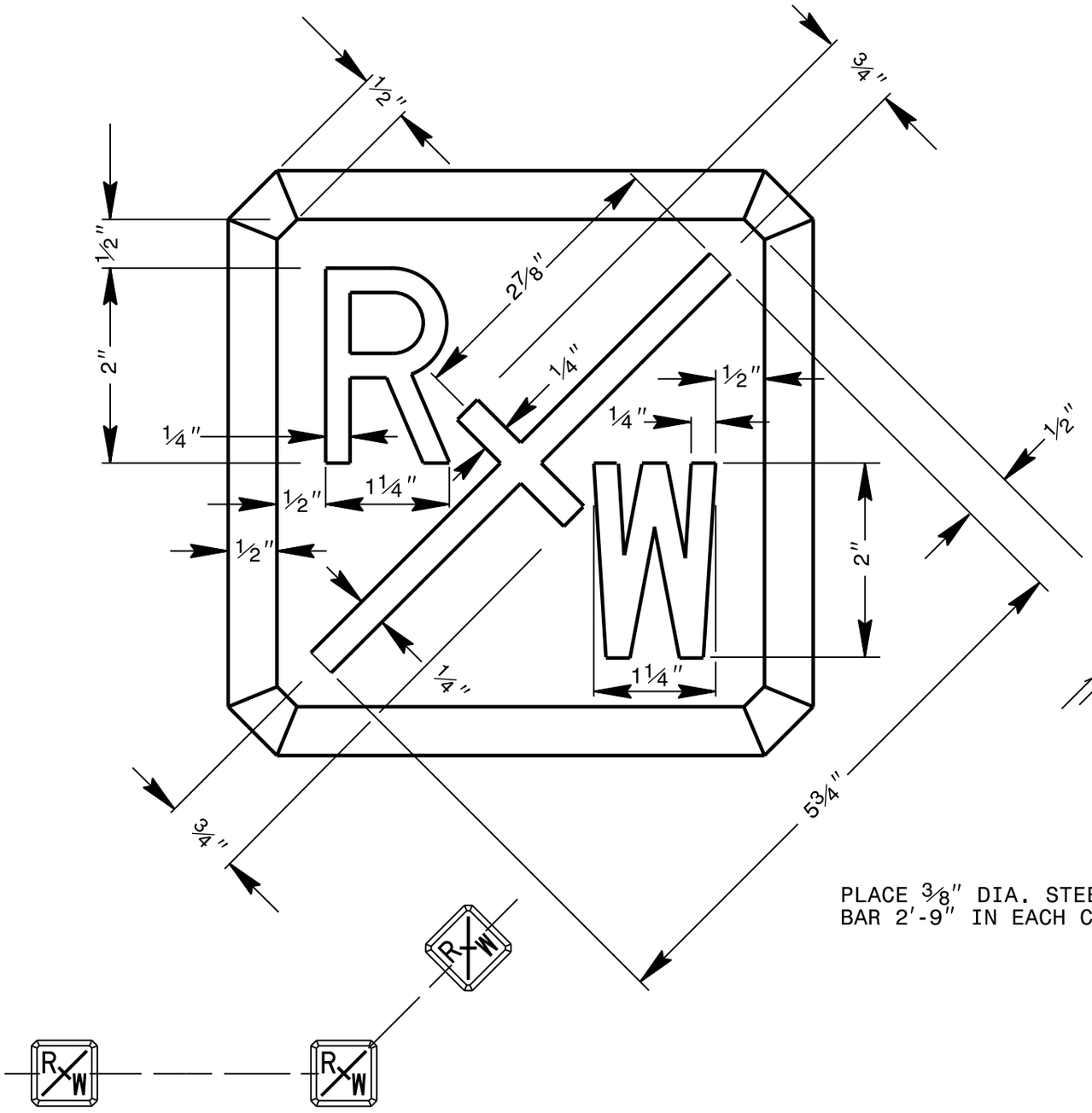
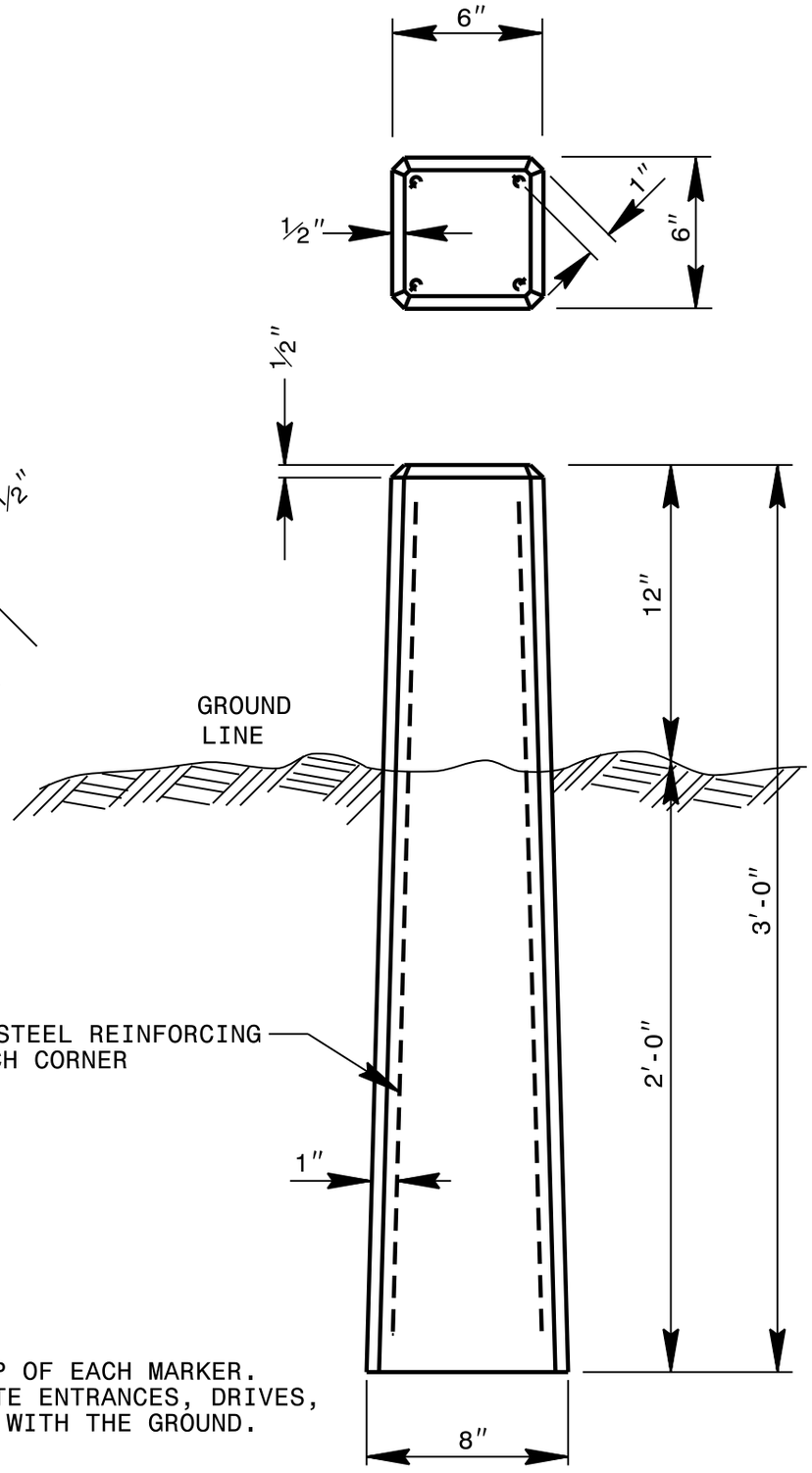



SET RIGHT-OF-WAY MARKER SO THAT THE RIGHT-OF-WAY LINE PASSES THROUGH THE INTERSECTION OF THE 'X' ON THE TOP OF THE MARKER.

NOTES:
INDENT THE LETTERS 'R/W' IN THE TOP OF EACH MARKER.
IN LOCATIONS SUCH AS LAWNS, PRIVATE ENTRANCES, DRIVES, ETC. CONSTRUCT 'R/W' MARKER FLUSH WITH THE GROUND.




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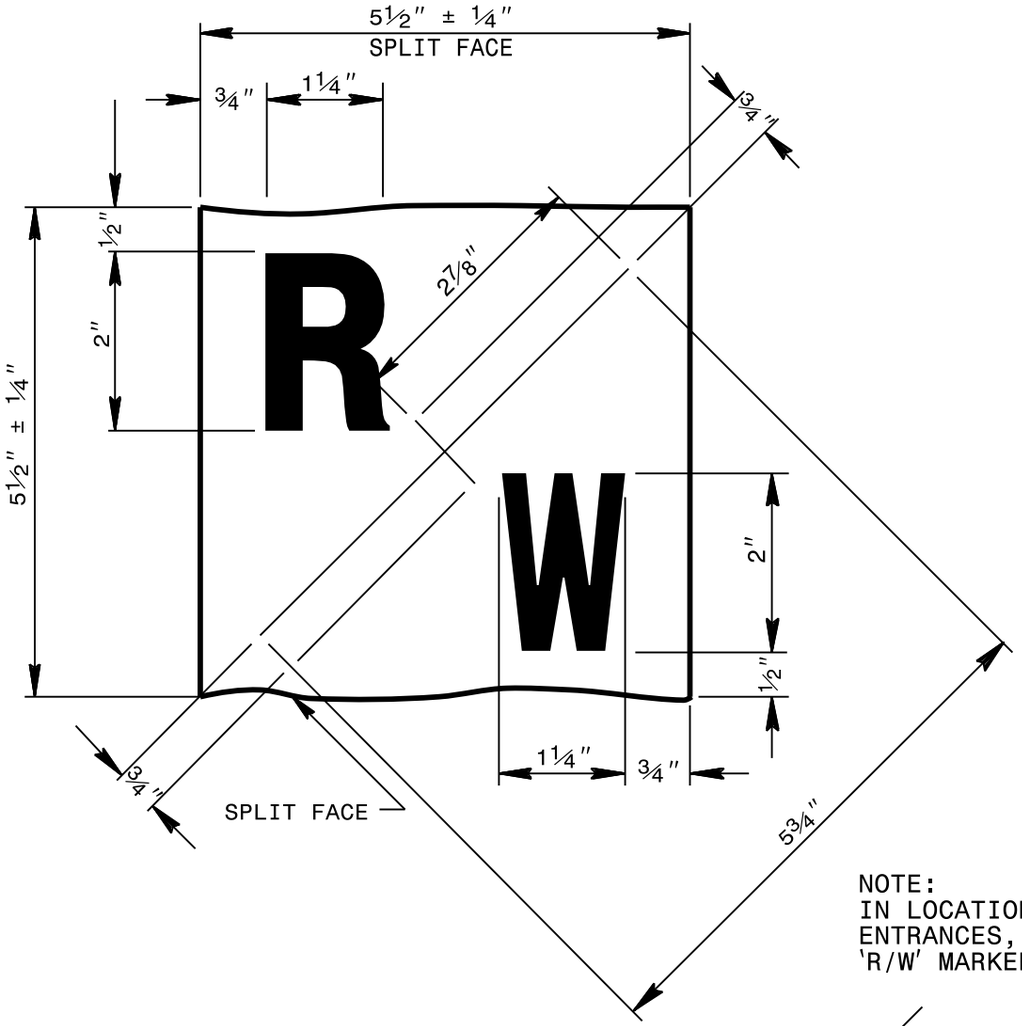
1-24

ROADWAY STANDARD DRAWING FOR

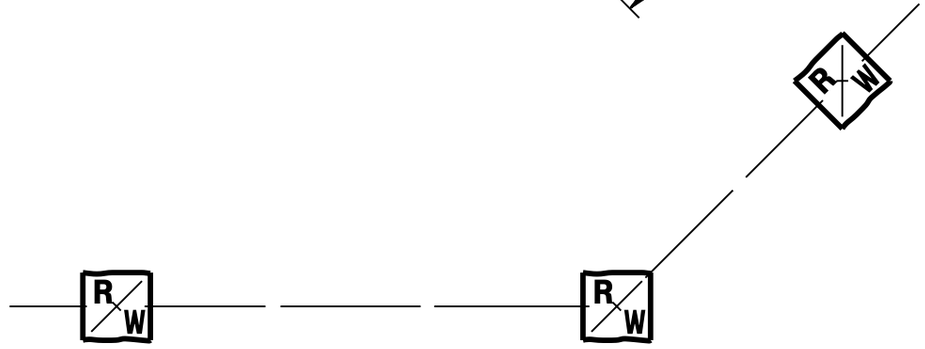
# CONCRETE RIGHT-OF-WAY MARKER

SHEET 1 OF 1

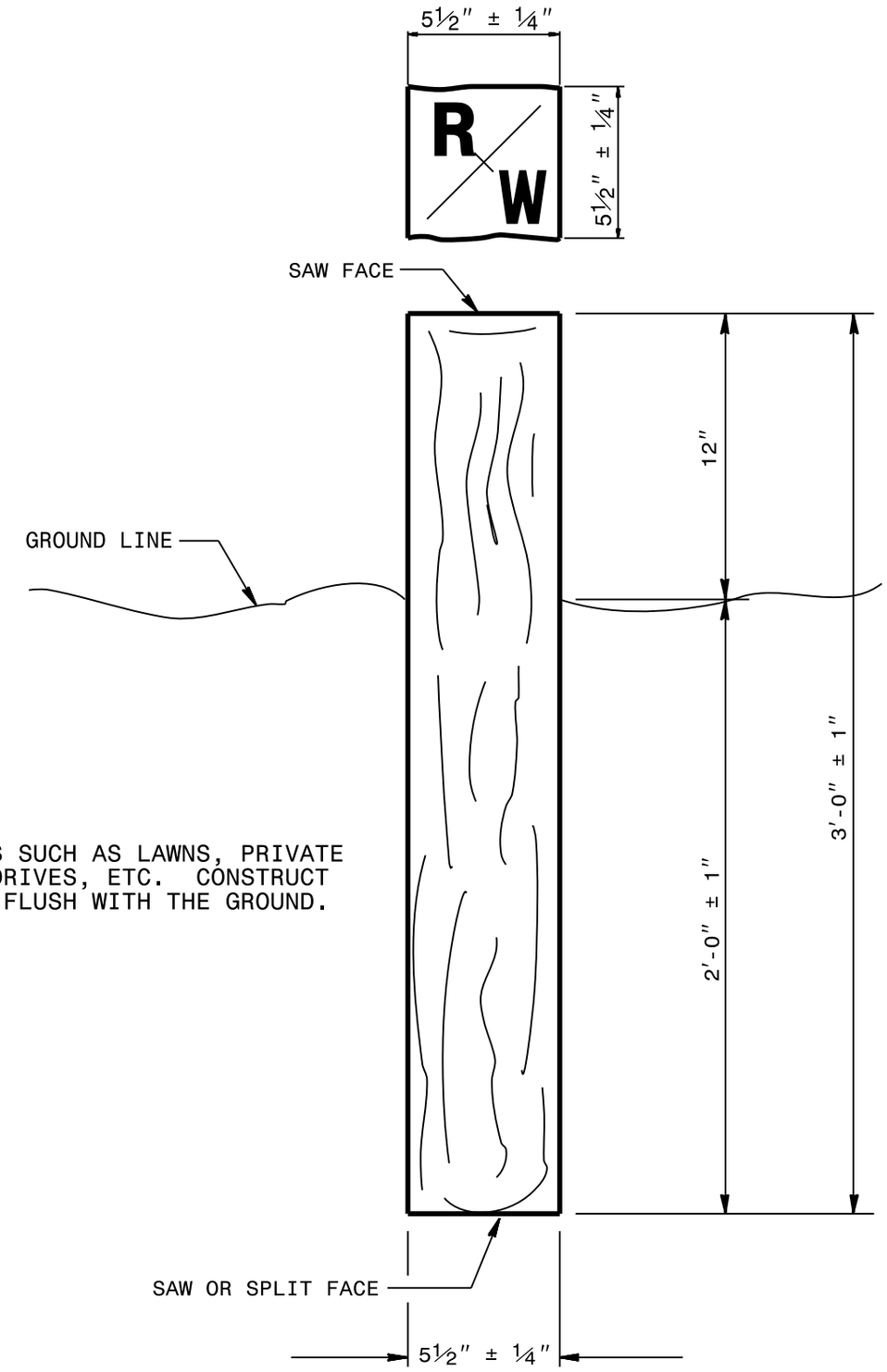
806.01




NOTE:
IN LOCATIONS SUCH AS LAWNS, PRIVATE ENTRANCES, DRIVES, ETC. CONSTRUCT 'R/W' MARKER FLUSH WITH THE GROUND.




SET RIGHT-OF-WAY MARKER SO THAT THE RIGHT-OF-WAY LINE PASSES THROUGH THE INTERSECTION OF THE 'X' ON THE TOP OF THE MARKER.




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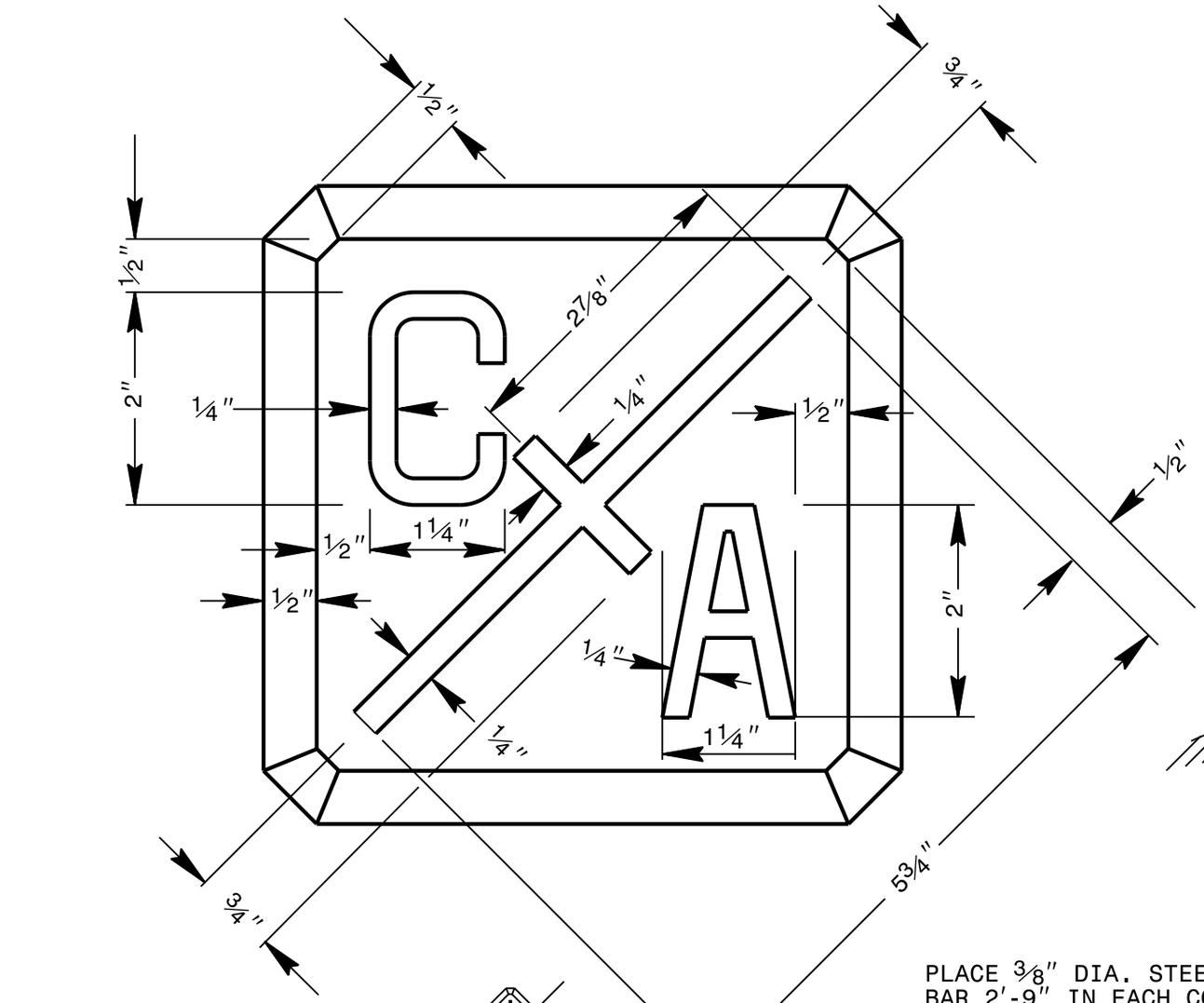
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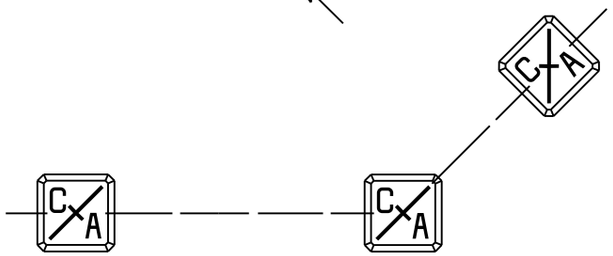
ROADWAY STANDARD DRAWING FOR

# GRANITE RIGHT-OF-WAY MARKER

SHEET 1 OF 1

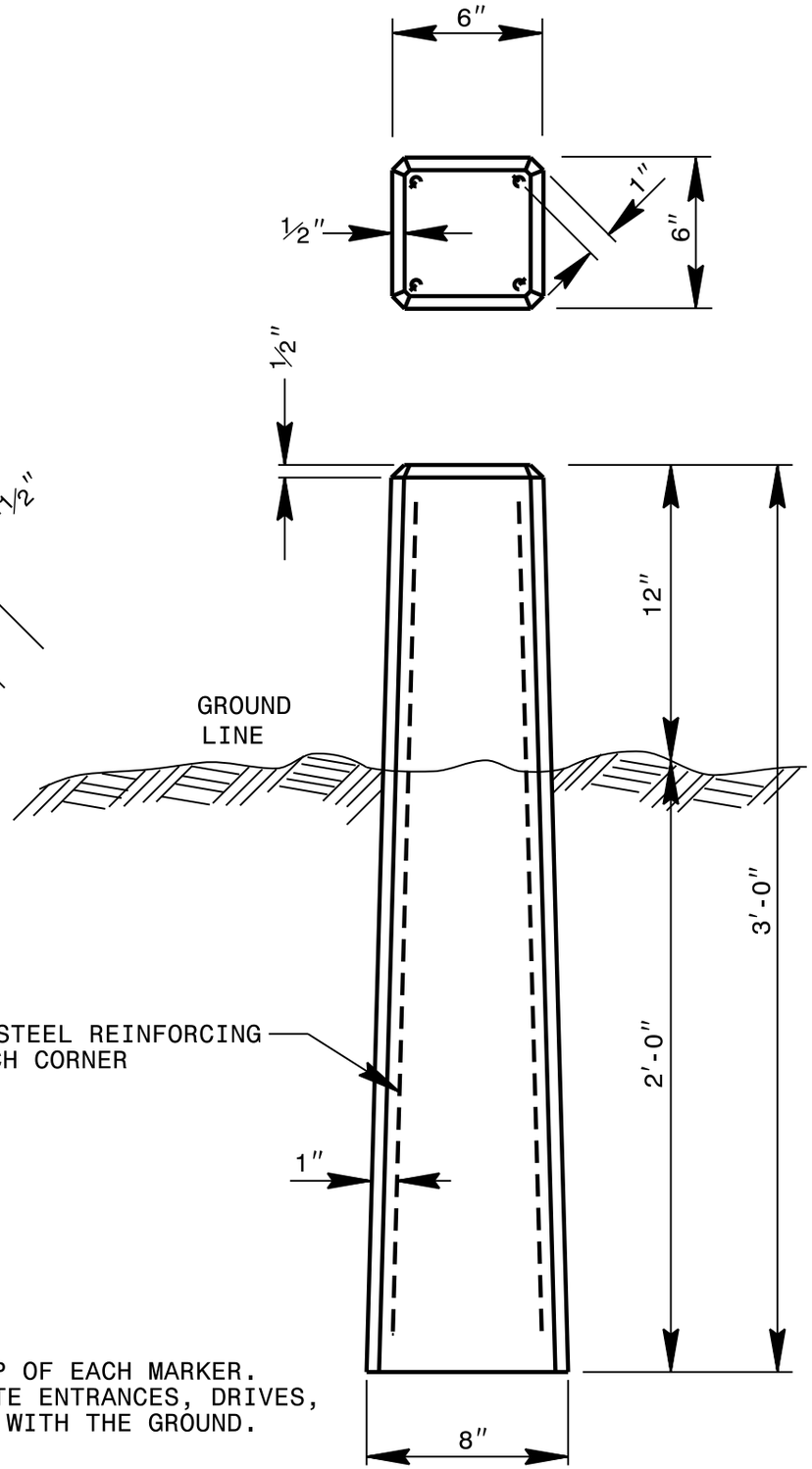
806.02




SET CONTROL-OF-ACCESS MARKER SO THAT THE CONTROL-OF-ACCESS LINE PASSES THROUGH THE INTERSECTION OF THE 'X' ON THE TOP OF THE MARKER.

NOTES:
INDENT THE LETTERS 'C/A' IN THE TOP OF EACH MARKER.
IN LOCATIONS SUCH AS LAWNS, PRIVATE ENTRANCES, DRIVES, ETC. CONSTRUCT 'C/A' MARKER FLUSH WITH THE GROUND.




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1-24

ROADWAY STANDARD DRAWING FOR

# CONCRETE CONTROL-OF-ACCESS MARKER

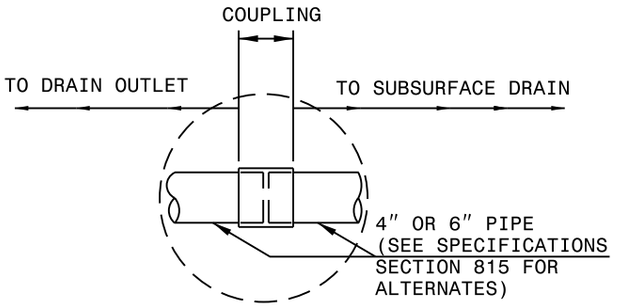
SHEET 1 OF 1

806.03

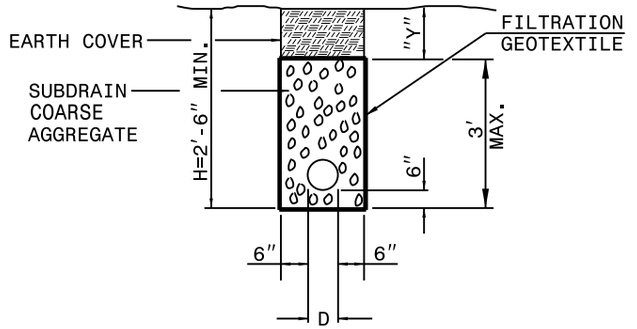
NOTES:
REFER TO SECTION 815 OF THE STANDARD SPECIFICATIONS FOR INSTALLATION DEPTHS OF DRAINAGE PIPES.

CONNECT PIPE OUTLET INTO DRAINAGE STRUCTURE WHEREVER POSSIBLE. IF NOT CONNECTED TO DRAINAGE STRUCTURE, PROTECT END OF PIPE BY CONCRETE PAD FOR OUTLET END OF DRAIN. PADS ARE NEEDED AT LOCATIONS WHERE PIPE IS NOT PLACED IN DRAINAGE STRUCTURE TO FACILITATE MAINTENANCE AND AID IN IDENTIFICATION. OUTLETS ARE REQUIRED EVERY 500′ OR AS DIRECTED BY THE ENGINEER

PROVIDE POSITIVE DRAINAGE TOWARD OUTLETS ON ALL SUBSURFACE DRAINAGE PIPES

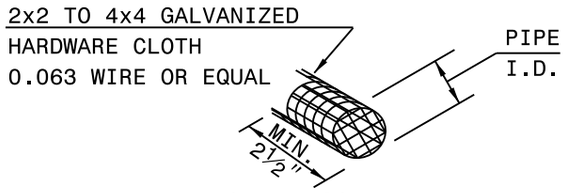



**AUXILIARY VIEW**

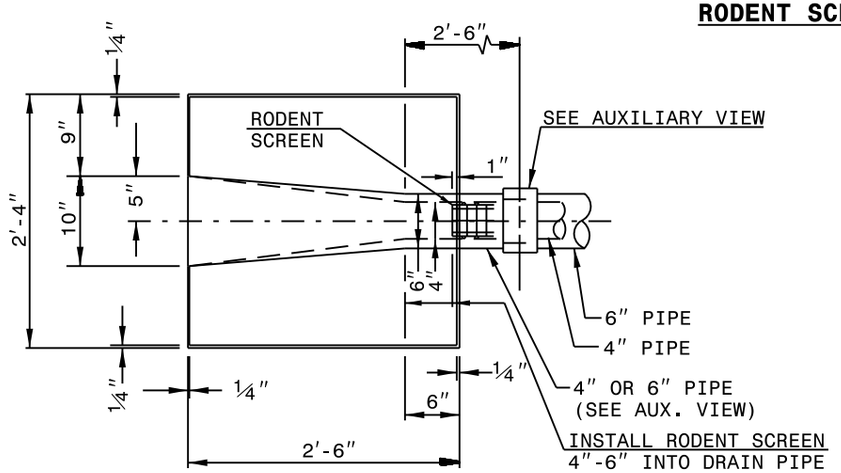



**SUBSURFACE DRAIN**

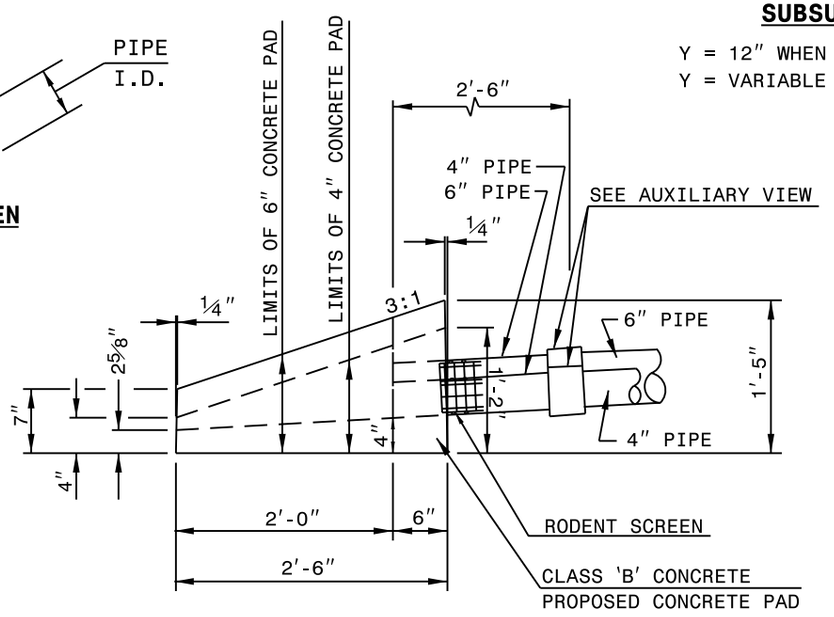
Y = 12″ WHEN "H" IS 4′-0″ OR LESS
Y = VARIABLE WHEN "H" IS OVER 4′-0″




**RODENT SCREEN**



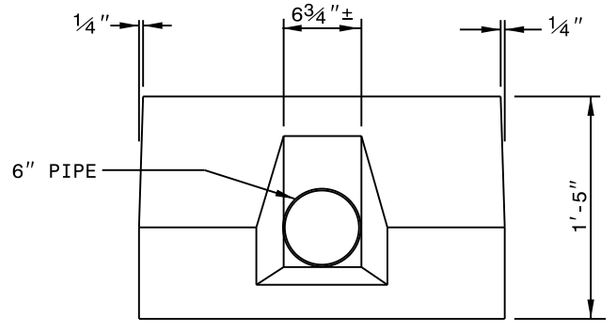

**PLAN VIEW**



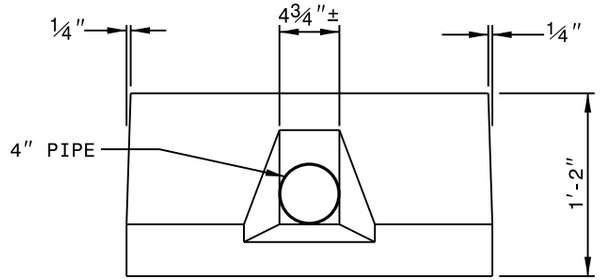

**ELEVATION VIEW**

| SUBDRAIN QUANTITIES |
|---|
| EXCAV. OR COURSE AGGREGATE CU. YDS. PER FT. DEPTH/LIN. FT. |
| 0.056 |

THE CONCRETE PAD CONSISTS OF 4″ DRAIN 0.137 CUBIC YARDS, 6″ DRAIN 0.177 CUBIC YARDS CLASS "B" CONCRETE.




**END ELEVATION VIEW**




**END ELEVATION VIEW**

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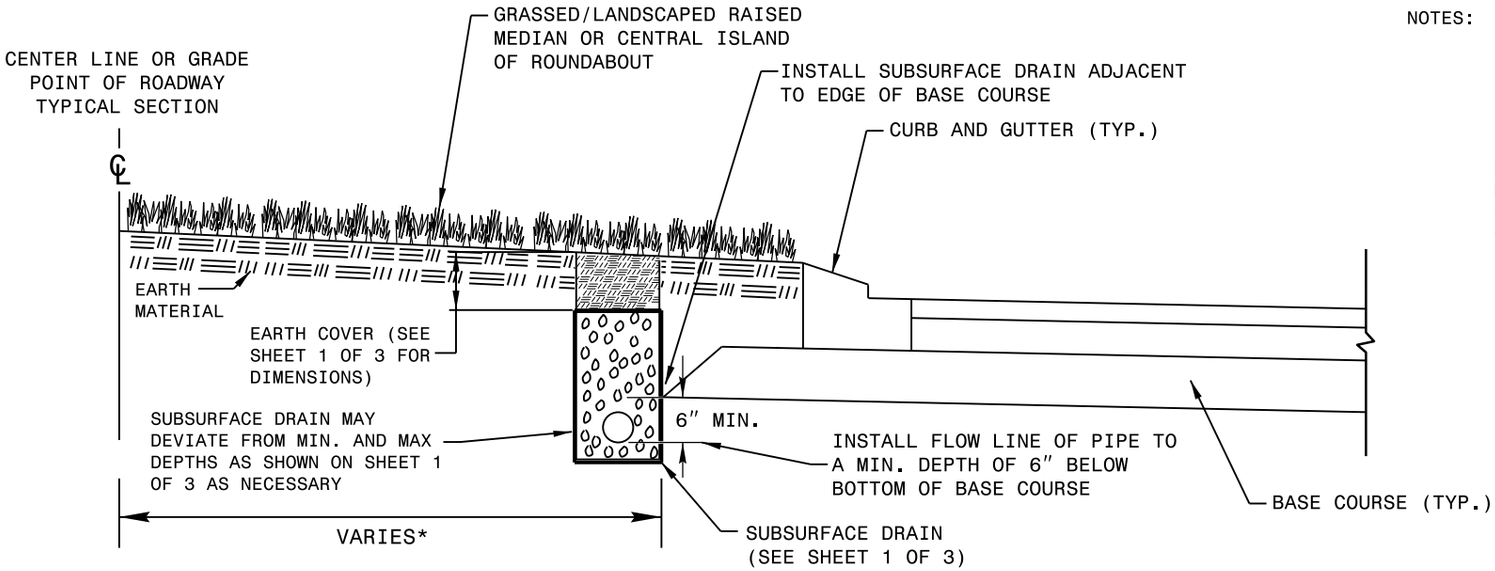
1-24

ROADWAY STANDARD DRAWING FOR

# SUBSURFACE DRAIN

SHEET 1 OF 3

**815.02**




*FOR MEDIAN WIDTHS NARROWER THAN 8 FEET BETWEEN BACKS OF CURB, ONE ROW OF SUBSURFACE DRAIN IS TO BE PLACED IN THE CENTER OF THE MEDIAN, RATHER THAN TWO ROWS AT THE EDGES OF THE BASE COURSE; OR AS DIRECTED BY ENGINEER (SEE PLANS FOR EXACT LOCATIONS)

## CROSS SECTION VIEW

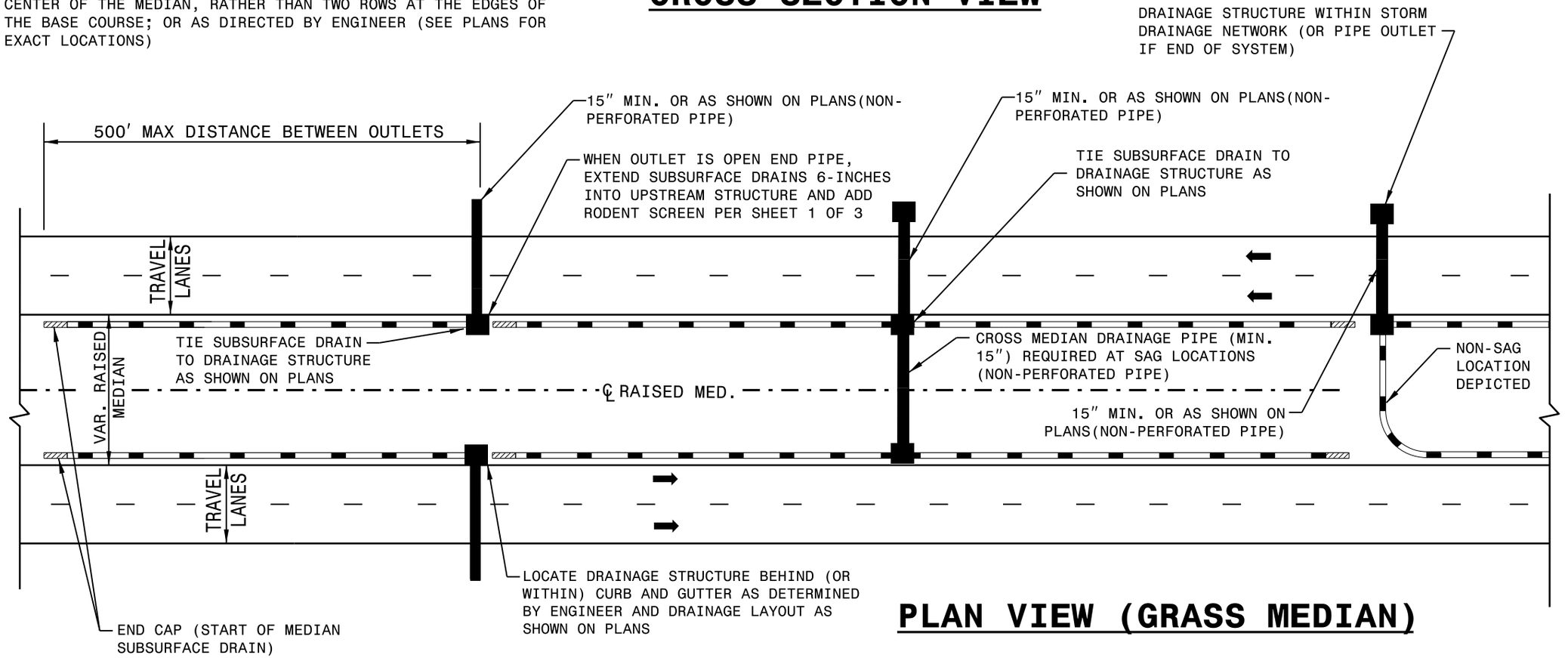
NOTES: MEDIAN APPLICATION OF SUBSURFACE DRAIN APPLIES ONLY TO RAISED MEDIANS (DOES NOT APPLY TO GRASSED MEDIAN DITCH SECTIONS)

DOES NOT APPLY TO CONCRETE CAPPED MEDIANS OR ISLANDS

INSTALL SUBSURFACE DRAINS ADJACENT TO EDGE OF BASE COURSE, BEHIND MEDIAN CURB, ON BOTH SIDES OF RAISED GRASS MEDIAN. THIS APPLIES TO BOTH NORMAL CROWN AND SUPERELEVATED ROADWAY SECTIONS OR AS SHOWN ON PLANS

SUBSURFACE DRAIN PIPE MUST DISCHARGE TO DRAINAGE STRUCTURE, WHICH DISCHARGES TO MIN. 15" PIPE PRIOR TO CROSSING TRAVEL LANES

PROVIDE POSITIVE DRAINAGE TOWARD OUTLETS ON ALL SUBSURFACE DRAINAGE PIPES




## PLAN VIEW (GRASS MEDIAN)

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ROADWAY STANDARD DRAWING FOR

# SUBSURFACE DRAIN

INSTALLATION IN GRASS MEDIANS AND ROUNDABOUTS



815.02

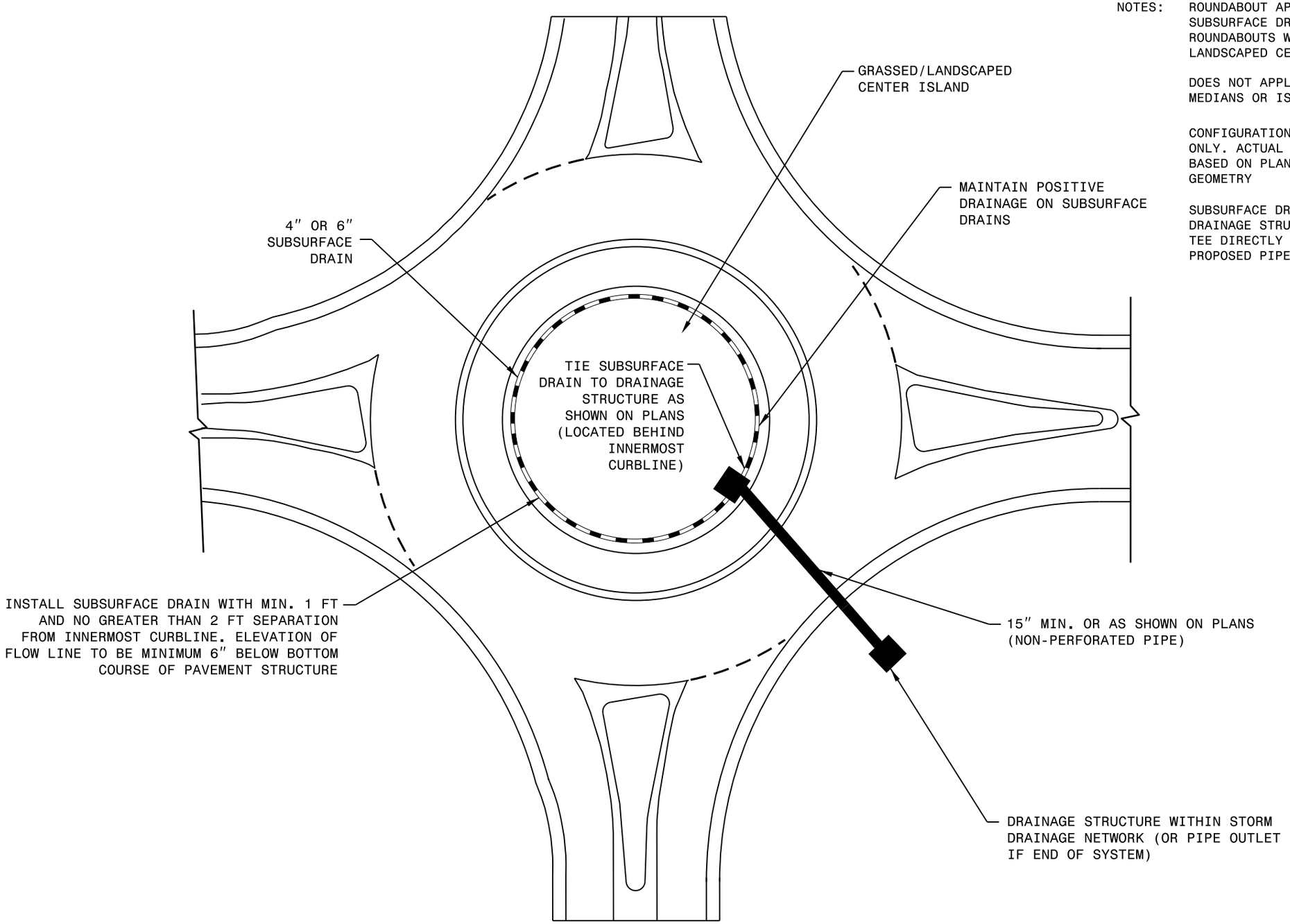
NOTES:

ROUNDABOUT APPLICATION OF SUBSURFACE DRAIN APPLIES TO ROUNDABOUTS WITH GRASS OR LANDSCAPED CENTER ISLANDS

DOES NOT APPLY TO CONCRETE CAPPED MEDIANS OR ISLANDS

CONFIGURATION SHOWN IS FOR EXAMPLE ONLY. ACTUAL DESIGN WILL VARY BASED ON PLANS AND ROUNDABOUT GEOMETRY

SUBSURFACE DRAIN MUST CONNECT TO DRAINAGE STRUCTURE AND MAY NOT TEE DIRECTLY INTO AN EXISTING OR PROPOSED PIPE




## PLAN VIEW (ROUNDABOUT)

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DEPT. OF TRANSPORTATION
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RALEIGH, N.C.

1-24

ROADWAY STANDARD DRAWING FOR

# SUBSURFACE DRAIN

## INSTALLATION IN GRASS MEDIANS AND ROUNDABOUTS

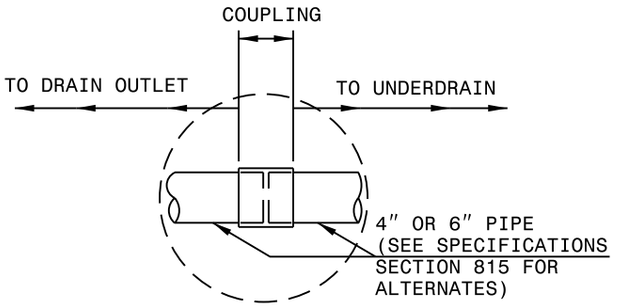


815.02

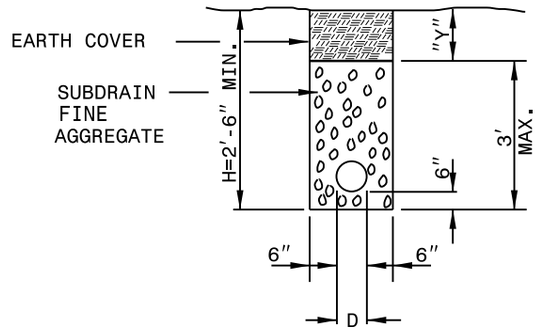
NOTES:

REFER TO SECTION 815 OF THE STANDARD SPECIFICATIONS FOR INSTALLATION DEPTHS OF DRAINAGE PIPES.

CONNECT PIPE OUTLET INTO DRAINAGE STRUCTURE WHEREVER POSSIBLE. IF NOT CONNECTED TO DRAINAGE STRUCTURE, PROTECT END OF PIPE BY CONCRETE PAD FOR OUTLET END OF DRAIN. PADS ARE NEEDED AT LOCATIONS WHERE PIPE IS NOT PLACED IN DRAINAGE STRUCTURE TO FACILITATE MAINTENANCE AND AID IN IDENTIFICATION. OUTLETS ARE REQUIRED EVERY 500' OR AS DIRECTED BY THE ENGINEER.

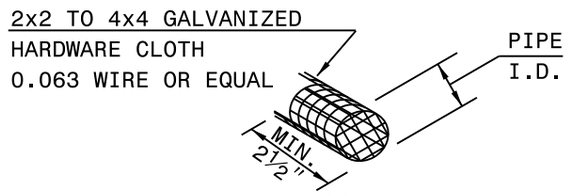



**AUXILIARY VIEW**

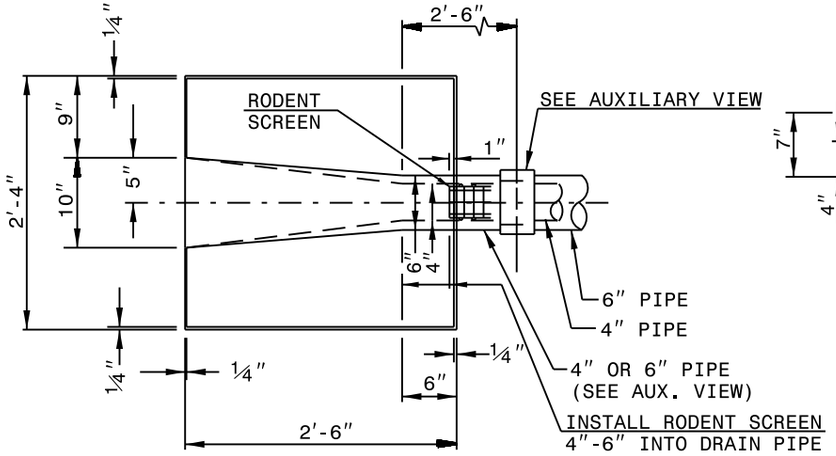



**PIPE UNDERDRAIN**

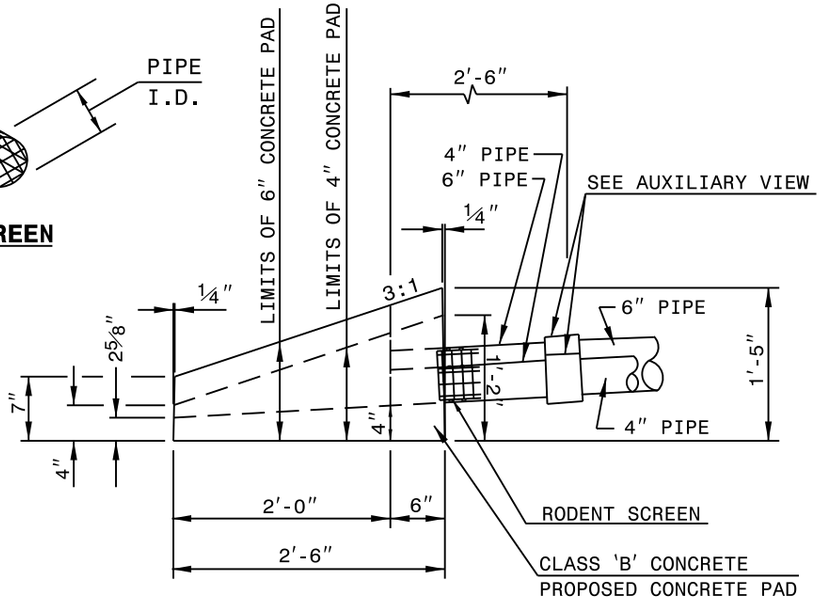
Y = 12" WHEN "H" IS 4'-0" OR LESS
Y = VARIABLE WHEN "H" IS OVER 4'-0"



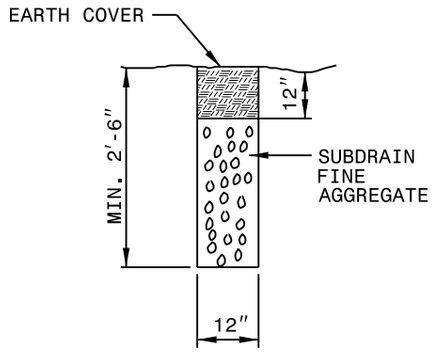

**RODENT SCREEN**




**PLAN VIEW**



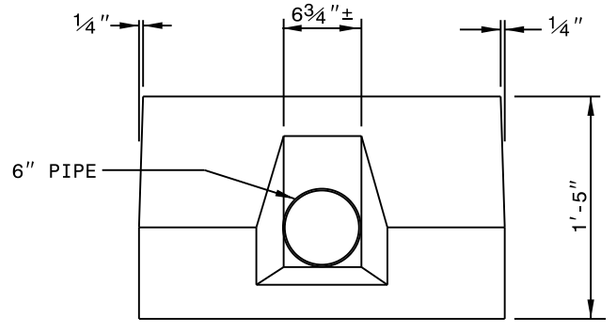

**ELEVATION VIEW**



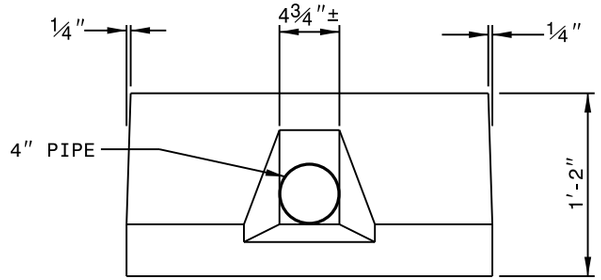

**BLIND DRAIN**

| SUBDRAIN QUANTITIES | |
|---|---|
| TYPE | EXCAV. OR FINE AGGR. CU. YDS. PER FT. DEPTH/LIN. FT. |
| UNDER DRAIN | 0.056 |
| BLIND DRAIN | 0.037 |

THE CONCRETE PAD CONSISTS OF 4" DRAIN 0.137 CUBIC YARDS, 6" DRAIN 0.177 CUBIC YARDS CLASS "B" CONCRETE.




**END ELEVATION VIEW**




**END ELEVATION VIEW**

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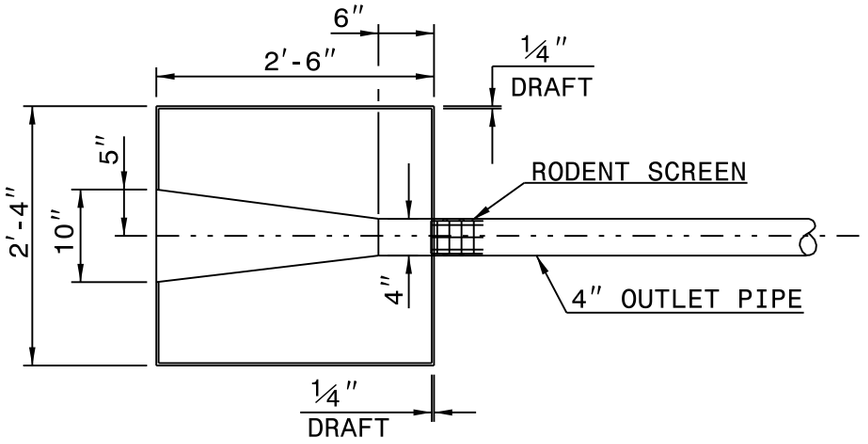
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ROADWAY STANDARD DRAWING FOR

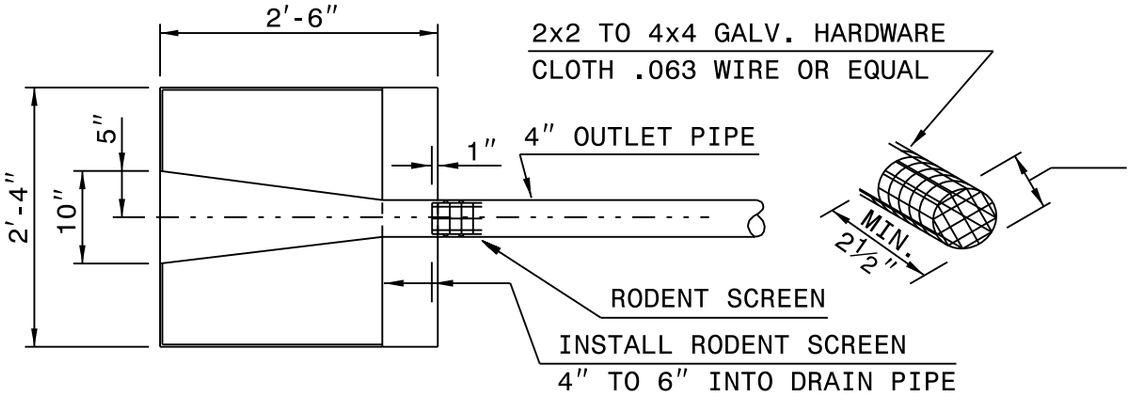
# PIPE UNDERDRAIN AND BLIND DRAIN

SHEET 1 OF 1

815.03

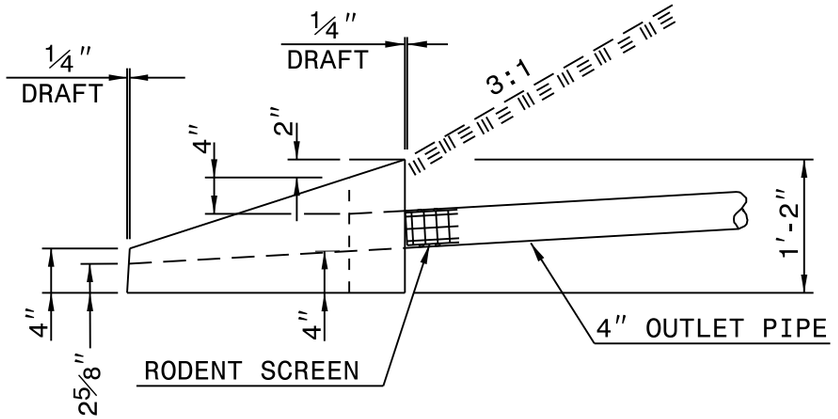



## PLAN VIEW

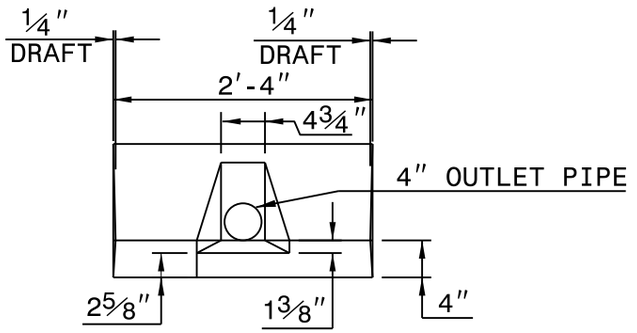



## TOP VIEW

## PARTIAL DETAIL OF RODENT SCREEN




## ELEVATION VIEW




## END ELEVATION VIEW

THE CONCRETE PAD CONSISTS OF 0.137 CUBIC YARDS OF CLASS "B" CONCRETE.

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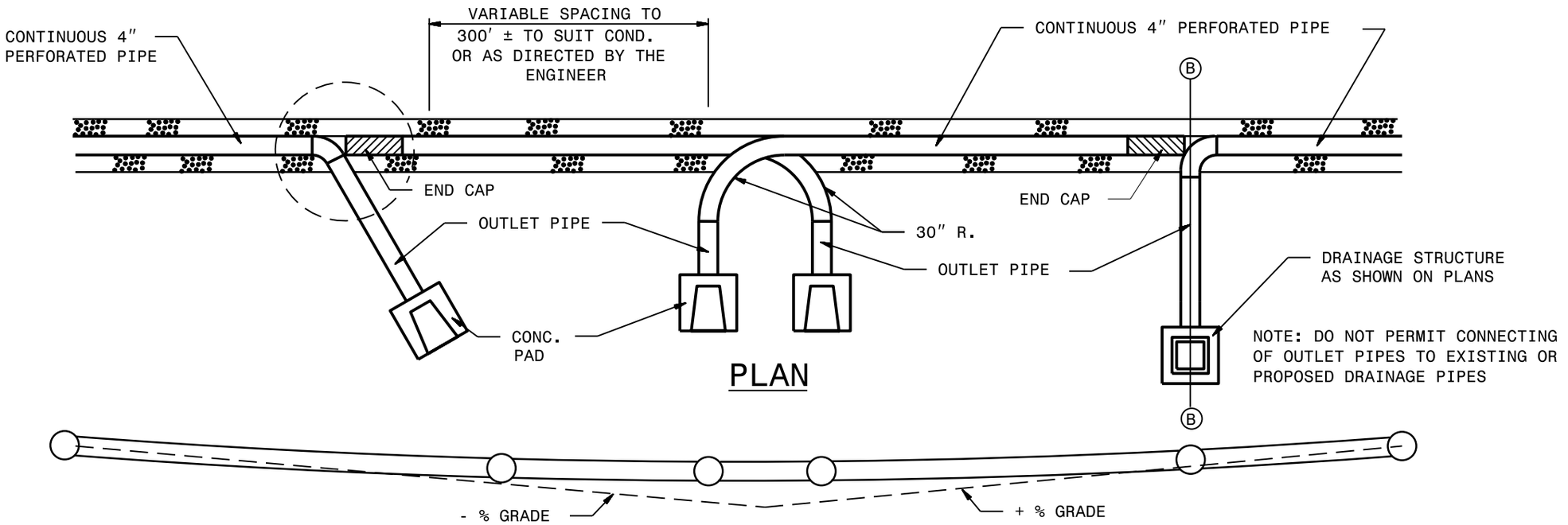
ROADWAY STANDARD DRAWING FOR

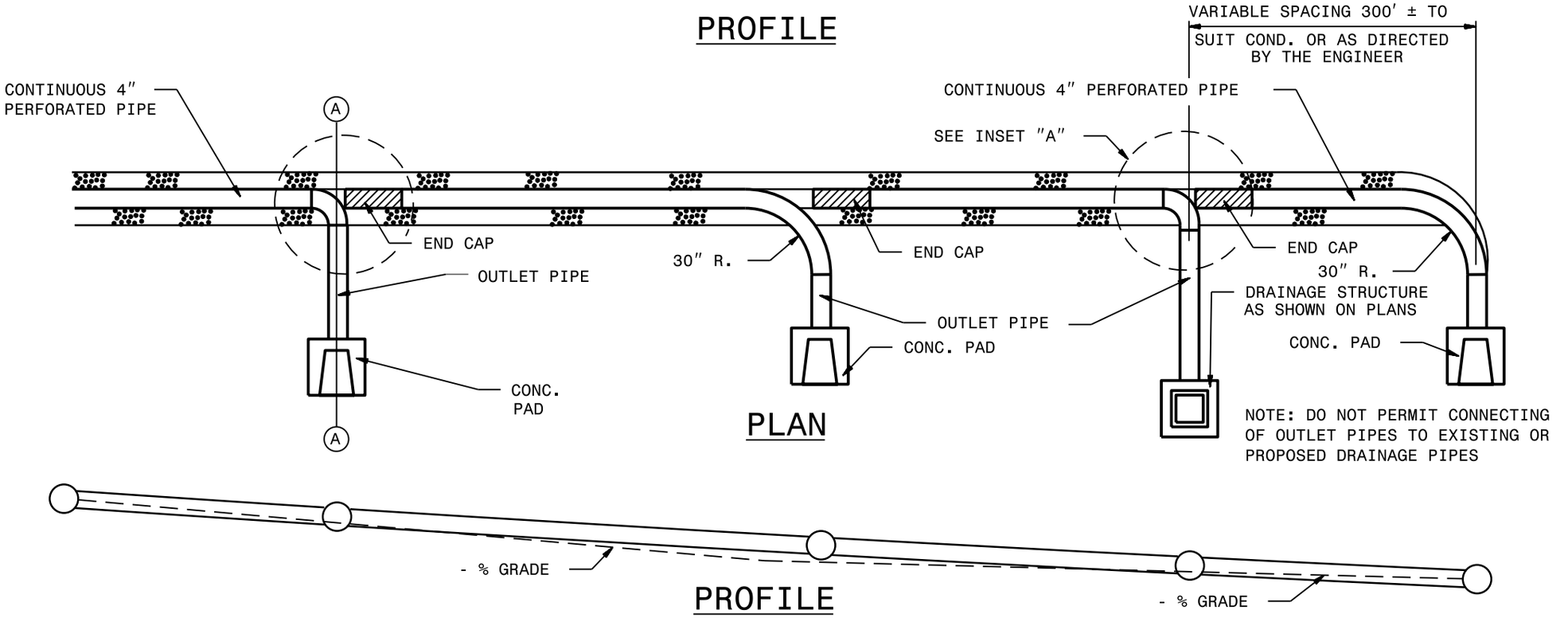
**CONCRETE PADS**

FOR SHOULDER DRAIN INSTALLATION

SHEET 1 OF 1

**816.01**




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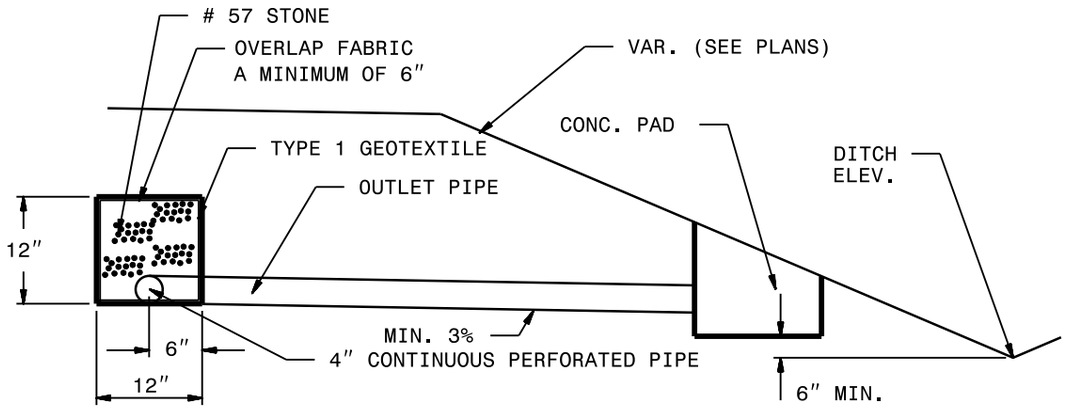
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ROADWAY STANDARD DRAWING FOR

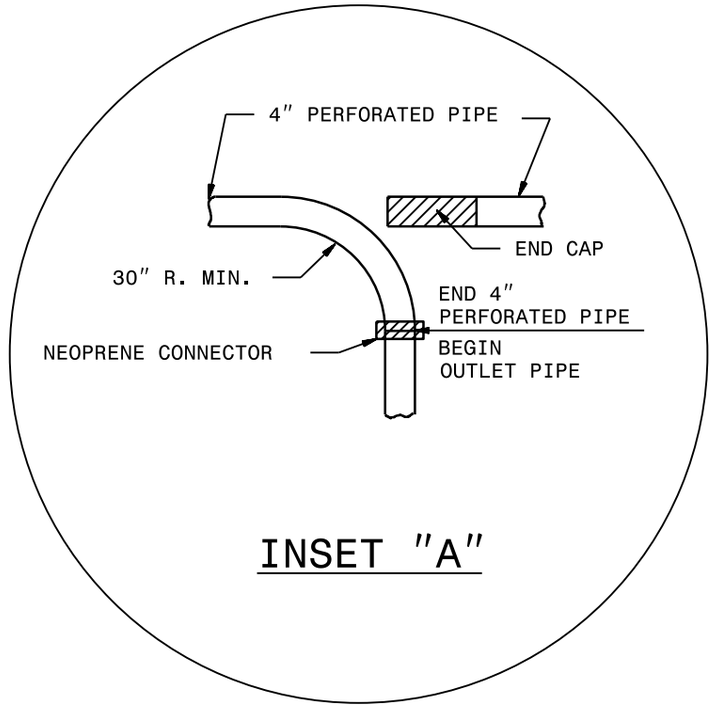
# AGGREGATE SHOULDER DRAIN

SHEET 1 OF 2

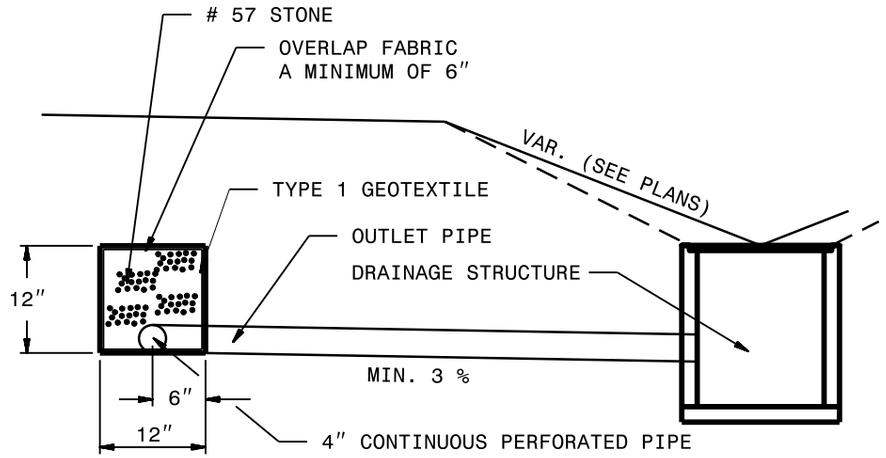
816.02




## TYPICAL SECTION A-A




## INSET "A"




## TYPICAL SECTION B-B

GENERAL NOTES:

USE THE FOLLOWING CRITERIA AS A GUIDE FOR THE LOCATION, QUANTITY AND INSTALLATION OF AGGREGATE SHOULDER DRAIN.

(1) INSTALL ON LOW SIDE OF PAVEMENT IN AREAS WITH GRADES FLATTER THAN 1% , AND SAG VERTICAL CURVES.

(2) OTHER LOCATIONS AS DIRECTED BY THE ENGINEER.

(3) PLACE OUTLETS AT THE LOW POINTS AND SPACE AS SHOWN ON THE PLAN VIEW.

(4) CONNECT OUTLET PIPE INTO DRAINAGE STUCTURE WHERE POSSIBLE. IF NOT CONNECTED TO DRAINAGE STRUCTURE, PROTECT END OF PIPE BY CONCRETE PAD. SEE DETAIL OF CONCRETE PAD.

(5) OUTLET PIPE GRADE MIN. 3%.

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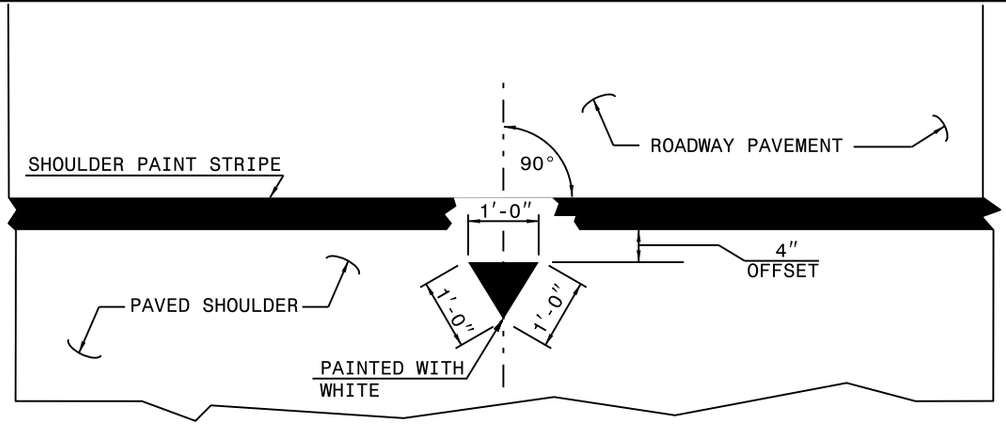
ROADWAY STANDARD DRAWING FOR

**AGGREGATE SHOULDER DRAIN**

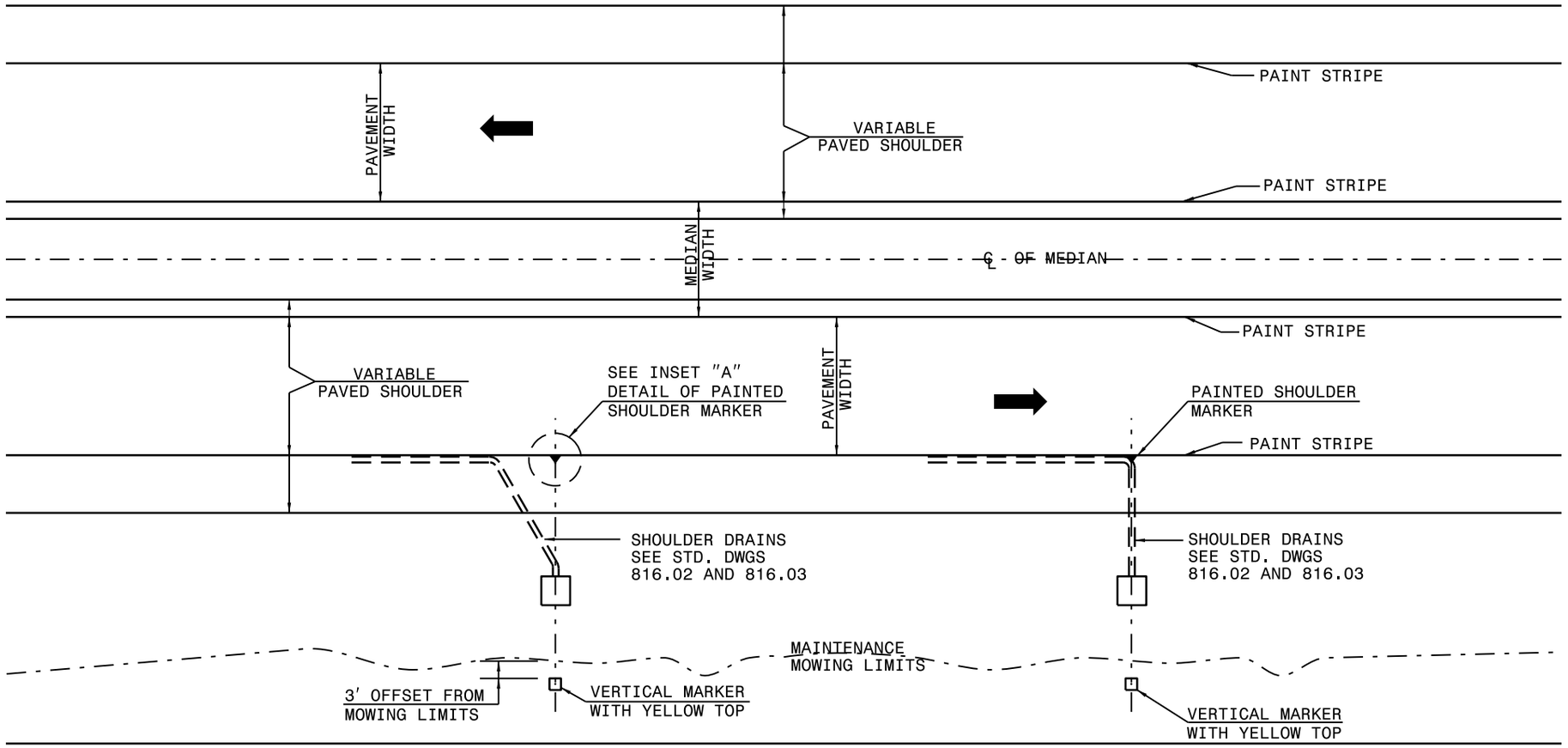
ADDITIONAL INFORMATION



**816.02**




INSET "A"




PAINTED SHOULDER AND VERTICAL MARKER

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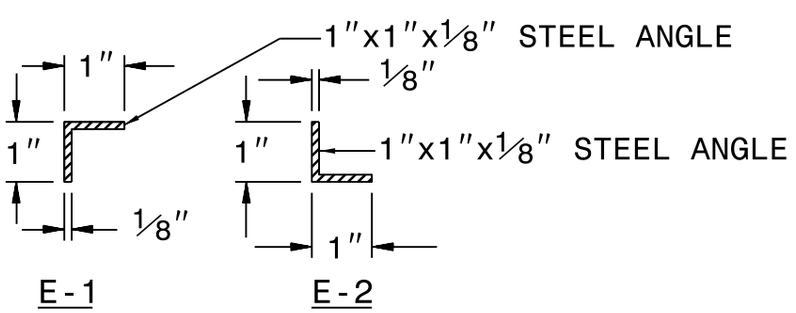
1-24

ROADWAY STANDARD DRAWING FOR

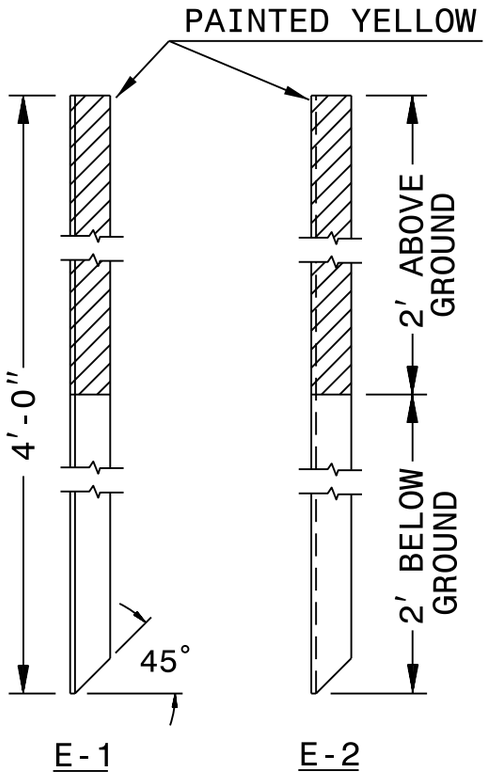
**MARKERS FOR DRAINAGE STRUCTURE AND CONCRETE PAD**

SHEET 1 OF 2

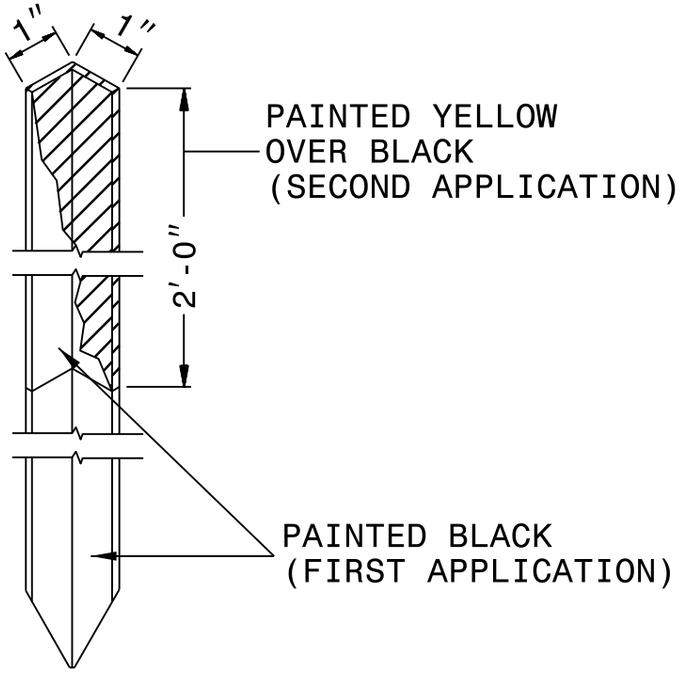
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PLAN




ELEVATION




ISOMETRIC VIEW

LEGEND

YELLOW PAINT

BLACK PAINT

GENERAL NOTES:

USE A36 GRADE STEEL. USE FLAT BLACK PAINT AS FIRST APPLICATION.

USE YELLOW AS SECOND APPLICATION FOR THE TOP HALF OF THE MARKER. USE EXTERIOR OIL BASE FOR ALL PAINT.

USE MARKERS FOR SUBSURFACE AND SHOULDER DRAIN CONCRETE PADS. PLACE MARKERS FOR OUTLETS AT DRAINAGE STRUCTURES WHERE APPLICABLE.

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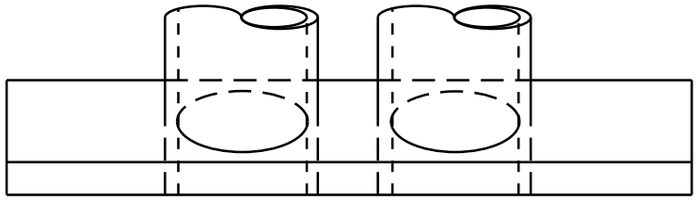
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ROADWAY STANDARD DRAWING FOR

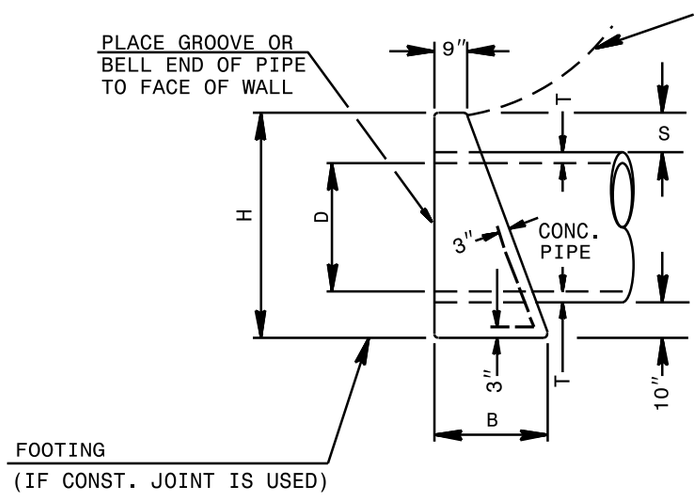
# MARKERS FOR DRAINAGE STRUCTURE AND CONCRETE PAD

SHEET 2 OF 2

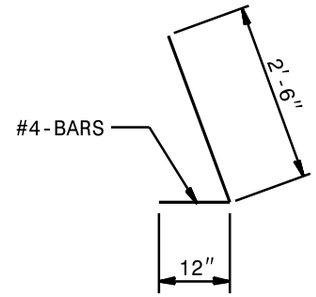
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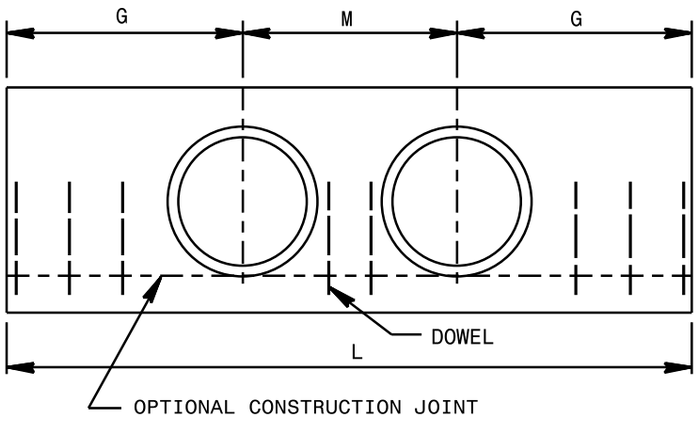
**PLAN**




**END ELEVATION**




DOWEL
BAR-″X″




**ELEVATION**

| DOWELS IN ENDWALL WITH REINFORCED CONCRETE PIPE | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOC. | PIPE | SINGLE PIPE | | | | | | | | DOUBLE PIPE | | | | | | | | | |
| | DIA. | 15″ | 18″ | 24″ | 30″ | 36″ | 42″ | | 48″ | | 15″ | 18″ | 24″ | 30″ | 36″ | 42″ | | 48″ | |
| | BARS | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | Y* | ″X″ | Y* | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | Y* | ″X″ | Y* |
| G | QTY. | 2 | 2 | 3 | 3 | 4 | 4 | 2 | 5 | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 2 | 5 | 2 |
| M | QTY. | - | - | - | - | - | - | | - | | 1 | 1 | 2 | 2 | 2 | 2 | | 3 | |
| G | QTY. | 2 | 2 | 3 | 3 | 4 | 4 | | 5 | | 2 | 2 | 3 | 3 | 4 | 4 | | 5 | |
| TOTAL LBS. | | 9 | 9 | 14 | 14 | 19 | 55 | | 65 | | 12 | 12 | 19 | 19 | 23 | 77 | | 92 | |

| DIMENSIONS AND CONCRETE QUANTITIES | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| USING CONCRETE PIPE | | | | | | | | | | |
| | COMMON DIMENSIONS | | | | | SINGLE PIPE | | DOUBLE PIPE | | |
| D | H | B | G | T | S | L | $YD^3$ | M | L | $YD^3$ |
| 15″ | 3′-3″ | 1′-8″ | 2′-9″ | 2¼″ | 9½″ | 5′-6″ | 0.7 | 2′-2″ | 7′-8″ | 1.0 |
| 18″ | 3′-7″ | 1′-10″ | 3′-2″ | 2½″ | 10″ | 6′-4″ | 1.0 | 2′-7″ | 8′-11″ | 1.3 |
| 24″ | 4′-2″ | 2′-1″ | 4′-0″ | 3″ | 10″ | 8′-0″ | 1.5 | 3′-5″ | 11′-5″ | 2.0 |
| 30″ | 5′-0″ | 2′-6″ | 4′-7″ | 4¼″ | 11½″ | 9′-2″ | 2.3 | 4′-3″ | 13′-5″ | 3.1 |
| 36″ | 5′-8″ | 2′-8″ | 5′-6″ | 4¾″ | 11½″ | 11′-0″ | 3.4 | 5′-0″ | 16′-0″ | 4.5 |
| 42″ | 6′-2″ | 3′-1″ | 6′-4″ | 5¼″ | 11½″ | 12′-8″ | 4.5 | 5′-10″ | 18′-6″ | 6.0 |
| 48″ | 6′-9″ | 3′-5″ | 7′-2″ | 5¾″ | 11½″ | 14′-4″ | 6.0 | 6′-8″ | 21′-0″ | 8.0 |

*SEE SHEET 3

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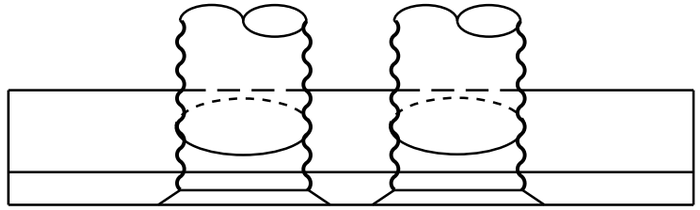
ROADWAY STANDARD DRAWING FOR

# CONCRETE ENDWALL FOR SINGLE AND DOUBLE PIPE CULVERTS

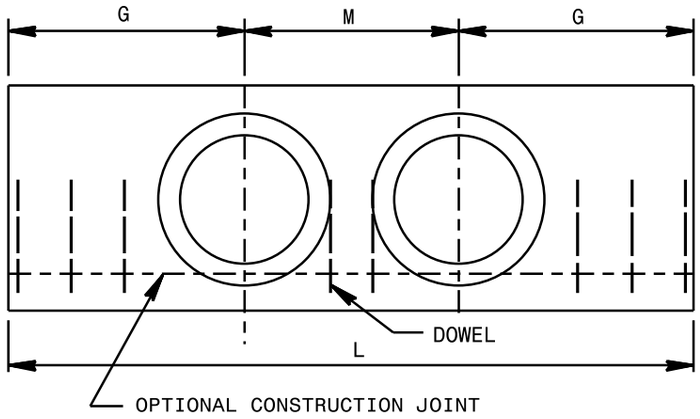
15″ THRU 48″ PIPE - 90° SKEW



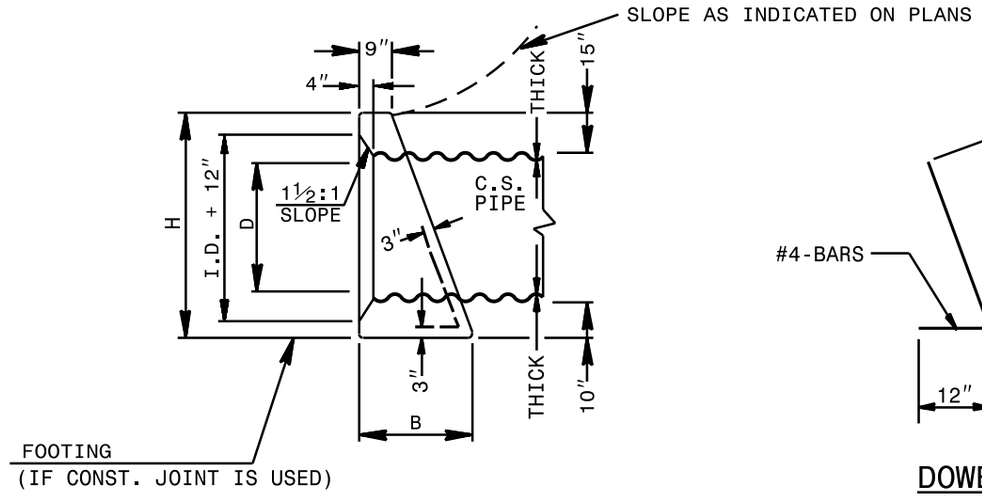
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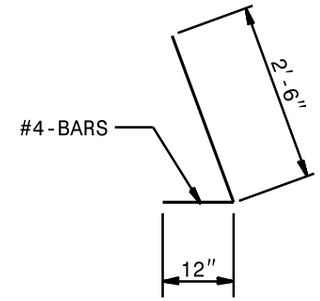
**PLAN**




**ELEVATION**




**END ELEVATION**




DOWEL
BAR-″X″

| DOWELS IN ENDWALL WITH C. S. PIPE | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOC. | PIPE DIA. | SINGLE PIPE | | | | | | | | DOUBLE PIPE | | | | | | | | | |
| | | 15″ | 18″ | 24″ | 30″ | 36″ | 42″ | | 48″ | | 15″ | 18″ | 24″ | 30″ | 36″ | 42″ | | 48″ | |
| | BARS | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | Y* | ″X″ | Y* | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | Y* | ″X″ | Y* |
| G | QTY. | 2 | 2 | 3 | 3 | 4 | 4 | 2 | 5 | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 2 | 5 | 2 |
| M | QTY. | - | - | - | - | - | - | | - | | 1 | 1 | 1 | 2 | 2 | 2 | | 2 | |
| G | QTY. | 2 | 2 | 3 | 3 | 4 | 4 | | 5 | | 2 | 2 | 3 | 3 | 4 | 4 | | 5 | |
| TOTAL LBS. | | 9 | 9 | 14 | 14 | 19 | 53 | | 62 | | 12 | 12 | 16 | 19 | 23 | 73 | | 85 | |

| DIMENSIONS AND CONCRETE QUANTITIES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| USING CORRUGATED STEEL PIPE | | | | | | | | |
| | COMMON | | | SINGLE PIPE | | DOUBLE PIPE | | |
| D | H | B | G | L | $YD^3$ | M | L | $YD^3$ |
| 15″ | 3′-4″ | 1′-8″ | 2′-6″ | 5′-0″ | 0.7 | 1′-11″ | 6′-11″ | 1.0 |
| 18″ | 3′-7″ | 1′-10″ | 2′-11″ | 5′-10″ | 1.0 | 2′-3″ | 8′-1″ | 1.2 |
| 24″ | 4′-1″ | 2′-1″ | 3′-8″ | 7′-4″ | 1.4 | 3′-0″ | 10′-4″ | 1.9 |
| 30″ | 4′-7″ | 2′-4″ | 4′-5″ | 8′-10″ | 2.0 | 3′-9″ | 12′-7″ | 2.7 |
| 36″ | 5′-1″ | 2′-7″ | 5′-2″ | 10′-4″ | 2.8 | 4′-6″ | 14′-10″ | 3.8 |
| 42″ | 5′-7″ | 2′-10″ | 5′-11″ | 11′-10″ | 3.8 | 5′-3″ | 17′-1″ | 5.0 |
| 48″ | 6′-1″ | 3′-1″ | 6′-8″ | 13′-4″ | 4.9 | 6′-0″ | 19′-4″ | 7.5 |

*SEE SHEET 3

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ROADWAY STANDARD DRAWING FOR

# CONCRETE ENDWALL FOR SINGLE AND DOUBLE PIPE CULVERTS

15″ THRU 48″ PIPE - 90° SKEW

GENERAL NOTES:

CHAMFER ALL CORNERS 1″ OR HAVE A RADIUS OF 1″.

PLACE 2 #6 ″Y″ BARS IN THE TOP OF ALL ENDWALL FOR PIPE CULVERTS 42″ AND OVER WITH A MINIMUM OF 3″ COVER AND A LENGTH OF 6″ LESS THAN ENDWALL LENGTH.

CONSTRUCT BOTTOM SLAB WITH FORMS.

DO NOT INTERPRET WALL THICKNESS (T) SHOWN FOR THE THICKNESS ACCEPTABLE, BUT IS USED IN COMPUTING ENDWALL QUANTITIES.

WHEN THE CONTRACTOR ELECTS TO USE A CONSTRUCTION JOINT AT THE BOTTOM OF THE PIPE, PLACE BAR ″X″ DOWELS IN THE BASE AS SHOWN ON PLANS. SPACE BARS APPROXIMATELY ON 12″ CENTERS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.

WHEN THE CONTRACTOR ELECTS TO USE A CONSTRUCTION JOINT AT THE BOTTOM OF THE PIPE AND POUR THE BASE SEPARATELY LEAVE THE POUR ROUGH.

USE CLASS ″B″ CONCRETE.

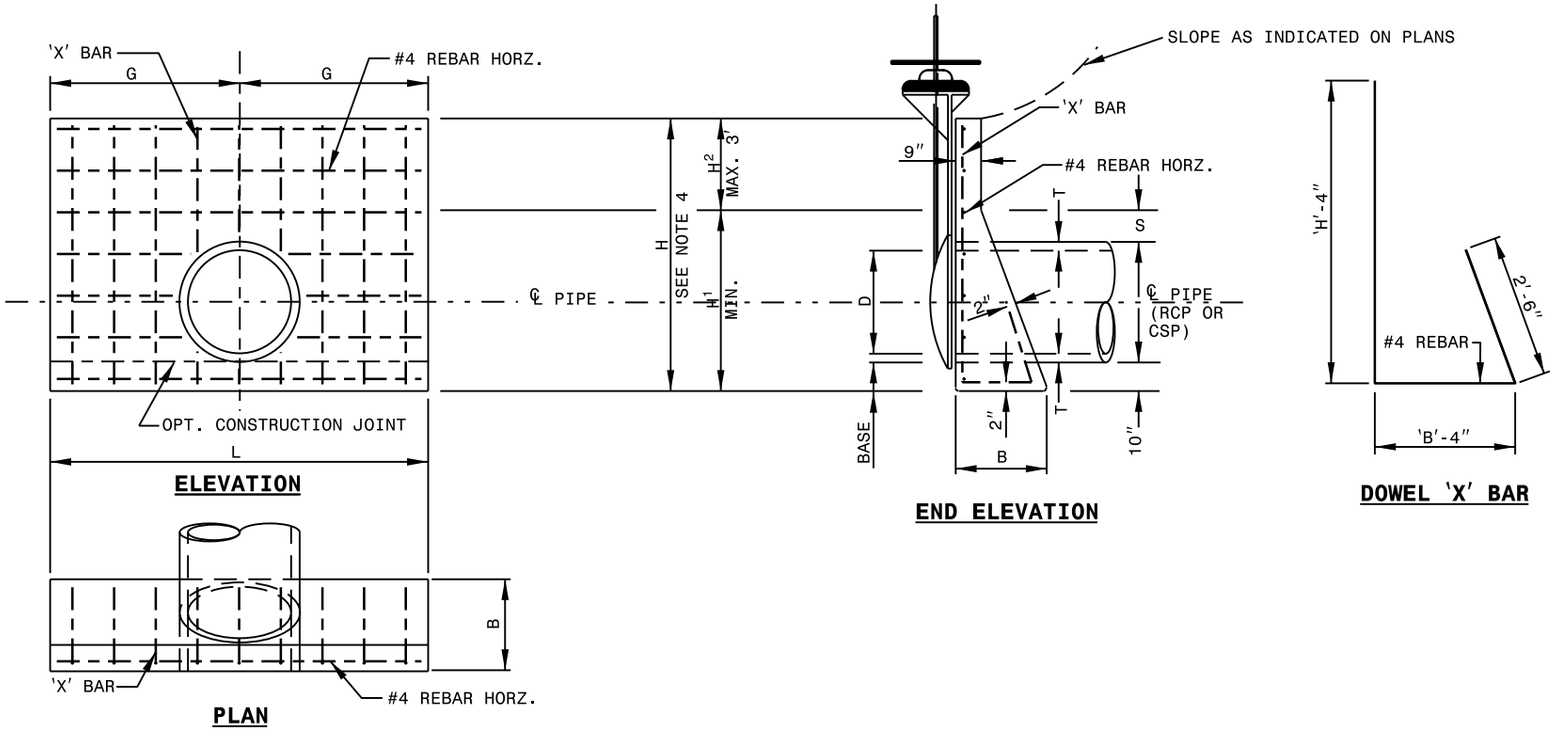
STATE OF
NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

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ROADWAY STANDARD DRAWING FOR

# CONCRETE ENDWALL FOR SINGLE AND DOUBLE PIPE CULVERTS

15″ THRU 48″ PIPE - 90° SKEW




**ELEVATION**

**PLAN**

**END ELEVATION**

**DOWEL 'X' BAR**

| DIMENSIONS AND QUANTITIES FOR RCP OR CSP | | | | | | | |
|---|---|---|---|---|---|---|---|
| CALCULATIONS BASED ON CONCRETE PIPE | | | | | | | |
| PIPE DIA. | $H^1$ MINIMUM DIMENSIONS | | | | | | |
| D | $H^1$ | B | G | T | S | L | CONC $YD^3$ |
| 15" | 3'-3" | 1'-8" | 2'-9" | 2¼" | 9½" | 5'-6" | 0.7 |
| 18" | 3'-7" | 1'-10" | 3'-2" | 2½" | 10" | 6'-4" | 1.0 |
| 24" | 4'-2" | 2'-1" | 4'-0" | 3" | 10" | 8'-0" | 1.5 |
| 30" | 5'-0" | 2'-6" | 4'-7" | 4¼" | 11½" | 9'-2" | 2.3 |
| 36" | 5'-8" | 2'-8" | 5'-6" | 4¾" | 12½" | 11'-0" | 3.4 |

| $H^2$ QUANTITES | | |
|---|---|---|
| PIPE DIA. | PER 1' ADDTIONAL HEIGHT | |
| D | STEEL LBS. | CONC $YD^3$ |
| 15" | 7.5 | 0.2 |
| 18" | 8.7 | 0.2 |
| 24" | 11.1 | 0.2 |
| 30" | 12.6 | 0.3 |
| 36" | 15.1 | 0.3 |

| REBAR IN ENDWALL ($H^1$ MIN.) | | | | | | | |
|---|---|---|---|---|---|---|---|
| USE WITH RC OR CS PIPE | PIPE DIA. | | | | | | |
| | 15" | 18" | 24" | 30" | 36" | 42" | 48" |
| | QTY | QTY | QTY | QTY | QTY | QTY | QTY |
| 'X' BARS | 6 | 7 | 9 | 10 | 12 | 14 | 15 |
| HORZ BARS | 4 | 4 | 5 | 6 | 7 | 7 | 8 |
| TOTAL LBS. | 41 | 50 | 74 | 112 | 131 | 161 | 195 |

GENERAL NOTES:

1. THIS STANDARD FOR THE SLUICE GATE PROVIDES ONLY BASIC INFORMATION FOR PLACEMENT.
2. INSTALL THE SLUICE GATE IN ACCORDANCE WITH THE MANUFACTURER'S DIMENSIONS AND SPECIFICATIONS.
3. SEE PLANS FOR LOCATIONS AND PIPE SIZES.
4. LIMIT VARIABLE HEIGHT DIMENSION (H) TO FRAME HEIGHT OF SLUICE GATE, 3' ABOVE THE $H^1$ DIMENSION OR 10' WHICHEVER IS LESS. FRAME HEIGHT OF SLUICE GATE TO BE PROVIDED BY MANUFACTURER OR FABICATOR.
5. ATTACHMENT OF GATE MAY REQUIRE SPECIFIC POSTIONING OF PIPE AND/OR MODIFICATION OF ENDWALL. CONFIRMATION OF GATE DIMENSIONS AND ATTACHMENT METHOD IS RECOMMENDED PRIOR TO CONSTRUCTION OF ENDWALL.
6. PLACE NO. 4 REBAR ON 12" HORIZONTAL AND VERTICAL CENTERS WITH 2" MINIMUM CONCRETE COVERAGE.
7. CONSTRUCT 1" CHAMFER OR RADIUS ON ALL EXTERIOR CORNERS.
8. USE FORMS TO CONSTRUCT THE BOTTOM SLAB.
9. WALL THICKNESS (T) IS USED TO COMPUTE QUANTITIES, NOT TO INFER SIZE.
10. WHEN THE BASE IS POURED SEPARATELY, LEAVE THE POUR ROUGH.
11. USE CLASS 'B' CONCRETE.
12. CUT OR BEND REBARS AS NEEDED TO ACCOMMODATE PIPE.
13. MAKE ADJUSTMENTS IF NECESSARY TO ALLOW SLUICE GATE TO OPERATE THROUGH FULL RANGE OF MOTION, FROM FULLY OPEN TO FULLY CLOSED.

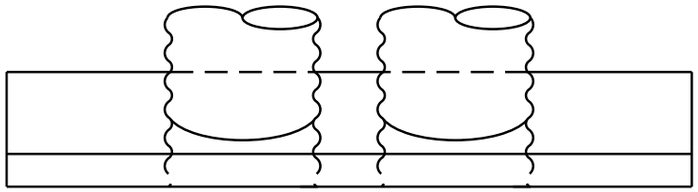

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RALEIGH, N.C.


ROADWAY STANDARD DRAWING FOR

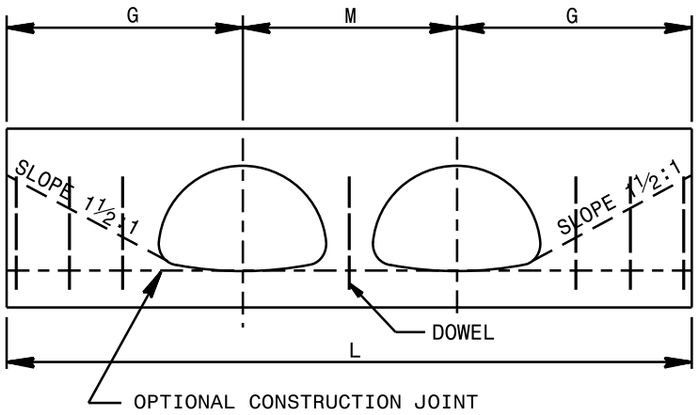
# CONCRETE ENDWALL AND SLUICE GATE

15" THRU 36" PIPE - 90° SKEW

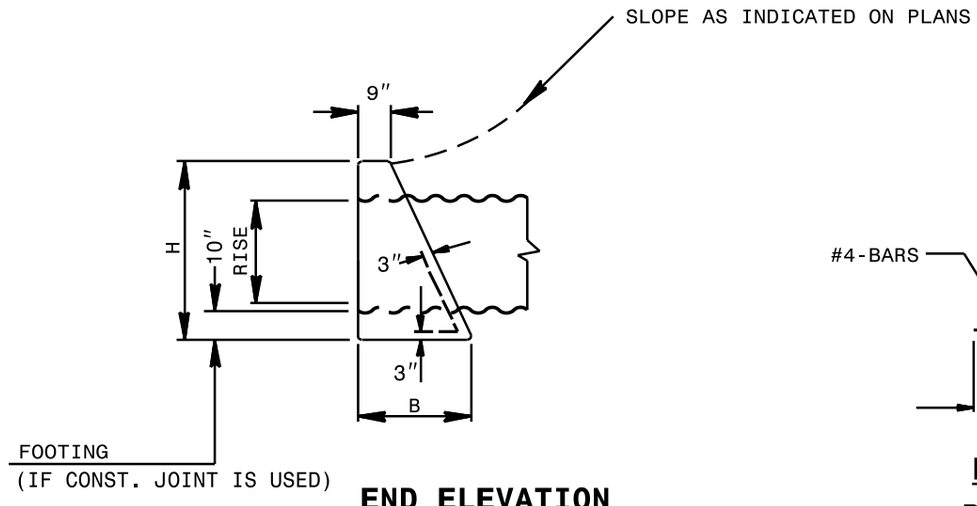


**PLAN**

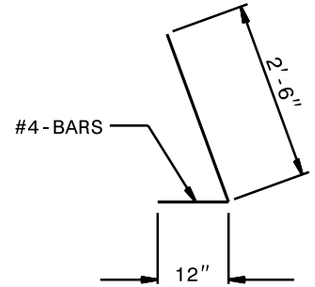
GENERAL NOTES:
-CHAMFER ALL CORNERS 1″. USE CLASS ″B″ CONCRETE.
-PLACE 2 #6 ″Y″ BARS IN THE TOP OF ALL ENDWALL FOR PIPE CULVERTS 42″ AND OVER WITH A MINIMUM OF 3″ COVER AND A LENGTH OF 6″ LESS THAN ENDWALL LENGTH.
-CONSTRUCT BOTTOM SLAB WITH FORMS.
-WHEN THE CONTRACTOR ELECTS TO USE A CONSTRUCTION JOINT AT THE BOTTOM OF THE PIPE, PLACE BAR ″X″ DOWELS IN THE BASE AS SHOWN ON PLANS. SPACE BARS APPROXIMATELY ON 12″ CENTERS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
-WHEN THE CONTRACTOR ELECTS TO USE A CONSTRUCTION JOINT AT THE BOTTOM OF THE PIPE AND POUR THE BASE SEPARATELY LEAVE THE POUR ROUGH.
-DO NOT INTERPRET WALL THICKNESS (T) SHOWN FOR THE THICKNESS ACCEPTABLE, BUT IS USED IN COMPUTING ENDWALL QUANTITIES.




**ELEVATION**




**END ELEVATION**




**DOWEL**
BAR-″X″

| LOC. | PIPE DIA. | DOWELS IN ENDWALL: SINGLE PIPE 18″ | 22″ | 25″ | 29″ | 36″ | 43″ | 50″ | 58″ | 65″ | 72″ | DOUBLE PIPE 18″ | 22″ | 25″ | 29″ | 36″ | 43″ | 50″ | 58″ | 65″ | 72″ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BARS | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ |
| G | QTY. | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 4 | 5 | 5 |
| M | QTY. | - | - | - | - | - | - | - | - | - | - | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| G | QTY. | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 4 | 5 | 5 |
| TOTAL LBS. | | 9 | 9 | 9 | 14 | 14 | 19 | 19 | 19 | 23 | 23 | 12 | 12 | 12 | 16 | 16 | 21 | 23 | 23 | 28 | 28 |

| DIMENSIONS AND CONCRETE QUANTITIES: COMMON DIMENSIONS USING C.S. PIPE ARCH SPAN | RISE | THICK. | H | B | G | M | SINGLE PIPE L | SINGLE PIPE YD³ | DOUBLE PIPE L | DOUBLE PIPE YD³ |
|---|---|---|---|---|---|---|---|---|---|---|
| 17″ | 13″ | 0.064 | 2′-9″ | 1′-5″ | 2′-7″ | 1′-11″ | 5′-2″ | 0.526 | 7′-0″ | 0.684 |
| 21″ | 15″ | 0.064 | 2′-11″ | 1′-6″ | 3′-0″ | 2′-4″ | 6′-0″ | 0.663 | 8′-4″ | 0.880 |
| 24″ | 18″ | 0.064 | 3′-2″ | 1′-7″ | 3′-5″ | 2′-8″ | 6′-10″ | 0.840 | 9′-6″ | 1.110 |
| 28″ | 20″ | 0.079 | 3′-4″ | 1′-8″ | 3′-9″ | 3′-1″ | 7′-5″ | 0.994 | 10′-6″ | 1.316 |
| 35″ | 24″ | 0.079 | 3′-8″ | 1′-10″ | 4′-6″ | 3′-11″ | 9′-0″ | 1.368 | 12′-11″ | 1.844 |
| 42″ | 29″ | 0.079 | 4′-1″ | 2′-1″ | 5′-4″ | 4′-8″ | 10′-8″ | 1.950 | 15′-4″ | 2.614 |
| 49″ | 33″ | 0.109 | 4′-5″ | 2′-3″ | 6′-0″ | 5′-5″ | 12′-0″ | 2.461 | 17′-5″ | 3.307 |
| 57″ | 38″ | 0.109 | 4′-10″ | 2′-6″ | 6′-10″ | 6′-4″ | 13′-8″ | 3.290 | 20′-0″ | 4.446 |
| 64″ | 43″ | 0.138 | 5′-3″ | 2′-8″ | 7′-8″ | 7′-1″ | 15′-4″ | 4.189 | 22′-5″ | 5.637 |
| 71″ | 47″ | 0.138 | 5′-7″ | 2′-10″ | 8′-4″ | 7′-11″ | 16′-8″ | 5.007 | 24′-7″ | 6.772 |

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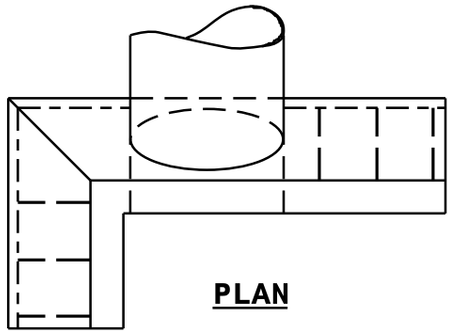
ROADWAY STANDARD DRAWING FOR

# CONCRETE ENDWALL FOR SINGLE AND DOUBLE PIPE CULVERTS

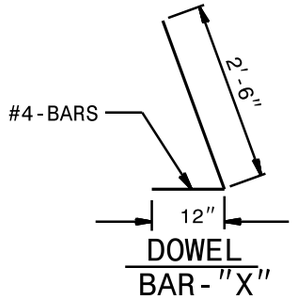
17″ X 13″ THRU 71″ X 47″ PIPE ARCH 2 2/3″ X ½″ CORRUGATIONS - 90° SKEW

SHEET 1 OF 1

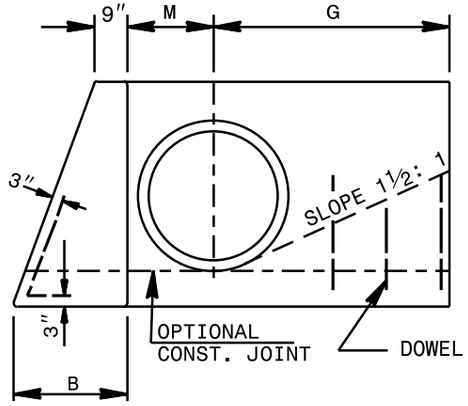
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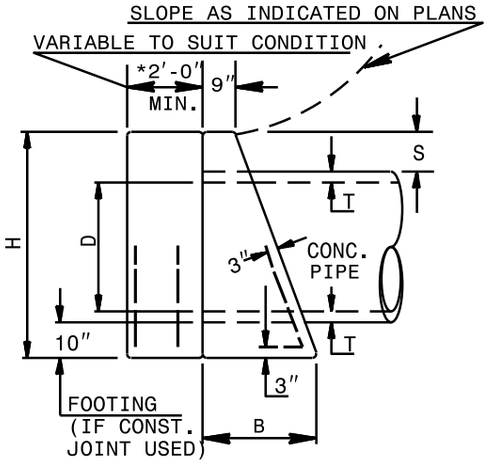
PLAN



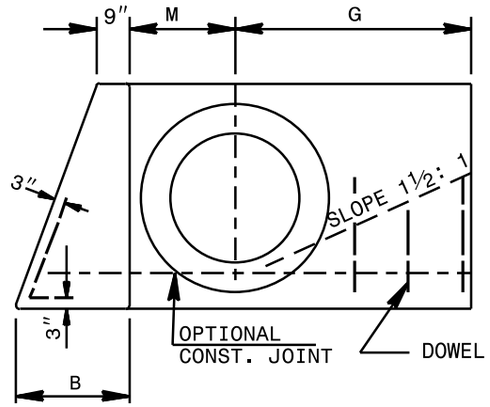

DOWEL
BAR-"X"



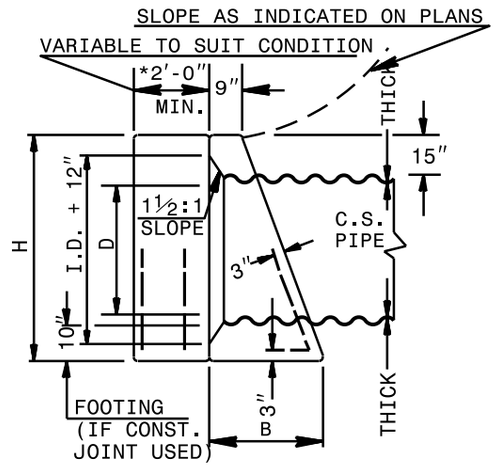

ELEVATION



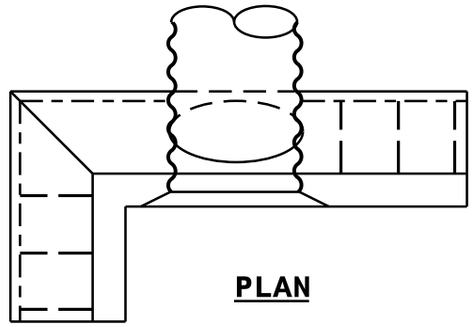

END ELEVATION



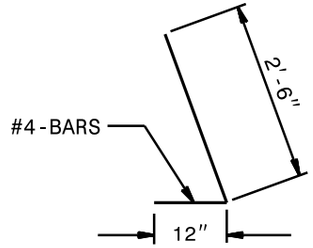

ELEVATION




END ELEVATION



PLAN




DOWEL
BAR-"X"

GENERAL NOTES:
-CHAMFER ALL CORNERS 1". USE CLASS "B" CONCRETE.
-PLACE 2 #6 "Y" BARS IN THE TOP OF ALL ENDWALL FOR PIPE CULVERTS 42" AND OVER WITH A MINIMUM OF 3" COVER AND A LENGTH OF 6" LESS THAN ENDWALL LENGTH.
-CONSTRUCT BOTTOM SLAB WITH FORMS.
-WHEN THE CONTRACTOR ELECTS TO USE A CONSTRUCTION JOINT AT THE BOTTOM OF THE PIPE, PLACE BAR "X" DOWELS IN THE BASE AS SHOWN ON PLANS. SPACE BARS APPROXIMATELY ON 12" CENTERS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
-WHEN THE CONTRACTOR ELECTS TO USE A CONSTRUCTION JOINT AT THE BOTTOM OF THE PIPE AND POUR THE BASE SEPARATELY LEAVE THE POUR ROUGH.
-DO NOT INTERPRET WALL THICKNESS (T) SHOWN FOR THE THICKNESS ACCEPTABLE, BUT IS USED IN COMPUTING ENDWALL QUANTITIES.

| REINFORCING QUANTITIES | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DIA. | 15" | 18" | 24" | 30" | 36" | 42" C.S. | | 42" R.C. | | 48" C.S. | | 48" R.C. | |
| BARS | "X" | "X" | "X" | "X" | "X" | "X" | "Y" | "X" | "Y" | "X" | "Y" | "X" | "Y" |
| QTY. | 5 | 5 | 6 | 6 | 7 | 7 | 2 | 7 | 2 | 8 | 2 | 8 | 2 |
| LBS. | 12 | 12 | 14 | 14 | 16 | 47 | | 49 | | 52 | | 55 | |

*QUANTITIES BASED ON 2'-0"

| DIMENSIONS AND CONCRETE QUANTITIES | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R.C.P. DIMENSIONS AND VOLUMES | | | | | | | C.S.P. DIMENSIONS AND VOLUMES | | | | |
| D | H | B | G | M | S | T | $YD^3$ | H | B | G | M | $YD^3$ |
| 15" | 3'-4" | 1'-8" | 2'-6" | 1'-1" | 10½" | 2¼" | 1.0 | 3'-4" | 1'-8" | 2'-5" | 1'-5" | 1.0 |
| 18" | 3'-7" | 1'-10" | 2'-11" | 1'-3" | 10" | 2½" | 1.2 | 3'-7" | 1'-10" | 2'-9" | 1'-6" | 1.3 |
| 24" | 4'-2" | 2'-1" | 3'-9" | 1'-6" | 10" | 3" | 1.7 | 4'-1" | 2'-1" | 3'-6" | 1'-9" | 1.8 |
| 30" | 4'-9" | 2'-5" | 4'-8" | 1'-10" | 10" | 3½" | 2.5 | 4'-7" | 2'-4" | 4'-3" | 2'-0" | 2.4 |
| 36" | 5'-5" | 2'-9" | 5'-8" | 2'-2" | 9½" | 4¾" | 3.6 | 5'-1" | 2'-7" | 5'-0" | 2'-3" | 3.1 |
| 42" | 6'-0" | 3'-0" | 6'-7" | 2'-5" | 9½" | 5¼" | 4.6 | 5'-7" | 2'-10" | 5'-9" | 2'-6" | 4.0 |
| 48" | 6'-7" | 3'-4" | 7'-5" | 2'-9" | 9½" | 5¾" | 6.0 | 6'-1" | 3'-1" | 6'-6" | 2'-9" | 5.1 |

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ROADWAY STANDARD DRAWING FOR

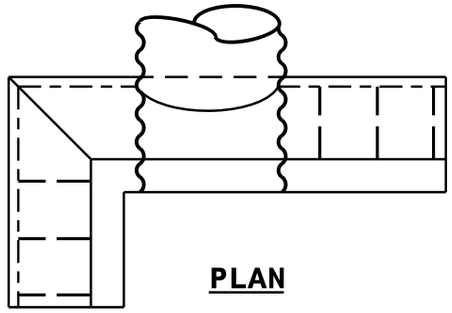
# CONCRETE "L" ENDWALL FOR SINGLE PIPE CULVERTS

15" THRU 48" PIPE

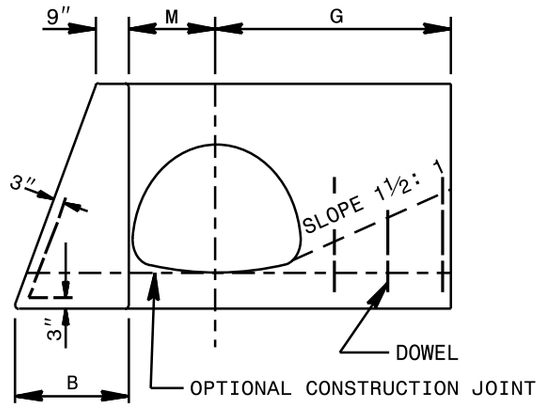
SHEET 1 OF 1

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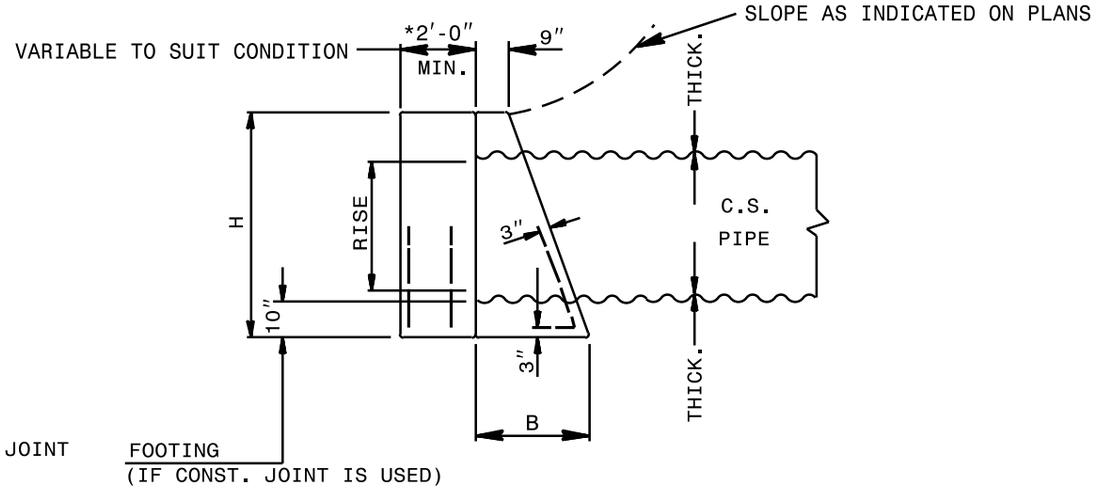
GENERAL NOTES:
-CHAMFER ALL CORNERS 1″. USE CLASS ″B″ CONCRETE.
-PLACE 2 #6 ″Y″ BARS IN THE TOP OF ALL ENDWALLS FOR PIPE CULVERTS 42″ AND OVER WITH A MINIMUM OF 3″ COVER AND A LENGTH OF 6″ LESS THAN ENDWALL LENGTH.
-CONSTRUCT BOTTOM SLAB WITH FORMS.
-WHEN THE CONTRACTOR ELECTS TO USE A CONSTRUCTION JOINT AT THE BOTTOM OF THE PIPE, PLACE BAR ″X″ DOWELS IN THE BASE AS SHOWN ON PLANS. SPACE BARS APPROXIMATELY ON 12″ CENTERS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
-WHEN THE CONTRACTOR ELECTS TO USE A CONSTRUCTION JOINT AT THE BOTTOM OF THE PIPE AND POUR THE BASE SEPARATELY LEAVE THE POUR ROUGH.
-DO NOT INTERPRET WALL THICKNESS (T) SHOWN FOR THE THICKNESS ACCEPTABLE, BUT IS USED IN COMPUTING ENDWALL QUANTITIES.



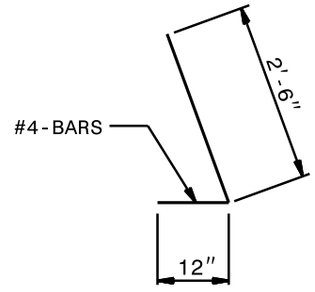
**PLAN**




**ELEVATION**




**END ELEVATION**




**DOWEL**
BAR-″X″

| REINFORCING QUANTITIES | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| DIA. | 18″ | 22″ | 25″ | 29″ | 36″ | 43″ | 50″ | 58″ | 65″ | 72″ |
| BARS | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″Y″ | ″X″ | ″Y″ | ″X″ |
| QTY. | 5 | 5 | 5 | 6 | 6 | 7 | 7 | 7 | 8 | 8 |
| LBS. | 12 | 12 | 12 | 14 | 14 | 16 | 16 | 16 | 19 | 19 |

*QUANTITIES BASED ON 2′-0″

| DIMENSIONS AND CONCRETE QUANTITIES | | | | | | | |
|---|---|---|---|---|---|---|---|
| COMMON DIMENSIONS | | | | | | | TOTAL CONC. |
| SPAN | RISE | THICK | H | B | G | M | $YD^3$ |
| 17″ | 13″ | 0.064 | 2′-9″ | 1′-5″ | 2′-7″ | 1′-0″ | 0.695 |
| 21″ | 15″ | 0.064 | 2′-11″ | 1′-6″ | 3′-0″ | 1′-2″ | 0.825 |
| 24″ | 18″ | 0.064 | 3′-2″ | 1′-7″ | 3′-5″ | 1′-3″ | 0.984 |
| 28″ | 20″ | 0.079 | 3′-4″ | 1′-8″ | 3′-9″ | 1′-5″ | 1.133 |
| 35″ | 24″ | 0.079 | 3′-8″ | 1′-10″ | 4′-6″ | 1′-9″ | 1.476 |
| 42″ | 29″ | 0.079 | 4′-1″ | 2′-1″ | 5′-4″ | 2′-0″ | 1.990 |
| 49″ | 33″ | 0.109 | 4′-5″ | 2′-3″ | 6′-0″ | 2′-4″ | 2.450 |
| 57″ | 38″ | 0.109 | 4′-10″ | 2′-6″ | 6′-10″ | 2′-8″ | 3.178 |
| 64″ | 43″ | 0.138 | 5′-3″ | 2′-8″ | 7′-8″ | 2′-11″ | 3.902 |
| 71″ | 47″ | 0.138 | 5′-7″ | 2′-10″ | 8′-4″ | 3′-3″ | 4.603 |

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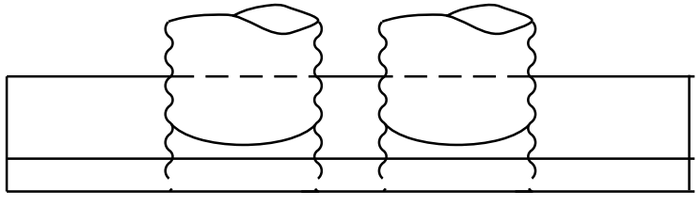
ROADWAY STANDARD DRAWING FOR

# CONCRETE ″L″ ENDWALL FOR SINGLE PIPE CULVERTS

17″ X 13″ THRU 71″ X 47″ PIPE ARCH 2 2/3″ X 1/2″ CORRUGATIONS

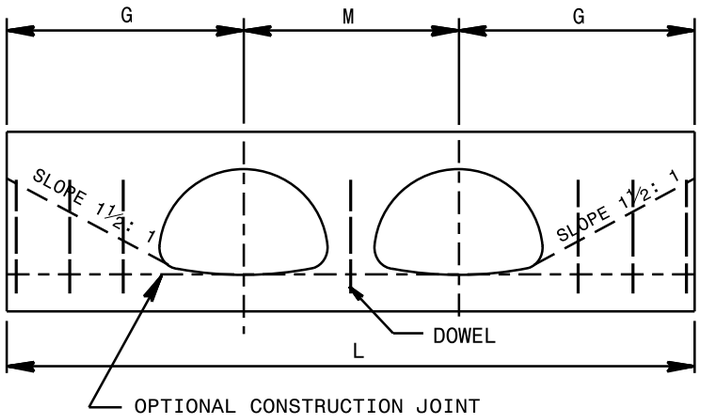
SHEET 1 OF 1

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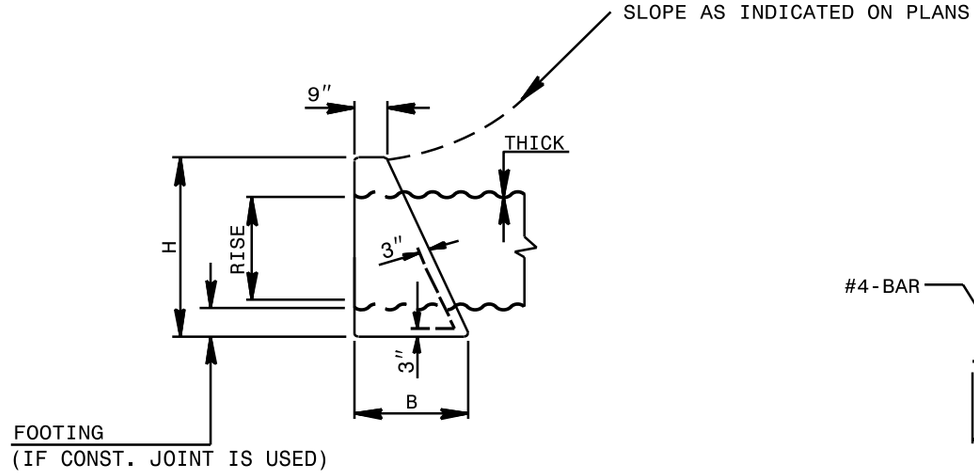


**PLAN**

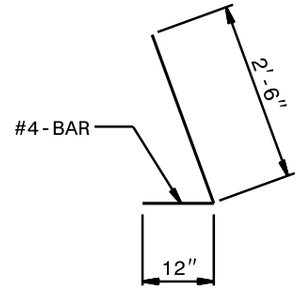
GENERAL NOTES:
-CHAMFER ALL CORNERS 1″. USE CLASS ″B″ CONCRETE.
-PLACE 2 #6 ″Y″ BARS IN THE TOP OF ALL ENDWALL FOR PIPE CULVERTS 42″ AND OVER WITH A MINIMUM OF 3″ COVER AND A LENGTH OF 6″ LESS THAN ENDWALL LENGTH.
-CONSTRUCT BOTTOM SLAB WITH FORMS.
-WHEN THE CONTRACTOR ELECTS TO USE A CONSTRUCTION JOINT AT THE BOTTOM OF THE PIPE, PLACE BAR ″X″ DOWELS IN THE BASE AS SHOWN ON PLANS. SPACE BARS APPROXIMATELY ON 12″ CENTERS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
-WHEN THE CONTRACTOR ELECTS TO USE A CONSTRUCTION JOINT AT THE BOTTOM OF THE PIPE AND POUR THE BASE SEPARATELY LEAVE THE POUR ROUGH.
-DO NOT INTERPRET WALL THICKNESS (T) SHOWN FOR THE THICKNESS ACCEPTABLE, BUT IS USED IN COMPUTING ENDWALL QUANTITIES.




**ELEVATION**




**END ELEVATION**




**DOWEL**
BAR-″X″

| DOWELS IN ENDWALL | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LOC. | PIPE SPAN | SINGLE PIPE | | | | | DOUBLE PIPE | | | | |
| | | 40″ | 46″ | 53″ | 60″ | 66″ | 40″ | 46″ | 53″ | 60″ | 66″ |
| | BARS | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ | ″X″ |
| G | QTY. | 4 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 5 | 5 |
| M | QTY. | - | - | - | - | - | 1 | 2 | 2 | 2 | 2 |
| G | QTY. | 4 | 4 | 4 | 5 | 5 | 4 | 5 | 5 | 5 | 5 |
| TOT. LBS. | | 19 | 19 | 19 | 23 | 23 | 21 | 23 | 23 | 28 | 28 |

| DIMENSIONS AND CONCRETE QUANTITIES | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| COMMON DIMENSIONS USING C.S. PIPE ARCH | | | | | | | SINGLE PIPE | | DOUBLE PIPE | |
| SPAN | RISE | THICK. | H | B | G | M | L | YD³ | L | YD³ |
| 40″ | 31″ | 0.079 | 4′-3″ | 2′-2″ | 5′-6″ | 4′-5″ | 11′-0″ | 2.179 | 15′-5″ | 2.848 |
| 46″ | 36″ | 0.109 | 4′-8″ | 2′-4″ | 6′-3″ | 5′-1″ | 12′-6″ | 2.834 | 17′-7″ | 3.692 |
| 53″ | 41″ | 0.109 | 5′-1″ | 2′-7″ | 7′-1″ | 5′-10″ | 14′-2″ | 3.742 | 20′-0″ | 4.868 |
| 60″ | 46″ | 0.109 | 5′-6″ | 2′-9″ | 7′-11″ | 6′-10″ | 15′-10″ | 4.717 | 22′-8″ | 6.234 |
| 66″ | 51″ | 0.109 | 5′-11″ | 3′-0″ | 8′-9″ | 7′-4″ | 17′-6″ | 5.968 | 24′-10″ | 7.759 |

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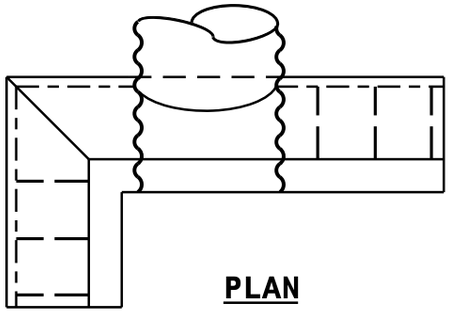
ROADWAY STANDARD DRAWING FOR

# CONCRETE ENDWALL FOR SINGLE AND DOUBLE PIPE CULVERTS

40″ X 31″ THRU 66″ X 51″ PIPE ARCH 3″ X 1″ CORRUGATIONS - 90° SKEW

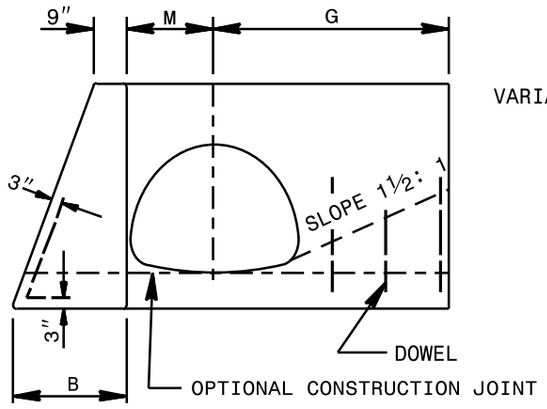
SHEET 1 OF 1

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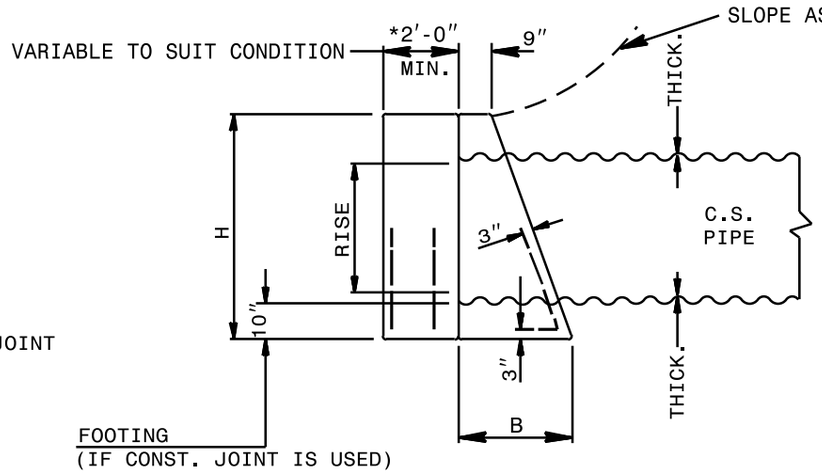


**PLAN**

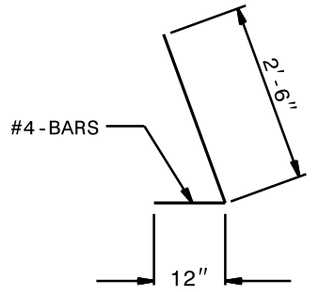
GENERAL NOTES:
-CHAMFER ALL CORNERS 1". USE CLASS "B" CONCRETE.
-PLACE 2 #6 "Y" BARS IN THE TOP OF ALL ENDWALL FOR PIPE CULVERTS 42" AND OVER WITH A MINIMUM OF 3" COVER AND A LENGTH OF 6" LESS THAN ENDWALL LENGTH.
-CONSTRUCT BOTTOM SLAB WITH FORMS.
-WHEN THE CONTRACTOR ELECTS TO USE A CONSTRUCTION JOINT AT THE BOTTOM OF THE PIPE, PLACE BAR "X" DOWELS IN THE BASE AS SHOWN ON PLANS. SPACE BARS APPROXIMATELY ON 12" CENTERS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
-WHEN THE CONTRACTOR ELECTS TO USE A CONSTRUCTION JOINT AT THE BOTTOM OF THE PIPE AND POUR THE BASE SEPARATELY LEAVE THE POUR ROUGH.
-DO NOT INTERPRET WALL THICKNESS (T) SHOWN FOR THE THICKNESS ACCEPTABLE, BUT IS USED IN COMPUTING ENDWALL QUANTITIES.




**ELEVATION**




**END ELEVATION**




**DOWEL**

BAR-"X"

| DOWELS IN ENDWALL | | | | | |
|---|---|---|---|---|---|
| DIA. | 40" | 46" | 53" | 60" | 66" |
| BARS | "X" | "X" | "X" | "X" | "X" |
| QTY. | 7 | 7 | 7 | 8 | 8 |
| LBS. | 16 | 16 | 16 | 19 | 19 |

| DIMENSIONS AND CONCRETE QUANTITIES | | | | | | | |
|---|---|---|---|---|---|---|---|
| COMMON DIMENSIONS | | | | | | | TOTAL CONC. |
| SPAN | RISE | THICK | H | B | G | M | $YD^3$ |
| 40" | 31" | 0.079 | 4'-3" | 2'-2" | 5'-6" | 1'-11" | 2.187 |
| 46" | 36" | 0.109 | 4'-8" | 2'-4" | 6'-3" | 2'-2" | 2.739 |
| 53" | 41" | 0.109 | 5'-1" | 2'-7" | 7'-1" | 2'-6" | 3.524 |
| 60" | 46" | 0.109 | 5'-6" | 2'-9" | 7'-11" | 2'-9" | 4.302 |
| 66" | 51" | 0.109 | 5'-11" | 3'-0" | 8'-9" | 3'-0" | 5.345 |

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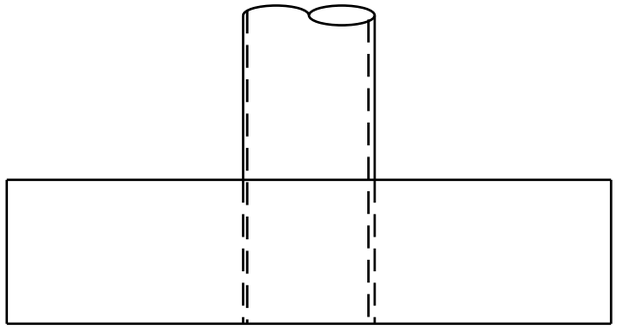
ROADWAY STANDARD DRAWING FOR

# CONCRETE "L" ENDWALL FOR SINGLE PIPE CULVERTS

40" X 31" THRU 66" X 51" PIPE ARCH 3" X 1" CORRUGATIONS

SHEET 1 OF 1

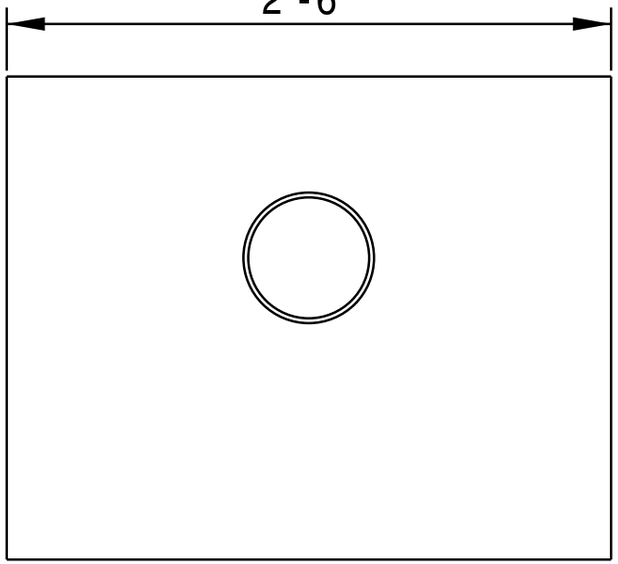
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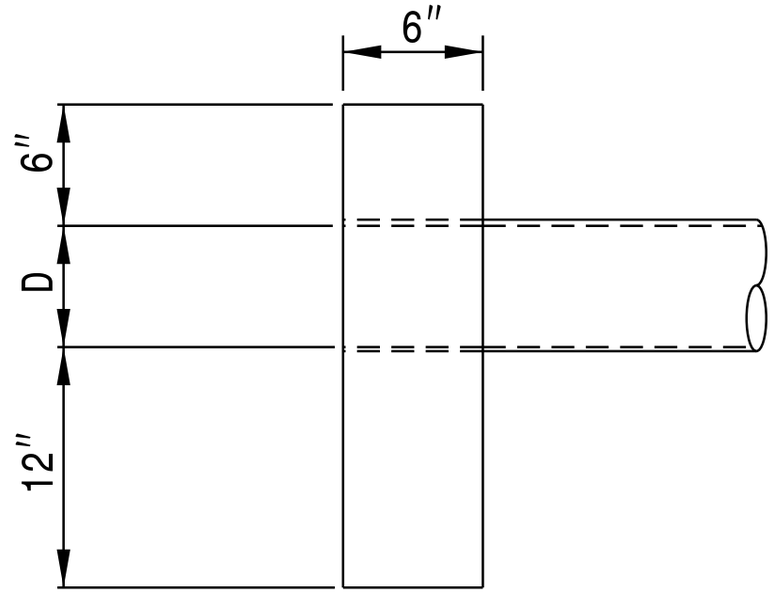
**PLAN**

GENERAL NOTES:
CHAMFER ALL CORNERS 1″.
USE CLASS "B" CONCRETE.

| CONCRETE QUANTITIES | | | |
|---|---|---|---|
| D | REINF. CONC. | BIT. FIBER | CORR. PLASTIC OR METAL |
| | $YD^3$ | $YD^3$ | $YD^3$ |
| 4″ | 0.082 | 0.083 | 0.083 |
| 6″ | 0.087 | 0.088 | 0.089 |
| 8″ | 0.091 | 0.092 | 0.094 |




**ELEVATION**




**END ELEVATION**

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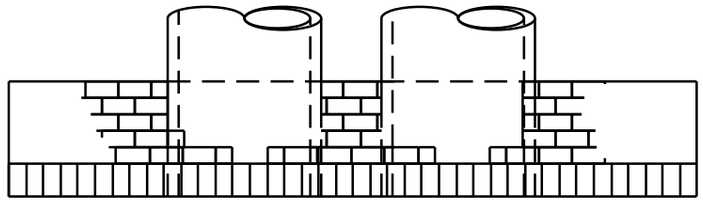
ROADWAY STANDARD DRAWING FOR

# CONCRETE ENDWALL FOR OUTFALL

4″, 6″ OR 8″ PIPE

SHEET 1 OF 1

838.10



**PLAN**

GENERAL NOTES:

-ALL MORTAR JOINTS ARE ½″ ± ⅛″.

-BOND BRICKWORK WITH FULL HEADERS EVERY THREE COURSES.

-CONCAVE TOOL ALL EXPOSED JOINTS.

-DO NOT INTERPRET WALL THICKNESS (T) SHOWN AS THE THICKNESS ACCEPTABLE, BUT IS USED ONLY IN COMPUTING ENDWALL DIMENSIONS AND QUANTITIES.

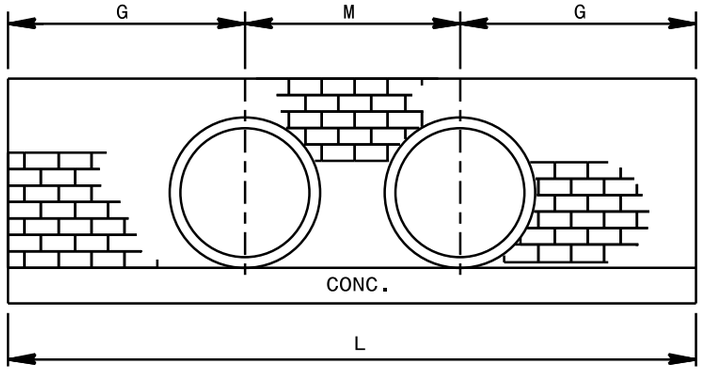
-CONSTRUCT THE BASE WITH FORMS.

-USE CLASS 'B' CONCRETE.

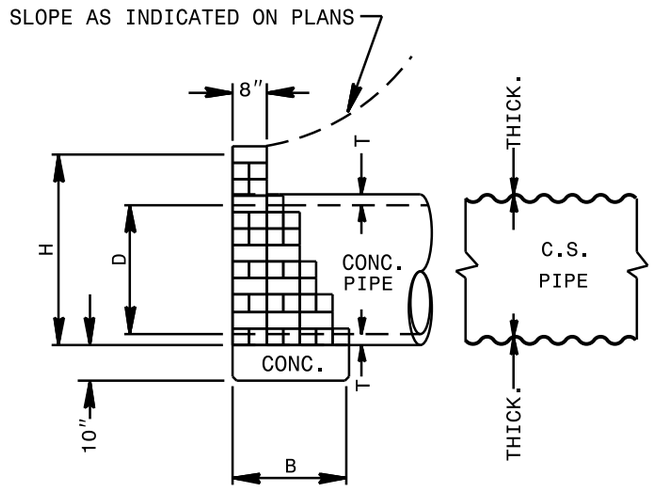
-PAY FOR CONCRETE AS BRICK MASONRY.

-CONCRETE BRICK MAY BE USED IN LIEU OF CLAY BRICK.

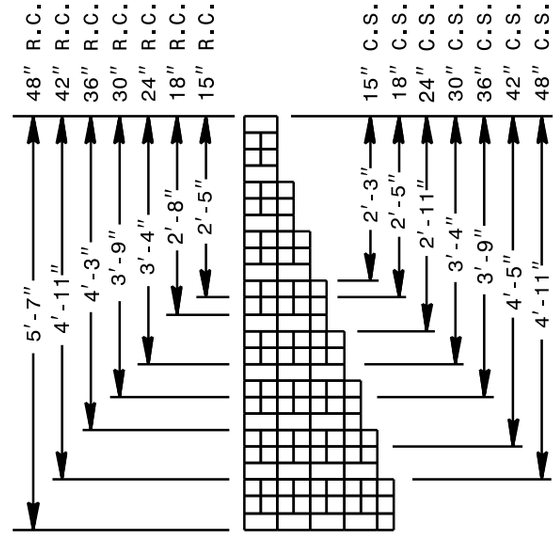
-JUMBO BRICK WILL BE PERMITTED.




**ELEVATION**




**END ELEVATION**




**TYPICAL SECTION THRU WALL**

**DIMENSIONS AND QUANTITIES**

| USING CONCRETE PIPE | | | | | | | | | | | | USING CORRUGATED METAL PIPE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | COMMON DIMS. | | | | SINGLE PIPE | | | DOUBLE PIPE | | | | | COMMON DIMS. | | | | SINGLE PIPE | | | DOUBLE PIPE | | | |
| D | H | B | G | T | L | BRICK YD³ | CONC. YD³ | M | L | BRICK YD³ | CONC. YD³ | D | H | B | G | L | L | BRICK YD³ | CONC. YD³ | M | L | BRICK YD³ | CONC. YD³ |
| 15″ | 2′-5″ | 1′-8″ | 2′-10″ | 1⅞″ | 5′-8″ | 0.441 | 0.291 | 2′-2″ | 7′-10″ | 0.555 | 0.403 | 15″ | 2′-3″ | 1′-4″ | 2′-9″ | 5′-6″ | 5′-6″ | 0.384 | 0.226 | 1′-11″ | 7′-5″ | 0.482 | 0.305 |
| 18″ | 2′-8″ | 1′-8″ | 3′-2″ | 2″ | 6′-4″ | 0.562 | 0.326 | 2′-7″ | 8′-11″ | 0.722 | 0.459 | 18″ | 2′-5″ | 1′-8″ | 3′-0″ | 6′-0″ | 6′-0″ | 0.478 | 0.309 | 2′-3″ | 8′-3″ | 0.605 | 0.424 |
| 24″ | 3′-4″ | 2′-0″ | 4′-1″ | 3″ | 8′-2″ | 1.008 | 0.504 | 3′-5″ | 11′-7″ | 1.285 | 0.715 | 24″ | 2′-11″ | 1′-8″ | 3′-9″ | 7′-6″ | 7′-6″ | 0.749 | 0.386 | 3′-0″ | 10′-6″ | 0.954 | 0.540 |
| 30″ | 3′-9″ | 2′-4″ | 4′-8″ | 3½″ | 9′-4″ | 1.391 | 0.672 | 4′-3″ | 13′-7″ | 1.820 | 0.978 | 30″ | 3′-4″ | 2′-0″ | 4′-5″ | 8′-10″ | 8′-10″ | 1.090 | 0.545 | 3′-9″ | 12′-7″ | 1.399 | 0.777 |
| 36″ | 4′-3″ | 2′-4″ | 5′-5″ | 4″ | 10′-10″ | 1.895 | 0.780 | 5′-0″ | 15′-10″ | 2.462 | 1.140 | 36″ | 3′-9″ | 2′-4″ | 5′-0″ | 10′-0″ | 10′-0″ | 1.503 | 0.720 | 4′-6″ | 14′-6″ | 1.965 | 1.044 |
| 42″ | 4′-11″ | 2′-8″ | 6′-4″ | 5¼″ | 12′-8″ | 2.867 | 1.043 | 5′-10″ | 18′-6″ | 3.729 | 1.523 | 42″ | 4′-5″ | 2′-8″ | 6′-0″ | 12′-0″ | 12′-0″ | 2.373 | 0.988 | 5′-3″ | 17′-3″ | 3.062 | 1.420 |
| 48″ | 5′-7″ | 3′-0″ | 7′-3″ | 5¾″ | 14′-6″ | 4.032 | 1.343 | 6′-8″ | 21′-2″ | 5.184 | 1.960 | 48″ | 4′-11″ | 2′-8″ | 6′-9″ | 13′-6″ | 13′-6″ | 3.102 | 1.111 | 6′-0″ | 19′-6″ | 4.002 | 1.606 |

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ROADWAY STANDARD DRAWING FOR

# BRICK ENDWALL FOR SINGLE AND DOUBLE PIPE CULVERTS

15″ THRU 48″ PIPE - 90° SKEW

SHEET 1 OF 1

838.11

GENERAL NOTES:

-ALL MORTAR JOINTS ARE ½″ ± ⅛″.

-BOND BRICKWORK WITH FULL HEADERS EVERY THREE COURSES.

-CONCAVE TOOL ALL EXPOSED JOINTS.

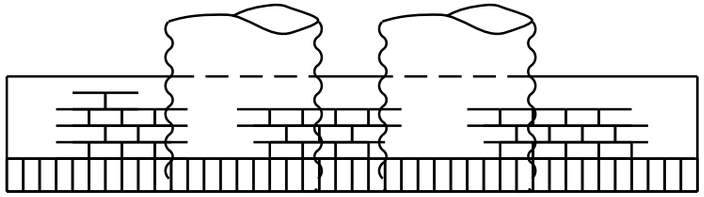
-CONSTRUCT THE BASE WITH FORMS.

-USE CLASS 'B' CONCRETE.

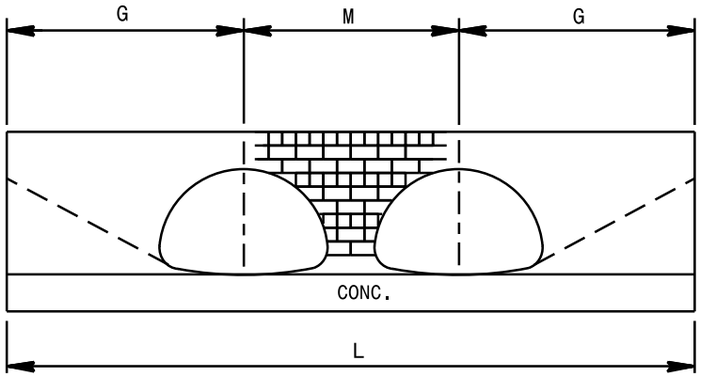
-PAY FOR CONCRETE AS BRICK MASONRY.

-CONCRETE BRICK MAY BE USED IN LIEU OF CLAY BRICK.

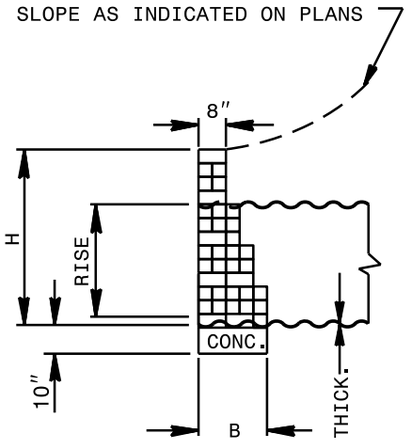
-JUMBO BRICK WILL BE PERMITTED.



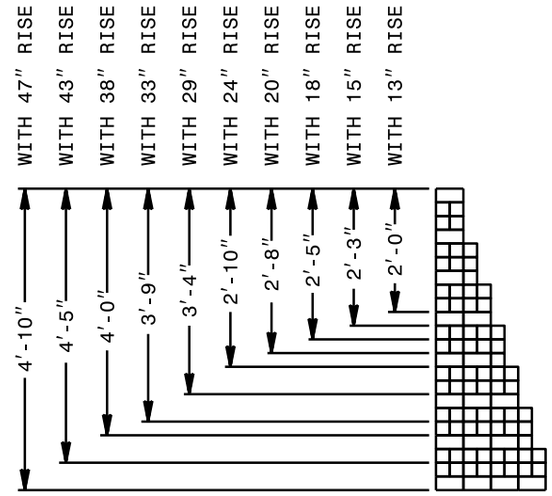
**PLAN**




**ELEVATION**




**END ELEVATION**




**TYPICAL SECTION THRU WALL**

DIMENSIONS AND BRICK QUANTITIES

| COMMON DIMENSIONS | | | | | | SINGLE PIPE | | | DOUBLE PIPE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SPAN | RISE | GAGE | H | B | G | L | BRICK YD³ | CONC. TD³ | M | L | BRICK YD³ | CONC. YD³ |
| 17″ | 13″ | 16 | 2′-0″ | 1′-4″ | 2′-9″ | 5′-6″ | 0.331 | 0.226 | 1′-10″ | 7′-4″ | 0.411 | 0.302 |
| 21″ | 15″ | 16 | 2′-3″ | 1′-4″ | 3′-1″ | 6′-2″ | 0.421 | 0.254 | 2′-4″ | 8′-6″ | 0.538 | 0.350 |
| 24″ | 18″ | 16 | 2′-5″ | 1′-8″ | 3′-7″ | 7′-2″ | 0.568 | 0.369 | 2′-8″ | 9′-10″ | 0.715 | 0.506 |
| 28″ | 20″ | 14 | 2′-8″ | 1′-8″ | 3′-11″ | 7′-10″ | 0.704 | 0.403 | 3′-1″ | 10′-11″ | 0.900 | 0.562 |
| 35″ | 24″ | 14 | 2′-10″ | 1′-8″ | 4′-7″ | 9′-2″ | 0.889 | 0.472 | 3′-10″ | 13′-0″ | 1.135 | 0.669 |
| 42″ | 29″ | 14 | 3′-4″ | 2′-0″ | 5′-5″ | 10′-10″ | 1.320 | 0.669 | 4′-8″ | 15′-6″ | 1.692 | 0.957 |
| 49″ | 33″ | 12 | 3′-9″ | 2′-4″ | 6′-1″ | 12′-2″ | 2.000 | 0.876 | 5′-5″ | 17′-7″ | 2.610 | 1.266 |
| 57″ | 38″ | 12 | 4′-0″ | 2′-4″ | 6′-11″ | 13′-10″ | 2.428 | 0.996 | 6′-4″ | 20′-2″ | 3.170 | 1.452 |
| 64″ | 43″ | 10 | 4′-5″ | 2′-8″ | 7′-9″ | 15′-6″ | 3.209 | 1.276 | 7′-1″ | 22′-7″ | 4.178 | 1.859 |
| 71″ | 47″ | 10 | 4′-10″ | 2′-8″ | 8′-10″ | 17′-8″ | 4.282 | 1.454 | 7′-10″ | 25′-6″ | 5.515 | 2.100 |

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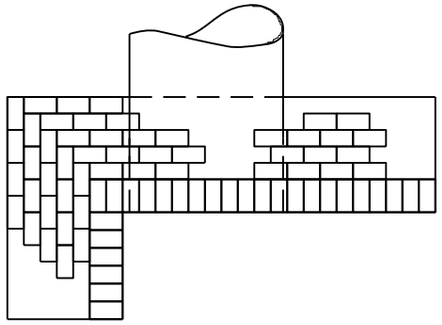
ROADWAY STANDARD DRAWING FOR

# BRICK ENDWALL FOR SINGLE AND DOUBLE PIPE CULVERTS

17″ X 13″ THRU 71″ X 47″ PIPE ARCH 2 2/3 ″ X ½″ CORRUGATIONS - 90° SKEW

SHEET 1 OF 1

838.14



**PLAN**

GENERAL NOTES:

-ALL MORTAR JOINTS ARE ½" ± ⅛".

-BOND BRICKWORK WITH FULL HEADERS EVERY THREE COURSES.

-CONCAVE TOOL ALL EXPOSED JOINTS.

-DO NOT INTERPRET WALL THICKNESS (T) SHOWN AS THE THICKNESS ACCEPTABLE, BUT IS USED ONLY IN COMPUTING ENDWALL DIMENSIONS AND QUANTITIES.

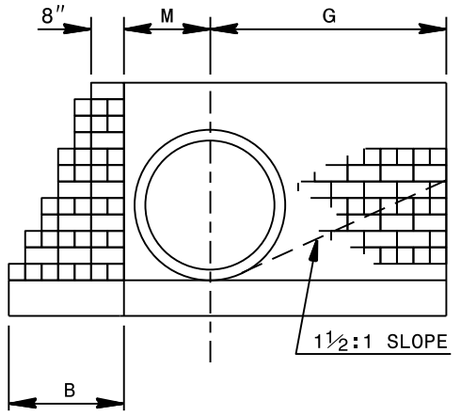
-CONSTRUCT THE BASE WITH FORMS.

-USE CLASS 'B' CONCRETE.

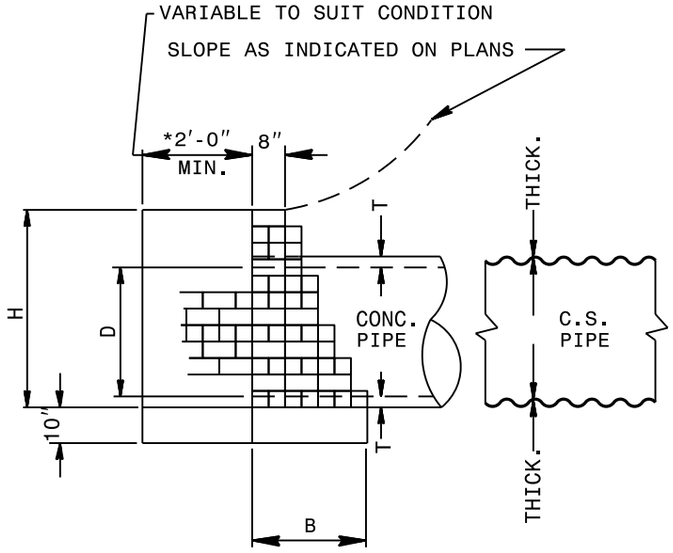
-PAY FOR CONCRETE AS BRICK MASONRY.

-CONCRETE BRICK MAY BE USED IN LIEU OF CLAY BRICK.

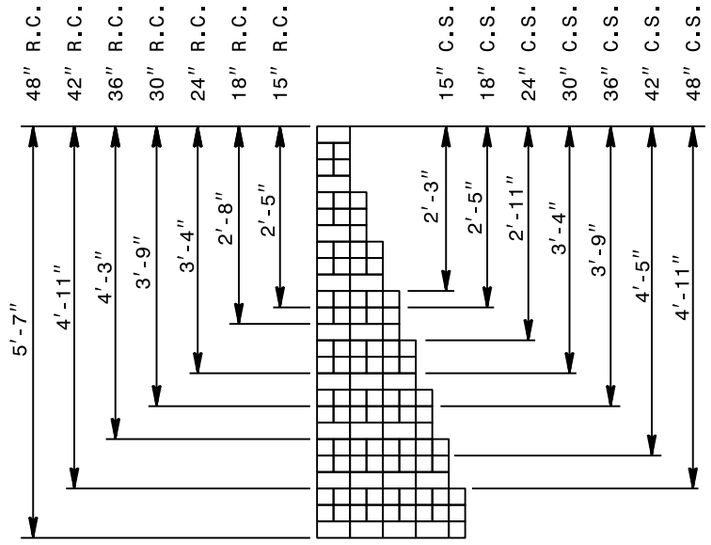
-JUMBO BRICK WILL BE PERMITTED.




**ELEVATION**




**END ELEVATION**




**TYPICAL SECTION THRU WALL**

*QUANTITIES BASED ON 2'-0"

| DIMENSIONS AND CONCRETE QUANTITIES | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COMMON DIMENSIONS | | | | | | USING R.C.P. | | COMMON DIMENSIONS | | | | USING C.S.P. | |
| D | H | B | G | M | T | BRICK YD³ | CONC. YD³ | H | B | G | M | BRICK YD³ | CONC. YD³ |
| 15" | 2'-5" | 1'-8" | 2'-10" | 1'-0" | 1⅞" | 0.562 | 0.386 | 2'-3" | 1'-4" | 2'-9" | 0'-11" | 0.480 | 0.288 |
| 18" | 2'-8" | 1'-8" | 3'-2" | 1'-2" | 2" | 0.691 | 0.412 | 2'-5" | 1'-8" | 3'-0" | 1'-0" | 0.581 | 0.394 |
| 24" | 3'-4" | 2'-0" | 4'-1" | 1'-5" | 3" | 1.123 | 0.586 | 2'-11" | 1'-8" | 3'-9" | 1'-3" | 1.840 | 0.446 |
| 30" | 3'-9" | 2'-4" | 4'-8" | 1'-9" | 3½" | 1.513 | 0.774 | 3'-4" | 2'-0" | 4'-5" | 1'-6" | 1.167 | 0.612 |
| 36" | 4'-3" | 2'-4" | 5'-5" | 2'-0" | 4" | 1.958 | 0.846 | 3'-9" | 2'-4" | 5'-0" | 1'-9" | 1.562 | 0.798 |
| 42" | 4'-11" | 2'-8" | 6'-4" | 2'-4" | 5¼" | 2.841 | 1.097 | 4'-5" | 2'-8" | 6'-0" | 2'-0" | 2.318 | 1.043 |
| 48" | 5'-7" | 3'-0" | 7'-3" | 2'-8" | 5¾" | 3.865 | 1.381 | 4'-11" | 2'-8" | 6'-9" | 2'-3" | 2.929 | 1.125 |


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ROADWAY STANDARD DRAWING FOR

# BRICK "L" ENDWALL FOR SINGLE PIPE CULVERTS

15" THRU 48" PIPE

GENERAL NOTES:

-ALL MORTAR JOINTS ARE ½" ± ⅛".

-BOND BRICKWORK WITH FULL HEADERS EVERY THREE COURSES.

-CONCAVE TOOL ALL EXPOSED JOINTS.

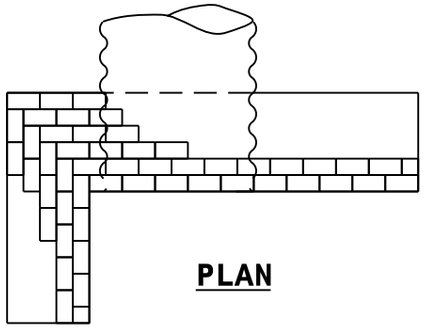
-CONSTRUCT THE BASE WITH FORMS.

-USE CLASS 'B' CONCRETE.

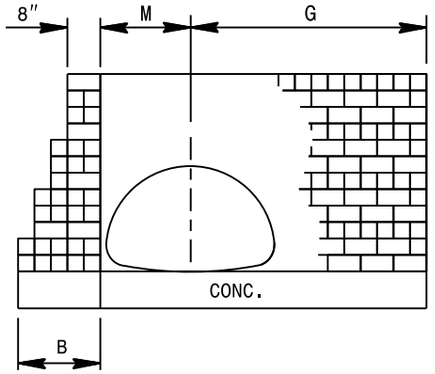
-PAY FOR CONCRETE AS BRICK MASONRY.

-CONCRETE BRICK MAY BE USED IN LIEU OF CLAY BRICK.

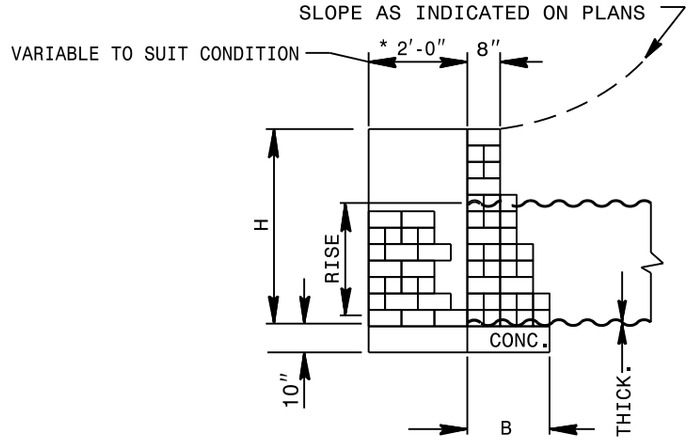
-JUMBO BRICK WILL BE PERMITTED.



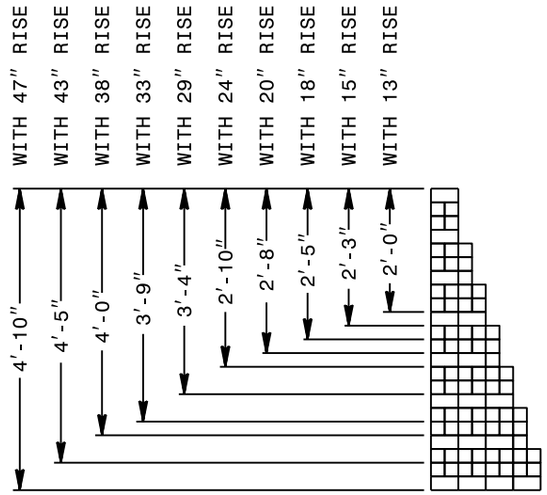
**PLAN**




**ELEVATION**




**END ELEVATION**




**TYPICAL SECTION THRU WALL**

**DIMENSIONS AND QUANTITIES**

| COMMON DIMENSIONS | | | | | | | QUANTITIES | |
|---|---|---|---|---|---|---|---|---|
| SPAN | RISE | GAGE | H | B | C | M | BRICK YD$^3$ | CONC. YD$^3$ |
| 17" | 13" | 16 | 2'-0" | 1'-4" | 2'-9" | 1'-0" | 0.417 | 0.291 |
| 21" | 15" | 16 | 2'-3" | 1'-4" | 3'-1" | 1'-2" | 0.511 | 0.312 |
| 24" | 18" | 16 | 2'-5" | 1'-8" | 3'-7" | 1'-3" | 0.643 | 0.437 |
| 28" | 20" | 14 | 2'-8" | 1'-8" | 3'-11" | 1'-5" | 0.780 | 0.463 |
| 35" | 24" | 14 | 2'-10" | 1'-8" | 4'-7" | 1'-9" | 0.940 | 0.514 |
| 42" | 29" | 14 | 3'-4" | 2'-0" | 5'-5" | 2'-0" | 1.320 | 0.705 |
| 49" | 33" | 12 | 3'-9" | 2'-4" | 6'-1" | 2'-4" | 1.763 | 0.918 |
| 57" | 38" | 12 | 4'-0" | 2'-4" | 6'-11" | 2'-8" | 2.124 | 1.002 |
| 64" | 43" | 10 | 4'-5" | 2'-8" | 7'-9" | 2'-11" | 2.690 | 1.262 |
| 71" | 47" | 10 | 4'-10" | 2'-8" | 8'-10" | 3'-3" | 3.500 | 1.379 |

* QUANTITIES BASED ON 2'-0"

STATE OF NORTH CAROLINA
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DIVISION OF HIGHWAYS
RALEIGH, N.C.

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ROADWAY STANDARD DRAWING FOR

# BRICK "L" ENDWALL FOR SINGLE PIPE CULVERTS

17" X 13" THRU 71" X 47" PIPE ARCH 2 2/3 " X 1/2" CORRUGATIONS

SHEET 1 OF 1

838.16

GENERAL NOTES:

-ALL MORTAR JOINTS ARE ½" ± ⅛".

-BOND BRICKWORK WITH FULL HEADERS EVERY THREE COURSES.

-CONCAVE TOOL ALL EXPOSED JOINTS.

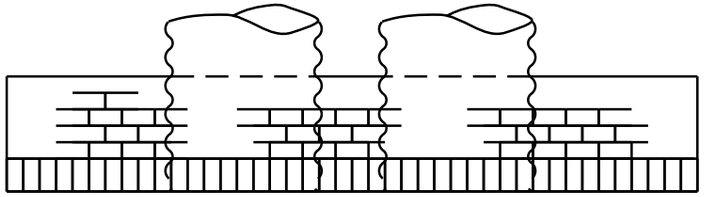
-CONSTRUCT THE BASE WITH FORMS.

-USE CLASS 'B' CONCRETE.

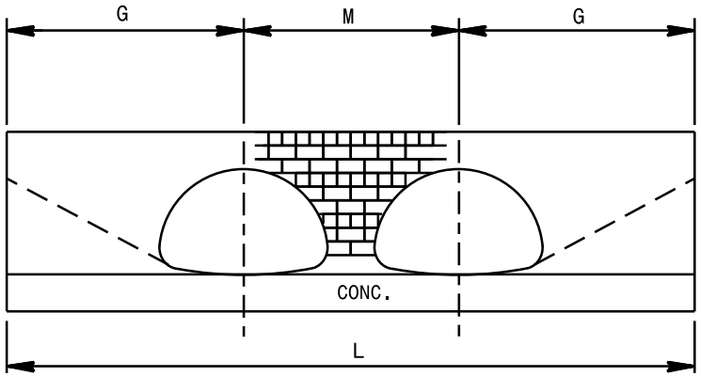
-PAY FOR CONCRETE AS BRICK MASONRY.

-CONCRETE BRICK MAY BE USED IN LIEU OF CLAY BRICK.

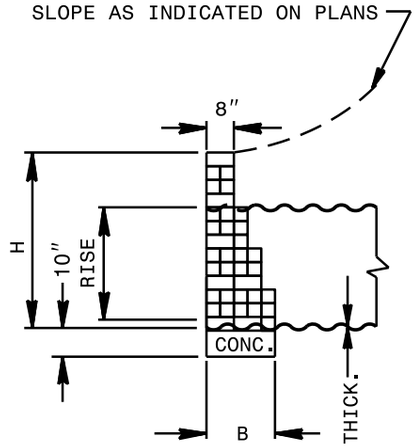
-JUMBO BRICK WILL BE PERMITTED.



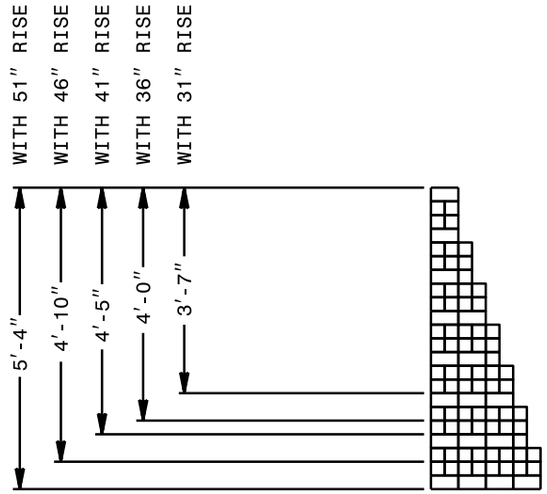
**PLAN**




**ELEVATION**




**END ELEVATION**




**TYPICAL SECTION THRU WALL**

**DIMENSIONS AND BRICK QUANTITIES**

| COMMON DIMENSIONS | | | | | | SINGLE PIPE | | | DOUBLE PIPE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SPAN | RISE | GAGE | H | B | G | L | BRICK YD$^3$ | CONC. YD$^3$ | M | L | BRICK YD$^3$ | CONC. YD$^3$ |
| 40" | 31" | 0.109 | 3'-7" | 2'-0" | 5'-8" | 11'-4" | 1.572 | 0.700 | 4'-5" | 15'-9" | 1.968 | 0.972 |
| 46" | 36" | 0.109 | 4'-0" | 2'-4" | 6'-5" | 12'-10" | 2.154 | 0.924 | 5'-1" | 17'-11" | 2.692 | 1.290 |
| 53" | 41" | 0.109 | 4'-5" | 2'-8" | 7'-2" | 14'-4" | 2.848 | 1.180 | 5'-10" | 20'-2" | 3.575 | 1.660 |
| 60" | 46" | 0.109 | 4'-10" | 2'-8" | 8'-0" | 16'-0" | 3.726 | 1.317 | 6'-8" | 22'-8" | 4.712 | 1.866 |
| 66" | 51" | 0.109 | 5'-4" | 3'-0" | 8'-10" | 17'-8" | 4.787 | 1.636 | 7'-4" | 25'-0" | 6.031 | 2.315 |

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ROADWAY STANDARD DRAWING FOR

# BRICK ENDWALL FOR SINGLE AND DOUBLE PIPE CULVERTS

40"X31" THRU 66"X51" PIPE ARCH 3"X1" CORRUGATIONS - 90° SKEW

SHEET 1 OF 1

838.17

GENERAL NOTES:

-ALL MORTAR JOINTS ARE ½" ± ⅛".

-BOND BRICKWORK WITH FULL HEADERS EVERY THREE COURSES.

-CONCAVE TOOL ALL EXPOSED JOINTS.

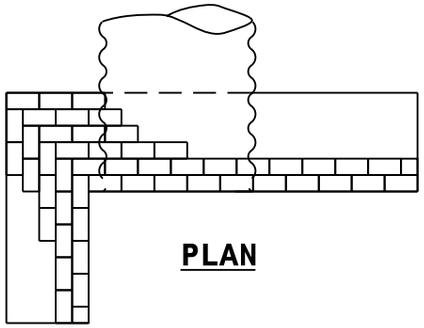
-CONSTRUCT THE BASE WITH FORMS.

-USE CLASS 'B' CONCRETE.

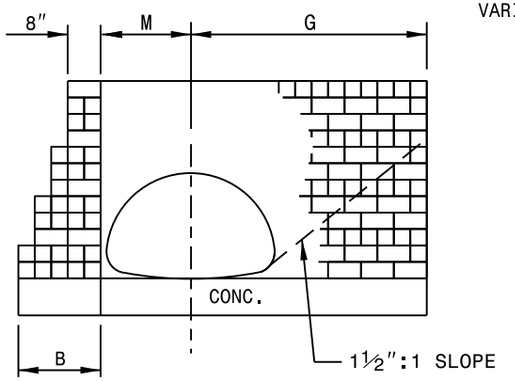
-PAY FOR CONCRETE AS BRICK MASONRY.

-CONCRETE BRICK MAY BE USED IN LIEU OF CLAY BRICK.

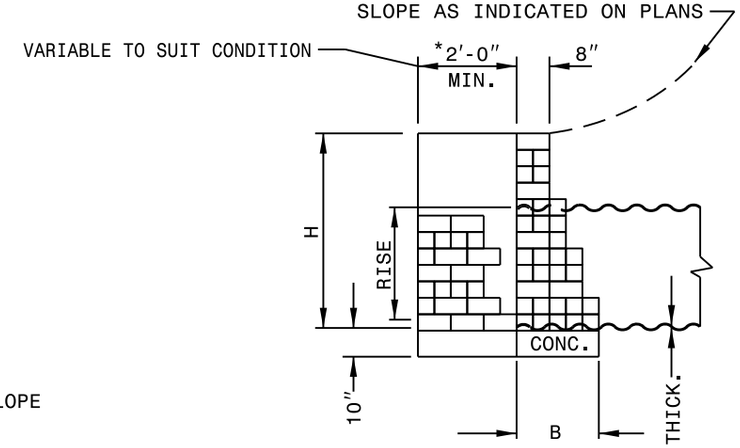
-JUMBO BRICK WILL BE PERMITTED.



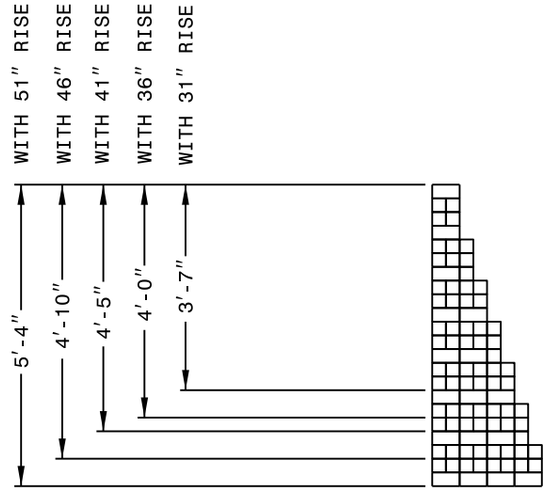
**PLAN**




**ELEVATION**




**END ELEVATION**




**TYPICAL SECTION THRU WALL**

* QUANTITIES BASED ON 2'-0"

| DIMENSIONS AND QUANTITIES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| COMMON DIMENSIONS | | | | | | | QUANTITIES | |
| SPAN | RISE | THICK | H | B | G | M | BRICK YD³ | CONC. YD³ |
| 40" | 31" | 0.109 | 3'-7" | 2'-0" | 5'-8" | 1'-11" | 1.525 | 0.715 |
| 46" | 36" | 0.109 | 4'-0" | 2'-4" | 6'-5" | 2'-2" | 2.025 | 0.930 |
| 53" | 41" | 0.109 | 4'-5" | 2'-8" | 7'-2" | 2'-6" | 2.626 | 1.180 |
| 60" | 46" | 0.109 | 4'-10" | 2'-8" | 8'-0" | 2'-9" | 3.332 | 1.269 |
| 66" | 51" | 0.109 | 5'-4" | 3'-0" | 8'-10" | 3'-0" | 4.074 | 1.560 |

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RALEIGH, N.C.

ROADWAY STANDARD DRAWING FOR

# BRICK ENDWALL FOR SINGLE PIPE CULVERTS

40"X31" THRU 66"X51" PIPE ARCH 3"X1" CORRUGATIONS

SHEET 1 OF 1

838.18

GENERAL NOTES:

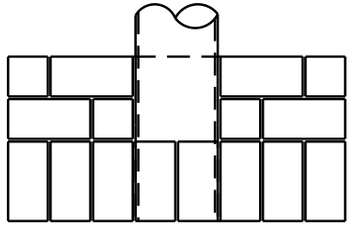
-ALL MORTAR JOINTS ARE ½" ± ⅛".

-BOND BRICKWORK WITH FULL HEADERS EVERY THREE COURSES.

-CONCAVE TOOL ALL EXPOSED JOINTS.

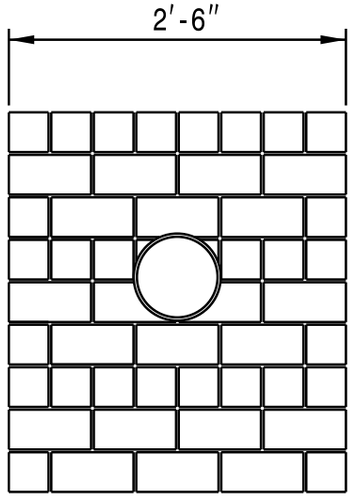
-CONCRETE BRICK MAY BE USED IN LIEU OF CLAY BRICK.

-JUMBO BRICK WILL BE PERMITTED.

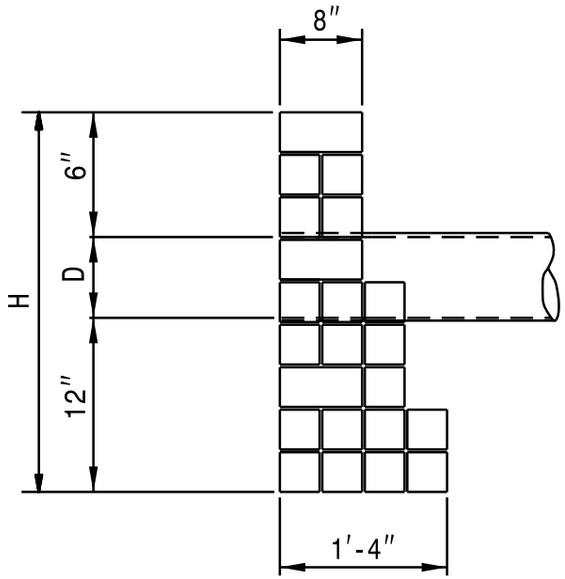


**PLAN**

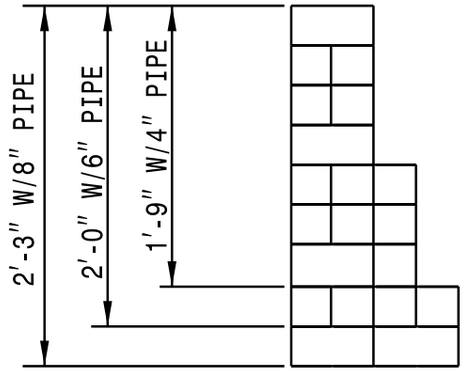
| CONCRETE QUANTITIES | | | | |
|---|---|---|---|---|
| D | H | REINF. CONC. | BIT. FIBER | CORR. PLASTIC OR METAL |
| | | $YD^3$ | $YD^3$ | $YD^3$ |
| 4" | 1'-9" | 0.140 | 0.141 | 0.142 |
| 6" | 2'-0" | 0.163 | 0.164 | 0.166 |
| 8" | 2'-3" | 0.186 | 0.187 | 0.190 |




**ELEVATION**




**END ELEVATION**




**TYPICAL SECTION THRU WALL**

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DEPT. OF TRANSPORTATION
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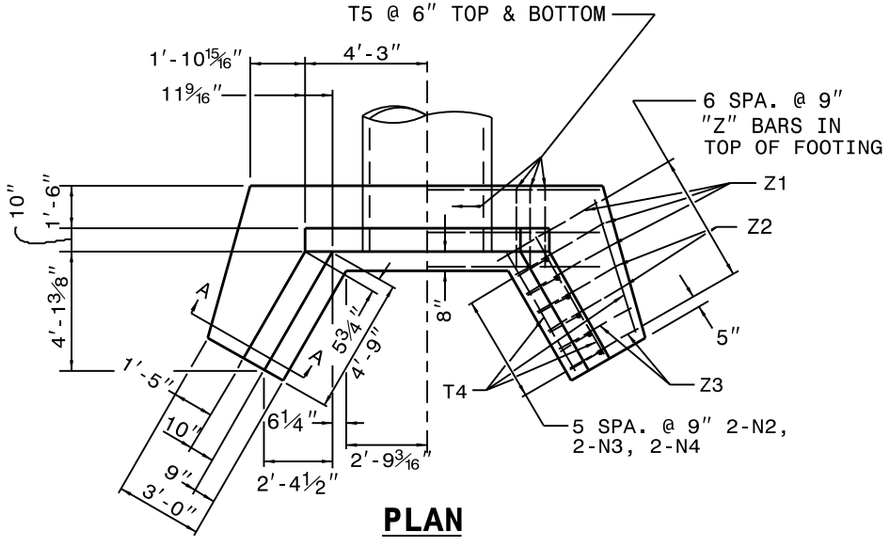
ROADWAY STANDARD DRAWING FOR

# BRICK ENDWALL FOR OUTFALL

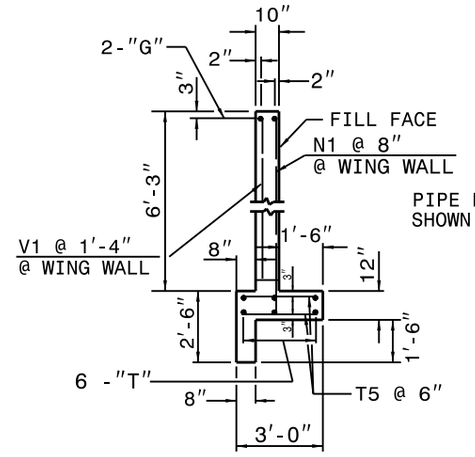
4", 6" OR 8" PIPE

SHEET 1 OF 1

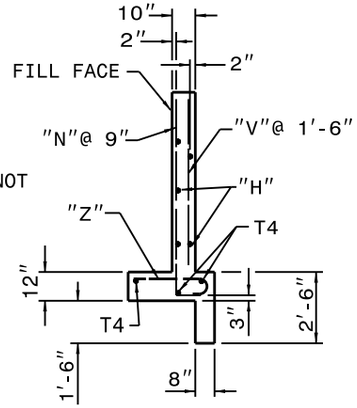
838.20




## PLAN

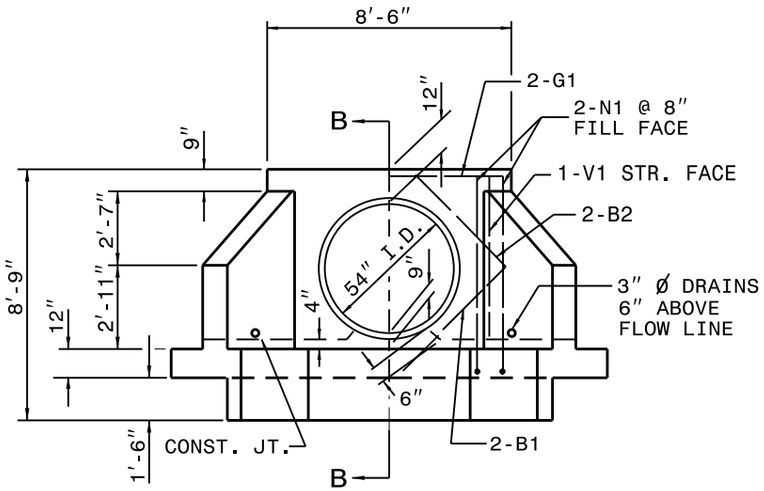



## SECTION - BB

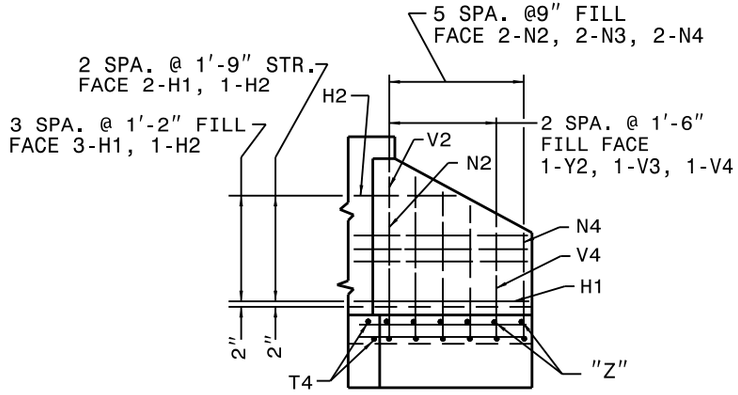



## SECTION - AA

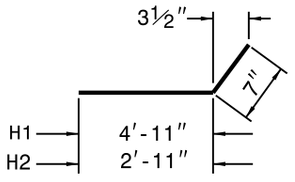
SEE STD. DWG. 838.45 FOR GENERAL NOTES.



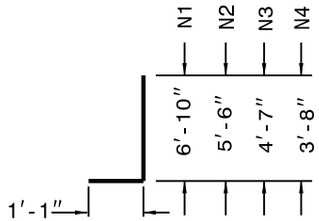

## ELEVATION



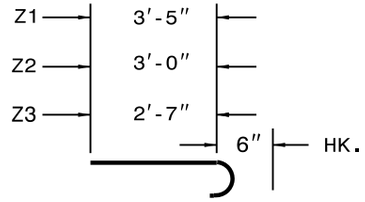

## WING ELEVATION




## "H" BARS




## "N" BARS




## "Z" BARS

"H", "N", & "Z" BAR DIMENSIONS ARE OUT TO OUT.

**BILL OF MATERIAL FOR ENDWALL**

| REINF. STEEL | | | 1 PIPE | |
|---|---|---|---|---|
| BAR | SIZE | LENGTH | NO. | WEIGHT |
| B1 | #4 | 5'-6" | 4 | 15 |
| B2 | #4 | 4'-6" | 4 | 12 |
| G1 | #7 | 8'-2" | 2 | 33 |
| H1 | #4 | 5'-6" | 10 | 37 |
| H2 | #4 | 3'-6" | 4 | 9 |
| N1 | #4 | 7'-11" | 4 | 21 |
| N2 | #4 | 6'-7" | 4 | 18 |
| N3 | #4 | 5'-8" | 4 | 15 |
| N4 | #4 | 4'-9" | 4 | 13 |
| T1 | #4 | 11'-10" | 6 | 47 |
| T4 | #4 | 5'-3" | 6 | 21 |
| T5 | #4 | 2'-6" | 34 | 57 |
| V1 | #4 | 5'-9" | 2 | 8 |
| V2 | #4 | 4'-10" | 2 | 6 |
| V3 | #4 | 3'-11" | 2 | 5 |
| V4 | #4 | 3'-1" | 2 | 4 |
| Z1 | #4 | 3'-11" | 6 | 16 |
| Z2 | #4 | 3'-6" | 4 | 9 |
| Z3 | #4 | 3'-1" | 4 | 8 |
| | | | | |
| | | | | |
| REINF. STEEL LBS. | | | X | 354 |
| | | | | |
| CON./R.C. CU. YDS | | | 5.0 | |

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NORTH CAROLINA
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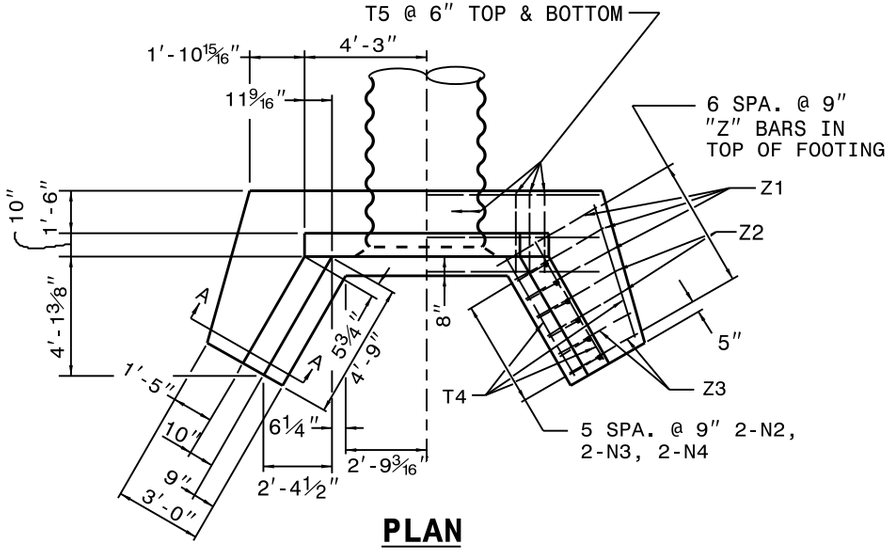
ROADWAY STANDARD DRAWING FOR

# REINFORCED CONCRETE ENDWALL

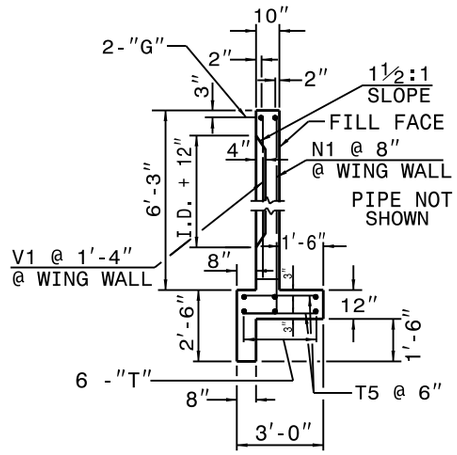
FOR SINGLE 54" PIPE - 90° SKEW

SHEET 1 OF 2

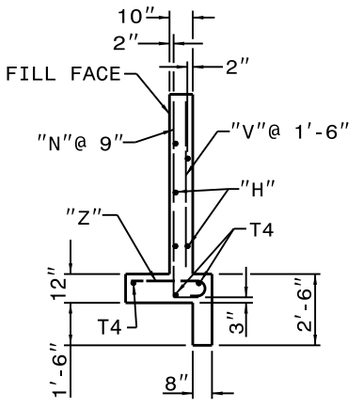
838.21




## PLAN




## SECTION - BB

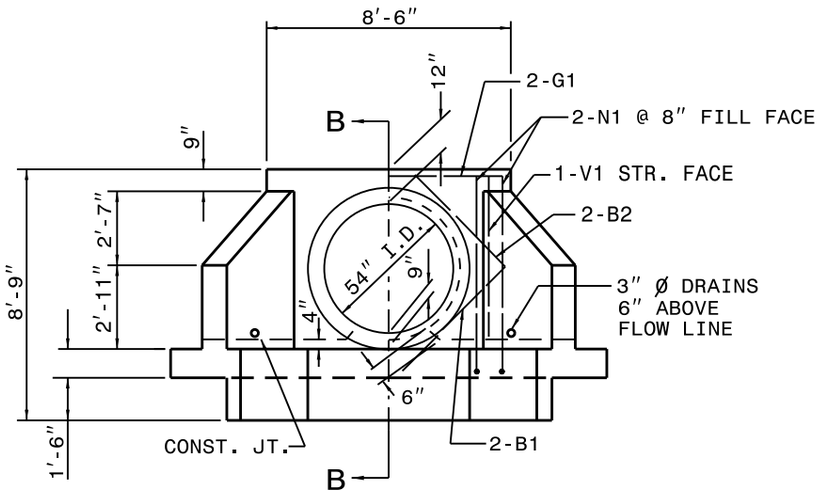



## SECTION - AA

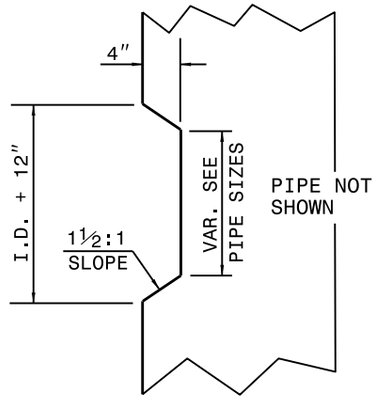
SEE STD. DWG. 838.45 FOR GENERAL NOTES.

**BILL OF MATERIAL FOR ENDWALL**

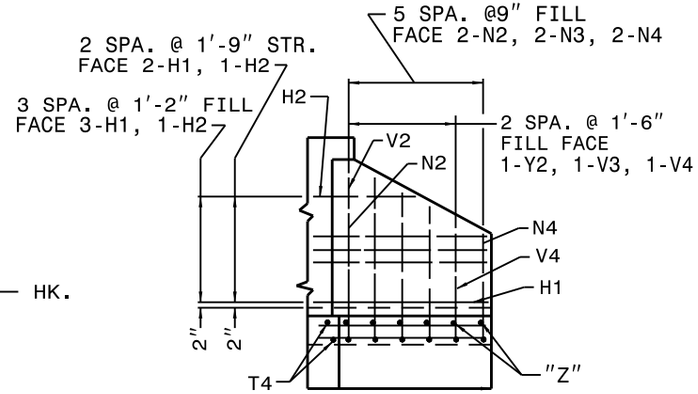
| REINF. STEEL | | | 1 PIPE | |
|---|---|---|---|---|
| BAR | SIZE | LENGTH | NO. | WEIGHT |
| B1 | #4 | 5'-6" | 4 | 15 |
| B2 | #4 | 4'-6" | 4 | 12 |
| G1 | #7 | 8'-2" | 2 | 33 |
| H1 | #4 | 5'-6" | 10 | 37 |
| H2 | #4 | 3'-6" | 4 | 9 |
| N1 | #4 | 7'-11" | 4 | 21 |
| N2 | #4 | 6'-7" | 4 | 18 |
| N3 | #4 | 5'-8" | 4 | 15 |
| N4 | #4 | 4'-9" | 4 | 13 |
| T1 | #4 | 11'-10" | 6 | 47 |
| T4 | #4 | 5'-3" | 6 | 21 |
| T5 | #4 | 2'-6" | 34 | 57 |
| V1 | #4 | 5'-9" | 2 | 8 |
| V2 | #4 | 4'-10" | 2 | 6 |
| V3 | #4 | 3'-11" | 2 | 5 |
| V4 | #4 | 3'-1" | 2 | 4 |
| Z1 | #4 | 3'-11" | 6 | 16 |
| Z2 | #4 | 3'-6" | 4 | 9 |
| Z3 | #4 | 3'-1" | 4 | 8 |
| | | | | |
| | | | | |
| REINF. STEEL LBS. | | | X | 354 |
| CON./C.S. CU. YDS | | | 5.2 | |
| | | | | |



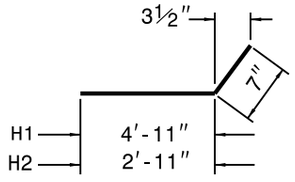

## ELEVATION



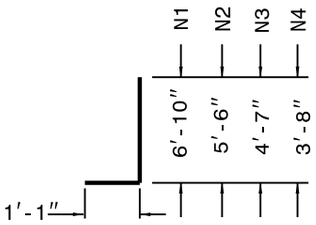

## TAPER DETAIL



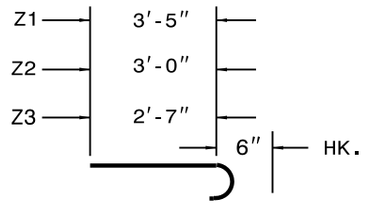

## WING ELEVATION




## "H" BARS




## "N" BARS




## "Z" BARS

"H", "N", & "Z" BAR DIMENSIONS ARE OUT TO OUT.

STATE OF
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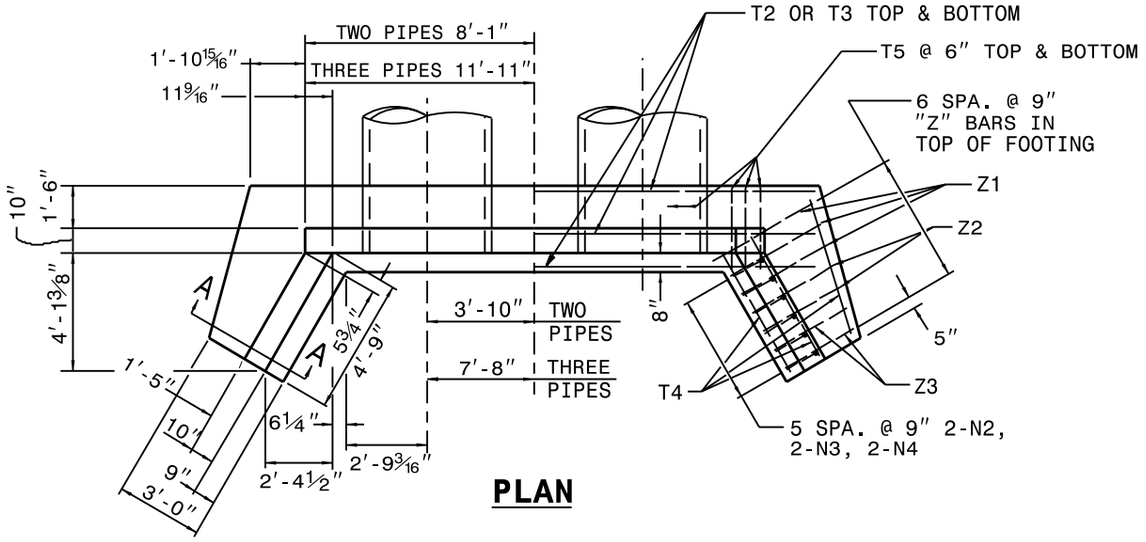
ROADWAY STANDARD DRAWING FOR

# REINFORCED CONCRETE ENDWALL

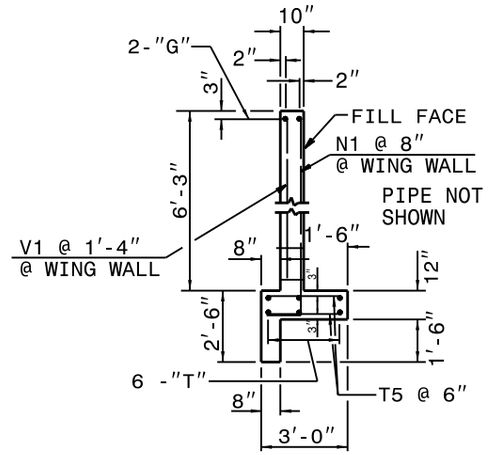
FOR SINGLE 54" PIPE - 90° SKEW

SHEET 2 OF 2

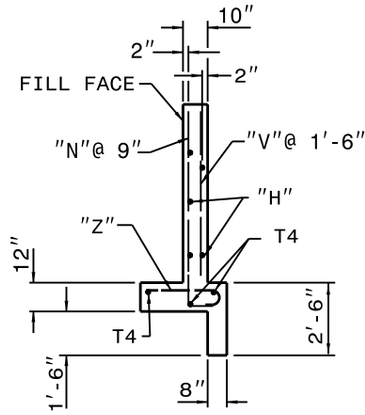
838.21



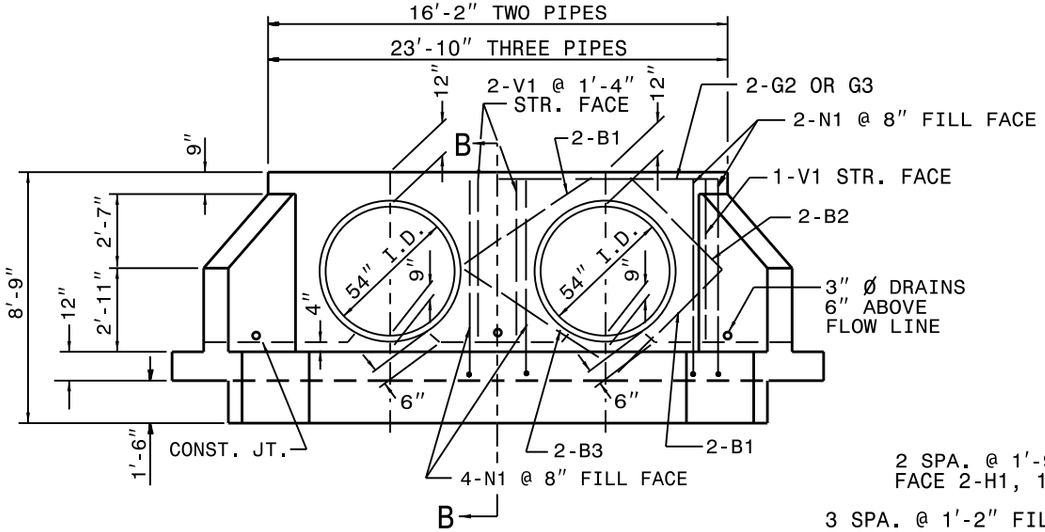

## PLAN



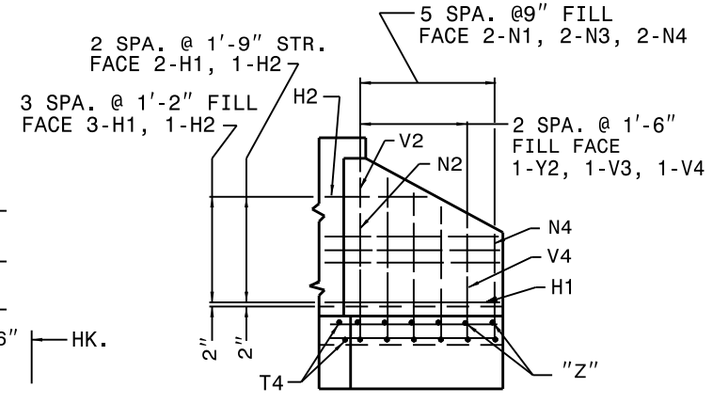

## SECTION - BB



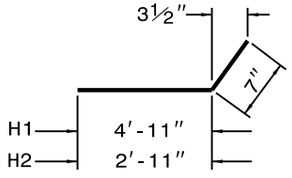

## SECTION - AA



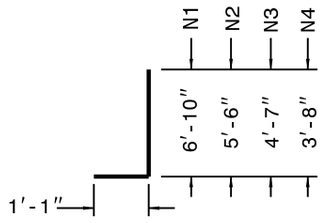

## ELEVATION



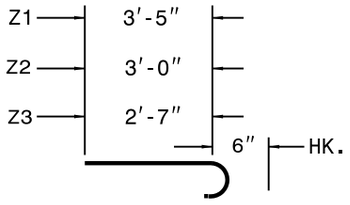

## WING ELEVATION




## "H" BARS




## "N" BARS




## "Z" BARS

"H", "N", & "Z" BAR DIMENSIONS ARE OUT TO OUT.

SEE STD. # 838.45 FOR GENERAL NOTES.

**BILL OF MATERIAL FOR ENDWALL**

| REINF. STEEL | | | 2 PIPES | | 3 PIPES | |
|---|---|---|---|---|---|---|
| BAR | SIZE | LENGTH | NO. | WEIGHT | NO. | WEIGHT |
| B1 | #4 | 5′-6″ | 8 | 29 | 12 | 44 |
| B2 | #4 | 4′-6″ | 4 | 12 | 4 | 12 |
| B3 | #4 | 6′-0″ | 4 | 16 | 8 | 32 |
| G1 | #7 | 8′-2″ | - | - | - | - |
| G2 | #7 | 15′-10″ | 2 | 65 | - | - |
| G3 | #7 | 23′-6″ | - | - | 2 | 96 |
| H1 | #4 | 5′-6″ | 10 | 37 | 10 | 37 |
| H2 | #4 | 3′-6″ | 4 | 9 | 4 | 9 |
| | | | | | | |
| N1 | #4 | 7′-11″ | 8 | 42 | 12 | 63 |
| N2 | #4 | 6′-7″ | 4 | 18 | 4 | 18 |
| N3 | #4 | 5′-8″ | 4 | 15 | 4 | 15 |
| N4 | #4 | 4′-9″ | 4 | 13 | 4 | 13 |
| T1 | #4 | 11′-10″ | - | - | - | - |
| T2 | #4 | 19′-6″ | 6 | 78 | - | - |
| T3 | #4 | 27′-2″ | - | - | 6 | 109 |
| T4 | #4 | 5′-3″ | 6 | 21 | 6 | 21 |
| T5 | #4 | 2′-6″ | 64 | 107 | 96 | 160 |
| V1 | #4 | 5′-9″ | 12 | 46 | 18 | 69 |
| V2 | #4 | 4′-10″ | 6 | 19 | 6 | 19 |
| V3 | #4 | 3′-11″ | 6 | 16 | 6 | 16 |
| V4 | #4 | 3′-1″ | 6 | 12 | 6 | 12 |
| Z1 | #4 | 3′-11″ | 6 | 16 | 6 | 16 |
| Z2 | #4 | 3′-6″ | 4 | 9 | 4 | 9 |
| Z3 | #4 | 3′-1″ | 4 | 8 | 4 | 8 |
| | | | | | | |
| | | | | | | |
| REINF. STEEL LBS. | | | | 588 | | 778 |
| | | | | | | |
| CON./R.C. CU. YDS | | | | 6.9 | | 8.8 |

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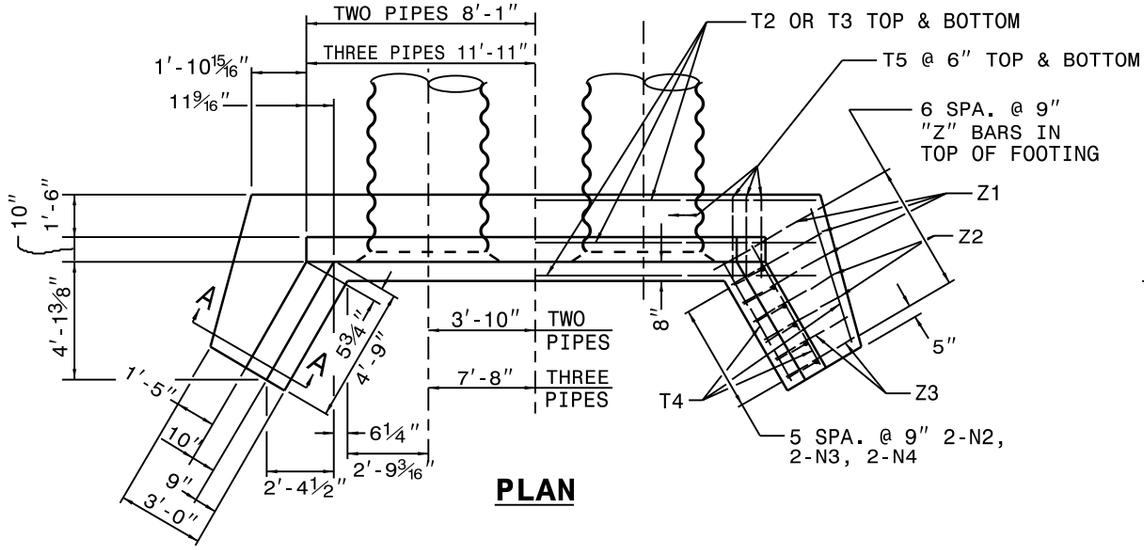
ROADWAY STANDARD DRAWING FOR

# REINFORCED CONCRETE ENDWALL

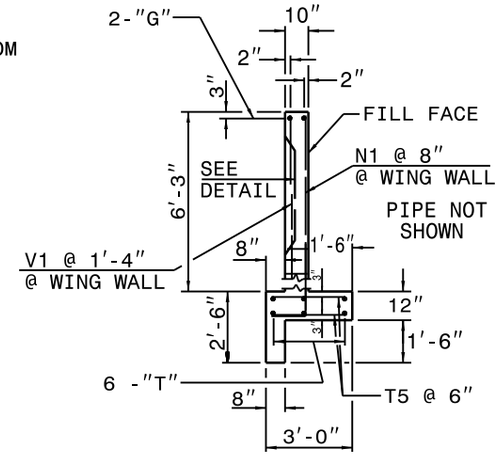
FOR DOUBLE & TRIPLE 54″ PIPE - 90° SKEW

SHEET 1 OF 2

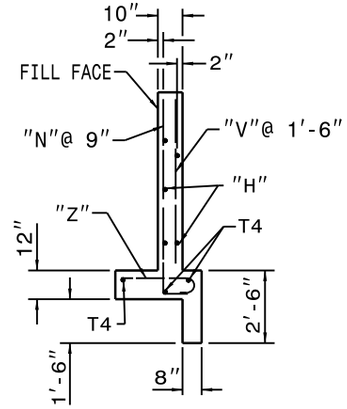
838.22




## PLAN

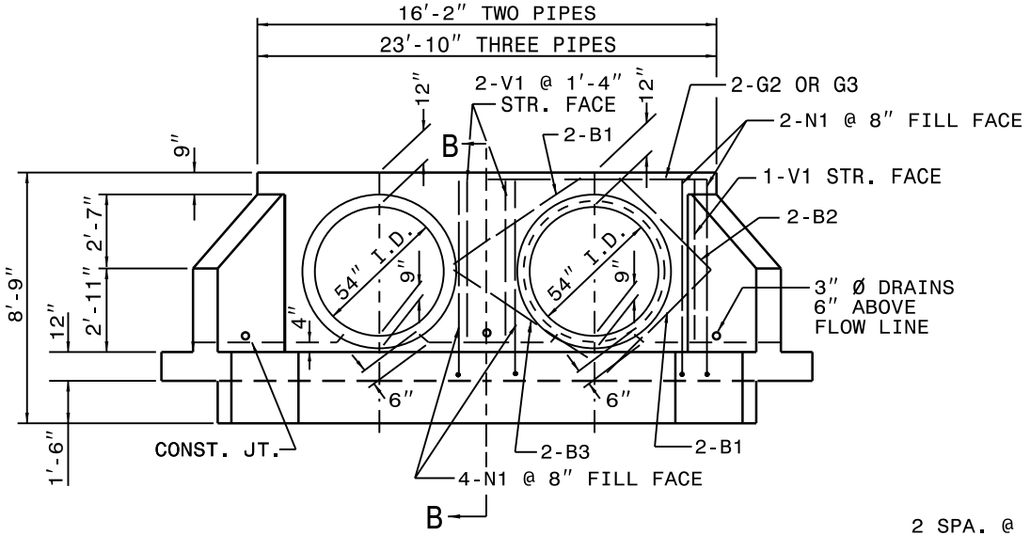



## SECTION - BB

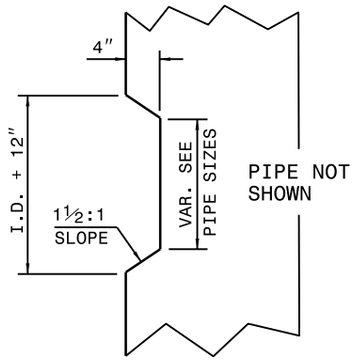



## SECTION - AA

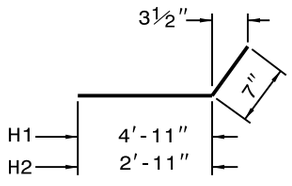
SEE STD. # 838.45 FOR GENERAL NOTES.



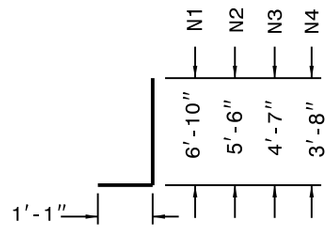

## ELEVATION



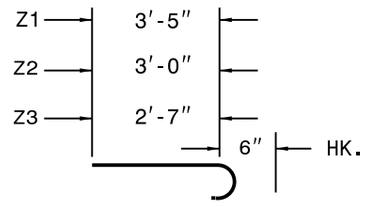

## TAPER DETAIL




## "H" BARS

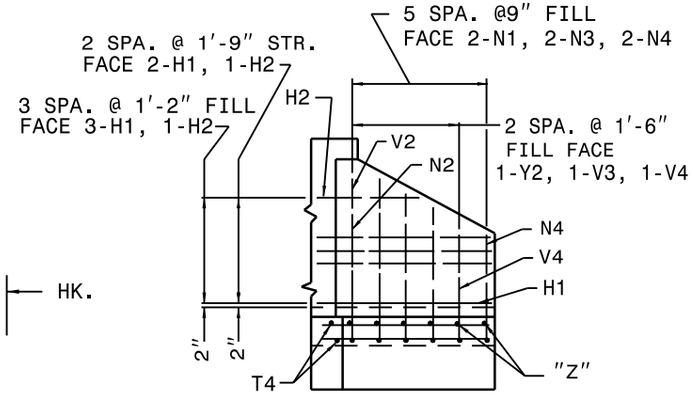



## "N" BARS




## "Z" BARS

"H", "N", & "Z" BAR DIMENSIONS ARE OUT TO OUT.




## WING ELEVATION

**BILL OF MATERIAL FOR ENDWALL**

| REINF. STEEL | | | 2 PIPES | | 3 PIPES | |
|---|---|---|---|---|---|---|
| BAR | SIZE | LENGTH | NO. | WEIGHT | NO. | WEIGHT |
| B1 | #4 | 5'-6" | 8 | 29 | 12 | 44 |
| B2 | #4 | 4'-6" | 4 | 12 | 4 | 12 |
| B3 | #4 | 6'-0" | 4 | 16 | 8 | 32 |
| G1 | #7 | 8'-2" | - | - | - | - |
| G2 | #7 | 15'-10" | 2 | 65 | - | - |
| G3 | #7 | 23'-6" | - | - | 2 | 96 |
| H1 | #4 | 5'-6" | 10 | 37 | 10 | 37 |
| H2 | #4 | 3'-6" | 4 | 9 | 4 | 9 |
| | | | | | | |
| N1 | #4 | 7'-11" | 8 | 42 | 12 | 63 |
| N2 | #4 | 6'-7" | 4 | 18 | 4 | 18 |
| N3 | #4 | 5'-8" | 4 | 15 | 4 | 15 |
| N4 | #4 | 4'-9" | 4 | 13 | 4 | 13 |
| T1 | #4 | 11'-10" | - | - | - | - |
| T2 | #4 | 19'-6" | 6 | 78 | - | - |
| T3 | #4 | 27'-2" | - | - | 6 | 109 |
| T4 | #4 | 5'-3" | 6 | 21 | 6 | 21 |
| T5 | #4 | 2'-6" | 64 | 107 | 96 | 160 |
| V1 | #4 | 5'-9" | 12 | 46 | 18 | 69 |
| V2 | #4 | 4'-10" | 6 | 19 | 6 | 19 |
| V3 | #4 | 3'-11" | 6 | 16 | 6 | 16 |
| V4 | #4 | 3'-1" | 6 | 12 | 6 | 12 |
| Z1 | #4 | 3'-11" | 6 | 16 | 6 | 16 |
| Z2 | #4 | 3'-6" | 4 | 9 | 4 | 9 |
| Z3 | #4 | 3'-1" | 4 | 8 | 4 | 8 |
| | | | | | | |
| | | | | | | |
| REINF. STEEL LBS. | | | | 588 | | 778 |
| CON./C.S. CU. YDS | | | | 7.3 | | 9.4 |

STATE OF NORTH CAROLINA
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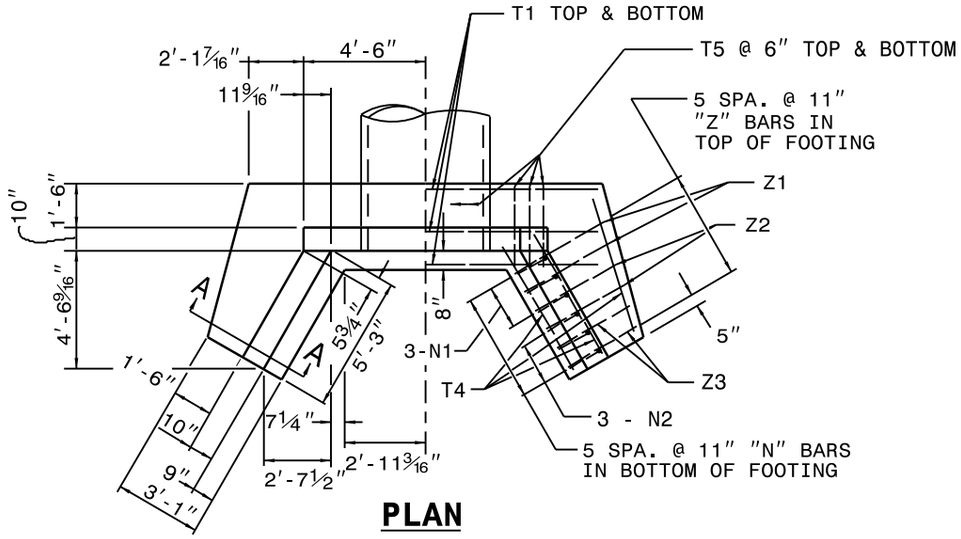
ROADWAY STANDARD DRAWING FOR

# REINFORCED CONCRETE ENDWALL

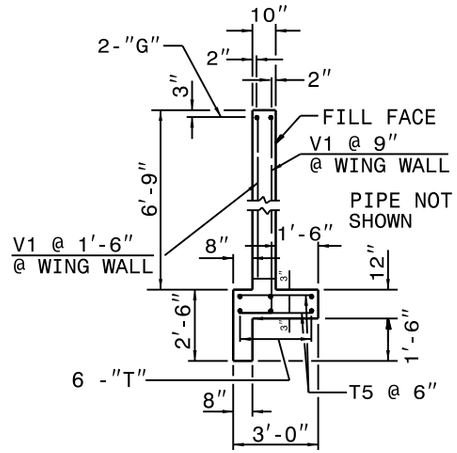
FOR DOUBLE & TRIPLE 54" PIPE - 90° SKEW

SHEET 2 OF 2

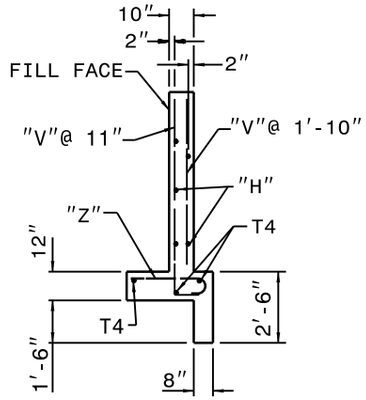
838.22




**PLAN**

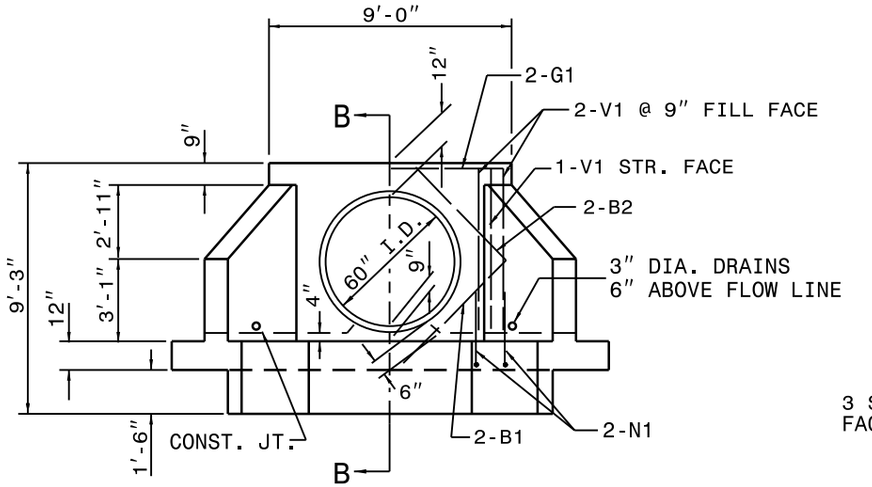



**SECTION - BB**

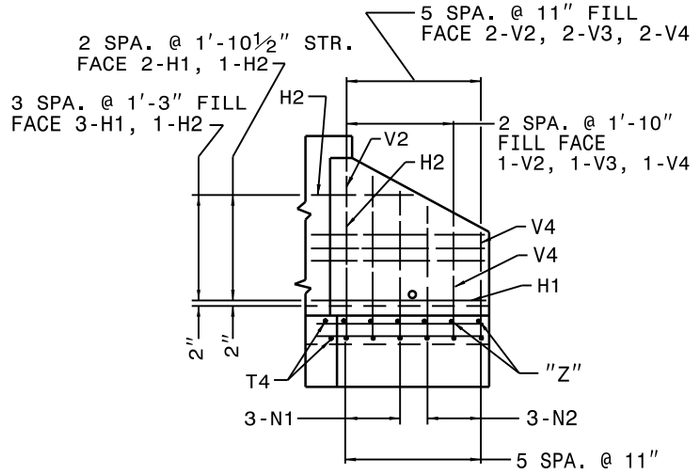



**SECTION - AA**

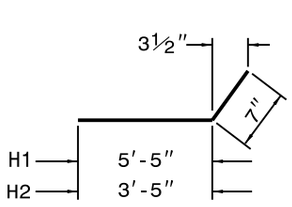
SEE STD. # 838.45 FOR GENERAL NOTES.



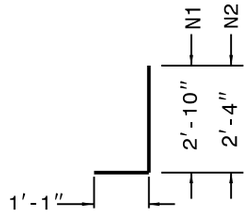

**ELEVATION**



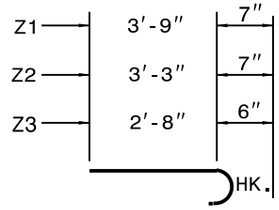

**WING ELEVATION**




**"H" BARS**




**"N" BARS**




**"Z" BARS**

"H", "N", & "Z" BAR DIMENSIONS ARE OUT TO OUT.

**BILL OF MATERIAL FOR ENDWALL**

| REINF. STEEL | | | 1 PIPE | |
|---|---|---|---|---|
| BAR | SIZE | LENGTH | NO. | WEIGHT |
| B1 | #4 | 5'-6" | 4 | 15 |
| B2 | #4 | 4'-6" | 4 | 12 |
| G1 | #7 | 8'-8" | 2 | 35 |
| H1 | #4 | 6'-0" | 10 | 40 |
| H2 | #4 | 4'-0" | 4 | 11 |
| N1 | #5 | 3'-11" | 10 | 41 |
| N2 | #4 | 3'-5" | 6 | 14 |
| | | | | |
| | | | | |
| T1 | #4 | 12'-8" | 6 | 51 |
| T4 | #4 | 5'-6" | 6 | 22 |
| T5 | #4 | 2'-6" | 36 | 60 |
| V1 | #4 | 6'-3" | 6 | 25 |
| V2 | #4 | 5'-1" | 6 | 20 |
| V3 | #4 | 3'-11" | 6 | 16 |
| V4 | #4 | 2'-9" | 6 | 11 |
| Z1 | #5 | 4'-4" | 4 | 18 |
| Z2 | #4 | 3'-10" | 4 | 10 |
| Z3 | #4 | 3'-2" | 4 | 8 |
| | | | | |
| | | | | |
| REINF. STEEL LBS. | | | | 409 |
| | | | | |
| CON./R.C. CU. YDS | | | | 5.6 |

STATE OF NORTH CAROLINA
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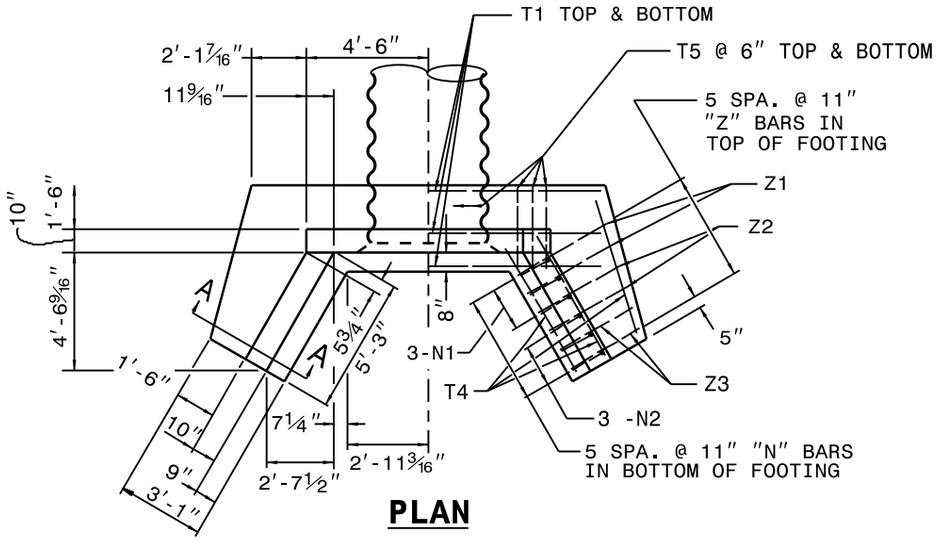
ROADWAY STANDARD DRAWING FOR

# REINFORCED CONCRETE ENDWALL

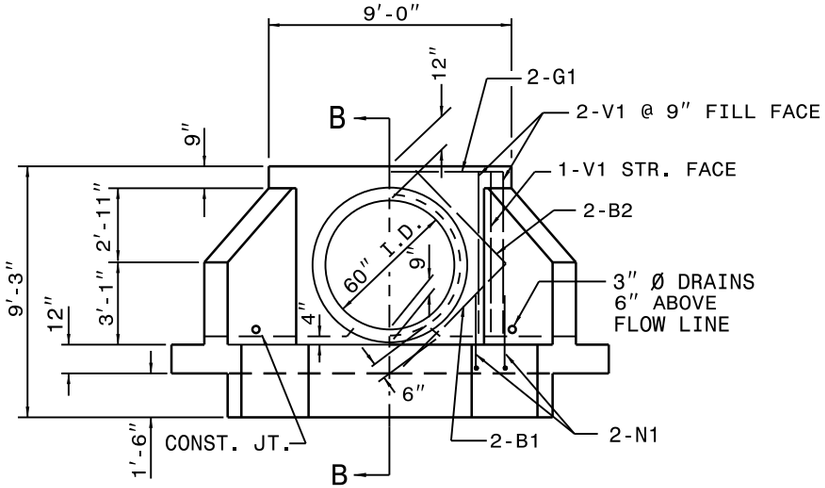
FOR SINGLE 60" PIPE - 90° SKEW

SHEET 1 OF 2

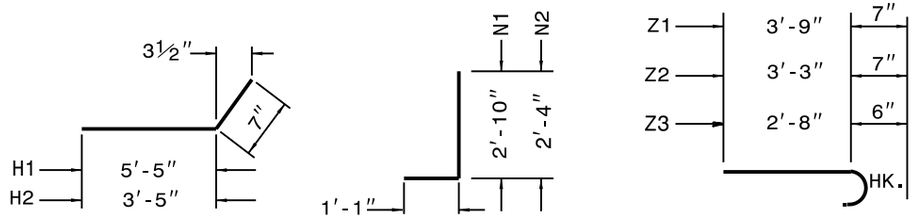
**838.27**




**PLAN**

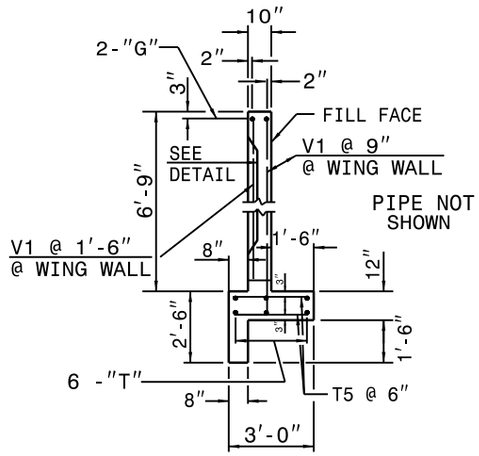



**ELEVATION**

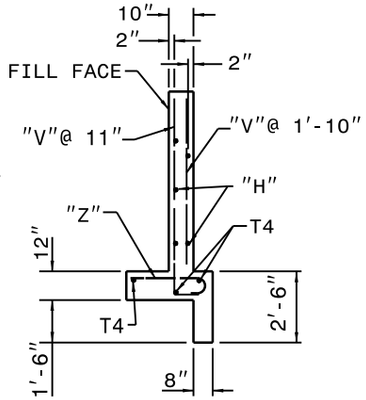



**"H" BARS** **"N" BARS** **"Z" BARS**

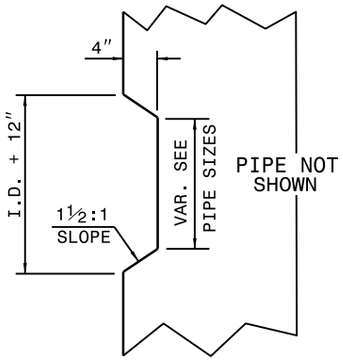
"H", "N", & "Z" BAR DIMENSIONS ARE OUT TO OUT.



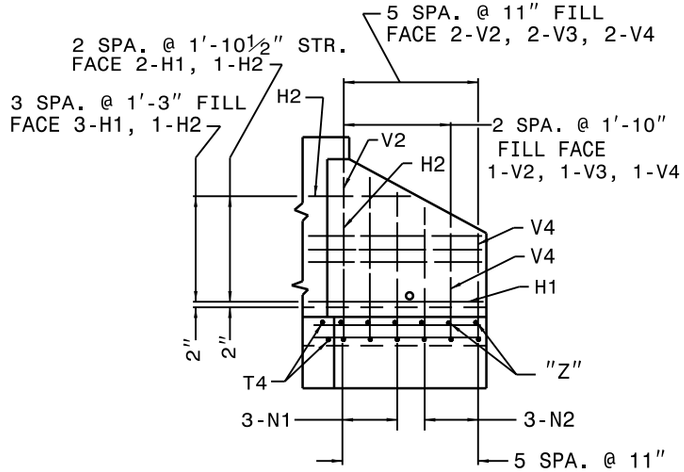

**SECTION - BB**




**SECTION - AA**




**TAPER DETAIL**




**WING ELEVATION**

SEE STD. # 838.45 FOR GENERAL NOTES.

**BILL OF MATERIAL FOR ENDWALL**

| REINF. STEEL | | | 1 PIPE | |
|---|---|---|---|---|
| BAR | SIZE | LENGTH | NO. | WEIGHT |
| B1 | #4 | 5'-6" | 4 | 15 |
| B2 | #4 | 4'-6" | 4 | 12 |
| G1 | #7 | 8'-8" | 2 | 35 |
| H1 | #4 | 6'-0" | 10 | 40 |
| H2 | #4 | 4'-0" | 4 | 11 |
| N1 | #5 | 3'-11" | 10 | 41 |
| N2 | #4 | 3'-5" | 6 | 14 |
| | | | | |
| | | | | |
| T1 | #4 | 12'-8" | 6 | 51 |
| T4 | #4 | 5'-6" | 6 | 22 |
| T5 | #4 | 2'-6" | 36 | 60 |
| V1 | #4 | 6'-3" | 6 | 25 |
| V2 | #4 | 5'-1" | 6 | 20 |
| V3 | #4 | 3'-11" | 6 | 16 |
| V4 | #4 | 2'-9" | 6 | 11 |
| Z1 | #5 | 4'-4" | 4 | 18 |
| Z2 | #4 | 3'-10" | 4 | 10 |
| Z3 | #4 | 3'-2" | 4 | 8 |
| | | | | |
| | | | | |
| REINF. STEEL LBS. | | | | 409 |
| CON./C.S. CU. YDS | | | 5.9 | |

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ROADWAY STANDARD DRAWING FOR

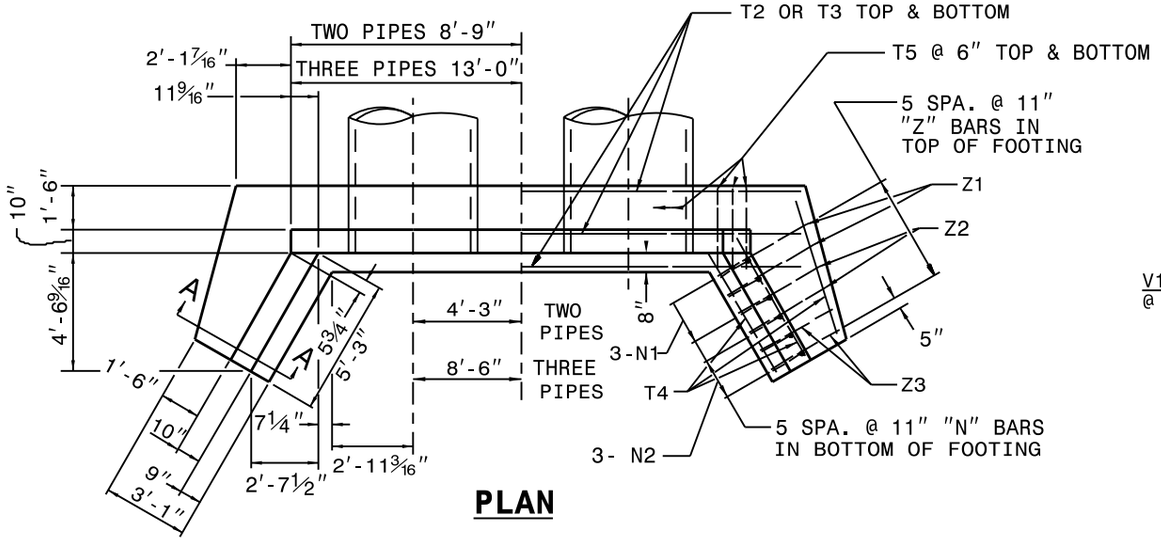
# REINFORCED CONCRETE ENDWALL

FOR SINGLE 60" PIPE - 90° SKEW

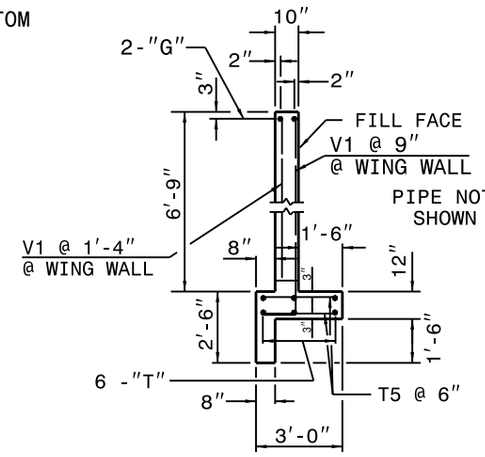
SHEET 2 OF 2

838.27

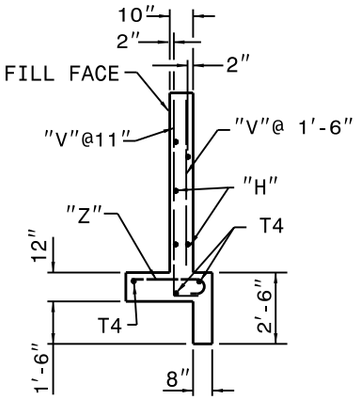
SEE STD. # 838.45 FOR GENERAL NOTES.



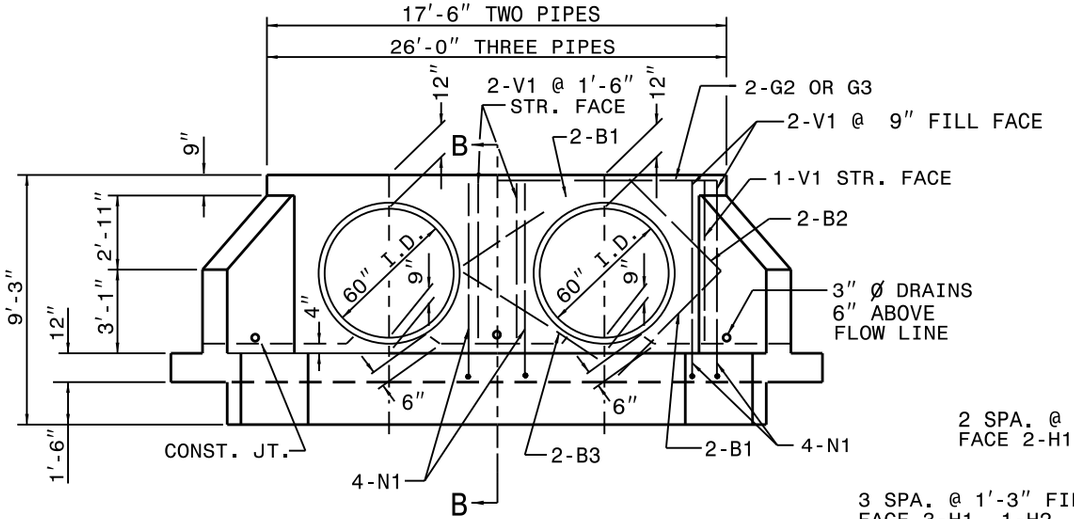

## PLAN



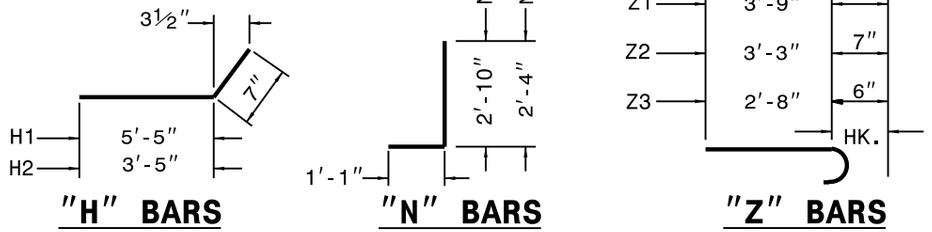

## SECTION - BB




## SECTION - AA




## ELEVATION

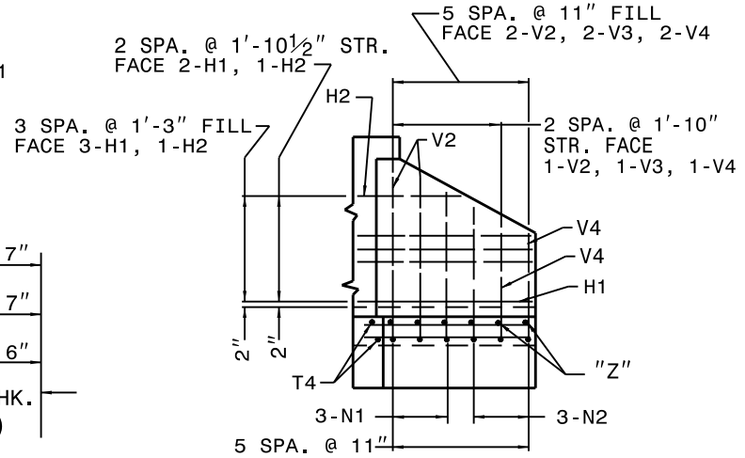



## "H" BARS

## "N" BARS

## "Z" BARS

"H", "N", & "Z" BAR DIMENSIONS ARE OUT TO OUT.




## WING ELEVATION

**BILL OF MATERIAL FOR ENDWALL**

| REINF. STEEL | | | 2 PIPES | | 3 PIPES | |
|---|---|---|---|---|---|---|
| BAR | SIZE | LENGTH | NO. | WEIGHT | NO. | WEIGHT |
| B1 | #4 | 5′-6″ | 8 | 29 | 12 | 44 |
| B2 | #4 | 4′-6″ | 4 | 12 | 4 | 12 |
| B3 | #4 | 6′-6″ | 4 | 17 | 8 | 35 |
| | | | | | | |
| G2 | #7 | 17′-2″ | 2 | 70 | - | - |
| G3 | #7 | 25′-8″ | - | - | 2 | 105 |
| H1 | #4 | 6′-0″ | 10 | 40 | 10 | 40 |
| H2 | #4 | 4′-0″ | 4 | 11 | 4 | 11 |
| | | | | | | |
| N1 | #4 | 3′-11″ | 14 | 57 | 18 | 74 |
| N2 | #4 | 3′-5″ | 6 | 14 | 6 | 14 |
| | | | | | | |
| | | | | | | |
| T1 | #4 | 21′-2″ | 6 | 85 | - | - |
| T2 | #4 | 29′-8″ | | | 6 | 119 |
| | | | | | | |
| T4 | #4 | 5′-6″ | 6 | 22 | 6 | 22 |
| T5 | #4 | 2′-6″ | 70 | 117 | 104 | 174 |
| V1 | #4 | 6′-3″ | 12 | 50 | 18 | 75 |
| V2 | #4 | 5′-1″ | 6 | 20 | 6 | 20 |
| V3 | #4 | 3′-11″ | 6 | 16 | 6 | 16 |
| V4 | #4 | 2′-9″ | 6 | 11 | 6 | 11 |
| Z1 | #5 | 4′-4″ | 4 | 18 | 4 | 18 |
| Z2 | #4 | 3′-10″ | 4 | 10 | 4 | 10 |
| Z3 | #4 | 3′-2″ | 4 | 8 | 4 | 8 |
| | | | | | | |
| | | | | | | |
| REINF. STEEL LBS. | | | | 607 | | 808 |
| | | | | | | |
| CON./R.C. CU. YDS | | | 7.9 | | 9.9 | |

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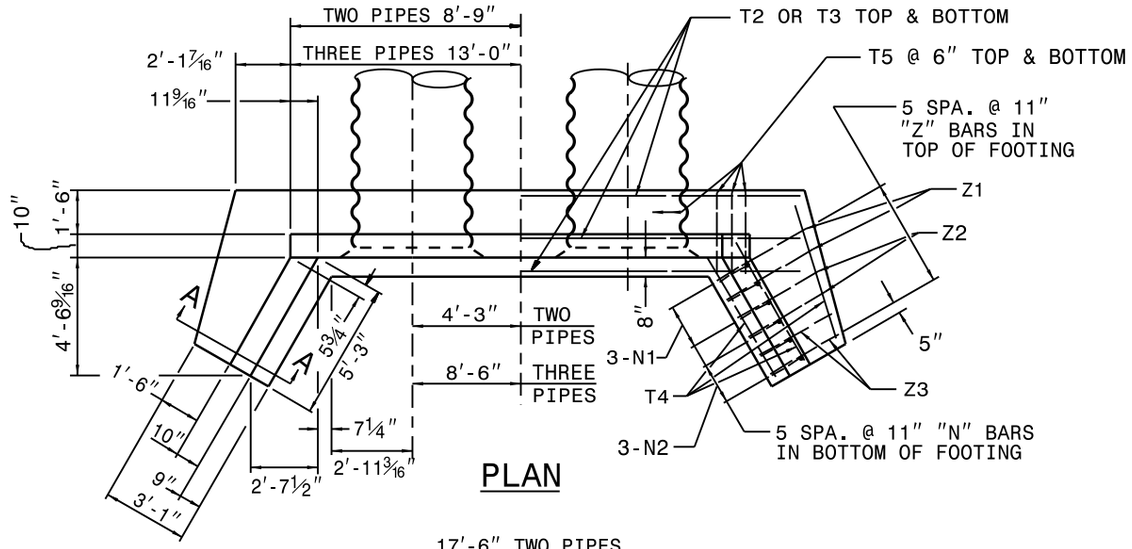
ROADWAY STANDARD DRAWING FOR

# REINFORCED CONCRETE ENDWALL

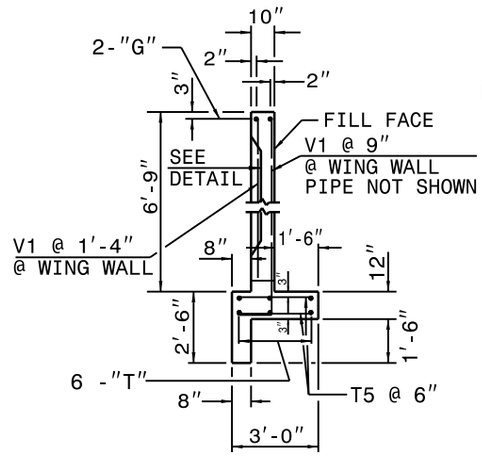
FOR DOUBLE & TRIPLE 60″ PIPE - 90° SKEW

SHEET 1 OF 2

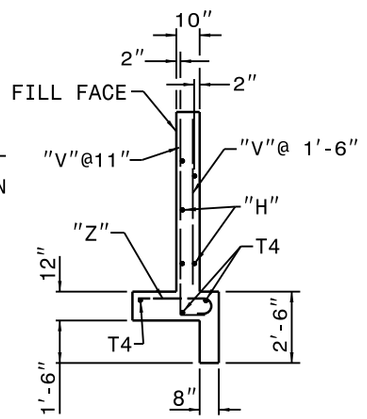
838.28



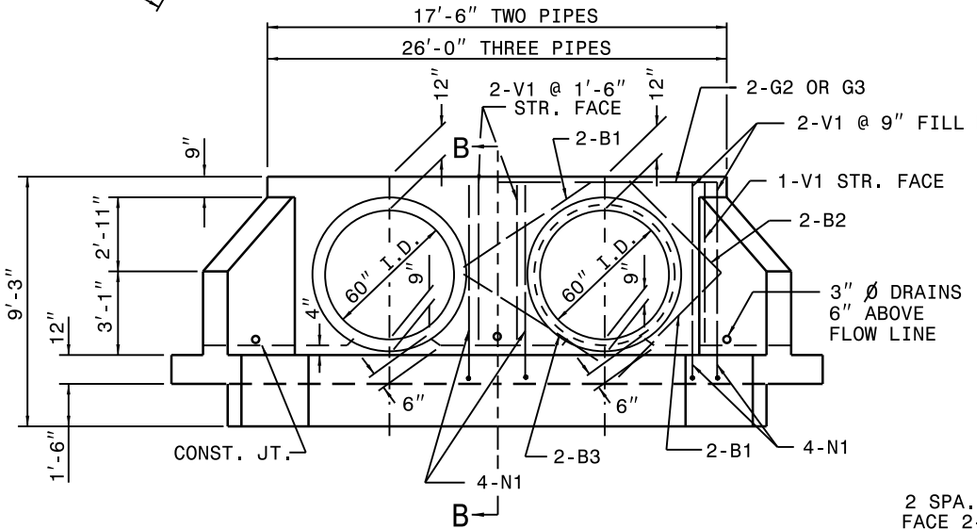

PLAN



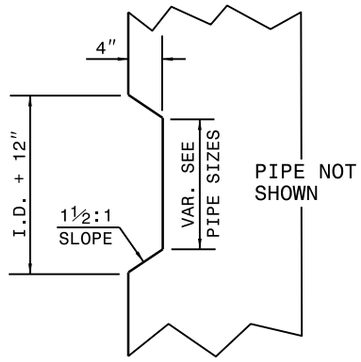

SECTION - BB



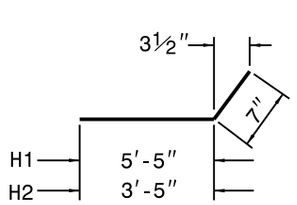

SECTION - AA



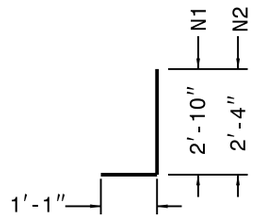

ELEVATION



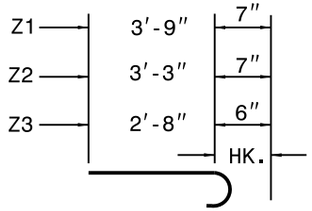

TAPER DETAIL




"H" BARS

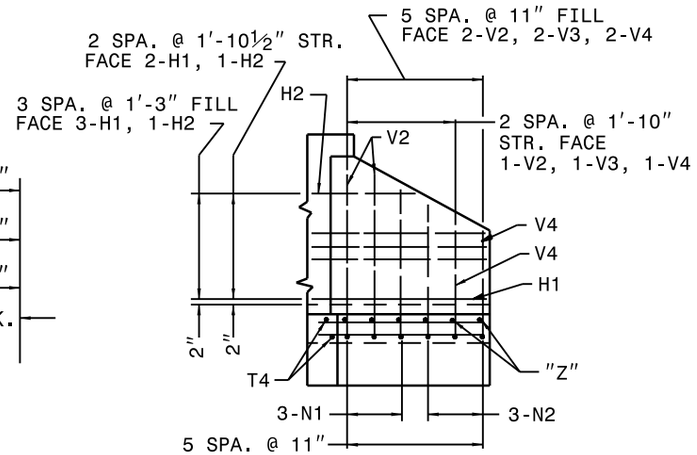



"N" BARS




"Z" BARS

"H", "N", & "Z" BAR DIMENSIONS ARE OUT TO OUT.




WING ELEVATION

SEE STD. # 838.45 FOR GENERAL NOTES.

**BILL OF MATERIAL FOR ENDWALL**

| REINF. STEEL | | | 2 PIPES | | 3 PIPES | |
|---|---|---|---|---|---|---|
| BAR | SIZE | LENGTH | NO. | WEIGHT | NO. | WEIGHT |
| B1 | #4 | 5'-6" | 8 | 29 | 12 | 44 |
| B2 | #4 | 4'-6" | 4 | 12 | 4 | 12 |
| B3 | #4 | 6'-6" | 4 | 17 | 8 | 35 |
| | | | | | | |
| G2 | #7 | 17'-2" | 2 | 70 | - | - |
| G3 | #7 | 25'-8" | - | - | 2 | 105 |
| H1 | #4 | 6'-0" | 10 | 40 | 10 | 40 |
| H2 | #4 | 4'-0" | 4 | 11 | 4 | 11 |
| | | | | | | |
| N1 | #4 | 3'-11" | 14 | 57 | 18 | 74 |
| N2 | #4 | 3'-5" | 6 | 14 | 6 | 14 |
| | | | | | | |
| | | | | | | |
| T1 | #4 | 21'-2" | 6 | 85 | - | - |
| T2 | #4 | 29'-8" | | | 6 | 119 |
| | | | | | | |
| T4 | #4 | 5'-6" | 6 | 22 | 6 | 22 |
| T5 | #4 | 2'-6" | 70 | 117 | 104 | 174 |
| V1 | #4 | 6'-3" | 12 | 50 | 18 | 75 |
| V2 | #4 | 5'-1" | 6 | 20 | 6 | 20 |
| V3 | #4 | 3'-11" | 6 | 16 | 6 | 16 |
| V4 | #4 | 2'-9" | 6 | 11 | 6 | 11 |
| Z1 | #5 | 4'-4" | 4 | 18 | 4 | 18 |
| Z2 | #4 | 3'-10" | 4 | 10 | 4 | 10 |
| Z3 | #4 | 3'-2" | 4 | 8 | 4 | 8 |
| | | | | | | |
| | | | | | | |
| REINF. STEEL LBS. | | | | 607 | | 808 |
| CON./C.S. CU. YDS | | | 8.3 | | 10.7 | |

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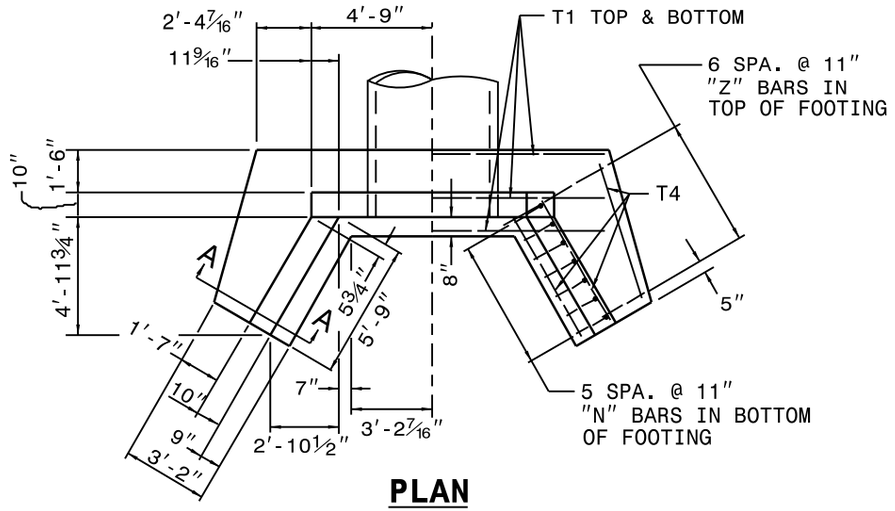
ROADWAY STANDARD DRAWING FOR

# REINFORCED CONCRETE ENDWALL

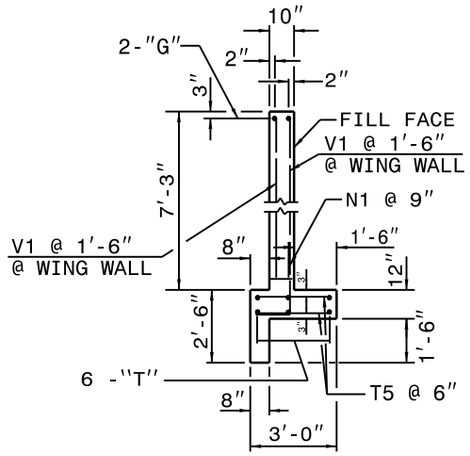
FOR DOUBLE & TRIPLE 60" PIPE - 90° SKEW

SHEET 2 OF 2

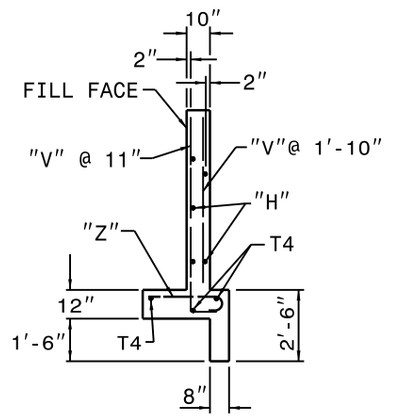
838.28




## PLAN

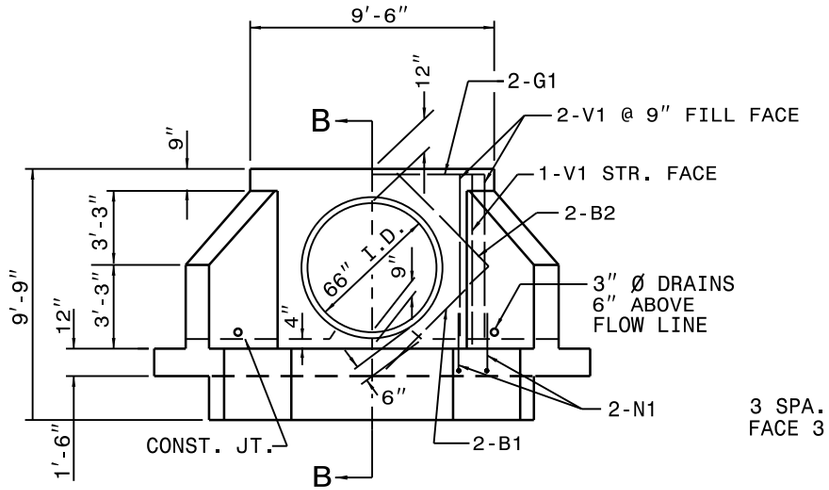



## SECTION - BB

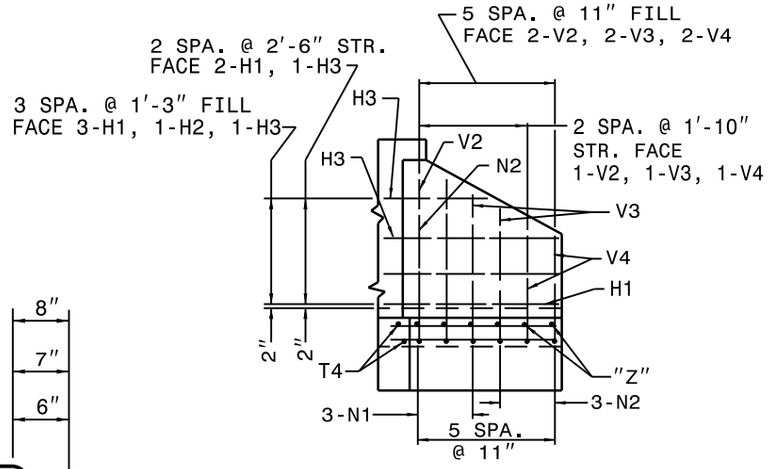



## SECTION - AA

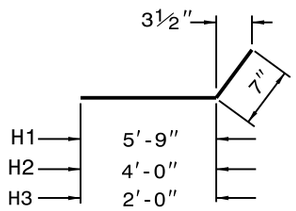
SEE STD. DWG. 838.45 FOR GENERAL NOTES.



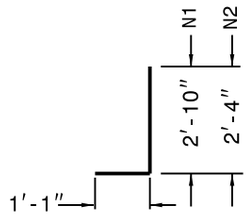

## ELEVATION



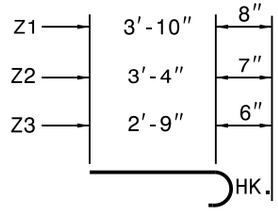

## WING ELEVATION




## "H" BARS




## "N" BARS




## "Z" BARS

"H", "N", & "Z" BAR DIMENSIONS ARE OUT TO OUT.

**BILL OF MATERIAL FOR ENDWALL**

| REINF. STEEL | | | 1 PIPE | |
|---|---|---|---|---|
| BAR | SIZE | LENGTH | NO. | WEIGHT |
| B1 | #4 | 5'-6" | 4 | 15 |
| B2 | #4 | 4'-6" | 4 | 12 |
| G1 | #7 | 9'-2" | 2 | 37 |
| H1 | #4 | 6'-4" | 10 | 42 |
| H2 | #4 | 4'-7" | 2 | 6 |
| H3 | #4 | 2'-7" | 4 | 7 |
| N1 | #5 | 3'-11" | 10 | 41 |
| N2 | #4 | 3'-5" | 6 | 14 |
| | | | | |
| | | | | |
| T1 | #4 | 13'-8" | 6 | 55 |
| T4 | #4 | 6'-0" | 6 | 24 |
| T5 | #4 | 2'-6" | 38 | 63 |
| V1 | #4 | 6'-9" | 6 | 27 |
| V2 | #4 | 5'-2" | 6 | 21 |
| V3 | #4 | 4'-1" | 6 | 16 |
| V4 | #4 | 2'-11" | 6 | 12 |
| Z1 | #6 | 4'-6" | 6 | 41 |
| Z2 | #5 | 3'-11" | 4 | 16 |
| Z3 | #4 | 3'-3" | 4 | 9 |
| | | | | |
| REINF. STEEL LBS. | | | | 458 |
| | | | | |
| CON./R.C. CU. YDS | | | 6.3 | |

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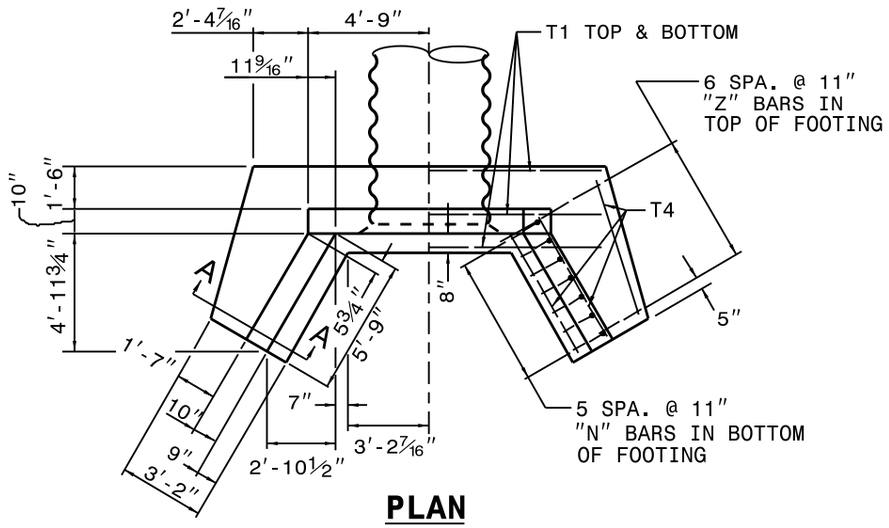
ROADWAY STANDARD DRAWING FOR

# REINFORCED CONCRETE ENDWALL

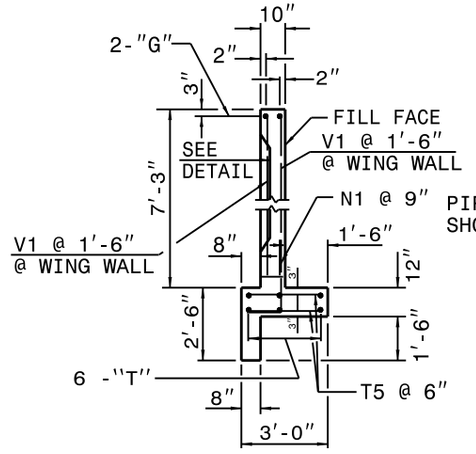
FOR SINGLE 66" PIPE - 90° SKEW

SHEET 1 OF 2

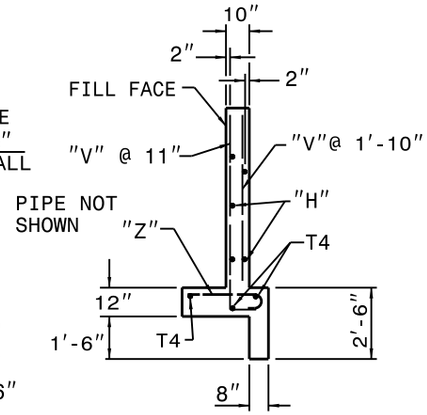
838.33




**PLAN**



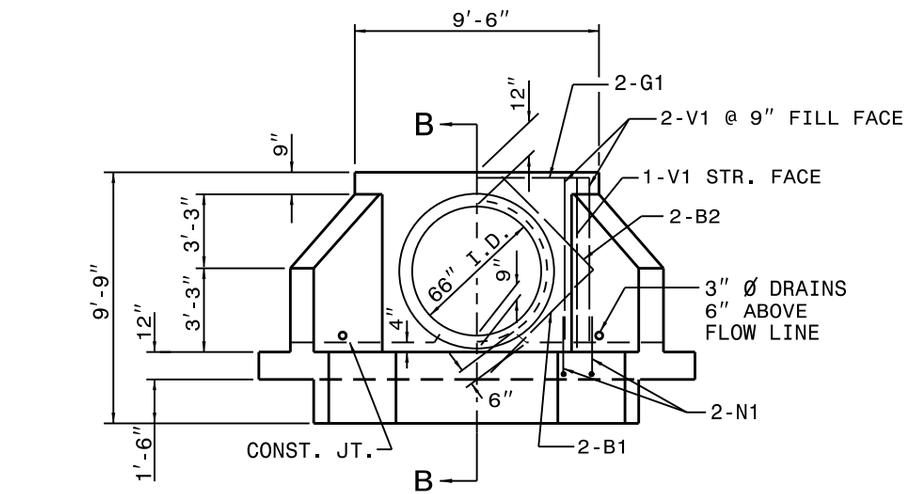

**SECTION - BB**



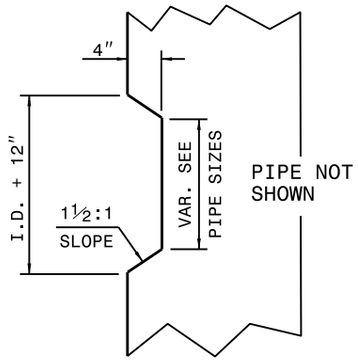

**SECTION - AA**

SEE STD.# 838.45 FOR GENERAL NOTES.

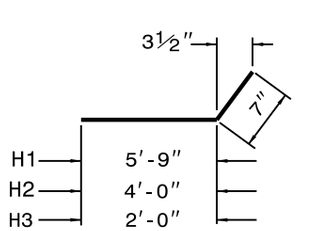
| BILL OF MATERIAL FOR ENDWALL | | | | |
|---|---|---|---|---|
| REINF. STEEL | | | 1 PIPE | |
| BAR | SIZE | LENGTH | NO. | WEIGHT |
| B1 | #4 | 5'-6" | 4 | 15 |
| B2 | #4 | 4'-6" | 4 | 12 |
| G1 | #7 | 9'-2" | 2 | 37 |
| H1 | #4 | 6'-4" | 10 | 42 |
| H2 | #4 | 4'-7" | 2 | 6 |
| H3 | #4 | 2'-7" | 4 | 7 |
| N1 | #5 | 3'-11" | 10 | 41 |
| N2 | #4 | 3'-5" | 6 | 14 |
| | | | | |
| | | | | |
| T1 | #4 | 13'-8" | 6 | 55 |
| T4 | #4 | 6'-0" | 6 | 24 |
| T5 | #4 | 2'-6" | 38 | 63 |
| V1 | #4 | 6'-9" | 6 | 27 |
| V2 | #4 | 5'-2" | 6 | 21 |
| V3 | #4 | 4'-1" | 6 | 16 |
| V4 | #4 | 2'-11" | 6 | 12 |
| Z1 | #6 | 4'-6" | 6 | 41 |
| Z2 | #5 | 3'-11" | 4 | 16 |
| Z3 | #4 | 3'-3" | 4 | 9 |
| | | | | |
| REINF. STEEL LBS. | | | X | 458 |
| CON./C.S. CU. YDS | | | 6.6 | |
| | | | | |



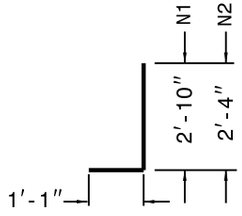

**ELEVATION**



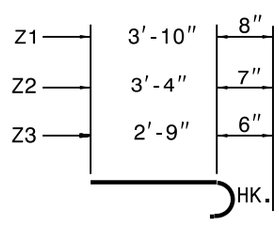

**TAPER DETAIL**




**"H" BARS**

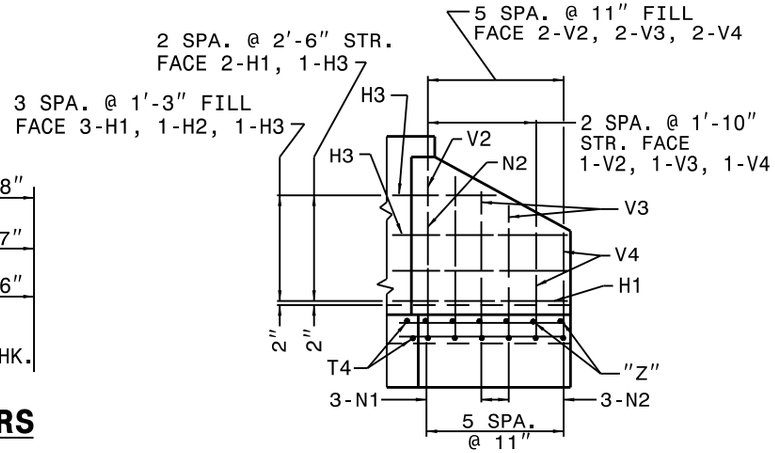



**"N" BARS**




**"Z" BARS**

"H", "N", & "Z" BAR DIMENSIONS ARE OUT TO OUT.




**WING ELEVATION**

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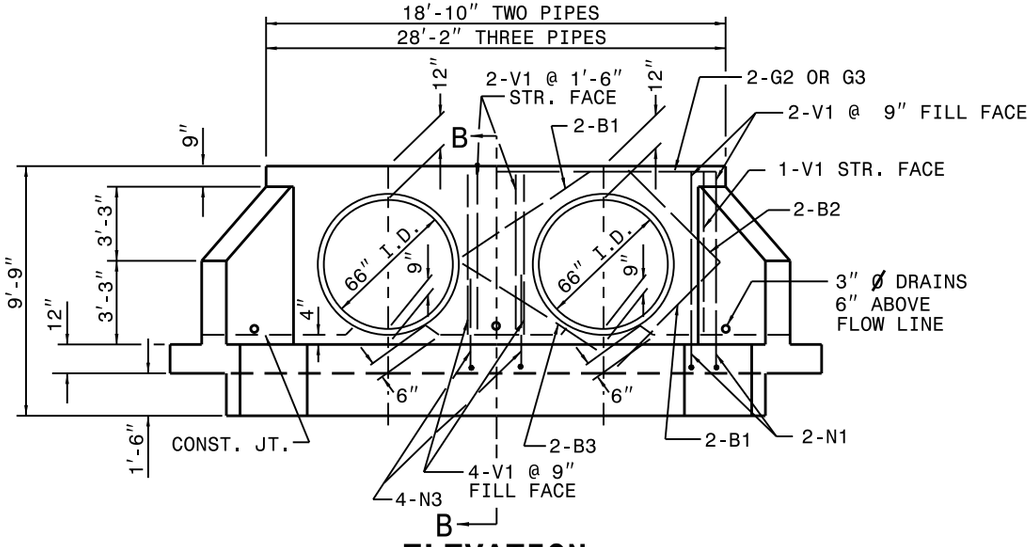
ROADWAY STANDARD DRAWING FOR

# REINFORCED CONCRETE ENDWALL

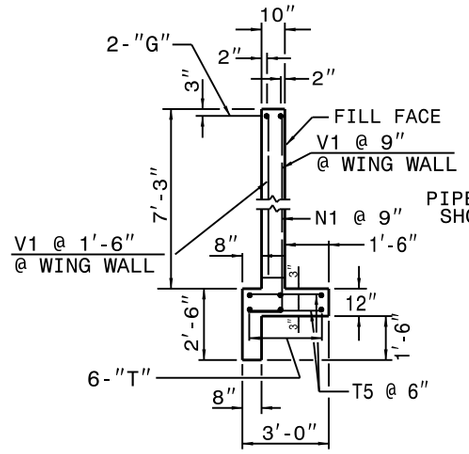
FOR SINGLE 66" PIPE - 90° SKEW

SHEET 2 OF 2

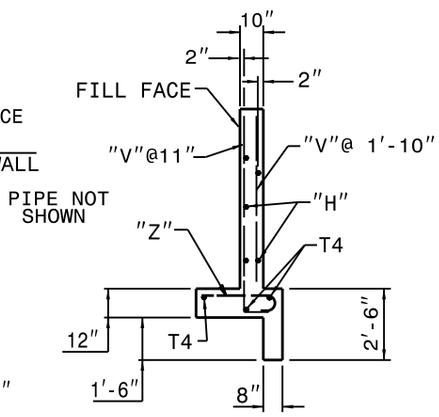
838.33



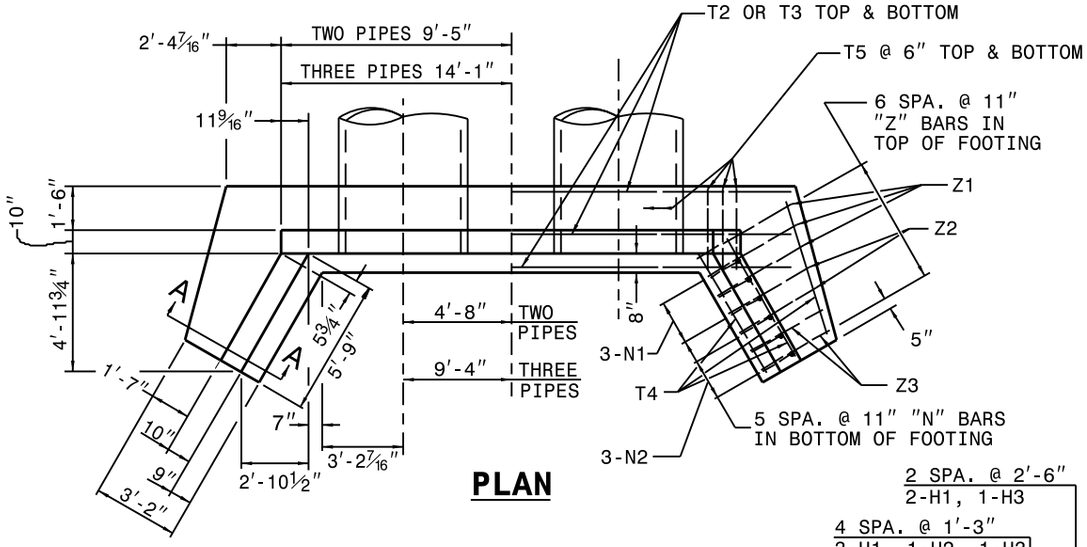

## ELEVATION



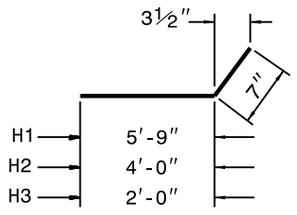

## SECTION - BB



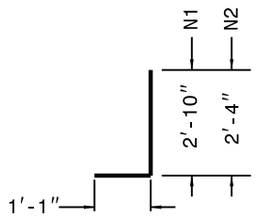

## SECTION - AA



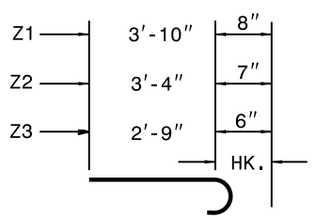

## PLAN




## "H" BARS

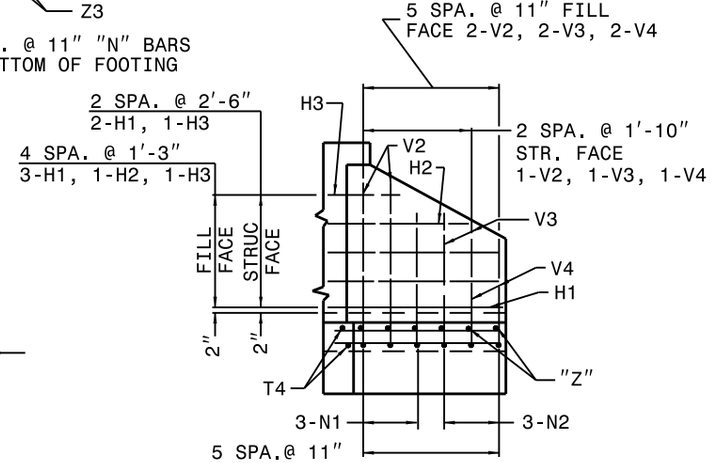



## "N" BARS




## "Z" BARS

"H", "N", & "Z" BAR DIMENSIONS ARE OUT TO OUT.




## WING ELEVATION

SEE STD. # 838.45 FOR GENERAL NOTES.

BILL OF MATERIAL FOR ENDWALL

| REINF. STEEL | | | 2 PIPES | | 3 PIPES | |
|---|---|---|---|---|---|---|
| BAR | SIZE | LENGTH | NO. | WEIGHT | NO. | WEIGHT |
| B1 | #4 | 5′-6″ | 8 | 29 | 12 | 44 |
| B2 | #4 | 4′-6″ | 4 | 12 | 4 | 12 |
| B3 | #4 | 7′-0″ | 4 | 19 | 8 | 37 |
| | | | | | | |
| G2 | #7 | 18′-6″ | 2 | 76 | - | - |
| G3 | #7 | 27′-10″ | - | - | 2 | 114 |
| H1 | #4 | 6′-4″ | 10 | 42 | 10 | 42 |
| H2 | #4 | 4′-7″ | 2 | 6 | 2 | 6 |
| H3 | #4 | 2′-7″ | 4 | 7 | 4 | 7 |
| | | | | | | |
| N1 | #5 | 3′-11″ | 14 | 57 | 18 | 74 |
| N2 | #4 | 3′-5″ | 6 | 14 | 6 | 14 |
| | | | | | | |
| T2 | #4 | 23′-0″ | 6 | 92 | | |
| T3 | #4 | 16′-10″ | | | 12 | 135 |
| T4 | #4 | 6′-0″ | 6 | 24 | 6 | 24 |
| T5 | #4 | 2′-6″ | 76 | 127 | 112 | 187 |
| | | | | | | |
| V1 | #4 | 6′-9″ | 12 | 54 | 18 | 81 |
| V2 | #4 | 5′-2″ | 6 | 21 | 6 | 21 |
| V3 | #4 | 4′-1″ | 6 | 16 | 6 | 16 |
| V4 | #4 | 2′-11″ | 6 | 12 | 6 | 12 |
| | | | | | | |
| Z1 | #6 | 4′-6″ | 6 | 41 | 6 | 41 |
| Z2 | #6 | 3′-11″ | 4 | 16 | 4 | 16 |
| Z3 | #4 | 3′-3″ | 4 | 9 | 4 | 9 |
| | | | | | | |
| REINF. STEEL LBS. | | | | 674 | | 892 |
| | | | | | | |
| CON./R.C. CU. YDS | | | | 8.7 | | 11.1 |

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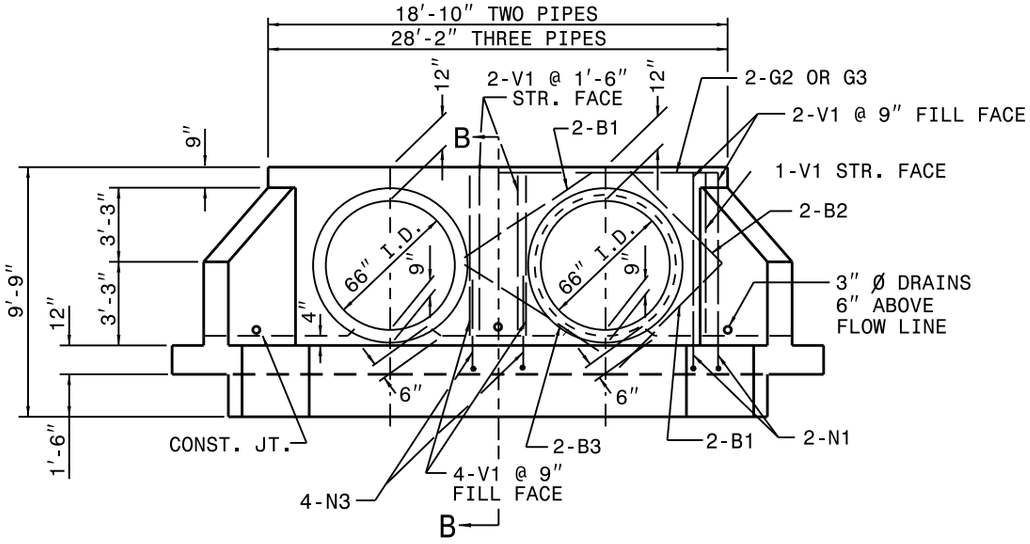
ROADWAY STANDARD DRAWING FOR

# REINFORCED CONCRETE ENDWALL

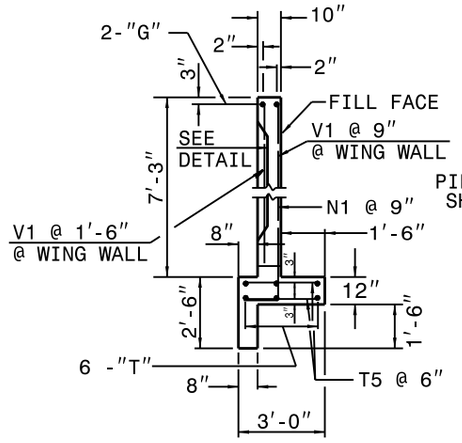
FOR DOUBLE & TRIPLE 66″ PIPE - 90° SKEW

SHEET 1 OF 2

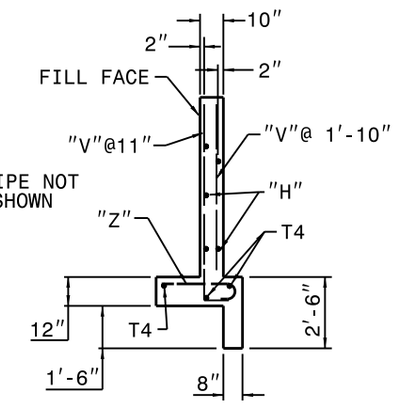
838.34



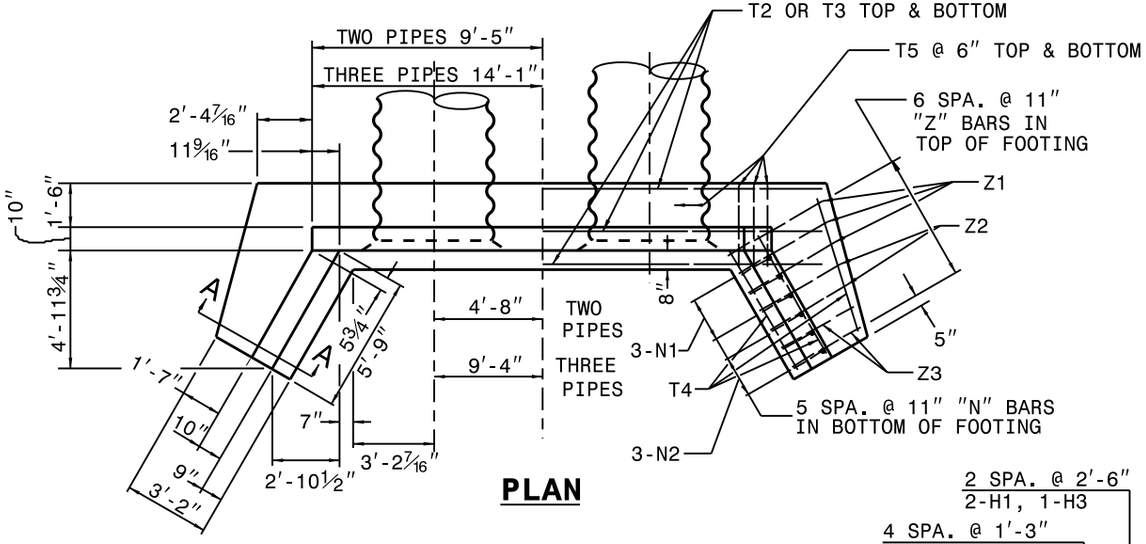

## ELEVATION



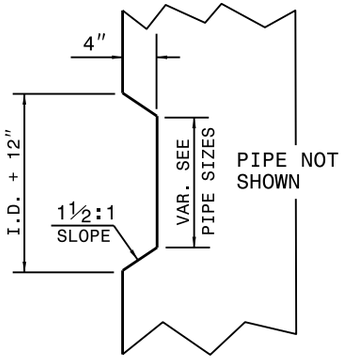

## SECTION - BB



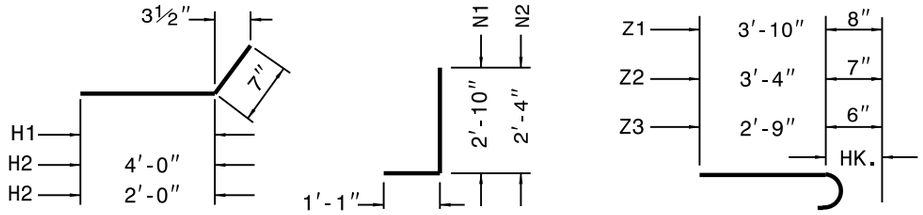

## SECTION - AA




## PLAN

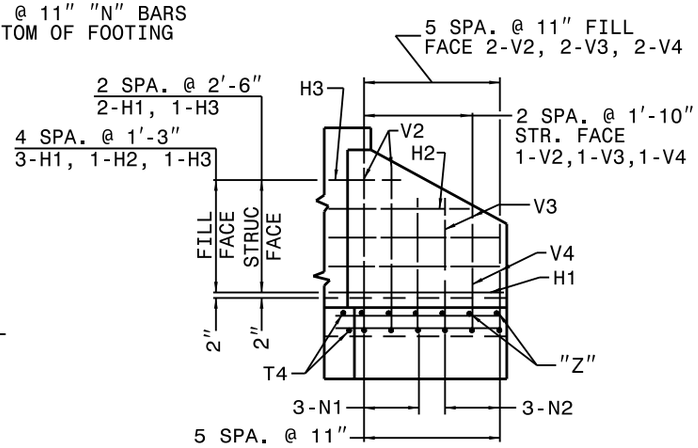



## TAPER DETAIL




## "H" BARS  "N" BARS  "Z" BARS

"H", "N", & "Z" BAR DIMENSIONS ARE OUT TO OUT.




## WING ELEVATION

SEE STD. # 838.45 FOR GENERAL NOTES.

**BILL OF MATERIAL FOR ENDWALL**

| REINF. STEEL | | | 2 PIPES | | 3 PIPES | |
|---|---|---|---|---|---|---|
| BAR | SIZE | LENGTH | NO. | WEIGHT | NO. | WEIGHT |
| B1 | #4 | 5'-6" | 8 | 29 | 12 | 44 |
| B2 | #4 | 4'-6" | 4 | 12 | 4 | 12 |
| B3 | #4 | 7'-0" | 4 | 19 | 8 | 37 |
| | | | | | | |
| G2 | #7 | 18'-6" | 2 | 76 | - | - |
| G3 | #7 | 27'-10" | - | - | 2 | 114 |
| H1 | #4 | 6'-4" | 10 | 42 | 10 | 42 |
| H2 | #4 | 4'-7" | 2 | 6 | 2 | 6 |
| H3 | #4 | 2'-7" | 4 | 7 | 4 | 7 |
| | | | | | | |
| N1 | #5 | 3'-11" | 14 | 57 | 18 | 74 |
| N2 | #4 | 3'-5" | 6 | 14 | 6 | 14 |
| | | | | | | |
| T2 | #4 | 23'-0" | 6 | 92 | | |
| T3 | #4 | 16'-10" | | | 12 | 135 |
| T4 | #4 | 6'-0" | 6 | 24 | 6 | 24 |
| T5 | #4 | 2'-6" | 76 | 127 | 112 | 187 |
| | | | | | | |
| V1 | #4 | 6'-9" | 12 | 54 | 18 | 81 |
| V2 | #4 | 5'-2" | 6 | 21 | 6 | 21 |
| V3 | #4 | 4'-1" | 6 | 16 | 6 | 16 |
| V4 | #4 | 2'-11" | 6 | 12 | 6 | 12 |
| | | | | | | |
| Z1 | #6 | 4'-6" | 6 | 41 | 6 | 41 |
| Z2 | #6 | 3'-11" | 4 | 16 | 4 | 16 |
| Z3 | #4 | 3'-3" | 4 | 9 | 4 | 9 |
| | | | | | | |
| REINF. STEEL LBS. | | | | 674 | | 892 |
| CON./C.S. CU. YDS | | | | 9.3 | | 12.0 |

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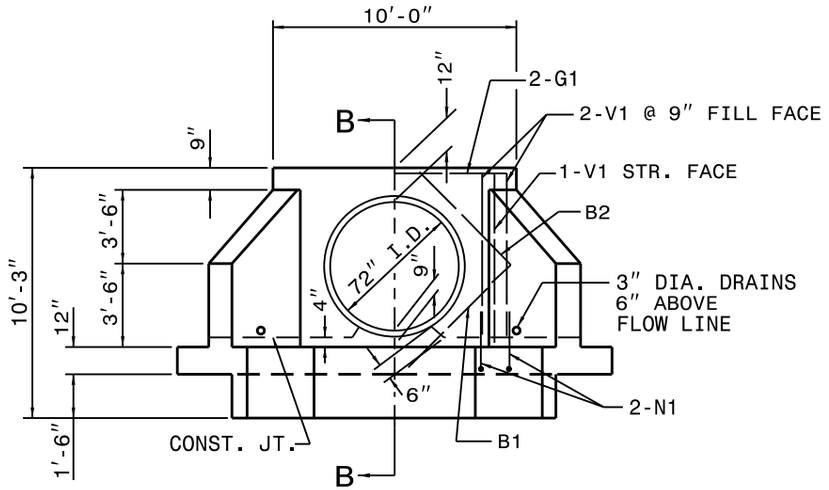
ROADWAY STANDARD DRAWING FOR

# REINFORCED CONCRETE ENDWALL

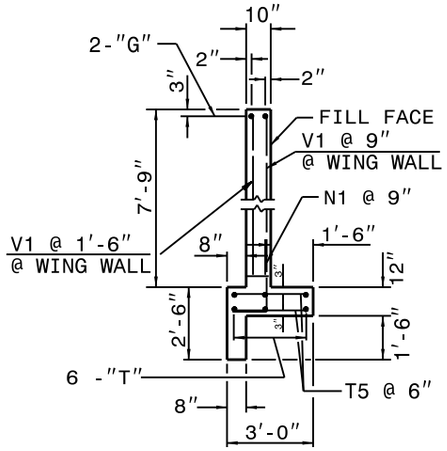
FOR DOUBLE & TRIPLE 66" PIPE - 90° SKEW

SHEET 2 OF 2

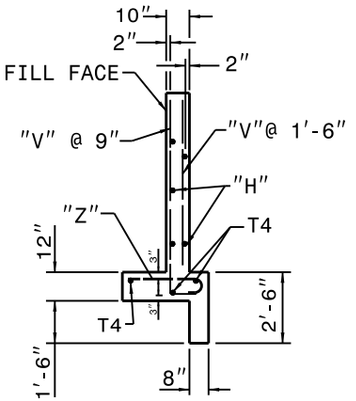
838.34




**ELEVATION**




**SECTION - BB**

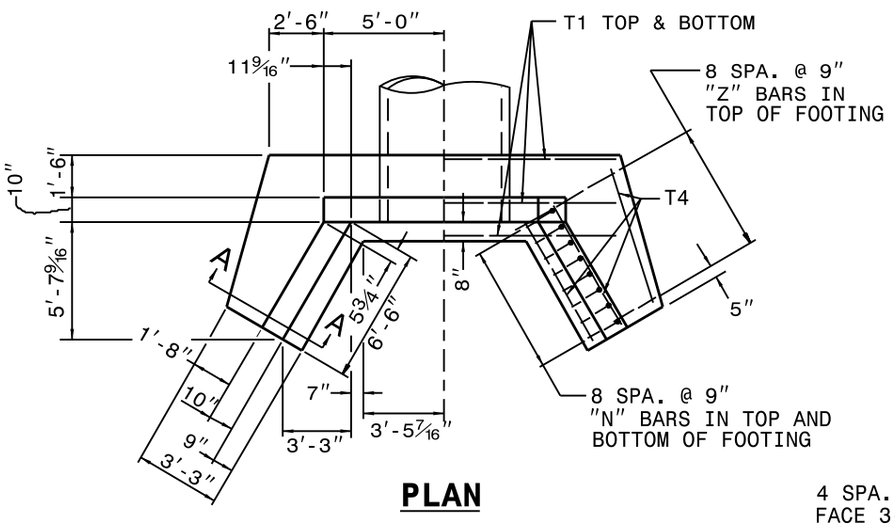



**SECTION - AA**

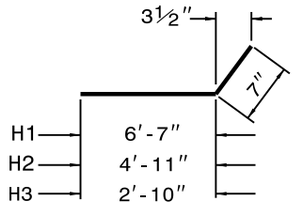
SEE STD.# 838.45 FOR GENERAL NOTES.

BILL OF MATERIAL FOR ENDWALL

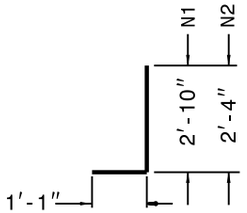
| REINF. STEEL | | | 1 PIPE | |
|---|---|---|---|---|
| BAR | SIZE | LENGTH | NO. | WEIGHT |
| B1 | #4 | 5'-6" | 4 | 15 |
| B2 | #4 | 4'-6" | 4 | 12 |
| G1 | #7 | 9'-8" | 2 | 40 |
| H1 | #4 | 7'-2" | 10 | 48 |
| H2 | #4 | 5'-6" | 2 | 7 |
| H3 | #4 | 3'-5" | 4 | 9 |
| N1 | #5 | 3'-11" | 14 | 57 |
| N2 | #4 | 3'-5" | 8 | 18 |
| | | | | |
| T1 | #4 | 14'-6" | 6 | 58 |
| T4 | #4 | 6'-9" | 6 | 27 |
| T5 | #4 | 2'-6" | 40 | 67 |
| V1 | #4 | 7'-3" | 6 | 29 |
| V2 | #4 | 5'-10" | 10 | 39 |
| V3 | #4 | 5'-0" | 6 | 20 |
| V4 | #4 | 4'-1" | 6 | 16 |
| V5 | #4 | 3'-2" | 6 | 13 |
| Z1 | #6 | 4'-8" | 6 | 42 |
| Z2 | #5 | 4'-0" | 6 | 25 |
| Z3 | #4 | 3'-4" | 6 | 13 |
| | | | | |
| REINF. STEEL LBS. | | | X | 555 |
| | | | | |
| CON./R.C. CU. YDS | | | | 7.1 |



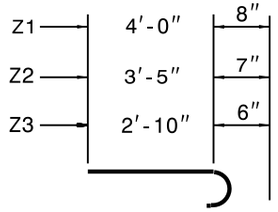

**PLAN**




**"H" BARS**

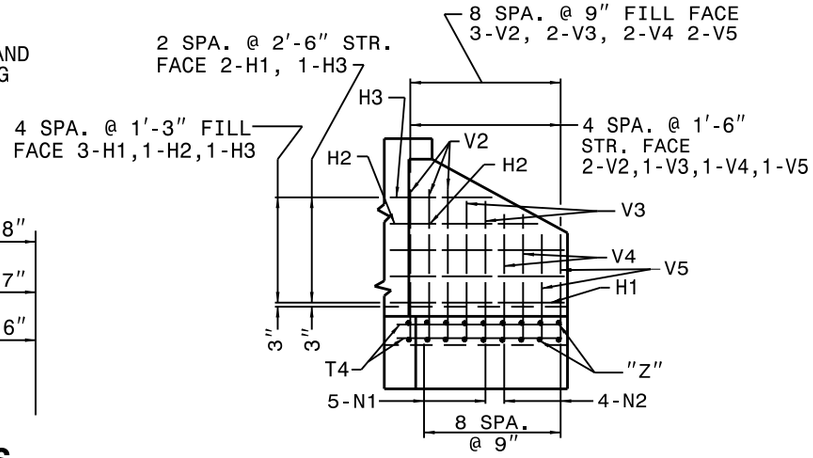



**"N" BARS**




**"Z" BARS**

"H", "N", & "Z" BAR DIMENSIONS ARE OUT TO OUT.




**WING ELEVATION**

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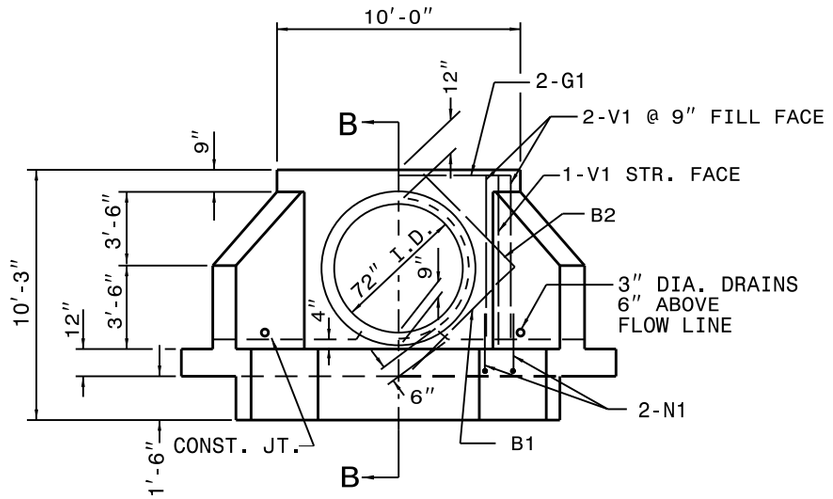
ROADWAY STANDARD DRAWING FOR

# REINFORCED CONCRETE ENDWALL

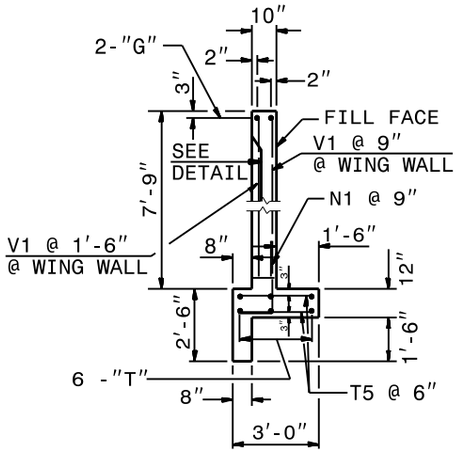
FOR SINGLE 72" PIPE - 90° SKEW

SHEET 1 OF 2

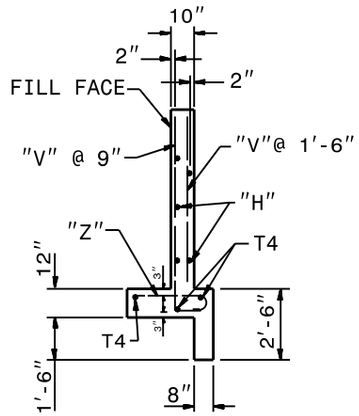
838.39




## ELEVATION

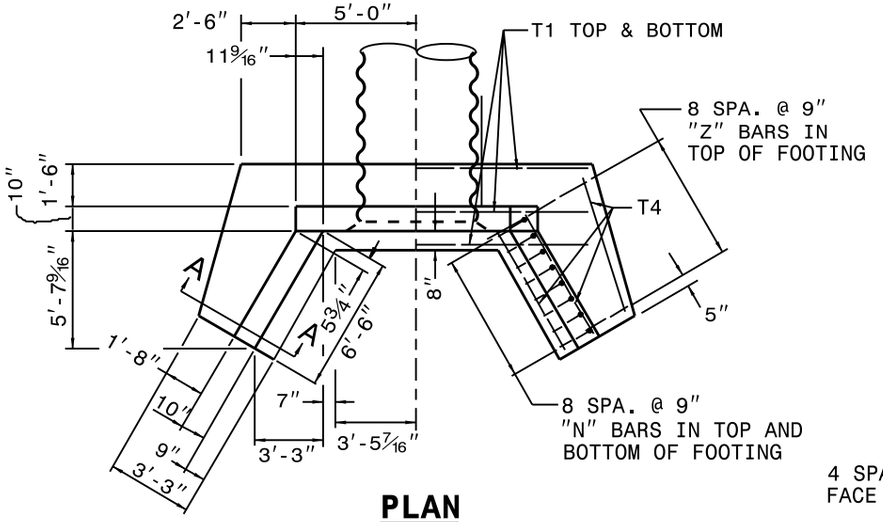



## SECTION - BB

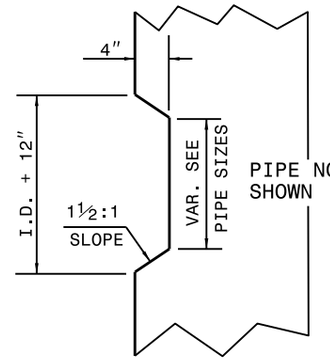



## SECTION - AA

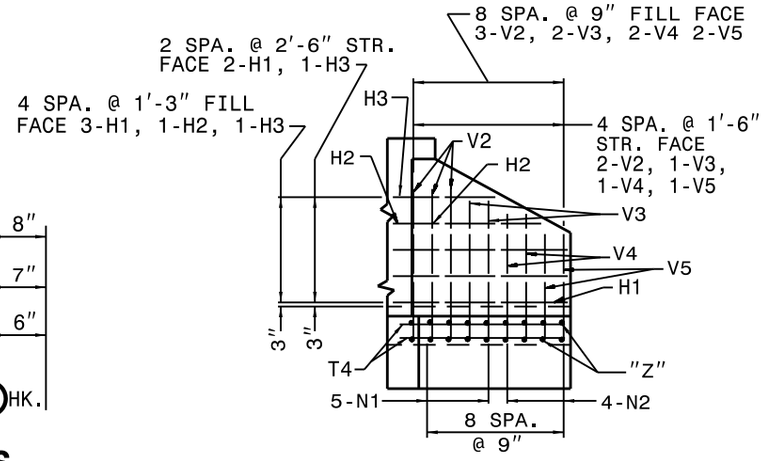
SEE STD.# 838.45 FOR GENERAL NOTES.



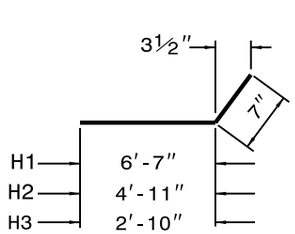

## PLAN



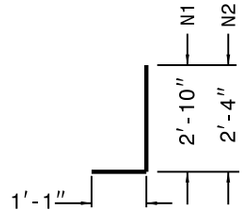

## TAPER DETAIL



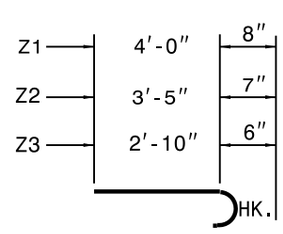

## WING ELEVATION




## ″H″ BARS




## ″N″ BARS




## ″Z″ BARS

″H″, ″N″, & ″Z″ BAR DIMENSIONS ARE OUT TO OUT.

**BILL OF MATERIAL FOR ENDWALL**

| REINF. STEEL | | | 1 PIPE | |
|---|---|---|---|---|
| BAR | SIZE | LENGTH | NO. | WEIGHT |
| B1 | #4 | 5′-6″ | 4 | 15 |
| B2 | #4 | 4′-6″ | 4 | 12 |
| G1 | #7 | 9′-8″ | 2 | 40 |
| H1 | #4 | 7′-2″ | 10 | 48 |
| H2 | #4 | 5′-6″ | 2 | 7 |
| H3 | #4 | 3′-5″ | 4 | 9 |
| N1 | #5 | 3′-11″ | 14 | 57 |
| N2 | #4 | 3′-5″ | 8 | 18 |
| | | | | |
| T1 | #4 | 14′-6″ | 6 | 58 |
| T4 | #4 | 6′-9″ | 6 | 27 |
| T5 | #4 | 2′-6″ | 40 | 67 |
| V1 | #4 | 7′-3″ | 6 | 29 |
| V2 | #4 | 5′-10″ | 10 | 39 |
| V3 | #4 | 5′-0″ | 6 | 20 |
| V4 | #4 | 4′-1″ | 6 | 16 |
| V5 | #4 | 3′-2″ | 6 | 13 |
| Z1 | #6 | 4′-8″ | 6 | 42 |
| Z2 | #5 | 4′-0″ | 6 | 25 |
| Z3 | #4 | 3′-4″ | 6 | 13 |
| | | | | |
| REINF. STEEL LBS. | | | | 555 |
| CON./C.S. CU. YDS | | | | 7.5 |

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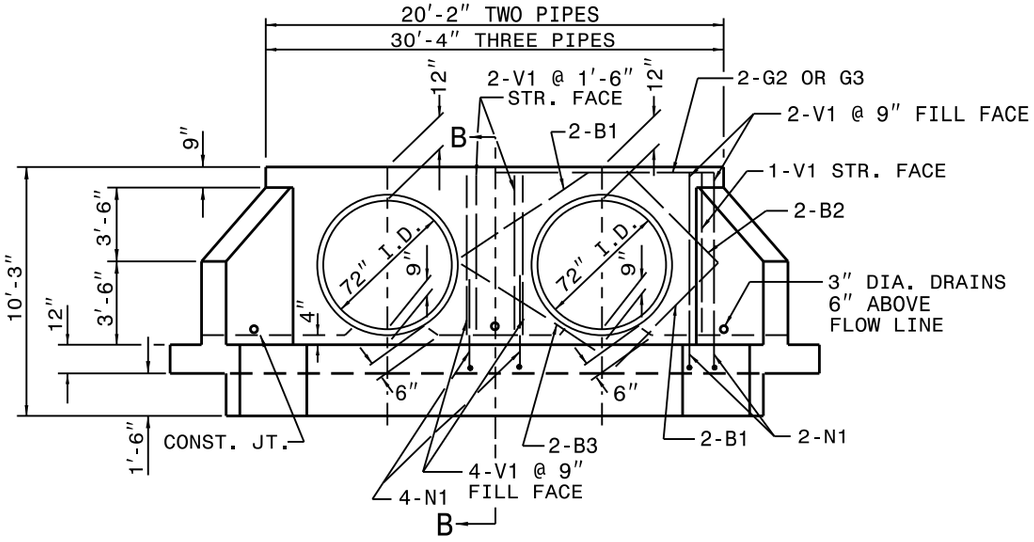
ROADWAY STANDARD DRAWING FOR

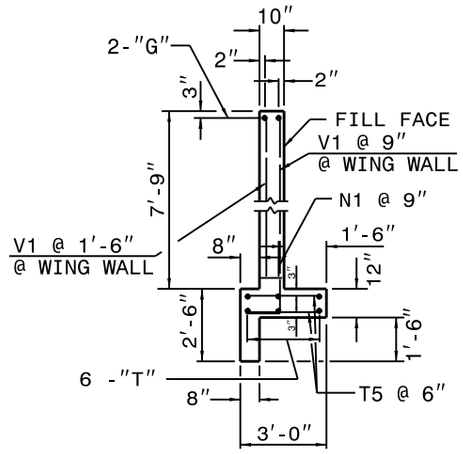
# REINFORCED CONCRETE ENDWALL

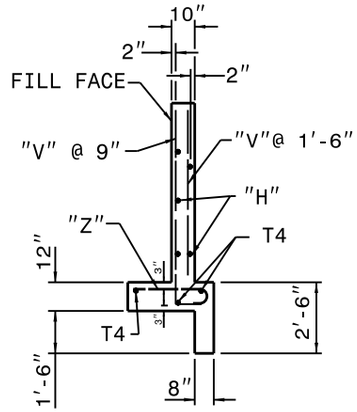
FOR SINGLE 72″ PIPE - 90° SKEW

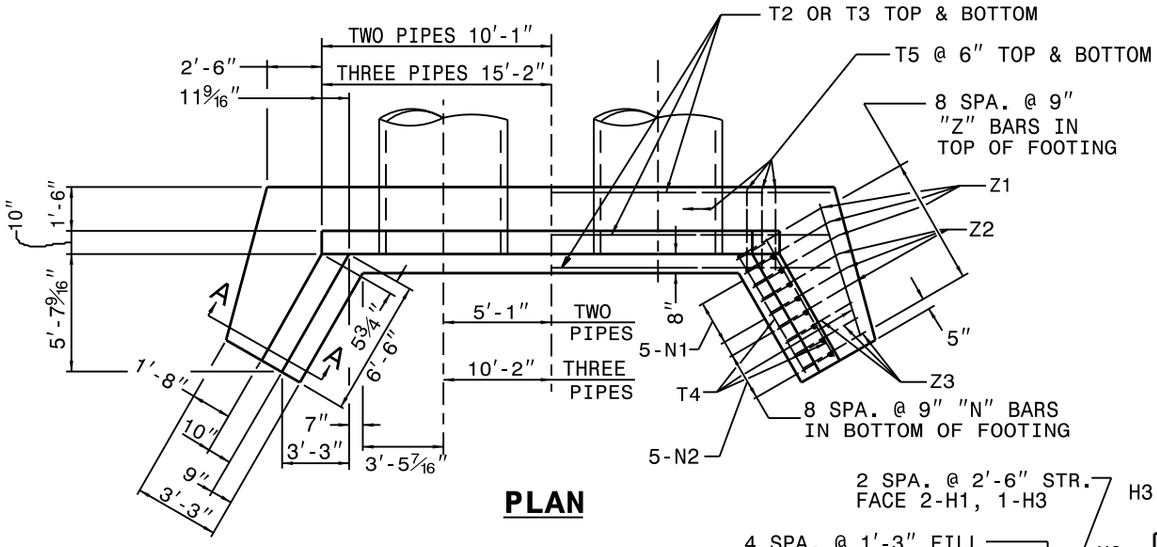
SHEET 2 OF 2

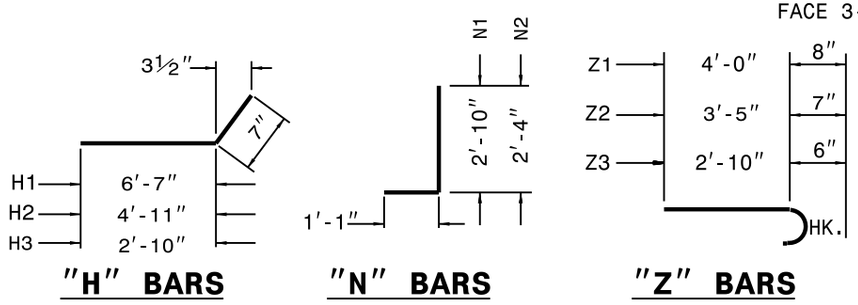
838.39



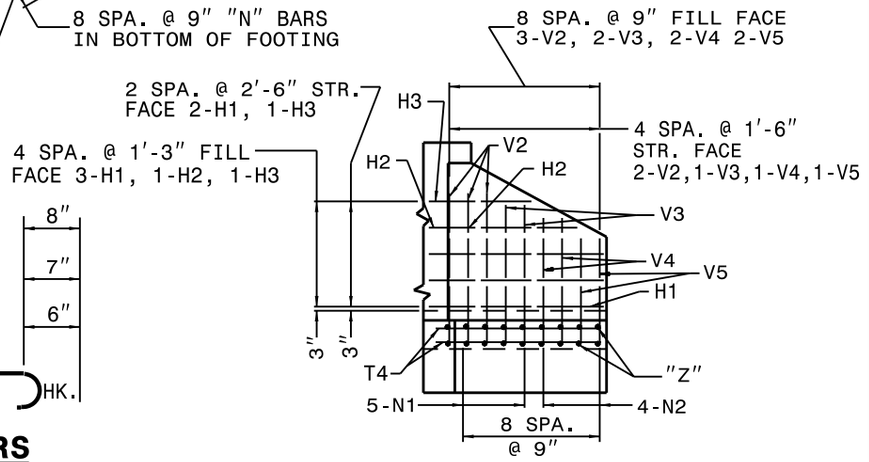




"H", "N", & "Z" BAR DIMENSIONS ARE OUT TO OUT.




SEE STD. # 838.45 FOR GENERAL NOTES.

**BILL OF MATERIAL FOR ENDWALL**

| REINF. STEEL | | | 2 PIPES | | 3 PIPES | |
|---|---|---|---|---|---|---|
| BAR | SIZE | LENGTH | NO. | WEIGHT | NO. | WEIGHT |
| B1 | #4 | 5′-6″ | 8 | 29 | 12 | 44 |
| B2 | #4 | 4′-6″ | 4 | 12 | 4 | 12 |
| B3 | #4 | 7′-0″ | 4 | 19 | 8 | 37 |
| | | | | | | |
| G2 | #7 | 19′-10″ | 2 | 81 | - | - |
| G3 | #7 | 30′-0″ | - | - | 2 | 123 |
| H1 | #4 | 7′-2″ | 10 | 48 | 10 | 48 |
| H2 | #4 | 5′-6″ | 2 | 7 | 2 | 7 |
| H3 | #4 | 3′-5″ | 4 | 9 | 4 | 9 |
| | | | | | | |
| N1 | #5 | 3′-11″ | 18 | 74 | 22 | 90 |
| N2 | #4 | 3′-5″ | 8 | 18 | 8 | 18 |
| | | | | | | |
| T2 | #4 | 24′-8″ | 6 | 99 | | |
| T3 | #4 | 18′-1″ | | | 12 | 145 |
| T4 | #4 | 6′-9″ | 6 | 22 | 6 | 27 |
| T5 | #4 | 2′-6″ | 80 | 134 | 122 | 204 |
| | | | | | | |
| V1 | #4 | 7′-3″ | 12 | 58 | 18 | 87 |
| V2 | #4 | 5′-10″ | 10 | 39 | 10 | 39 |
| V3 | #4 | 5′-0″ | 6 | 20 | 6 | 20 |
| V4 | #4 | 4′-1″ | 6 | 16 | 6 | 16 |
| V5 | #4 | 3′-2″ | 6 | 13 | 6 | 13 |
| Z1 | #6 | 4′-8″ | 6 | 42 | 6 | 42 |
| Z2 | #5 | 4′-0″ | 6 | 25 | 6 | 25 |
| Z3 | #4 | 3′-4″ | 6 | 13 | 6 | 13 |
| | | | | | | |
| REINF. STEEL LBS. | | | | 783 | | 1019 |
| | | | | | | |
| CON./R.C. CU. YDS | | | 9.8 | | 12.5 | |

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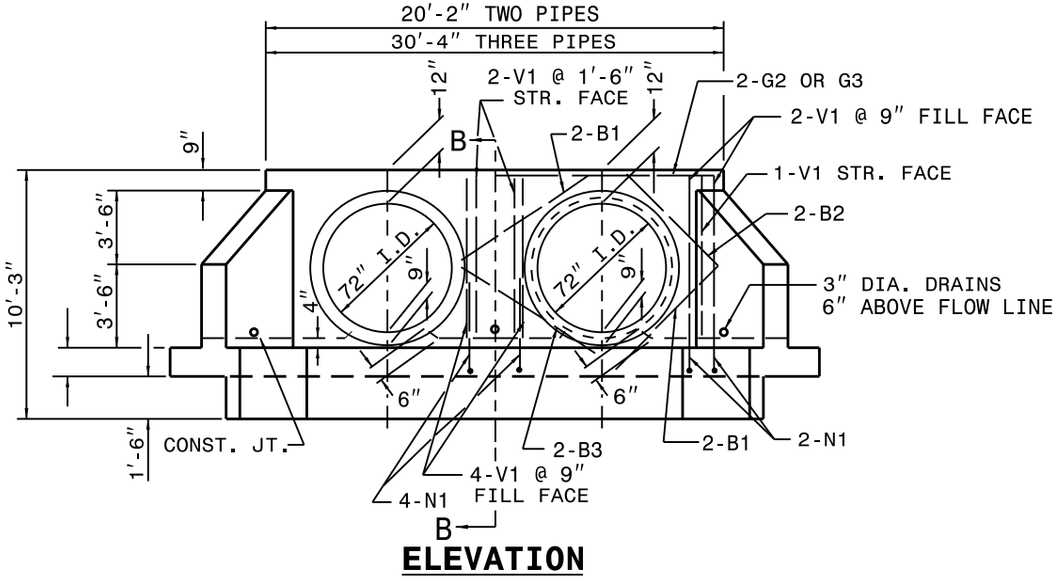
ROADWAY STANDARD DRAWING FOR

# REINFORCED CONCRETE ENDWALL

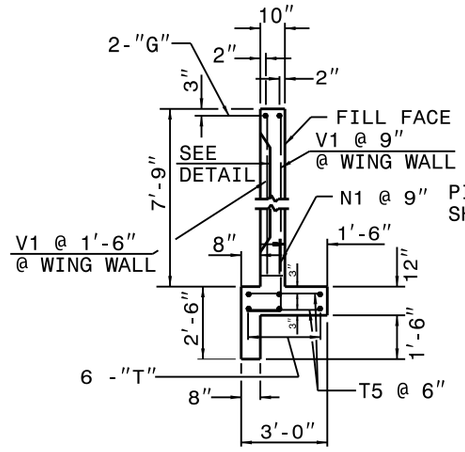
FOR DOUBLE AND TRIPLE 72″ PIPE - 90° SKEW

SHEET 1 OF 2

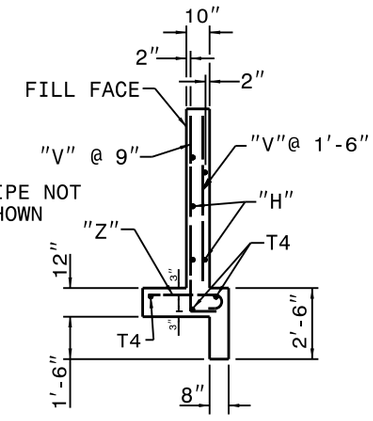
838.40



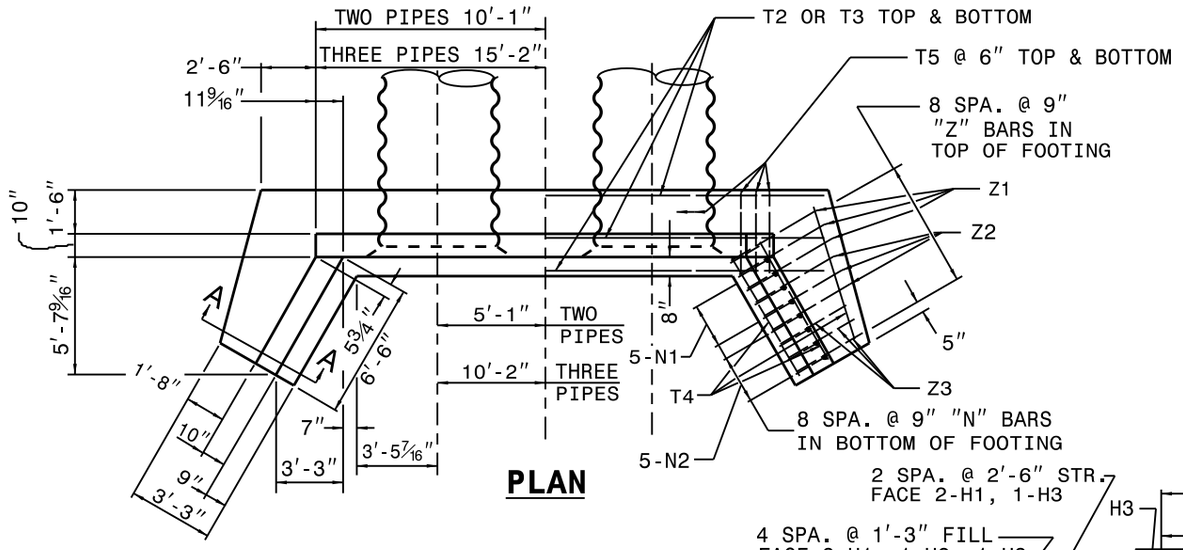

## ELEVATION



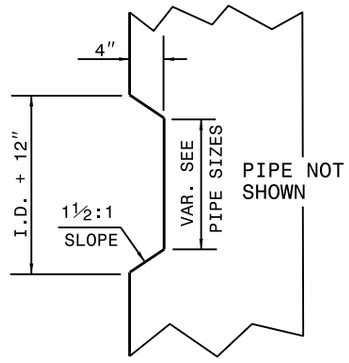

## SECTION - BB



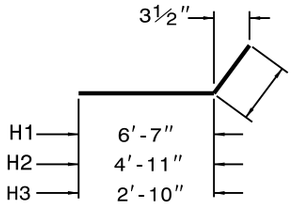

## SECTION - AA



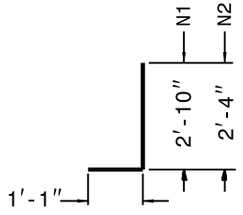

## PLAN



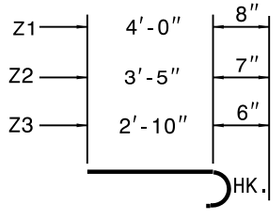

## TAPER DETAIL




## ″H″ BARS

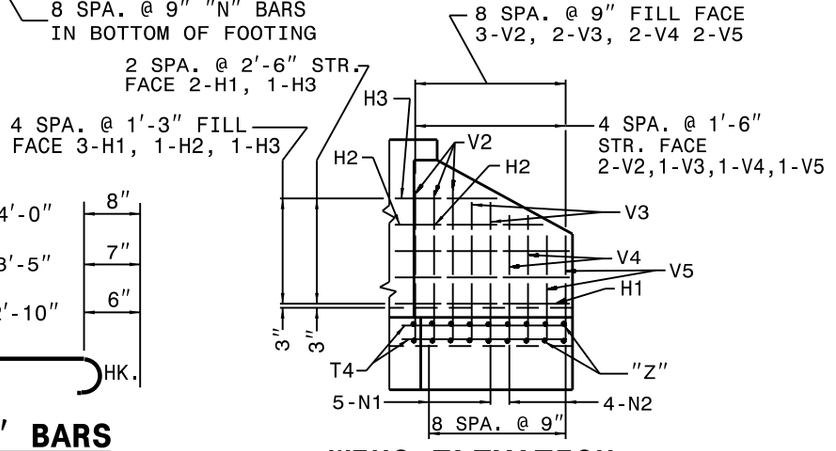



## ″N″ BARS




## ″Z″ BARS

"H", "N", & "Z" BAR DIMENSIONS ARE OUT TO OUT.




## WING ELEVATION

SEE STD. # 838.45 FOR GENERAL NOTES.

**BILL OF MATERIAL FOR ENDWALL**

| REINF. STEEL | | | 2 PIPES | | 3 PIPES | |
|---|---|---|---|---|---|---|
| BAR | SIZE | LENGTH | NO. | WEIGHT | NO. | WEIGHT |
| B1 | #4 | 5′-6″ | 8 | 29 | 12 | 44 |
| B2 | #4 | 4′-6″ | 4 | 12 | 4 | 12 |
| B3 | #4 | 7′-0″ | 4 | 19 | 8 | 37 |
| | | | | | | |
| G2 | #7 | 19′-10″ | 2 | 81 | - | - |
| G3 | #7 | 30′-0″ | - | - | 2 | 123 |
| H1 | #4 | 7′-2″ | 10 | 48 | 10 | 48 |
| H2 | #4 | 5′-6″ | 2 | 7 | 2 | 7 |
| H3 | #4 | 3′-5″ | 4 | 9 | 4 | 9 |
| | | | | | | |
| N1 | #5 | 3′-11″ | 18 | 74 | 22 | 90 |
| N2 | #4 | 3′-5″ | 8 | 18 | 8 | 18 |
| | | | | | | |
| T2 | #4 | 24′-8″ | 6 | 99 | | |
| T3 | #4 | 18′-1″ | | | 12 | 145 |
| T4 | #4 | 6′-9″ | 6 | 22 | 6 | 27 |
| T5 | #4 | 2′-6″ | 80 | 134 | 122 | 204 |
| | | | | | | |
| V1 | #4 | 7′-3″ | 12 | 58 | 18 | 87 |
| V2 | #4 | 5′-10″ | 10 | 39 | 10 | 39 |
| V3 | #4 | 5′-0″ | 6 | 20 | 6 | 20 |
| V4 | #4 | 4′-1″ | 6 | 16 | 6 | 16 |
| V5 | #4 | 3′-2″ | 6 | 13 | 6 | 13 |
| Z1 | #6 | 4′-8″ | 6 | 42 | 6 | 42 |
| Z2 | #5 | 4′-0″ | 6 | 25 | 6 | 25 |
| Z3 | #4 | 3′-4″ | 6 | 13 | 6 | 13 |
| | | | | | | |
| REINF. STEEL LBS. | | | | 783 | | 1019 |
| CON./C.S. CU. YDS | | | 10.5 | | 13.6 | |

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ROADWAY STANDARD DRAWING FOR

# REINFORCED CONCRETE ENDWALL

FOR DOUBLE AND TRIPLE 72″ PIPE - 90° SKEW

SHEET 2 OF 2

838.40

GENERAL NOTES:

USE CLASS "A" CONCRETE.

CHAMFER ALL EXPOSED CORNERS 1".

ALL DIMENSIONS RELATIVE TO PLACEMENT OF REINFORCING STEEL ARE TO CENTERS OF BARS.

COVER WEEP HOLES WITH HARDWARE CLOTH IN ACCORDANCE WITH ARTICLE 420-11 OF THE STANDARD SPECIFICATIONS. PLACE A STONE DRAIN CONSISTING OF ONE (1) CUBIC FOOT OF NUMBER 78M STONE CONTAINED IN A BAG OF TYPE 1 GEOTEXTILE AT EACH WEEP HOLE. PLACE SUBDRAIN FINE AGGREGATE BENEATH, AROUND AND OVER THE STONE DRAIN SO THE STONE DRAIN IS COMPLETELY COVERED BY A LAYER OF SUBDRAIN FINE AGGREGATE AT LEAST ONE (1) FOOT THICK. WHERE THERE IS MORE THAN ONE WEEP HOLE IN A WING WALL, PLACE A HORIZONTAL DRAIN OF SUBDRAIN FINE AGGREGATE AT LEAST ONE (1) FOOT SQUARE IN CROSS SECTION TO CONNECT ALL STONE DRAINS. PLACE A VERTICAL DRAIN OF SUBDRAIN FINE AGGREGATE AT LEAST ONE (1) FOOT SQUARE IN CROSS SECTION AT EACH WEEP HOLE TO AN ELEVATION OF TWO (2) FEET BELOW THE SURFACE OF THE EMBANKMENT.

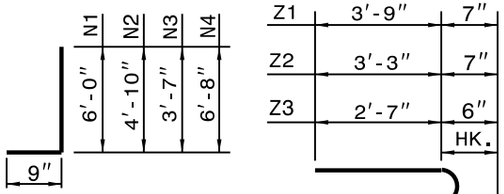
STATE OF
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DIVISION OF HIGHWAYS
RALEIGH, N.C.

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ROADWAY STANDARD DRAWING FOR

# NOTES FOR REINFORCED CONCRETE ENDWALL

STANDARD DRAWINGS 838.21 THRU 838.40




## "N" BARS

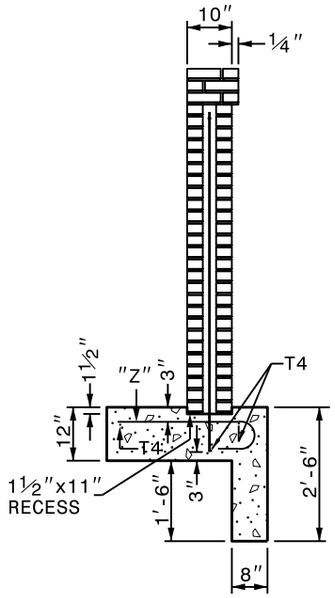



## "Z" BARS

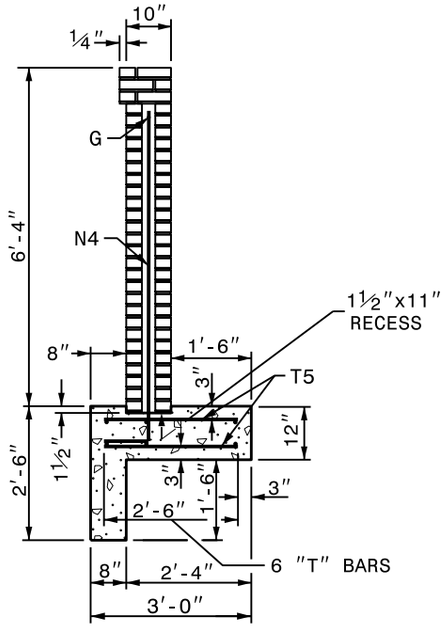
"N" & "Z" BAR DIMENSIONS ARE OUT TO OUT.

*PAY FOR CONCRETE AS BRICK MASONRY

| BILL OF MATERIAL FOR ENDWALL | | | | |
|---|---|---|---|---|
| REINF. STEEL | | | 1 PIPE | |
| BAR | SIZE | LENGTH | NO. | WEIGHT |
| B1 | #5 | 5'-3" | 2 | 11 |
| B2 | #5 | 3'-9" | 2 | 8 |
| G1 | #5 | 7'-8" | 2 | 31 |
| H1 | #4 | 5'-3" | 6 | 21 |
| H2 | #4 | 3'-6" | 2 | 5 |
| N1 | #5 | 6'-9" | 2 | 14 |
| N2 | #5 | 5'-7" | 4 | 23 |
| N3 | #4 | 4'-4" | 4 | 12 |
| N4 | #4 | 7'-5" | 6 | 30 |
| T1 | #4 | 12'-0" | 6 | 48 |
| T4 | #4 | 4'-11" | 6 | 20 |
| T5 | #4 | 2'-6" | 34 | 57 |
| Z1 | #5 | 4'-4" | 4 | 18 |
| Z2 | #5 | 3'-10" | 4 | 16 |
| Z3 | #5 | 3'-1" | 4 | 8 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| REINF. STEEL LBS. | | | | 322 |
| | | | | |
| *CL. "A" CONC. FOOT. C.Y. | | | 2.8 | |
| BR. MASONRY/C.S. C.Y. | | | 2.5 | |
| BR. MASONRY/R.C. C.Y. | | | 2.3 | |

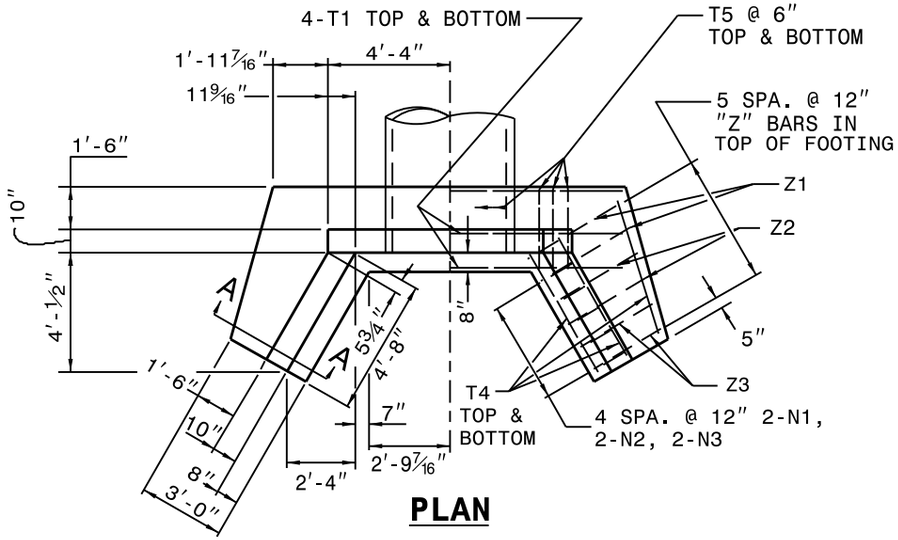



## SECTION A-A

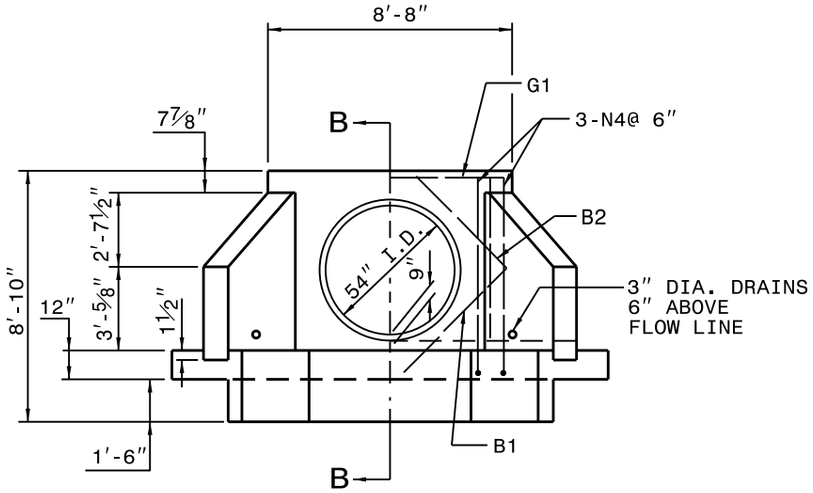



## SECTION B-B

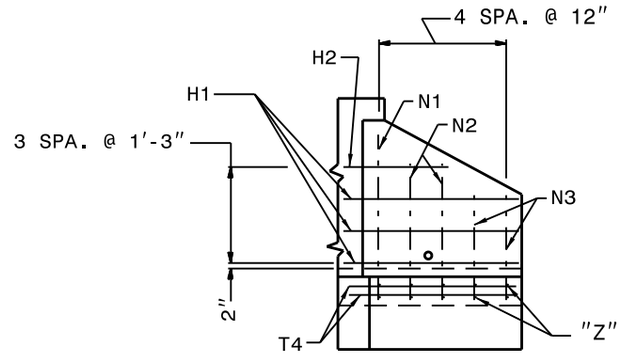
SEE STD. DWG. NO. 838.75 FOR GENERAL NOTES.




## PLAN




## ELEVATION




## WING ELEVATION

STATE OF NORTH CAROLINA
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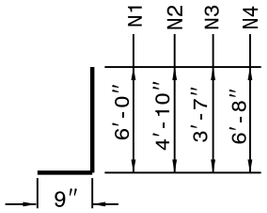
ROADWAY STANDARD DRAWING FOR

# REINFORCED BRICK ENDWALL

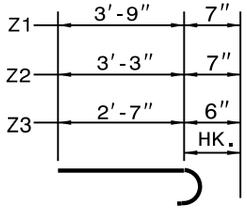
FOR SINGLE 54" PIPE - 90° SKEW

SHEET 1 OF 1

838.51




## "N" BARS



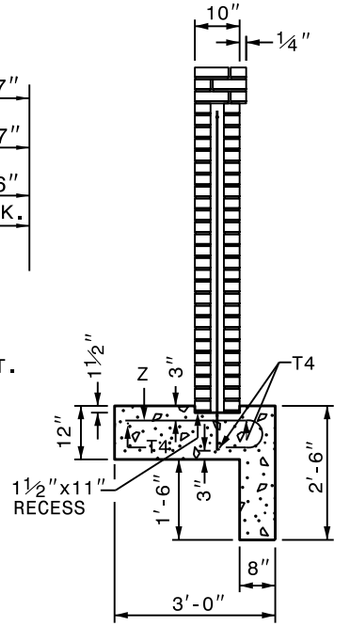

## "Z" BARS

"N" & "Z" BAR DIMENSIONS ARE OUT TO OUT.

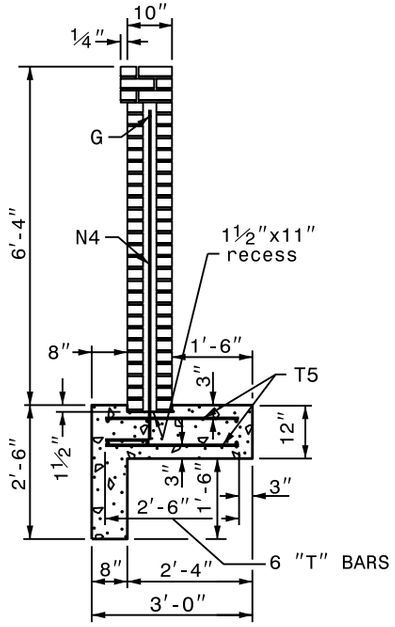
*PAY FOR CONCRETE AS BRICK MASONRY

**BILL OF MATERIAL FOR ENDWALL**

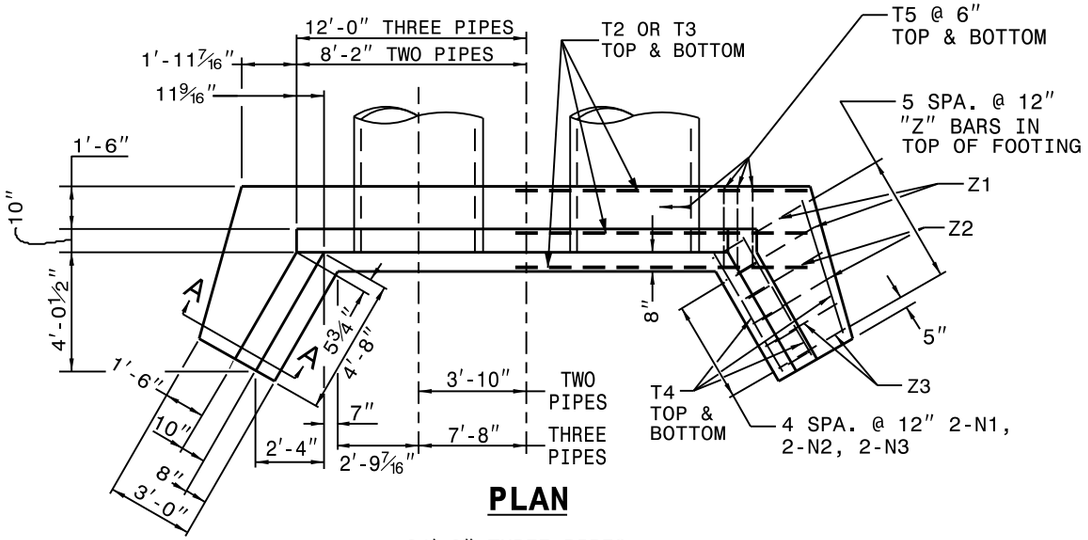
| REINF. STEEL | | | 2 PIPES | | 3 PIPES | |
|---|---|---|---|---|---|---|
| BAR | SIZE | LENGTH | NO. | WEIGHT | NO. | WEIGHT |
| B1 | #5 | 5'-3" | 4 | 22 | 6 | 33 |
| B2 | #5 | 3'-9" | 2 | 8 | 2 | 8 |
| B3 | #5 | 6'-0" | 2 | 13 | 4 | 25 |
| | | | | | | |
| G2 | #7 | 15'-4" | 2 | 63 | - | - |
| G3 | #7 | 23'-0" | - | - | 2 | 94 |
| H1 | #4 | 5'-3" | 6 | 21 | 6 | 21 |
| H2 | #4 | 3'-6" | 2 | 5 | 2 | 5 |
| | | | | | | |
| N1 | #5 | 6'-9" | 2 | 14 | 2 | 14 |
| N2 | #5 | 5'-7" | 4 | 23 | 4 | 23 |
| N3 | #4 | 4'-4" | 4 | 12 | 4 | 12 |
| N4 | #4 | 7'-5" | 11 | 54 | 16 | 79 |
| | | | | | | |
| T2 | #4 | 19'-8" | 6 | 79 | - | - |
| T3 | #4 | 27'-4" | - | - | 6 | 110 |
| T4 | #4 | 4'-11" | 6 | 20 | 6 | 20 |
| T5 | #4 | 2'-6" | 66 | 110 | 96 | 160 |
| | | | | | | |
| Z1 | #5 | 4'-4" | 4 | 18 | 4 | 18 |
| Z2 | #5 | 3'-10" | 4 | 16 | 4 | 16 |
| Z3 | #4 | 3'-1" | 4 | 8 | 4 | 8 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| REINF. STEEL LBS. | | | | 486 | | 646 |
| | | | | | | |
| *CL. "A" CONC. FOOT. C.Y. | | | | 4.0 | | 5.1 |
| BR. MASONRY/C.S. C.Y. | | | | 3.5 | | 4.5 |
| BR. MASONRY/R.C. C.Y. | | | | 3.1 | | 3.9 |



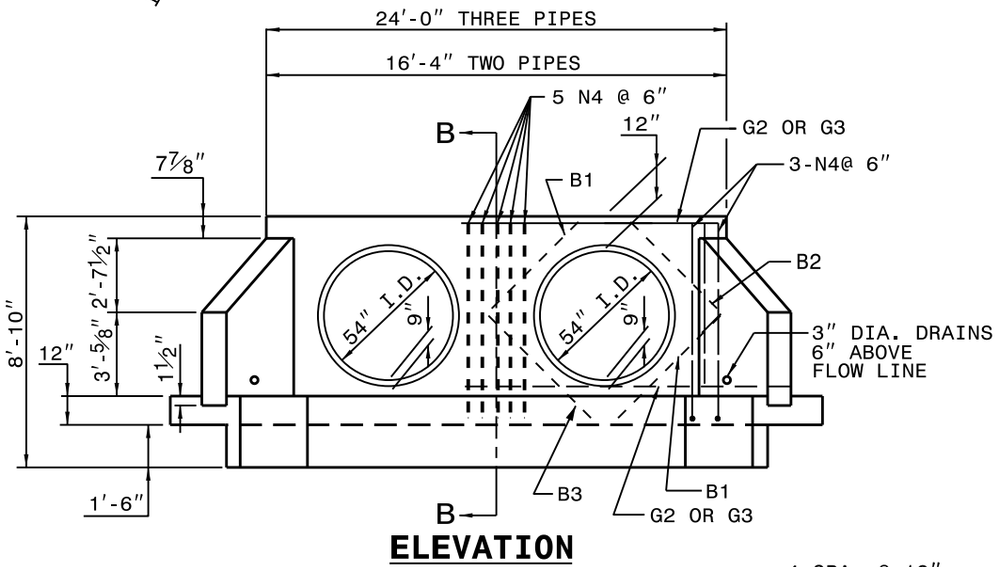

## SECTION A-A



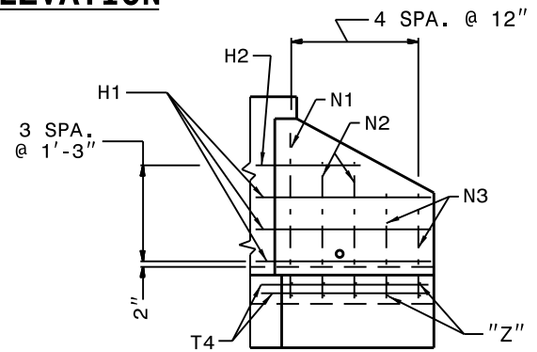

## SECTION B-B




## PLAN




## ELEVATION




## WING ELEVATION

SEE STD. DWG. NO. 838.75 FOR GENERAL NOTES.

STATE OF
NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

1-24

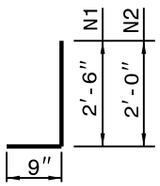
ROADWAY STANDARD DRAWING FOR

# REINFORCED BRICK ENDWALL

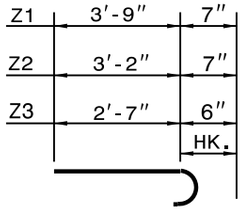
FOR DOUBLE AND TRIPLE 54" PIPES - 90° SKEW

SHEET 1 OF 1

838.52




## "N" BARS

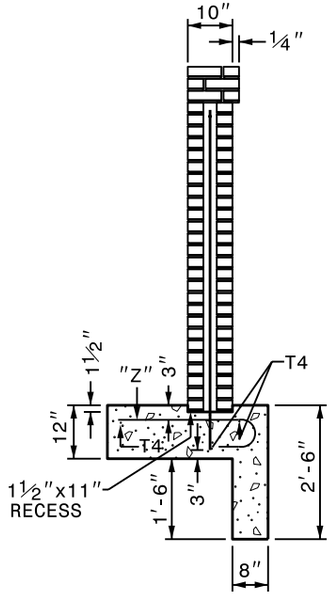



## "Z" BARS

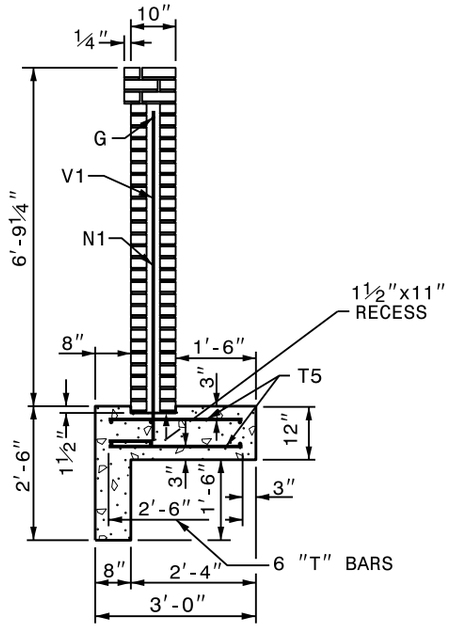
"N" & "Z" BAR DIMENSIONS ARE OUT TO OUT.

*PAY FOR CONCRETE AS BRICK MASONRY

| BILL OF MATERIAL FOR ENDWALL | | | | |
|---|---|---|---|---|
| REINF. STEEL | | | 1 PIPE | |
| BAR | SIZE | LENGTH | NO. | WEIGHT |
| B1 | #5 | 5'-3" | 2 | 11 |
| B2 | #5 | 3'-9" | 2 | 8 |
| G1 | #7 | 8'-0" | 2 | 33 |
| H1 | #4 | 5'-9" | 6 | 23 |
| H2 | #4 | 4'-0" | 2 | 5 |
| H3 | #4 | 2'-1" | 2 | 3 |
| N1 | #5 | 3'-3" | 12 | 41 |
| N2 | #4 | 2'-9" | 6 | 11 |
| T1 | #4 | 13'-0" | 6 | 52 |
| T4 | #4 | 5'-8" | 6 | 23 |
| T5 | #4 | 2'-6" | 36 | 60 |
| V1 | #4 | 6'-4" | 6 | 25 |
| V2 | #4 | 5'-2" | 4 | 14 |
| V3 | #4 | 3'-11" | 4 | 10 |
| V4 | #4 | 2'-9" | 4 | 7 |
| Z1 | #5 | 4'-4" | 6 | 27 |
| Z2 | #5 | 3'-9" | 4 | 16 |
| Z3 | #5 | 3'-1" | 4 | 8 |
| | | | | |
| REINF. STEEL LBS. | | | | 377 |
| | | | | |
| *CL. "A" CONC. FOOT. C.Y. | | | 3.1 | |
| BR. MASONRY/C.S. C.Y. | | | 2.8 | |
| BR. MASONRY/R.C. C.Y. | | | 2.6 | |

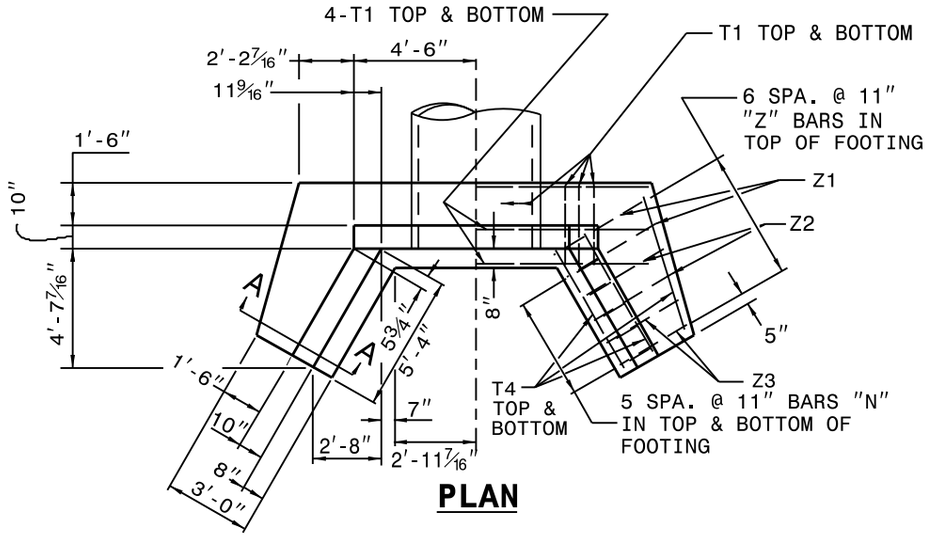



## SECTION A-A

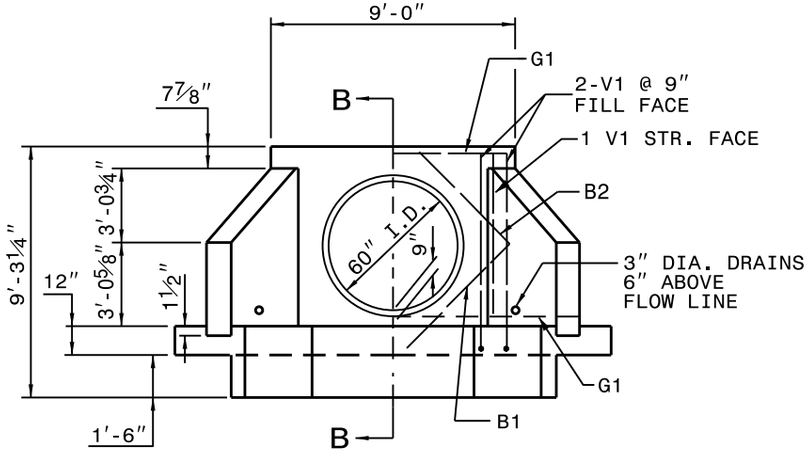



## SECTION B-B

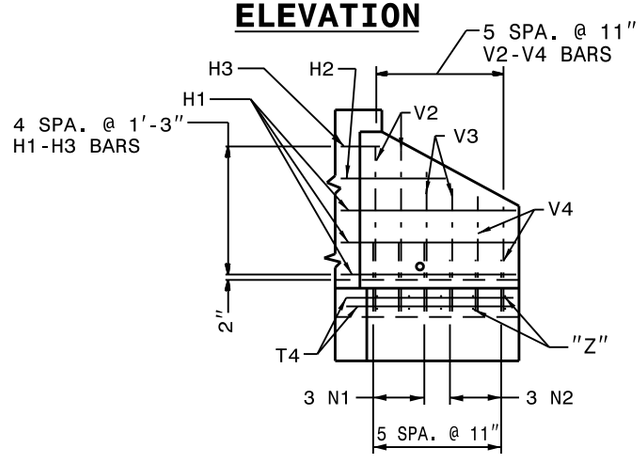
SEE STD. DWG. NO. 838.75 FOR GENERAL NOTES.




## PLAN




## ELEVATION




## WING ELEVATION

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

1-24

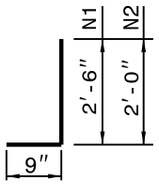
ROADWAY STANDARD DRAWING FOR

# REINFORCED BRICK ENDWALL

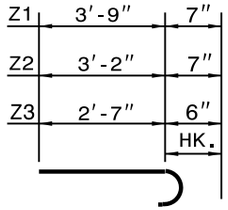
FOR SINGLE 60" PIPE - 90° SKEW

SHEET 1 OF 1

838.57




"N" BARS



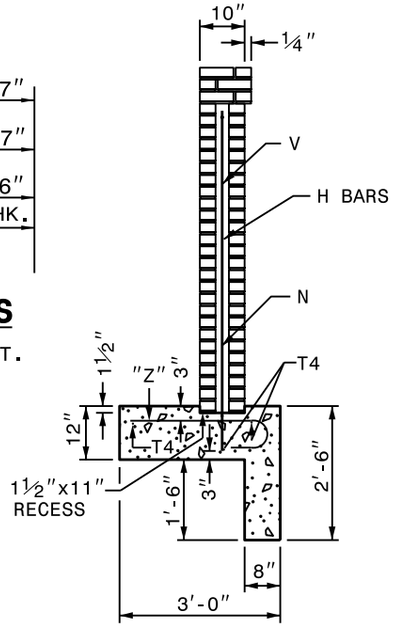

"Z" BARS

"N" & "Z" BAR DIMENSIONS ARE OUT TO OUT.

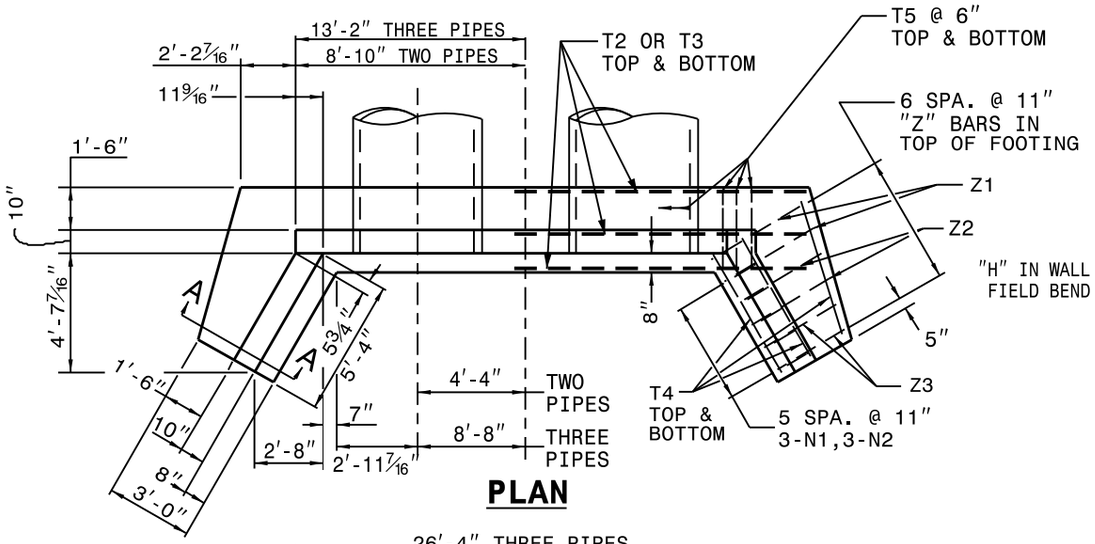
*PAY FOR CONCRETE AS BRICK MASONRY

| BILL OF MATERIAL FOR ENDWALL | | | | | | |
|---|---|---|---|---|---|---|
| REINF. STEEL | | | 2 PIPES | | 3 PIPES | |
| BAR | SIZE | LENGTH | NO. | WEIGHT | NO. | WEIGHT |
| B1 | #5 | 5'-3" | 4 | 22 | 6 | 33 |
| B2 | #5 | 3'-9" | 2 | 8 | 2 | 8 |
| B3 | #5 | 6'-3" | 2 | 13 | 4 | 26 |
| | | | | | | |
| G2 | #7 | 16'-8" | 2 | 68 | - | - |
| G3 | #7 | 25'-4" | - | - | 2 | 104 |
| H1 | #4 | 5'-9" | 6 | 23 | 6 | 23 |
| H2 | #4 | 4'-0" | 2 | 5 | 2 | 5 |
| H3 | #4 | 2'-1" | 2 | 3 | 2 | 3 |
| N1 | #5 | 3'-3" | 17 | 58 | 22 | 75 |
| N2 | #4 | 2'-9" | 6 | 11 | 6 | 11 |
| T2 | #4 | 21'-8" | 6 | 87 | - | - |
| T3 | #4 | 15'-10" | - | - | 12 | 127 |
| T4 | #4 | 5'-8" | 6 | 23 | 6 | 23 |
| T5 | #4 | 2'-6" | 70 | 117 | 106 | 177 |
| V1 | #4 | 6'-4" | 11 | 47 | 16 | 68 |
| V2 | #4 | 5'-2" | 4 | 14 | 4 | 14 |
| V3 | #4 | 3'-11" | 4 | 10 | 4 | 10 |
| V4 | #4 | 2'-9" | 4 | 7 | 4 | 7 |
| Z1 | #5 | 4'-4" | 6 | 27 | 6 | 27 |
| Z2 | #5 | 3'-9" | 4 | 16 | 4 | 16 |
| Z3 | #4 | 3'-1" | 4 | 8 | 4 | 8 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| REINF. STEEL LBS. | | | X | 567 | | 765 |
| | | | | | X | |
| *CL. "A" CONC. FOOT. C.Y. | | | 4.4 | | X | 5.6 |
| BR. MASONRY/C.S. C.Y. | | | 4.0 | | X | 5.3 |
| BR. MASONRY/R.C. C.Y. | | | 3.5 | | X | 4.5 |

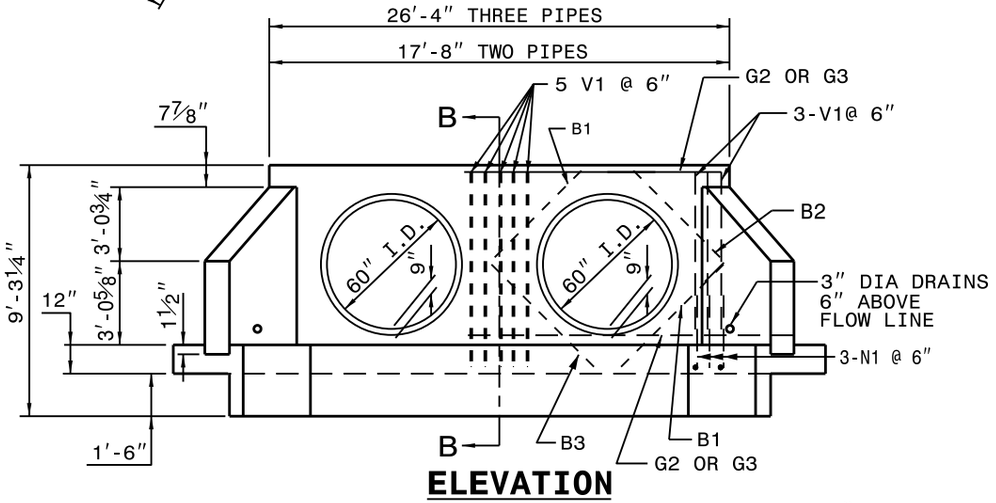
SEE STD. DWG. NO. 838.75 FOR GENERAL NOTES.



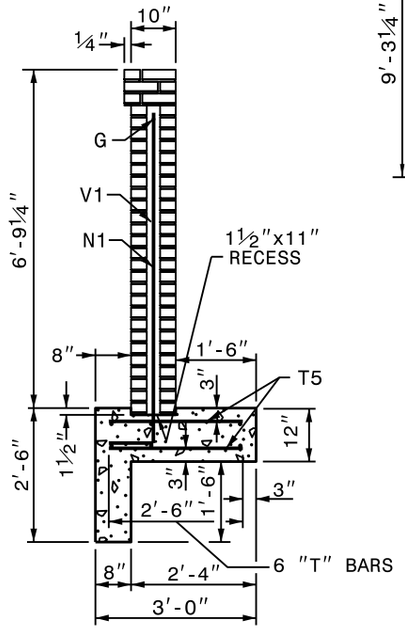

SECTION A-A



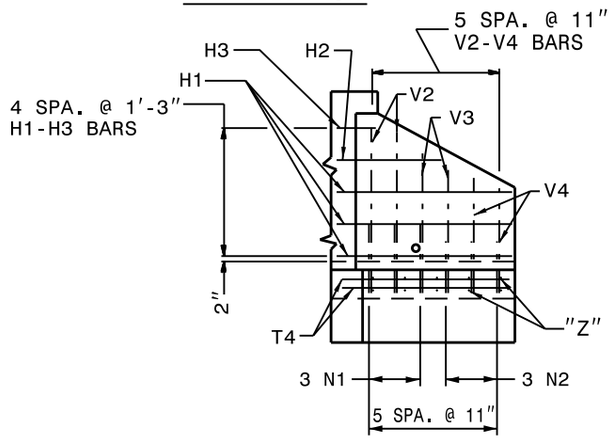

PLAN




ELEVATION




SECTION B-B




WING ELEVATION

1-24

STATE OF
NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

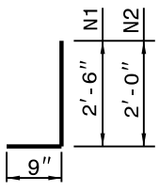
ROADWAY STANDARD DRAWING FOR

# REINFORCED BRICK ENDWALL

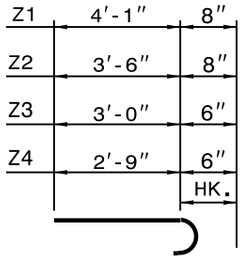
FOR DOUBLE AND TRIPLE 60" PIPES - 90° SKEW

SHEET 1 OF 1

838.58




## "N" BARS



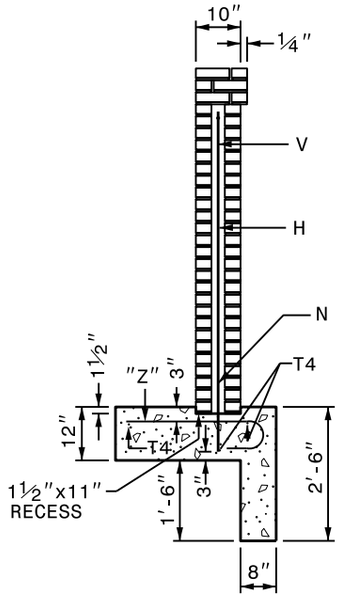

## "Z" BARS

"N" & "Z" BAR DIMENSIONS ARE OUT TO OUT.

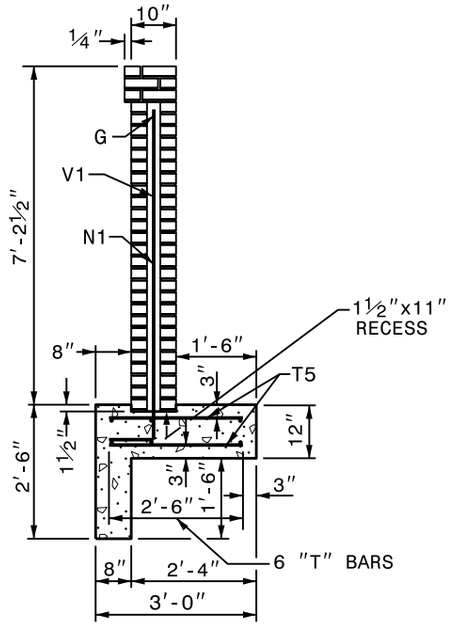
*PAY FOR CONCRETE AS BRICK MASONRY

| BILL OF MATERIAL FOR ENDWALL | | | | |
|---|---|---|---|---|
| REINF. STEEL | | | 1 PIPE | |
| BAR | SIZE | LENGTH | NO. | WEIGHT |
| B1 | #5 | 5'-3" | 2 | 11 |
| B2 | #5 | 4'-0" | 2 | 8 |
| G1 | #7 | 8'-8" | 2 | 35 |
| H1 | #4 | 6'-3" | 6 | 25 |
| H2 | #4 | 5'-0" | 2 | 7 |
| H3 | #4 | 3'-0" | 2 | 4 |
| N1 | #5 | 3'-3" | 14 | 47 |
| N2 | #4 | 2'-9" | 6 | 11 |
| T1 | #4 | 13'-10" | 6 | 55 |
| T4 | #4 | 5'-9" | 6 | 23 |
| T5 | #4 | 2'-6" | 36 | 60 |
| V1 | #4 | 6'-11" | 6 | 27 |
| V2 | #4 | 6'-2" | 2 | 8 |
| V3 | #4 | 5'-3" | 4 | 14 |
| V4 | #4 | 4'-2" | 4 | 11 |
| V5 | #4 | 3'-2" | 4 | 8 |
| Z1 | #6 | 4'-9" | 6 | 43 |
| Z2 | #6 | 4'-2" | 4 | 25 |
| Z3 | #4 | 3'-6" | 4 | 9 |
| Z4 | #4 | 3'-3" | 2 | 4 |
| REINF. STEEL LBS. | | | | 435 |
| *CL. "A" CONC. FOOT. C.Y. | | | 3.4 | |
| BR. MASONRY/C.S. C.Y. | | | 3.2 | |
| BR. MASONRY/R.C. C.Y. | | | 2.8 | |

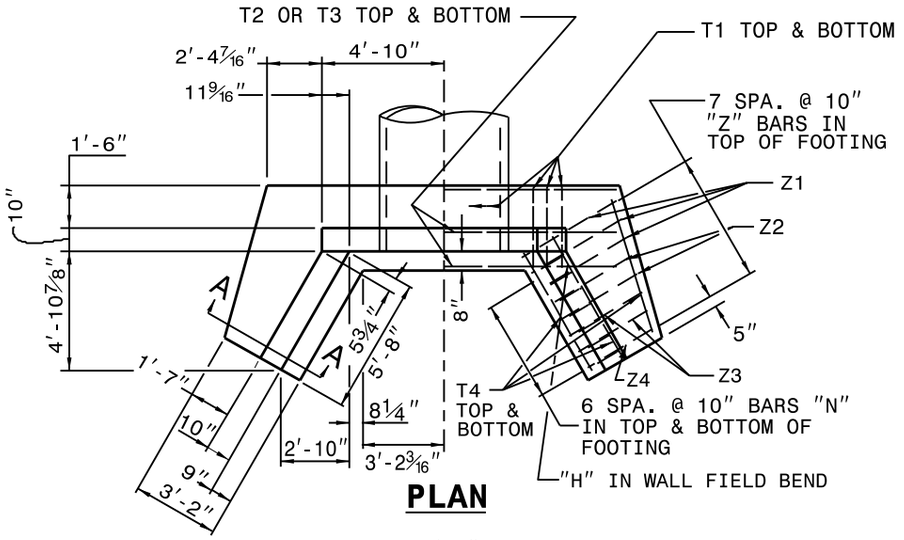
SEE STD. DWG. NO. 838.75 FOR GENERAL NOTES.



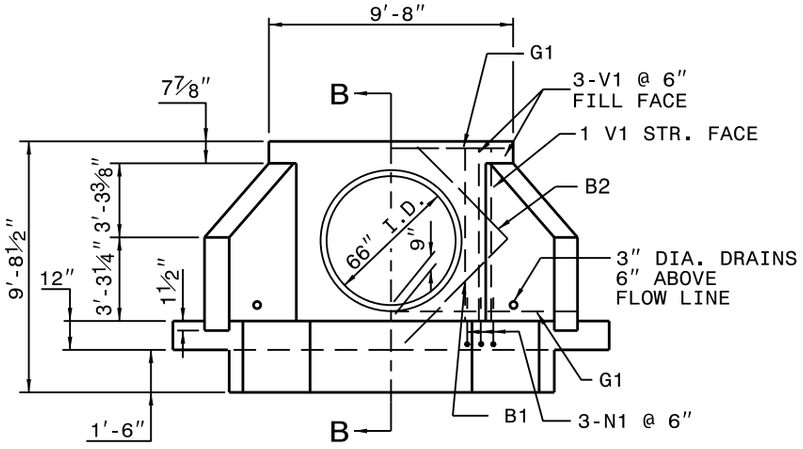

## SECTION A-A



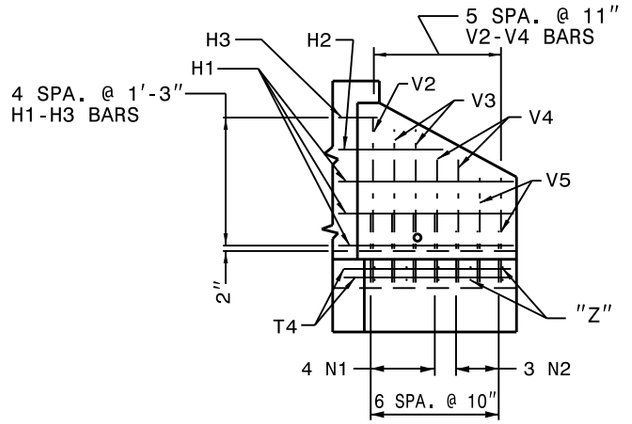

## SECTION B-B




## PLAN




## ELEVATION




## WING ELEVATION

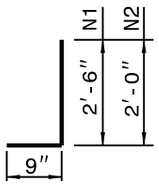

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

1-24

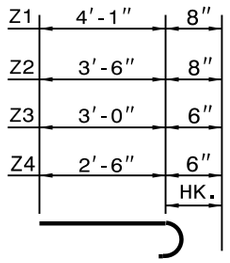

ROADWAY STANDARD DRAWING FOR

# REINFORCED BRICK ENDWALL

FOR SINGLE 66" PIPE - 90° SKEW




"N" BARS



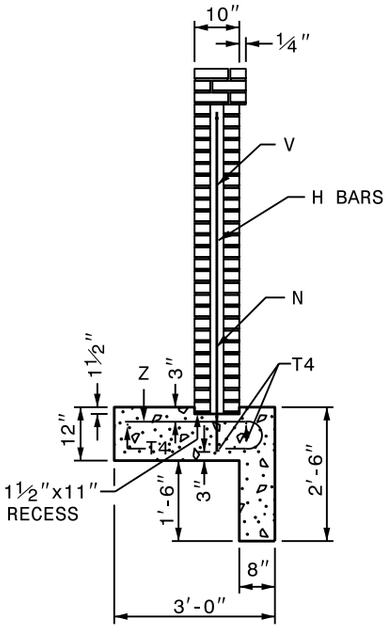

"Z" BARS

"N" & "Z" BAR DIMENSIONS ARE OUT TO OUT.

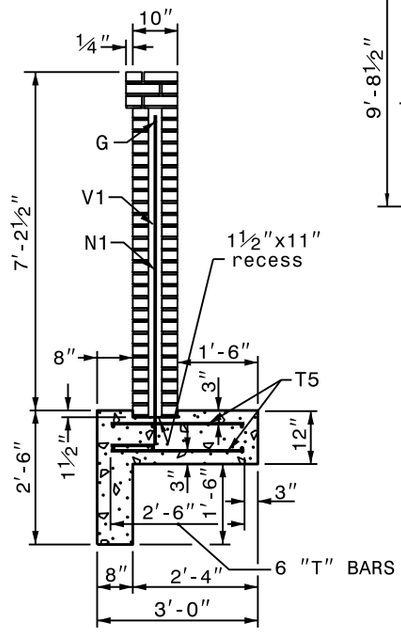
*PAY FOR CONCRETE AS BRICK MASONRY

| BILL OF MATERIAL FOR ENDWALL | | | | | | |
|---|---|---|---|---|---|---|
| REINF. STEEL | | | 2 PIPES | | 3 PIPES | |
| BAR | SIZE | LENGTH | NO. | WEIGHT | NO. | WEIGHT |
| B1 | #5 | 5'-3" | 4 | 22 | 6 | 33 |
| B2 | #5 | 4'-0" | 2 | 8 | 2 | 8 |
| B3 | #5 | 7'-0" | 2 | 15 | 4 | 29 |
| | | | | | | |
| G2 | #7 | 18'-0" | 2 | 74 | - | - |
| G3 | #7 | 27'-4" | - | - | 2 | 112 |
| H1 | #4 | 6'-3" | 6 | 25 | 6 | 25 |
| H2 | #4 | 5'-0" | 2 | 7 | 2 | 7 |
| H3 | #4 | 3'-0" | 2 | 4 | 2 | 4 |
| N1 | #5 | 3'-3" | 19 | 64 | 24 | 81 |
| N2 | #4 | 2'-9" | 6 | 11 | 6 | 11 |
| T2 | #4 | 23'-2" | 6 | 93 | - | - |
| T3 | #4 | 16'-11" | - | - | 12 | 136 |
| T4 | #4 | 5'-9" | 6 | 23 | 6 | 23 |
| T5 | #4 | 2'-6" | 76 | 127 | 112 | 187 |
| V1 | #4 | 6'-11" | 11 | 51 | 16 | 74 |
| V2 | #4 | 6'-2" | 2 | 8 | 2 | 8 |
| V3 | #4 | 5'-3" | 4 | 14 | 4 | 14 |
| V4 | #4 | 4'-2" | 4 | 11 | 4 | 11 |
| V5 | #4 | 3'-2" | 4 | 8 | 4 | 8 |
| Z1 | #6 | 4'-9" | 6 | 43 | 6 | 43 |
| Z2 | #6 | 4'-2" | 4 | 25 | 4 | 25 |
| Z3 | #4 | 3'-6" | 4 | 9 | 4 | 9 |
| Z4 | #4 | 3'-3" | 2 | 4 | 2 | 4 |
| | | | | | | |
| REINF. STEEL LBS. | | | X | 646 | X | 852 |
| | | | | | | |
| *CL. "A" CONC. FOOT. C.Y. | | | | 4.8 | X | 6.1 |
| BR. MASONRY/C.S. C.Y. | | | | 4.5 | X | 5.9 |
| BR. MASONRY/R.C. C.Y. | | | | 3.9 | X | 5.0 |

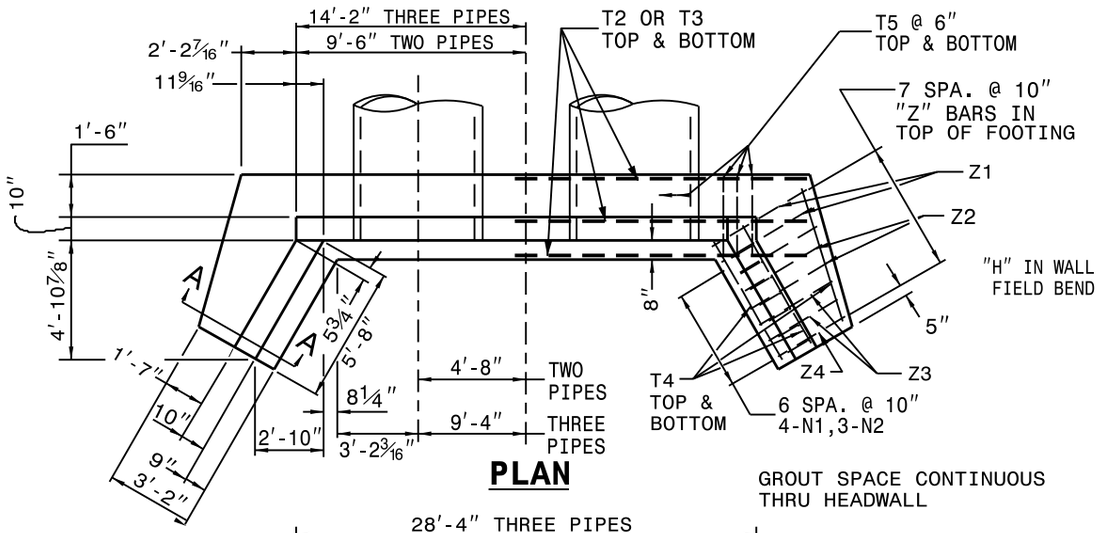
SEE STD. DWG. NO. 838.75 FOR GENERAL NOTES.




SECTION A-A

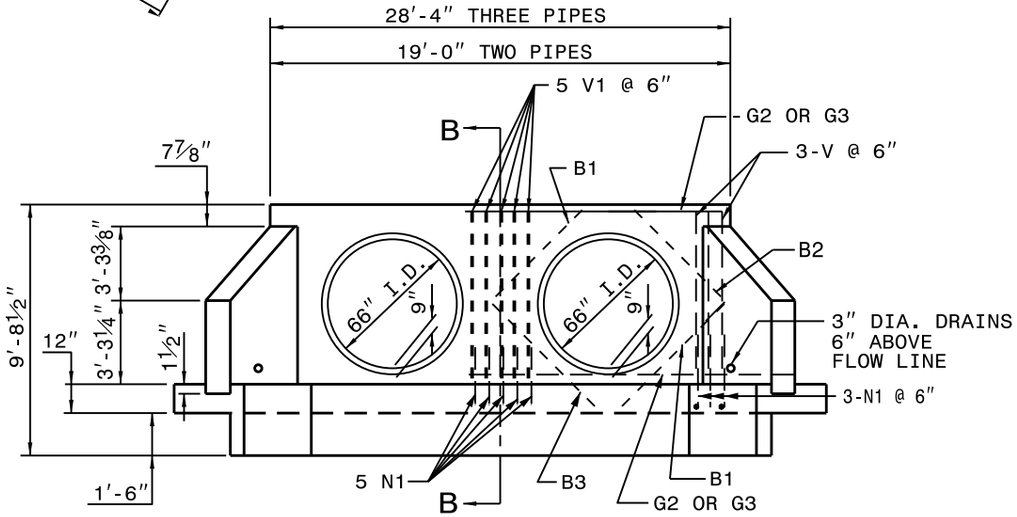



SECTION B-B

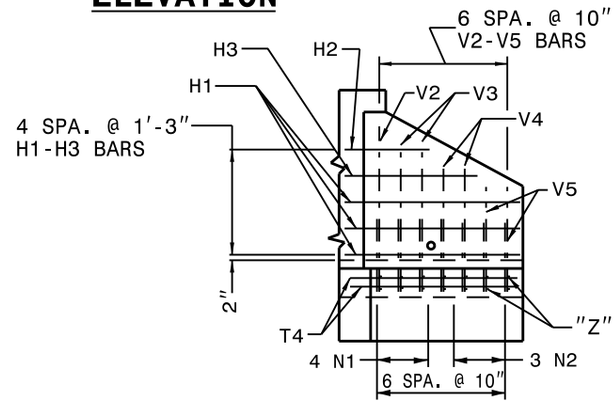



PLAN

GROUT SPACE CONTINUOUS
THRU HEADWALL




ELEVATION




WING ELEVATION

STATE OF
NORTH CAROLINA
DEPT. OF TRANSPORTATION
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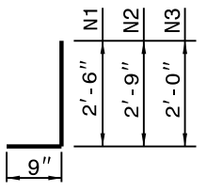
ROADWAY STANDARD DRAWING FOR

# REINFORCED BRICK ENDWALL

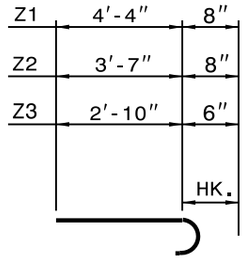
FOR DOUBLE AND TRIPLE 66" PIPES - 90° SKEW

SHEET 1 OF 1

838.64




## "N" BARS



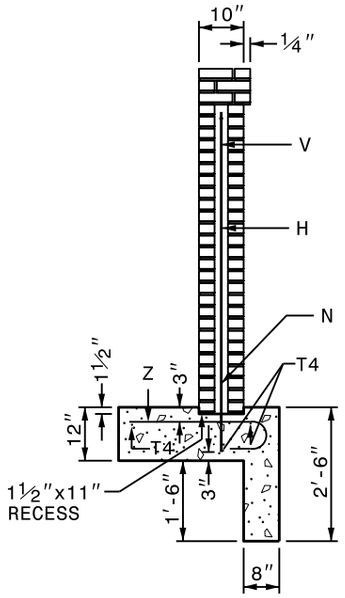

## "Z" BARS

"N" & "Z" BAR DIMENSIONS ARE OUT TO OUT.

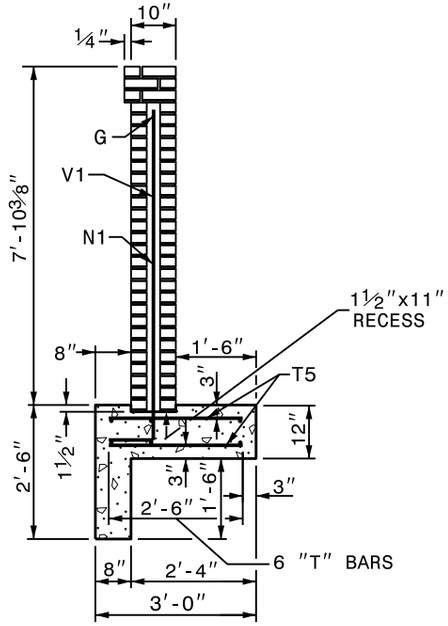
*PAY FOR CONCRETE AS BRICK MASONRY

| BILL OF MATERIAL FOR ENDWALL | | | | |
|---|---|---|---|---|
| REINF. STEEL | | | 1 PIPE | |
| BAR | SIZE | LENGTH | NO. | WEIGHT |
| B1 | #5 | 5'-6" | 2 | 11 |
| B2 | #5 | 4'-3" | 2 | 9 |
| G1 | #7 | 9'-0" | 2 | 37 |
| H1 | #4 | 6'-9" | 6 | 27 |
| H2 | #4 | 5'-8" | 2 | 8 |
| H3 | #4 | 3'-8" | 2 | 5 |
| N1 | #5 | 3'-3" | 6 | 20 |
| N2 | #6 | 3'-6" | 8 | 42 |
| N3 | #4 | 2'-9" | 8 | 15 |
| T1 | #4 | 14'-8" | 6 | 59 |
| T4 | #4 | 6'-6" | 6 | 26 |
| T5 | #4 | 2'-6" | 38 | 67 |
| V1 | #4 | 7'-6" | 6 | 30 |
| V2 | #4 | 6'-7" | 4 | 18 |
| V3 | #4 | 5'-6" | 4 | 15 |
| V4 | #4 | 4'-9" | 4 | 12 |
| V5 | #4 | 3'-5" | 4 | 9 |
| Z1 | #6 | 5'-0" | 6 | 45 |
| Z2 | #6 | 4'-3" | 6 | 38 |
| Z3 | #4 | 3'-4" | 6 | 13 |
| REINF. STEEL LBS. | | | | 506 |
| *CL. "A" CONC. FOOT. C.Y. | | | 3.8 | |
| BR. MASONRY/C.S. C.Y. | | | 3.7 | |
| BR. MASONRY/R.C. C.Y. | | | 3.3 | |

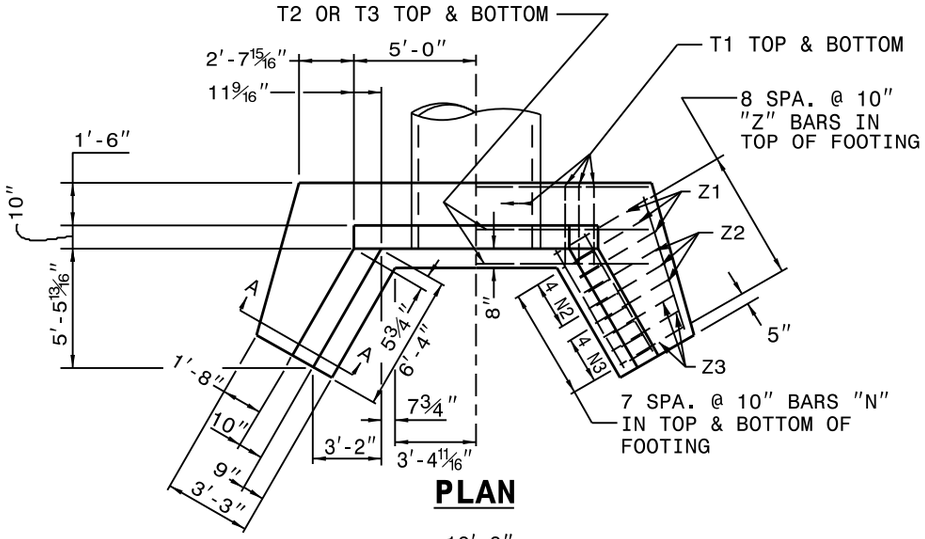
SEE STD. DWG. NO. 838.75 FOR GENERAL NOTES.



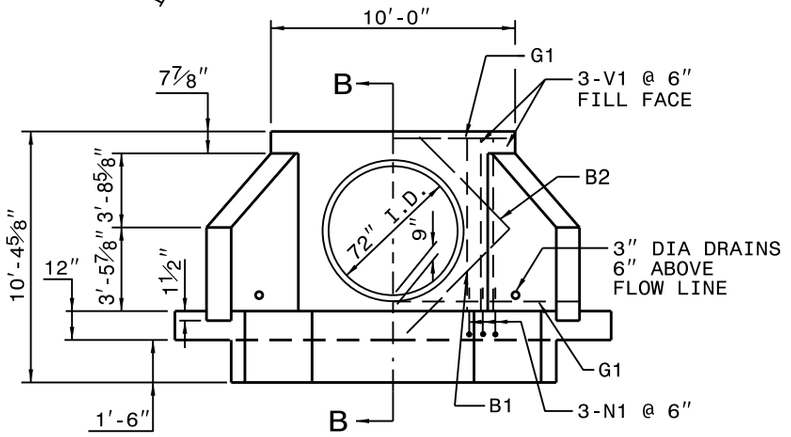

## SECTION A-A



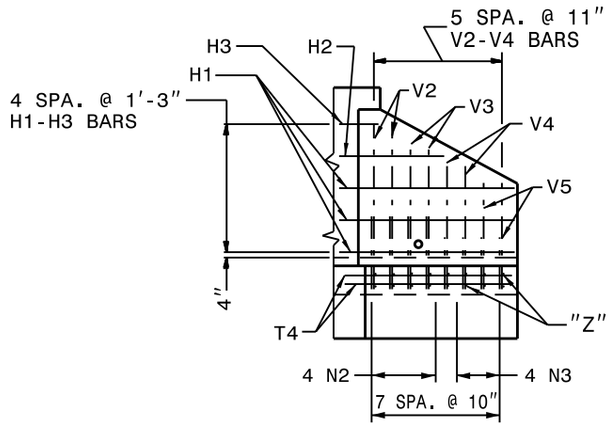

## SECTION B-B




## PLAN




## ELEVATION




## WING ELEVATION

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DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

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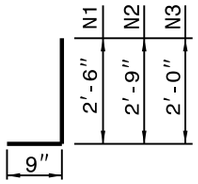
ROADWAY STANDARD DRAWING FOR

# REINFORCED BRICK ENDWALL

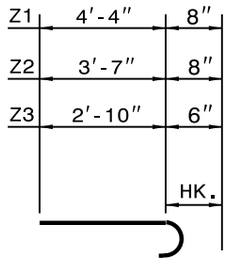
FOR SINGLE 72" PIPE - 90° SKEW

SHEET 1 OF 1

838.69




## "N" BARS




## "Z" BARS

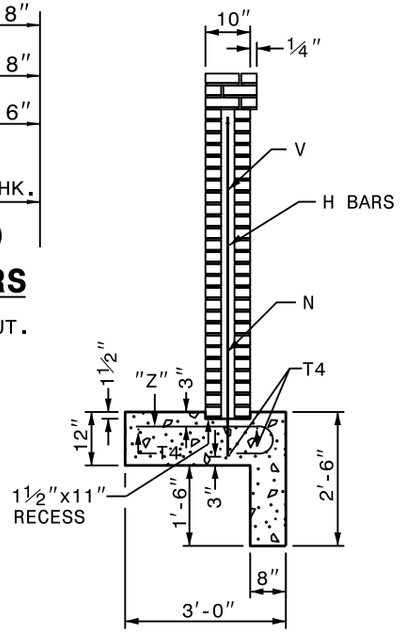
"N" & "Z" BARS DIMENSIONS ARE OUT TO OUT.

*PAY FOR CONCRETE AS BRICK MASONRY

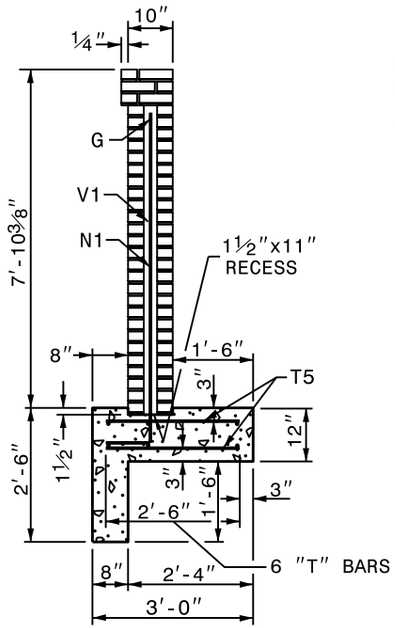
**BILL OF MATERIAL FOR ENDWALL**

| REINF. STEEL | | | 2 PIPES | | 3 PIPES | |
|---|---|---|---|---|---|---|
| BAR | SIZE | LENGTH | NO. | WEIGHT | NO. | WEIGHT |
| B1 | #5 | 5'-6" | 4 | 23 | 6 | 34 |
| B2 | #5 | 4'-3" | 2 | 9 | 2 | 9 |
| B3 | #5 | 7'-3" | 2 | 15 | 4 | 30 |
| G2 | #7 | 19'-4" | 2 | 79 | - | - |
| G3 | #7 | 29'-8" | - | - | 2 | 121 |
| H1 | #4 | 6'-9" | 6 | 27 | 6 | 27 |
| H2 | #4 | 5'-8" | 2 | 8 | 2 | 8 |
| H3 | #4 | 3'-8" | 2 | 5 | 2 | 5 |
| N1 | #5 | 3'-3" | 11 | 37 | 16 | 54 |
| N2 | #6 | 3'-6" | 8 | 42 | 8 | 42 |
| N3 | #4 | 2'-9" | 8 | 15 | 8 | 15 |
| T2 | #4 | 25'-0" | 6 | 100 | - | - |
| T3 | #4 | 18'-4" | - | - | 12 | 147 |
| T4 | #4 | 6'-6" | 6 | 26 | 6 | 26 |
| T5 | #4 | 2'-6" | 82 | 137 | 122 | 204 |
| V1 | #4 | 7'-6" | 11 | 55 | 16 | 80 |
| V2 | #4 | 6'-7" | 4 | 18 | 4 | 18 |
| V3 | #4 | 5'-6" | 4 | 15 | 4 | 15 |
| V4 | #4 | 4'-6" | 4 | 12 | 4 | 12 |
| V5 | #4 | 3'-5" | 4 | 9 | 4 | 9 |
| Z1 | #6 | 5'-0" | 6 | 45 | 6 | 45 |
| Z2 | #6 | 4'-3" | 6 | 38 | 6 | 38 |
| Z3 | #4 | 3'-4" | 6 | 13 | 6 | 13 |
| | | | | | | |
| | | | | | | |
| REINF. STEEL LBS. | | | | 728 | | 952 |
| | | | | | | |
| *CL. "A" CONC. FOOT. C.Y. | | | | 5.3 | | 6.8 |
| BR. MASONRY/C.S. C.Y. | | | | 5.3 | | 7.0 |
| BR. MASONRY/R.C. C.Y. | | | | 4.6 | | 5.9 |

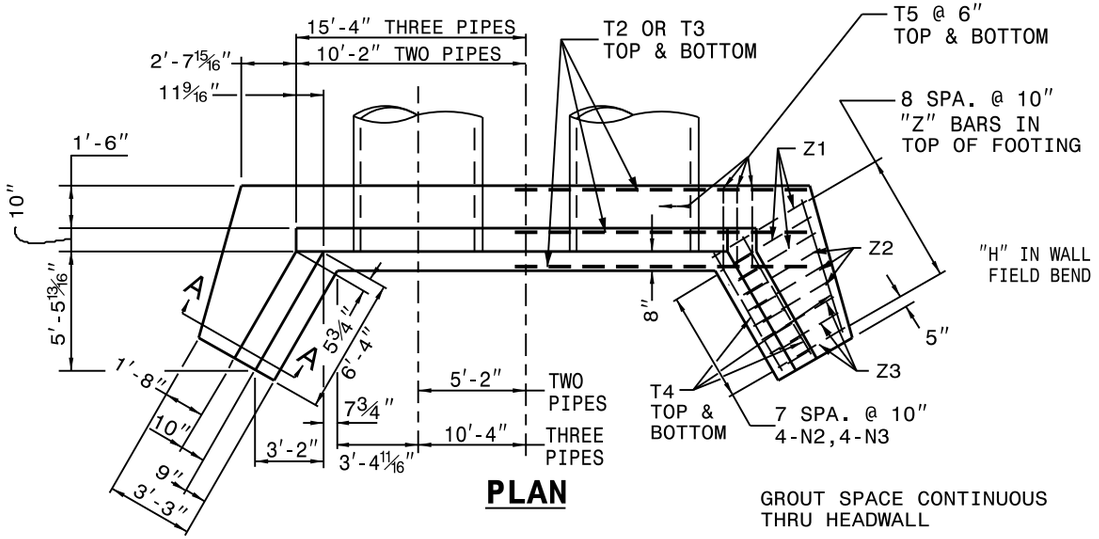
SEE STD. DWG. NO. 838.75 FOR GENERAL NOTES.




## SECTION A-A

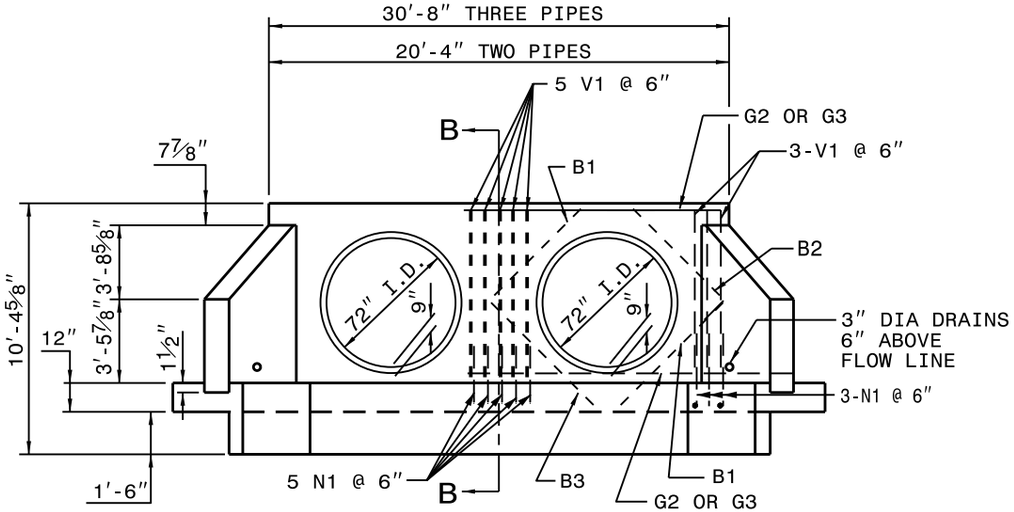



## SECTION B-B

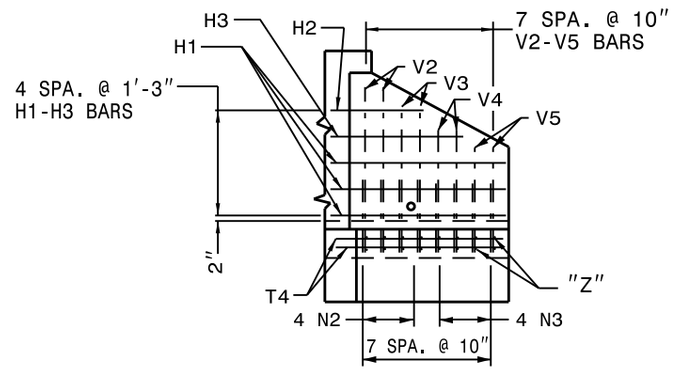



## PLAN

GROUT SPACE CONTINUOUS
THRU HEADWALL




## ELEVATION




## WING ELEVATION

STATE OF
NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

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ROADWAY STANDARD DRAWING FOR

# REINFORCED BRICK ENDWALL

FOR DOUBLE AND TRIPLE 72" PIPES - 90° SKEW

SHEET 1 OF 1

838.70

DESIGN DATA

| | |
|---|---|
| SPECIFICATIONS | AASHTO |
| STEEL IN TENSION | 20,000 PSI |
| CONCRETE IN COMPRESSION | 1,200 PSI |
| BRICK MASONRY IN COMPRESSION | 1,000 PSI |
| CONCRETE IN SHEAR | 90 PSI |
| BRICK MASONRY IN SHEAR | 50 PSI |
| EQUIVALENT FLUID PRESSURE OF EARTH | 30 LBS. PER CU. FT. |

GENERAL NOTES:

SELECT BRICK FROM SAMPLES SUBMITTED TO THE ENGINEER PRIOR TO BEGINNING CONSTRUCTION. USE BRICK OF SIZE 2¼″x 3⅝″x 7⅝″. CONTRACTOR MAY SUBSTITUTE A LARGER BRICK BUT NOT EXCEEDING 3⅝″ X 3⅝″ X 11⅝″. IF A LARGER SIZE IS USED, KEEP BRICK FALL WITHIN NEAT LINES SHOWN ON PLANS. USE ONLY ONE SIZE BRICK IN ANY ONE STRUCTURE. USE CLASS ″B″ OR BETTER CONCRETE TO FILL THE CAVITY AREA AT INTERVALS FROM ONE TO NOT MORE THAN FOUR BRICK COURSES AT A TIME. STOP EACH CONCRETE PLACEMENT AT LEAST 1″ BELOW TOP OF BRICK COURSE AND ROD TO ENSURE FILLING OF ALL VOIDS.

DO NOT PERMIT HEADERS TO CROSS THE CONCRETE FILLED AREA. PLACE HORIZONTAL REINFORCEMENT LOOSE IN THE CONCRETE FILLED SPACE AS WORK PROGRESSES. PLACE VERTICAL REINFORCEMENT IN THE CENTER OF THE CONCRETE FILLED SPACE. PERMANENT TIES ARE NOT NECESSARY. USE TEMPORARY TIES TO HOLD VERTICAL BARS IN PLACE. CONSTRUCT NEITHER SIDE OF OF THE WALL ABOVE THE OTHER SIDE TO A HEIGHT EXCEEDING SIX (6) COURSES. CONCAVE ALL EXPOSED JOINTS.

USE CLASS 'A' CONCRETE IN THE FOOTINGS.

CONSTRUCT ALL MORTAR JOINTS ⅜″ ± ⅛″.

COVER WEEP HOLES WITH HARDWARE CLOTH IN ACCORDANCE WITH ARTICLE 420-11 OF THE STANDARD SPECIFICATIONS. PLACE A STONE DRAIN CONSISTING OF ONE (1) CUBIC FOOT OF NUMBER 78M STONE CONTAINED IN A BAG OF TYPE 1 GEOTEXTILE AT EACH WEEP HOLE. PLACE SUBDRAIN FINE AGGREGATE BENEATH, AROUND AND OVER THE STONE DRAIN SO THE STONE DRAIN IS COMPLETELY COVERED BY A LAYER OF SUBDRAIN FINE AGGREGATE AT LEAST ONE (1) FOOT THICK. WHERE THERE IS MORE THAN ONE WEEP HOLE IN A WING WALL, PLACE A HORIZONTAL DRAIN OF SUBDRAIN FINE AGGREGATE AT LEAST ONE (1) FOOT SQUARE IN CROSS SECTION TO CONNECT ALL STONE DRAINS. PLACE A VERTICAL DRAIN OF SUBDRAIN FINE AGGREGATE AT LEAST ONE (1) FOOT SQUARE IN CROSS SECTION AT EACH WEEP HOLE TO AN ELEVATION OF TWO (2) FEET BELOW THE SURFACE OF THE EMBANKMENT.

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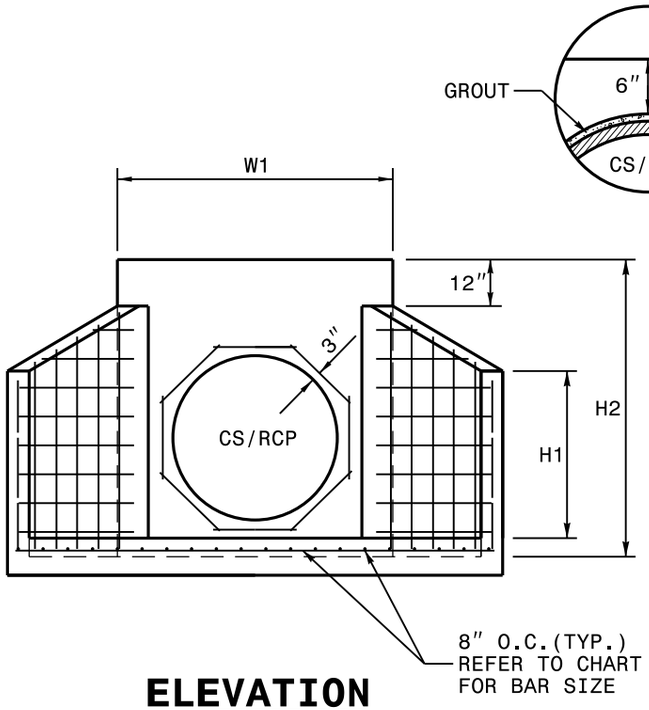
ROADWAY STANDARD DRAWING FOR

**NOTES FOR REINFORCED BRICK ENDWALL**

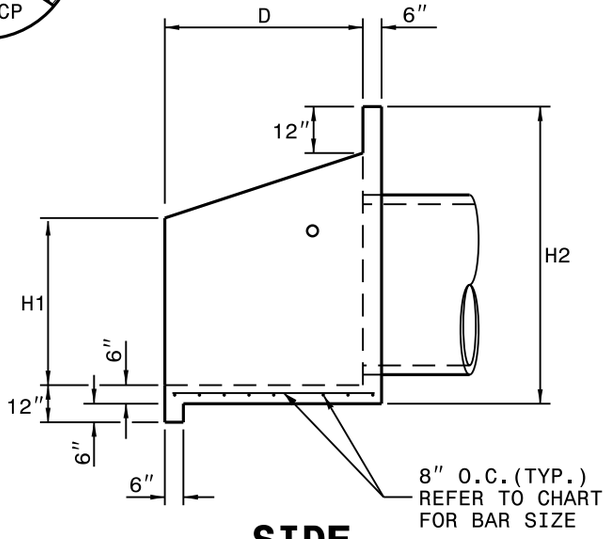
STANDARD DRAWINGS 838.51 THRU 838.70

SHEET 1 OF 1

**838.75**




**ELEVATION**

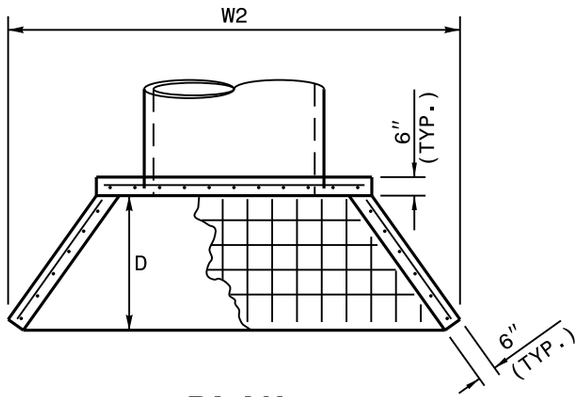



**SIDE**

NOTES:

* THIS PRECAST ENDWALL MAY BE USED FOR THE FOLLOWING STANDARDS: 838.01, 838.11, 838.21, 838.27, 838.33, 838.39, 838.51, 838.57, 838.63 AND 838.69.
* INSTALL PRECAST ENDWALLS WITH WINGS AND PAY FOR IN ACCORDANCE WITH SPECIFICATION SECTION 838.
* USE 4000 PSI CONCRETE.
* PROVIDE ALL REINFORCING STEEL WHICH MEETS ASTM A615 FOR GRADE 60 AND WELDED WIRE FABRIC CONFORMING TO ASTM A185 WITH 2" MIN. CLEARANCE.
* PLACE LIFT HOLES OR PINS IN ACCORDANCE WITH OSHA STANDARD 1926.704.
* PIPE TO BE GROUTED INTO ENDWALL AT JOB SITE BY CONTRACTOR.
* ALL ELEMENTS PRECAST TO MEET ASTM C913.
* WELDED WIRE FABRIC MAY BE SUBSTITUTED FOR REBAR AS LONG AS THE SAME AREA OF STEEL IS PROVIDED.
* CHAMFER ALL CORNERS 1" OR HAVE A RADIUS OF 1".

NOTE: THE MINIMUM BAR SIZE SHALL BE #5 BARS AT 8" CTS.THE CONTRACTOR WILL HAVE THE OPTION TO INCREASE THIS BAR SIZE AS NEEDED.




**PLAN**

**ENDWALL DIMENSIONS**

| | MINIMUM | MIN./MAX. | MIN./MAX. | MIN./MAX. | MIN./MAX. | MIN./MAX. |
|---|---|---|---|---|---|---|
| PIPE DIA. | BAR SIZE | H1 | H2 | D | W1 | W2 |
| 12" | #5 @ 8" | 15"/24" | 33"/45" | 15"/21" | 36"/45" | 66"/72" |
| 15" | #5 @ 8" | 15"/24" | 37"/45" | 15"/24" | 42"/45" | 78"/81" |
| 18" | #5 @ 8" | 15"/24" | 40"/51" | 15"/30" | 42"/45" | 78"/81" |
| 24" | #5 @ 8" | 18"/32" | 47"/57" | 21"/30" | 48"/51" | 90"/99" |
| 30" | #5 @ 8" | 30"/42" | 54"/72" | 24"/36" | 54"/66" | 120"/138" |
| 36" | #5 @ 8" | 36"/42" | 61"/72" | 33"/42" | 63"/69" | 138"/141" |
| 42" | #5 @ 8" | 39"/52" | 68"/81" | 39"/42" | 72"/81" | 144"/159" |
| 48" | #5 @ 8" | 42"/52" | 75"/84" | 39"/42" | 78"/81" | 156"/159" |
| 54" | #5 @ 8" | 48"/60" | 82"/102" | 39"/48" | 84"/111" | 162"/189" |
| 60" | #5 @ 8" | 54"/60" | 89"/102" | 39"/48" | 89"/111" | 165"/189" |
| 66" | #5 @ 8" | 54"/60" | 96"/102" | 39"/48" | 96"/111" | 168"/189" |
| 72" | #5 @ 8" | 54"/60" | 103"/108" | 39"/48" | 103"/111" | 177"/201" |

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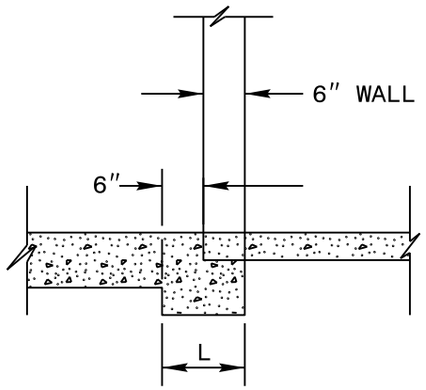
ROADWAY STANDARD DRAWING FOR

# PRECAST CONCRETE ENDWALL

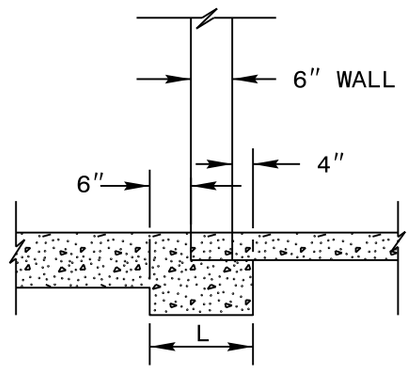
FOR SINGLE 12" THRU 72" PIPE - 90° SKEW



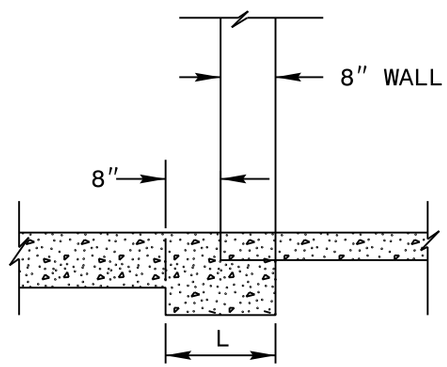
838.80



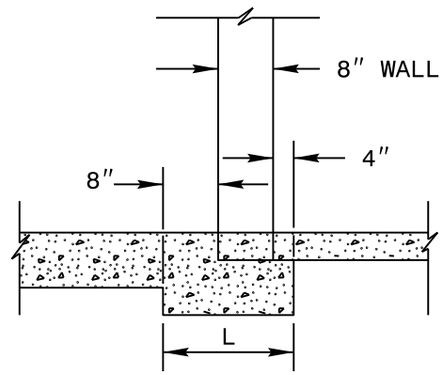

**PART SECTION**
**6" WALL**



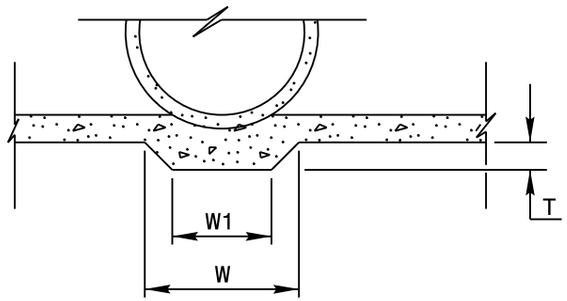

**PART SECTION**
**6" WALL WITH 4" LIP**




**PART SECTION**
**8" WALL**




**PART SECTION**
**8" WALL WITH 4" LIP**




**PART SECTION**
**OF END ELEVATION**

## TABLES OF QUANTITIES FOR PIPE SET IN PAD

| *PIPE* | "W" | "W1" | "T" | *C.Y. QUANTITIES WHEN L IS* | | |
|---|---|---|---|---|---|---|
| *D* | *DIM* | *DIM* | *DIM* | 12″ | 16″ | 20″ |
| 12″ | 1′-1⅞″ | 0′-7⅞″ | 0′-2″ | 0.005 | 0.007 | 0.008 |
| 15″ | 1′-3⅝″ | 0′-9⅛″ | 0′-2″ | 0.006 | 0.008 | 0.010 |
| 18″ | 1′-5¼″ | 0′-10⅜″ | 0′-2″ | 0.007 | 0.010 | 0.012 |
| 24″ | 1′-8¾″ | 1′-0⅛″ | 0′-3″ | 0.011 | 0.014 | 0.018 |
| 30″ | 2′-0¼″ | 1′-2¾″ | 0′-3½″ | 0.014 | 0.018 | 0.023 |
| 36″ | 2′-3¾″ | 1′-5⅜″ | 0′-4″ | 0.017 | 0.023 | 0.025 |
| 42″ | 2′-7⅛″ | 1′-7″ | 0′-5¼″ | 0.025 | 0.030 | 0.038 |
| 48″ | 2′-10⅝″ | 1′-8¾″ | 0′-5¾″ | 0.028 | 0.038 | 0.047 |
| 54″ | 3′-2⅛″ | 1′-10½″ | 0′-6¼″ | 0.035 | 0.047 | 0.058 |
| 60″ | 3′-5⅝″ | 2′-0¼″ | 0′-6¾″ | 0.042 | 0.056 | 0.071 |
| 66″ | 3′-9″ | 2′-2¼″ | 0′-7¼″ | 0.050 | 0.067 | 0.084 |
| 72″ | 4′-0½″ | 2′-3¾″ | 0′-7¾″ | 0.059 | 0.078 | 0.098 |

GENERAL NOTES:

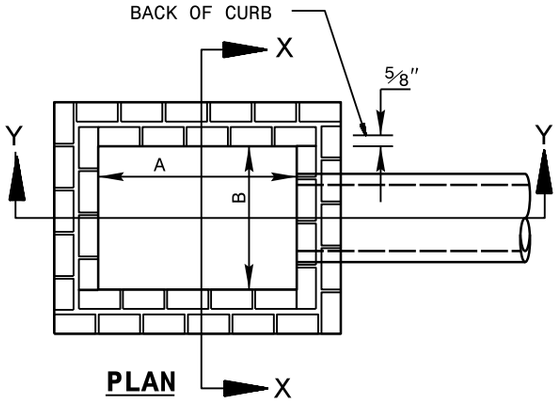
USE THIS STANDARD WITH ALL DRAINAGE STRUCTURES USING REINFORCED CONCRETE PIPE SET IN BASE SLAB.


1-24

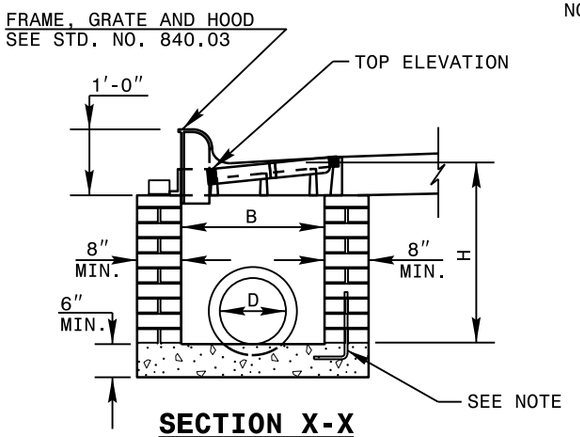
STATE OF
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DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.


ROADWAY STANDARD DRAWING FOR

# CONCRETE BASE PAD FOR DRAINAGE STRUCTURES

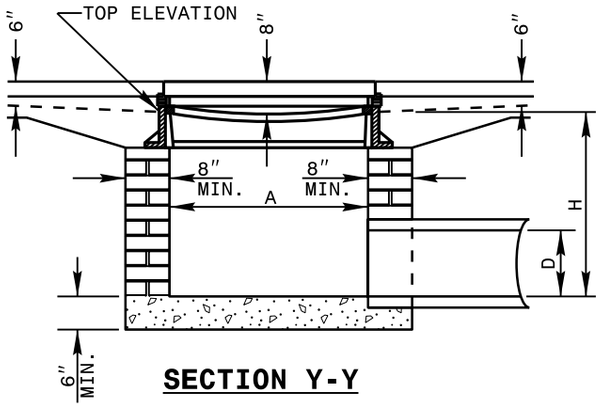



**PLAN**

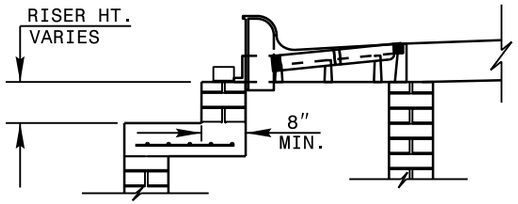



**SECTION X-X**

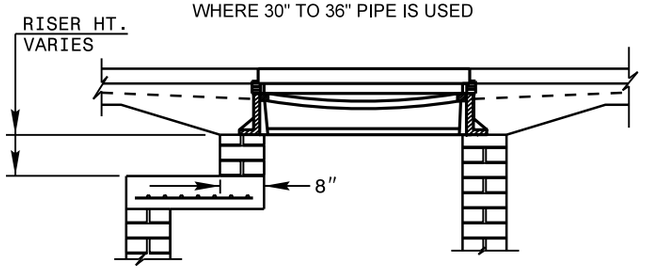
NOTES:
MORTAR JOINTS ½" +/- ⅛" THICK.
USE CLASS "B" CONCRETE THROUGHOUT.
USE FORMS FOR CONSTRUCTION OF THE BOTTOM SLAB.
DEDUCT FOR PIPE(S) FROM TOTAL CU. YDS. OF BRICK MASONRY.
USE #4 BAR DOWELS AT 12" CENTERS FOR ALL PIPE SIZES.
PROVIDE ALL CATCH BASINS OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.
USE TYPE "E", "F" AND "G" GRATES UNLESS OTHERWISE INDICATED.
USE BRICK OR CONCRETE BLOCK WHICH COMPLIES WITH THE REQUIREMENTS OF SECTION 840 OF THE STANDARD SPECIFICATIONS.
IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.
FOR 8'-0" IN HEIGHT OR LESS, USE 8" WALL. OVER 8'-0" IN HEIGHT, USE 12" WALL TO 6'-0" FROM TOP OF WALL AND 8" WALL FOR THE REMAINING 6'-0". QUANTITES TO BE ADJUSTED ACCORDINGLY.
MAXIMUN DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 12'-0". STD. NO. 840.45 CONTROLS MAXIMUM DEPTH OF PRECAST BOX IF USED.
CONSTRUCT WITH PIPE CROWNS MATCHING.
CHAMFER ALL EXPOSED CORNERS 1".
DRAWING NOT TO SCALE.




**SECTION Y-Y**

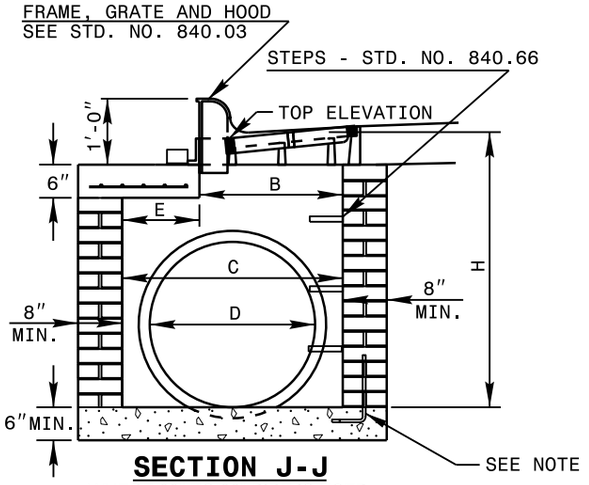



WHERE 30" TO 36" PIPE IS USED



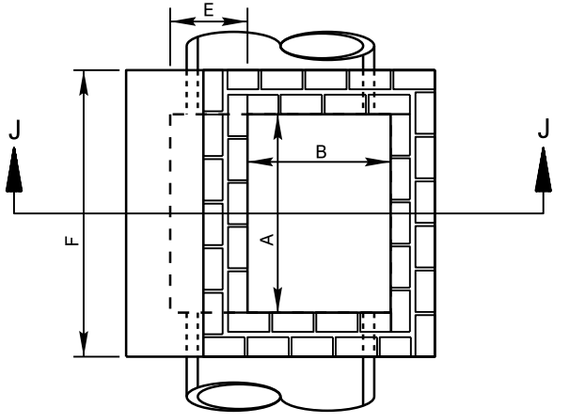

WHERE 42" TO 54" PIPE IS USED

**DETAIL SHOWING METHOD OF RISER CONSTRUCTION**

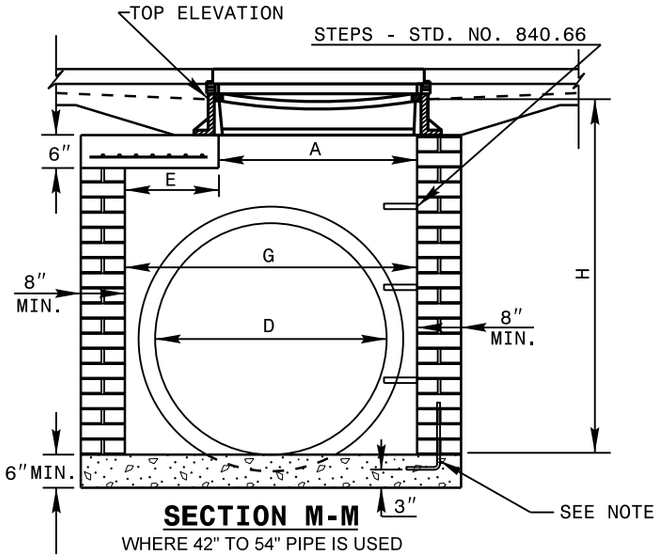



**SECTION J-J**

WHERE 30" TO 36" PIPE IS USED

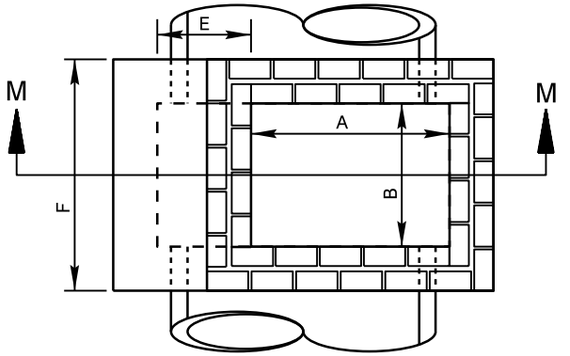



**PLAN**




**SECTION M-M**

WHERE 42" TO 54" PIPE IS USED




**PLAN**

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RALEIGH, N.C.

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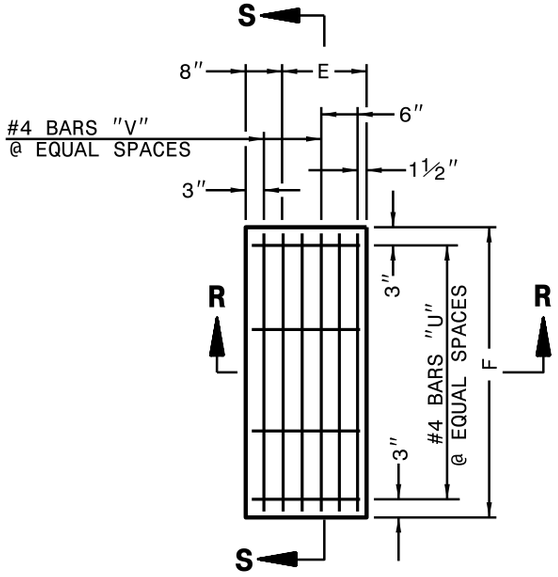
ROADWAY STANDARD DRAWING FOR

# BRICK CATCH BASIN

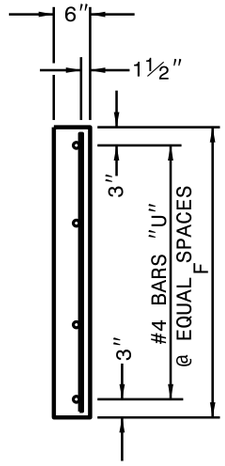
12" THRU 54" PIPE

SHEET 1 OF 2

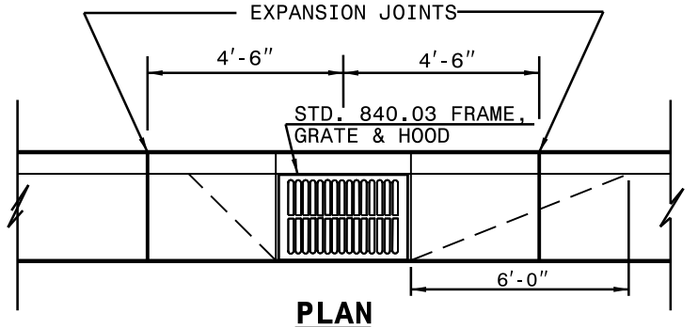
**840.01**




**PLAN OF TOP SLAB**

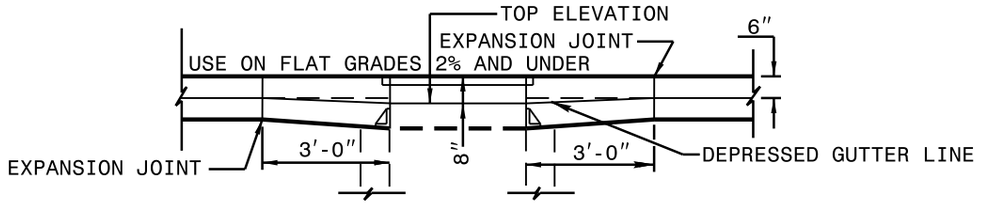



**SECTION S-S**



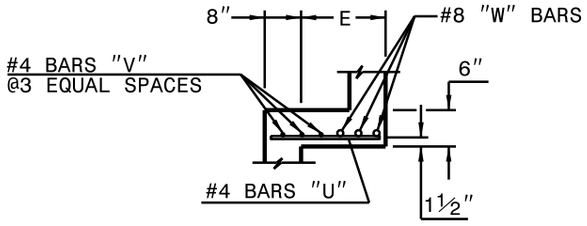

**PLAN**

CURB AND GUTTER WITH CATCH BASIN ON STEEP GRADES

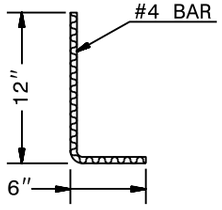



**ELEVATION**

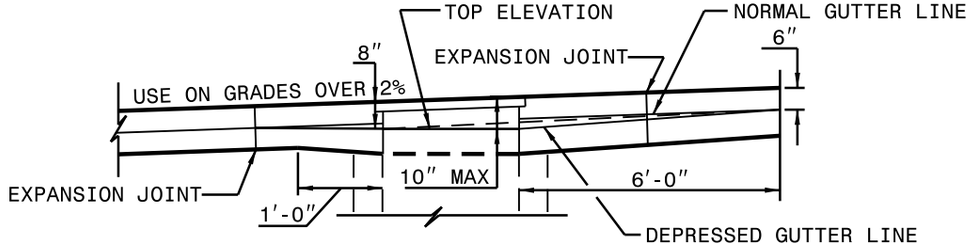
NORMAL CURB AND GUTTER ON LIGHT GRADES




**SECTION R-R**




**DOWEL**




**ELEVATION**

NORMAL CURB AND GUTTER ON STEEP GRADES

**MINIMUM DIMENSIONS AND QUANTITIES FOR BRICK CATCH BASIN(BASED ON MIN. HEIGHT, H, WITH NO RISER)***

| DIMENSIONS OF BOX AND PIPE | | | | | | TOP SLAB DIMENSIONS | | BARS-U | | BARS-V | | BARS-W | | TOTAL LBS. | CU.YDS. CONC. IN BOX | | | BRICK MASONRY | | DEDUCTIONS ONE PIPE | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PIPE | SPAN | WIDTH | WIDTH | SPAN | MIN. HEIGHT | | | NO. | LENGTH | NO. | LENGTH | NO. | LENGTH | | TOP SLAB | BOTTOM SLAB | TOTAL CONC. | BRICK MSNR. IN WALLS | TOTAL BRICK AND CONCRETE | C.M. | R.C. |
| D | A | B | C | G | H | E | F | | | | | | | | | | | | | | |
| 12" | 3'-0" | 2'-2" | -- | -- | 2'-9" | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.281 | 0.281 | 0.883 | 1.164 | 0.020 | 0.042 |
| 15" | 3'-0" | 2'-2" | | | 3'-0" | | | | | | | | | | | 0.281 | 0.281 | 0.963 | 1.244 | 0.031 | 0.047 |
| 18" | 3'-0" | 2'-2" | | | 3'-3" | | | | | | | | | | | 0.281 | 0.281 | 1.043 | 1.324 | 0.044 | 0.065 |
| 24" | 3'-0" | 2'-2" | | | 3'-9" | | | | | | | | | | | 0.281 | 0.281 | 1.204 | 1.485 | 0.078 | 0.121 |
| 30" | 3'-0" | 2'-2" | 3'-4" | | 4'-3" | 1'-2" | 4'-4" | 4 | 1'-6" | 3 | 4'-1" | 3 | 4'-1" | 45 | 0.147 | 0.374 | 0.521 | 1.606 | 2.217 | 0.122 | 0.184 |
| 36" | 3'-0" | 2'-2" | 3'-10" | | 4'-9" | 1'-8" | 4'-4" | 4 | 2'-0" | 4 | 4'-1" | 3 | 4'-1" | 49 | 0.187 | 0.415 | 0.602 | 1.914 | 2.516 | 0.176 | 0.261 |
| 42" | 3'-0" | 2'-2" | | 4'-5" | 5'-3" | 1'-5" | 3'-6" | 4 | 1'-9" | 3 | 3'-3" | 3 | 3'-3" | 38 | 0.135 | 0.373 | 0.508 | 2.152 | 2.660 | 0.240 | 0.371 |
| 48" | 3'-0" | 2'-2" | | 5'-0" | 5'-9" | 2'-0" | 3'-6" | 4 | 2'-6" | 4 | 3'-3" | 3 | 3'-3" | 41 | 0.173 | 0.410 | 0.583 | 2.415 | 2.998 | 0.313 | 0.477 |
| 54" | 3'-0" | 2'-2" | | 5'-7" | 6'-3" | 2'-7" | 3'-6" | 4 | 3'-0" | 6 | 3'-3" | 3 | 3'-3" | 47 | 0.211 | 0.448 | 0.659 | 2.806 | 3.465 | 0.396 | 0.595 |

* RISER HAS .321 CUBIC YARDS OF BRICK MASONRY PER FOOT HEIGHT

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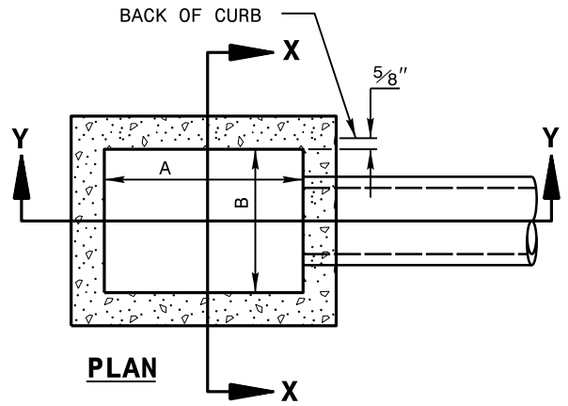
ROADWAY STANDARD DRAWING FOR

# BRICK CATCH BASIN

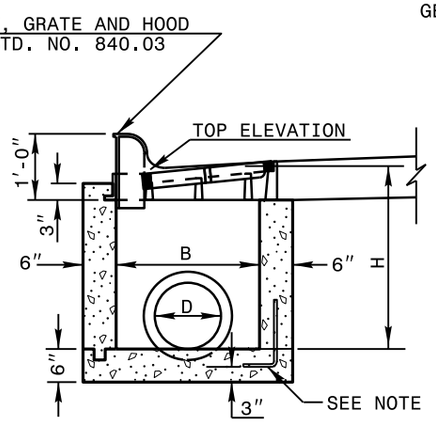
12" THRU 54" PIPE

SHEET 2 OF 2

840.01




PLAN




SECTION X-X

GENERAL NOTES:

USE CLASS "B" CONCRETE THROUGHOUT.

PROVIDE ALL CATCH BASINS OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.

OPTIONAL CONSTRUCTION - MONOLITHIC POUR, 2" KEYWAY, OR #4 BAR DOWELS AT 12" CENTERS AS DIRECTED BY THE ENGINEER.

USE FORMS FOR THE CONSTRUCTION OF THE BOTTOM SLAB.

IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.

USE TYPE "E", "F" AND "G" GRATES UNLESS OTHERWISE INDICATED.

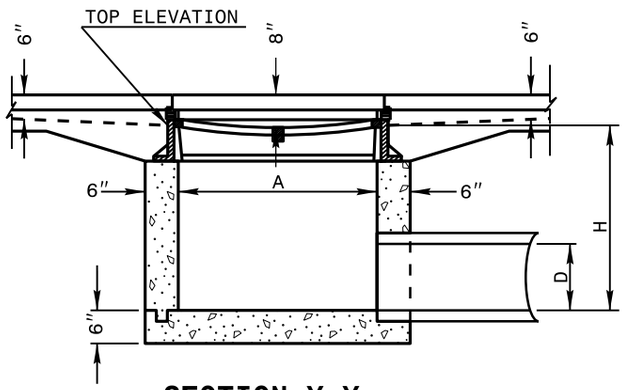
FOR 8'-0" IN HEIGHT OR LESS USE 6" WALLS AND BOTTOM SLAB. OVER 8'-0" TO 16'-0" IN HEIGHT USE 8" WALLS AND BOTTOM SLAB. ADJUST QUANTITIES ACCORDINGLY.

MAXIMUM DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 16'-0". STD. NO. 840.45 CONTROLS MAXIMUM DEPTH IF PRECAST BOX IS USED.

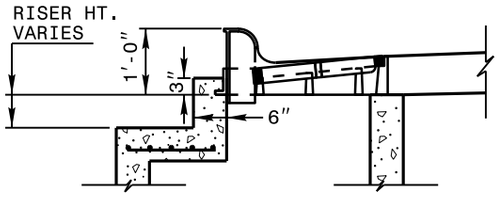
CONSTRUCT WITH PIPE CROWNS MATCHING.

CHAMFER ALL EXPOSED CORNERS 1".

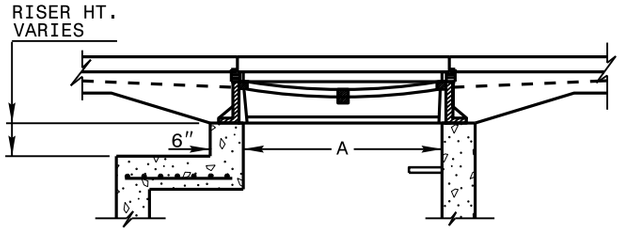
DRAWING NOT TO SCALE.




SECTION Y-Y

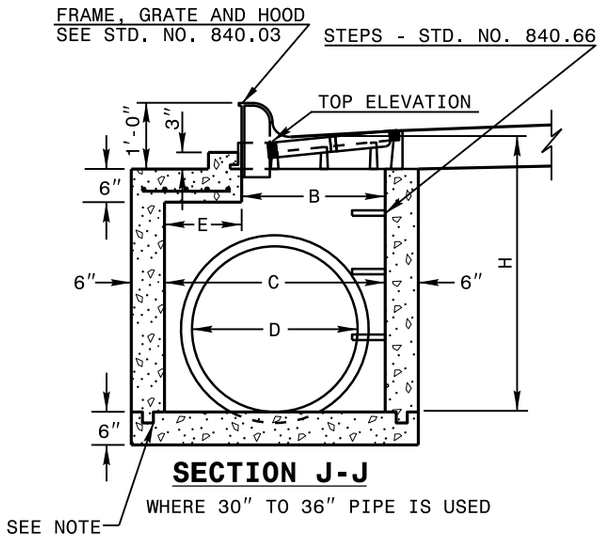



WHERE 30" TO 36" PIPE IS USED



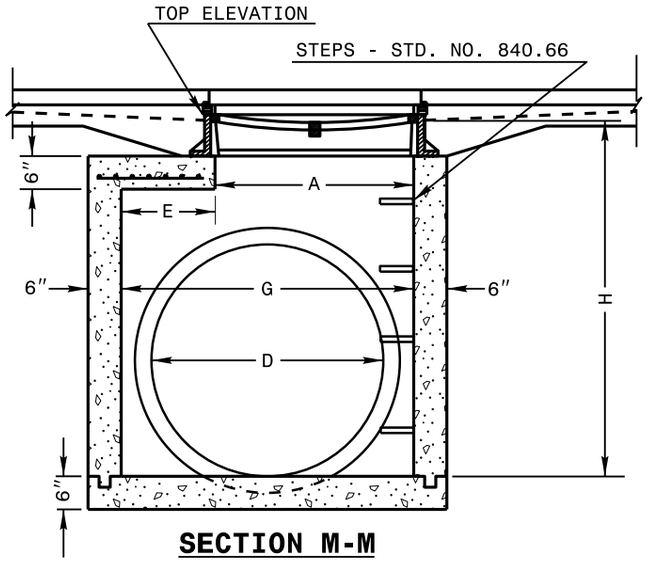

WHERE 42" TO 54" PIPE IS USED

**DETAIL SHOWING METHOD OF RISER CONSTRUCTION**



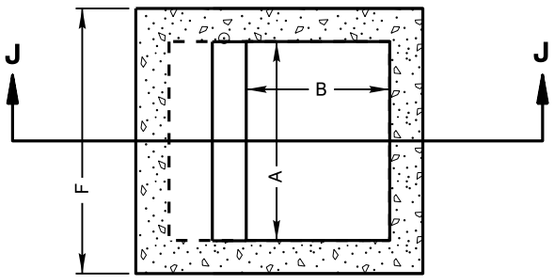

SECTION J-J

WHERE 30" TO 36" PIPE IS USED

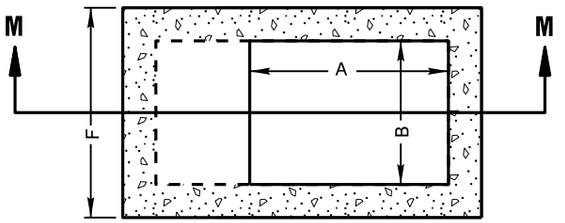



SECTION M-M

WHERE 42" TO 54" PIPE IS USED




PLAN




PLAN

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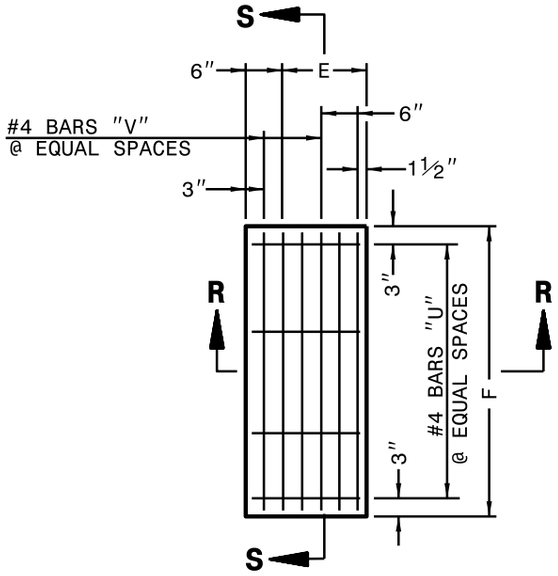
ROADWAY STANDARD DRAWING FOR

# CONCRETE CATCH BASIN

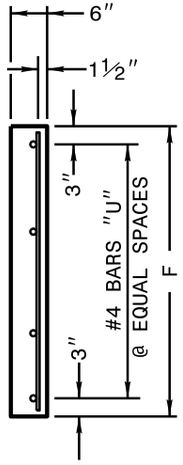
12" THRU 54" PIPE

SHEET 1 OF 2

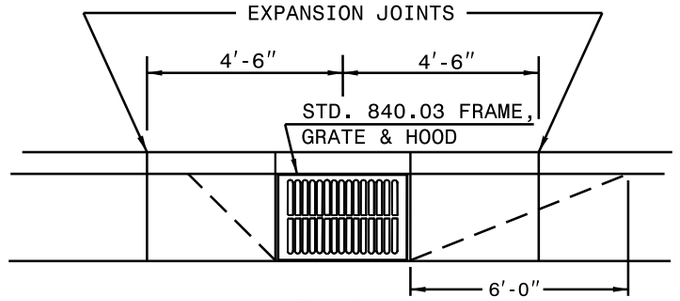
840.02




**PLAN OF TOP SLAB**

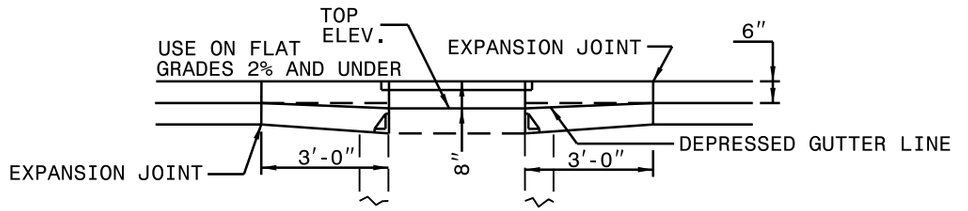



**SECTION S-S**



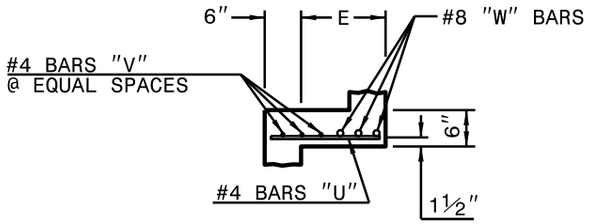

**PLAN**

CURB AND GUTTER WITH CATCH BASIN ON STEEP GRADES

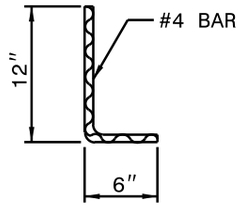



**ELEVATION**

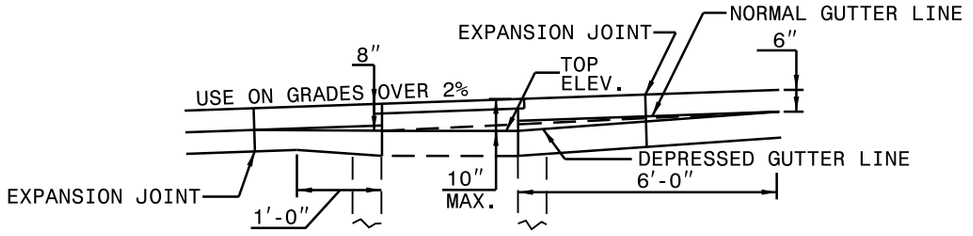
NORMAL CURB AND GUTTER ON LIGHT GRADES




**SECTION R-R**




**DOWEL**




**ELEVATION**

NORMAL CURB AND GUTTER ON STEEP GRADES

**MINIMUM DIMENSIONS AND QUANTITIES FOR CONCRETE CATCH BASIN(BASED ON MIN. HEIGHT, H, WITH NO RISER) ***

| DIMENSIONS OF BOX AND PIPE | | | | | | COVER DIMENSION | | BARS-U | | BARS-V | | BARS-W | | TOTAL LBS. | CU.YDS. CONC. IN BOX | | | DEDUCTIONS ONE PIPE | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PIPE | SPAN | WIDTH | WIDTH | SPAN | MIN. HEIGHT | | | | | | | | | | TOP SLAB | BOTTOM SLAB | TOT. CONC. FOR MINIMUM HEIGHT, H | | |
| D | A | B | C | G | H | E | F | NO. | LENGTH | NO. | LENGTH | NO. | LENGTH | | | | | C.M. | R.C. |
| 12″ | 3′-0″ | 2′-2″ | -- | -- | 2′-9″ | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.235 | 0.772 | 0.015 | 0.026 |
| 15″ | 3′-0″ | 2′-2″ | | | 3′-0″ | | | | | | | | | | | 0.235 | 0.829 | 0.023 | 0.036 |
| 18″ | 3′-0″ | 2′-2″ | | | 3′-3″ | | | | | | | | | | | 0.235 | 0.887 | 0.033 | 0.049 |
| 24″ | 3′-0″ | 2′-2″ | | | 3′-9″ | | | | | | | | | | | 0.235 | 1.001 | 0.059 | 0.085 |
| 30″ | 3′-0″ | 2′-2″ | 3′-4″ | | 4′-3″ | 1′-2″ | 4′-0″ | 4 | 1′-5″ | 2 | 3′-9″ | 3 | 3′-9″ | 39 | 0.123 | 0.321 | 1.433 | 0.092 | 0.127 |
| 36″ | 3′-0″ | 2′-2″ | 3′-10″ | | 4′-9″ | 1′-8″ | 4′-0″ | 4 | 1′-11″ | 3 | 3′-9″ | 3 | 3′-9″ | 43 | 0.161 | 0.358 | 1.714 | 0.132 | 0.178 |
| 42″ | 3′-0″ | 2′-2″ | | 4′-5″ | 5′-3″ | 1′-5″ | 3′-2″ | 4 | 1′-8″ | 2 | 2′-11″ | 3 | 2′-11″ | 32 | 0.112 | 0.318 | 1.738 | 0.180 | 0.243 |
| 48″ | 3′-0″ | 2′-2″ | | 5′-0″ | 5′-9″ | 2′-0″ | 3′-2″ | 4 | 2′-3″ | 3 | 2′-11″ | 3 | 2′-11″ | 35 | 0.145 | 0.352 | 2.052 | 0.235 | 0.317 |
| 54″ | 3′-0″ | 2′-2″ | | 5′-7″ | 6′-3″ | 2′-7″ | 3′-2″ | 4 | 2′-10″ | 5 | 2′-11″ | 3 | 2′-11″ | 41 | 0.180 | 0.386 | 2.387 | 0.297 | 0.401 |

* RISER HAS .228 CUBIC YARDS OF CONCRETE PER FOOT HEIGHT

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ROADWAY STANDARD DRAWING FOR

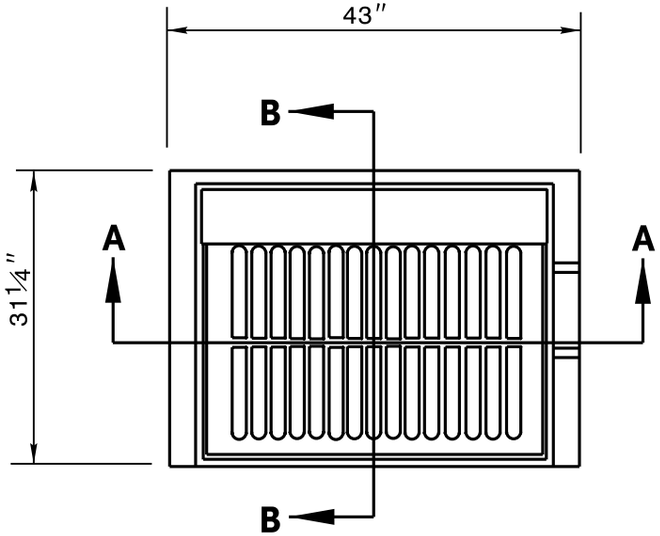
# CONCRETE CATCH BASIN

12″ THRU 54″ PIPE

SHEET 2 OF 2

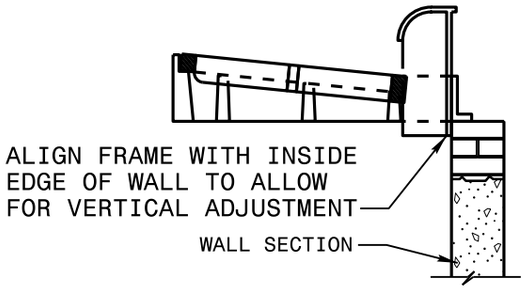
840.02

NOTE: USE TYPE "E", "F" AND "G" GRATE UNLESS OTHERWISE NOTED.

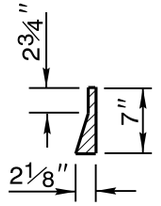



**PLAN**

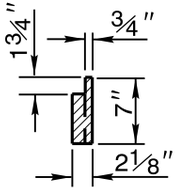
FRAME,GRATE, & HOOD ASS'Y



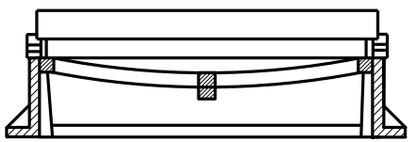

**SECTION - BB**



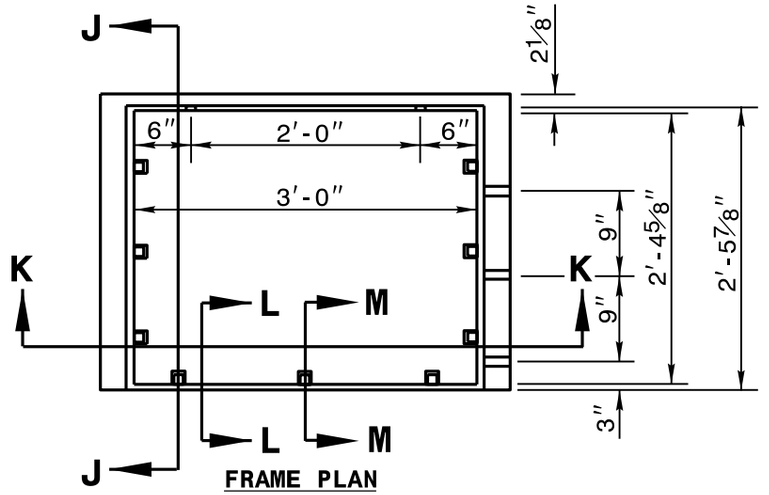

**SECTION - LL**



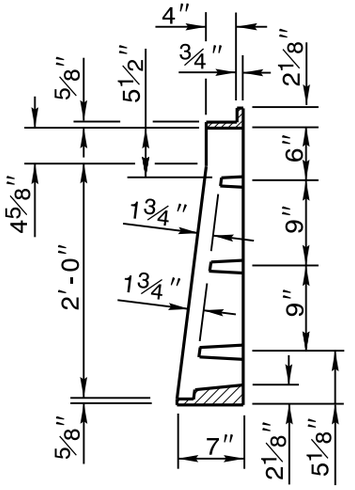

**SECTION - MM**



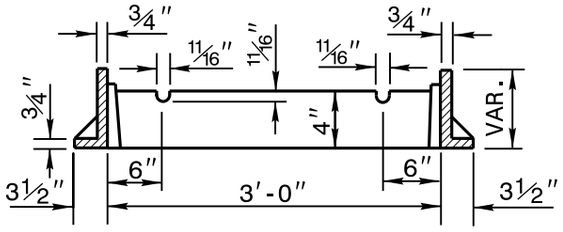
**SECTION - AA**



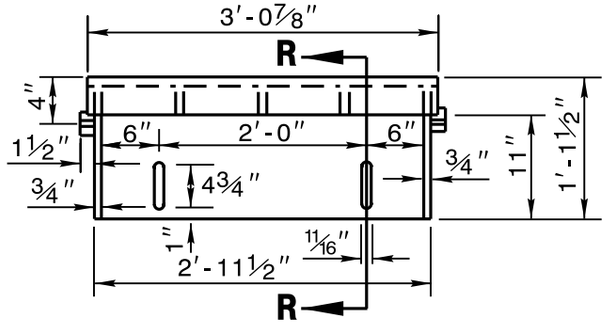

**FRAME PLAN**



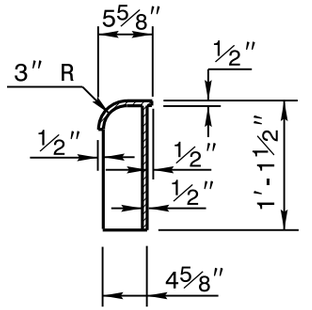

**SECTION - JJ**




**SECTION - KK**




**HOOD ELEVATION**




**SECTION - RR**

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ROADWAY STANDARD DRAWING FOR

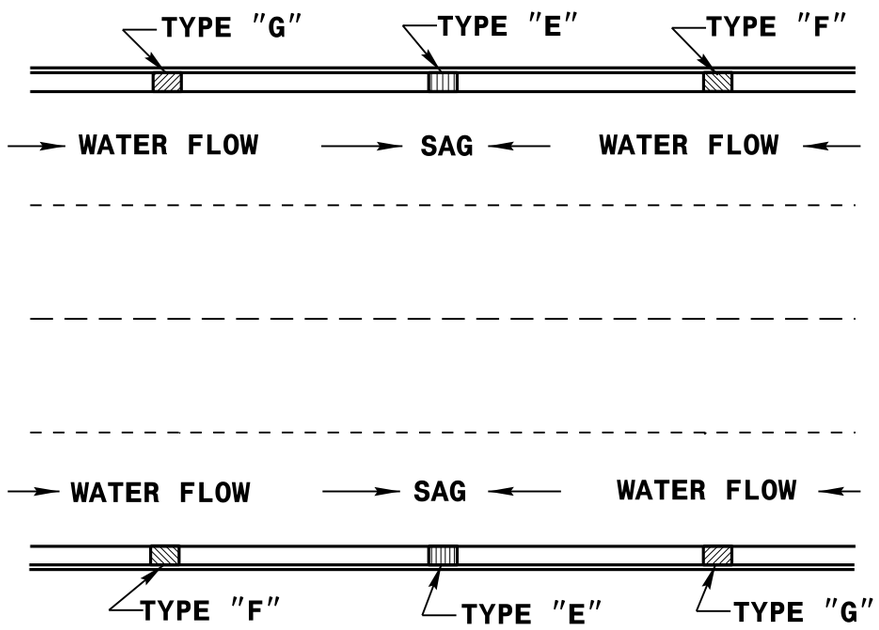
# FRAME, GRATES, AND HOOD

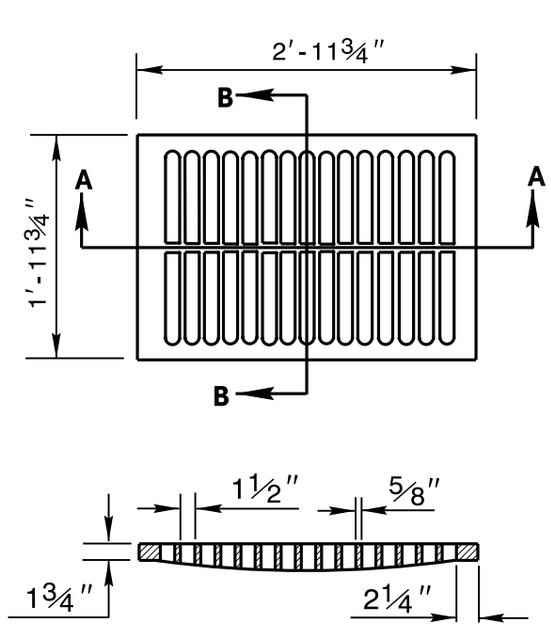
FOR USE ON STANDARD CATCH BASIN

SHEET 1 OF 2

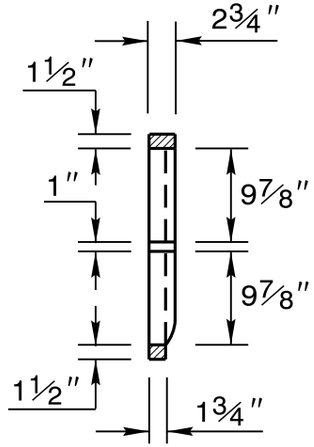
**840.03**

DETAIL SHOWING TYPES OF GRATES
USE ACCORDING TO WATER FLOW.



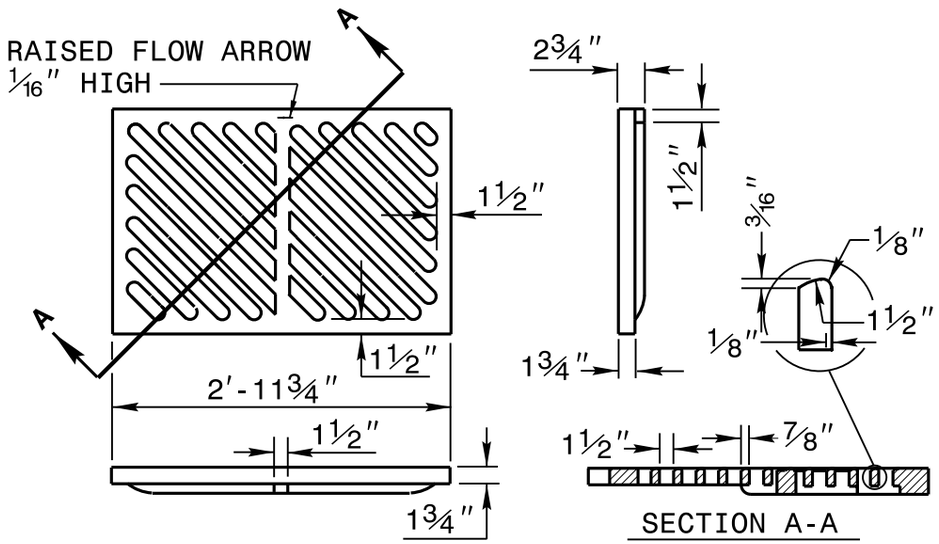




SECTION A-A

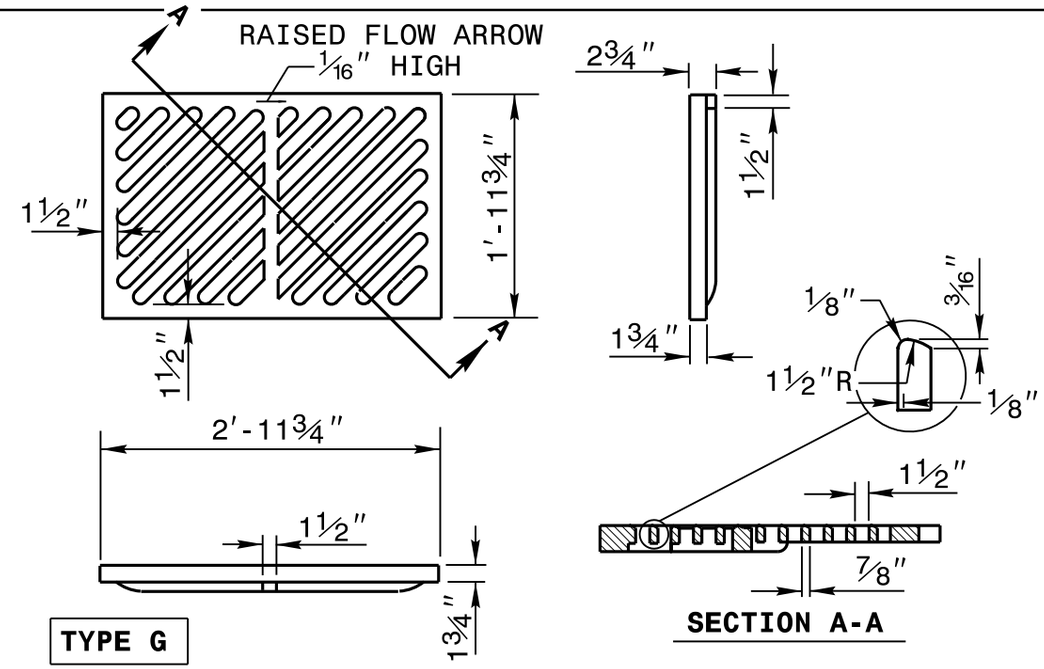



SECTION B-B

TYPE - E




TYPE - F




TYPE G

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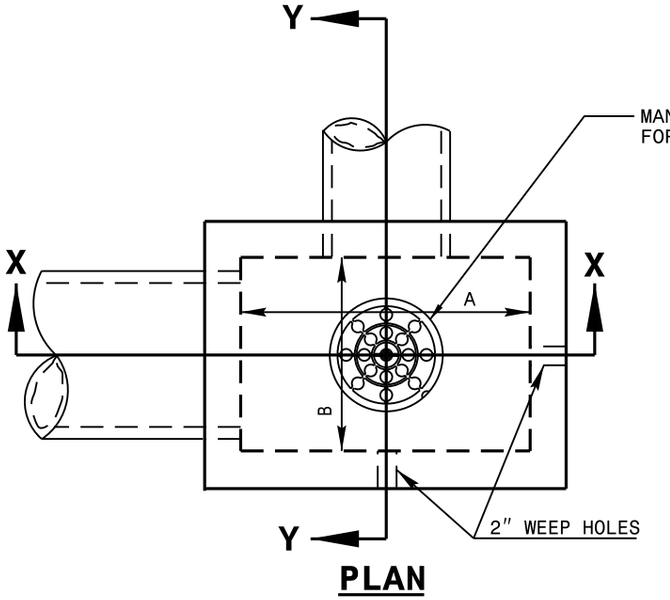
ROADWAY STANDARD DRAWING FOR

**FRAME, GRATES, AND HOOD**

FOR USE ON STANDARD CATCH BASIN

SHEET 2 OF 2

**840.03**




**PLAN**

NOTES: USE CLASS "B" CONCRETE THROUGHOUT.

PROVIDE ALL CATCH BASINS OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.

USE #4 BAR DOWELS AT 12" CENTERS

USE FORMS FOR THE CONSTRUCTION OF THE BOTTOM SLAB.

IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.

FOR 8'-0" IN HEIGHT OR LESS USE 6" WALLS AND BOTTOM SLAB. OVER 8'-0" TO 16'-0" IN HEIGHT USE 8" WALLS AND BOTTOM SLAB. ADJUST QUANTITIES ACCORDINGLY.

MAX. DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 16'-0". STD. DWG. 840.45 OR 840.46 CONTROLS MAX. DEPTH IF PRECAST BOX IS USED.

CONSTRUCT WITH PIPE CROWNS MATCHING.

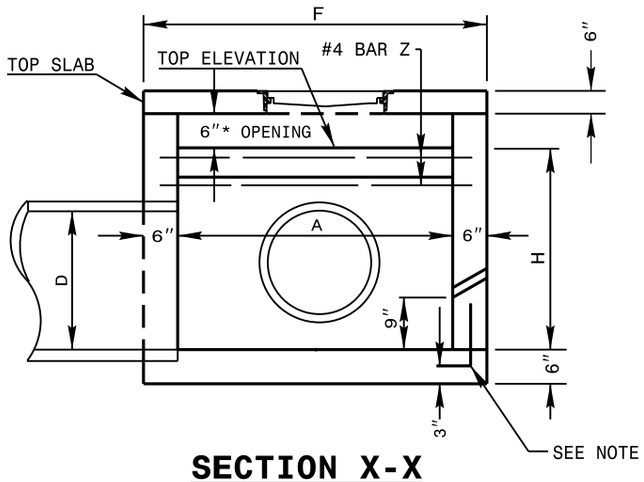
INSTALL 2" WEEPHOLES AS DIRECTED BY THE ENGINEER.

INSTALL STONE DRAINS, OF A MINIMUM OF 1 CUBIC FOOT OF NO. 78M STONE IN A POROUS FABRIC BAG OR WRAP, AT EACH WEEP HOLE OR AS DIRECTED BY THE ENGINEER.

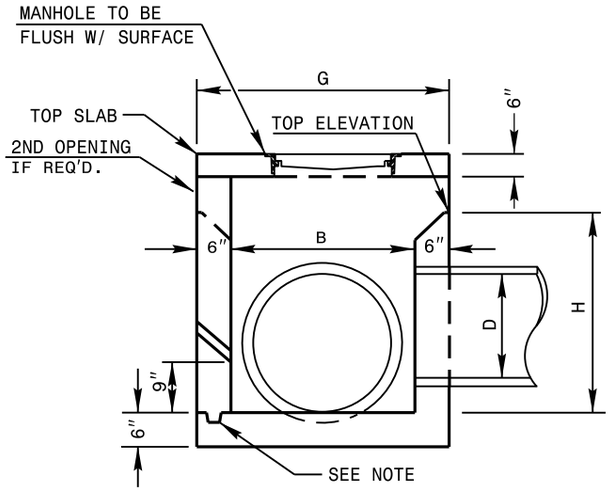
CHAMFER ALL EXPOSED CORNERS 1".

DRAWING NOT TO SCALE.

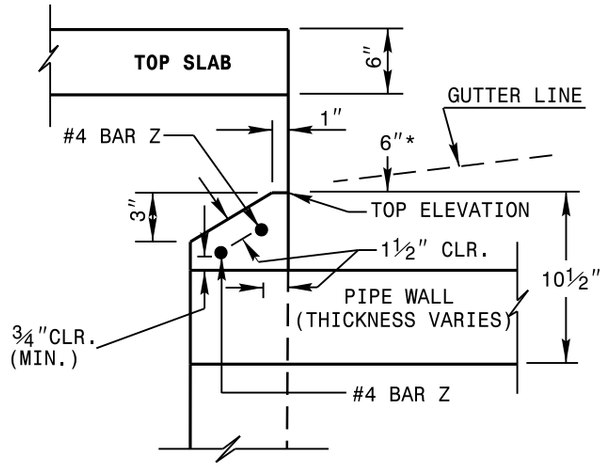
* INCREASE THE SIZE OF THE 6" OPENING TO 8" MAX., AS DIRECTED BY THE ENGINEER BY ADDING 2" TO THE WALL HIEGHT ABOVE THE TOP ELEVATION. ADJUST QUANTITIES ACCORDINGLY.




**SECTION X-X**




**SECTION Y-Y**




**PART SECTION Y-Y**

**SHOWING DETAILS AT OPENING**

MIN. DIMENSIONS AND QUANTITIES FOR CONCRETE CATCH BASIN (BASED ON MIN. HEIGHT, H)

| DIM'S OF BOX & PIPE | | | | REINFORCING | | | | | | | | TOP & BOT. SLAB DIMENSIONS | | CU. YDS. CONC. IN BOX | | | TOTAL QUANTITIES BOX & SLABS | | DEDUCTION ONE PIPE | | DED. ONE 6" THROAT OPENING |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PIPE | SPAN | WIDTH | HEIGHT | BARS - W | | BARS - X | | BARS - Y | | BARS - Z | | | | | | | | | | | |
| D | A | B | H | NO. | LENGTH | NO. | LENGTH | NO. | LENGTH | NO. | LENGTH | F | G | TOP SLAB | BOT. SLAB | WALL/FT. HT. | LBS. REINF. | $YD^3$ (MIN H) | C.S. | R.C. | $YD^3$ |
| 12" | 3'-6" | 2'-3" | 1'-10" | 8 | 3'-8" | 4 | 3'-0" | 6 | 4'-3" | 2 | 4'-3" | 4'-6" | 3'-3" | 0.207 | 0.271 | 0.250 | 47 | 1.046 | 0.015 | 0.032 | 0.046 |
| 15" | 3'-6" | 2'-3" | 2'-1" | 8 | 3'-8" | 4 | 3'-0" | 6 | 4'-3" | 2 | 4'-3" | 4'-6" | 3'-3" | 0.207 | 0.271 | 0.250 | 47 | 1.108 | 0.023 | 0.036 | 0.046 |
| 18" | 4'-0" | 2'-8" | 2'-4" | 8 | 5'-0" | 5 | 3'-5" | 7 | 4'-9" | 2 | 4'-9" | 5'-0" | 3'-8" | 0.275 | 0.340 | 0.284 | 61 | 1.379 | 0.033 | 0.049 | 0.053 |
| 24" | 4'-0" | 2'-8" | 2'-10" | 8 | 5'-0" | 5 | 3'-5" | 7 | 4'-9" | 2 | 4'-9" | 5'-0" | 3'-8" | 0.275 | 0.340 | 0.284 | 61 | 1.521 | 0.059 | 0.085 | 0.053 |
| 30" | 4'-0" | 3'-6" | 3'-4" | 8 | 6'-2" | 5 | 4'-3" | 9 | 4'-9" | 2 | 4'-9" | 5'-0" | 4'-6" | 0.353 | 0.417 | 0.315 | 77 | 1.916 | 0.092 | 0.127 | 0.053 |
| 36" | 4'-6" | 4'-0" | 3'-10" | 8 | 7'-7" | 5 | 4'-9" | 10 | 5'-3" | 2 | 5'-3" | 5'-6" | 5'-0" | 0.445 | 0.510 | 0.352 | 94 | 2.390 | 0.132 | 0.178 | 0.059 |
| 42" | 5'-0" | 4'-6" | 4'-4" | 8 | 9'-0" | 5 | 5'-3" | 12 | 5'-9" | 2 | 5'-9" | 6'-0" | 5'-6" | 0.547 | 0.611 | 0.389 | 119 | 2.914 | 0.180 | 0.243 | 0.066 |
| 48" | 5'-0" | 5'-0" | 4'-10" | 8 | 9'-8" | 5 | 5'-9" | 13 | 5'-9" | 2 | 5'-9" | 6'-0" | 6'-0" | 0.603 | 0.666 | 0.407 | 128 | 3.298 | 0.235 | 0.317 | 0.066 |

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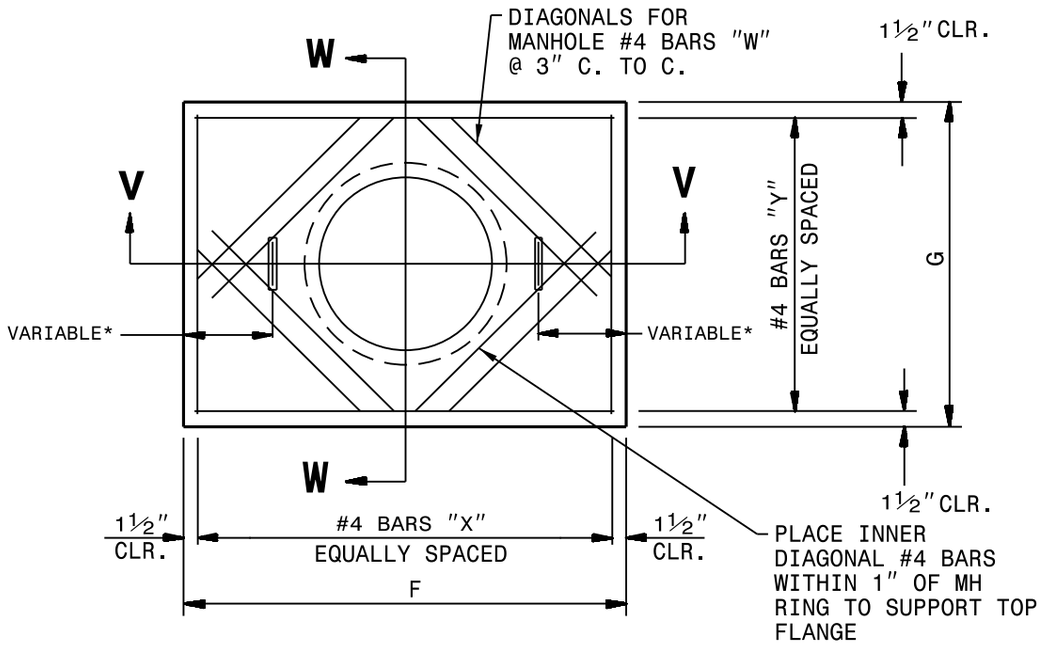
ROADWAY STANDARD DRAWING FOR

# CONCRETE OPEN THROAT CATCH BASIN

(WITH MANHOLE)
12" THRU 48" PIPE

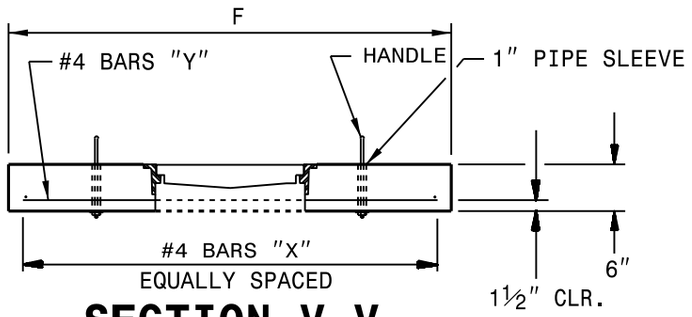


840.04

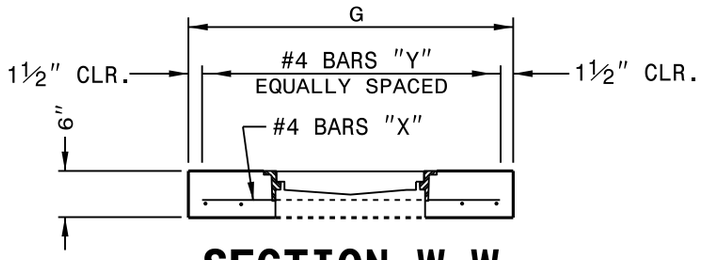



## PLAN

PRECAST OR CAST IN PLACE TOP SLAB

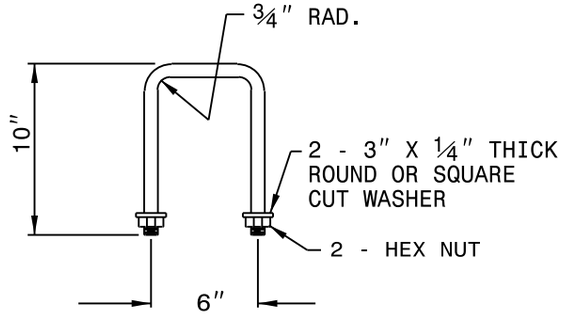



## SECTION V-V

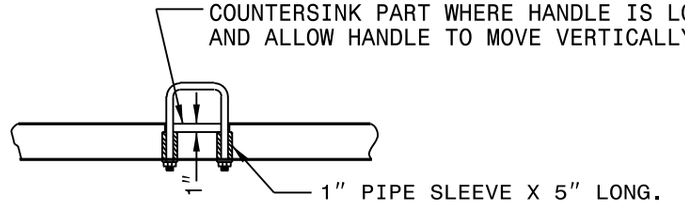



## SECTION W-W

*PLACE HANDLES A MINIMUM 8" FROM OUTSIDE EDGE AND IN A MANNER TO AVOID REINFORCEMENT BARS AS DIRECTED BY THE ENGINEER

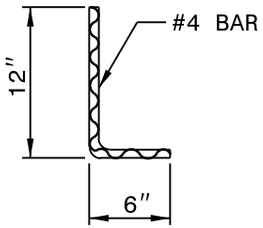



## DETAIL OF HANDLE




## PART SECTION

THRU COVER SHOWING HANDLE




## DOWEL

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ROADWAY STANDARD DRAWING FOR

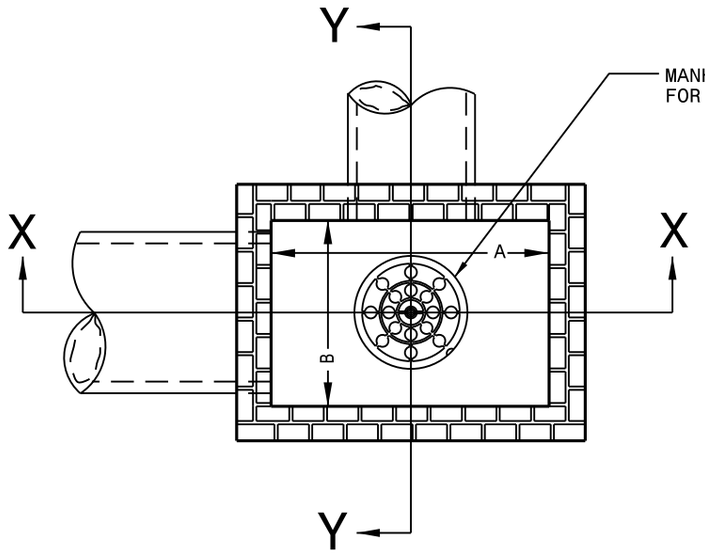
# CONCRETE OPEN THROAT CATCH BASIN

(WITH MANHOLE)

12" THRU 48" PIPE

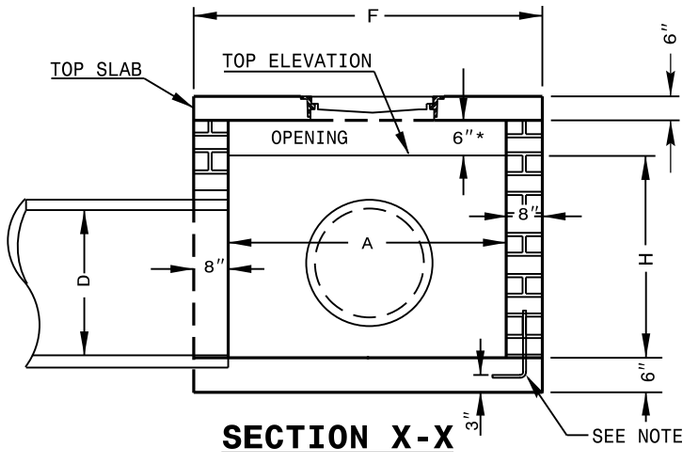
SHEET 2 OF 2

840.04

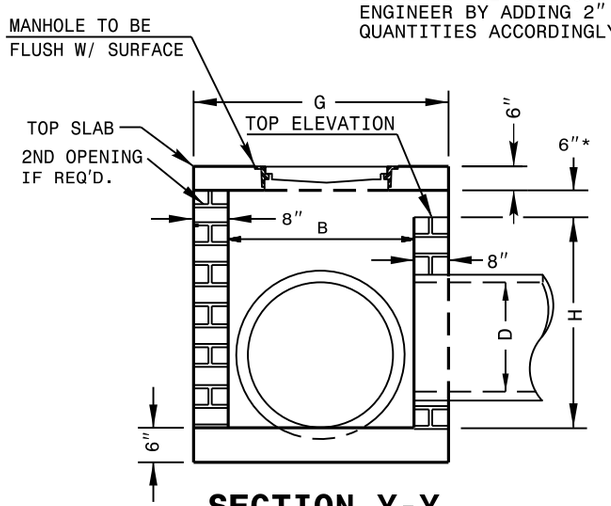



**PLAN**

NOTES:
- MORTAR JOINTS ½″ +/- ⅛″ THICK.
- USE CLASS "B" CONCRETE THROUGHOUT.
- USE FORMS FOR CONSTRUCTION OF THE BOTTOM SLAB.
- USE #4 BAR DOWELS AT 12″ CENTERS.
- DEDUCT FOR PIPE(S) FROM TOTAL CU. YDS. OF BRICK MASONRY.
- PROVIDE ALL CATCH BASINS OVER 3′-6″ IN DEPTH WITH STEPS 12″ ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.
- CONCAVE TOOL ALL EXPOSED MORTAR JOINTS.
- USE BRICK OR CONCRETE BLOCK WHICH COMPLIES WITH THE REQUIREMENTS OF SECTION 840 OF THE STANDARD SPECIFICATIONS.
- IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.
- FOR 8′-0″ IN HEIGHT OR LESS USE 6″ WALLS AND BOTTOM SLAB. OVER 8′-0″ TO 16′-0″ IN HEIGHT USE 8″ WALLS AND BOTTOM SLAB. ADJUST QUANTITIES ACCORDINGLY.
- MAX. DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 16′-0″. STD. DWG. 840.45 OR 840.46 CONTROLS MAX. DEPTH IF PRECAST BOX IS USED.
- CONSTRUCT WITH PIPE CROWNS MATCHING.
- CHAMFER ALL EXPOSED CORNERS 1″.
- DRAWING NOT TO SCALE.
- * INCREASE THE SIZE OF THE 6″ OPENING TO 8″ MAX., AS DIRECTED BY THE ENGINEER BY ADDING 2″ TO THE WALL HIEGHT ABOVE THE TOP ELEVATION. ADJUST QUANTITIES ACCORDINGLY.




**SECTION X-X**




**SECTION Y-Y**

**MIN. DIMENSIONS AND QUANTITIES FOR CATCH BASIN (BASED ON MIN. HEIGHT, H)**

| DIM'S OF BOX & PIPE | | | | REINFORCING | | | | | | | SLAB DIMENSIONS | | CU. YDS. CONC. IN BOX | | | TOTAL BRICK MASONRY | | DEDUCTION ONE PIPE | | DED. ONE 6″ THROAT OPENING |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PIPE | SPAN | WIDTH | HEIGHT | BARS - W | | BARS - X | | BARS - Y | | TOTAL | | | | | | | | | | |
| D | A | B | H | NO. | LENGTH | NO. | LENGTH | NO. | LENGTH | LBS | F | G | TOP SLAB | BOT. SLAB | TOTAL | PER FT. HT. | TOT. FOR H | C.S. | R.C. | CU.YDS. |
| 12″ | 3′-6″ | 2′-3″ | 1′-10″ | 8 | 3′-8″ | 5 | 3′-4″ | 7 | 4′-7″ | 49 | 4′-10″ | 3′-7″ | 0.257 | 0.321 | 0.535 | 0.350 | 0.656 | 0.020 | 0.037 | 0.043 |
| 15″ | 3′-6″ | 2′-3″ | 2′-1″ | 8 | 3′-8″ | 5 | 3′-4″ | 7 | 4′-7″ | 49 | 4′-10″ | 3′-7″ | 0.257 | 0.321 | 0.535 | 0.350 | 0.744 | 0.031 | 0.059 | 0.043 |
| 18″ | 4′-0″ | 2′-8″ | 2′-4″ | 8 | 5′-0″ | 6 | 3′-9″ | 8 | 5′-1″ | 64 | 5′-4″ | 4′-0″ | 0.331 | 0.395 | 0.658 | 0.395 | 0.938 | 0.044 | 0.081 | 0.049 |
| 24″ | 4′-0″ | 2′-8″ | 2′-10″ | 8 | 5′-0″ | 6 | 3′-9″ | 8 | 5′-1″ | 64 | 5′-4″ | 4′-0″ | 0.331 | 0.395 | 0.658 | 0.395 | 1.136 | 0.078 | 0.134 | 0.049 |
| 30″ | 4′-0″ | 3′-6″ | 3′-4″ | 8 | 6′-2″ | 6 | 4′-7″ | 10 | 5′-1″ | 81 | 5′-4″ | 4′-10″ | 0.414 | 0.477 | 0.795 | 0.436 | 1.472 | 0.122 | 0.199 | 0.049 |
| 36″ | 4′-6″ | 4′-0″ | 3′-10″ | 8 | 7′-7″ | 6 | 5′-1″ | 11 | 5′-7″ | 98 | 5′-10″ | 5′-4″ | 0.512 | 0.576 | 0.960 | 0.485 | 1.879 | 0.176 | 0.278 | 0.056 |
| 42″ | 5′-0″ | 4′-6″ | 4′-4″ | 8 | 9′-0″ | 6 | 5′-7″ | 13 | 6′-1″ | 124 | 6′-4″ | 5′-10″ | 0.620 | 0.684 | 1.140 | 0.535 | 2.340 | 0.240 | 0.371 | 0.062 |
| 48″ | 5′-0″ | 5′-0″ | 4′-10″ | 8 | 9′-8″ | 6 | 6′-1″ | 14 | 6′-1″ | 134 | 6′-4″ | 6′-4″ | 0.679 | 0.743 | 1.238 | 0.559 | 2.725 | 0.313 | 0.476 | 0.062 |

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ROADWAY STANDARD DRAWING FOR

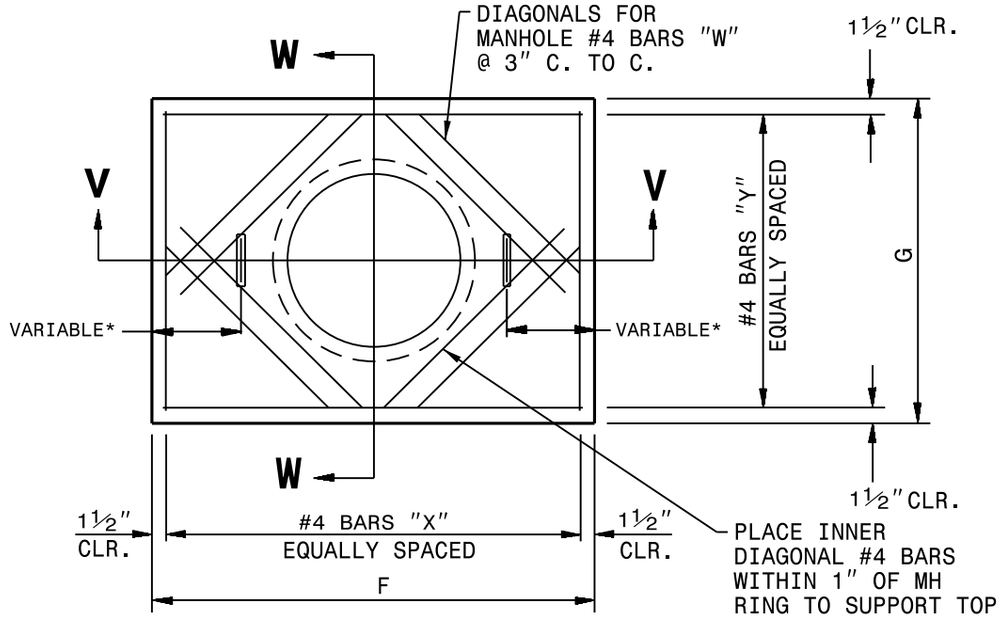
# BRICK OPEN THROAT CATCH BASIN

(WITH MANHOLE)

12″ THRU 48″ PIPE

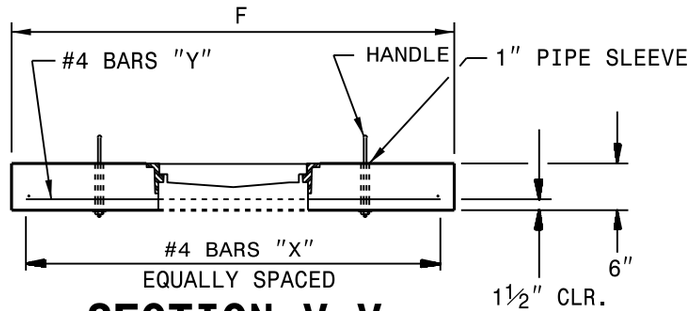


840.05

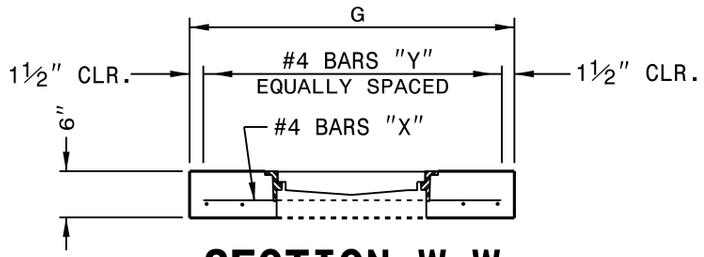



## PLAN

PRECAST OR CAST IN PLACE TOP SLAB

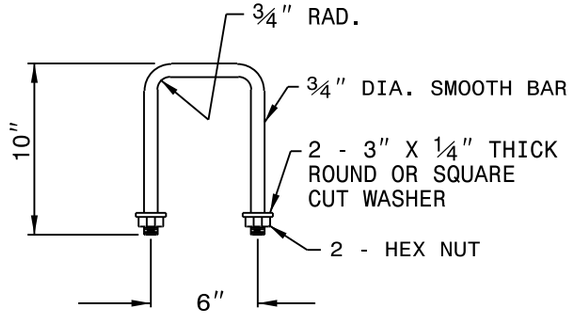



## SECTION V-V

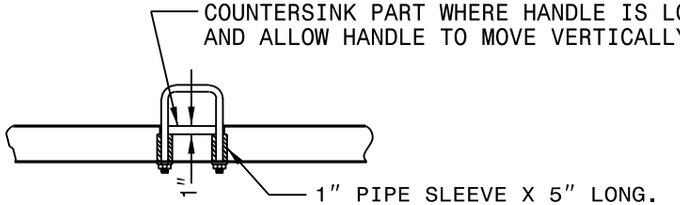



## SECTION W-W

*PLACE HANDLES A MINIMUM 8" FROM OUTSIDE EDGE AND IN A MANNER TO AVOID REINFORCEMENT BARS AS DIRECTED BY THE ENGINEER

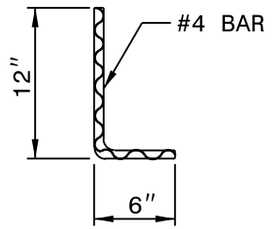



## DETAIL OF HANDLE




## PART SECTION

THRU COVER SHOWING HANDLE




## DOWEL

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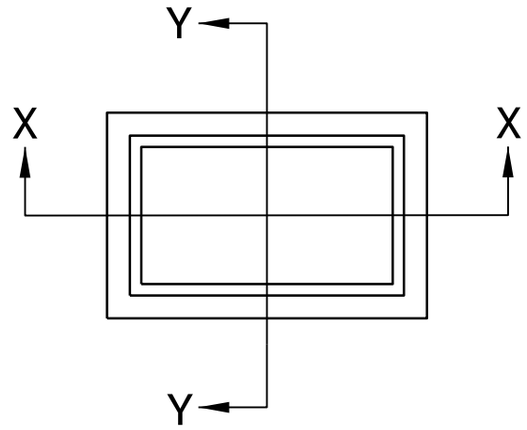
ROADWAY STANDARD DRAWING FOR

# BRICK CATCH BASIN WITH SINGLE AND MULTIPLE PIPES

(WITH MANHOLE)12" THRU 48" PIPE

SHEET 2 OF 2

840.05




**PLAN**

GENERAL NOTES:

USE CLASS "B" CONCRETE THROUGHOUT.

PROVIDE ALL DROP INLETS OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.

OPTIONAL CONSTRUCTION - MONOLITHIC POUR, 2" KEYWAY, OR #4 BAR DOWELS AT 12" CENTERS AS DIRECTED BY THE ENGINEER.

USE FORMS FOR THE CONSTRUCTION OF THE BOTTOM SLAB.

IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.

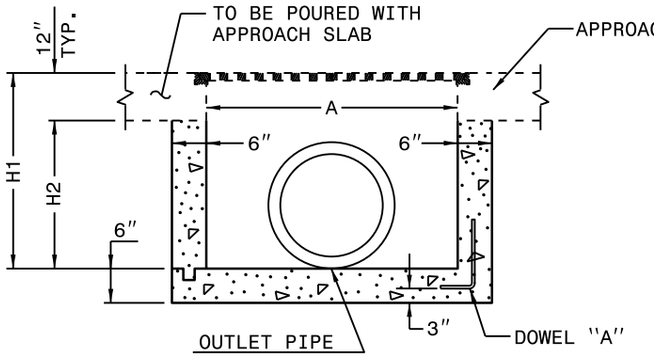
#4 BAR DOWELS "B" AT 12" CENTERS.

MAX. DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 12'-0". STD. NO. 840.45 CONTROLS MAXIMUM DEPTH IF PRECAST BOX IS USED.

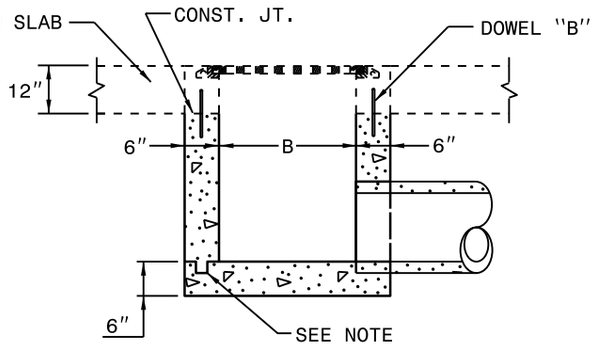
FOR LOCATIONS OF DROP INLET, SEE BRIDGE APPROACH SLABS IN THE STRUCTURE PLANS.

CONSTRUCT WITH PIPE CROWNS MATCHING.

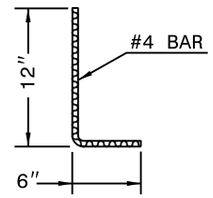
DRAWING NOT TO SCALE.



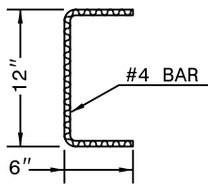

**SECTION X-X**




**SECTION Y-Y**




**DOWEL "A"**




**DOWEL "B"**

**MINIMUM DIMENSIONS AND QUANTITIES FOR CONCRETE DROP INLET**

| PIPE | SPAN | WIDTH | HEIGHT | HEIGHT | CUBIC YARDS OF CONCRETE IN BOX | | | | DEDUCTIONS FOR ONE PIPE | |
|---|---|---|---|---|---|---|---|---|---|---|
| D | A | B | H1 | H2 | BOTTOM SLAB | H PER FT. HT. | H MIN. TOTAL | TOTAL | C.S. | R.C. |
| 12" | 3'-8" | 2'-0" | 2'-6" | 1'-6" | 0.259 | 0.247 | 0.597 | 0.856 | 0.020 | 0.032 |
| 15" | 3'-8" | 2'-0" | 2'-9" | 1'-9" | 0.259 | 0.247 | 0.659 | 0.918 | 0.023 | 0.036 |
| 18" | 3'-8" | 2'-0" | 3'-0" | 2'-0" | 0.259 | 0.247 | 0.720 | 0.979 | 0.033 | 0.049 |
| 24" | 3'-8" | 2'-0" | 3'-6" | 2'-6" | 0.259 | 0.247 | 0.865 | 1.124 | 0.059 | 0.085 |

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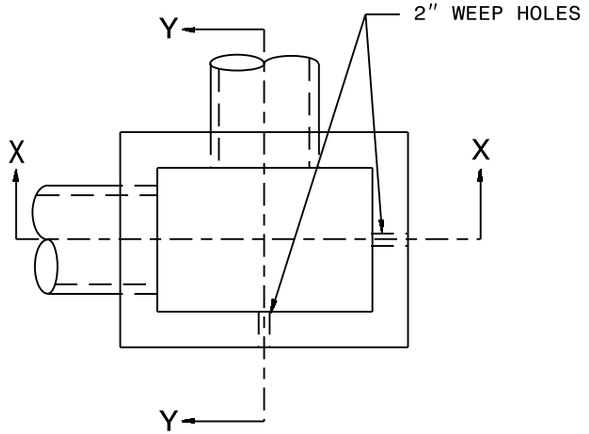
ROADWAY STANDARD DRAWING FOR

# CONCRETE BRIDGE APPROACH DROP INLET

12" THRU 24" PIPE

SHEET 1 OF 1

**840.13**




## PLAN

WITH GRATE & FRAME REMOVED

GENERAL NOTES:

USE CLASS "B" CONCRETE THROUGHOUT.

PROVIDE ALL DROP INLETS OVER 3′-6″ IN DEPTH WITH STEPS 12″ ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.

OPTIONAL CONSTRUCTION - MONOLITHIC POUR 2″ KEYWAY OR #4 BAR DOWELS AT 12″ CENTERS AS DIRECTED BY THE ENGINEER.

USE FORMS FOR THE CONSTRUCTION OF THE BOTTOM SLAB.

IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.

MAX.DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 12′-0″. STD. DWG. 840.45 OR 840.46 CONTROLS MAXIMUM DEPTH IF PRECAST BOX IS USED.

CONSTRUCT WITH PIPE CROWNS MATCHING.

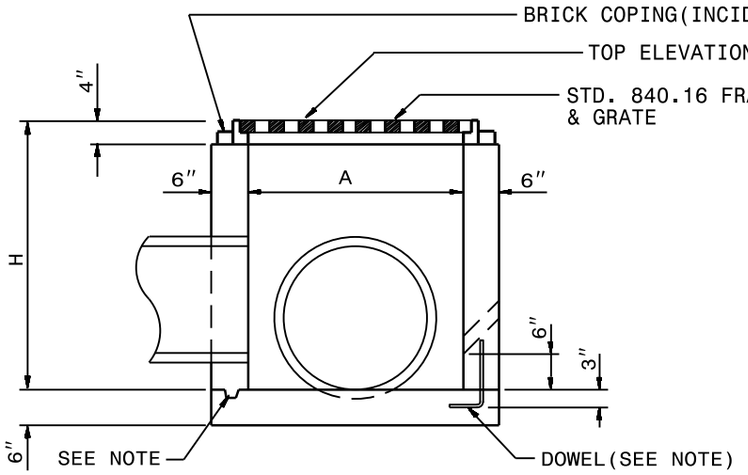
SEE STANDARD DRAWING 840.25 FOR ATTACHMENT OF FRAMES AND GRATES NOT SHOWN.

INSTALL 2″ WEEPHOLES AS DIRECTED BY THE ENGINEER.

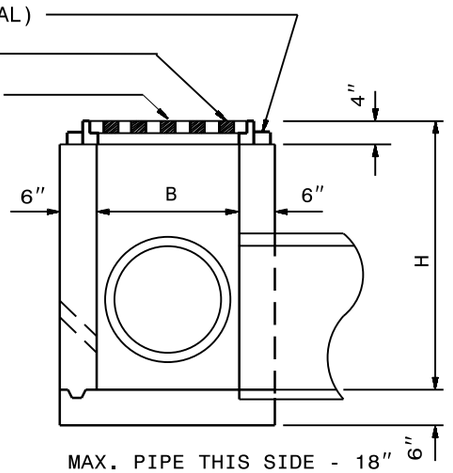
INSTALL STONE DRAINS, OF A MINIMUM OF 1 CUBIC FOOT OF NO. 78M STONE IN A POROUS FABRIC BAG OR WRAP, AT EACH WEEP HOLE OR AS DIRECTED BY THE ENGINEER.

CHAMFER ALL EXPOSED CORNERS 1″.

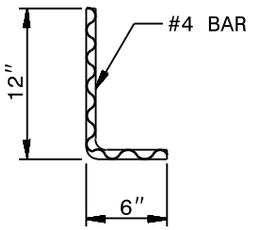
DRAWING NOT TO SCALE.




## SECTION X-X




## SECTION Y-Y




## DOWEL

| DIMENSIONS AND QUANTITIES FOR DROP INLET(BASED ON MIN. HEIGHT, H) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DIMENSIONS OF BOX & PIPE | | | | CUBIC YARDS CONC. IN BOX | | | DEDUCTIONS FOR ONE PIPE | |
| PIPE | SPAN | WIDTH | MIN. HEIGHT | | | | | |
| D | A | B | H | BOTTOM SLAB | WALL PER FT. HT. | TOTAL CONCRETE FOR MINIMUM HEIGHT, H | C.M. | R.C. |
| 12″ | 3′-0″ | 2′-0″ | 2′-0″ | 0.222 | 0.222 | 0.592 | 0.015 | 0.026 |
| 15″ | 〃 | 〃 | 2′-3″ | 〃 | 〃 | 0.648 | 0.023 | 0.036 |
| 18″ | 〃 | 〃 | 2′-6″ | 〃 | 〃 | 0.703 | 0.033 | 0.049 |
| 24″ | 〃 | 〃 | 3′-0″ | 〃 | 〃 | 0.814 | 0.059 | 0.085 |
| 30″ | 3′-0″ | 2′-0″ | 3′-6″ | 0.222 | 0.222 | 0.925 | 0.092 | 0.127 |

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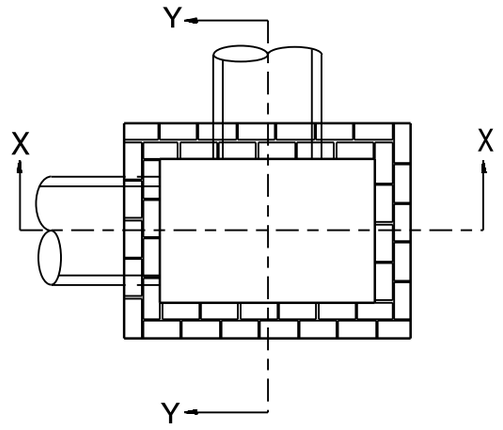
ROADWAY STANDARD DRAWING FOR

# CONCRETE DROP INLET

12″ THRU 30″ PIPE

SHEET 1 OF 1

840.14




## PLAN

WITH COPING REMOVED

GENERAL NOTES:

MORTAR JOINTS ½″ +/- ⅛″ THICK.

USE CLASS "B" CONCRETE THROUGHOUT.

USE FORMS FOR CONSTRUCTION OF THE BOTTOM SLAB.

USE #4 BAR DOWELS AT 12″ CENTERS.

DEDUCT FOR PIPE(S) FROM TOTAL CU. YDS. OF BRICK MASONRY.

PROVIDE ALL CATCH BASINS OVER 3′-6″ IN DEPTH WITH STEPS 12″ ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.

USE BRICK OR CONCRETE BLOCK WHICH COMPLIES WITH THE REQUIREMENTS OF SECTION 840 OF THE STANDARD SPECIFICATIONS.

IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.

FOR 8′-0″ IN HEIGHT OR LESS, USE 8″ WALL. OVER 8′-0″ IN HEIGHT, USE 12″ WALL TO 6′-0″ FROM TOP OF WALL AND 8″ WALL FOR THE REMAINING 6′-0″. QUANTITES TO BE ADJUSTED ACCORDINGLY.

MAX.DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 12′-0″. STD. DWG. 840.45 OR 840.46 CONTROLS MAXIMUM DEPTH IF PRECAST BOX IS USED.

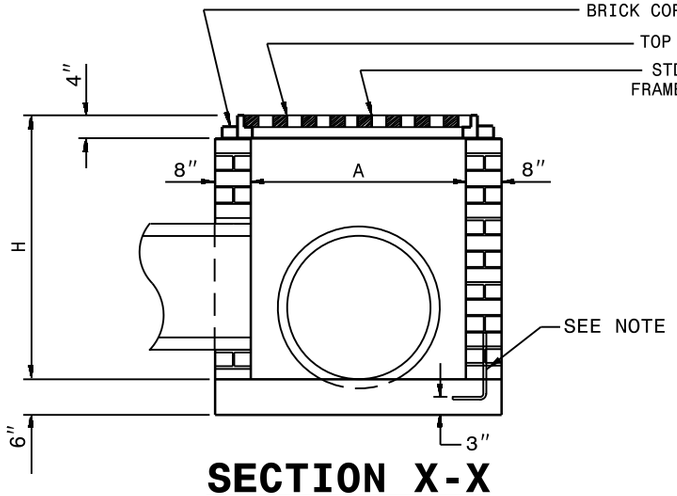
CONSTRUCT WITH PIPE CROWNS MATCHING.

SEE STANDARD DRAWING 840.25 FOR ATTACHMENT OF FRAMES AND GRATES.

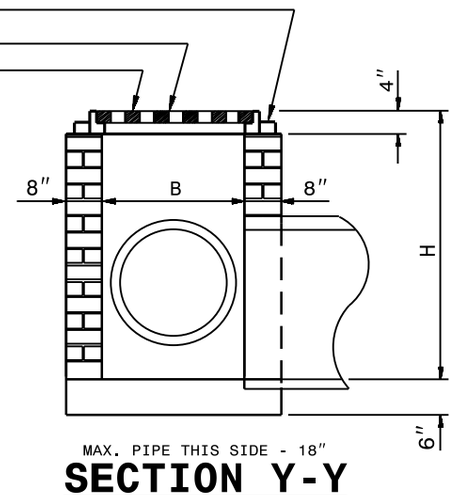
DO NOT USE BRICK MASONRY DROP INLET IN LOCATIONS SUBJECT TO TRAFFIC.

CHAMFER ALL EXPOSED CORNERS 1″.

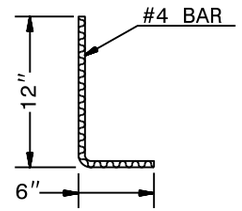
DRAWING NOT TO SCALE.




## SECTION X-X




## SECTION Y-Y




## DOWEL

**DIMENSIONS AND QUANTITIES FOR DROP INLET(BASED ON MIN. HEIGHT, H)**

| DIMENSIONS OF BOX & PIPE | | | | CUBIC YARDS CONCRETE | CUBIC YARDS BRICK MASONRY | | DEDUCTIONS FOR ONE PIPE | |
|---|---|---|---|---|---|---|---|---|
| PIPE | SPAN | WIDTH | MIN. HEIGHT | | | | | |
| D | A | B | H | BOTTOM SLAB | WALL PER FOOT HT. | TOTAL BRICK MASONRY FOR MIN. HEIGHT, H | C.S. | R.C. |
| 12″ | 3′-0″ | 2′-0″ | 2′-0″ | 0.268 | 0.313 | 0.522 | 0.020 | 0.032 |
| 15″ | | | 2′-3″ | 0.268 | 0.313 | 0.600 | 0.031 | 0.047 |
| 18″ | | | 2′-6″ | 0.268 | 0.313 | 0.678 | 0.044 | 0.065 |
| 24″ | | | 3′-0″ | 0.268 | 0.313 | 0.835 | 0.078 | 0.113 |
| 30″ | 3′-0″ | 2′-0″ | 3′-6″ | 0.268 | 0.313 | 0.991 | 0.122 | 0.170 |

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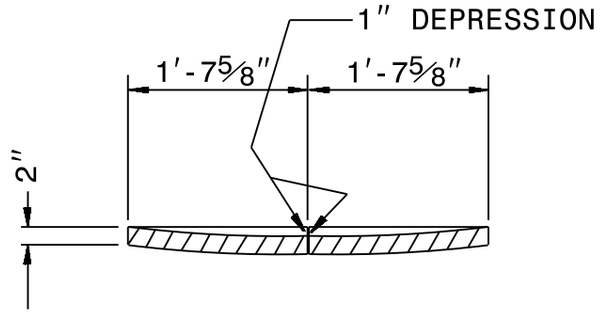
ROADWAY STANDARD DRAWING FOR

# BRICK DROP INLET

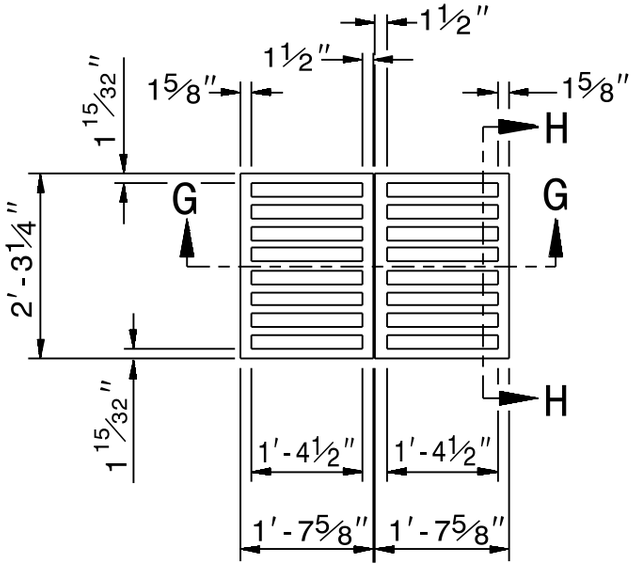
12″ THRU 30″ PIPE

SHEET 1 OF 1

840.15

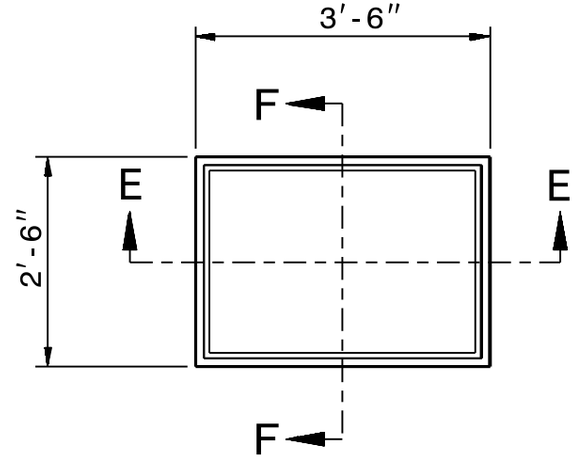



SECTION G-G



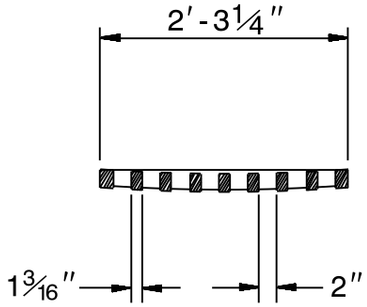

PLAN OF GRATING

CAST IRON

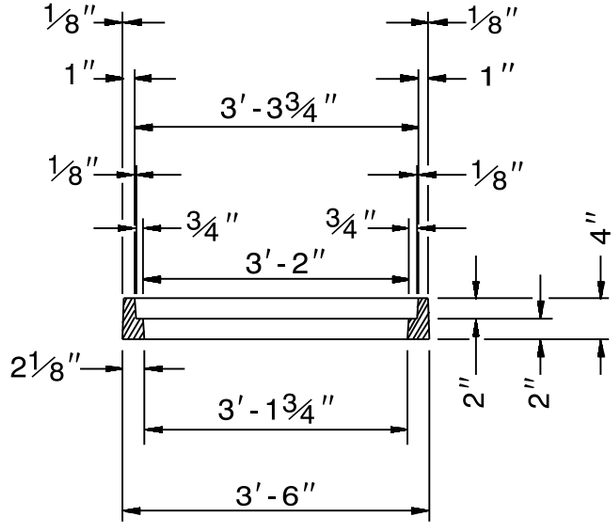



PLAN OF FRAME

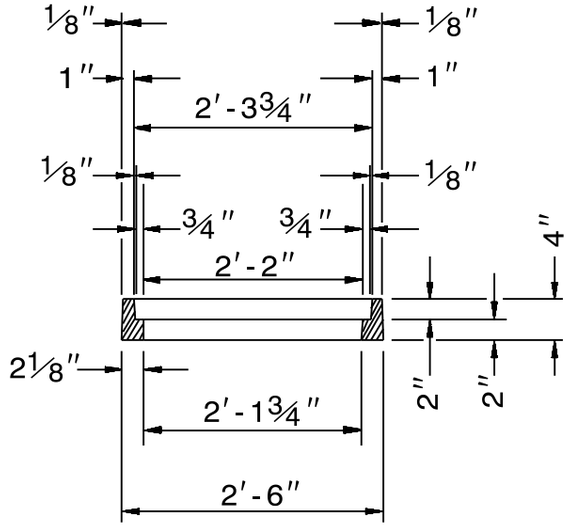
CAST IRON




SECTION H-H




SECTION E-E




SECTION F-F

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DIVISION OF HIGHWAYS
RALEIGH, N.C.

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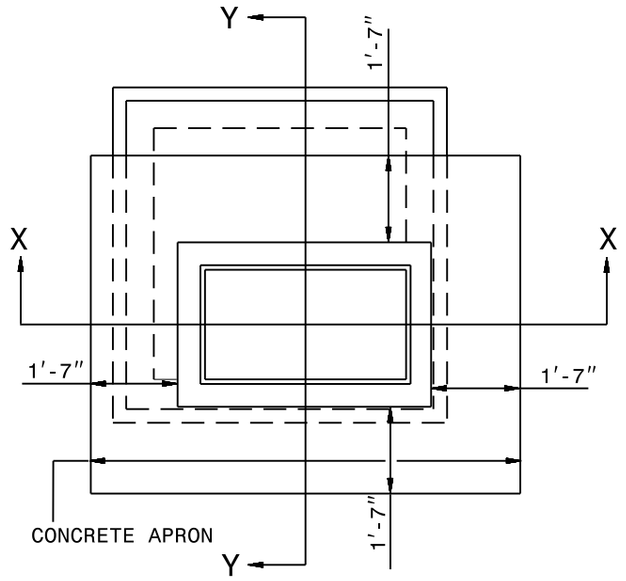
ROADWAY STANDARD DRAWING FOR

# DROP INLET FRAME AND GRATES

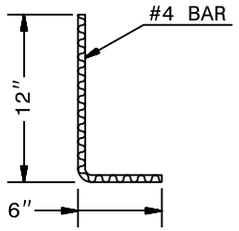
FOR USE WITH STD. DWG.S 840.14 AND 840.15

SHEET 1 OF 1

840.16




## PLAN




## DOWEL-A

GENERAL NOTES:

USE CLASS "B" CONCRETE THROUGHOUT.

PROVIDE ALL GRATED DROP INLETS OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.

OPTIONAL CONSTRUCTION - MONOLITHIC POUR, 2" KEYWAY, OR #4 BAR DOWELS AT 12" CENTERS AS DIRECTED BY THE ENGINEER.

USE FORMS FOR THE CONSTRUCTION OF THE BOTTOM SLAB.

IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.

MAX. DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 12 FEET. STD. DWG. 840.45 CONTROLS MAXIMUM DEPTH IF PRECAST BOX IS USED.

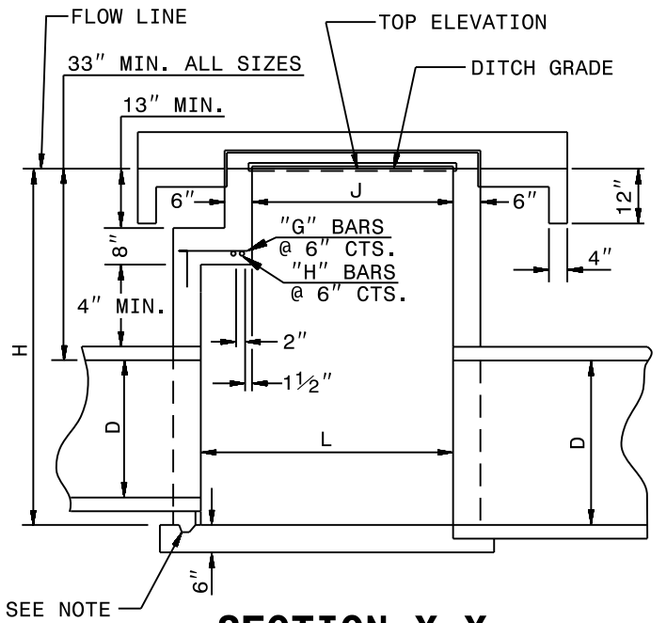
CONSTRUCT WITH PIPE CROWNS MATCHING.

USE STANDARD FRAMES AND GRATES 840.22 (SHOWN), 840.24(SHOWN), 840.20 (NOT SHOWN) OR 840.29 (NOT SHOWN).

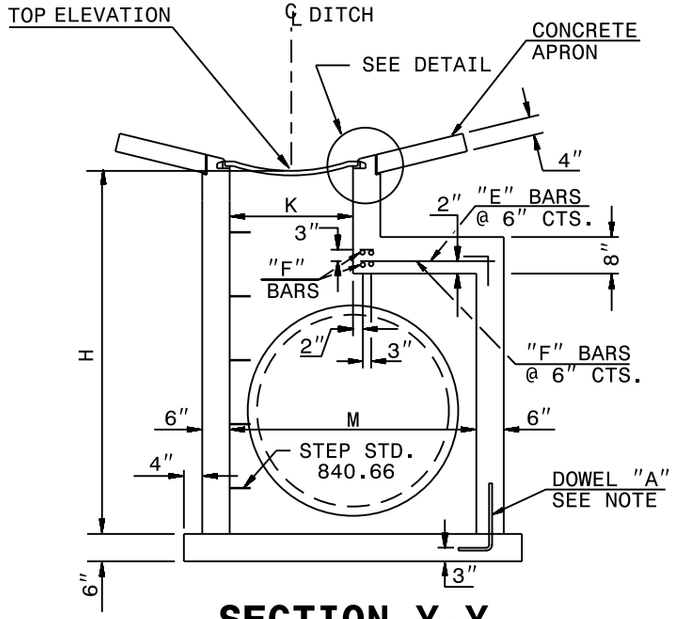
SEE STANDARD DRAWING 840.25 FOR ATTACHMENT OF FRAMES AND GRATES.

CHAMFER ALL EXPOSED CORNERS 1".

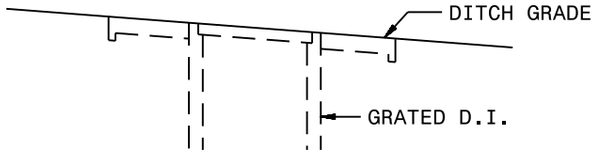
DRAWING NOT TO SCALE.

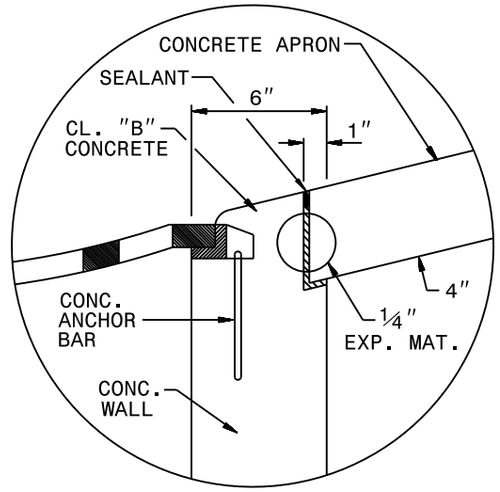



## SECTION X-X




## SECTION Y-Y




## DETAIL

(APRON SUPPORT NOTCH)

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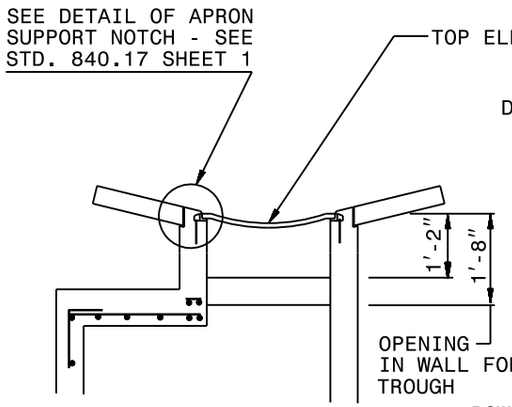
ROADWAY STANDARD DRAWING FOR

# CONCRETE GRATED DROP INLET TYPE 'A'

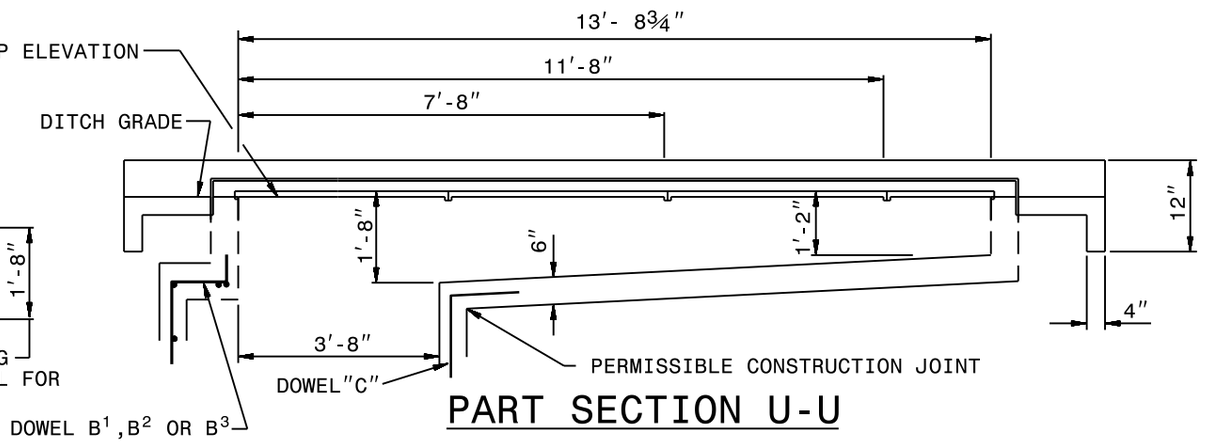
12" THRU 72" PIPE

SHEET 1 OF 2

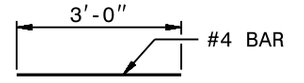
840.17




PART SECTION V-V

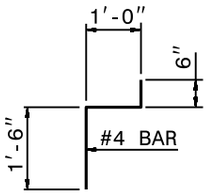



PART SECTION U-U



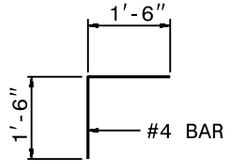

DOWEL-B¹

FOR 15" THRU 36" INLET

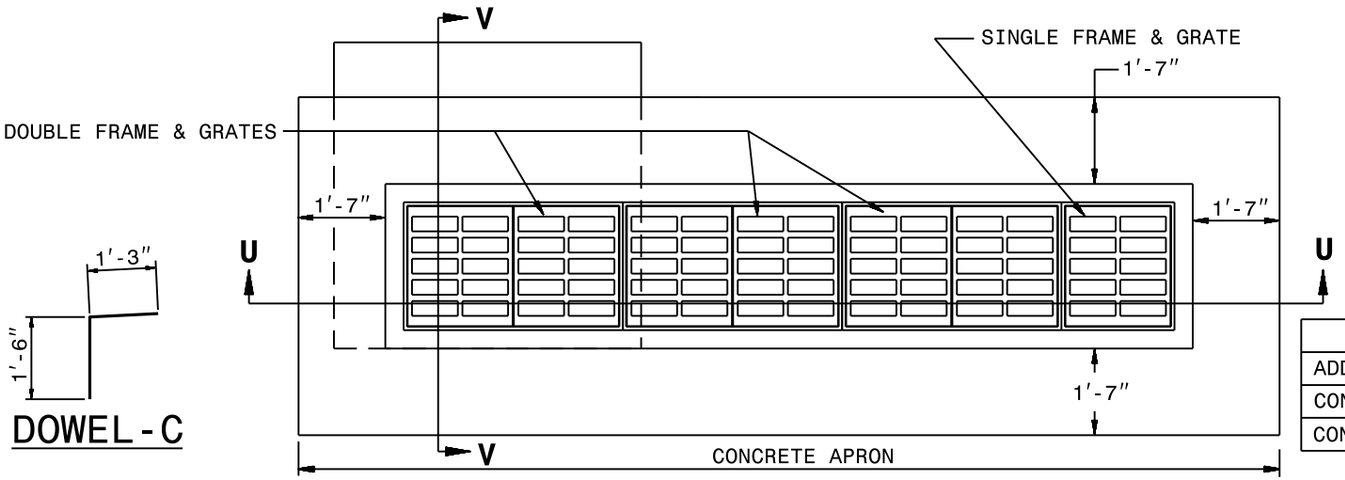



DOWEL-B²

FOR 42" INLET




DOWEL-B³







DOWEL-C

| QUANTITY TO BE ADDED FOR EACH 2' INCREMENT INLET OPENING | | | | | | |
|---|---|---|---|---|---|---|
| ADDITIONAL INLETS | 2'-0" | 4'-0" | 6'-0" | 8'-0" | 10'-0" | 12'-0" |
| CONCRETE CU. YDS. | 0.191 | 0.417 | 0.665 | 0.897 | 1.145 | 1.380 |
| CONCRETE APRON CU. YDS. | 0.074 | 0.148 | 0.222 | 0.296 | 0.370 | 0.444 |

**MIN. DIMENSIONS AND QUANTITIES FOR CONCRETE GRATED DROP INLET(BASED ON MIN. HEIGHT, H)**

| DIMENSIONS OF BOX AND PIPE | | | | | | REINFORCING STEEL - NO. 4 BARS | | | | | | | | | CU YDS CONC. IN BOX | | | | | DEDUCTIONS FOR ONE PIPE | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PIPE | SPAN | WIDTH | SPAN | WIDTH | HEIGHT | BARS E | | BARS F | | BARS G | | BARS H | | TOTAL | BOTTOM | H | H PER | APRON | TOTAL | | |
| D | J | K | L | M | H | NO. | LENGTH | NO. | LENGTH | NO. | LENGTH | NO. | LENGTH | LBS. | SLAB | TOTAL | FT HT | | | C.S. | R.C. |
| 12" | 3'-8" | 2'-0" | 3'-8" | 2'-0" | 3'-9" | — | — | — | — | — | — | — | — | — | 0.362 | 0.926 | 0.247 | 0.395 | 1.683 | 0.015 | 0.024 |
| 15" | 3'-8" | 2'-0" | 3'-8" | 2'-0" | 4'-0" | — | — | — | — | — | — | — | — | — | 0.362 | 0.988 | 0.247 | 0.395 | 1.745 | 0.023 | 0.036 |
| 18" | | | | 2'-0" | 4'-3" | — | — | — | — | — | — | — | — | — | 0.362 | 1.050 | 0.247 | | 1.807 | 0.033 | 0.049 |
| 24" | | | | 2'-10" | 4'-9" | 8 | 1'-5" | 6 | 4'-9" | — | — | — | — | 27 | 0.444 | 1.362 | 0.278 | | 2.201 | 0.059 | 0.085 |
| 30" | | | 3'-8" | 3'-5" | 5'-3" | 8 | 2'-0" | 7 | 4'-9" | — | — | — | — | 33 | 0.502 | 1.644 | 0.288 | | 2.541 | 0.092 | 0.127 |
| 36" | | | 4'-0" | 4'-0" | 5'-9" | 8 | 2'-5" | 8 | 4'-11" | 4 | 0'-9" | 2 | 4'-11" | 47 | 0.560 | 1.931 | 0.321 | | 2.920 | 0.132 | 0.178 |
| 42" | | | 4'-10" | 4'-10" | 6'-3" | 10 | 3'-1" | 9 | 5'-7" | | 1'-5" | 3 | 5'-7" | 67 | 0.704 | 2.500 | 0.370 | | 3.677 | 0.180 | 0.243 |
| 48" | | | 5'-4" | 5'-4" | 6'-9" | 11 | 3'-7" | 10 | 6'-1" | | 1'-11" | 4 | 6'-1" | 87 | 0.823 | 3.013 | 0.407 | | 4.315 | 0.235 | 0.317 |
| 54" | | | 6'-0" | 6'-0" | 7'-3" | 12 | 4'-1" | 11 | 6'-7" | | 2'-5" | 5 | 6'-7" | 107 | 0.951 | 3.589 | 0.444 | | 5.072 | 0.297 | 0.401 |
| 60" | | | 6'-6" | 6'-6" | 7'-9" | 13 | 4'-9" | 12 | 7'-3" | | 3'-1" | 6 | 7'-3" | 135 | 1.311 | 4.539 | 0.494 | | 6.170 | 0.367 | 0.495 |
| 66" | | | 7'-2" | 7'-2" | 8'-3" | 14 | 5'-4" | 14 | 7'-10" | | 3'-7" | 7 | 7'-10" | 168 | 1.136 | 5.061 | 0.537 | | 6.901 | 0.444 | 0.599 |
| 72" | 3'-8" | 2'-0" | 7'-8" | 7'-8" | 8'-9" | 15 | 5'-11" | 15 | 8'-5" | 4 | 4'-3" | 8 | 8'-5" | 199 | 1.500 | 5.860 | 0.580 | 0.395 | 7.868 | 0.528 | 0.713 |

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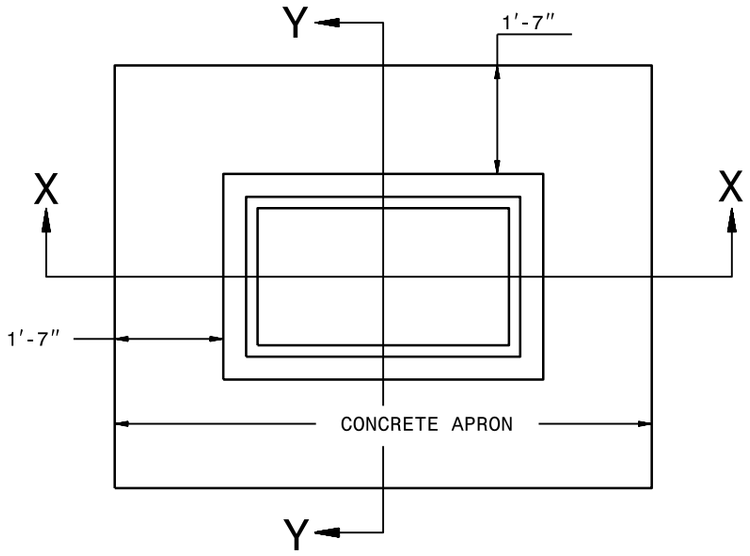
ROADWAY STANDARD DRAWING FOR

# CONCRETE GRATED DROP INLET TYPE 'A'

12" THRU 72" PIPE

SHEET 2 OF 2

840.17




**PLAN**

GENERAL NOTES:

USE CLASS "B" CONCRETE THROUGHOUT.

PROVIDE ALL GRATED DROP INLETS OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.

OPTIONAL CONSTRUCTION - MONOLITHIC POUR, 2" KEYWAY, OR #4 BAR DOWELS AT 12" CENTERS AS DIRECTED BY THE ENGINEER.

USE FORMS FOR THE CONSTRUCTION OF THE BOTTOM SLAB.

IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.

CONSTRUCT WITH PIPE CROWNS MATCHING.

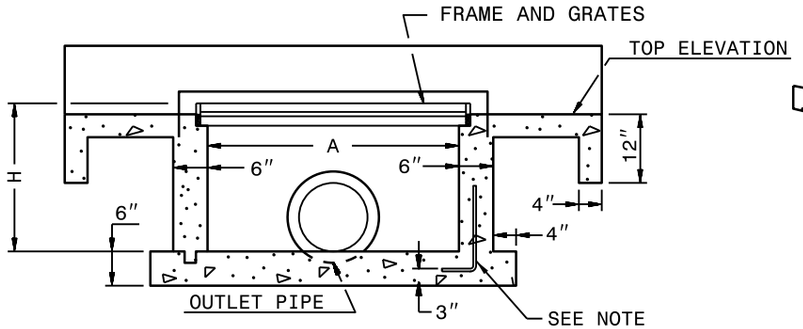
MAX. DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 12 FEET. STD. DWG. 840.45 CONTROLS MAXIMUM DEPTH IF PRECAST BOX IS USED.

USE STANDARD FRAMES AND GRATES 840.22 (SHOWN), 840.24(SHOWN), 840.20, 840.29, AND 840.33.

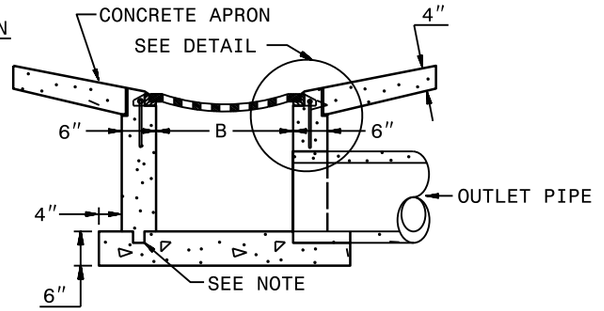
SEE STANDARD DRAWING 840.25 FOR ATTACHMENT OF FRAMES AND GRATES NOT SHOWN.

CHAMFER ALL EXPOSED CORNERS 1".

DRAWING NOT TO SCALE.

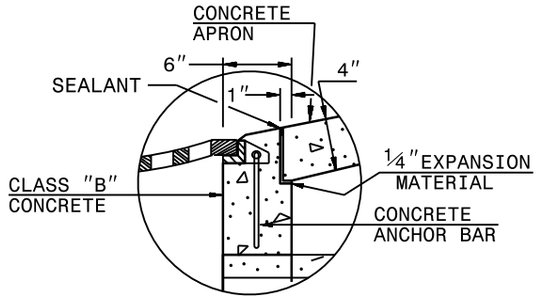



**SECTION X-X**



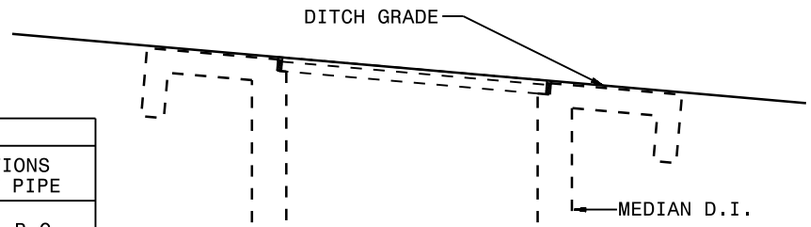

MAX. PIPE THIS SIDE - 18"

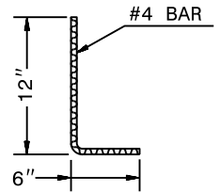
**SECTION Y-Y**




**DETAIL**

(APRON SUPPORT NOTCH)




**DOWEL "A"**

| MINIMUM DIMENSIONS AND QUANTITIES FOR CONCRETE GRATED DROP INLET | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| PIPE | SPAN | WIDTH | HEIGHT | CUBIC YARDS OF CONCRETE IN BOX | | | | DEDUCTIONS FOR ONE PIPE | |
| D | A | B | H | BOTTOM SLAB | H PER FT. HT. | H MIN. TOTAL | TOTAL | C.S. | R.C. |
| 12" | 3'-8" | 2'-0" | 2'-6" | 0.362 | 0.247 | 0.597 | 0.958 | 0.020 | 0.032 |
| 15" | 3'-8" | 2'-0" | 2'-9" | 0.362 | 0.247 | 0.659 | 1.021 | 0.023 | 0.036 |
| 18" | 3'-8" | 2'-0" | 3'-0" | 0.362 | 0.247 | 0.720 | 1.082 | 0.033 | 0.049 |
| 24" | 3'-8" | 2'-0" | 3'-6" | 0.362 | 0.247 | 0.865 | 1.227 | 0.059 | 0.085 |
| 30" | 3'-8" | 2'-0" | 4'-0" | 0.362 | 0.247 | 0.988 | 1.350 | 0.092 | 0.127 |
| 36" | 3'-8" | 2'-0" | 4'-6" | 0.362 | 0.247 | 1.112 | 1.474 | 0.132 | 0.178 |

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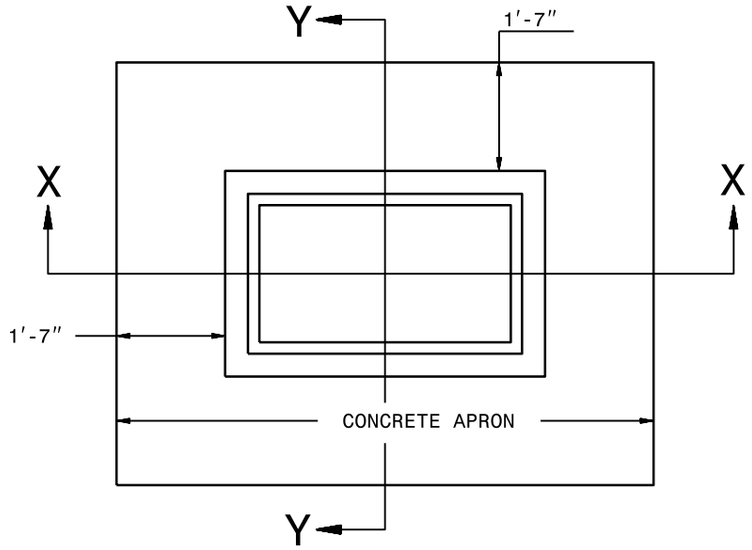
ROADWAY STANDARD DRAWING FOR

# CONCRETE GRATED DROP INLET TYPE 'B'

12" THRU 36" PIPE

SHEET 1 OF 1

840.18




**PLAN**

GENERAL NOTES:

USE CLASS "B" CONCRETE THROUGHOUT.

PROVIDE ALL DROP INLETS OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.

OPTIONAL CONSTRUCTION - MONOLITHIC POUR, 2" KEYWAY, OR #4 BAR DOWELS AT 12" CENTERS AS DIRECTED BY THE ENGINEER.

USE FORMS FOR THE CONSTRUCTION OF THE BOTTOM SLAB.

IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.

CONSTRUCT WITH PIPE CROWNS MATCHING.

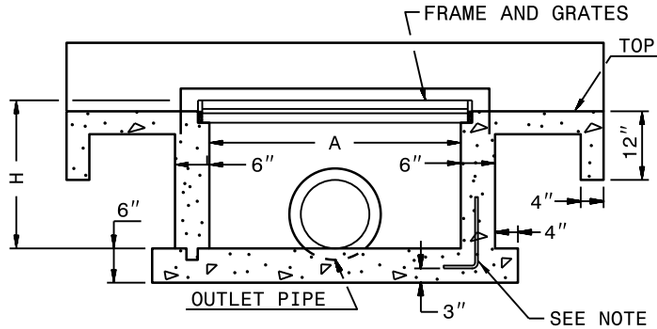
MAX. DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 12"-0". STD. DWG. 840.45 CONTROLS MAXIMUM DEPTH IF PRECAST BOX IS USED.

USE STANDARD FRAMES AND GRATES 840.22 (SHOWN), 840.24(SHOWN), 840.20, 840.29, AND 840.33.

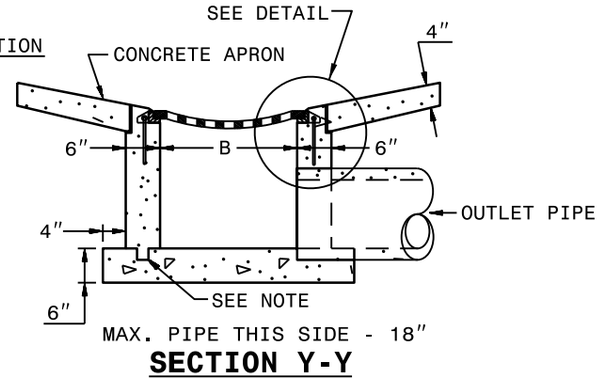
SEE STANDARD DRAWING 840.25 FOR ATTACHMENT OF FRAMES AND GRATES NOT SHOWN.

CHAMFER ALL EXPOSED CORNERS 1".

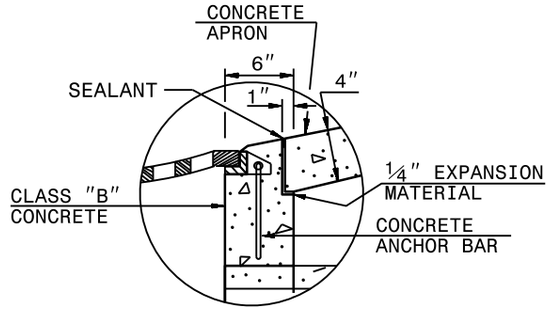
DRAWING NOT TO SCALE.




**SECTION X-X**

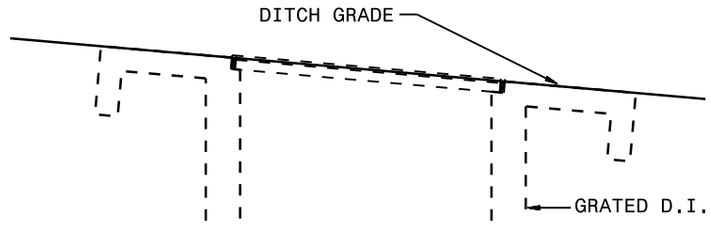


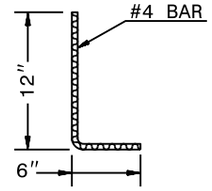

**SECTION Y-Y**




**DETAIL**

(APRON SUPPORT NOTCH)




**DOWEL "A"**

**MINIMUM DIMENSIONS AND QUANTITIES FOR CONCRETE GRATED DROP INLET**

| PIPE | SPAN | WIDTH | HEIGHT | CUBIC YARDS OF CONCRETE IN BOX | | | | DEDUCTIONS FOR ONE PIPE | |
|---|---|---|---|---|---|---|---|---|---|
| D | A | B | H | BOTTOM SLAB | H PER FT. HT. | H MIN. TOTAL | TOTAL | C.S. | R.C. |
| 12" | 3'-8" | 2'-0" | 1'-8" | 0.362 | 0.247 | 0.391 | 0.753 | 0.020 | 0.032 |
| 15" | 3'-8" | 2'-0" | 1'-11" | 0.362 | 0.247 | 0.453 | 0.815 | 0.023 | 0.036 |
| 18" | 3'-8" | 2'-0" | 2'-2" | 0.362 | 0.247 | 0.515 | 0.877 | 0.033 | 0.049 |
| 24" | 3'-8" | 2'-0" | 2'-8" | 0.362 | 0.247 | 0.659 | 1.021 | 0.059 | 0.085 |
| 30" | 3'-8" | 2'-0" | 3'-2" | 0.362 | 0.247 | 0.782 | 1.144 | 0.092 | 0.127 |
| 36" | 3'-8" | 2'-0" | 3'-8" | 0.362 | 0.247 | 0.906 | 1.268 | 0.132 | 0.178 |

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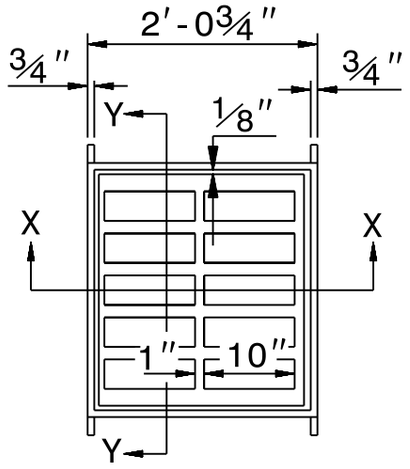
ROADWAY STANDARD DRAWING FOR

# CONCRETE GRATED DROP INLET TYPE 'D'

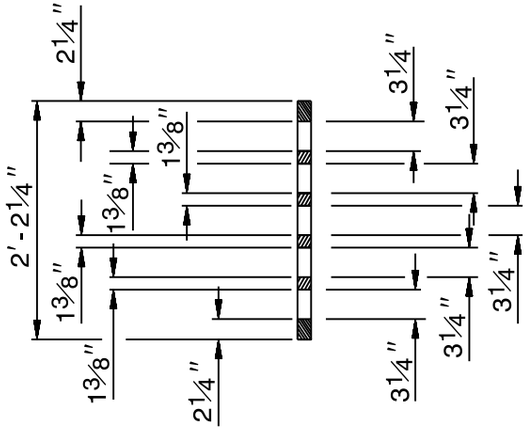
12" THRU 36" PIPE

SHEET 1 OF 1

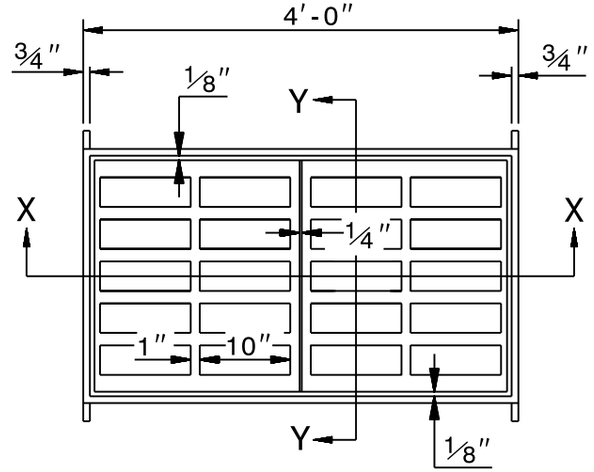
840.19



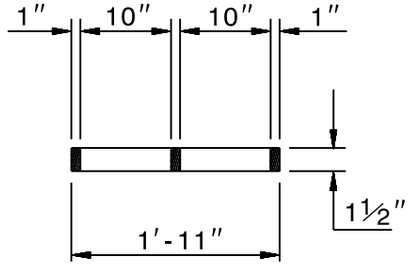

**PLAN**




**GRATE SECTION Y-Y**

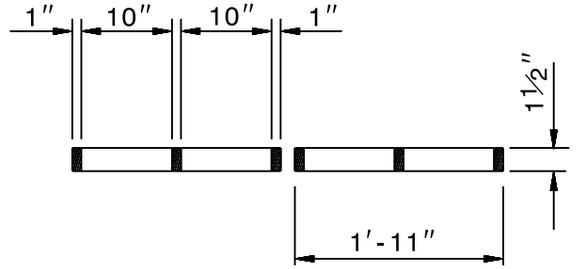



**PLAN**

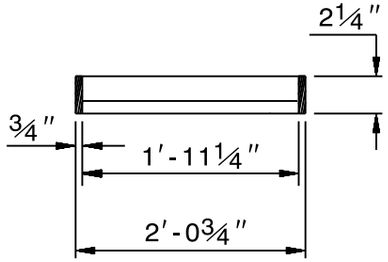



**GRATE SECTION X-X**

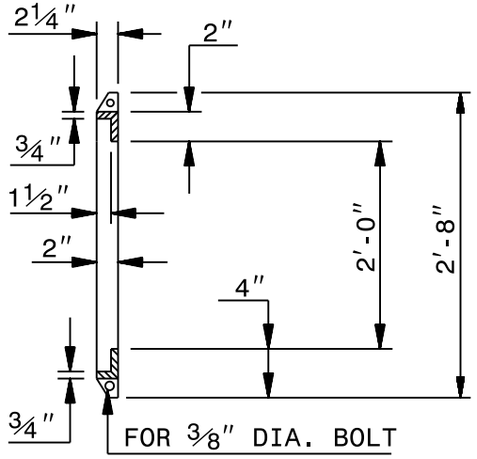
NOTE:
SEE STD. DWG. 840.25
FOR FRAME ANCHORAGE.



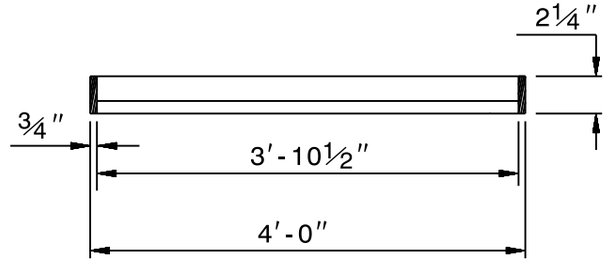

**GRATE SECTION X-X**




**FRAME SECTION X-X**




**FRAME SECTION Y-Y**




**FRAME SECTION X-X**

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RALEIGH, N.C.

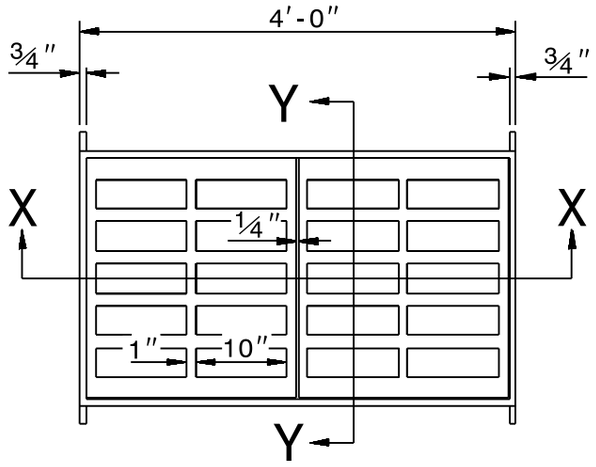
1-24

ROADWAY STANDARD DRAWING FOR

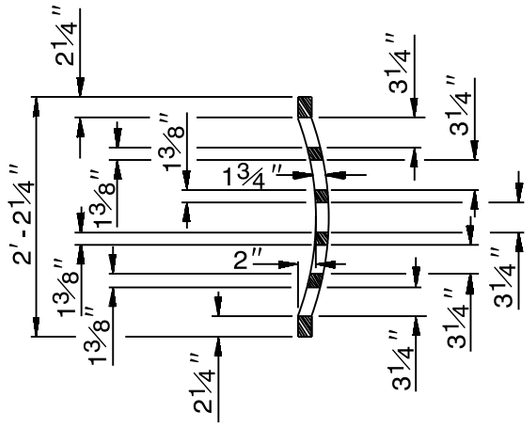
# FRAMES AND WIDE SLOT FLAT GRATES

SHEET 1 OF 1

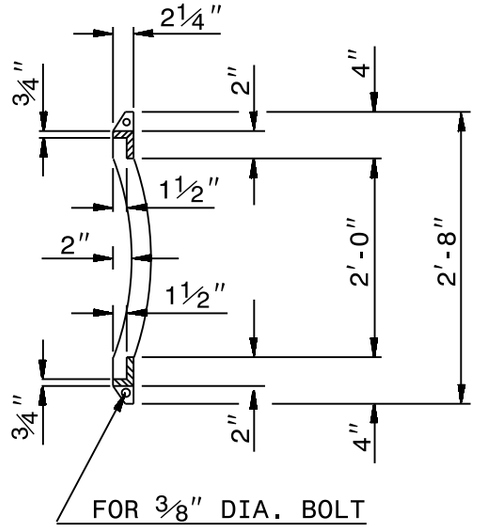
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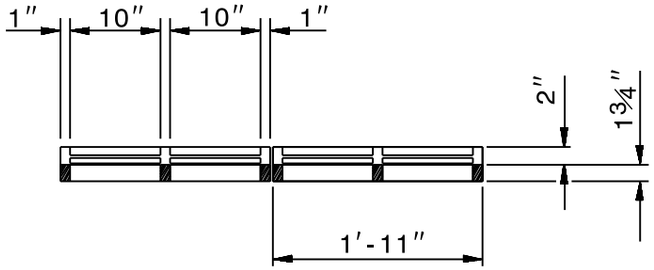

**PLAN**



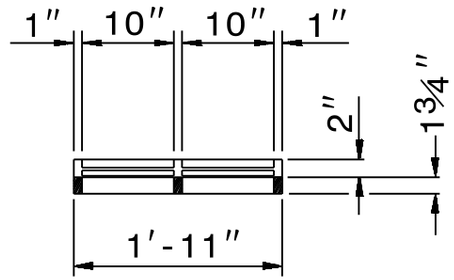

**GRATE SECTION Y-Y**



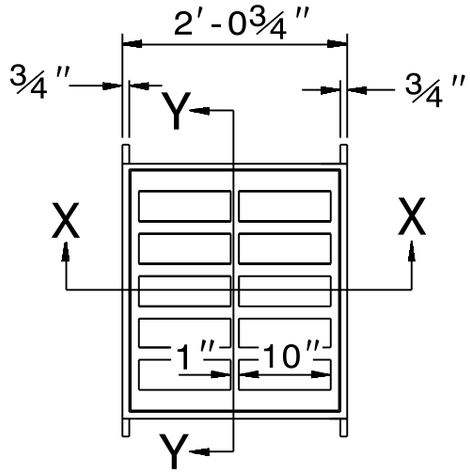

**FRAME SECTION Y-Y**



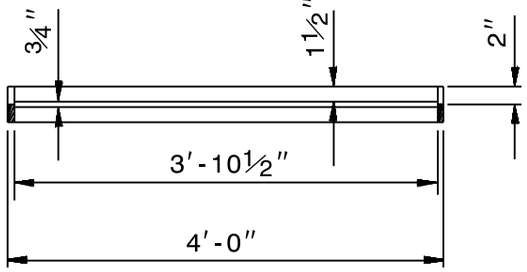

**GRATE SECTION X-X**



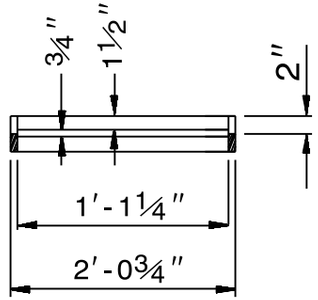

**GRATE SECTION X-X**




**PLAN**




**FRAME SECTION X-X**




**FRAME SECTION X-X**

NOTE:
SEE STD. DWG. 840.25
FOR FRAME ANCHORAGE.

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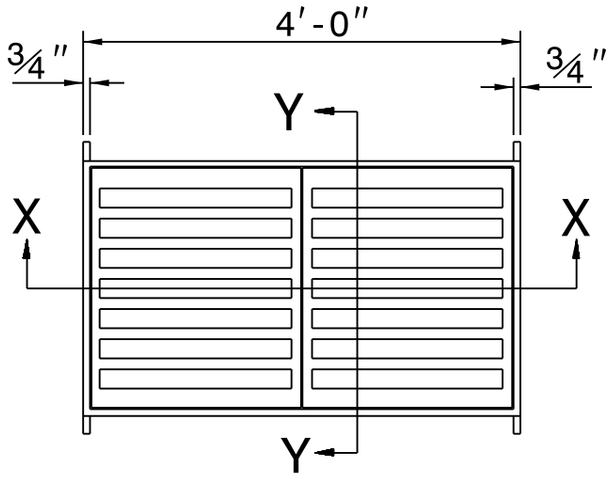
1-24

ROADWAY STANDARD DRAWING FOR

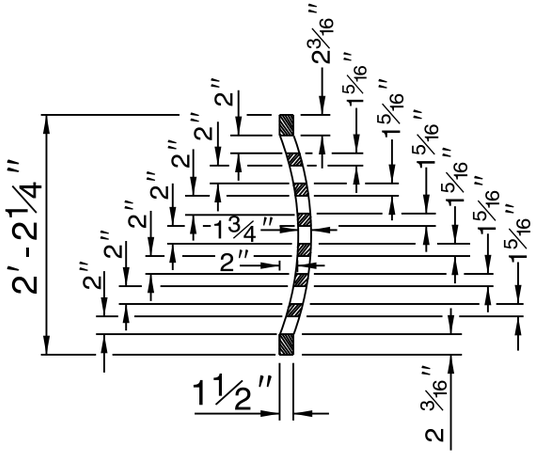
# FRAMES AND WIDE SLOT SAG GRATES

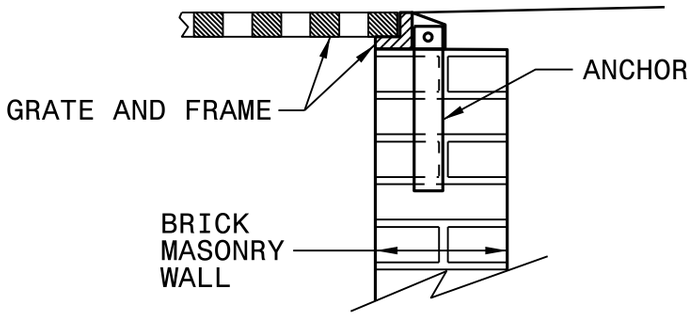
SHEET 1 OF 1

840.22

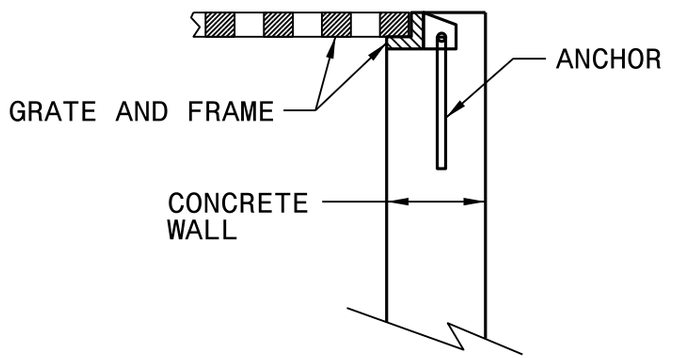



**PLAN**

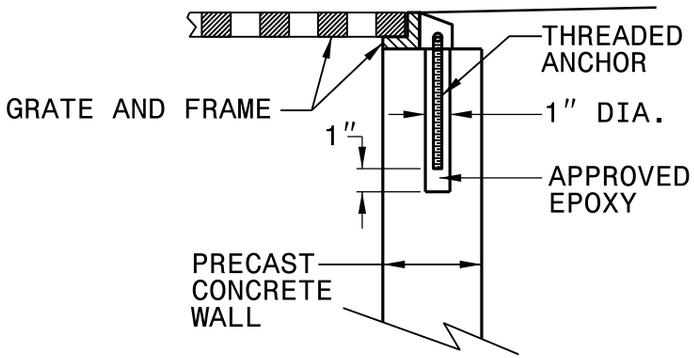

2′-2¼″
2″
2″
2




**BRICK MASONRY CONSTRUCTION**



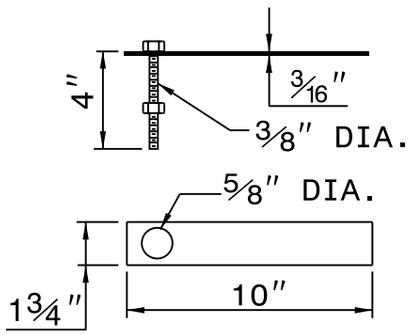

**CONCRETE CONSTRUCTION**




**PRECAST CONCRETE CONSTRUCTION**

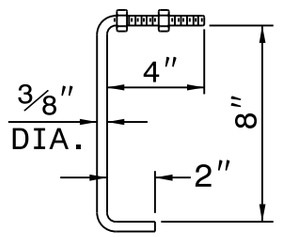
# DETAIL SHOWING ANCHORAGE OF FRAME FOR GRATED DROP INLET

NOTE:
CONSTRUCT GRATED DROP INLET TO COINCIDE WITH NORMAL OR SUPERELEVATED SHOULDER OR PAVEMENT SLOPE.



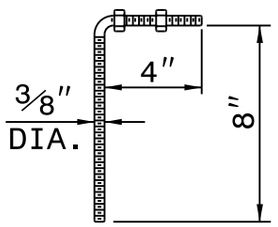

**MASONRY ANCHOR**

3/8″ DIA. BOLT WITH PLATE



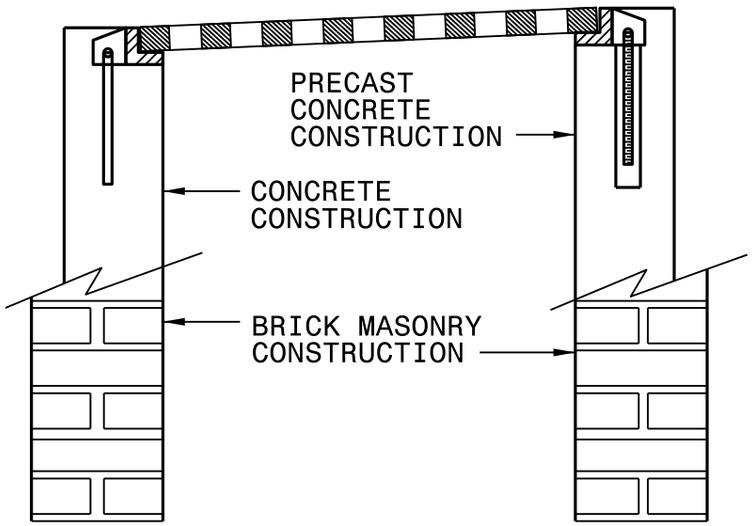

**CONCRETE ANCHOR**

3/8″ DIA. BENT BAR




**PRECAST CONCRETE ANCHOR**

3/8″ DIA. BENT BAR




**FRAME AND GRATE INSTALLATION FOR NORMAL CROWN AND SUPERELEVATED SECTIONS**

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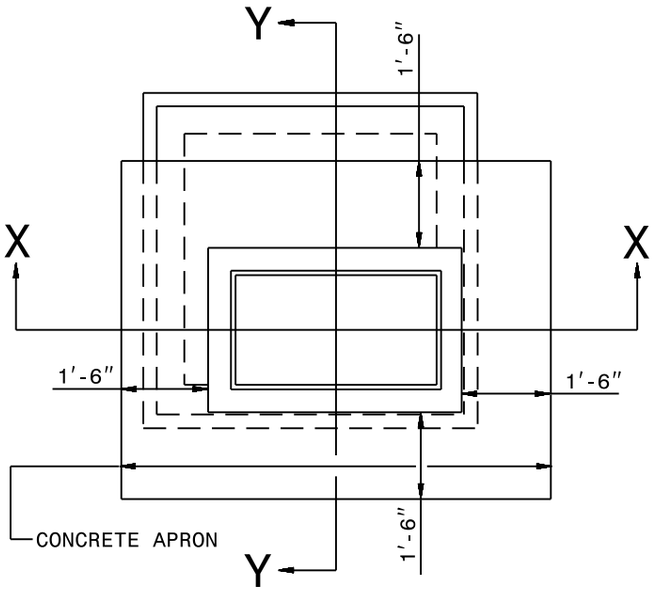
ROADWAY STANDARD DRAWING FOR

**ANCHORAGE FOR FRAMES**

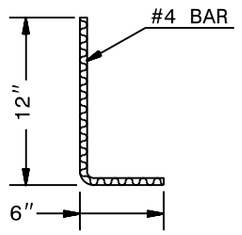
BRICK/CONCRETE/PRECAST CONCRETE

SHEET 1 OF 1

**840.25**




**PLAN**




**DOWEL-A**

GENERAL NOTES:

USE CLASS "B" CONCRETE THROUGHOUT.

JUMBO BRICK WILL BE PERMITTED. CONCRETE BRICK OR 4" SOLID CONCRETE BLOCKS MAY BE USED IN LIEU OF CLAY BRICKS.

PROVIDE ALL DROP INLETS OVER 3'-6" IN DEPTH WITH STEPS 12" ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.

USE #4 BAR DOWELS AT 12" CENTERS.

USE FORMS FOR THE CONSTRUCTION OF THE BOTTOM SLAB.

IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.

CONSTRUCT WITH PIPE CROWNS MATCHING.

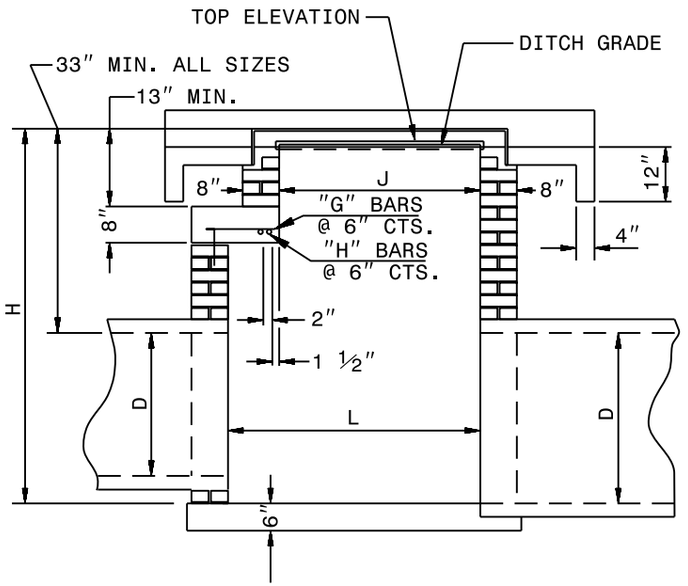
MAX. DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 12'-0". STANDARD DRAWING 840.45 CONTROLS MAXIMUM DEPTH IF PRECAST BOX IS USED.

USE STANDARD FRAMES AND GRATES 840.22 (SHOWN), 840.24(SHOWN), 840.20, 840.29, AND 840.33.

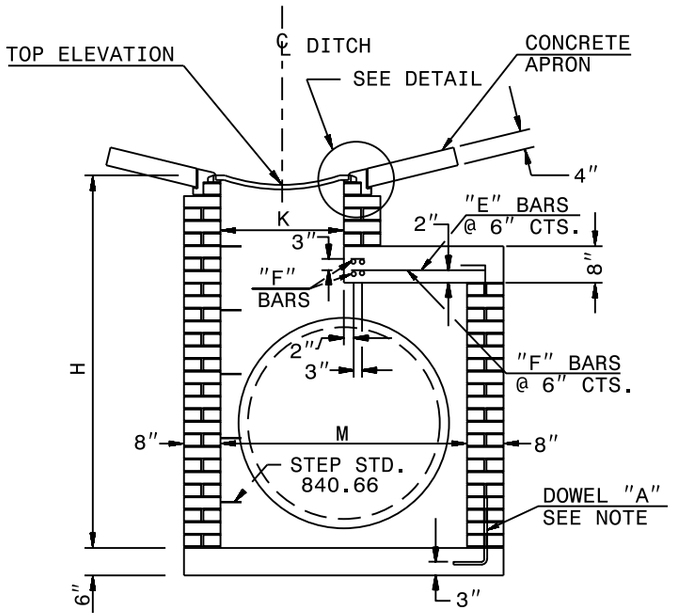
SEE STANDARD DRAWING 840.25 FOR ATTACHMENT OF FRAMES AND GRATES NOT SHOWN.

CHAMFER ALL EXPOSED CORNERS 1".

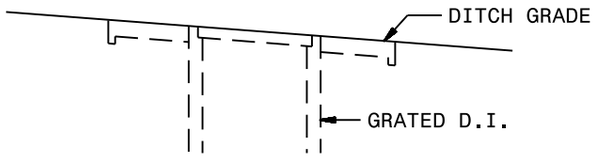
DRAWING NOT TO SCALE.

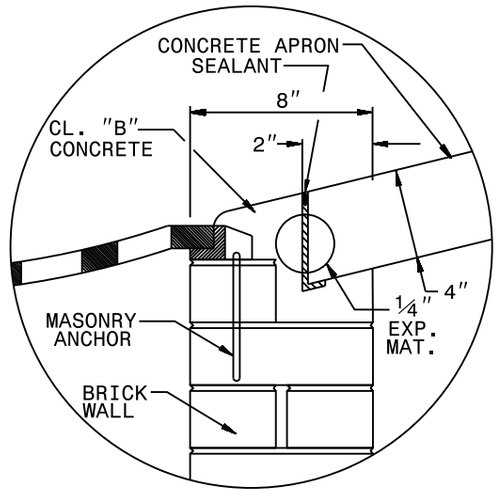



**SECTION X-X**




**SECTION Y-Y**




**DETAIL**

(APRON SUPPORT NOTCH)

STATE OF
NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

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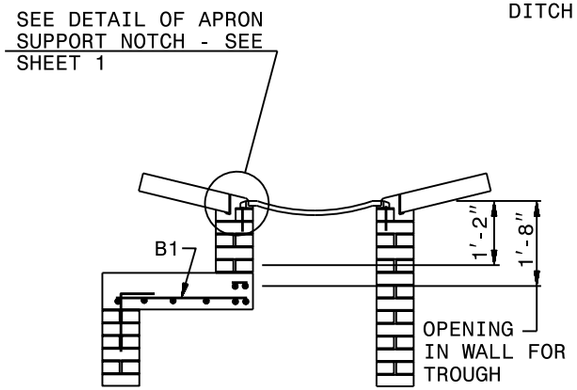
ROADWAY STANDARD DRAWING FOR

# BRICK GRATED DROP INLET TYPE 'A'

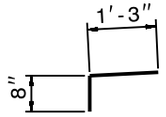
12" THRU 72" PIPE

SHEET 1 OF 2

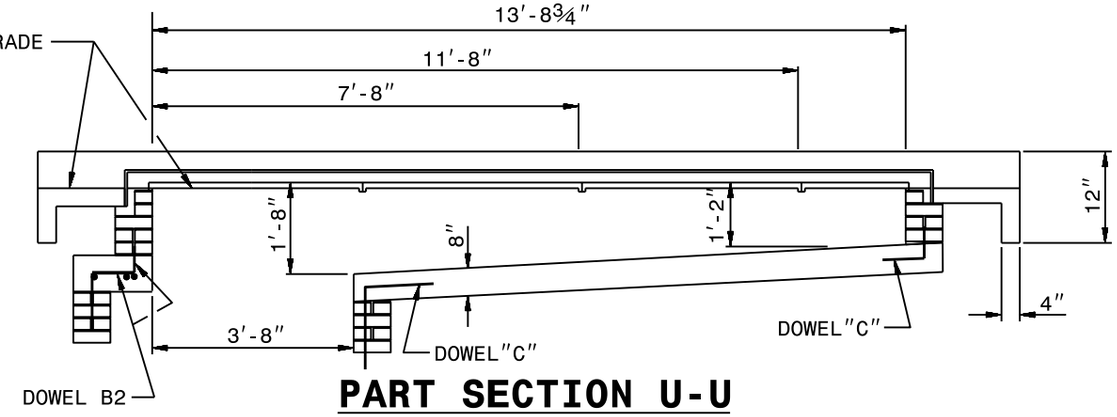
**840.26**



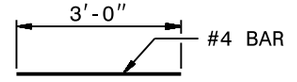

## PART SECTION V-V




## DOWEL-C

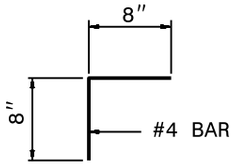



## PART SECTION U-U

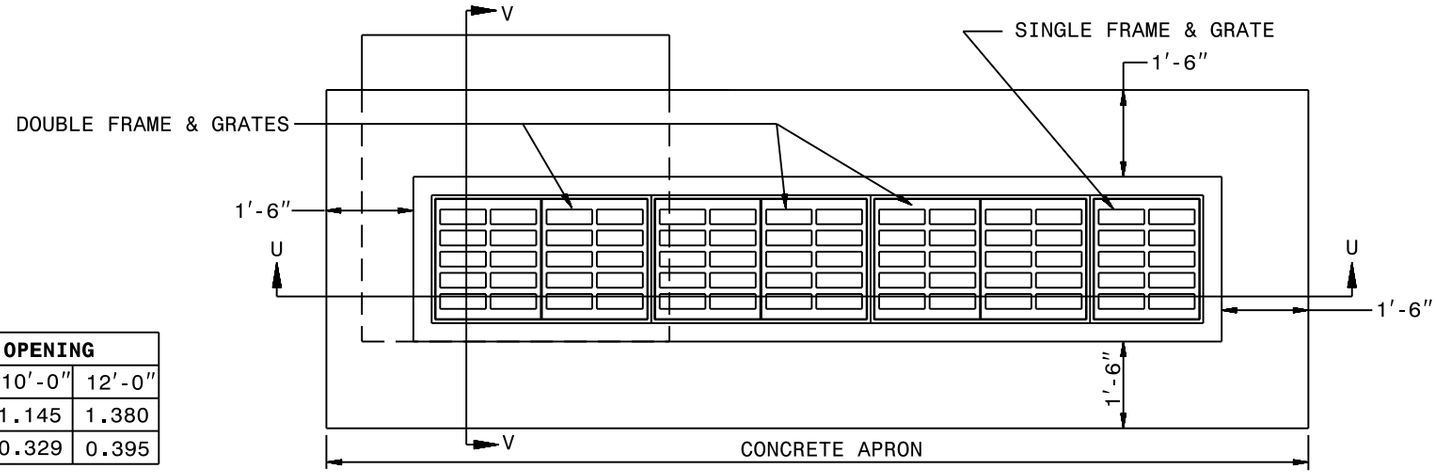



## DOWEL-B1

FOR 12" THRU 36" INLET




## DOWEL-B2




| QUANTITY TO BE ADDED FOR EACH 2' INCREMENT INLET OPENING | | | | | | |
|---|---|---|---|---|---|---|
| ADDITIONAL INLETS | 2'-0" | 4'-0" | 6'-0" | 8'-0" | 10'-0" | 12'-0" |
| CONCRETE CU. YDS. | 0.191 | 0.417 | 0.665 | 0.897 | 1.145 | 1.380 |
| CONCRETE APRON CU. YDS. | 0.065 | 0.132 | 0.198 | 0.263 | 0.329 | 0.395 |

**DIMENSIONS AND QUANTITIES FOR BRICK GRATED DROP INLET (BASED ON MIN. HEIGHT, H)**

| DIMENSIONS OF BOX AND PIPE | | | | | | REINFORCING STEEL - NO. 4 BARS | | | | | | | | | CU.YDS. CONC. IN BOX | | | | CU.YDS. BRICK MASONRY IN BOX | | BRICK AND CONC. | DEDUCTIONS FOR ONE PIPE | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PIPE | SPAN | WIDTH | SPAN | WIDTH | HEIGHT | BARS E | | BARS F | | BARS G | | BARS H | | TOTAL LBS. | TOP SLAB | BOTTOM SLAB | APRON | TOTAL | H TOTAL | H PER FT HT | TOTAL | C.S. | R.C. |
| D | J | K | L | M | H | NO. | LENGTH | NO. | LENGTH | NO. | LENGTH | NO. | LENGTH | | | | | | | | | | |
| 12" | 3'-8" | 2'-0" | 3'-8" | 2'-0" | 3'-9" | — | — | — | — | — | — | — | — | — | — | 0.308 | 0.351 | 0.659 | 1.301 | 0.346 ABOVE MIN H | 1.960 | 0.020 | 0.032 |
| 15" | 3'-8" | 2'-0" | 3'-8" | 2'-0" | 4'-0" | — | — | — | — | — | — | — | — | — | — | 0.308 | 0.351 | 0.659 | 1.407 | | 2.066 | 0.031 | 0.047 |
| 18" | | | | 2'-0" | 4'-3" | — | — | — | — | — | — | — | — | — | — | 0.308 | | 0.659 | 1.471 | | 2.130 | 0.044 | 0.065 |
| 24" | | | | 2'-10" | 4'-9" | 8 | 1'-3" | 6 | 4'-9" | — | — | — | — | 26 | 0.185 | 0.386 | | 0.922 | 1.646 | 0.346 | 2.568 | 0.078 | 0.113 |
| 30" | | | 3'-8" | 3'-5" | 5'-3" | 8 | 1'-10" | 7 | 4'-9" | — | — | — | — | 32 | 0.301 | 0.410 | | 1.062 | 1.936 | | 2.998 | 0.122 | 0.170 |
| 36" | | | 3'-10" | 3'-10" | 5'-9" | 8 | 2'-3" | 8 | 4'-10" | 4 | 0'-7" | 2 | 4'-11" | 46 | 0.374 | 0.494 | | 1.219 | 2.187 | | 3.406 | 0.176 | 0.238 |
| 42" | | | 4'-6" | 4'-6" | 6'-3" | 10 | 2'-11" | 9 | 5'-7" | | 1'-3" | 3 | 5'-7" | 68 | 0.555 | 0.630 | | 1.536 | 2.717 | | 4.253 | 0.240 | 0.323 |
| 48" | | | 5'-0" | 5'-0" | 6'-9" | 11 | 3'-5" | 10 | 6'-1" | | 1'-9" | 4 | 6'-1" | 87 | 0.705 | 0.743 | | 1.799 | 3.221 | H | 5.020 | 0.313 | 0.422 |
| 54" | | | 5'-6" | 5'-6" | 7'-3" | 12 | 3'-11" | 11 | 6'-7" | | 2'-3" | 5 | 6'-7" | 108 | 0.868 | 0.865 | | 2.084 | 3.786 | | 5.870 | 0.396 | 0.535 |
| 60" | | | 6'-2" | 6'-2" | 7'-9" | 13 | 4'-7" | 12 | 7'-3" | | 2'-11" | 6 | 7'-3" | 135 | 1.104 | 1.042 | | 2.497 | 4.701 | | 7.198 | 0.489 | 0.660 |
| 66" | | | 6'-9" | 6'-9" | 8'-3" | 14 | 5'-2" | 14 | 7'-10" | | 3'-6" | 7 | 7'-10" | 168 | 1.328 | 1.210 | | 2.889 | 5.189 | | 8.078 | 0.591 | 0.798 |
| 72" | 3'-8" | 2'-0" | 7'-4" | 7'-4" | 8'-9" | 15 | 5'-9" | 15 | 8'-5" | 4 | 4'-1" | 8 | 8'-5" | 198 | 1.569 | 1.391 | 0.351 | 3.311 | 5.954 | 0.346 | 8.905 | 0.704 | 0.950 |

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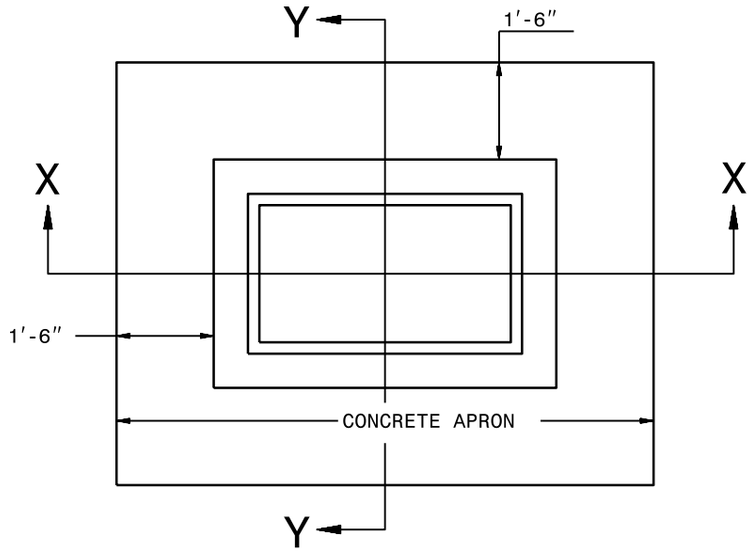
ROADWAY STANDARD DRAWING FOR

# BRICK GRATED DROP INLET TYPE 'A'

12" THRU 72" PIPE

SHEET 2 OF 2

840.26




**PLAN**

GENERAL NOTES:

USE CLASS "B" CONCRETE THROUGHOUT.

JUMBO BRICK WILL BE PERMITTED. CONCRETE BRICK OR 4″ SOLID CONCRETE BLOCKS MAY BE USED IN LIEU OF CLAY BRICKS.

PROVIDE ALL DROP INLETS OVER 3′-6″ IN DEPTH WITH STEPS 12″ ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.

USE #4 BAR DOWELS AT 12″ CENTERS.

USE FORMS FOR THE CONSTRUCTION OF THE BOTTOM SLAB.

IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.

CONSTRUCT WITH PIPE CROWNS MATCHING.

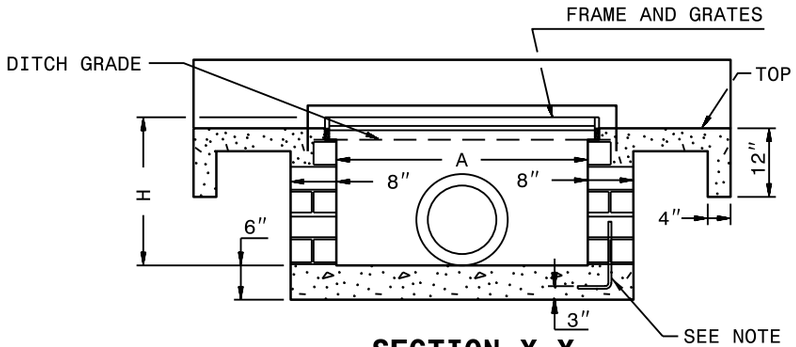
MAX. DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 12′-0″. STANDARD DRAWING 840.45 CONTROLS MAXIMUM DEPTH IF PRECAST BOX IS USED.

USE STANDARD FRAMES AND GRATES 840.22 (SHOWN), 840.24(SHOWN), 840.20, 840.29, AND 840.33.

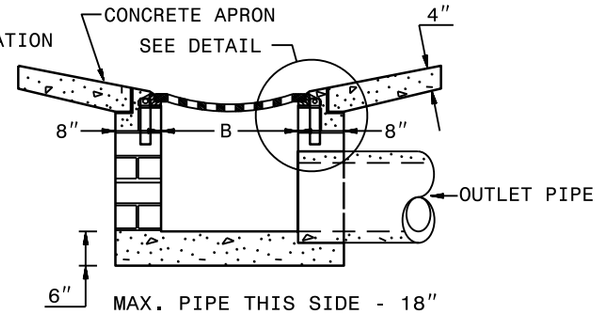
SEE STANDARD DRAWING 840.25 FOR ATTACHMENT OF FRAMES AND GRATES NOT SHOWN.

CHAMFER ALL EXPOSED CORNERS 1″.

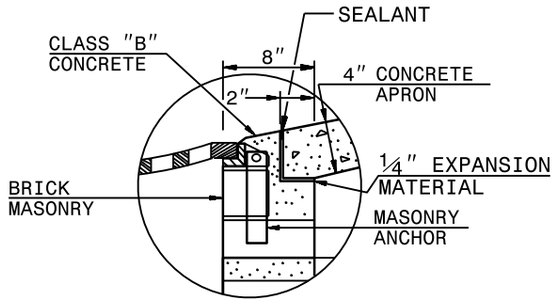
DRAWING NOT TO SCALE.




**SECTION X-X**

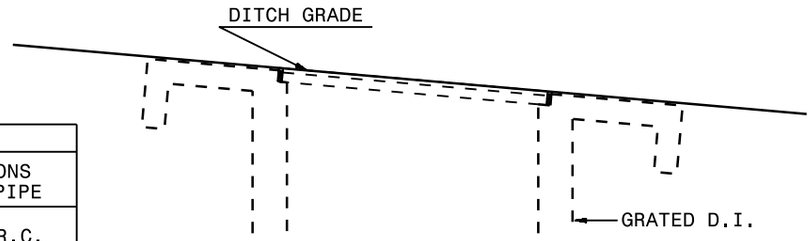


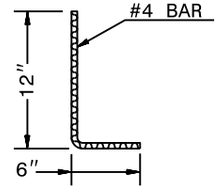

**SECTION Y-Y**




**DETAIL**

(APRON SUPPORT NOTCH)




**DOWEL "A"**

**MINIMUM DIMENSIONS AND QUANTITIES FOR BRICK GRATED DROP INLET**

| PIPE | SPAN | WIDTH | HEIGHT | CU. YD. OF CONC IN BOX | CU. YD. OF BRICK MASONRY IN BOX | | TOTAL CU. YD. IN BOX | DEDUCTIONS FOR ONE PIPE | |
|---|---|---|---|---|---|---|---|---|---|
| D | A | B | H | BOTTOM SLAB | H PER FT. HT. | TOTAL H | | C.S. | R.C. |
| 12″ | 3′-8″ | 2′-0″ | 2′-6″ | 0.309 | 0.346 | 0.836 | 1.145 | 0.020 | 0.032 |
| 15″ | 3′-8″ | 2′-0″ | 2′-9″ | 0.309 | 0.346 | 0.923 | 1.232 | 0.023 | 0.036 |
| 18″ | 3′-8″ | 2′-0″ | 3′-0″ | 0.309 | 0.346 | 1.009 | 1.318 | 0.033 | 0.049 |
| 24″ | 3′-8″ | 2′-0″ | 3′-6″ | 0.309 | 0.346 | 1.211 | 1.520 | 0.059 | 0.085 |
| 30″ | 3′-8″ | 2′-0″ | 4′-0″ | 0.309 | 0.346 | 1.384 | 1.693 | 0.092 | 0.127 |
| 36″ | 3′-8″ | 2′-0″ | 4′-6″ | 0.309 | 0.346 | 1.557 | 1.866 | 0.132 | 0.178 |

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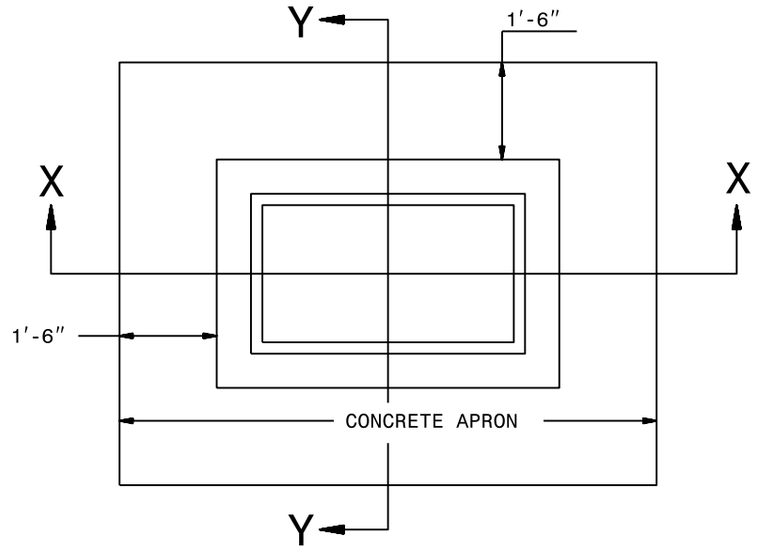
ROADWAY STANDARD DRAWING FOR

# BRICK GRATED DROP INLET TYPE 'B'

12″ THRU 36″ PIPE

SHEET 1 OF 1

840.27




**PLAN**

GENERAL NOTES:

USE CLASS "B" CONCRETE THROUGHOUT.

JUMBO BRICK WILL BE PERMITTED. CONCRETE BRICK OR 4″ SOLID CONCRETE BLOCKS MAY BE USED IN LIEU OF CLAY BRICKS.

PROVIDE ALL DROP INLETS OVER 3′-6″ IN DEPTH WITH STEPS 12″ ON CENTER. USE STEPS WHICH COMPLY WITH STD. DRAWING 840.66.

USE #4 BAR DOWELS AT 12″ CENTERS.

USE FORMS FOR THE CONSTRUCTION OF THE BOTTOM SLAB.

IF REINFORCED CONCRETE PIPE IS SET IN BOTTOM SLAB OF BOX, ADD TO SLAB AS SHOWN ON STD. NO. 840.00.

CONSTRUCT WITH PIPE CROWNS MATCHING.

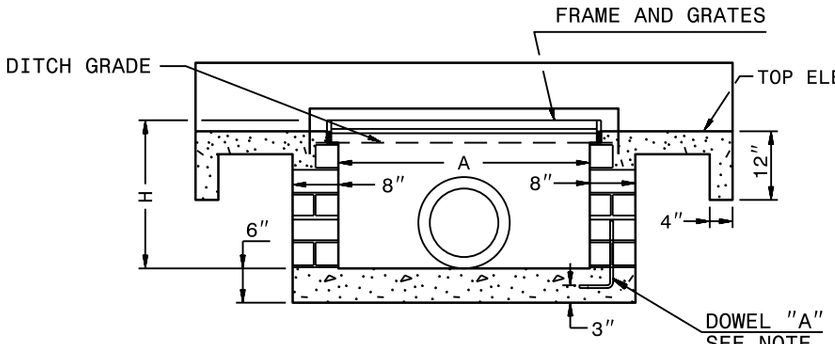
MAX. DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 12′-0″. STANDARD DRAWING 840.45 CONTROLS MAXIMUM DEPTH IF PRECAST BOX IS USED.

USE STANDARD FRAMES AND GRATES 840.22 (SHOWN), 840.24(SHOWN), 840.20, 840.29, AND 840.33.

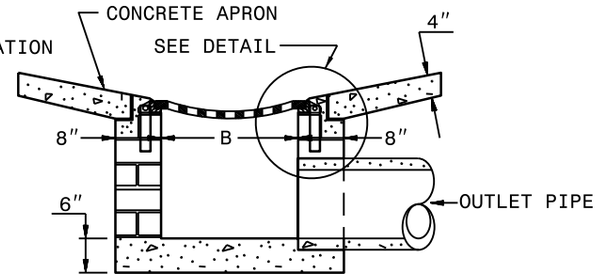
SEE STANDARD DRAWING 840.25 FOR ATTACHMENT OF FRAMES AND GRATES NOT SHOWN.

CHAMFER ALL EXPOSED CORNERS 1″.

DRAWING NOT TO SCALE.

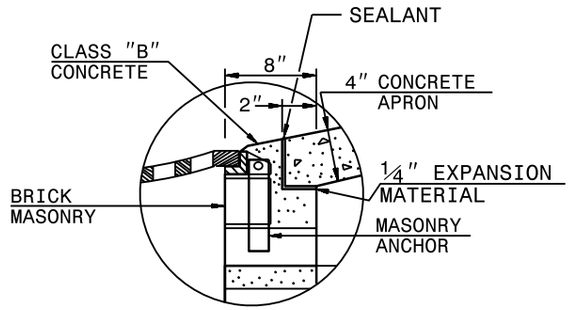



**SECTION X-X**



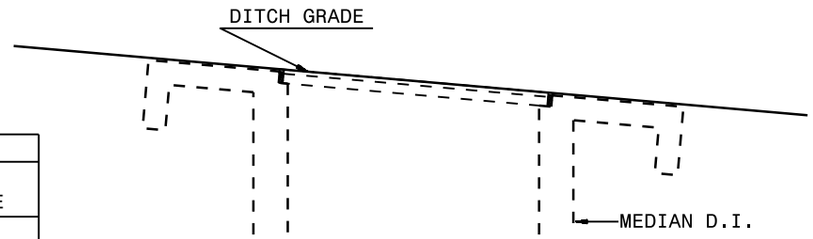

MAX. PIPE THIS SIDE - 18″

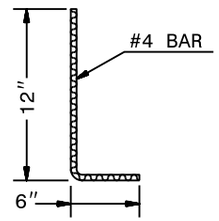
**SECTION Y-Y**




**DETAIL**

(APRON SUPPORT NOTCH)




**DOWEL "A"**

**MINIMUM DIMENSIONS AND QUANTITIES FOR BRICK GRATED DROP INLET**

| PIPE | SPAN | WIDTH | HEIGHT | CU. YD. OF CONC IN BOX | CU. YD. OF BRICK MASONRY IN BOX | | TOTAL CU. YD. IN BOX | DEDUCTIONS FOR ONE PIPE | |
|---|---|---|---|---|---|---|---|---|---|
| D | A | B | H | BOTTOM SLAB | H PER FT. HT. | TOTAL H | | C.S. | R.C. |
| 12″ | 3′-8″ | 2′-0″ | 1′-8″ | 0.309 | 0.346 | 0.548 | 0.857 | 0.020 | 0.032 |
| 15″ | 3′-8″ | 2′-0″ | 1′-11″ | 0.309 | 0.346 | 0.634 | 0.943 | 0.023 | 0.036 |
| 18″ | 3′-8″ | 2′-0″ | 2′-2″ | 0.309 | 0.346 | 0.721 | 1.030 | 0.033 | 0.049 |
| 24″ | 3′-8″ | 2′-0″ | 2′-8″ | 0.309 | 0.346 | 0.923 | 1.232 | 0.059 | 0.085 |
| 30″ | 3′-8″ | 2′-0″ | 3′-2″ | 0.309 | 0.346 | 1.096 | 1.405 | 0.092 | 0.127 |
| 36″ | 3′-8″ | 2′-0″ | 3′-8″ | 0.309 | 0.346 | 1.269 | 1.578 | 0.132 | 0.178 |

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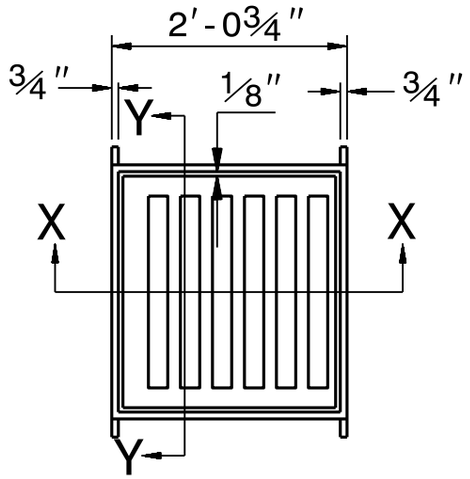
ROADWAY STANDARD DRAWING FOR

# BRICK GRATED DROP INLET TYPE 'D'

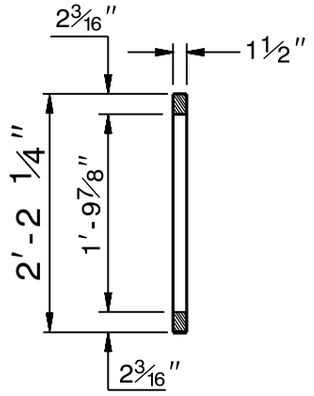
12″ THRU 36″ PIPE

SHEET 1 OF 1

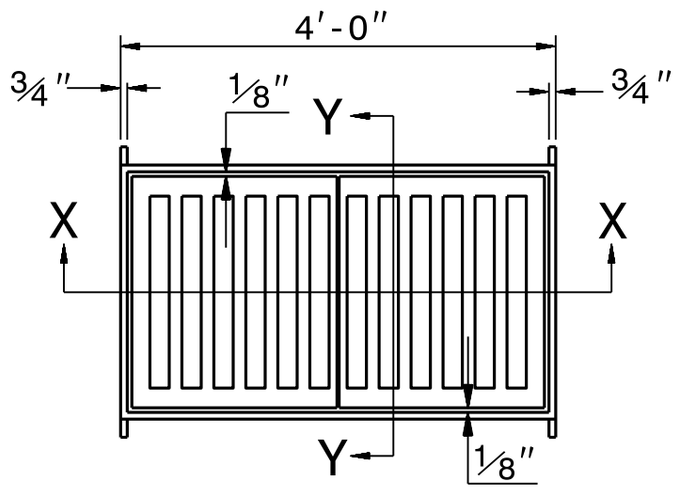
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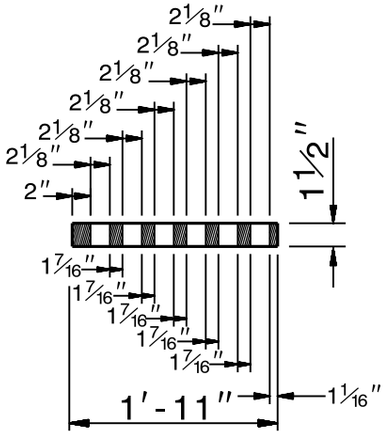

**PLAN**




**GRATE ELEVATION Y-Y**

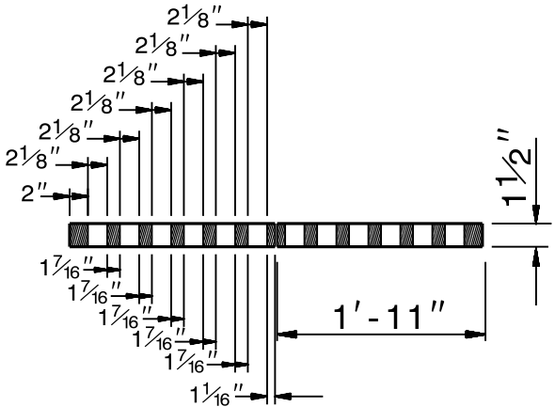



**PLAN**

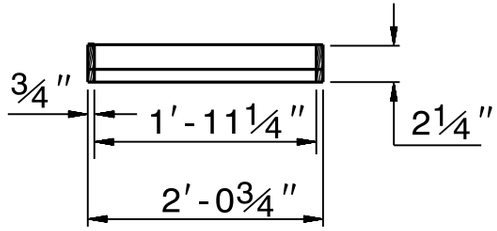



**GRATE ELEVATION X-X**

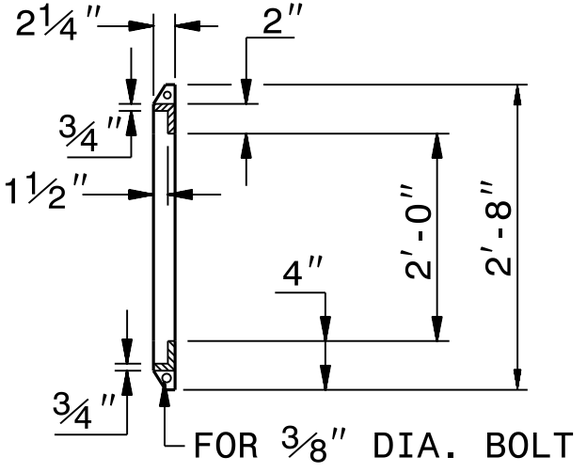
NOTE:
SEE STD. DWG. 840.25
FOR FRAME ANCHORAGE.



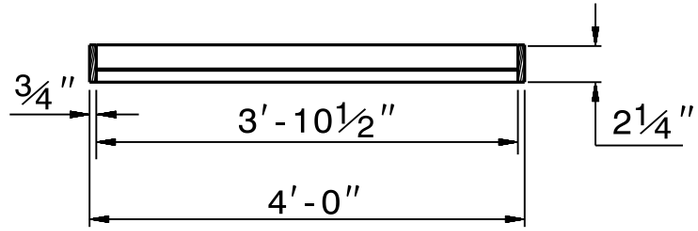

**GRATE SECTION X-X**




**FRAME ELEVATION X-X**




**FRAME ELEVATION Y-Y**




**FRAME SECTION X-X**

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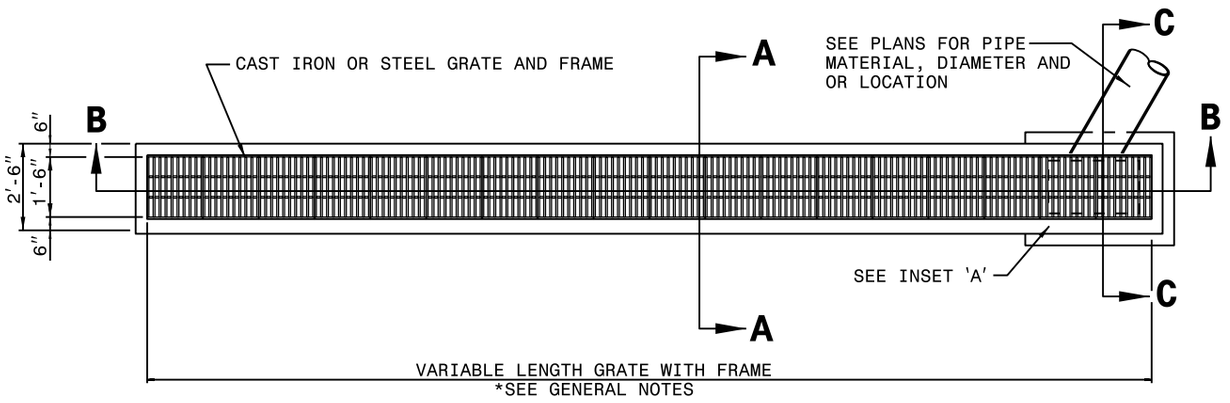
1-24

ROADWAY STANDARD DRAWING FOR

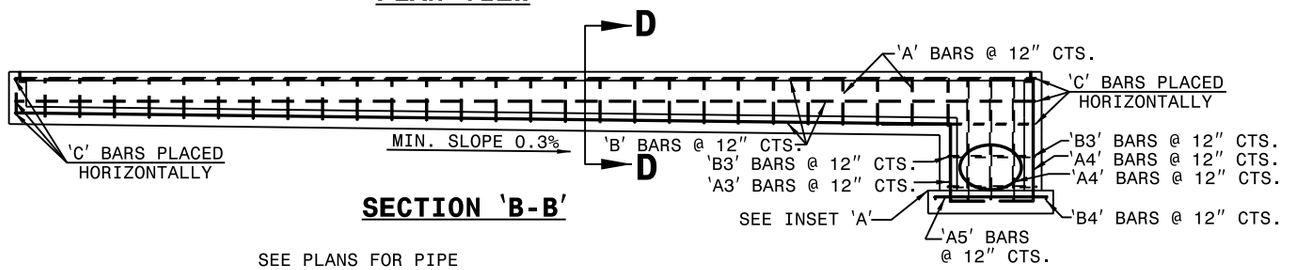
# FRAMES AND NARROW SLOT FLAT GRATES

SHEET 1 OF 1

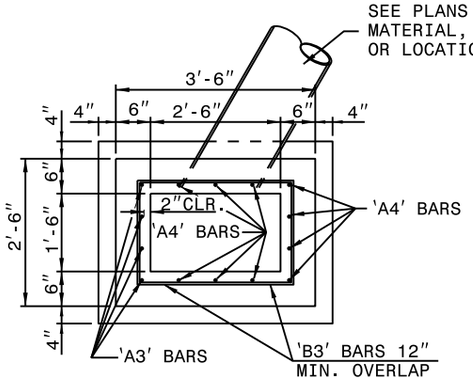
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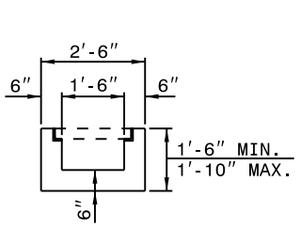

**PLAN VIEW**



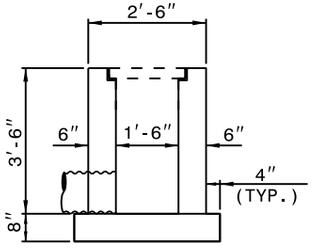

**SECTION 'B-B'**



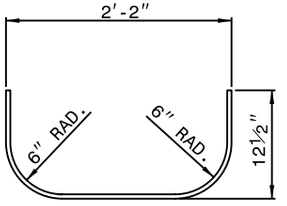

**INSET 'A'**



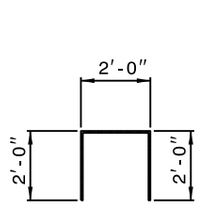

**SECTION 'A-A'**



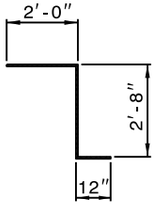

**SECTION 'C-C'**



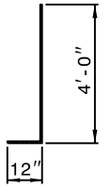

**A**



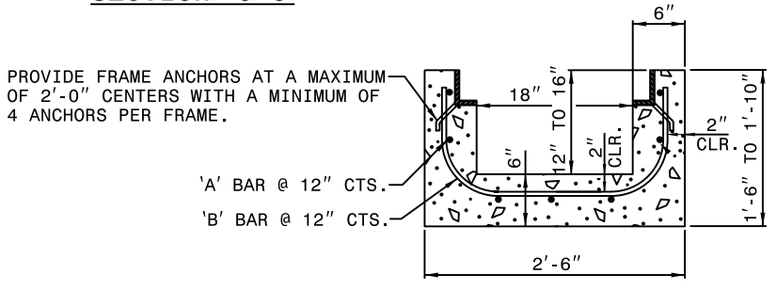

**B3**




**A3**




**A4**




**SECTION 'D-D'**

GENERAL NOTES:

ALL MASONRY COMPONENTS OF THIS DRAINAGE DEVICE (EXCLUDING PIPE) ARE TO BE CONSTRUCTED WITH CLASS 'B' CONCRETE AND PAID FOR AT THE CONTRACT UNIT PRICE PER EACH FOR MASONRY DRAINAGE STRUCTURES.

* PAY FOR THE GRATE AND FRAME FOR THE DRIVEWAY DROP INLET AT THE CONTRACT UNIT PRICE PER LINEAR FOOT FOR GRATE WITH FRAME, DRIVEWAY DROP INLET. FABRICATE THE GRATE SECTION(S) TO FIT THE OPENING INDICATED IN THE PLANS.

THE CONTRACTOR MAY, AT HIS OPTION, SHORTEN LENGTHS FOR BARS 'B' AND LAP THEM TO OBTAIN THE PROPER LENGTH OF BARS. DO NOT OVERLAP BARS LESS THAN 1'-6" LONG.

INCLUDE THE COST OF ALL REINFORCING STEEL IN THE CONTRACT UNIT PRICE PER EACH FOR MASONRY DRAINAGE STRUCTURES.

DESIGN THE GRATES TO MEET HS-20 LOADING.

PROVIDE GRATES WITH A MINIMUM CLEAR WATERWAY OPENING OF 50in$^2$ PER 1'-0" LENGTH OF GRATE.

ADDITIONAL PER LINEAR FOOT QUANTITIES MAY BE USED TO ADJUST QUANTITIES FOR LENGTH INCREASE OR DECREASE AS INDICATED BY THE PLANS (SEE CHART BELOW).

## BILL OF MATERIAL

QUANTITIES BASED ON 30' GRATE LENGTH

| BAR | NO. | SIZE | LENGTH | WEIGHT |
|---|---|---|---|---|
| A | 28 | 5 | 3'-11" | 114.4 |
| A3 | 4 | 5 | 5'-8" | 23.6 |
| A4 | 10 | 5 | 5'-0" | 52.2 |
| A5 | 4 | 5 | 3'-10" | 16.0 |
| B | 7 | 5 | 30'-0" | 219.0 |
| | | | | |
| B3 | 6 | 5 | 6'-0" | 37.5 |
| B4 | 5 | 5 | 2'-10" | 14.8 |
| C | 6 | 5 | 2'-0" | 12.5 |
| | | | | |
| TOTAL REINF. STEEL lbs. | | | | 490.0 |
| CLASS 'B' CONC. cu. yds. | | | | 3.30 |
| ADDITIONAL CONCRETE PER FT. IN CU. YDS. OVER 3'-6" | | | | 0.22 |
| | | | | |
| PER LINEAR FOOT QUANTITY ADJUSTMENTS FOR DRAINAGE STRUCTURES DEVIATING FROM THE 30' GRATE LENGTH | | | | |
| A | 1 | 5 | 3'-11" | 4.1 |
| B | 7 | 5 | 1'-0" | 7.3 |
| CLASS 'B' CONC. cu. yds. | | | | 0.10 |
| | | | | |

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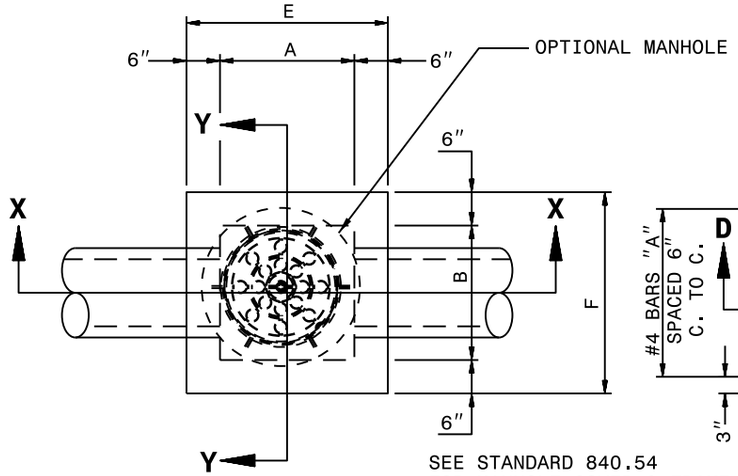
1-24

ROADWAY STANDARD DRAWING FOR

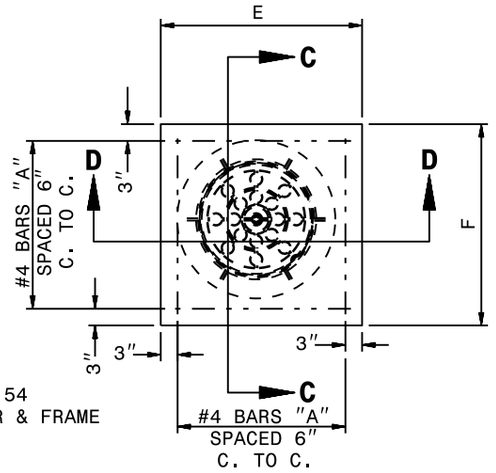
# DRIVEWAY DROP INLET

SHEET 1 OF 1

840.30




## PLAN




GENERAL NOTES:

CHAMFER ALL EXPOSED CORNERS 1″.

USE CLASS "B" CONCRETE THROUGHOUT.

OPTIONAL CONSTRUCTION - MONOLITHIC POUR, 2″ KEYWAY, OR #4 BAR DOWELS AT 12″ CENTERS AS DIRECTED BY THE ENGINEER.

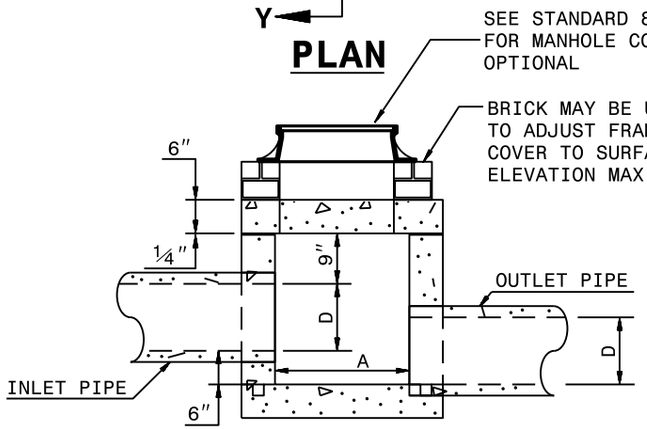
USE FORMS TO CONSTRUCT THE BOTTOM SLAB.

IF REINFORCED CONCRETE PIPE IS SET IN BASE SLAB OF BOX, ADD TO BASE AS SHOWN ON STANDARD NO. 840.00.

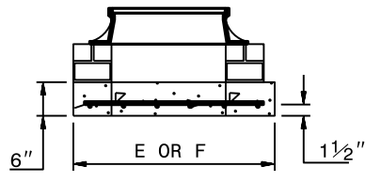
PROVIDE ALL JUNCTION BOXES OVER 3′-6″ IN DEPTH WITH STEPS 12″ ON CENTERS IN ACCORDANCE WITH STD. NO. 840.66.

ADJUST THE STEEL, CONCRETE AND BRICK MASONRY QUANTITIES TO INCLUDE THE ADDITION OF THE MANHOLE (I.E. DIAGONAL BARS SHORTENED AROUND OPENING IN TOP SLAB, ADDITIONAL VARIABLE HEIGHT BRICK MASONRY, OPENING IN TOP SLAB.)

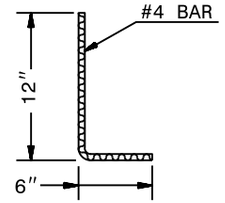
MAX. DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 12′-0″. STANDARD DRAWING 840.45 OR 840.46 CONTROLS MAXIMUM DEPTH IF PRECAST BOX IS USED.



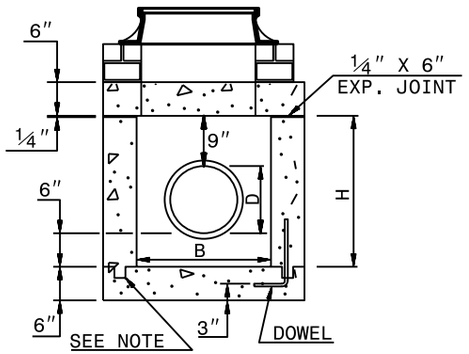

## SECTION X-X




## SECTION C-C OR D-D




## DOWEL




## SECTION Y-Y

**DIMENSIONS AND QUANTITIES FOR CONCRETE JUNCTION BOXES**

| DIMENSIONS OF BOX AND PIPE | | | | REINFORCEMENT BARS "A" | | TOP SLAB DIMENSIONS | | CUBIC YARDS IN BOX | | | TOTAL QUANTITIES BOX AND SLABS | | DEDUCTIONS FOR ONE PIPE CU.YDS. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PIPE | SPAN | WIDTH | HEIGHT | | | | | | | | | | | |
| D | A | B | H | NO. | LENGTH | E | F | TOP SLAB | BOTTOM SLAB | WALL/ FT. OF HT. | LBS. REINF | CU. YDS. MIN. "H" | C.S. | R.C. |
| 12″ | 2′-0″ | 2′-0″ | 2′-3″ | 12 | 2′-9″ | 3′-0″ | 3′-0″ | 0.167 | 0.167 | 0.185 | 22 | 0.750 | 0.015 | 0.024 |
| 15″ | 2′-3″ | 2′-3″ | 2′-6″ | 12 | 3′-0″ | 3′-3″ | 3′-3″ | 0.196 | 0.196 | 0.204 | 24 | 0.902 | 0.023 | 0.036 |
| 18″ | 2′-6″ | 2′-6″ | 2′-9″ | 14 | 3′-3″ | 3′-6″ | 3′-6″ | 0.227 | 0.227 | 0.222 | 30 | 1.065 | 0.033 | 0.049 |
| 24″ | 3′-0″ | 3′-0″ | 3′-3″ | 16 | 3′-9″ | 4′-0″ | 4′-0″ | 0.296 | 0.296 | 0.259 | 40 | 1.434 | 0.059 | 0.085 |
| 30″ | 3′-6″ | 3′-6″ | 3′-9″ | 18 | 4′-3″ | 4′-6″ | 4′-6″ | 0.375 | 0.375 | 0.296 | 51 | 1.860 | 0.092 | 0.127 |
| 36″ | 4′-0″ | 4′-0″ | 4′-3″ | 20 | 4′-9″ | 5′-0″ | 5′-0″ | 0.463 | 0.463 | 0.333 | 64 | 2.341 | 0.132 | 0.178 |
| 42″ | 4′-6″ | 4′-6″ | 4′-9″ | 22 | 5′-3″ | 5′-6″ | 5′-6″ | 0.560 | 0.560 | 0.370 | 77 | 2.878 | 0.180 | 0.243 |
| 48″ | 5′-4″ | 5′-4″ | 5′-3″ | 26 | 6′-3″ | 6′-4″ | 6′-4″ | 0.743 | 0.743 | 0.407 | 111 | 3.623 | 0.235 | 0.317 |
| 54″ | 5′-10″ | 5′-10″ | 5′-9″ | 28 | 6′-7″ | 6′-10″ | 6′-10″ | 0.865 | 0.865 | 0.444 | 126 | 4.283 | 0.297 | 0.401 |
| 60″ | 6′-6″ | 6′-6″ | 6′-3″ | 30 | 7′-3″ | 7′-6″ | 7′-6″ | 1.042 | 1.042 | 0.481 | 145 | 5.090 | 0.367 | 0.495 |
| 66″ | 7′-1″ | 7′-1″ | 6′-9″ | 32 | 7′-10″ | 8′-1″ | 8′-1″ | 1.210 | 1.210 | 0.518 | 169 | 5.917 | 0.444 | 0.589 |

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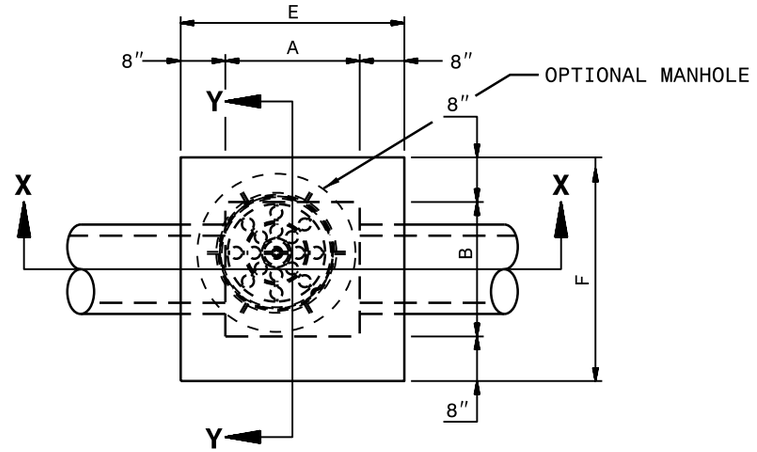
ROADWAY STANDARD DRAWING FOR

# CONCRETE JUNCTION BOX

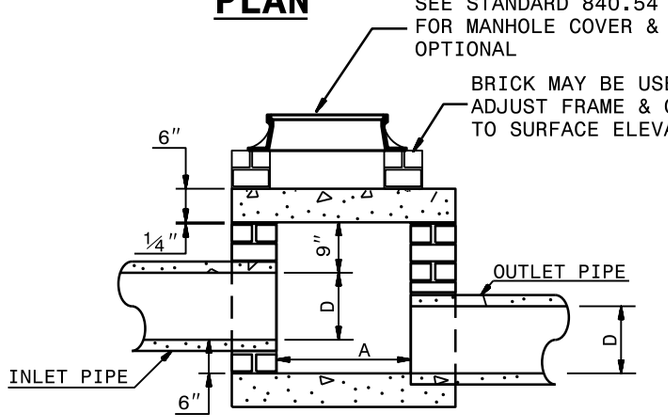
12″ THRU 66″ PIPE

SHEET 1 OF 1

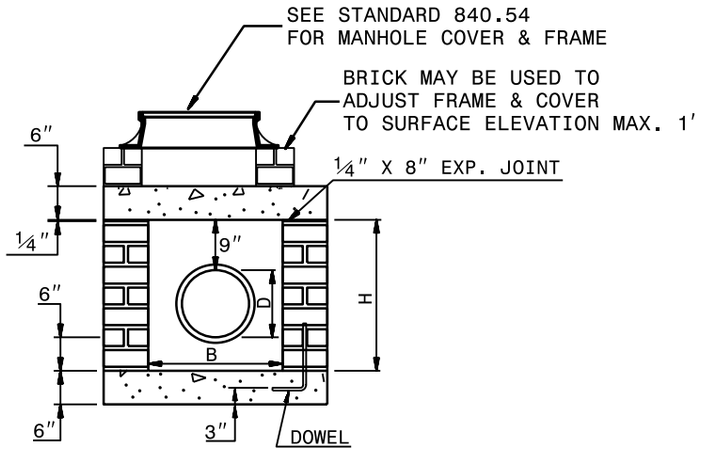
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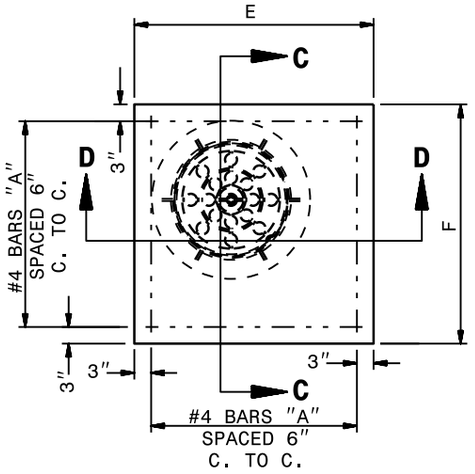

## PLAN

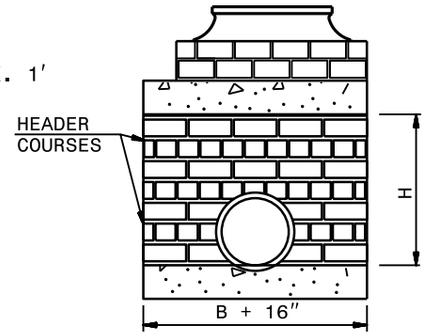



## SECTION X-X




## SECTION Y-Y




## OUTLET ELEVATION

GENERAL NOTES:

CHAMFER ALL EXPOSED CORNERS 1″.

USE CLASS "B" CONCRETE THROUGHOUT.

USE #4 BAR DOWELS AT 12″ CENTERS.

MORTAR JOINTS ½″ ± ⅛″ THICK.

CONCAVE TOO ALL EXPOSED JOINTS.

USE FORMS TO CONSTRUCT THE BOTTOM SLAB.

JUMBO BRICK WILL BE PERMITTED. CONCRETE BRICK OR 4″ SOLID CONCRETE BLOCKS MAY BE USED IN LIEU OF CLAY BRICK.

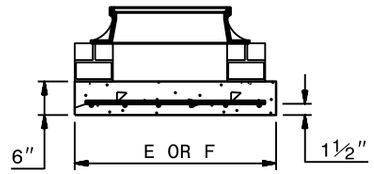
FOR 8′-0″ IN HEIGHT OR LESS, USE 8″ WALL. OVER 8′-0″ IN HEIGHT, USE 12″ WALL TO 6′-0″ FROM TOP OF WALL, AND 8″ WALL FOR THE REMAINING 6′-0″. ADJUST DIMENSIONS AND QUANTITIES ACCORDINGLY.

IF REINFORCED CONCRETE PIPE IS SET IN BASE SLAB OF BOX, ADD TO BASE AS SHOWN ON STANDARD NO. 840.00.

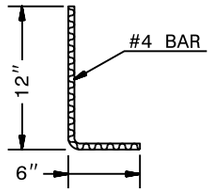
PROVIDE ALL JUNCTION BOXES OVER 3′-6″ IN DEPTH WITH STEPS 12″ ON CENTERS IN ACCORDANCE WITH STD. NO. 840.66.

ADJUST THE STEEL, CONCRETE AND BRICK MASONRY QUANTITIES TO INCLUDE THE ADDITION OF THE MANHOLE (I.E. DIAGONAL BARS SHORTENED AROUND OPENING IN TOP SLAB, ADDITIONAL VARIABLE HEIGHT BRICK MASONRY, OPENING IN TOP SLAB.)

MAX. DEPTH OF THIS STRUCTURE FROM TOP OF BOTTOM SLAB TO TOP ELEVATION IS 12′-0″. STANDARD DRAWING 840.45 OR 840.46 CONTROLS MAXIMUM DEPTH IF PRECAST BOX IS USED.




## SECTION C-C OR D-D




## DOWEL

DIMENSIONS AND QUANTITIES FOR BRICK JUNCTION BOXES

| DIMENSIONS OF BOX AND PIPE | | | | REINFORCEMENT BARS | | TOP SLAB DIMENSIONS | | CUBIC YARDS | | | DEDUCTIONS FOR ONE PIPE CU.YDS. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PIPE | SPAN | WIDTH | HEIGHT | | | | | CONC. | BRICK MASONRY | | | |
| D | A | B | H | NO. | LENGTH | E | F | TOP & BOTTOM CU. YD. | MIN. HEIGHT CU. YD. | WALL PER FT. HT. CU. YD. | C.S. | R.C. |
| 12″ | 2′-0″ | 2′-0″ | 2′-3″ | 12 | 3′-1″ | 3′-4″ | 3′-4″ | 0.412 | 0.591 | 0.263 | 0.020 | 0.032 |
| 15″ | 2′-0″ | 2′-0″ | 2′-6″ | 12 | 3′-1″ | 3′-4″ | 3′-4″ | 0.412 | 0.657 | 0.263 | 0.031 | 0.047 |
| 18″ | 2′-4″ | 2′-4″ | 2′-9″ | 14 | 3′-5″ | 3′-8″ | 3′-8″ | 0.498 | 0.814 | 0.296 | 0.044 | 0.065 |
| 24″ | 3′-0″ | 3′-0″ | 3′-3″ | 16 | 4′-1″ | 4′-4″ | 4′-4″ | 0.695 | 1.176 | 0.362 | 0.078 | 0.113 |
| 30″ | 3′-4″ | 3′-4″ | 3′-9″ | 16 | 4′-5″ | 4′-8″ | 4′-8″ | 0.807 | 1.481 | 0.395 | 0.122 | 0.170 |
| 36″ | 4′-0″ | 4′-0″ | 4′-3″ | 20 | 5′-1″ | 5′-4″ | 5′-4″ | 1.053 | 1.959 | 0.461 | 0.176 | 0.238 |
| 42″ | 4′-8″ | 4′-8″ | 4′-9″ | 22 | 5′-9″ | 6′-0″ | 6′-0″ | 1.333 | 2.503 | 0.527 | 0.240 | 0.323 |
| 48″ | 5′-4″ | 5′-4″ | 5′-3″ | 26 | 6′-5″ | 6′-8″ | 6′-8″ | 1.646 | 2.940 | 0.560 | 0.313 | 0.422 |
| 54″ | 5′-10″ | 5′-10″ | 5′-9″ | 28 | 6′-11″ | 7′-2″ | 7′-2″ | 1.902 | 3.502 | 0.609 | 0.396 | 0.535 |
| 60″ | 6′-6″ | 6′-6″ | 6′-3″ | 30 | 7′-7″ | 7′-10″ | 7′-10″ | 2.272 | 4.113 | 0.658 | 0.489 | 0.660 |
| 66″ | 7′-1″ | 7′-1″ | 6′-9″ | 32 | 8′-2″ | 8′-5″ | 8′-5″ | 2.624 | 4.778 | 0.708 | 0.591 | 0.798 |

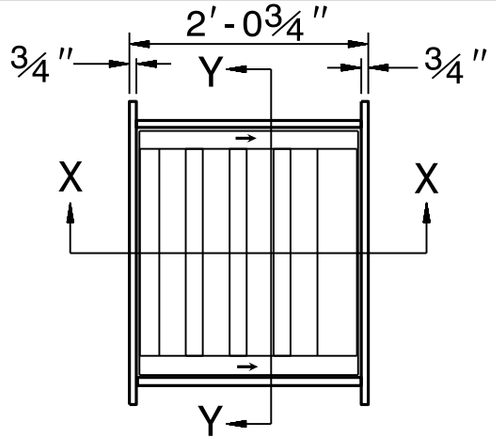

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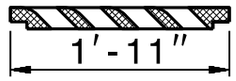

ROADWAY STANDARD DRAWING FOR

# BRICK JUNCTION BOX

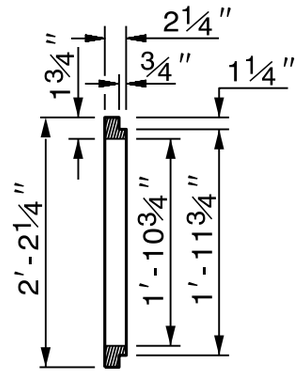
12″ THRU 66″ PIPE



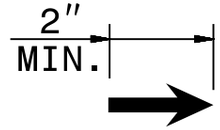

GRATE PLAN



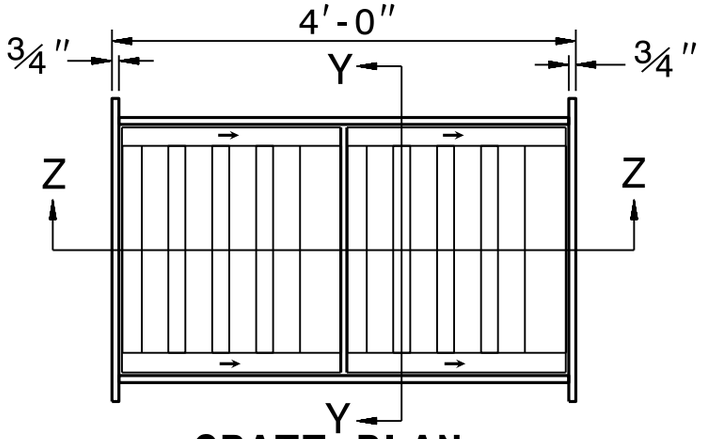

GRATE SECTION X-X



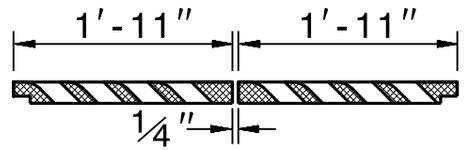

GRATE SECTION Y-Y




RAISED DIRECTIONAL FLOW INDICATOR

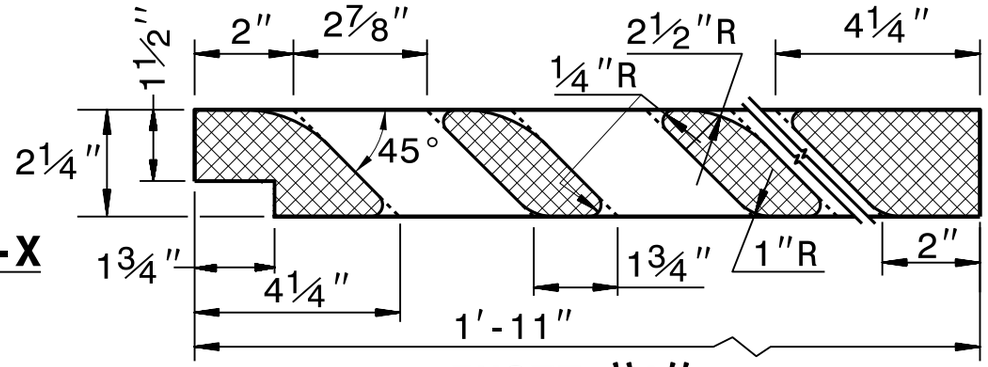



GRATE PLAN




GRATE SECTION Z-Z

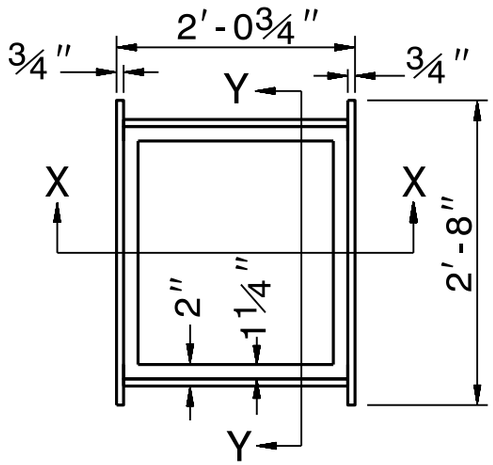
SEE INSET "A" FOR SECTION VIEW



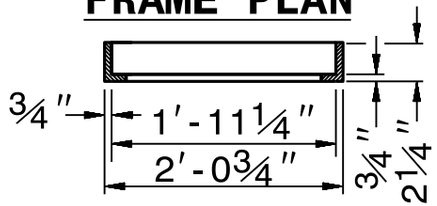

INSET "A"

(TYPICAL UNIT FOR SECTION Z-Z)

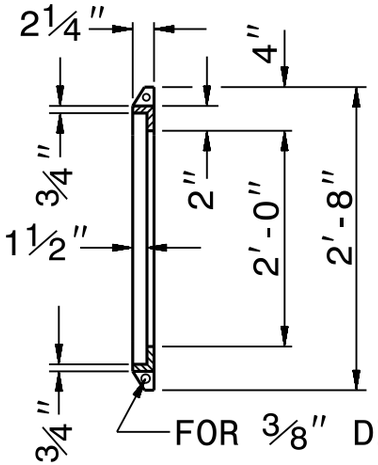
NOTE: SEE STD. DWG. 840.25 FOR FRAME ANCHORAGE.




FRAME PLAN

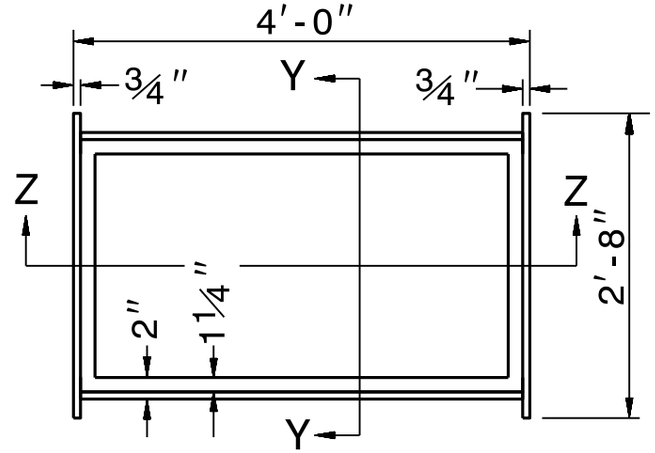



FRAME SECTION X-X

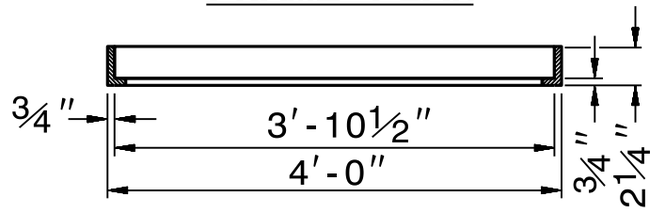



FOR ⅜″ DIA. BOLT

FRAME SECTION Y-Y




FRAME PLAN




FRAME SECTION Z-Z

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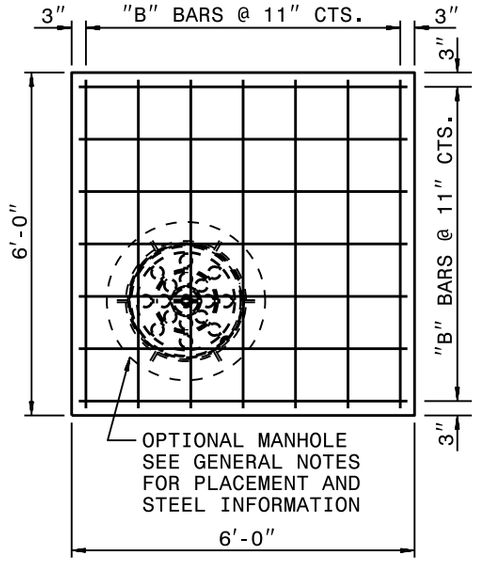
1-24

ROADWAY STANDARD DRAWING FOR

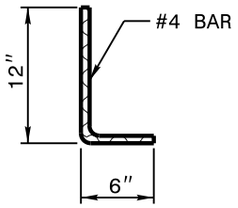
# ANGLED VANE GRATES AND FRAMES

SHEET 1 OF 1

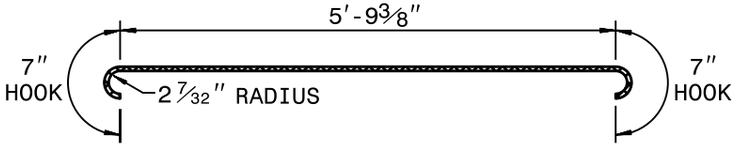
840.33




## PLAN OF TOP SLAB

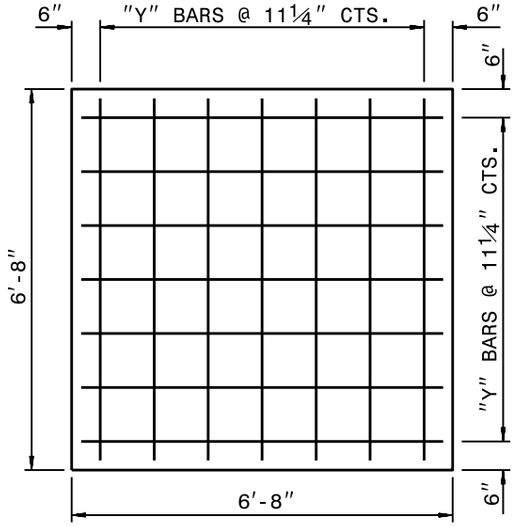



## DOWEL "C"

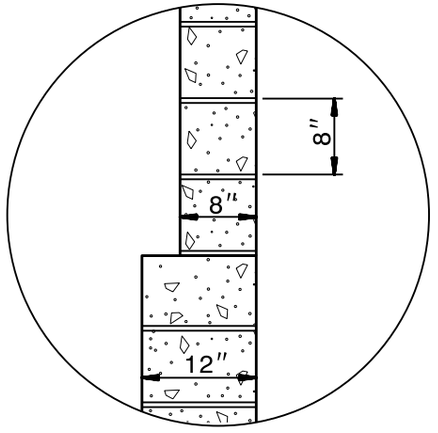



## "Y" BARS

BAR DIMENSIONS ARE OUT TO OUT

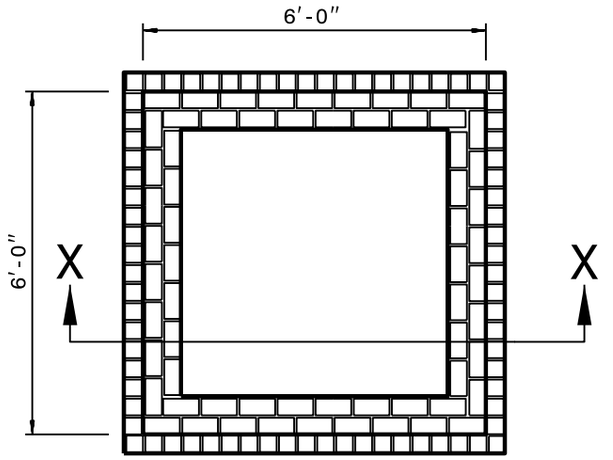



## PLAN OF BOTTOM SLAB



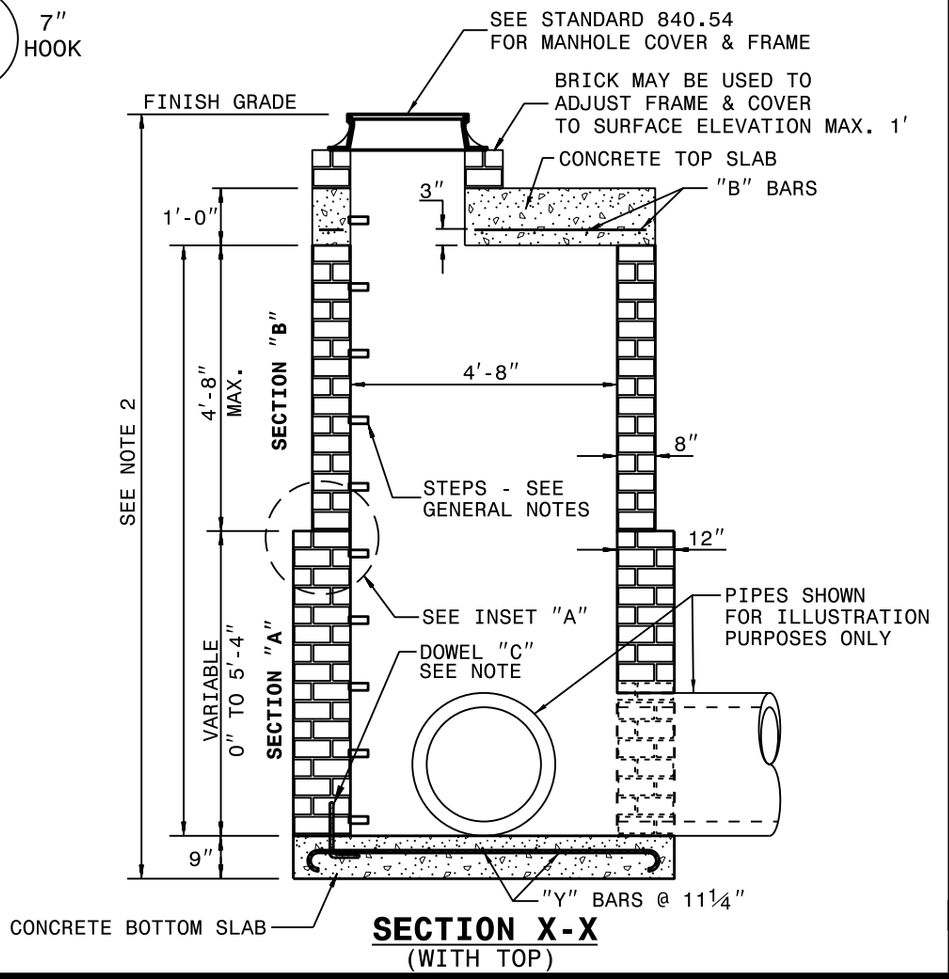

## INSET "A"

CONCRETE BLOCK




## PLAN

(WITHOUT TOP)




## SECTION X-X

(WITH TOP)

NOTE 1: CONSTRUCT SECTION "B" OF THE PROPOSED WALL 8" THICK. AND SECTION "A" 12" THICK.

NOTE 2: IF PROPOSED STRUCTURE EXCEEDS 12'-0" VERTICAL HEIGHT A DESIGN WILL BE REQUIRED FOR APPROVAL.

NOTE 3: USE SINGLE MAT REINFORCING STEEL; EXCEPT DOUBLE MAT STEEL MAY BE USED IN LIEU OF HOOK BARS IN BASE SLAB.


1-24

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ROADWAY STANDARD DRAWING FOR

# TRAFFIC BEARING JUNCTION BOX

FOR USE WITH PIPES 42" AND UNDER

GENERAL NOTES:

USE STANDARD OR JUMBO BRICK FOR WALL CONSTRUCTION. SOLID CONCRETE BRICK OR BLOCK ARE OPTIONAL WALL CONSTRUCTION MATERIAL

INCLUDE ALL ADJUSTMENTS TO WALLS, SLABS OR REINFORCING MATERIAL IN THE UNIT PRICE BID FOR EACH UNIT.

INSTALL OPTIONAL MANHOLE IN POSITION AS DIRECTED BY THE ENGINEER. CUT OR BEND ALL REBAR CROSSING THIS OPENING TO ALLOW 2″ MINIMUM CONCRETE COVERAGE. ENCLOSE THE OPENING WITH 8 "A" BARS TIED TO TO THE REBAR MAT AND SET SO A MINIMUM OF 3″ CONCRETE COVER IS ATTAINED. REFERENCE STD. NO. 840.54 FOR MANHOLE INFORMATION.

PROVIDE JUNCTION BOXES WITH MAHNOLES OVER 3′-6″ IN DEPTH WITH STEPS PLACED ON 12″ CENTERS. REFERENCE STD. NO. 840.66.

SPACE DOWEL "C" BARS AT A MAXIMUM OF 12″ CENTERS.

MAXIMUM DEPTH OF THIS UNIT AS SHOWN IS 12′-0″.
STD. DWG. 840.46 CONTROLS MAXIMUM DEPTH IF PRECAST BOX IS USED.

CONSTRUCT THE JUNCTION BOX IN ACCORDANCE WITH SECTIONS 830, 832, 834 AND 840 OF THE STANDARD SPECIFICATIONS.

## BILL OF MATERIAL

| BAR | QTY. | SIZE | LENGTH | WEIGHT |
|---|---|---|---|---|
| A | 8 | #5 | 1′-2″ | 9.7 |
| B | 14 | #5 | 5′-6″ | 80.3 |
| C | 26 | #4 | 1′-6″ | 26.1 |
| Y | 14 | #5 | 6′-11 3/8″ | 101.5 |
| STEEL TOTAL WEIGHT | | | | 217.6 |
| | | | | |
| CU. YDS. CLASS "AA" CONC. | | | | 2.6 |
| CU. YDS. BRICK/FT. HT. (8″) | | | | 0.53 |
| CU. YDS. BRICK/FT. HT. (12″) | | | | 0.84 |
| | | | | |

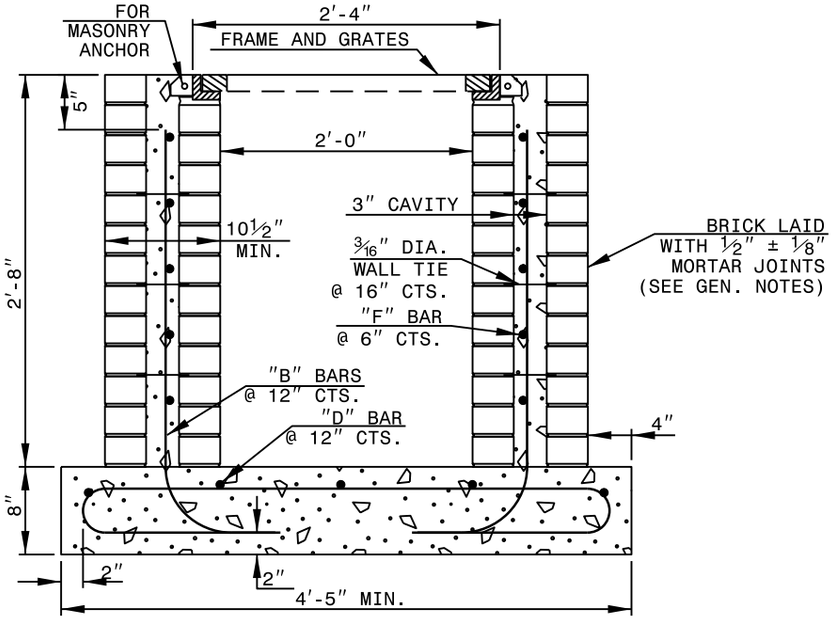
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NORTH CAROLINA
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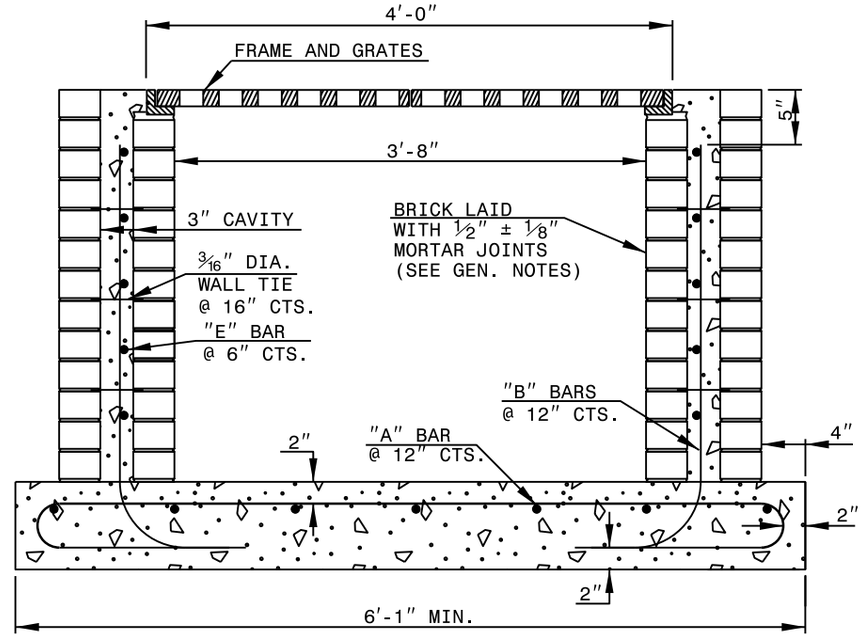
ROADWAY STANDARD DRAWING FOR

# TRAFFIC BEARING JUNCTION BOX

FOR USE WITH PIPES 42″ AND UNDER



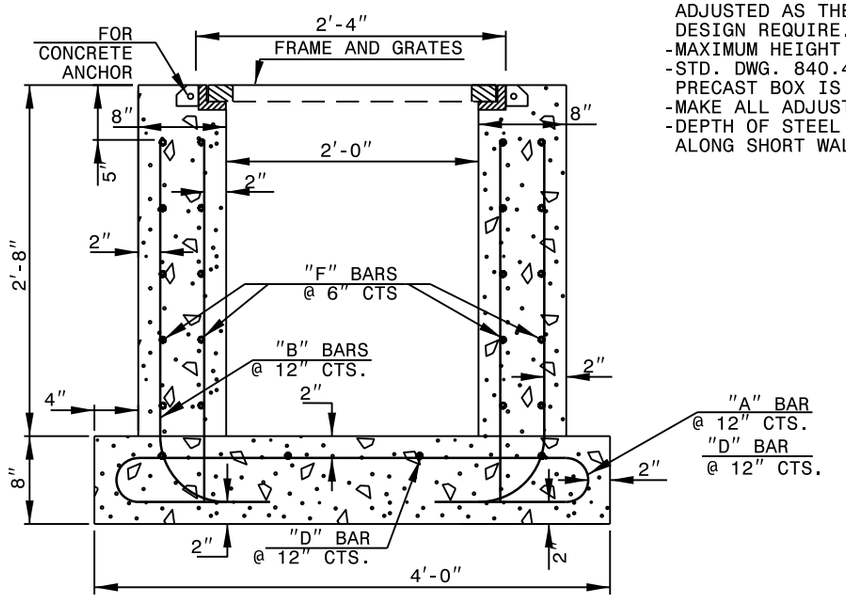

## SECTION X-X




## SECTION Y-Y

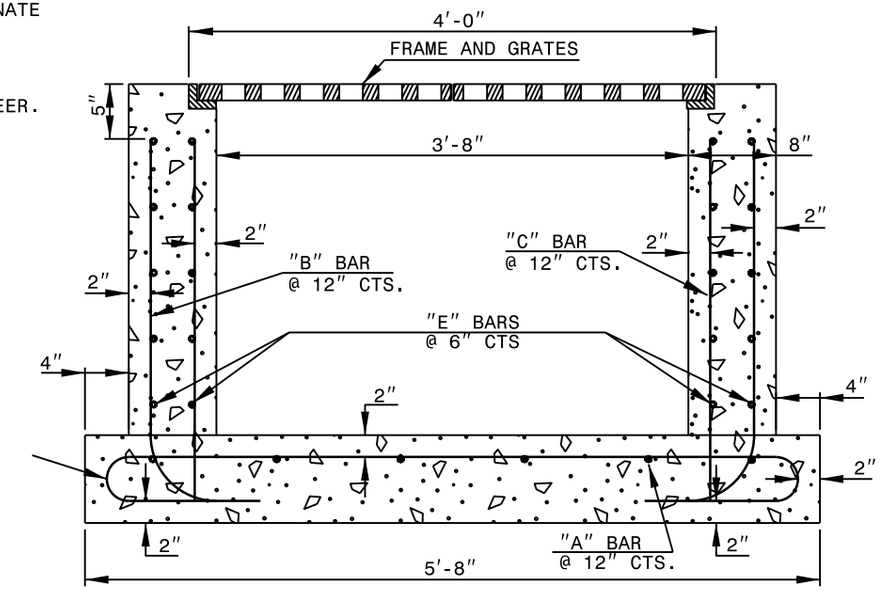
# BRICK ALT.

NOTES:
- HORIZONTAL AND VERTICAL DIMENSIONS MAY BE ADJUSTED AS THE FIELD CONDITIONS AND/OR ALTERNATE DESIGN REQUIRE.
- MAXIMUM HEIGHT FOR THIS STRUCTURE IS 14'-0".
- STD. DWG. 840.46 CONTROLS MAXIMUM DEPTH IF PRECAST BOX IS USED.
- MAKE ALL ADJUSTMENTS AS DIRECTED BY THE ENGINEER.
- DEPTH OF STEEL GRATE WILL REQIURE DEEPER SEAT ALONG SHORT WALLS.




MAX. PIPE DIAMETER IS 18" R.C.P.

## SECTION X-X




MAX. PIPE DIAMETER IS 36" R.C.P.

## SECTION Y-Y

# CONCRETE ALT.

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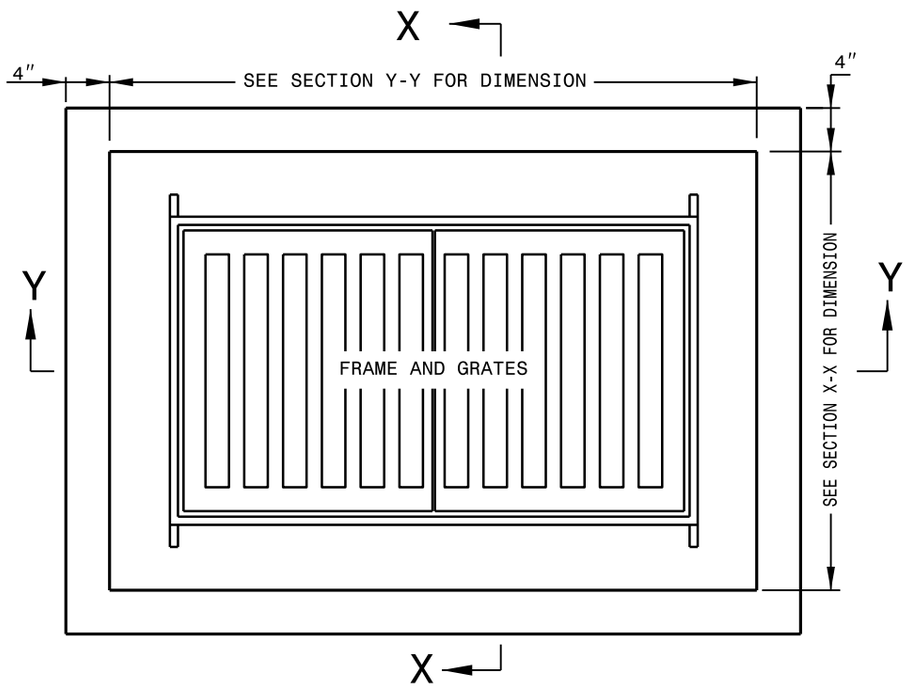
ROADWAY STANDARD DRAWING FOR

# TRAFFIC BEARING GRATED DROP INLET

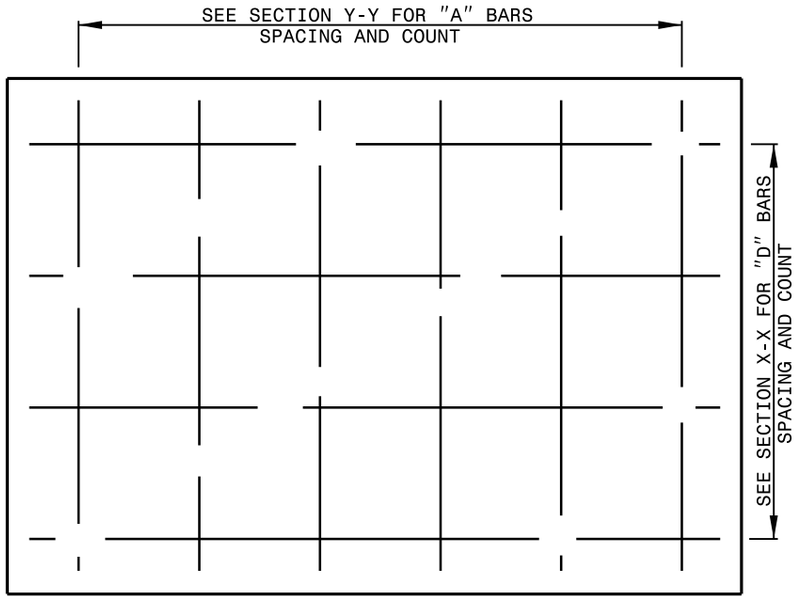
FOR DOUBLE FRAME AND GRATES

SHEET 1 OF 2

840.35



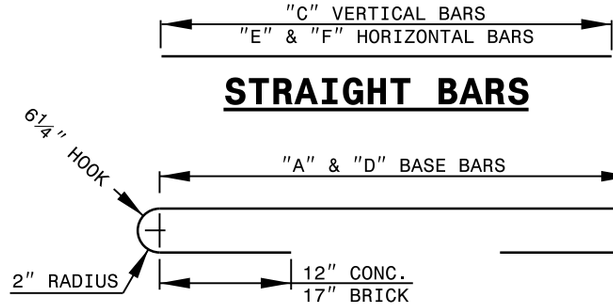

## PLAN




## PLAN OF BASE

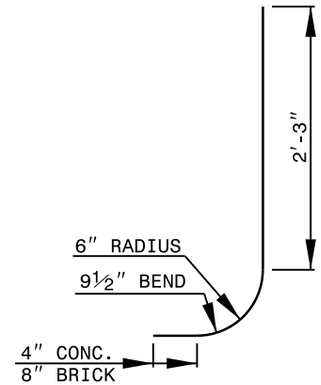
## BILL OF MATERIALS

| COMMON | | CONCRETE ALT. | | | BRICK ALT. | | |
|---|---|---|---|---|---|---|---|
| BAR | SIZE | LENGTH | QUANTITY | WEIGHT | LENGTH | QUANTITY | WEIGHT |
| A | #5 | 6'-4½" | 6 | 39.9 | 7'-7½" | 6 | 47.7 |
| B | #5 | 3'-4½" | 16 | 56.3 | 3'-4½" | 16 | 56.3 |
| C | #5 | 2'-8" | 14 | 38.9 | -0- | -0- | -0- |
| D | #5 | 8'-0½" | 4 | 33.6 | 9'-3½" | 4 | 38.8 |
| E | #5 | 3'-0" | 20 | 62.6 | 3'-0" | 10 | 31.3 |
| F | #5 | 4'-8" | 20 | 97.3 | 4'-8" | 10 | 48.7 |
| | | | | | | | |
| REINF. STEEL (TOTAL WEIGHT LBS.) | | | | 328.6 | | | 222.8 |
| CONCRETE IN BASE CLASS 'AA' (CUBIC YARDS) | | | | 0.56 | | | 0.66 |
| CONCRETE IN WALLS CLASS 'AA' (CUBIC YARDS) | | | | 0.92 | | | -0- |
| CONCRETE IN WALLS CLASS 'B' (CUBIC YARDS) | | | | -0- | | | 0.36 |
| BRICK IN WALLS (CUBIC YARDS) | | | | -0- | | | 0.91 |
| CONCRETE TOTAL (CUBIC YARDS) | | | | 1.48 | | | 1.02 |
| BRICK & CONCRETE TOTAL (CUBIC YARDS) | | | | 1.48 | | | 1.93 |
| CONC. CUBIC YARDS IN WALL/FOOT OF HEIGHT | | | | 0.35 | | | 0.14 |
| BRICK CUBIC YARDS IN WALL/FOOT OF HEIGHT | | | | -0- | | | 0.34 |
| LBS. OF REINF. STEEL IN WALL/FOOT OF HEIGHT | | | | 94.9 | | | 47.6 |




## STRAIGHT BARS

## BASE BARS




## CORNER BARS

GENERAL NOTES:
-USE CLASS 'AA' CONCRETE FOR CAST IN PLACE CONCRETE BOX.
-USE CLASS 'B' CONCRETE IN THE WALL CAVITY FOR REINFORCED BRICK CONSTRUCTION AND CLASS 'AA' FOR THE FOOTING BASE.
-CHAMFER ALL EXPOSED CONCRETE CORNERS 1".
-USE FORMS TO CONSTRUCT THE BOTTOM SLAB.
-IF PIPES ARE SET IN THE BASE FOLLOW CONSTRUCTION PROCEDURES SHOWN BY STD. DWG. 840.00.
-PRECAST UNITS MADE OF CLASS 'AA' CONCRETE MAY BE USED IN LIEU OF BRICK MASONRY CONSTRUCTION.
-INCLUDE REINFORCING STEEL COST IN THE UNIT OR LINEAR FOOT BID PRICE FOR "MASONRY DRAINAGE STRUCTURE".
-REFERENCE STD. DWG. 840.25 FOR FRAME ANCHORAGE.
-CONCRETE BRICK, JUMBO BRICK AND 4" SOLID CONCRETE BLOCK WILL BE PERMITTED.
-CONCRETE FOR BRICK BOX REFER TO SECTION 832 OF THE STANDARD SPECIFICATIONS.
-PROVIDE GRATED DROP INLETS OVER 3'-6" DEEP WITH STEPS SPACED 12" ON CENTER AS DIRECTED BY STD. DWG. 840.66.
-FRAME AND GRATES ARE SEPARATE CONTRACT ITEMS.

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ROADWAY STANDARD DRAWING FOR

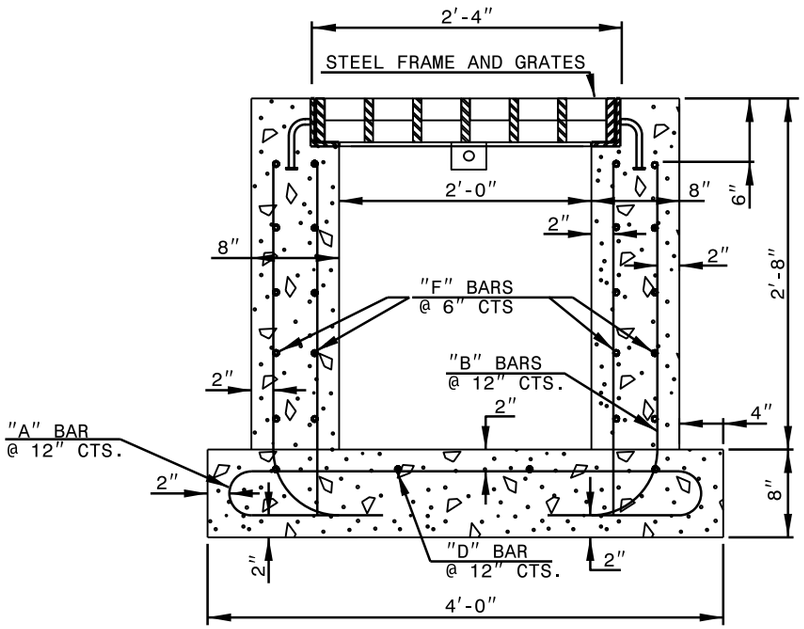
# TRAFFIC BEARING GRATED DROP INLET

FOR DOUBLE FRAME AND GRATES



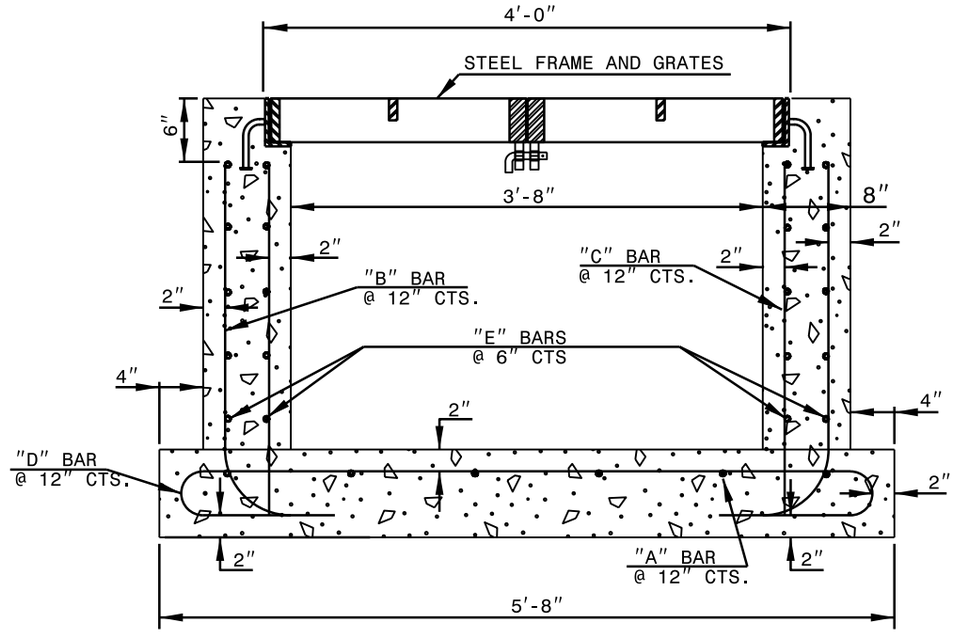
840.35

NOTES:
-HORIZONTAL AND VERTICAL DIMENSIONS MAY BE ADJUSTED AS THE FIELD CONDITIONS AND/OR ALTERNATE DESIGN REQUIRE.
-MAXIMUM HEIGHT FOR THIS STRUCTURE IS 14′-0″.
-STD. DWG. 840.46 CONTROLS MAXIMUN DEPTH IF PRECAST BOX IS USED.
-MAKE ALL ADJUSTMENTS AS DIRECTED BY THE ENGINEER.
-ANCHOR STEEL FRAME AND GRATES IN ACCORDANCE WITH DETAILS SHOWN.
-NO BRICK RISERS ARE PERMITTED ON ANY PART OF THIS DRAINAGE STRUCTURE.




MAX. PIPE DIAMETER IS 18″ R.C.P.

## SECTION X-X




MAX. PIPE DIAMETER IS 36″ R.C.P.

## SECTION Y-Y

# TRAFFIC BEARING DROP INLET

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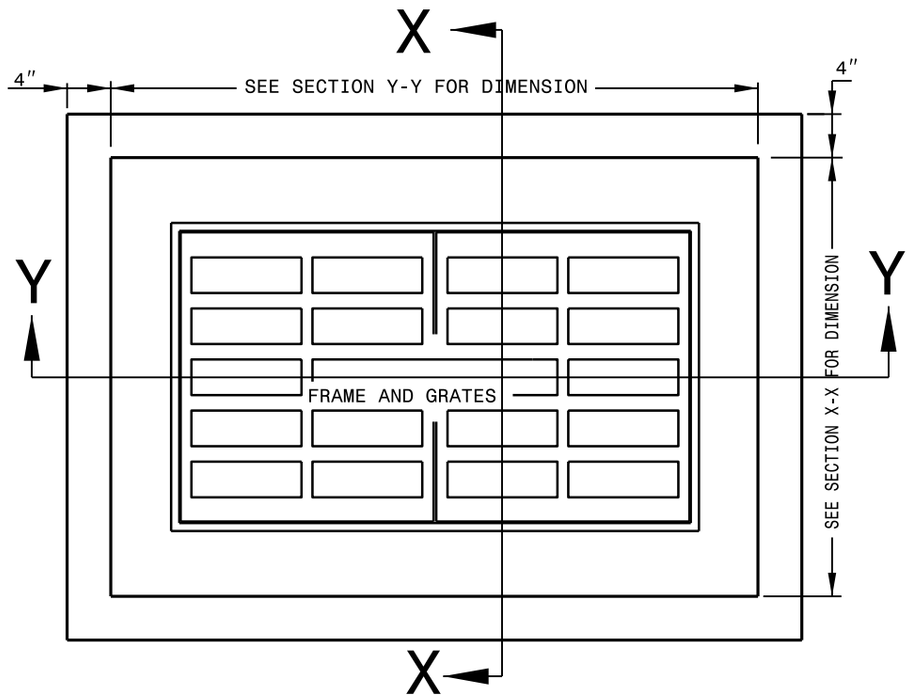
ROADWAY STANDARD DRAWING FOR

**TRAFFIC BEARING GRATED DROP INLET**

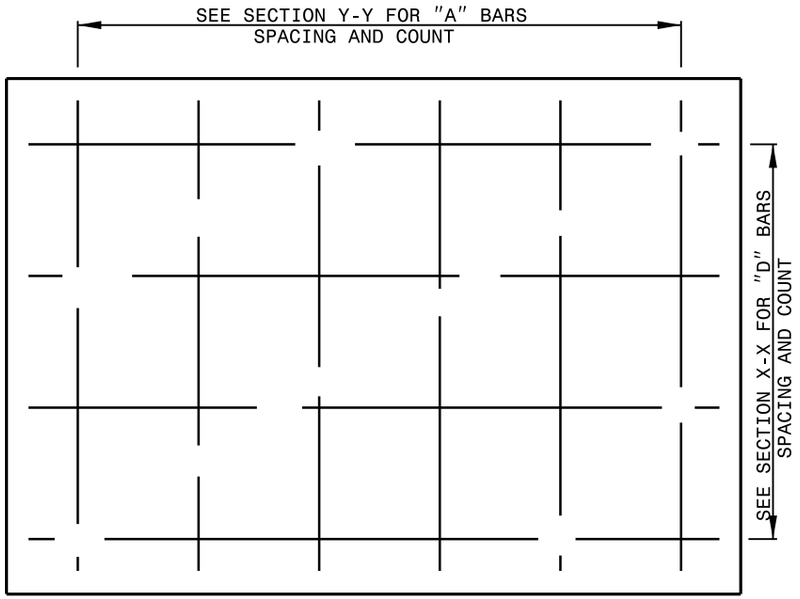
FOR STEEL (840.37) DOUBLE FRAME AND GRATES



**840.36**



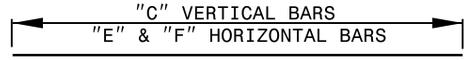

**PLAN**



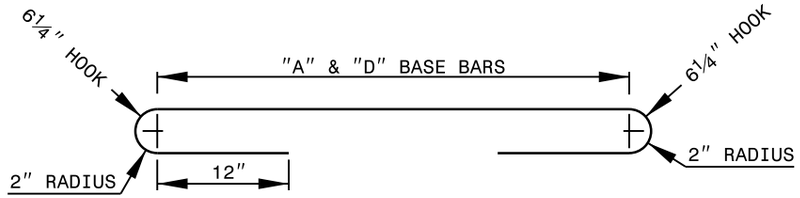

**PLAN OF BASE**

## BILL OF MATERIALS

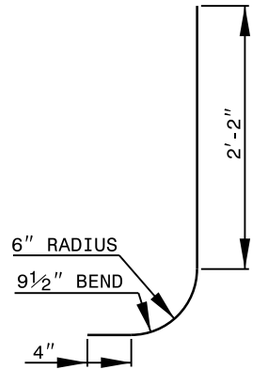
| COMMON | | CONCRETE | | |
|---|---|---|---|---|
| BAR | SIZE | LENGTH | QUANTITY | WEIGHT |
| A | #5 | 6′-4½″ | 6 | 39.9 |
| B | #5 | 3′-3½″ | 16 | 54.9 |
| C | #5 | 2′-8″ | 14 | 38.9 |
| D | #5 | 8′-0½″ | 4 | 33.6 |
| E | #5 | 3′-0″ | 20 | 62.6 |
| F | #5 | 4′-8″ | 20 | 97.3 |
| | | | | |
| REINF. STEEL (TOTAL WEIGHT LBS.) | | | | 327.2 |
| CONCRETE IN BASE (CUBIC YARDS) | | | | 0.56 |
| CONCRETE IN WALLS (CUBIC YARDS) | | | | 0.92 |
| CONCRETE TOTAL (CUBIC YARDS) | | | | 1.48 |
| | | | | |
| CONC. CUBIC YARDS IN WALL/FOOT OF HEIGHT | | | | 0.35 |
| LBS. OF REINF. STEEL IN WALL/FOOT OF HEIGHT | | | | 94.9 |




**STRAIGHT BARS**




**BASE BARS**




**CORNER BARS**

GENERAL NOTES:
-USE CLASS 'AA' CONCRETE FOR CAST IN PLACE BOX.
-CHAMFER ALL EXPOSED CONCRETE CORNERS 1".
-USE FORMS TO CONSTRUCT THE BOTTOM SLAB.
-IF PIPES ARE SET IN THE BASE FOLLOW CONSTRUCTION PROCEDURES SHOWN BY STD. DWG. 840.00.
-INCLUDE REINFORCING STEEL COST IN THE BID PRICE FOR "MASONRY DRAINAGE STRUCTURE".
-PROVIDE GRATED DROP INLETS OVER 3′-6" DEEP WITH STEPS SPACED 12" ON CENTER AS DIRECTED BY STD. DWG. 840.66.
-FRAME AND GRATES ARE SEPARATE CONTRACT ITEMS.

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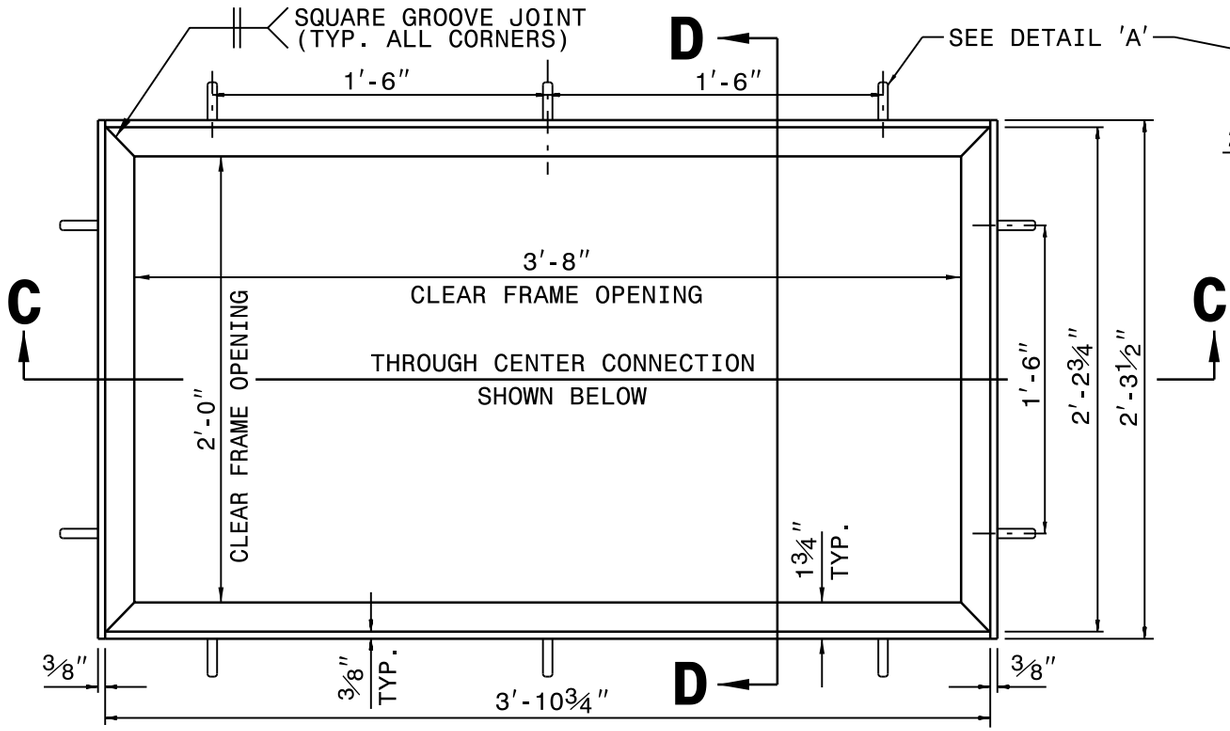
ROADWAY STANDARD DRAWING FOR

# TRAFFIC BEARING GRATED DROP INLET

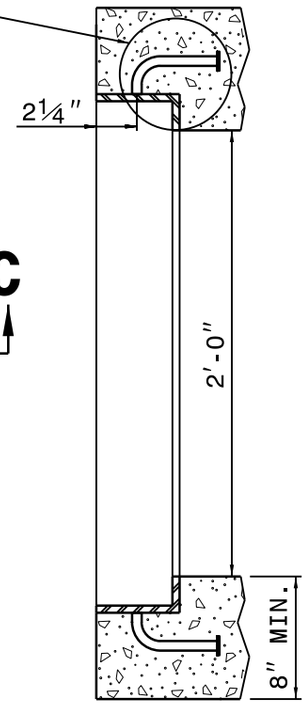
FOR STEEL (840.37) DOUBLE FRAME AND GRATES



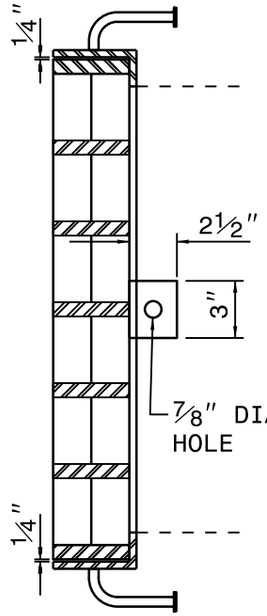
840.36



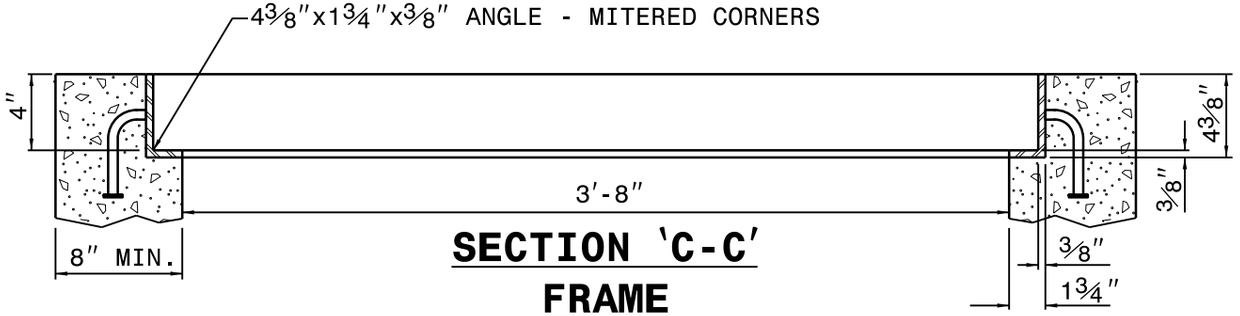

## PLAN VIEW



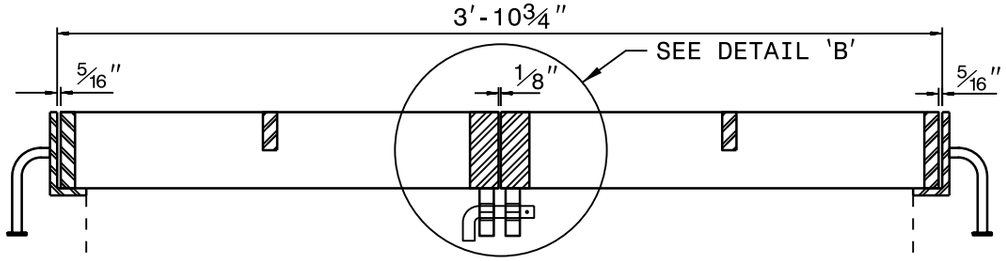

## SECTION 'D-D'



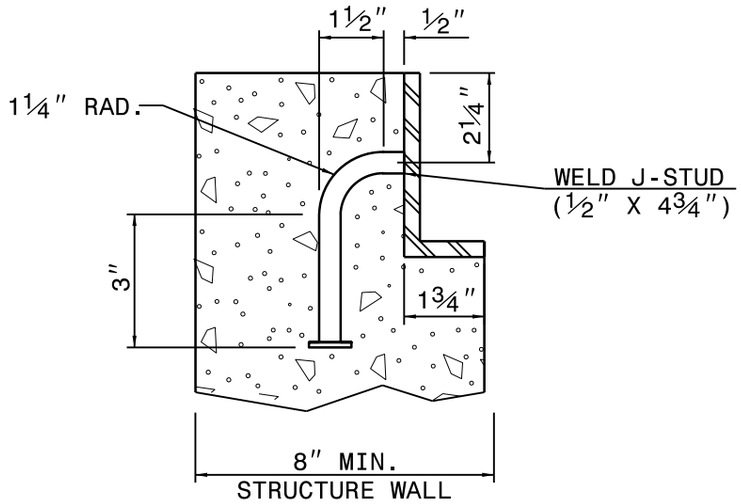

## ELEVATION OF GRATE IN FRAME SYSTEM SHOWN THROUGH SECTION 'D-D'




## SECTION 'C-C'
## FRAME




## ELEVATION OF GRATES IN FRAME SYSTEM SECTION 'C-C'




## DETAIL 'A' STUD ANCHOR

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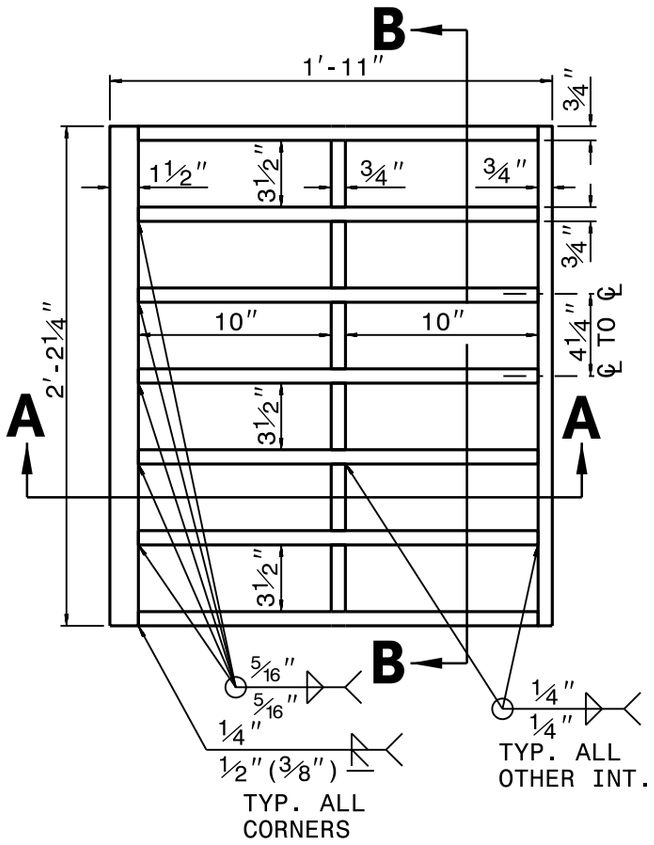
1-24

ROADWAY STANDARD DRAWING FOR

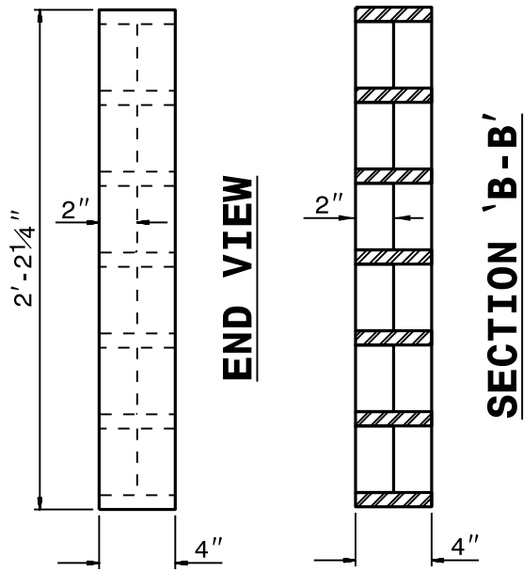
# STEEL GRATE AND FRAME

SHEET 1 OF 2

840.37




## PLAN VIEW



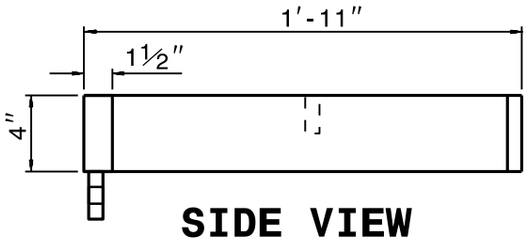

## END VIEW



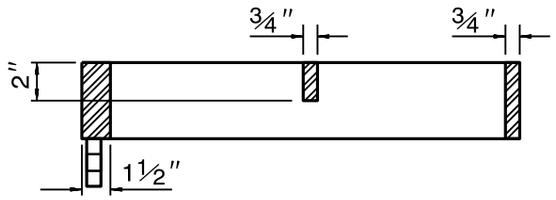

## SECTION 'B-B'

NOTES:

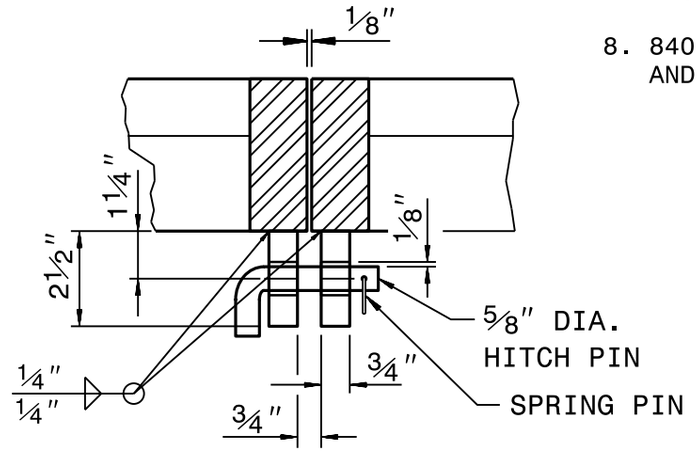
1. HOT DIP GALVANIZE FRAME AND GRATE IN ACCORDANCE WITH ASTM DESIGNATION A-123 AND AASHTO M-111.
2. GRATE IS DESIGNED TO WITHSTAND HS25-44 LOADING.
3. TWO (2) GRATES REQUIRED PER FRAME. ONE (1) GRATE DEPICTED FOR CLARITY.
4. PROVIDE STEEL CONFORMING TO THE LATEST REQUIRMENTS OF AASHTO M270 (ASTM A709) GRADE 36.
5. WELD IN ACCORDANCE WITH THE AASHTO/AWS D1.5 BRIDGE WELDING CODE. SEAL WELD ALL CONNECTIONS ALONG TOP AND BOTTOM HORIZONTAL SEAMS OF CONNECTIONS IN ADDITION TO ANY REQUIRED STRUCTURAL WELDS.
6. USE 5/16" DOUBLE FILLET WELDS FOR CONNECTING MAIN BARS TO EDGE BARS AND 1/4" FILLETS AT ALL OTHER LOCATIONS.
7. NOTCHING OF BEARING BARS TO ACCEPT CROSS BAR IS PROHIBITED.
8. 840.37 FRAMES AND GRATES ARE SUBJECT TO LIVE LOADS AND ARE NOT CONSIDERED TO BE ANCILLARY PRODUCTS.




## SIDE VIEW




## SECTION 'A-A'




## DETAIL 'B' CENTER LOCK

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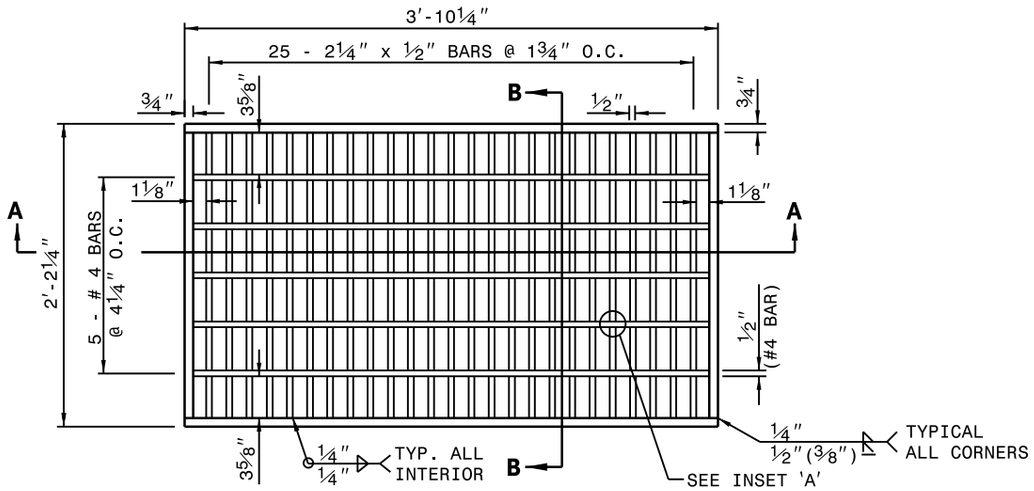
1-24

ROADWAY STANDARD DRAWING FOR

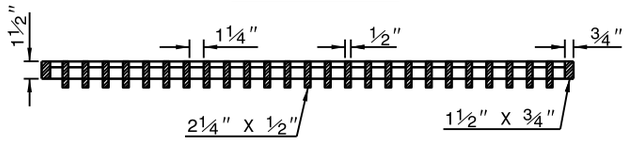
# STEEL GRATE AND FRAME

SHEET 2 OF 2

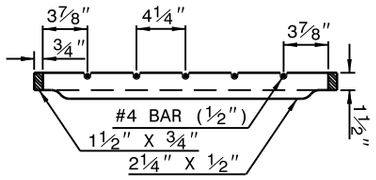
840.37



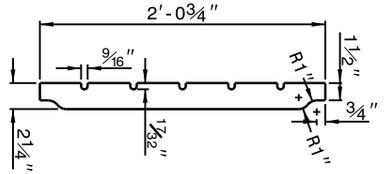

## PLAN VIEW



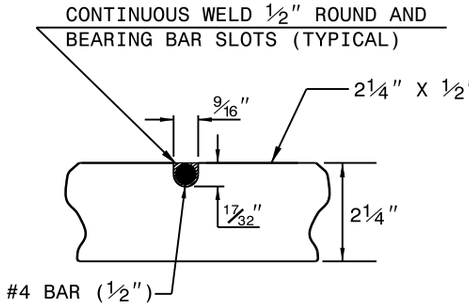

## SECTION A-A GRATE




## SECTION B-B

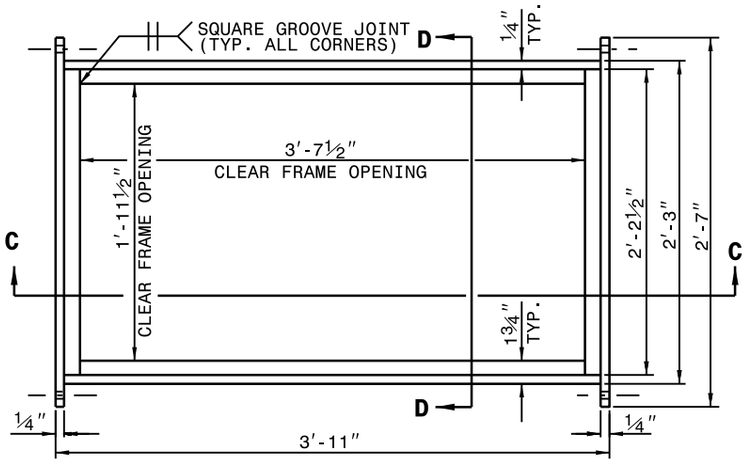



## DETAIL OF BEARING BAR

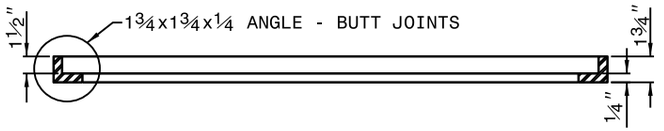



## INSET 'A'

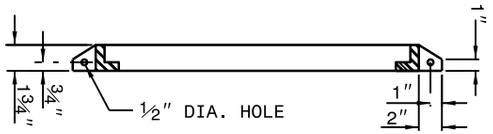
(1⁷⁄32" X 9⁄16" NOTCH IN 2¼" X ½" BAR)




## PLAN VIEW




## SECTION C-C FRAME




## SECTION 'D-D'

NOTES:

1. HOT DIP GALVANIZE FRAME AND GRATE IN ACCORDANCE WITH ASTM DESIGNATION A-123 AND AASHTO M-111.
2. GRATE SHOULD MEET HS-20 LOADING.
3. PROVIDE STEEL CONFORMING TO THE LATEST REQUIRMENTS OF AASHTO M270 (ASTM A709) GRADE 36.
4. WELD IN ACCORDANCE WITH THE AASHTO/AWS D1.5 BRIDGE WELDING CODE. SEAL WELD ALL CONNECTIONS ALONG TOP AND BOTTOM HORIZONTAL SEAMS OF CONNECTIONS IN ADDITION TO ANY REQUIRED STRUCTURAL WELDS.
5. 840.39 FRAMES AND GRATES ARE SUBJECT TO LIVE LOADS AND ARE NOT CONSIDERED TO BE ANCILLARY PRODUCTS.
6. SEE STANDARD DRAWING 840.25 FOR FRAME ANCHORAGE.

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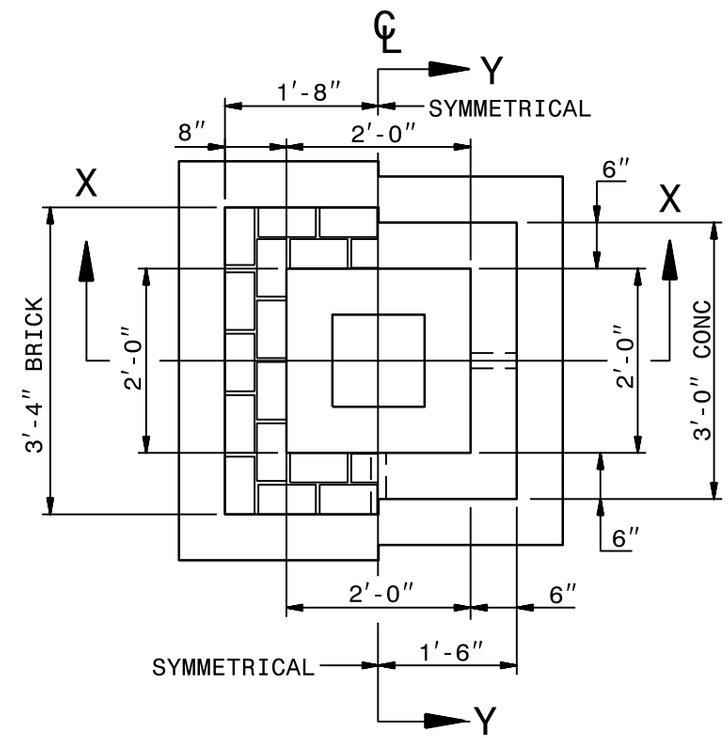
ROADWAY STANDARD DRAWING FOR

# STEEL GRATE AND FRAME

BICYCLE SAFE

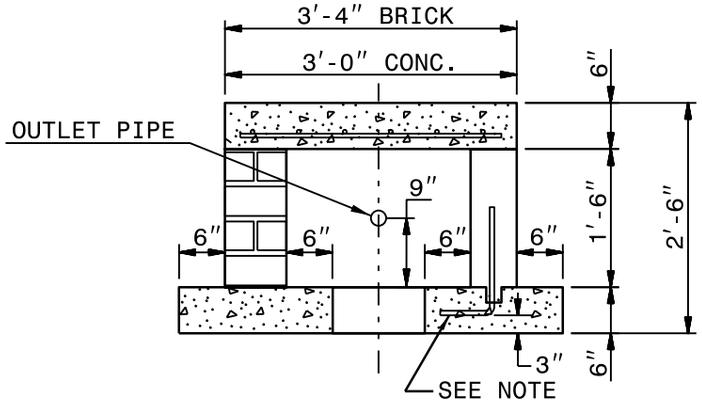
SHEET 1 OF 1

840.39




## PLAN

COVER REMOVED




## SECTION X-X OR Y-Y

GENERAL NOTES:

USE CLASS "B" CONCRETE THROUGHOUT.

OPTIONAL CONSTRUCTION OF CONCRETE BOX - MONOLITHIC POUR, 2" KEYWAY, OR #4 BAR DOWELS AT 12" CENTERS AS DIRECTED BY THE ENGINEER.

REINFORCING STEEL (A-BARS) TO BE #3 STRAIGHT BARS, 12 BARS REQUIRED 2′-9" LONG FOR CONCRETE BOX AND 3′-1" LONG FOR BRICK BOX.

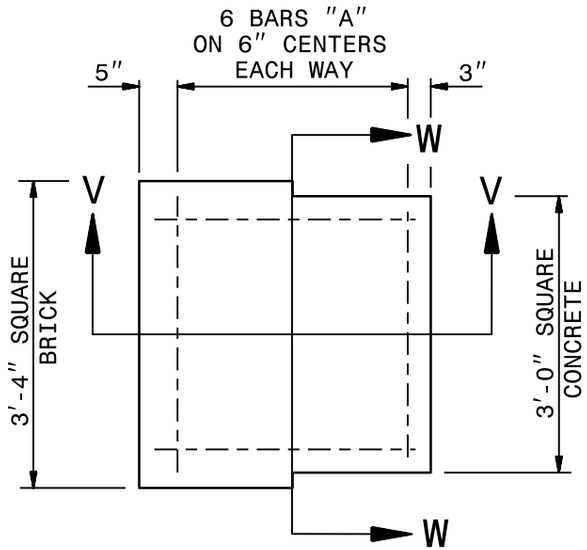
DIMENSIONS OF BOX MAY BE CHANGED BY THE ENGINEER.

MORTAR JOINTS ½" ± ⅛" THICK.

CONCAVE TOOL ALL EXPOSED JOINTS.

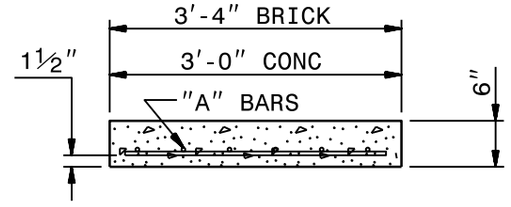
USE FORMS TO CONSTRUCT THE BOTTOM SLAB.

JUMBO BRICK WILL BE PERMITTED. CONCRETE BRICK OR 4" SOLID CONCRETE BLOCKS MAY BE USED IN LIEU OF CLAY BRICK.



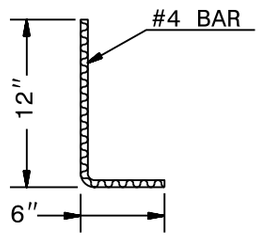

## PLAN OF COVER

FOR BRICK BOX | FOR CONCRETE BOX




## SECTION V-V OR W-W

| TABLE OF QTY.'S FOR CONC. SPRING BOX | | | |
|---|---|---|---|
| FILL HEIGHT | TOP SLAB THICKNESS | CONC. CU. YD. | REINF. LBS. |
| 25′ OR LESS | 6″ | 0.722 | 12 |
| 26′ THRU 50′ | 6½″* | 0.737 | 22 |
| 51′ THRU 75′ | 7½″ | 0.742 | 34 |
| 76′ THRU 100′ | 8½″ | 0.792 | 34 |




## DOWEL

| TABLE OF QUANTITIES FOR BRICK SPRING BOX | | | | | |
|---|---|---|---|---|---|
| FILL HEIGHT | TOP SLAB THICKNESS | CONC. CU. YD. | BRICK CU. YD. | TOTAL CU. YD. | REINF. LBS. |
| 25′ OR LESS | 6″ | 0.535 | 0.395 | 0.930 | 14 |
| 26′ THRU 50′ | 6½″* | 0.552 | 0.395 | 0.947 | 25 |
| 51′ THRU 75′ | 7½″ | 0.586 | 0.395 | 0.981 | 39 |
| 76′ THRU 100′ | 8½″ | 0.620 | 0.395 | 1.015 | 39 |

* USE THIS TOP SLAB FOR LIVE LOAD UP TO 2′ OF FILL.

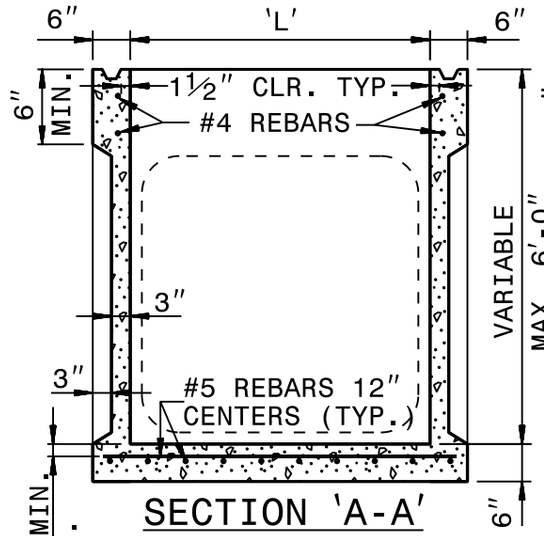

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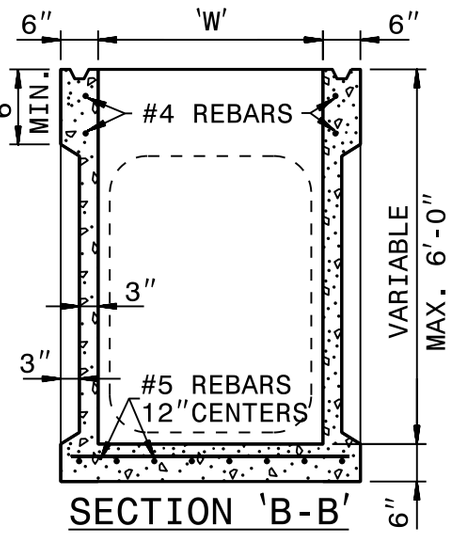
ROADWAY STANDARD DRAWING FOR

# SPRING BOX

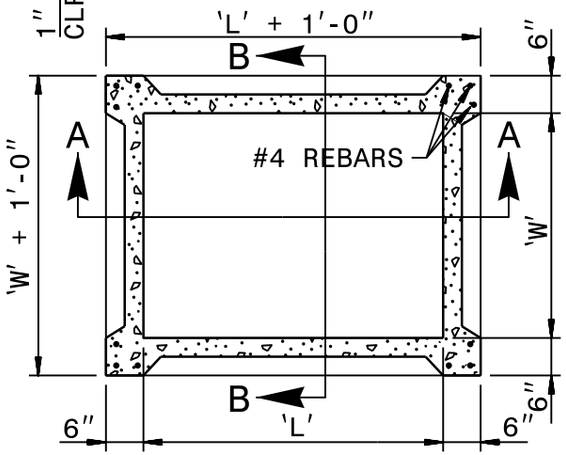
CONCRETE OR BRICK



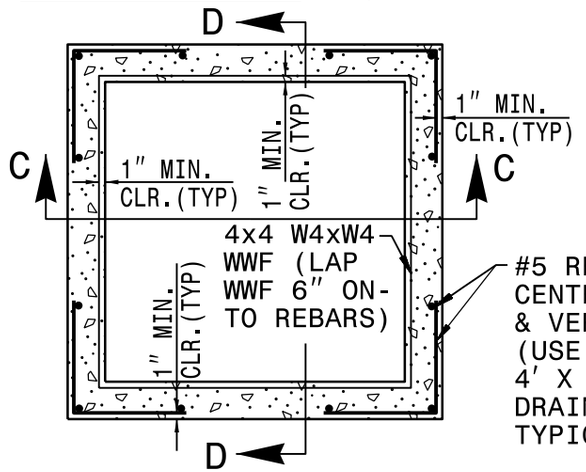

SECTION 'A-A'




SECTION 'B-B'



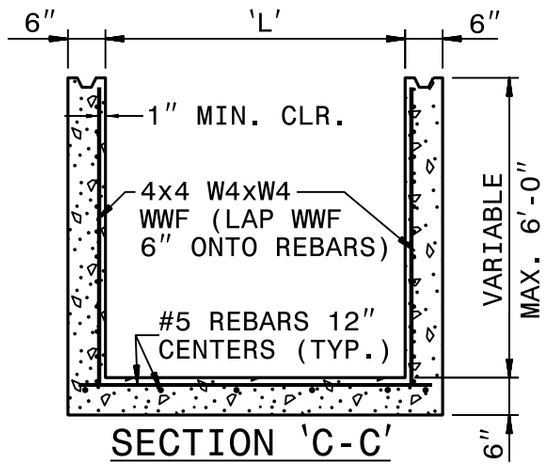

WAFFLE WALL PLAN VIEW



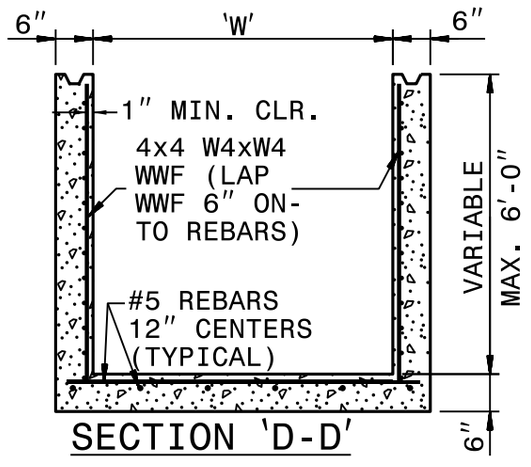

SOLID WALL PLAN VIEW

#5 REBARS @ 12″ CENTERS (HORIZ. & VERT.) (USE WITH 4′ X 4′ & LARGER DRAINAGE STRUCTURES TYPICAL)

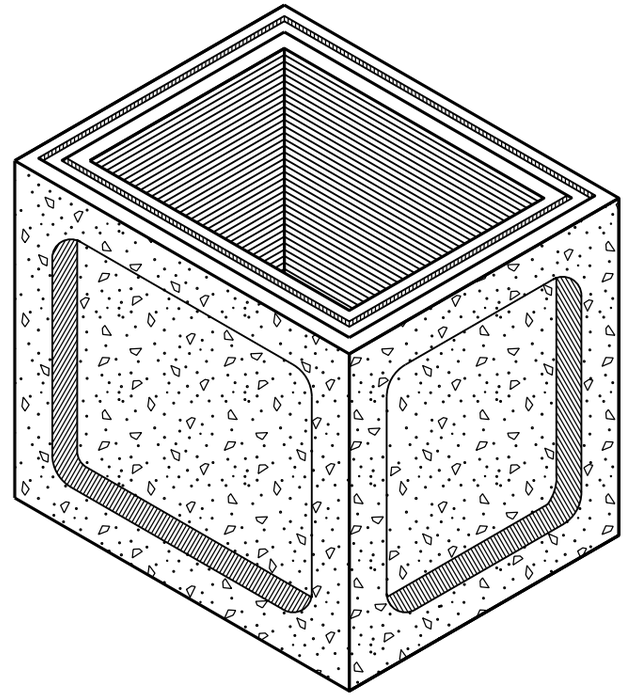
**THE PATTERN OF THE KNOCK-OUT PANELS ARE SHOWN FOR ILLUSTRATIVE PURPOSES ONLY.**



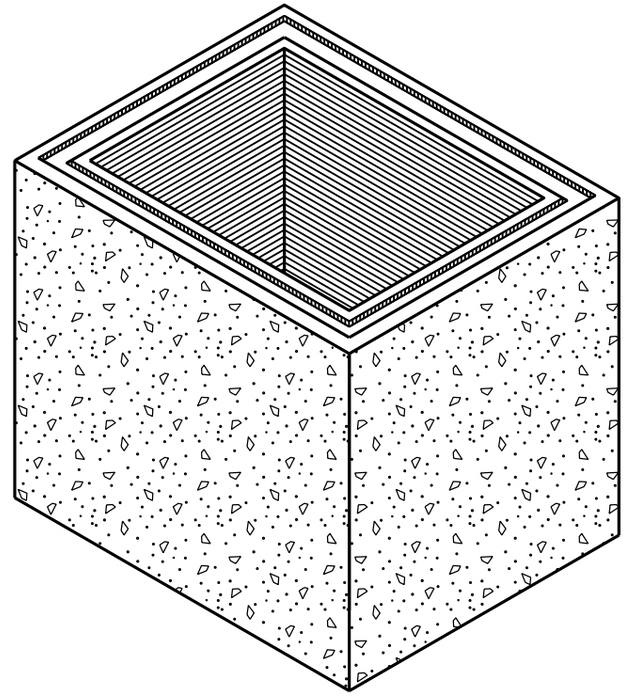

SECTION 'C-C'




SECTION 'D-D'



WAFFLE WALL ISOMETRIC VIEW



SOLID WALL ISOMETRIC VIEW

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ROADWAY STANDARD DRAWING FOR

# PRECAST DRAINAGE STRUCTURE

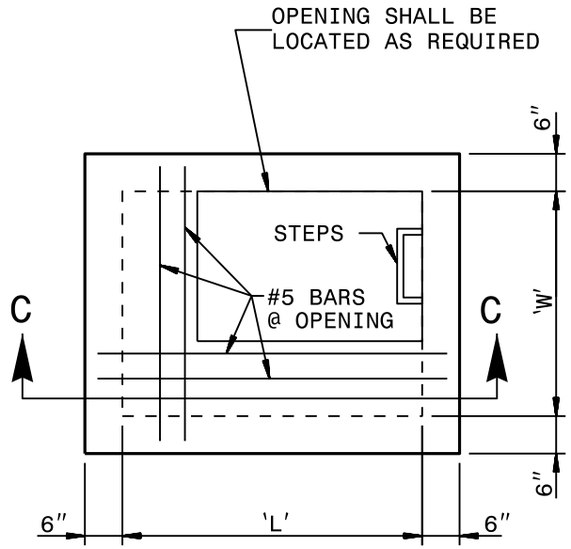
(SOLID AND WAFFLE WALL)

SHEET 1 OF 2

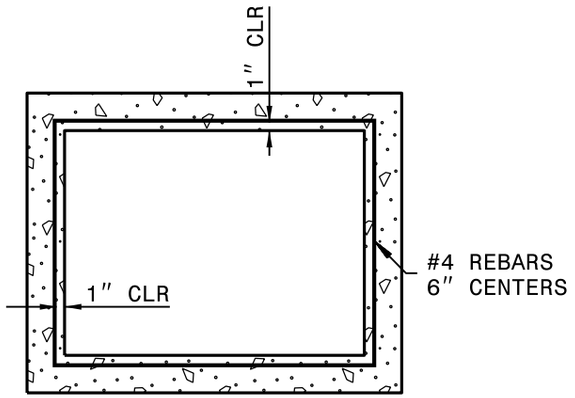
840.45

## GENERAL NOTES:

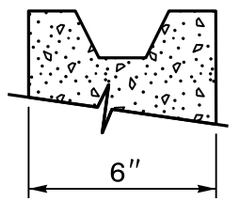
* THIS PRECAST BOX MAY BE USED FOR THE FOLLOWING STANDARDS: 840.01, 840.02, 840.04, 840.05, 840.13, 840.14, 840.15, 840.17, 840.18, 840.19, 840.26, 840.27, 840.28, 840.31, 840.32 AND 840.41.
* INSTALL PRECAST DRAINAGE STRUCTURES AND PAY FOR IN ACCORDANCE WITH SPECIFICATION SECTION 840.
* DO NOT PLACE PRECAST DRAINAGE STRUCTURES UNDER TRAFFIC OR WHERE TRAFFIC WILL BE DETOURED.
* USE 4000 PSI CONCRETE.
* PROVIDE ALL REINFORCING STEEL WHICH MEETS ASTM A615 FOR GRADE 60 AND WELDED WIRE FABRIC CONFORMING TO ASTM A1064.
* LIMIT MAXIMUM DEPTH TO TOP OF BOTTOM SLAB FOR WAFFLE WALL STRUCTURE TO 10′-0″; LIMIT SOLID WALL STRUCTURE TO 15′-0″.
* PLACE LIFT HOLES OR PINS IN ACCORDANCE WITH OSHA STANDARD 1926.704.
* CUT OR FORM OPENINGS FOR PIPE TO PROVIDE REQUIRED SIZE AND LOCATION. ORIENT WAFFLE WALL STRUCTURES SO THAT PIPES ENTER THROUGH THE KNOCKOUT/WAFFLE PANELS ONLY. PIPES MAY ENTER THROUGH THE CORNERS OF SOLID WALL BOXES IF A MINIMUM OF 6″ OF WALL IS PROVIDED ABOVE THE HOLE.
* ALL ELEMENTS PRECAST TO MEET ASTM C913.
* FRAME AND GRATE HEIGHT MAY BE ADJUSTED WITH CONCRETE OR BRICK IN ACCORDANCE WITH STANDARD 840.25.
* PROVIDE PRECAST STRUCTURES OVER 3′-6″ IN DEPTH WITH STEPS AS DIRECTED BY THE ENGINEER.
* WELDED WIRE FABRIC MAY BE SUBSTITUTED FOR REBAR AS LONG AS THE SAME AREA OF STEEL IS PROVIDED.
* SEAL JOINTS WITH A FLEXIBLE BUTYL RUBBER BASE CONFORMING TO FEDERAL SPECIFICATION SS-S-21A, AASHTO M-198, TYPE B - BUTYL RUBBER.
* LIMIT MAXIMUM STRUCTURE SIZE TO INSIDE CLEAR DIMENSIONS OF 5′-0″ X 5′-0″.
* THE OUTSIDE PIPE DIAMETER PLUS 2″ OR THE OPENING REQUIRED FOR FRAME AND GRATE IS THE MINIMUM STRUCTURE SIZE WHICHEVER IS GREATER.
* USE MANHOLE FRAME AND COVER AS INDICATED ON THE PLANS. REINFORCE OPENING AS SHOWN ON THIS SHEET.



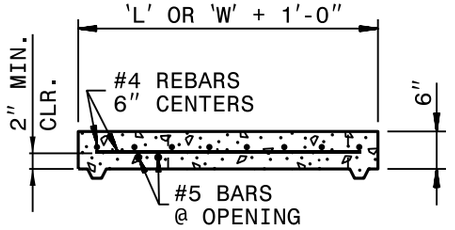

PLAN TOP SLAB



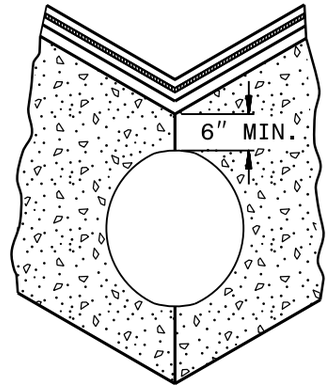

PRECAST RISER PLAN



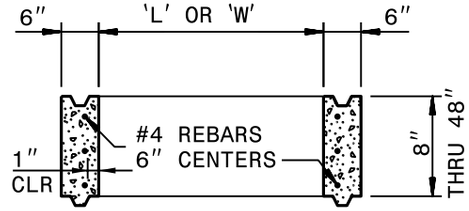

SECTION VIEW



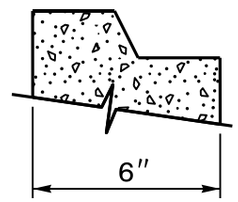

SECTION 'C-C'




CORNER CUT DETAIL (SOLID WALL BOX)




PRECAST RISER DETAIL




SECTION VIEW

**OPTIONAL JOINT DETAILS**

STATE OF NORTH CAROLINA
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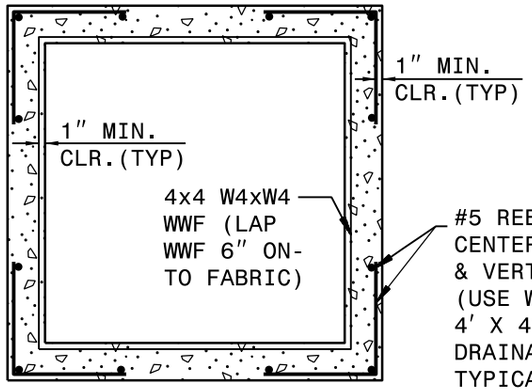
ROADWAY STANDARD DRAWING FOR

**PRECAST DRAINAGE STRUCTURE**

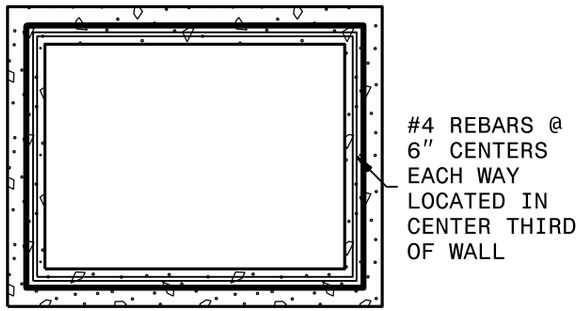
(GENERAL NOTES AND DETAILS)

SHEET 2 OF 2

**840.45**




PLAN VIEW OF BASE UNIT

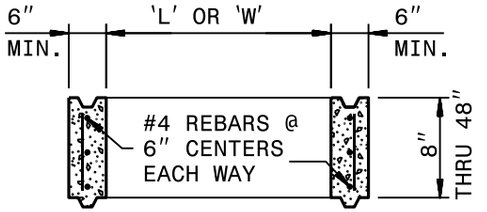



PRECAST RISER PLAN




SECTION VIEWS

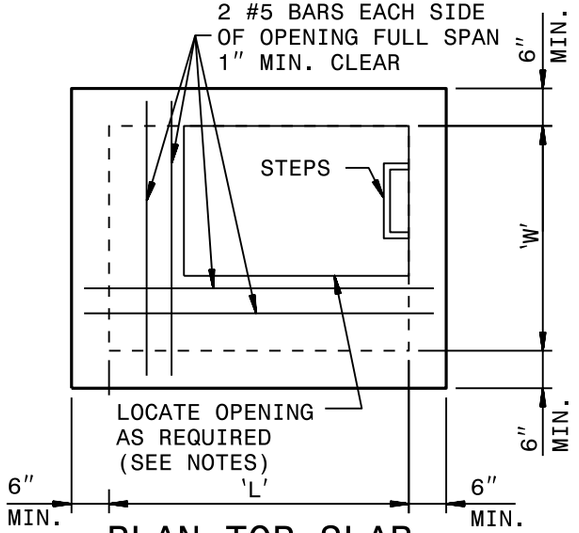
OPTIONAL JOINT DETAILS



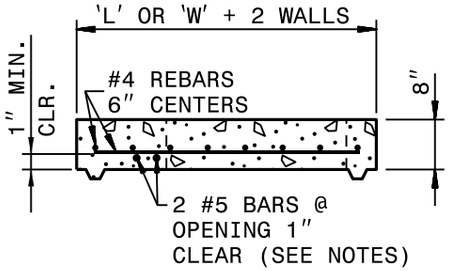

TYPICAL PRECAST
RISER SECTION

## GENERAL NOTES:

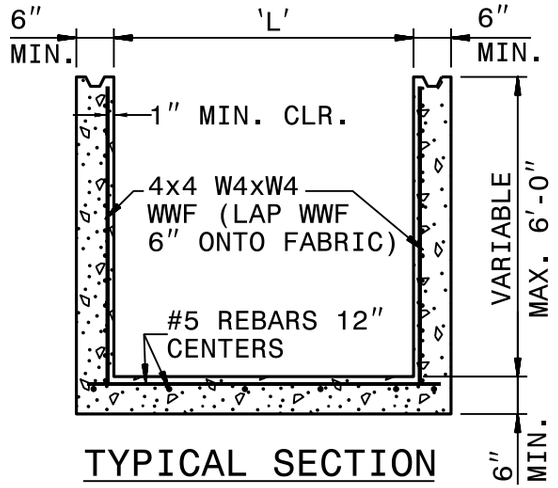
* THIS PRECAST BOX MAY BE USED FOR THE FOLLOWING STANDARDS: 840.01, 840.02, 840.04, 840.05, 840.14, 840.15, 840.31, 840.32, 840.34, 840.35, 840.36 AND 840.41.
* INSTALL AND PAY FOR PRECAST DRAINAGE STRUCTURES IN ACCORDANCE WITH NCDOT STANDARD SPECIFICATION SECTION 840.
* USE 4000 PSI MINIMUM COMPRESSIVE STRENGTH CONCRETE.
* USE ASTM A615 GRADE 60 REINFORCING STEEL. USE ASTM A1064 WELDED WIRE FABRIC (WWF).
* LIMIT MAXIMUM DEPTH TO TOP OF BOTTOM SLAB TO 15′-0″.
* PLACE LIFT HOLES OR PINS IN ACCORDANCE WITH OSHA STANDARD 1926.704.
* ORIENT STRUCTURES SO THAT CORNERS WILL NOT BE CUT OR MODIFIED UNLESS ALLOWED BY DETAIL IN PLANS.
* PRECAST ALL ELEMENTS TO MEET ASTM C913.
* FRAME AND GRATE HEIGHT MAY BE ADJUSTED WITH CONCRETE OR BRICK IN ACCORDANCE WITH STANDARD 840.25.
* PROVIDE PRECAST STRUCTURES OVER 3′-6″ IN DEPTH WITH STEPS 12″ ON CENTERS IN ACCORDANCE WITH STD. NO. 840.66.
* WELDED WIRE FABRIC MAY BE SUBSTITUTED FOR REBAR IF THE SAME MIN. AREA OF STEEL IS PROVIDED.
* SEAL JOINTS WITH A FLEXIBLE BUTYL RUBBER BASE CONFORMING TO FEDERAL SPECIFICATIONS SS-S-21A, AASHTO M-198, TYPE B - BUTYL RUBBER.
* LIMIT MAXIMUM STRUCTURE SIZE INSIDE CLEAR DIMENSIONS TO 6′-0″ X 6′-0″.
* THE OUTSIDE PIPE DIAMETER PLUS 2″ IS THE MINIMUM STRUCTURE SIZE OR THE OPENING REQUIRED FOR GRATE AND FRAME WHICHEVER IS GREATER.
* ROUND MANHOLE MAY BE USED IN LIEU OF SQUARE PROVIDED 2 EXTRA #5′S ARE PLACED ON EVERY SIDE NOT ADJACENT TO A WALL. SEE STD. DWG. 840.34 FOR MANHOLE INSTALLATION.



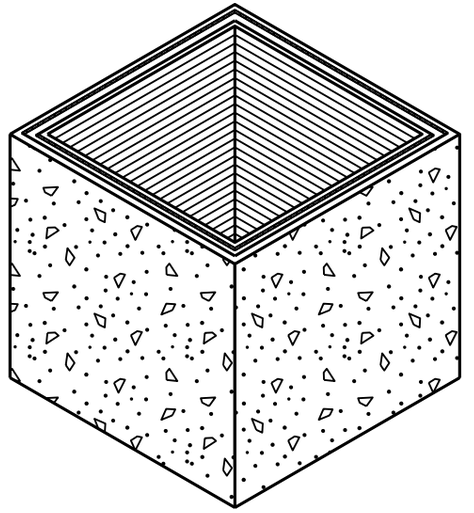

PLAN TOP SLAB




TYPICAL SECTION
TOP SLAB




TYPICAL SECTION
OF BASE UNIT



ISOMETRIC VIEW

STATE OF
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DEPT. OF TRANSPORTATION
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RALEIGH, N.C.

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ROADWAY STANDARD DRAWING FOR

# TRAFFIC BEARING PRECAST DRAINAGE STRUCTURE

SHEET 1 OF 1

840.46

GENERAL NOTES:

MORTAR JOINTS ½″ ± ⅛″ THICK.

CONCAVE TOOL ALL EXPOSED JOINTS.

USE CLASS "B" CONCRETE THROUGHOUT.

USE FORMS TO CONSTRUCT THE BASE SLAB.

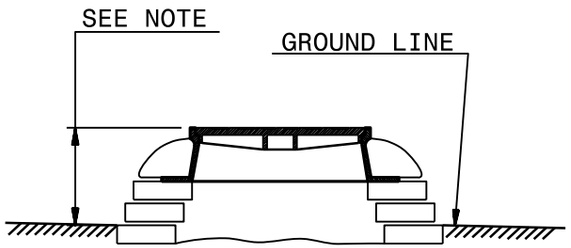
JUMBO BRICK WILL BE PERMITTED. CONCRETE BRICK OR 4″ SOLID CONCRETE BLOCKS MAY BE USED IN LIEU OF CLAY BRICK.

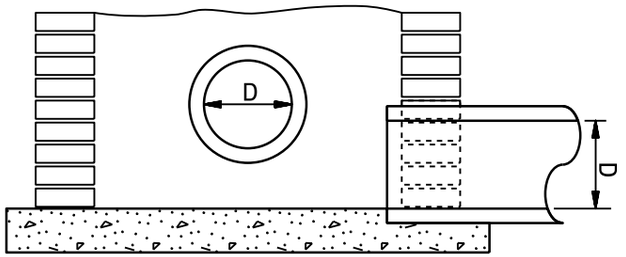
IF REINFORCED CONCRETE PIPE IS SET IN BASE SLAB OF BOX, ADD TO BASE AS SHOWN IN STD. NO. 840.00.

WHERE THE MANHOLE IS EXPOSED TO ROAD TRAFFIC, CONSTRUCT THE TOP OF THE MANHOLE FLUSH WITH THE GROUND. AT OTHER LOCATIONS CONSTRUCT A MINIMUM OF 9″ ABOVE THE GROUND.

THE HEIGHT OF GRADE ADJUSTMENT RINGS OR BRICK PLUS FRAME AND COVER SHALL NOT EXCEED 24″.

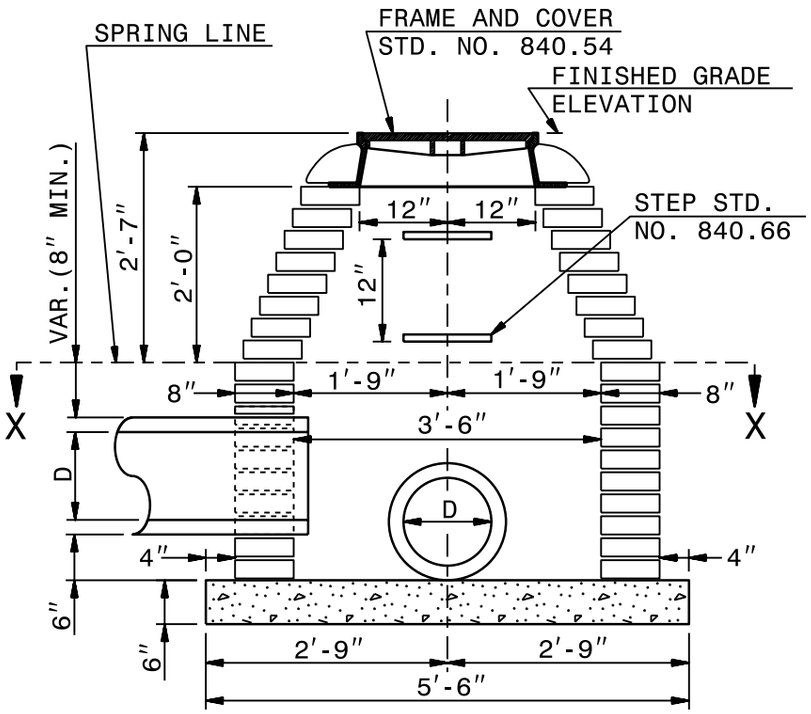
PROVIDE MANHOLES OVER 3′-6″ IN DEPTH WTH STEPS 12″ ON CENTERS IN ACCORDANCE WITH STD. NO. 840.66.



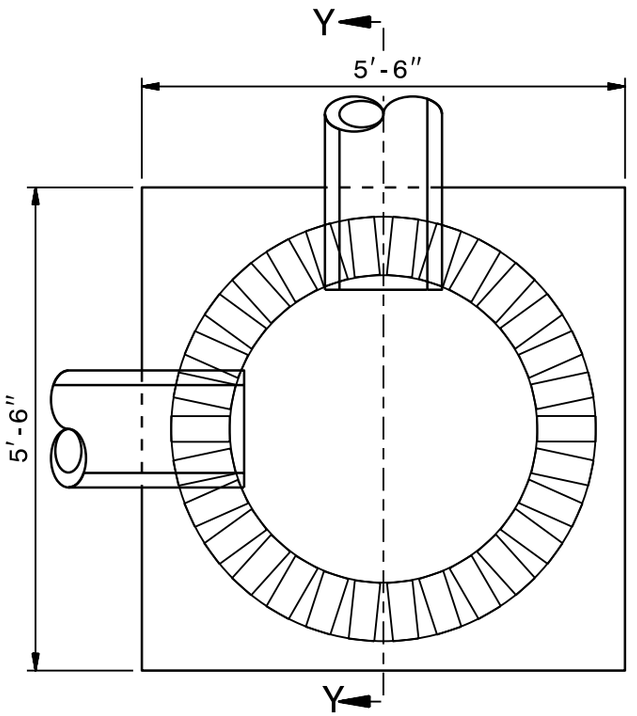




## PART SECTION Y-Y

| MINIMUM DIMENSIONS AND QUANTITIES FOR MANHOLE | | | | | |
|---|---|---|---|---|---|
| PIPE DIM. | CU. YDS. CONCRETE | TOTAL BRICK MASONRY CU. YDS. | CU. YDS. BRICK MASONRY PER FT. HT. | DEDUCTIONS FOR ONE PIPE (CU.YD.) | |
| D | BASE | ABOVE S-L | BELOW S-L | C.M. | R.C. |
| 12″ | 0.560 | 0.530 | 0.323 | 0.020 | 0.032 |
| 15″ | 0.560 | 0.530 | 0.323 | 0.031 | 0.047 |
| 18″ | 0.560 | 0.530 | 0.323 | 0.044 | 0.065 |
| 24″ | 0.560 | 0.530 | 0.323 | 0.078 | 0.113 |
| 30″ | 0.560 | 0.530 | 0.323 | 0.122 | 0.170 |
| 36″ | 0.560 | 0.530 | 0.323 | 0.176 | 0.238 |




## SECTION ON ℄




## SECTION X-X

STATE OF NORTH CAROLINA
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RALEIGH, N.C.

1-24

ROADWAY STANDARD DRAWING FOR

# BRICK MANHOLE

12″ THRU 36″ PIPE

SHEET 1 OF 1

840.51

GENERAL NOTES

USE 4000 PSI MINIMUM COMPRESSIVE STRENGTH CONCRETE.

USE ASTM A615 GRADE 60 REINFORCING STEEL. USE ASTM A1064 WELDED WIRE FABRIC (WWF).

FABRICATE, ASSEMBLE AND DESIGN PRECAST MANHOLE COMPONENTS ACCORDANCE WITH AASHTO M199.

ASSEMBLE RISER AND GRADE RINGS WITH THE STEPS SPACED 12″ FROM THE TOP TO THE BOTTOM OF THE MANHOLE.

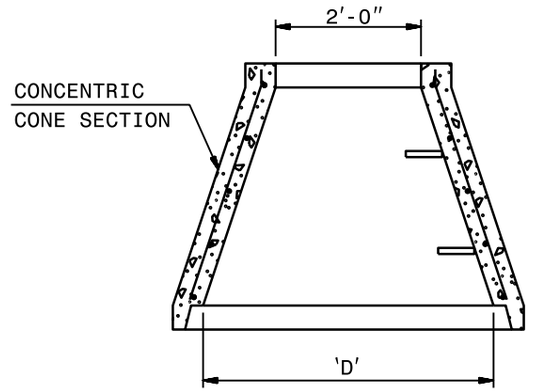
THE HEIGHT OF GRADE ADJUSTMENT RINGS PLUS FRAME AND COVER SHALL NOT EXCEED 24″.

WHERE THE MANHOLE IS EXPOSED TO ROAD TRAFFIC, CONSTRUCT THE TOP OF THE MANHOLE FLUSH WITH THE GROUND AND A MINIMUM OF 9″ ABOVE THE GROUND AT OTHER LOCATIONS.

LIMIT DEPTH OF FILL TO 30′-0″ FROM FINISH GRADE TO TOP OF BOTTOM SLAB.

THE MIN. SLAB THICKNESS 'T' IS THE DIMENSION OF THE THINNEST PORTION OF THE TOP/BOTTOM SLAB.

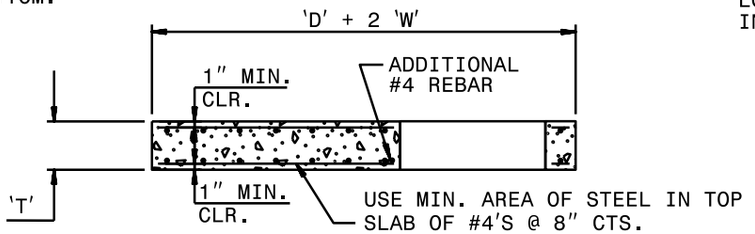
* TOP MAT OF REINFORCEMENT MAY BE NEGLECTED IF TOP SLAB HAS A DISTINGUISHABLE TOP AND BOTTOM.



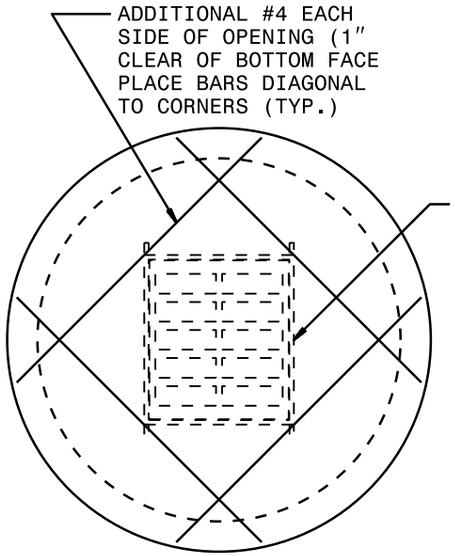

## ALTERNATE CONE SECTION

| D | W | T | As |
|---|---|---|---|
| INTERNAL DIAMETER (FT.) | MIN. WALL THICKNESS (IN.) | MIN. TOP/BOTTOM SLAB THICKNESS (IN.) | MIN. CIRCUMFERENTIAL AREA OF STEEL PER VERTICAL FT. (SQ. IN.) |
| 4 | 4 | 6 | 0.12 |
| 5 | 5 | 8 | 0.15 |
| 6 | 6 | 8 | 0.18 |

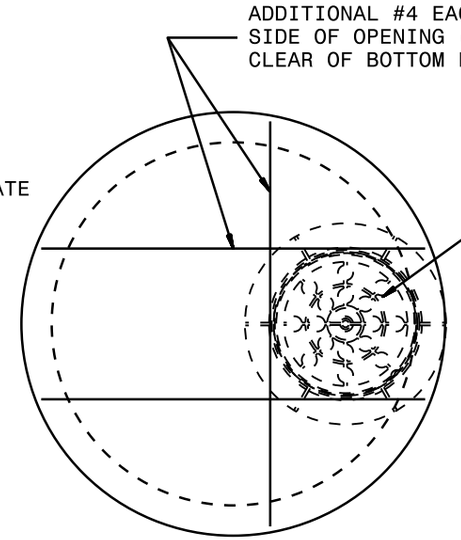
| FRAME AND GRATES | STD. NO. |
|---|---|
| TRAFFIC BEARING | 840.37 |
| | 840.39 |
| NONTRAFFIC BEARING: | 840.22 |
| | 840.24 |
| | 840.20 |
| | 840.29 |
| | 840.33 |



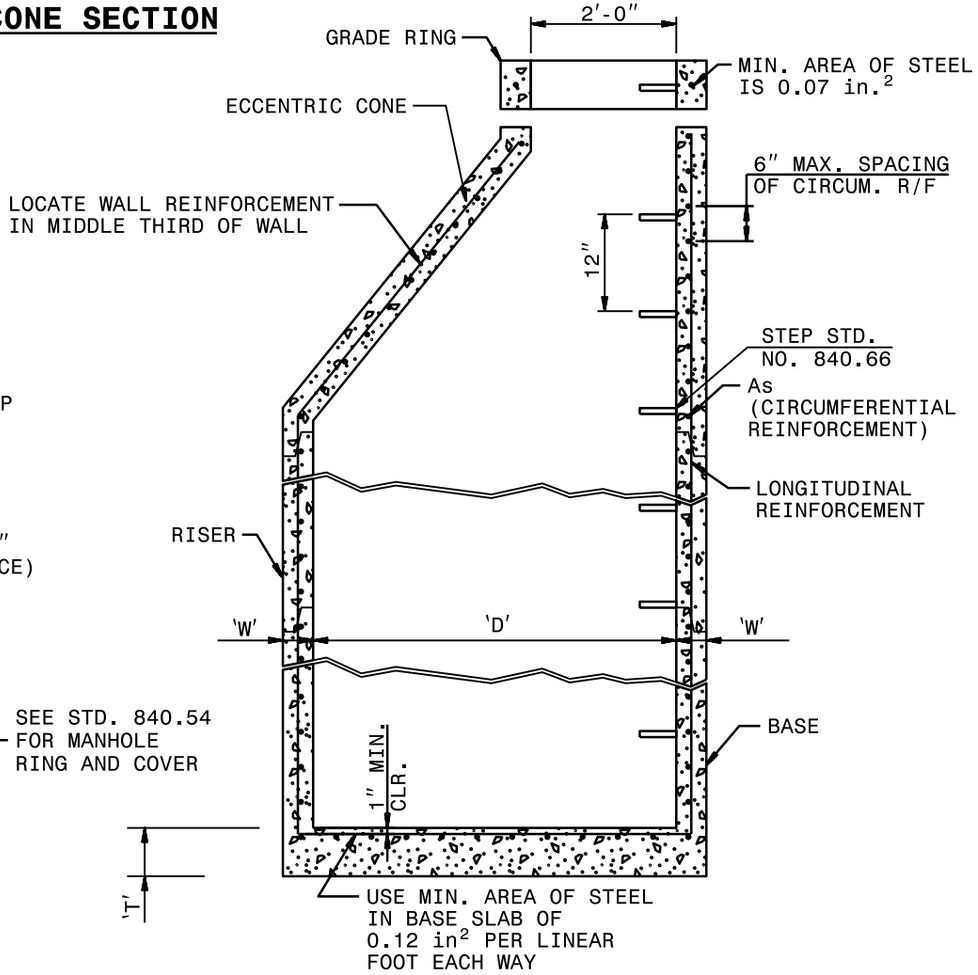

## FLAT TOP SLAB




## GRATED INLET OPTION




## MANHOLE OPTION




## TYPICAL MANHOLE SECTION

STATE OF NORTH CAROLINA
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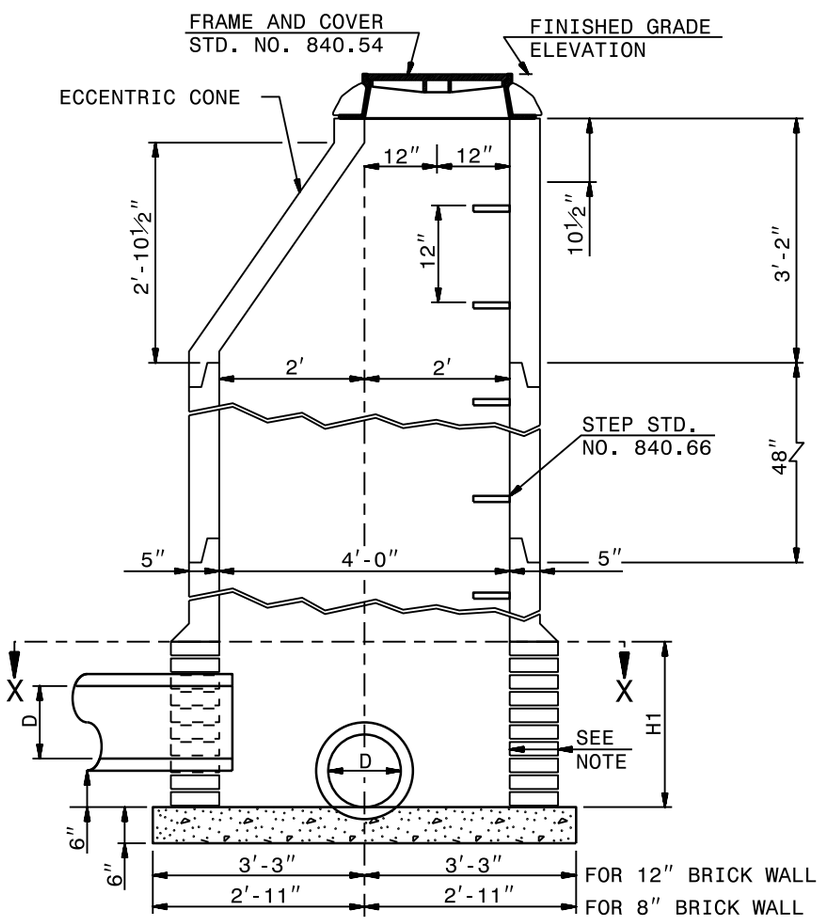
ROADWAY STANDARD DRAWING FOR

# PRECAST MANHOLE 4′,5′ AND 6′ DIAMETER

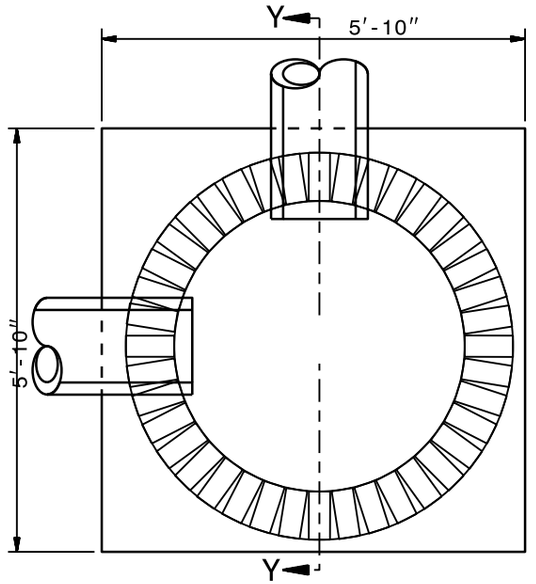
12″ THRU 48″ PIPE

SHEET 1 OF 1

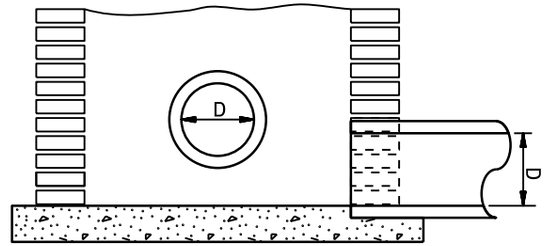
840.52



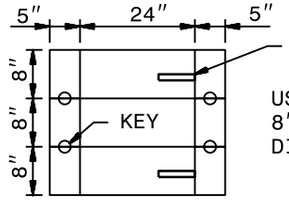

## SECTION ON ℄




## SECTION X-X




## PART SECTION Y-Y




STEP STD. NO. 840.66

USE 24" GRADE RINGS IN 8" HIGH SECTIONS AS DIRECTED BY THE ENGINEER.

| DIMENSIONS | |
|---|---|
| PIPE DIM. | BRICK HEIGHT |
| D | H1 (MIN) |
| 12" | 1'-5" |
| 15" | 1'-8" |
| 18" | 1'-11" |
| 24" | 2'-6" |
| 30" | 3'-0" |
| 36" | 3'-7" |
| 42" | 4'-2" |

GENERAL NOTES:

MORTAR JOINTS ½" ± ⅛" THICK.

USE CLASS "B" CONCRETE THROUGHOUT.

USE FORMS TO CONSTRUCT THE BASE SLAB.

JUMBO BRICK WILL BE PERMITTED. CONCRETE BRICK OR 4" SOLID CONCRETE BLOCK WILL BE USED IN LIEU OF CLAY BRICK.

USE PRECAST MANHOLE COMPONENTS MEETING REQUIREMENTS OF STD.NO.840.52 AND AASHTO M199.

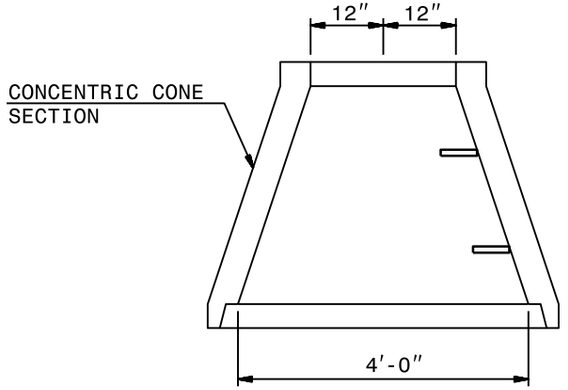
FOR MANHOLE OVER 12' VERTICAL WALL DEPTH, CONSTRUCT BRICK MASONRY WALL 12" THICK. FOR MANHOLES WITH A VERTICAL WALL DEPTH LESS THAN 12', CONSTRUCT BRICK MASONRY WALL 8" THICK.

ASSEMBLE RISERS AND GRADE RINGS WITH THE STEPS SPACED 12" FROM THE TOP TO THE BOTTOM OF THE MANHOLE.

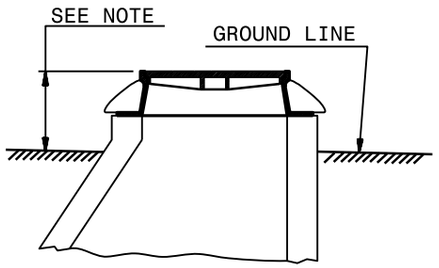
THE HEIGHT OF GRADE ADJUSTMENT RINGS PLUS FRAME AND COVER SHALL NOT EXCEED 24".

WHERE THE MANHOLE IS EXPOSED TO ROAD TRAFFIC, CONSTRUCT THE TOP OF THE MANHOLE FLUSH WITH THE GROUND AND A MINIMUM OF 9" ABOVE THE GROUND AT OTHER LOCATIONS.

IF REINFORCED CONCRETE PIPE IS SET IN BASE SLAB OF BOX, ADD TO BASE AS SHOWN IN STD. NO. 840.00.




## ALTERNATE CONE SECTION




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ROADWAY STANDARD DRAWING FOR

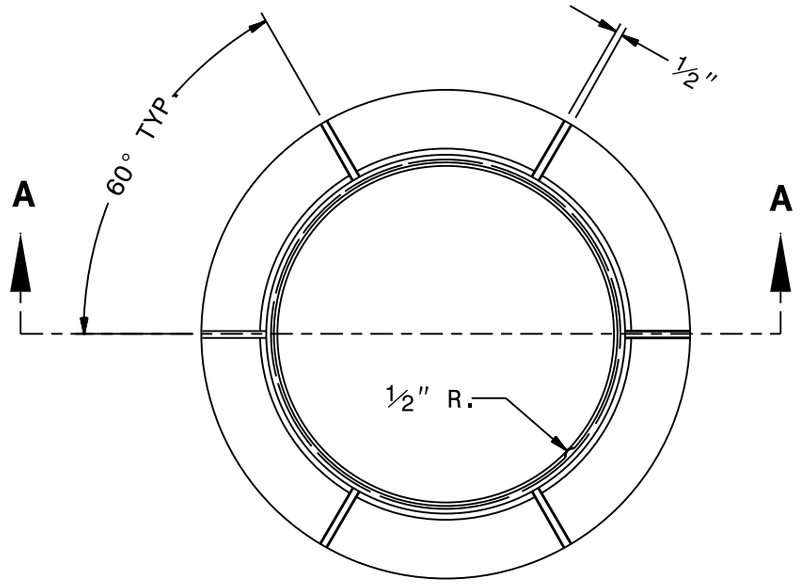
# PRECAST MANHOLE WITH MASONRY BASE

12" THRU 42" PIPE

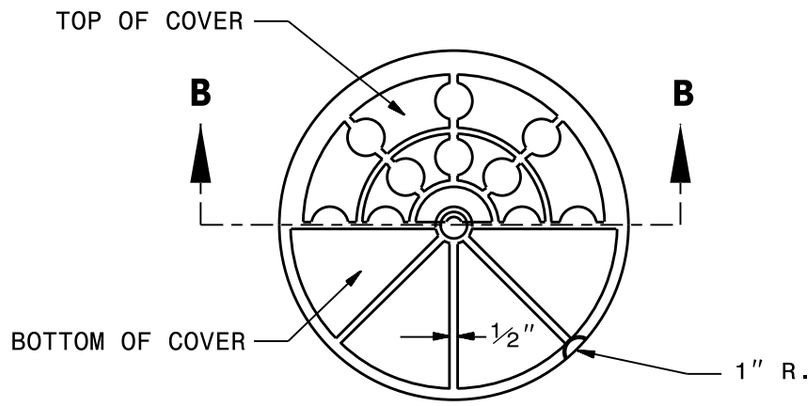
SHEET 1 OF 1

840.53

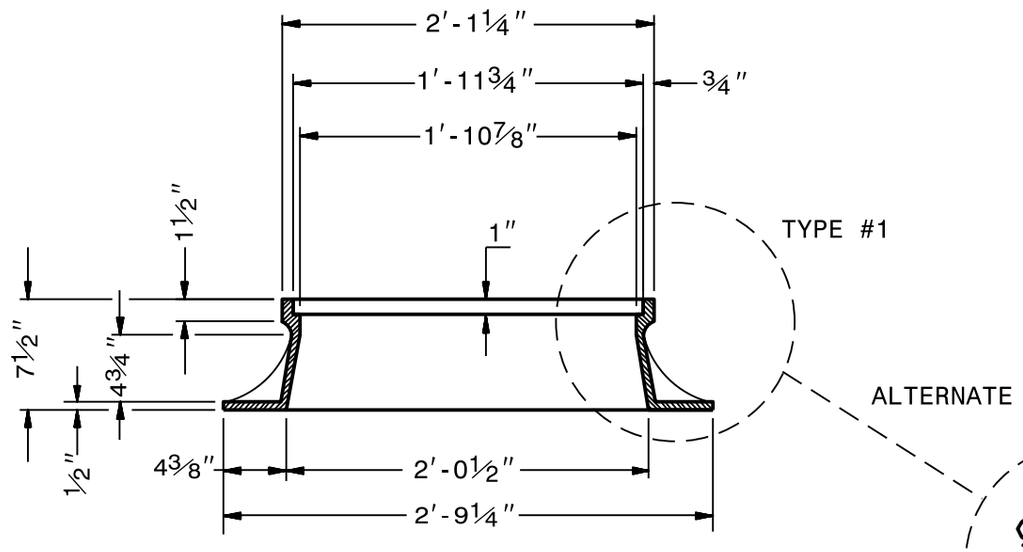
SOLID COVER SHOWN PERFORATED. PERFORATED AVAILABLE IF SPECIFIED.
STATE USE OF SYSTEM ON COVER
(I.E.: SEWER, STORM DRAIN, ELECTRICAL)



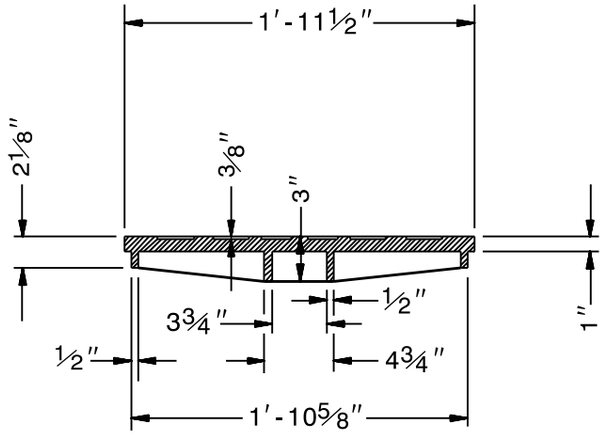

**PLAN OF FRAME**




**PLAN OF COVER**




**SECTION A-A**




**SECTION B-B**

MINIMUM WEIGHTS - LBS.
FRAME - 180
COVER - 120
TOTAL - 300

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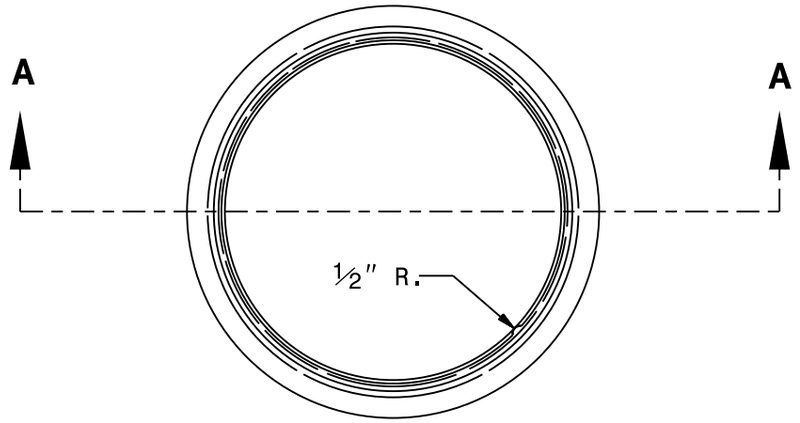
ROADWAY STANDARD DRAWING FOR

# MANHOLE FRAME AND COVER

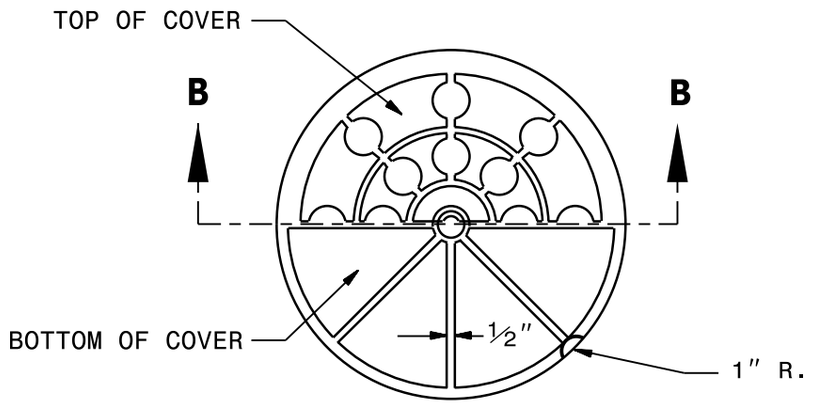
SHEET 1 OF 1

840.54

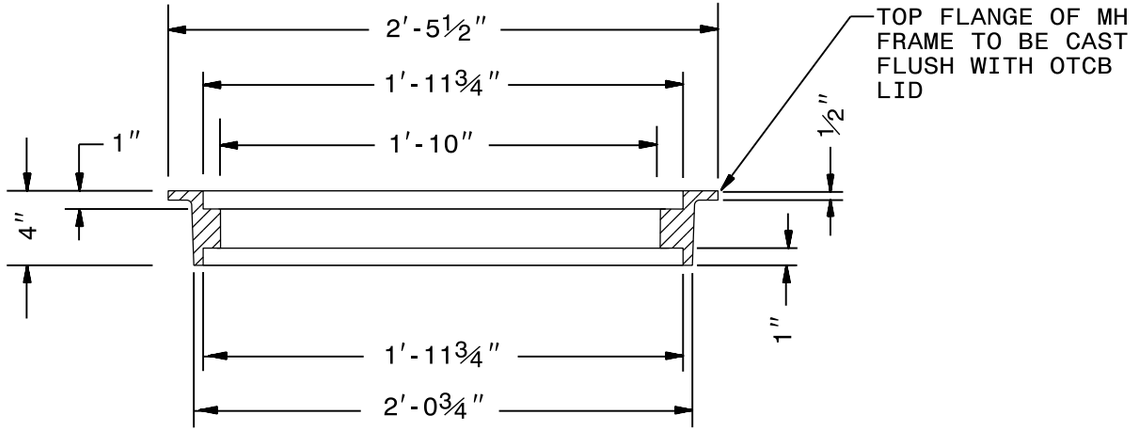
SOLID COVER SHOWN PERFORATED. PERFORATED AVAILABLE IF SPECIFIED.
STATE USE OF SYSTEM ON COVER
(I.E.: SEWER, STORM DRAIN, ELECTRICAL)



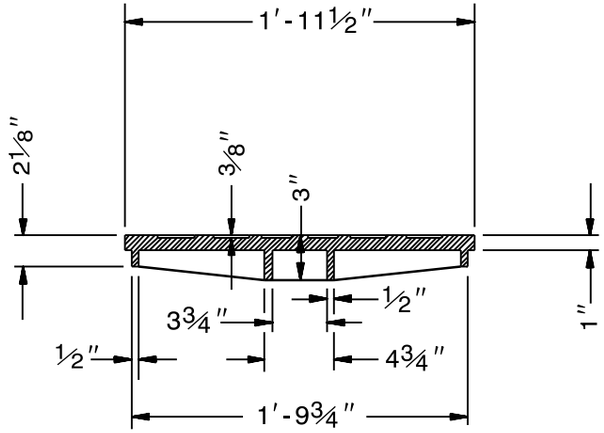

**PLAN OF FRAME**




**PLAN OF COVER**




**SECTION A-A**




**SECTION B-B**

MINIMUM WEIGHTS - LBS.
FRAME - 180
COVER - 120
TOTAL - 300

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ROADWAY STANDARD DRAWING FOR

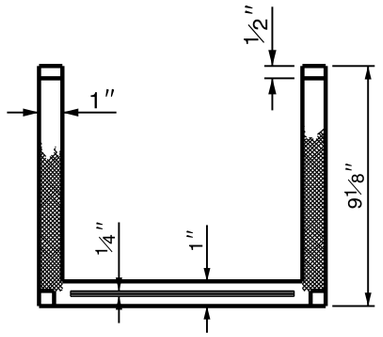
# MANHOLE FRAME AND COVER

(FLUSH WITH SLAB FOR OPEN THROAT CATCH BASIN)

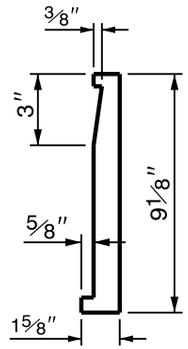
SHEET 1 OF 1

840.55

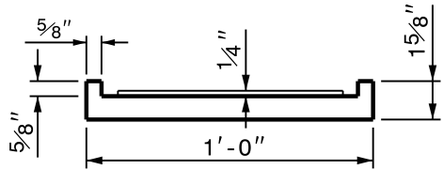
NOTES:
INSTALL ALL STEPS PROTRUDING 4″ FROM INSIDE FACE OF STRUCTURE WALL.
STEPS DIFFERING IN DIMENSIONS, CONFIGURATION, OR MATERIALS FROM THOSE SHOWN MAY ALSO BE USED PROVIDED THE CONTRACTOR HAS FURNISHED THE ENGINEER WITH DETAILS OF THE PROPOSED STEPS AND HAS RECEIVED WRITTEN APPROVAL FROM THE ENGINEER FOR THE USE OF SUCH STEPS.




PLAN

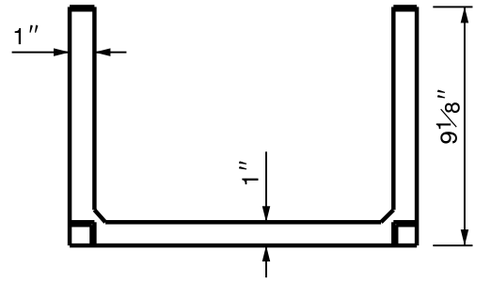



SIDE ELEVATION

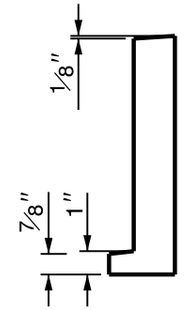



ELEVATION

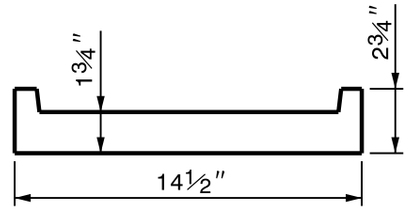
CAST IRON




PLAN

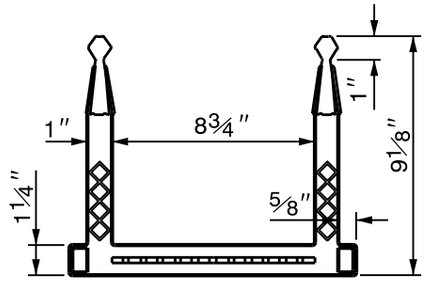



SIDE ELEVATION

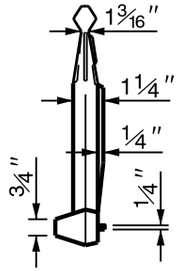



ELEVATION

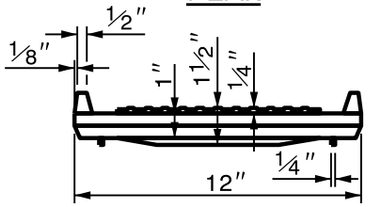
CAST IRON



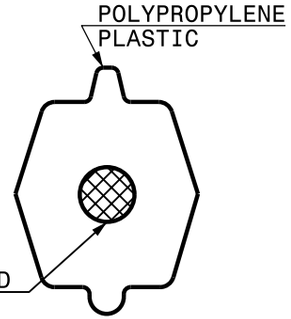

PLAN



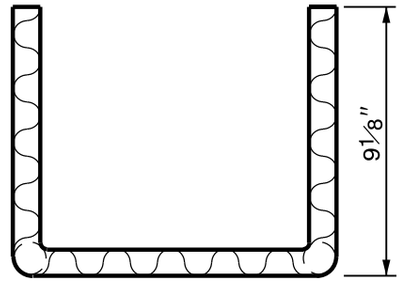

SIDE ELEVATION
COMPOSITE



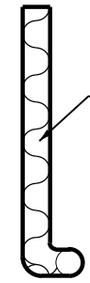

ELEVATION




SECTION A-A

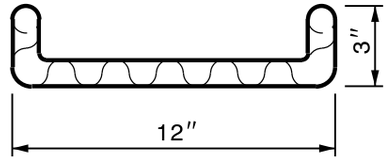



PLAN




SIDE ELEVATION

REINFORCING STEEL




ELEVATION

NOTE:
DO NOT USE IN
SANITARY SEWER MANHOLES.

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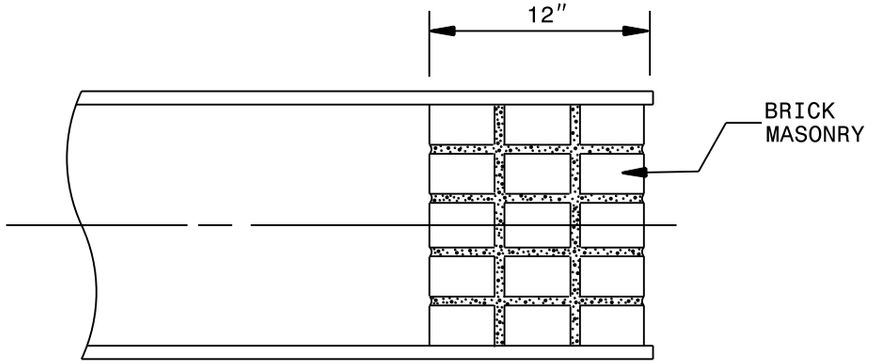
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ROADWAY STANDARD DRAWING FOR

# DRAINAGE STRUCTURE STEPS

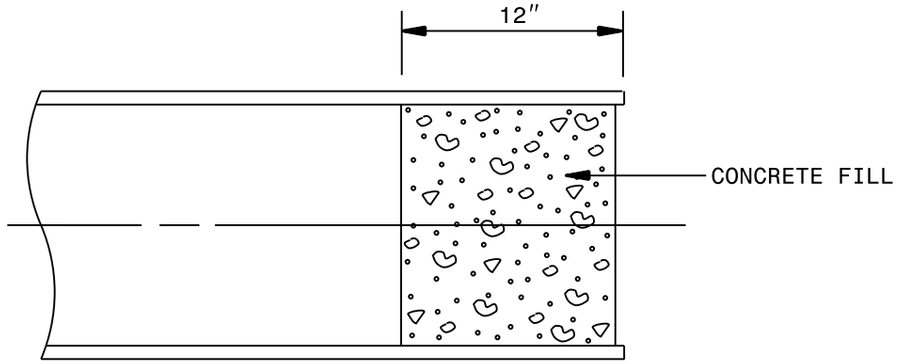
SHEET 1 OF 1

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SECTION OF MASONRY

PIPE PLUG




SECTION OF CONCRETE

PIPE PLUG

| QUANTITIES | |
|---|---|
| PIPE SIZE | CUBIC YARDS |
| 12″ | 0.029 |
| 15″ | 0.045 |
| 18″ | 0.065 |
| 24″ | 0.116 |
| 30″ | 0.182 |
| 36″ | 0.262 |
| 42″ | 0.356 |
| 48″ | 0.465 |
| 54″ | 0.589 |
| 60″ | 0.727 |
| 66″ | 0.880 |

NOTE:

EITHER BRICK MASONRY OR CONCRETE MAY BE USED.

CONCRETE BRICK MAY BE USED IN LIEU OF CLAY BRICK. JUMBO BRICK WILL BE PERMITTED.

NOTE:

USE PAY LIMITS (C.Y.) FOR PIPE PLUGS 12″ IN THICKNESS ONLY.

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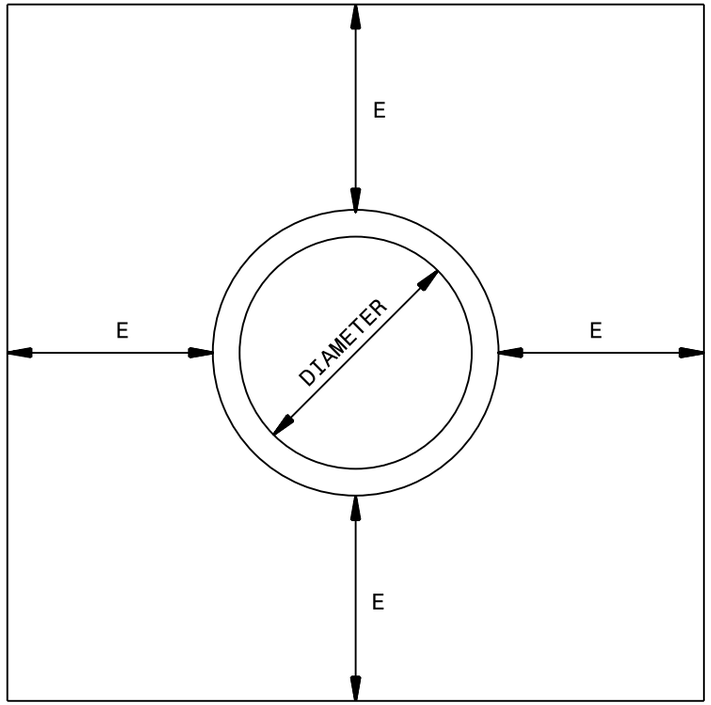
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ROADWAY STANDARD DRAWING FOR

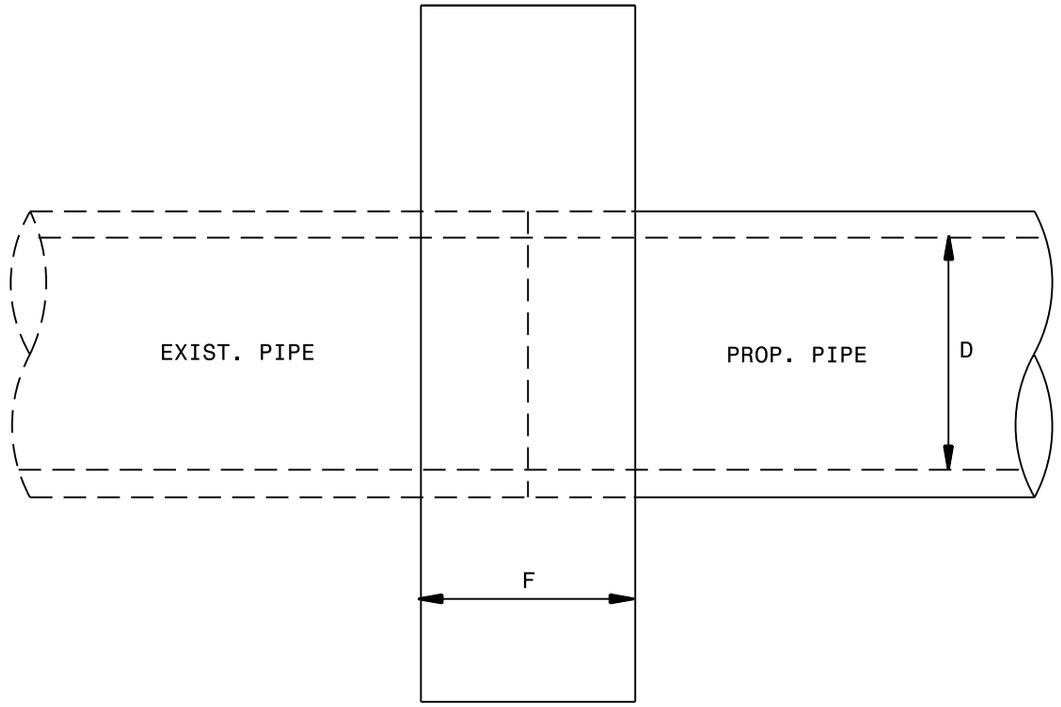
# CONCRETE AND BRICK PIPE PLUG

SHEET 1 OF 1

840.71




## ELEVATION




## SIDE ELEVATION

GENERAL NOTES:

USE PIPE COLLAR FOR EXTENDING EXISTING CONCRETE PIPE CULVERTS AT LOCATIONS SHOWN ON PLANS OR AS DIRECTED BY THE ENGINEER. THIS INCLUDES EXTENDING EXISTING PIPES WITH PIPES OF DIFFERENT MATERIALS.

CONSTRUCT THE PIPE COLLAR WITH CLASS "B" OR BETTER CONCRETE.

OBSERVE ALL REQUIREMENTS OF SECTION 840 OF THE STANDARD SPECIFICATIONS.

* USE 12 INCH DIAMETER VALUES FOR PIPE DIAMETERS LESS THAN 12 INCH.

| D | E | F | CU. YD. |
|---|---|---|---|
| 12″ | 12″ | 12″ | 0.3528 |
| 15″ | 12″ | 12″ | 0.3990 |
| 18″ | 12″ | 12″ | 0.4465 |
| 24″ | 12″ | 12″ | 0.5526 |
| 30″ | 12″ | 12″ | 0.6560 |
| 36″ | 12″ | 12″ | 0.7640 |
| 42″ | 12″ | 12″ | 0.8856 |
| 48″ | 12″ | 12″ | 1.0126 |
| 54″ | 18″ | 18″ | 2.5793 |
| 60″ | 18″ | 18″ | 2.8506 |
| 66″ | 18″ | 18″ | 3.1307 |
| 72″ | 18″ | 18″ | 3.4176 |

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ROADWAY STANDARD DRAWING FOR

# PIPE COLLAR