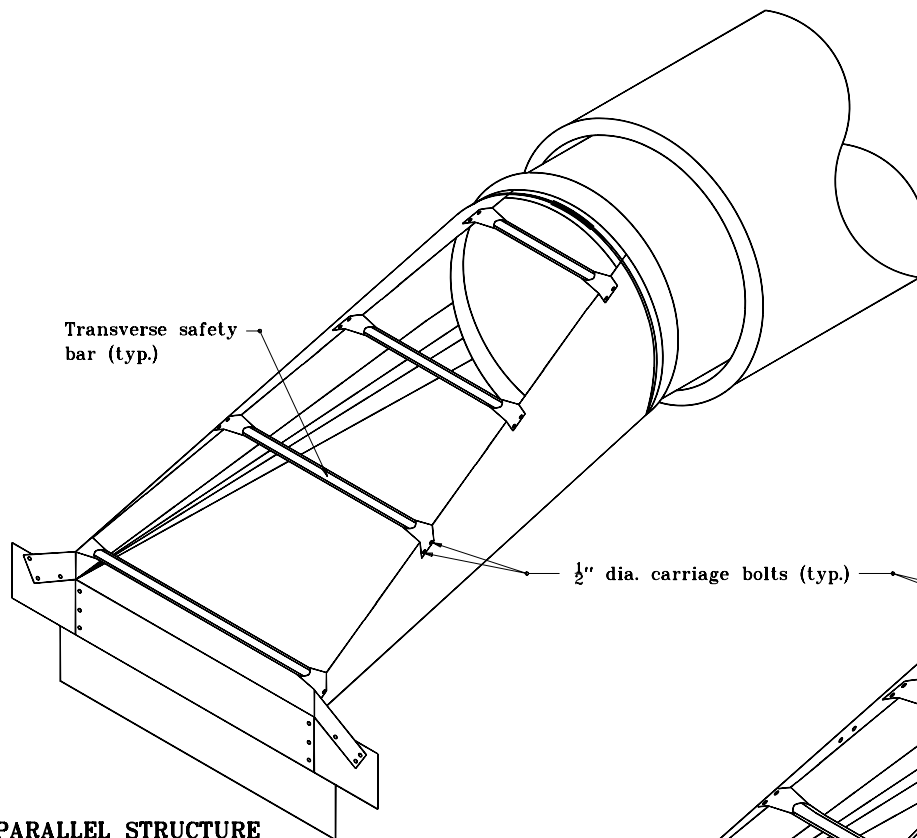
| METAL END SECTIONS FOR CIRCULAR PIPES |                |                 |    |    |                  |              |                 |       |                 |
|---------------------------------------|----------------|-----------------|----|----|------------------|--------------|-----------------|-------|-----------------|
| Pipe<br>Dia.                          | Min.<br>Thick. | Dimensions, in. |    |    |                  | L Dimensions |                 |       |                 |
|                                       |                | A               | H  | W  | Overall<br>Width | Slope        | Length<br>(in.) | Slope | Length<br>(in.) |
| 15                                    | .064           | 8               | 6  | 37 | 37               | 4:1          | 20              | 6:1   | 30              |
| 18                                    | .064           | 8               | 6  | 40 | 40               | 4:1          | 32              | 6:1   | 48              |
| 21                                    | .064           | 8               | 6  | 43 | 43               | 4:1          | 44              | 6:1   | 66              |
| 24                                    | .064           | 8               | 6  | 46 | 46               | 4:1          | 56              | 6:1   | 84              |
| 30                                    | .109           | 12              | 9  | 60 | 60               | 4:1          | 80              | 6:1   | 120             |
| 36                                    | .109           | 12              | 9  | 66 | 66               | 4:1          | 104             | 6:1   | 156             |
| 42                                    | .109           | 16              | 12 | 80 | 80               | 4:1          | 128             | 6:1   | 192             |
| 48                                    | .109           | 16              | 12 | 86 | 86               | 4:1          | 152             | 6:1   | 228             |
| 54                                    | .109           | 16              | 12 | 92 | 92               | 4:1          | 176             | 6:1   | 264             |
| 60                                    | .109           | 16              | 12 | 66 | 98               | 4:1          | 200             | 6:1   | 300             |

| SAFETY METAL END SECTIONS FOR PIPE-ARCHES |          |      |                       |                 |    |    |                  |              |                 |       |                 |
|-------------------------------------------|----------|------|-----------------------|-----------------|----|----|------------------|--------------|-----------------|-------|-----------------|
| Equiv.<br>Dia.<br>(in.)                   | (inches) |      | Min.<br>Thick.<br>in. | Dimensions, in. |    |    |                  | L Dimensions |                 |       |                 |
|                                           | Span     | Rise |                       | A               | H  | W  | Overall<br>Width | Slope        | Length<br>(in.) | Slope | Length<br>(in.) |
| 18                                        | 21       | 15   | .064                  | 8               | 6  | 27 | 43               | 4:1          | 20              | 6:1   | 30              |
| 21                                        | 24       | 18   | .064                  | 8               | 6  | 30 | 46               | 4:1          | 32              | 6:1   | 48              |
| 24                                        | 28       | 20   | .064                  | 8               | 6  | 34 | 50               | 4:1          | 40              | 6:1   | 60              |
| 30                                        | 35       | 24   | .079                  | 12              | 9  | 41 | 65               | 4:1          | 56              | 6:1   | 84              |
| 36                                        | 42       | 29   | .109                  | 12              | 9  | 48 | 72               | 4:1          | 76              | 6:1   | 114             |
| 42                                        | 49       | 33   | .109                  | 16              | 12 | 55 | 87               | 4:1          | 92              | 6:1   | 138             |
| 48                                        | 57       | 38   | .109                  | 16              | 12 | 63 | 95               | 4:1          | 112             | 6:1   | 168             |
| 54                                        | 64       | 43   | .109                  | 16              | 12 | 70 | 102              | 4:1          | 132             | 6:1   | 198             |
| 60                                        | 71       | 47   | .109                  | 16              | 12 | 77 | 109              | 4:1          | 148             | 6:1   | 222             |
| 72                                        | 83       | 57   | .109                  | 16              | 12 | 89 | 121              | 4:1          | 188             | 6:1   | 282             |

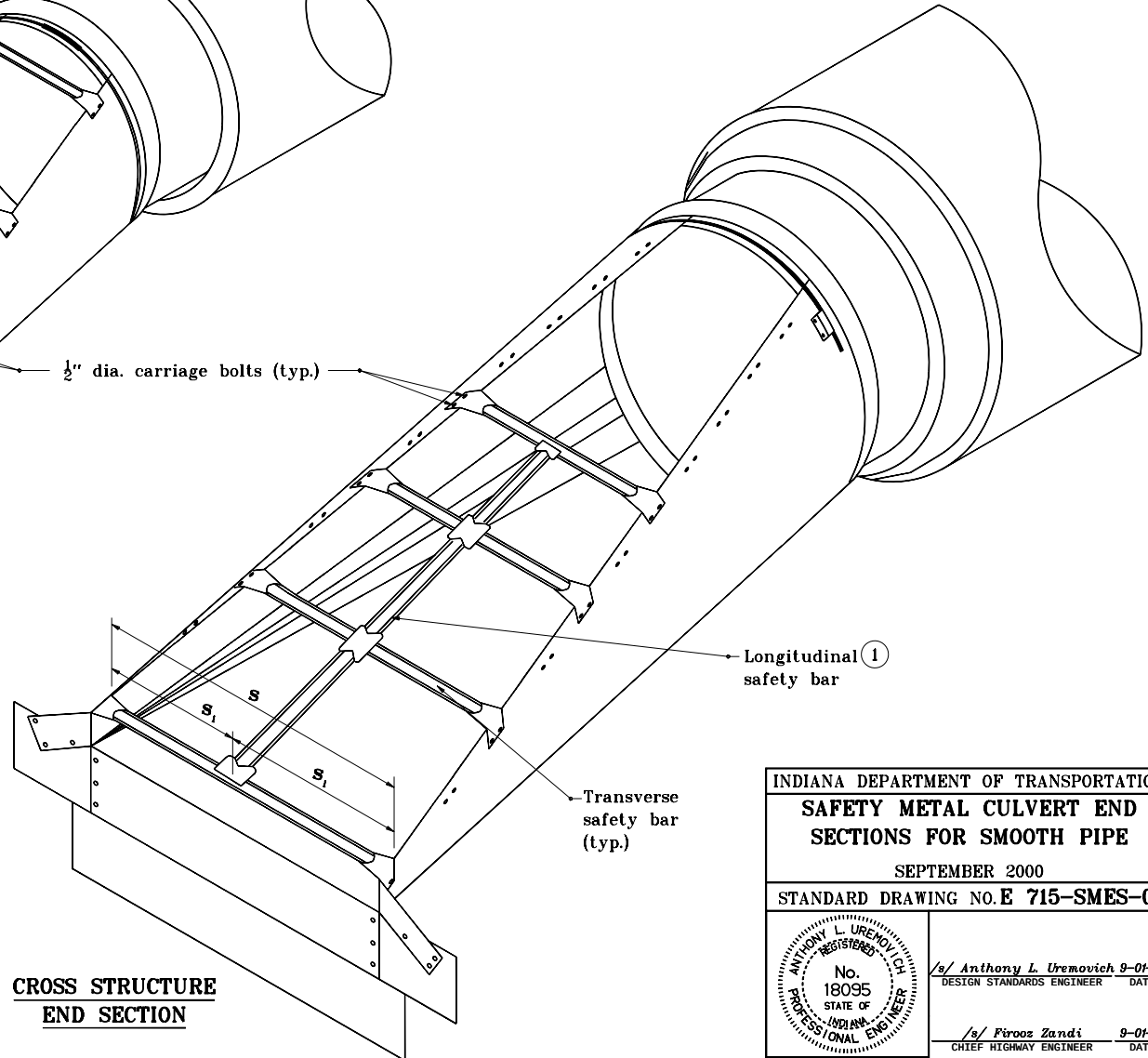
|                                                                                       |                                                                     |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                     |
| SAFETY METAL CULVERT END SECTIONS FOR CORRUGATED PIPE                                 |                                                                     |
| JANUARY 1998                                                                          |                                                                     |
| STANDARD DRAWING NO. E 715-SMES-06                                                    |                                                                     |
|  | DETAILS PLACED IN THIS FORMAT 11-15-99                              |
|                                                                                       | /s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE |
|                                                                                       | /s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE            |
|                                                                                       | DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 1-02-98               |

## GENERAL NOTES

- ① Longitudinal safety bar shall be welded to transverse bars. For cross structure and section, if  $S < 2'-6"$ , no longitudinal safety bar is required. If  $S > 2'-6"$ , longitudinal safety bar(s) shall be provided so  $S_1 < 2'-6"$ .
2. Bolts shall be oriented with threads to inside of end section.



**PARALLEL STRUCTURE  
END SECTION**



**CROSS STRUCTURE  
END SECTION**

## LEGEND

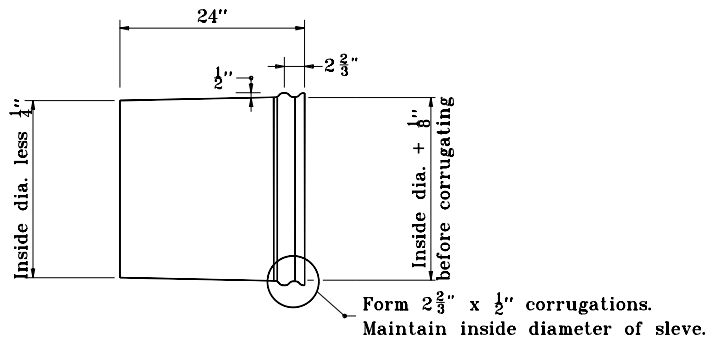
$s$  - Overall span

$s_1$  - Span between end section edge and longitudinal safety bar or between longitudinal safety bars.

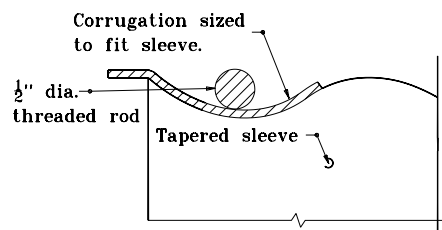
$$s_1 = \frac{s}{n + 1}$$

where  $n$  = Number of longitudinal safety bars

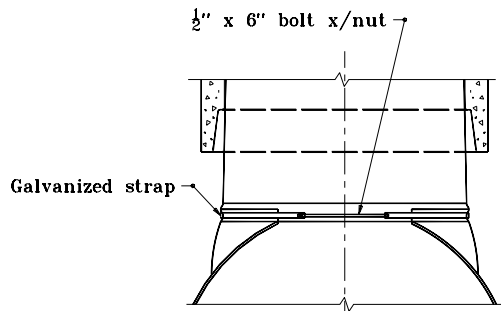
|                                                   |                                                                    |
|---------------------------------------------------|--------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION              |                                                                    |
| SAFETY METAL CULVERT END SECTIONS FOR SMOOTH PIPE |                                                                    |
| SEPTEMBER 2000                                    |                                                                    |
| STANDARD DRAWING NO. E 715-SMES-07                |                                                                    |
|                                                   | /s/ Anthony L. Uremovich 9-01-00<br>DESIGN STANDARDS ENGINEER DATE |
|                                                   | /s/ Firooz Zandi 9-01-00<br>CHIEF HIGHWAY ENGINEER DATE            |



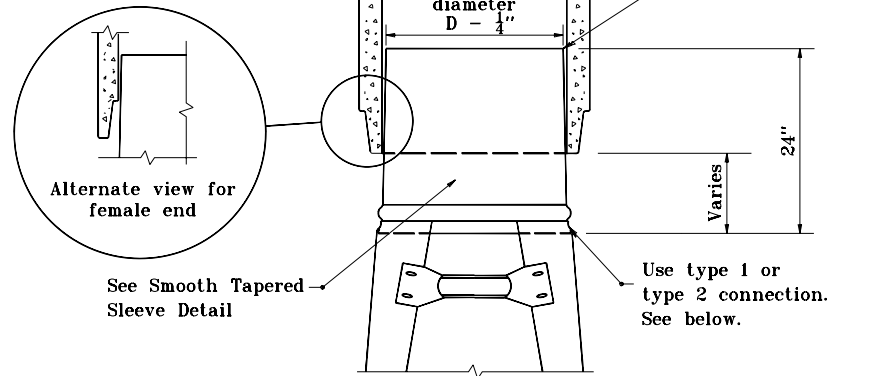
### SMOOTH TAPERED SLEEVE DETAIL



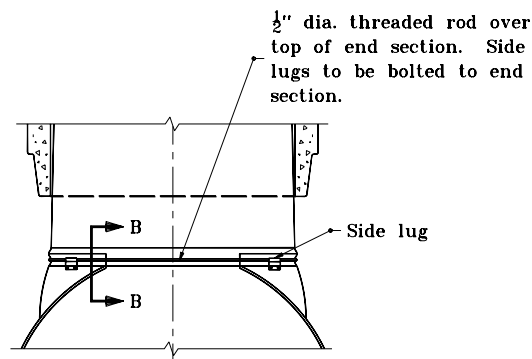
### SECTION B-B



### TYPE 1 CONNECTOR DETAIL for all circular pipes through 24"



### TAPERED SLEEVE FOR ATTACHING STEEL END SECTION TO SMOOTH INTERIOR PIPE

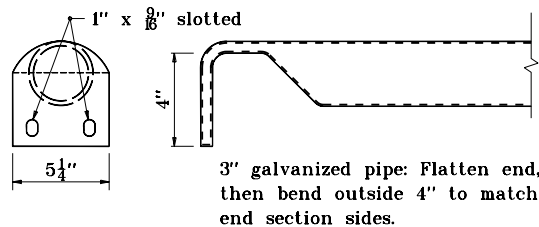


### TYPE 2 CONNECTOR DETAIL all circular pipes larger than 24" and all horizontal elliptical pipes

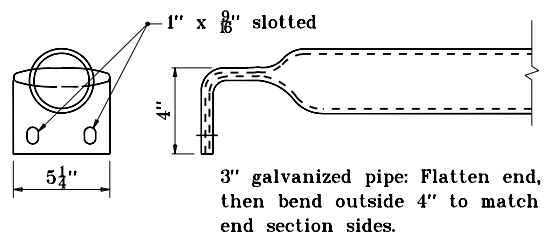
### GENERAL NOTES

1. For circular pipe diameters through 24", attach end section to pipe with type 1 connector. For all other sizes, attach end section to pipe with type 2 connector.

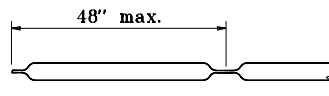
|                                                   |                                                                    |
|---------------------------------------------------|--------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION              |                                                                    |
| SAFETY METAL CULVERT END SECTIONS FOR SMOOTH PIPE |                                                                    |
| JANUARY 1998                                      |                                                                    |
| STANDARD DRAWING NO. E 715-SMES-08                |                                                                    |
| DETAILS PLACED IN THIS FORMAT 7-27-99             |                                                                    |
|                                                   | /s/ Anthony L. Uremovich 7-27-99<br>DESIGN STANDARDS ENGINEER DATE |
|                                                   | /s/ Firooz Zandi 7-27-99<br>CHIEF HIGHWAY ENGINEER DATE            |
|                                                   | ORIGINALLY APPROVED 1-02-98                                        |



OR



### TRANSVERSE SAFETY BAR DETAILS



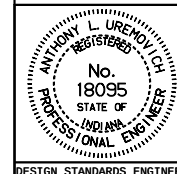
### LONGITUDINAL SAFETY BAR DETAIL

INDIANA DEPARTMENT OF TRANSPORTATION

### SAFETY METAL CULVERT END SECTIONS FOR SMOOTH PIPE

JANUARY 1998

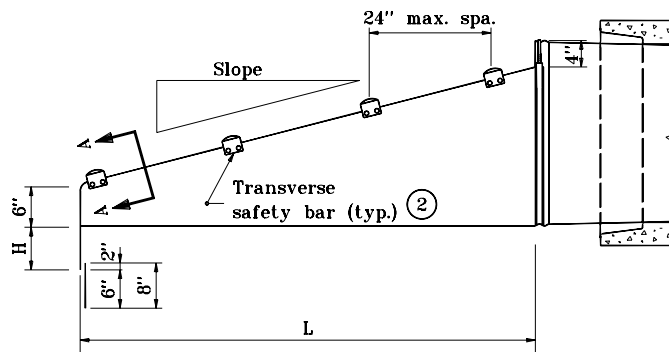
STANDARD DRAWING NO. **E 715-SMES-09**



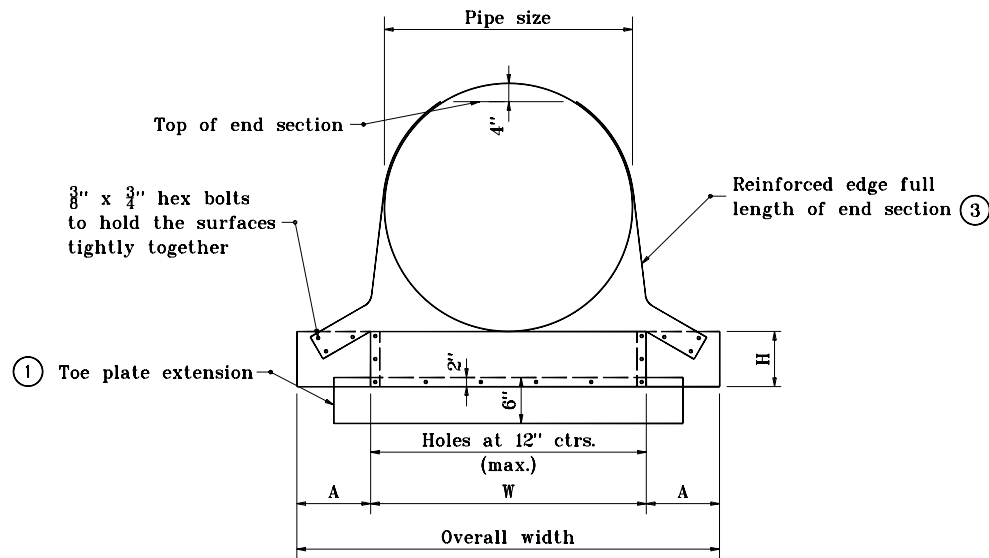
DETAILS PLACED IN THIS FORMAT 7-27-99

/s/ Anthony L. Uremovich 7-27-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 7-27-99  
CHIEF HIGHWAY ENGINEER DATE  
ORIGINALLY APPROVED 1-02-98



**SIDE ELEVATION OF PARALLEL STRUCTURE END SECTION**



**FRONT VIEW**

**GENERAL NOTES**

- ① Toe plate extension is to be the same thickness as the end section. Dimension shall be end section overall width less 6".
- ② Transverse safety bars shall be Schedule 40 galvanized steel pipe. Pipe to be galvanized after forming. Number of bars req'd will vary depending on the length of the end section.
- ③ See Standard Drawing E 715-SMES-11 for Section A-A.
4. See Standard Drawing E 715-SMES-12 for variable dimensions.

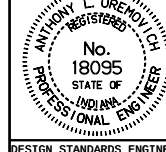
INDIANA DEPARTMENT OF TRANSPORTATION

**SAFETY METAL CULVERT END  
SECTIONS FOR SMOOTH PIPE**

JANUARY 1998

**STANDARD DRAWING NO. E 715-SMES-10**

DETAILS PLACED IN THIS FORMAT 7-27-99



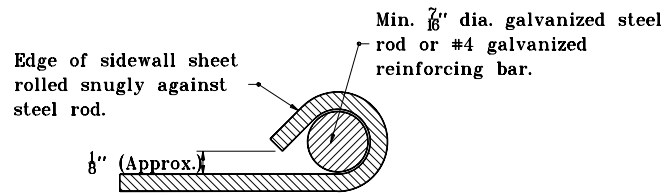
/s/ Anthony L. Uremovich 7-27-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 7-27-99  
CHIEF HIGHWAY ENGINEER DATE  
ORIGINALLY APPROVED 1-02-98

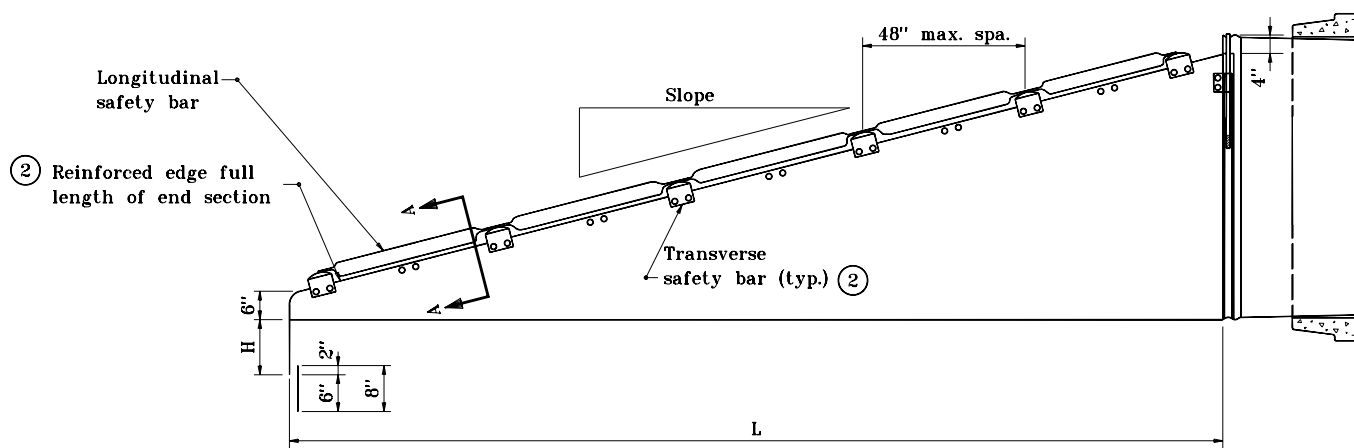


## GENERAL NOTES

- ① Toe plate extension is to be the same thickness as the end section. Dimensions shall be overall width less 6", by 8" high.
- ② Transverse safety bars shall be Schedule 40 galvanized steel pipe. Pipe to be galvanized after forming. Number of bars req'd. will vary depending on the length of the end section.
3. Slotted holes for safety bar attachment shall be provided for all end sections.
4. See Standard Drawing E 715-SMES-12 for variable dimensions.
- ⑤ See Standard Drawing E 715-SMES-07 for warrant of longitudinal safety bar.



**SECTION A-A**



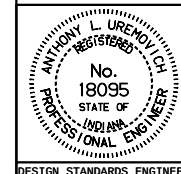
**SIDE ELEVATION FOR CROSS STRUCTURE END SECTION**

INDIANA DEPARTMENT OF TRANSPORTATION

## SAFETY METAL CULVERT END SECTIONS FOR SMOOTH PIPE

JANUARY 1998

STANDARD DRAWING NO. E 715-SMES-11



DETAILS PLACED IN THIS FORMAT 7-27-99

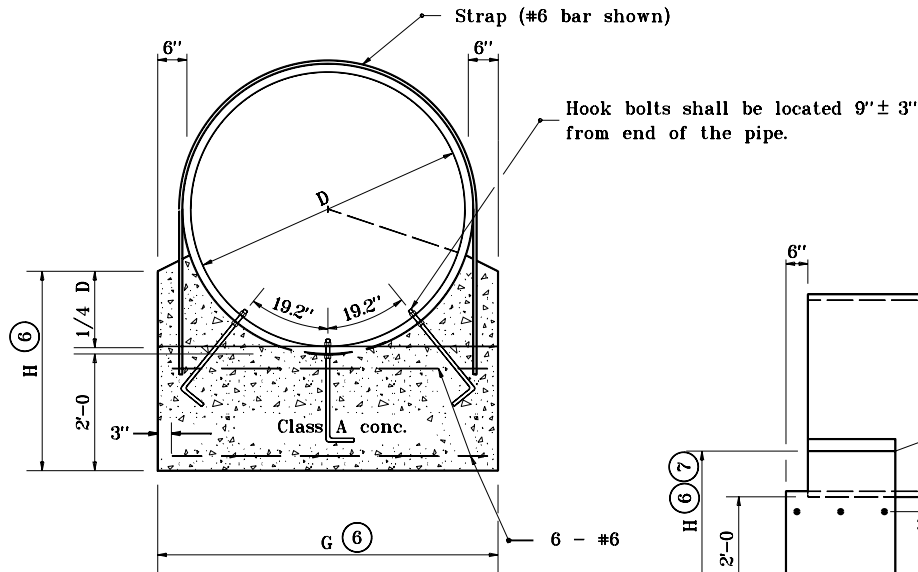
/s/ Anthony L. Uremovich 7-27-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 7-27-99  
CHIEF HIGHWAY ENGINEER DATE  
ORIGINALLY APPROVED 1-02-98

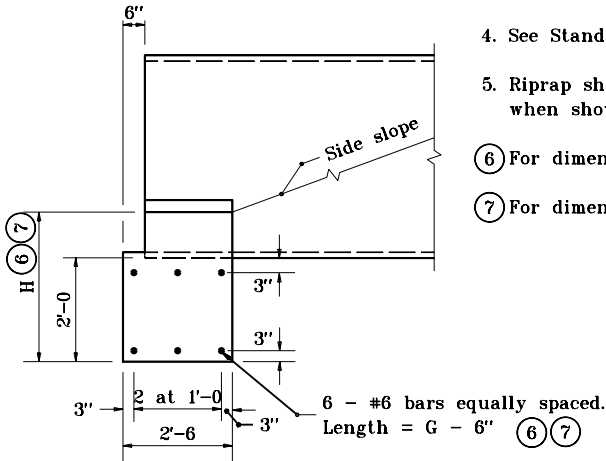
| SAFETY METAL END SECTIONS FOR CIRCULAR PIPES |             |                 |    |    |               |              |              |       |              |
|----------------------------------------------|-------------|-----------------|----|----|---------------|--------------|--------------|-------|--------------|
| Pipe Dia.<br>(in.)                           | Min. Thick. | Dimensions, in. |    |    |               | L Dimensions |              |       |              |
|                                              |             | A               | H  | W  | Overall Width | Slope        | Length (in.) | Slope | Length (in.) |
| 15                                           | .064        | 8               | 6  | 21 | 37            | 4:1          | 20           | 6:1   | 30           |
| 18                                           | .064        | 8               | 6  | 24 | 40            | 4:1          | 32           | 6:1   | 48           |
| 21                                           | .064        | 8               | 6  | 27 | 43            | 4:1          | 44           | 6:1   | 66           |
| 24                                           | .064        | 8               | 6  | 30 | 46            | 4:1          | 56           | 6:1   | 84           |
| 27                                           | .109        | 12              | 9  | 33 | 57            | 4:1          | 68           | 6:1   | 102          |
| 30                                           | .109        | 12              | 9  | 36 | 60            | 4:1          | 80           | 6:1   | 120          |
| 33                                           | .109        | 12              | 9  | 39 | 63            | 4:1          | 92           | 6:1   | 138          |
| 36                                           | .109        | 12              | 9  | 42 | 66            | 4:1          | 104          | 6:1   | 156          |
| 42                                           | .109        | 16              | 12 | 48 | 80            | 4:1          | 128          | 6:1   | 192          |
| 48                                           | .109        | 16              | 12 | 54 | 86            | 4:1          | 152          | 6:1   | 228          |
| 54                                           | .109        | 16              | 12 | 60 | 92            | 4:1          | 176          | 6:1   | 264          |
| 60                                           | .109        | 16              | 12 | 66 | 98            | 4:1          | 200          | 6:1   | 300          |

| SAFETY METAL END SECTIONS FOR HORIZONTAL ELLIPTICAL PIPE |          |      |             |                     |    |    |               |             |              |       |              |
|----------------------------------------------------------|----------|------|-------------|---------------------|----|----|---------------|-------------|--------------|-------|--------------|
| Equiv. Dia.<br>(in.)                                     | (inches) |      | Min. Thick. | Dimensions (inches) |    |    |               | L Dimension |              |       |              |
|                                                          | Span     | Rise |             | A                   | H  | W  | Overall Width | Slope       | Length (in.) | Slope | Length (in.) |
| 18                                                       | 23       | 14   | .064        | 8                   | 6  | 29 | 45            | 4:1         | 16           | 6:1   | 24           |
| 24                                                       | 30       | 19   | .064        | 8                   | 6  | 36 | 52            | 4:1         | 36           | 6:1   | 54           |
| 27                                                       | 34       | 22   | .079        | 12                  | 9  | 40 | 64            | 4:1         | 48           | 6:1   | 72           |
| 30                                                       | 38       | 24   | .079        | 12                  | 9  | 44 | 68            | 4:1         | 56           | 6:1   | 84           |
| 33                                                       | 42       | 27   | .109        | 12                  | 9  | 48 | 72            | 4:1         | 68           | 6:1   | 102          |
| 36                                                       | 45       | 29   | .109        | 16                  | 12 | 51 | 83            | 4:1         | 76           | 6:1   | 114          |
| 42                                                       | 53       | 34   | .109        | 16                  | 12 | 59 | 91            | 4:1         | 96           | 6:1   | 144          |
| 48                                                       | 60       | 38   | .109        | 16                  | 12 | 66 | 98            | 4:1         | 112          | 6:1   | 168          |
| 54                                                       | 68       | 43   | .109        | 16                  | 12 | 74 | 106           | 4:1         | 132          | 6:1   | 198          |
| 60                                                       | 76       | 48   | .109        | 16                  | 12 | 80 | 112           | 4:1         | 152          | 6:1   | 228          |

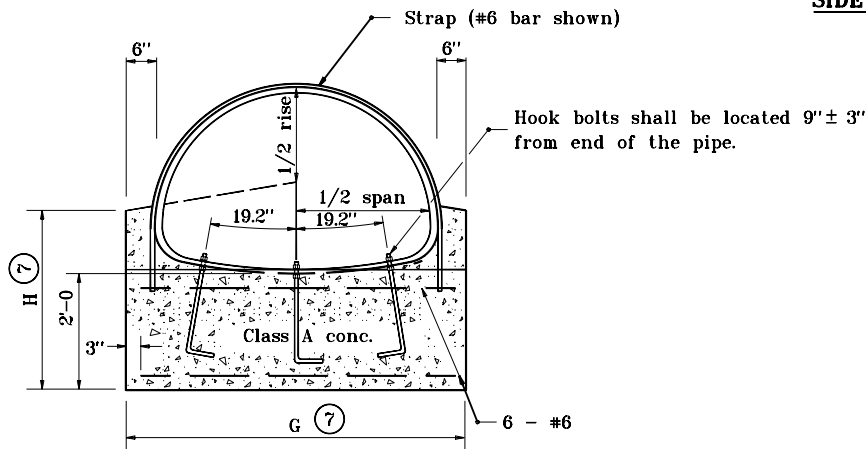
|                                                                                       |                                                                     |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                     |
| SAFETY METAL CULVERT END SECTIONS FOR SMOOTH PIPE                                     |                                                                     |
| JANUARY 1998                                                                          |                                                                     |
| STANDARD DRAWING NO. E 715-SMES-12                                                    |                                                                     |
|  | DETAILS PLACED IN THIS FORMAT 11-15-99                              |
|                                                                                       | /s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE |
|                                                                                       | /s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE            |
|                                                                                       | DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 1-02-98               |



**ANCHOR FOR CIRCULAR CORRUGATED METAL PIPE**  
**FRONT ELEVATION**



**SIDE ELEVATION**



**ANCHOR FOR CORRUGATED METAL PIPE-ARCH**  
**FRONT ELEVATION**

## GENERAL NOTES

1. Anchor straps shall be used at both upstream and downstream ends of all C.M. pipes with a diameter or span of 42" or greater.
2. See Standard Drawing E 715-PASD-01 for anchor strap details.
3. Hook bolts and anchor straps shall be used for all C.M. pipes with a diameter or span of 84" or greater.
4. See Standard Drawing E 715-PAHB-01 for hook bolt details.
5. Riprap shall be placed at the ends of pipe structures when shown on plans.

⑥ For dimension chart see Standard Drawing E 715-ANCH-01.

⑦ For dimension chart see Standard Drawing E 715-ANCH-02.

## LEGEND

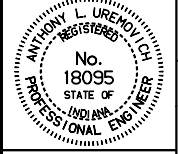
C.M. = Corrugated Metal

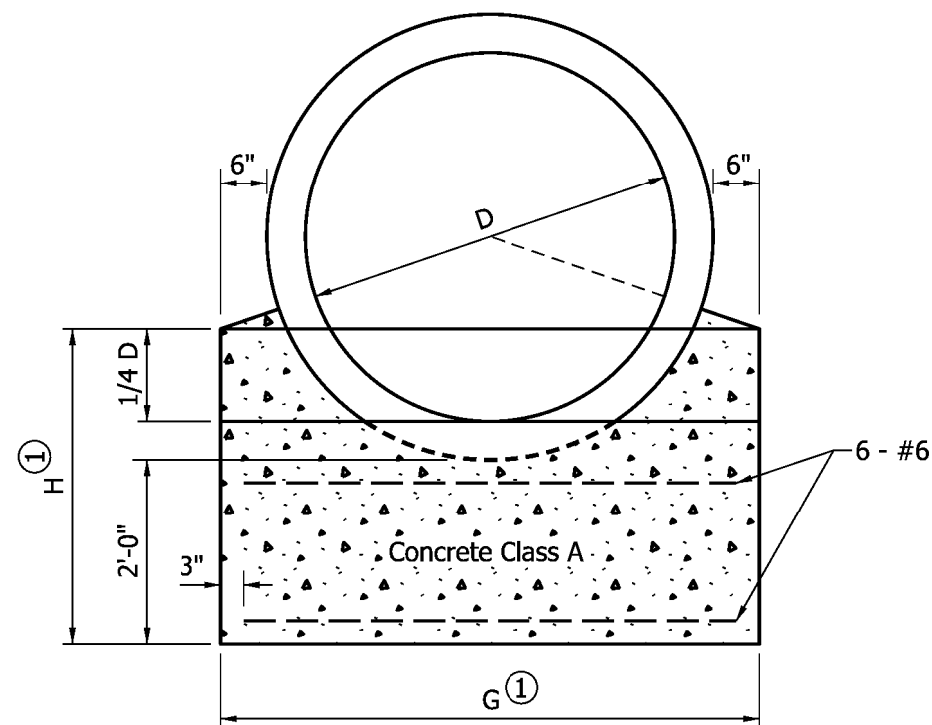
INDIANA DEPARTMENT OF TRANSPORTATION

## SINGLE PIPE CONCRETE ANCHOR

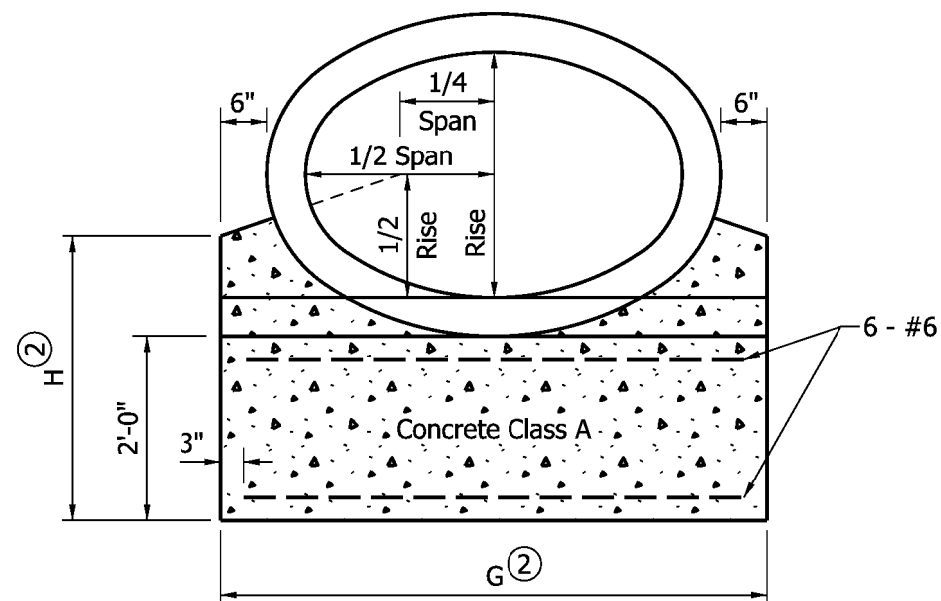
JANUARY 1998

STANDARD DRAWING NO. E 715-SPCA-01

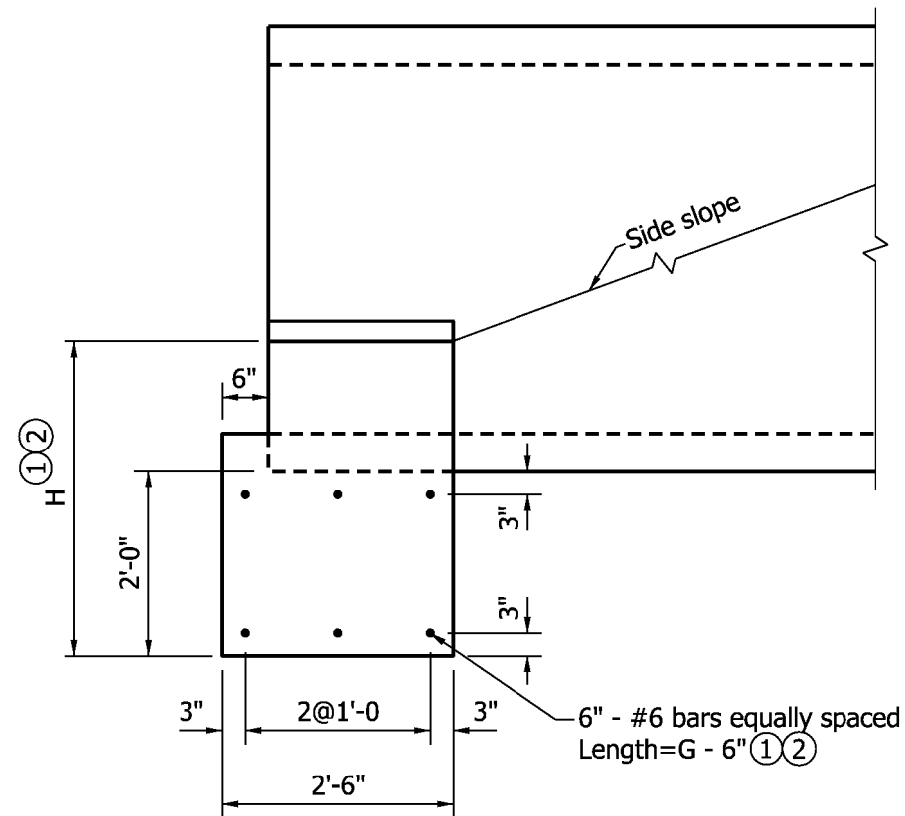
| DETAILS PLACED IN THIS FORMAT                                                         |                           | 7-27-99 |
|---------------------------------------------------------------------------------------|---------------------------|---------|
|  | /s/ Anthony L. Uremovich  | 7-27-99 |
|                                                                                       | DESIGN STANDARDS ENGINEER | DATE    |
|                                                                                       | /s/ Firooz Zandi          | 7-27-99 |
|                                                                                       | CHIEF HIGHWAY ENGINEER    | DATE    |
| DESIGN STANDARDS ENGINEER                                                             | ORIGINALLY APPROVED       | 1-02-98 |



ANCHOR FOR  
REINFORCED CONCRETE PIPE  
FRONT ELEVATION



ANCHOR FOR  
REINFORCED CONCRETE HORIZONTAL ELLIPTICAL PIPE  
FRONT ELEVATION



SIDE ELEVATION

#### GENERAL NOTES

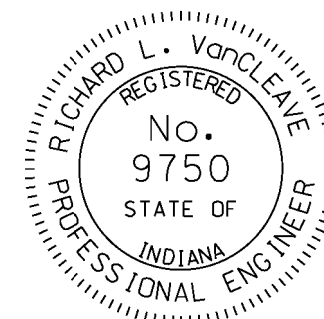
- 1 For dimension, enter chart on Standard Drawing E 715-ANCH-01 with known dimension D.
- 2 For dimension enter chart on Standard Drawing E 715-ANCH-02 with known span and rise.
3. Riprap shall be placed at the ends of pipe structures when shown on plans.

INDIANA DEPARTMENT OF TRANSPORTATION

SINGLE PIPE  
CONCRETE ANCHOR

SEPTEMBER 2009

STANDARD DRAWING NO. E 715-SPCA-02



DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave 09/01/09  
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller 09/01/09  
CHIEF HIGHWAY ENGINEER DATE

| STEEL STRUCTURAL PLATE PIPE-ARCH |        |       |         |        |             |                            |             |                            |             |                            |
|----------------------------------|--------|-------|---------|--------|-------------|----------------------------|-------------|----------------------------|-------------|----------------------------|
| SPAN                             | RISE   | H     | R       | S      | SINGLE PIPE |                            | DOUBLE PIPE |                            | TRIPLE PIPE |                            |
|                                  |        |       |         |        | G           | CU.YDS. CONC.<br>2 ANCHORS | G           | CU.YDS. CONC.<br>2 ANCHORS | G           | CU.YDS. CONC.<br>2 ANCHORS |
| 6'-1                             | 4'-7   | 3'-11 | 3'-7½   | 9'-6   | 7'-5        | 3.5                        | 16'-11      | 8.4                        | 26'-5       | 13.3                       |
| 6'-4                             | 4'-9   | 3'-11 | 3'-10   | 9'-10  | 7'-8        | 3.6                        | 17'-5       | 8.6                        | 27'-4       | 13.6                       |
| 6'-9                             | 4'-11  | 4'-0  | 4'-0½   | 10'-6  | 8'-1        | 3.8                        | 18'-7       | 9.3                        | 29'-1       | 14.8                       |
| 7'-0                             | 5'-1   | 4'-0  | 4'-2    | 10'-10 | 8'-4        | 3.9                        | 19'-2       | 9.5                        | 30'-0       | 15.1                       |
| 7'-3                             | 5'-3   | 3'-11 | 4'-3½   | 11'-3  | 8'-7        | 4.0                        | 19'-10      | 9.7                        | 31'-1       | 15.4                       |
| 7'-8                             | 5'-5   | 4'-0  | 4'-6    | 11'-10 | 9'-0        | 4.2                        | 20'-10      | 10.4                       | 32'-8       | 16.5                       |
| 7'-11                            | 5'-7   | 4'-0  | 4'-7½   | 12'-3  | 9'-3        | 4.3                        | 21'-6       | 10.6                       | 33'-9       | 16.9                       |
| 8'-2                             | 5'-9   | 3'-11 | 4'-9    | 12'-6  | 9'-6        | 4.4                        | 22'-0       | 10.7                       | 34'-6       | 17.0                       |
| 8'-7                             | 5'-11  | 4'-1  | 4'-11½  | 12'-11 | 9'-11       | 4.6                        | 22'-10      | 11.3                       | 35'-9       | 18.0                       |
| 8'-10                            | 6'-1   | 4'-0  | 5'-1    | 13'-2  | 10'-2       | 4.7                        | 23'-4       | 11.4                       | 36'-6       | 18.1                       |
| 9'-4                             | 6'-3   | 4'-2  | 5'-4    | 13'-8  | 10'-8       | 5.0                        | 24'-4       | 12.1                       | 38'-0       | 19.3                       |
| 9'-6                             | 6'-5   | 4'-1  | 5'-5    | 13'-10 | 10'-10      | 5.0                        | 24'-8       | 12.1                       | 38'-6       | 19.2                       |
| 9'-9                             | 6'-7   | 4'-0  | 5'-6½   | 14'-1  | 11'-1       | 5.1                        | 25'-2       | 12.1                       | 39'-3       | 19.2                       |
| 10'-3                            | 6'-9   | 4'-2  | 5'-9½   | 14'-7  | 11'-7       | 5.4                        | 26'-2       | 12.9                       | 40'-9       | 20.4                       |
| 10'-8                            | 6'-11  | 4'-4  | 6'-0    | 15'-0  | 12'-0       | 5.8                        | 27'-0       | 13.7                       | 42'-0       | 21.6                       |
| 10'-11                           | 7'-1   | 4'-3  | 6'-1½   | 15'-3  | 12'-3       | 5.8                        | 27'-6       | 13.7                       | 42'-9       | 21.6                       |
| 11'-5                            | 7'-3   | 4'-6  | 6'-4½   | 15'-9  | 12'-9       | 6.2                        | 28'-6       | 14.6                       | 44'-3       | 23.0                       |
| 11'-7                            | 7'-5   | 4'-5  | 6'-5½   | 15'-11 | 12'-11      | 6.2                        | 28'-10      | 14.5                       | 44'-9       | 22.9                       |
| 11'-10                           | 7'-7   | 4'-3  | 6'-7    | 16'-2  | 13'-2       | 6.2                        | 29'-4       | 14.5                       | 45'-6       | 22.8                       |
| 12'-4                            | 7'-9   | 4'-6  | 6'-10   | 16'-8  | 13'-8       | 6.6                        | 30'-4       | 15.4                       | 47'-0       | 24.3                       |
| 12'-6                            | 7'-11  | 4'-4  | 6'-11   | 16'-10 | 13'-10      | 6.6                        | 30'-8       | 15.3                       | 47'-6       | 24.0                       |
| 12'-8                            | 8'-1   | 4'-3  | 7'-0    | 17'-0  | 14'-0       | 6.5                        | 31'-0       | 15.2                       | 48'-0       | 23.8                       |
| 12'-10                           | 8'-4   | 4'-2  | 7'-1    | 17'-2  | 14'-2       | 6.5                        | 31'-4       | 15.1                       | 48'-6       | 23.7                       |
| 13'-3                            | 9'-4   | 5'-0  | 7'-3½   | 17'-7  | 14'-7       | 7.3                        | 32'-2       | 17.1                       | 49'-9       | 26.9                       |
| 13'-6                            | 9'-6   | 5'-0  | 7'-5    | 17'-10 | 14'-10      | 7.4                        | 32'-8       | 17.2                       | 50'-6       | 27.0                       |
| 14'-0                            | 9'-8   | 5'-0  | 7'-8    | 18'-4  | 15'-4       | 7.7                        | 33'-8       | 17.9                       | 52'-0       | 28.1                       |
| 14'-2                            | 9'-10  | 5'-0  | 7'-9    | 18'-6  | 15'-6       | 7.7                        | 34'-0       | 17.9                       | 52'-6       | 28.1                       |
| 14'-5                            | 10'-0  | 5'-0  | 7'-10½  | 18'-9  | 15'-9       | 7.8                        | 34'-6       | 18.0                       | 53'-3       | 28.2                       |
| 14'-11                           | 10'-2  | 5'-2  | 8'-1½   | 19'-3  | 16'-3       | 8.2                        | 35'-6       | 18.9                       | 54'-9       | 29.6                       |
| 15'-4                            | 10'-4  | 5'-2  | 8'-4    | 19'-8  | 16'-8       | 8.6                        | 36'-4       | 19.6                       | 56'-0       | 30.7                       |
| 15'-7                            | 10'-6  | 5'-2  | 8'-5½   | 19'-11 | 16'-11      | 8.6                        | 36'-10      | 19.7                       | 56'-9       | 30.8                       |
| 15'-10                           | 10'-8  | 5'-2  | 8'-7    | 20'-2  | 17'-2       | 8.6                        | 37'-4       | 19.7                       | 57'-6       | 30.9                       |
| 16'-3                            | 10'-10 | 5'-2  | 8'-9½   | 20'-7  | 17'-7       | 9.0                        | 38'-2       | 20.5                       | 58'-9       | 32.0                       |
| 16'-6                            | 11'-0  | 5'-5  | 8'-11   | 20'-10 | 17'-10      | 9.1                        | 38'-8       | 20.7                       | 59'-6       | 32.4                       |
| 17'-0                            | 11'-2  | 5'-5  | 9'-2    | 21'-4  | 18'-4       | 9.5                        | 39'-8       | 21.6                       | 61'-0       | 33.7                       |
| 17'-2                            | 11'-4  | 5'-5  | 9'-3    | 21'-6  | 18'-6       | 9.5                        | 40'-0       | 21.5                       | 61'-6       | 33.6                       |
| 17'-5                            | 11'-6  | 5'-5  | 9'-4½   | 21'-9  | 18'-9       | 9.5                        | 40'-6       | 21.6                       | 62'-3       | 33.7                       |
| 17'-11                           | 11'-8  | 5'-5  | 9'-7½   | 22'-3  | 19'-3       | 9.9                        | 41'-6       | 22.5                       | 63'-9       | 35.0                       |
| 18'-1                            | 11'-10 | 5'-6  | 9'-8½   | 22'-5  | 19'-5       | 9.9                        | 41'-10      | 22.7                       | 64'-3       | 35.4                       |
| 18'-7                            | 12'-0  | 5'-6  | 9'-11½  | 22'-11 | 19'-11      | 10.3                       | 42'-10      | 23.4                       | 65'-9       | 36.7                       |
| 18'-9                            | 12'-2  | 5'-6  | 10'-0½  | 23'-1  | 20'-1       | 10.3                       | 43'-2       | 23.6                       | 66'-3       | 36.7                       |
| 19'-3                            | 12'-4  | 5'-6  | 10'-3½  | 23'-7  | 20'-7       | 10.8                       | 44'-2       | 24.6                       | 67'-9       | 38.8                       |
| 19'-6                            | 12'-6  | 5'-6  | 10'-5   | 23'-10 | 20'-10      | 10.8                       | 44'-8       | 24.6                       | 68'-6       | 38.2                       |
| 19'-8                            | 12'-8  | 5'-6  | 10'-6   | 24'-0  | 21'-0       | 10.7                       | 45'-0       | 24.4                       | 69'-0       | 37.9                       |
| 19'-11                           | 12'-10 | 5'-6  | 10'-7½  | 24'-3  | 21'-3       | 10.7                       | 45'-6       | 24.2                       | 69'-9       | 37.7                       |
| 20'-5                            | 13'-0  | 5'-6  | 10'-10½ | 24'-9  | 21'-9       | 11.2                       | 46'-5       | 25.4                       | 71'-3       | 39.4                       |
| 20'-7                            | 13'-2  | 5'-6  | 10'-11½ | 24'-11 | 21'-11      | 11.1                       | 46'-10      | 25.3                       | 71'-9       | 39.5                       |

|                                                                                       |                                                                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                                                                                            |
| <b>CONCRETE ANCHOR</b><br><b>TABLES</b><br>JANUARY 1998                               |                                                                                                                                                                                                                                            |
| STANDARD DRAWING NO. <b>E 717-ANCH-01</b>                                             |                                                                                                                                                                                                                                            |
|  | DETAILS PLACED IN THIS FORMAT 11-15-99<br><br>/s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE<br><br>/s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE<br>DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 1-02-98 |

# STEEL OR ALUMINUM ALLOY STRUCTURAL PLATE PIPE

| D     | H     | R      | S      | SINGLE PIPE |                            | DOUBLE PIPE |                            | TRIPLE PIPE |                            |
|-------|-------|--------|--------|-------------|----------------------------|-------------|----------------------------|-------------|----------------------------|
|       |       |        |        | G           | CU.YDS. CONC.<br>2 ANCHORS | G           | CU.YDS. CONC.<br>2 ANCHORS | G           | CU.YDS. CONC.<br>2 ANCHORS |
| 5'-0  | 3'-5  | 3'-2   | 7'-10  | 6'-4        | 3.1                        | 14'-2       | 7.1                        | 22'-0       | 11.0                       |
| 5'-6  | 3'-7  | 3'-5   | 8'-7   | 6'-10       | 3.4                        | 15'-5       | 7.9                        | 24'-0       | 12.4                       |
| 6'-0  | 3'-8  | 3'-8   | 9'-4   | 7'-4        | 3.7                        | 16'-8       | 8.6                        | 26'-0       | 13.6                       |
| 6'-6  | 3'-10 | 3'-11  | 10'-1  | 7'-10       | 4.1                        | 17'-11      | 9.5                        | 28'-0       | 15.0                       |
| 7'-0  | 3'-11 | 4'-2   | 10'-10 | 8'-4        | 4.3                        | 19'-2       | 10.3                       | 30'-0       | 16.2                       |
| 7'-6  | 4'-1  | 4'-5   | 11'-7  | 8'-10       | 4.7                        | 20'-5       | 11.3                       | 32'-0       | 17.8                       |
| 8'-0  | 4'-2  | 4'-8   | 12'-4  | 9'-4        | 5.0                        | 21'-8       | 12.1                       | 34'-0       | 19.1                       |
| 8'-6  | 4'-4  | 4'-11  | 12'-10 | 9'-10       | 5.4                        | 22'-8       | 12.9                       | 35'-6       | 20.4                       |
| 9'-0  | 4'-5  | 5'-2   | 13'-4  | 10'-4       | 5.7                        | 23'-8       | 13.5                       | 37'-0       | 21.4                       |
| 9'-6  | 4'-7  | 5'-5   | 13'-10 | 10'-10      | 6.1                        | 24'-8       | 14.4                       | 38'-6       | 22.7                       |
| 10'-0 | 4'-8  | 5'-8   | 14'-4  | 11'-4       | 6.4                        | 25'-8       | 15.1                       | 40'-0       | 23.7                       |
| 10'-6 | 4'-10 | 5'-11  | 14'-10 | 11'-10      | 6.8                        | 26'-8       | 16.0                       | 41'-6       | 25.2                       |
| 11'-0 | 4'-11 | 6'-2   | 15'-4  | 12'-4       | 7.2                        | 27'-8       | 16.7                       | 43'-0       | 26.2                       |
| 11'-6 | 5'-1  | 6'-5   | 15'-10 | 12'-10      | 7.6                        | 28'-8       | 17.6                       | 44'-6       | 27.7                       |
| 12'-0 | 5'-2  | 6'-8   | 16'-4  | 13'-4       | 7.9                        | 29'-8       | 18.3                       | 46'-0       | 28.7                       |
| 12'-6 | 5'-4  | 6'-11  | 16'-10 | 13'-10      | 8.4                        | 30'-8       | 19.3                       | 47'-6       | 30.3                       |
| 13'-0 | 5'-5  | 7'-2   | 17'-4  | 14'-4       | 8.7                        | 31'-8       | 20.0                       | 49'-0       | 31.3                       |
| 13'-6 | 5'-7  | 7'-5   | 17'-10 | 14'-10      | 9.2                        | 32'-8       | 21.1                       | 50'-6       | 32.9                       |
| 14'-0 | 5'-8  | 7'-8   | 18'-4  | 15'-4       | 9.6                        | 33'-8       | 21.8                       | 52'-0       | 34.0                       |
| 14'-6 | 5'-10 | 7'-11  | 18'-10 | 15'-10      | 10.1                       | 34'-8       | 22.9                       | 53'-6       | 35.7                       |
| 15'-0 | 5'-11 | 8'-2   | 19'-4  | 16'-4       | 10.4                       | 35'-8       | 23.6                       | 55'-0       | 36.8                       |
| 15'-6 | 6'-1  | 8'-5   | 19'-10 | 16'-10      | 10.9                       | 36'-8       | 24.7                       | 56'-6       | 38.5                       |
| 16'-0 | 6'-2  | 8'-8   | 20'-4  | 17'-4       | 11.3                       | 37'-8       | 25.5                       | 58'-0       | 39.7                       |
| 16'-6 | 6'-4  | 8'-11  | 20'-10 | 17'-10      | 11.9                       | 38'-8       | 26.7                       | 59'-0       | 41.5                       |
| 17'-0 | 6'-5  | 9'-2   | 21'-4  | 18'-4       | 12.3                       | 39'-8       | 27.5                       | 61'-0       | 42.7                       |
| 17'-6 | 6'-7  | 9'-5   | 21'-10 | 18'-10      | 12.8                       | 40'-8       | 28.6                       | 62'-6       | 44.5                       |
| 18'-0 | 6'-8  | 9'-8   | 22'-4  | 19'-4       | 13.2                       | 41'-8       | 29.5                       | 64'-0       | 45.7                       |
| 18'-6 | 6'-10 | 9'-11  | 22'-10 | 19'-10      | 13.8                       | 42'-8       | 30.7                       | 65'-6       | 47.6                       |
| 19'-0 | 6'-11 | 10'-2  | 23'-4  | 20'-4       | 14.2                       | 43'-8       | 31.5                       | 67'-0       | 48.8                       |
| 19'-6 | 7'-1  | 10'-5  | 23'-10 | 20'-10      | 14.8                       | 44'-8       | 32.8                       | 68'-6       | 50.8                       |
| 20'-0 | 7'-2  | 10'-8  | 24'-4  | 21'-4       | 15.2                       | 45'-8       | 33.6                       | 70'-0       | 52.1                       |
| 20'-6 | 7'-4  | 10'-11 | 24'-10 | 21'-10      | 15.8                       | 46'-8       | 34.9                       | 71'-6       | 54.2                       |
| 21'-0 | 7'-5  | 11'-2  | 25'-4  | 22'-4       | 16.2                       | 47'-8       | 35.8                       | 73'-0       | 55.6                       |

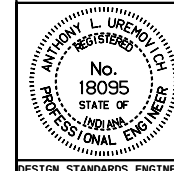
## GENERAL NOTES

1. Refer to Standard Drawing E 717-SPCA-01 for single pipe anchor details.
2. Refer to Standard Drawings E 717-MPCA-01 and E 717-MPCA-02 for multiple pipe anchor details.

INDIANA DEPARTMENT OF TRANSPORTATION

## CONCRETE ANCHOR TABLES JANUARY 1998

STANDARD DRAWING NO. **E 717-ANCH-02**



DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

ORIGINALLY APPROVED 1-02-98

### ALUMINUM ALLOY STRUCTURAL PLATE PIPE-ARCH

| SPAN   | RISE   | H    | R         | S      | SINGLE PIPE |                            | DOUBLE PIPE |                                    | TRIPLE PIPE |                                    |
|--------|--------|------|-----------|--------|-------------|----------------------------|-------------|------------------------------------|-------------|------------------------------------|
|        |        |      |           |        | G           | CU.YDS. CONC.<br>2 ANCHORS | G           | m <sup>3</sup> CONC.,<br>2 ANCHORS | G           | m <sup>3</sup> CONC.,<br>2 ANCHORS |
| 6'-7   | 5'-8   | 5'-0 | 4'-0      | 10'-4  | 8'-0        | 4.2                        | 18'-4       | 10.3                               | 28'-8       | 16.4                               |
| 6'-11  | 5'-9   | 5'-0 | 4'-2      | 10'-10 | 8'-4        | 4.3                        | 19'-2       | 10.7                               | 30'-0       | 17.1                               |
| 7'-3   | 5'-11  | 5'-0 | 4'-4      | 11'-4  | 8'-8        | 4.4                        | 20'-0       | 11.1                               | 31'-4       | 17.7                               |
| 7'-9   | 6'-0   | 5'-0 | 4'-7      | 12'-1  | 9'-2        | 4.8                        | 21'-3       | 11.9                               | 33'-4       | 19.1                               |
| 8'-1   | 6'-1   | 5'-0 | 4'-9      | 12'-6  | 9'-6        | 4.9                        | 22'-0       | 12.2                               | 34'-6       | 19.6                               |
| 8'-5   | 6'-3   | 5'-2 | 4'-11     | 12'-10 | 9'-10       | 5.0                        | 22'-8       | 12.6                               | 35'-6       | 20.1                               |
| 8'-10  | 6'-4   | 5'-2 | 5'-1 1/2  | 13'-3  | 10'-3       | 5.3                        | 23'-6       | 13.2                               | 36'-9       | 21.1                               |
| 9'-3   | 6'-5   | 5'-2 | 5'-4      | 13'-8  | 10'-8       | 5.5                        | 24'-4       | 13.5                               | 38'-0       | 21.6                               |
| 9'-7   | 6'-6   | 5'-2 | 5'-6      | 14'-0  | 11'-0       | 5.6                        | 25'-0       | 13.7                               | 39'-0       | 21.9                               |
| 9'-11  | 6'-8   | 5'-2 | 5'-8      | 14'-4  | 11'-4       | 5.7                        | 25'-8       | 13.9                               | 40'-0       | 22.2                               |
| 10'-3  | 6'-9   | 5'-2 | 5'-10     | 14'-8  | 11'-8       | 5.8                        | 26'-4       | 14.1                               | 41'-0       | 22.4                               |
| 10'-9  | 6'-10  | 5'-5 | 6'-1      | 15'-2  | 12'-2       | 6.3                        | 27'-4       | 15.2                               | 42'-6       | 24.2                               |
| 11'-1  | 7'-0   | 5'-5 | 6'-3      | 15'-6  | 12'-6       | 6.4                        | 28'-0       | 15.4                               | 43'-6       | 24.4                               |
| 11'-5  | 7'-1   | 5'-5 | 6'-5      | 15'-10 | 12'-10      | 6.4                        | 28'-8       | 15.5                               | 44'-6       | 24.6                               |
| 11'-9  | 7'-2   | 5'-5 | 6'-7      | 16'-2  | 13'-2       | 6.5                        | 29'-4       | 15.7                               | 45'-6       | 24.8                               |
| 12'-3  | 7'-3   | 5'-6 | 6'-10     | 16'-8  | 13'-8       | 7.1                        | 30'-4       | 16.8                               | 47'-0       | 26.6                               |
| 12'-7  | 7'-5   | 5'-6 | 7'-0      | 17'-0  | 14'-0       | 7.1                        | 31'-0       | 16.9                               | 48'-0       | 26.8                               |
| 12'-11 | 7'-6   | 5'-6 | 7'-2      | 17'-4  | 14'-4       | 7.2                        | 31'-8       | 17.1                               | 49'-0       | 26.9                               |
| 13'-1  | 8'-2   | 5'-6 | 7'-3      | 17'-6  | 14'-6       | 7.7                        | 32'-0       | 18.1                               | 49'-6       | 28.5                               |
| 13'-1  | 8'-4   | 5'-6 | 7'-3      | 17'-6  | 14'-6       | 7.2                        | 32'-0       | 17.1                               | 49'-6       | 26.9                               |
| 13'-11 | 8'-5   | 5'-9 | 7'-8      | 18'-4  | 15'-4       | 8.5                        | 33'-8       | 19.7                               | 52'-0       | 31.0                               |
| 14'-0  | 8'-7   | 5'-9 | 7'-8 1/2  | 18'-5  | 15'-5       | 7.9                        | 33'-10      | 18.7                               | 52'-3       | 29.4                               |
| 13'-11 | 9'-5   | 5'-9 | 7'-8      | 18'-4  | 15'-4       | 8.2                        | 33'-8       | 19.2                               | 52'-0       | 30.2                               |
| 14'-3  | 9'-7   | 5'-9 | 7'-10     | 18'-8  | 15'-8       | 8.3                        | 34'-4       | 19.4                               | 53'-0       | 30.5                               |
| 14'-8  | 9'-8   | 5'-9 | 8'-0 1/2  | 19'-1  | 16'-1       | 8.6                        | 35'-2       | 20.1                               | 54'-3       | 31.5                               |
| 14'-11 | 9'-10  | 5'-9 | 8'-2      | 19'-4  | 16'-4       | 8.7                        | 35'-8       | 20.2                               | 55'-0       | 31.7                               |
| 15'-4  | 10'-0  | 6'-0 | 8'-4 1/2  | 19'-9  | 16'-9       | 9.1                        | 36'-6       | 21.1                               | 56'-3       | 33.1                               |
| 15'-7  | 10'-2  | 6'-0 | 8'-6      | 20'-0  | 17'-0       | 9.1                        | 37'-0       | 21.2                               | 57'-0       | 33.2                               |
| 16'-1  | 10'-4  | 6'-0 | 8'-9      | 20'-6  | 17'-6       | 9.6                        | 38'-0       | 22.1                               | 58'-6       | 34.5                               |
| 16'-4  | 10'-6  | 6'-0 | 8'-10 1/2 | 20'-9  | 17'-9       | 9.6                        | 38'-6       | 22.1                               | 59'-3       | 34.6                               |
| 16'-9  | 10'-8  | 6'-0 | 9'-1      | 21'-2  | 18'-2       | 10.0                       | 39'-4       | 22.9                               | 60'-6       | 35.8                               |
| 17'-0  | 10'-10 | 6'-0 | 9'-2 1/2  | 21'-5  | 18'-5       | 10.0                       | 39'-10      | 22.9                               | 61'-3       | 35.9                               |
| 17'-3  | 11'-0  | 6'-0 | 9'-4      | 21'-8  | 18'-8       | 10.0                       | 40'-4       | 23.0                               | 62'-0       | 35.9                               |
| 17'-9  | 11'-2  | 6'-0 | 9'-7      | 22'-2  | 19'-2       | 10.5                       | 41'-4       | 24.1                               | 63'-6       | 37.7                               |
| 18'-0  | 11'-4  | 6'-3 | 9'-8 1/2  | 22'-5  | 19'-5       | 10.6                       | 41'-10      | 24.3                               | 64'-3       | 38.0                               |
| 18'-5  | 11'-6  | 6'-3 | 9'-11     | 22'-10 | 19'-10      | 11.0                       | 42'-8       | 25.2                               | 65'-6       | 39.5                               |
| 18'-8  | 11'-8  | 6'-3 | 10'-0 1/2 | 23'-1  | 20'-1       | 11.0                       | 43'-2       | 25.2                               | 66'-3       | 39.4                               |
| 19'-2  | 11'-9  | 6'-3 | 10'-3 1/2 | 23'-7  | 20'-7       | 11.5                       | 44'-2       | 26.1                               | 67'-9       | 40.7                               |
| 19'-5  | 11'-11 | 6'-3 | 10'-5     | 23'-10 | 20'-10      | 11.5                       | 44'-8       | 26.2                               | 68'-6       | 40.9                               |
| 19'-10 | 12'-1  | 6'-3 | 10'-7 1/2 | 24'-3  | 21'-3       | 12.0                       | 45'-6       | 27.2                               | 69'-9       | 42.5                               |
| 20'-1  | 12'-3  | 6'-3 | 10'-9     | 24'-6  | 21'-6       | 12.0                       | 46'-0       | 27.1                               | 70'-6       | 42.3                               |
| 20'-1  | 12'-6  | 6'-3 | 10'-9     | 24'-6  | 21'-6       | 11.4                       | 46'-0       | 25.8                               | 70'-6       | 40.1                               |
| 20'-10 | 12'-7  | 6'-6 | 11'-1 1/2 | 25'-3  | 22'-3       | 12.5                       | 47'-6       | 28.3                               | 72'-9       | 44.0                               |
| 21'-1  | 12'-9  | 6'-6 | 11'-3     | 25'-6  | 22'-6       | 12.5                       | 48'-0       | 28.1                               | 73'-6       | 43.8                               |
| 21'-6  | 12'-11 | 6'-6 | 11'-5 1/2 | 25'-11 | 22'-11      | 13.0                       | 48'-10      | 29.4                               | 74'-9       | 45.9                               |

### GENERAL NOTES

1. Refer to Standard Drawing E 717-SPCA-01 for single pipe anchor details.
2. Refer to Standard Drawings E 717-MPCA-01 and E 717-MPCA-02 for multiple pipe anchor details.

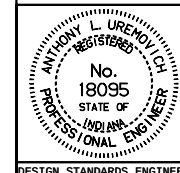
INDIANA DEPARTMENT OF TRANSPORTATION

### CONCRETE ANCHOR

### TABLES

JANUARY 1998

STANDARD DRAWING NO. **E 717-ANCH-03**



DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

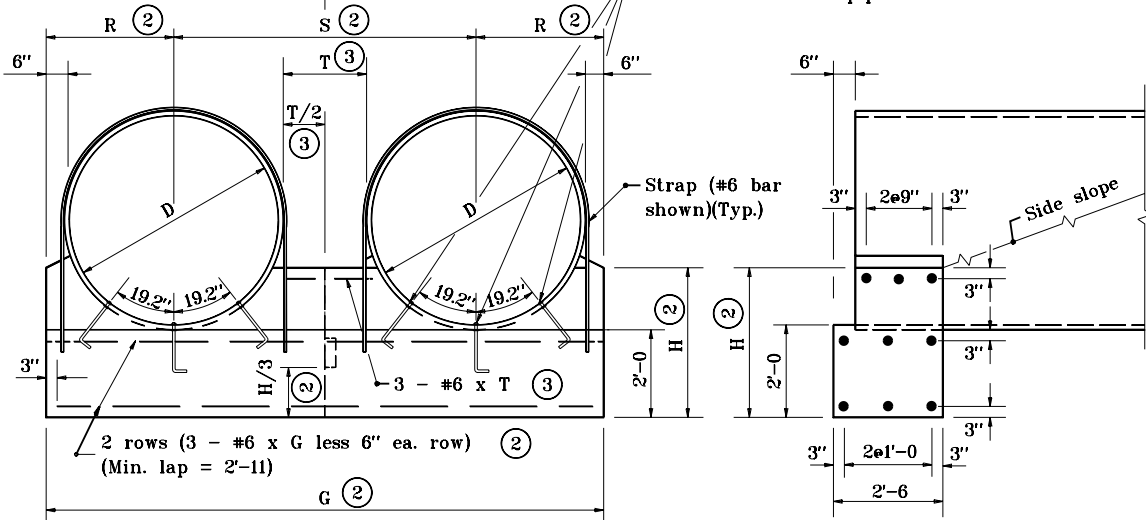
DESIGN STANDARDS ENGINEER

ORIGINALLY APPROVED 1-02-98

④

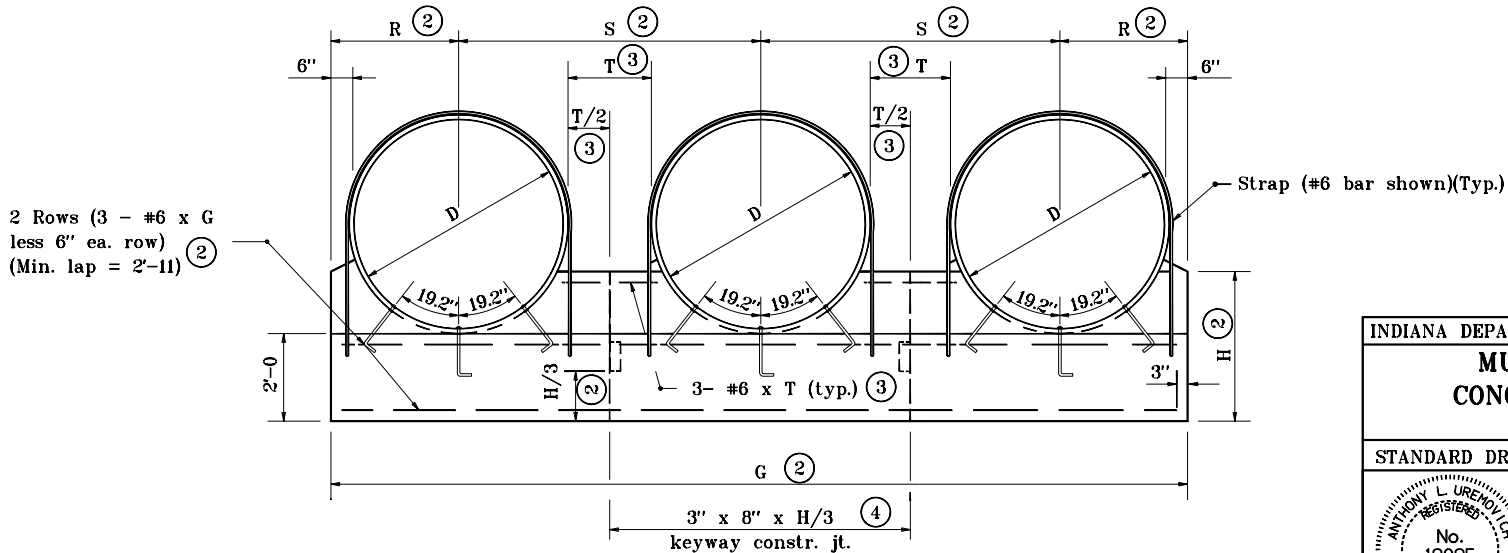
3" x 8" x H/3 keyway constr. jt.

Hook bolts shall be located  $9'' \pm 3''$  from the end of pipe.



### ANCHOR FOR DOUBLE PIPE INSTALLATION

**SECTION THROUGH**  
**ANCHOR**



### ANCHOR FOR TRIPLE PIPE INSTALLATION

## GENERAL NOTES

1. Circular pipes shown. For details of structural plate pipe-arches alternates, see partial elevations on Standard Drawing E 717-MPCA-02.
- ② For dimension, enter chart on Standard Drawing E 717-ANCH-01 with known dimension D.
- ③  $T$  = Clear distance between pipes.  
For  $D$  less than 48",  $T = 2'-0$ .  
For  $D$  of 48" to 96"  $T = 1/2 D$   
For  $D$  greater than 96",  $T = 4'-0$ .
- ④ No joint required if  $G$  is less than or equal to 30'. One joint required if  $G$  is greater than 30' but less than or equal to 42'. Two joints required if  $G$  is greater than 42'.

# INDIANA DEPARTMENT OF TRANSPORTATION

## MULTIPLE PIPE CONCRETE ANCHOR

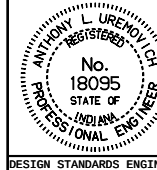
JANUARY 1998

**STANDARD DRAWING NO. E 717-MPCA-01**

DETAILS PLACED IN THIS FORMAT 7-27-99

/s/ Anthony L. Uremovich 7-27-99  
DESIGN STANDARDS ENGINEER DATE

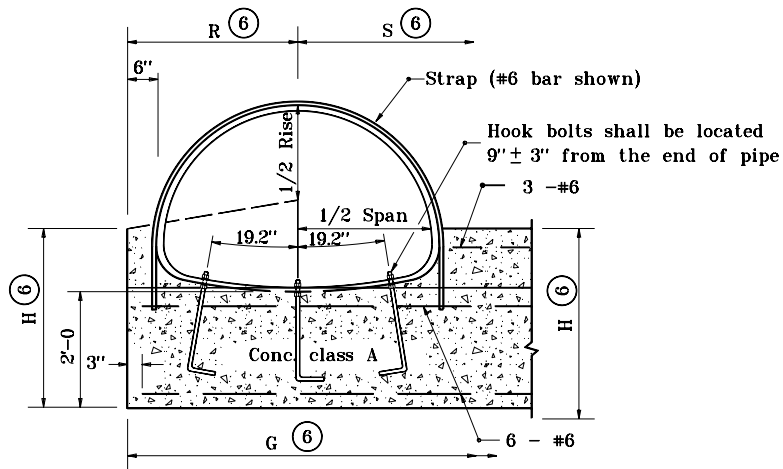
|                        |         |
|------------------------|---------|
| /s/ Firooz Zandi       | 7-27-99 |
| CHIEF HIGHWAY ENGINEER | DATE    |
| ORIGINALLY APPROVED    | 1-02-98 |





## GENERAL NOTES

1. Anchor straps shall be used at both upstream and downstream ends of all structural plate pipes and pipe-arches.
2. See Standard Drawing E 715-PASD-01 for anchor strap details.
3. Hook bolts and anchor straps shall be used for all structural plate pipes and pipe-arches with a diameter or span of 84" or greater.
4. See Standard Drawing E 715-PAHB-01 for hook bolt details.
5. Riprap shall be placed at the ends of pipe structures when shown on the plans.
- 6 For dimension, enter chart on Standard Drawings E 717-ANCH-01 or E 717-ANCH-02 with known dimension D or span and rise.



**ANCHOR FOR STRUCTURAL PLATE PIPE-ARCH  
PARTIAL ELEVATION**

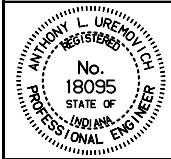
|                                           |                                                                    |
|-------------------------------------------|--------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION      |                                                                    |
| <b>MULTIPLE PIPE<br/>CONCRETE ANCHOR</b>  |                                                                    |
| JANUARY 1998                              |                                                                    |
| STANDARD DRAWING NO. <b>E 717-MPCA-02</b> |                                                                    |
|                                           | DETAILS PLACED IN THIS FORMAT 7-27-99                              |
|                                           | /s/ Anthony L. Uremovich 7-27-99<br>DESIGN STANDARDS ENGINEER DATE |
|                                           | /s/ Firooz Zandi 7-27-99<br>CHIEF HIGHWAY ENGINEER DATE            |
|                                           | DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 1-02-98              |

**9" x 2½" STRUCTURAL PLATE ALUMINUM ALLOY PIPE (STEEL BOLTED)  
HEIGHT OF COVER LIMITS (ft.)**

|  | AREA<br>(sft) | DIAMETER<br>(in.) | THICKNESS (in.) |      |       |      |       |      |       |      |       |      |  |  |
|--|---------------|-------------------|-----------------|------|-------|------|-------|------|-------|------|-------|------|--|--|
|  |               |                   | 0.100           |      | 0.125 |      | 0.150 |      | 0.175 |      | 0.200 |      |  |  |
|  |               |                   | MIN.            | MAX. | MIN.  | MAX. | MIN.  | MAX. | MIN.  | MAX. | MIN.  | MAX. |  |  |
|  | 19.6          | 60                | 1.0             | 31.1 | 1.0   | 45.5 | 1.0   | 60.1 | 1.0   | 70.7 | 1.0   | 81.5 |  |  |
|  | 23.8          | 66                | 1.0             | 28.2 | 1.0   | 41.4 | 1.0   | 54.6 | 1.0   | 64.3 | 1.0   | 74.1 |  |  |
|  | 28.3          | 72                | 1.0             | 25.9 | 1.0   | 37.9 | 1.0   | 50.0 | 1.0   | 58.9 | 1.0   | 67.9 |  |  |
|  | 33.2          | 78                | 1.0             | 23.9 | 1.0   | 35.0 | 1.0   | 46.2 | 1.0   | 54.4 | 1.0   | 62.7 |  |  |
|  | 38.5          | 84                | 1.0             | 22.2 | 1.0   | 32.5 | 1.0   | 42.9 | 1.0   | 50.5 | 1.0   | 58.2 |  |  |
|  | 44.2          | 90                | 1.1             | 20.7 | 1.0   | 30.3 | 1.0   | 40.0 | 1.0   | 47.1 | 1.0   | 54.3 |  |  |
|  | 50.3          | 96                | 1.1             | 19.4 | 1.0   | 28.4 | 1.0   | 37.5 | 1.0   | 44.2 | 1.0   | 50.9 |  |  |
|  | 56.7          | 102               | 1.1             | 18.3 | 1.1   | 26.7 | 1.1   | 35.3 | 1.1   | 41.6 | 1.1   | 47.9 |  |  |
|  | 63.6          | 108               | 1.2             | 17.2 | 1.1   | 25.3 | 1.1   | 33.3 | 1.1   | 39.3 | 1.1   | 45.3 |  |  |
|  | 70.9          | 114               | 1.3             | 16.3 | 1.2   | 23.9 | 1.2   | 31.6 | 1.2   | 37.2 | 1.2   | 42.9 |  |  |
|  | 78.5          | 120               | 1.3             | 15.5 | 1.3   | 22.7 | 1.3   | 30.0 | 1.3   | 35.3 | 1.3   | 40.7 |  |  |
|  | 86.6          | 126               | 1.4             | 14.8 | 1.3   | 21.6 | 1.3   | 28.6 | 1.3   | 33.7 | 1.3   | 38.8 |  |  |
|  | 95.0          | 132               | 1.4             | 14.1 | 1.4   | 20.7 | 1.4   | 27.3 | 1.4   | 32.1 | 1.4   | 37.0 |  |  |
|  | 103.9         | 138               | 1.5             | 13.5 | 1.4   | 19.8 | 1.4   | 26.1 | 1.4   | 30.7 | 1.4   | 35.4 |  |  |
|  | 113.1         | 144               | 1.6             | 12.9 | 1.5   | 18.9 | 1.5   | 25.0 | 1.5   | 29.4 | 1.5   | 33.9 |  |  |
|  | 122.7         | 150               |                 |      | 1.6   | 18.2 | 1.6   | 24.0 | 1.6   | 28.3 | 1.6   | 32.6 |  |  |
|  | 132.7         | 156               |                 |      | 1.6   | 17.5 | 1.6   | 23.1 | 1.6   | 27.2 | 1.6   | 31.3 |  |  |
|  | 143.1         | 162               |                 |      |       |      | 1.7   | 22.2 | 1.7   | 26.2 | 1.7   | 30.2 |  |  |
|  | 153.9         | 168               |                 |      |       |      | 1.8   | 21.4 | 1.8   | 25.2 | 1.8   | 29.1 |  |  |
|  | 165.1         | 174               |                 |      |       |      | 1.8   | 20.7 | 1.8   | 24.4 | 1.8   | 28.1 |  |  |
|  | 176.7         | 180               |                 |      |       |      |       |      | 1.9   | 23.5 | 1.9   | 27.1 |  |  |
|  | 188.7         | 186               |                 |      |       |      |       |      | 1.9   | 22.8 | 1.9   | 26.3 |  |  |
|  | 201.1         | 192               |                 |      |       |      |       |      |       |      | 2.0   | 25.4 |  |  |
|  | 213.8         | 198               |                 |      |       |      |       |      |       |      | 2.1   | 24.7 |  |  |
|  | 227.0         | 204               |                 |      |       |      |       |      |       |      | 2.1   | 23.9 |  |  |
|  | 240.5         | 210               |                 |      |       |      |       |      |       |      |       |      |  |  |
|  | 254.5         | 216               |                 |      |       |      |       |      |       |      |       |      |  |  |
|  | 268.8         | 222               |                 |      |       |      |       |      |       |      |       |      |  |  |
|  | 283.5         | 228               |                 |      |       |      |       |      |       |      |       |      |  |  |

**NOTE:**

- The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.

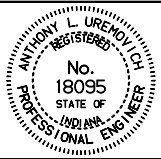
|                                                                                       |                                                                                                                   |
|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                   |
| <b>PIPE HEIGHT OF<br/>COVER LIMITS</b>                                                |                                                                                                                   |
| JANUARY 1998                                                                          |                                                                                                                   |
| <b>STANDARD DRAWING NO. E 717-PHCL-01</b>                                             |                                                                                                                   |
|  | DETAILS PLACED IN THIS FORMAT 11-15-99<br><br>/s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE |
| DESIGN STANDARDS ENGINEER                                                             | /s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE<br>ORIGINALLY APPROVED 1-02-98                           |

**9" x 2½" STRUCTURAL PLATE ALUMINUM ALLOY PIPE (STEEL BOLTED)  
HEIGHT OF COVER LIMITS (ft.)**

|  | AREA<br>(sft.) | DIAMETER<br>(in.) | THICKNESS (in.) |      |       |       |  |  |  |  |  |  |  |
|--|----------------|-------------------|-----------------|------|-------|-------|--|--|--|--|--|--|--|
|  |                |                   | 0.225           |      | 0.250 |       |  |  |  |  |  |  |  |
|  |                |                   | MIN.            | MAX. | MIN.  | MAX.  |  |  |  |  |  |  |  |
|  | 19.6           | 60                | 1.0             | 92.4 | 1.0   | 100.0 |  |  |  |  |  |  |  |
|  | 23.8           | 66                | 1.0             | 84.0 | 1.0   | 94.0  |  |  |  |  |  |  |  |
|  | 28.3           | 72                | 1.0             | 77.0 | 1.0   | 86.2  |  |  |  |  |  |  |  |
|  | 33.2           | 78                | 1.0             | 71.1 | 1.0   | 79.5  |  |  |  |  |  |  |  |
|  | 38.5           | 84                | 1.0             | 66.0 | 1.0   | 73.8  |  |  |  |  |  |  |  |
|  | 44.2           | 90                | 1.0             | 61.6 | 1.0   | 68.9  |  |  |  |  |  |  |  |
|  | 50.3           | 96                | 1.0             | 57.7 | 1.0   | 64.6  |  |  |  |  |  |  |  |
|  | 56.7           | 102               | 1.1             | 54.3 | 1.1   | 60.8  |  |  |  |  |  |  |  |
|  | 63.6           | 108               | 1.1             | 51.3 | 1.1   | 57.4  |  |  |  |  |  |  |  |
|  | 70.9           | 114               | 1.2             | 48.6 | 1.2   | 54.4  |  |  |  |  |  |  |  |
|  | 78.5           | 120               | 1.3             | 46.2 | 1.3   | 51.7  |  |  |  |  |  |  |  |
|  | 86.6           | 126               | 1.3             | 44.0 | 1.3   | 49.2  |  |  |  |  |  |  |  |
|  | 95.0           | 132               | 1.4             | 42.0 | 1.4   | 47.0  |  |  |  |  |  |  |  |
|  | 103.9          | 138               | 1.4             | 40.1 | 1.4   | 44.9  |  |  |  |  |  |  |  |
|  | 113.1          | 144               | 1.5             | 38.5 | 1.5   | 43.1  |  |  |  |  |  |  |  |
|  | 122.7          | 150               | 1.6             | 36.9 | 1.6   | 41.3  |  |  |  |  |  |  |  |
|  | 132.7          | 156               | 1.6             | 35.5 | 1.6   | 39.7  |  |  |  |  |  |  |  |
|  | 143.1          | 162               | 1.7             | 34.2 | 1.7   | 38.3  |  |  |  |  |  |  |  |
|  | 153.9          | 168               | 1.8             | 33.0 | 1.8   | 36.9  |  |  |  |  |  |  |  |
|  | 165.1          | 174               | 1.8             | 31.8 | 1.8   | 35.6  |  |  |  |  |  |  |  |
|  | 176.7          | 180               | 1.9             | 30.8 | 1.9   | 34.4  |  |  |  |  |  |  |  |
|  | 188.7          | 186               | 1.9             | 29.8 | 1.9   | 33.3  |  |  |  |  |  |  |  |
|  | 201.1          | 192               | 2.0             | 28.8 | 2.0   | 32.3  |  |  |  |  |  |  |  |
|  | 213.8          | 198               | 2.1             | 28.0 | 2.1   | 31.3  |  |  |  |  |  |  |  |
|  | 227.0          | 204               | 2.1             | 27.1 | 2.1   | 30.4  |  |  |  |  |  |  |  |
|  | 240.5          | 210               | 2.2             | 26.4 | 2.2   | 29.5  |  |  |  |  |  |  |  |
|  | 254.5          | 216               | 2.3             | 25.6 | 2.3   | 28.7  |  |  |  |  |  |  |  |
|  | 268.8          | 222               |                 |      | 2.3   | 27.9  |  |  |  |  |  |  |  |
|  | 283.5          | 228               |                 |      | 2.4   | 27.2  |  |  |  |  |  |  |  |

**NOTE:**

- The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.

|                                                                                       |                                                                                                                   |
|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                   |
| <b>PIPE HEIGHT OF<br/>COVER LIMITS</b>                                                |                                                                                                                   |
| JANUARY 1998                                                                          |                                                                                                                   |
| <b>STANDARD DRAWING NO. E 717-PHCL-02</b>                                             |                                                                                                                   |
|  | DETAILS PLACED IN THIS FORMAT 11-15-99<br><br>/s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE |
| DESIGN STANDARDS ENGINEER                                                             | /s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE<br>ORIGINALLY APPROVED 1-02-98                           |

**9' x 2½" STRUCTURAL PLATE ALUMINUM ALLOY PIPE-ARCH (STEEL BOLTED)  
HEIGHT OF COVER LIMITS (ft.)**

| Re<br>(in.) | SPAN<br>(ft.-in.) | RISE<br>(ft.-in.) | AREA<br>(sft.) | THICKNESS (in.) |      |       |      |       |      |       |      |       |      |
|-------------|-------------------|-------------------|----------------|-----------------|------|-------|------|-------|------|-------|------|-------|------|
|             |                   |                   |                | 0.100           |      | 0.125 |      | 0.150 |      | 0.175 |      | 0.200 |      |
|             |                   |                   |                | MIN.            | MAX. | MIN.  | MAX. | MIN.  | MAX. | MIN.  | MAX. | MIN.  | MAX. |
| 31.75       | 6'-7              | 5'-8              | 29             | 1.0             | 23.6 | 1.0   | 26.7 | 1.0   | 26.7 | 1.0   | 26.7 | 1.0   | 26.7 |
| 31.75       | 6'-11             | 5'-9              | 31             | 1.0             | 22.4 | 1.0   | 25.4 | 1.0   | 25.4 | 1.0   | 25.4 | 1.0   | 25.4 |
| 31.75       | 7'-3              | 5'-11             | 34             | 1.1             | 21.4 | 1.0   | 24.2 | 1.0   | 24.2 | 1.0   | 24.2 | 1.0   | 24.2 |
| 31.75       | 7'-9              | 6'-0              | 36             | 1.1             | 20.0 | 1.0   | 22.7 | 1.0   | 22.7 | 1.0   | 22.7 | 1.0   | 22.7 |
| 31.75       | 8'-1              | 6'-1              | 39             | 1.1             | 19.2 | 1.1   | 21.7 | 1.1   | 21.7 | 1.1   | 21.7 | 1.1   | 21.7 |
| 31.75       | 8'-5              | 6'-3              | 41             | 1.1             | 18.4 | 1.1   | 20.9 | 1.1   | 20.9 | 1.1   | 20.9 | 1.1   | 20.9 |
| 31.75       | 8'-10             | 6'-4              | 44             | 1.2             | 17.6 | 1.1   | 19.9 | 1.1   | 19.9 | 1.1   | 19.9 | 1.1   | 19.9 |
| 31.75       | 9'-3              | 6'-5              | 47             | 1.2             | 16.8 | 1.2   | 19.0 | 1.2   | 19.0 | 1.2   | 19.0 | 1.2   | 19.0 |
| 31.75       | 9'-7              | 6'-6              | 49             | 1.3             | 16.2 | 1.2   | 18.3 | 1.2   | 18.3 | 1.2   | 18.3 | 1.2   | 18.3 |
| 31.75       | 9'-11             | 6'-8              | 52             | 1.3             | 15.6 | 1.2   | 17.7 | 1.2   | 17.7 | 1.2   | 17.7 | 1.2   | 17.7 |
| 31.75       | 10'-3             | 6'-9              | 55             | 1.3             | 15.1 | 1.3   | 17.1 | 1.3   | 17.1 | 1.3   | 17.1 | 1.3   | 17.1 |
| 31.75       | 10'-9             | 6'-10             | 58             | 1.4             | 14.4 | 1.3   | 16.3 | 1.3   | 16.3 | 1.3   | 16.3 | 1.3   | 16.3 |
| 31.75       | 11'-1             | 7'-0              | 61             | 1.5             | 14.0 | 1.4   | 15.8 | 1.4   | 15.8 | 1.4   | 15.8 | 1.4   | 15.8 |
| 31.75       | 11'-5             | 7'-1              | 64             | 1.5             | 13.6 | 1.4   | 15.4 | 1.4   | 15.4 | 1.4   | 15.4 | 1.4   | 15.4 |
| 31.75       | 11'-9             | 7'-2              | 67             | 1.5             | 13.2 | 1.5   | 14.9 | 1.5   | 14.9 | 1.5   | 14.9 | 1.5   | 14.9 |
| 31.75       | 12'-3             | 7'-3              | 70             | 1.6             | 12.6 | 1.5   | 14.3 | 1.5   | 14.3 | 1.5   | 14.3 | 1.5   | 14.3 |
| 31.75       | 12'-7             | 7'-5              | 73             | 1.7             | 11.7 | 1.6   | 13.9 | 1.6   | 13.9 | 1.6   | 13.9 | 1.6   | 13.9 |
| 31.75       | 12'-11            | 7'-6              | 77             | 1.7             | 11.3 | 1.6   | 13.6 | 1.6   | 13.6 | 1.6   | 13.6 | 1.6   | 13.6 |
| 31.75       | 13'-1             | 8'-2              | 83             | 1.7             | 11.2 | 1.6   | 13.4 | 1.6   | 13.4 | 1.6   | 13.4 | 1.6   | 13.4 |
| 31.75       | 13'-1             | 8'-4              | 86             | 1.7             | 11.2 | 1.6   | 13.4 | 1.6   | 13.4 | 1.6   | 13.4 | 1.6   | 13.4 |
| 31.75       | 13'-11            | 8'-5              | 90             | 1.9             | 10.4 | 1.7   | 12.0 | 1.7   | 12.0 | 1.7   | 12.0 | 1.7   | 12.0 |
| 31.75       | 14'-0             | 8'-7              | 94             | 1.9             | 10.3 | 1.8   | 11.9 | 1.8   | 11.9 | 1.8   | 11.9 | 1.8   | 11.9 |
| 31.75       | 13'-11            | 9'-5              | 101            | 1.9             | 10.4 | 1.7   | 12.0 | 1.7   | 12.0 | 1.7   | 12.0 | 1.7   | 12.0 |
| 31.75       | 14'-3             | 9'-7              | 105            | 1.9             | 10.1 | 1.8   | 11.7 | 1.8   | 11.7 | 1.8   | 11.7 | 1.8   | 11.7 |
| 31.75       | 14'-8             | 9'-8              | 109            |                 |      | 1.8   | 11.3 | 1.8   | 11.3 | 1.8   | 11.3 | 1.8   | 11.3 |
| 31.75       | 14'-11            | 9'-10             | 114            |                 |      | 1.9   | 11.1 | 1.9   | 11.1 | 1.9   | 11.1 | 1.9   | 11.1 |
|             |                   |                   |                |                 |      |       |      |       |      |       |      |       |      |
|             |                   |                   |                |                 |      |       |      |       |      |       |      |       |      |
|             |                   |                   |                |                 |      |       |      |       |      |       |      |       |      |

**NOTE:**

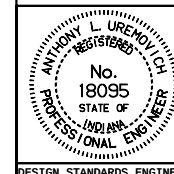
- The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.
- A specific design shall be performed for structures with corner radii other than those tabulated above to determine the appropriate cover depth limits.

INDIANA DEPARTMENT OF TRANSPORTATION

**PIPE HEIGHT OF  
COVER LIMITS**

JANUARY 1998

**STANDARD DRAWING NO. E 717-PHCL-03**



DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

ORIGINALLY APPROVED 1-02-98

**9' x 2½" STRUCTURAL PLATE ALUMINUM ALLOY PIPE-ARCH (STEEL BOLTED)  
HEIGHT OF COVER LIMITS (ft.)**

| Rc<br>(in.) | RISE<br>(ft.-in.) | RISE<br>(ft.-in.) | AREA<br>(sft.) | THICKNESS (in.) |      |       |      |  |  |  |  |  |  |
|-------------|-------------------|-------------------|----------------|-----------------|------|-------|------|--|--|--|--|--|--|
|             |                   |                   |                | 0.225           |      | 0.250 |      |  |  |  |  |  |  |
|             |                   |                   |                | MIN.            | MAX. | MIN.  | MAX. |  |  |  |  |  |  |
| 31.75       | 6'-7              | 5'-8              | 29             | 1.0             | 26.7 | 1.0   | 26.7 |  |  |  |  |  |  |
| 31.75       | 6'-11             | 5'-9              | 31             | 1.0             | 25.4 | 1.0   | 25.4 |  |  |  |  |  |  |
| 31.75       | 7'-3              | 5'-11             | 34             | 1.0             | 24.2 | 1.0   | 24.2 |  |  |  |  |  |  |
| 31.75       | 7'-9              | 6'-0              | 36             | 1.0             | 22.7 | 1.0   | 22.7 |  |  |  |  |  |  |
| 31.75       | 8'-1              | 6'-1              | 39             | 1.1             | 21.7 | 1.1   | 21.7 |  |  |  |  |  |  |
| 31.75       | 8'-5              | 6'-3              | 41             | 1.1             | 20.9 | 1.1   | 20.9 |  |  |  |  |  |  |
| 31.75       | 8'-10             | 6'-4              | 44             | 1.1             | 19.9 | 1.1   | 19.9 |  |  |  |  |  |  |
| 31.75       | 9'-3              | 6'-5              | 47             | 1.2             | 19.0 | 1.2   | 19.0 |  |  |  |  |  |  |
| 31.75       | 9'-7              | 6'-6              | 49             | 1.2             | 18.3 | 1.2   | 18.3 |  |  |  |  |  |  |
| 31.75       | 9'-11             | 6'-8              | 52             | 1.2             | 17.7 | 1.2   | 17.7 |  |  |  |  |  |  |
| 31.75       | 10'-3             | 6'-9              | 55             | 1.3             | 17.1 | 1.3   | 17.1 |  |  |  |  |  |  |
| 31.75       | 10'-9             | 6'-10             | 58             | 1.3             | 16.3 | 1.3   | 16.3 |  |  |  |  |  |  |
| 31.75       | 11'-1             | 7'-0              | 61             | 1.4             | 15.8 | 1.4   | 15.8 |  |  |  |  |  |  |
| 31.75       | 11'-5             | 7'-1              | 64             | 1.4             | 15.4 | 1.4   | 15.4 |  |  |  |  |  |  |
| 31.75       | 11'-9             | 7'-2              | 67             | 1.5             | 14.9 | 1.5   | 14.9 |  |  |  |  |  |  |
| 31.75       | 12'-3             | 7'-3              | 70             | 1.5             | 14.3 | 1.5   | 14.3 |  |  |  |  |  |  |
| 31.75       | 12'-7             | 7'-5              | 73             | 1.6             | 13.9 | 1.6   | 13.9 |  |  |  |  |  |  |
| 31.75       | 12'-11            | 7'-6              | 77             | 1.6             | 13.6 | 1.6   | 13.6 |  |  |  |  |  |  |
| 31.75       | 13'-1             | 8'-2              | 83             | 1.6             | 13.4 | 1.6   | 13.4 |  |  |  |  |  |  |
| 31.75       | 13'-1             | 8'-4              | 86             | 1.6             | 13.4 | 1.6   | 13.4 |  |  |  |  |  |  |
| 31.75       | 13'-11            | 8'-5              | 90             | 1.7             | 12.0 | 1.7   | 12.0 |  |  |  |  |  |  |
| 31.75       | 14'-0             | 8'-7              | 94             | 1.8             | 11.9 | 1.8   | 11.9 |  |  |  |  |  |  |
| 31.75       | 13'-11            | 9'-5              | 101            | 1.7             | 12.0 | 1.7   | 12.0 |  |  |  |  |  |  |
| 31.75       | 14'-3             | 9'-7              | 105            | 1.8             | 11.7 | 1.8   | 11.7 |  |  |  |  |  |  |
| 31.75       | 14'-8             | 9'-8              | 109            | 1.8             | 11.3 | 1.8   | 11.3 |  |  |  |  |  |  |
| 31.75       | 14'-11            | 9'-10             | 114            | 1.9             | 11.1 | 1.9   | 11.1 |  |  |  |  |  |  |
|             |                   |                   |                |                 |      |       |      |  |  |  |  |  |  |
|             |                   |                   |                |                 |      |       |      |  |  |  |  |  |  |
|             |                   |                   |                |                 |      |       |      |  |  |  |  |  |  |

**NOTE:**

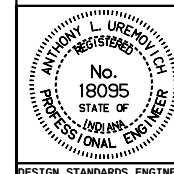
- The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.
- A specific design shall be performed for structures with corner radii other than those tabulated above to determine the appropriate cover depth limits.

INDIANA DEPARTMENT OF TRANSPORTATION

**PIPE HEIGHT OF  
COVER LIMITS**

JANUARY 1998

**STANDARD DRAWING NO.E 717-PHCL-04**



DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

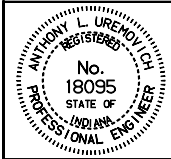
ORIGINALLY APPROVED 1-02-98

**9' x 2½" STRUCTURAL PLATE ALUMINUM ALLOY PIPE-ARCH (STEEL BOLTED)  
HEIGHT OF COVER LIMITS (ft.)**

| Re<br>(in.) | SPAN<br>(ft.-in.) | RISE<br>(ft.-in.) | AREA<br>(sft ) | THICKNESS (in.) |      |       |      |       |      |       |      |       |      |
|-------------|-------------------|-------------------|----------------|-----------------|------|-------|------|-------|------|-------|------|-------|------|
|             |                   |                   |                | 0.100           |      | 0.125 |      | 0.150 |      | 0.175 |      | 0.200 |      |
|             |                   |                   |                | MIN.            | MAX. | MIN.  | MAX. | MIN.  | MAX. | MIN.  | MAX. | MIN.  | MAX. |
| 31.75       | 15-4              | 10-0              | 118            |                 |      | 1.9   | 10.7 | 1.9   | 10.7 | 1.9   | 10.7 | 1.9   | 10.7 |
| 31.75       | 15-7              | 10-2              | 123            |                 |      | 2.0   | 10.5 | 2.0   | 10.5 | 2.0   | 10.5 | 2.0   | 10.5 |
| 31.75       | 16-1              | 10-4              | 127            |                 |      | 2.0   | 10.1 | 2.0   | 10.1 | 2.0   | 10.1 | 2.0   | 10.1 |
| 31.75       | 16-4              | 10-6              | 132            |                 |      |       |      | 2.0   | 9.9  | 2.0   | 9.9  | 2.0   | 9.9  |
| 31.75       | 16-9              | 10-8              | 136            |                 |      |       |      | 2.1   | 9.6  | 2.1   | 9.6  | 2.1   | 9.6  |
| 31.75       | 17-0              | 10-10             | 141            |                 |      |       |      | 2.1   | 9.5  | 2.1   | 9.5  | 2.1   | 9.5  |
| 31.75       | 17-3              | 11-0              | 146            |                 |      |       |      | 2.2   | 9.3  | 2.2   | 9.3  | 2.2   | 9.3  |
| 31.75       | 17-9              | 11-2              | 151            |                 |      |       |      |       |      | 2.2   | 8.9  | 2.2   | 8.9  |
| 31.75       | 18-0              | 11-4              | 156            |                 |      |       |      |       |      | 2.3   | 8.8  | 2.3   | 8.8  |
| 31.75       | 18-5              | 11-6              | 161            |                 |      |       |      |       |      | 2.3   | 8.5  | 2.3   | 8.5  |
| 31.75       | 18-8              | 11-8              | 167            |                 |      |       |      |       |      | 2.3   | 8.4  | 2.3   | 8.4  |
| 31.75       | 19-2              | 11-9              | 172            |                 |      |       |      |       |      |       |      | 2.4   | 8.0  |
| 31.75       | 19-5              | 11-11             | 177            |                 |      |       |      |       |      |       |      | 2.4   | 7.9  |
| 31.75       | 19-10             | 12-1              | 182            |                 |      |       |      |       |      |       |      | 2.5   | 7.7  |
| 31.75       | 20-1              | 12-3              | 188            |                 |      |       |      |       |      |       |      | 2.5   | 7.5  |
| 31.75       | 20-1              | 12-6              | 194            |                 |      |       |      |       |      |       |      |       |      |
| 31.75       | 20-10             | 12-7              | 199            |                 |      |       |      |       |      |       |      |       |      |
| 31.75       | 21-1              | 12-9              | 205            |                 |      |       |      |       |      |       |      |       |      |
| 31.75       | 21-6              | 12-11             | 211            |                 |      |       |      |       |      |       |      |       |      |
| 47.00       | 20-1              | 13-11             | 216            |                 |      |       |      |       |      |       |      |       |      |
| 47.00       | 20-7              | 14-3              | 224            |                 |      |       |      |       |      |       |      |       |      |
| 47.00       | 21-5              | 14-7              | 241            |                 |      |       |      |       |      |       |      |       |      |
| 47.00       | 21-11             | 14-11             | 254            |                 |      |       |      |       |      |       |      |       |      |
| 47.00       | 22-8              | 15-3              | 267            |                 |      |       |      |       |      |       |      |       |      |
|             |                   |                   |                |                 |      |       |      |       |      |       |      |       |      |
|             |                   |                   |                |                 |      |       |      |       |      |       |      |       |      |
|             |                   |                   |                |                 |      |       |      |       |      |       |      |       |      |
|             |                   |                   |                |                 |      |       |      |       |      |       |      |       |      |
|             |                   |                   |                |                 |      |       |      |       |      |       |      |       |      |

**NOTE:**

- The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.
- A specific design shall be performed for structures with corner radii other than those tabulated above to determine the appropriate cover depth limits.

|                                                                                       |                                                                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                                                                                            |
| <b>PIPE HEIGHT OF<br/>COVER LIMITS</b>                                                |                                                                                                                                                                                                                                            |
| JANUARY 1998                                                                          |                                                                                                                                                                                                                                            |
| <b>STANDARD DRAWING NO. E 717-PHCL-05</b>                                             |                                                                                                                                                                                                                                            |
|  | DETAILS PLACED IN THIS FORMAT 11-15-99<br><br>/s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE<br><br>/s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE<br>DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 1-02-98 |

**9' x 2½" STRUCTURAL PLATE ALUMINUM ALLOY PIPE-ARCH (STEEL BOLTED)  
HEIGHT OF COVER LIMITS (ft.)**

| Re<br>(in.) | SPAN<br>(ft.-in.) | RISE<br>(ft.-in.) | AREA<br>(sft) | THICKNESS (in.) |      |       |      |  |  |  |  |  |  |
|-------------|-------------------|-------------------|---------------|-----------------|------|-------|------|--|--|--|--|--|--|
|             |                   |                   |               | 0.225           |      | 0.250 |      |  |  |  |  |  |  |
|             |                   |                   |               | MIN.            | MAX. | MIN.  | MAX. |  |  |  |  |  |  |
| 31.75       | 15-4              | 10-0              | 118           | 1.9             | 10.7 | 1.9   | 10.7 |  |  |  |  |  |  |
| 31.75       | 15-7              | 10-2              | 123           | 2.0             | 10.5 | 2.0   | 10.5 |  |  |  |  |  |  |
| 31.75       | 16-1              | 10-4              | 127           | 2.0             | 10.1 | 2.0   | 10.1 |  |  |  |  |  |  |
| 31.75       | 16-4              | 10-6              | 132           | 2.0             | 9.9  | 2.0   | 9.9  |  |  |  |  |  |  |
| 31.75       | 16-9              | 10-8              | 136           | 2.1             | 9.6  | 2.1   | 9.6  |  |  |  |  |  |  |
| 31.75       | 17-0              | 10-10             | 141           | 2.1             | 9.5  | 2.1   | 9.5  |  |  |  |  |  |  |
| 31.75       | 17-3              | 11-0              | 146           | 2.2             | 9.3  | 2.2   | 9.3  |  |  |  |  |  |  |
| 31.75       | 17-9              | 11-2              | 151           | 2.2             | 8.9  | 2.2   | 8.9  |  |  |  |  |  |  |
| 31.75       | 18-0              | 11-4              | 156           | 2.3             | 8.8  | 2.3   | 8.8  |  |  |  |  |  |  |
| 31.75       | 18-5              | 11-6              | 161           | 2.3             | 8.5  | 2.3   | 8.5  |  |  |  |  |  |  |
| 31.75       | 18-8              | 11-8              | 167           | 2.3             | 8.4  | 2.3   | 8.4  |  |  |  |  |  |  |
| 31.75       | 19-2              | 11-9              | 172           | 2.4             | 8.0  | 2.4   | 8.0  |  |  |  |  |  |  |
| 31.75       | 19-5              | 11-11             | 177           | 2.4             | 7.9  | 2.4   | 7.9  |  |  |  |  |  |  |
| 31.75       | 19-10             | 12-1              | 182           | 2.5             | 7.7  | 2.5   | 7.7  |  |  |  |  |  |  |
| 31.75       | 20-1              | 12-3              | 188           | 2.5             | 7.5  | 2.5   | 7.5  |  |  |  |  |  |  |
| 31.75       | 20-1              | 12-6              | 194           | 2.5             | 7.5  | 2.5   | 7.5  |  |  |  |  |  |  |
| 31.75       | 20-10             | 12-7              | 199           | 2.6             | 7.1  | 2.6   | 7.1  |  |  |  |  |  |  |
| 31.75       | 21-1              | 12-9              | 205           | 2.6             | 7.0  | 2.6   | 7.0  |  |  |  |  |  |  |
| 31.75       | 21-6              | 12-11             | 211           | 2.7             | 6.7  | 2.7   | 6.7  |  |  |  |  |  |  |
| 47.00       | 20-1              | 13-11             | 216           |                 |      | 2.5   | 12.4 |  |  |  |  |  |  |
| 47.00       | 20-7              | 14-3              | 224           |                 |      | 2.6   | 12.1 |  |  |  |  |  |  |
| 47.00       | 21-5              | 14-7              | 241           |                 |      | 2.7   | 11.5 |  |  |  |  |  |  |
| 47.00       | 21-11             | 14-11             | 254           |                 |      | 2.7   | 11.2 |  |  |  |  |  |  |
| 47.00       | 22-8              | 15-3              | 267           |                 |      | 2.8   | 10.8 |  |  |  |  |  |  |
|             |                   |                   |               |                 |      |       |      |  |  |  |  |  |  |
|             |                   |                   |               |                 |      |       |      |  |  |  |  |  |  |
|             |                   |                   |               |                 |      |       |      |  |  |  |  |  |  |
|             |                   |                   |               |                 |      |       |      |  |  |  |  |  |  |
|             |                   |                   |               |                 |      |       |      |  |  |  |  |  |  |

**NOTE:**

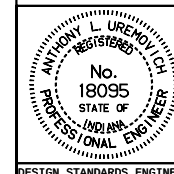
- The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.
- A specific design shall be performed for structures with corner radii other than those tabulated above to determine the appropriate cover depth limits.

INDIANA DEPARTMENT OF TRANSPORTATION

**PIPE HEIGHT OF  
COVER LIMITS**

JANUARY 1998

**STANDARD DRAWING NO. E 717-PHCL-06**



DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

ORIGINALLY APPROVED 1-02-98

**6" x 2" STRUCTURAL PLATE STEEL PIPE (BOLTED)  
HEIGHT OF COVER LIMITS (ft)**

|  | AREA<br>(sft) | DIAMETER<br>(in.) | THICKNESS (in.) |      |       |      |       |      |  |  |  |  |
|--|---------------|-------------------|-----------------|------|-------|------|-------|------|--|--|--|--|
|  |               |                   | 0.111           |      | 0.140 |      | 0.170 |      |  |  |  |  |
|  |               |                   | MIN.            | MAX. | MIN.  | MAX. | MIN.  | MAX. |  |  |  |  |
|  | 19.6          | 60                | 1.0             | 47.7 | 1.0   | 68.8 | 1.0   | 90.0 |  |  |  |  |
|  | 23.8          | 66                | 1.0             | 43.4 | 1.0   | 62.6 | 1.0   | 81.8 |  |  |  |  |
|  | 28.3          | 72                | 1.0             | 39.8 | 1.0   | 57.4 | 1.0   | 75.0 |  |  |  |  |
|  | 33.2          | 78                | 1.0             | 36.7 | 1.0   | 52.9 | 1.0   | 69.2 |  |  |  |  |
|  | 38.5          | 84                | 1.0             | 34.1 | 1.0   | 49.2 | 1.0   | 64.2 |  |  |  |  |
|  | 44.2          | 90                | 1.0             | 31.8 | 1.0   | 45.9 | 1.0   | 60.0 |  |  |  |  |
|  | 50.3          | 96                | 1.0             | 29.8 | 1.0   | 43.0 | 1.0   | 56.2 |  |  |  |  |
|  | 56.7          | 102               | 1.1             | 28.1 | 1.1   | 40.5 | 1.1   | 52.9 |  |  |  |  |
|  | 63.6          | 108               | 1.1             | 26.5 | 1.1   | 38.2 | 1.1   | 50.0 |  |  |  |  |
|  | 70.9          | 114               | 1.2             | 25.1 | 1.2   | 36.2 | 1.2   | 47.3 |  |  |  |  |
|  | 78.5          | 120               | 1.3             | 23.8 | 1.3   | 34.4 | 1.3   | 45.0 |  |  |  |  |
|  | 86.6          | 126               | 1.3             | 22.7 | 1.3   | 32.8 | 1.3   | 42.8 |  |  |  |  |
|  | 95.0          | 132               | 1.4             | 21.7 | 1.4   | 31.3 | 1.4   | 40.9 |  |  |  |  |
|  | 103.9         | 138               | 1.4             | 20.7 | 1.4   | 29.9 | 1.4   | 39.1 |  |  |  |  |
|  | 113.1         | 144               | 1.5             | 19.9 | 1.5   | 28.7 | 1.5   | 37.5 |  |  |  |  |
|  | 122.7         | 150               | 1.6             | 19.1 | 1.6   | 27.5 | 1.6   | 36.0 |  |  |  |  |
|  | 132.7         | 156               | 1.6             | 18.3 | 1.6   | 26.4 | 1.6   | 34.6 |  |  |  |  |
|  | 143.1         | 162               | 1.7             | 17.6 | 1.7   | 25.5 | 1.7   | 33.3 |  |  |  |  |
|  | 153.9         | 168               | 1.8             | 17.0 | 1.8   | 24.6 | 1.8   | 32.1 |  |  |  |  |
|  | 165.1         | 174               | 1.8             | 16.4 | 1.8   | 23.7 | 1.8   | 31.0 |  |  |  |  |
|  | 176.7         | 180               | 1.9             | 15.9 | 1.9   | 22.9 | 1.9   | 30.0 |  |  |  |  |
|  | 188.7         | 186               | 1.9             | 15.4 | 1.9   | 22.2 | 1.9   | 29.0 |  |  |  |  |
|  | 201.1         | 192               |                 |      | 2.0   | 21.5 | 2.0   | 28.1 |  |  |  |  |
|  | 213.8         | 198               |                 |      | 2.1   | 20.8 | 2.1   | 27.2 |  |  |  |  |
|  | 227.0         | 204               |                 |      | 2.1   | 20.2 | 2.1   | 26.4 |  |  |  |  |
|  | 240.5         | 210               |                 |      | 2.2   | 19.6 | 2.2   | 25.7 |  |  |  |  |
|  | 254.5         | 216               |                 |      |       |      | 2.3   | 25.0 |  |  |  |  |
|  | 268.8         | 222               |                 |      |       |      | 2.3   | 24.3 |  |  |  |  |
|  | 283.5         | 228               |                 |      |       |      | 2.4   | 23.0 |  |  |  |  |
|  | 298.6         | 234               |                 |      |       |      | 2.4   | 7.0  |  |  |  |  |
|  | 314.2         | 240               |                 |      |       |      |       |      |  |  |  |  |
|  | 330.1         | 246               |                 |      |       |      |       |      |  |  |  |  |
|  | 346.4         | 252               |                 |      |       |      |       |      |  |  |  |  |

**NOTE:**

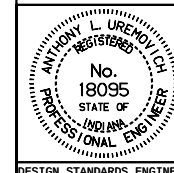
- The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.
- The tabulated plate thickness reflects the required thickness for top and side plates. Refer to 908.09 (a) for the required bottom plate thickness.

INDIANA DEPARTMENT OF TRANSPORTATION

**PIPE HEIGHT OF  
COVER LIMITS**

JANUARY 1998

**STANDARD DRAWING NO. E 717-PHCL-07**



DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

ORIGINALLY APPROVED 1-02-98

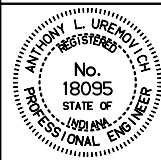
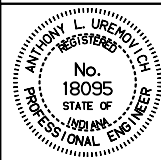


**6" x 2" STRUCTURAL PLATE STEEL PIPE (BOLTED)**  
**HEIGHT OF COVER LIMITS (in.)**

| AREA<br>(sft) | DIAMETER<br>(in.) | THICKNESS (in.) |       |       |       |       |       |       |       |  |  |  |  |
|---------------|-------------------|-----------------|-------|-------|-------|-------|-------|-------|-------|--|--|--|--|
|               |                   | 0.188           |       | 0.218 |       | 0.249 |       | 0.280 |       |  |  |  |  |
|               |                   | MIN.            | MAX.  | MIN.  | MAX.  | MIN.  | MAX.  | MIN.  | MAX.  |  |  |  |  |
| 19.6          | 60                | 1.0             | 100.0 | 1.0   | 100.0 | 1.0   | 100.0 | 1.0   | 100.0 |  |  |  |  |
| 23.8          | 66                | 1.0             | 93.9  | 1.0   | 100.0 | 1.0   | 100.0 | 1.0   | 100.0 |  |  |  |  |
| 28.3          | 72                | 1.0             | 86.1  | 1.0   | 100.0 | 1.0   | 100.0 | 1.0   | 100.0 |  |  |  |  |
| 33.2          | 78                | 1.0             | 79.4  | 1.0   | 95.7  | 1.0   | 100.0 | 1.0   | 100.0 |  |  |  |  |
| 38.5          | 84                | 1.0             | 73.8  | 1.0   | 88.8  | 1.0   | 100.0 | 1.0   | 100.0 |  |  |  |  |
| 44.2          | 90                | 1.0             | 68.8  | 1.0   | 82.9  | 1.0   | 97.7  | 1.0   | 100.0 |  |  |  |  |
| 50.3          | 96                | 1.0             | 64.5  | 1.0   | 77.7  | 1.0   | 91.6  | 1.0   | 100.0 |  |  |  |  |
| 56.7          | 102               | 1.1             | 60.7  | 1.1   | 73.2  | 1.1   | 86.2  | 1.1   | 94.1  |  |  |  |  |
| 63.6          | 108               | 1.1             | 57.4  | 1.1   | 69.1  | 1.1   | 84.1  | 1.1   | 88.8  |  |  |  |  |
| 70.9          | 114               | 1.2             | 54.3  | 1.2   | 65.4  | 1.2   | 77.1  | 1.2   | 84.2  |  |  |  |  |
| 78.5          | 120               | 1.3             | 51.6  | 1.3   | 62.2  | 1.3   | 73.3  | 1.3   | 80.0  |  |  |  |  |
| 86.6          | 126               | 1.3             | 49.2  | 1.3   | 59.2  | 1.3   | 69.8  | 1.3   | 76.1  |  |  |  |  |
| 95.0          | 132               | 1.4             | 46.9  | 1.4   | 56.5  | 1.4   | 66.6  | 1.4   | 72.7  |  |  |  |  |
| 103.9         | 138               | 1.4             | 44.9  | 1.4   | 54.1  | 1.4   | 63.7  | 1.4   | 69.5  |  |  |  |  |
| 113.1         | 144               | 1.5             | 43.0  | 1.5   | 51.8  | 1.5   | 61.1  | 1.5   | 66.6  |  |  |  |  |
| 122.7         | 150               | 1.6             | 41.3  | 1.6   | 49.7  | 1.6   | 58.6  | 1.6   | 64.0  |  |  |  |  |
| 132.7         | 156               | 1.6             | 39.7  | 1.6   | 47.8  | 1.6   | 56.4  | 1.6   | 61.5  |  |  |  |  |
| 143.1         | 162               | 1.7             | 38.2  | 1.7   | 46.0  | 1.7   | 54.3  | 1.7   | 59.2  |  |  |  |  |
| 153.9         | 168               | 1.8             | 36.9  | 1.8   | 44.4  | 1.8   | 52.3  | 1.8   | 57.1  |  |  |  |  |
| 165.1         | 174               | 1.8             | 35.6  | 1.8   | 42.9  | 1.8   | 50.5  | 1.8   | 55.1  |  |  |  |  |
| 176.7         | 180               | 1.9             | 34.4  | 1.9   | 41.4  | 1.9   | 48.8  | 1.9   | 53.3  |  |  |  |  |
| 188.7         | 186               | 1.9             | 33.3  | 1.9   | 40.1  | 1.9   | 47.3  | 1.9   | 51.6  |  |  |  |  |
| 210.1         | 192               | 2.0             | 32.2  | 2.0   | 38.8  | 2.0   | 45.8  | 2.0   | 50.0  |  |  |  |  |
| 213.8         | 198               | 2.1             | 31.3  | 2.1   | 37.7  | 2.1   | 44.4  | 2.1   | 48.4  |  |  |  |  |
| 227.0         | 204               | 2.1             | 30.3  | 2.1   | 36.6  | 2.1   | 43.1  | 2.1   | 47.0  |  |  |  |  |
| 240.5         | 210               | 2.1             | 29.5  | 2.1   | 35.5  | 2.1   | 41.9  | 2.1   | 45.7  |  |  |  |  |
| 254.5         | 216               | 2.3             | 28.7  | 2.3   | 34.5  | 2.3   | 40.7  | 2.3   | 44.4  |  |  |  |  |
| 268.8         | 222               | 2.3             | 27.9  | 2.3   | 33.6  | 2.3   | 39.6  | 2.3   | 43.2  |  |  |  |  |
| 283.5         | 228               | 2.4             | 27.1  | 2.4   | 32.7  | 2.4   | 38.5  | 2.4   | 42.1  |  |  |  |  |
| 298.6         | 234               | 2.4             | 26.4  | 2.4   | 31.9  | 2.4   | 37.6  | 2.4   | 41.0  |  |  |  |  |
| 314.2         | 240               | 2.5             | 25.8  | 2.5   | 31.1  | 2.5   | 36.6  | 2.5   | 40.0  |  |  |  |  |
| 330.1         | 246               | 2.5             | 25.2  | 2.6   | 30.3  | 2.6   | 35.7  | 2.6   | 39.0  |  |  |  |  |
| 346.4         | 252               |                 |       | 2.6   | 28.8  | 2.6   | 34.0  | 2.6   | 38.0  |  |  |  |  |

**NOTE:**

1. The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.
2. The tabulated thickness reflects the required thickness for top and side plates. Refer to 908.08 (a) for the required bottom plate thickness.

|                                                                                       |                                                                                                                          |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                          |
| <b>PIPE HEIGHT OF<br/>COVER LIMITS</b>                                                |                                                                                                                          |
| JANUARY 1998                                                                          |                                                                                                                          |
| <b>STANDARD DRAWING NO. E 717-PHCL-08</b>                                             |                                                                                                                          |
|  | DETAILS PLACED IN THIS FORMAT 11-15-99<br><br><i>/s/ Anthony L. Uremovich</i> 11-15-99<br>DESIGN STANDARDS ENGINEER DATE |
|  | <i>/s/ Firooz Zandi</i> 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE<br>ORIGINALLY APPROVED 1-02-98                           |

**6" x 2" STRUCTURAL PLATE STEEL PIPE-ARCH (BOLTED)  
HEIGHT OF COVER LIMITS (ft.)**

| Rc<br>(in.) | SPAN<br>(ft.-in.) | RISE<br>(ft.-in.) | AREA<br>(sft) | THICKNESS (in.) |      |                  |      |  |  |  |  |
|-------------|-------------------|-------------------|---------------|-----------------|------|------------------|------|--|--|--|--|
|             |                   |                   |               | 0.111           |      | 0.140 thru 0.280 |      |  |  |  |  |
|             |                   |                   |               | MIN.            | MAX. | MIN.             | MAX. |  |  |  |  |
| 18          | 6-1               | 4-7               | 22            | 1.3             | 16.4 | 1.3              | 16.4 |  |  |  |  |
| 18          | 6-4               | 4-9               | 24            | 1.3             | 15.7 | 1.3              | 15.7 |  |  |  |  |
| 18          | 6-9               | 4-11              | 26            | 1.4             | 14.8 | 1.4              | 14.8 |  |  |  |  |
| 18          | 7-0               | 5-1               | 28            | 1.4             | 14.2 | 1.4              | 14.2 |  |  |  |  |
| 18          | 7-3               | 5-3               | 31            | 1.5             | 13.7 | 1.5              | 13.7 |  |  |  |  |
| 18          | 7-8               | 5-5               | 33            | 1.6             | 13.0 | 1.6              | 13.0 |  |  |  |  |
| 18          | 7-11              | 5-7               | 35            | 1.6             | 12.6 | 1.6              | 12.6 |  |  |  |  |
| 18          | 8-2               | 5-9               | 38            | 1.7             | 12.2 | 1.7              | 12.2 |  |  |  |  |
| 18          | 8-7               | 5-11              | 40            | 1.8             | 11.6 | 1.8              | 11.6 |  |  |  |  |
| 18          | 8-10              | 6-1               | 43            | 1.8             | 11.3 | 1.8              | 11.3 |  |  |  |  |
| 18          | 9-4               | 6-3               | 46            | 2.0             | 10.7 | 2.0              | 10.7 |  |  |  |  |
| 18          | 9-6               | 6-5               | 49            | 2.0             | 10.5 | 2.0              | 10.5 |  |  |  |  |
| 18          | 9-9               | 6-7               | 52            | 2.1             | 10.2 | 2.1              | 10.2 |  |  |  |  |
| 18          | 10-3              | 6-9               | 55            | 2.1             | 8.7  | 2.1              | 8.7  |  |  |  |  |
| 18          | 10-8              | 6-11              | 58            | 2.1             | 8.3  | 2.1              | 8.3  |  |  |  |  |
| 18          | 10-11             | 7-1               | 61            | 2.2             | 8.0  | 2.2              | 8.0  |  |  |  |  |
| 18          | 11-5              | 7-3               | 64            | 2.3             | 7.5  | 2.3              | 7.5  |  |  |  |  |
| 18          | 11-7              | 7-5               | 67            | 2.4             | 7.3  | 2.4              | 7.3  |  |  |  |  |
| 18          | 11-10             | 7-7               | 71            | 2.5             | 7.1  | 2.5              | 7.1  |  |  |  |  |
| 18          | 12-4              | 7-9               | 74            | 2.6             | 6.6  | 2.6              | 6.6  |  |  |  |  |
| 18          | 12-6              | 7-11              | 78            | 2.7             | 6.5  | 2.7              | 6.5  |  |  |  |  |
| 18          | 12-8              | 8-1               | 81            | 2.8             | 6.3  | 2.8              | 6.3  |  |  |  |  |
| 18          | 12-10             | 8-4               | 85            | 2.8             | 6.2  | 2.8              | 6.2  |  |  |  |  |
| 31          | 13-3              | 9-4               | 97            | 1.7             | 12.4 | 1.7              | 12.4 |  |  |  |  |
| 31          | 13-6              | 9-6               | 102           | 1.7             | 12.1 | 1.7              | 12.1 |  |  |  |  |
| 31          | 14-0              | 9-8               | 105           | 1.8             | 11.6 | 1.8              | 11.6 |  |  |  |  |
| 31          | 14-2              | 9-10              | 109           | 1.8             | 11.5 | 1.8              | 11.5 |  |  |  |  |
| 31          | 14-5              | 10-0              | 114           | 1.8             | 11.2 | 1.8              | 11.2 |  |  |  |  |
| 31          | 14-11             | 10-2              | 118           | 1.9             | 10.8 | 1.9              | 10.8 |  |  |  |  |

**NOTE:**

1. The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.
2. A specific design shall be performed for structures with corner radii other than those tabulated above to determine the appropriate cover depth limits.
3. The tabulated plate thickness reflects the required thickness for top and side plates. Refer to 908.09 (a) for the required bottom plate thickness.

|                                                                                       |                                                                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                                                                                            |
| <b>PIPE HEIGHT OF<br/>COVER LIMITS</b>                                                |                                                                                                                                                                                                                                            |
| JANUARY 1998                                                                          |                                                                                                                                                                                                                                            |
| <b>STANDARD DRAWING NO. E 717-PHCL-09</b>                                             |                                                                                                                                                                                                                                            |
|  | DETAILS PLACED IN THIS FORMAT 11-15-99<br><br>/s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE<br><br>/s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE<br>DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 1-02-98 |

| 6" x 2" STRUCTURAL PLATE STEEL PIPE-ARCH (BOLTED) |      |
|---------------------------------------------------|------|
| HEIGHT OF COVER LIMITS (ft.)                      |      |
| 1                                                 | 1.0  |
| 2                                                 | 1.5  |
| 3                                                 | 2.0  |
| 4                                                 | 2.5  |
| 5                                                 | 3.0  |
| 6                                                 | 3.5  |
| 7                                                 | 4.0  |
| 8                                                 | 4.5  |
| 9                                                 | 5.0  |
| 10                                                | 5.5  |
| 11                                                | 6.0  |
| 12                                                | 6.5  |
| 13                                                | 7.0  |
| 14                                                | 7.5  |
| 15                                                | 8.0  |
| 16                                                | 8.5  |
| 17                                                | 9.0  |
| 18                                                | 9.5  |
| 19                                                | 10.0 |
| 20                                                | 10.5 |
| 21                                                | 11.0 |
| 22                                                | 11.5 |
| 23                                                | 12.0 |
| 24                                                | 12.5 |
| 25                                                | 13.0 |
| 26                                                | 13.5 |
| 27                                                | 14.0 |
| 28                                                | 14.5 |
| 29                                                | 15.0 |
| 30                                                | 15.5 |
| 31                                                | 16.0 |
| 32                                                | 16.5 |
| 33                                                | 17.0 |
| 34                                                | 17.5 |
| 35                                                | 18.0 |
| 36                                                | 18.5 |
| 37                                                | 19.0 |
| 38                                                | 19.5 |
| 39                                                | 20.0 |
| 40                                                | 20.5 |
| 41                                                | 21.0 |
| 42                                                | 21.5 |
| 43                                                | 22.0 |
| 44                                                | 22.5 |
| 45                                                | 23.0 |
| 46                                                | 23.5 |
| 47                                                | 24.0 |
| 48                                                | 24.5 |
| 49                                                | 25.0 |
| 50                                                | 25.5 |
| 51                                                | 26.0 |
| 52                                                | 26.5 |
| 53                                                | 27.0 |
| 54                                                | 27.5 |
| 55                                                | 28.0 |
| 56                                                | 28.5 |
| 57                                                | 29.0 |
| 58                                                | 29.5 |
| 59                                                | 30.0 |
| 60                                                | 30.5 |
| 61                                                | 31.0 |
| 62                                                | 31.5 |
| 63                                                | 32.0 |
| 64                                                | 32.5 |
| 65                                                | 33.0 |
| 66                                                | 33.5 |
| 67                                                | 34.0 |
| 68                                                | 34.5 |
| 69                                                | 35.0 |
| 70                                                | 35.5 |
| 71                                                | 36.0 |
| 72                                                | 36.5 |
| 73                                                | 37.0 |
| 74                                                | 37.5 |
| 75                                                | 38.0 |
| 76                                                | 38.5 |
| 77                                                | 39.0 |
| 78                                                | 39.5 |
| 79                                                | 40.0 |
| 80                                                | 40.5 |
| 81                                                | 41.0 |
| 82                                                | 41.5 |
| 83                                                | 42.0 |
| 84                                                | 42.5 |
| 85                                                | 43.0 |
| 86                                                | 43.5 |
| 87                                                | 44.0 |
| 88                                                | 44.5 |
| 89                                                | 45.0 |
| 90                                                | 45.5 |
| 91                                                | 46.0 |
| 92                                                | 46.5 |
| 93                                                | 47.0 |
| 94                                                | 47.5 |
| 95                                                | 48.0 |
| 96                                                | 48.5 |
| 97                                                | 49.0 |
| 98                                                | 49.5 |
| 99                                                | 50.0 |
| 100                                               | 50.5 |

[illegible]

**NOTE:**

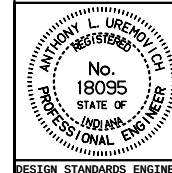
1. The tabulated cover depths shall be measured from the bottom of the asphalt or concrete pavement to the top of the pipe.
2. A specific design shall be performed for structures with corner radii other than those tabulated above to determine the appropriate cover depth limits.
3. The tabulated plate thickness reflects the required thickness for top and side plates. Refer to 908.09 (a) for the required bottom plate thickness.

INDIANA DEPARTMENT OF TRANSPORTATION

## PIPE HEIGHT OF COVER LIMITS

JANUARY 1998

STANDARD DRAWING NO. E 717-PHCL-10



|                               |          |
|-------------------------------|----------|
| DETAILS PLACED IN THIS FORMAT | 11-15-99 |
|-------------------------------|----------|

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

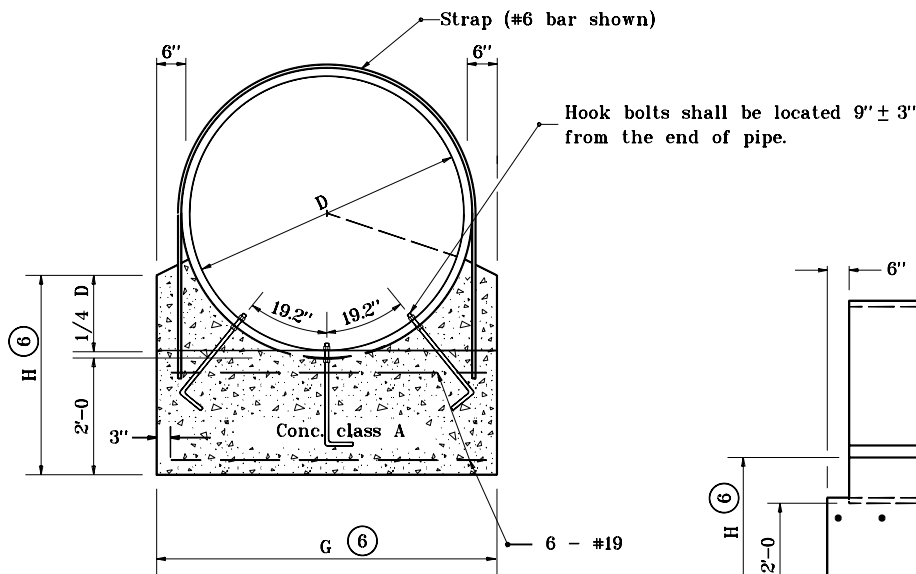
|                         |                 |
|-------------------------|-----------------|
| <u>/s/ Firooz Zandi</u> | <u>11-15-99</u> |
| CHIEF HIGHWAY ENGINEER  | DATE            |

DESIGN STANDARDS ENGINEER

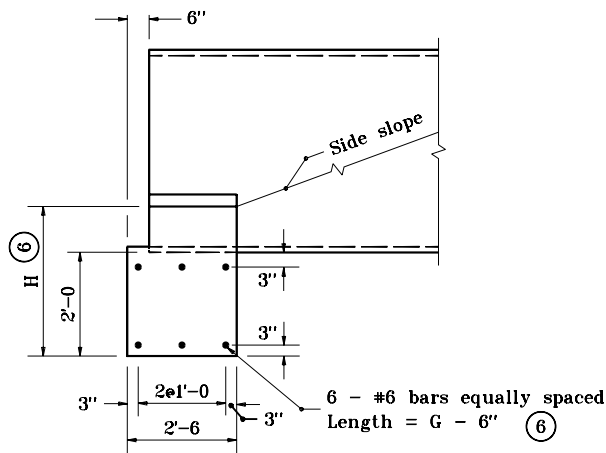
ORIGINALLY APPROVED 1-02-98

## GENERAL NOTES

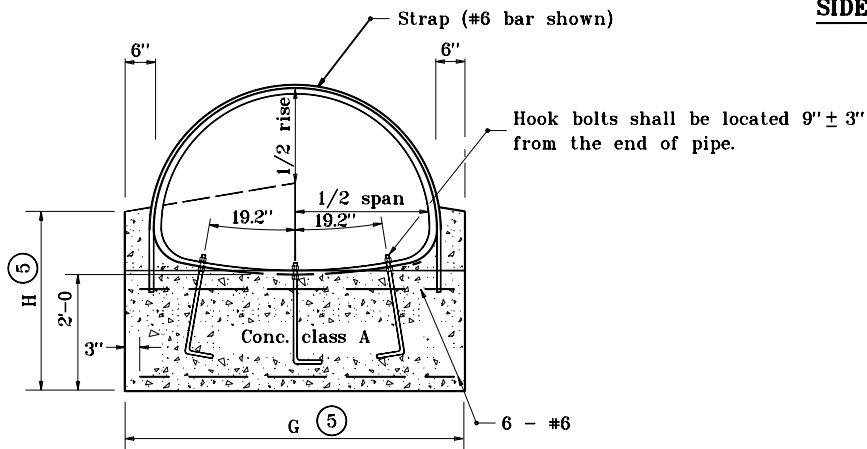
1. Anchor straps shall be used at both upstream and downstream ends of all structural plate pipes and pipe-arches.
2. See Standard Drawing E 715-PASD-01 for anchor strap details.
3. Hook bolts, and anchor straps shall be used at all structural plate pipes and pipe arches with a diameter or span of 84" or greater.
4. See Standard Drawing E 715-PAHB-01 for hook bolt details.
- 5 For dimension, enter chart on Standard Drawing E 717-ANCH-01 or E 717-ANCH-03 with known span and rise.
- 6 For dimension, enter chart on Standard Drawing E 717-ANCH-02 with known dimension D.



**ANCHOR FOR STRUCTURAL PLATE PIPE  
FRONT ELEVATION**

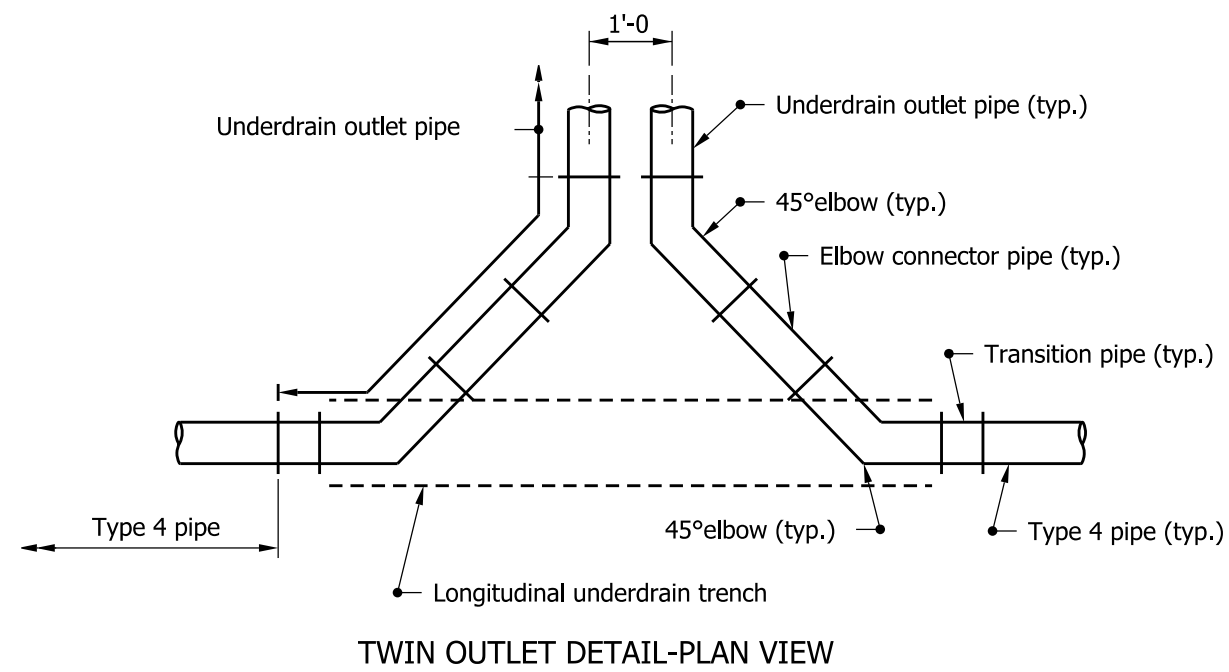


**SIDE ELEVATION**



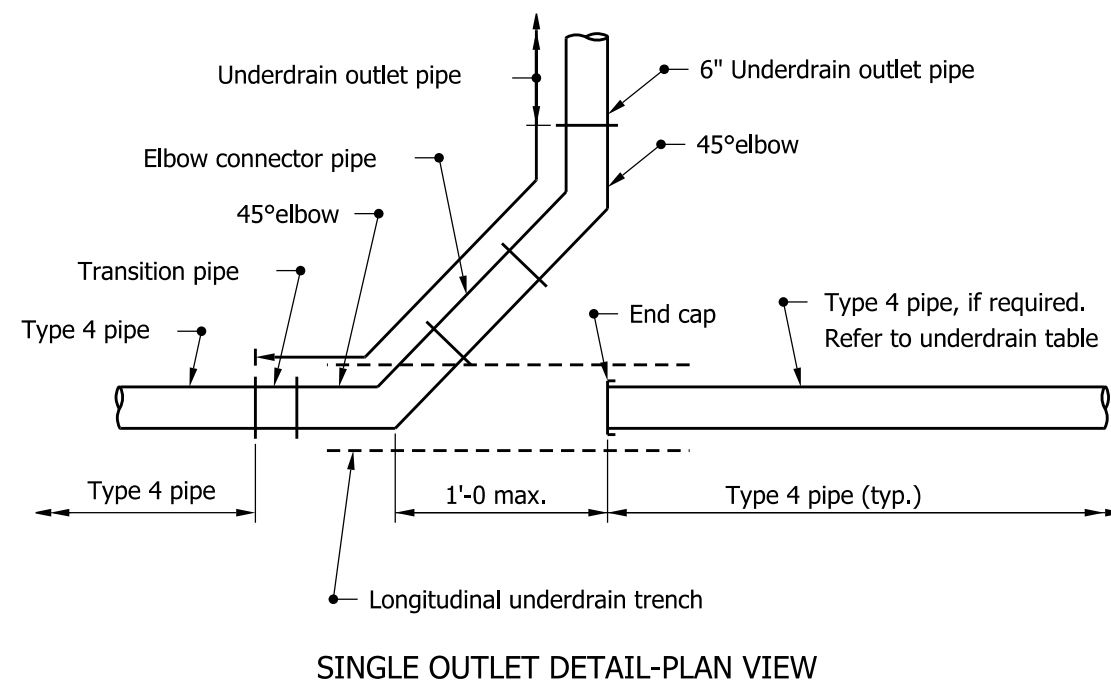
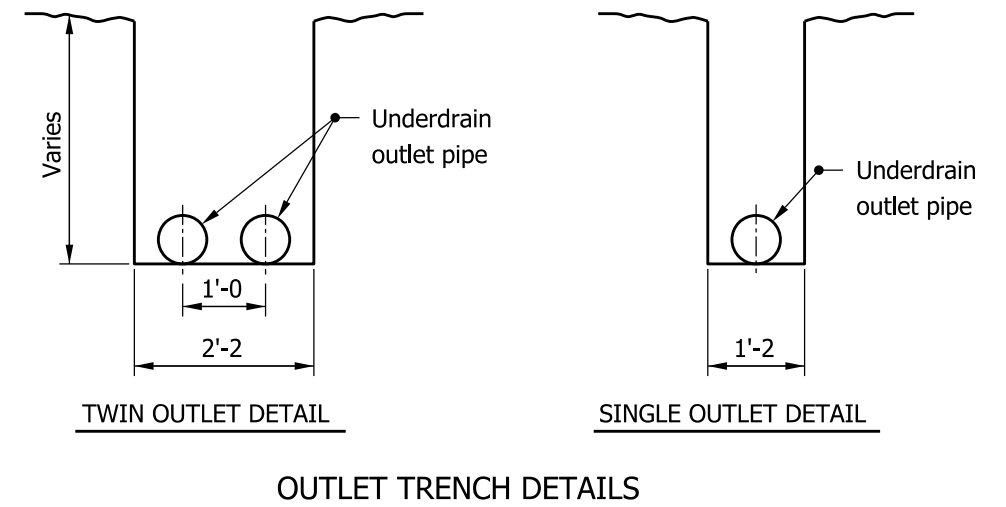
**ANCHOR FOR STRUCTURAL  
PLATE PIPE-ARCH  
FRONT ELEVATION**

|                                                 |                                                                    |
|-------------------------------------------------|--------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION            |                                                                    |
| SINGLE STRUCTURAL PLATE<br>PIPE CONCRETE ANCHOR |                                                                    |
| JANUARY 1998                                    |                                                                    |
| STANDARD DRAWING NO. E 717-SPCA-01              |                                                                    |
| DETAILS PLACED IN THIS FORMAT 7-27-99           |                                                                    |
|                                                 | /s/ Anthony L. Uremovich 7-27-99<br>DESIGN STANDARDS ENGINEER DATE |
|                                                 | /s/ Firooz Zandi 7-27-99<br>CHIEF HIGHWAY ENGINEER DATE            |
|                                                 | ORIGINALLY APPROVED 1-02-98                                        |



**NOTE:**

1. See Standard Drawing E 718-UNDR-07 for General Notes.

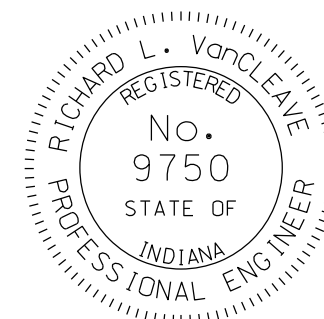


INDIANA DEPARTMENT OF TRANSPORTATION

UNDERDRAIN DETAILS

SEPTEMBER 2009

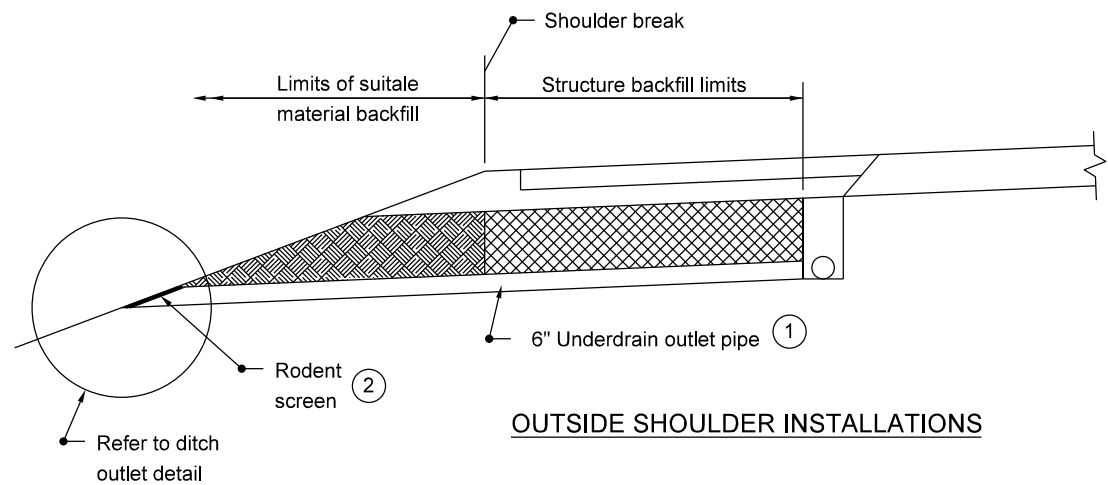
STANDARD DRAWING NO. E 718-UNDR-01



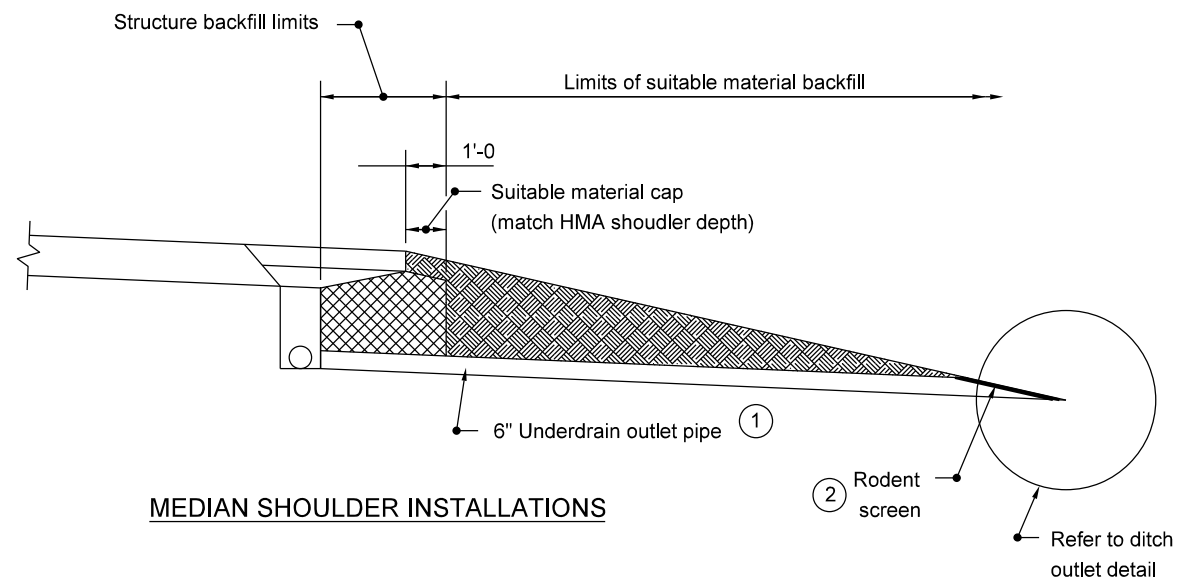
DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave 09/01/09  
DESIGN STANDARDS ENGINEER DATE

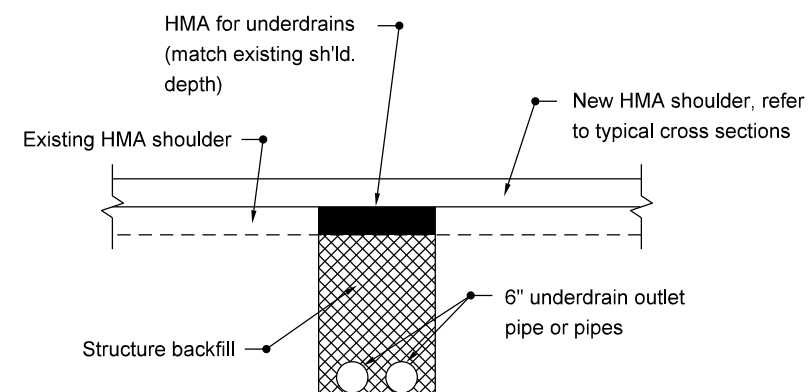
/s/ Mark A. Miller 09/01/09  
CHIEF HIGHWAY ENGINEER DATE



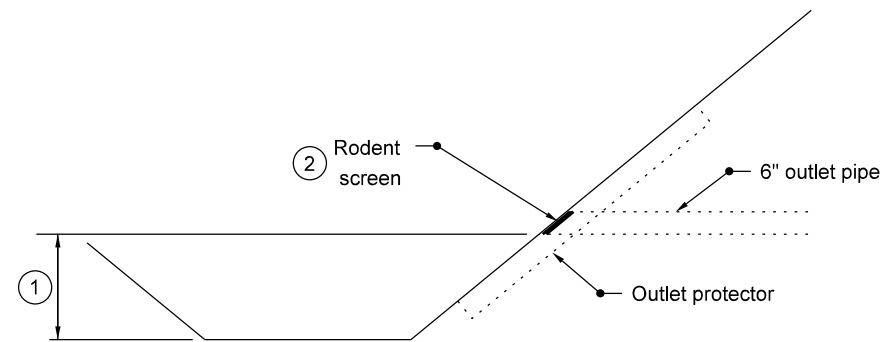
OUTSIDE SHOULDER INSTALLATIONS



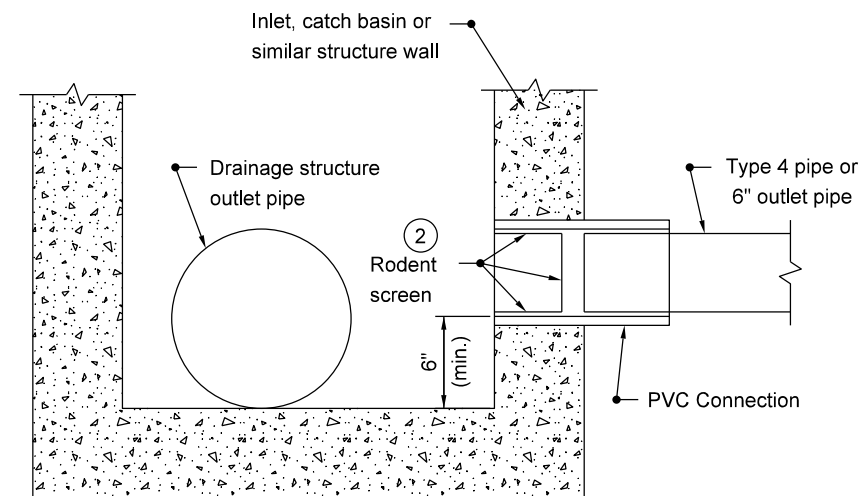
MEDIAN SHOULDER INSTALLATIONS



RETROFIT UNDERDRAIN OUTLET DETAIL (UNDER PAVED SHOULDER)



DITCH OUTLET DETAIL



DRAINAGE STRUCTURE OUTLET DETAIL

NOTE:

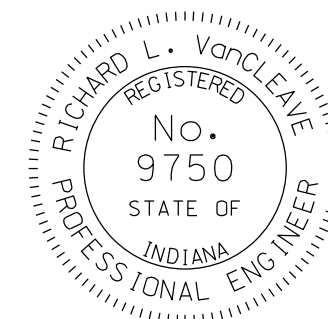
1. See Standard Drawing E 718-UNDR-07 for General Notes.

INDIANA DEPARTMENT OF TRANSPORTATION

UNDERDRAIN DETAILS

SEPTEMBER 2009

STANDARD DRAWING NO. E 718-UNDR-02



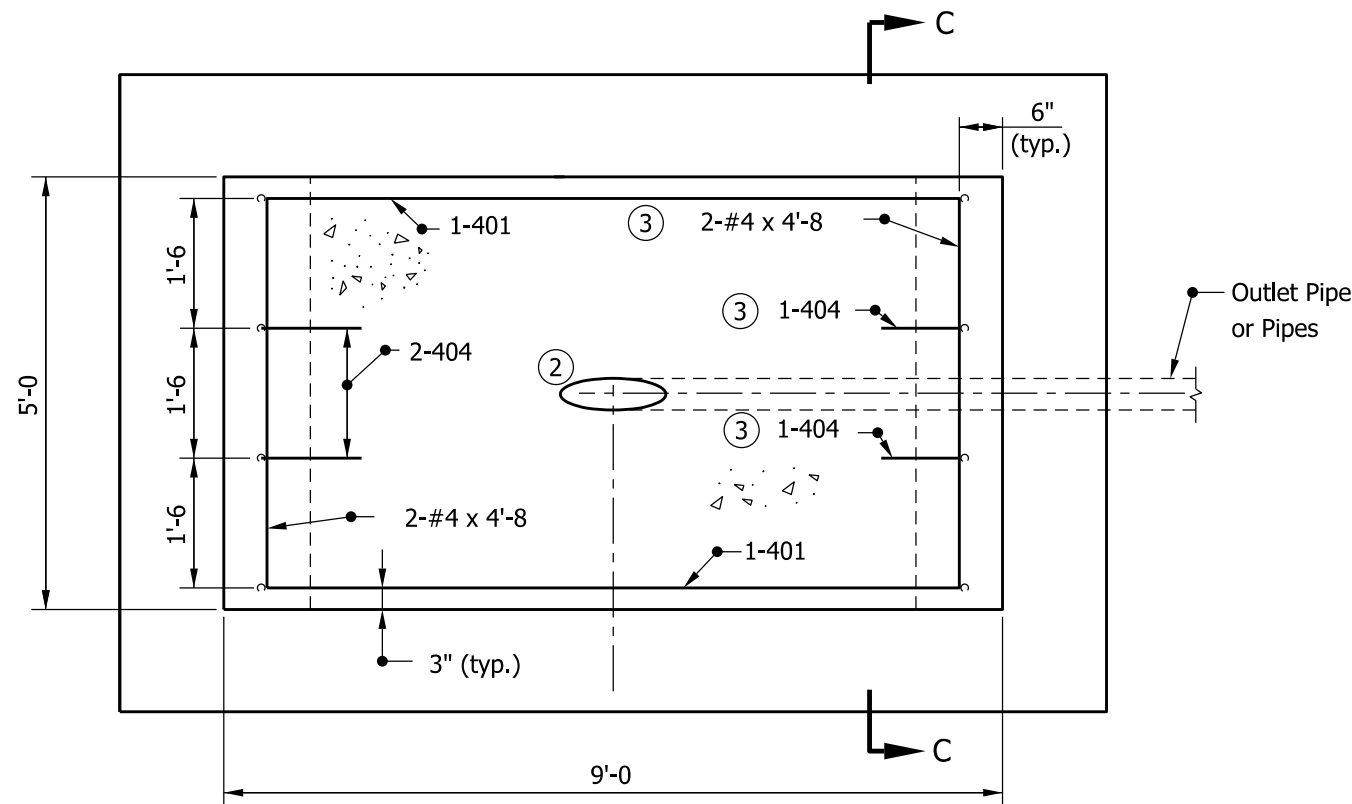
DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave 09/01/09  
DESIGN STANDARDS ENGINEER DATE

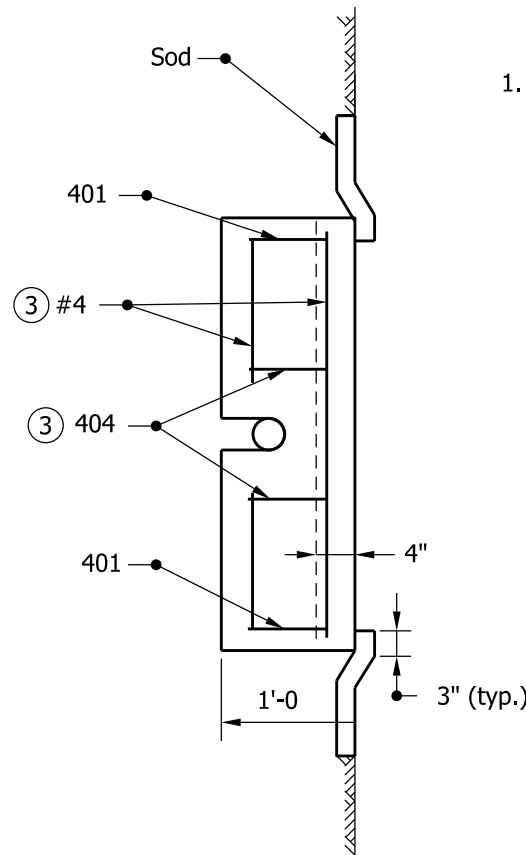
/s/ Mark A. Miller 09/01/09  
CHIEF HIGHWAY ENGINEER DATE

**NOTE:**

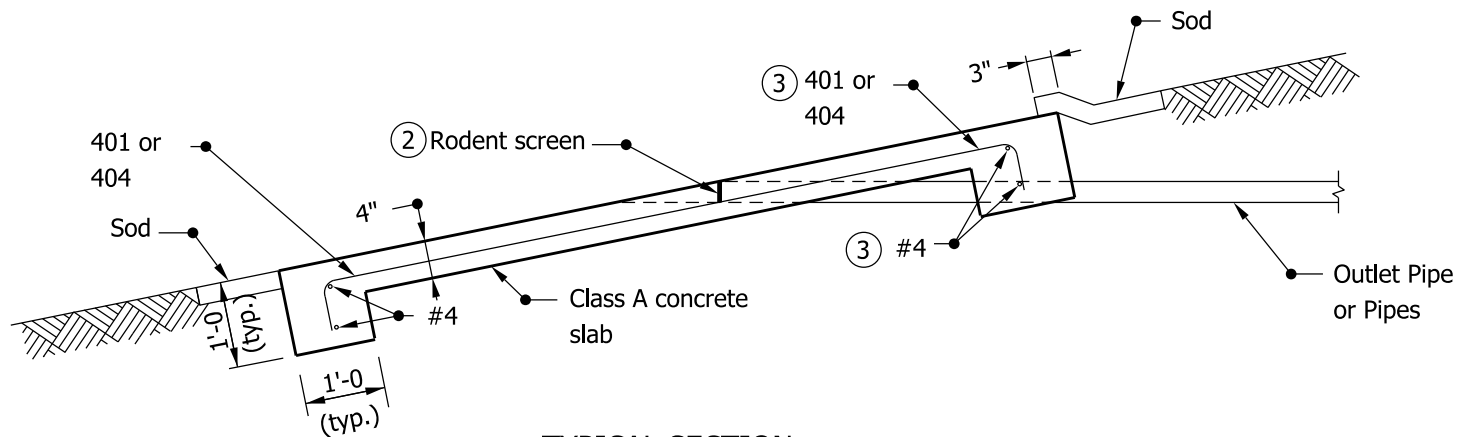
1. See Standard Drawing E 718-UNDR-07 for General Notes.



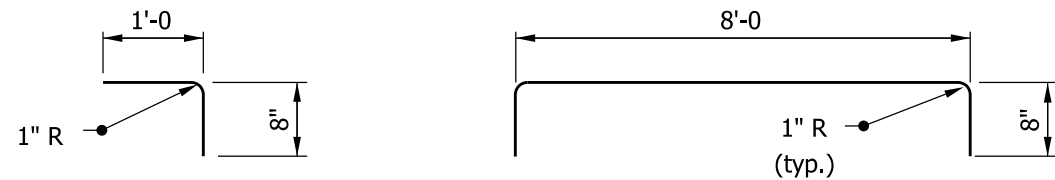
**PLAN VIEW**



**SECTION C-C**



**TYPICAL SECTION**



**404 x 1'-8"**

**401 x 9'-4"**

INDIANA DEPARTMENT OF TRANSPORTATION

OUTLET PROTECTOR, TYPE 1

SEPTEMBER 2009

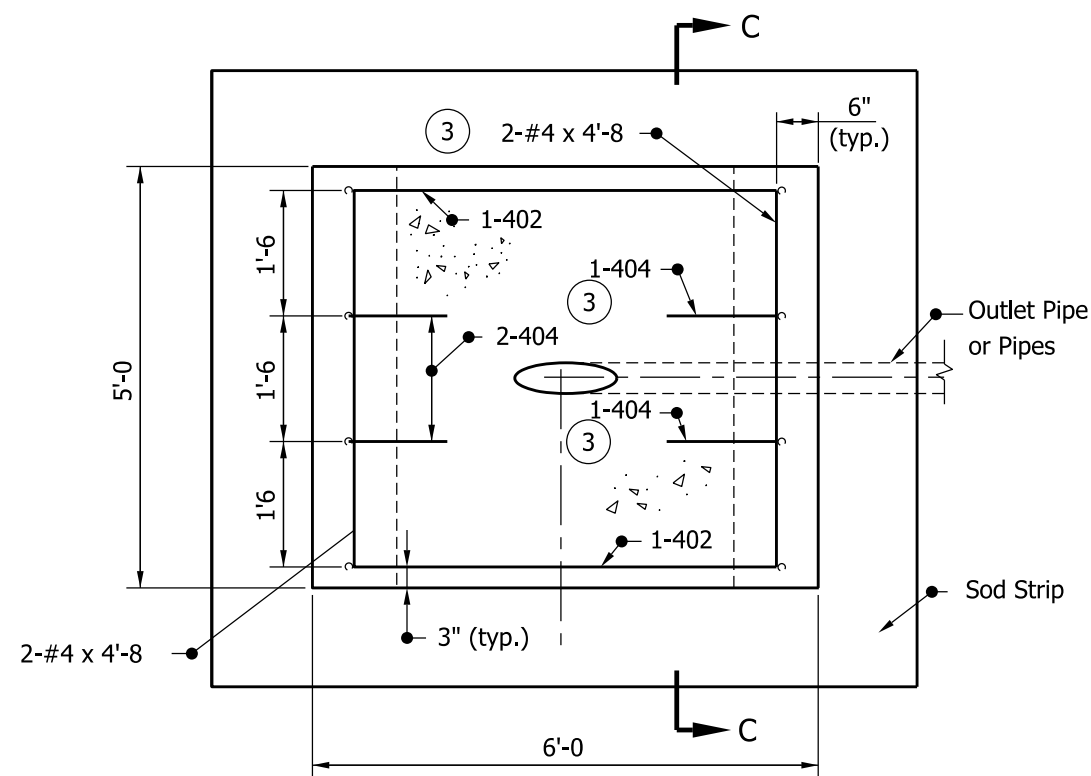
STANDARD DRAWING NO. E 718-UNDR-03



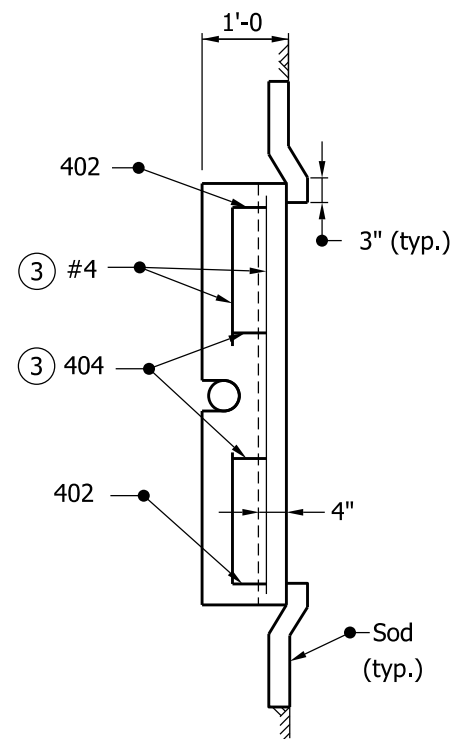
DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave 09/01/09  
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller 09/01/09  
CHIEF HIGHWAY ENGINEER DATE



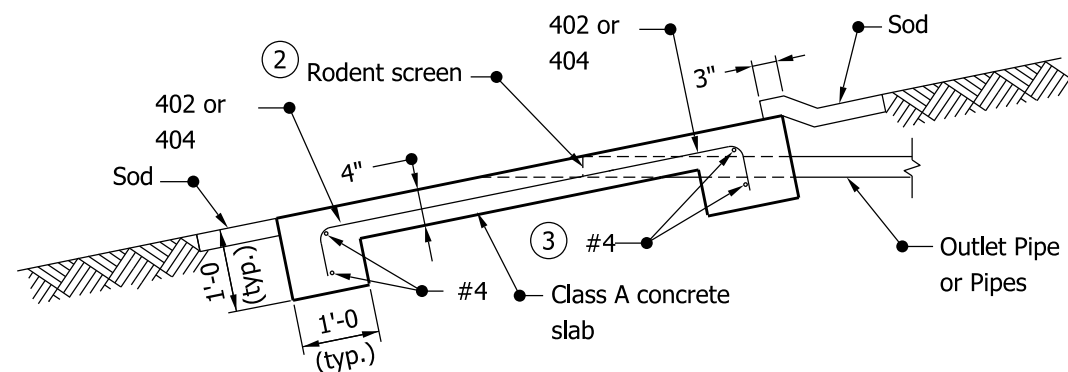
PLAN VIEW



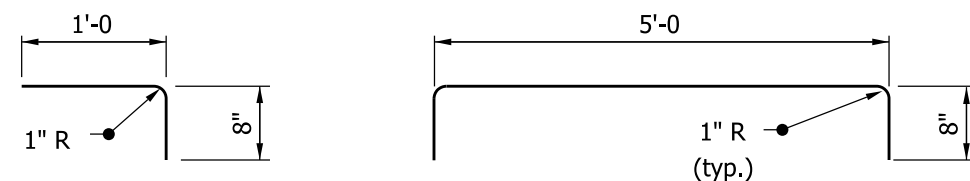
SECTION C-C

NOTE:

1. See Standard Drawing E 718-UNDR-07 for General Notes.



TYPICAL SECTION



404 x 1'-8

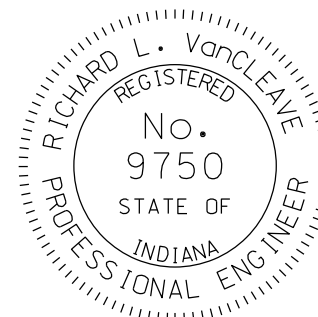
402 x 6'-4

INDIANA DEPARTMENT OF TRANSPORTATION

OUTLET PROTECTOR, TYPE 2

SEPTEMBER 2009

STANDARD DRAWING NO. E 718-UNDR-04

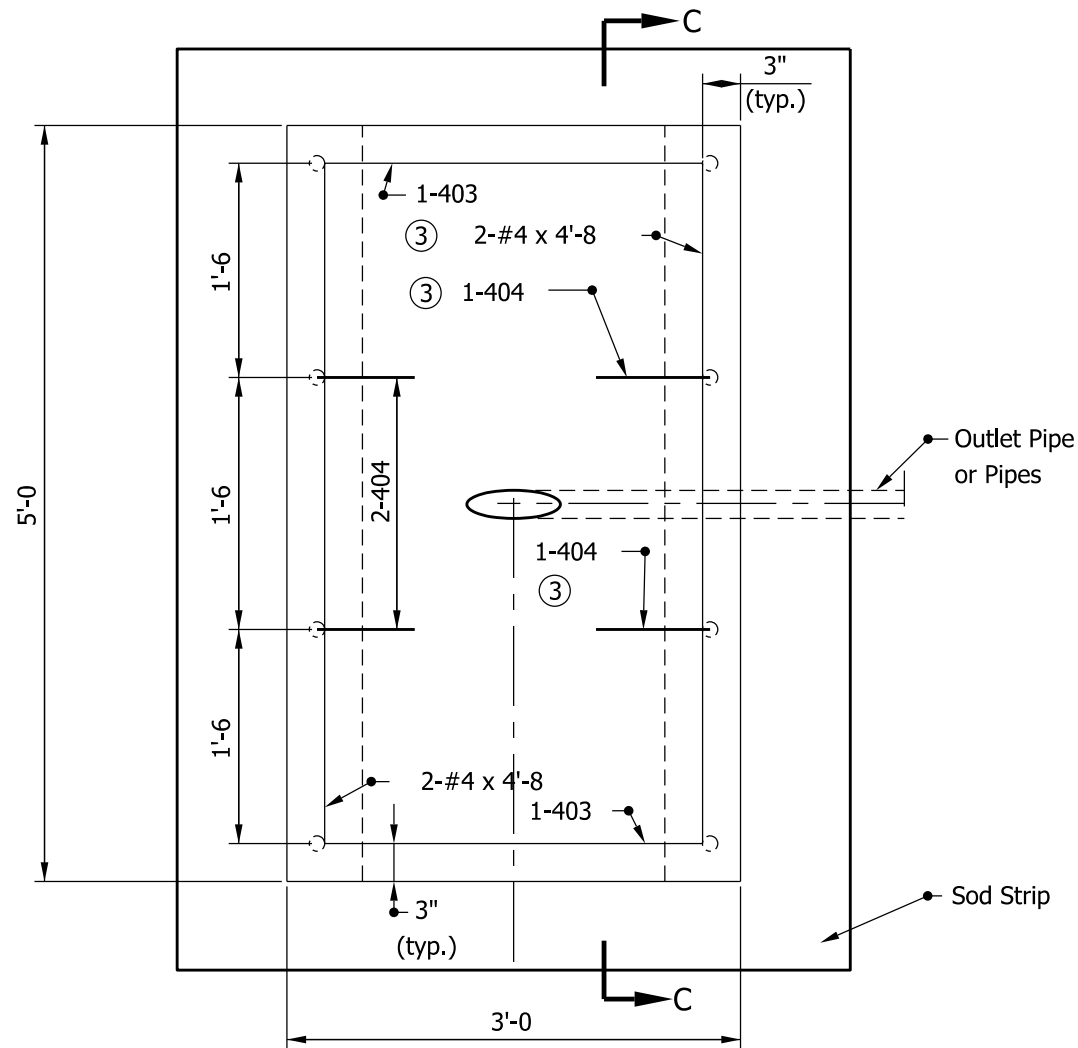


DESIGN STANDARDS ENGINEER

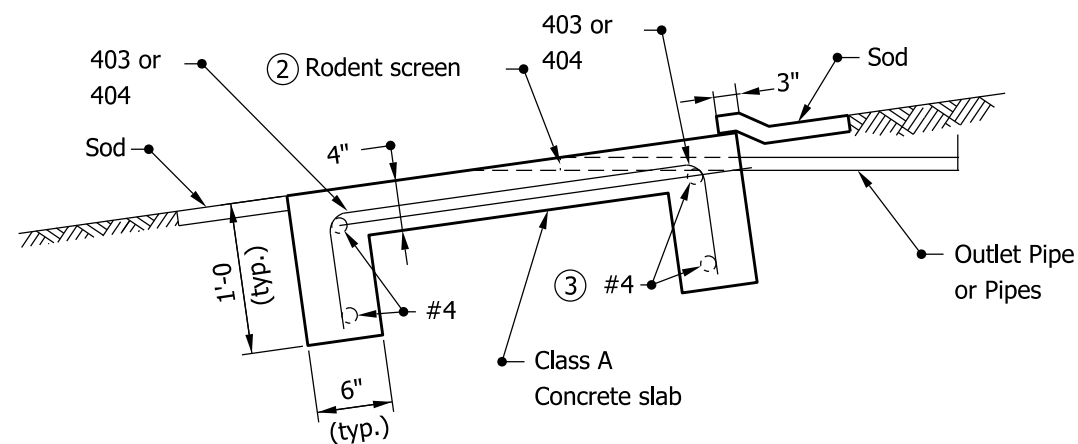
/s/ Richard L. VanCleave 09/01/09  
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller 09/01/09  
CHIEF HIGHWAY ENGINEER DATE

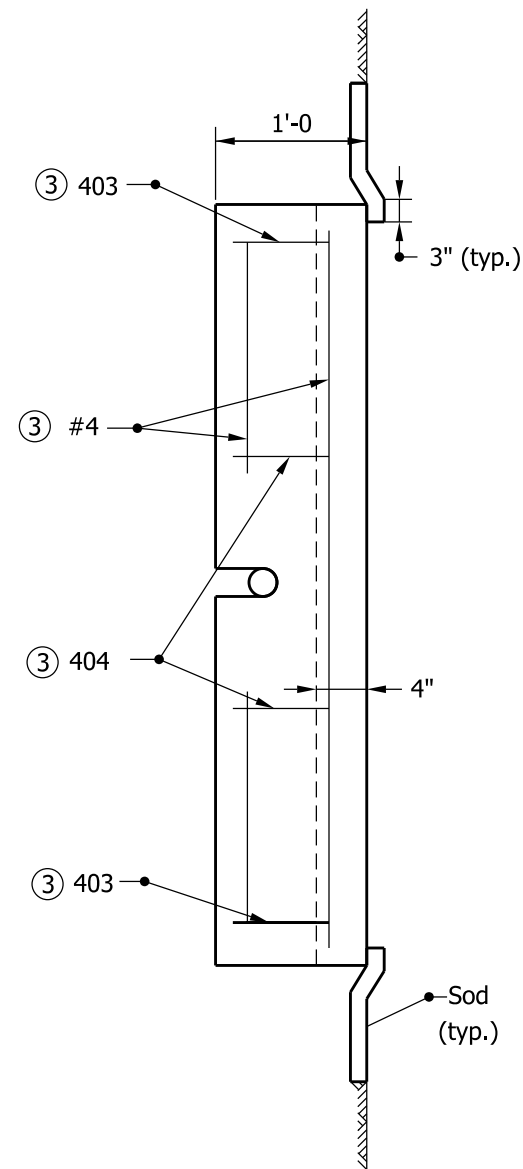




PLAN VIEW



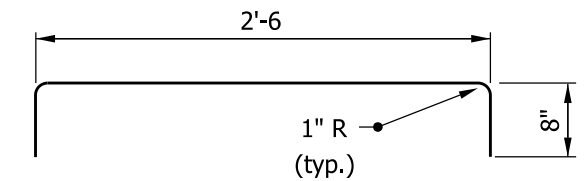
TYPICAL SECTION



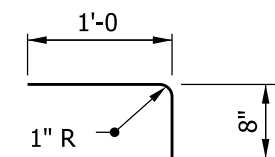
SECTION C-C

NOTE:

1. See Standard Drawing E 718-UNDR-07 for General Notes.



403 x 3'-10



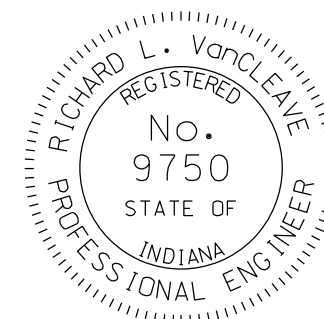
404 x 1'-8

INDIANA DEPARTMENT OF TRANSPORTATION

OUTLET PROTECTOR, TYPE 3

SEPTEMBER 2009

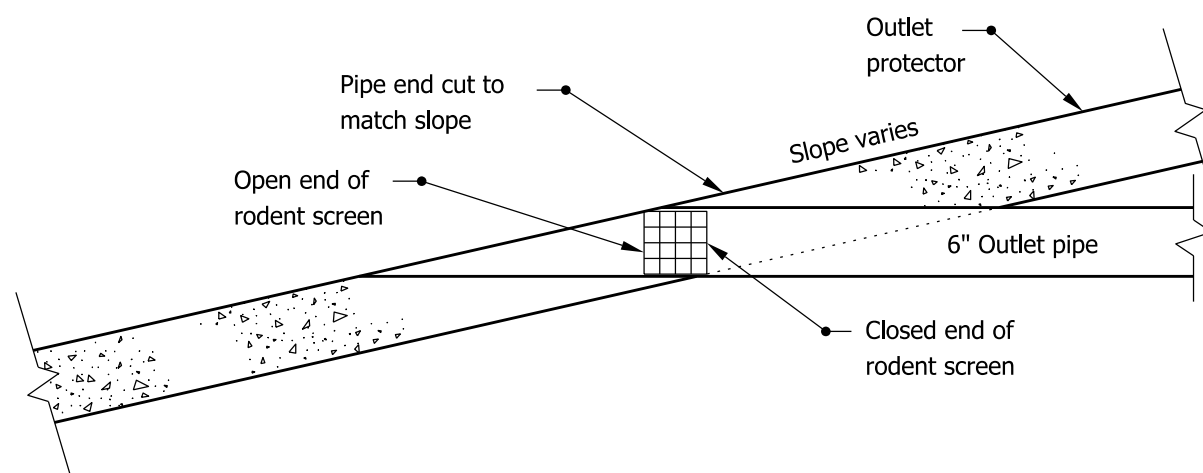
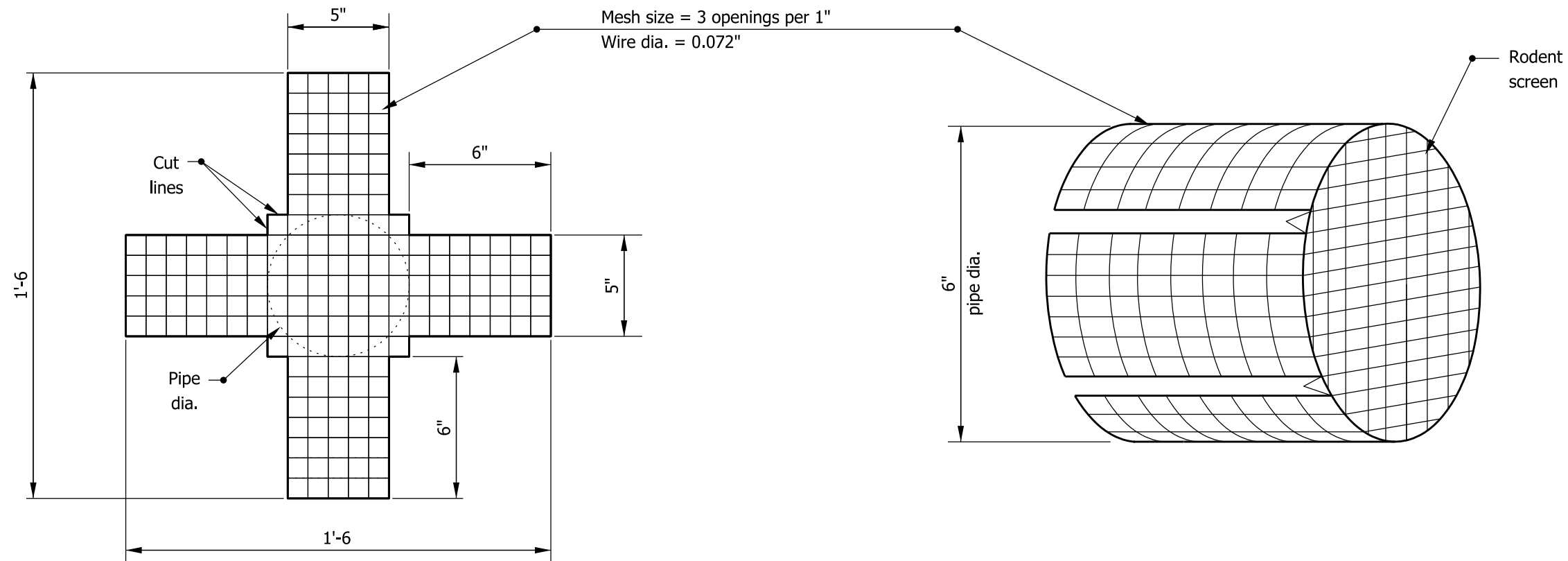
STANDARD DRAWING NO. E 718-UNDR-05



DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave 09/01/09  
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller 09/01/09  
CHIEF HIGHWAY ENGINEER DATE



|                                                     |                                                              |                  |
|-----------------------------------------------------|--------------------------------------------------------------|------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                |                                                              |                  |
| OUTLET PROTECTOR<br>RODENT SCREEN<br>SEPTEMBER 2009 |                                                              |                  |
| STANDARD DRAWING NO. E 718-UNDR-06                  |                                                              |                  |
|                                                     | <i>/s/ Richard L. VanCleave</i><br>DESIGN STANDARDS ENGINEER | 09/01/09<br>DATE |
|                                                     | <i>/s/ Mark A. Miller</i><br>CHIEF HIGHWAY ENGINEER          | 09/01/09<br>DATE |
| DESIGN STANDARDS ENGINEER                           |                                                              |                  |

GENERAL NOTES

- 1

If underdrain outlet-pipe elevations are not shown on Underdrain Table, the minimum outlet-pipe slope shall be 0.3%. The minimum freeboard between the outlet-pipe outfall and the ditch line shall be 1'-0 for median ditches and 2'-0 for side ditches.
- 2

See Standard Drawing E 718-UNDR-06 for rodent screen details.
- 3

The #4 transverse bars in the upslope lug may be field cut to accomodate the outlet pipe or pipes. The 404 bars in the upslope lug may be moved to accomodate the outlet pipe or pipes.

| APPROXIMATE OUTLET PROTECTEOR QUANTITIES |                            |                          |                  |
|------------------------------------------|----------------------------|--------------------------|------------------|
| TYPE                                     | CONCRETE, CLASS A<br>(cys) | REINFORCING BARS<br>(lb) | SODDING<br>(sys) |
| 1                                        | 0.8                        | 29                       | 4.9              |
| 2                                        | 0.6                        | 25                       | 4.0              |
| 3                                        | 0.3                        | 22                       | 3.2              |

|                                                                                                                                                                                                                                                                        |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                                                                                                                                                                                                   |  |
| UNDERDRAIN NOTES                                                                                                                                                                                                                                                       |  |
| SEPTEMBER 2009                                                                                                                                                                                                                                                         |  |
| STANDARD DRAWING NO. E 718-UNDR-07                                                                                                                                                                                                                                     |  |
| <div><div><div><div><div><div><span></span></div><div>REGISTERED</div><div>No.</div><div>9750</div><div>STATE OF</div><div>INDIANA</div><div>PROFESSIONAL ENGINEER</div></div></div><div><div><div>RICHARD L. VANCLEAVE</div><div></div></div></div></div></div></div> |  |

DESIGN STANDARDS ENGINEER

| EXTRA-QUALITY  |      |       |      |       |      |       |      |       |      |       |      |       |      |       |      |       |      |       |      |       |  |
|----------------|------|-------|------|-------|------|-------|------|-------|------|-------|------|-------|------|-------|------|-------|------|-------|------|-------|--|
| COVER<br>(ft.) | 3    |       | 4    |       | 5    |       | 6    |       | 7    |       | 8    |       | 9    |       | 10   |       | 11   |       | 12   |       |  |
| SIZE           | CLAY | CONC. | CLAY | CONC. | CLAY | CONC. | CLAY | CONC. | CLAY | CONC. | CLAY | CONC. | CLAY | CONC. | CLAY | CONC. | CLAY | CONC. | CLAY | CONC. |  |
| 6''            |      |       |      |       |      |       |      |       |      |       |      |       | X    | X     | X    | X     | X    | X     | X    | X     |  |
| 8''            |      |       |      |       |      |       |      |       | X    | X     | X    | X     | X    | X     |      |       |      |       |      |       |  |
| 10''           |      |       |      |       |      |       | X    | X     | X    | X     | X    | X     |      |       |      |       |      |       |      |       |  |
| 12''           |      |       |      |       | X    | X     | X    | X     |      |       |      |       |      |       |      |       |      |       |      |       |  |
| 15''           |      | X     | X    | X     | X    | X     |      |       |      |       |      |       |      |       |      |       |      |       |      |       |  |
| 18''           | X    | X     | X    | X     | X    | X     |      |       |      |       |      |       |      |       |      |       |      |       |      |       |  |
| 21''           | X    | X     | X    | X     | X    | X     |      | X     |      |       |      |       |      |       |      |       |      |       |      |       |  |
| 24''           | X    | X     | X    | X     | X    | X     |      | X     |      |       |      |       |      |       |      |       |      |       |      |       |  |
| 27''           | X    |       | X    |       | X    |       |      |       |      |       |      |       |      |       |      |       |      |       |      |       |  |
| 30''           | X    |       | X    |       | X    |       | X    |       |      |       |      |       |      |       |      |       |      |       |      |       |  |

| EXTRA-DUTY EXTRA-QUALITY |      |       |      |       |      |       |      |       |      |       |      |       |      |       |      |       |  |
|--------------------------|------|-------|------|-------|------|-------|------|-------|------|-------|------|-------|------|-------|------|-------|--|
| COVER<br>(ft.)           | 5    | 6     | 7    | 8     | 9    | 10    | 11   | 12    | 13   | 14    | 15   | 16    | 17   | 18    | 19   | 20    |  |
| SIZE                     | CLAY | CONC. | CLAY | CONC. | CLAY | CONC. | CLAY | CONC. | CLAY | CONC. | CLAY | CONC. | CLAY | CONC. | CLAY | CONC. |  |
| 6"                       |      |       |      |       | X    | X     | X    | X     | X    | X     | X    | X     | X    | X     | X    | X     |  |
| 8"                       |      |       | X    | X     | X    | X     | X    | X     | X    | X     | X    | X     | X    | X     | X    | X     |  |
| 10"                      |      | X     | X    | X     | X    | X     | X    | X     | X    | X     | X    | X     | X    | X     | X    | X     |  |
| 12"                      | X    | X     | X    | X     | X    | X     | X    | X     | X    | X     | X    | X     | X    |       |      |       |  |
| 15"                      | X    | X     | X    | X     | X    | X     | X    | X     | X    | X     | X    | X     |      |       |      |       |  |
| 18"                      | X    | X     | X    | X     | X    | X     | X    | X     | X    | X     | X    | X     | X    | X     |      |       |  |
| 21"                      | X    | X     | X    | X     | X    | X     | X    | X     | X    |       |      |       |      |       |      |       |  |
| 24"                      | X    | X     | X    | X     | X    | X     | X    | X     | X    | X     | X    | X     | X    | X     |      |       |  |
| 27"                      | X    | X     | X    | X     | X    | X     | X    | X     |      |       |      |       |      |       |      |       |  |
| 30"                      | X    | X     | X    | X     | X    | X     | X    | X     | X    | X     | X    |       |      |       |      |       |  |

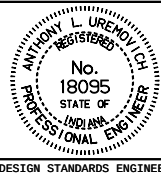
| SPECIAL-QUALITY |         |         |         |         |         |          |
|-----------------|---------|---------|---------|---------|---------|----------|
| COVER<br>(ft.)  | UP TO 5 | UP TO 6 | UP TO 7 | UP TO 8 | UP TO 9 | UP TO 15 |
| SIZE            | CONC.   | CONC.   | CONC.   | CONC.   | CONC.   | CONC.    |
| 6"              | X       | X       | X       | X       | X       | X        |
| 8"              | X       | X       | X       | X       | X       |          |
| 10"             | X       | X       | X       | X       | X       |          |
| 12"             | X       | X       |         |         |         |          |
| 15"             | X       |         |         |         |         |          |
| 18"             | X       |         |         |         |         |          |
| 21"             | X       | X       |         |         |         |          |
| 24"             | X       | X       |         |         |         |          |

INDIANA DEPARTMENT OF TRANSPORTATION

### DRAINTILE CLASSES

JANUARY 1998

STANDARD DRAWING NO. E 719-DTCL-01



DETAILS PLACED IN THIS FORMAT 11-15-99

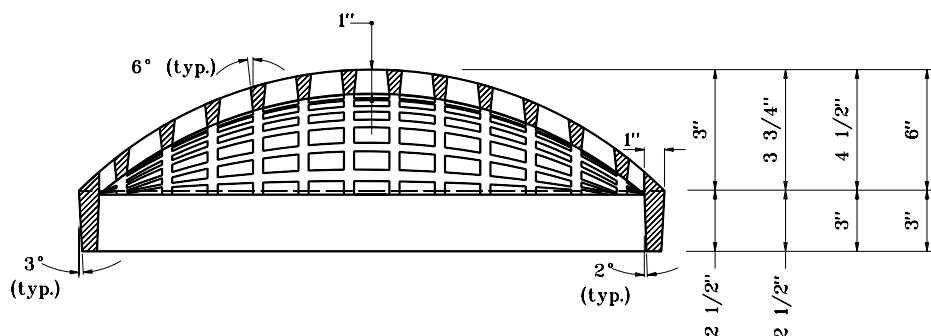
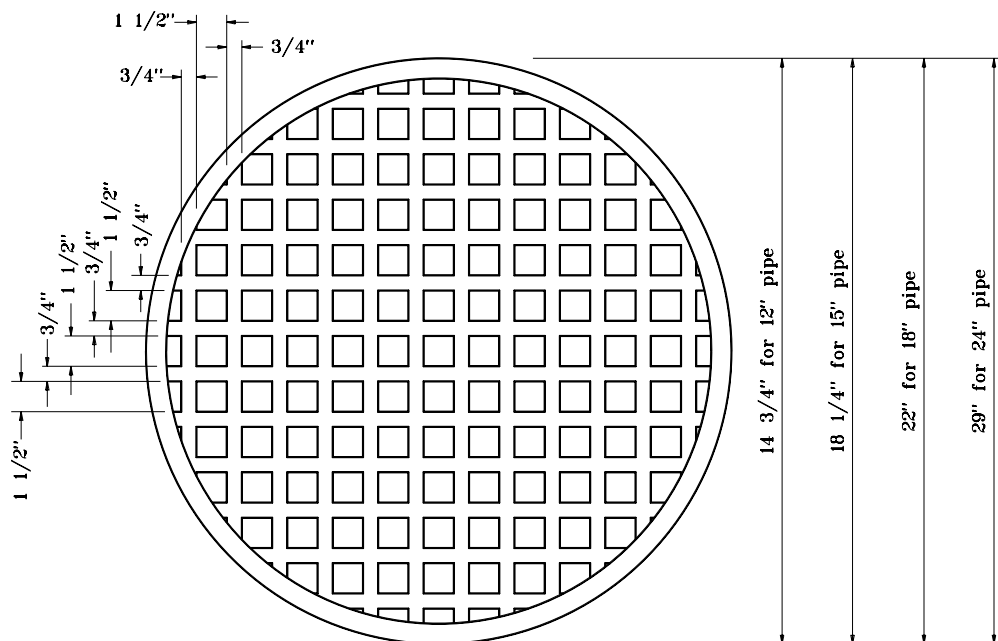
/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

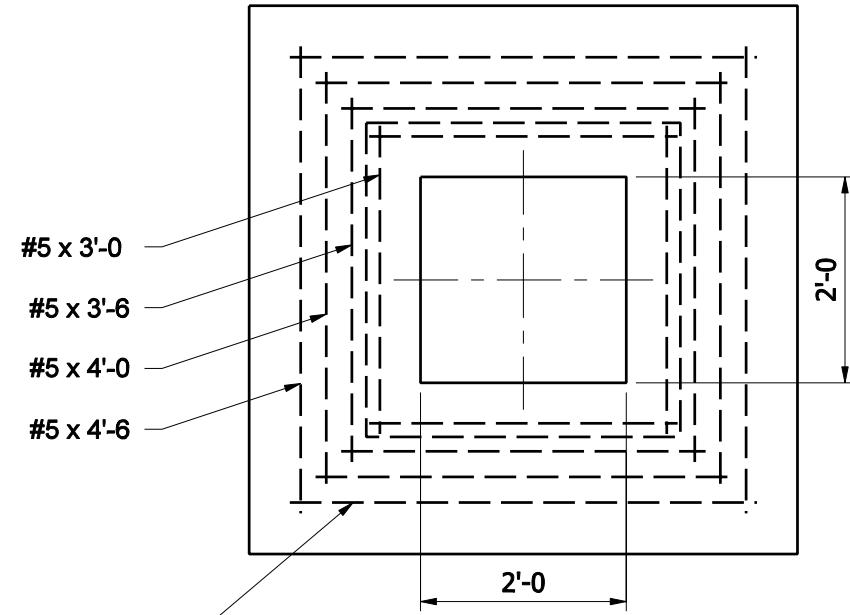
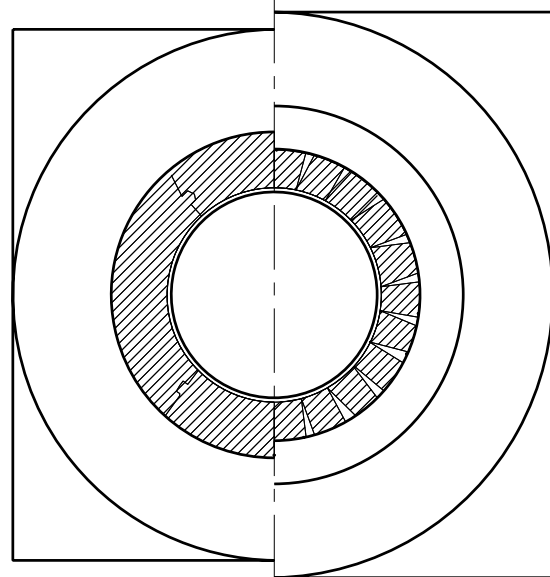
ORIGINALLY APPROVED

1-02-98



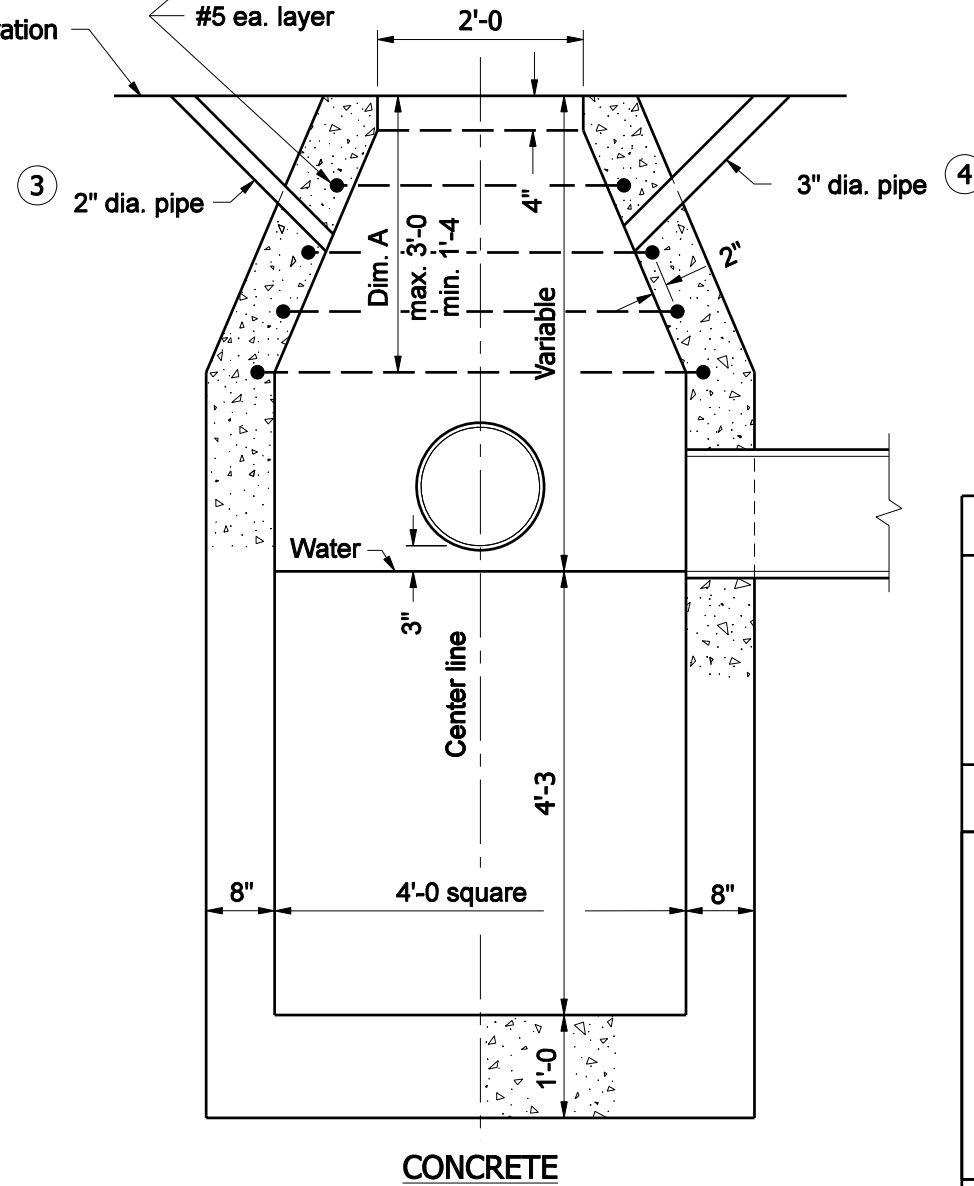
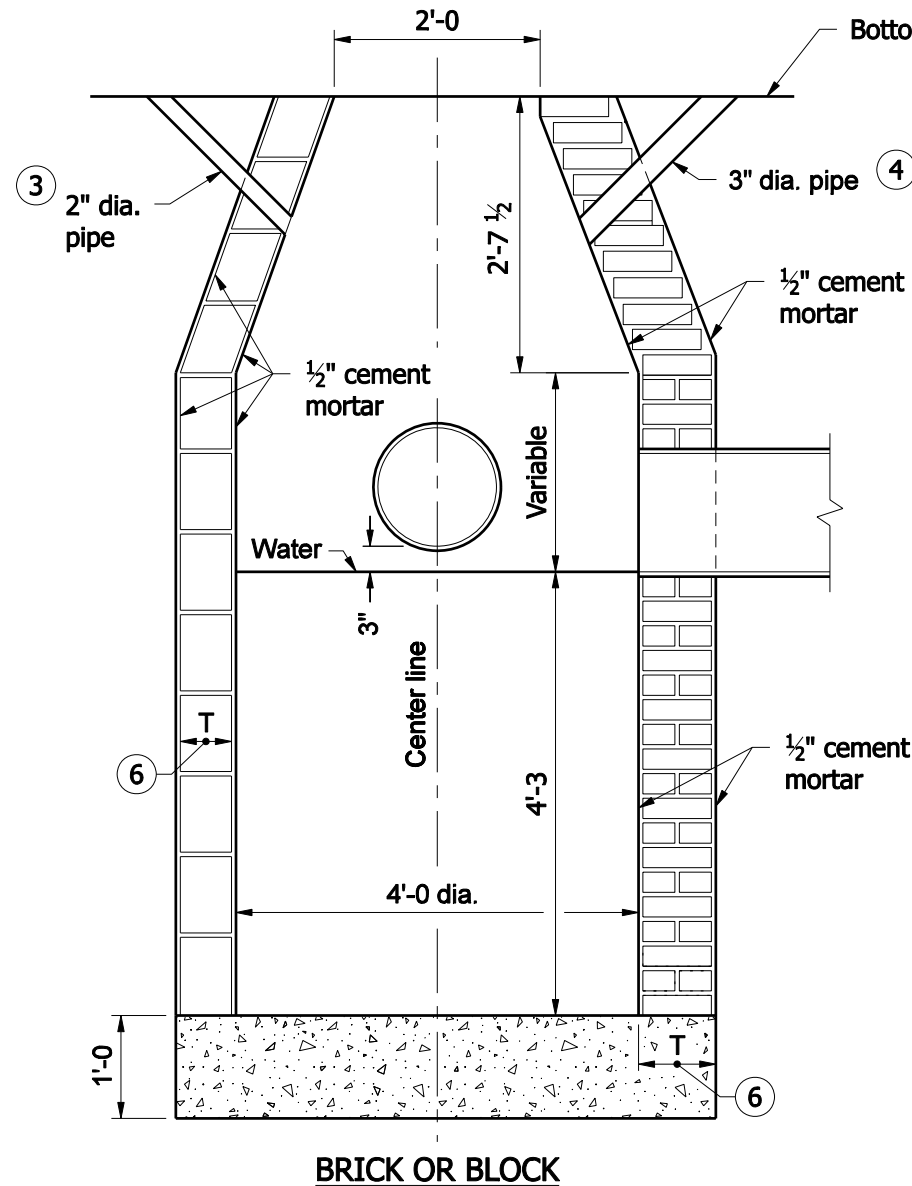
**PIPE CATCH BASIN CASTING**

|                                           |                                                                     |
|-------------------------------------------|---------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION      |                                                                     |
| <b>PIPE CATCH BASIN<br/>CASTING</b>       |                                                                     |
| APRIL 1995                                |                                                                     |
| <b>STANDARD DRAWING NO. E 720-CBCA-01</b> |                                                                     |
|                                           | DETAILS PLACED IN THIS FORMAT 11-15-99                              |
|                                           | /s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE |
|                                           | /s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE            |
|                                           | DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 4-03-95               |



#### GENERAL NOTES

1. Brick, block, or concrete may be used.
2. Precast catch basin type W may be substituted for catch basin type A.
3. 2" dia. pipe drain from bottom of curb to inlet. Aggregate to be placed around inlet end of pipe.
4. 3" dia. pipe to be kept open for drainage of subgrade or base until surface is placed.
5. Reinforcement required if Dim. A < 2'-6. Reinforcement not required if Dim. A ≥ 2'-6.
6. T = 8" for brick structure  
T = 6" for segmental block structure

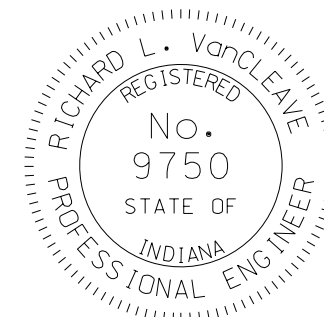


INDIANA DEPARTMENT OF TRANSPORTATION

CATCH BASIN  
TYPE A

SEPTEMBER 2008

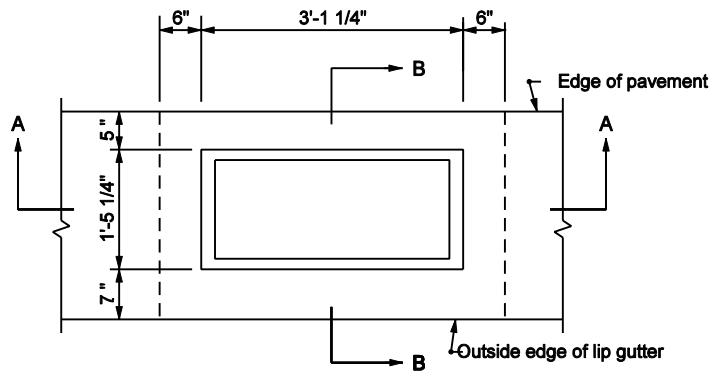
STANDARD DRAWING NO. E 720- CBST-01



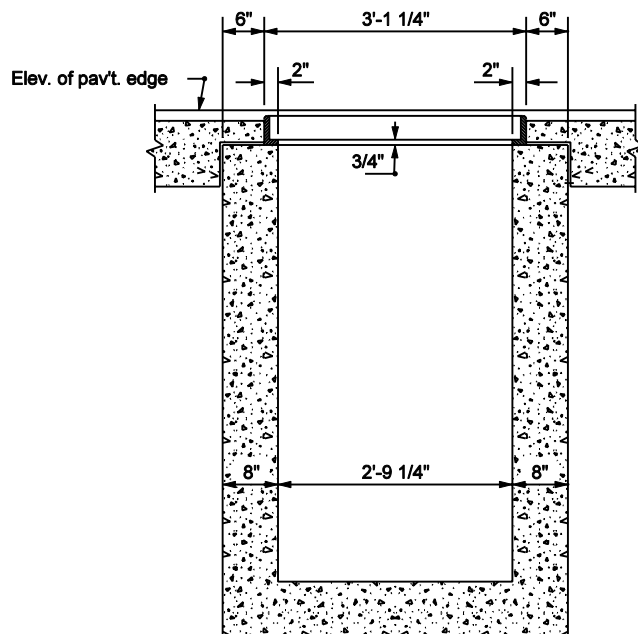
DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave 09/02/08  
DESIGN STANDARDS ENGINEER DATE

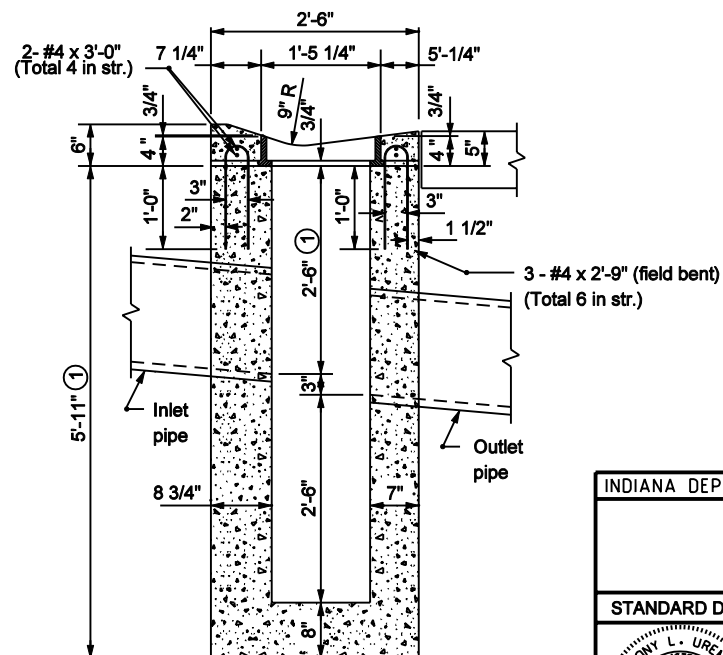
/s/ Mark A. Miller 09/02/08  
CHIEF HIGHWAY ENGINEER DATE



**PLAN**



**SECTION A-A**

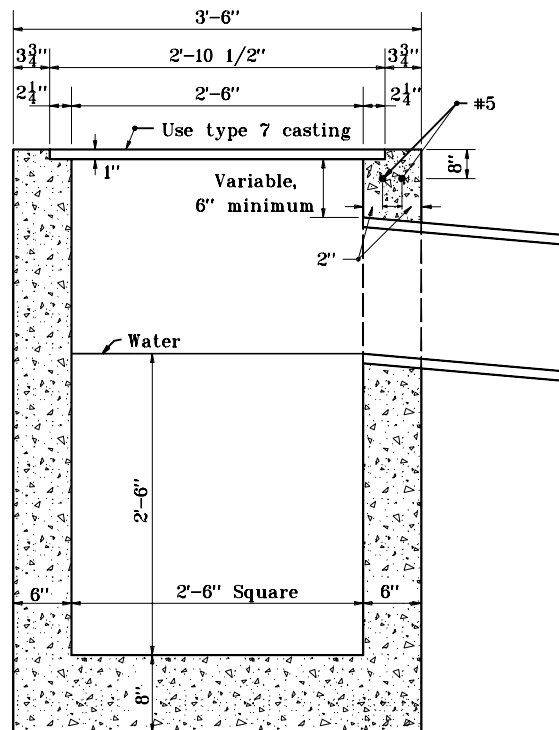


**SECTION B-B**

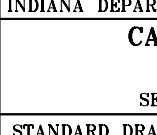
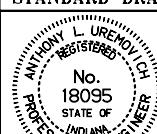
**NOTES**

- ① These dimensions may be increased or decreased by 1'-0", as directed.

|                                      |                                                                          |
|--------------------------------------|--------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION |                                                                          |
| CATCH BASIN<br>TYPE D                |                                                                          |
| SEPTEMBER 2003                       |                                                                          |
| STANDARD DRAWING NO. E 720-CBST-02   |                                                                          |
|                                      | /s/ Anthony L. Uremovich<br>DESIGN STANDARDS ENGINEER<br>3-02-03<br>DATE |
|                                      | /s/ Richard K. Smutzer<br>CHIEF HIGHWAY ENGINEER<br>3-02-03<br>DATE      |



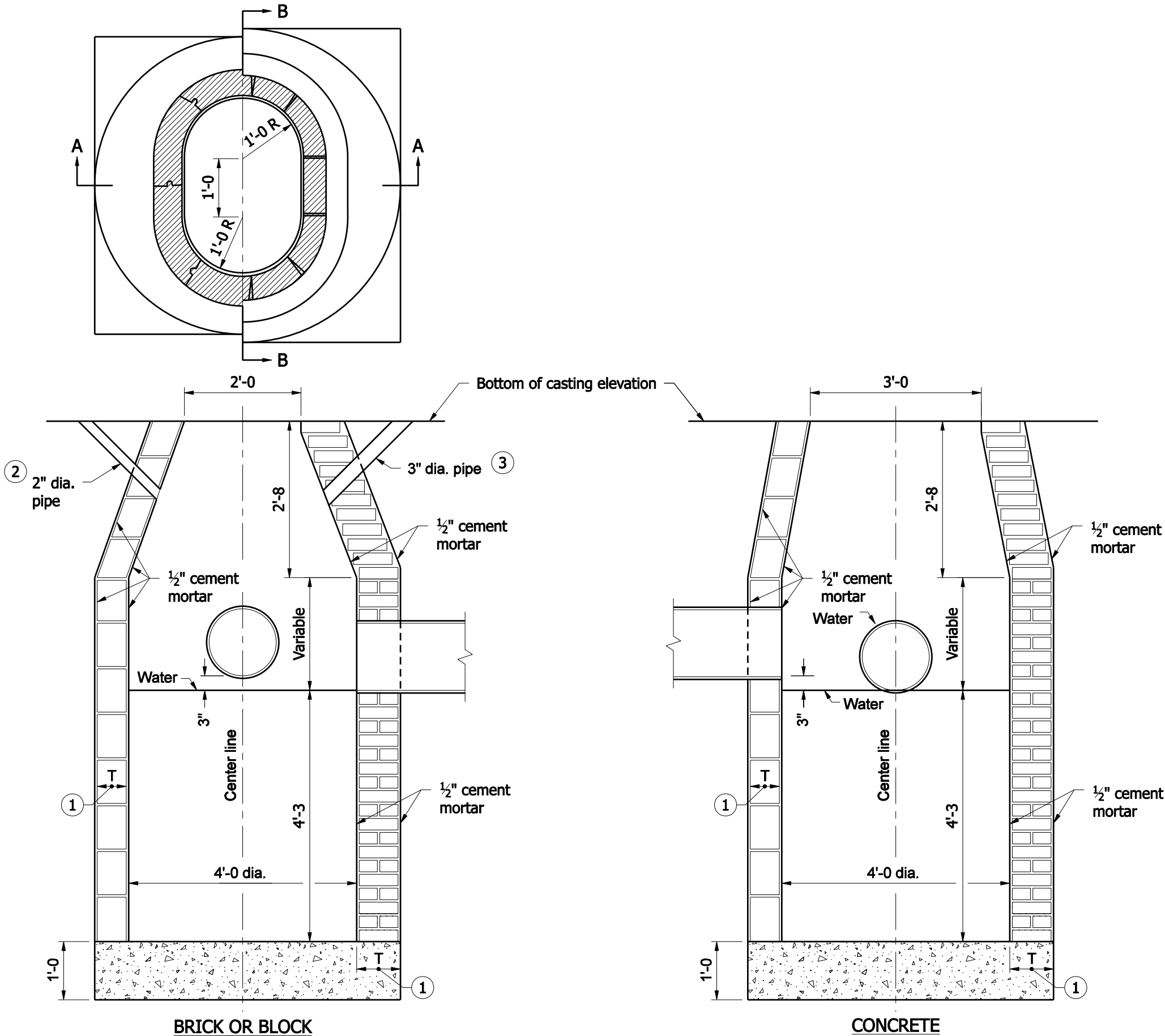
**SECTION A-A**

|                                                                                                                          |                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                                                     |                                                                                                                                           |
| <p align="center"><b>CATCH BASIN</b></p> <p align="center"><b>TYPE E</b></p> <p align="center"><b>SEPTEMBER 1997</b></p> |                                                                                                                                           |
| <b>STANDARD DRAWING NO. E 720-CBST-03</b>                                                                                |                                                                                                                                           |
|                                     | DETAILS PLACED IN THIS FORMAT      11-15-99<br><br><u>/s/ Anthony L. Uremovich</u> <u>11-15-99</u><br>DESIGN STANDARDS ENGINEER      DATE |
|                                     | <u>/s/ Firooz Zandi</u> <u>11-15-99</u><br>CHIEF HIGHWAY ENGINEER      DATE<br>ORIGINALLY APPROVED                                        |
|                                                                                                                          | DESIGN STANDARDS ENGINEER                                                                                                                 |

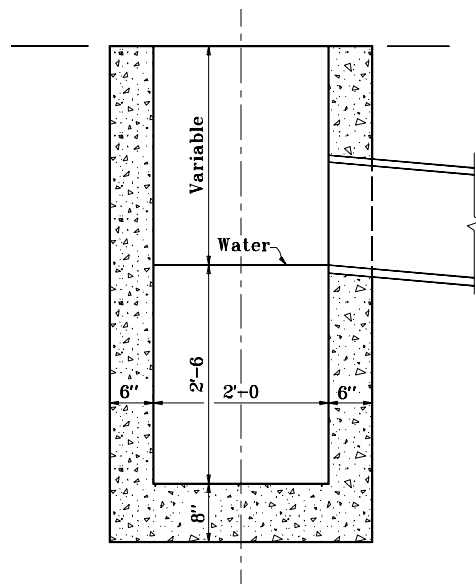
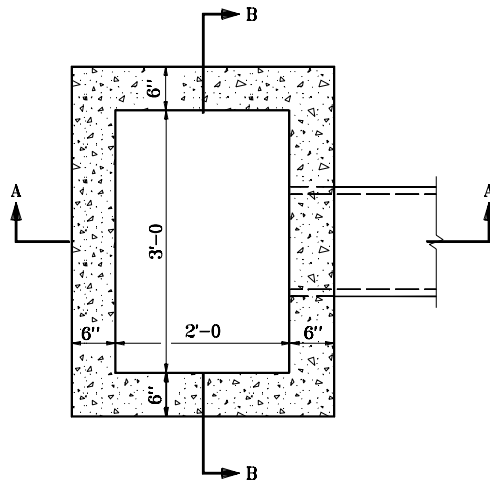


GENERAL NOTES

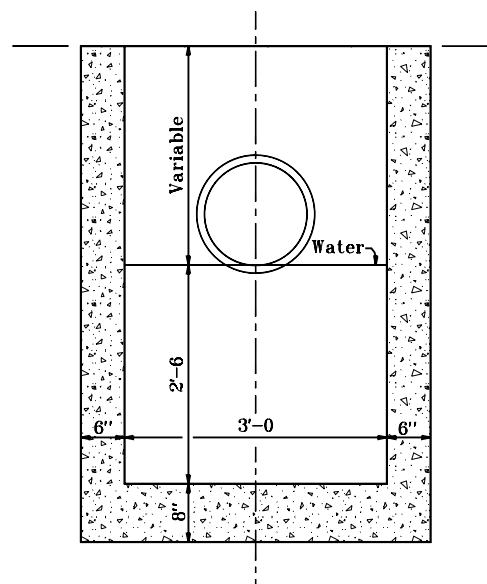
- 1 T = 8" for brick structure  
T = 6" for segmental block structure
- 2 2" pipe drain from bottom of curb to inlet. Aggregate to be placed around inlet end of pipe.
- 3 3" min. dia. pipe to be kept open for drainage of subgrade or base until surface is placed.



|                                                                                       |                                                                            |
|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                            |
| CATCH BASIN<br>TYPE J                                                                 |                                                                            |
| SEPTEMBER 2008                                                                        |                                                                            |
| STANDARD DRAWING NO. E 720- CBST-04                                                   |                                                                            |
|  | <i>/s/ Richard L. VanCleave</i> 09/02/08<br>DESIGN STANDARDS ENGINEER DATE |
|                                                                                       | <i>/s/ Mark A. Miller</i> 09/02/08<br>CHIEF HIGHWAY ENGINEER DATE          |
| DESIGN STANDARDS ENGINEER                                                             |                                                                            |

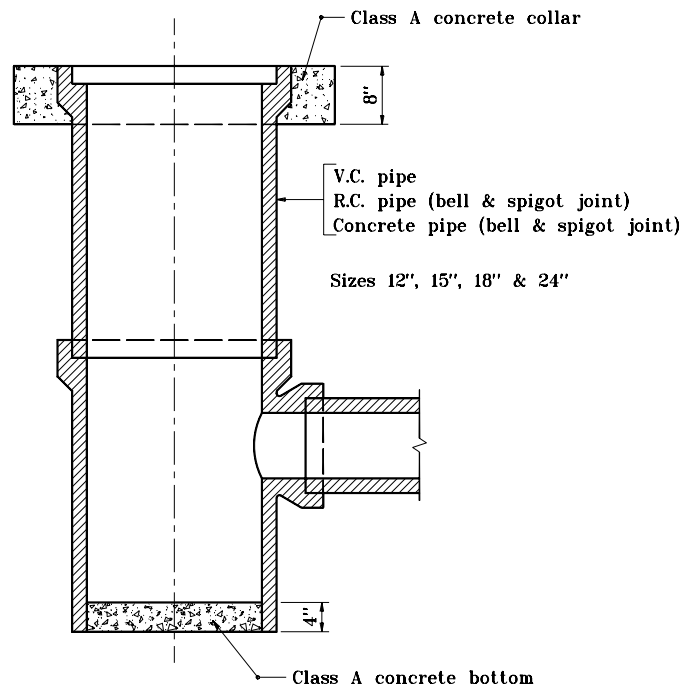
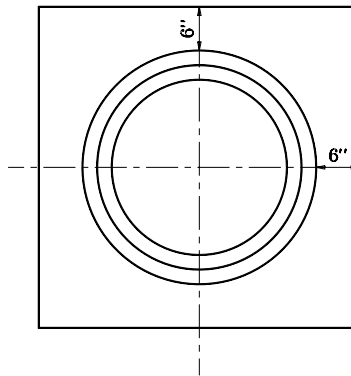


**SECTION A-A**

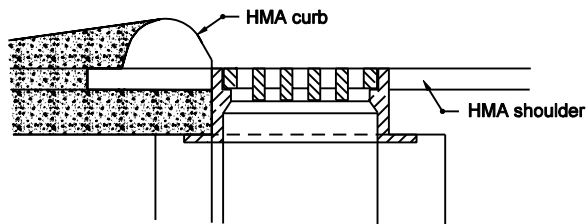


**SECTION B-B**

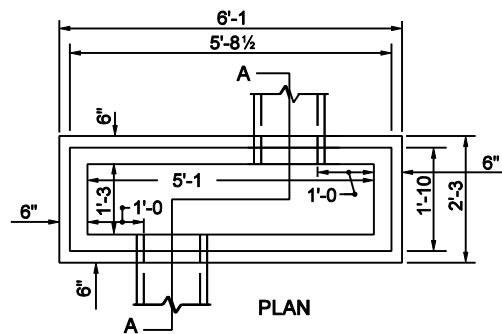
|                                           |                               |                        |          |
|-------------------------------------------|-------------------------------|------------------------|----------|
| INDIANA DEPARTMENT OF TRANSPORTATION      |                               |                        |          |
| <b>CATCH BASIN<br/>TYPE K</b>             |                               |                        |          |
| APRIL 1995                                |                               |                        |          |
| <b>STANDARD DRAWING NO. E 720-CBST-05</b> |                               |                        |          |
|                                           | DETAILS PLACED IN THIS FORMAT |                        | 11-15-99 |
|                                           | /s/ Anthony L. Uremovich      |                        | 11-15-99 |
|                                           | DESIGN STANDARDS ENGINEER     |                        | DATE     |
|                                           | /s/ Firooz Zandi              |                        | 11-15-99 |
| DESIGN STANDARDS ENGINEER                 |                               | CHIEF HIGHWAY ENGINEER | DATE     |
|                                           |                               | ORIGINALLY APPROVED    | 4-03-95  |



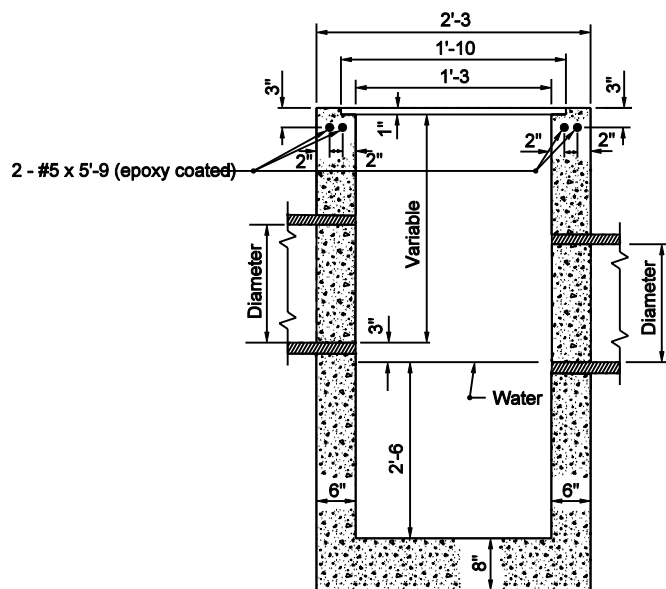
|                                      |                                                                                                               |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION |                                                                                                               |
| CATCH BASIN<br>PIPE                  |                                                                                                               |
| APRIL 1995                           |                                                                                                               |
| STANDARD DRAWING NO. E 720-CBST-06   |                                                                                                               |
|                                      | DETAILS PLACED IN THIS FORMAT 11-15-99<br>/s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE |
| DESIGN STANDARDS ENGINEER            | /s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE<br>ORIGINALLY APPROVED 4-03-95                       |



PLACEMENT DETAIL FOR  
CASTING

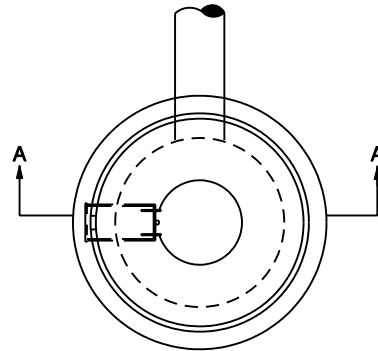


CATCH BASIN TYPE S



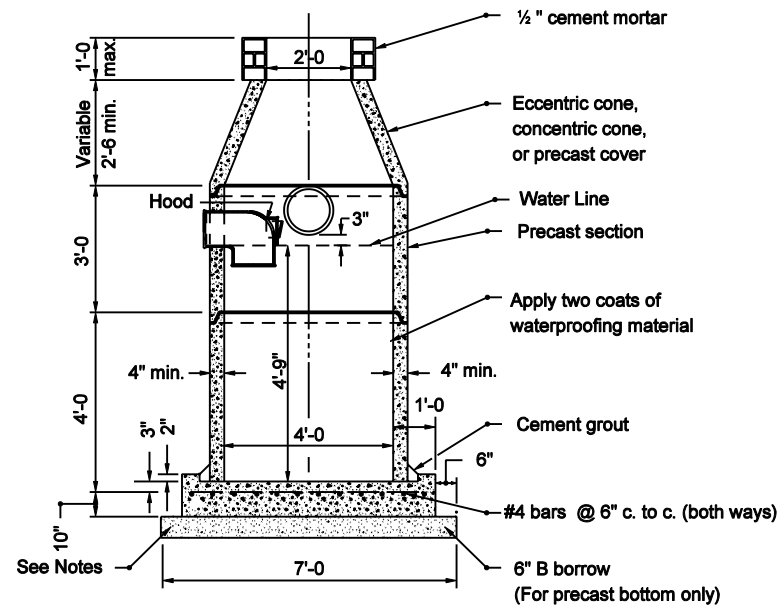
SECTION A-A

|                                      |                                                                    |
|--------------------------------------|--------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION |                                                                    |
| CATCH BASIN<br>TYPE S                |                                                                    |
| SEPTEMBER 2003                       |                                                                    |
| STANDARD DRAWING NO. E 720-CBST-07   |                                                                    |
|                                      | /s/ Richard L. VanCleave 9-02-03<br>DESIGN STANDARDS ENGINEER DATE |
|                                      | /s/ Richard K. Smutzer 9-02-03<br>CHIEF HIGHWAY ENGINEER DATE      |
| DESIGN STANDARDS ENGINEER            |                                                                    |



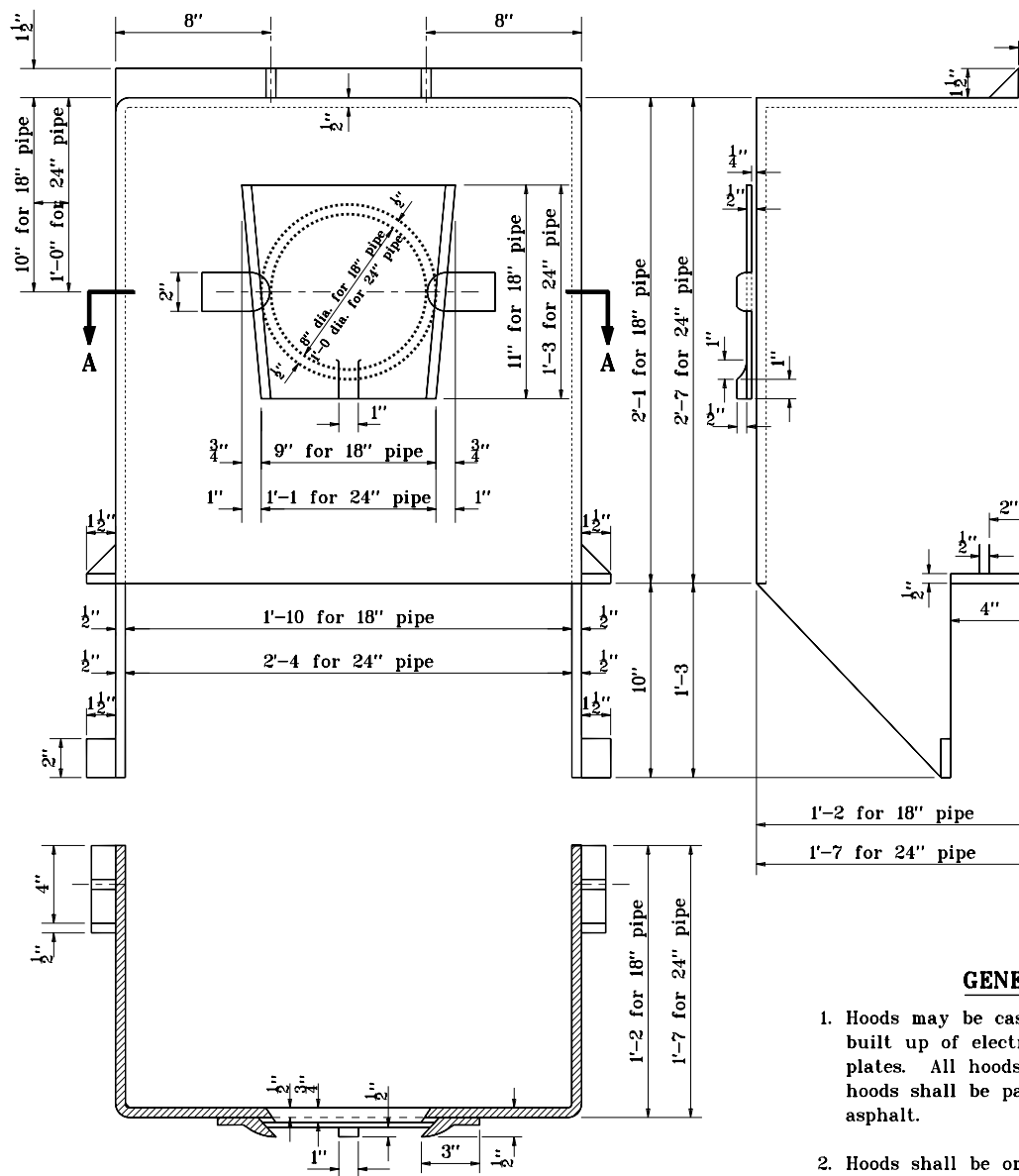
**NOTES:**

1. Concentric concrete section will not be permitted on any manhole that will be under the jurisdiction of the Indianapolis Sanitary District
2. The contractor will be permitted to substitute precast catch basin type "W" for catch basin type "A".

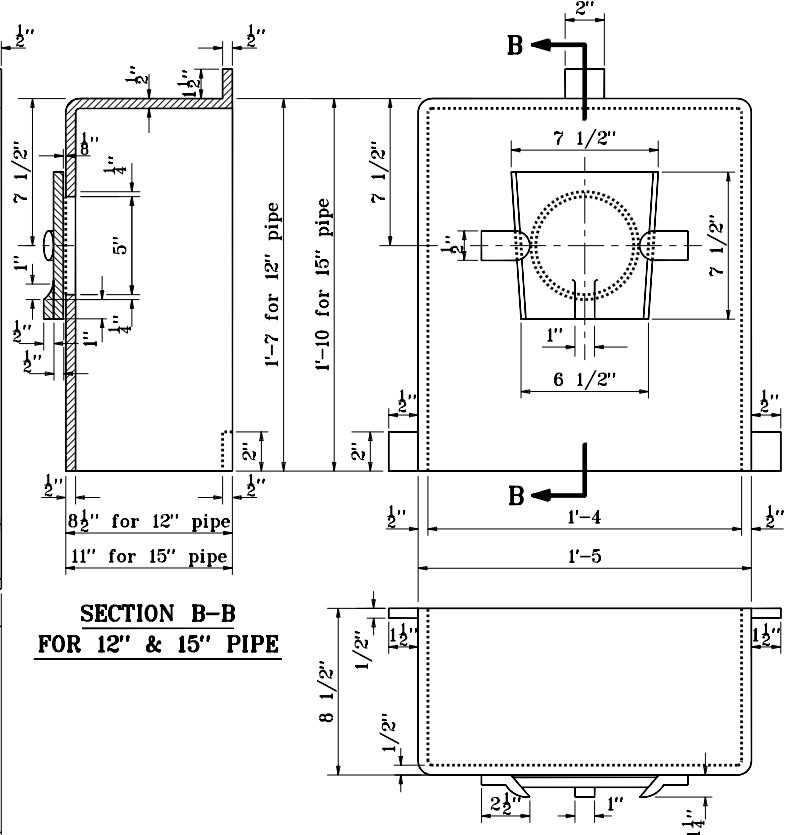


**SECTION A-A**

|                                      |                                                       |
|--------------------------------------|-------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION |                                                       |
| <b>CATCH BASIN<br/>TYPE W</b>        |                                                       |
| SEPTEMBER 2003                       |                                                       |
| STANDARD DRAWING NO. E 720-CBST-08   |                                                       |
|                                      | /s/ Richard L. VanCleave<br>DESIGN STANDARDS ENGINEER |
|                                      | 9-02-03<br>DATE                                       |
|                                      | /s/ Richard K. Smutzer<br>CHIEF HIGHWAY ENGINEER      |
|                                      | 9-02-03<br>DATE                                       |



**SECTION A-A  
FOR 18" & 24" PIPE**



**SECTION B-B  
FOR 12" & 15" PIPE**

### GENERAL NOTES

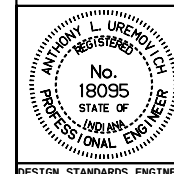
1. Hoods may be cast in one piece or may be built up of electrically welded 1/2" steel plates. All hoods shall be gas tight. Steel hoods shall be painted with waterproofing asphalt.
2. Hoods shall be omitted on earth ditch type catch basin unless otherwise specified.

INDIANA DEPARTMENT OF TRANSPORTATION

### CATCH BASIN HOOD

MAY 1998

STANDARD DRAWING NO. **E 720-CBST-09**



DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

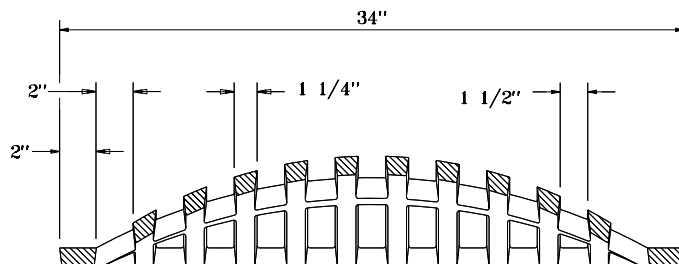
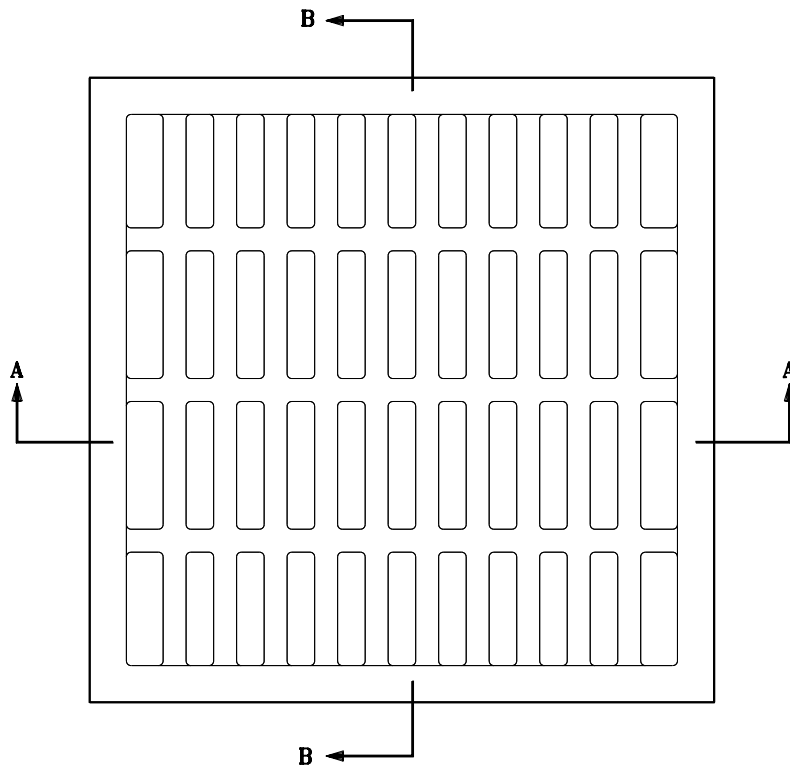
ORIGINALLY APPROVED 5-01-98

| Str.         | Type           | Casting Types |   |   |   |   |   |   |    |    |     |    |    |    |  |
|--------------|----------------|---------------|---|---|---|---|---|---|----|----|-----|----|----|----|--|
|              |                | 2             | 3 | 4 | 5 | 6 | 7 | 8 | 10 | 12 | 12A | 13 | 14 | 15 |  |
| Catch Basins | A              | X             | X |   |   |   |   | X |    |    |     |    |    |    |  |
|              | D              |               |   |   |   | X |   |   |    |    |     |    |    |    |  |
|              | E              |               |   |   |   |   | X |   |    |    |     |    |    |    |  |
|              | J              |               |   |   |   |   |   |   | X  |    |     |    |    |    |  |
|              | K              |               |   |   |   |   |   |   | X  |    |     |    |    |    |  |
|              | S              |               |   |   |   |   |   |   |    |    |     |    | X  |    |  |
|              | W <sup>①</sup> | X             | X |   |   |   |   | X |    |    |     |    |    |    |  |
| Inlets       | A              | X             | X |   |   |   |   | X |    |    |     |    |    |    |  |
|              | B              |               |   |   |   |   |   |   |    |    |     |    |    | X  |  |
|              | C              |               |   |   |   |   |   |   |    |    |     |    |    | X  |  |
|              | D              |               |   |   |   | X |   |   |    |    |     |    |    |    |  |
|              | E              |               |   |   |   |   | X |   |    |    |     |    |    |    |  |
|              | F              |               |   |   |   |   | X |   |    |    |     |    |    |    |  |
|              | G              |               |   |   |   |   | X |   |    |    |     |    |    |    |  |
|              | H, HA          |               |   |   | X |   |   |   |    |    |     |    |    |    |  |
|              | J              |               |   |   |   |   |   |   | X  |    |     |    |    |    |  |
|              | M              |               |   |   |   |   |   |   | X  |    |     |    |    |    |  |
|              | N              |               |   |   |   |   |   |   |    | X  |     |    |    |    |  |
|              | P              |               |   |   |   |   |   |   |    |    | X   |    |    |    |  |
|              | R              |               |   |   |   |   |   |   |    |    |     | X  |    |    |  |
|              | S              |               |   |   |   |   |   |   |    |    |     |    | X  |    |  |
|              | T              |               |   |   |   |   |   |   |    |    |     |    | X  |    |  |
| Manholes     | A              | X             |   | X |   |   |   | X |    |    |     |    |    |    |  |
|              | B              | X             |   | X |   |   |   | X |    |    |     |    |    |    |  |
|              | C <sup>②</sup> | X             |   | X |   |   |   | X |    |    |     |    |    |    |  |
|              | D              | X             |   | X |   |   |   | X |    |    |     |    |    |    |  |
|              | E              | X             |   | X |   |   |   | X |    |    |     |    |    |    |  |
|              | F              | X             |   | X |   |   |   | X |    |    |     |    |    |    |  |
|              | G              | X             |   | X |   |   |   | X |    |    |     |    |    |    |  |
|              | H              | X             |   | X |   |   |   | X |    |    |     |    |    |    |  |
|              | J              | X             |   | X |   |   |   | X |    |    |     |    |    |    |  |
|              | K              | X             |   | X |   |   |   | X |    |    |     |    |    |    |  |
|              | L              | X             |   | X |   |   |   | X |    |    |     |    |    |    |  |
|              | M              | X             |   | X |   |   |   | X |    |    |     |    |    |    |  |
|              | N              | X             |   | X |   |   |   | X |    |    |     |    |    |    |  |

# NOTES

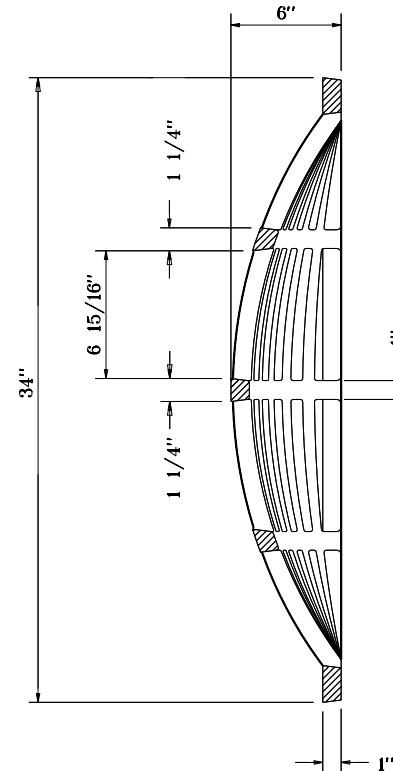
- ① May be substituted for catch basin type A.
- ② May be substituted for manhole type A or B.

|                                                                                       |                                                                              |
|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                              |
| <b>COMPATIBILITY OF DRAINAGE<br/>STRUCTURES AND CASTINGS</b>                          |                                                                              |
| SEPTEMBER 2006                                                                        |                                                                              |
| STANDARD DRAWING NO. E 720-CDSC-01                                                    |                                                                              |
|  | /s/ Richard L. VanCleave      9-01-06<br>DESIGN STANDARDS ENGINEER      DATE |
|  | /s/ Richard K. Smutzer      9-01-06<br>CHIEF HIGHWAY ENGINEER      DATE      |
| DESIGN STANDARDS ENGINEER                                                             |                                                                              |



**SECTION A-A**

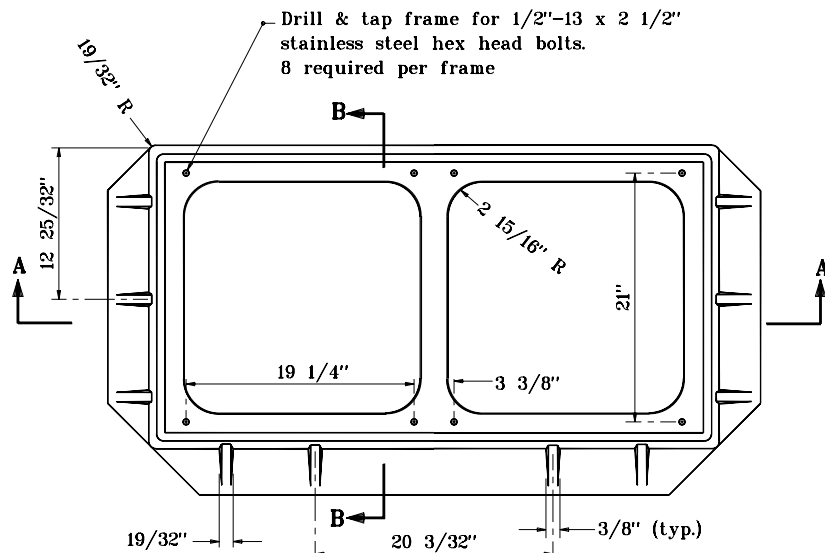
**EARTH DITCH CASTING TYPE 7**



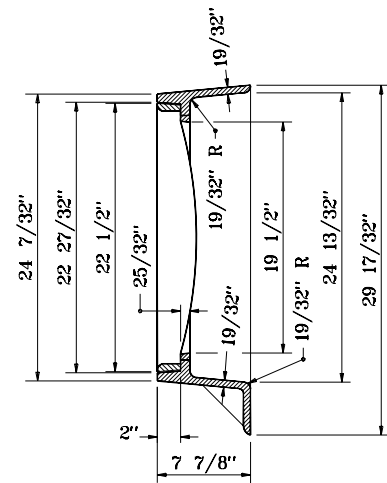
**SECTION B-B**

|                                                               |                                                                     |
|---------------------------------------------------------------|---------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                          |                                                                     |
| <b>EARTH DITCH</b><br><b>CASTING TYPE 7</b><br>SEPTEMBER 1998 |                                                                     |
| STANDARD DRAWING NO. <b>E 720-EDCA-01</b>                     |                                                                     |
|                                                               | DETAILS PLACED IN THIS FORMAT 11-15-99                              |
|                                                               | /s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE |
|                                                               | /s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE            |
|                                                               | DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 9-01-98               |

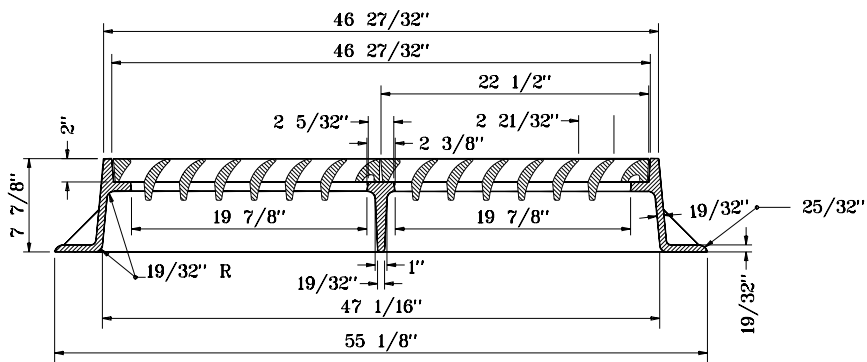




**PLAN**

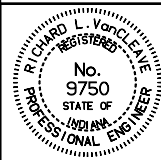


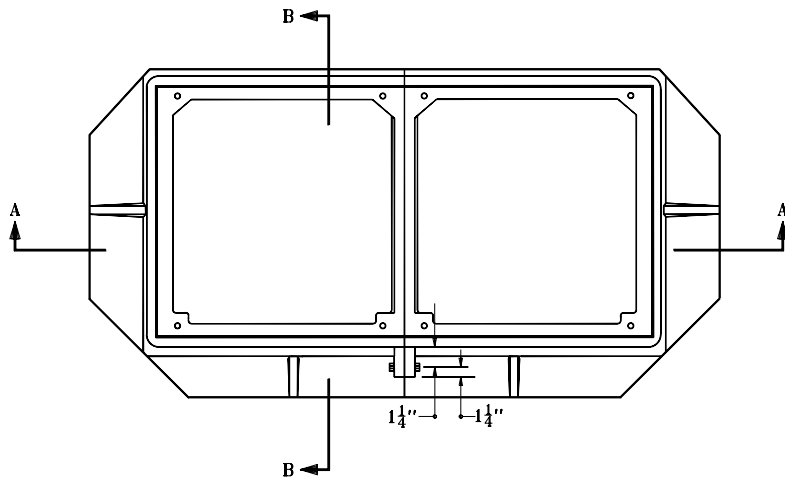
**SECTION B-B**



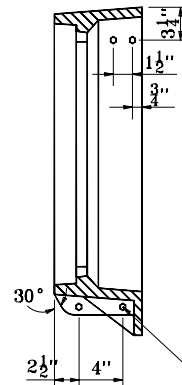
**SECTION A-A**

**FRAME  
CASTING TYPE 5**

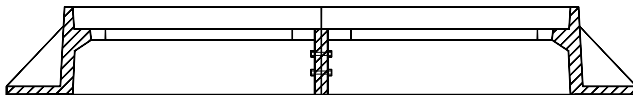
|                                                                                       |                                                                    |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                    |
| CASTING TYPE 5                                                                        |                                                                    |
| FRAME                                                                                 |                                                                    |
| SEPTEMBER 2001                                                                        |                                                                    |
| STANDARD DRAWING NO. E 720-ICCA-01                                                    |                                                                    |
|  | /s/ Anthony L. Uremovich 9-04-01<br>DESIGN STANDARDS ENGINEER DATE |
|                                                                                       | /s/ Firooz Zandi 9-04-01<br>CHIEF HIGHWAY ENGINEER DATE            |
| DESIGN STANDARDS ENGINEER                                                             |                                                                    |



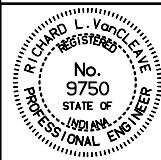
PLAN



SECTION B-B

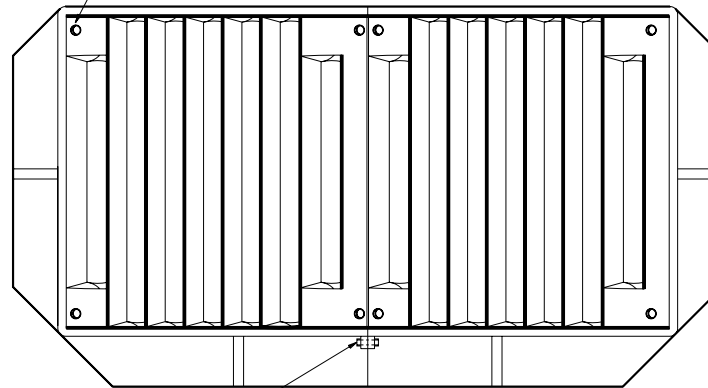


SECTION A-A

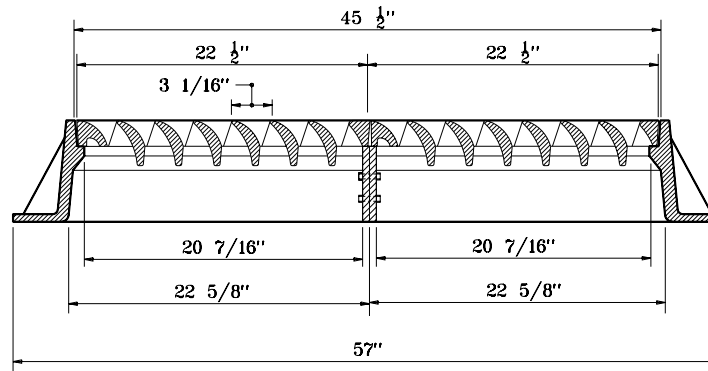
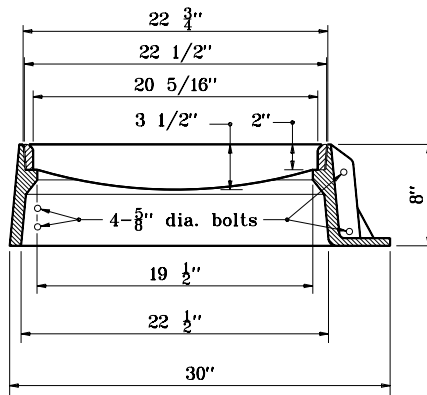
|                                                                                       |                                                                    |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                    |
| CASTING TYPE 5                                                                        |                                                                    |
| ALTERNATE BOLTED FRAME                                                                |                                                                    |
| SEPTEMBER 2001                                                                        |                                                                    |
| STANDARD DRAWING NO. E 720-ICCA-02                                                    |                                                                    |
|  | /s/ Anthony L. Uremovich 9-04-01<br>DESIGN STANDARDS ENGINEER DATE |
|                                                                                       | /s/ Firooz Zandi 9-04-01<br>CHIEF HIGHWAY ENGINEER DATE            |
| DESIGN STANDARDS ENGINEER                                                             |                                                                    |

Grate is bolted to  
frame with 1/2" hex head  
SS bolts. 4 req'd. each grate.

**BARRIER SIDE**



4-5/8" dia. bolts — Left hand flow —>



**FRAME AND GRATE  
CASTING TYPE 5 (ALTERNATE)**

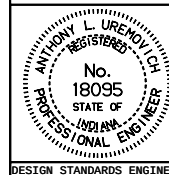
INDIANA DEPARTMENT OF TRANSPORTATION

**CASTING TYPE 5 (ALTERNATE)**

**FRAME AND GRATE**

SEPTEMBER 2001

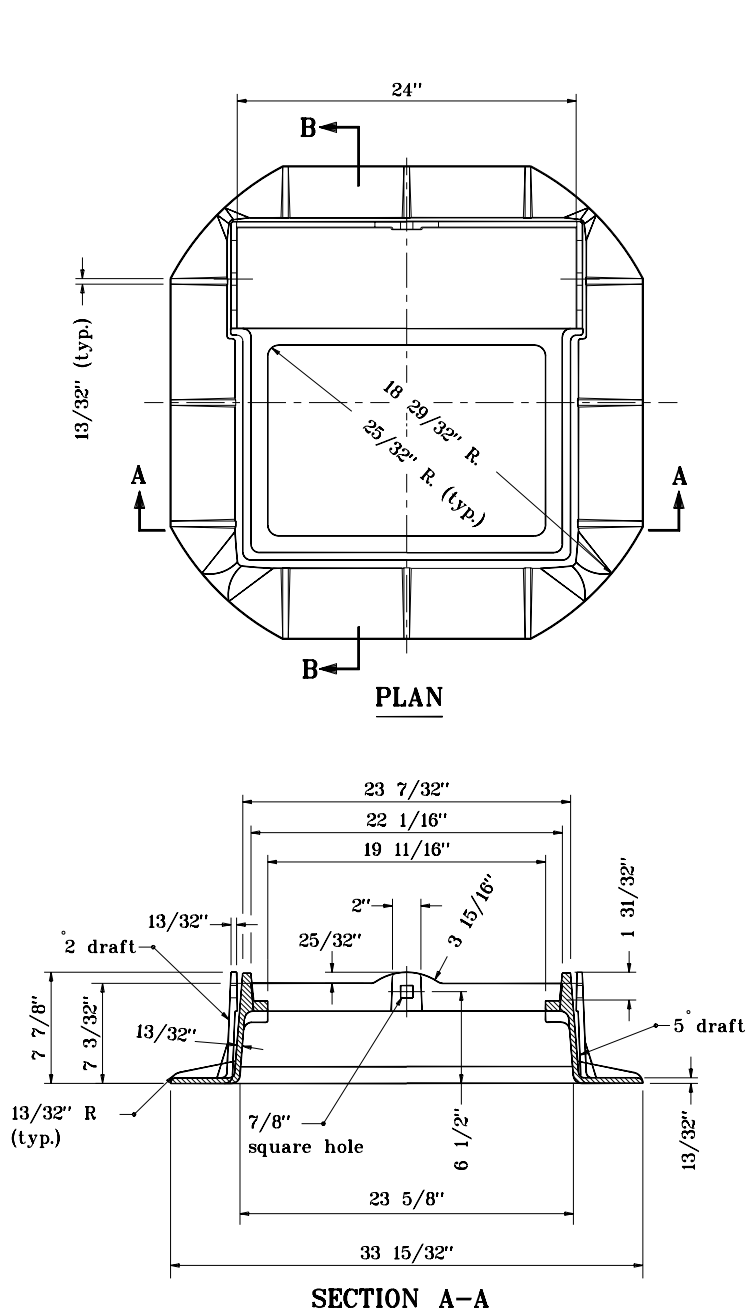
STANDARD DRAWING NO. **E 720-ICCA-03**



/s/ Anthony L. Uremovich 9-04-01  
DESIGN STANDARDS ENGINEER DATE

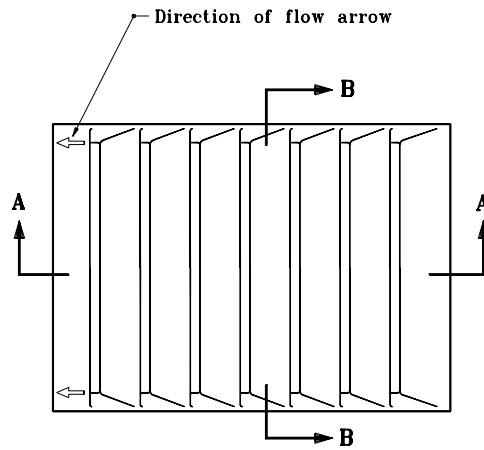
/s/ Firooz Zandi 9-04-01  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

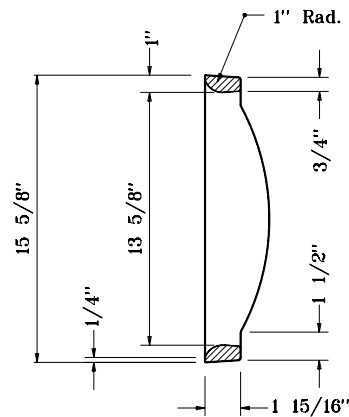


**FRAME  
CASTING TYPE 8**

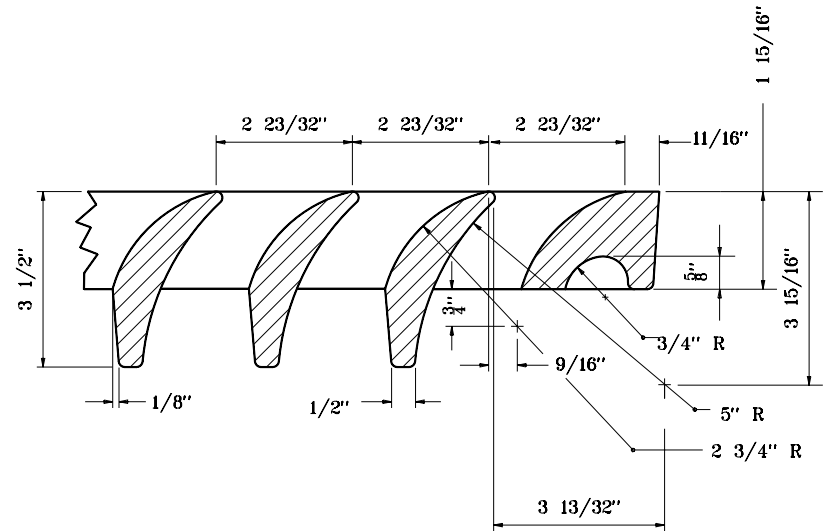
|                                           |                                                                     |
|-------------------------------------------|---------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION      |                                                                     |
| <b>CASTING TYPE 8</b>                     |                                                                     |
| <b>FRAME</b>                              |                                                                     |
| SEPTEMBER 1998                            |                                                                     |
| <b>STANDARD DRAWING NO. E 720-ICCA-04</b> |                                                                     |
|                                           | DETAILS PLACED IN THIS FORMAT 11-15-99                              |
|                                           | /s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE |
|                                           | /s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE            |
| DESIGN STANDARDS ENGINEER                 | ORIGINALLY APPROVED 9-01-98                                         |



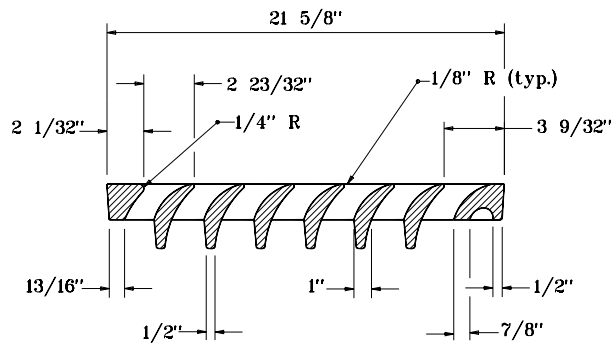
PLAN



SECTION B-B



DETAIL OF SECTION A-A  
GRATE  
CASTING TYPE 8

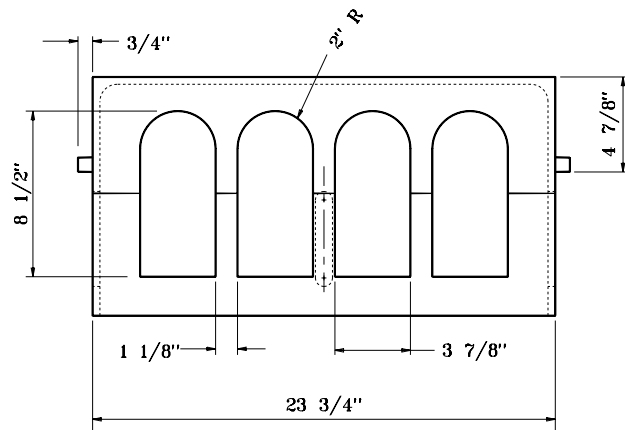


SECTION A-A

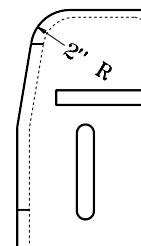
|                                      |                                                                     |
|--------------------------------------|---------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION |                                                                     |
| CASTING TYPE 8                       |                                                                     |
| GRATE                                |                                                                     |
| SEPTEMBER 1998                       |                                                                     |
| STANDARD DRAWING NO.E 720-ICCA-05    |                                                                     |
|                                      | DETAILS PLACED IN THIS FORMAT 11-15-99                              |
|                                      | /s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE |
|                                      | /s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE            |
|                                      | DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 9-01-98               |

# **GENERAL NOTES**

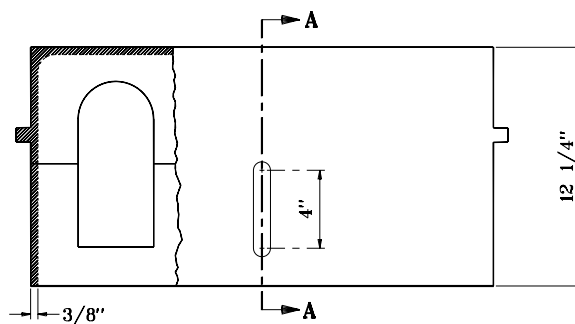
1. Curb box adjustable from 5 1/4" to 8 3/4".



**FRONT**

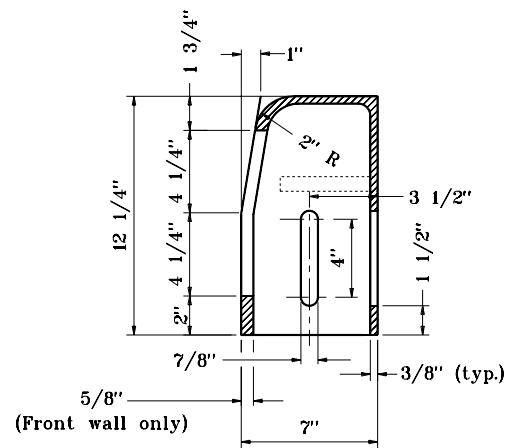


**SIDE**



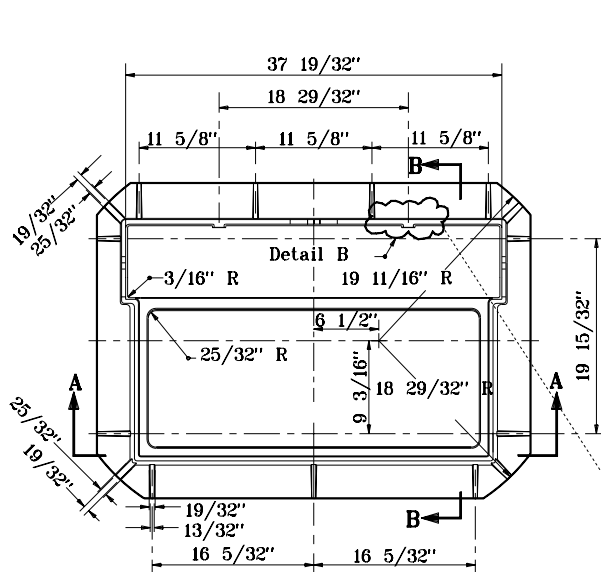
**BACK**

**CURB BOX  
CASTING TYPE 8**

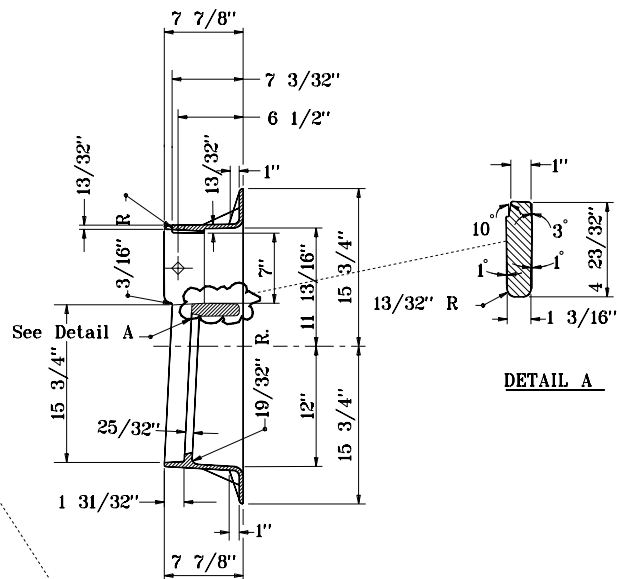


**SECTION A-A**

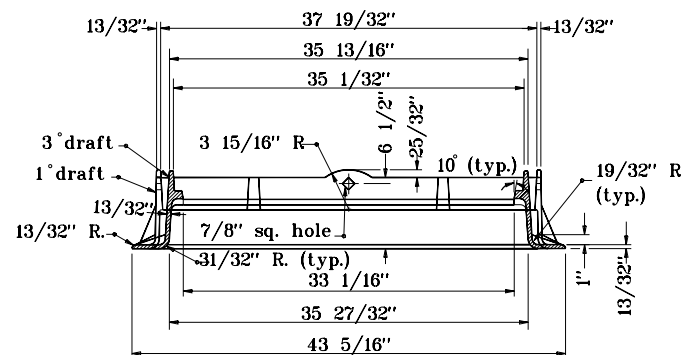
|                                           |                                                                                                                                                                                                                                    |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION      |                                                                                                                                                                                                                                    |
| <b>CASTING TYPE 8</b>                     |                                                                                                                                                                                                                                    |
| <b>CURB BOX</b>                           |                                                                                                                                                                                                                                    |
| SEPTEMBER 1998                            |                                                                                                                                                                                                                                    |
| <b>STANDARD DRAWING NO. E 720-ICCA-06</b> |                                                                                                                                                                                                                                    |
|                                           | DETAILS PLACED IN THIS FORMAT 11-15-99<br>/s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE<br>/s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE<br>DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 9-01-98 |



**PLAN**

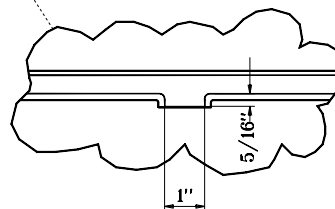


**SECTION B-B**

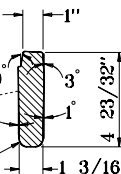


**SECTION A-A**

**FRAME  
CASTING TYPE 10**



**DETAIL B**



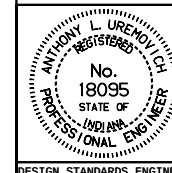
**DETAIL A**

INDIANA DEPARTMENT OF TRANSPORTATION

**CASTINGS TYPE 10  
FRAME**

SEPTEMBER 1998

STANDARD DRAWING NO. **E 720-ICCA-08**



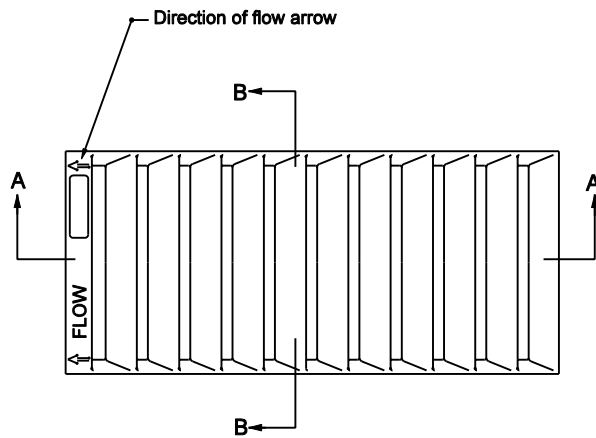
DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

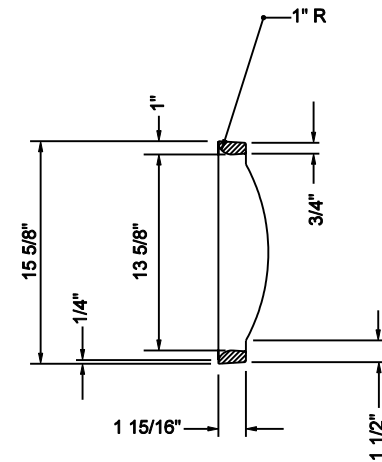
/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

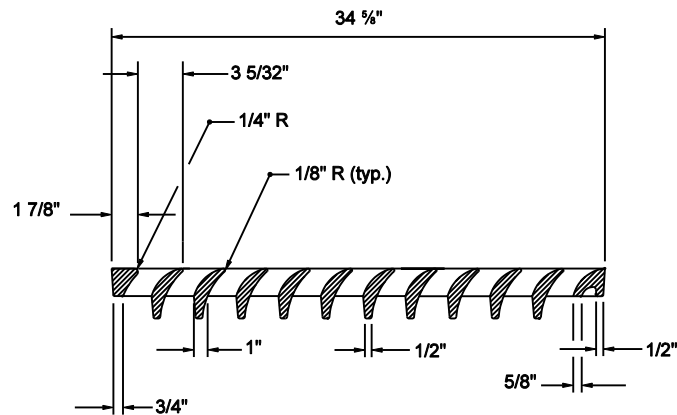
ORIGINALLY APPROVED 9-01-98



PLAN

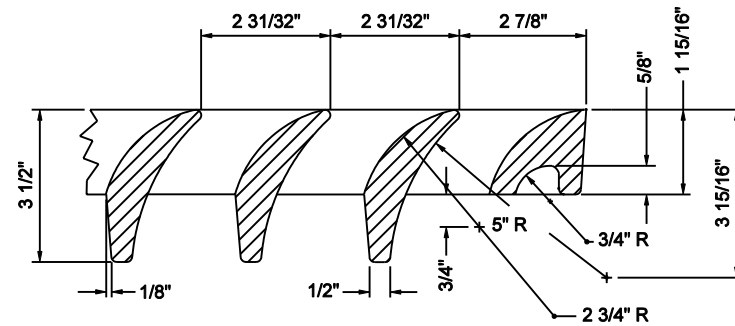


SECTION B-B



SECTION A-A

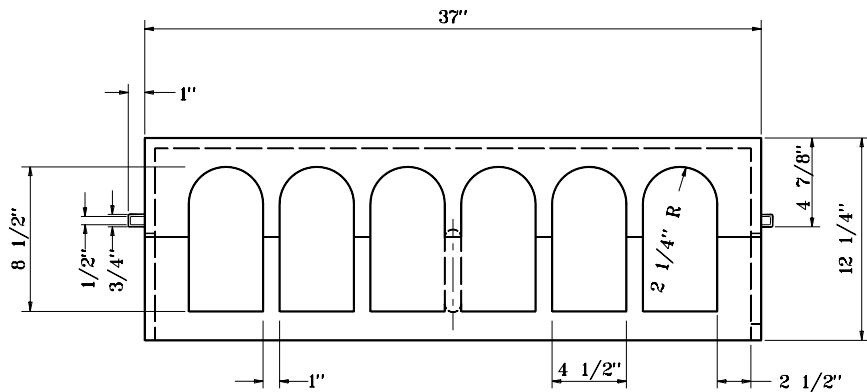
GRATE  
CASTING TYPE 10



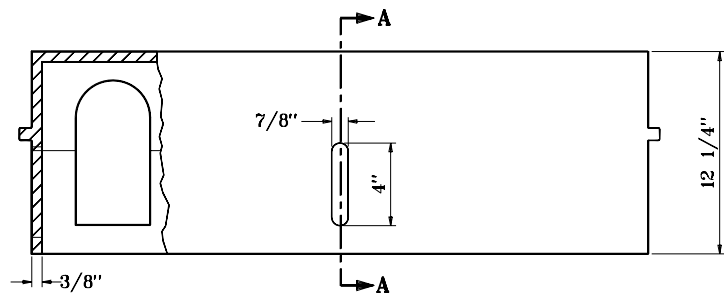
DETAIL OF SECTION A-A

|                                      |                                                       |
|--------------------------------------|-------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION |                                                       |
| CASTING TYPE 10<br>GRATE             |                                                       |
| SEPTEMBER 2003                       |                                                       |
| STANDARD DRAWING NO. E 720-ICCA-09   |                                                       |
|                                      | /s/ Richard L. VanCleave<br>DESIGN STANDARDS ENGINEER |
|                                      | /s/ Richard K. Smutzer<br>CHIEF HIGHWAY ENGINEER      |
| DESIGN STANDARDS ENGINEER            | 9-02-03<br>DATE<br>9-02-03<br>DATE                    |





**FRONT**

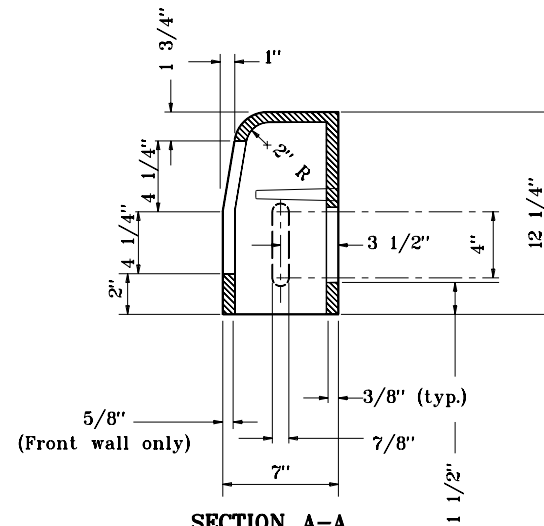


**BACK**

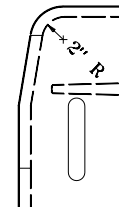
**CURB BOX  
CASTING 10**

**GENERAL NOTES**

1. Curb box adjustable  
5 1/4" to 8 3/4".

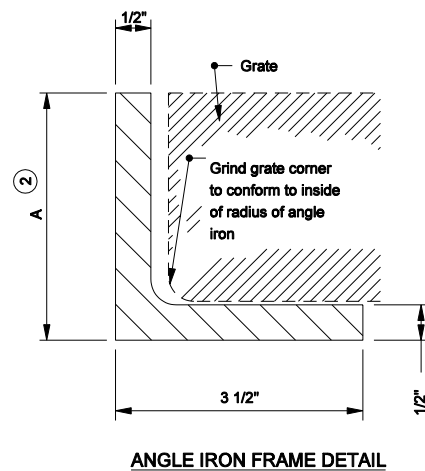
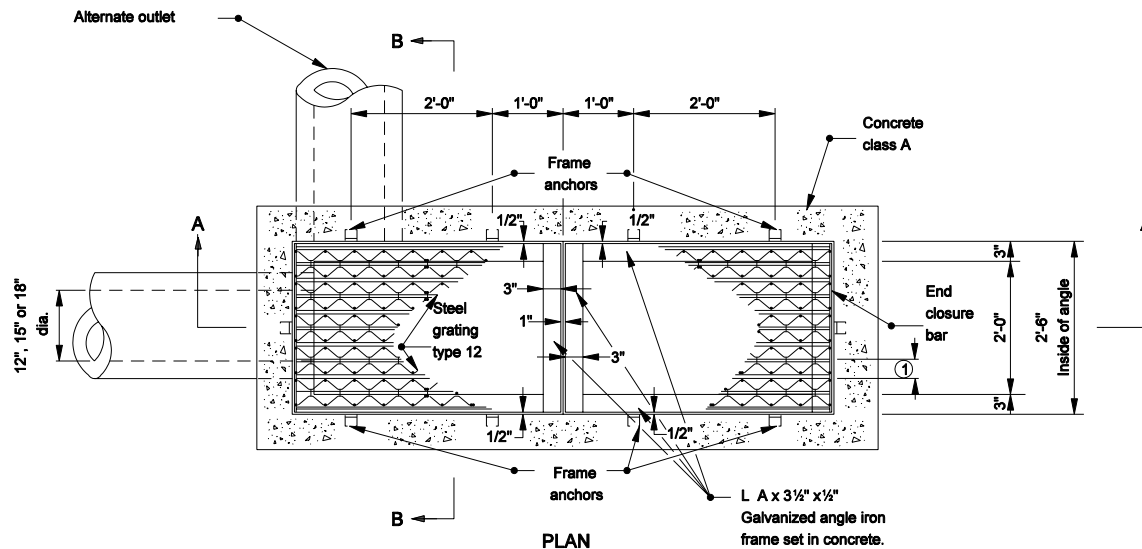


**SECTION A-A**



**SIDE**

|                                      |                                                                     |
|--------------------------------------|---------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION |                                                                     |
| CASTING TYPE 10                      |                                                                     |
| CURB BOX                             |                                                                     |
| SEPTEMBER 1998                       |                                                                     |
| STANDARD DRAWING NO.E 720-ICCA-09A   |                                                                     |
|                                      | DETAILS PLACED IN THIS FORMAT 11-15-99                              |
|                                      | /s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE |
|                                      | /s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE            |
|                                      | DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 9-01-98               |



## NOTES

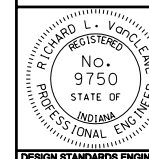
- ① Bar spacing shall be 1 1/4" c. to c. minimum and 2 1/4" c. to c. maximum.
- ② The dimensions of the angle iron frame shall be as shown except that the A dimension may vary according to type of grating used.
- ③ For Section A-A, Section B-B see Standard Drawing E 720-INST-08.

INDIANA DEPARTMENT OF TRANSPORTATION

## STEEL GRATING TYPE 12 FRAME AND GRATE

SEPTEMBER 2005

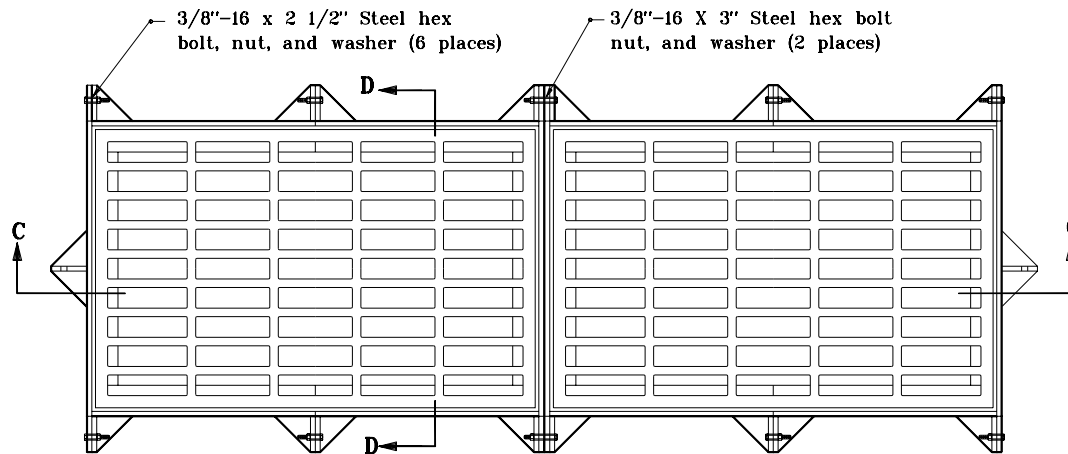
STANDARD DRAWING NO. E 720-ICCA-10



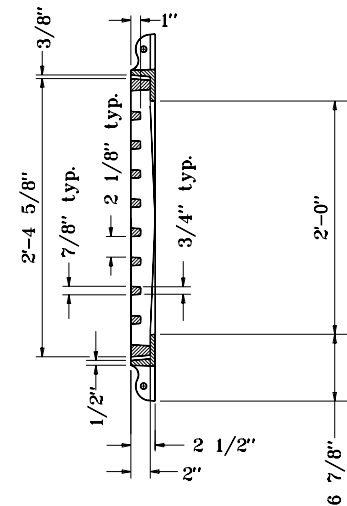
/s/ Richard L. VanCleave 9-01-05  
DESIGN STANDARDS ENGINEER DATE

/s/ Richard K. Smutzer 9-01-05  
CHIEF HIGHWAY ENGINEER DATE

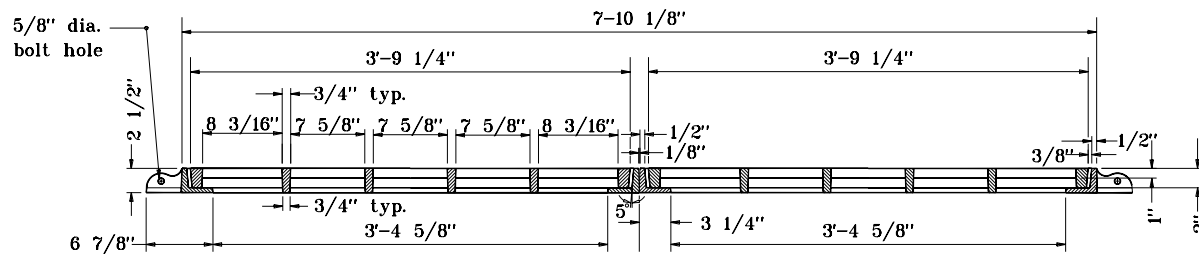
DESIGN STANDARDS ENGINEER



**PLAN**



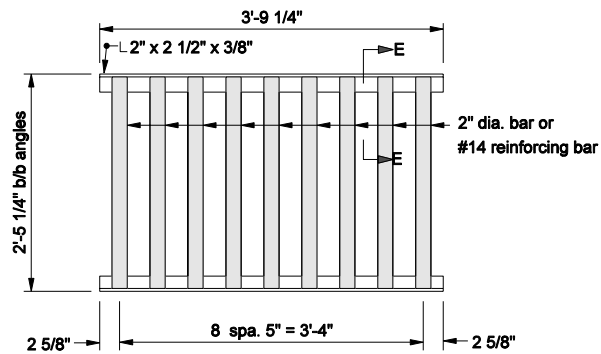
**SECTION D-D**



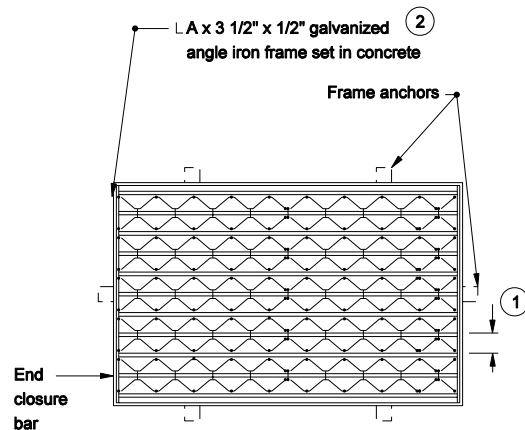
**SECTION A-A**

**GRATE AND FRAME CASTING  
ALTERNATE TYPE 12**

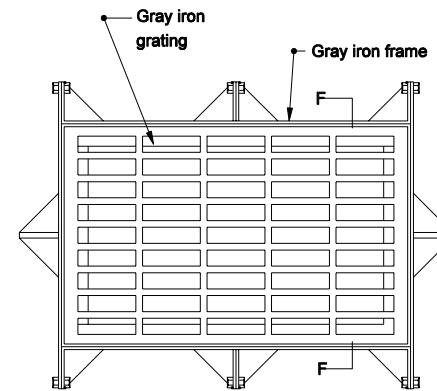
|                                      |                                                                     |
|--------------------------------------|---------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION |                                                                     |
| CASTING TYPE 12 (ALTERNATE)          |                                                                     |
| FRAME AND GRATE                      |                                                                     |
| SEPTEMBER 1998                       |                                                                     |
| STANDARD DRAWING NO. E 720-ICCA-11   |                                                                     |
|                                      | DETAILS PLACED IN THIS FORMAT 11-15-99                              |
|                                      | /s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE |
|                                      | /s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE            |
| DESIGN STANDARDS ENGINEER            | ORIGINALLY APPROVED 9-01-98                                         |



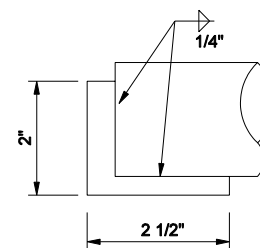
**ALTERNATE STEEL GRATING**  
(To be used with steel frame type 12A)



**STEEL GRATING AND FRAME**  
**TYPE 12A**



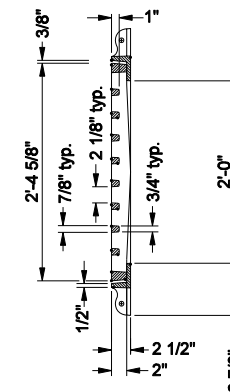
**GRATE AND FRAME CASTING**  
**ALTERNATE TYPE 12A**



**SECTION E-E**

**GENERAL NOTES**

- 1 Spacing shall be 1 7/8" c. to c. min., and 2 3/8" c. to c. max.
- 2 The dimensions of the angle iron frame shall be as shown except that the A dimension may vary according to type of grating used.



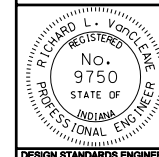
**SECTION F-F**

INDIANA DEPARTMENT OF TRANSPORTATION

**STEEL GRATING TYPE 12A**  
**FRAME AND GRATE**

SEPTEMBER 2005

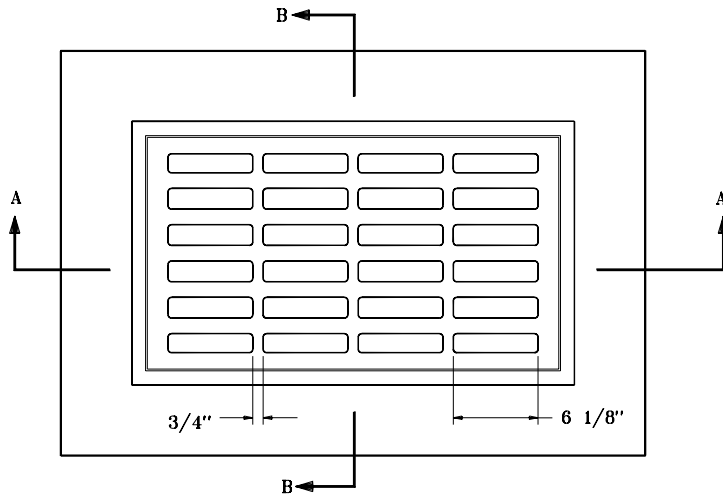
STANDARD DRAWING NO. E 720-ICCA-12



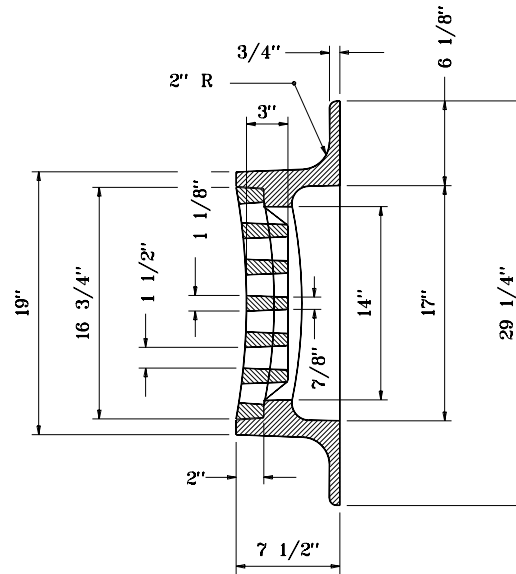
/s/ Richard L. VanCleave 9-01-05  
DESIGN STANDARDS ENGINEER DATE

/s/ Richard K. Smutzer 9-01-05  
CHIEF HIGHWAY ENGINEER DATE

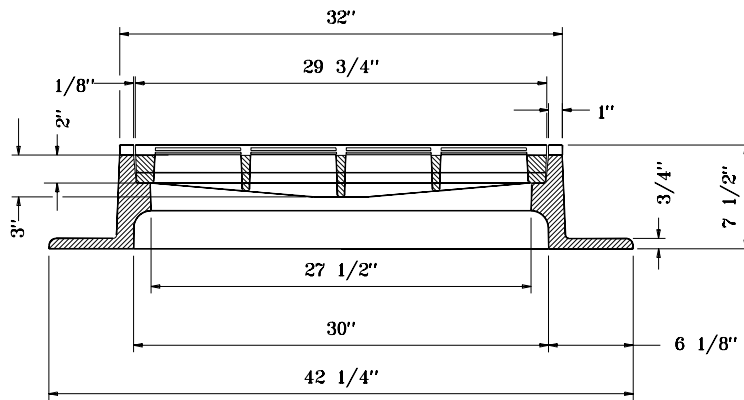
DESIGN STANDARDS ENGINEER



**PLAN**



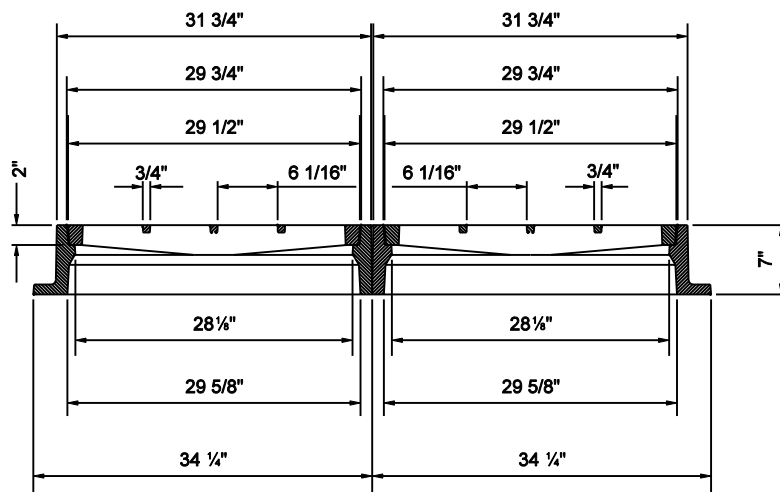
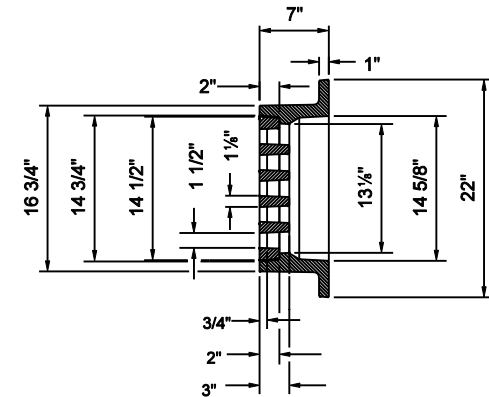
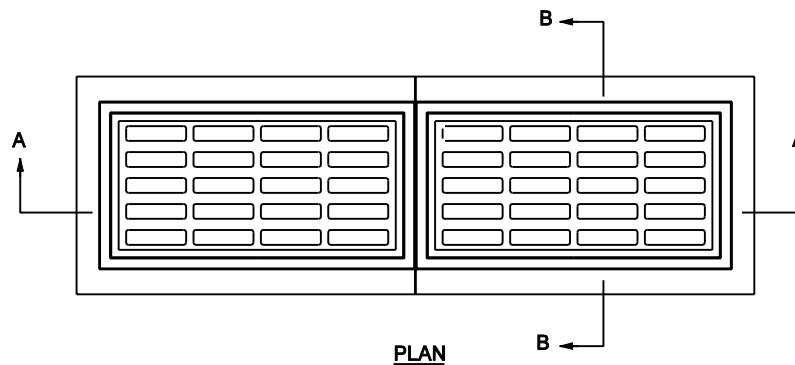
**SECTION B-B**



**SECTION A-A**

**FRAME AND GRATE  
CASTING TYPE 13**

|                                           |                                                                     |
|-------------------------------------------|---------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION      |                                                                     |
| <b>CASTING TYPE 13</b>                    |                                                                     |
| <b>FRAME &amp; GRATE</b>                  |                                                                     |
| SEPTEMBER 1998                            |                                                                     |
| <b>STANDARD DRAWING NO. E 720-ICCA-13</b> |                                                                     |
|                                           | DETAILS PLACED IN THIS FORMAT 11-15-99                              |
|                                           | /s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE |
|                                           | /s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE            |
|                                           | DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 9-01-98               |



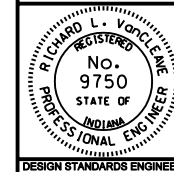
**FRAME AND GRATE**  
**CASTING TYPE 14**

INDIANA DEPARTMENT OF TRANSPORTATION

**CASTING TYPE 14**  
**FRAME AND GRATE**

SEPTEMBER 2003

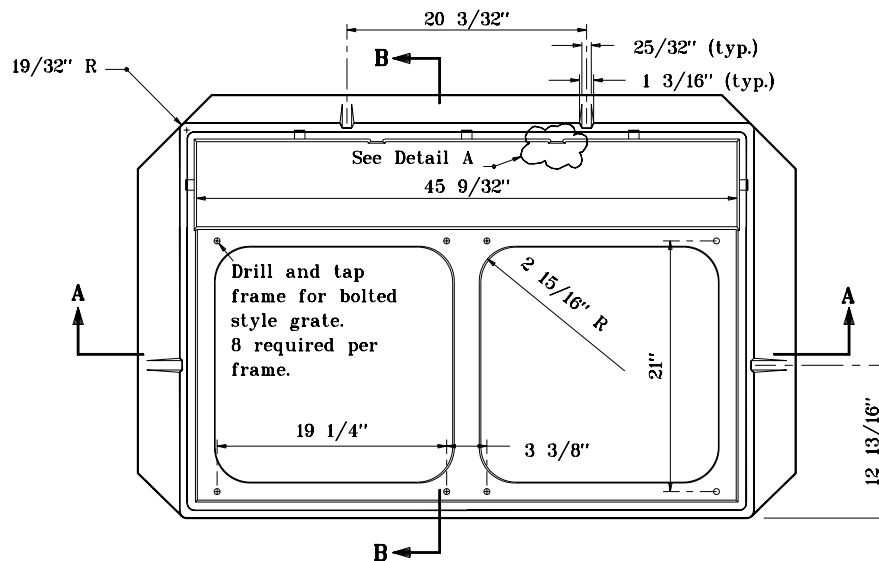
STANDARD DRAWING NO. E 720-ICCA-15



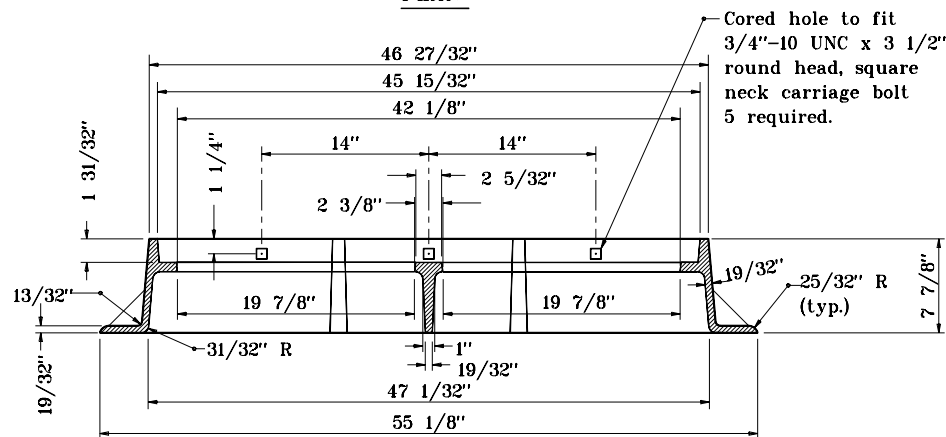
/s/ Richard L. VanCleave 9-02-03  
DESIGN STANDARDS ENGINEER DATE

/s/ Richard K. Smutzer 9-02-03  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

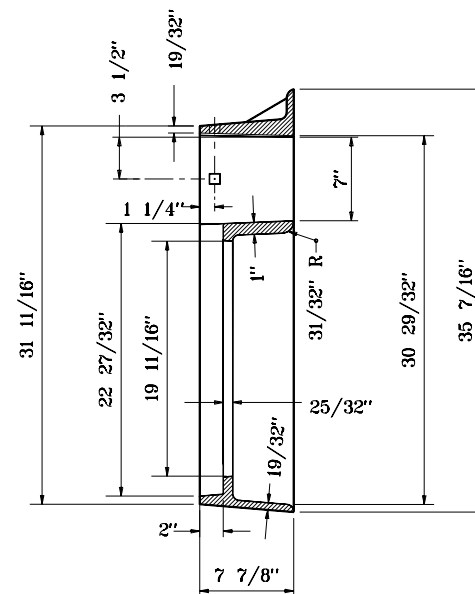


**PLAN**

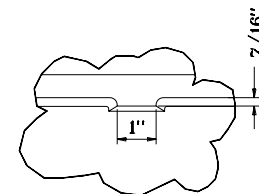


**SECTION A-A**

**FRAME  
CASTING TYPE 15**

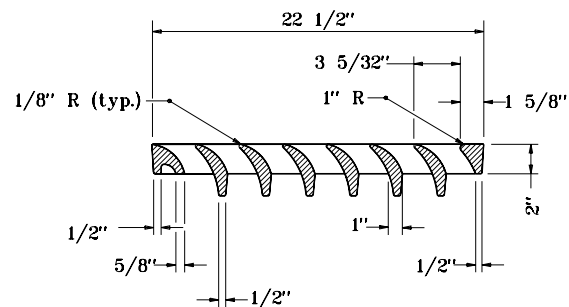
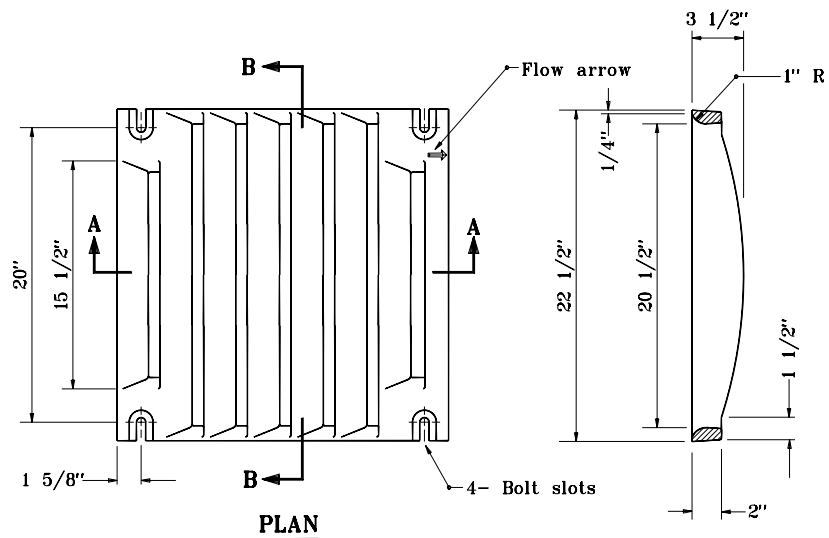


**SECTION B-B**

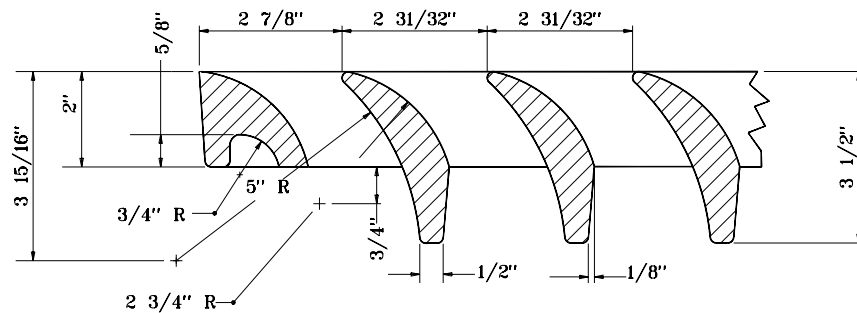
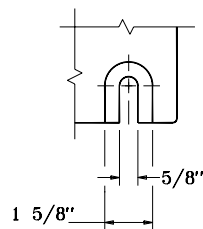


**DETAIL A**

|                                           |                                                                                                               |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION      |                                                                                                               |
| <b>CASTING TYPE 15</b>                    |                                                                                                               |
| <b>FRAME</b>                              |                                                                                                               |
| SEPTEMBER 1998                            |                                                                                                               |
| <b>STANDARD DRAWING NO. E 720-ICCA-16</b> |                                                                                                               |
|                                           | DETAILS PLACED IN THIS FORMAT 11-15-99<br>/s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE |
| DESIGN STANDARDS ENGINEER                 | /s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE<br>ORIGINALLY APPROVED 9-01-98                       |



SECTION B-B

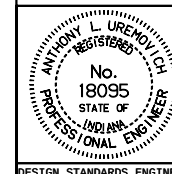


INDIANA DEPARTMENT OF TRANSPORTATION

**CASTING TYPE 15  
GRATE**

SEPTEMBER 1998

STANDARD DRAWING NO. E 720-ICCA-17



DETAILS PLACED IN THIS FORMAT 11-15-99

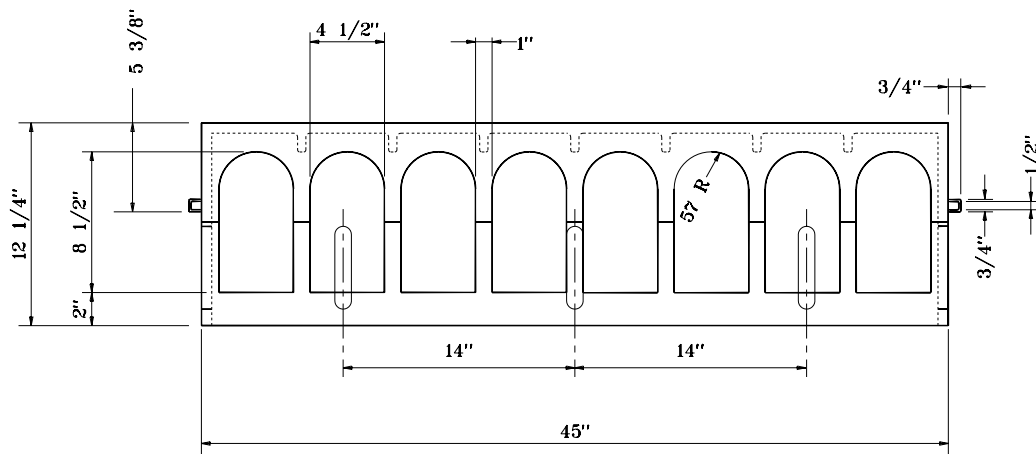
/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

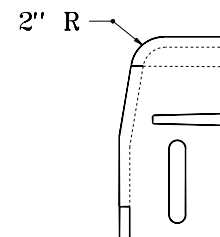
DESIGN STANDARDS ENGINEER

ORIGINALLY APPROVED 9-01-98

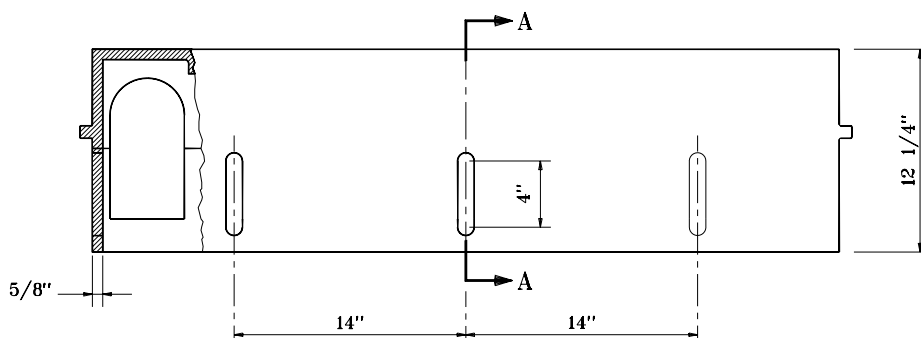




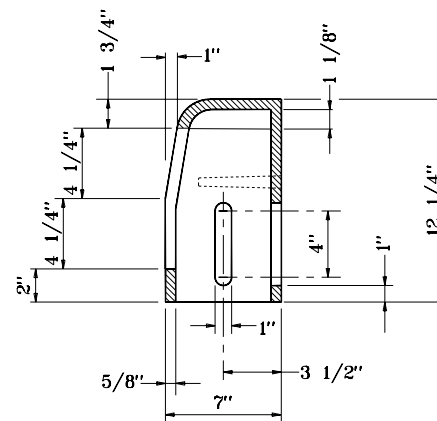
**FRONT**



**SIDE**



**BACK**



**SECTION A-A**

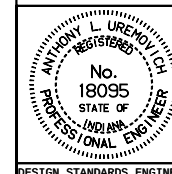
INDIANA DEPARTMENT OF TRANSPORTATION

**CASTING TYPE 15**

**CURB BOX**

SEPTEMBER 1998

**STANDARD DRAWING NO. E 720-ICCA-18**



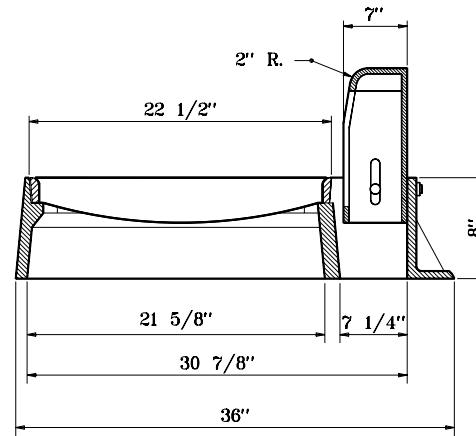
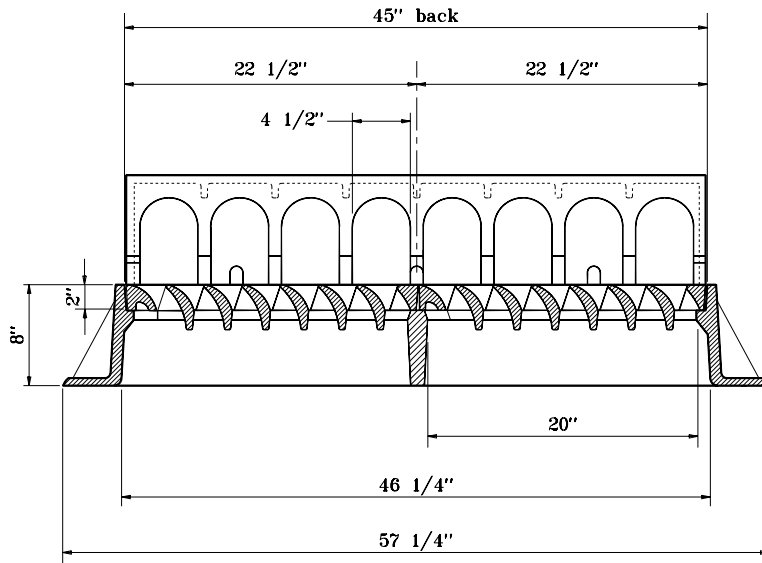
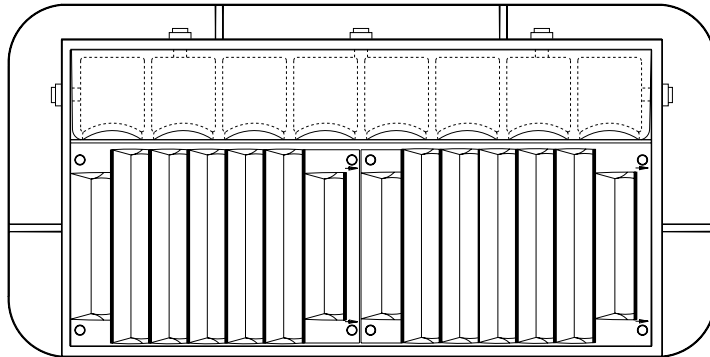
DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

ORIGINALLY APPROVED 9-01-98

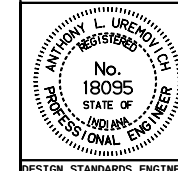


## GENERAL NOTES

1. Curb adjustment 5 1/2" to 9 1/2".

INDIANA DEPARTMENT OF TRANSPORTATION  
CASTING TYPE 15 (ALTERNATE)  
FRAME, GRATE, AND CURB BOX  
SEPTEMBER 1998

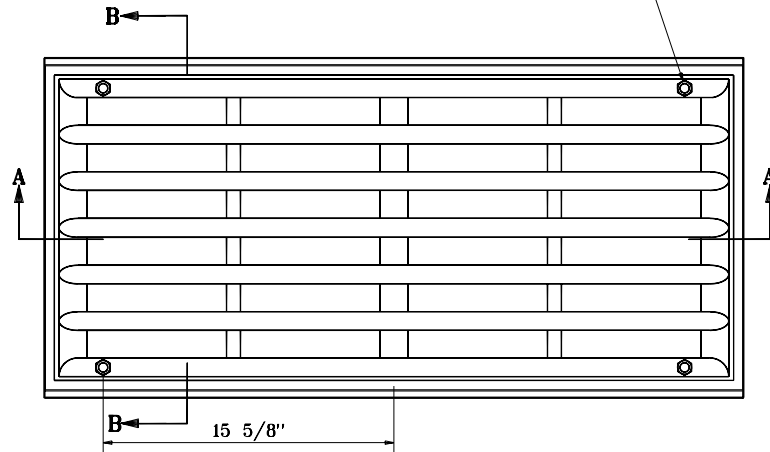
STANDARD DRAWING NO. E 720-ICCA-19



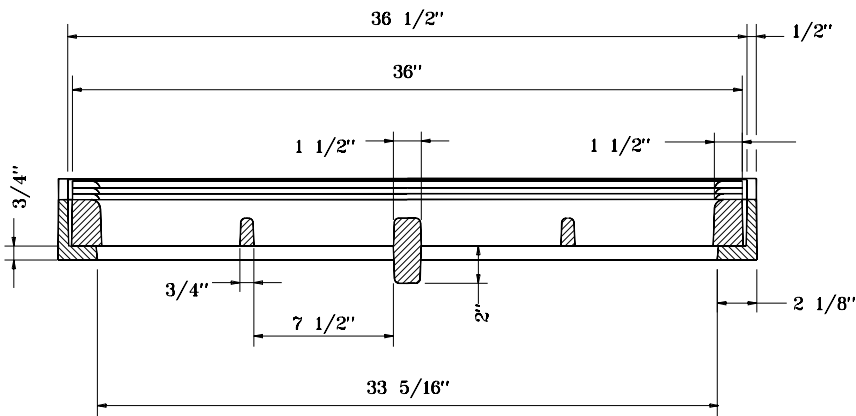
|                               |          |          |
|-------------------------------|----------|----------|
| DETAILS PLACED IN THIS FORMAT |          | 11-15-99 |
| /s/ Anthony L. Uremovich      | 11-15-99 | DATE     |
| DESIGN STANDARDS ENGINEER     |          |          |
| /s/ Firooz Zandi              | 11-15-99 | DATE     |
| CHIEF HIGHWAY ENGINEER        |          |          |
| ORIGINALLY APPROVED           |          | 9-01-98  |

DESIGN STANDARDS ENGINEER

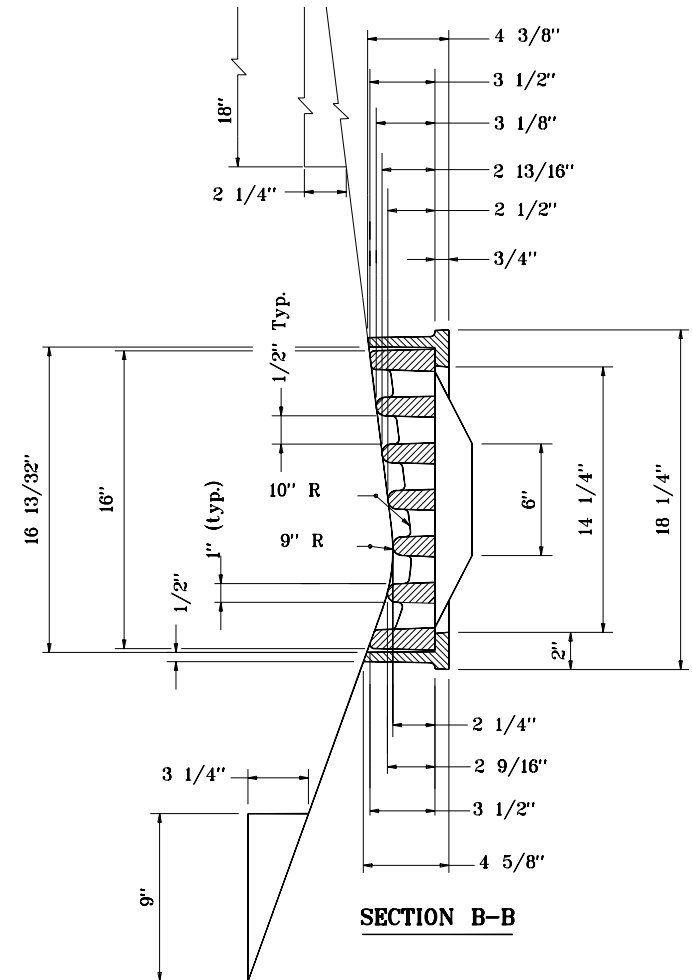
Drill and tap for  
3/8" x 2" stainless steel  
hex bolt with washer (4 places)



**PLAN**



**SECTION A-A**



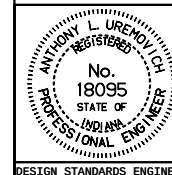
**SECTION B-B**

INDIANA DEPARTMENT OF TRANSPORTATION

**INLET CASTING  
TYPE 6**

SEPTEMBER 1998

STANDARD DRAWING NO. **E 720-INCA-01**



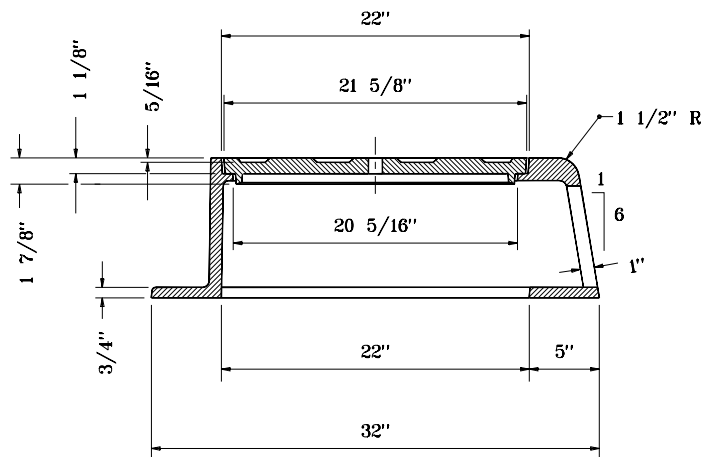
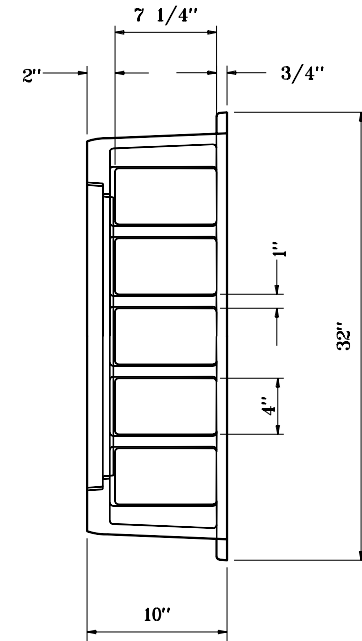
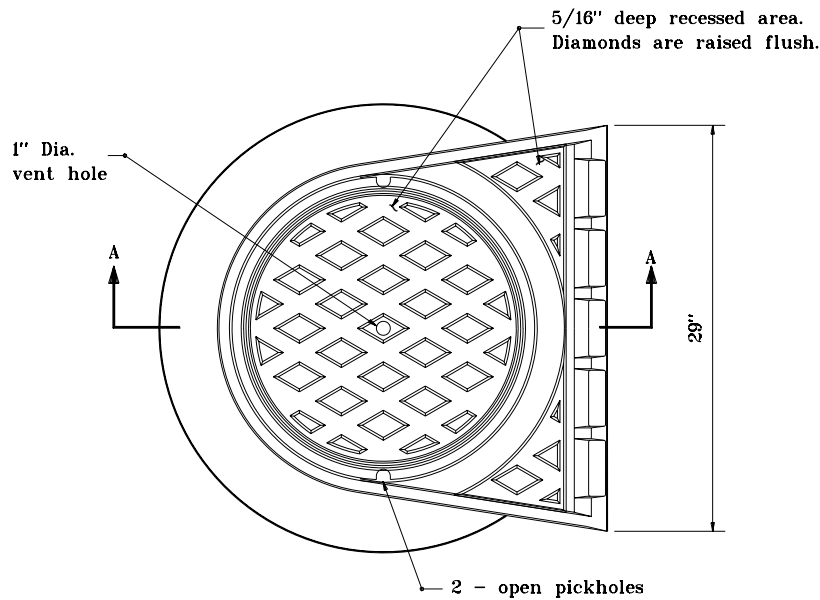
DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

ORIGINALLY APPROVED 9-01-98



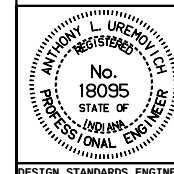
**SECTION A-A**  
**CURB CASTING TYPE 3**

INDIANA DEPARTMENT OF TRANSPORTATION

**CURB INLET CASTING**  
**TYPE 3**

SEPTEMBER 1998

STANDARD DRAWING NO. E 720-INCA-02



DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

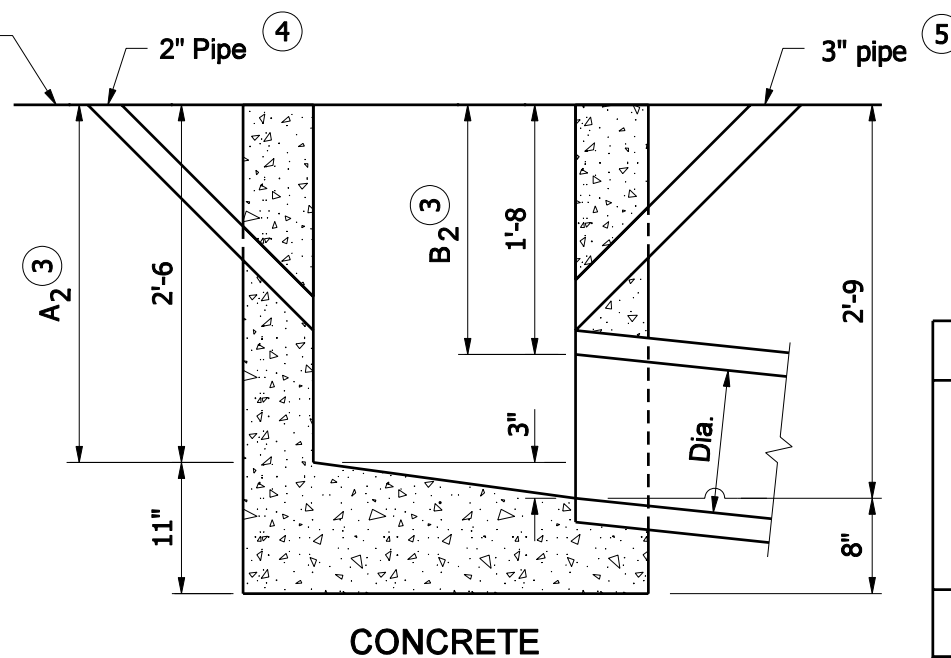
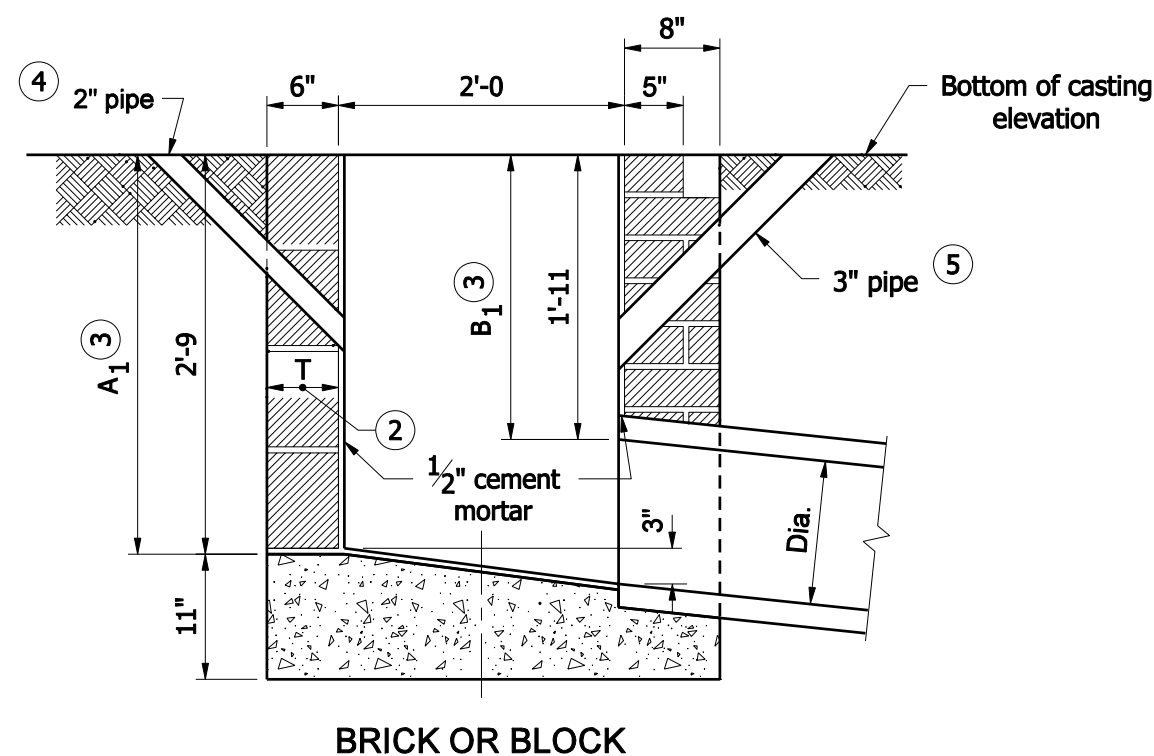
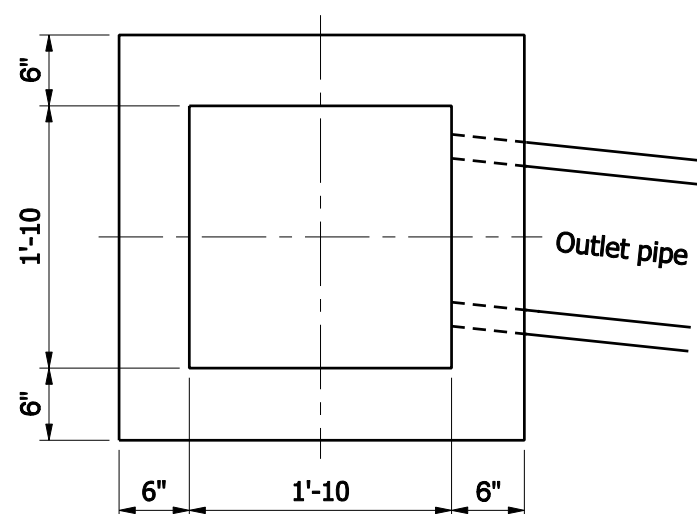
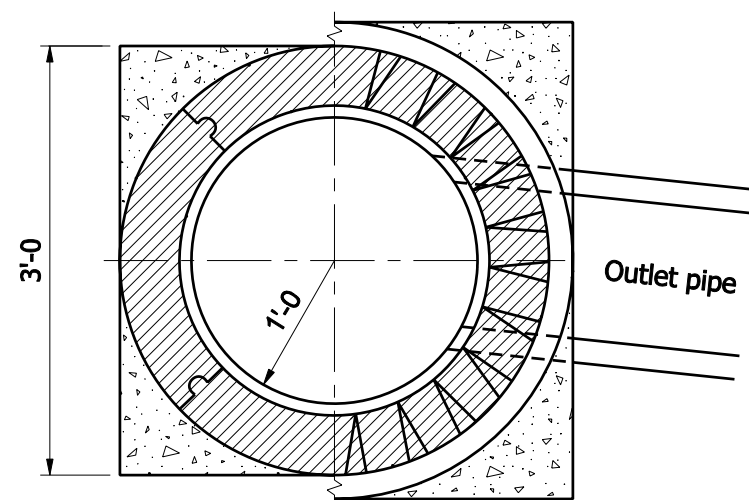
/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

ORIGINALLY APPROVED 9-01-98

# GENERAL NOTES

1. Brick, block, or concrete may be used.
2. T = 8" for brick structure  
T = 6" for segmental block structure
- 3 In special cases or where inlet pipe is required, A<sub>1</sub>, B<sub>1</sub>, A<sub>2</sub>, and B<sub>2</sub> shall be increased or decreased 1'-0", as directed.
- 4 2" dia. pipe drain from bottom of curb to inlet. Aggregate to be placed around inlet end of pipe.
- 5 3" dia. pipe to be kept open for drainage of subgrade or base until surface is placed.

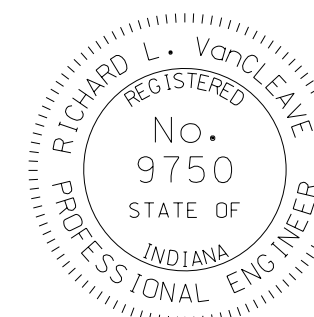


INDIANA DEPARTMENT OF TRANSPORTATION

INLET TYPE A

SEPTEMBER 2008

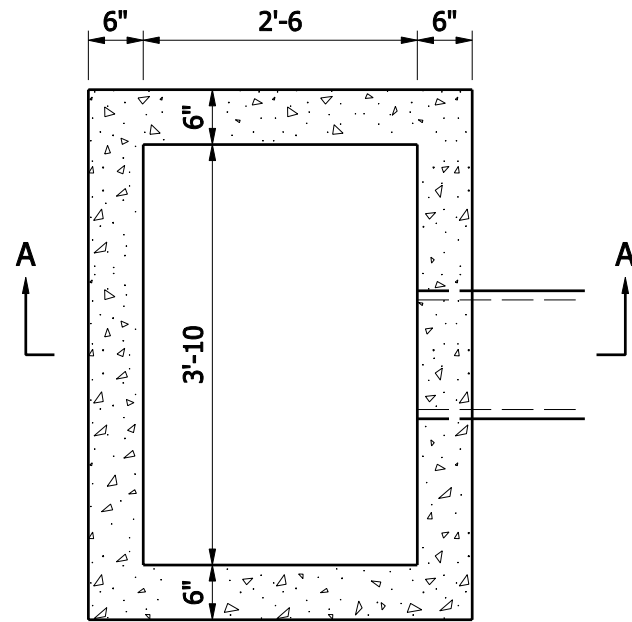
STANDARD DRAWING NO. E 720- INST-01



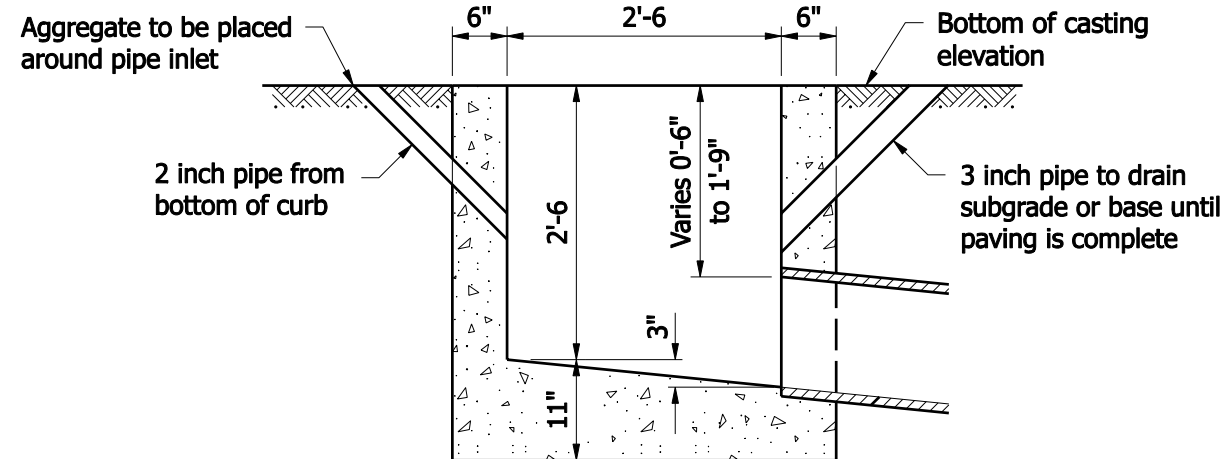
DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave 09/02/08  
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller 09/02/08  
CHIEF HIGHWAY ENGINEER DATE

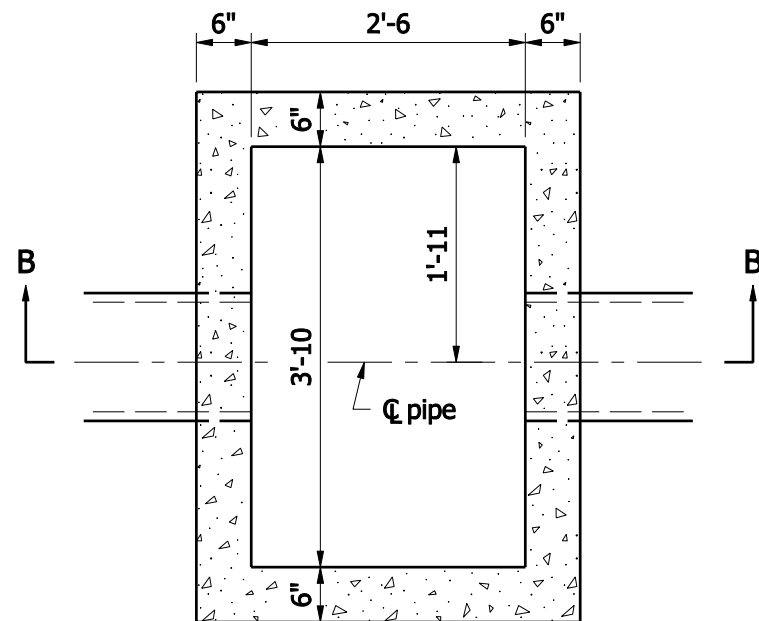


PLAN

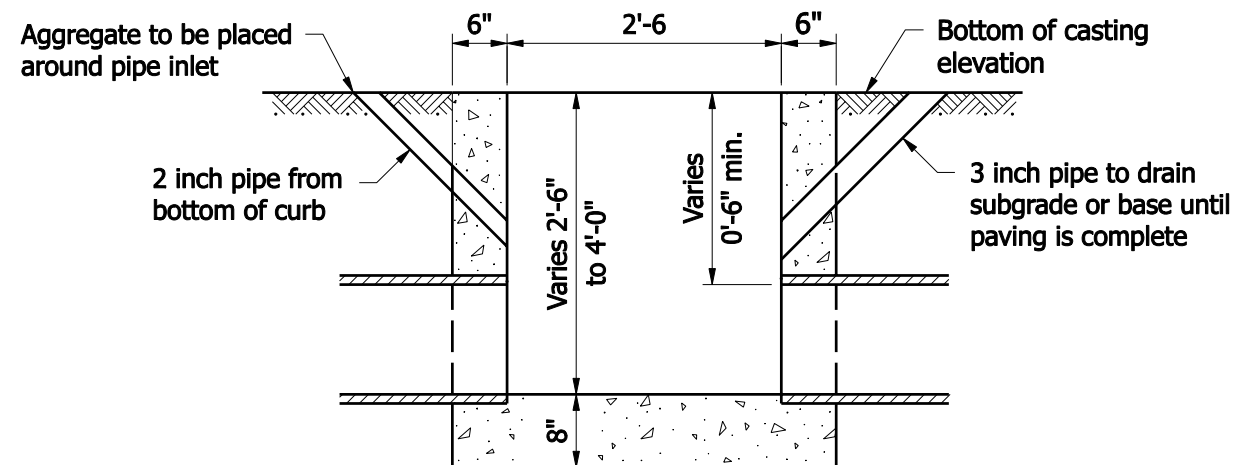


SECTION A-A

INLET-TYPE B



PLAN



SECTION B-B

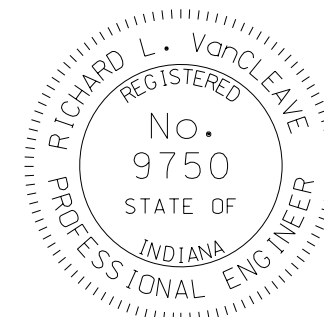
INLET-TYPE C

INDIANA DEPARTMENT OF TRANSPORTATION

INLET TYPE B AND C

SEPTEMBER 2008

STANDARD DRAWING NO. E 720- INST-02



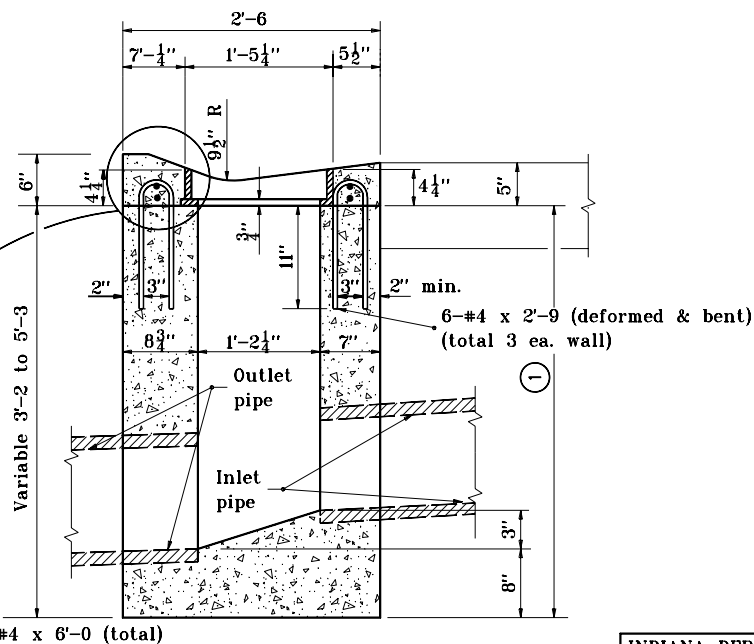
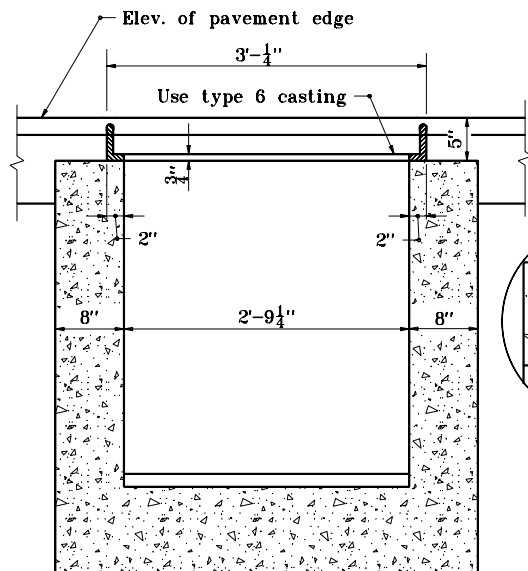
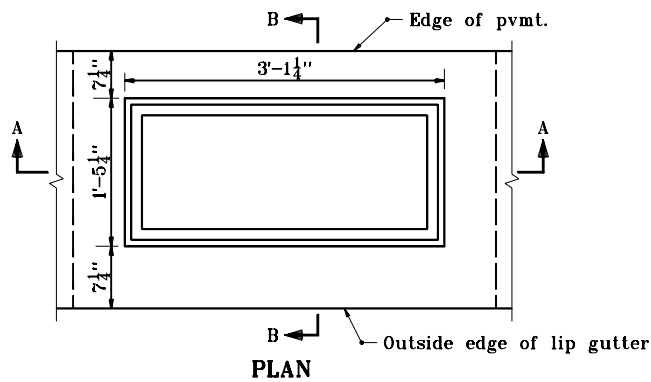
DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave  
DESIGN STANDARDS ENGINEER

09/02/08  
DATE

/s/ Mark A. Miller  
CHIEF HIGHWAY ENGINEER

09/02/08  
DATE



### GENERAL NOTES

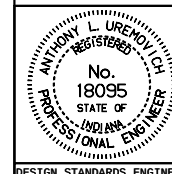
- ① If inlet pipe is required, this dimension shall be increased or decreased 1'-0 as directed.

INDIANA DEPARTMENT OF TRANSPORTATION

### INLET TYPE D

SEPTEMBER 1997

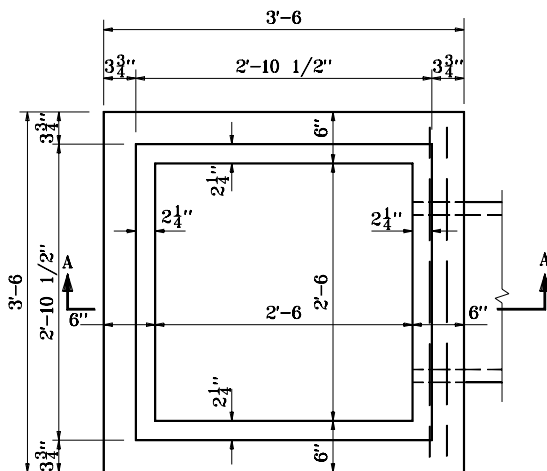
STANDARD DRAWING NO. E 720-INST-03



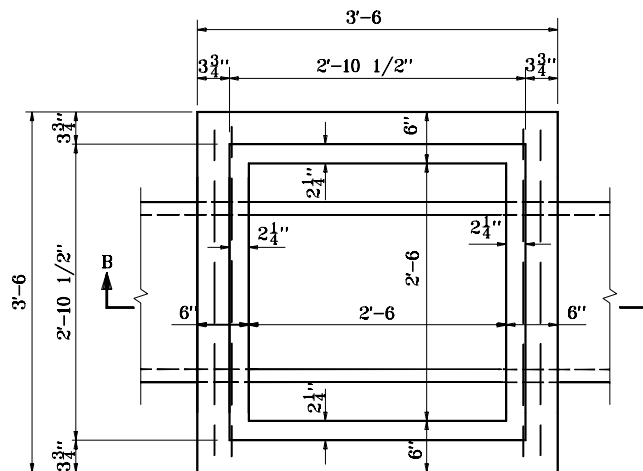
DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

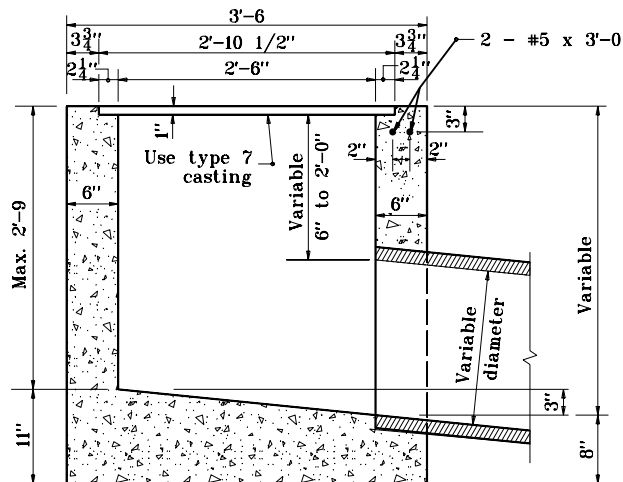
/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE  
ORIGINALLY APPROVED 9-01-97



**PLAN**

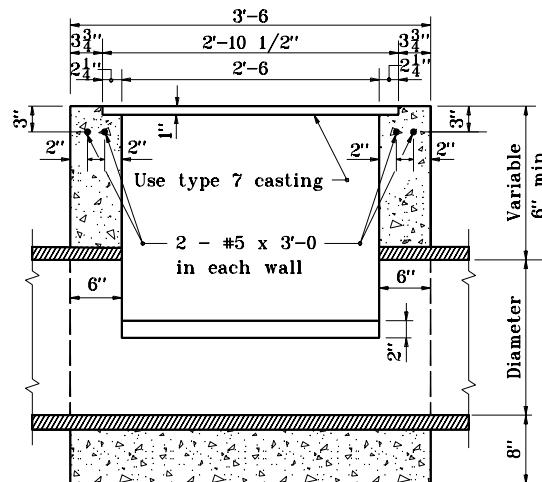


**PLAN**



**SECTION A-A**

**INLET TYPE E (CONC.)**

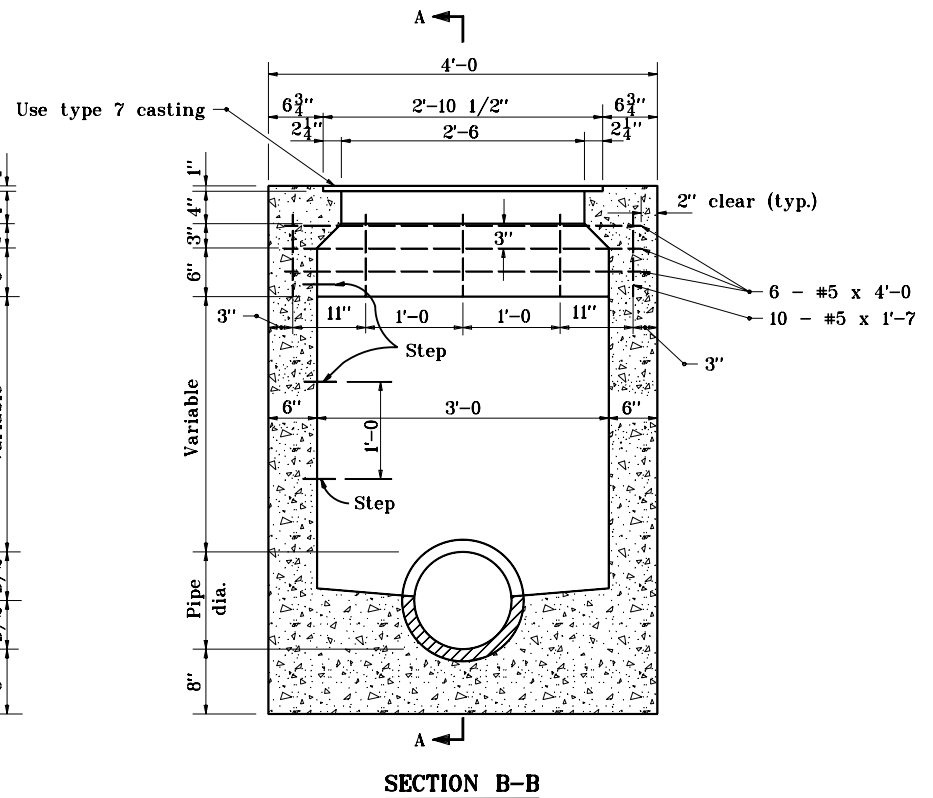
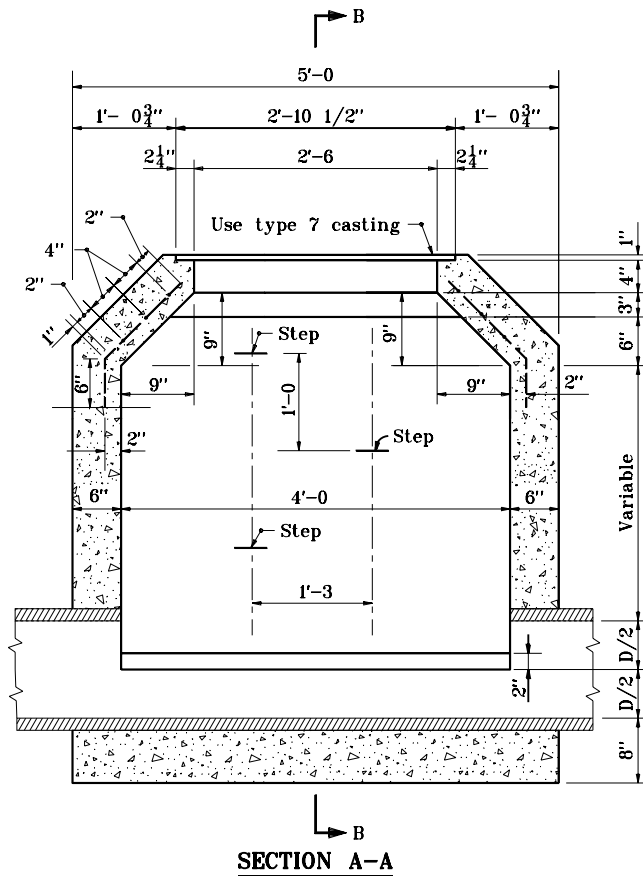


**SECTION B-B**

**INLET TYPE F (CONC.)**

|                                           |                                                                                                                                                                                                                                    |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION      |                                                                                                                                                                                                                                    |
| <b>INLETS TYPE E AND F</b>                |                                                                                                                                                                                                                                    |
| SEPTEMBER 1997                            |                                                                                                                                                                                                                                    |
| <b>STANDARD DRAWING NO. E 720-INST-04</b> |                                                                                                                                                                                                                                    |
|                                           | DETAILS PLACED IN THIS FORMAT 11-15-99<br>/s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE<br>/s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE<br>DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 9-02-97 |



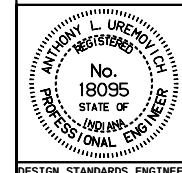


INDIANA DEPARTMENT OF TRANSPORTATION

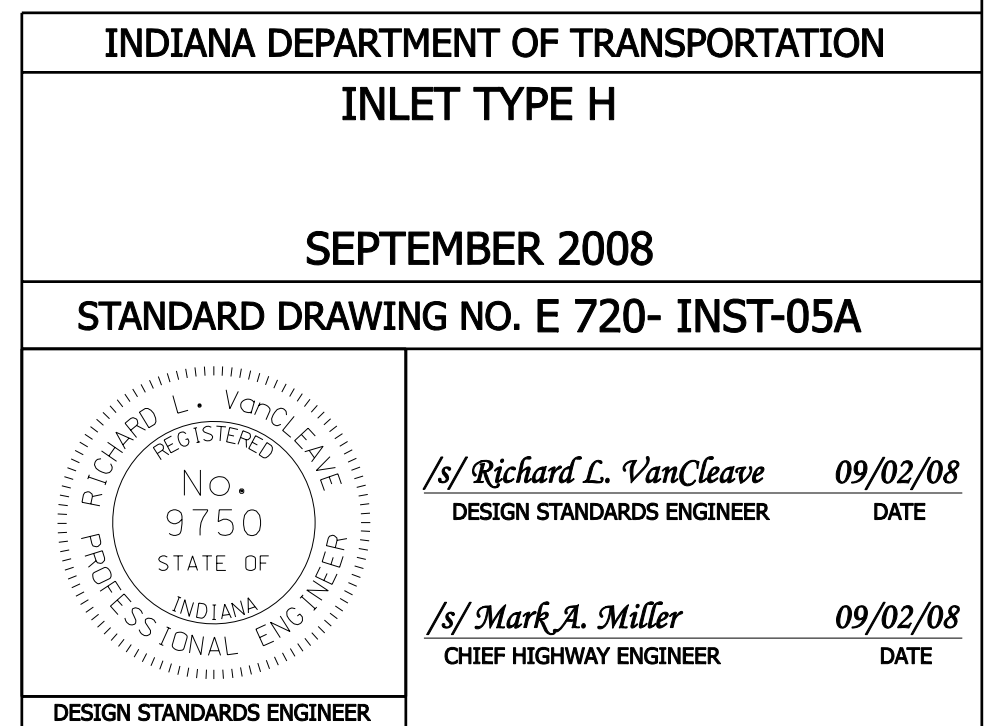
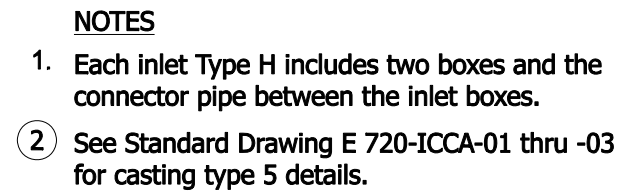
# INLET TYPE G

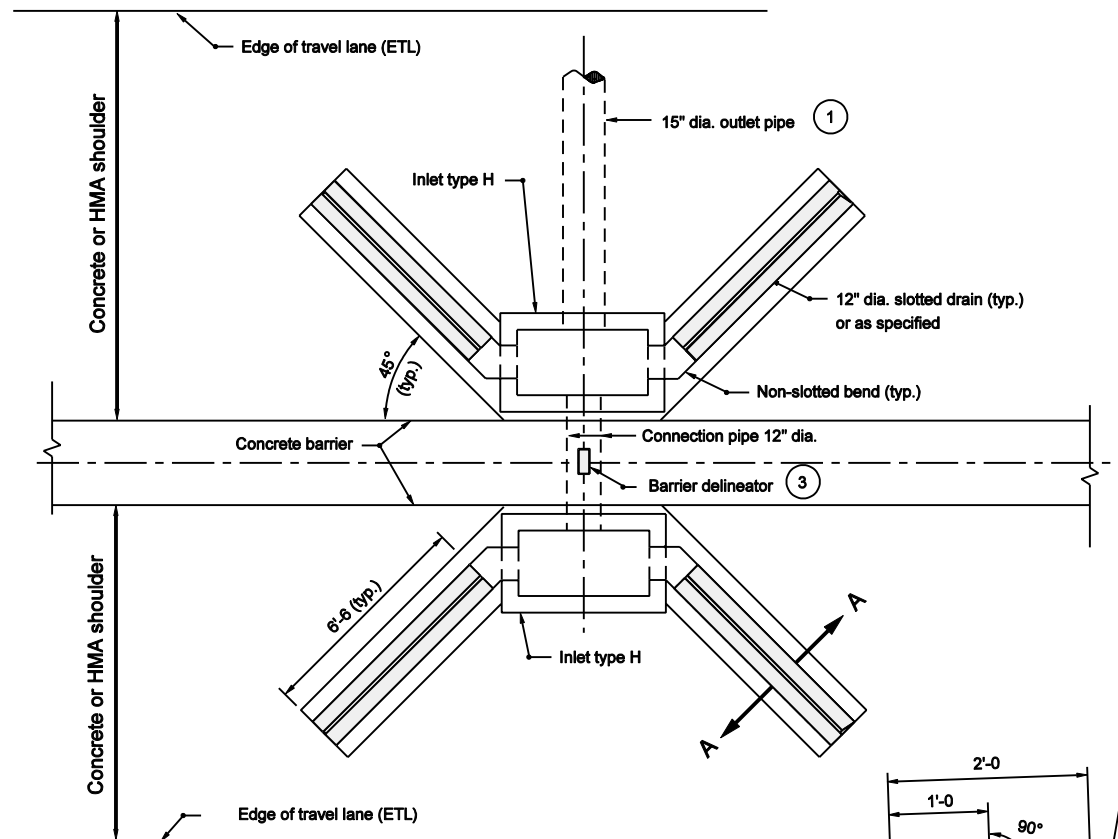
SEPTEMBER 1997

STANDARD DRAWING NO. E 720-INST-05

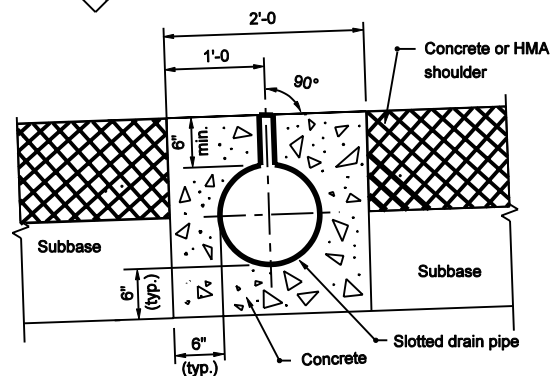


|                               |                           |          |
|-------------------------------|---------------------------|----------|
| DETAILS PLACED IN THIS FORMAT |                           | 11-15-99 |
| /s/ Anthony L. Uremovich      | DESIGN STANDARDS ENGINEER | 11-15-99 |
| /s/ Firooz Zandi              | CHIEF HIGHWAY ENGINEER    | 11-15-99 |
| ORIGINALLY APPROVED           |                           | 9-01-97  |





**PLAN VIEW**



**SECTION A-A**

**NOTES :**

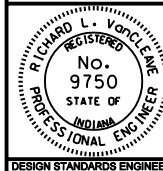
- ① Inlet and outlet pipe orientation to meet site conditions.
2. See Standard Drawing E 720-INST-05A for inlet Type H placement and details.
- ③ Barrier delineators provided to indicate the location of the inlets and shall be centered on top of concrete barrier at the inlets.

INDIANA DEPARTMENT OF TRANSPORTATION

**INLET TYPE H  
WITH SLOTTED DRAIN PIPE**

MARCH 2003

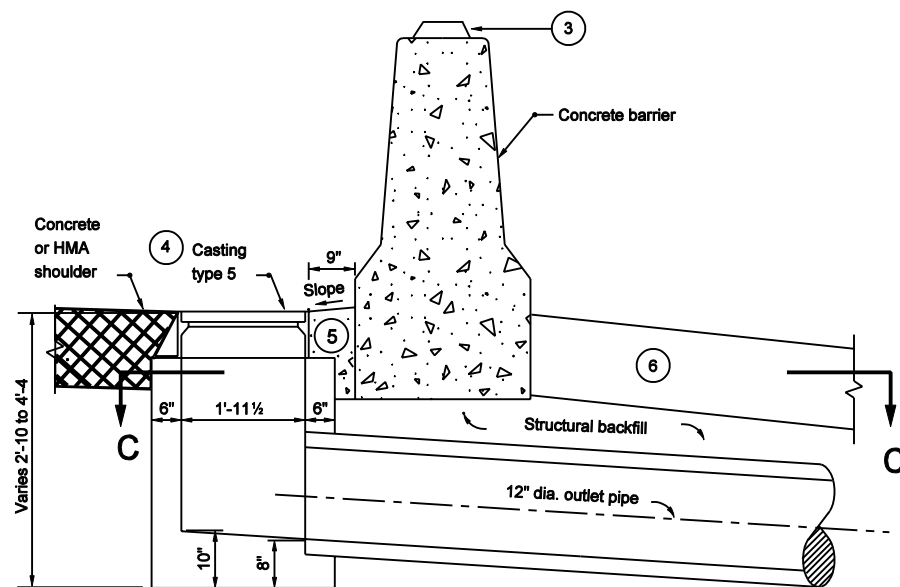
STANDARD DRAWING NO. E 720-INST-05B



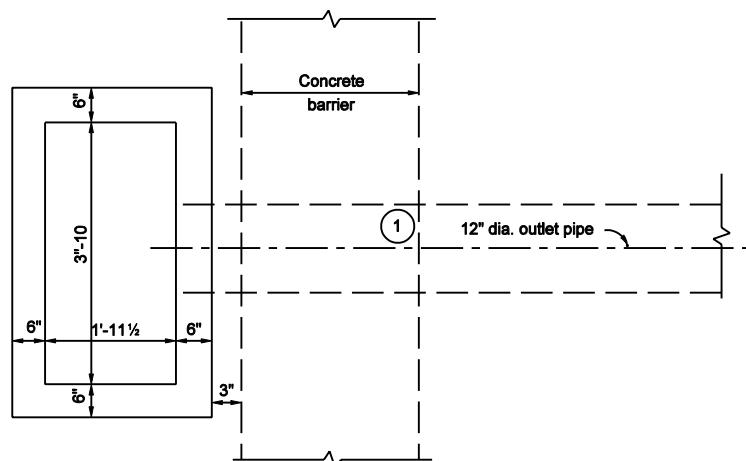
/s/ Richard L. VanCleave 3-03-03  
DESIGN STANDARDS ENGINEER DATE

/s/ Richard K. Smutzer 3-03-03  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER



**SECTION B-B**



**SECTION C-C**

**NOTES :**

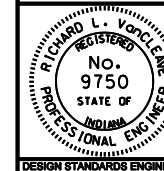
- ① Outlet pipe orientation to meet site conditions.
2. See Standard Drawing E 720-INST-05D for Type HA inlet with slotted drain pipe placement.
- ③ All barrier delineator assemblies shall be centered on top of concrete barrier at the inlets.
- ④ See Standard Drawing E 720-ICCA-01 to -03 for casting type 5 details.
- ⑤ Concrete shoulder or pavement between type 5 casting and concrete barrier wall.
- ⑥ Concrete, HMA or earth shoulder as appropriate at site.

INDIANA DEPARTMENT OF TRANSPORTATION

**INLET TYPE HA  
SECTION B-B**

**MARCH 2003**

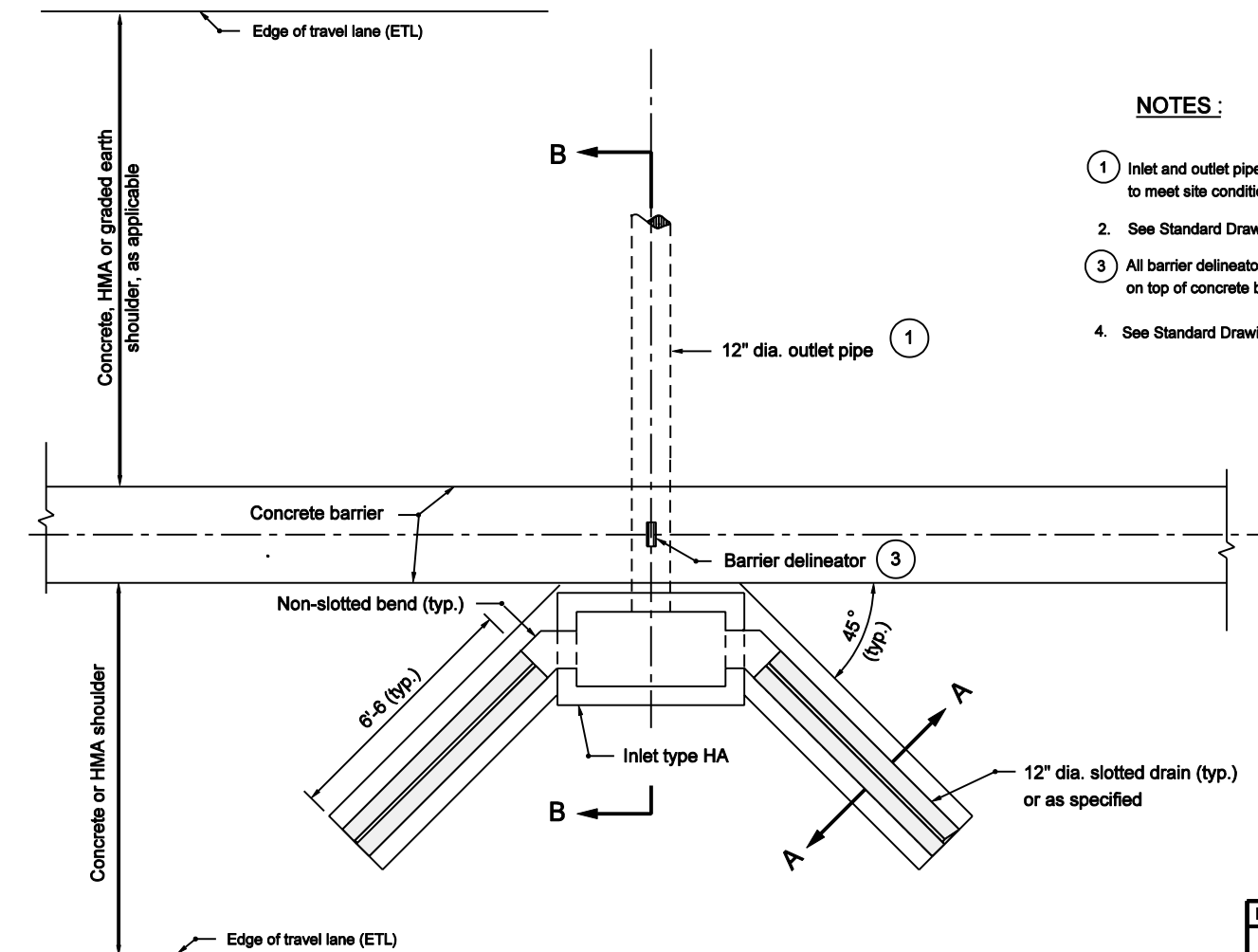
**STANDARD DRAWING NO. E 720-INST-05C**



/s/ Richard L. VanCleave 3-03-03  
DESIGN STANDARDS ENGINEER DATE

/s/ Richard K. Smutzer 3-03-03  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER



**PLAN VIEW**

**NOTES :**

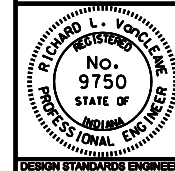
- ① Inlet and outlet pipe orientation to meet site conditions.
2. See Standard Drawing E 720-INST-05B for section A-A.
- ③ All barrier delineator assemblies shall be centered on top of concrete barrier at the inlets.
4. See Standard Drawing E 720-INST-05C for section B-B.

INDIANA DEPARTMENT OF TRANSPORTATION

**INLET TYPE HA  
WITH SLOTTED DRAIN PIPE**

MARCH 2003

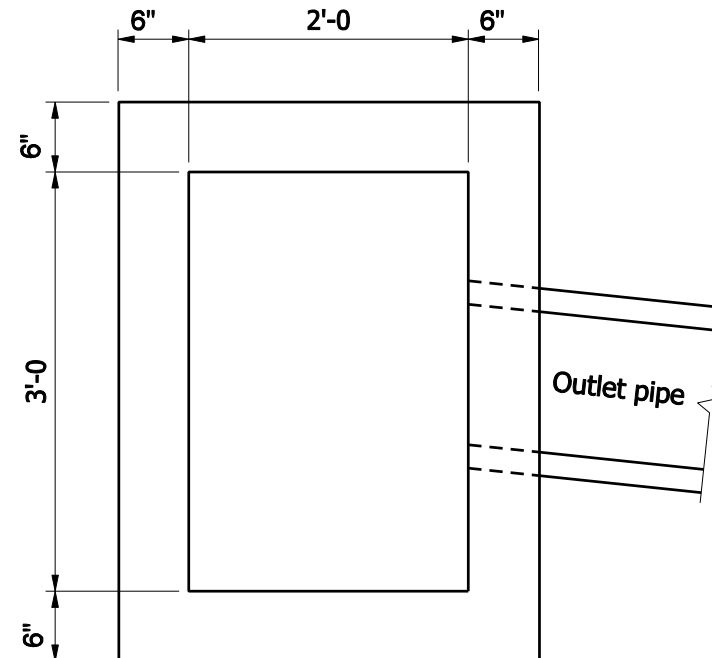
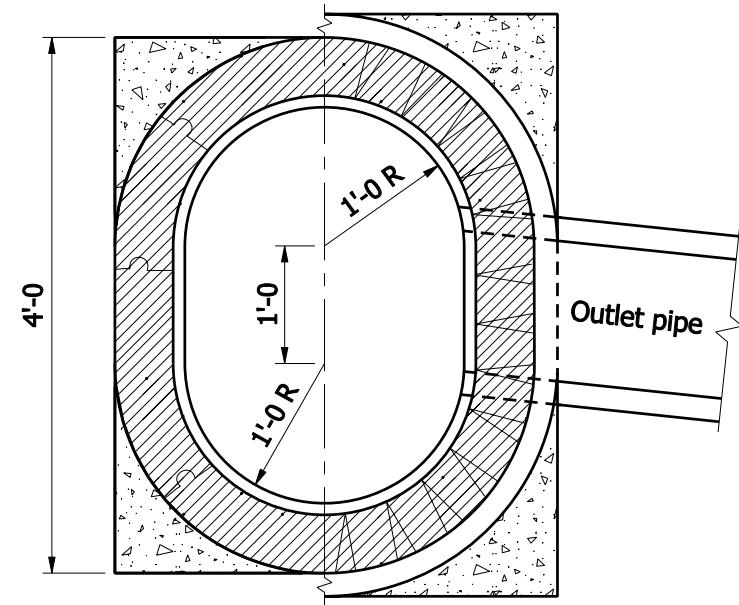
STANDARD DRAWING NO. E 720-INST-05D



/s/ Richard L. VanCleave 3-03-03  
DESIGN STANDARDS ENGINEER DATE

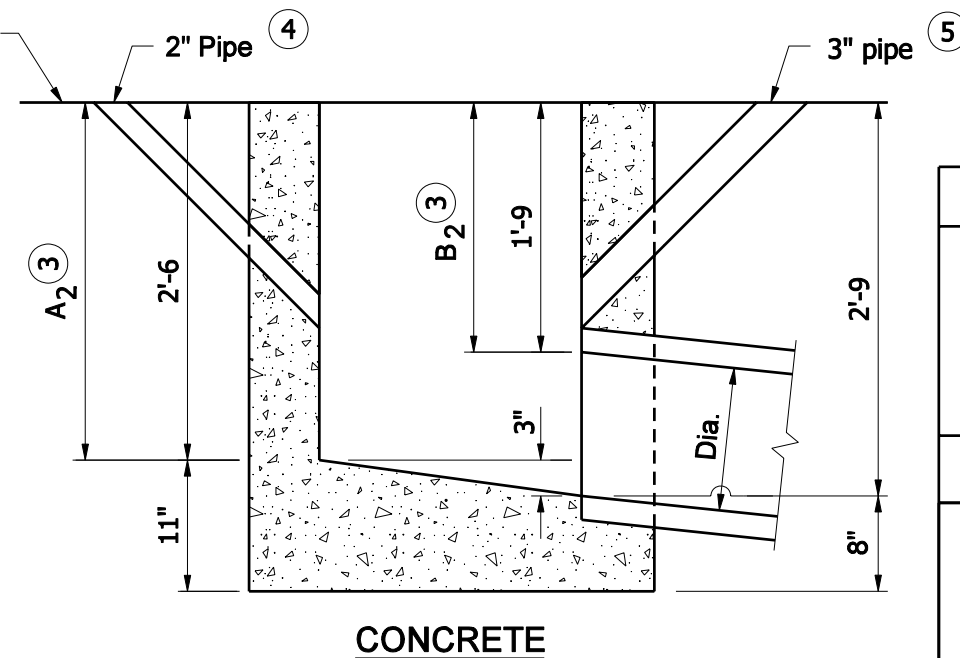
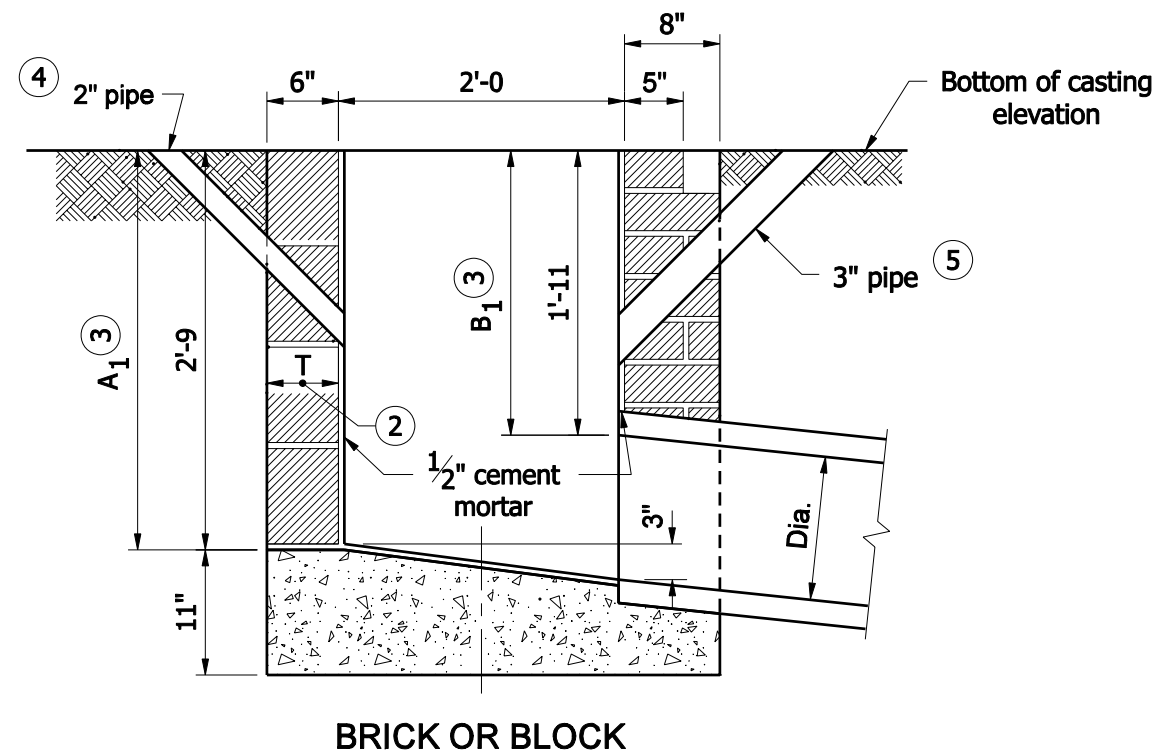
/s/ Richard K. Smutzer 3-03-03  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER



#### GENERAL NOTES

1. Brick, block, or concrete may be used.
2. T = 8" for brick structure  
T = 6" for segmental block structure
- ③ In special cases or where inlet pipe is required, A<sub>1</sub>, B<sub>1</sub>, A<sub>2</sub>, and B<sub>2</sub> shall be increased or decreased 1'-0, as directed.
- ④ 2" dia. pipe drain from bottom of curb to inlet. Aggregate to be placed around inlet end of pipe.
- ⑤ 3" dia. pipe to be kept open for drainage of subgrade or base until surface is placed.

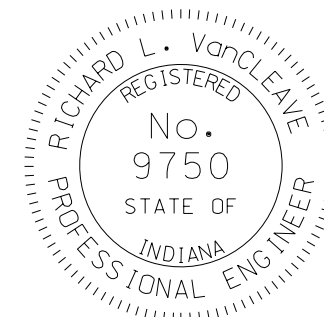


INDIANA DEPARTMENT OF TRANSPORTATION

INLET TYPE J

SEPTEMBER 2008

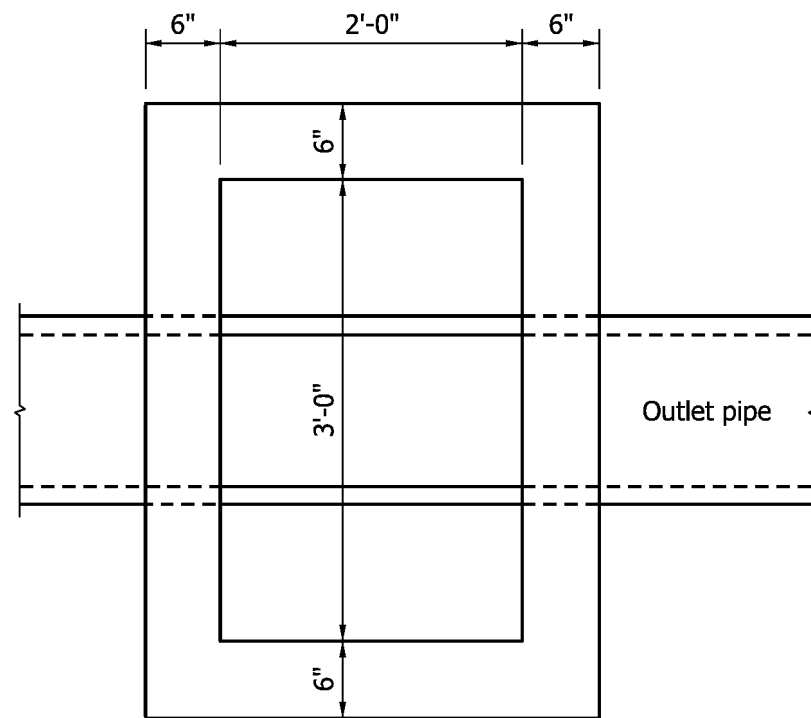
STANDARD DRAWING NO. E 720- INST-06



DESIGN STANDARDS ENGINEER

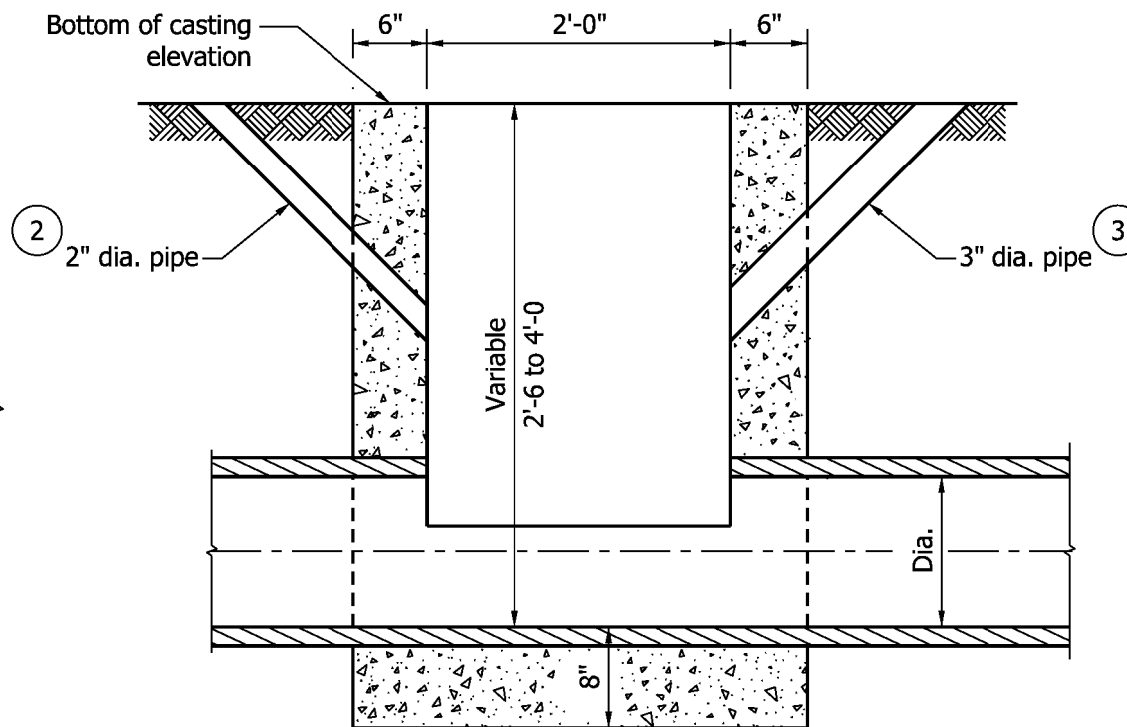
/s/ *Richard L. VanCleave* 09/02/08  
DESIGN STANDARDS ENGINEER DATE

/s/ *Mark A. Miller* 09/02/08  
CHIEF HIGHWAY ENGINEER DATE



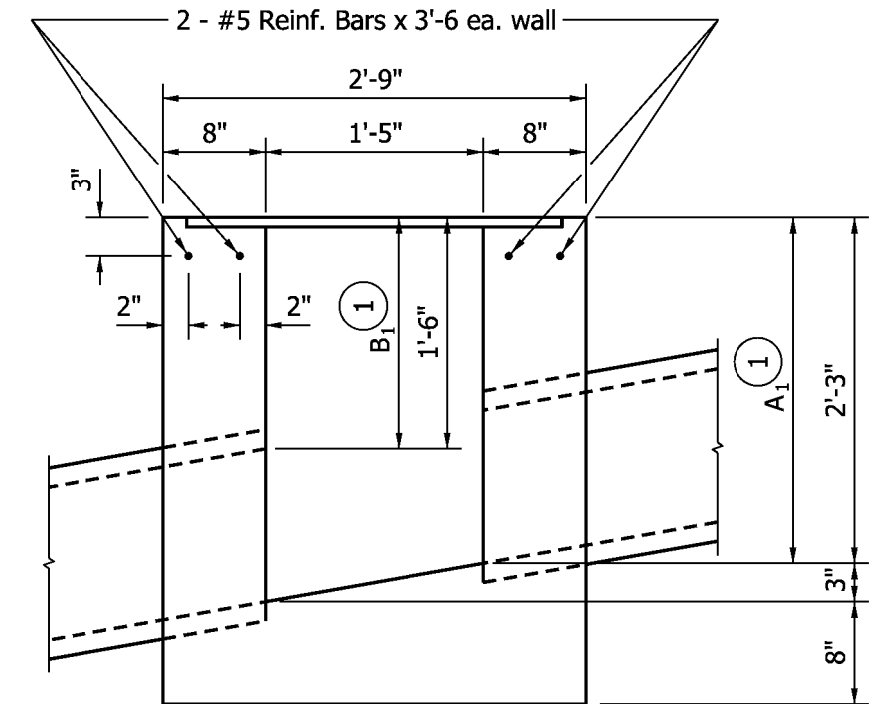
PLAN

INLET TYPE M (CONC)

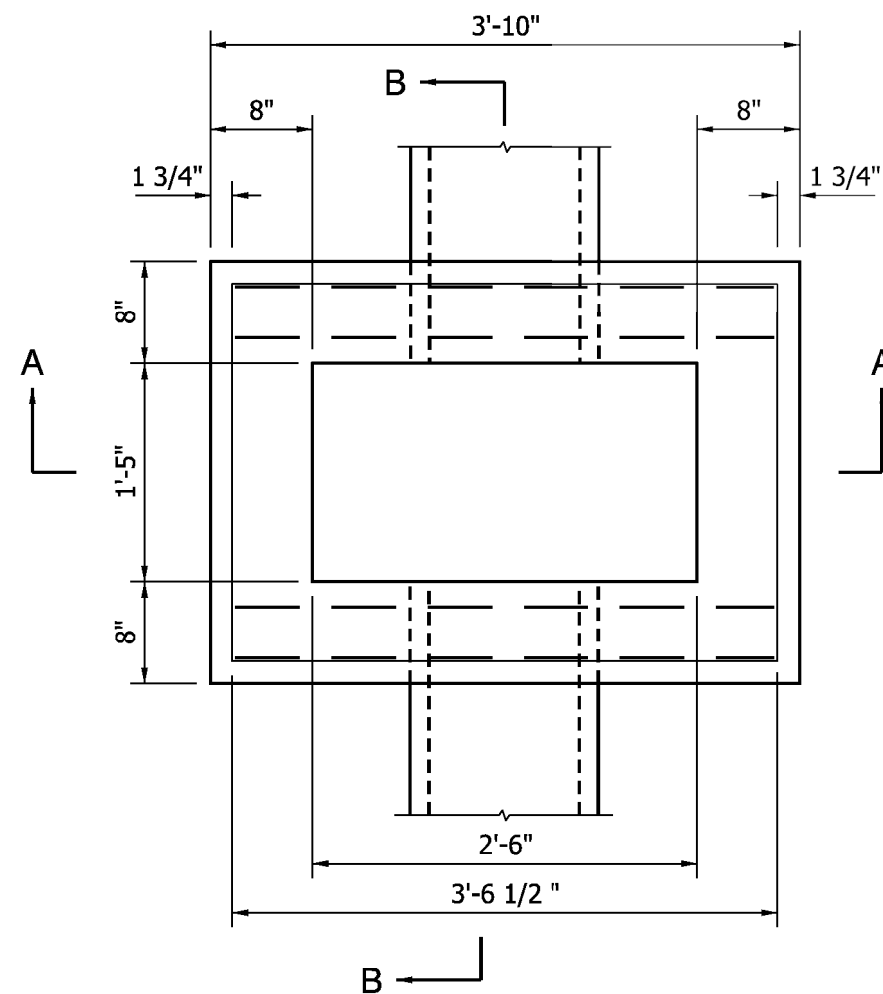


SECTION

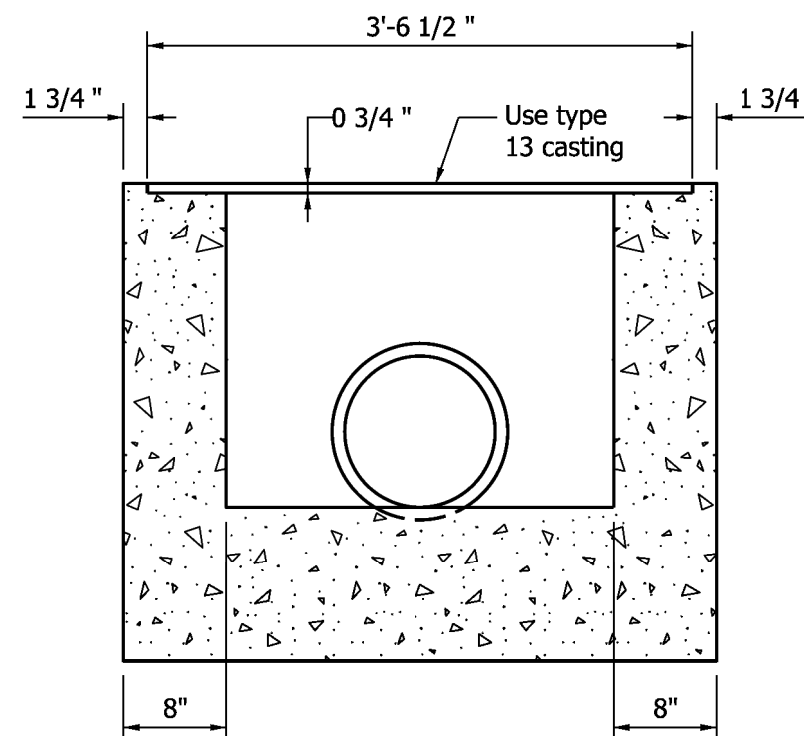
- GENERAL NOTES**
- 1 If inlet pipe is required,  $A_1$  and  $B_1$  shall be increased or decreased 1'-0 as directed.
  - 2 2" dia. drain from bottom of curb to inlet. Aggregate to be placed around inlet end of pipe.
  - 3 3" min. dia. pipe to be kept open for drainage of subgrade or base until surface is placed.



SECTION B-B



SECTION A-A  
INLET TYPE R (Conc.)

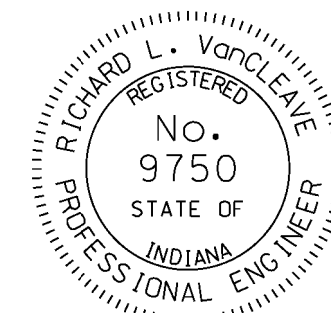


INDIANA DEPARTMENT OF TRANSPORTATION

INLET TYPE M & R

SEPTEMBER 2009

STANDARD DRAWING NO. E 720 INST-07



DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave 09/01/09  
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller 09/01/09  
CHIEF HIGHWAY ENGINEER DATE





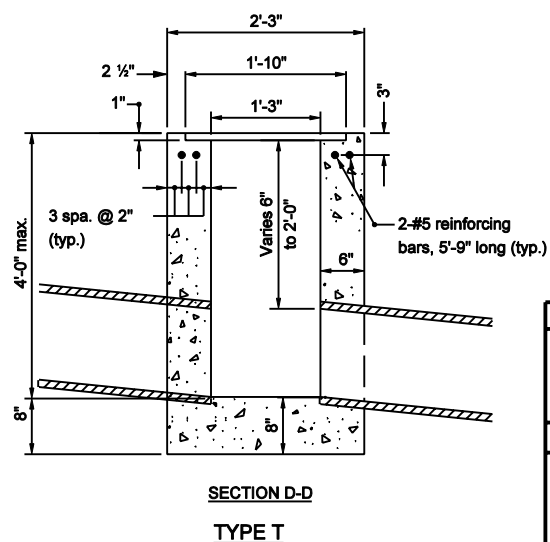
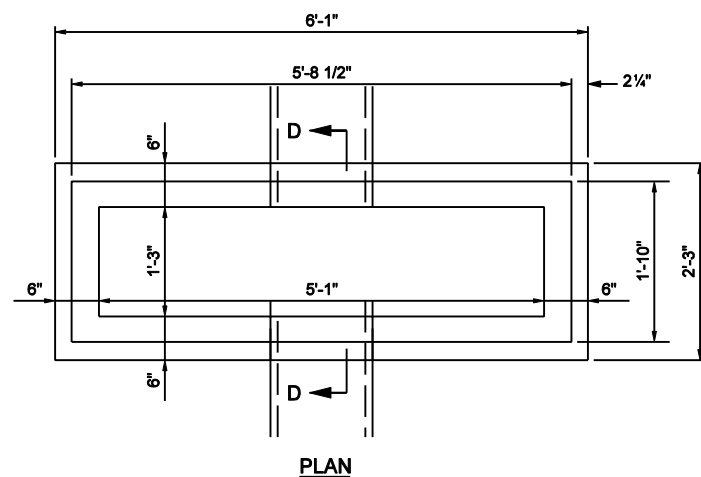


**NOTE:**

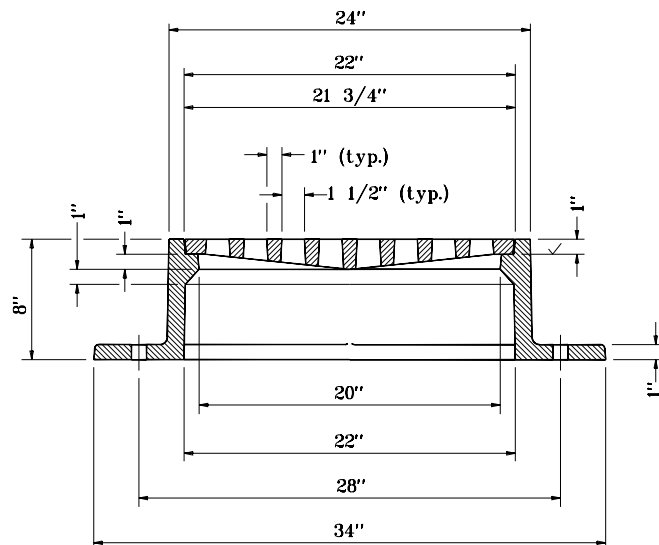
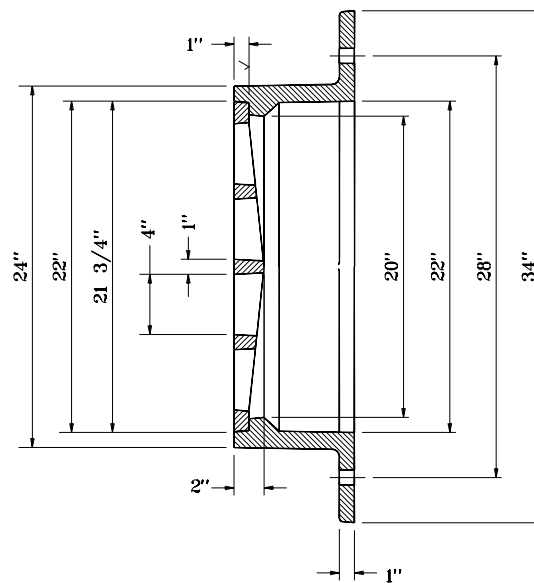
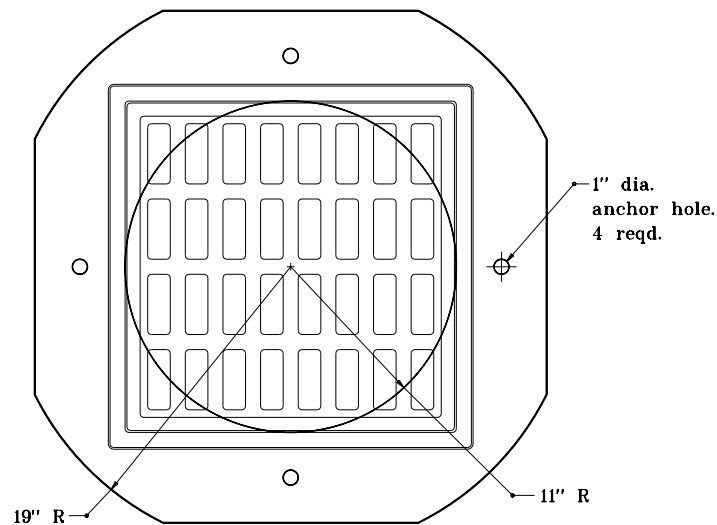
1. See Standard Drawing E 720-ICCA-10 for steel grating  
Type 12 or E 720-ICCA-11 for castion Type 12 Alternate.



|                                                                                       |                                                                                         |
|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                         |
| INLET TYPE P                                                                          |                                                                                         |
| SEPTEMBER 2005                                                                        |                                                                                         |
| STANDARD DRAWING NO. E 720-INST-09                                                    |                                                                                         |
|  | <i>/s/ Richard L. VanCleave</i> 9-01-05<br><b>DESIGN STANDARDS ENGINEER</b> <b>DATE</b> |
|  | <i>/s/ Richard K. Smutzer</i> 9-01-05<br><b>CHIEF HIGHWAY ENGINEER</b> <b>DATE</b>      |
| <b>DESIGN STANDARDS ENGINEER</b>                                                      |                                                                                         |



|                                                                                       |                                                                                                                                                                                                                                                                                      |                                 |                |                           |      |                                   |                    |                        |      |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------|---------------------------|------|-----------------------------------|--------------------|------------------------|------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                                                                                                                                      |                                 |                |                           |      |                                   |                    |                        |      |
| INLETS TYPE S AND T                                                                   |                                                                                                                                                                                                                                                                                      |                                 |                |                           |      |                                   |                    |                        |      |
| SEPTEMBER 2003                                                                        |                                                                                                                                                                                                                                                                                      |                                 |                |                           |      |                                   |                    |                        |      |
| STANDARD DRAWING NO. E 720-INST-10                                                    |                                                                                                                                                                                                                                                                                      |                                 |                |                           |      |                                   |                    |                        |      |
|  | <table><tr><td><i>/s/ Richard L. VanCleave</i></td><td><b>9-02-03</b></td></tr><tr><td>DESIGN STANDARDS ENGINEER</td><td>DATE</td></tr><tr><td><br/><i>/s/ Richard K. Smutzer</i></td><td><br/><b>9-02-03</b></td></tr><tr><td>CHIEF HIGHWAY ENGINEER</td><td>DATE</td></tr></table> | <i>/s/ Richard L. VanCleave</i> | <b>9-02-03</b> | DESIGN STANDARDS ENGINEER | DATE | <br><i>/s/ Richard K. Smutzer</i> | <br><b>9-02-03</b> | CHIEF HIGHWAY ENGINEER | DATE |
| <i>/s/ Richard L. VanCleave</i>                                                       | <b>9-02-03</b>                                                                                                                                                                                                                                                                       |                                 |                |                           |      |                                   |                    |                        |      |
| DESIGN STANDARDS ENGINEER                                                             | DATE                                                                                                                                                                                                                                                                                 |                                 |                |                           |      |                                   |                    |                        |      |
| <br><i>/s/ Richard K. Smutzer</i>                                                     | <br><b>9-02-03</b>                                                                                                                                                                                                                                                                   |                                 |                |                           |      |                                   |                    |                        |      |
| CHIEF HIGHWAY ENGINEER                                                                | DATE                                                                                                                                                                                                                                                                                 |                                 |                |                           |      |                                   |                    |                        |      |
| DESIGN STANDARDS ENGINEER                                                             |                                                                                                                                                                                                                                                                                      |                                 |                |                           |      |                                   |                    |                        |      |



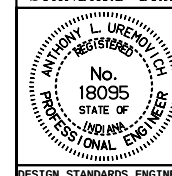
INDIANA DEPARTMENT OF TRANSPORTATION

# FLAT TOP GRATE CASTING

TYPE 2

SEPTEMBER 1998

STANDARD DRAWING NO. E 720-MHCA-01



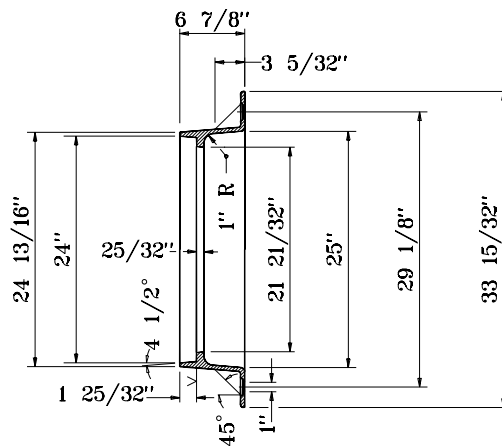
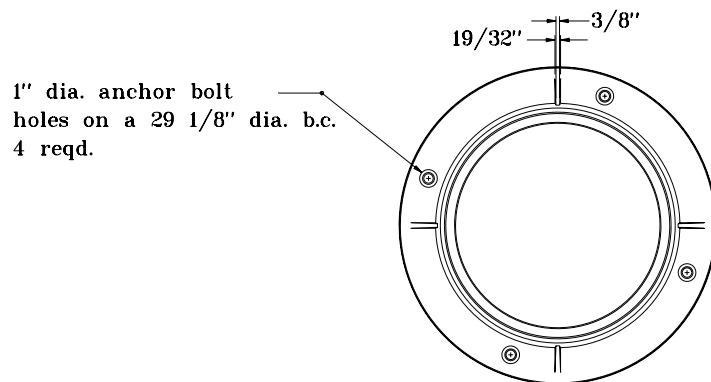
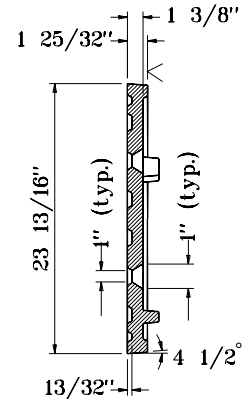
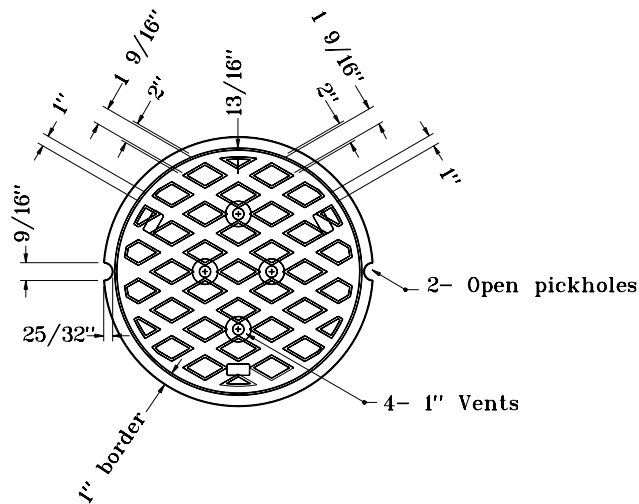
DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

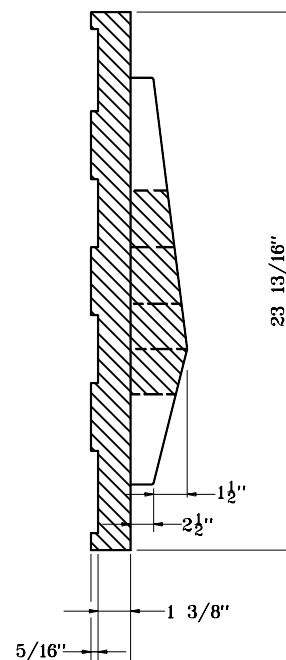
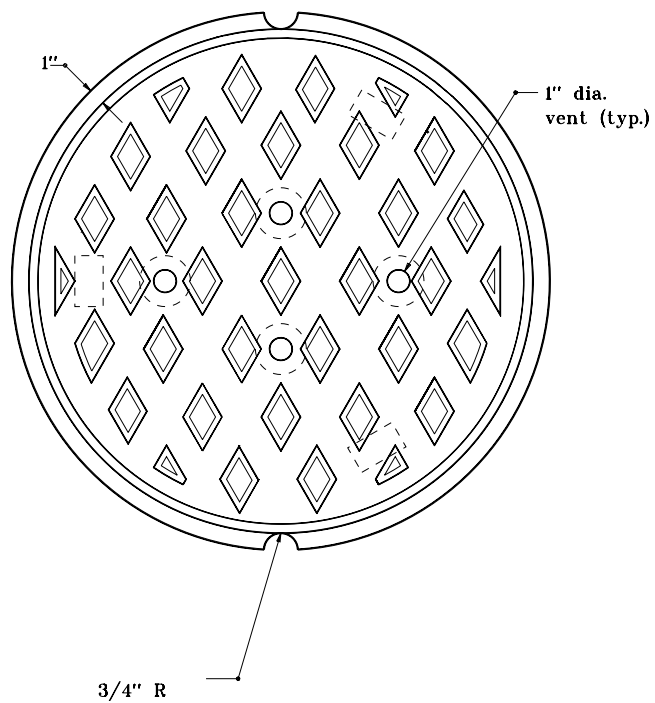
/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

ORIGINALLY APPROVED 9-01-98



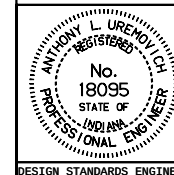
|                                          |                                                                     |
|------------------------------------------|---------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION     |                                                                     |
| <b>MANHOLE CASTING</b>                   |                                                                     |
| <b>TYPE 4 RING AND COVER</b>             |                                                                     |
| SEPTEMBER 1998                           |                                                                     |
| STANDARD DRAWING NO <b>E 720-MHCA-02</b> |                                                                     |
|                                          | DETAILS PLACED IN THIS FORMAT 11-15-99                              |
|                                          | /s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE |
|                                          | /s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE            |
| DESIGN STANDARDS ENGINEER                | ORIGINALLY APPROVED 9-01-98                                         |



INDIANA DEPARTMENT OF TRANSPORTATION

**MANHOLE CASTING TYPE 4  
ALTERNATE COVER**  
SEPTEMBER 1998

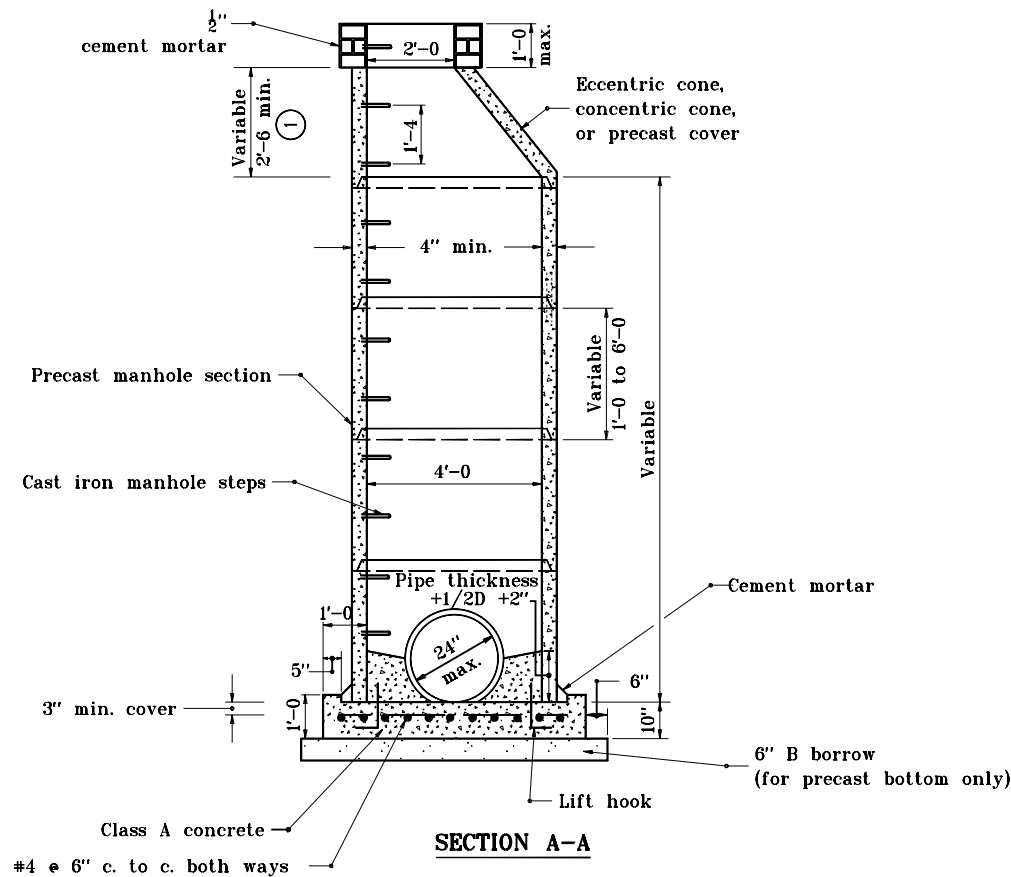
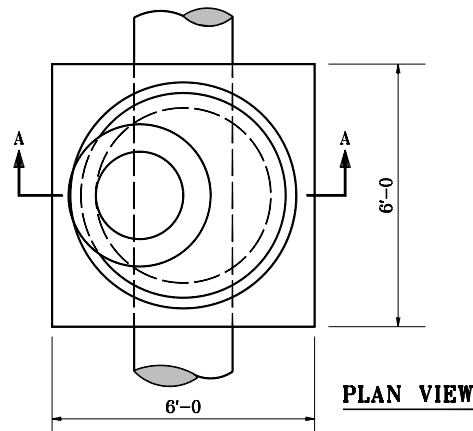
STANDARD DRAWING NO.E 720-MHCA-03



|                               |                           |                  |
|-------------------------------|---------------------------|------------------|
| DETAILS PLACED IN THIS FORMAT |                           | 11-15-99         |
| /s/ Anthony L. Uremovich      | DESIGN STANDARDS ENGINEER | 11-15-99<br>DATE |
| /s/ Firooz Zandi              | CHIEF HIGHWAY ENGINEER    | 11-15-99<br>DATE |
| ORIGINALLY APPROVED           |                           | 9-01-98          |

DESIGN STANDARDS ENGINEER





## GENERAL NOTES

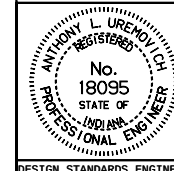
- For eccentric and concentric cone heights see cone heights table on Standard Drawing E 720-MHST-08.

INDIANA DEPARTMENT OF TRANSPORTATION

## MANHOLE TYPE C

SEPTEMBER 1997

STANDARD DRAWING NO. E 720-MHST-02



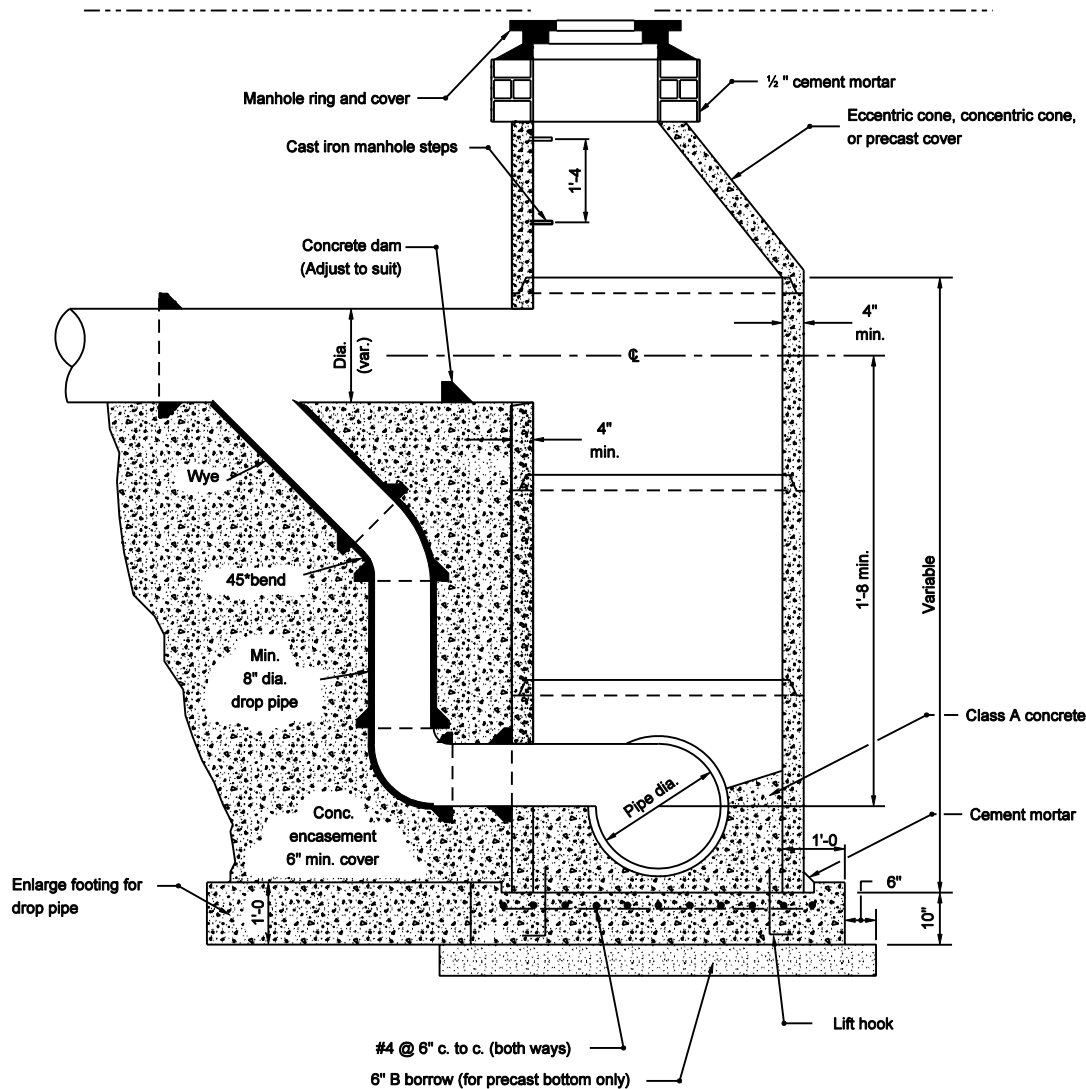
DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE  
ORIGINALLY APPROVED 9-02-97

# **NOTES**

- Drop pipe may be used with manhole type D, E, F, or G. Such manhole shall be referred to as drop manhole type D, E, F, or G.



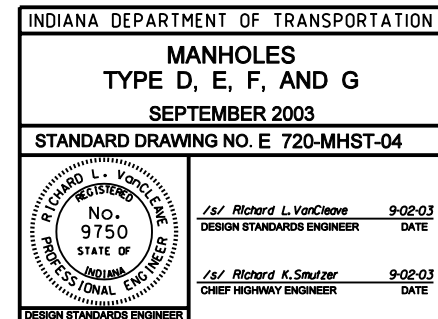
|                                      |                                                                    |
|--------------------------------------|--------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION |                                                                    |
| DROP MANHOLE<br>TYPE C               |                                                                    |
| SEPTEMBER 2003                       |                                                                    |
| STANDARD DRAWING NO. E 720-MHST-03   |                                                                    |
|                                      | /s/ Richard L. VanCleave 9-02-03<br>DESIGN STANDARDS ENGINEER DATE |
|                                      | /s/ Richard K. Smutzer 9-02-03<br>CHIEF HIGHWAY ENGINEER DATE      |
| DESIGN STANDARDS ENGINEER            |                                                                    |



|                  |                  |                  |
|------------------|------------------|------------------|
| 1/2"             | 1/2"             | 1/2"             |
| cement<br>mortar | cement<br>mortar | cement<br>mortar |
| 1/2"             | 1/2"             | 1/2"             |
| cement<br>mortar | cement<br>mortar | cement<br>mortar |



1. Manhole type H, J, K, L, M, or N, may be substituted for manhole type C, D, E, or F for comparable pipe sizes. See Standard Drawing E 720-MHST-05 for manholes type H, J, K, L, M, and N details.
- ② For eccentric and concentric cone heights see Cone Heights Table on Standard Drawing 720-MHST-08.
3. See Standard Drawing 720-MHST-10 for Reinforcing Steel for Manholes table.

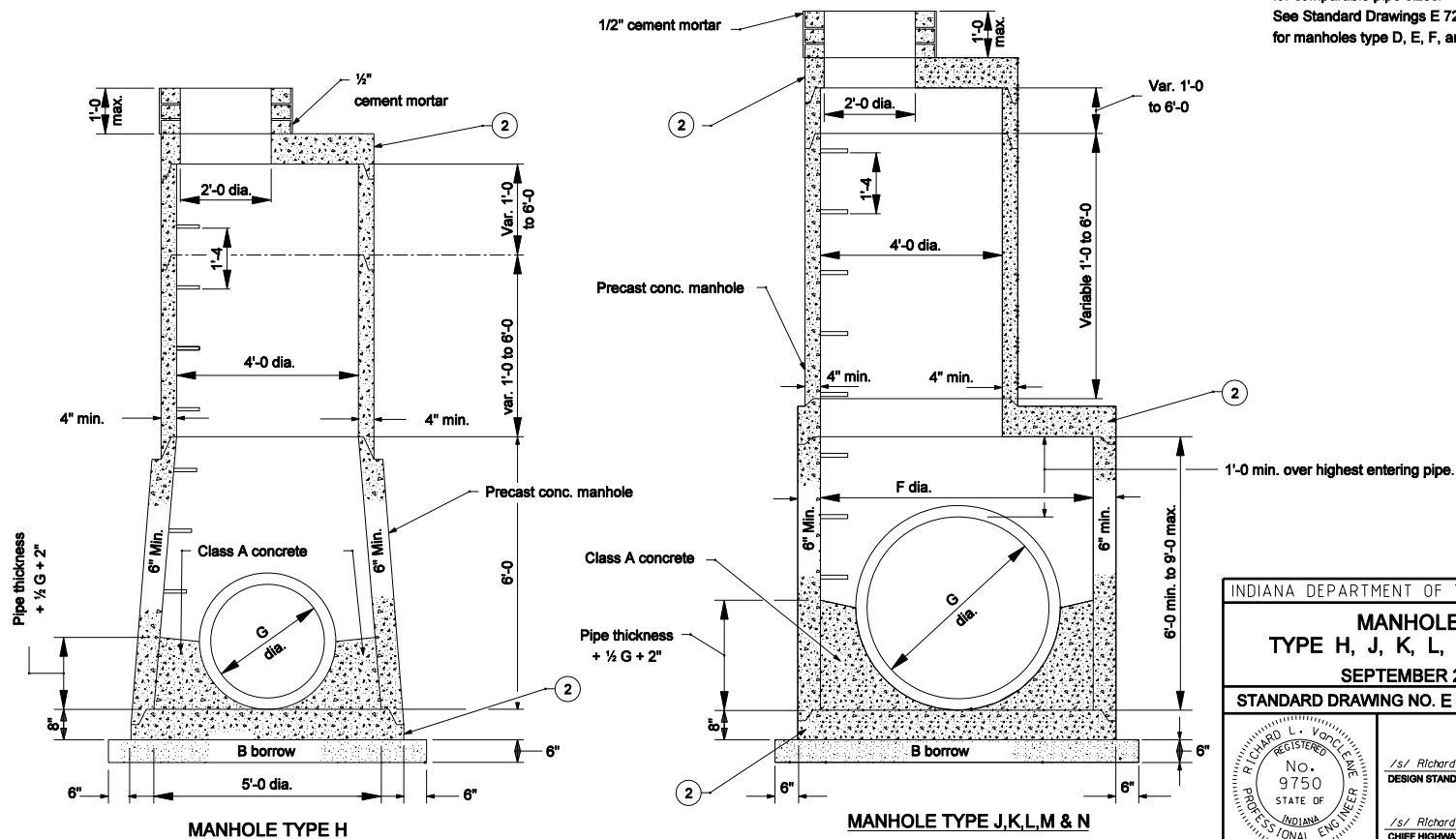


# MANHOLE PIPE SIZES

| Type | G (in.)  | F (ft. in.) | Maximum Pipe Size Rt. $\angle$ to Mainline (in.) | Maximum Pipe Size for Mainline (in.) |
|------|----------|-------------|--------------------------------------------------|--------------------------------------|
| H    | 24 to 36 |             | 30                                               | 36                                   |
| J    | 24 to 36 | 5'-0        | 30                                               | 36                                   |
| K    | 36 to 48 | 6'-0        | 36                                               | 48                                   |
| L    | 48 to 54 | 8'-0        | 48                                               | 54                                   |
| M    | 54 to 72 | 8'-6        | 66                                               | 72                                   |
| N    | 72 to 84 | 9'-0        | 72                                               | 84                                   |

## NOTES

- Drop pipe may be used with manholes Type H, J, K, L, M, or N. Such manhole shall be referred to as drop manholes type H, J, K, L, M, or N. For details of construction see Standard Drawing E 720-MHST-03.
- See Standard Drawing E 720-MHST-06 for Details A, B, and C.
- Manholes type C, D, E, or F. may be substituted for manholes type H, J, K, L, M, or N. for comparable pipe sizes. See Standard Drawings E 720-MHST-02 and -04 for manholes type D, E, F, and G details..

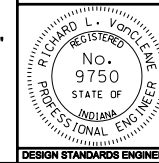


INDIANA DEPARTMENT OF TRANSPORTATION

## MANHOLES TYPE H, J, K, L, M, AND N

SEPTEMBER 2006

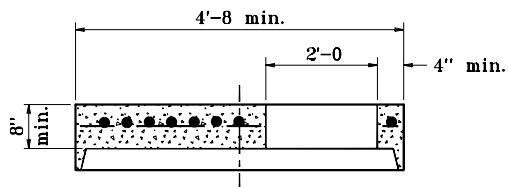
STANDARD DRAWING NO. E 720-MHST-05



/s/ Richard L. VanCleave 9-01-06  
DESIGN STANDARDS ENGINEER DATE

/s/ Richard K. Smutzer 9-01-06  
CHIEF HIGHWAY ENGINEER DATE

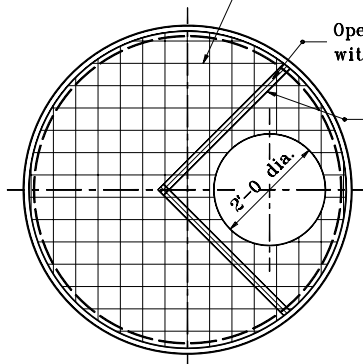
DESIGN STANDARDS ENGINEER



Min. steel area  $0.12 \text{ in}^2 / \text{ft}$  of width in both directions.

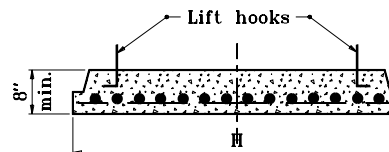
Opening additionally reinforced with equivalent of  $0.20 \text{ in}^2 / \text{ft} @ 90^\circ$

Straight rods, min length = dia. of opening plus 2".

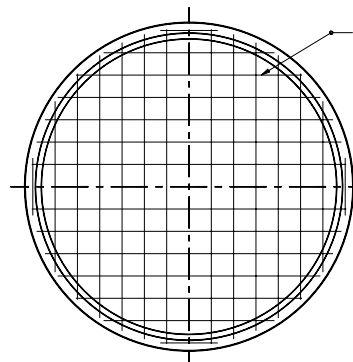


**DETAIL A**

**COVER CAP FOR PRECAST CONCRETE MANHOLE SECTION**



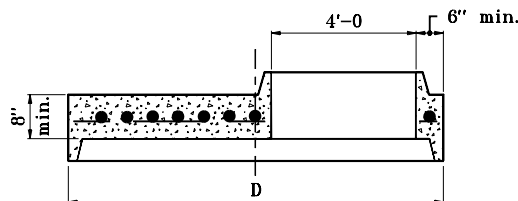
Min. steel area  $0.12 \text{ in}^2 / \text{ft}$  of width in both directions.  
Rebar or wire mesh equivalent.



**DETAIL C**

**BASE FOR PRECAST CONCRETE MANHOLE SECTIONS (5'-0 to 9'-0 DIA.)**

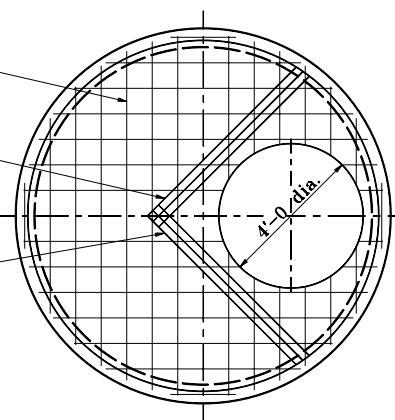
| Section Dia. | H     |
|--------------|-------|
| 5'-0         | 6'-0  |
| 6'-0         | 7'-2  |
| 8'-0         | 9'-6  |
| 8'-6         | 10'-0 |
| 9'-0         | 10'-8 |



Min. steel area  $0.12 \text{ in}^2 / \text{ft}$  of width in both directions.

Opening additionally reinforced with equivalent of  $0.20 \text{ in}^2 / \text{ft} @ 90^\circ$

Straight rods, min length = dia. of opening plus 2".

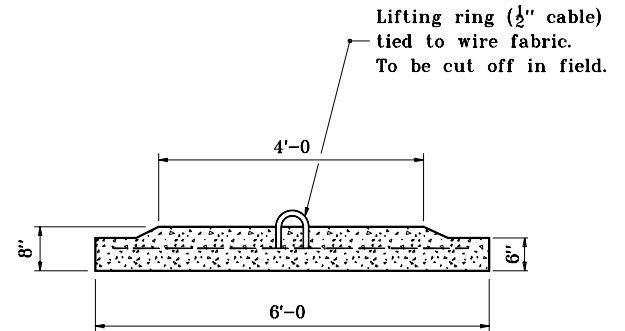
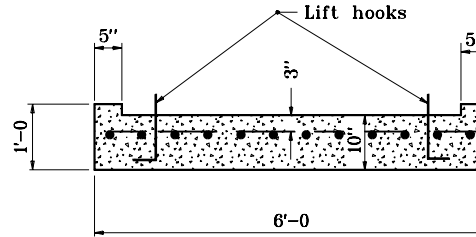
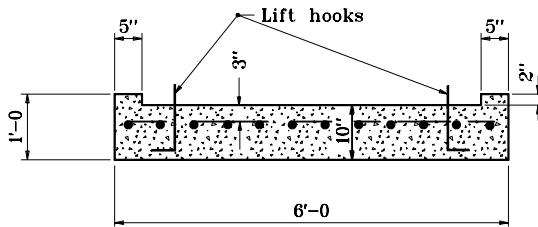


**DETAIL B**

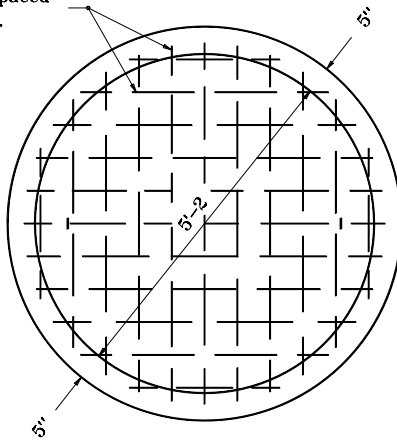
**REDUCER CAP FOR PRECAST MANHOLE SECTION (5'-0 to 9'-0 DIA.)**

| Section Dia. | D     |
|--------------|-------|
| 5'-0         | 6'-0  |
| 6'-0         | 7'-2  |
| 8'-0         | 9'-6  |
| 8'-6         | 10'-0 |
| 9'-0         | 10'-8 |

|                                           |                                                                     |
|-------------------------------------------|---------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION      |                                                                     |
| <b>PRECAST CONCRETE MANHOLE SECTIONS</b>  |                                                                     |
| APRIL 1995                                |                                                                     |
| STANDARD DRAWING NO. <b>E 720-MHST-06</b> |                                                                     |
|                                           | DETAILS PLACED IN THIS FORMAT 11-15-99                              |
|                                           | /s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE |
|                                           | /s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE            |
|                                           | DESIGN STANDARDS ENGINEER ORIGINALLY APPROVED 4-03-95               |

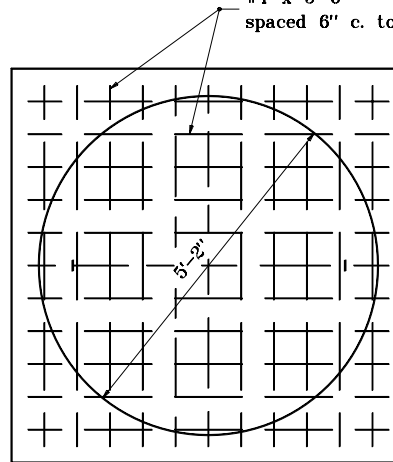


#4 bars spaced  
6" c. to c.



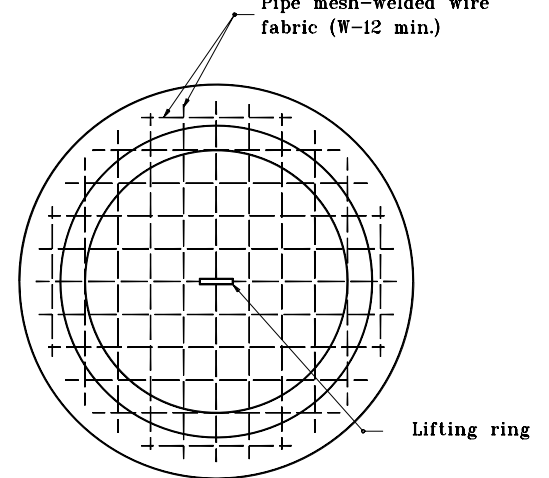
**ROUND**

#4 x 5'-6"  
spaced 6" c. to c.



**SQUARE**

Pipe mesh-welded wire  
fabric (W-12 min.)

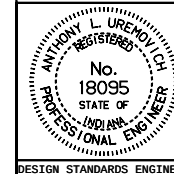


**ROUND ALTERNATE**

INDIANA DEPARTMENT OF TRANSPORTATION

**PRECAST MANHOLE  
BOTTOM SECTION**  
SEPTEMBER 1997

STANDARD DRAWING NO. **E 720-MHST-07**



DETAILS PLACED IN THIS FORMAT 11-15-99

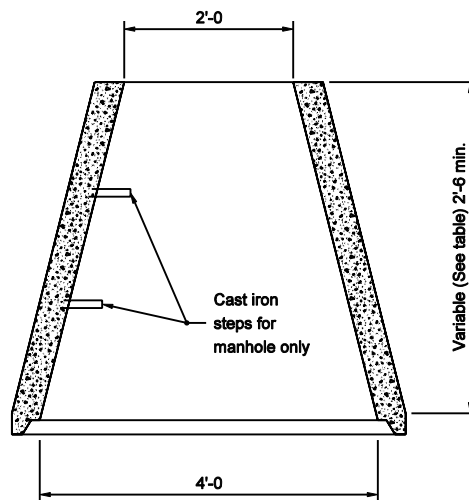
/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

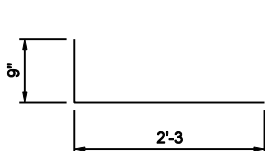
DESIGN STANDARDS ENGINEER

ORIGINALLY APPROVED 9-01-97

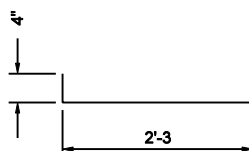
| CONE HEIGHTS |            |
|--------------|------------|
| ECCENTRIC    | CONCENTRIC |
| 2'-6         | 2'-6       |
| 3'-0         | 3'-0       |
| 3'-2         | 3'-2       |
| 3'-6         | 4'-0       |



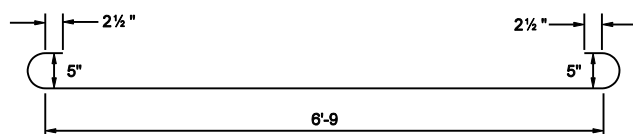
CONCENTRIC CONE



L BARS



T BARS

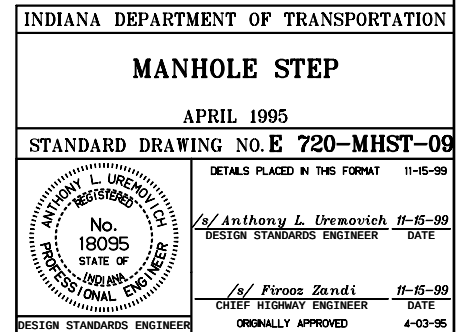


H BARS

# NOTES

1. The concentric concrete section will not be permitted for manholes which are under the jurisdiction of the Indianapolis Sanitary District.

|                                      |                                                       |
|--------------------------------------|-------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION |                                                       |
| MANHOLE BARS AND<br>CONCENTRIC CONE  |                                                       |
| SEPTEMBER 2003                       |                                                       |
| STANDARD DRAWING NO. E 720-MHST-08   |                                                       |
|                                      | /s/ Richard L. VanCleave<br>DESIGN STANDARDS ENGINEER |
|                                      | 9-02-03<br>DATE                                       |
|                                      | /s/ Richard K. Smutzer<br>CHIEF HIGHWAY ENGINEER      |
|                                      | 9-02-03<br>DATE                                       |
| DESIGN STANDARDS ENGINEER            |                                                       |



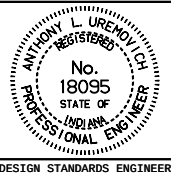
| REINFORCING STEEL FOR MANHOLES |                |     |      |      |                |     |      |      |                |     |      |      |                |     |      |      |
|--------------------------------|----------------|-----|------|------|----------------|-----|------|------|----------------|-----|------|------|----------------|-----|------|------|
|                                | Manhole Type D |     |      |      | Manhole Type E |     |      |      | Manhole Type F |     |      |      | Manhole Type G |     |      |      |
| Bars                           | Length         | No. | Spa. | Size | Length         | No. | Spa. | Size | Length         | No. | Spa. | Size | Length         | No. | Spa. | Size |
| B                              | 8'-0           | 10  | 9"   | #5   | 8'-0           | 12  | 9"   | #5   | 8'-0           | 16  | 9"   | #5   | 8'-0           | 19  | 9"   | #5   |
| B <sub>1</sub>                 | 6'-9           | 12  | 9"   | #5   | 8'-6           | 12  | 9"   | #5   | 11'-0          | 12  | 9"   | #5   | 13'-3          | 12  | 9"   | #5   |
| E                              | 7'-3           | 3   | 2"   | #5   | 7'-3           | 3   | 2"   | #5   | 7'-3           | 3   | 2"   | #5   | 7'-3           | 3   | 2"   | #5   |
| H                              | 8'-6           | 22  | 6"   | #5   | 8'-6           | 33  | 6"   | #5   | 8'-6           | 41  | 6"   | #5   | 8'-6           | 58  | 6"   | #5   |
| L                              | 3'-0           | 16  | 12"  | #5   | 3'-0           | 16  | 12"  | #5   | 3'-0           | 16  | 12"  | #5   | 3'-0           | 16  | 12"  | #5   |
| T                              | 1'-3           | 16  | 6"   | #5   | 3'-0           | 16  | 6"   | #5   | 5'-3           | 16  | 6"   | #5   | 7'-6           | 16  | 6"   | #5   |
| V                              | 5'-0           | 16  | 6"   | #5   | 6'-9           | 16  | 6"   | #5   | 9'-0           | 16  | 6"   | #5   | 11'-6          | 16  | 6"   | #5   |
| V <sub>1</sub>                 | 4'-9           | 16  | 6"   | #5   | 6'-6           | 16  | 6"   | #5   | 8'-9           | 16  | 6"   | #5   | 11'-3          | 16  | 6"   | #5   |

INDIANA DEPARTMENT OF TRANSPORTATION

TABLE OF REINFORCING STEEL  
FOR MANHOLES

SEPTEMBER 1997

STANDARD DRAWING NO.E 720-MHST-10



DETAILS PLACED IN THIS FORMAT 11-15-99

/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

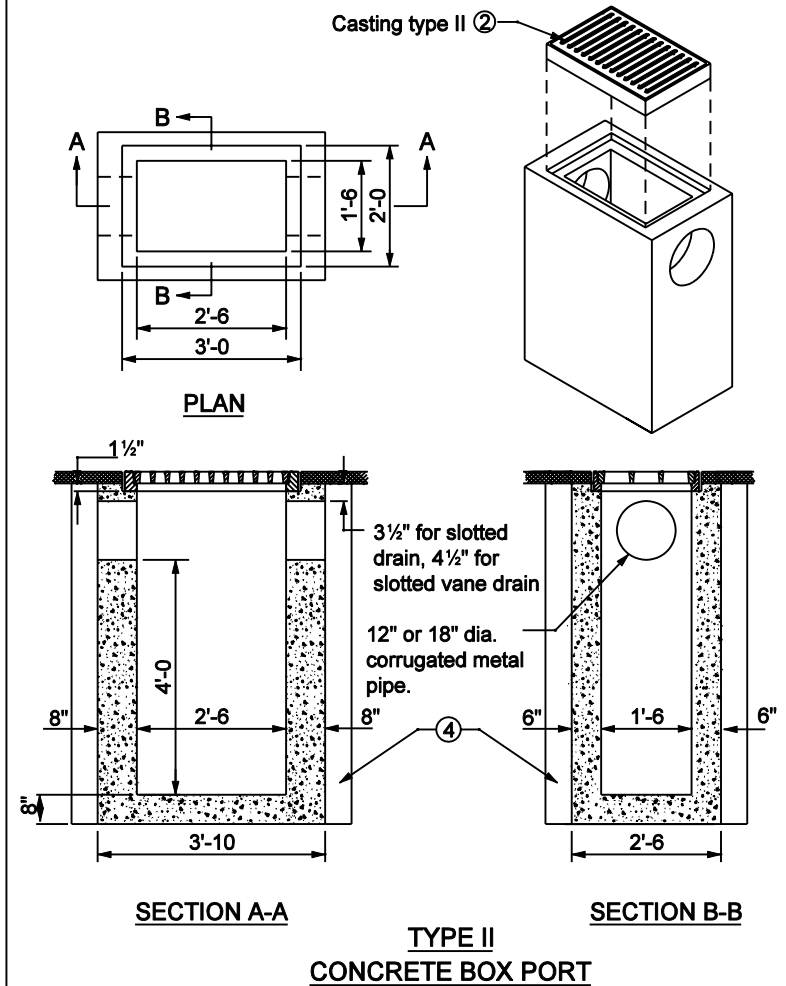
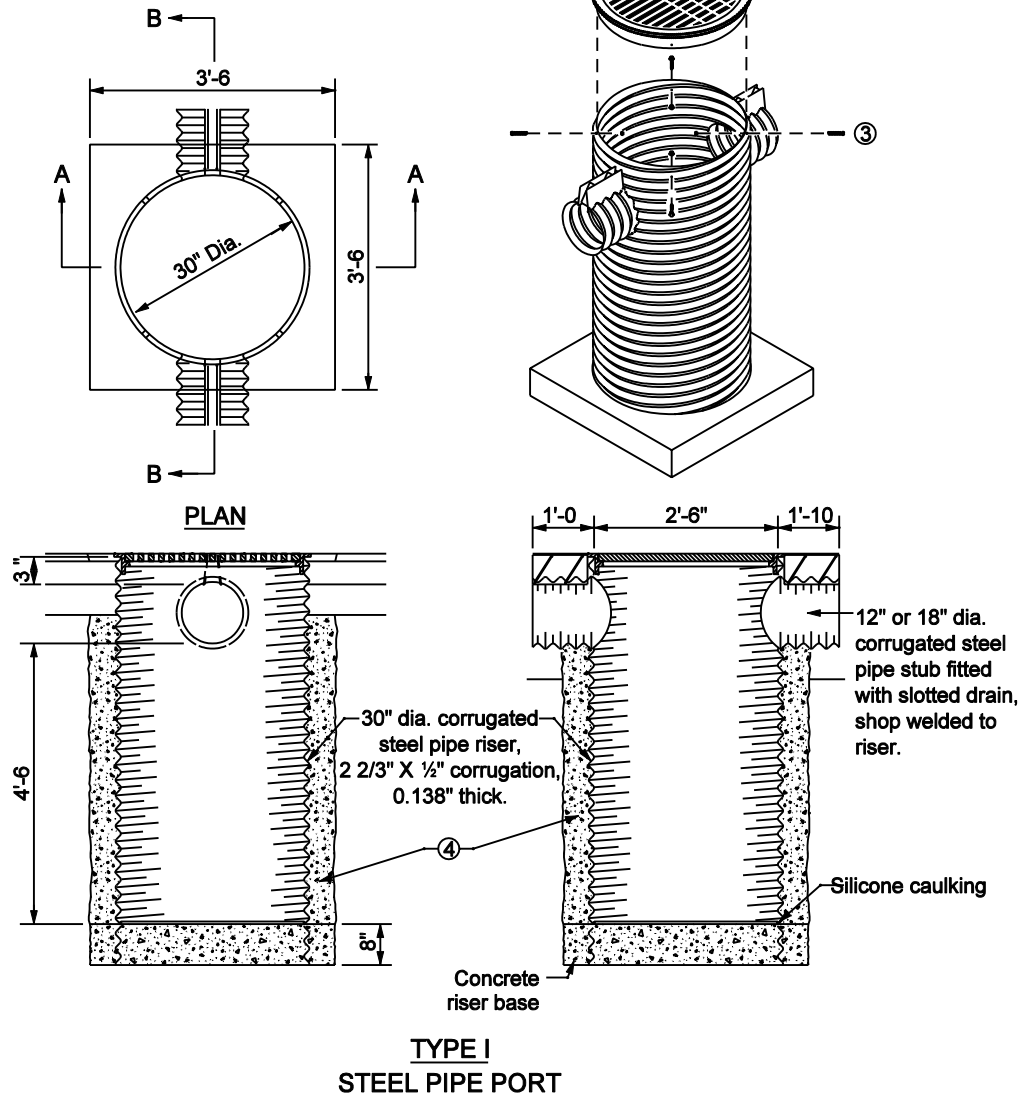
/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

ORIGINALLY APPROVED 9-02-97

### GENERAL NOTES

- ① See Standard Drawing E 720-SDCP-02 for casting details.
- ② See Standard Drawing E 720-SDCP-03 for casting details.
- ③  $\frac{3}{8}$ " x  $1\frac{1}{2}$ " stainless steel nonthreaded hex head bolt with locknut washer. (typ.)
- ④ Class A concrete, 6" min. thick. (typ.)
5. Cleanout ports shall be spaced at 250 ft or as shown on plans.

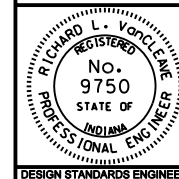


INDIANA DEPARTMENT OF TRANSPORTATION

### SLOTTED DRAIN PIPE CLEANOUT PORT

MARCH 2003

STANDARD DRAWING NO. E 720-SDCP-01



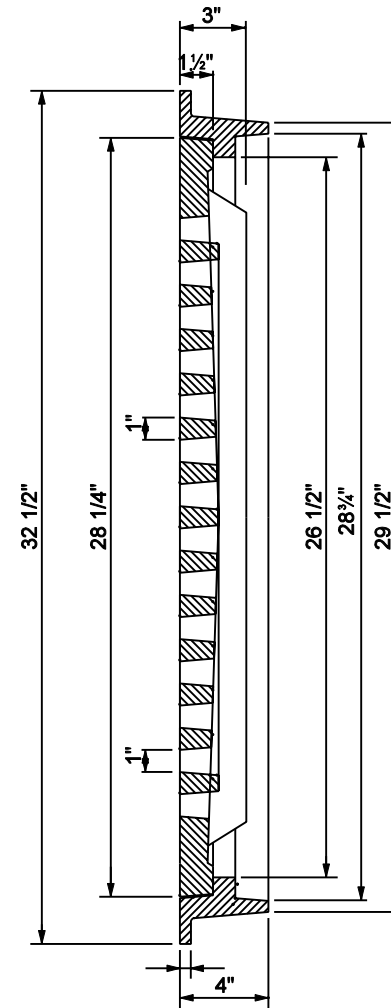
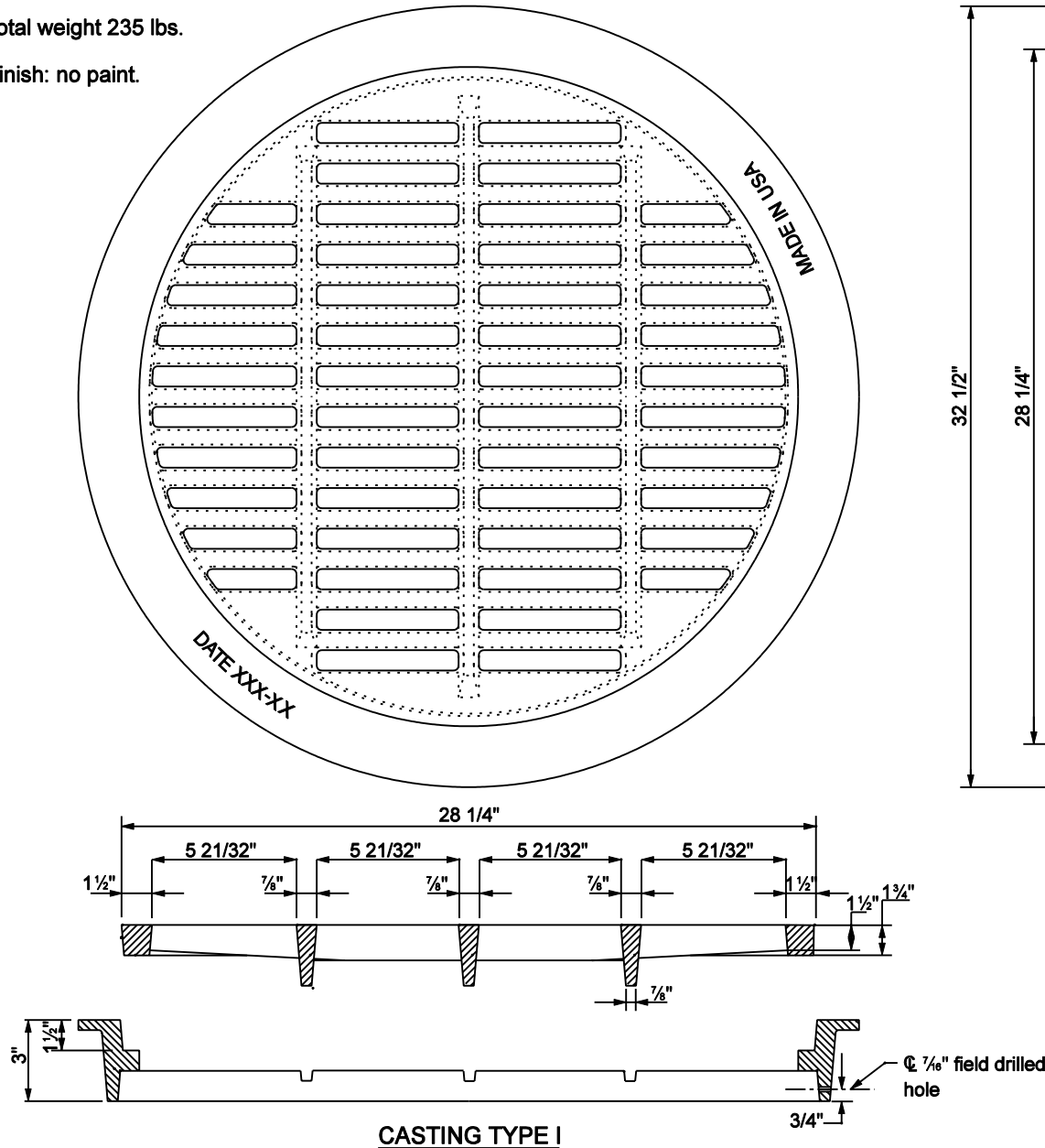
/s/ Richard L. VanCleave 3-03-03  
DESIGN STANDARDS ENGINEER DATE

/s/ Richard K. Smutzer 3-03-03  
CHIEF HIGHWAY ENGINEER DATE

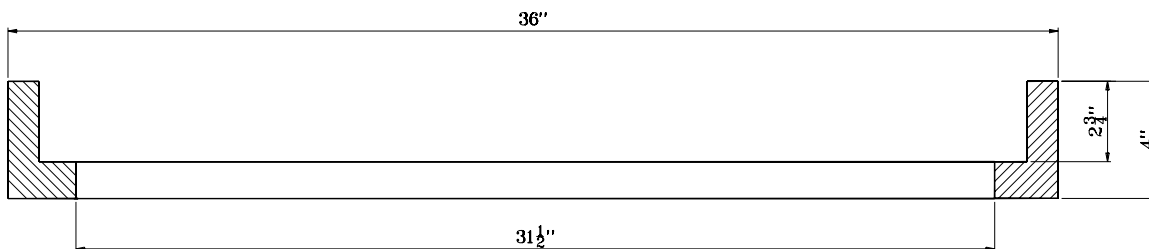
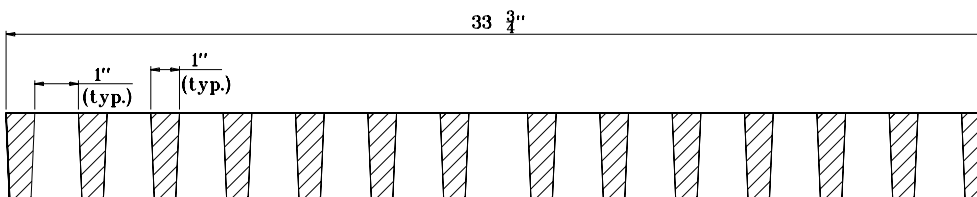
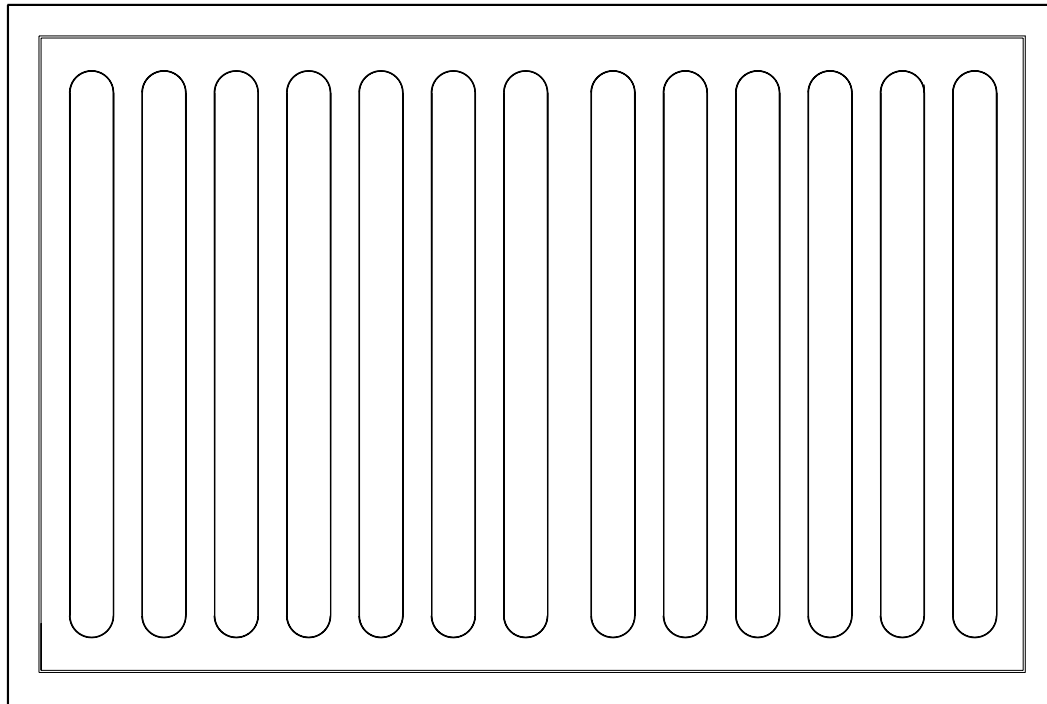


# GENERAL NOTES

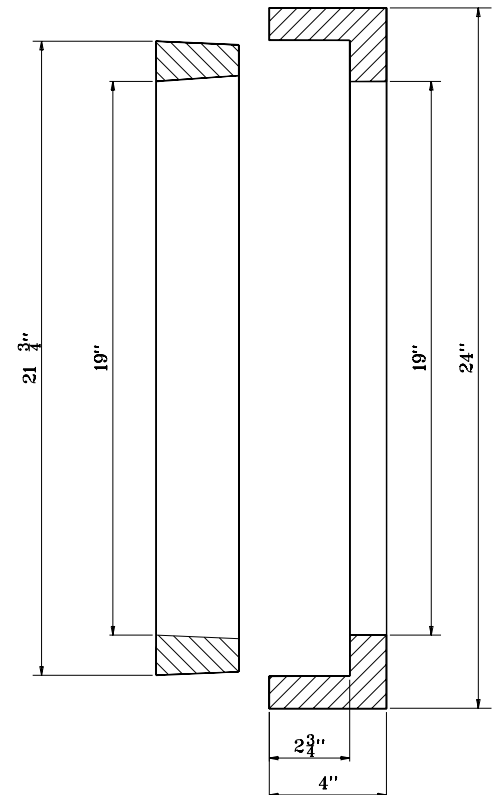
1. Casting total weight 235 lbs.
2. Casting finish: no paint.



|                                      |                                                                          |
|--------------------------------------|--------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION |                                                                          |
| CASTING TYPE I<br>FRAME AND GRATE    |                                                                          |
| MARCH 2003                           |                                                                          |
| STANDARD DRAWING NO. E 720-SDCP-02   |                                                                          |
|                                      | /s/ Richard L. VanCleave<br>DESIGN STANDARDS ENGINEER<br>3-03-03<br>DATE |
|                                      | /s/ Richard K. Smutzer<br>CHIEF HIGHWAY ENGINEER<br>3-03-03<br>DATE      |



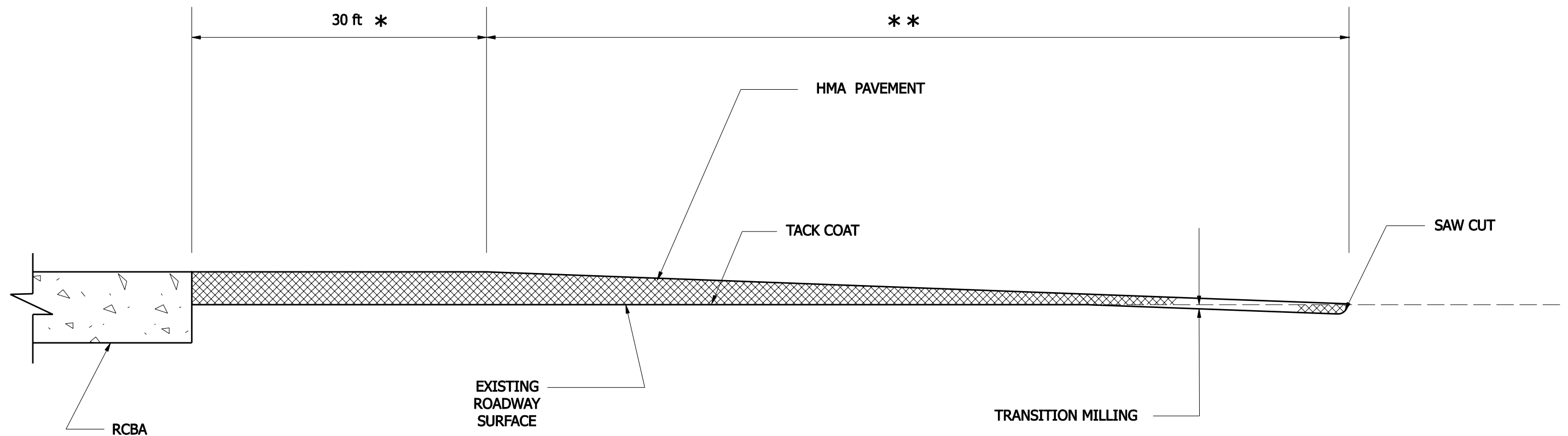
**CASTING TYPE II**



**GENERAL NOTES**

1. Casting total weight 440 lb.
2. Casting finish: no paint.

|                                           |                                                                     |
|-------------------------------------------|---------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION      |                                                                     |
| <b>CASTING TYPE II</b>                    |                                                                     |
| <b>FRAME AND GRATE</b>                    |                                                                     |
| JANUARY 1999                              |                                                                     |
| <b>STANDARD DRAWING NO. E 720-SDCP-03</b> |                                                                     |
|                                           | DETAILS PLACED IN THIS FORMAT 11-15-99                              |
|                                           | /s/ Anthony L. Uremovich 11-15-99<br>DESIGN STANDARDS ENGINEER DATE |
| DESIGN STANDARDS ENGINEER                 | /s/ Firooz Zandi 11-15-99<br>CHIEF HIGHWAY ENGINEER DATE            |
|                                           | ORIGINALLY APPROVED 1-04-99                                         |



\* WEDGE TO BE A CONTINUATION OF BRIDGE DECK PROFILE.

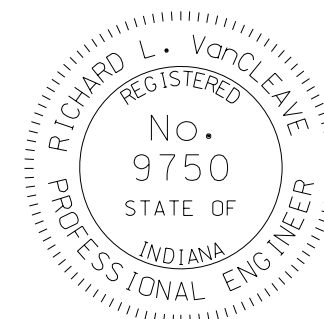
\*\* WEDGE AND TRANSITION MILLING LIMITS PER STANDARD  
DRAWING E 306-TMPT-01.

INDIANA DEPARTMENT OF TRANSPORTATION

HMA PAVEMENT WEDGE  
AT RCBA

SEPTEMBER 2007

STANDARD DRAWING NO. E 722-HMAW-01



DESIGN STANDARDS ENGINEER

*/s/ Richard L. VanCleave* 09/04/07  
DESIGN STANDARDS ENGINEER DATE

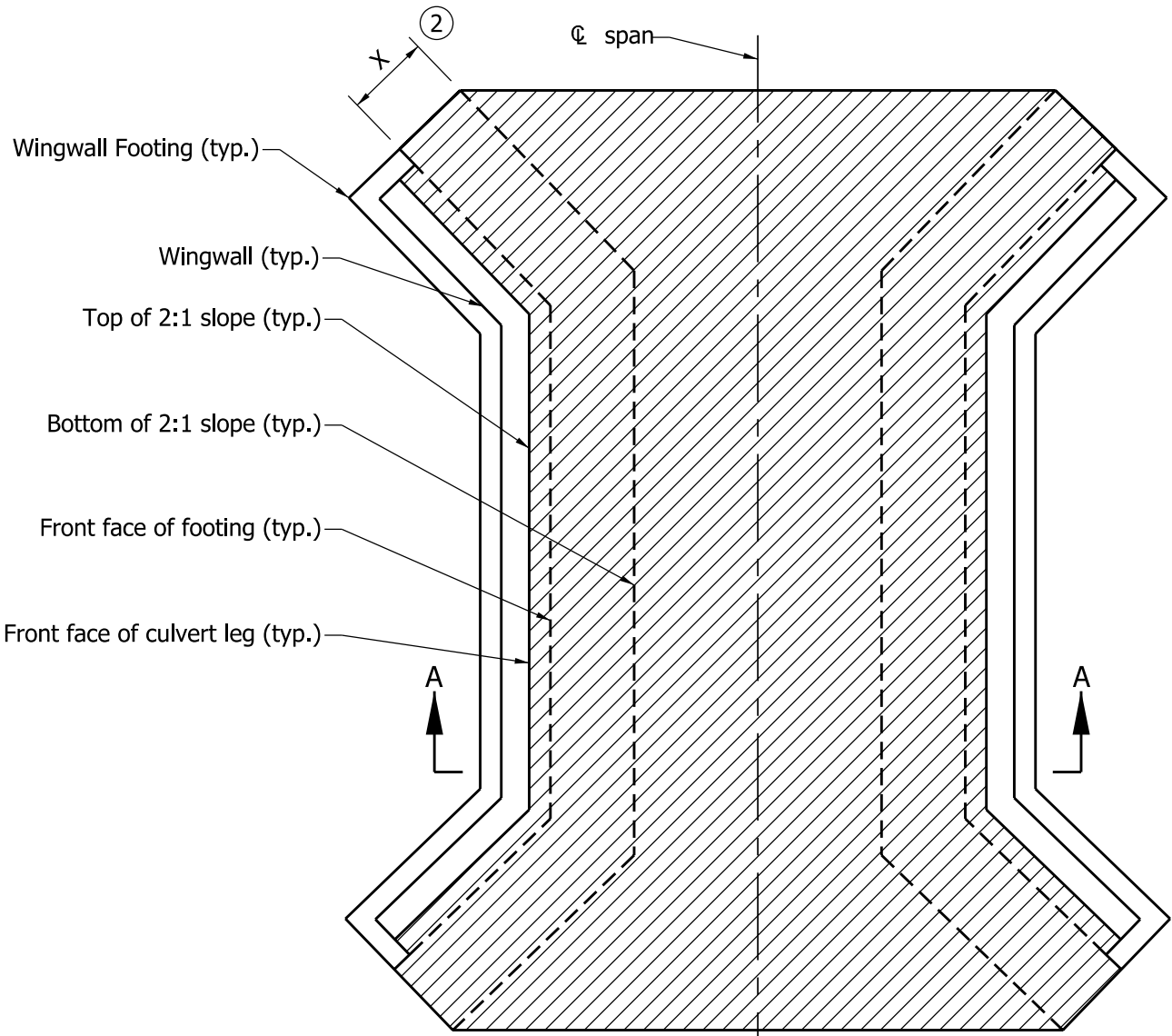
*/s/ Mark A. Miller* 09/04/07  
CHIEF HIGHWAY ENGINEER DATE

NOTES:

- 1. See Standard Drawing E 723-CCSP-02 for Section A-A.
- ② Distance X is equal to two times the sump depth shown on plans.

LEGEND:

 Riprap on geotextiles as shown on the plans.

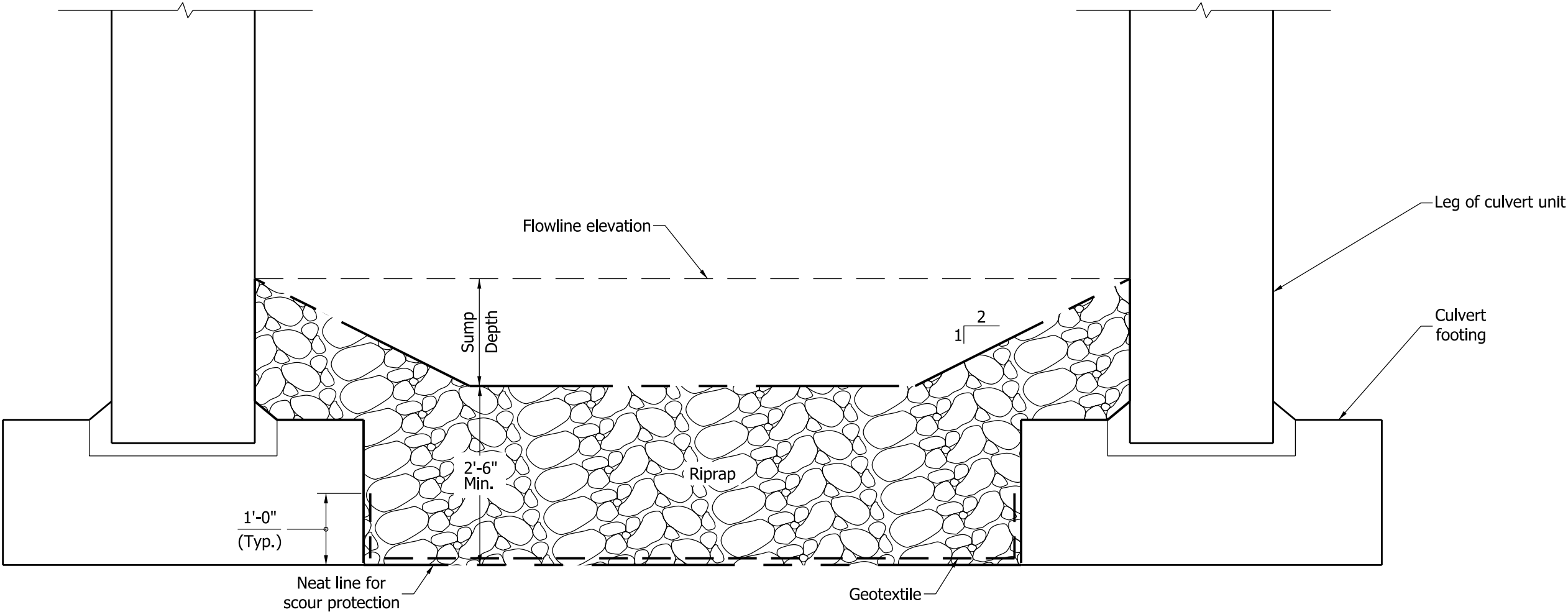


RIPRAP METHOD  
PLAN - WITH WINGWALLS

| INDIANA DEPARTMENT OF TRANSPORTATION                                                               |                                 |          |
|----------------------------------------------------------------------------------------------------|---------------------------------|----------|
| THREE-SIDED CONCRETE CULVERT<br>SCOUR PROTECTION<br>10'-0" ≤ SPAN WIDTH < 20'-0"<br>SEPTEMBER 2011 |                                 |          |
| STANDARD DRAWING NO. E 723-CCSP-01                                                                 |                                 |          |
|               | /s/ <i>Richard L. VanCleave</i> | 09/01/11 |
|                                                                                                    | DESIGN STANDARDS ENGINEER       | DATE     |
|                                                                                                    | /s/ <i>Mark A. Miller</i>       | 09/01/11 |
|                                                                                                    | CHIEF HIGHWAY ENGINEER          | DATE     |
| DESIGN STANDARDS ENGINEER                                                                          |                                 |          |

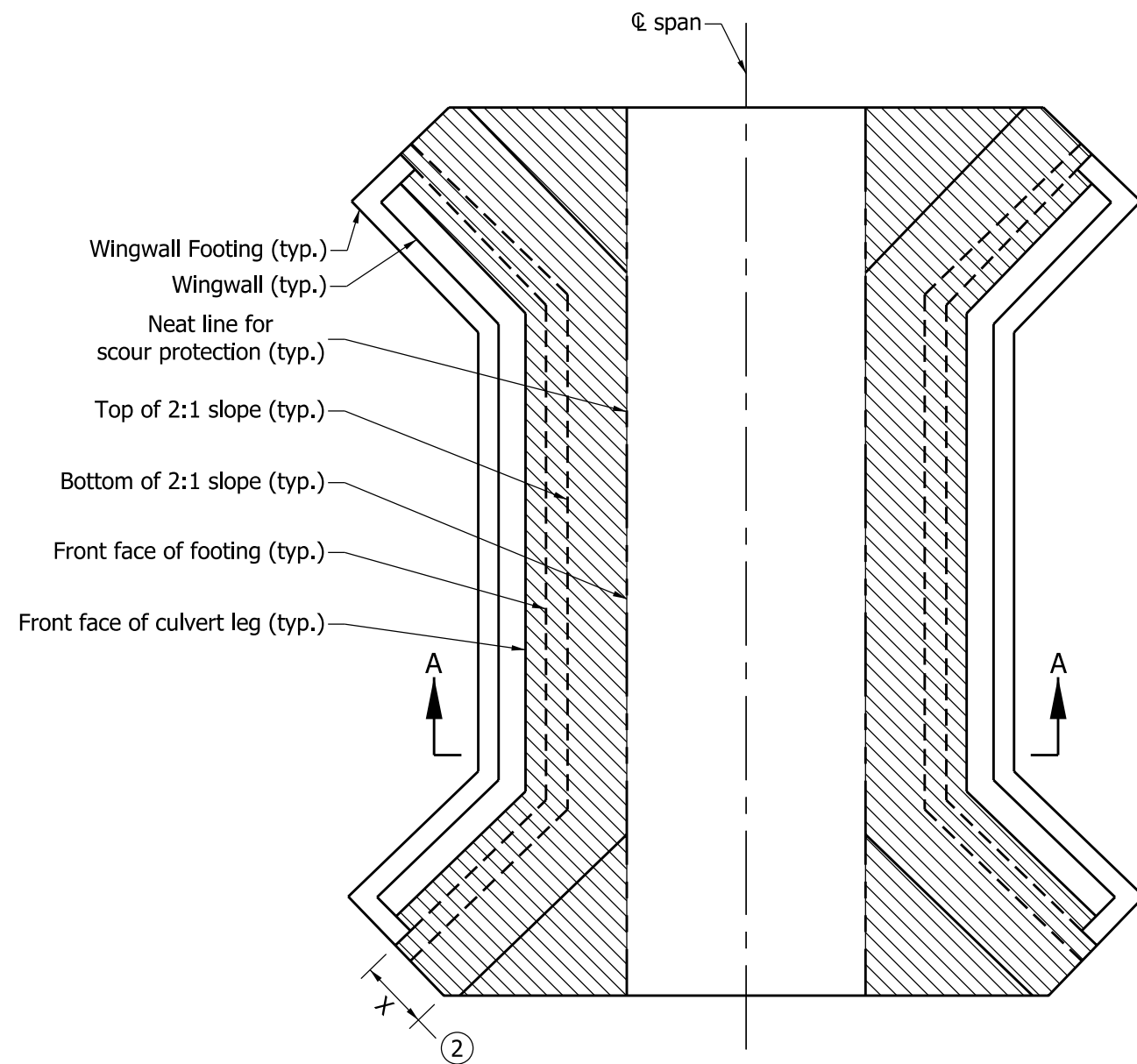
NOTES:

1. See Standard Drawing E 723-CCSP-01 for plan view of Section A-A.



SECTION A-A  
RIPRAP METHOD

| INDIANA DEPARTMENT OF TRANSPORTATION                                                                         |                                 |               |
|--------------------------------------------------------------------------------------------------------------|---------------------------------|---------------|
| THREE-SIDED CONCRETE CULVERT<br>SCOUR PROTECTION, SECTION,<br>10'-0" ≤ SPAN WIDTH < 20'-0"<br>SEPTEMBER 2011 |                                 |               |
| STANDARD DRAWING NO.                                                                                         |                                 | E 723-CCSP-02 |
|                         | /s/ <i>Richard L. VanCleave</i> | 09/01/11      |
|                                                                                                              | DESIGN STANDARDS ENGINEER       | DATE          |
|                                                                                                              | /s/ <i>Mark A. Miller</i>       | 09/01/11      |
|                                                                                                              | CHIEF HIGHWAY ENGINEER          | DATE          |
| DESIGN STANDARDS ENGINEER                                                                                    |                                 |               |



PLAN - WITH WINGWALLS  
RIPRAP METHOD

NOTES:

1. See Standard Drawing E723-CCSP-04 for Section A-A.
- ② Distance X is equal to two times the sump depth shown on the plans or 6'-0", whichever is greater.

LEGEND:

 Riprap on geotextiles as shown on the plans.

INDIANA DEPARTMENT OF TRANSPORTATION

THREE-SIDED CONCRETE STRUCTURE  
SCOUR PROTECTION, PLAN,  
SPAN WIDTH  $\geq 20'$ -0"  
SEPTEMBER 2011

STANDARD DRAWING NO. E 723-CCSP-03

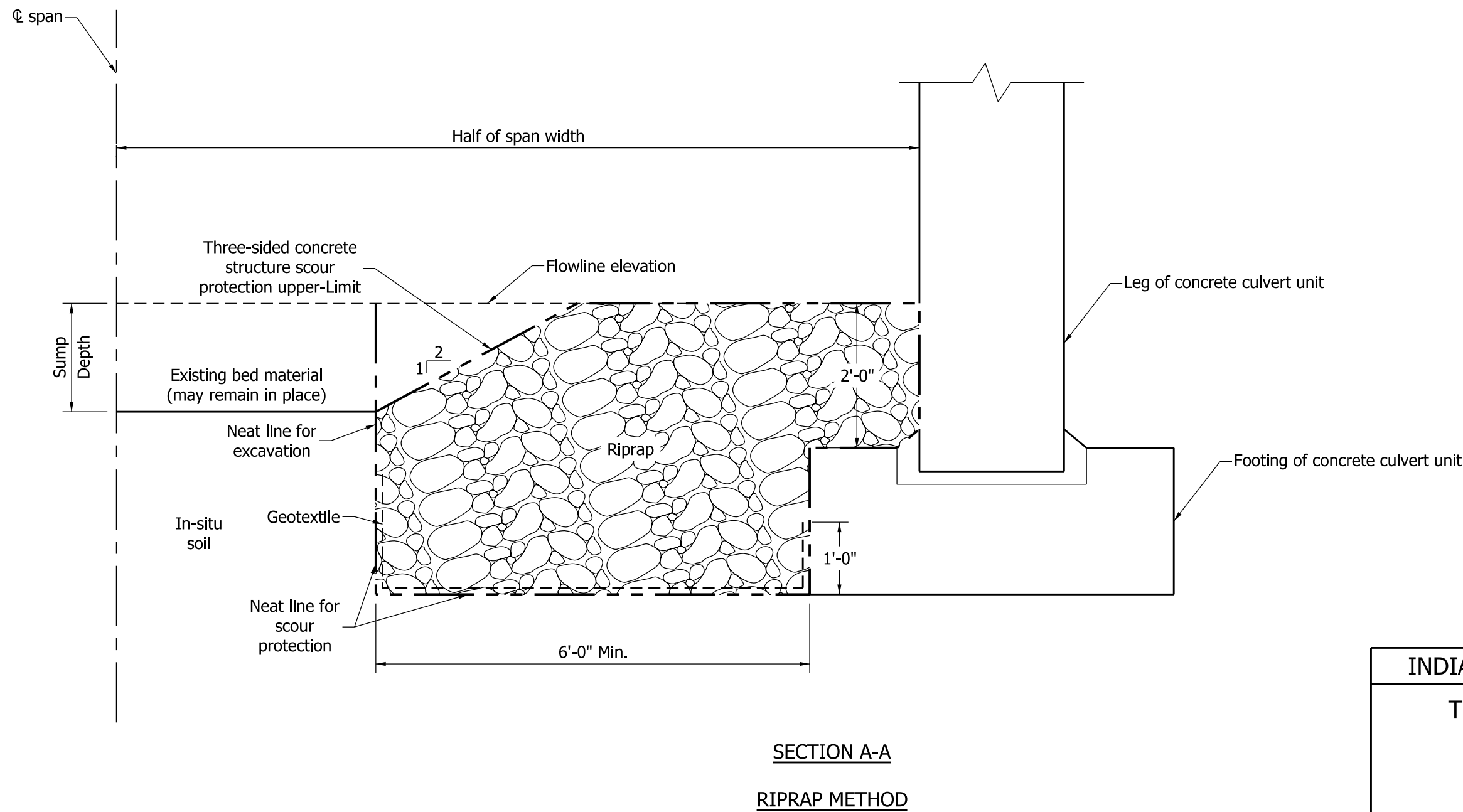


DESIGN STANDARDS ENGINEER

/s/ *Richard L. VanCleave* 09/01/11  
DESIGN STANDARDS ENGINEER DATE

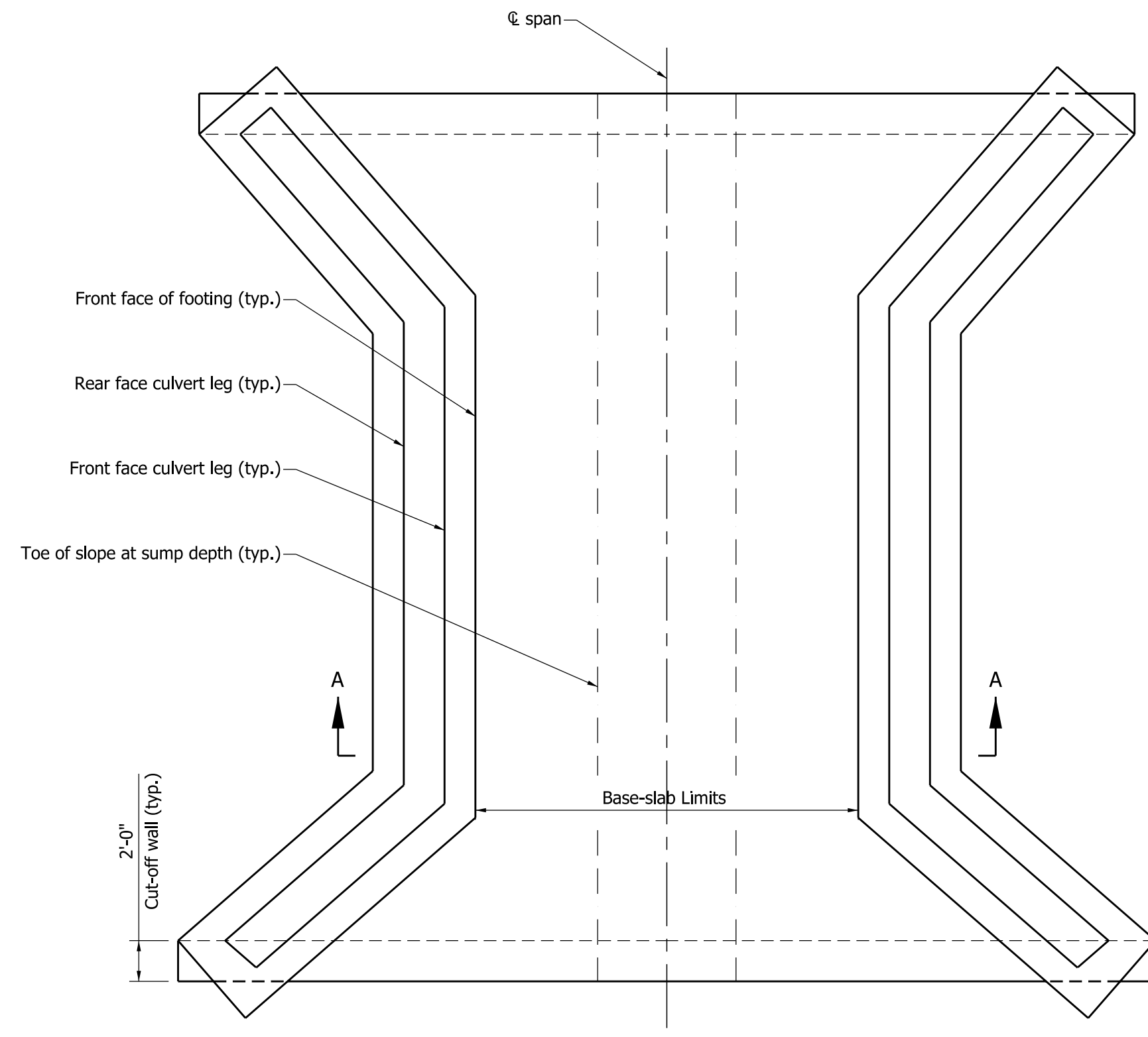
/s/ *Mark A. Miller* 09/01/11  
CHIEF HIGHWAY ENGINEER DATE

- NOTES:
1. See Standard Drawing E 723-CCSP-03 for plan view of Section A-A.



|                                                                                       |                                 |               |
|---------------------------------------------------------------------------------------|---------------------------------|---------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                 |               |
| THREE-SIDED CONCRETE STRUCTURE<br>SCOUR PROTECTION, SECTION,<br>SPAN WIDTH ≥ 20'-0"   |                                 |               |
| SEPTEMBER 2011                                                                        |                                 |               |
| STANDARD DRAWING NO.                                                                  |                                 | E 723-CCSP-04 |
|  | /s/ <i>Richard L. VanCleave</i> | 09/01/11      |
|                                                                                       | DESIGN STANDARDS ENGINEER       | DATE          |
|                                                                                       | /s/ <i>Mark A. Miller</i>       | 09/01/11      |
|                                                                                       | CHIEF HIGHWAY ENGINEER          | DATE          |
| DESIGN STANDARDS ENGINEER                                                             |                                 |               |

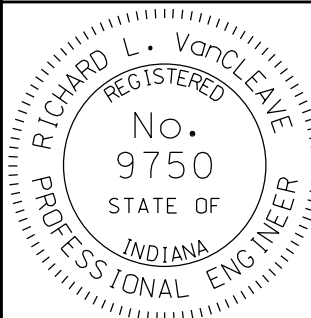




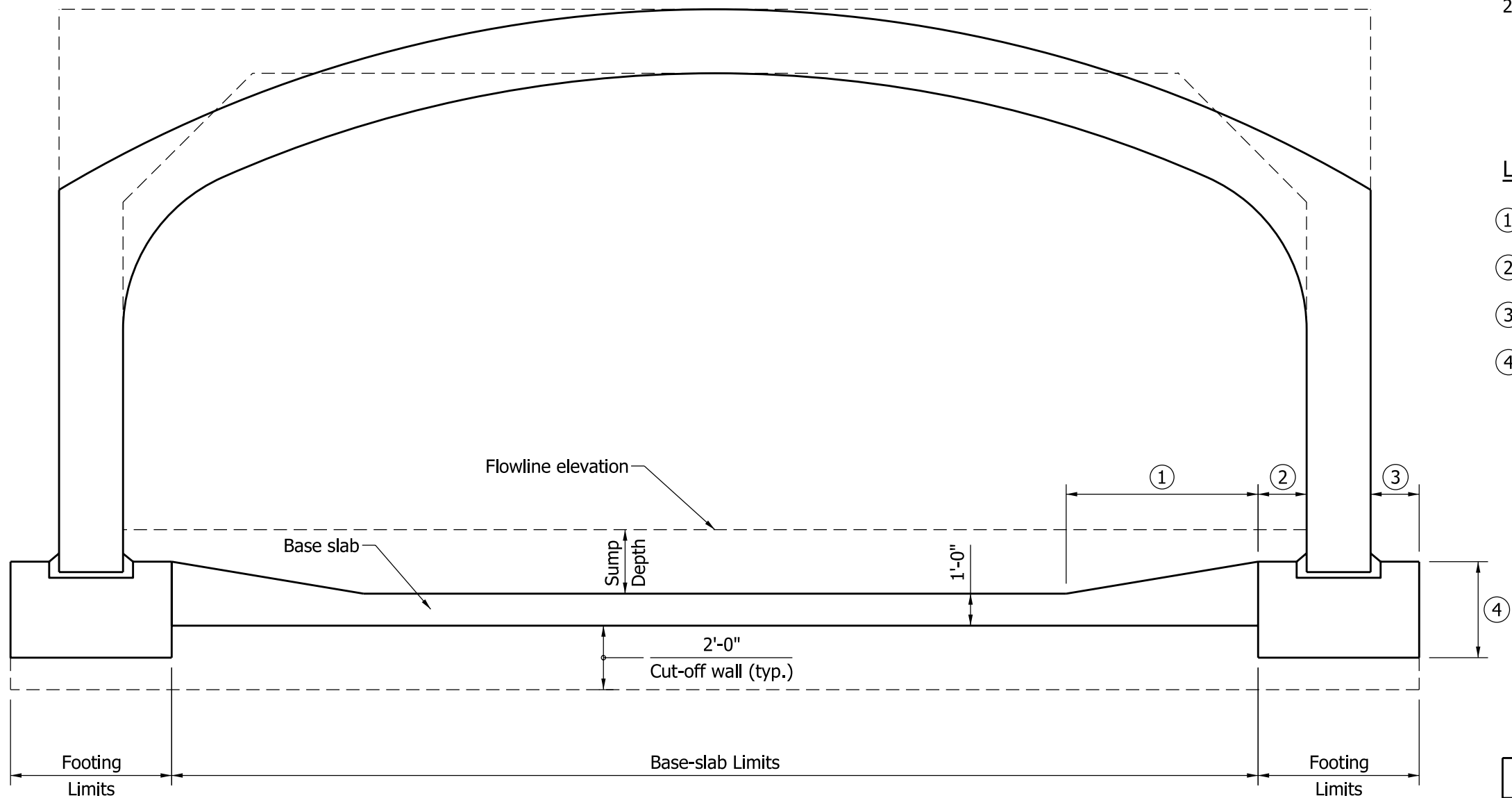
**PLAN - WITH WINGWALLS**  
**BASE SLAB METHOD**

**NOTES:**

1. See Standard Drawing E 723-CCSP-06 for Section A-A.

|                                                                                       |                                 |               |
|---------------------------------------------------------------------------------------|---------------------------------|---------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                 |               |
| THREE-SIDED CONCRETE CULVERT<br>SCOUR PROTECTION, PLAN,<br>BASE-SLAB METHOD           |                                 |               |
| SEPTEMBER 2011                                                                        |                                 |               |
| STANDARD DRAWING NO.                                                                  |                                 | E 723-CCSP-05 |
|  |                                 |               |
|                                                                                       | /s/ <i>Richard L. VanCleave</i> | 09/01/11      |
|                                                                                       | DESIGN STANDARDS ENGINEER       | DATE          |
|                                                                                       |                                 |               |
|                                                                                       | /s/ <i>Mark A. Miller</i>       | 09/01/11      |
|                                                                                       | CHIEF HIGHWAY ENGINEER          | DATE          |
| DESIGN STANDARDS ENGINEER                                                             |                                 |               |





SECTION A-A  
BASE SLAB METHOD

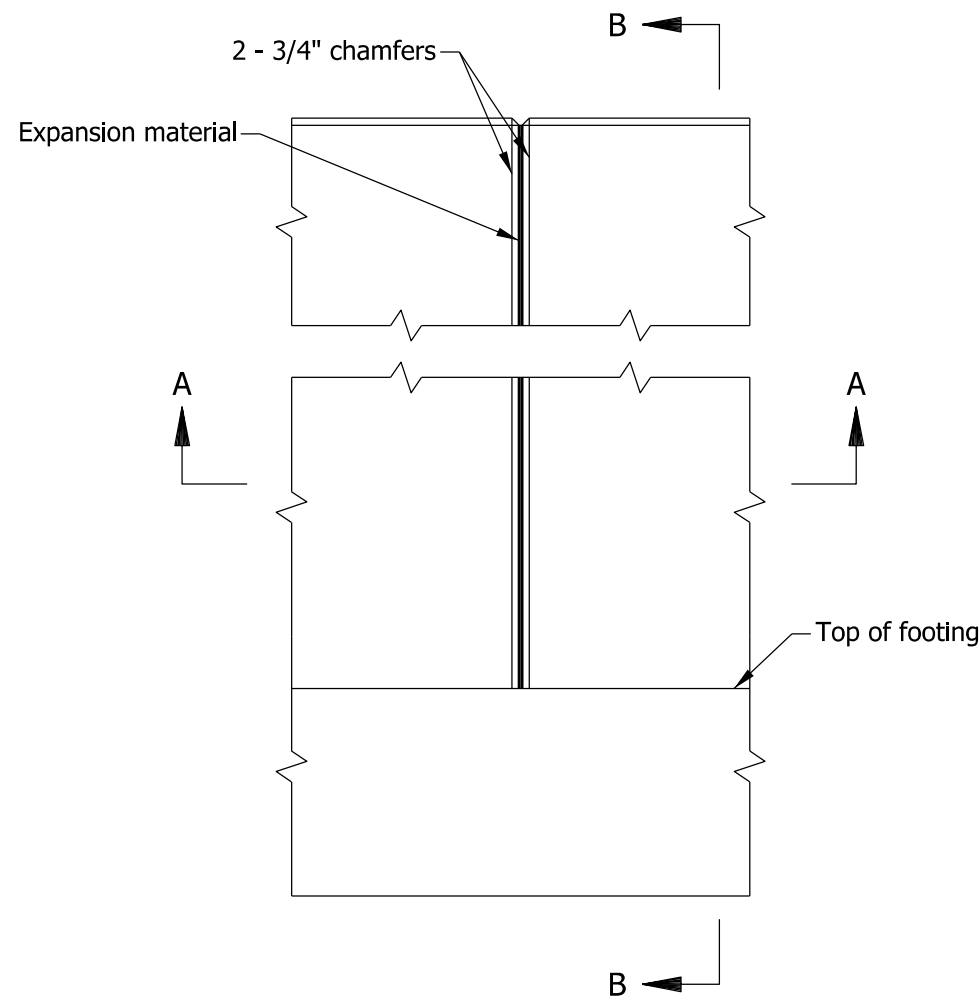
NOTES:

1. See the working drawings for dimension ① through ④.
2. See Standard Drawing E 723-CCSP-05 for plan view of Section A-A

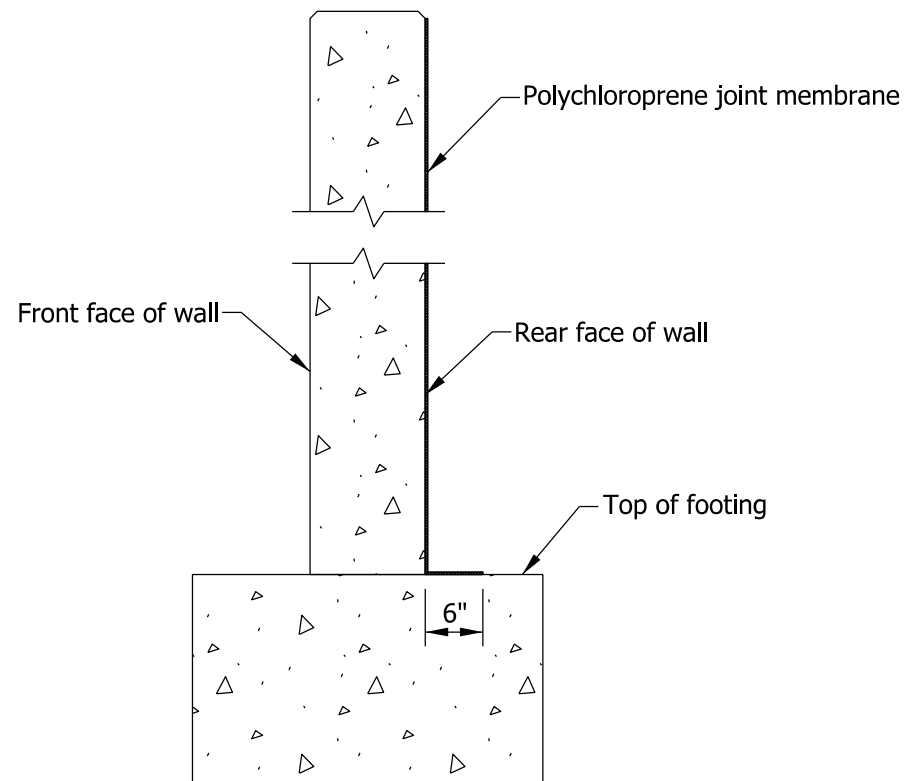
LEGEND:

- ① Taper length
- ② Inside-footing width
- ③ Outside-footing width
- ④ Footing depth

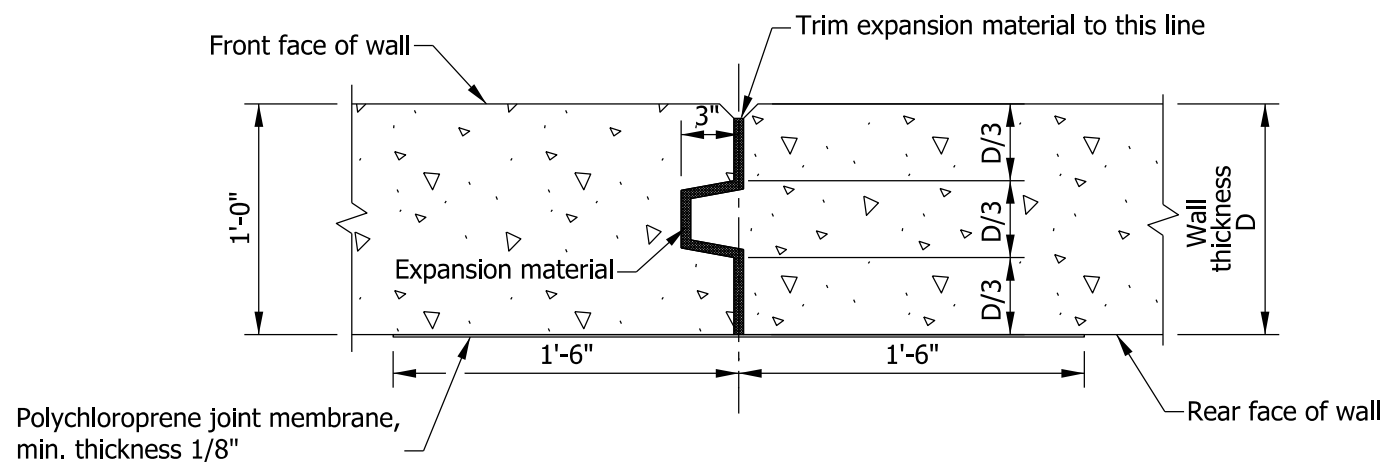
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                 |               |          |
|---------------------------------------------------------------------------------------|---------------------------------|---------------|----------|
| THREE-SIDED CONCRETE CULVERT<br>SCOUR PROTECTION, SECTION,<br>BASE-SLAB METHOD        |                                 |               |          |
| SEPTEMBER 2011                                                                        |                                 |               |          |
| STANDARD DRAWING NO.                                                                  |                                 | E 723-CCSP-06 |          |
|  | /s/ <i>Richard L. VanCleave</i> |               | 09/01/11 |
|                                                                                       | DESIGN STANDARDS ENGINEER       |               | DATE     |
|                                                                                       | /s/ <i>Mark A. Miller</i>       |               | 09/01/11 |
|                                                                                       | CHIEF HIGHWAY ENGINEER          |               | DATE     |
| DESIGN STANDARDS ENGINEER                                                             |                                 |               |          |



WALL FRONT FACE



SECTION B-B



SECTION A-A

NOTES

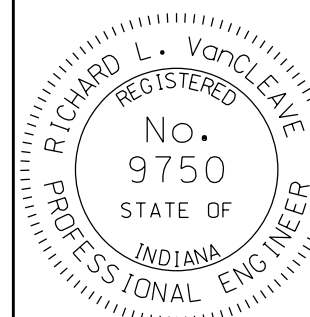
1. Expansion material in joints shall be preformed joint filler.
2. All chamfered edges shall be 3/4".

INDIANA DEPARTMENT OF TRANSPORTATION

EXPANSION JOINT

SEPTEMBER 2012

STANDARD DRAWING NO. E 724-BJTS-01

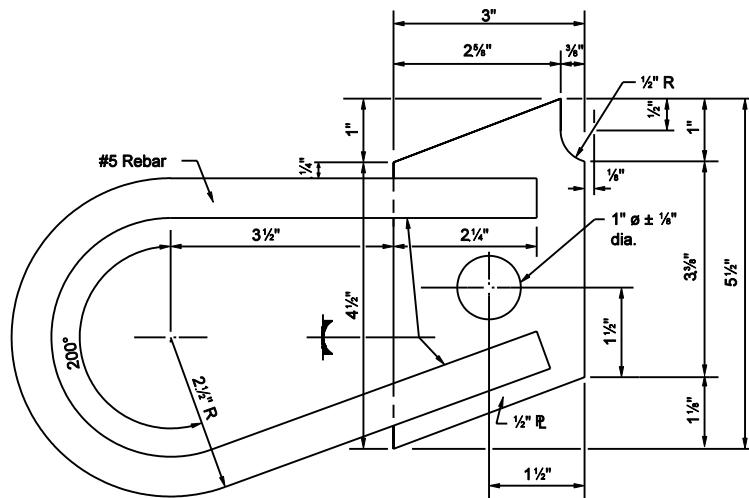


/s/ *Richard L. VanCleave* 09/04/12

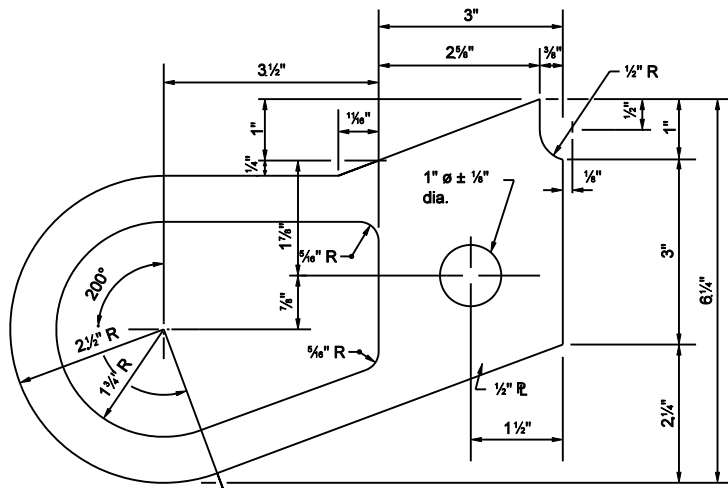
SUPERVISOR, ROADWAY STANDARDS DATE

/s/ *Mark A. Miller* 09/04/12

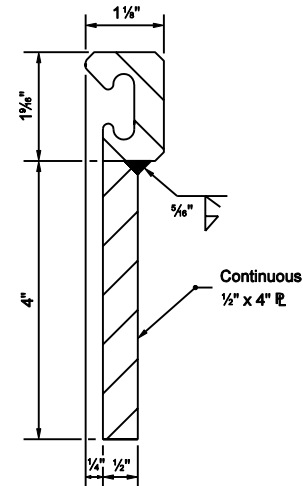
CHIEF ENGINEER DATE



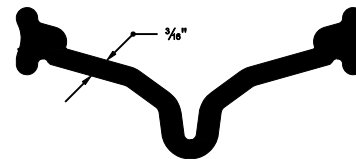
**ANCHOR PLATE ALTERNATE A-1**



**ANCHOR PLATE ALTERNATE A-2**

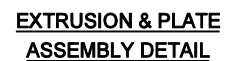


**EXTRUSION & PLATE  
ASSEMBLY DETAIL**

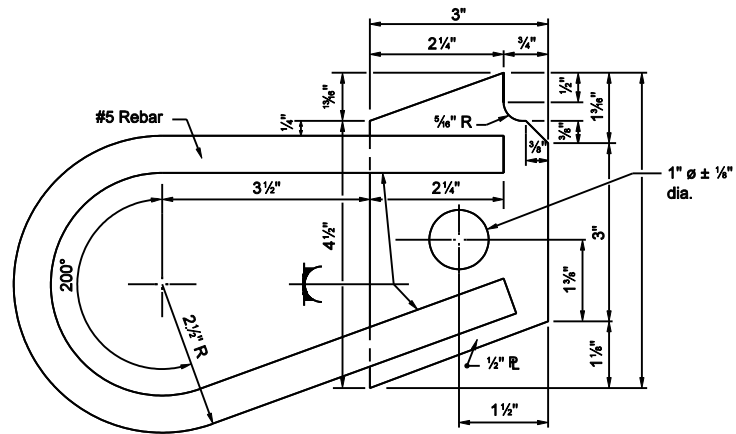


**STRIP SEAL**

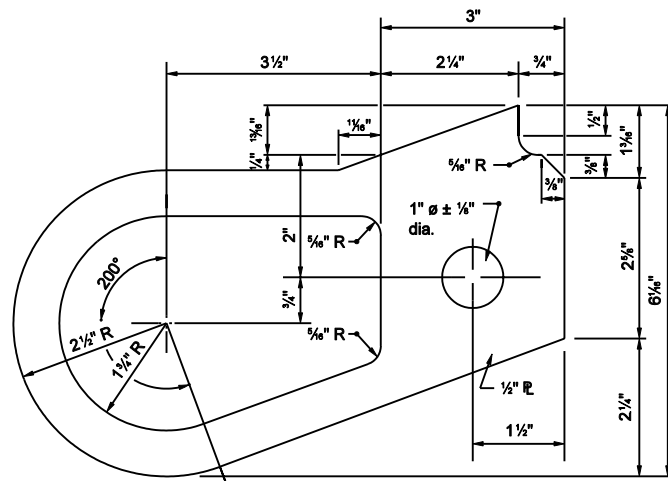
|                                            |                                                                    |
|--------------------------------------------|--------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION       |                                                                    |
| EXPANSION JOINTS<br>CLASS SS (ALTERNATE A) |                                                                    |
| SEPTEMBER 2003                             |                                                                    |
| STANDARD DRAWING NO. E 724-BSSJ -01        |                                                                    |
|                                            | /s/ Richard L. VanCleave 9-02-03<br>DESIGN STANDARDS ENGINEER DATE |
|                                            | /s/ Richard K. Smutzer 9-02-03<br>CHIEF HIGHWAY ENGINEER DATE      |
| DESIGN STANDARDS ENGINEER                  |                                                                    |



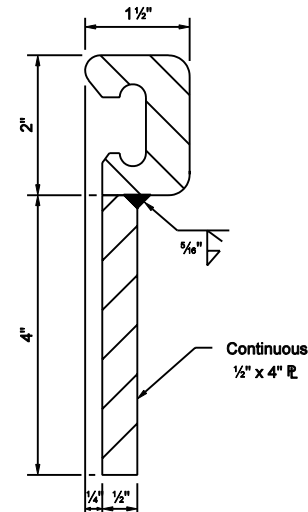
|                                                                                       |                                                                                                                     |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                     |
| <p align="center"><b>EXPANSION JOINTS</b><br/> <b>CLASS SS (ALTERNATE B)</b></p>      |                                                                                                                     |
| <p align="center"><b>SEPTEMBER 2003</b></p>                                           |                                                                                                                     |
| <p align="center"><b>STANDARD DRAWING NO. E 724-BSSJ -02</b></p>                      |                                                                                                                     |
|  | <p><i>/s/ Richard L. VanCleave</i>      <b>9-02-03</b></p> <p><b>DESIGN STANDARDS ENGINEER</b>      <b>DATE</b></p> |
|  | <p><i>/s/ Richard K. Smutzer</i>      <b>9-02-03</b></p> <p><b>CHIEF HIGHWAY ENGINEER</b>      <b>DATE</b></p>      |
| <p><b>DESIGN STANDARDS ENGINEER</b></p>                                               |                                                                                                                     |



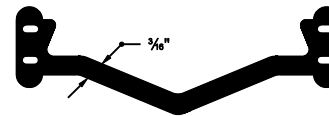
**ANCHOR PLATE ALTERNATE C-1**



**ANCHOR PLATE ALTERNATE C-2**



**EXTRUSION & PLATE  
ASSEMBLY DETAIL**



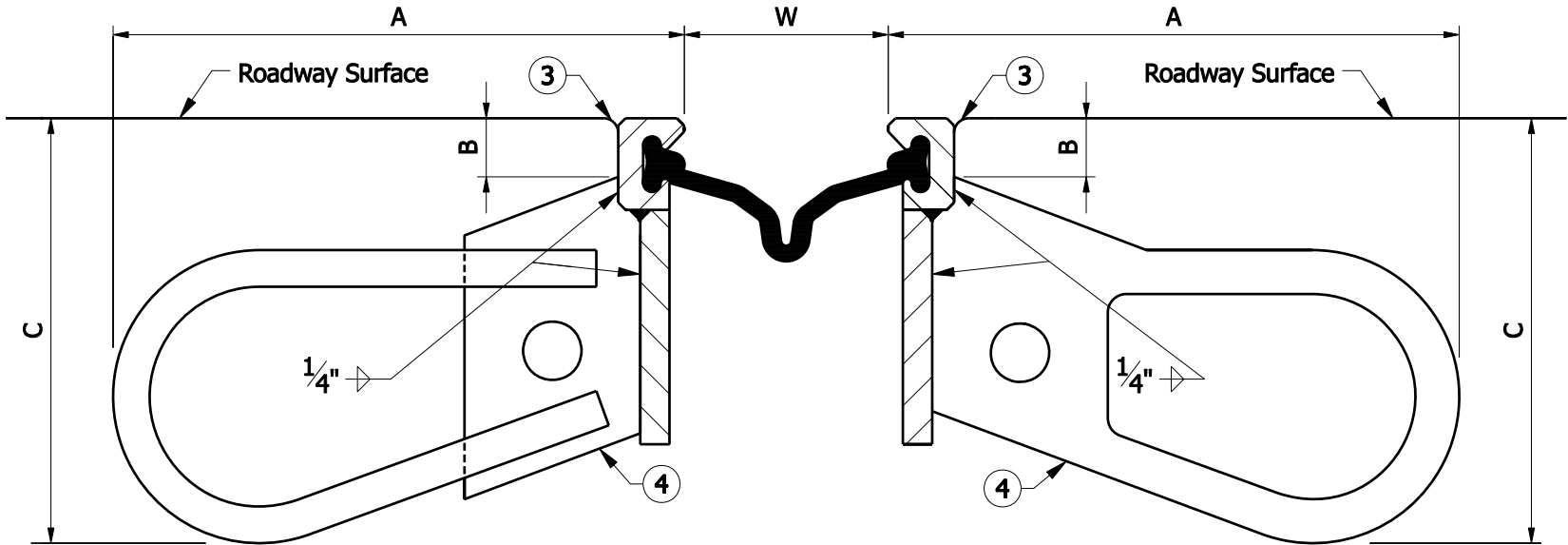
**STRIP SEAL**

|                                            |                           |         |
|--------------------------------------------|---------------------------|---------|
| INDIANA DEPARTMENT OF TRANSPORTATION       |                           |         |
| EXPANSION JOINTS<br>CLASS SS (ALTERNATE C) |                           |         |
| SEPTEMBER 2003                             |                           |         |
| STANDARD DRAWING NO. E 724-BSSJ-03         |                           |         |
|                                            | /s/ Richard L. VanCleave  | 9-02-03 |
|                                            | DESIGN STANDARDS ENGINEER | DATE    |
|                                            | /s/ Richard K. Smulzer    | 9-02-03 |
|                                            | CHIEF HIGHWAY ENGINEER    | DATE    |
| DESIGN STANDARDS ENGINEER                  |                           |         |

GENERAL NOTES

- 1. This sheet shall be used in conjunction with Standard Drawing Nos. E 724-BSSJ-05 through 09.
- 2. Allowable expansion lengths shall not be increased for skewed structures.
- 3 Tool concrete edges to 1/4" to 3/8" radius.
- 4 Anchors shall be spaced at 9 in.

| DIMENSIONS |     |          |         |
|------------|-----|----------|---------|
| ALTERNATES | A   | B        | C       |
| A-1        | 9¾" | 1"       | 7¼"     |
| A-2        |     |          |         |
| B-1        | 9¾" | 15/16"   | 7 1/8"  |
| B-2        |     |          |         |
| C-1        | 9¾" | 1 13/16" | 7¼"     |
| C-2        |     |          |         |
| D-1        | 9¾" | 1"       | 7 5/16" |
| D-2        |     |          |         |



INSTALLATION DETAIL

| JOINT SETTING TABLE       |                  |           |           |
|---------------------------|------------------|-----------|-----------|
| Ambient Temperature<br>°F | DIMENSION "W"    |           |           |
|                           | Expansion Length |           |           |
|                           | 100'-200'        | 200'-300' | 300'-400' |
| 120°                      | 2 1/8"           | 1 5/16"   | 1/2"      |
| 100°                      | 2 7/8"           | 1 3/4"    | 1 1/8"    |
| 80°                       | 2 11/16"         | 2 3/16"   | 1 11/16"  |
| 60°                       | 3"               | 2 5/8"    | 2 1/4"    |
| 40°                       | 3 5/16"          | 3 1/16"   | 2 13/16"  |
| 20°                       | 3 9/16"          | 3 1/2"    | 3 3/8"    |
| 0°                        | 3 7/8"           | 3 5/16"   | 4"        |

INDIANA DEPARTMENT OF TRANSPORTATION

EXPANSION JOINTS  
CLASS SS

SEPTEMBER 2007

STANDARD DRAWING NO. E 724-BSSJ-04

REGISTERED

No. 9750

STATE OF INDIANA

PROFESSIONAL ENGINEER

RICHARD L. VANCLEAVE

DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave

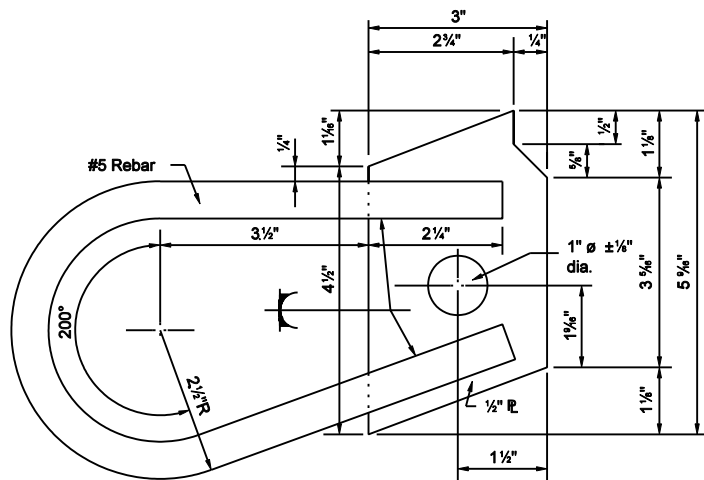
09/04/07

DESIGN STANDARDS ENGINEERDATE

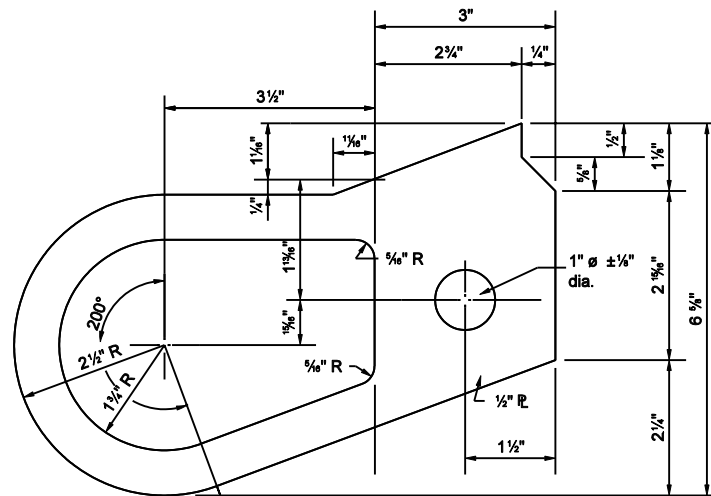
/s/ Mark A. Miller

09/04/07

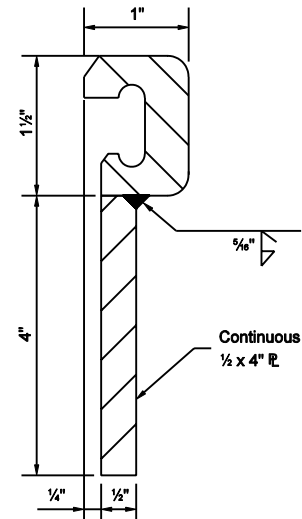
CHIEF HIGHWAY ENGINEERDATE



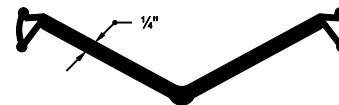
**ANCHOR PLATE ALTERNATE D-1**



**ANCHOR PLATE ALTERNATE D-2**

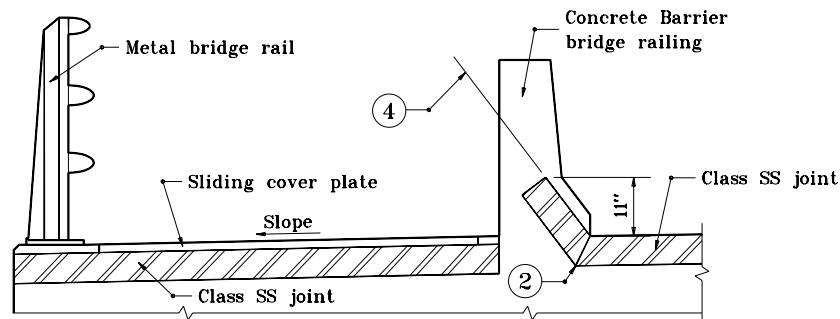


**EXTRUSION & PLATE  
ASSEMBLY DETAIL**

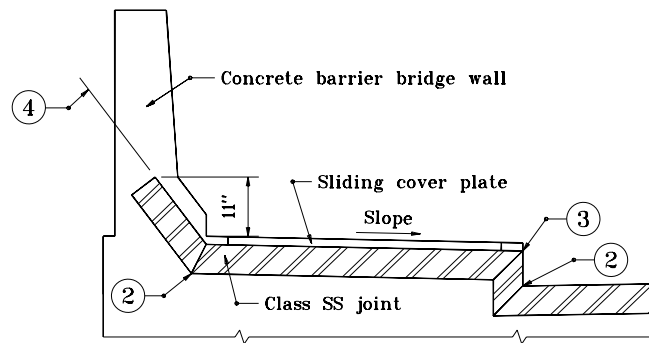


**RJ-400 STRIP  
SEAL GLAND**

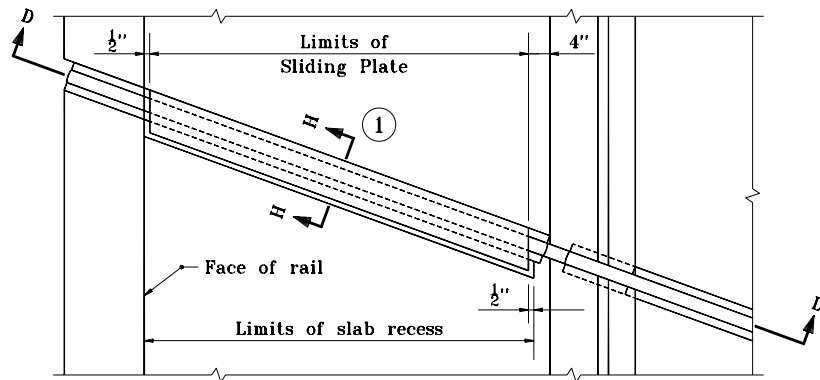
|                                            |                                                       |
|--------------------------------------------|-------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION       |                                                       |
| EXPANSION JOINTS<br>CLASS SS (ALTERNATE D) |                                                       |
| SEPTEMBER 2003                             |                                                       |
| STANDARD DRAWING NO. E 724-BSSJ-04A        |                                                       |
|                                            | /s/ Richard L. VanCleave<br>DESIGN STANDARDS ENGINEER |
|                                            | 9-02-03<br>DATE                                       |
|                                            | /s/ Richard K. Smulzer<br>CHIEF HIGHWAY ENGINEER      |
|                                            | 9-02-03<br>DATE                                       |



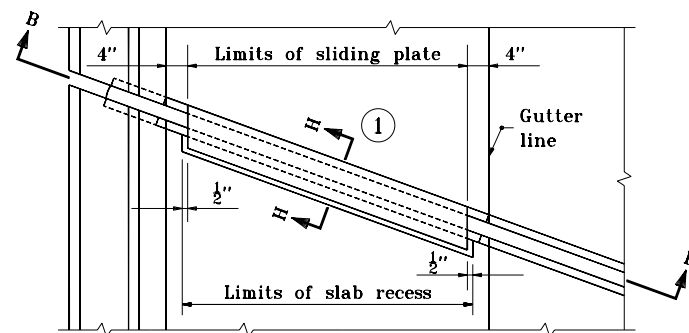
**SECTION D-D**



**SECTION B-B**



**PLAN**



**PLAN**

## **SIDEWALKS**

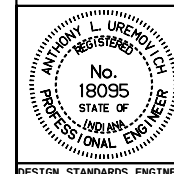
- ① For section H-H see sheet number E 724-BSSJ-08.
- ② The extrusion and plate assemblies with anchors shall be miter cut and shop spliced at this location. A miter cut, vulcanized shop splice will be require in the strip seal at this location.
- ③ The extrusion and plate assemblies with anchors shall be shop prepared for field welding at this location. A miter cut vulcanized shop splice will be require in the strip seal at this location.
- ④ The joint shall be placed parallel to the lower sloped face of the rail with a maximum 3 in. depth to the top of the extrusion.

INDIANA DEPARTMENT OF TRANSPORTATION

## **EXPANSION JOINTS CLASS SS**

SEPTEMBER 1994

STANDARD DRAWING NO. **E 724-BSSJ-05**



DETAILS PLACED IN THIS FORMAT 11-15-99

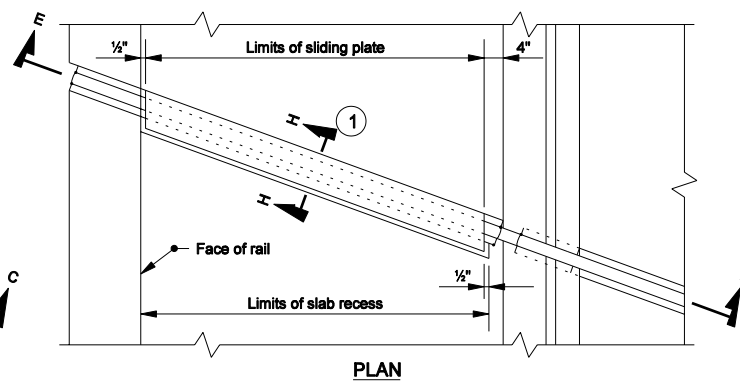
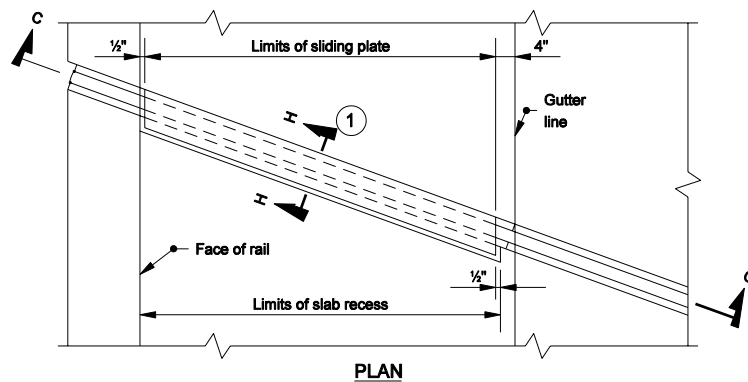
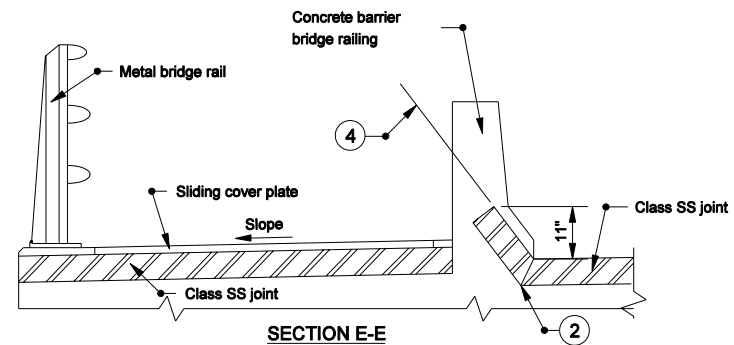
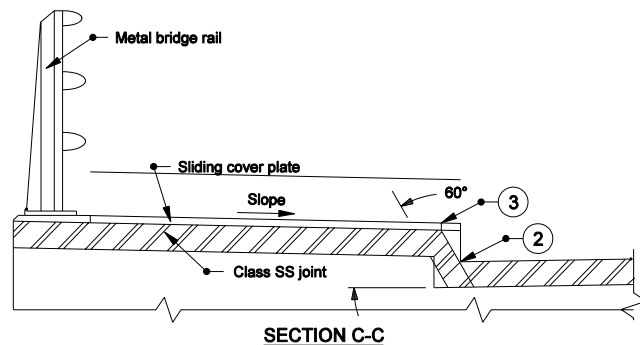
/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

DESIGN STANDARDS ENGINEER

ORIGINALLY APPROVED 9-30-94





### SIDEWALKS

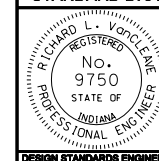
- ① For section H-H see sheet number E 724-BSSJ-08.
- ② The extrusion and plate assemblies with anchors shall be miter cut and shop spliced at this location. A miter cut, vulcanized shop splice will be required in the strip seal at this location.
- ③ The extrusion and plate assemblies with anchors shall be shop prepared for field welding at this location. A miter cut vulcanized shop splice will be required in the strip seal at this location.
- ④ The joint shall be placed parallel to the lower sloped face of the rail with a maximum 3 in. depth to the top of the extrusion.

INDIANA DEPARTMENT OF TRANSPORTATION

### EXPANSION JOINTS CLASS SS

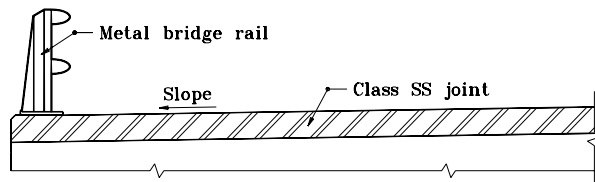
MARCH 2005

STANDARD DRAWING NO. E 724-BSSJ-06

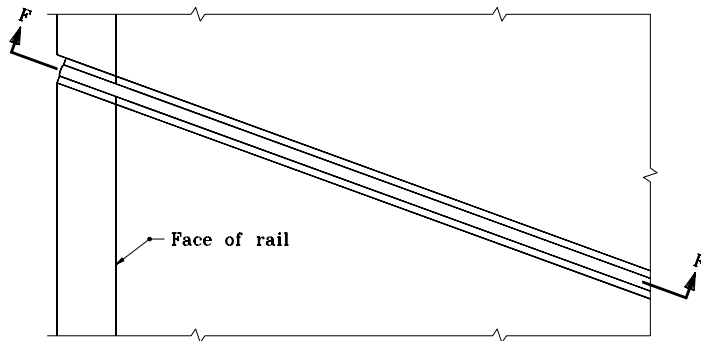


/s/ Richard L. VanCleave 3-01-05  
DESIGN STANDARDS ENGINEER DATE

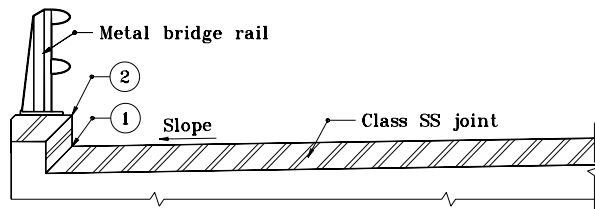
/s/ Richard K. Smutzer 3-01-05  
CHIEF HIGHWAY ENGINEER DATE



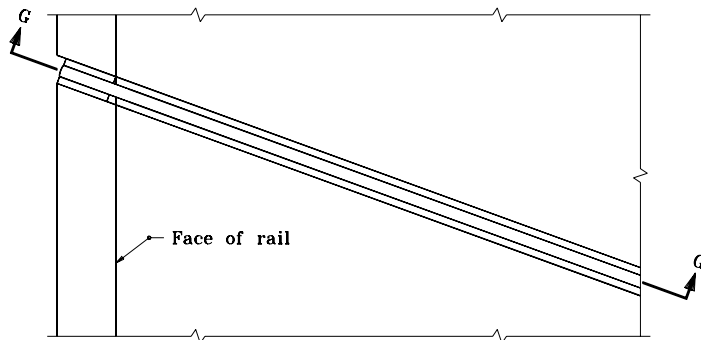
**SECTION F-F**



**PLAN**



**SECTION G-G**



**PLAN**

**METAL RAILING WITHOUT SIDEWALK**

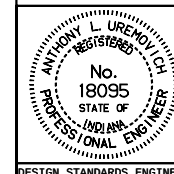
- ① The extrusion and plate assemblies with anchors shall be miter cut and shop spliced at this location. A miter cut, vulcanized shop spliced will be required in the strip seal at the location.
- ② The extrusion and plate assemblies with anchors shall be shop prepared for field welding at this location. A miter cut, vulcanized shop splice will be required in the strip seal at this location.

INDIANA DEPARTMENT OF TRANSPORTATION

**EXPANSION JOINTS CLASS SS**

SEPTEMBER 1994

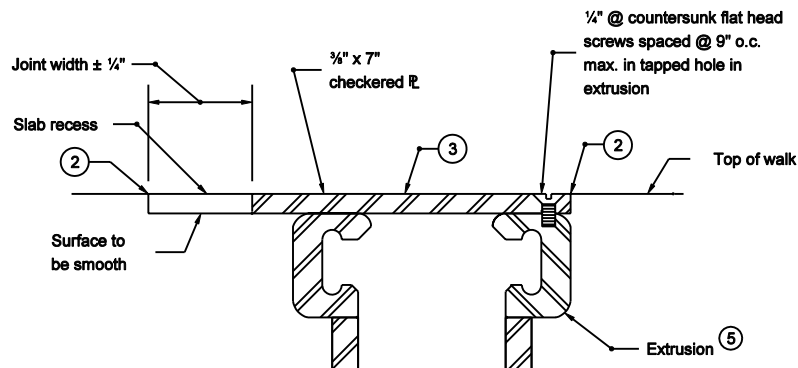
STANDARD DRAWING NO. **E 724-BSSJ-07**



DETAILS PLACED IN THIS FORMAT 11-15-99

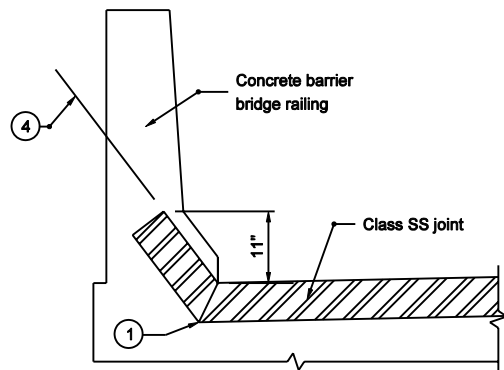
/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE  
ORIGINALLY APPROVED 9-30-94

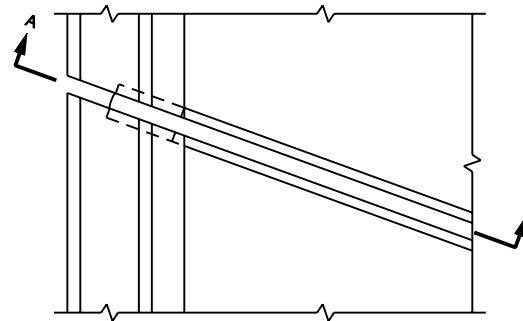


SECTION H-H

SLIDING COVER PLATE DETAIL



SECTION A-A



PLAN

CONCRETE BARRIER BRIDGE RAILING

- ① The extrusion and plate assemblies with anchors shall be miter cut and shop spliced at this location. A miter cut, vulcanized shop splice will be required in the strip seal at this location.
- ② Tool concrete edges to 1/4" to 3/8" radius.
- ③ The length of the sliding cover plate, measured along the centerline of the Class SS Joint, shall be 3/4" shorter at each end than the limits of the recess as shown on these details.
- ④ The joint shall be placed parallel to the lower sloped face of the rail with a maximum 3" depth to the top of the extrusion.
- ⑤ See Standard Drawings E 724-BSSJ-03 and -04 for details.

|                                      |                                                       |
|--------------------------------------|-------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION |                                                       |
| EXPANSION JOINTS<br>CLASS SS         |                                                       |
| SEPTEMBER 2003                       |                                                       |
| STANDARD DRAWING NO. E 724-BSSJ-08   |                                                       |
|                                      | /s/ Richard L. VanCleave<br>DESIGN STANDARDS ENGINEER |
|                                      | 9-02-03<br>DATE                                       |
|                                      | /s/ Richard K. Smutzer<br>CHIEF HIGHWAY ENGINEER      |
|                                      | 9-02-03<br>DATE                                       |

GENERAL NOTES

- 1. Standard Drawing Nos. E 724-BSSJ-05 through 09 shall be used in conjunction with Standard Drawing Nos. E 724-BSSJ-01 through 04.
- 2. The details shown on Standard Drawing Nos. E 724-BSSJ-05 through 09 are the only approved methods of placing Class SS Joints in curbs, sidewalks, concrete bridge railing and under metal bridge railing.
- 3. The locations of the anchor plates in sidewalks and in the concrete barrier bridge rail shall be as shown on the approved shop drawings but in no case shall the spacing exceed 9 in.

INDIANA DEPARTMENT OF TRANSPORTATION

EXPANSION JOINTS CLASS SS

SEPTEMBER 1994

STANDARD DRAWING NO. E 724-BSSJ-09



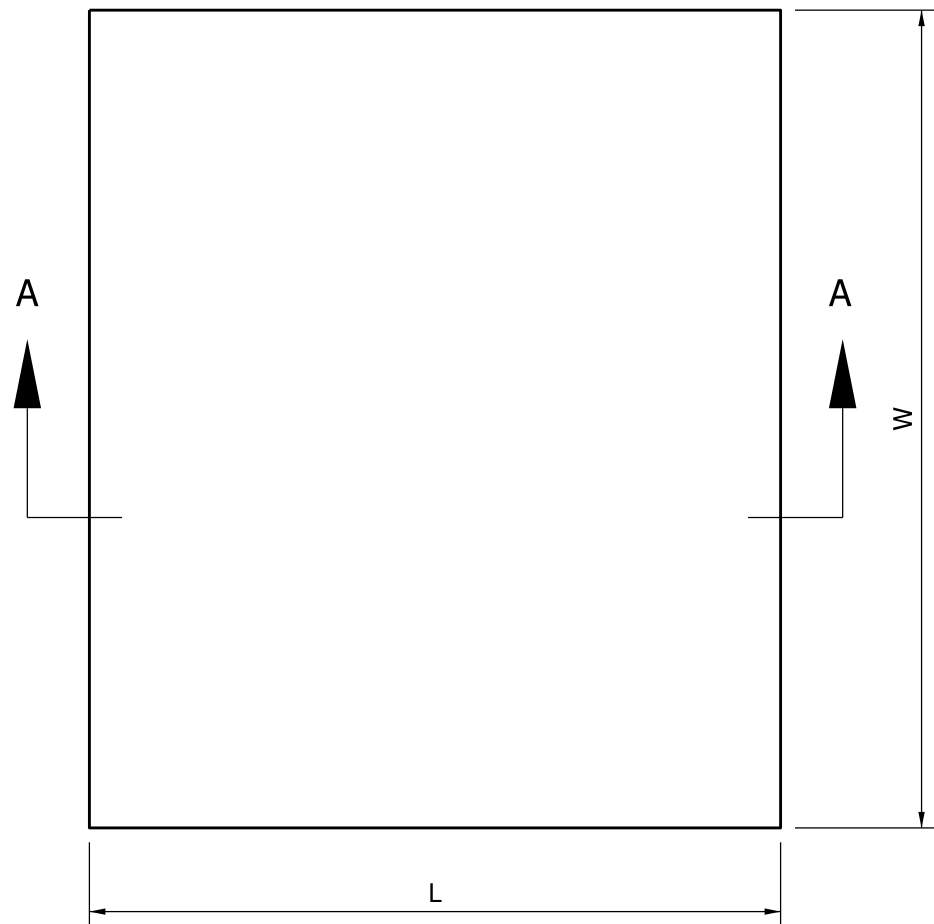
DESIGN STANDARDS ENGINEER

DETAILS PLACED IN THIS FORMAT 11-15-99

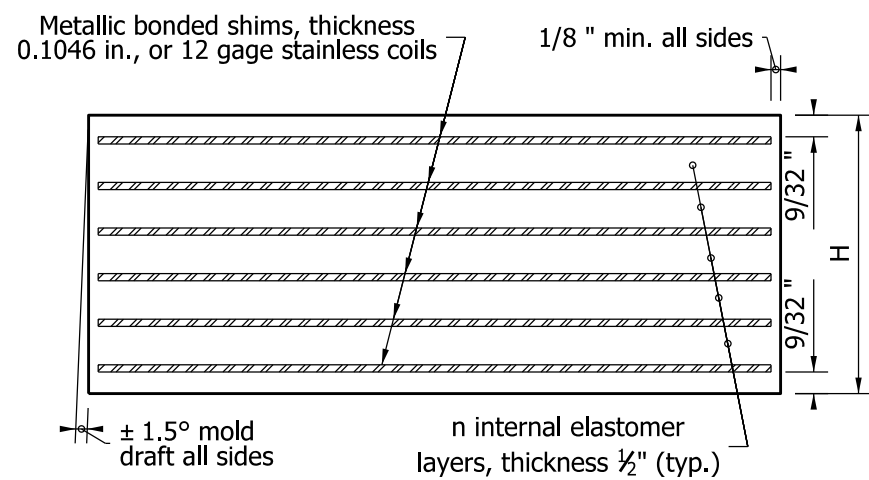
/s/ Anthony L. Uremovich 11-15-99  
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99  
CHIEF HIGHWAY ENGINEER DATE

ORIGINALLY APPROVED 9-30-94



ELASTOMERIC BEARING PAD  
PLAN



SECTION A - A

NOTES:

1. The rectangular Elastomeric Bearing Pad shall be placed with L dimension parallel to longitudinal bridge axis.
2.  $h_{rt}$  is defined as the summation of all internal elastomer thickness plus the two external layers thickness.

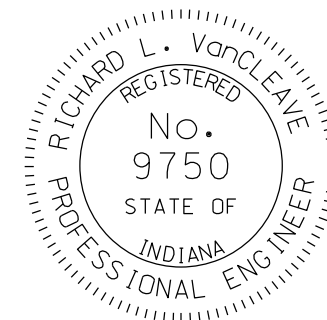
TABLE OF DIMENSIONS

| Bearing Designation | Bearing Width W | Bearing Length L | Number of Internal Elastomer Layers n | $h_{rt}$ | Number of Steel Shims $n_s$ | Bearing Total Thickness H |
|---------------------|-----------------|------------------|---------------------------------------|----------|-----------------------------|---------------------------|
| TYPE 1              | 14"             | 10 1/2"          | 3                                     | 2 1/16"  | 4                           | 2 15/32"                  |
| TYPE 2              | 14"             | 11 1/2"          | 4                                     | 2 9/16"  | 5                           | 3 3/32"                   |
| TYPE 3              | 18"             | 11"              | 4                                     | 2 9/16"  | 5                           | 3 3/32"                   |
| TYPE 4              | 24"             | 12"              | 5                                     | 3 1/16"  | 6                           | 3 11/16"                  |
| TYPE 5A             | 22"             | 11"              | 4                                     | 2 9/16"  | 5                           | 3 3/32"                   |
| TYPE 6A             | 22"             | 10"              | 4                                     | 2 9/16"  | 5                           | 3 3/32"                   |
| TYPE 7A             | 22"             | 9"               | 3                                     | 2 1/16"  | 4                           | 2 15/32"                  |
| TYPE 5B             | 12"             | 12"              | 4                                     | 2 9/16"  | 5                           | 3 3/32"                   |
| TYPE 6B             | 12"             | 11"              | 4                                     | 2 9/16"  | 5                           | 3 3/32"                   |
| TYPE 7B             | 12"             | 10"              | 3                                     | 2 1/16"  | 4                           | 2 15/32"                  |

INDIANA DEPARTMENT OF TRANSPORTATION

BRIDGE ELASTOMERIC BEARING PADS  
TYPE 1 to 7  
FOR PRESTRESSED I-BEAMS & BOX BEAMS  
SEPTEMBER 2009

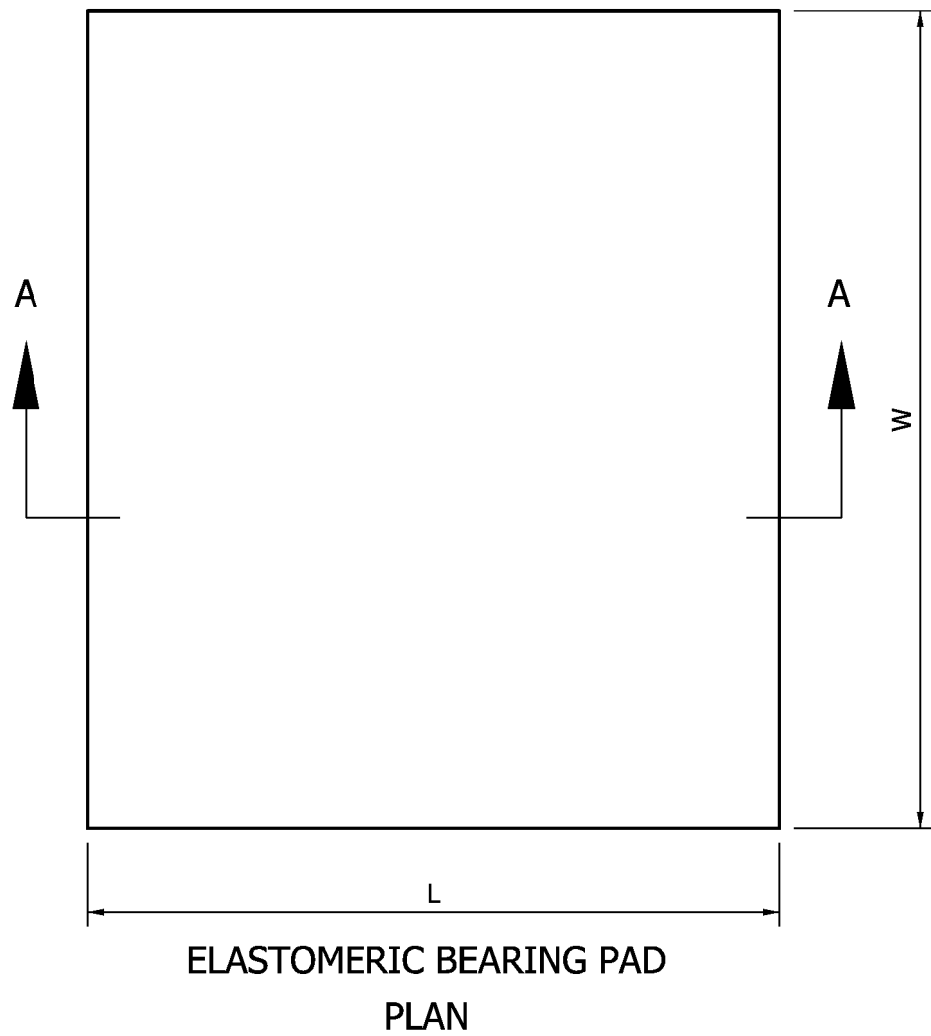
STANDARD DRAWING NO. E 726-BEBP-01



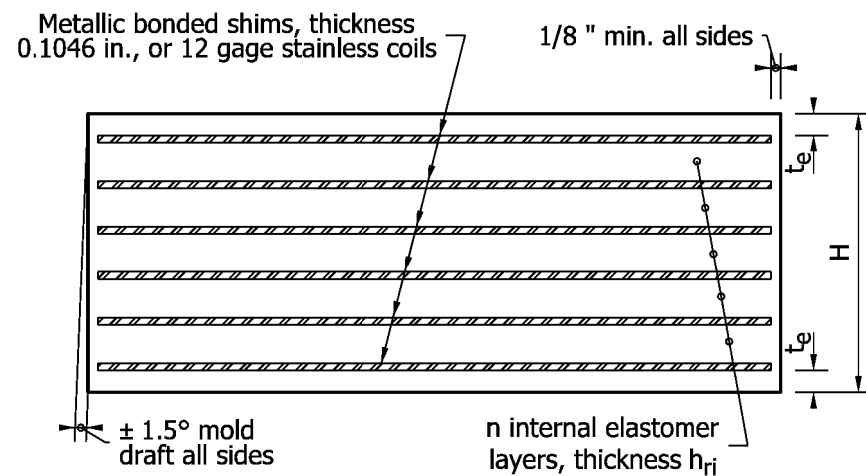
DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave 09/01/09  
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller 09/01/09  
CHIEF HIGHWAY ENGINEER DATE



ELASTOMERIC BEARING PAD  
PLAN



SECTION A - A

- NOTES:
- 1. The rectangular Elastomeric Bearing Pad shall be placed with L dimension parallel to longitudinal bridge axis.
  - 2.  $h_{rt}$  is defined as the summation of all internal elastomer thickness plus the two external layers thickness.

TABLE OF DIMENSIONS

| Bearing Designation | Bearing Width W | Bearing Length L | Internal Elastomer Thickness $h_{ri}$ | Number of Internal Elastomer Layers n | External Elastomer Thickness $t_e$ | $h_{rt}$           | Number of Steel Shims $n_s$ | Bearing Total Thickness H |
|---------------------|-----------------|------------------|---------------------------------------|---------------------------------------|------------------------------------|--------------------|-----------------------------|---------------------------|
| T1                  | 23"             | 12"              | $\frac{1}{2}"$                        | 5                                     | $\frac{9}{32}"$                    | $3 \frac{1}{16}"$  | 6                           | $3 \frac{1}{16}"$         |
| T2                  | 23"             | 14"              | $\frac{1}{2}"$                        | 6                                     | $\frac{9}{32}"$                    | $3 \frac{9}{16}"$  | 7                           | $4 \frac{5}{16}"$         |
| T3                  | 23"             | 17"              | $\frac{19}{32}"$                      | 7                                     | $\frac{5}{16}"$                    | $4 \frac{25}{32}"$ | 8                           | $5 \frac{5}{8}"$          |
| T4                  | 24"             | 19"              | $\frac{19}{32}"$                      | 8                                     | $\frac{5}{16}"$                    | $5 \frac{3}{8}"$   | 9                           | $6 \frac{5}{16}"$         |

INDIANA DEPARTMENT OF TRANSPORTATION

BRIDGE ELASTOMERIC BEARING PADS  
TYPE T-1 to T-4  
FOR PRESTRESSED BULB-TEE BEAMS  
SEPTEMBER 2009

STANDARD DRAWING NO. E 726-BEBP-02

REGISTERED

No. 9750

STATE OF INDIANA

PROFESSIONAL ENGINEER

DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave

DESIGN STANDARDS ENGINEER

09/01/09

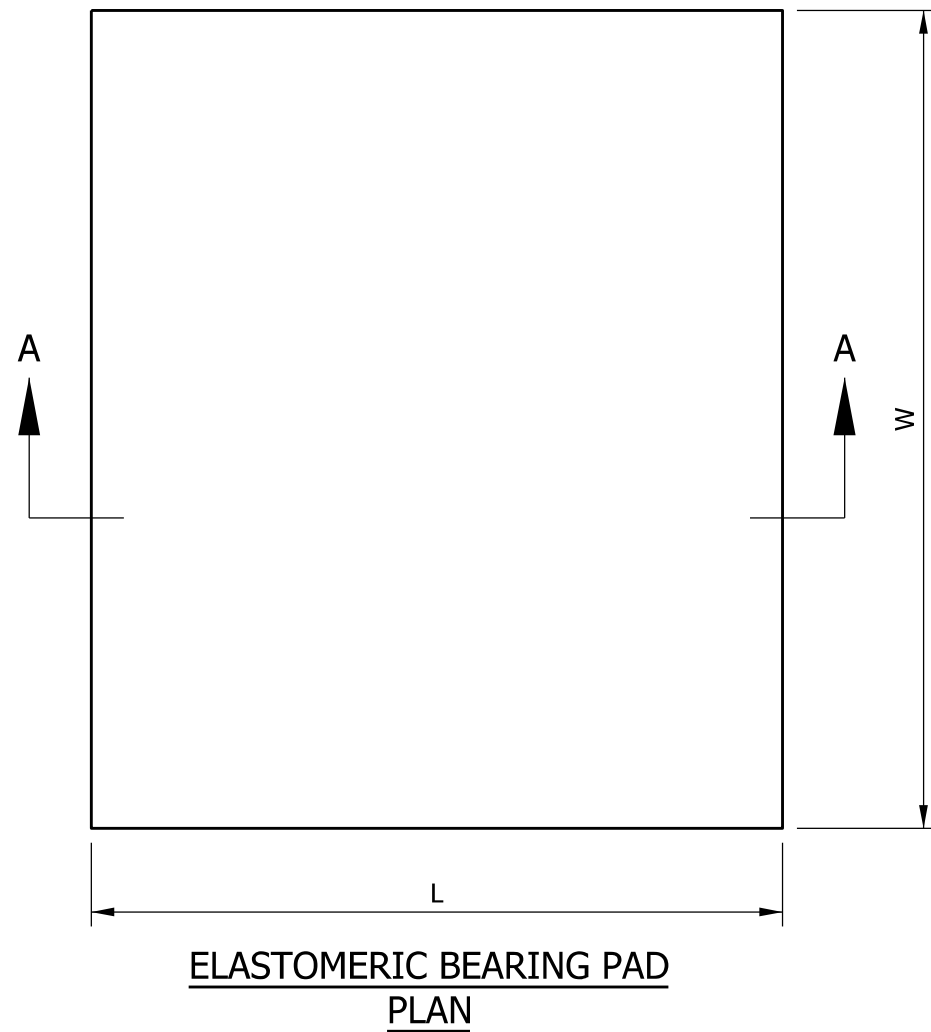
DATE

/s/ Mark A. Miller

CHIEF HIGHWAY ENGINEER

09/01/09

DATE

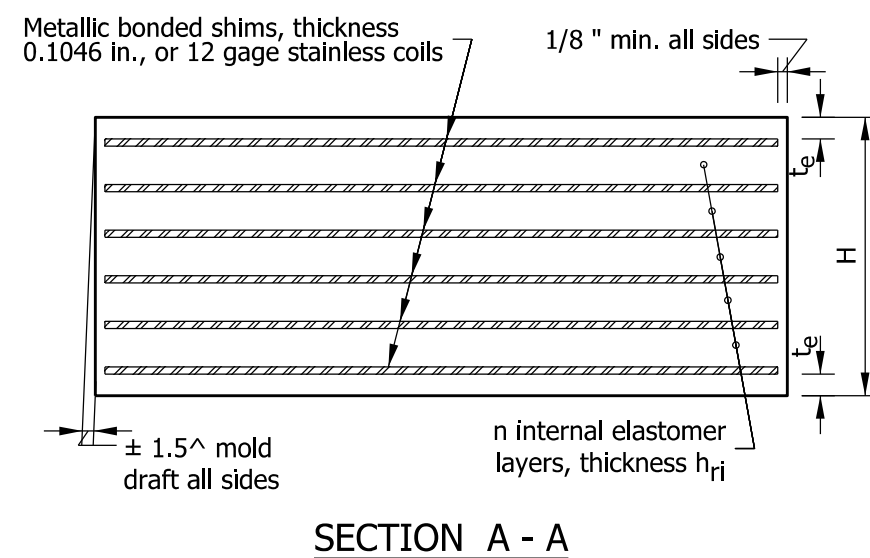


**NOTES:**

1. The rectangular Elastomeric Bearing Pad shall be placed with  $L$  dimension parallel to longitudinal bridge axis.
2.  $h_{rt}$  is defined as the summation of all internal elastomer thickness plus the two external layers thickness.
3. The Contractor shall check that the bearing seat is level. Grinding may be required to obtain a level seat.
4. The bridge seat shall be finished level at the time concrete is placed. Finished concrete shall be ground if necessary to ensure full and level contact between the seat and the bearing pads when the beams are set.

**TABLE OF DIMENSIONS**

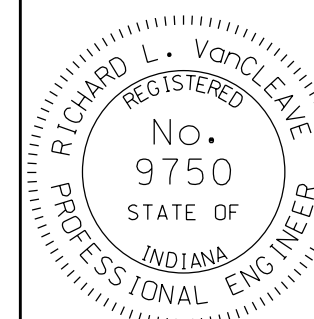
| Bearing Designation | Bearing Width $W$ | Bearing Length $L$ | Internal Elastomer Thickness $h_{ri}$ | Number of Internal Elastomer Layers $n$ | External Elastomer Thickness $t_e$ | $h_{rt}$ | Number of Steel Shims $n_s$ | Bearing Total Thickness $H$ |
|---------------------|-------------------|--------------------|---------------------------------------|-----------------------------------------|------------------------------------|----------|-----------------------------|-----------------------------|
| TH1                 | 36"               | 12"                | 1/2"                                  | 5                                       | 9/32"                              | 3 1/16"  | 6                           | 3 11/16"                    |
| TH2                 | 36"               | 14"                | 1/2"                                  | 6                                       | 9/32"                              | 3 9/16"  | 7                           | 4 5/16"                     |
| TH3                 | 36"               | 17"                | 19/32"                                | 7                                       | 5/16"                              | 4 25/32" | 8                           | 5 5/8"                      |
| TH4                 | 36"               | 19"                | 19/32"                                | 8                                       | 5/16"                              | 5 3/8"   | 9                           | 6 5/16"                     |



**INDIANA DEPARTMENT OF TRANSPORTATION**

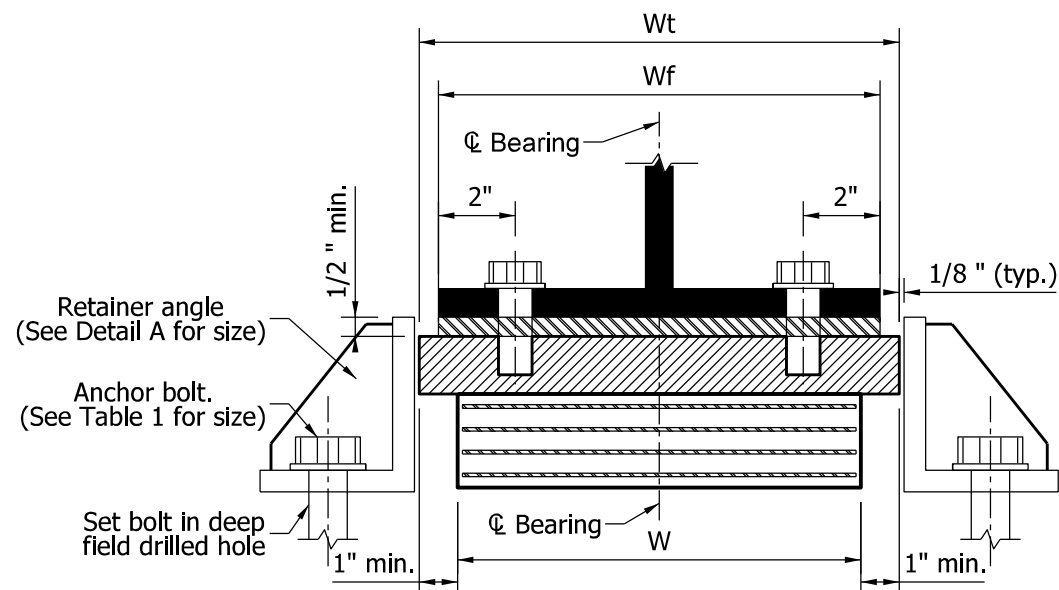
**BRIDGE ELASTOMERIC BEARING PADS  
TYPE TH1 - TH4 FOR PRESTRESSED  
WIDE-FLANGE BULB-TEE BEAMS  
SEPTEMBER 2012**

**STANDARD DRAWING NO. E 726-BEBP-03**

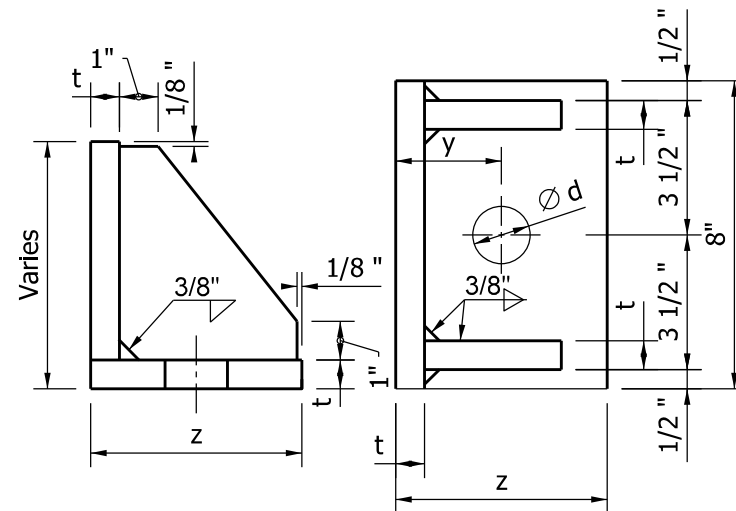


*/s/ Richard L. VanCleave* 09/04/12  
SUPERVISOR, ROADWAY STANDARDS DATE

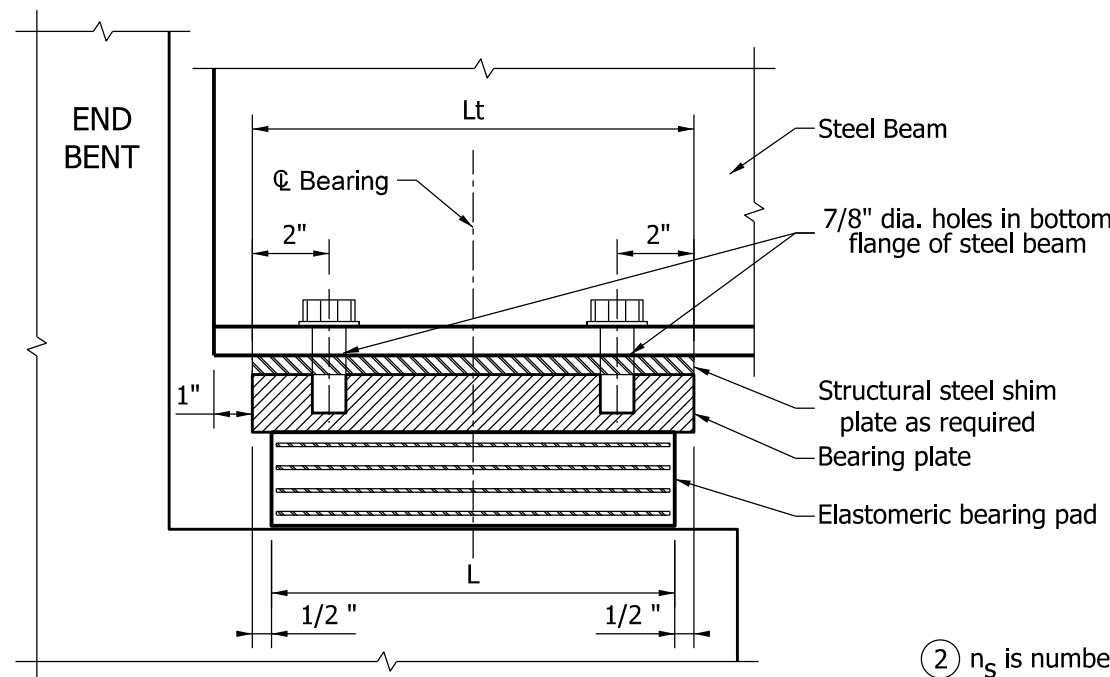
*/s/ Mark A. Miller* 09/04/12  
CHIEF ENGINEER DATE



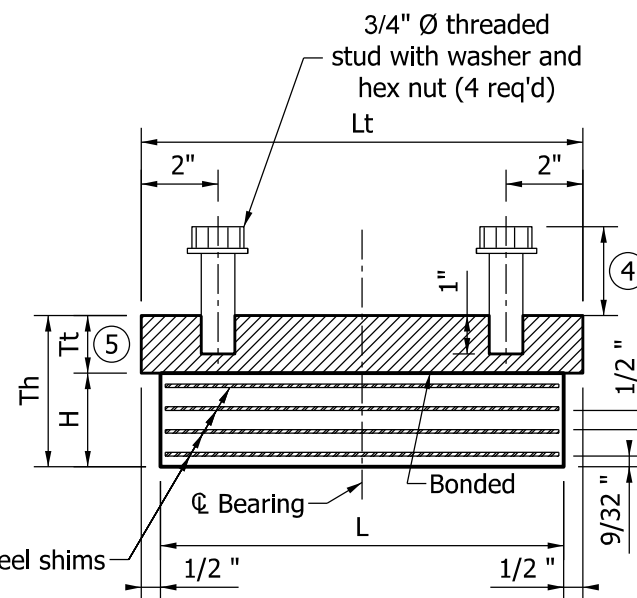
**CROSS SECTION THROUGH ASSEMBLY**



**DETAIL A ③**



**LONGITUDINAL SECTION THROUGH ASSEMBLY**



**BEARING ASSEMBLY**

②  $n_s$  is number of steel shims

**NOTES:**

- The bearing plate size shall be calculated as follows:  
 $L_t = L + 1"$      $W_t = W_f + 2"$     or     $W_t = W + 2"$  whichever is greater.
- The shim thickness is 0.1046 in., which corresponds to 12 gage stainless coils.
- Equivalent rolled angle shape with stiffeners may be used in lieu of welded plates.
- Minimum dimension required is  $1 \frac{1}{2}" + \text{flange thickness} + \frac{1}{3}"$  (for shim plate).
- Minimum thickness  $1 \frac{1}{2}"$
- See standard drawing E 726-BEBP-05 for Table of Dimensions.

**TABLE 1**

| ANCHOR BOLT SIZE |           |              |
|------------------|-----------|--------------|
| BEARING SIZE     |           | BOLT SIZE    |
| S1               | 11" x 8"  | 1" x 12"     |
| S2               | 12" x 9"  | 1" x 12"     |
| S3               | 13" x 10" | 1" x 12"     |
| S4               | 15" x 11" | 1 1/4" x 15" |
| S5               | 16" x 12" | 1 1/4" x 15" |
| S6               | 20" x 13" | 1 1/2" x 18" |
| S7               | 20" x 15" | 1 1/2" x 18" |

**TABLE 2**

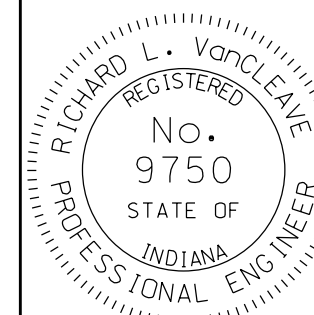
| BOLT DIA. | y      | z      | t    | d      |
|-----------|--------|--------|------|--------|
| 1"        | 2 1/8" | 4"     | 1/2" | 1 1/8" |
| 1 1/4"    | 2 1/4" | 4 3/4" | 1/2" | 1 3/8" |
| 1 1/2"    | 2 3/4" | 5 1/2" | 3/4" | 1 5/8" |

**INDIANA DEPARTMENT OF TRANSPORTATION**

**BRIDGE ELASTOMERIC BEARING PADS  
TYPE S - FOR STEEL BEAMS**

**SEPTEMBER 2012**

**STANDARD DRAWING NO. E 726-BEBP-04**



/s/ *Richard L. VanCleave* 09/04/12

SUPERVISOR, ROADWAY STANDARDS DATE

/s/ *Mark A. Miller* 09/04/12

CHIEF ENGINEER DATE



NOTES

- ①  $h_{rt}$  is defined as the summation of all internal elastomer thicknesses plus the external elastomer thicknesses.
2. See Standard Drawing E 726-BEBP-04 for Type S bearing assembly details.

TABLE OF DIMENSIONS - TYPE S BEARINGS FOR STEEL BEAMS

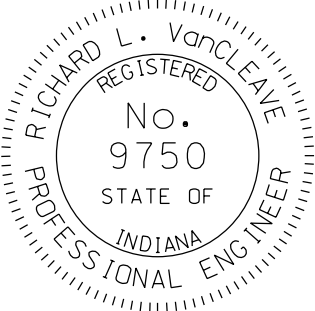
| Bearing Designation | Bearing Width W | Bearing Length L | Number of Internal Elastomer Layers n | $h_{rt}$ ① | Number of Steel Shims ns | Bearing Total Thickness H |
|---------------------|-----------------|------------------|---------------------------------------|------------|--------------------------|---------------------------|
| S1-A                | 11"             | 8"               | 2                                     | 1 9/16"    | 3                        | 1 27/32"                  |
| S1-B                | 11"             | 8"               | 3                                     | 2 1/16"    | 4                        | 2 7/16"                   |
| S2-A                | 12"             | 9"               | 2                                     | 1 9/16"    | 3                        | 1 27/32"                  |
| S2-B                | 12"             | 9"               | 3                                     | 2 1/16"    | 4                        | 2 7/16"                   |
| S3-A                | 13"             | 10"              | 3                                     | 2 1/16"    | 4                        | 2 7/16"                   |
| S3-B                | 13"             | 10"              | 4                                     | 2 9/16"    | 5                        | 3 1/32"                   |
| S4-A                | 15"             | 11"              | 4                                     | 2 9/16"    | 5                        | 3 1/32"                   |
| S4-B                | 15"             | 11"              | 5                                     | 3 1/16"    | 6                        | 3 5/8"                    |
| S5-A                | 16"             | 12"              | 4                                     | 2 9/16"    | 5                        | 3 1/32"                   |
| S5-B                | 16"             | 12"              | 5                                     | 3 1/16"    | 6                        | 3 5/8"                    |
| S6-A                | 20"             | 13"              | 5                                     | 3 1/16"    | 6                        | 3 5/8"                    |
| S6-B                | 20"             | 13"              | 6                                     | 3 9/16"    | 7                        | 4 7/32"                   |
| S7-A                | 20"             | 15"              | 6                                     | 3 9/16"    | 7                        | 4 7/32"                   |
| S7-B                | 20"             | 15"              | 7                                     | 4 1/16"    | 8                        | 4 13/16"                  |

INDIANA DEPARTMENT OF TRANSPORTATION

ELASTOMERIC BEARING PADS  
TYPE S

SEPTEMBER 2012

STANDARD DRAWING NO. E 726-BEBP-05



/s/ Richard L. VanCleave09/04/12

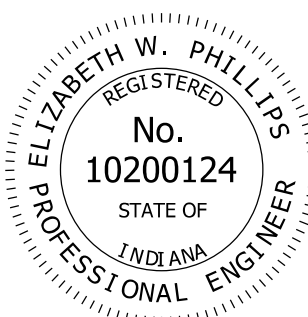
SUPERVISOR, ROADWAY STANDARDSDATE

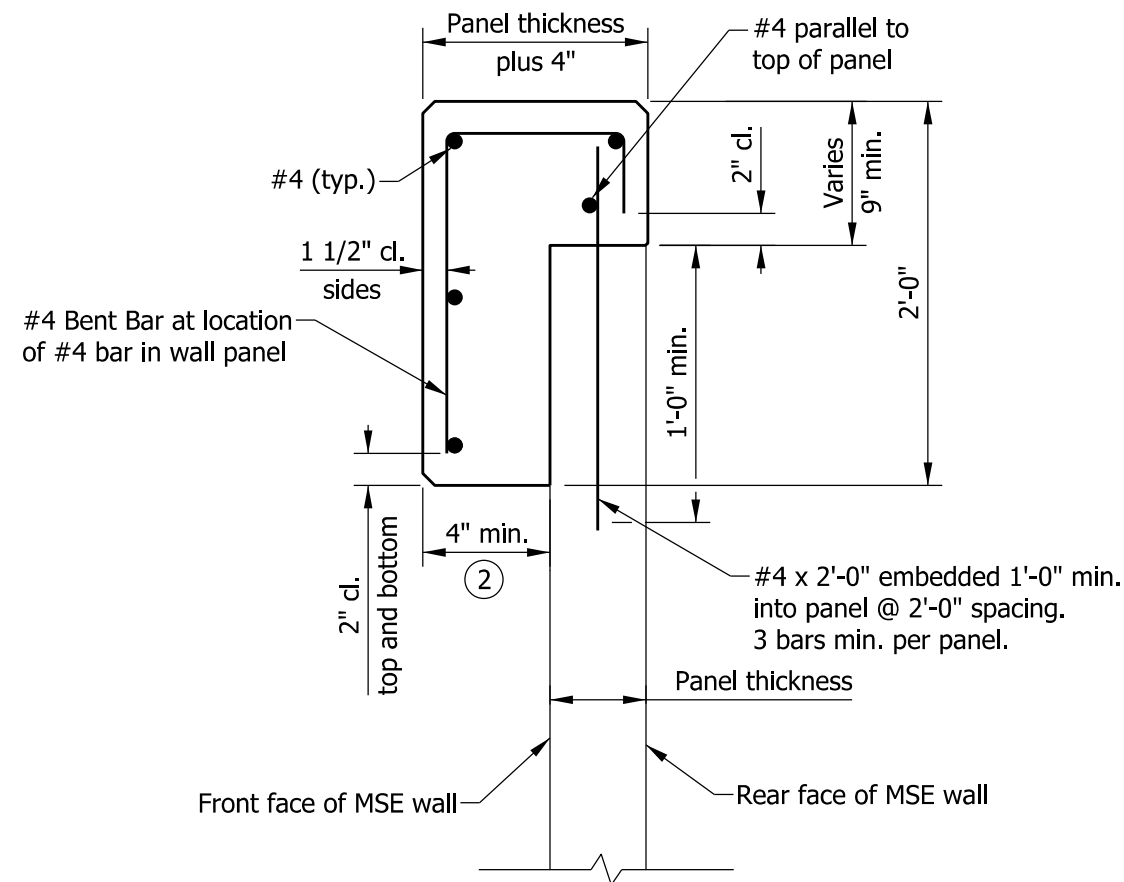
/s/ Mark A. Miller09/04/12

CHIEF ENGINEERDATE



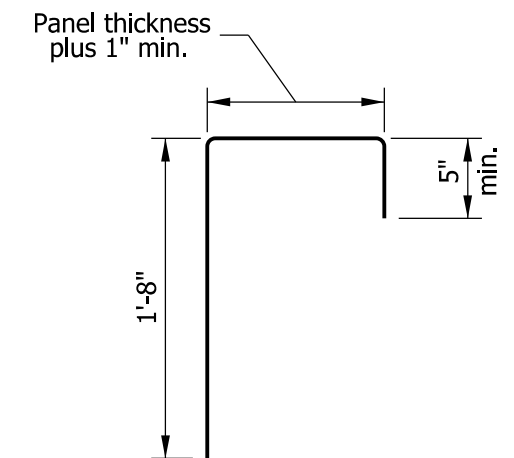
1. Precast coping unit length shall be 10'-0".
2. Reinforcing bar size, length, and spacing shall be determined by the manufacturer.
3. All chamfered edges shall be 3/4".
4. See Standard Drawing E 703-BRST-01 for reinforcing-bar bending details and notes.
5. Leveling concrete is required when adjacent top panels do not provide a continuous surface on which to place the precast coping, e.g., stepped panels or rectangular panels on a sloping grade. Leveling concrete is not required when custom top panels provide a surface parallel to the finished grade.
6. Use only when leveling concrete is required.

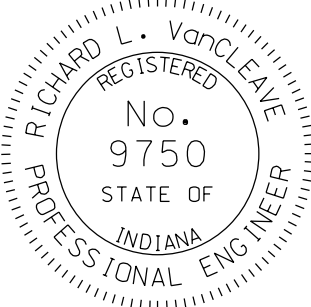
|                                                                                       |                                                                                                                                                                                                                                                                                               |                                  |                 |                           |      |                           |                 |                |      |
|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------|---------------------------|------|---------------------------|-----------------|----------------|------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                                                                                                                                               |                                  |                 |                           |      |                           |                 |                |      |
| <p>MSE WALL</p> <p>PRECAST CONCRETE COPING</p> <p>SEPTEMBER 2013</p>                  |                                                                                                                                                                                                                                                                                               |                                  |                 |                           |      |                           |                 |                |      |
| STANDARD DRAWING NO.      E 731-MSEW-01                                               |                                                                                                                                                                                                                                                                                               |                                  |                 |                           |      |                           |                 |                |      |
|  | <table border="0"> <tr> <td><i>/s/ Elizabeth W. Phillips</i></td> <td><i>02/22/13</i></td> </tr> <tr> <td>DESIGN STANDARDS ENGINEER</td> <td>DATE</td> </tr> <tr> <td><i>/s/ Mark A. Miller</i></td> <td><i>03/27/13</i></td> </tr> <tr> <td>CHIEF ENGINEER</td> <td>DATE</td> </tr> </table> | <i>/s/ Elizabeth W. Phillips</i> | <i>02/22/13</i> | DESIGN STANDARDS ENGINEER | DATE | <i>/s/ Mark A. Miller</i> | <i>03/27/13</i> | CHIEF ENGINEER | DATE |
| <i>/s/ Elizabeth W. Phillips</i>                                                      | <i>02/22/13</i>                                                                                                                                                                                                                                                                               |                                  |                 |                           |      |                           |                 |                |      |
| DESIGN STANDARDS ENGINEER                                                             | DATE                                                                                                                                                                                                                                                                                          |                                  |                 |                           |      |                           |                 |                |      |
| <i>/s/ Mark A. Miller</i>                                                             | <i>03/27/13</i>                                                                                                                                                                                                                                                                               |                                  |                 |                           |      |                           |                 |                |      |
| CHIEF ENGINEER                                                                        | DATE                                                                                                                                                                                                                                                                                          |                                  |                 |                           |      |                           |                 |                |      |

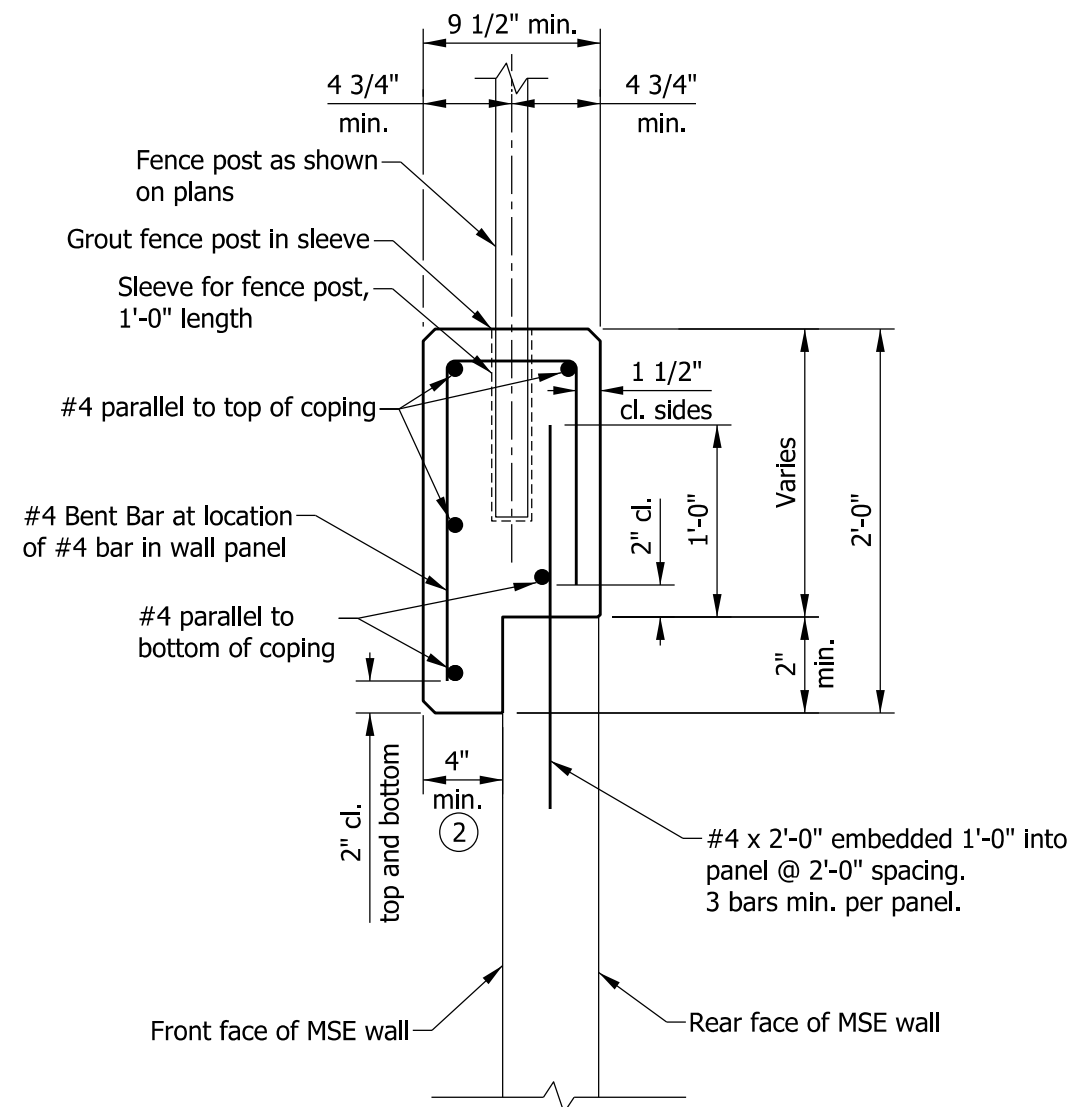


- ## NOTES

1. Coping joints shall coincide approximately with the panel joints. Reinforcing bars' ends shall be 2" short of near side of each joint.
- ② The front face of a cast-in-place coping shall match the front face of a precast coping where used in conjunction.
3. All chamfered edges shall be 3/4".
4. See Standard Drawing E 703-BRST-01 for reinforcing-bar bending details and notes.

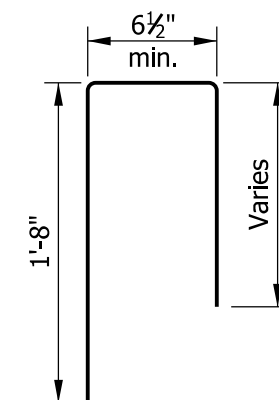


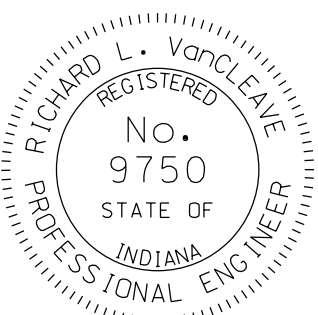
|                                                                                       |                                                                                                                                                                               |
|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                               |
| <p>MSE WALL</p> <p>CAST-IN-PLACE CONCRETE COPING</p> <p>SEPTEMBER 2012</p>            |                                                                                                                                                                               |
| STANDARD DRAWING NO. E 731-MSEW-02                                                    |                                                                                                                                                                               |
|  | <p><i>/s/ Richard L. VanCleave</i> 09/04/12</p> <hr/> <p>SUPERVISOR, ROADWAY STANDARDS DATE</p><br><p><i>/s/ Mark A. Miller</i> 09/04/12</p> <hr/> <p>CHIEF ENGINEER DATE</p> |



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|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INDIANA DEPARTMENT OF TRANSPORTATION                                                  |                                                                                                                                                                                                                        |
| MSE WALL<br>CAST-IN-PLACE CONCRETE COPING<br>WITH PEDESTRIAN FENCE<br>SEPTEMBER 2012  |                                                                                                                                                                                                                        |
| STANDARD DRAWING NO.      E 731-MSEW-03                                               |                                                                                                                                                                                                                        |
|  | <div> <div> /s/ <i>Richard L. VanCleave</i> 09/04/12 </div> <div> SUPERVISOR, ROADWAY STANDARDS DATE </div> </div> <hr/> <div> <div> /s/ <i>Mark A. Miller</i> 09/04/12 </div> <div> CHIEF ENGINEER DATE </div> </div> |