

JUNE 2014



The Commonwealth of Massachusetts

Deval L. Patrick
Governor

Richard A. Davey
Secretary & CEO

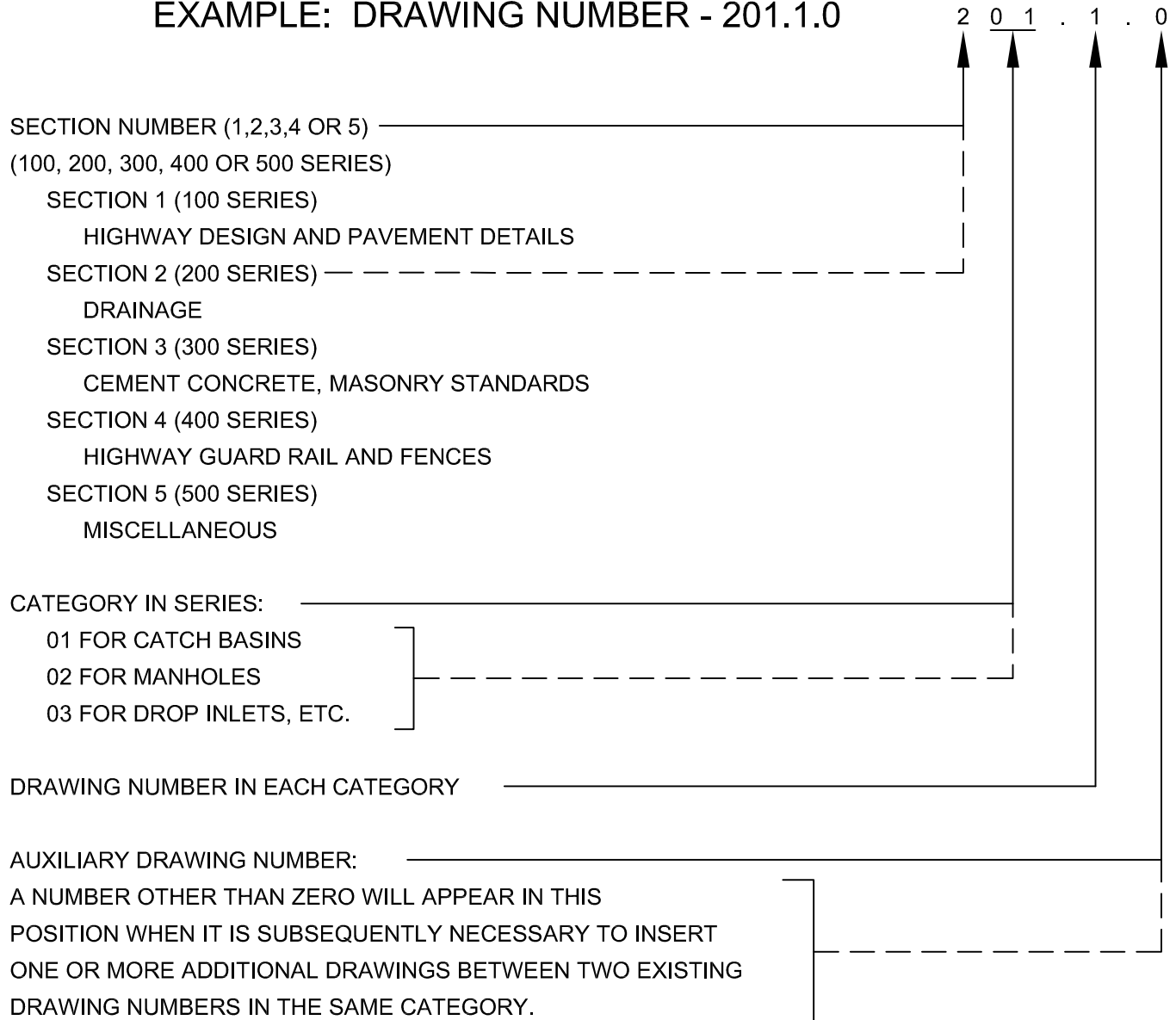
Frank DePaola, P.E.
Administrator



Prepared by
The Massachusetts Department of Transportation - Highway Division

June 2014

EXAMPLE: DRAWING NUMBER - 201.1.0



DESCRIPTIONDRAWING
NUMBERSECTION 1
HIGHWAY DESIGN AND PAVEMENT DETAILS

LIMIT OF MUCK EXCAVATION.....	E 101.1.0
ROCK CUT SELECTION.....	E 102.1.0
METHOD OF ROUNDING SLOPES- CUT AND FILL SLOPES.....	E 103.1.0
METHOD OF STEPPING SURFACE AND BASE COURSE LAYERS.....	E 104.1.0
TRANSVERSE JOINTS AT EXPANSION JOINTS.....	E 104.1.1
LOCATION OF SAW CUT FOR TRANSVERSE JOINTS AT BRIDGE ABUTMENT.....	E 104.1.2
SCORED CEMENT CONCRETE PAVEMENT AT RAMPS.....	E 105.2.0
SHOULDER SECTION OF SCORED CEMENT CONCRETE PAVEMENT....	E 105.2.1
FREEWAY ENTRANCE RAMP DETAIL - RUMBLE STRIP INSTALLATION AT GORE AREAS.....	E 105.3.2
FREEWAY ENTRANCE RAMP DETAIL - PAVEMENT MARKING INSTALLATION AT GORE AREAS.....	E 105.3.3
RUMBLE STRIP INSTALLATION DETAILS BICYCLES PROHIBITED.....	E 105.5.0
RUMBLE STRIP INSTALLATION DETAILS BICYCLES PERMITTED.....	E 105.7.0
HOT MIX ASPHALT BERM TYPE A.....	E 106.1.0
HOT MIX ASPHALT CURBS.....	E 106.2.0
METHOD OF SETTING VERTICAL CURB.....	E 106.3.0
METHOD OF SETTING SLOPED EDGING.....	E 106.5.0
INTERSECTIONS.....	E 107.1
WHEELCHAIR RAMPS LESS THAN 12'-4 " SIDEWALK.....	E 107.2.0
WHEELCHAIR RAMP ON NARROW SIDEWALK WITH DETECTABLE WARNING PANEL.....	E 107.2.1
WHEELCHAIR RAMPS GREATER THAN 12'-4 " SIDEWALK.....	E 107.3.0
WHEELCHAIR RAMP FOR ONE CONTINUOUS DIRECTION OF PEDESTRIAN TRAFFIC.....	E 107.6.0
WHEELCHAIR RAMP WITH 3" CURB REVEAL.....	E 107.6.3
"T" INTERSECTION WHEELCHAIR RAMP.....	E 107.6.4
DETECTABLE WARNING PANEL FOR WHEELCHAIR RAMPS AND STANDARD RAMP TERMINOLOGY.....	E 107.6.5
WHEELCHAIR RAMP WITH LANDSCAPING STRIP.....	E 107.6.9
SIDEWALK THROUGH DRIVEWAYS WITHOUT CURB RETURNS 6'.....	E 107.7.0
SIDEWALK THROUGH DRIVEWAYS WITH CURB RETURNS 2' CURB CORNERS.....	E 107.8.0
RESIDENTIAL DRIVEWAYS.....	E 107.8.1
CURB TRANSITION LENGTH FOR WHEELCHAIR RAMPS.....	E 107.9.0

DESCRIPTIONDRAWING
NUMBERSECTION 2
DRAINAGE

CONCRETE BLOCK CATCH BASIN.....	E 201.3.0
PRECAST CONCRETE CATCH BASIN.....	E 201.4.0
PRECAST CONCRETE CATCH BASIN TUB.....	E 201.5.0
CATCH BASIN FRAME.....	E 201.6.0
HOOK LOCK CASCADE GRATE- FLOW FROM LEFT.....	E 201.7.0
HOOK LOCK CASCADE GRATE- FLOW FROM RIGHT.....	E 201.7.1
FRAME AND HOOK LOCK CASCADE GRATE- FLOW FROM LEFT- ASSEMBLY DETAILS.....	E 201.9.0
FRAME AND HOOK LOCK CASCADE GRATE- FLOW FROM RIGHT- ASSEMBLY DETAILS.....	E 201.9.1
HOOK LOCK BAR GRATE.....	E 201.10.0
FRAME AND HOOK LOCK BAR GRATE- FRAME ASSEMBLY DETAILS....	E 201.10.1
DROP INLET GRATE.....	E 201.11.0
CATCH BASIN HOOD.....	E 201.12.0
CONCRETE BLOCK MANHOLE - MANHOLES 9' OR LESS IN DEPTH.....	E 202.2.0
CONCRETE BLOCK MANHOLE - MANHOLES OVER 9' IN DEPTH.....	E 202.3.0
PRECAST CONCRETE MANHOLES 9' OR LESS IN DEPTH.....	E 202.4.0
SPECIAL MANHOLES FOR 36" TO 84" DIAMETER R.C. PIPE.....	E 202.5.0
MANHOLE FRAME AND COVER - A FRAME.....	E 202.6.0
MANHOLE FRAME AND COVER - B FRAME.....	E 202.7.0
MANHOLE COVER DETAILS.....	E 202.8.0
CONCRETE COLLARS.....	E 202.9.0
DROP INLETS TYPE A - PRECAST CONCRETE TYPE B - CONCRETE BLOCK.....	E 203.1.0
DROP INLETS TYPE AF - PRECAST CONCRETE TYPE BF - CONCRETE BLOCK.....	E 203.2.0
DROP INLET TYPE C.....	E 203.3.0
DROP INLET TYPE CF.....	E 203.4.0
DROP INLET TYPE D.....	E 203.5.0
DROP INLET TYPE DF.....	E 203.6.0
FLUSH DROP INLET THROAT.....	E 203.7.0
GUTTER INLET.....	E 204.2.0
DRY STONE MASONRY LEACHING BASIN.....	E 205.1.0
CONCRETE BLOCK LEACHING BASIN.....	E 205.2.0
CORRUGATED STEEL METAL PIPE - TABLE OF MINIMUM WALL THICKNESS.....	E 206.1.0

DESCRIPTIONDRAWING
NUMBERSECTION 2
DRAINAGE CONT.

CORRUGATED STEEL METAL PIPE ARCH - TABLE OF MINIMUM WALL THICKNESS.....	E 206.2.0
CORRUGATED METAL PIPE UNDER FILL SLOPE.....	E 206.3.0
CONCRETE AND FIELD STONE MASONRY PIPE ENDS FOR 8" TO 30" PIPE.....	E 206.4.0
QUANTITY TABLES FOR CONCRETE AND FIELD STONE MASONRY PIPE ENDS.....	E 206.4.1
CONCRETE AND FIELDSTONE MASONRY PIPE ENDS FOR COMBINATION PIPES UP TO 30".....	E 206.5.0
CONCRETE AND FIELDSTONE MASONRY PIPE ENDS FOR 30" TO 84" PIPE CULVERTS.....	E 206.6.0
STONE PIPE ENDS FOR PIPES 24" AND LESS IN DIA.	E 206.7.0
REINFORCED CONCRETE PIPE FLARED ENDS.....	E 206.8.0
STANDARD METAL END.....	E 206.9.0
CONCRETE SPLASH PADS.....	E 208.1.0
SUBDRAIN.....	E 209.1.0
DITCH CHECK DAMS FOR EROSION CONTROL.....	E 210.2.0
HAY BALES AND SILT FENCES FOR EROSION CONTROL.....	E 210.3.0
HALF CIRCLE CCM PIPE WATERWAYS.....	E 211.1.0
PAVED WATERWAYS AND APRON.....	E 211.2.0
PAVED WATERWAYS.....	E 211.3.0

SECTION 3
CEMENT CONCRETE & MASONRY STRUCTURES

CEMENTED STONE MASONRY WALL.....	E 302.2.0
SPECIAL SLOPE PAVING UNDER BRIDGES REINFORCED CONCRETE SLAB.....	E 303.1.0
SPECIAL SLOPE PAVING UNDER BRIDGES REINFORCED CONCRETE SLAB DETAILS.....	E 303.1.1
CEMENT CONCRETE STEPS 1/2.....	E 304.1.0
CEMENT CONCRETE STEPS 2/2.....	E 304.2.0
TYPICAL CANTILEVER RETAINING WALL SECTION.....	E 305.1.0
CANTILEVER RETAINING WALLS DENSE FOUNDATION SOILS, SLOPING BACKFILL.....	E 305.2.0
CANTILEVER RETAINING WALLS DENSE FOUNDATION SOILS, LEVEL BACKFILL, SURCHARGE.....	E 305.3.0

DESCRIPTIONDRAWING
NUMBERSECTION 3
CEMENT CONCRETE & MASONRY STRUCTURES CONT.

CANTILEVER RETAINING WALLS LOOSE FOUNDATION SOILS, SLOPING BACKFILL.....	E 305.4.0
CANTILEVER RETAINING WALLS LOOSE FOUNDATION SOILS, LEVEL BACKFILL, SURCHARGE.....	E 305.5.0
CANTILEVER RETAINING WALLS ROCK FOUNDATION, SLOPING BACKFILL.....	E 305.6.0
CANTILEVER RETAINING WALLS ROCK FOUNDATION, LEVEL BACKFILL, SURCHARGE.....	E 305.7.0

SECTION 4
HIGHWAY GUARD RAIL & FENCES

STEEL W BEAM HIGHWAY GUARD	E 401.1.0
STEEL W BEAM HIGHWAY GUARD SECTIONS.....	E 401.1.1
STEEL W BEAM HIGHWAY GUARD FOR SIGN PROTECTION.....	E 401.2.0
STEEL W BEAM HIGHWAY GUARD BURIED IN BACK-SLOPE PLAN VIEW.....	E 401.2.1a
STEEL W BEAM HIGHWAY GUARD BURIED IN BACK-SLOPE POST LOCATION.....	E 401.2.1b
STEEL W BEAM HIGHWAY GUARD BURIED IN BACK-SLOPE POST LOCATION.....	E 401.2.1c
STEEL W BEAM HIGHWAY GUARD BURIED IN BACK-SLOPE ANCHORAGE DETAILS.....	E 401.2.1d
STEEL W BEAM HIGHWAY GUARD BURIED IN BACK-SLOPE END ANCHORAGE DETAILS FOR POSTS 1, 2 AND 3.....	E 401.2.1e
TABLE OF OFFSETS FOR HIGHWAY GUARD FLARED ENDS.....	E 401.3.0
STEEL THRIE BEAM HIGHWAY GUARD RAIL DETAILS.....	E 401.5.0
BRIDGE RAIL TO HIGHWAY GUARD TRANSITION.....	E 401.5.1
BRIDGE RAIL TO HIGHWAY GUARD TRANSITION SECTIONS.....	E 401.5.2
STEEL THRIE BEAM HIGHWAY TERMINAL CONNECTOR	E 401.5.3
BRIDGE RAIL TO HIGHWAY GUARD COLLAPSING TUBE	E 401.5.4
BRIDGE RAIL TO HIGHWAY GUARD AT SIDEWALK	E 401.5.5
BRIDGE RAIL TO HIGHWAY GUARD AT SIDEWALK SECTIONS.....	E 401.5.6
STEEL THRIE BEAM HIGHWAY GUARD DETAILS.....	E 401.6.0
STEEL HIGHWAY GUARD TRANSITION BEAM	E 401.6.1
STEEL W BEAM HIGHWAY GUARD RAIL DETAILS	E 401.7.0
STEEL W BEAM HIGHWAY GUARD POSTS AND TERMINAL SECTION DETAILS.....	E 401.8.0

DESCRIPTIONDRAWING
NUMBERSECTION 4
HIGHWAY GUARD RAIL & FENCES CONT.

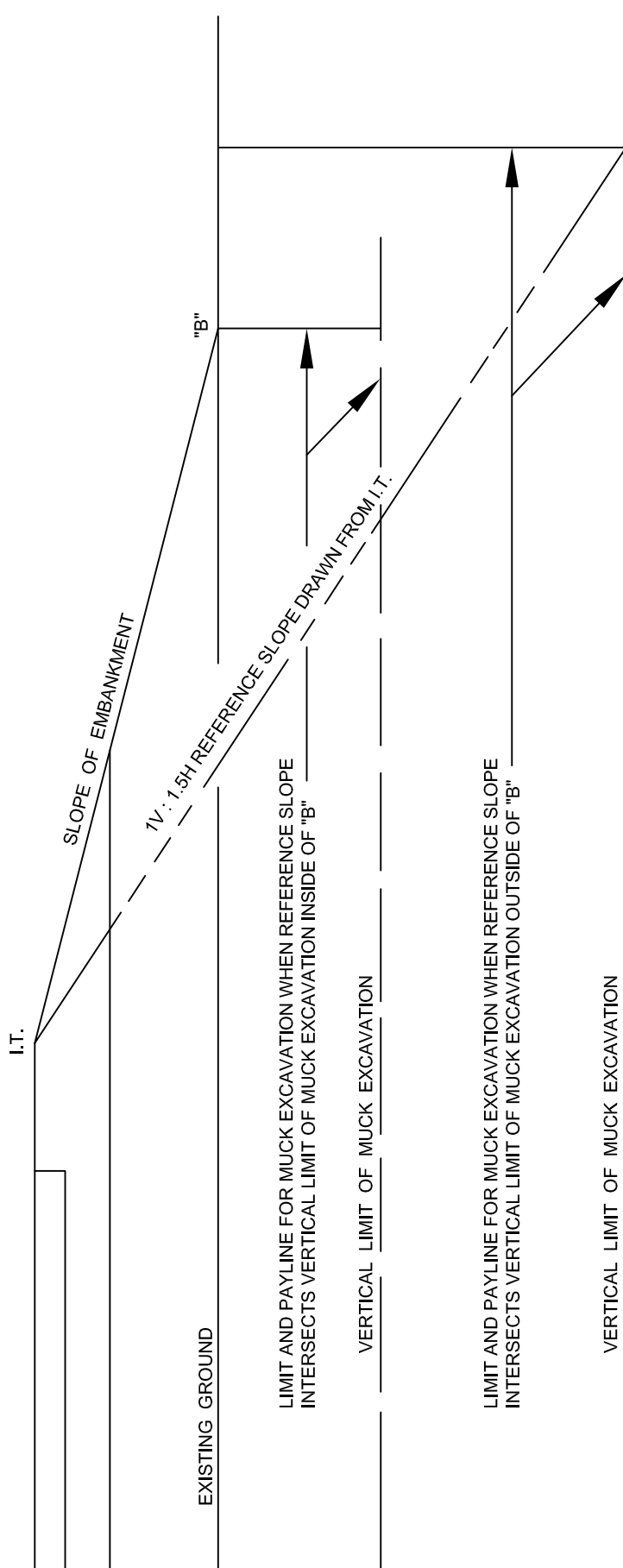
STEEL BEAM HIGHWAY GUARD WITH WOOD POST.....	E 401.10.0
SPECIAL BASE ANCHOR FOR HIGHWAY GUARD INSTALLATION ON CONCRETE.....	E 401.11.0
MODIFIED HIGHWAY GUARD POST INSTALLATION WHERE STANDARD EMBEDMENT IS NOT FEASIBLE	E 401.12.0
STEEL THRIE BEAM HIGHWAY GUARD MEDIAN - BARRIER.....	E 401.16.0
OFFSET BLOCKS FOR STEEL W BEAM HIGHWAY GUARD.....	E 401.20.0
OFFSET BLOCKS FOR STEEL THRIE BEAM HIGHWAY GUARD	E 401.21.0
STEEL W BEAM HIGHWAY GUARD TERMINAL CONNECTORS ON EXIST. BRIDGE W-RAIL LEADING END AT ABUTMENTS & END POSTS.....	E 402.2.0
INSTALLATION OF STEEL W BEAM HIGHWAY GUARD (TRAILING END) AT EXISTING BRIDGE ABUTMENTS AND END POSTS (W-RAIL).....	E 402.3.0
MASONRY BRACKET FOR STEEL W BEAM HIGHWAY GUARD ON ABUTMENTS AND END POSTS (TRAILING END).....	E 402.4.0
MASONRY BRACKET FOR STEEL W BEAM HIGHWAY GUARD ON ABUTMENTS AND END POSTS (TRAILING END).....	E 402.5.0
STEEL THRIE BEAM HIGHWAY GUARD TERMINAL CONNECTORS ON AN EXIST. BRIDGE LEADING END AT ABUTMENTS & END POST.....	E 402.7.0
STEEL THRIE BEAM HIGHWAY GUARD (TRAILING END) AT EXISTING BRIDGE ABUTMENTS AND END POSTS.....	E 402.8.0
MASONRY BRACKET FOR STEEL THRIE BEAM HIGHWAY GUARD ON ABUTMENTS AND END POSTS (TRAILING END).....	E 402.9.0
GUARDRAIL RETROFIT ON BRIDGES (PLAN VIEW).....	E 402.9.1
GUARDRAIL RETROFIT ON BRIDGES (DETAILS).....	E 402.9.2
GUARDRAIL RETROFIT ON BRIDGES (NOTES)	E 402.9.3
F SHAPE CONCRETE BARRIER.....	E 402.10.0
F SHAPE CONCRETE BARRIER SYMMETRICAL SECTION REINFORCING DETAILS.....	E 402.11.0
F SHAPE CONCRETE BARRIER ASYMMETRICAL SECTION REINFORCING DETAILS.....	E 402.12.0
F SHAPE CONCRETE BARRIER DOWEL DETAILS.....	E 402.13.0
F SHAPE CONCRETE BARRIER WITH CONCRETE SEPARATOR.....	E 402.20.0
F SHAPE CONCRETE BARRIER WITH CONCRETE SEPARATOR REINFORCING DETAILS.....	E 402.21.0
F SHAPE CONCRETE BARRIER WITH CONCRETE SEPARATOR DOWEL DETAILS.....	E 402.22.0

DESCRIPTIONDRAWING
NUMBERSECTION 4
HIGHWAY GUARD RAIL & FENCES CONT.

PRECAST PORTABLE CONCRETE BARRIER 1/3.....	E 403.1.0
PRECAST PORTABLE CONCRETE BARRIER 2/3.....	E 403.2.0
PRECAST PORTABLE CONCRETE BARRIER 3/3.....	E 403.3.0
PRECAST PORTABLE CONCRETE BARRIER FOR USE WITH WIND BARRIER, FENCE OR PED. RAIL 1/4.....	E 403.4.0
PRECAST PORTABLE CONCRETE BARRIER FOR USE WITH WIND BARRIER, FENCE OR PED. RAIL 2/4.....	E 403.5.0
PRECAST PORTABLE CONCRETE BARRIER - TYPICAL PEDESTRIAN RAIL DETAILS 3/4.....	E 403.6.0
PRECAST PORTABLE CONCRETE BARRIER - TYPICAL MODIFIED PEDESTRIAN RAIL DETAILS 4/4.....	E 403.7.0
CHAIN LINK FENCE (SPRING TENSION WIRE)	E 404.1.0
CHAIN LINK FENCE (SPRING TENSION WIRE)	E 404.2.0
CHAIN LINK FENCE (PIPE TOP RAIL)	E 404.4.0
CHAIN LINK FENCE DETAILS OF CABLE ATTACHMENTS & POST BASES.....	E 404.5.0
CHAIN LINK FENCE - SWING GATE.....	E 404.6.0
CHAIN LINK FENCE CANTILEVER GATE	E 404.7.0
CHAIN LINK FENCE MOUNTED ON GUARD RAIL.....	E 404.8.0
CHAIN LINK FENCE POST DETAILS	E 404.10.0

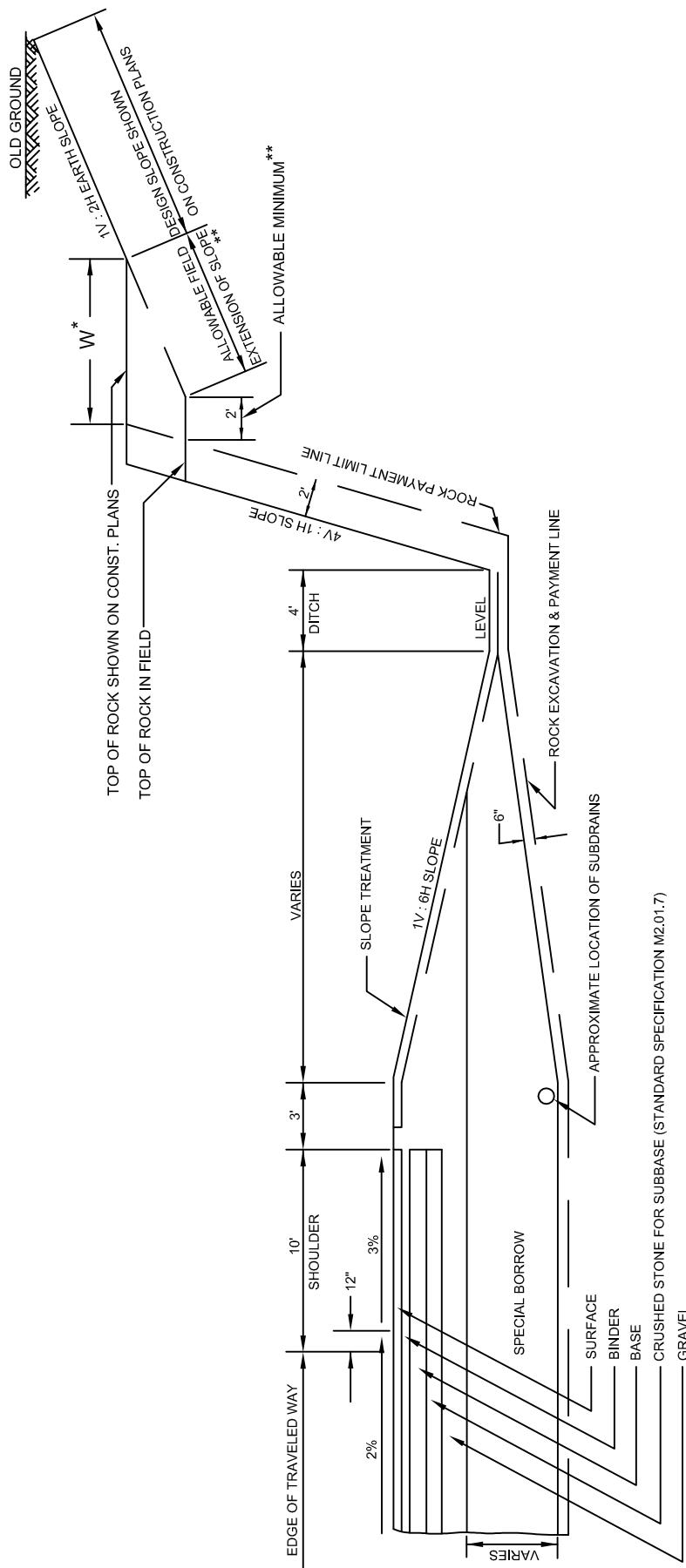
SECTION 5
MISCELLANEOUS

WETLANDS PROTECTION ACT SIGN.....	E 501.1.0
TREE WELLS.....	E 502.1.0
SETTING RURAL MAILBOXES.....	E 504.1.0
DEMOUNTABLE REFLECTORIZED STATION MARKER AND PROJECT MARKER.....	E 505.1.0
BOUND LETTERED GRANITE	E 506.2.0



NOTES:

1. "B" - INTERSECTION OF EXISTING GROUND AND SLOPE OF EMBANKMENT
2. THE ABOVE METHOD MAY ALSO BE USED TO DETERMINE THE LIMIT FOR EXCAVATION OF OTHER UNSUITABLE MATERIALS
3. I.T. - INTERSECTION OF TANGENT



* **DESIGN** { W=12' FOR ROCK CUTS OF 20' OR LESS
W=17' FOR ROCK CUTS 25' OR MORE
W-VARIES 12' - 17' FOR ROCK CUTS BETWEEN 20' - 25'; DETERMINE PROPORTIONATELY

** THE EXTENSION OF THE DESIGN SLOPE IN THE FIELD IS PERMISSIBLE WITHIN THE LIMITS SHOWN (2' SHELF ON TOP OF THE ROCK), WHEN THE HEIGHT OF THE ROCK CUT IN THE FIELD IS LESS THAN THAT SHOWN ON THE CONSTRUCTION PLANS

NOTES:

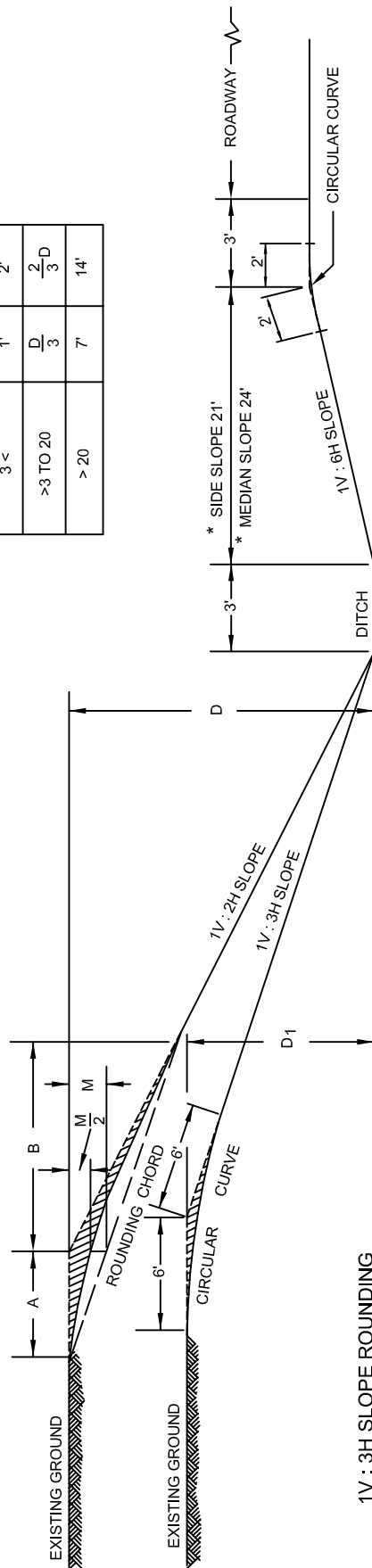
1. ONLY ROCK ACTUALLY REMOVED IS PAYABLE. NO PAYMENT WILL BE MADE BEYOND THE ROCK PAYMENT LINE

METHOD OF ROUNDING SLOPES CUT AND FILL SLOPES

METHOD OF ROUNDING CUT SLOPES

ROUNDING TABLE FOR 1V:2H SLOPE

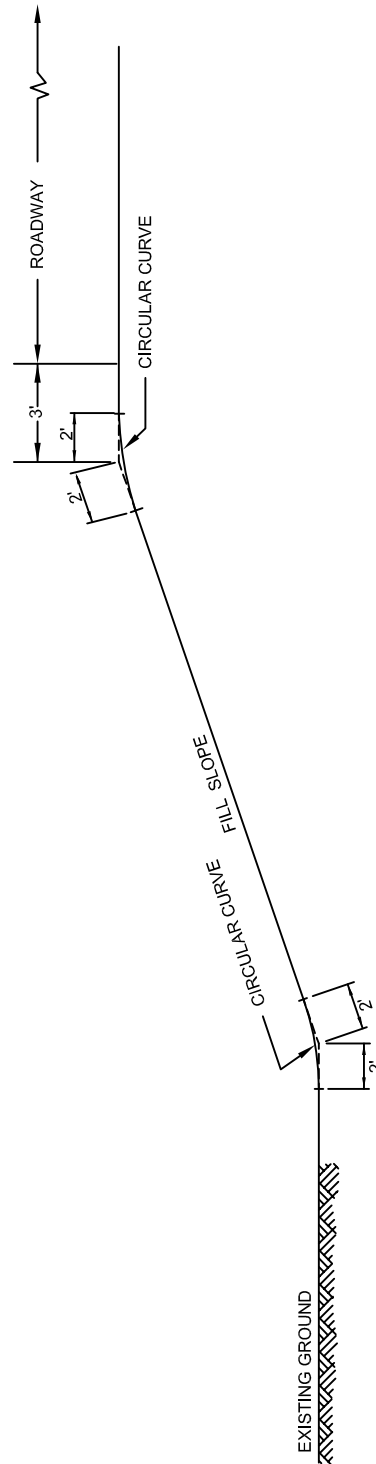
D FEET	A	B
3 <	1'	2'
>3 TO 20	$\frac{D}{3}$	$\frac{2}{3}D$
> 20	7'	14'



1V : 3H SLOPE ROUNDING

1. WHEN "D1" IS 2' OR MORE ROUND AS SHOWN IN TABLE ABOVE.
2. WHEN "D1" IS LESS THAN 2' ROUND FULL LENGTH OF SLOPE.

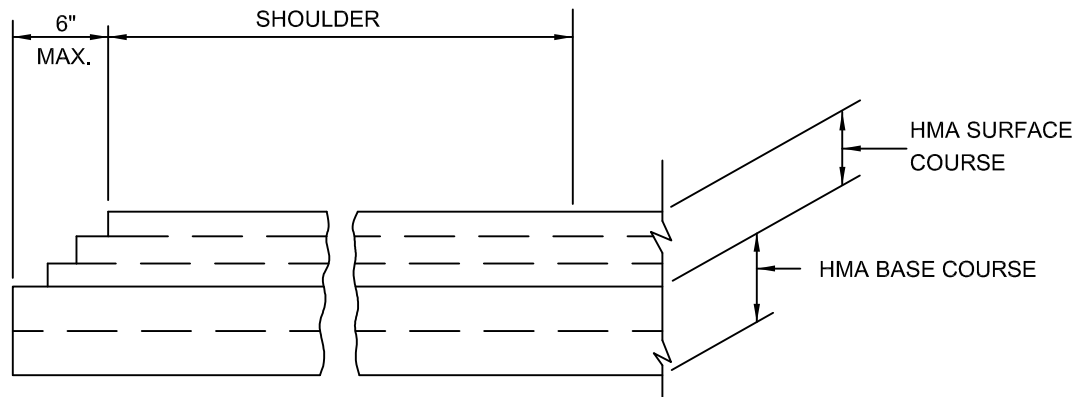
METHOD OF ROUNDING FILL SLOPES



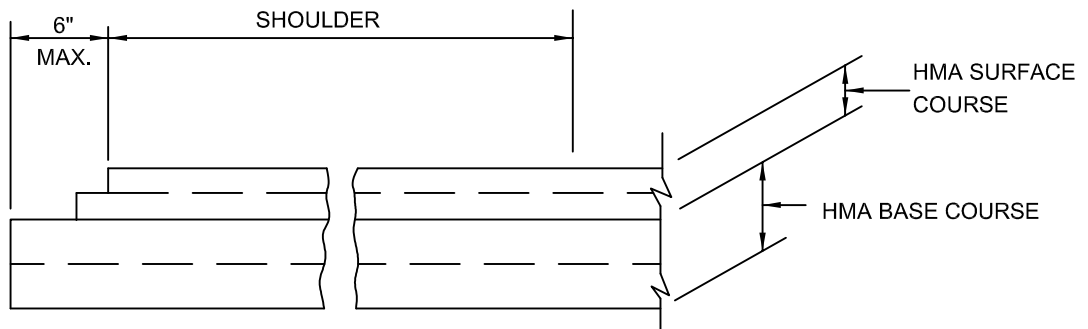
* USE SLOPE LENGTHS FOR LIMITED ACCESS OR HIGH SPEED ROADWAYS.

NOTE:

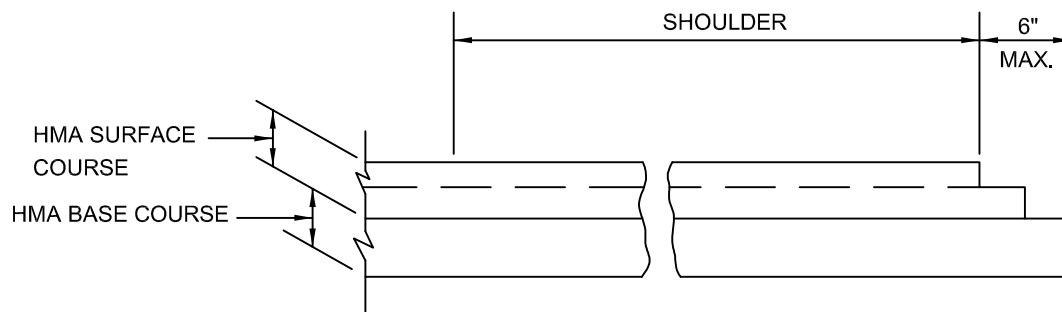
1. THE DIMENSIONS SHOWN FOR ROUNDING CUT AND FILL SLOPES ARE APPROXIMATE; THEY ARE TO BE USED AS GUIDES.



3 - LAYERED SURFACE AND 2 - LAYERED BASE COURSE



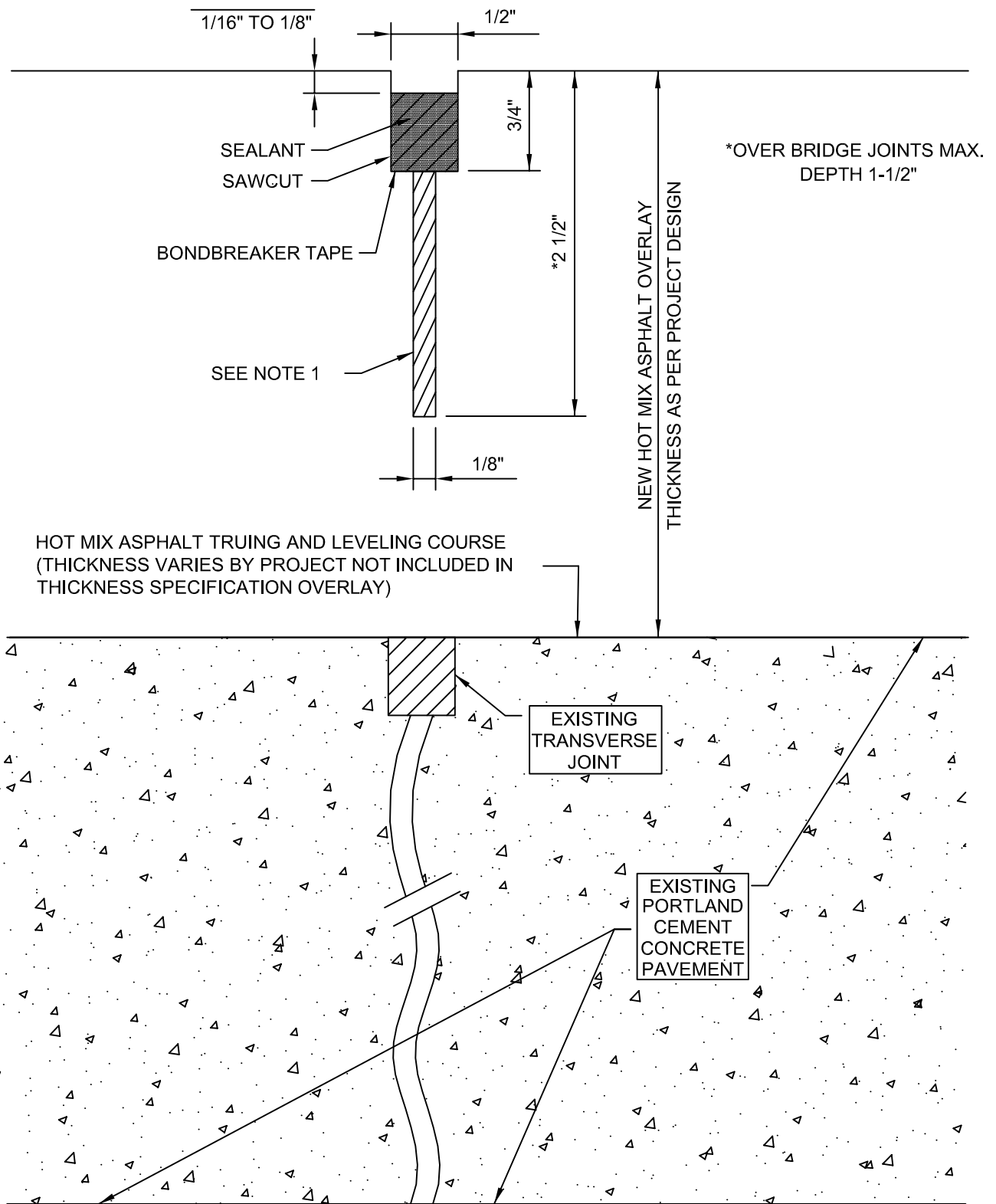
2 - LAYERED SURFACE AND 2 - LAYERED BASE COURSE



2 - LAYERED SURFACE AND 1 - LAYER BASE COURSE

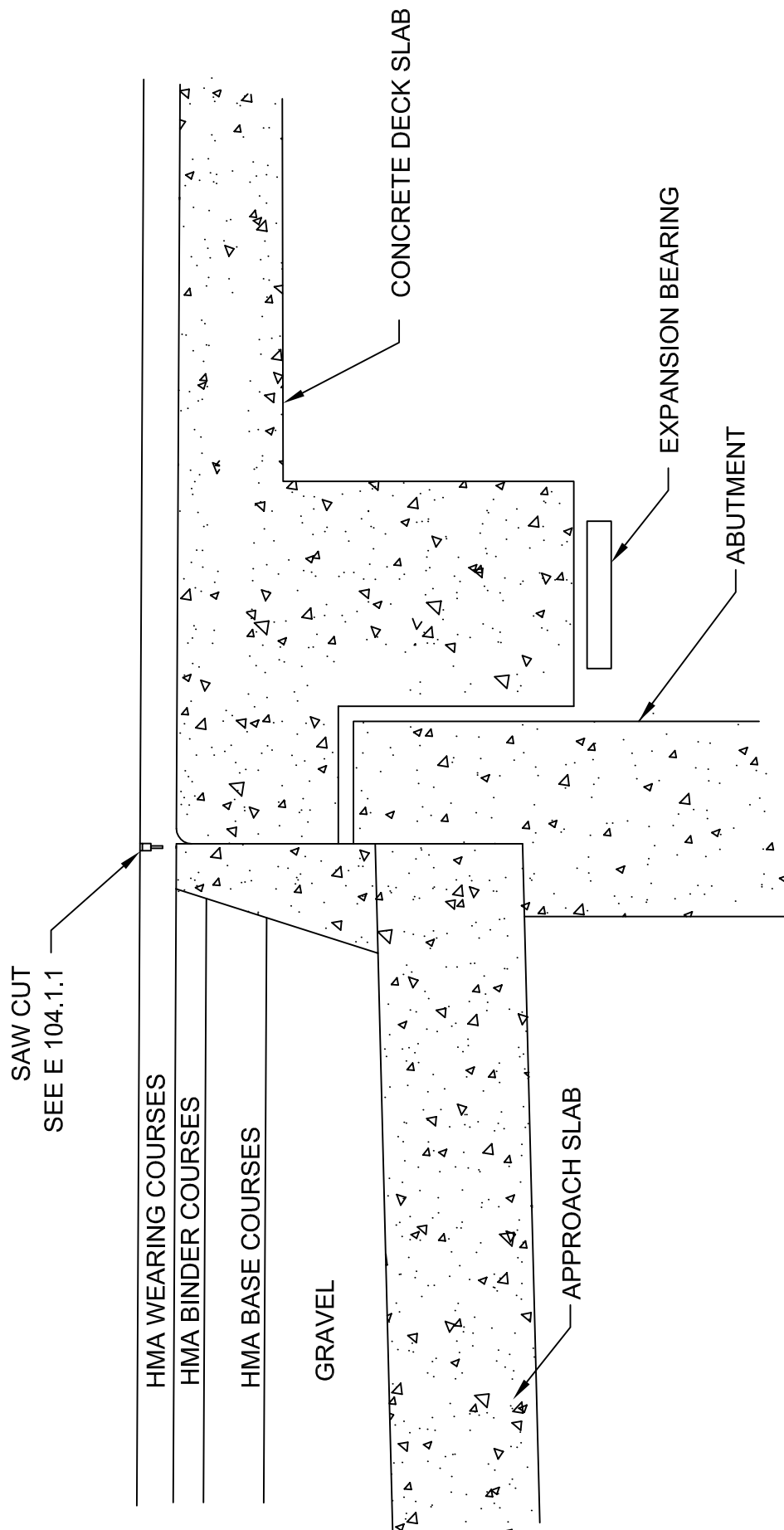
NOTES:

1. ONLY APPLICABLE STEPPING METHODS OF THIS DRAWING ARE TO BE SHOWN IN THE TYPICAL SECTION OF THE CONSTRUCTION PLANS. THIS SHALL BE SHOWN AS A SEPARATE DETAIL AND NOT INCLUDED ON EACH SECTION.
2. STEPPING SHALL NOT BE SHOWN ON THE CROSS SECTION TEMPLATES.
3. ADDITIONAL MATERIAL REQUIRED FOR STEPPING SHALL BE INCLUDED IN ESTIMATED QUANTITIES.



NOTES:

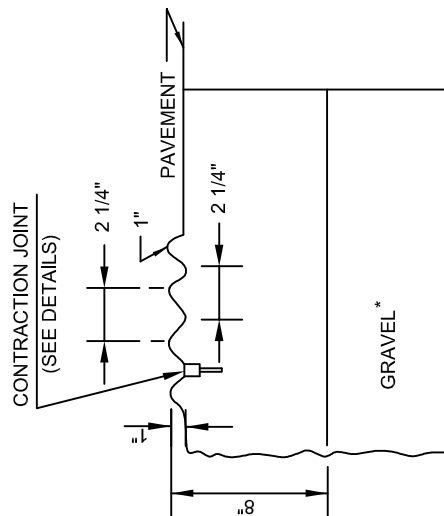
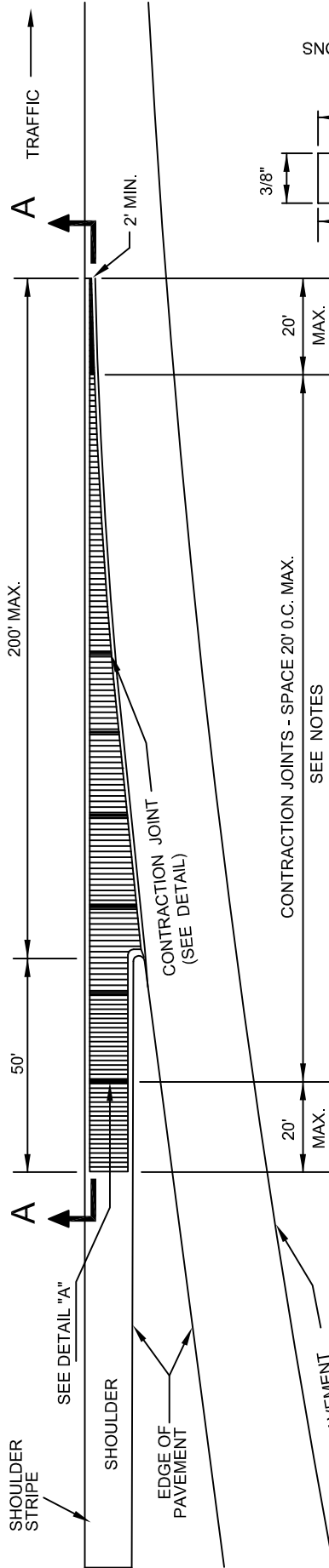
1. WHEN THE TOTAL THICKNESS OF HOT MIX ASPHALT OVER THE EXISTING JOINT EXCEEDS 4-3/8", A 1/8" SAWCUT SHALL BE INCLUDED IN THE JOINT AS SHOWN TO A MINIMUM DEPTH OF 2-1/2".
2. PRIOR TO PLACING THE OVERLAY, ALL JOINTS SHALL BE LOCATED AND REFERENCED.



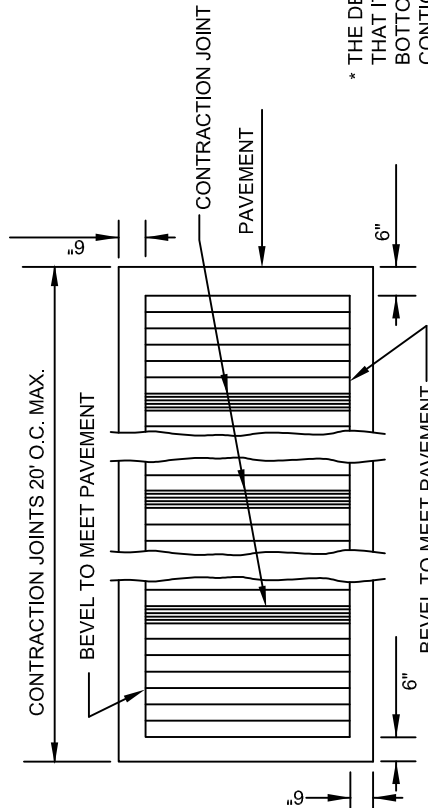
NOTES:

1. BEFORE SAW-CUTTING THE TRANSVERSE JOINT THE CONTRACTOR SHALL LOCATE THE END OF THE BRIDGE DECK. SAW-CUTTING MUST TAKE INTO ACCOUNT THE SKEW ANGLE OF THE BRIDGE.
2. ONLY EXPANSION JOINTS SHALL BE SAW-CUT AND SEALED.
3. ONLY REQUIRED WITH A CONTINUOUS BITUMINOUS CONCRETE SURFACE FROM ROADWAY TO BRIDGE.

SCORED CEMENT CONCRETE PAVEMENT RAMPS

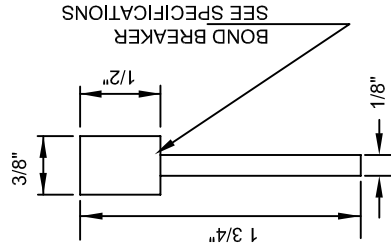


DETAIL OF CORRUGATIONS



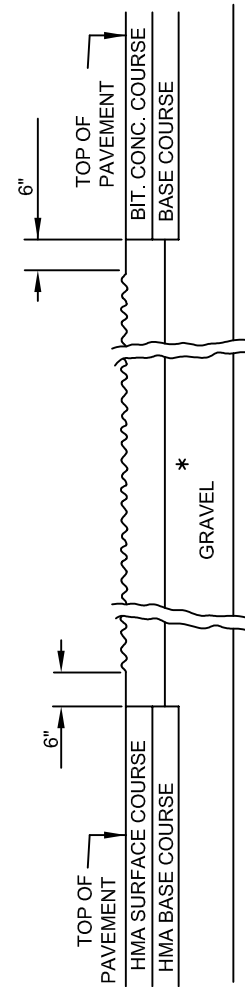
* THE DEPTH OF THE GRAVEL IS TO BE SUCH THAT ITS BOTTOM LINE MEETS THE BOTTOM OF THE GRAVEL LINE OF THE CONTIGUOUS PAVEMENT.

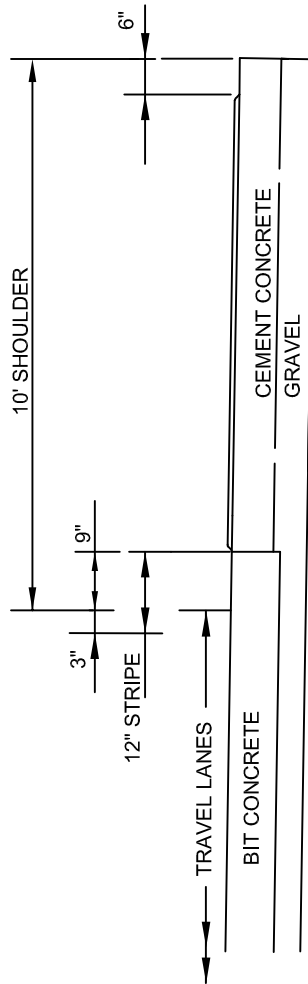
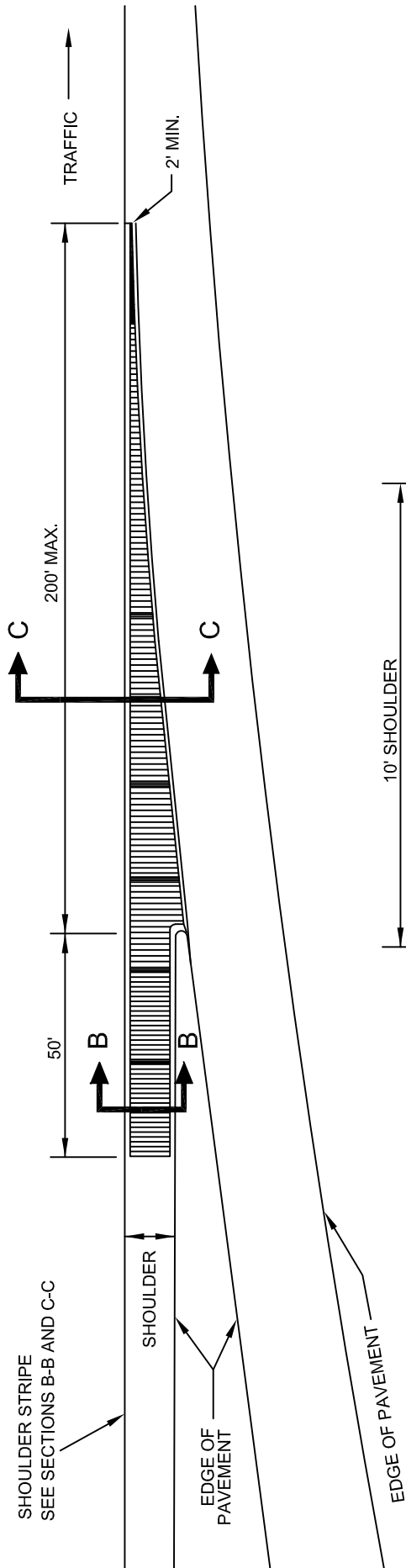
CONTRACTION JOINT DETAIL



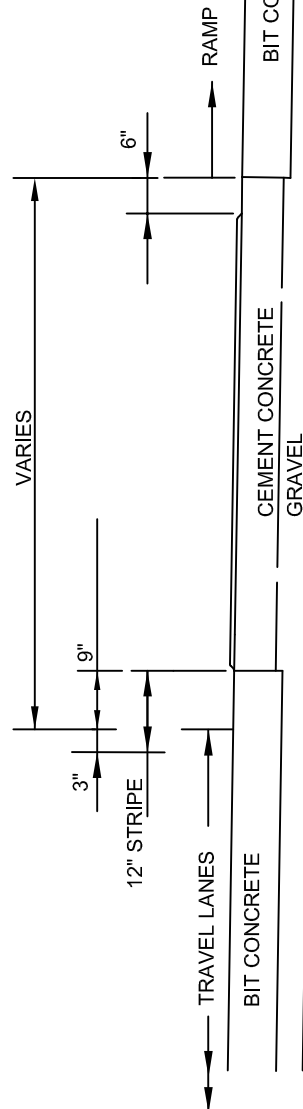
NOTES:

1. CONTRACTION JOINTS ARE TO BE SPACED AT A MAXIMUM OF 20' APART.
2. THE JOINTS ARE TO BE SAWED AND LOCATED IN THE DEPRESSIONS OF THE CORRUGATIONS. SEE DETAIL OF CORRUGATIONS.
3. END OF CORRUGATED RIDGES TO BE BEVELED.
4. FOR DESCRIPTION OF MATERIAL AND CONSTRUCTION METHODS SEE STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS.
5. SCORED CEMENT CONCRETE TO BE 5000 psi. SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS.
6. TROUGH FLUSH WITH OR ABOVE ADJACENT PAVEMENT FOR DRAINAGE.

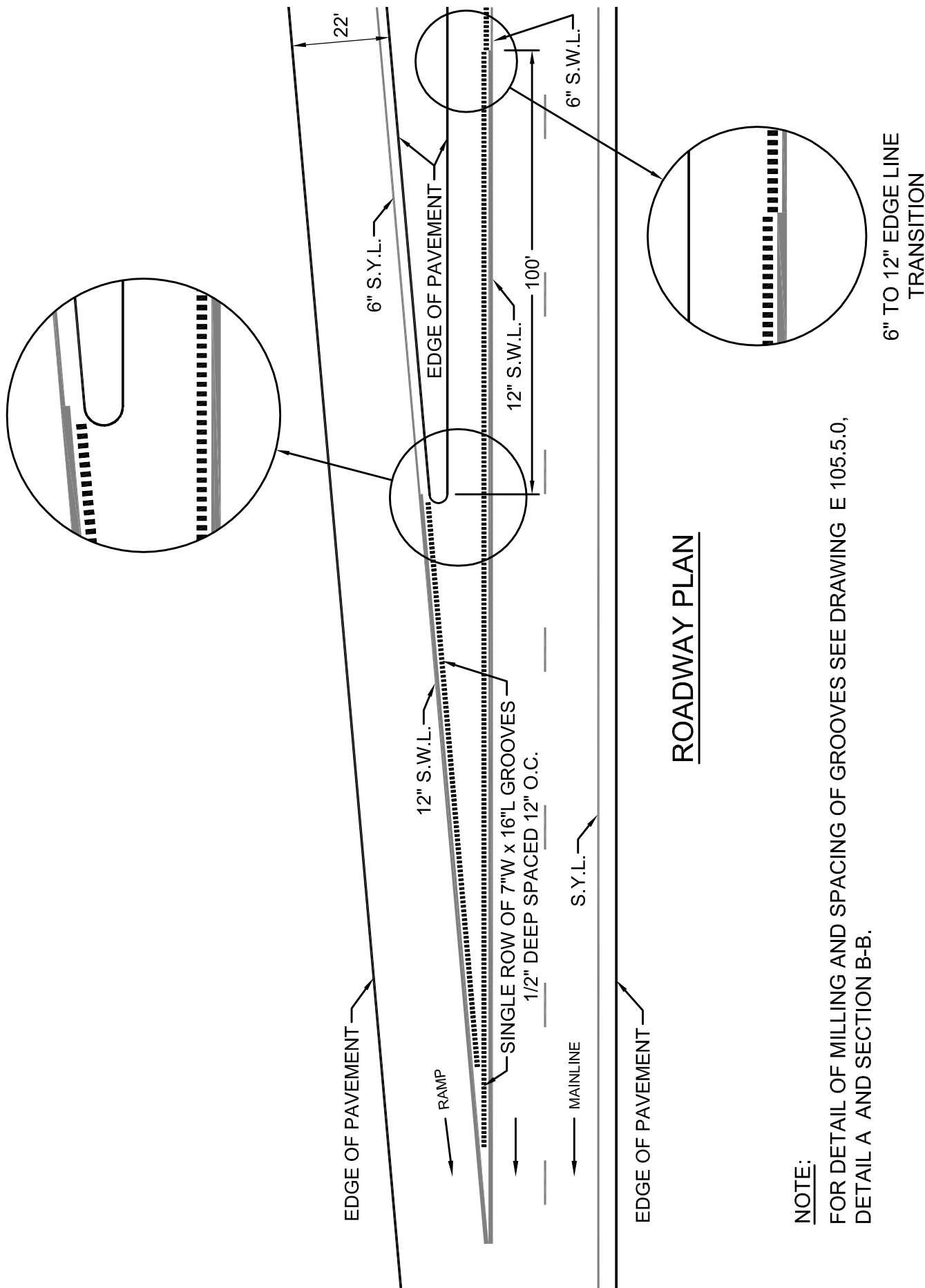




SECTION B - B



SECTION C - C



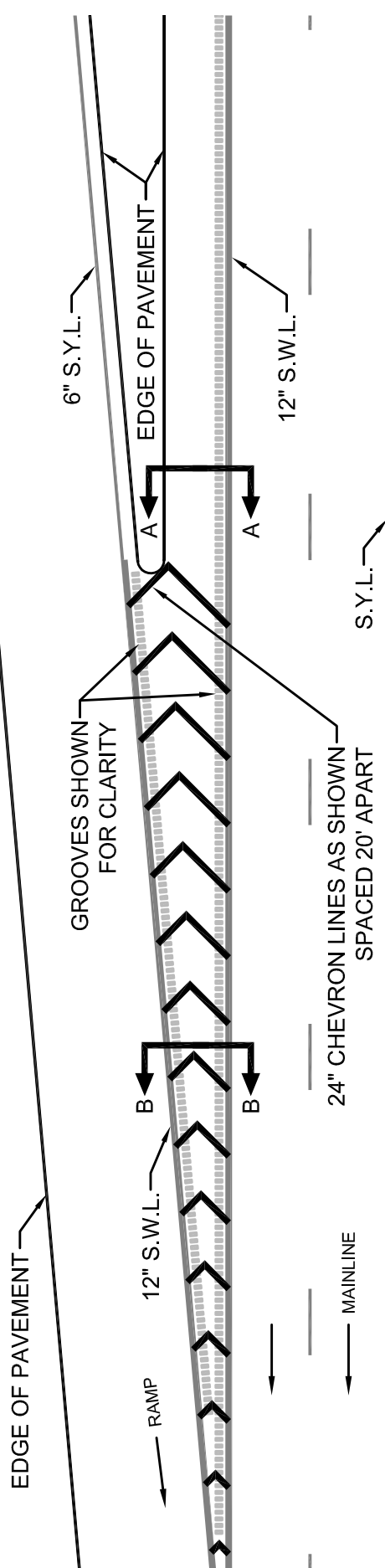
NOTE:

FOR DETAIL OF MILLING AND SPACING OF GROOVES SEE DRAWING E 105.5.0,
DETAIL A AND SECTION B-B.

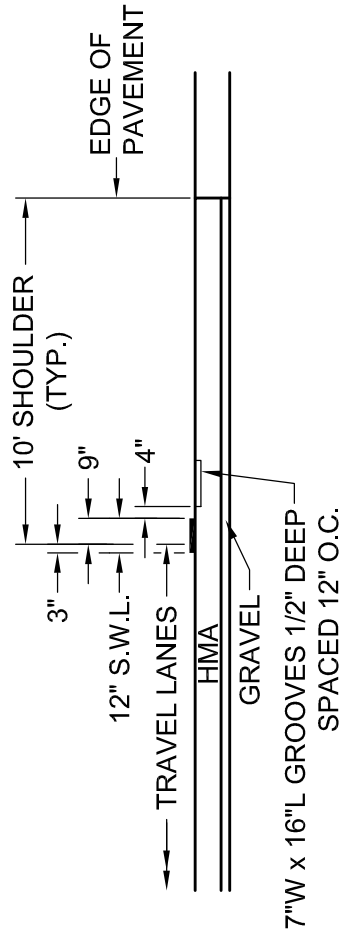
FREEWAY ENTRANCE RAMP DETAIL PAVEMENT MARKING INSTALLATION AT GORE AREAS

DATE OF ISSUE
JUNE 2014

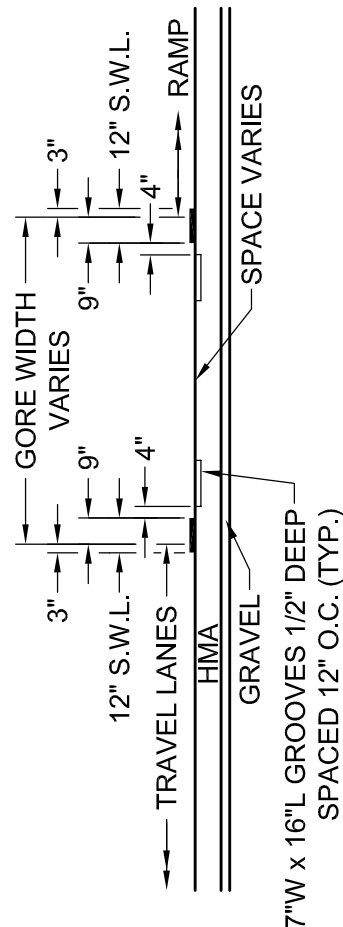
DRAWING NUMBER
E 105.3.3



ROADWAY PLAN



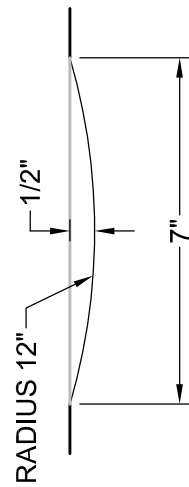
SECTION A-A



SECTION B-B

NOTE:

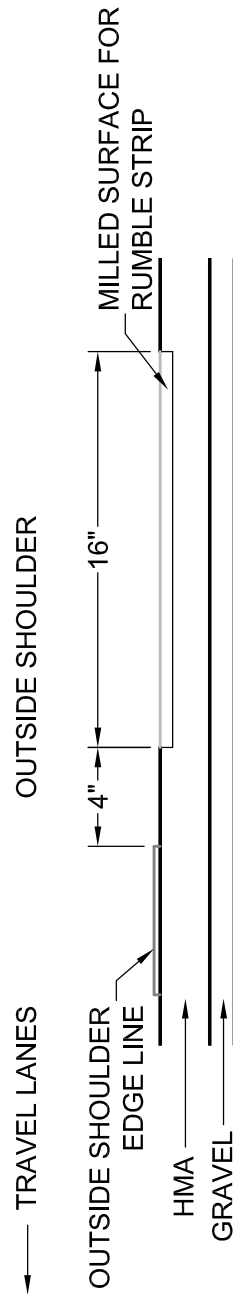
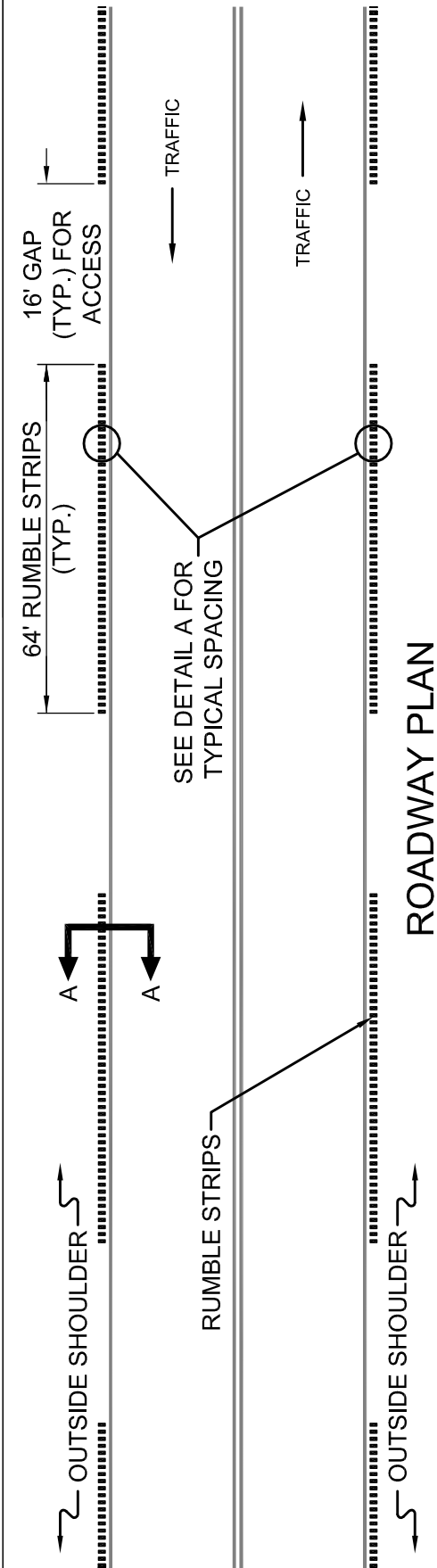
SEE DRAWING E 105.3.2 FOR TRANSITION FROM 6" TO 12" LINES
AND OTHER INFORMATION.



TYPICAL SPACING PLAN

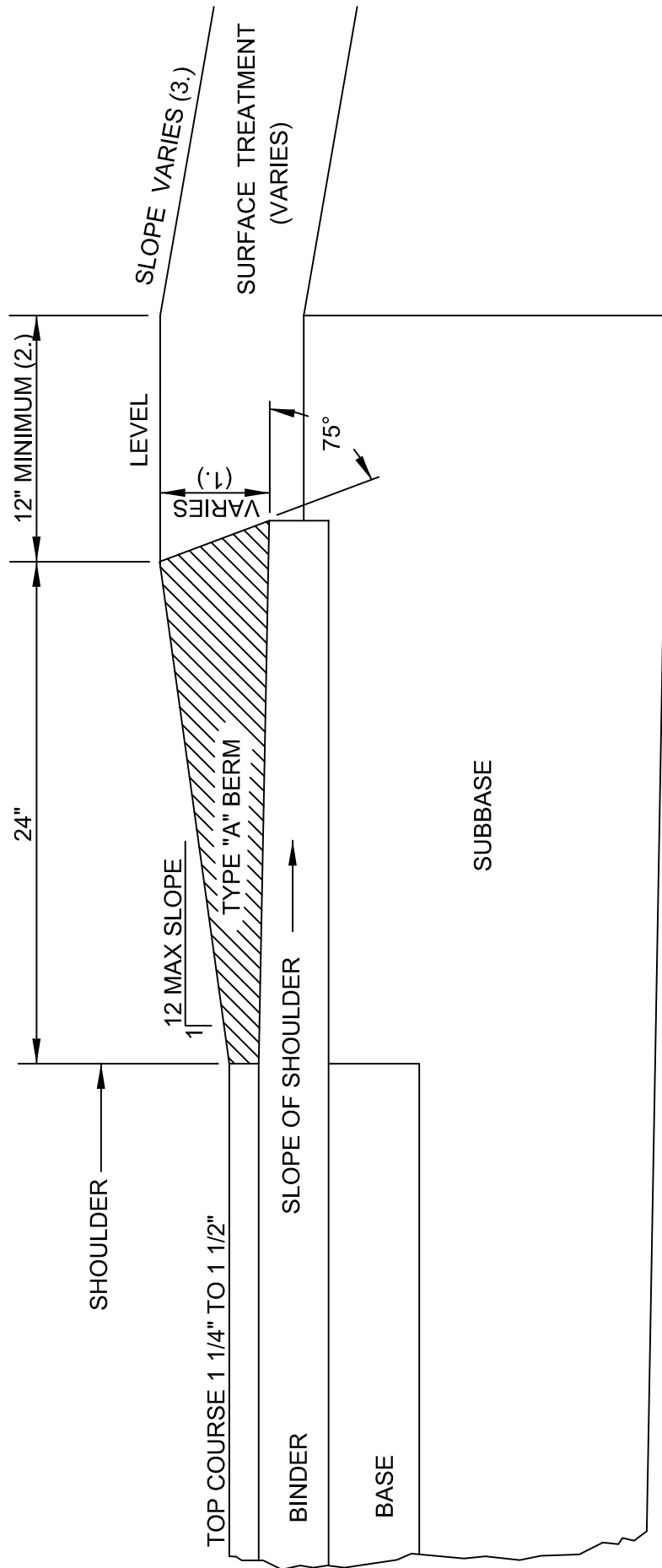
2. NOT TO BE INSTALLED ON BRIDGE DECKS.

RUMBLE STRIP INSTALLATION DETAILS BICYCLES PERMITTED



SECTION B-B

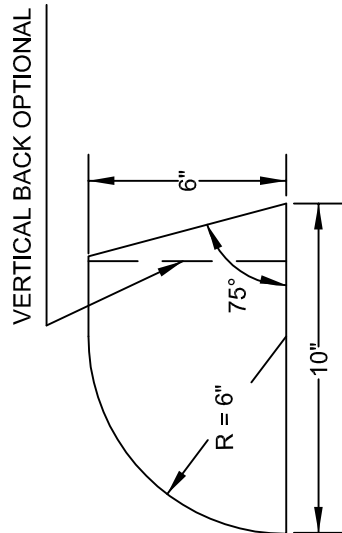
- NOTES FOR RUMBLE STRIPS:
1. NOT TO BE INSTALLED ON SHOULDERS LESS THAN 8' WIDE.
 2. NOT TO BE INSTALLED ON BRIDGE DECKS.



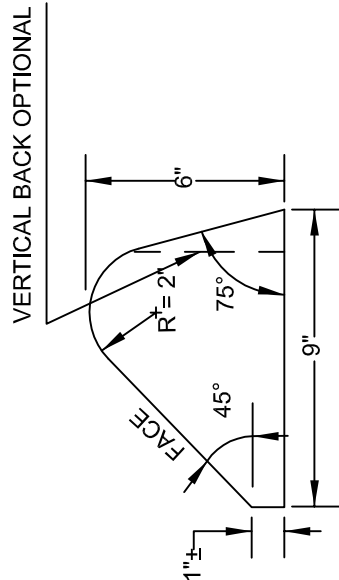
NOTE:

FOR MODIFIED BERM THE SLOPE REMAINS CONSTANT AT 1 (V) TO 12 (H)

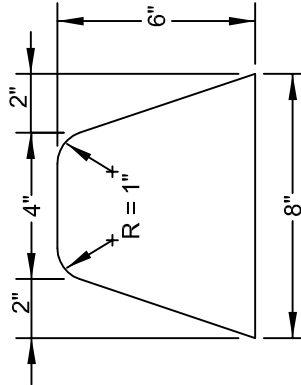
1. THIS DIMENSION VARIES WITH THE THICKNESS OF THE TOP COURSE AND SLOPE OF BINDER
2. SEE E 401.1.1 FOR TYPICAL SECTION AT GUARDRAIL LOCATIONS
3. SEE TYPICAL SECTIONS FOR PROJECT



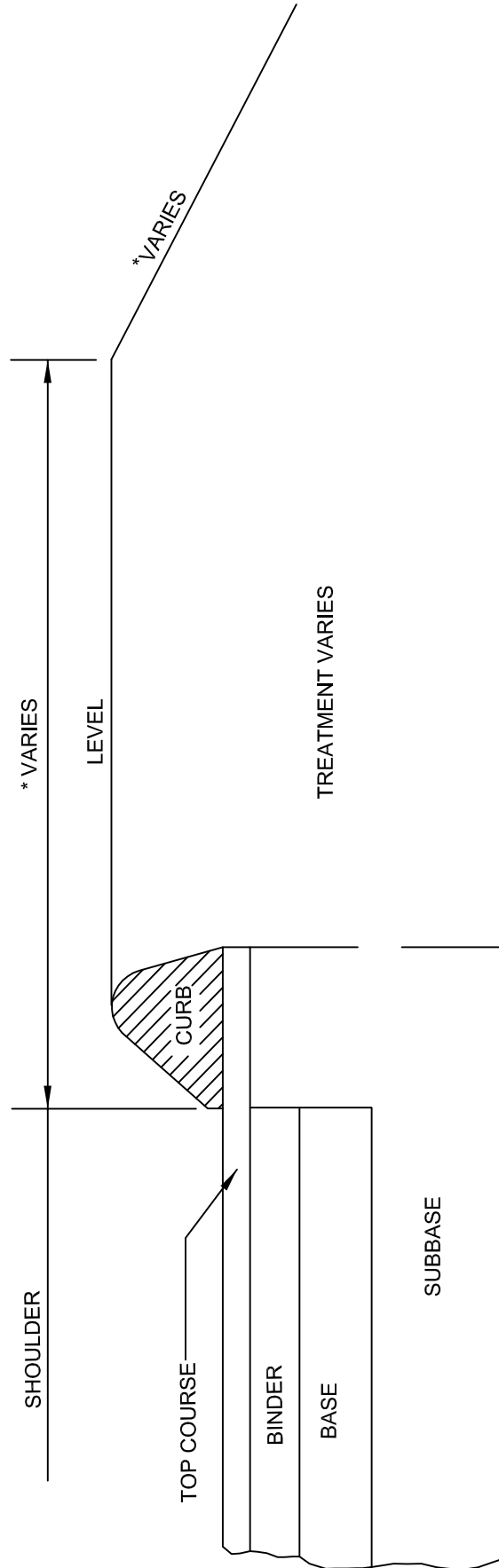
TYPE - 1



TYPE - 2

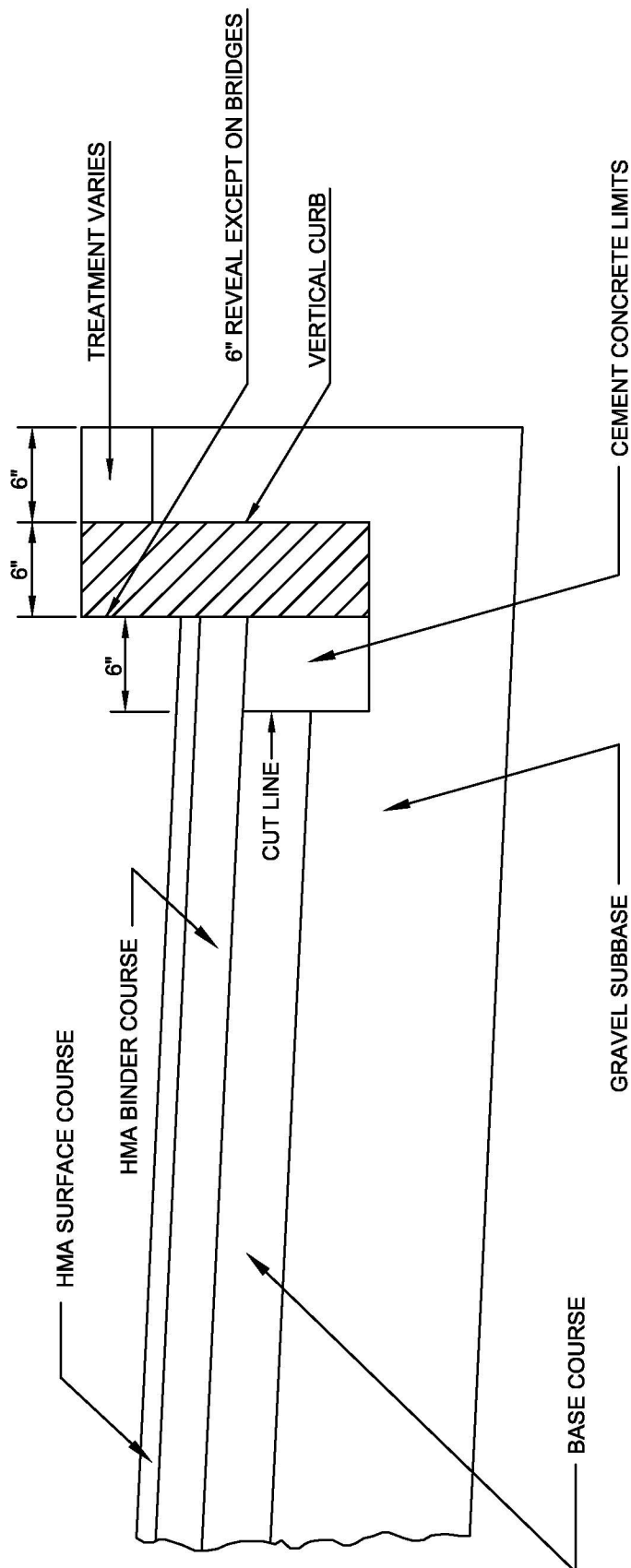


TYPE - 3



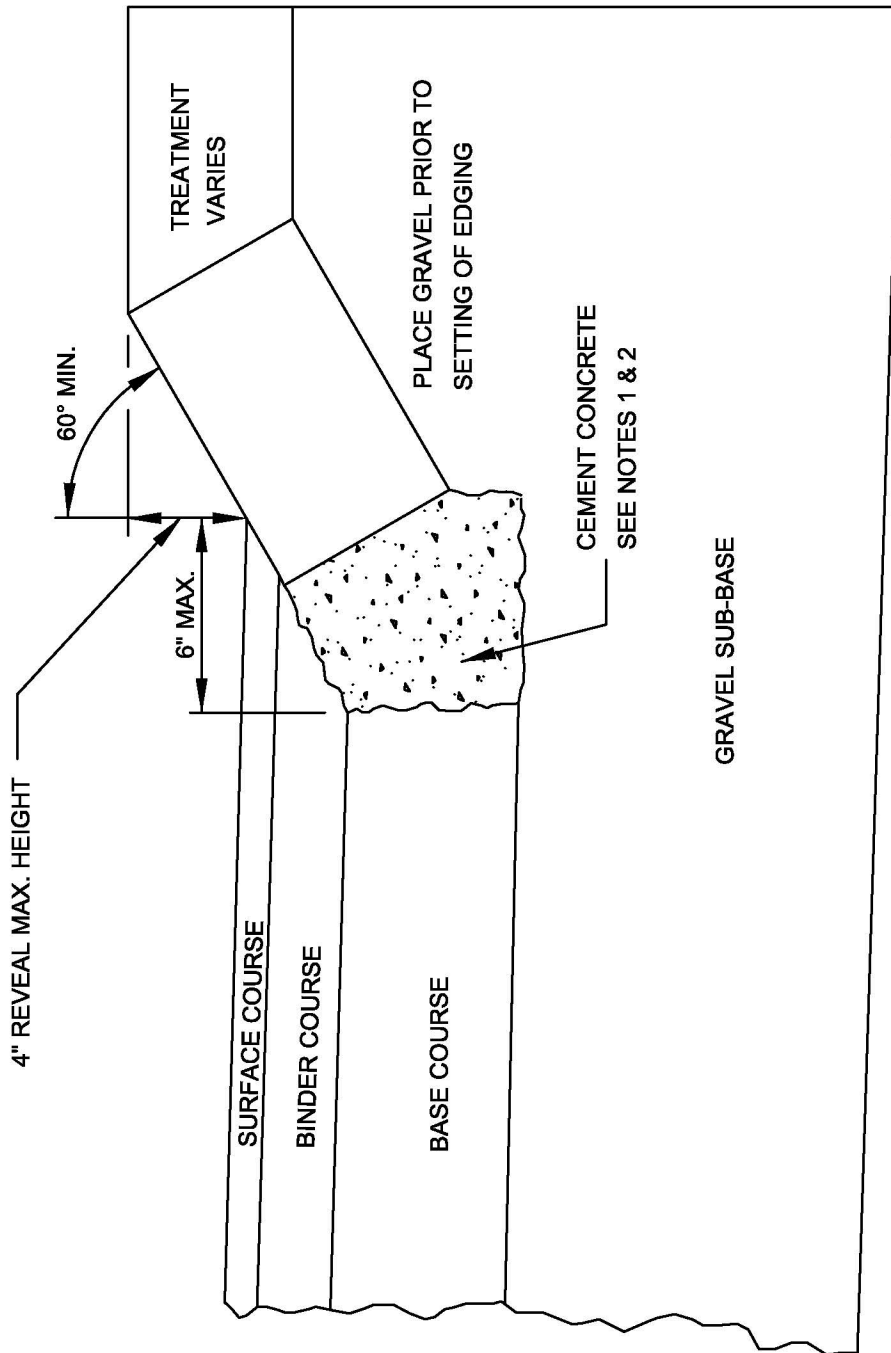
METHOD OF SETTING-TYPICAL FOR ALL TYPES

* SEE TYPICAL SECTIONS FOR PROJECT.



NOTES:

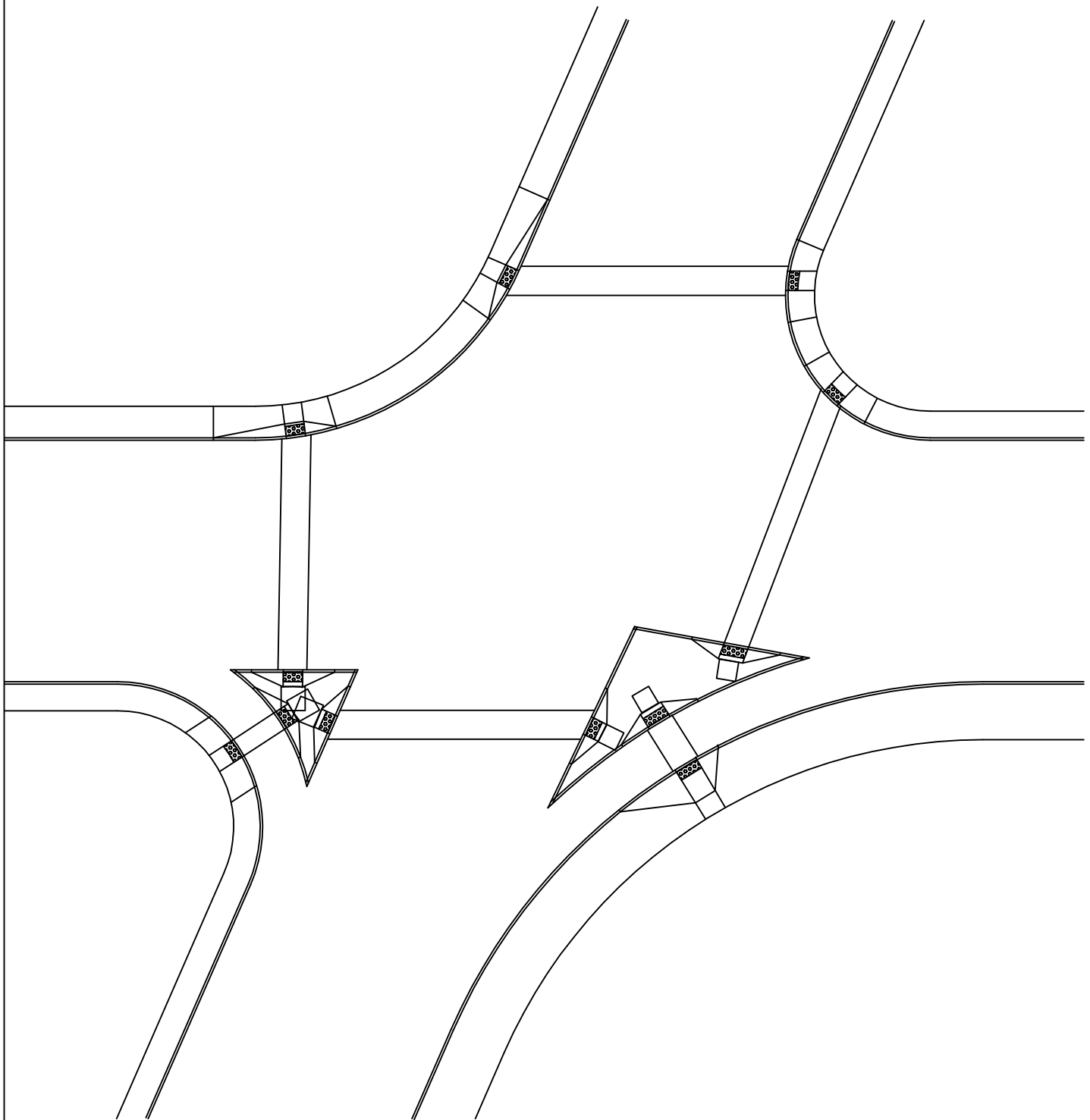
1. THIS PROCEDURE IS APPLICABLE ONLY IF CURB IS TO BE SET AFTER BASE COURSE IS IN PLACE PRIOR TO BINDER AND TOP PLACEMENT.
2. CUT NEAT LINE 6" FROM CURB LINE AND REMOVE BASE AND GRAVEL. REPLACE WITH CEMENT CONCRETE.
3. ANY DESIGNATED CEMENT CONCRETE THAT IS ACCEPTABLE UNDER SECTION M4 OF THE STANDARD SPECIFICATIONS MAY BE USED; ALL TEST REQUIREMENTS ARE WAIVED. HOT MIX ASPHALT SHALL NOT TO BE USED AS A SUBSTITUTE.



SLOPED EDGING

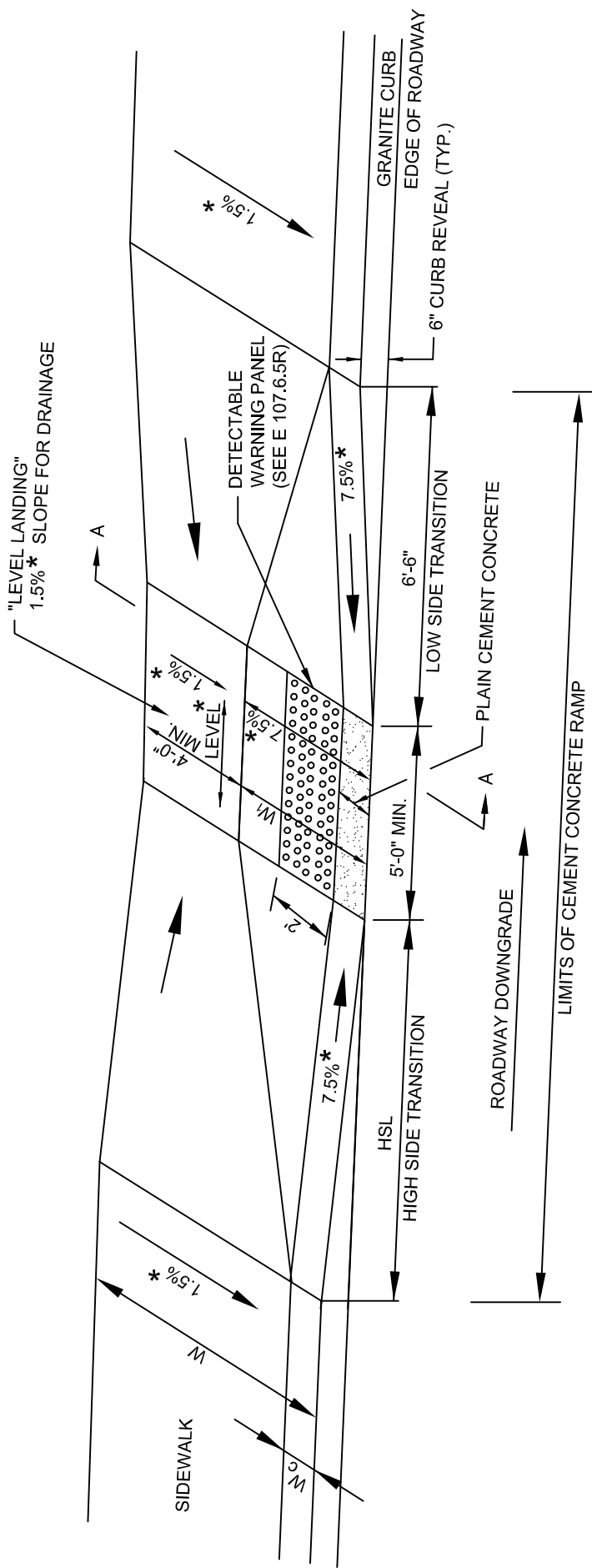
NOTES:

1. ANY DESIGNATED CEMENT CONCRETE THAT IS ACCEPTABLE TO THE DEPARTMENT UNDER SECTION M4 OF THE STANDARD SPECIFICATIONS; ALL TEST REQUIREMENTS ARE WAIVED. HOT MIX ASPHALT SHALL NOT BE USED AS A SUBSTITUTE.
2. THE REVEAL IS TO BE A MAXIMUM OF 4" UNDER ALL CONDITIONS, THE ANGLE IS TO BE A MINIMUM OF 60° FROM VERTICAL UNDER ALL CONDITIONS.



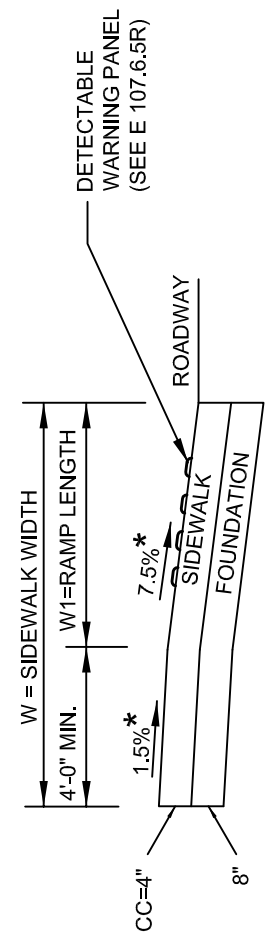
NOTES:

1. LEVEL LANDINGS CAN OVERLAP
2. ISLAND AREAS SUBJECT TO TRAVEL SHOULD BE TREATED AS PLAZAS "NOT MORE THAN 2% SLOPE IN ANY DIRECTION"
3. ALL RAMPS BY REGULATION MUST BE PERPENDICULAR TO THE CURB AT THE GUTTER
4. RAMPS SHOULD BE BOTH ALIGNED TOWARD THE RECEIVING RAMP AND WITHIN THE GENERALLY PREFERRED PEDESTRIAN PHASE OF TRAFFIC



LEGEND

- HSL = HIGH SIDE TRANSITION LENGTH
(SEE E 107.9.0R)
- W = SIDEWALK WIDTH
- W_C = CURB WIDTH
- W₁ = PERPENDICULAR RAMP LENGTH
- CC = CEMENT CONCRETE
- * = TOLERANCE FOR CONSTRUCTION ±0.5%
- USABLE SIDEWALK WIDTH PER AAB = W-W_C
- RAMP LENGTH, W₁ = W-4'-0" Min



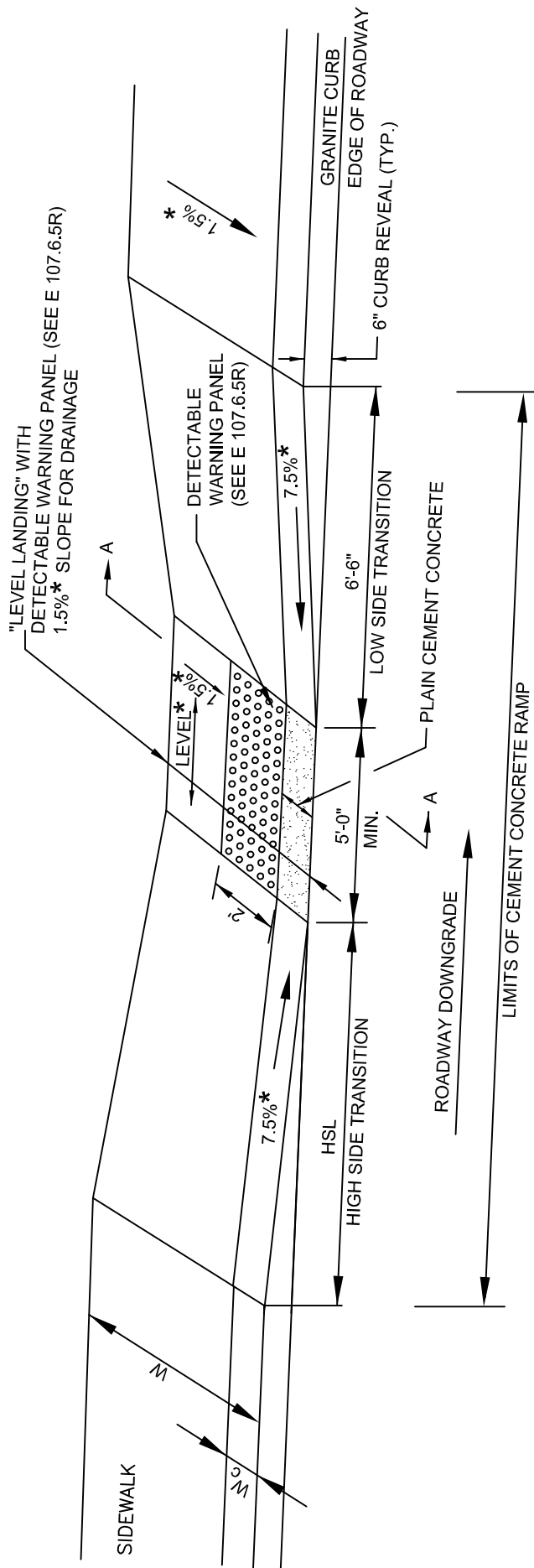
SECTION A-A

**WHEELCHAIR RAMPS
LESS THAN 12'-4" SIDEWALK**

WHEELCHAIR RAMP ON NARROW SIDEWALK WITH DETECTABLE WARNING PANEL

DATE OF ISSUE
JUNE 2014

DRAWING NUMBER
E 107.2.1



LEGEND

HSL = HIGH SIDE TRANSITION LENGTH
(SEE E 107.9.0R)

W = SIDEWALK WIDTH

W_c = CURB WIDTH

CC = CEMENT CONCRETE

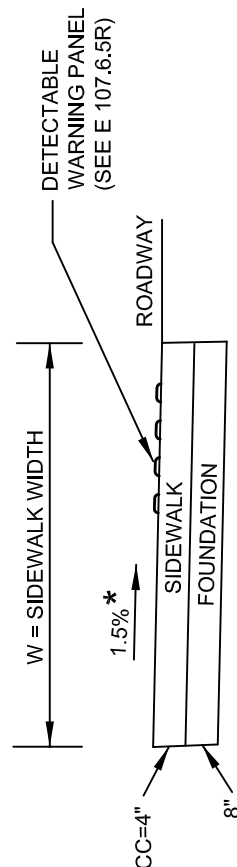
* = TOLERANCE FOR CONSTRUCTION ±0.5%

USABLE SIDEWALK WIDTH PER AAB = W-W_c
USABLE SIDEWALK WIDTH PER AAB IS NOT TO
BE LESS THAN 4'0"

SEE E 107.6.5R FOR DETAILS OF DETECTABLE
WARNING PANEL

NOTE:

ROADWAY, GUTTER, AND FIRST 6"
OF SIDEWALK TO BE ADJUSTED
FOR FIELD CONDITIONS



SECTION A-A

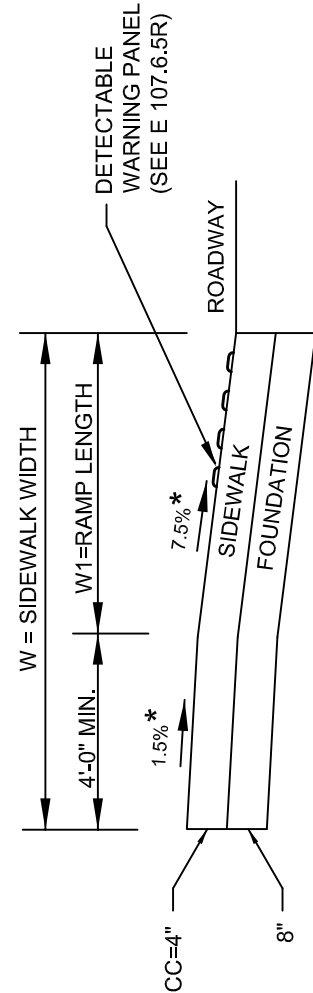
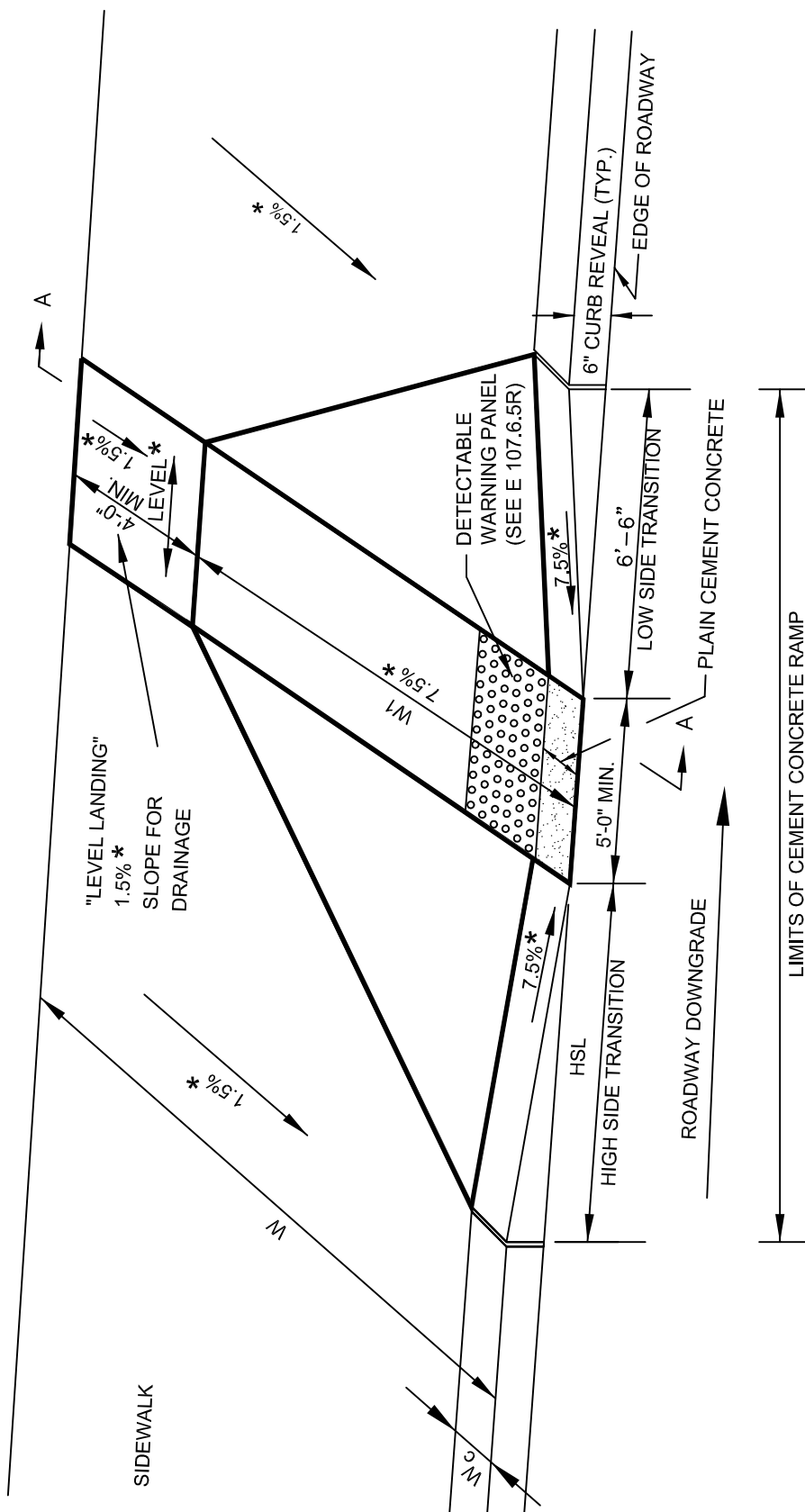
WHEELCHAIR RAMPS GREATER THAN 12'-4" SIDEWALK

DATE OF ISSUE
JUNE 2014

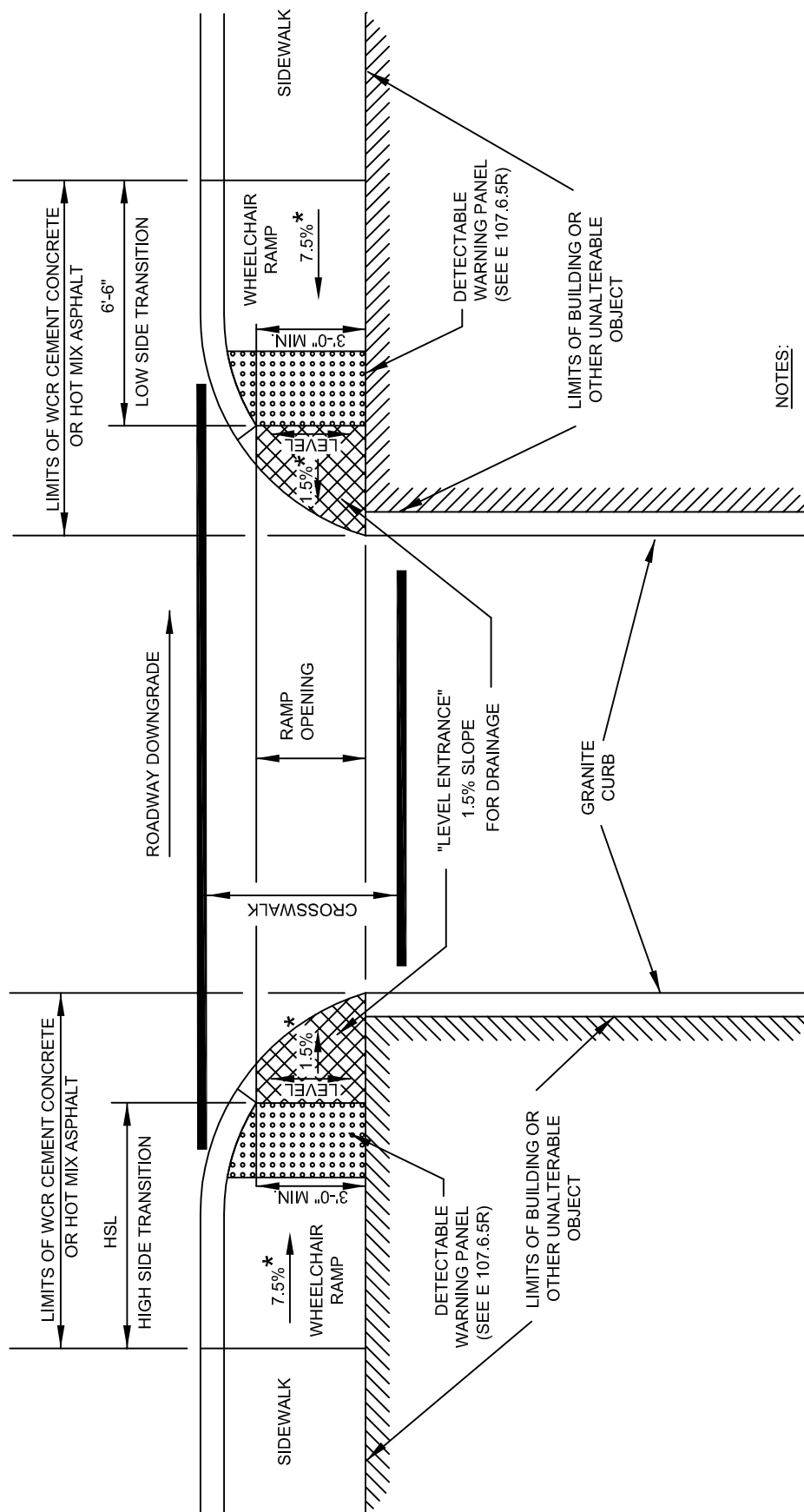
DRAWING NUMBER
E 107.3.0

LEGEND

- HSL = HIGH SIDE TRANSITION LENGTH
(SEE E 107.9.0R)
 - W = SIDEWALK WIDTH
 - W_C = CURB WIDTH
 - W₁ = PERPENDICULAR RAMP LENGTH
 - C_c = CEMENT CONCRETE
 - * = TOLERANCE FOR CONSTRUCTION ±0.5%
- USABLE SIDEWALK WIDTH PER AAB = W-W_C
- RAMP LENGTH, W₁ = W-4'-0" Min



SECTION A-A



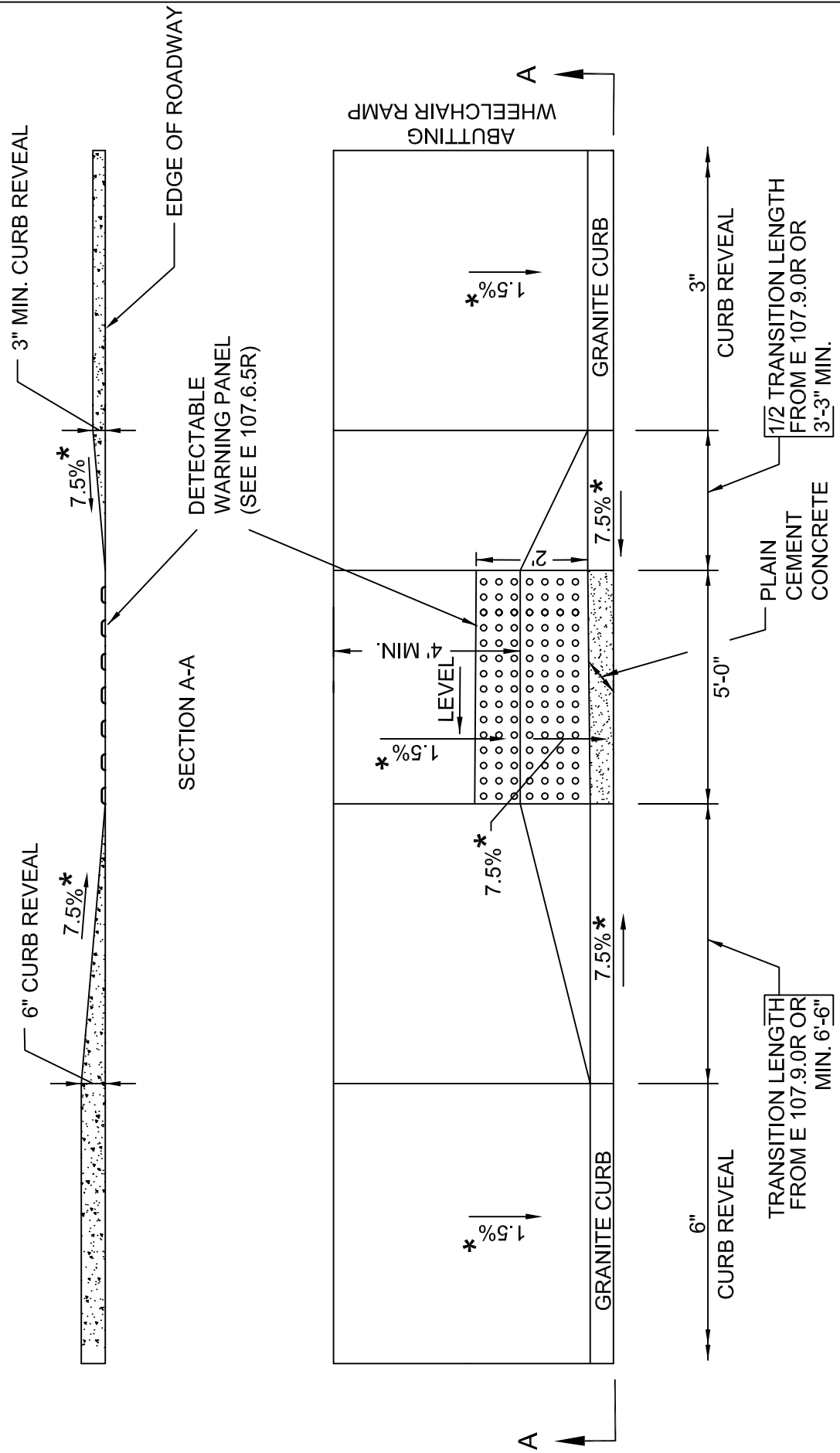
NOTES:

DETECTABLE WARNING PANEL
LOCATED NOT LESS THAN 6" OR MORE THAN 24"
FROM ROADWAY EDGE (GUTTER LINE). TRUNCATED
DOMES TO BE ALIGNED WITH DIRECTION OF TRAVEL.
FOR DETAILS OF TRUNCATED DOMES SEE DRAWING
E 107.6.5R.
ROADWAY, GUTTER, AND FIRST 6" OF SIDEWALK TO
BE ADJUSTED FOR FIELD CONDITIONS.

LEGEND

HSL = HIGH SIDE TRANSITION LENGTH
(SEE E 107.9.0R)
* = TOLERANCE FOR CONSTRUCTION $\pm 0.5\%$

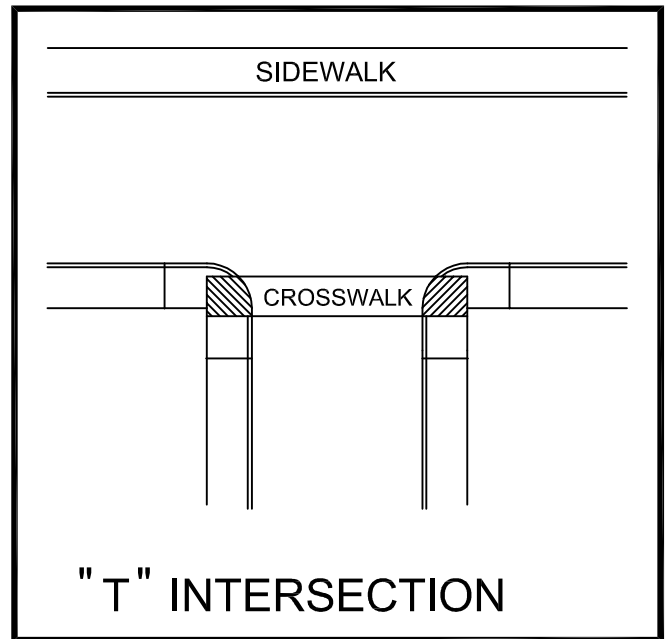
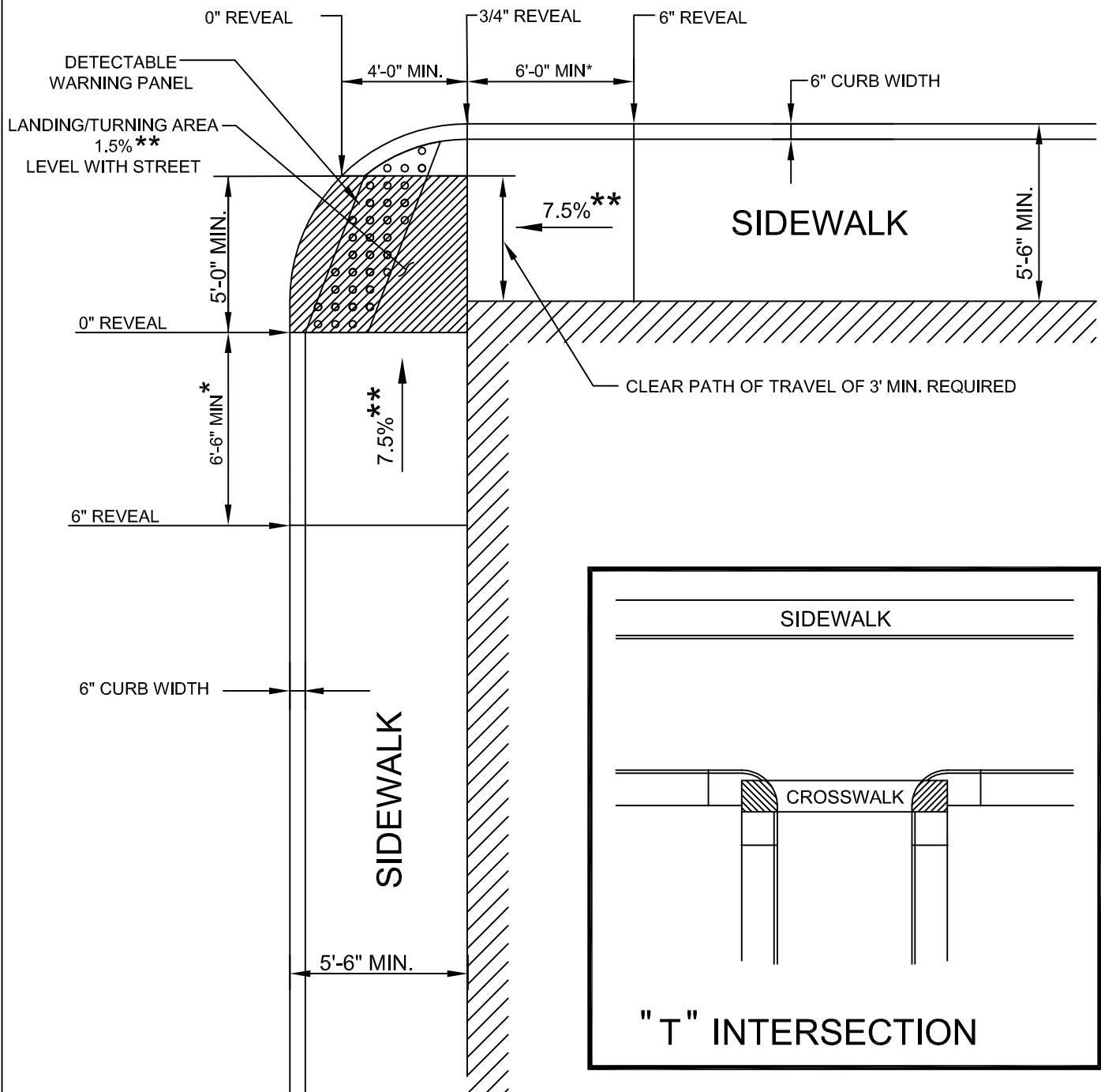
WHEELCHAIR RAMP WITH 3" CURB REVEAL



LEGEND

HSL = HIGH SIDE TRANSITION LENGTH
SEE E 107.9.0R

* = TOLERANCE FOR CONSTRUCTION ±0.5%



LEGEND



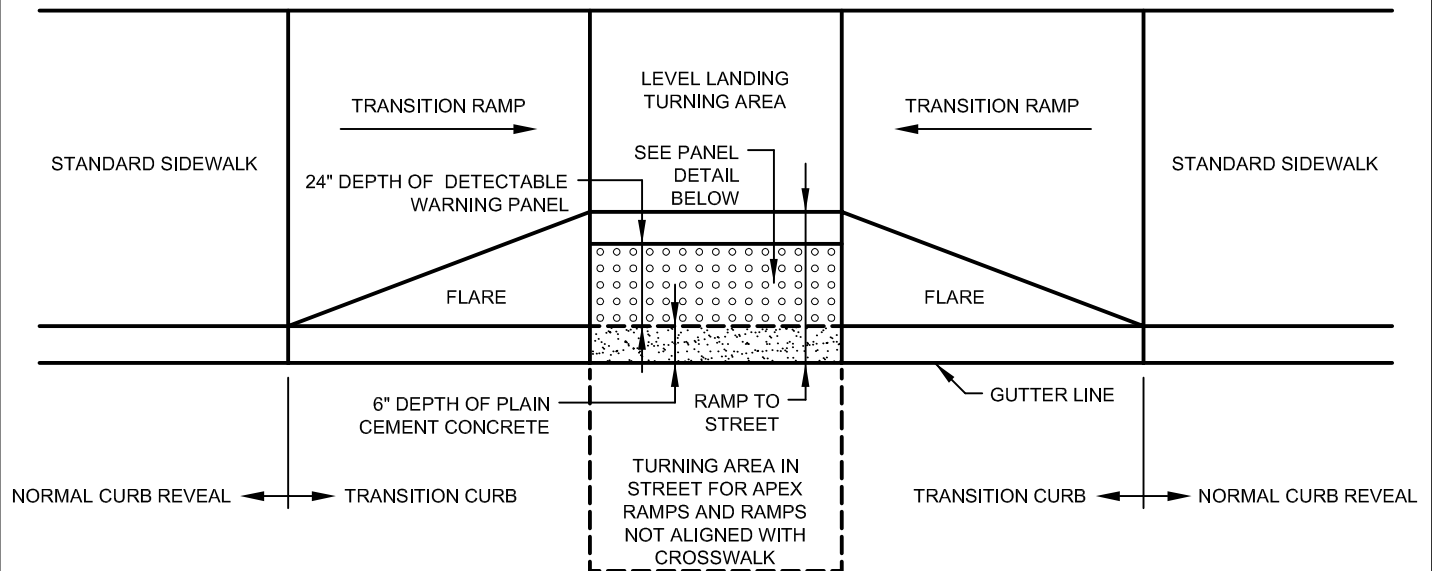
BUILDING OR OTHER UNALTERABLE CONDITION

* TRANSITION LENGTH SHOWN IS MINIMUM.
(SEE E 107.9.0R)

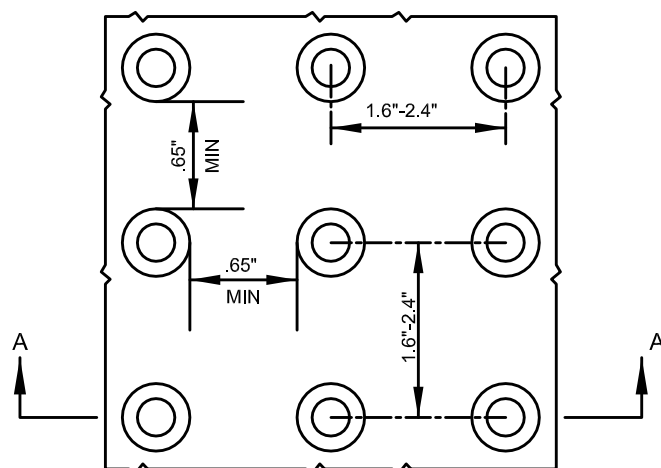
** TOLERANCE FOR CONSTRUCTION $\pm 0.5\%$

NOTE:

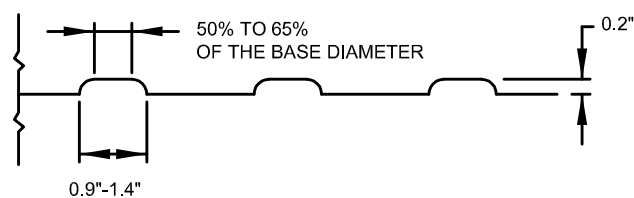
ROADWAY, GUTTER, AND FIRST 6"
OF SIDEWALK TO BE ADJUSTED
FOR FIELD CONDITIONS



TYPICAL INSTALLATION



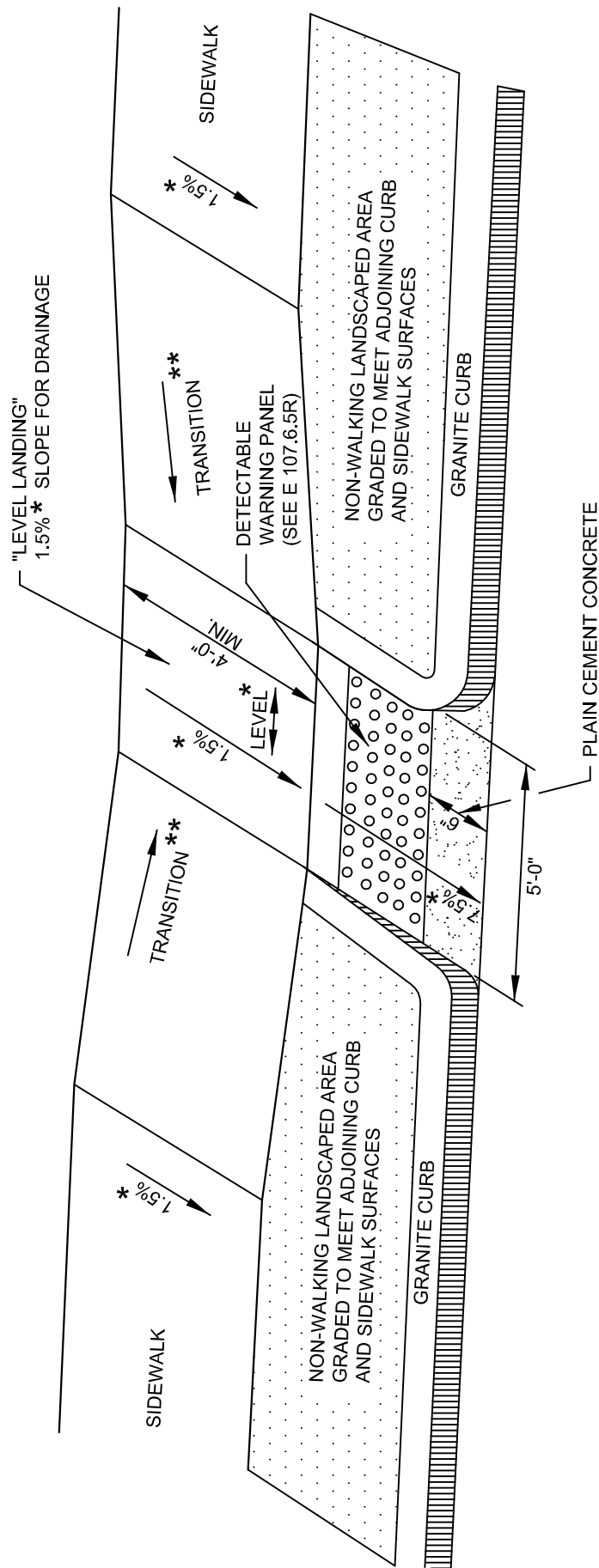
DETAIL OF DETECTABLE WARNING PANEL



SECTION A-A

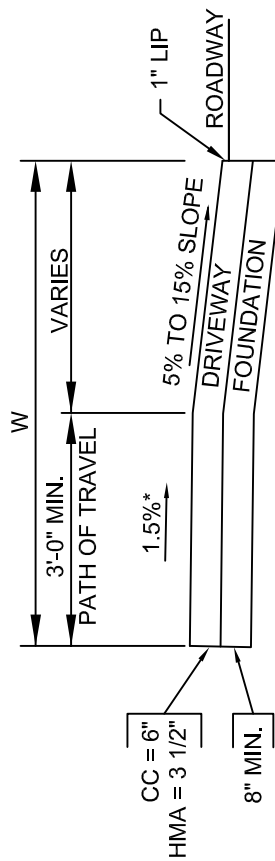
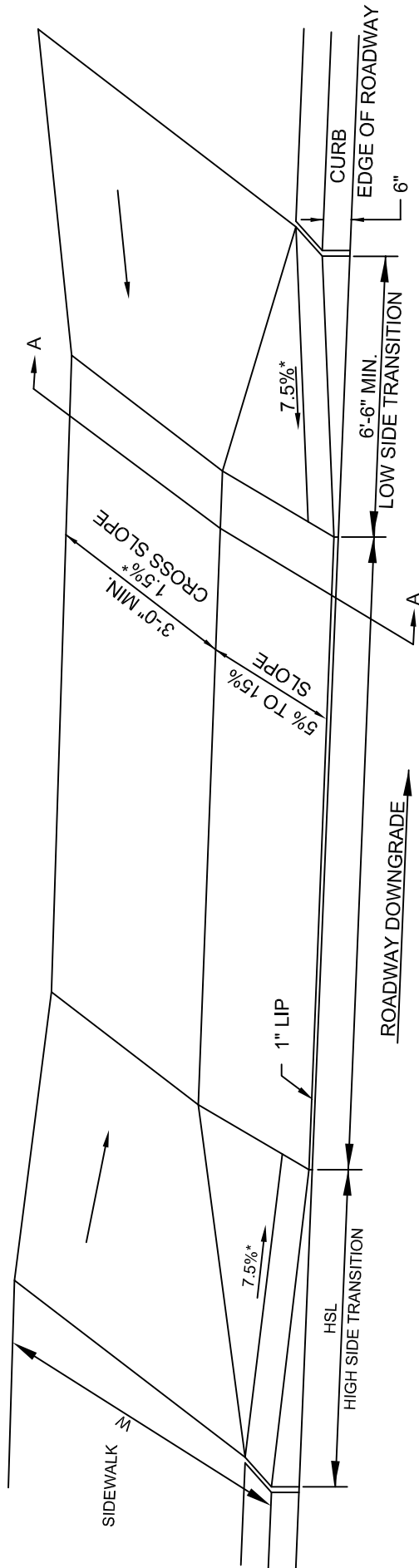
NOTE:

PANELS MAY BE CONCRETE PRECAST OR CAST IN PLACE OR OTHER SUITABLE MATERIAL PERMANENTLY APPLIED TO THE RAMP. DETECTABLE WARNING SURFACES SHALL CONTRAST VISUALLY WITH ADJACENT WALKING SURFACES EITHER LIGHT-ON-DARK, OR DARK-ON-LIGHT.



LEGEND

- * = TOLERANCE FOR CONSTRUCTION $\pm 0.5\%$
- ** = SEE E 107.9R FOR TRANSITION LENGTH



SECTION A-A

LEGEND

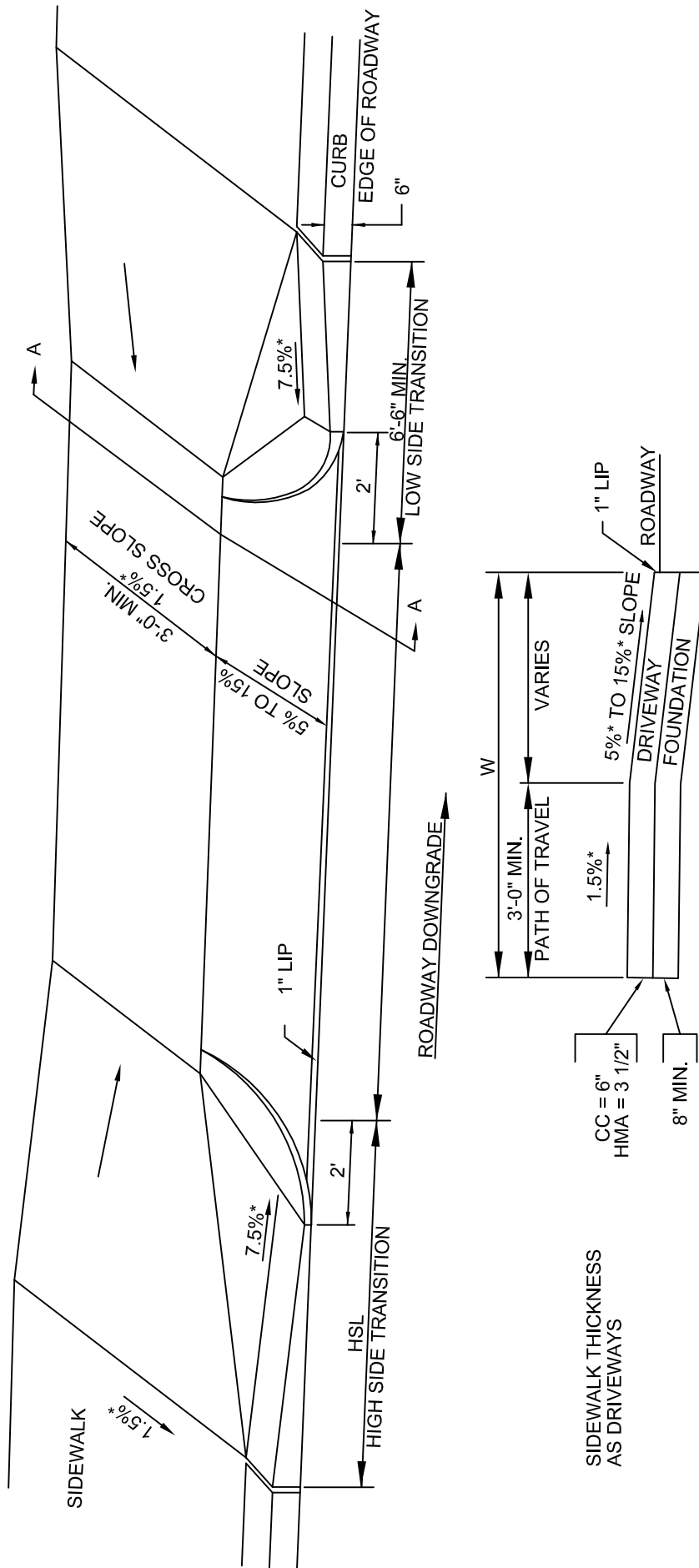
HSL = HIGH SIDE TRANSITION LENGTH. SEE E 107.9.0

W = SIDEWALK WIDTH

* = TOLERANCE FOR CONSTRUCTION $\pm 0.5\%$

CC = CEMENT CONCRETE

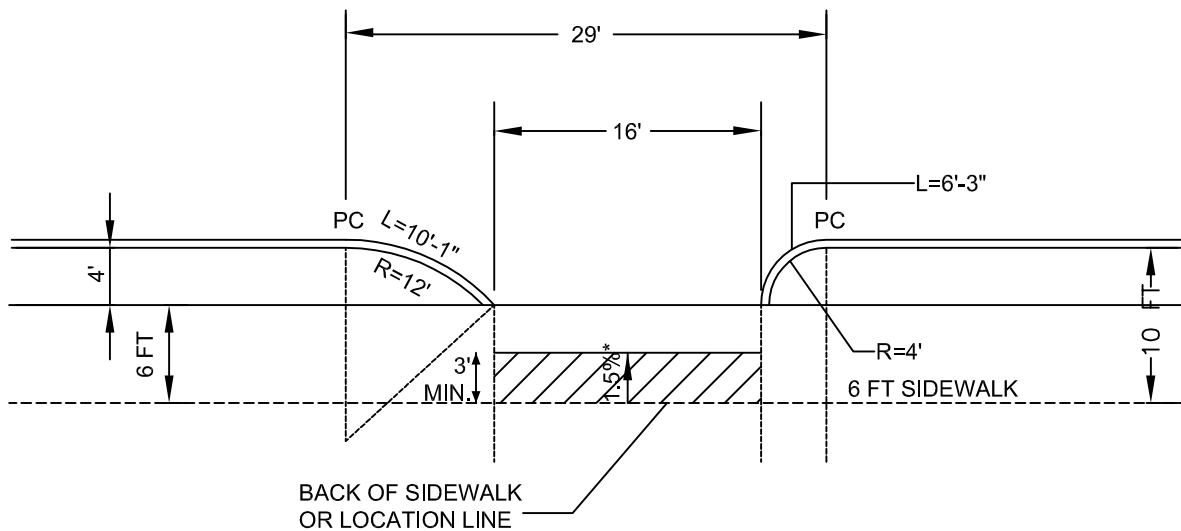
HMA = HOT MIX ASPHALT



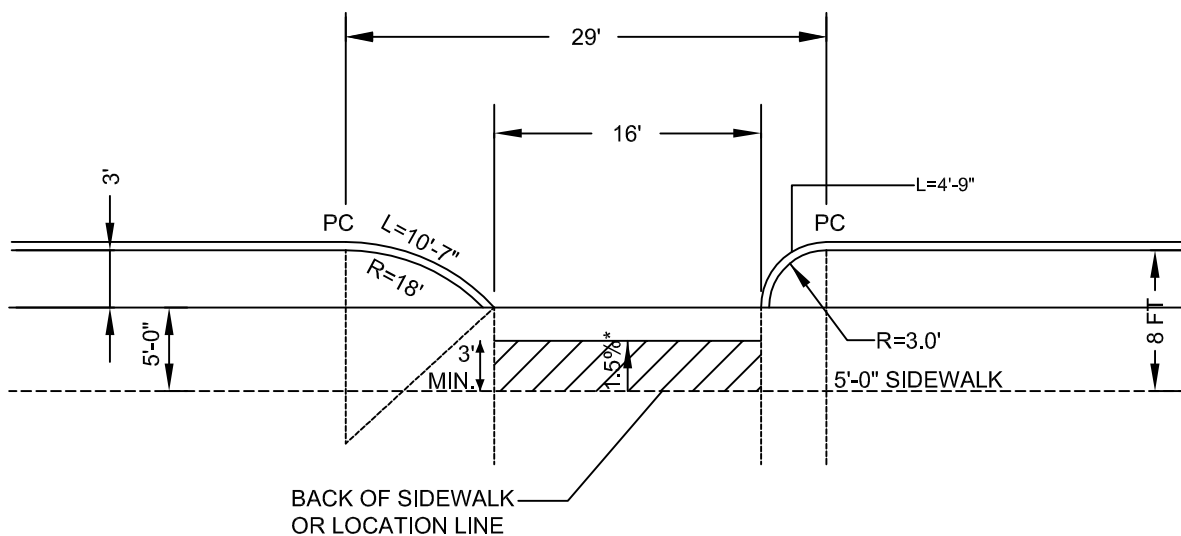
SECTION A-A

LEGEND

HSL = HIGH SIDE TRANSITION LENGTH
W = SIDEWALK WIDTH
* = TOLERANCE FOR CONSTRUCTION $\pm 0.5\%$
CC = CEMENT CONCRETE
HMA = HOT MIX ASPHALT



10 FT SIDEWALK LAYOUT



8 FT SIDEWALK LAYOUT

NOTES:

1. WHEN THE SIDEWALK IS PAVED TO THE CURB LINE, USE SHORT CURB RETURNS AT THE HIGHWAY CURB LINE PC'S, SHOWN IN THESE DESIGNS.



*MUST MAINTAIN PATH OF TRAVEL WITH 1.5% CROSS SLOPE ($\pm 0.5\%$ CONSTRUCTION TOLERANCE)

CURB TRANSITION LENGTH FOR WHEELCHAIR RAMPS

DATE OF ISSUE
JUNE 2014

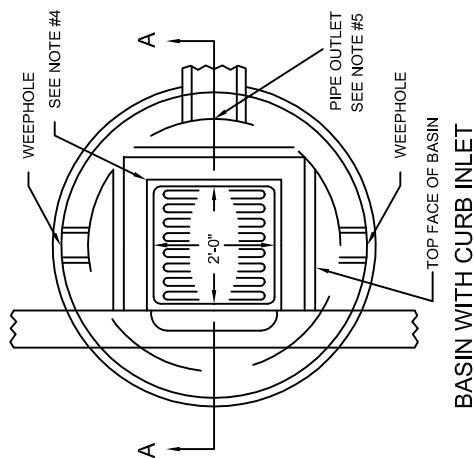
DRAWING NUMBER
E 107.9.0

ROADWAY PROFILE GRADE	* HIGH SIDE TRANSITION LENGTH
%	ENGLISH UNITS
=0%	6'-6"
>0% TO 1%	7'-8"
>1% TO 2%	9'-0"
>2% TO 3%	11'-0"
>3% TO 4%	14'-0"
>4% TO 5%	15'-0" Max

NOTE:

* BASED ON A DESIGN SLOPE OF
7.5% AND A REVEAL OF 6" .

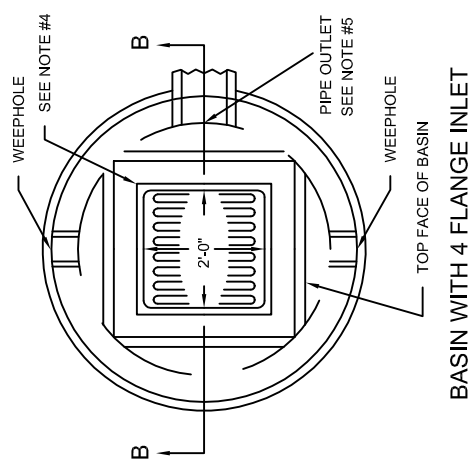
CONCRETE BLOCK CATCH BASIN



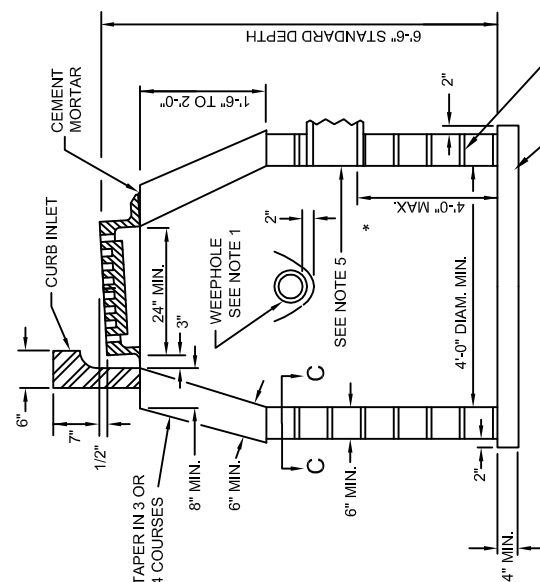
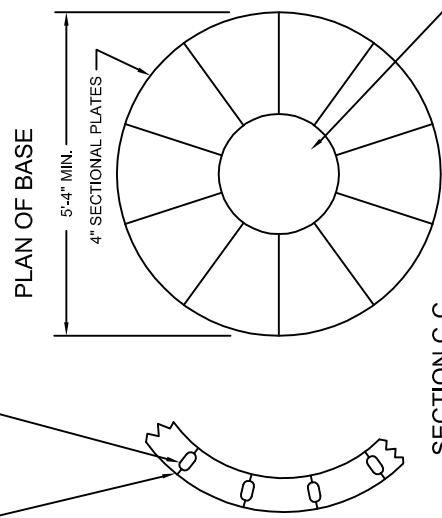
* MINIMUM DEPTH OF SUMP TO BE 2' STANDARD DEPTH 3'

NOTES:

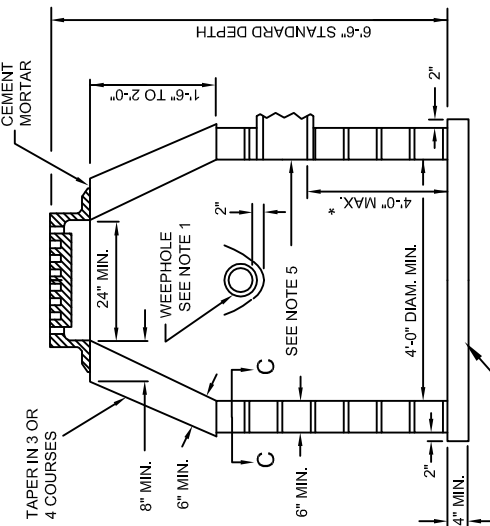
1. WEEPHOLES SHALL BE 4" PIPE OPENING OR EQUIVALENT WITH 1/4 IN. MESH, 23 GAGE GALVANIZED WIRE SCREEN COVERING. 2 CUBIC FEET OF CRUSHED STONE SHALL BE PLACED AROUND EACH WEEPHOLE.
2. BRICKS MAY BE USED BETWEEN TOP COURSE AND C.B. FRAME FOR GRADE ADJUSTMENT. FRAME SHALL BE SET IN FULL BED OF MORTAR.
3. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.
4. DETAILS SHOWN ON DRAWINGS E 201.6.0 - E 201.11.0
5. FACE OF PIPE FLUSH OR NOT TO PROJECT MORE THAN 4 IN. FROM FACE OF WALL ALONG CENTERLINE OF PIPE.



MORTAR NOT REQUIRED IN VERTICAL JOINTS
KEYWAYS TO BE FILLED WITH CEMENT MORTAR



SECTION A-A

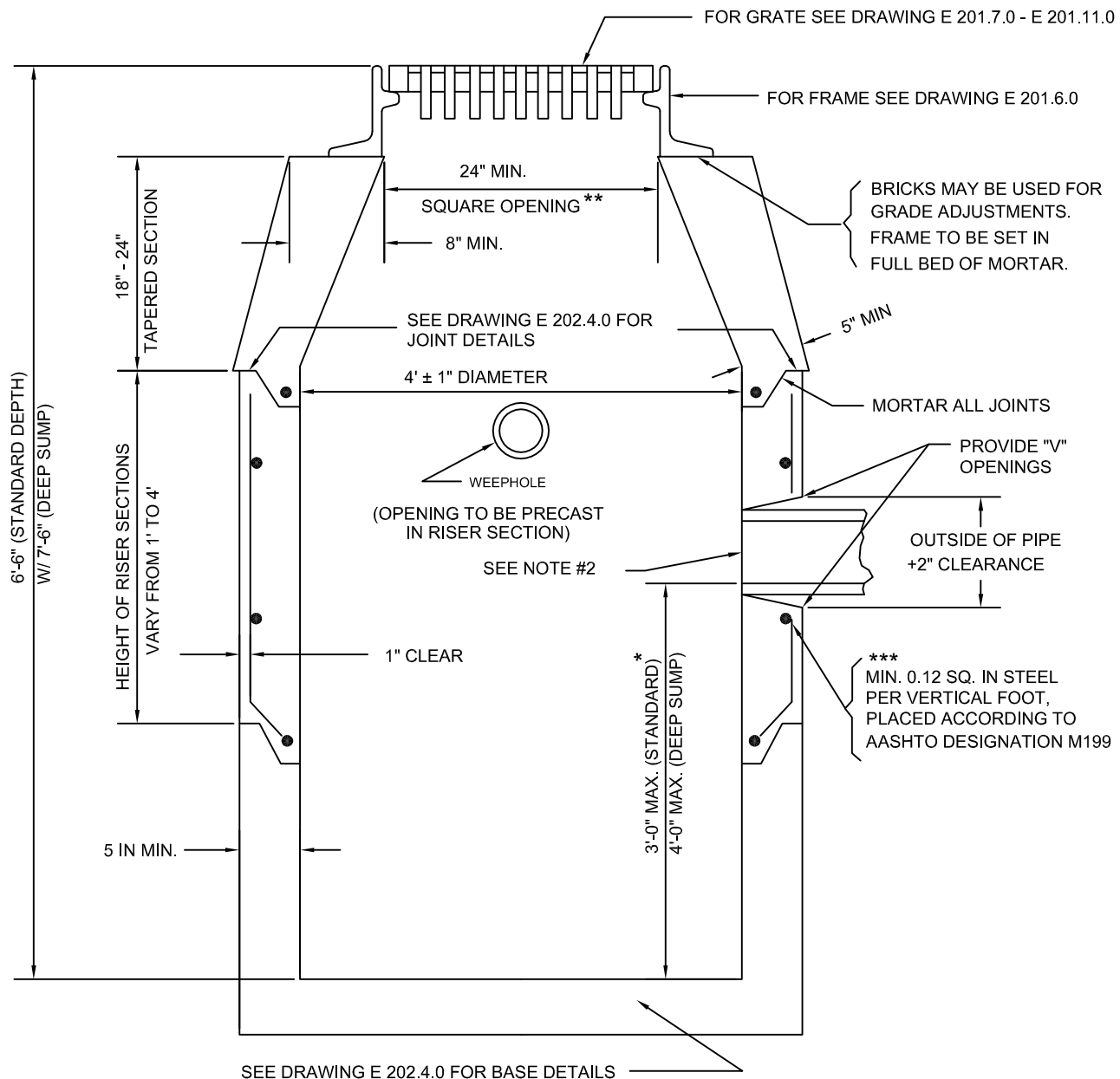


SECTION B-B

SECTION C-C

SOLID SECTION, OR FILL HOLE WITH BRICKS AND MORTAR, OR FILL WITH 4000 PSI CEMENT CONCRETE (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS) (IF CONCRETE IS HAND MIXED SEE LATEST SPECIFICATIONS.)

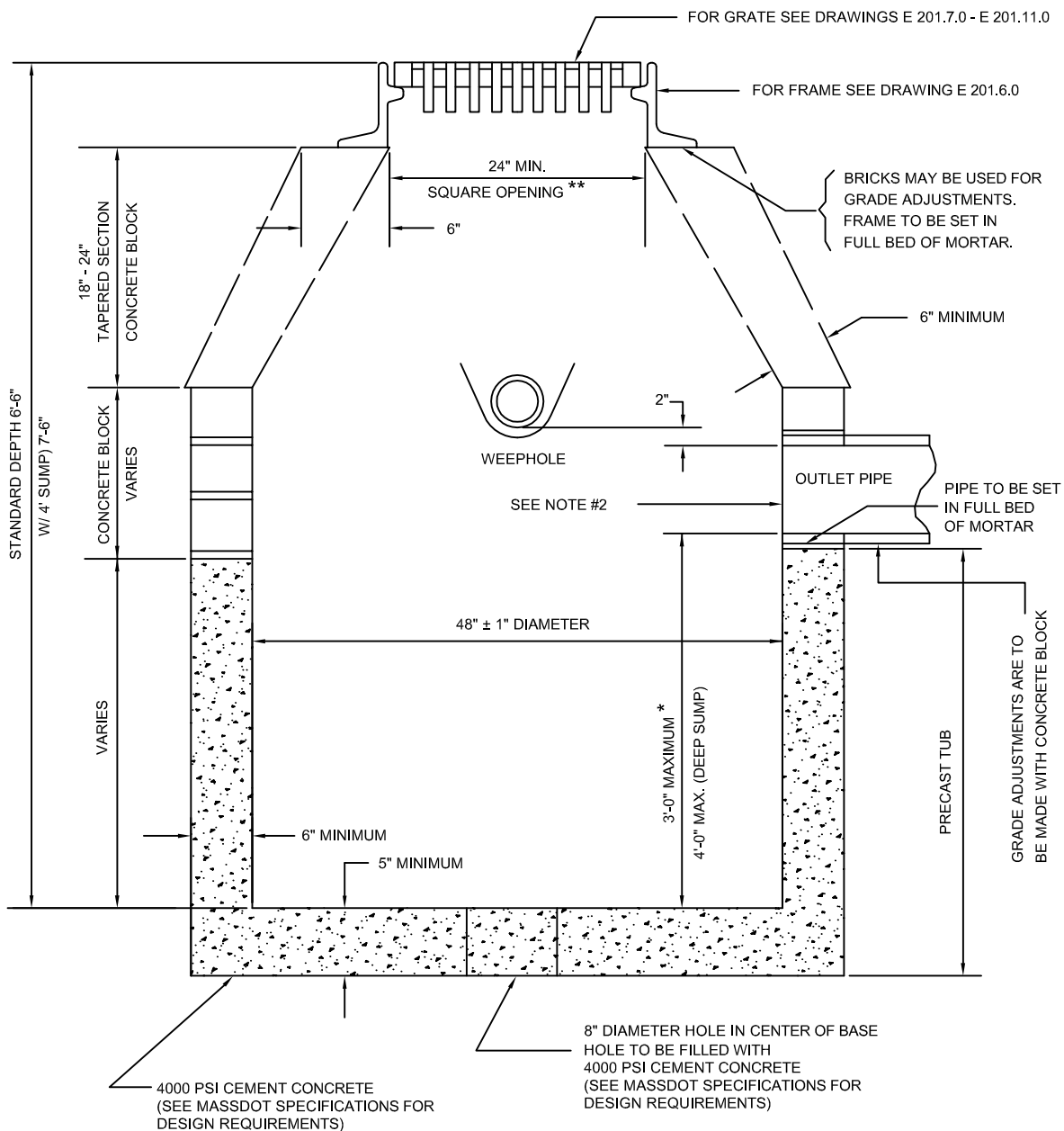
BLOCKS TO BE SET IN FULL BED OF CEMENT MORTAR
4000 PSI CEMENT CONCRETE (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS) OR PRECAST CONCRETE SECTIONAL PLATES. SEE ABOVE.



- * MINIMUM DEPTH OF SUMP TO BE 2 FT
- ** WHEN A CURB INLET IS INSTALLED, THE OPENING IS TO BE 24"±1" X 27"±1"
- *** REINFORCING STEEL BASED ON A WALL THICKNESS OF 5".

NOTES:

1. DETAILS NOT INDICATED ABOVE ARE TO BE SIMILAR TO THOSE SHOWN ON E 201.3.0
2. FACE OF PIPE FLUSH OR NOT TO PROJECT MORE THAN 4" FROM FACE OF WALL
ALONG CENTERLINE OF PIPE.
3. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHOD, SEE STANDARD SPECIFICATIONS.
4. ALL CONCRETE TO BE AIR ENTRAINED

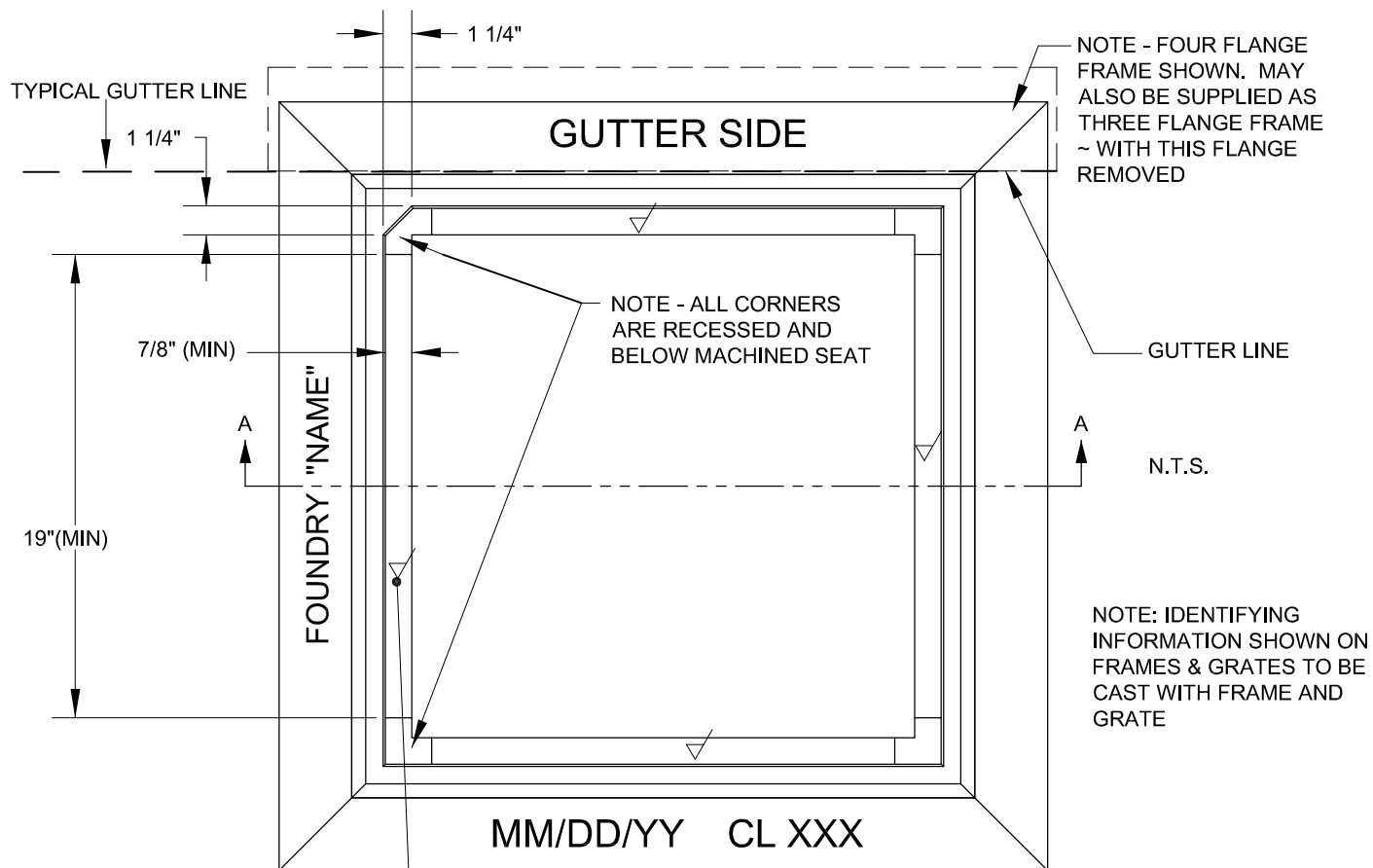


* MINIMUM DEPTH OF SUMP TO BE 2'

** WHEN A CURB INLET IS INSTALLED, THE OPENING IS TO BE 24"±1" X 27"±1"

NOTES:

1. DETAILS NOT INDICATED ABOVE ARE TO BE SIMILAR TO THOSE SHOWN ON DRAWING E 201.3.0
2. FACE OF PIPE FLUSH OR NOT TO PROJECT MORE THAN 4" FROM FACE OF WALL
ALONG CENTERLINE OF PIPE.
3. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHOD, SEE STANDARD SPECIFICATIONS.
4. ALL CONCRETE TO BE AIR ENTRAINED

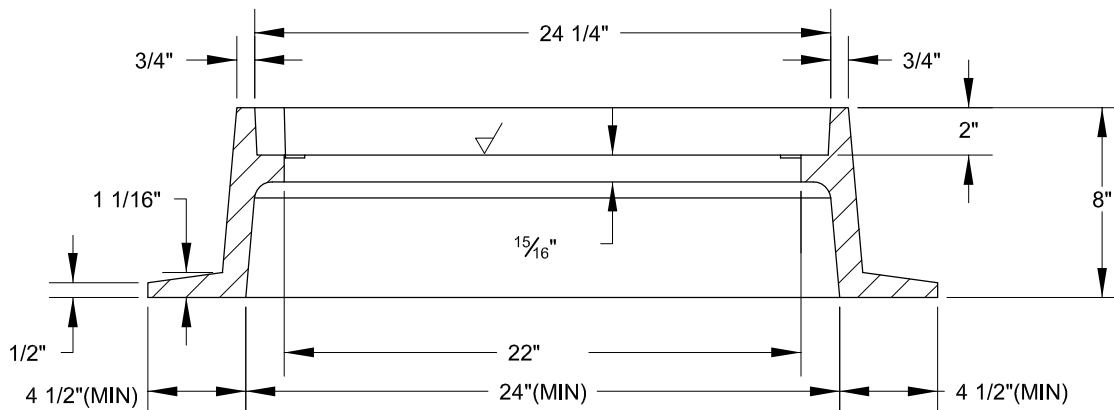


MACHINE TOLERANCES:

▽ MACHINED SEATS (4) REQUIRED
FLAT AND IN PLANE WITHIN .010"
TOTAL INDICATOR READING

CLASSIFICATION:

CAST IRON - SEE STANDARD SPECIFICATIONS
WITH NO BLACK ASPHALT COATING ALLOWED



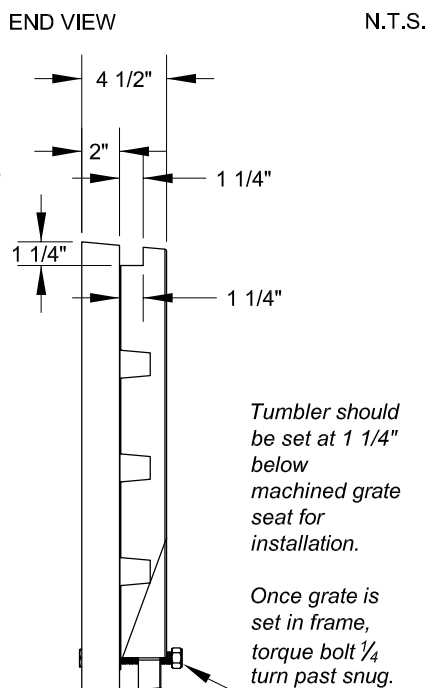
WEIGHTS:

3-FLANGE FRAME 240 LBS. MIN
4-FLANGE FRAME 270 LBS. MIN

AASHTO HS 20 LOAD RATED

CASTING TOLERANCES:

SHALL CONFORM TO AASHTO
M306



Tumbler should be set at 1 1/4" below machined grate seat for installation.

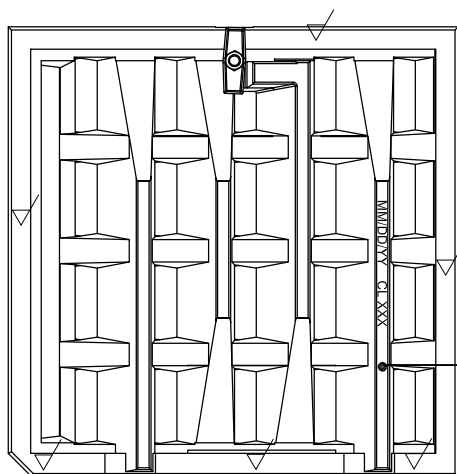
Once grate is
set in frame,
torque bolt $\frac{1}{4}$
turn past snug.

A schematic diagram of a polymer chain, represented by a horizontal line with a series of downward-pointing triangles. A circle labeled 'D' is drawn around one of the triangles, indicating a defect or a specific site of interest. The label 'N C-C' is positioned to the left of the chain.

5/8" x 5" ST. STL. BOLT
5/8" ST. STL. FLAT WASHER
CAST IRON TUMBLER
ST. STL. CAPTURE NUT

STAINLESS STEEL GRADE 304

CLASSIFICATION:
CAST IRON - SEE STANDARD SPECIFICATIONS
WITH NO BLACK ASPHALT COATING ALLOWED



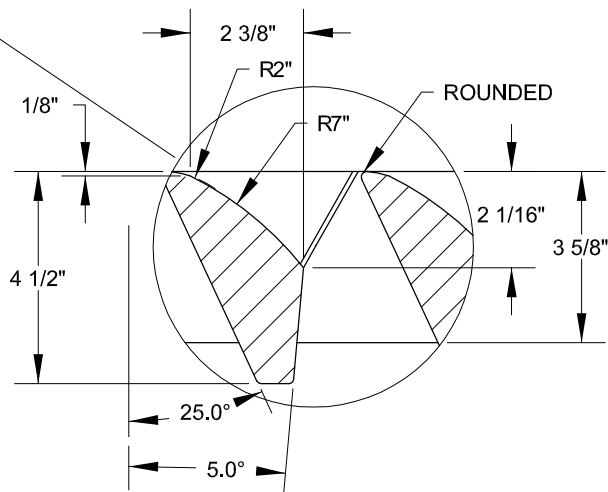
WEIGHT: 265 LBS. MIN
AASHTO HS 20 PROOF LOAD

**NOTE: IDENTIFYING INFORMATION
SHOWN ON FRAMES & GRATES TO BE
CAST WITH FRAME AND GRATE**

-CAST BACK
FACE WITH
MOLD DATE
AND PART NO.

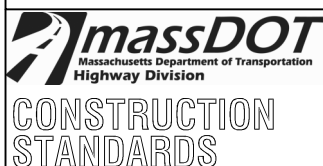
Machine tolerances:

Surfaces noted  must be machined flat and in-plane within .010" Total Indicator Reading



CASTING TOLERANCES:
SHALL CONFORM TO AASHTO
M306

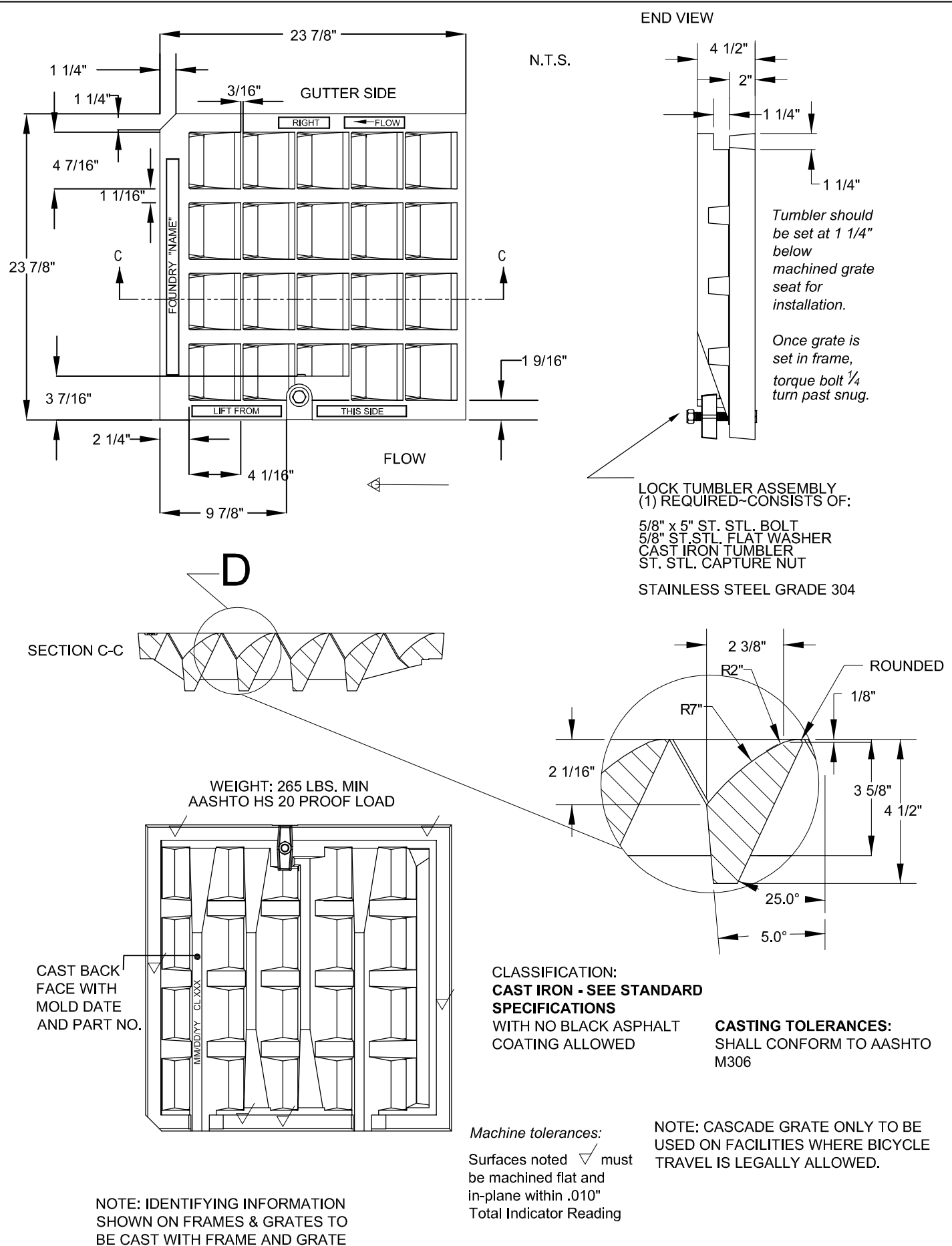
NOTE: CASCADE GRATE ONLY TO BE
USED ON FACILITIES WHERE BICYCLE
TRAVEL IS LEGALLY ALLOWED.

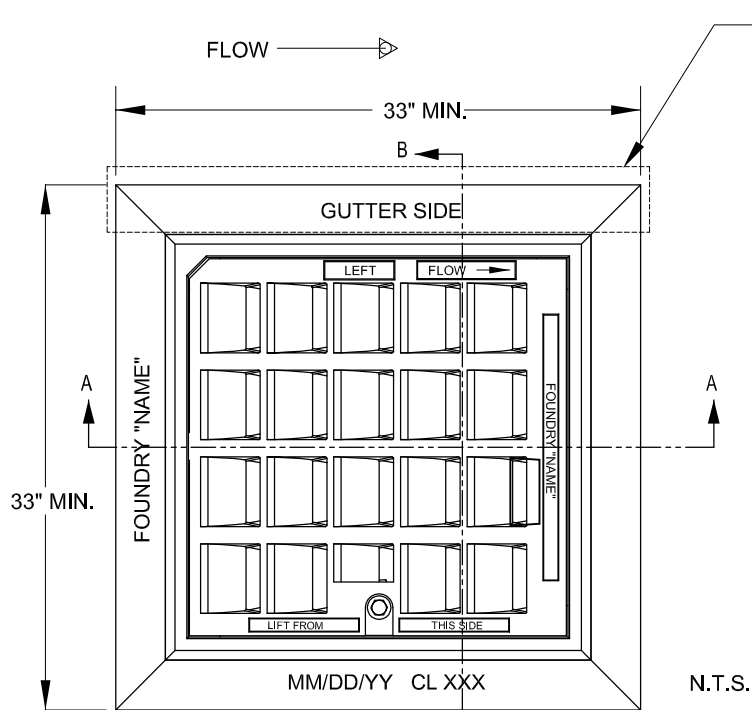


HOOK LOCK CASCADE GRATE FLOW FROM LEFT

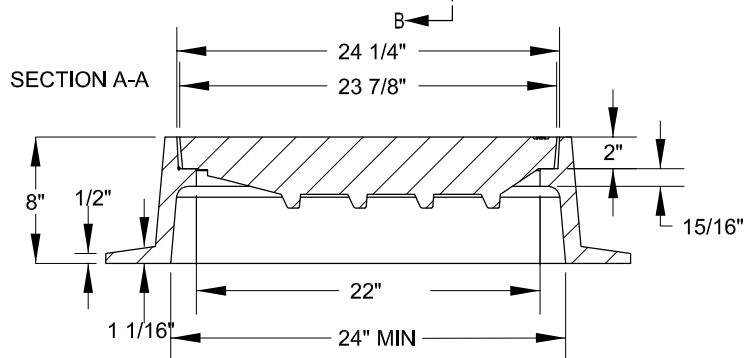
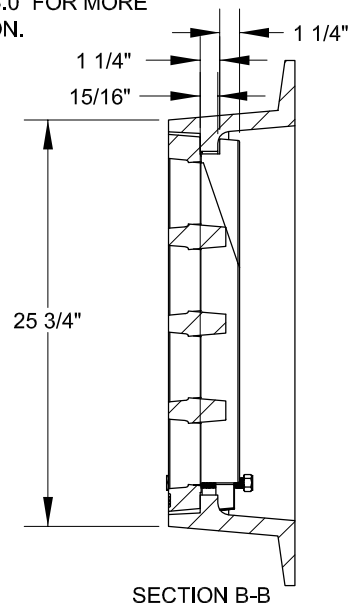
DATE OF ISSUE	JUNE 2014
---------------	-----------

DRAWING NUMBER
E 201.7.0

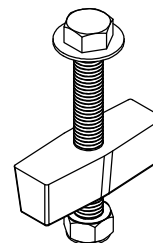




FRAME MAY BE INSTALLED WITH THIS FLANGE REMOVED FOR CURB INLET. FOUR FLANGE IS SHOWN. ~ SEE DWG E 201.6.0 FOR MORE INFORMATION.



AASHTO HS 20 PROOF LOAD



LOCK TUMBLER ASSEMBLY
(1) REQUIRED~CONSISTS OF:

5/8" x 5" ST. STL. BOLT
5/8" ST. STL. FLAT WASHER
CAST IRON TUMBLER
ST. STL. CAPTURE NUT

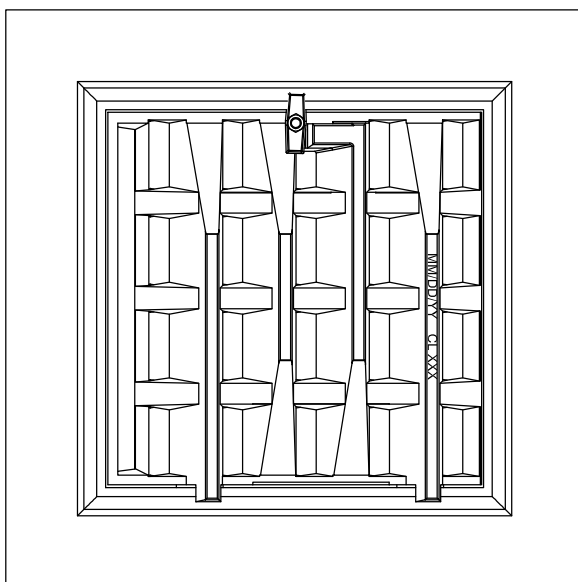
STAINLESS STEEL GRADE 304

CLASSIFICATION:
CAST IRON - SEE STANDARD SPECIFICATIONS
WITH NO BLACK ASPHALT COATING ALLOWED

Tumbler should be set at 1 1/4" below machined grate seat for installation.

Once grate is set in frame, torque bolt 1/4 turn past snug.

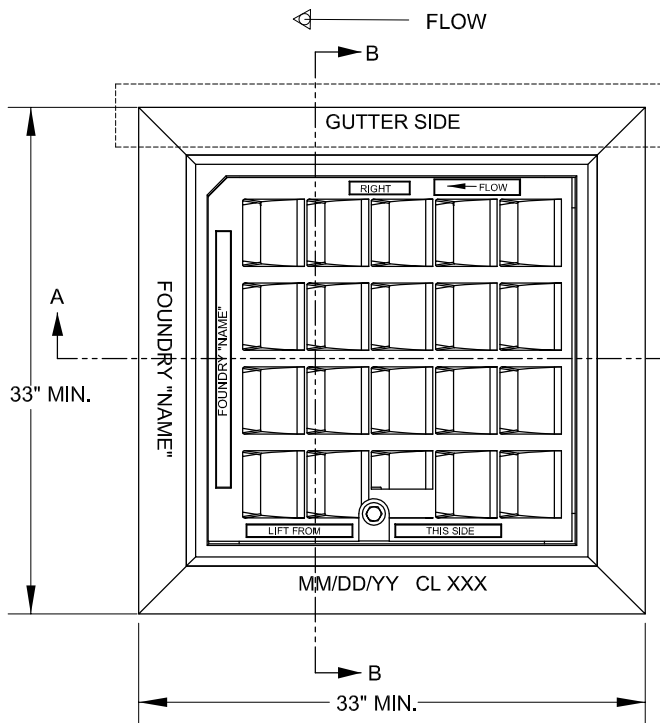
WEIGHTS:
3-FLANGE FRAME 240 LBS. MIN
4-FLANGE FRAME 270 LBS. MIN
B-1 GRATE 265 LBS. MIN



NOTE: SEAT SURFACES ON BOTH FRAME AND GRATE ARE MACHINED AND GRATE MUST NOT ROCK IN FRAME WHEN ASSEMBLED.

CASTING TOLERANCES:
SHALL CONFORM TO AASHTO M306

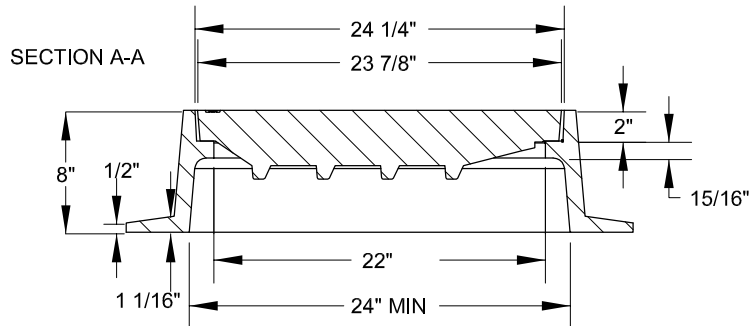
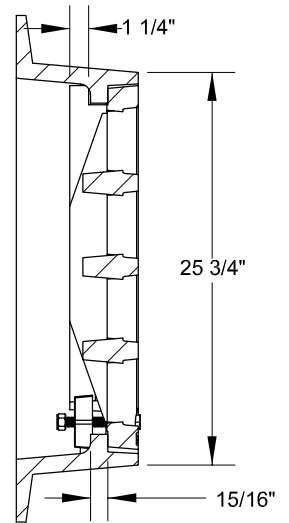
NOTE: IDENTIFYING INFORMATION SHOWN ON FRAMES & GRATES TO BE CAST WITH FRAME AND GRATE



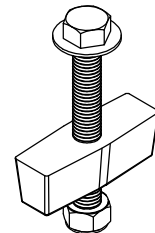
FRAME MAY BE INSTALLED
WITH THIS FLANGE REMOVED
FOR CURB INLET. FOUR
FLANGE IS SHOWN. ~ SEE
DWG E 201.6.0 FOR MORE
INFORMATION.

CLASSIFICATION:
**CAST IRON - SEE STANDARD
SPECIFICATIONS**
WITH NO BLACK ASPHALT
COATING ALLOWED

AASHTO HS 20 PROOF LOAD
N.T.S.



SECTION B-B



LOCK TUMBLER ASSEMBLY
(1) REQUIRED~CONSISTS OF:

5/8" x 5" ST. STL. BOLT
5/8" ST. STL. FLAT WASHER
CAST IRON TUMBLER
ST. STL. CAPTURE NUT

STAINLESS STEEL GRADE 304

*Tumbler should be set at 1 1/4" below machined grate seat
for installation.*

Once grate is set in frame, torque bolt 1/4 turn past snug.

WEIGHTS:

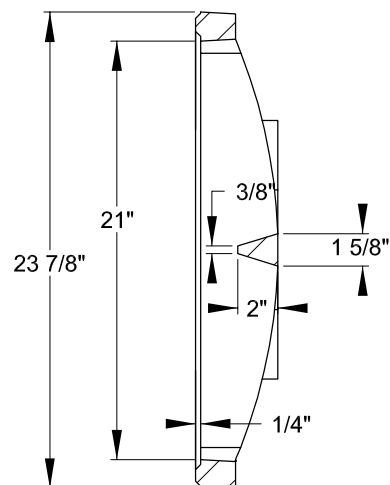
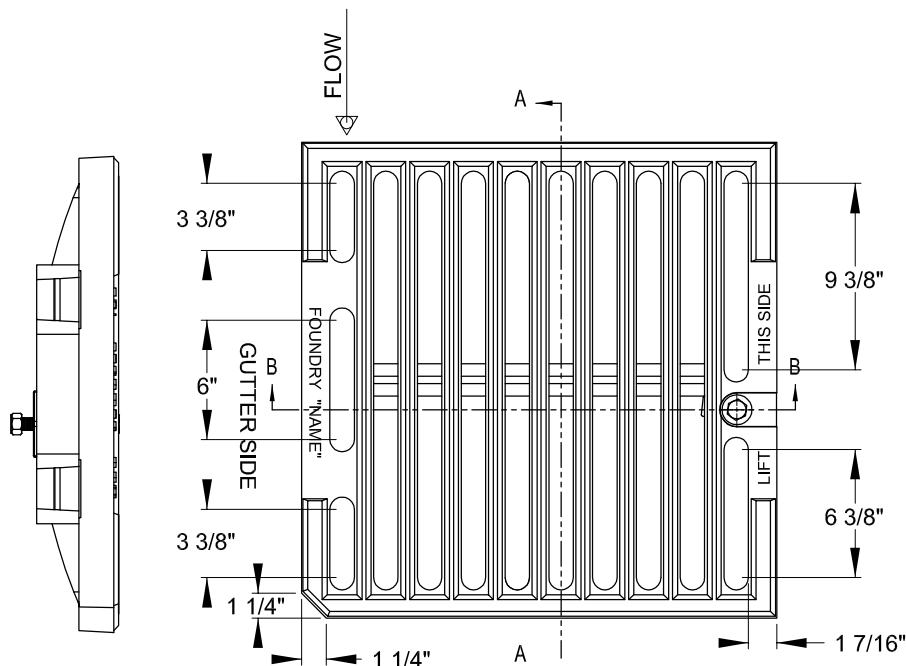
3-FLANGE FRAME	240 LBS. MIN
4-FLANGE FRAME	270 LBS. MIN
B-2 GRATE	265 LBS. MIN

CASTING TOLERANCES:

SHALL CONFORM TO AASHTO
M306

NOTE: SEAT SURFACES ON BOTH FRAME AND GRATE ARE MACHINED
AND GRATE MUST NOT ROCK IN FRAME WHEN ASSEMBLED.

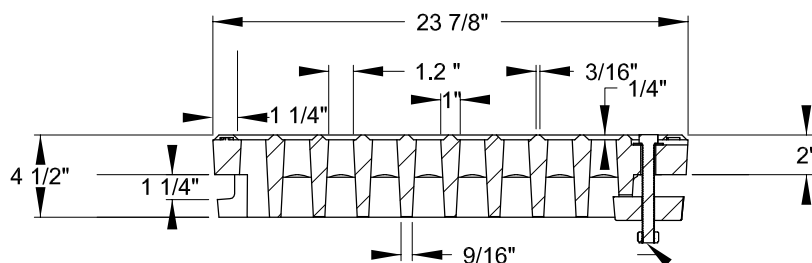
NOTE: IDENTIFYING INFORMATION SHOWN ON FRAMES & GRATES TO
BE CAST WITH FRAME AND GRATE



N.T.S.

WEIGHT: 205 LBS. (MIN)

NOTE: IDENTIFYING
INFORMATION SHOWN ON
FRAMES & GRATES TO BE
CAST WITH FRAME AND
GRATE



LOCK TUMBLER ASSEMBLY

(1) REQUIRED~CONSISTS OF:

5/8" x 5" ST. STL. BOLT
5/8" ST. STL. FLAT WASHER
CAST IRON TUMBLER
ST. STL. CAPTURE NUT
STAINLESS STEEL GRADE 304

AASHTO HS 20 PROOF LOAD

CLASSIFICATION:
**CAST IRON - SEE STANDARD
SPECIFICATIONS**
WITH NO BLACK ASPHALT
COATING ALLOWED

Machine tolerances:

Surfaces noted ∇ must
be machined flat and
in-plane within .010"
Total Indicator Reading

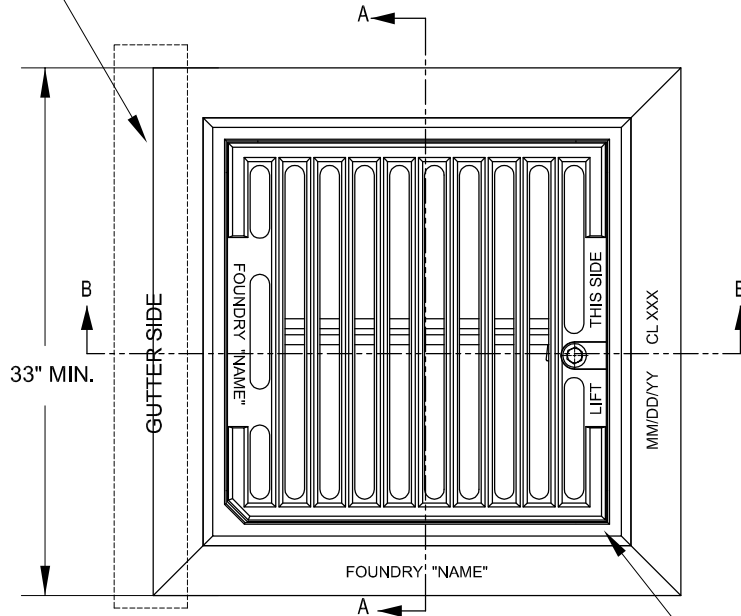
CASTING TOLERANCES:
SHALL CONFORM TO AASHTO M306

Tumbler should be set at 1 1/4" below machined grate seat for installation.

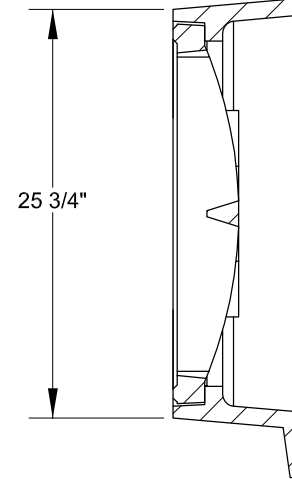
Once grate is set in frame, torque bolt $\frac{1}{4}$ turn past snug.

NOTE: BAR GRATE NOT TO BE USED ON
FACILITIES WHERE BICYCLE TRAVEL IS
LEGALLY ALLOWED.

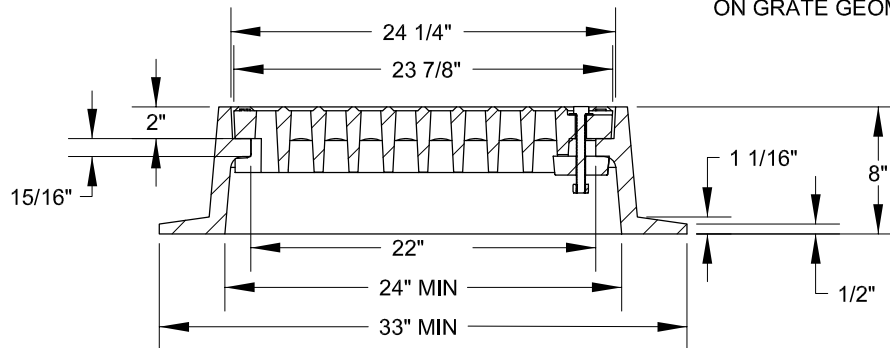
FRAME MAY BE INSTALLED WITH THIS FLANGE REMOVED FOR CURB INLET. FOUR FLANGE IS SHOWN. SEE DWG 201.6.0 R2 FOR MORE INFORMATION.



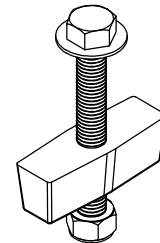
NOTE: IDENTIFYING INFORMATION SHOWN ON FRAMES & GRATES TO BE CAST WITH FRAME AND GRATE



SEE DWG # FOR MORE INFORMATION ON GRATE GEOMETRY.



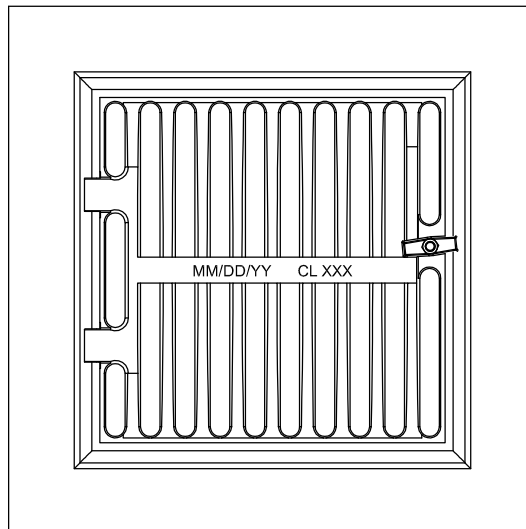
N.T.S.



LOCK TUMBLER ASSEMBLY
(1) REQUIRED~CONSISTS OF:

5/8" x 5" ST. STL. BOLT
5/8" ST. STL. FLAT WASHER
CAST IRON TUMBLER
ST. STL. CAPTURE NUT
STAINLESS STEEL GRADE 304

AASHTO
HS 20
PROOF
LOAD



CASTING TOLERANCES:
SHALL CONFORM TO AASHTO
M306

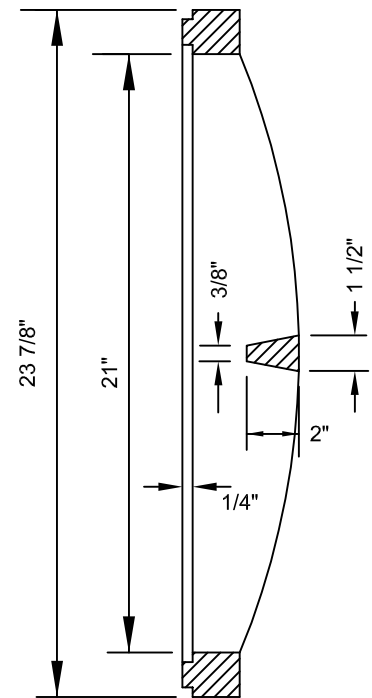
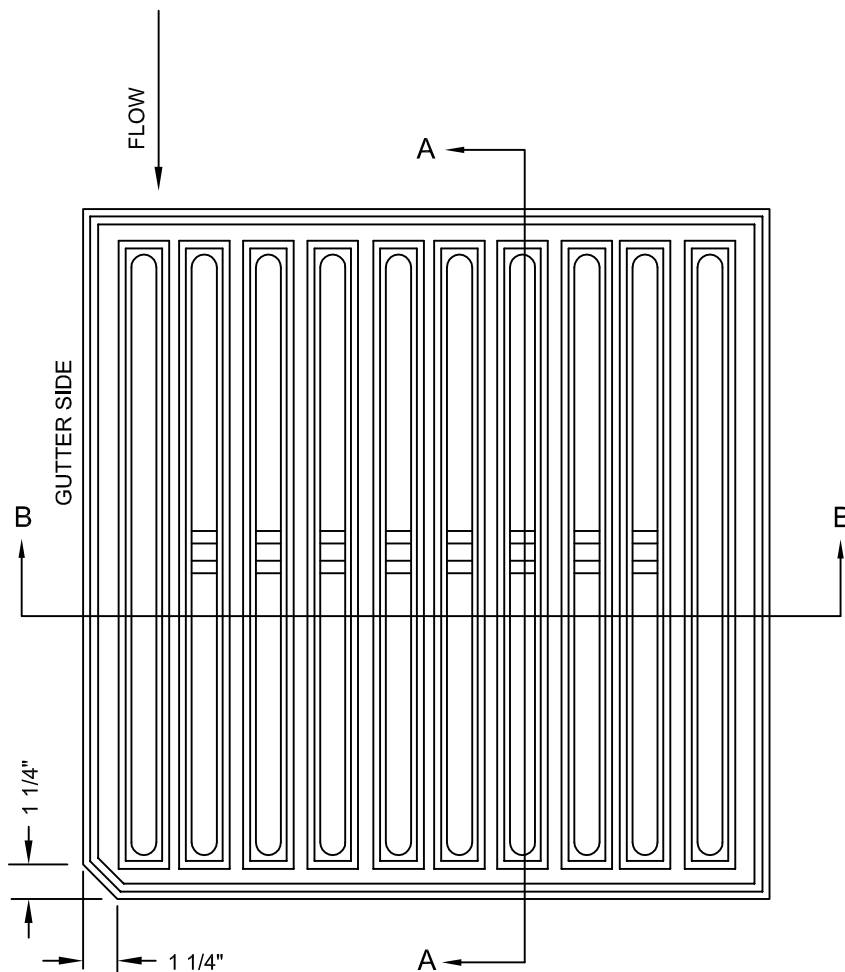
CLASSIFICATION:
CAST IRON - SEE STANDARD SPECIFICATIONS
WITH NO BLACK ASPHALT COATING ALLOWED

NOTE: SEAT SURFACES ON BOTH FRAME AND GRATE ARE MACHINED AND GRATE MUST NOT ROCK IN FRAME WHEN ASSEMBLED.

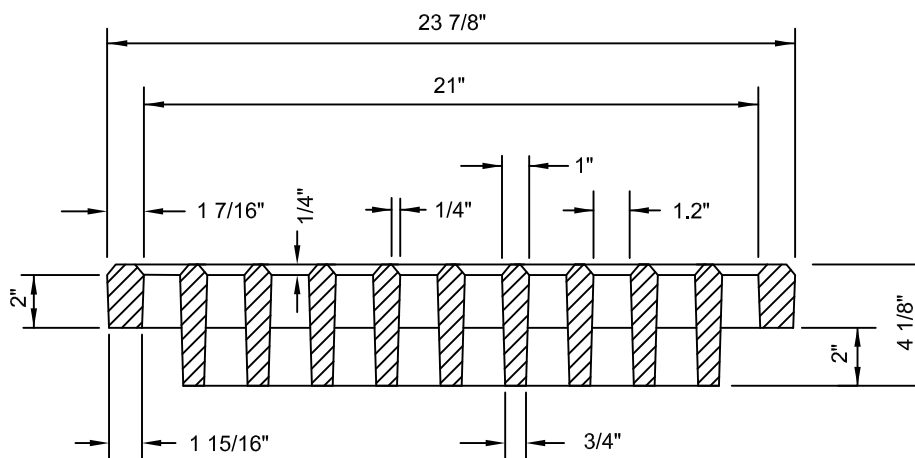
Tumbler should be set at 1 1/4" below machined grate seat for installation.

Once grate is set in frame, torque bolt 1/4 turn past snug.

WEIGHTS:
3-FLANGE FRAME 240 LBS. MIN
4-FLANGE FRAME 270 LBS. MIN
A-4 GRATE 205 LBS. MIN



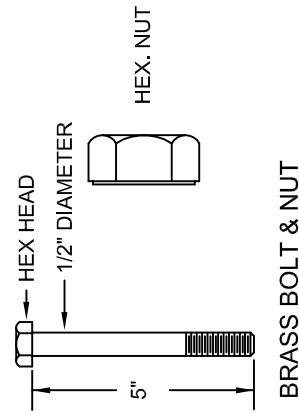
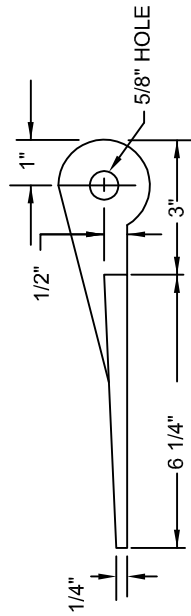
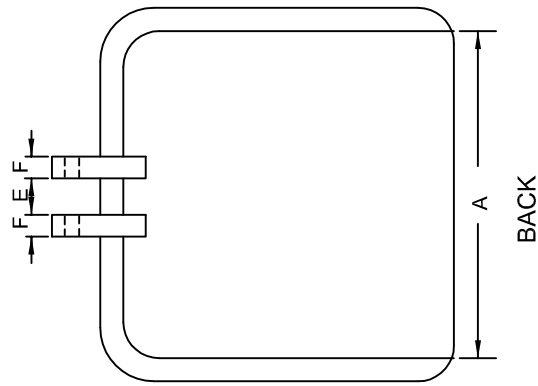
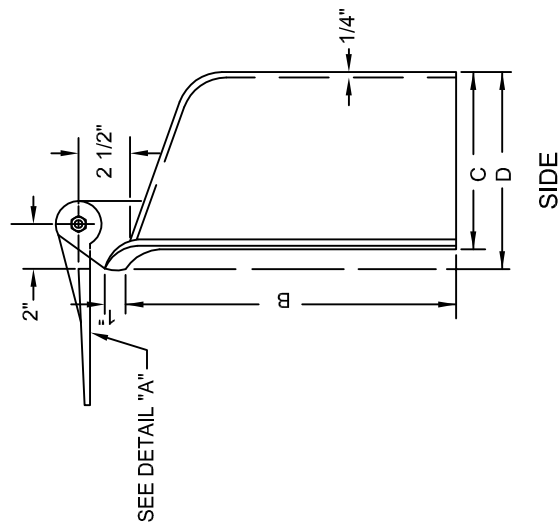
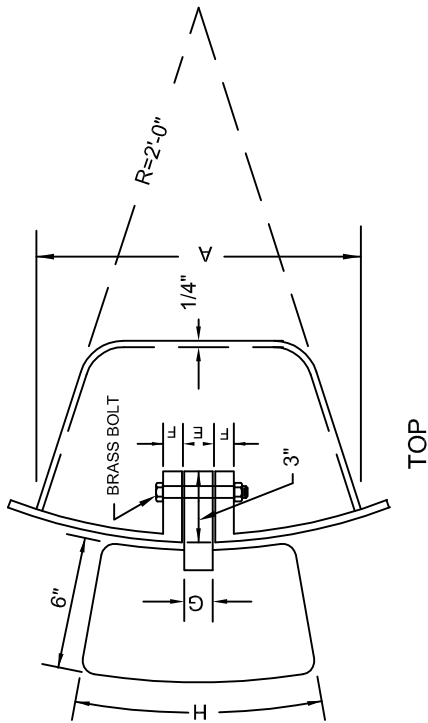
SECTION A-A



SECTION B-B

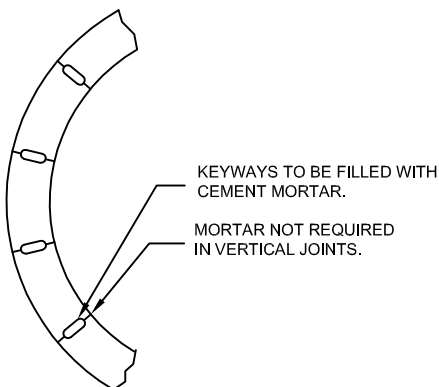
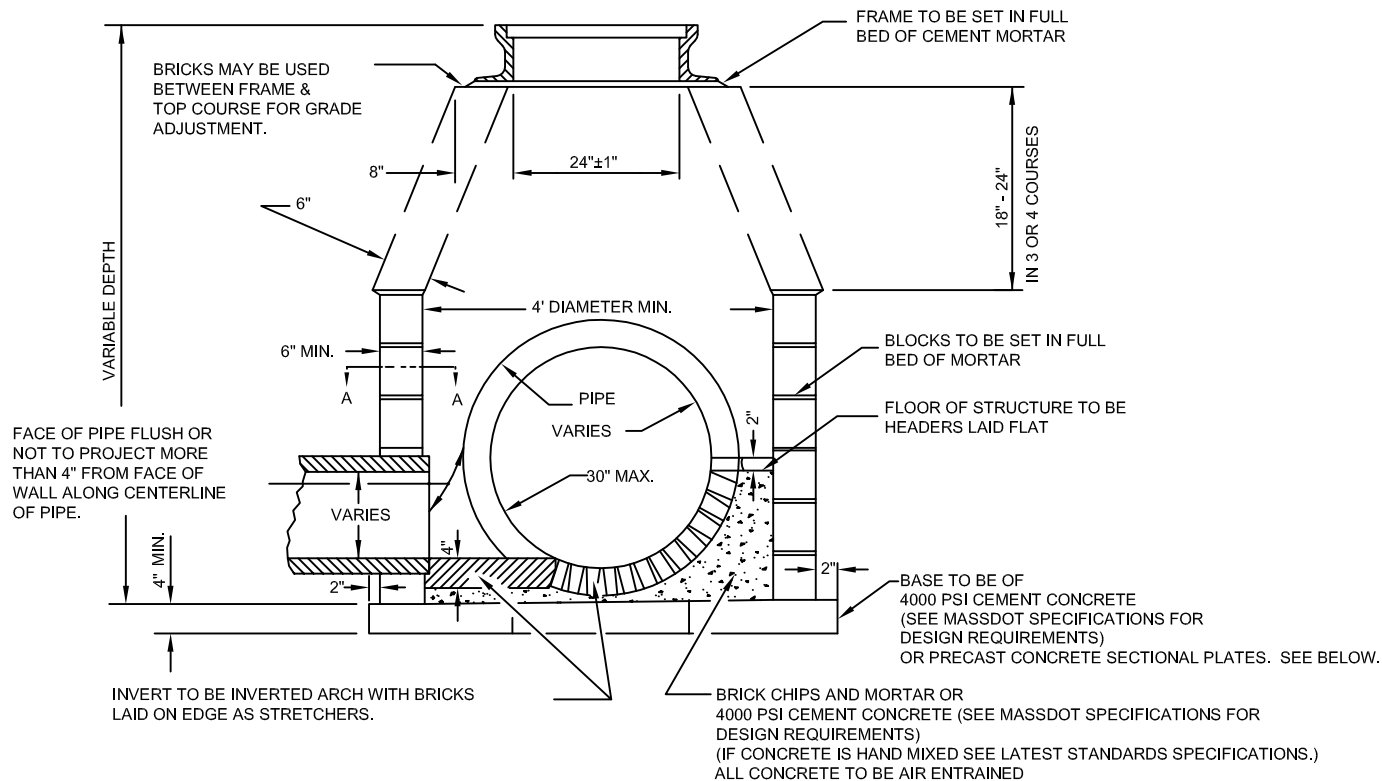
NOTES:

1. MATERIAL - CAST IRON; SEE STANDARD SPECIFICATIONS
2. MINIMUM MASS - 210 LBS.

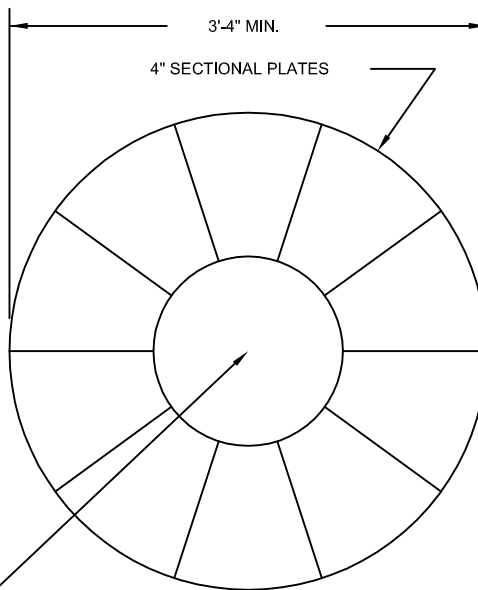


DIMENSIONS (in.)	A	B	C	D	E	F	G	H
8" and 10" PIPE	15	15	8	9	2	7/8	1 7/8	14
12" and 15" PIPE	18	18	10	11 1/4	2	1	1 7/8	14

NOTE:
1. HOODS TO BE GRAY CAST IRON - SEE STANDARD SPECIFICATIONS
WITH NO BLACK ASPHALT COATING ALLOWED



SECTION A-A

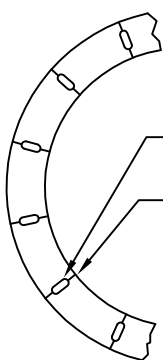
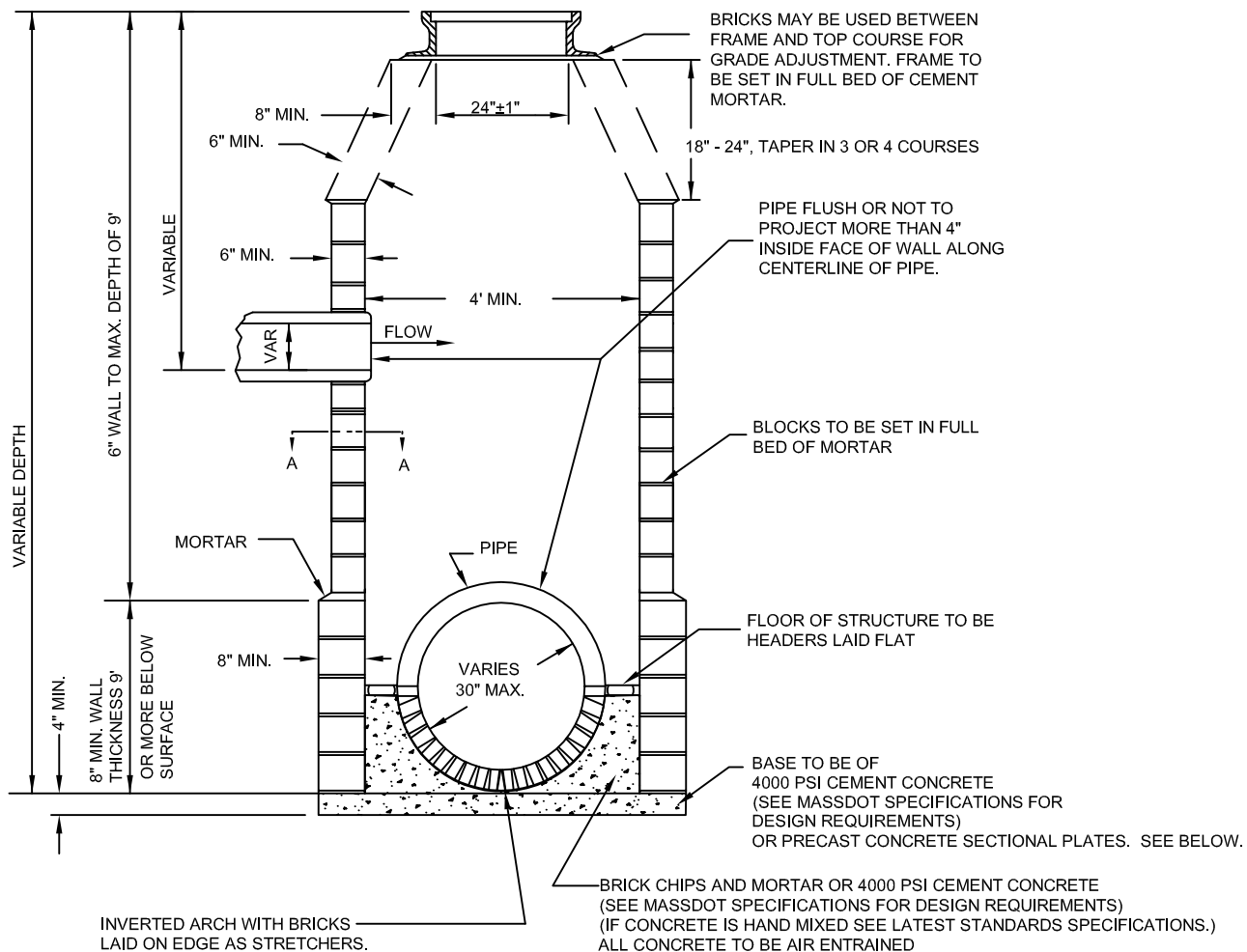


PLAN OF BASE

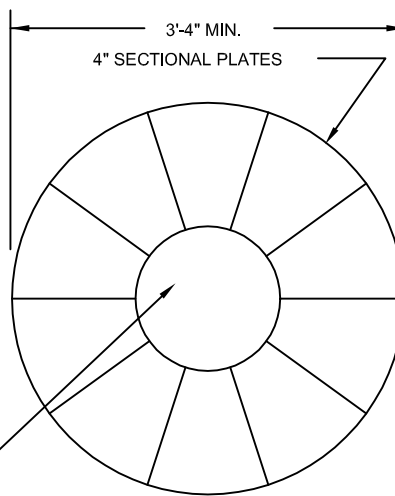
SOLID SECTION; OR FILL HOLE WITH BRICKS AND MORTAR;
OR FILL WITH 4000 PSI CEMENT CONCRETE
(SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)
(IF CONCRETE IS HAND MIXED SEE LATEST STANDARD SPECIFICATIONS)

NOTE:

1. DESIGN SHOWN IS FOR MANHOLE OF 9' OR LESS AND PIPE DIAMETER OF 30" OR LESS.
2. STANDARD MANHOLE DEPTH TO BE 6'-6" OR LESS



SECTION A-A

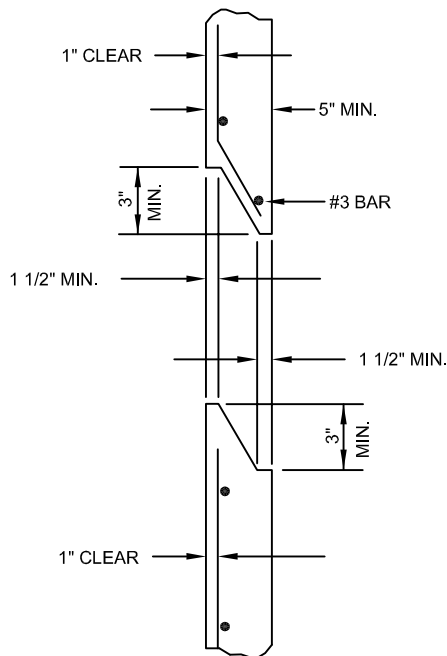
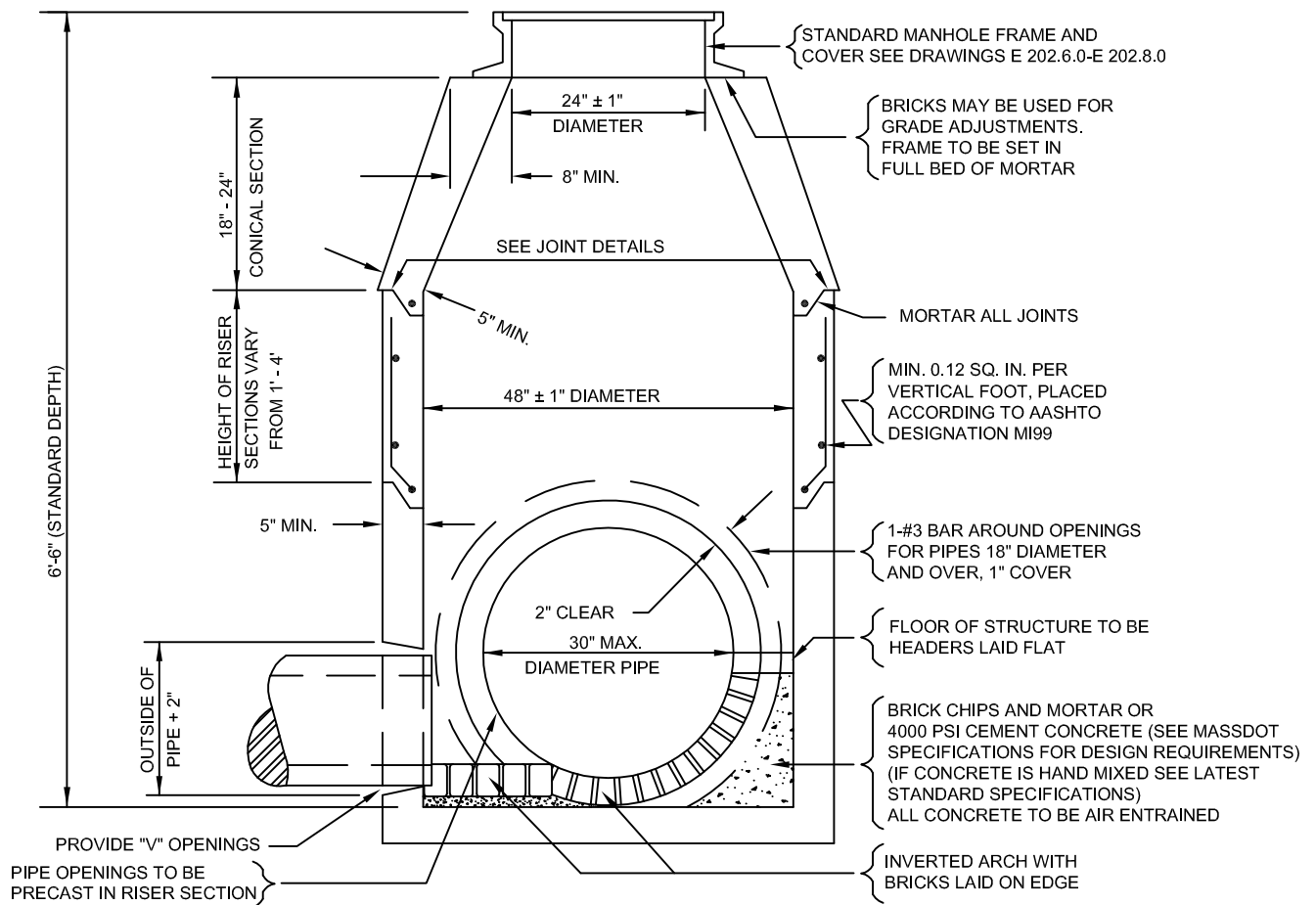


PLAN OF BASE

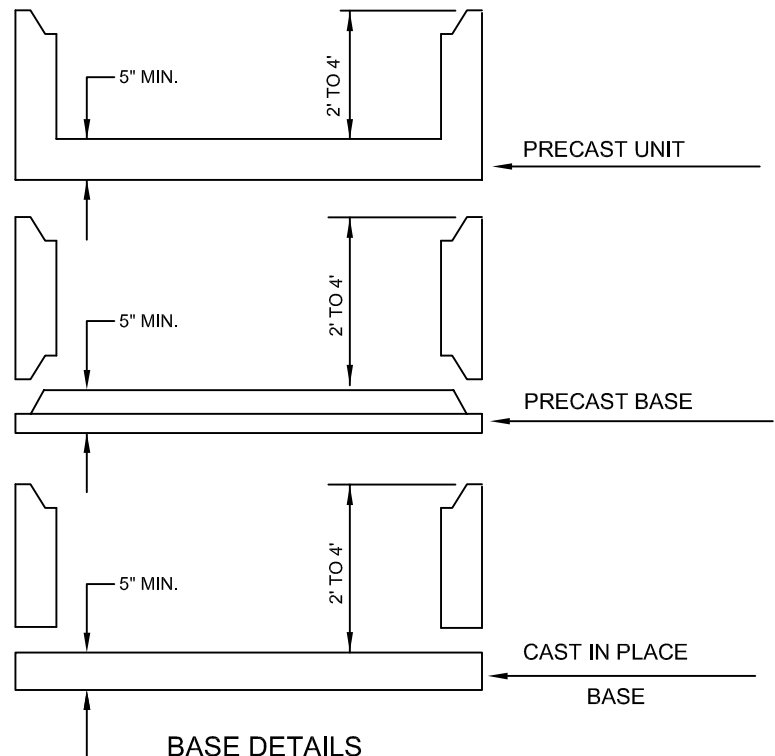
SOLID SECTION; OR FILL HOLE WITH BRICKS AND MORTAR;
OR FILL WITH 4000 PSI CEMENT CONCRETE
(SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)
(IF CONCRETE IS HAND MIXED SEE LATEST STANDARD SPECIFICATIONS)

NOTE:

1. MANHOLE DESIGN IS FOR PIPE DIAMETER OF 30" OR LESS



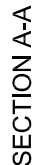
JOINT DETAILS



BASE DETAILS

NOTE:

1. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS, SEE LATEST STANDARD SPECIFICATIONS.



TOP AND BOTTOM SLABS & SIDEWALLS
TO BE CLASS "B" CONC.

SIZE OF PIPE	WIDTH "F"	HEIGHT "G"	HEIGHT "H"							
			8.0"-15.9'		16.0"-23.9'		24.0"-29.9'		30.0"-35.9'	
			T	W	T	W	T	W	T	W
36"	4'-0"	5'-6"	8"	10"	8"	12"	9"	12"	9"	12"
42"	4'-0"	5'-6"	8"	10"	8"	12"	9"	12"	9"	12"
48"	4'-0"	5'-6"	8"	10"	8"	12"	9"	12"	9"	12"
54"	4'-6"	5'-6"	8"	10"	8"	12"	10"	12"	10"	12"
60"	5'-0"	5'-6"	8"	10"	9"	12"	12"	11"	12"	12"
72"	6'-0"	6'-0"	9"	10"	10"	12"	12"	12"	12"	12"
84"	7'-0"	7'-0"	10"	10"	11"	12"	13"	13"	13"	13"

SIZE NUMBER AND SPACING OF BARS.

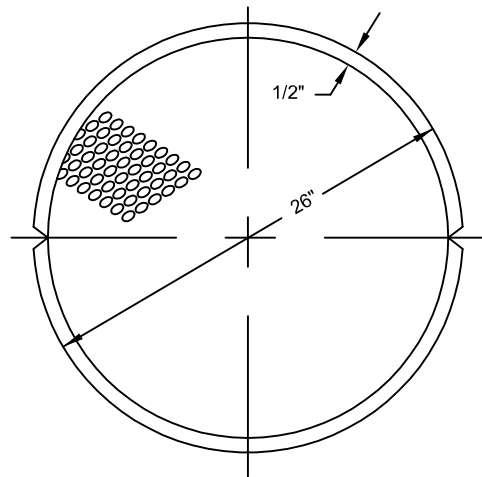
T	SIZE NUMBER AND # OF BARS.				
	TOP SLAB		BOTTOM SLAB		SIDEWALLS
	TRANS. BARS.	LONG BARS	TRANS. #6 BARS	LONG #4 BARS	VERTICAL #4 BARS
8"	6-#7	3-#6	6 1/2" OC	24" OC	12" OC
9"	6-#7	3-#6	5 1/2" OC	DO	DO
10"	6-#8	3-#6	5" OC	DO	DO
11"	6-#8	3-#6	4 1/2" OC	DO	DO
12"	6-#9	3-#6	4" OC	DO	DO
13"	6-#10	3-#6	4" OC	DO	DO

4000 PSI CEMENT CONCRETE
SEE MASSDOT SPECIFICATIONS
FOR DESIGN REQUIREMENTS)

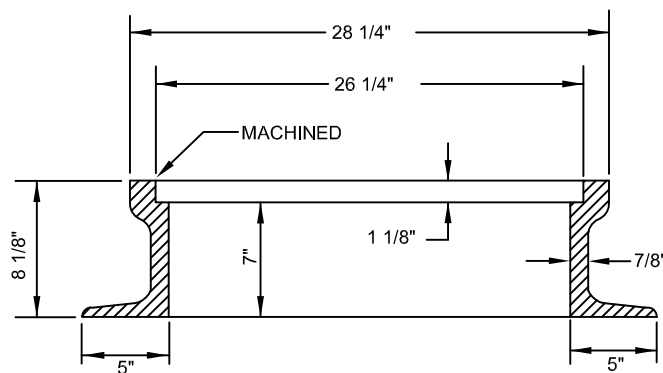
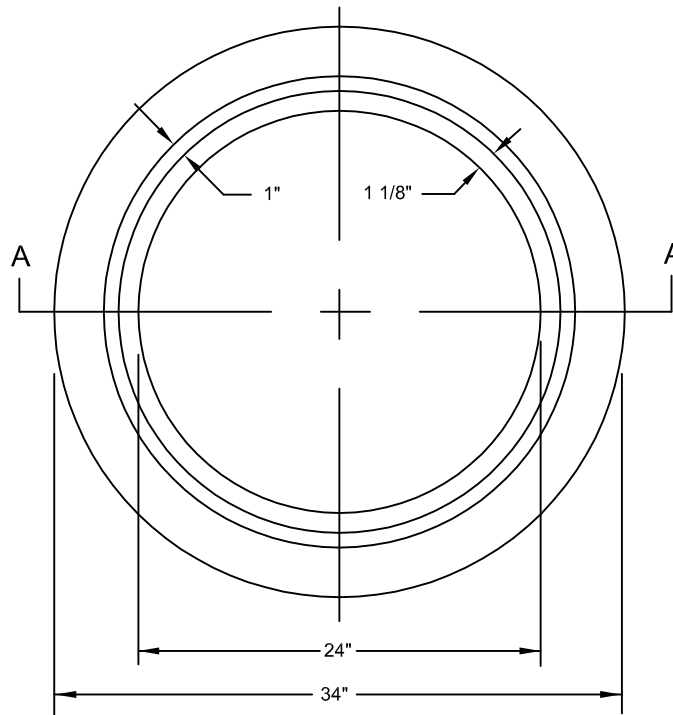
SPECIAL MANHOLES FOR 36" TO 84" DIAMETER R.C. PIPE

DATE OF ISSUE	JUNE 2014
---------------	-----------

DRAWING NUMBER
E 202.5.0



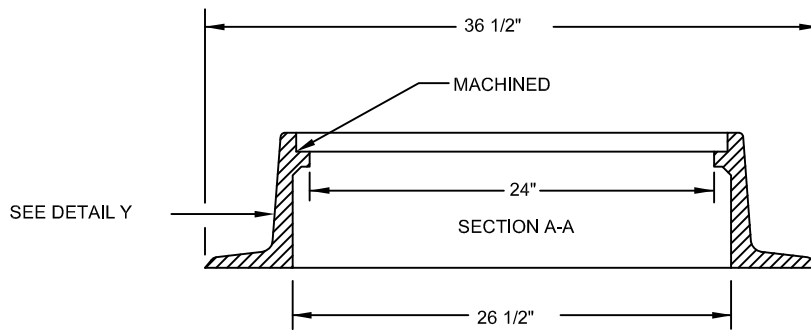
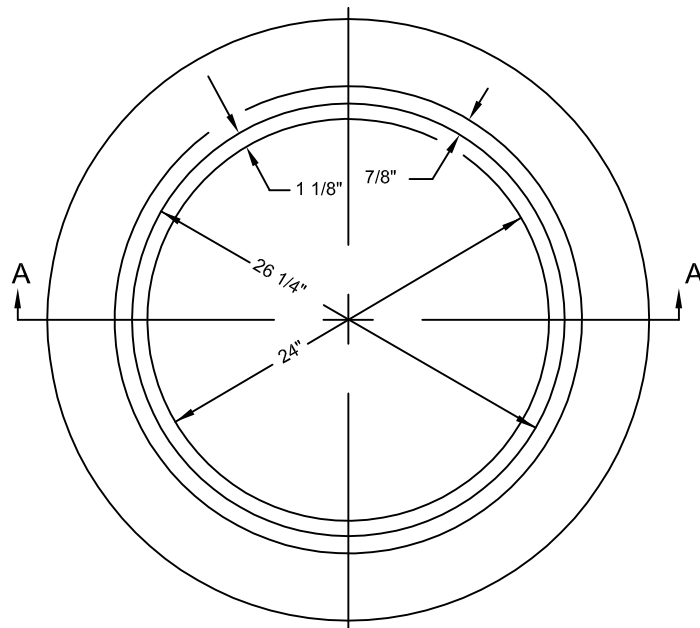
STANDARD COVER
FOR COVER DETAILS SEE DRAWING E 202.8.0



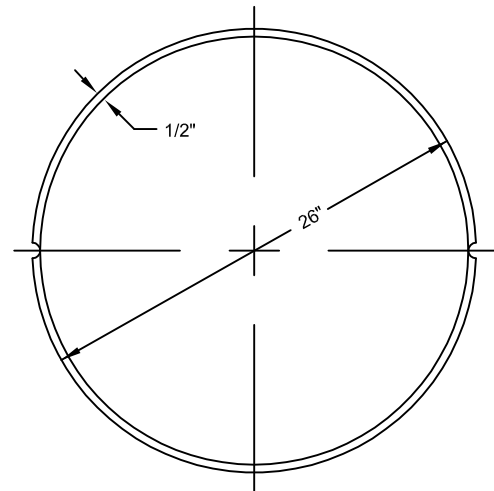
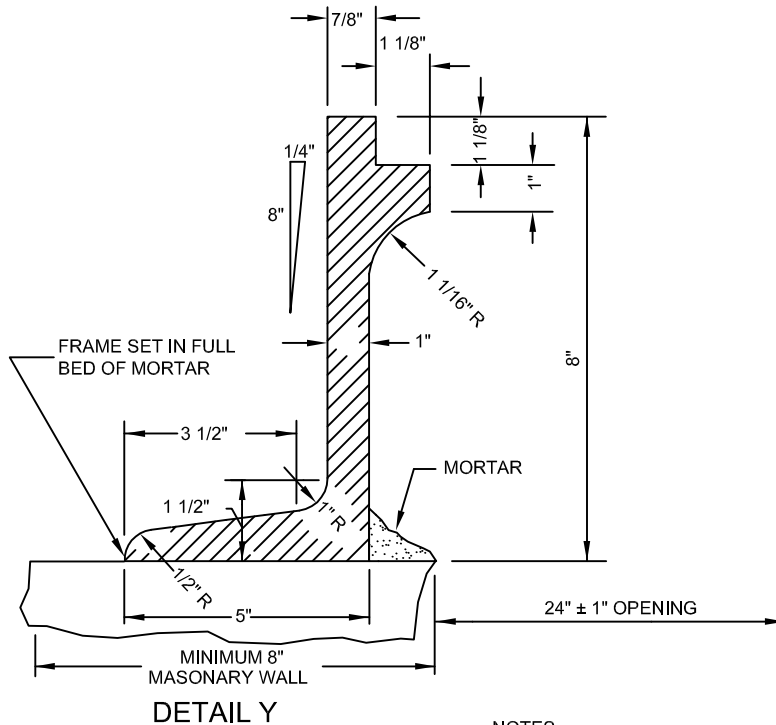
TYPE - A FRAME

NOTES:

1. MINIMUM MASS - 265 LBS.
2. MATERIAL - CAST IRON - SEE STANDARD SPECIFICATIONS
WITH NO BLACK ASPHALT COATING ALLOWED



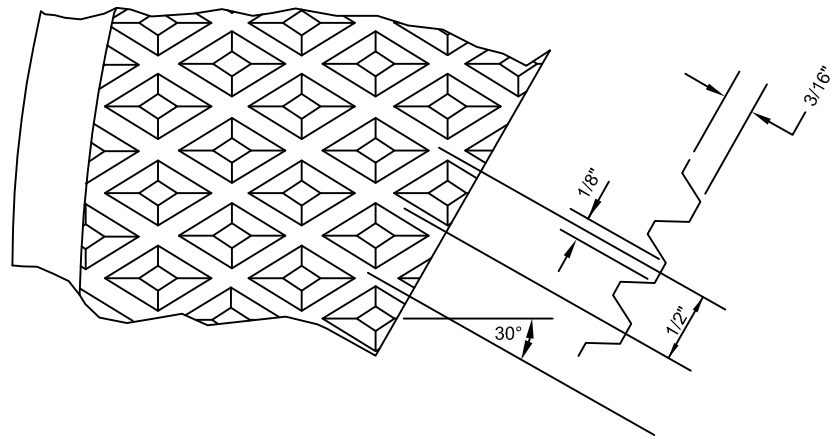
TYPE - B FRAME



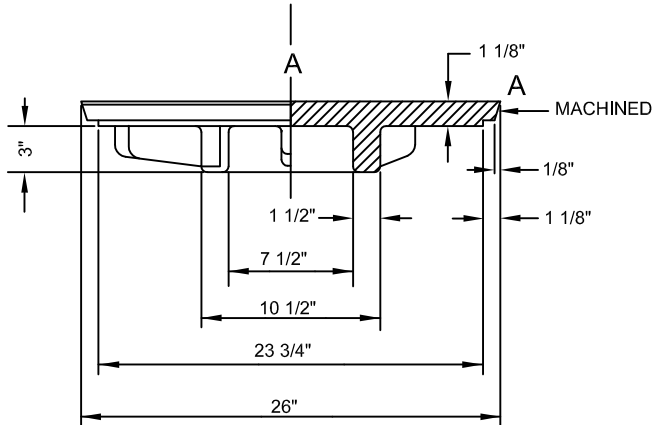
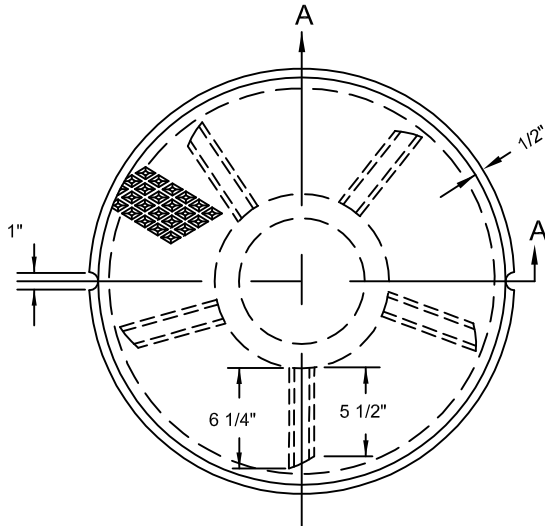
STANDARD COVER
FOR COVER DETAIL, SEE DRAWING E 202.8.0

NOTES:

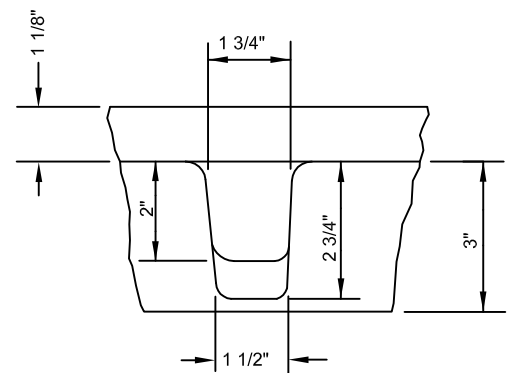
1. MINIMUM FRAME MASS 265 LBS.
2. MATERIAL - CAST IRON - SEE STANDARD SPECIFICATIONS
WITH NO BLACK ASPHALT COATING ALLOWED



DETAIL OF TREAD



MANHOLE COVER FOR TYPE A & B FRAMES

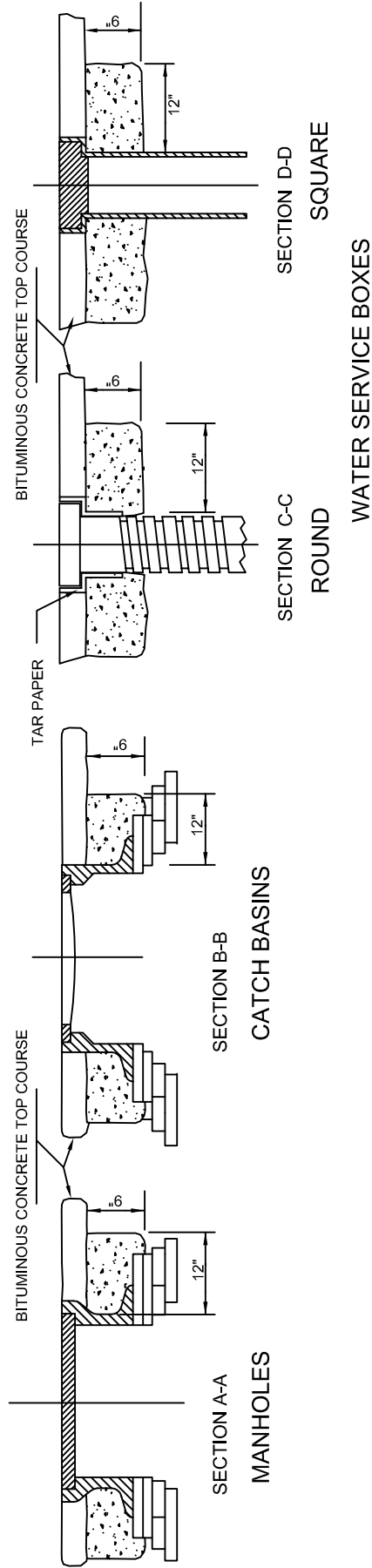
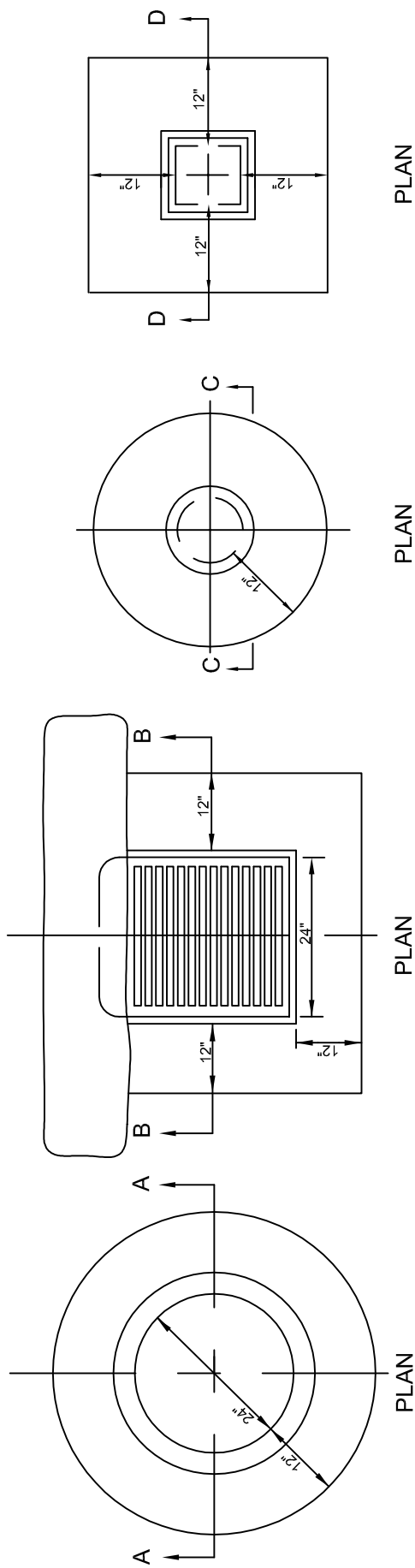


DETAIL OF FIN

NOTES:

1. MINIMUM COVER MASS - 200 LBS.
2. MATERIAL - CAST IRON - SEE STANDARD SPECIFICATIONS WITH NO BLACK ASPHALT COATING ALLOWED

CONCRETE COLLARS

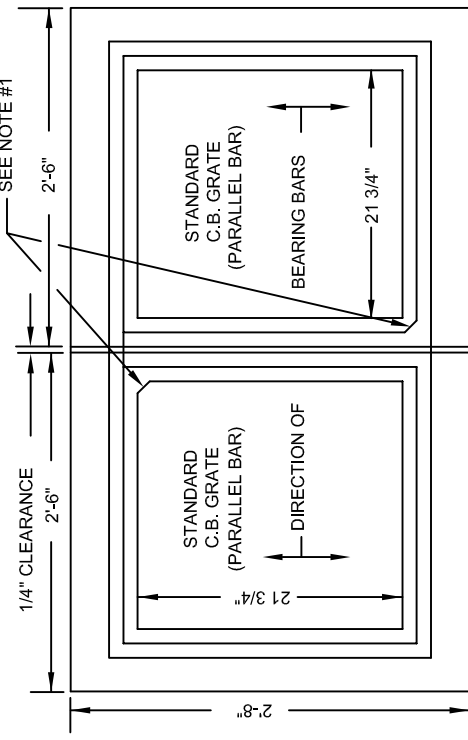
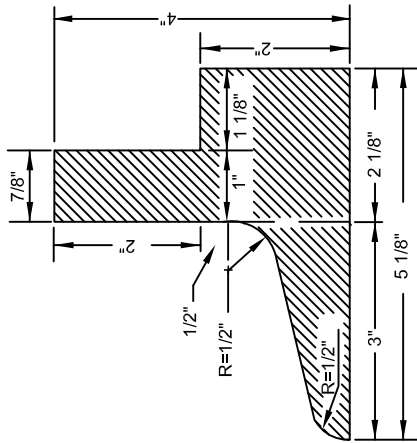
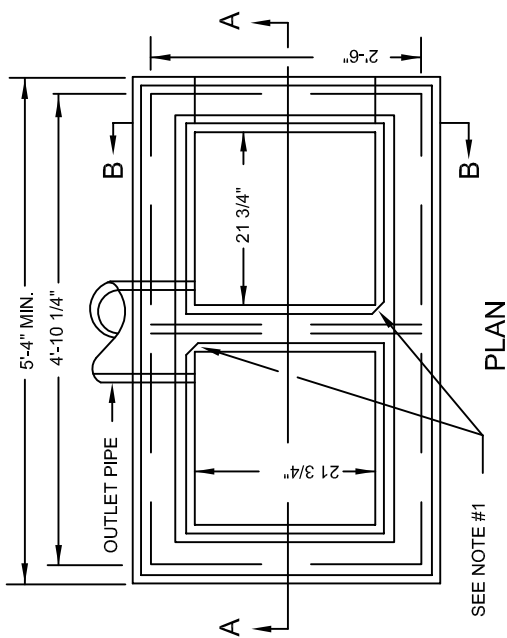


- NOTES:
1. COLLARS TO BE 4000PSI CEMENT CONCRETE MASONRY REGULAR OR H.E.S. AS DIRECTED.
(SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS).
(IF HAND MIXED, SEE LATEST STANDARD SPECIFICATIONS).
 2. NO CONCRETE REQUIRED IN CONCRETE PAVEMENT.

DROP INLETS

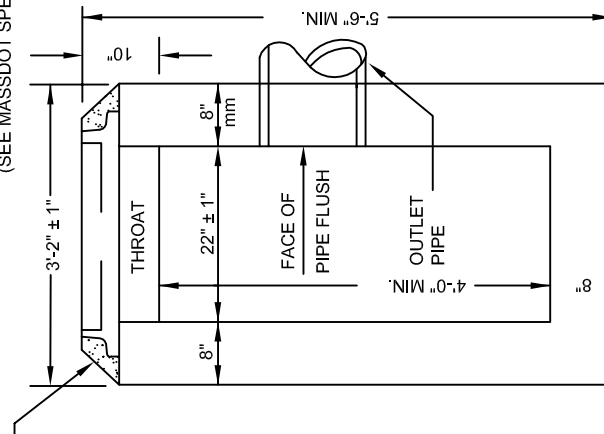
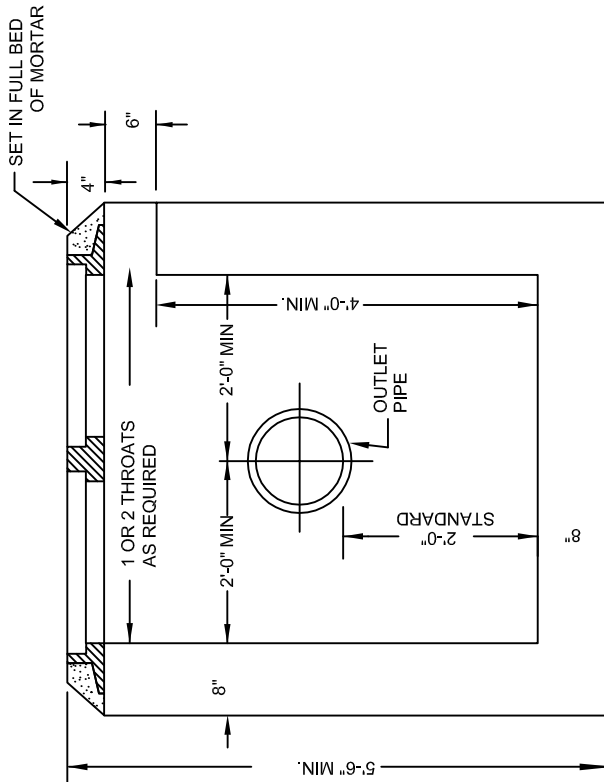
TYPE A - PRECAST CONCRETE

TYPE B - CONCRETE BLOCK



2-3 FLANGE 4" C.I. FRAMES

1. COLLARS TO BE 4000PSI CEMENT CONCRETE MASONRY REGULAR OR H.E.S. AS DIRECTED. (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS).



NOTES:

1. STANDARD PARALLEL BAR GRATES TO BE USED. SEE DETAILS ON DRAWINGS E 201.10.0
2. MINIMUM C.I. FRAME MASS - 205 LBS. EACH
3. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS SEE LATEST STANDARD SPECIFICATIONS

TYPE "A"

4. 4000 PSI CEMENT CONCRETE (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS).

TYPE "B"

5. NOMINAL CONCRETE BLOCK DIMENSIONS
HEIGHT, 4" TO 8"
WIDTH, 8"
LENGTH, 8" TO 16"
6. BLOCKS TO BE SET IN FULL BED OF MORTAR
7. THIS DROP INLET IS NOT TO BE USED AT ANY LOCATION WHERE IT MAY PRESENT A HAZARD TO VEHICLES THAT RUN OFF THE ROAD.
FOR FLUSH TYPE SEE DRAWING E 203.2.0

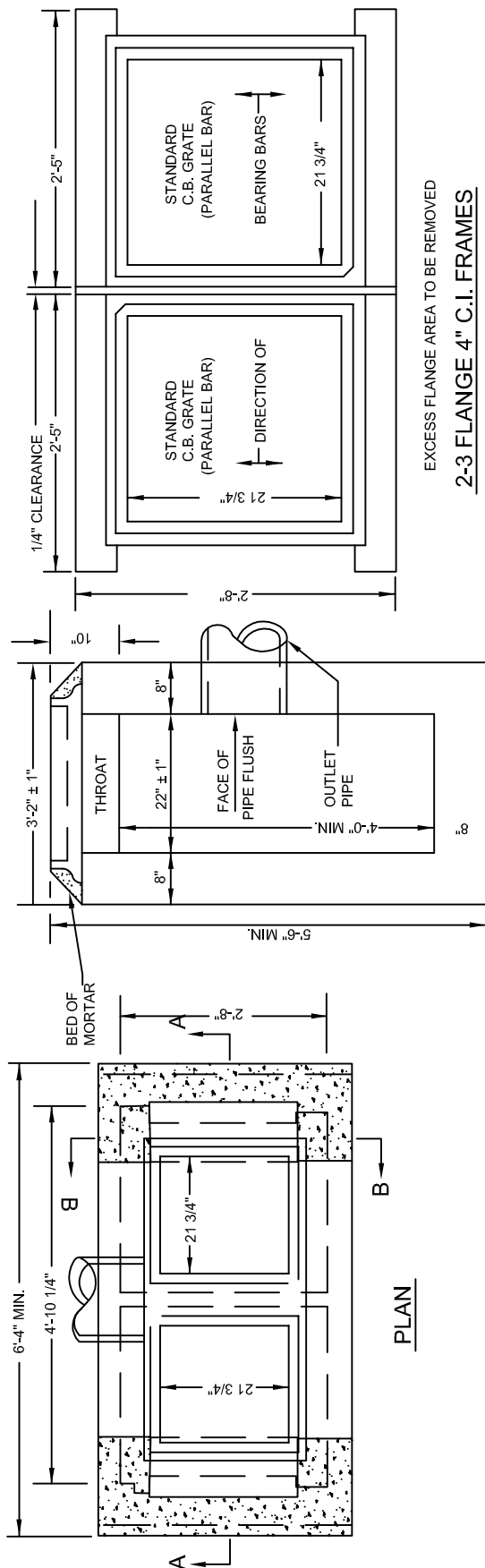
DROP INLETS **TYPE AF - PRECAST CONCRETE** **TYPE BF - CONCRETE BLOCK**

DATE OF ISSUE

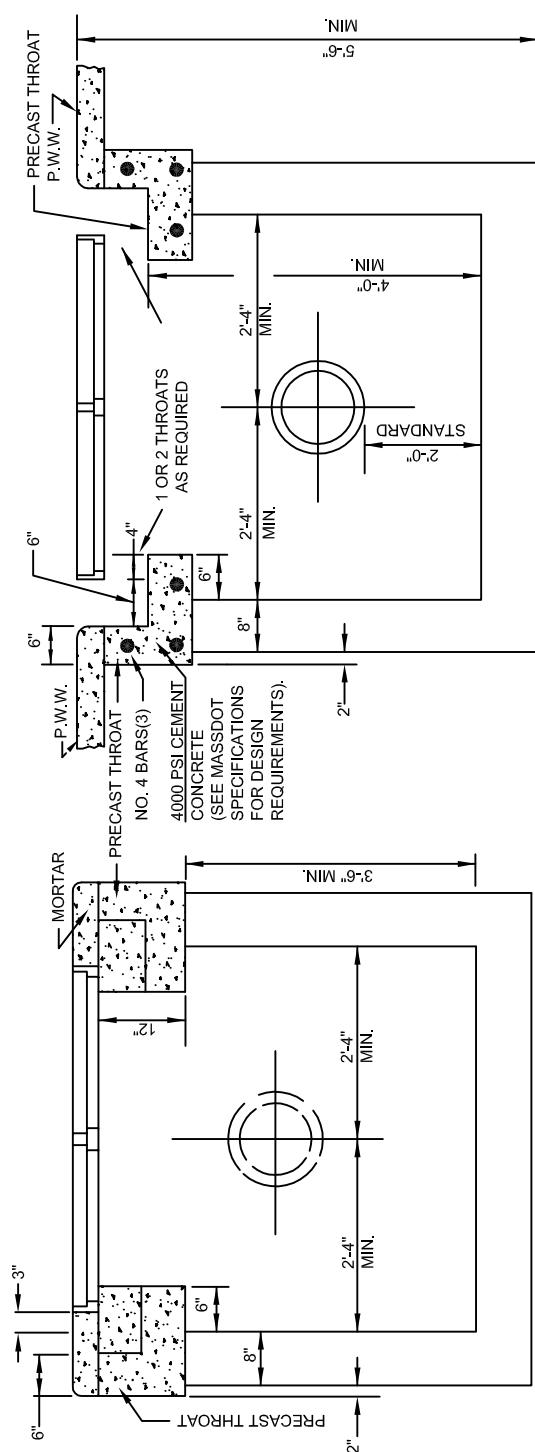
JUNE 2014

DRAWING NUMBER

E 203.2.0

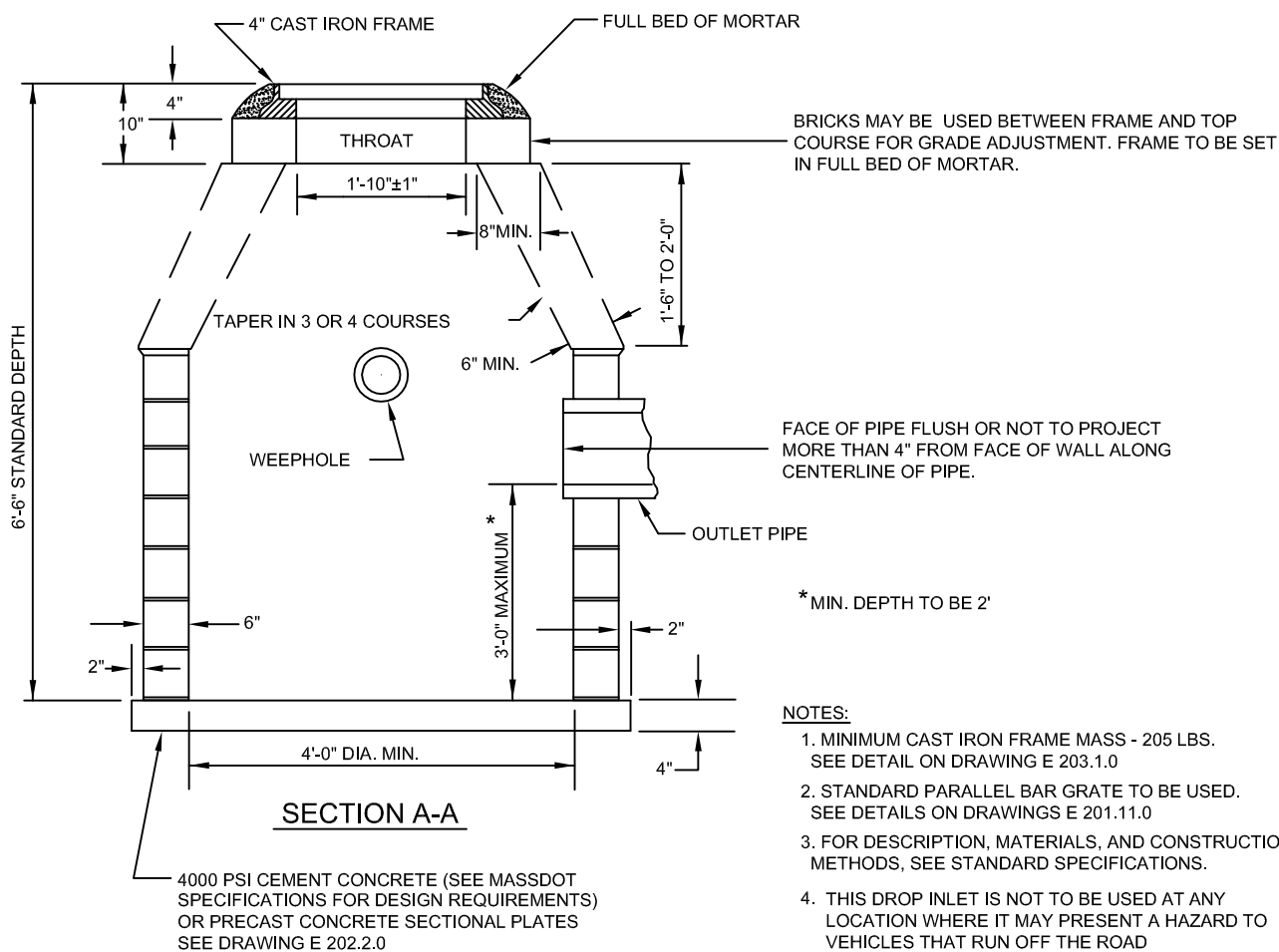
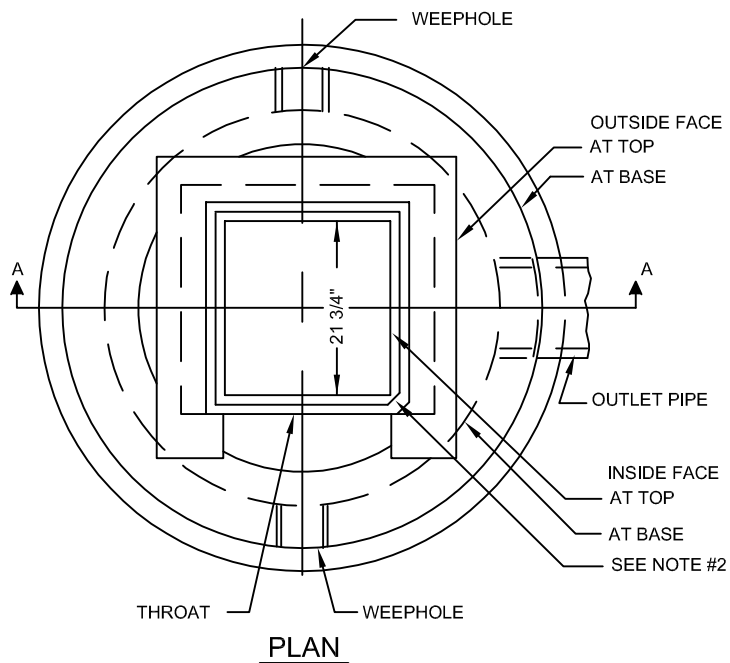


SECTION B-B



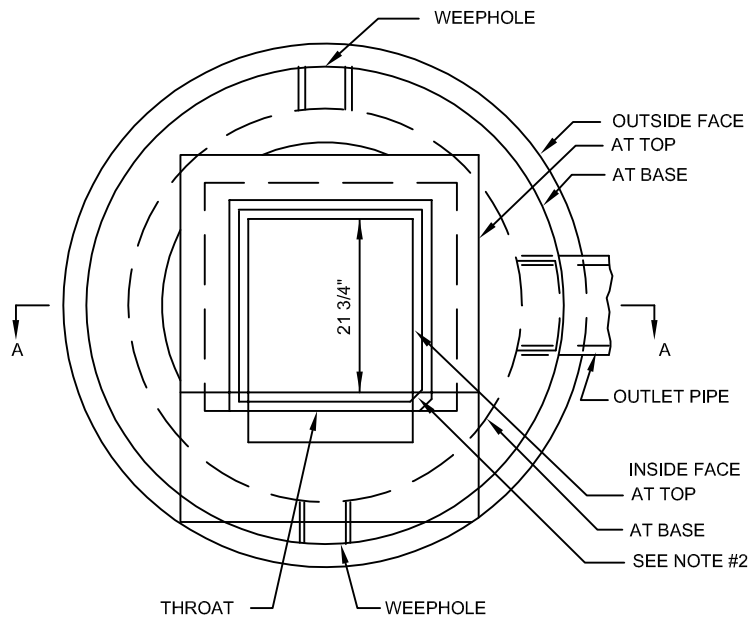
NOTES:

1. FOR DETAILS OF PRECAST THROAT SEE DRAWING E 203.7.0
2. SEE DRAWING 203.1.0 FOR DETAILS NOT SHOWN

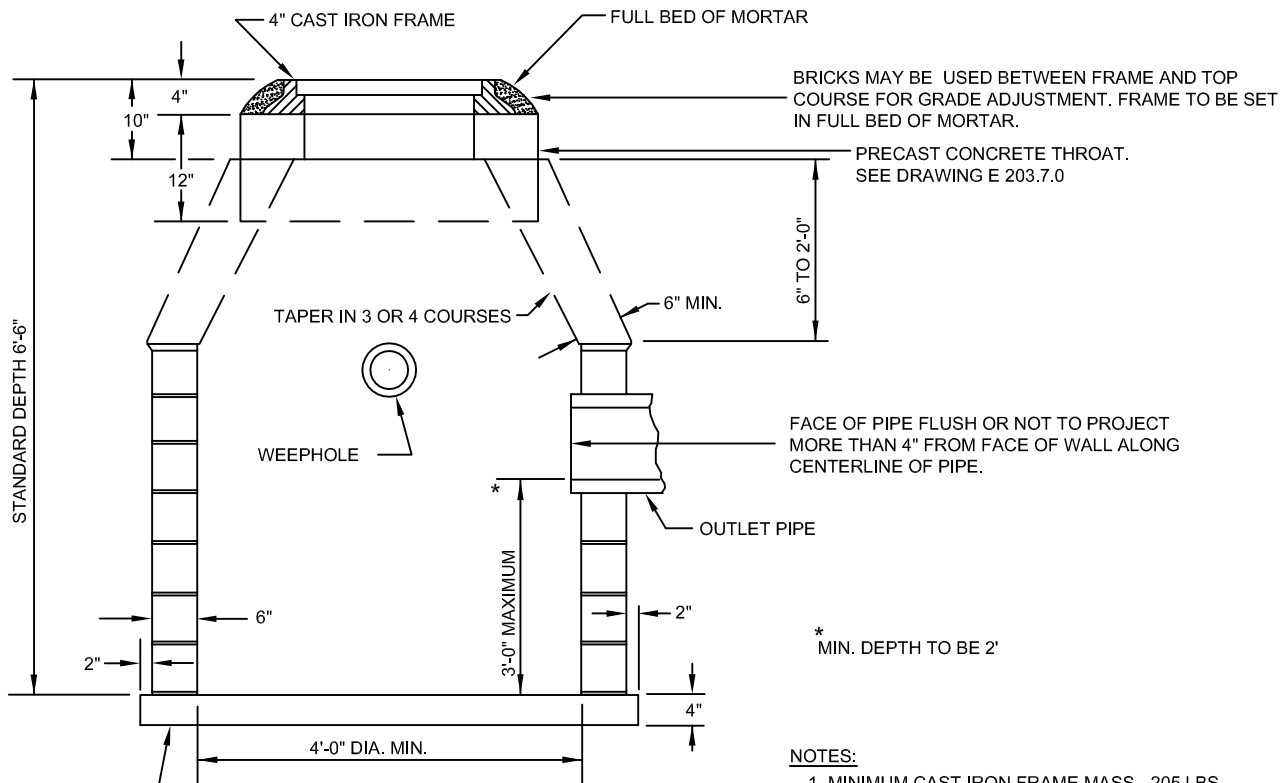


NOTES:

1. MINIMUM CAST IRON FRAME MASS - 205 LBS.
SEE DETAIL ON DRAWING E 203.1.0
2. STANDARD PARALLEL BAR GRATE TO BE USED.
SEE DETAILS ON DRAWINGS E 201.11.0
3. FOR DESCRIPTION, MATERIALS, AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.
4. THIS DROP INLET IS NOT TO BE USED AT ANY LOCATION WHERE IT MAY PRESENT A HAZARD TO VEHICLES THAT RUN OFF THE ROAD
FOR FLUSH TYPE SEE DRAWING E 203.4.0
5. SEE DRAWING E 201.3.0 CONCRETE BLOCK CATCH BASIN FOR DETAILS



PLAN

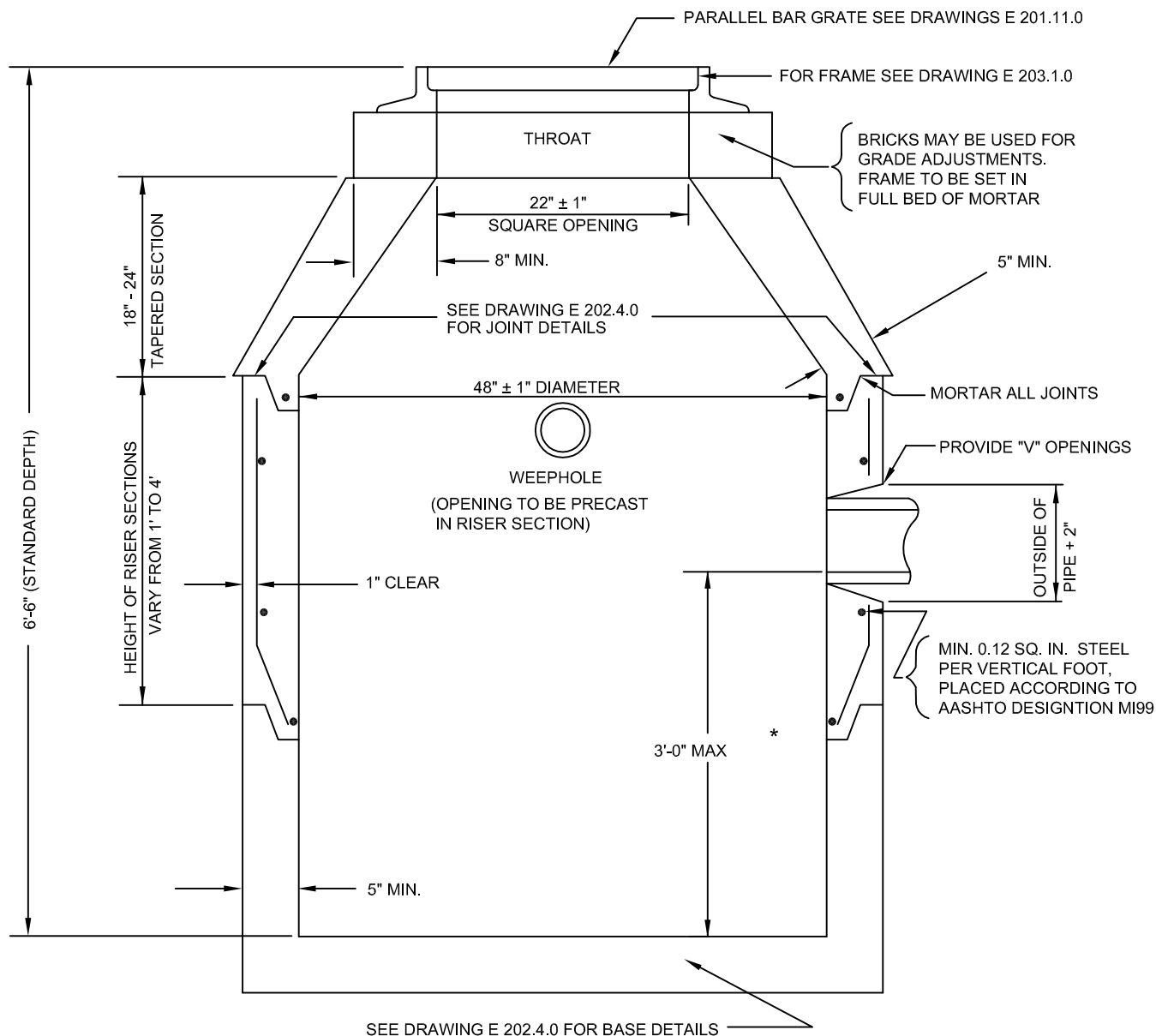


SECTION A-A

4000 PSI CEMENT CONCRETE (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS) OR PRECAST CONCRETE SECTIONAL PLATES SEE DRAWING E 201.3.0

NOTES:

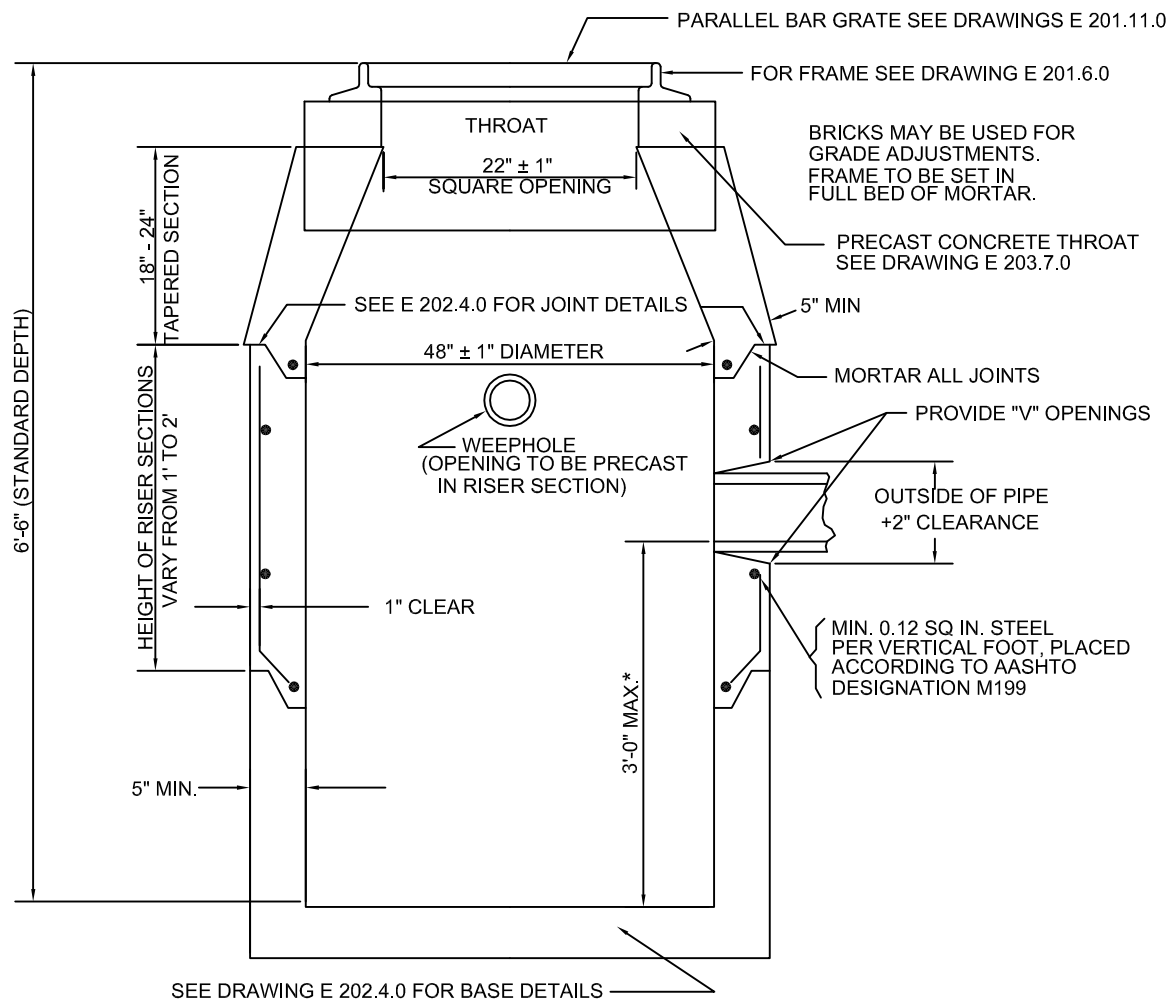
1. MINIMUM CAST IRON FRAME MASS - 205 LBS. SEE DETAIL ON DRAWING E 203.1.0
2. STANDARD PARALLEL BAR GRATE TO BE USED. SEE DETAILS DRAWINGS E 201.11.0
3. FOR DESCRIPTION, MATERIALS, AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.
4. TO BE USED IN MEDIANS AND DITCHES THAT ARE WITHIN THE RECOVERY AREA.
5. SEE DRAWING E 201.3.0 CONCRETE BLOCK CATCH BASIN FOR DETAILS



* MINIMUM DEPTH OF SUMP TO BE 2'

NOTES:

1. DETAILS NOT INDICATED ABOVE ARE TO BE SIMILAR TO THOSE SHOWN ON DRAWING E 203.3.0
2. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHOD, SEE LATEST STANDARD SPECIFICATIONS
3. THIS DROP INLET IS NOT TO BE USED AT ANY LOCATION WHERE IT MAY PRESENT A HAZARD TO VEHICLES THAT RUN OFF THE ROAD. FOR FLUSH TYPE SEE DRAWING E 203.6.0



* MINIMUM DEPTH OF SUMP TO BE 2'

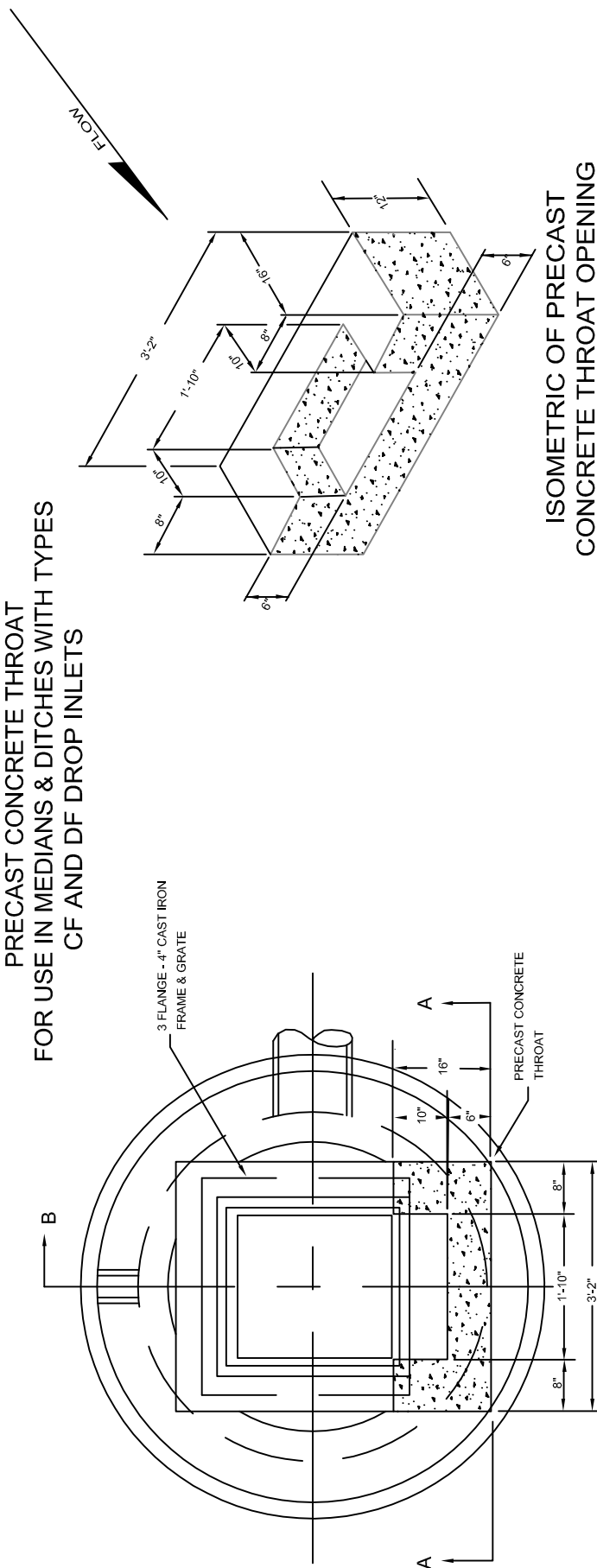
NOTES:

1. DETAILS NOT INDICATED ABOVE ARE TO BE SIMILAR TO THOSE SHOWN ON DRAWINGS E 203.3.0 AND E 203.4.0
2. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHOD, SEE LATEST STANDARD SPECIFICATIONS
3. TO BE USED IN MEDIANS AND DITCHES THAT ARE WITHIN THE RECOVERY AREA

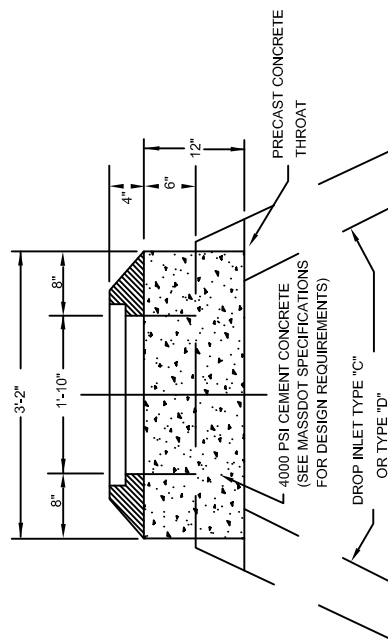


DATE OF ISSUE JUNE 2014
DRAWING NUMBER E 203.7.0

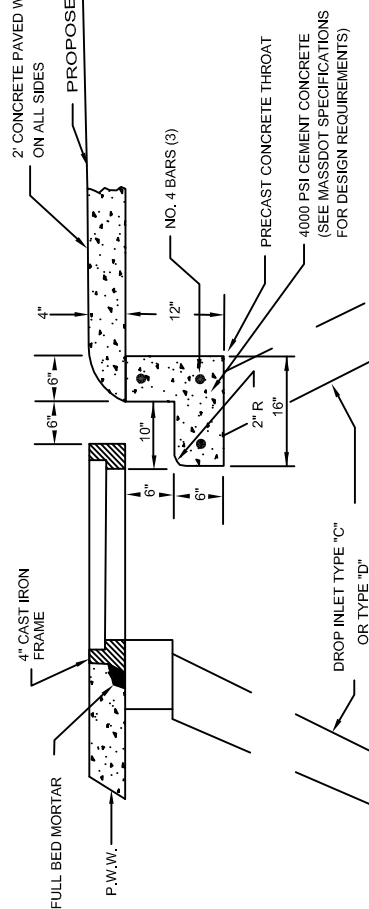
PRECAST CONCRETE THROAT FOR USE IN MEDIANS & DITCHES WITH TYPES CF AND DF DROP INLETS



ISOMETRIC OF PRECAST CONCRETE THROAT OPENING



SECTION A-A

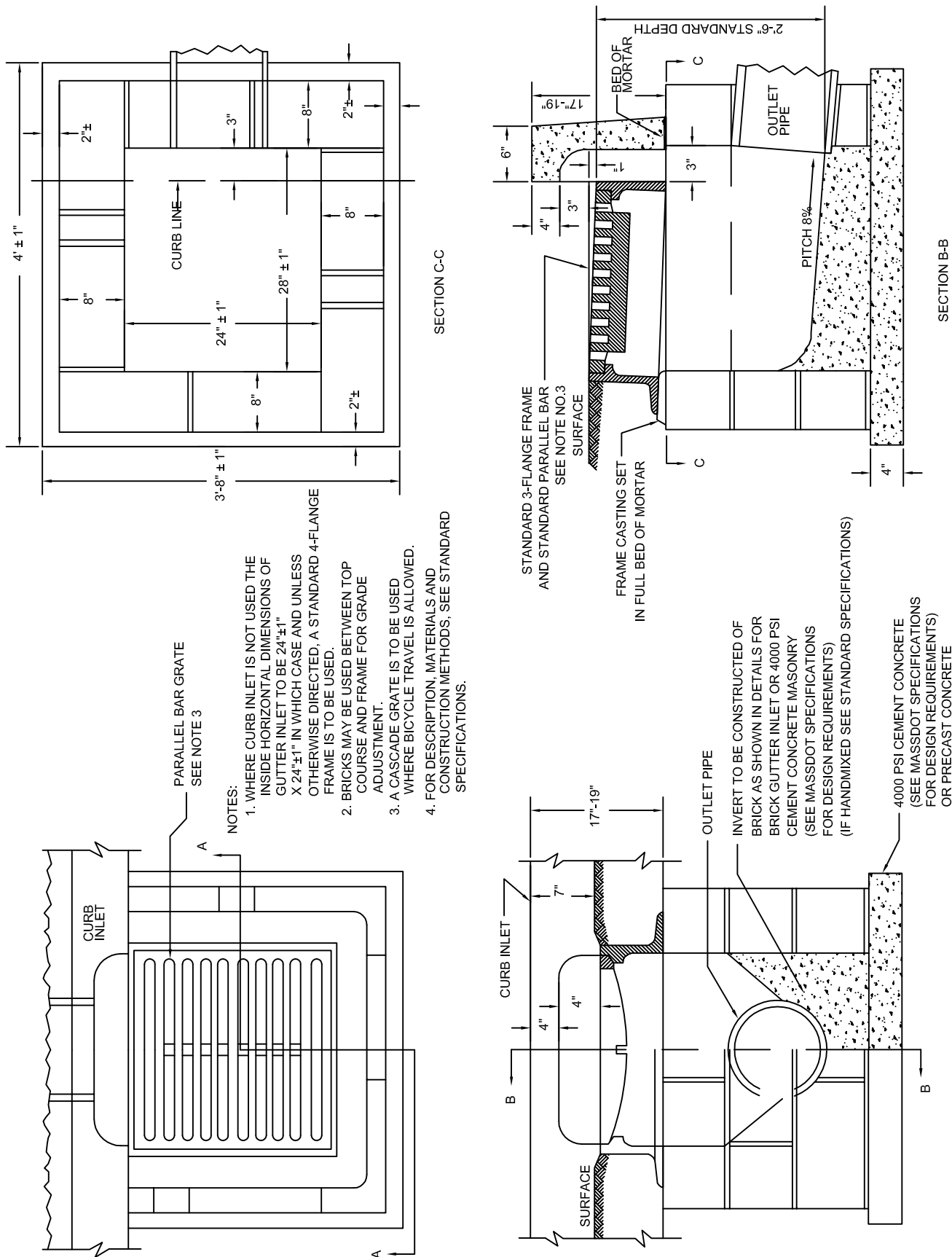


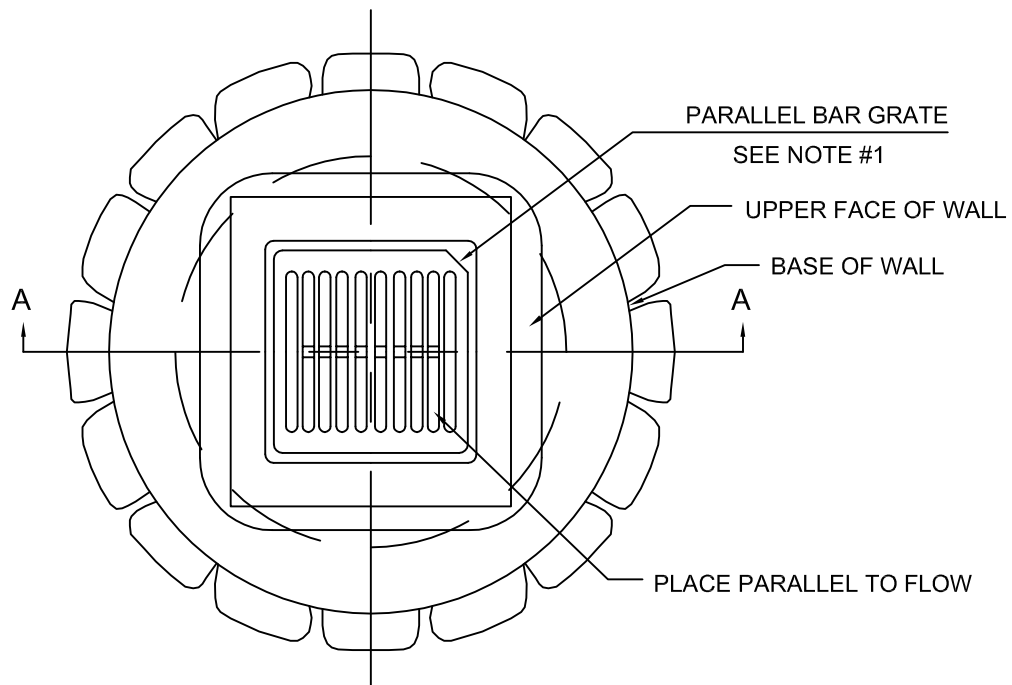
SECTION B-B

GUTTER INLET

DATE OF ISSUE
JUNE 2014

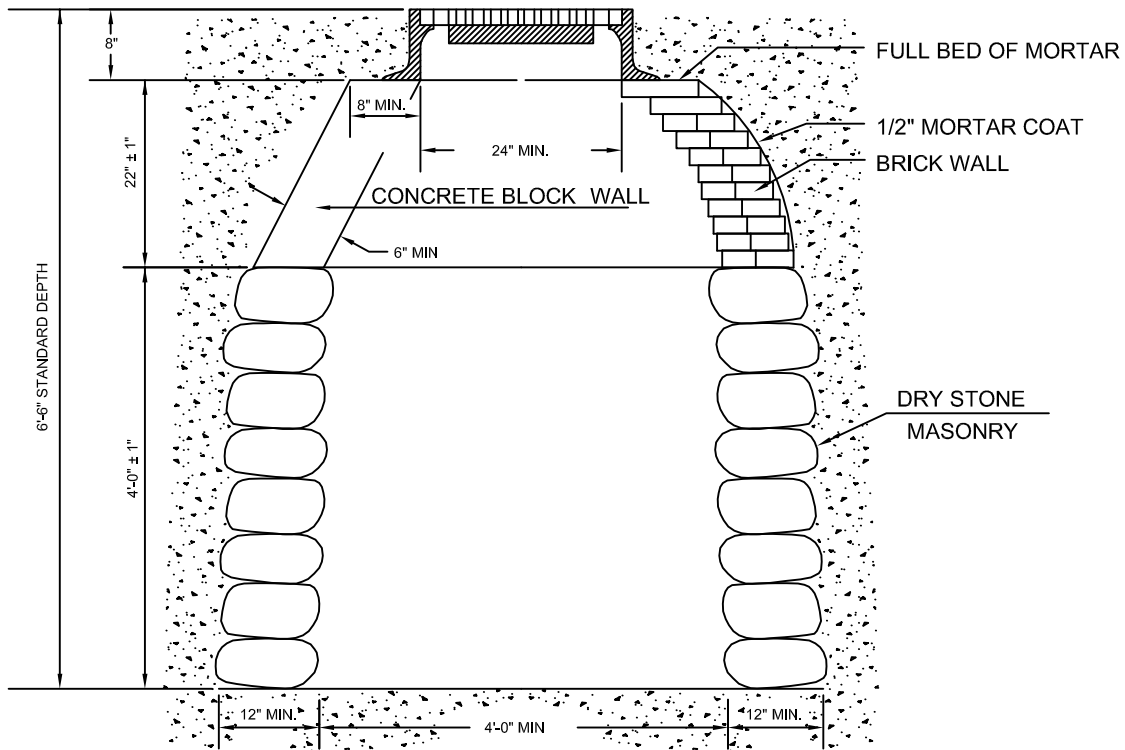
DRAWING NUMBER
E 204.2.0





NOTES:

1. USE CASCADE GRATE WHERE BICYCLE TRAVEL IS LEGALLY ALLOWED.
SEE DRAWINGS E 201.7.0 - E 201.9.0
2. BRICK WALL TO BE 8" THICK; EVERY FIFTH COURSE TO BE HEADERS;
OUTSIDE TO BE FINISHED WITH CEMENT MORTAR COATING.
3. WHEN USING CONCRETE BLOCKS, BLOCKS TO BE SET IN FULL BED
OF MORTAR AND TAPERED IN 3 OR 4 COURSES.
4. BACKFILL FOR FULL DEPTH OF BASIN EXCAVATION TO BE GRAVEL.
5. FOR DESCRIPTION, MATERIALS AND METHOD OF CONSTRUCTION
SEE STANDARD SPECIFICATIONS.

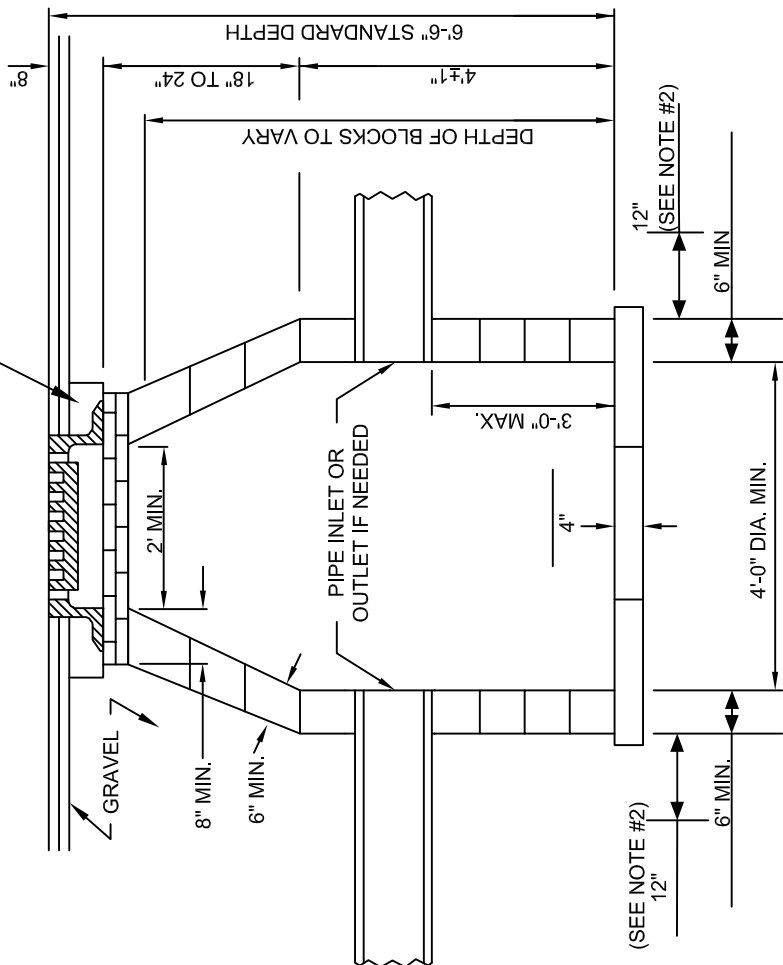


SECTION A-A

PLACE PARALLEL TO FLOW



HIGH EARLY 4,000 PSI
CEMENT CONCRETE COLLAR
(SEE MASSDOT SPECIFICATIONS
FOR DESIGN REQUIREMENTS)



SECTION A-A

1. USE CASCADE GRATE WHERE BICYCLE TRAVEL IS LEGALLY ALLOWED. SEE DRAWINGS E 201.7.0 - E 201.9.0.

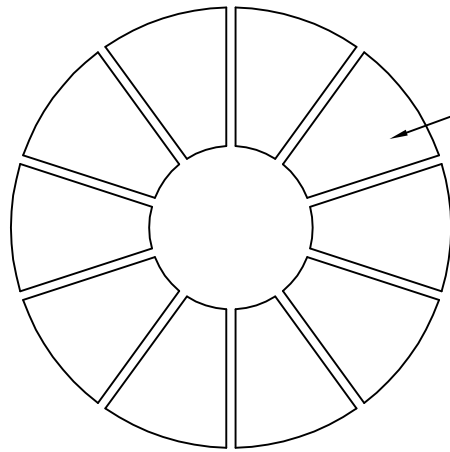
2. BACKFILL FOR FULL DEPTH OF BASIN EXCAVATION TO BE 1/2" CRUSHED STONE.

3. FOR DESCRIPTION, MATERIALS, AND METHOD OF CONSTRUCTION SEE STANDARD SPECIFICATIONS.

4. FACE OF PIPE FLUSH OR NOT TO PROJECT MORE THAN 4" FROM FACE OF WALL ALONG CENTERLINE OF PIPE.

5. THE LEACHING BASIN SHALL BE CONSTRUCTED OF CEMENT CONCRETE BLOCKS TO CONFORM TO THE REQUIREMENTS OF STANDARD SPECIFICATION SUBSECTION M4.05.1.

PLAN OF BASE



**BOTTOM PLATES REQUIRE
10 PIECES PER CIRCLE WITH
1/2" SPACING BETWEEN PLATES.
4" THICK**

CONCRETE BLOCK LEACHING BASIN

DATE OF ISSUE	JUNE 2014
---------------	-----------

DRAWING NUMBER
E 205.2.0

CORRUGATED STEEL METAL PIPE TABLE OF MINIMUM WALL THICKNESS

TABLE OF MINIMUM WALL THICKNESS (FT)
(2 2/3" x 1/2" CORRUGATION)

HEIGHT OF COVER ABOVE TOP OF PIPE (FEET)											
DIA. (IN)	MIN. - 10	11 - 15	16 - 20	21 - 25	26 - 30	31 - 35	38 - 40	41 - 45	46 - 50	51 - 55	56 - 60
15	16	16	16	16	16	16	16	16			
18	16	16	16	16	16	16	14	14	14		
21	16	16	16	16	16	16	14	14	14	12	
24	16	16	16	14	14	14	14	12	12	10	10
30	14	14	14	14	12	12	12	10	10	10	8
36	14	14	12	12	10	10	10	10	8	8	8
42	12	12	12	10	10	10	8	8	8	8	8
48	12	12	12	10	8	8	10	10	10	8	8
54	10	10	8	8	10	10	10	8	8		
60	8	10	10	10	8	8	8	8			
66	10	10	10	8	8	8	8				
72	8	8	8	8	8						

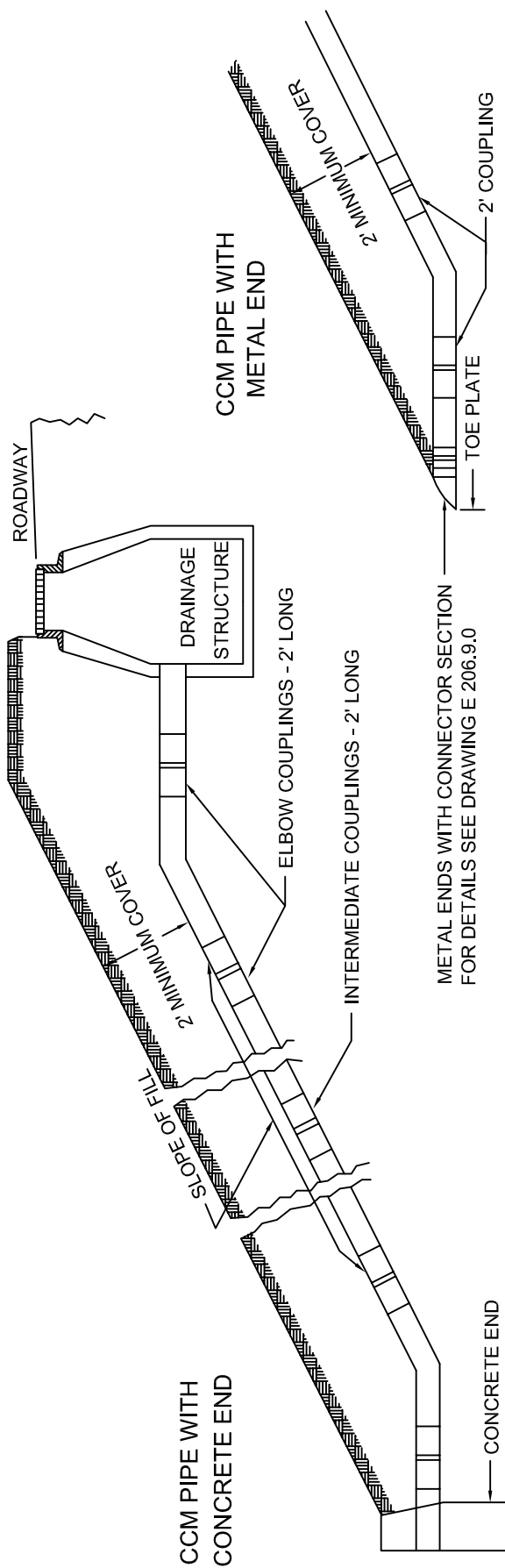
NOTES:
1. ALL PIPE BELOW SOLID LINE TO BE SHOP STRUTTED AS PER STATE SPECIFICATIONS
2. MINIMUM COVER IS TOP OF PIPE TO ROAD - 18" GRADE

TABLE OF MINIMUM WALL THICKNESS (IN.)

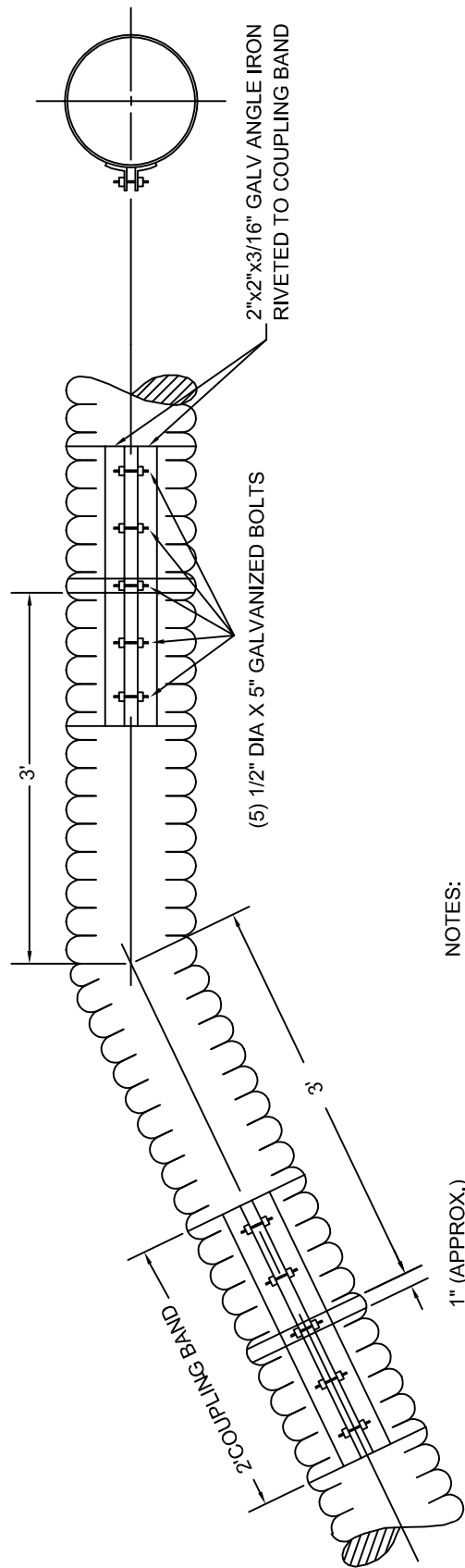
MADE FROM PIPE OF DIA. (IN.)	SPAN (IN.)	RISE (IN.)	HEIGHT OF COVER ABOVE TOP OF PIPE ARCH (FEET)			
			MIN. - 3	4 - 5	6 - 10	11 - 15
15	18	11	16	16	16	16
18	22	13	16	16	16	16
24	29	18	14	14	14	14
30	36	22	14	14	14	14
36	43	27	12	12	12	12
42	50	31	12	12	12	12
48	58	36	10	12	12	10
54	65	40	10	10	10	8
60	72	44	8	8	8	

NOTES:

1. MINIMUM COVER IS TOP OF PIPE TO ROAD GRADE - 18"
2. FOR HEAVIER FILLS USE STRUCTURAL PLATE



ELBOW AND COUPLING DETAILS



NOTES:

1. A TOE PLATE IS REQUIRED FOR ALL METAL ENDS.
2. ALL METAL END UNITS AND ELBOWS TO BE SHOP FABRICATED.

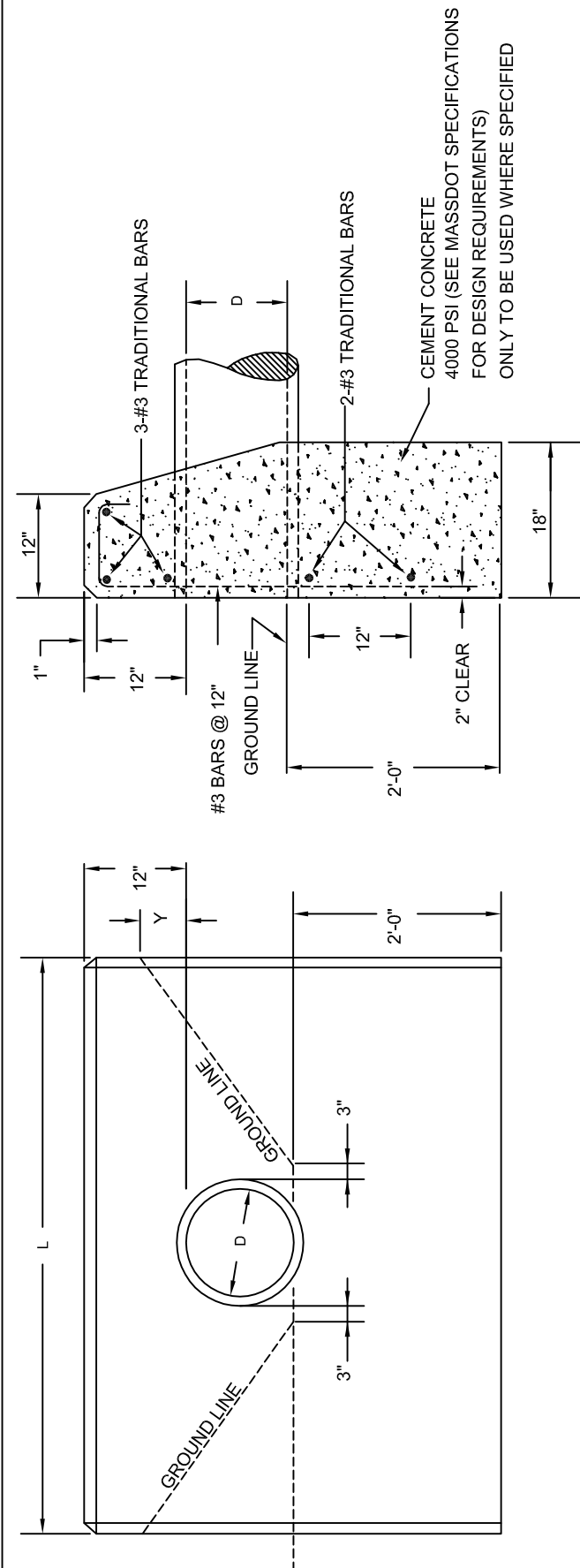
CONCRETE AND FIELD STONE MASONRY PIPE ENDS FOR 8" TO 30" PIPE

DATE OF ISSUE

JUNE 2014

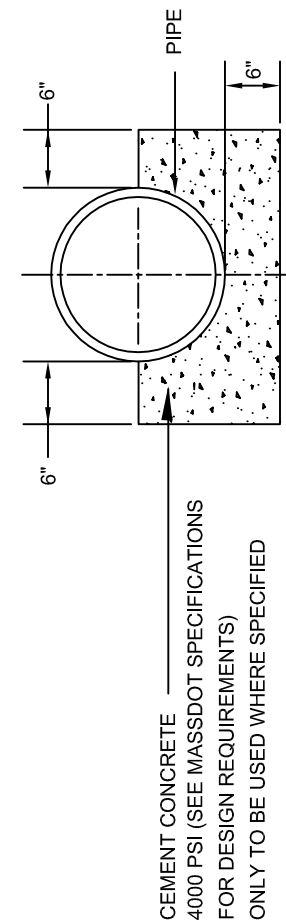
DRAWING NUMBER

E 206.4.0

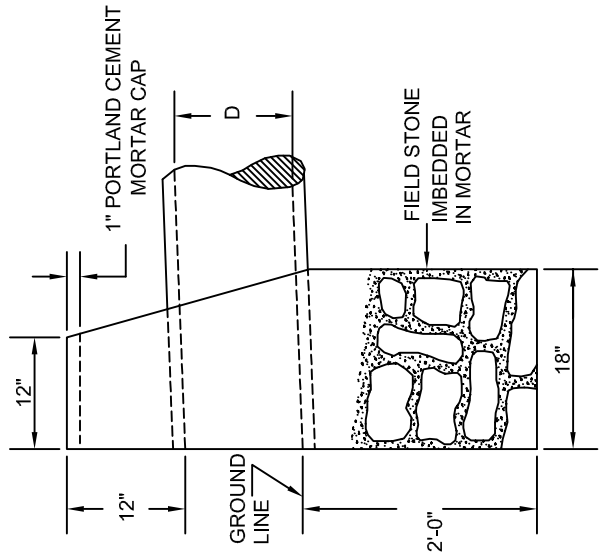


FRONT ELEVATION

END ELEVATION



CONCRETE CRADLE
FOR PIPE CULVERTS

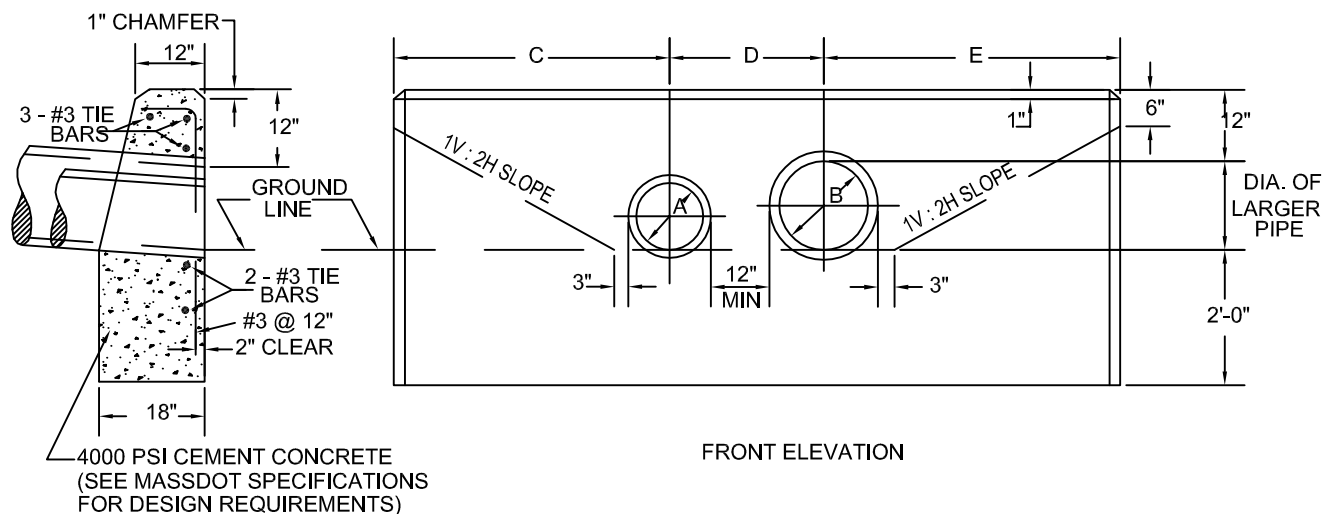


END ELEVATION

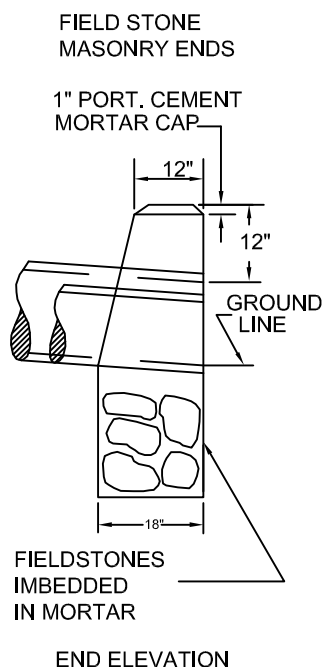
NOTES:

1. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS, SEE LATEST STANDARD SPECIFICATIONS.
2. ALL CONCRETE DIMENSIONS SHOWN ARE MINIMUM.
3. PAYMENTS WILL BE BASED ON THE ACCOMPANYING TABLE.
4. FOR QUANTITY TABLES SEE E 206.4.1

ENGLISH UNITS									
PIPE DIAM. D	1 1/2 : 1 SLOPE					2 : 1 SLOPE			
	L	CONC. OR F.S.M. CU. YDS.	STEEL LBS.	TRENCH EXCAV. 1'-0" DEPTH CU. FT.	L	CONC. OR F.S.M. CU. YDS.	STEEL LBS.	TRENCH EXCAV. 1'-0" DEPTH CU. FT.	
8"	4'-2"	0.77	15	21.60	5'-10"	1.08	21	27.40	
10"	4'-10"	0.92	20	23.91	6'-8"	1.28	23	30.35	
12"	5'-6"	1.08	21	26.25	7'-6"	1.49	29	33.25	
15"	6'-6"	1.34	24	29.75	8'-9"	1.82	32	37.63	
18"	7'-6"	1.61	30	33.25	10'-0"	2.18	39	42.00	
21"	8'-6"	1.95	34	37.35	11'-6"	2.62	43	47.25	
24"	9'-3"	2.16	35	39.38	12'-6"	2.97	50	50.75	
30"	10'-6"	2.63	44	43.75	15'-0"	3.86	62	59.50	
Y					4" FOR 1 1/2 : 1 SLOPE				
					6" FOR 2 : 1 SLOPE				



END ELEVATION



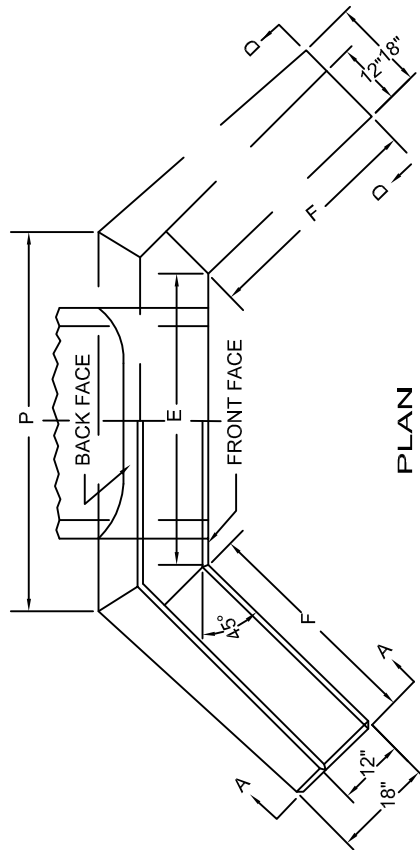
DESIGN NO.	DIAMETER (IN.)		LENGTHS			MASONRY (CY)	STEEL (LBS)	TRENCH EXCAV. 1'-0" DEPTH (CF)
	A	B	C	D	E			
1	12	12	3'-9"	2'-2"	3'-9"	1.89	37	40.85
2	12	15	4'-3"	2'-4"	4'-5"	2.27	42	45.50
3	12	18	4'-9"	2'-6"	5'-0"	2.66	48	49.88
4	12	21	5'-4"	2'-8"	5'-8"	3.12	54	54.85
5	12	24	5'-9"	2'-10"	6'-3"	3.54	59	58.91
6	12	30	6'-9"	3'-0"	7'-6"	4.48	71	67.38
7	15	15	4'-5"	2'-6"	4'-5"	2.32	41	46.66
8	15	18	4'-11"	2'-8"	5'-0"	2.72	48	51.03
9	15	21	5'-5"	2'-10"	5'-8"	3.16	54	55.72
10	15	24	5'-11"	3'-0"	6'-3"	3.60	60	60.10
11	15	30	6'-11"	3'-2"	7'-6"	4.54	72	68.53
12	18	18	5'-0"	2'-8"	5'-0"	2.72	48	51.35
13	18	21	5'-7"	2'-10"	5'-8"	3.17	52	56.28
14	18	24	6'-0"	3'-0"	6'-3"	3.58	60	60.38
15	18	30	7'-0"	3'-2"	7'-6"	4.53	72	68.85
16	21	21	5'-8"	3'-0"	5'-8"	3.20	53	57.19
17	21	24	6'-2"	3'-4"	6'-3"	3.69	61	62.13
18	21	30	7'-2"	3'-6"	7'-6"	4.65	73	70.60
19	24	24	6'-3"	3'-4"	6'-3"	3.67	61	62.40
20	24	30	7'-3"	3'-8"	7'-6"	4.69	74	64.47
21	30	30	7'-6"	4'-0"	7'-6"	4.76	75	73.50

NOTE:

1. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.
2. ALL CONCRETE DIMENSIONS SHOWN ARE MINIMUM.
3. PAYMENTS WILL BE BASED ON THE QUANTITIES SHOWN IN ACCOMPANYING TABLE.

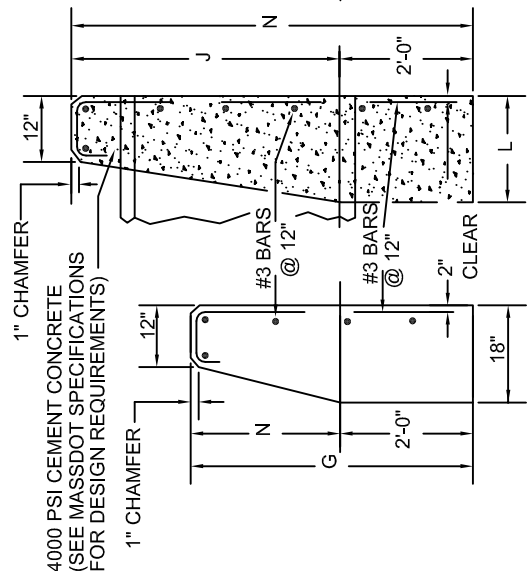
CONCRETE AND FIELDSTONE MASONRY PIPE ENDS FOR 30" TO 84" PIPE

- NOTE:**
1. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHOD, SEE STANDARD SPECIFICATIONS.
 2. ALL CONCRETE DIMENSIONS SHOWN ARE MINIMUM.
 3. PAYMENTS WILL BE BASED ON THE QUANTITIES SHOWN IN THE ACCOMPANYING TABLE.



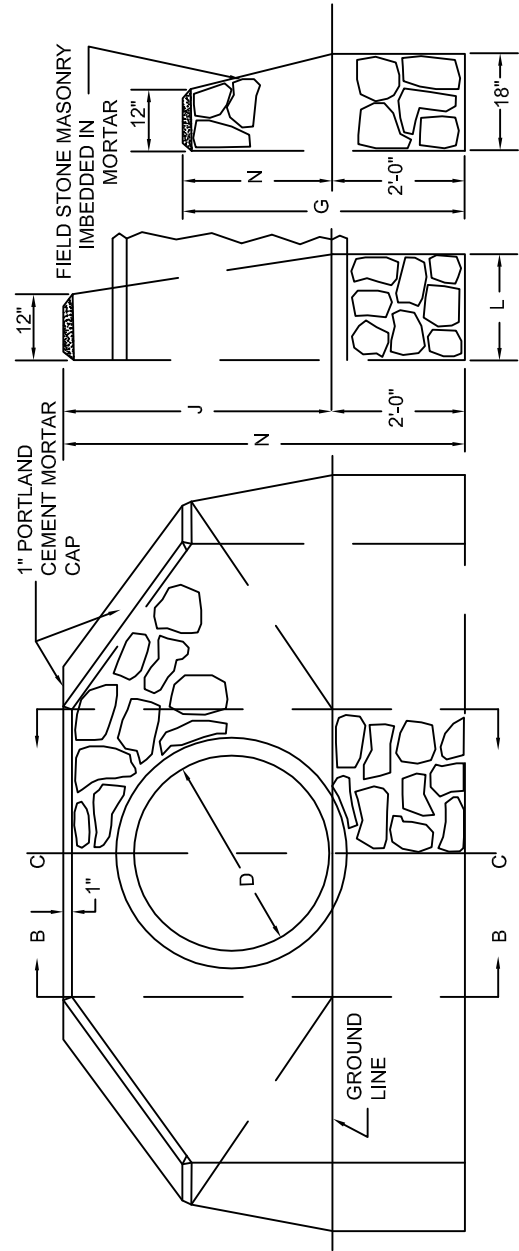
1V:1.5H AND 1V:2H SLOPES							1V:1.5H SLOPE			1V:2H SLOPE			TRENCH EXCAV. FOR 12 SLOPE	
D	E	G	H	J	L	N	P	CONC. MASONRY CY	STEEL LBS	F	CONC. MASONRY CY	STEEL LBS	12 SLOPE FOR 1'-0" DEPTH CU. FT.	
30"	4'-0"	4'-0"	5'-6"	3'-6"	1'-6"	2'-0"	5'-3"	3'-0"	2.60	45	4'-3"	3.16	54	55.16
36"	4'-6"	4'-3"	6'-0"	4'-0"	1'-8"	2'-3"	5'-11"	3'-6"	3.35	54	5'-0"	4.15	64	64.36
42"	5'-0"	4'-6"	6'-6"	4'-6"	1'-10"	2'-6"	6'-6"	4'-0"	4.20	59	5'-9"	5.25	70	73.70
48"	5'-6"	4'-9"	7'-0"	5'-0"	2'-0"	2'-9"	7'-2"	4'-6"	5.19	65	6'-6"	6.50	83	83.96
54"	6'-0"	5'-0"	7'-6"	5'-6"	2'-2"	3'-0"	7'-10"	5'-0"	6.26	73	7'-3"	7.88	93	94.46
60"	6'-6"	5'-3"	8'-0"	6'-0"	2'-4"	3'-3"	8'-5"	5'-6"	7.43	85	8'-0"	9.37	106	105.30
72"	7'-6"	5'-9"	9'-0"	7'-0"	2'-8"	3'-9"	9'-9"	6'-6"	10.25	98	9'-6"	12.99	128	128.92
84"	8'-6"	6'-3"	10'-0"	8'-0"	3'-0"	4'-3"	11'-0"	7'-6"	13.49	120	11'-0"	17.32	154	153.86

CONCRETE ENDS



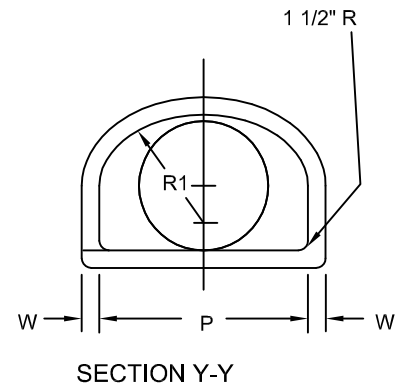
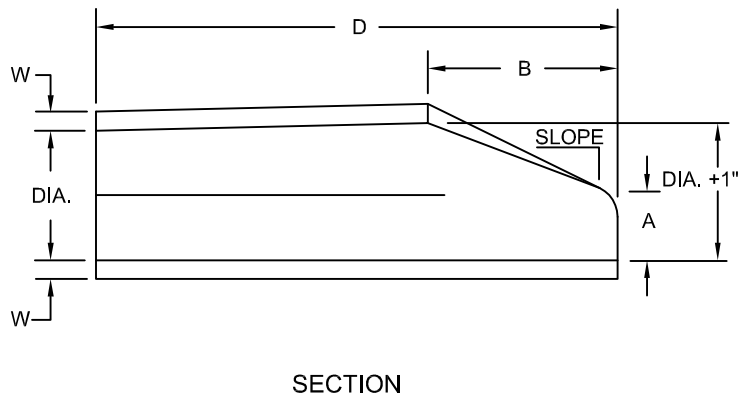
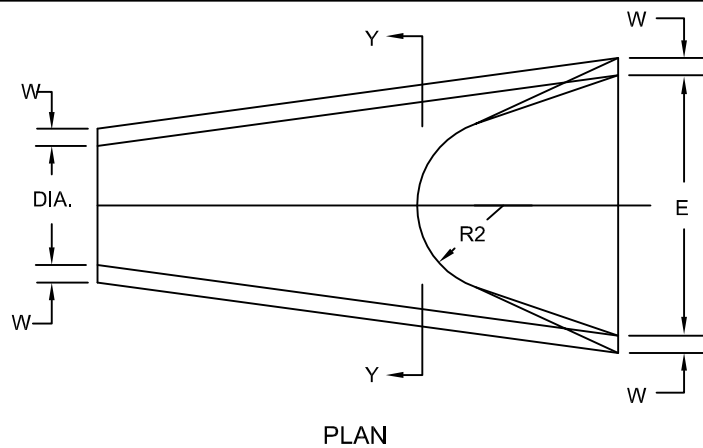
ELEV. A-A SECTION B-B

FIELD STONE MASONRY ENDS



FRONT ELEVATION

SECTION C-C ELEV. D-D



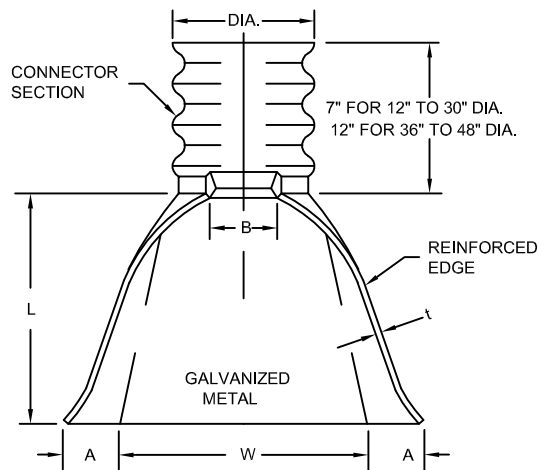
TABLE

[ALL DIMENSIONS ARE inches OR feet]

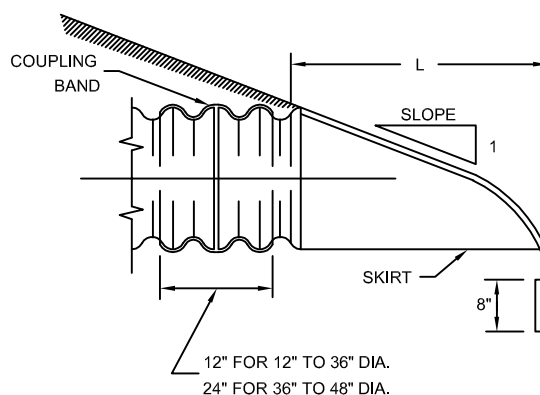
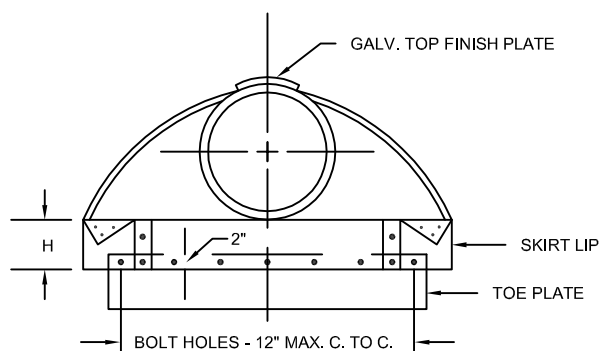
DIAMETER Inch	W	A	B	D	E	P	DIA. +1"	R1	R2	SLOPE
12"	2"	4"	2'-0"	6'-0"	2'-0"	19 15/16"	13"	10 1/8"	9"	1V : 3H
15"	2 1/4"	6"	2'-3"	6'-0"	2'-6"	24 5/16"	16"	12 1/2"	11"	1V : 3H
18"	2 1/2"	9"	2'-3"	6'-0"	3'-0"	29"	19"	15 1/2"	12"	1V : 3H
21"	2 3/4"	9"	2'-11"	6'-0"	3'-6"	31 5/8"	22"	16 1/8"	13"	1V : 3H
24"	3"	9 1/2"	3'-7 1/2"	6'-0"	4'-0"	33 3/16"	25"	16 13/16"	14"	1V : 3H
27"	3 1/4"	10 1/2"	4'-0"	6'-0"	4'-6"	36"	28"	18 9/16"	14 1/2"	1V : 3H
30"	3 1/2"	12"	4'-6"	6'-0"	5'-0"	37"	31"	18 1/2"	15"	1V : 3H
36"	4"	15"	5'-3"	8'-0"	6'-0"	47 13/16"	37"	24 5/16"	20"	1V : 3H
42"	4 1/2"	21"	5'-3"	8'-0"	6'-6"	53 7/8"	43"	27 1/2"	22"	1V : 3H
48"	5"	24"	6'-0"	8'-0"	7'-0"	56 1/2"	49"	28 1/2"	22"	1V : 3H

NOTES:

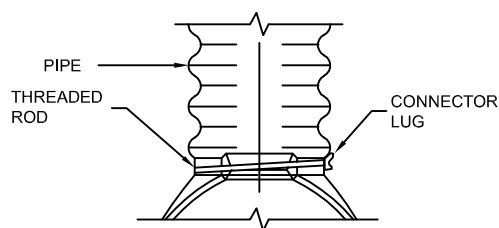
1. SEE STANDARD SPECIFICATIONS FOR THE TYPE OF PIPE TO BE USED (BELL & SPIGOT OR TONGUE & GROOVE)
2. SEE STANDARD SPECIFICATIONS FOR THE TYPE OF PIPE AND PLACING OF STEEL REINFORCEMENT.
3. THE JOINTS ARE TO BE COMPATIBLE WITH THE MAIN RUN OF PIPE.



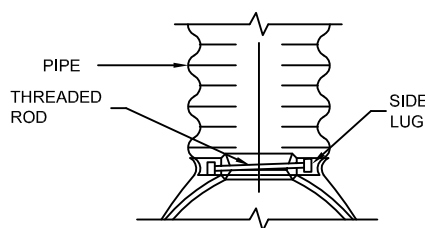
PIPE DIA. (IN)	GA.	DIMENSIONS (IN.)					APPROX. SLOPE
		A (± 1")	B (MAX.)	H (± 1")	L (± 1 1/2")	W (± 2")	
12	16	6	6	6	21	24	1V : 2.5H
15	16	7	8	6	26	30	1V : 2.5H
18	16	8	10	6	31	36	1V : 2.5H
21	16	9	12	6	36	42	1V : 2.5H
24	16	10	13	6	41	48	1V : 2.5H
30	14	12	16	8	51	60	1V : 2.5H
36	14	14	19	9	60	72	1V : 2.5H
42	12	16	22	11	39	84	1V : 2.5H
48	12	18	27	12	78	90	1V : 2.25H



ALTERNATE CONNECTIONS



FOR 12" TO 24" ONLY



FOR 30" AND 36" ONLY

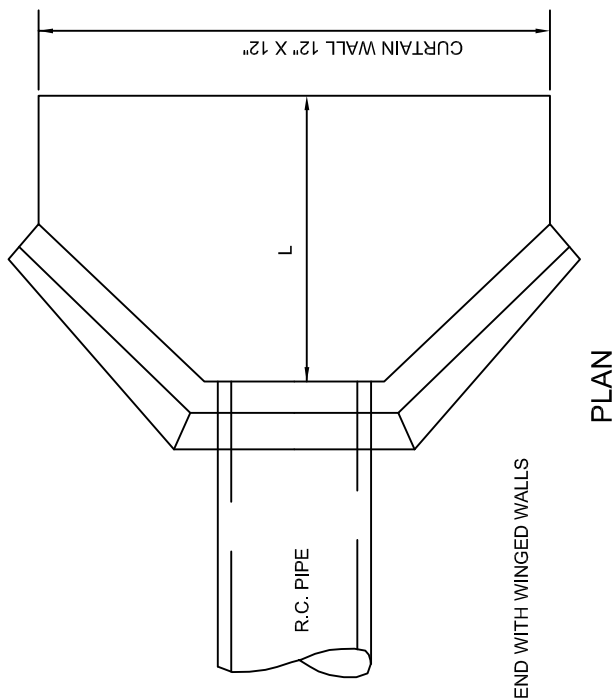
NOTES:

1. TOE PLATE TO BE PUNCHED TO MATCH HOLES IN SKIRT LIP. 3/8" Ø GALVANIZED BOLTS TO BE FURNISHED. LENGTH OF TOE PLATE TO BE W+10" FOR 12" TO 30" DIA. PIPE AND W+22" FOR 36" TO 48" DIA.
2. SKIRT SECTION FOR 12" TO 24" DIA. PIPE TO BE MADE IN ONE PIECE. SKIRT SECTION FOR 12" TO 30" DIA. PIPE MAY BE MADE FROM TWO SHEETS JOINED BY RIVETING OR BOLTING ON CENTER LINE WITH 3/8" DIA. FASTENERS.
3. CONNECTOR SECTION, TOE PLATE AND SKIRT TO BE OF SAME THICKNESS METAL; EACH TO BE GALVANIZED AND COATED WITH A TAR BASE PAINT.
4. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHOD, SEE LATEST STANDARD SPECIFICATIONS.

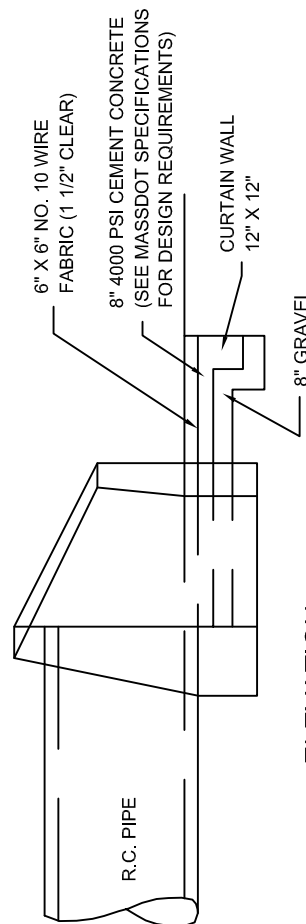
CONCRETE SPLASH PADS

DATE OF ISSUE
JUNE 2014

DRAWING NUMBER
E 208.1.0

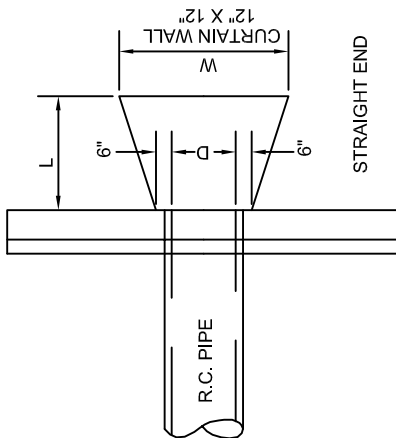


PLAN

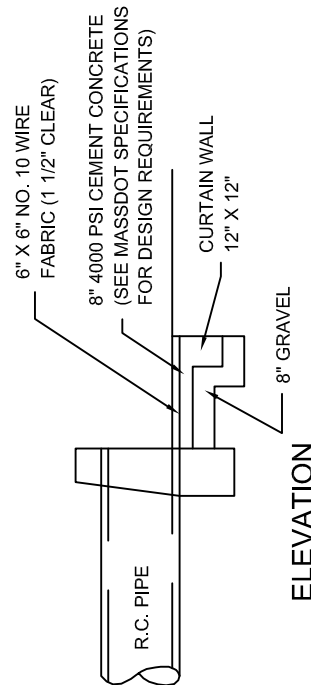


ELEVATION

PIPE DIAM. (IN)	36	42	48	54	60	66	72	84
L (FT)	6	7	8	9	10	11	12	14



PLAN



ELEVATION

PIPE DIAM. (IN)	12	15	18	21	24	30
L	3'-0"	3'-0"	3'-0"	3'-6"	4'-0"	5'-0"
W	4'-0"	4'-0"	4'-6"	5'-3"	6'-0"	7'-6"

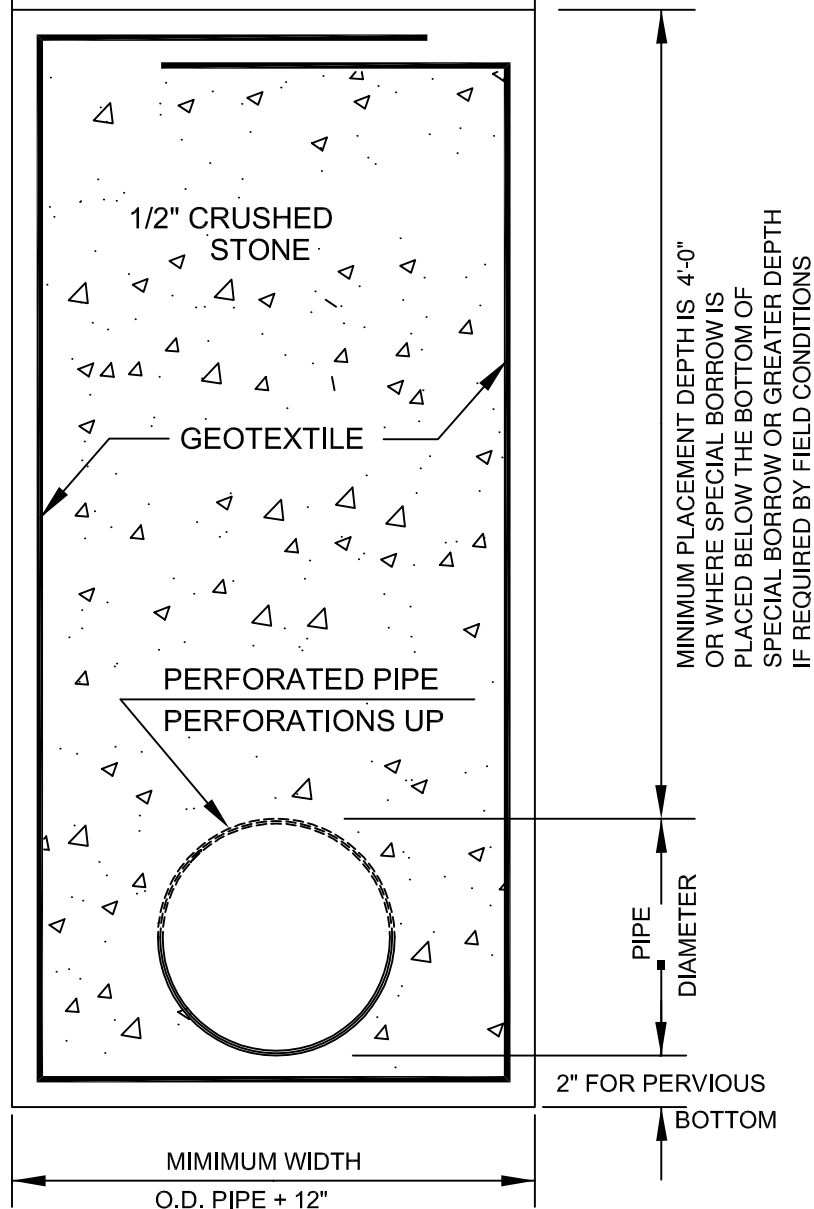
NOTE:
1) ALL PIPE DIAMETERS NOMINAL SIZE

SURFACE TREATMENT:

4" PLANTABLE SOIL AND SEED
OVER

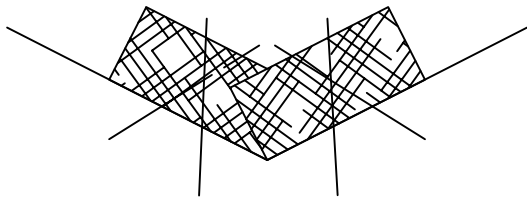
8" COMPACT GRAVEL OR

4" MINIMUM DEPTH OF PAVEMENT
MILLING MULCH PLACE DIRECTLY
OVER GEOTEXTILE AND CRUSHED
STONE BOX



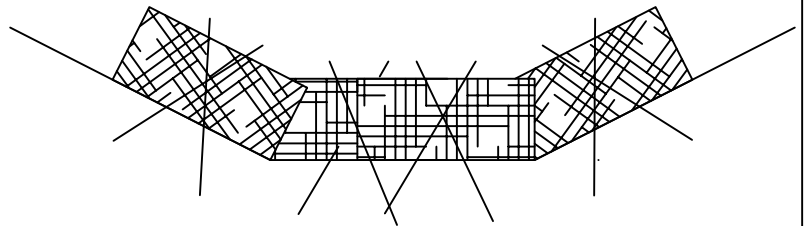
NOTES:

1. GEOTEXTILE FABRIC AS DESCRIBED IN SECTION M9.50
2. PIPE SHALL BE SET AT BOTTOM OF TRENCH FOR IMPERVIOUS BOTTOM.
3. SUBDRAIN LOCATED APPROXIMATELY AT INTERSECTION OF TANGENTS (SEE DWG. E102.1.0)
4. GRAVEL (AND SPECIAL BORROW WHERE REQUIRED) SHALL INTERSECT CRUSHED STONE FOR SUBDRAIN



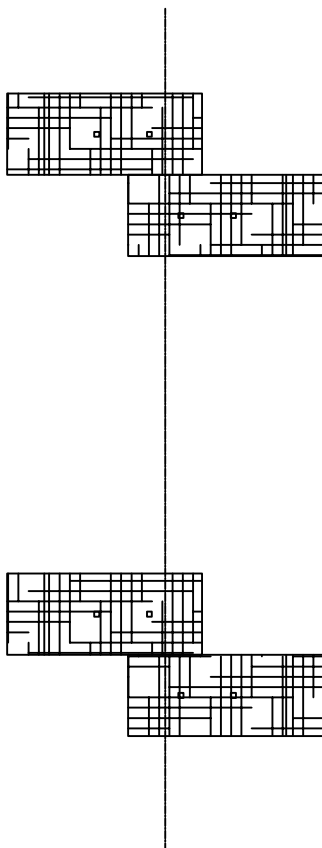
V DITCH

CROSS SECTION



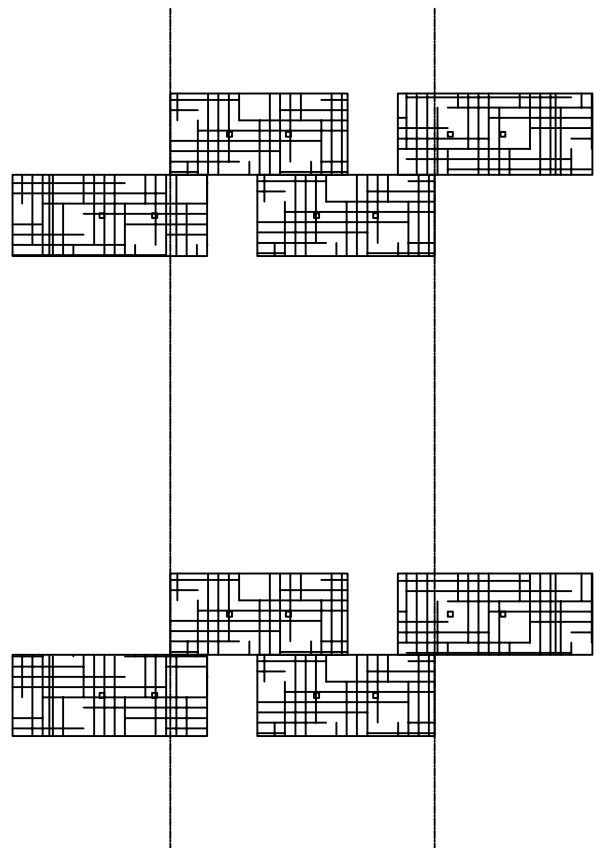
FLAT DITCH

CROSS SECTION



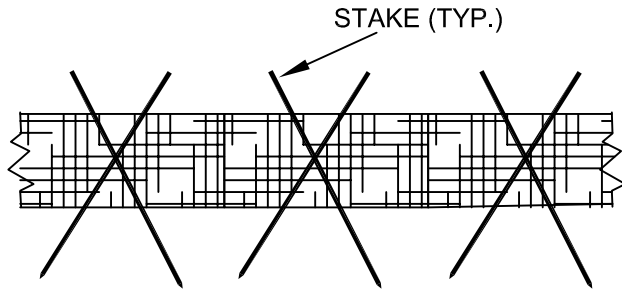
V DITCH

PLAN

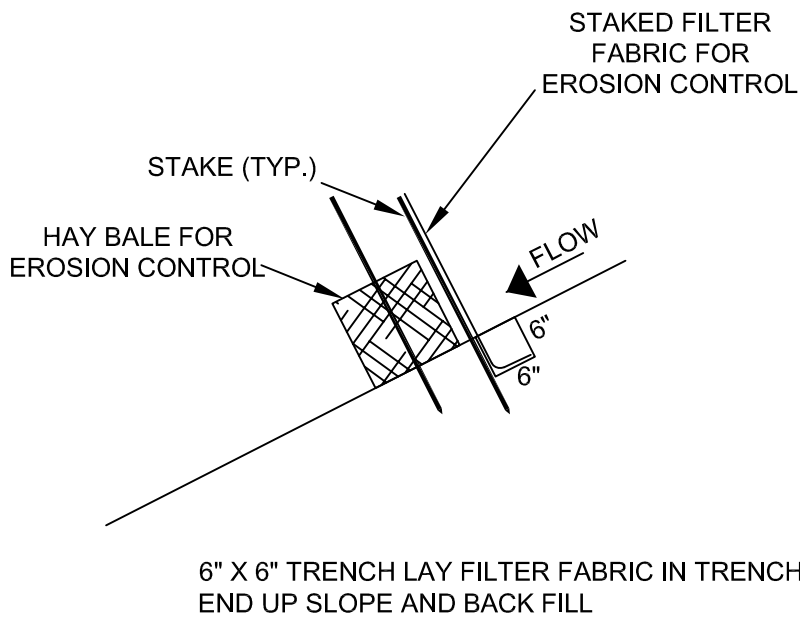
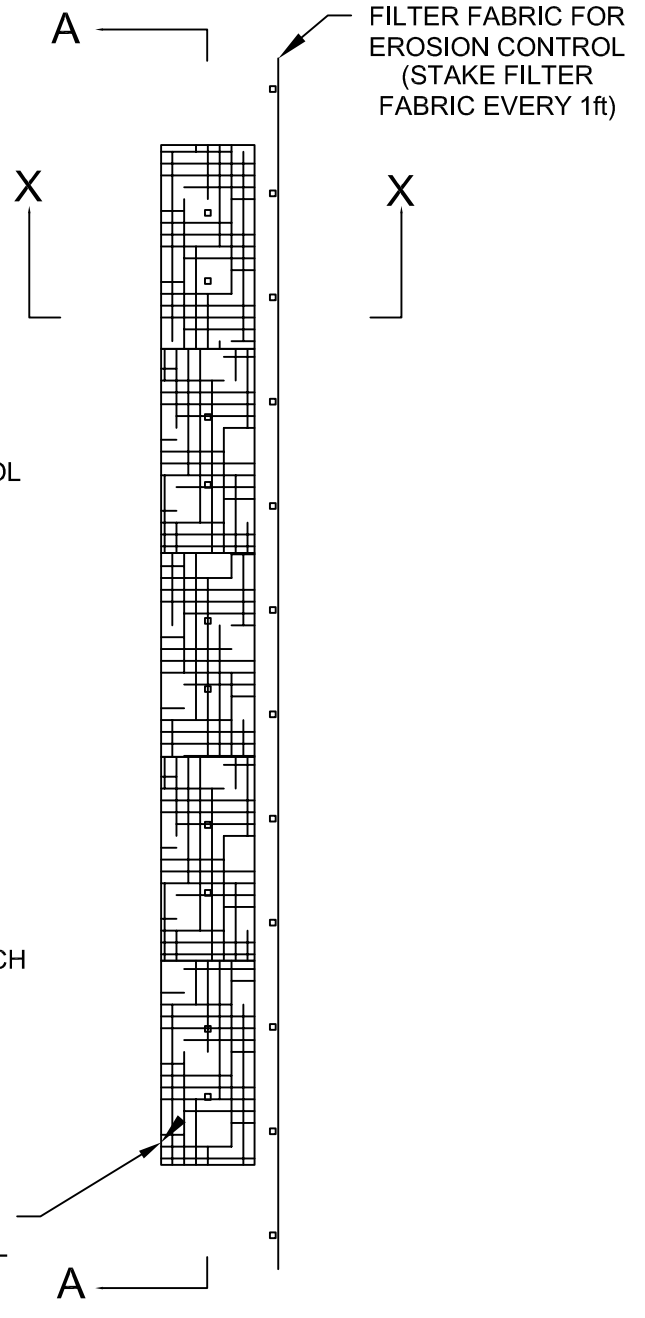


FLAT DITCH

PLAN

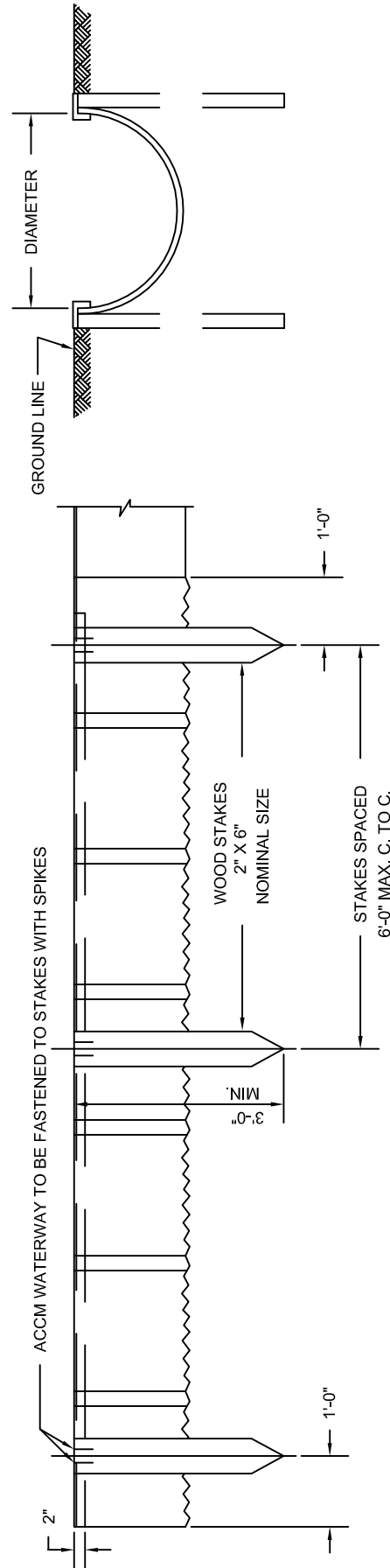
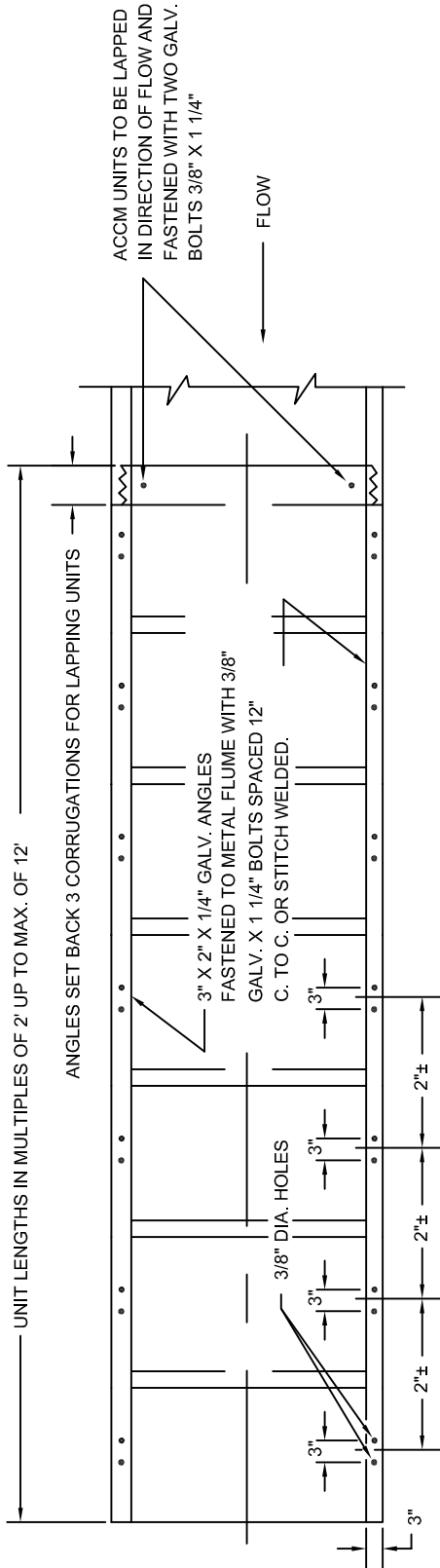


SECTION A-A

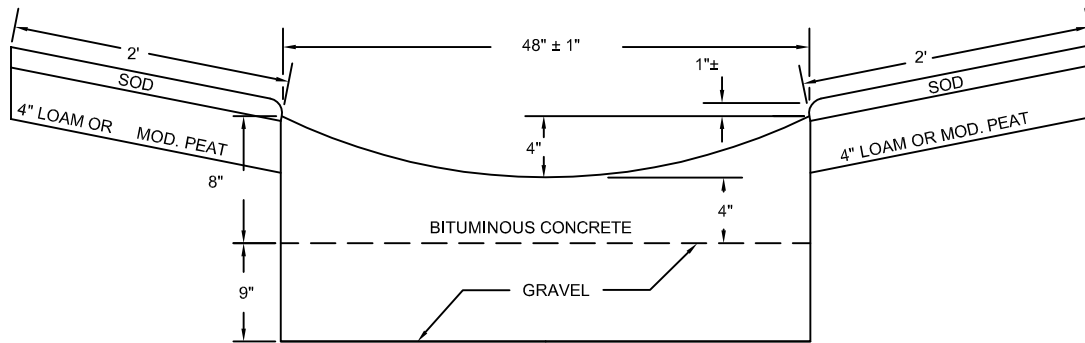


SECTION X-X

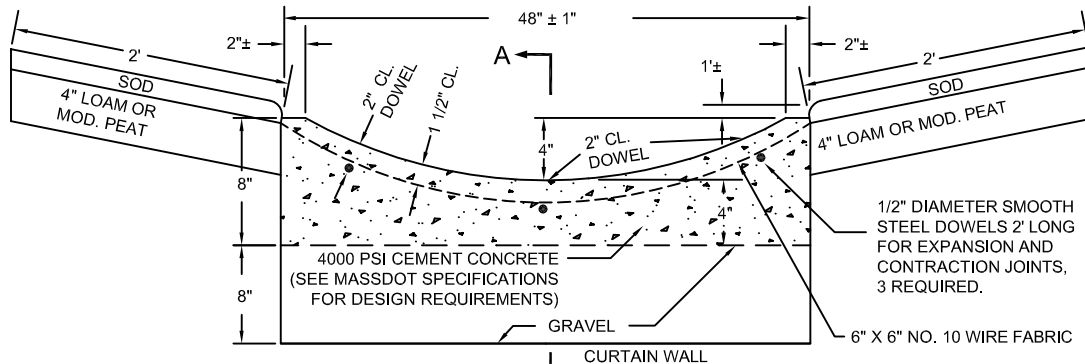
HAY BALES FOR
EROSION CONTROL
(2 STAKES
PER BALE)



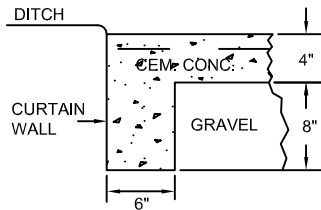
- NOTE:
1. DIAMETER OF HALF CCM PIPE WATERWAY TO BE AS SPECIFIED.
 2. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.



BITUMINOUS CONCRETE

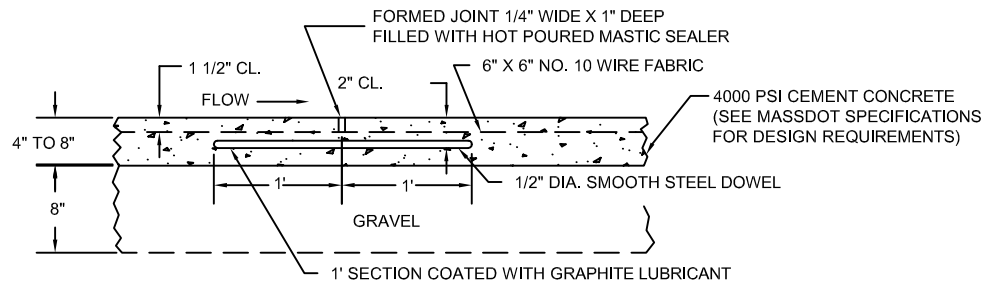


CEMENT CONCRETE



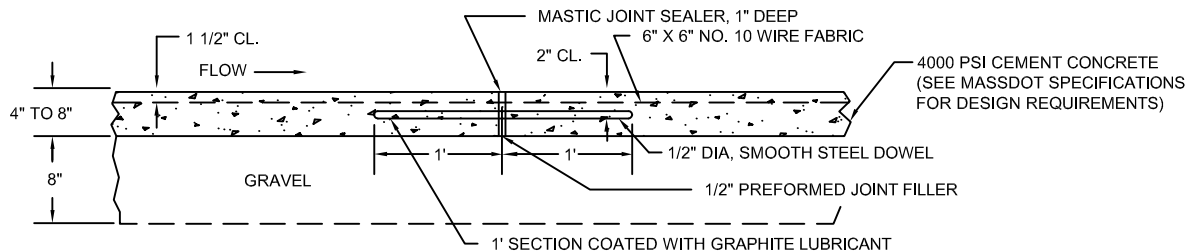
CURTAIN WALL TO BE INSTALLED
AT TERMINI OF PAVING

SECTION A-A



CONTRACTION JOINT TO BE PLACED 30' MAXIMUM CENTER TO CENTER

DETAILS OF CONTRACTION JOINTS



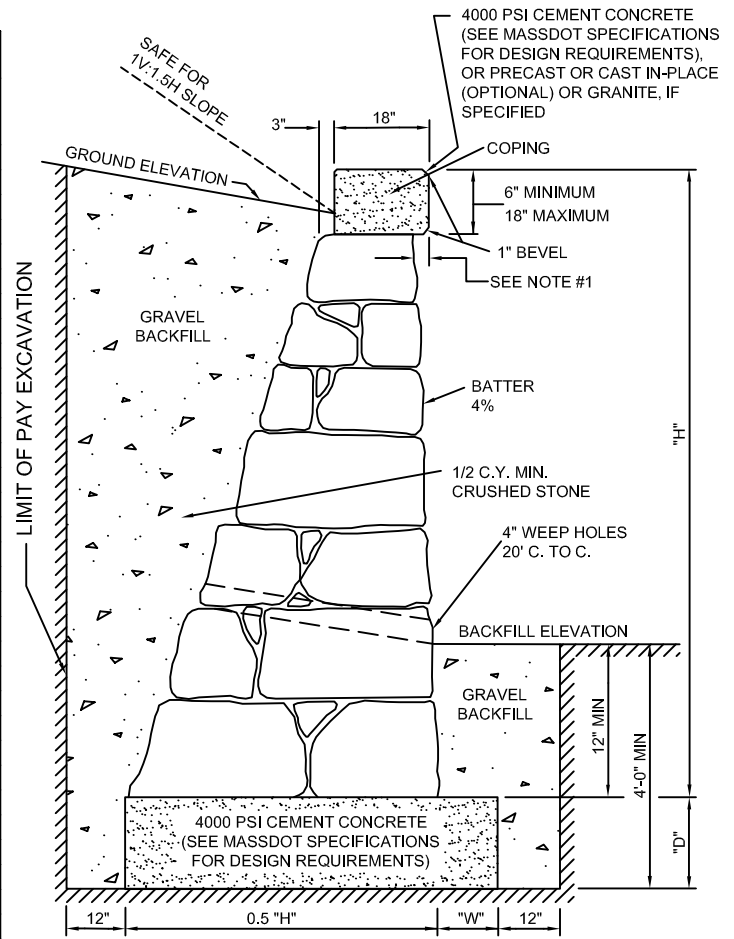
EXPANSION JOINTS TO BE INSTALLED AT APPROACHES TO STRUCTURES

DETAILS OF EXPANSION JOINTS

NOTES:

1. ON CURVED ALIGNMENT, WATERWAYS SHALL BE BANKED AS DIRECTED.
2. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS, SEE LATEST STANDARD SPECIFICATIONS.

H (FT)	W (FT)	D (FT)	CONCRETE MASONRY FOOTING		STONE MASONRY EXCLUDING COPING	
			SECTION AREA (SQ. FT.)	VOLUME PER UNIT LENGTH (CU. YD./LIN. FT.)	SECTION AREA (SQ. FT.)	VOLUME PER UNIT LENGTH (CU. YD./LIN. FT.)
5.0	0.75	1.25	4.06	0.150	9.00	0.333
5.5			4.38	0.162	10.63	0.394
6.0			4.69	0.174	12.38	0.458
6.5			5.00	0.185	14.16	0.524
7.0			5.31	0.197	16.05	0.594
7.5			5.63	0.208	18.06	0.669
8.0	1.0	1.5	7.50	0.278	20.16	0.747
8.5			7.88	0.292	22.40	0.829
9.0			8.25	0.306	24.75	0.917
9.5			8.63	0.319	27.22	1.008
10.0	1.2	2.0	12.40	0.459	29.80	1.104
10.5			12.90	0.478	32.50	1.204
11.0			13.40	0.496	35.28	1.307
11.5			13.90	0.515	38.21	1.415
12.0			14.40	0.533	41.25	1.528
12.5			14.90	0.552	44.41	1.645
13.0	1.5	2.5	20.00	0.741	47.68	1.766
13.5			20.63	0.764	51.07	1.891
14.0			21.25	0.787	54.53	2.020
14.5			21.88	0.810	58.14	2.153
15.0			22.50	0.833	61.88	2.292
15.5			23.13	0.856	65.72	2.434
16.0			23.75	0.880	69.68	2.581
16.5	1.8	3.0	30.15	1.117	73.76	2.732
17.0			30.90	1.144	77.90	2.885
17.5			31.65	1.172	82.21	3.045
18.0			32.40	1.200	86.63	3.208
18.5			33.15	1.228	91.38	3.384
19.0			33.90	1.256	96.25	3.565
19.5			34.65	1.283	101.25	3.750
20.0			35.40	1.311	106.38	3.940
20.5			36.15	1.339	111.63	4.134
21.0			36.90	1.367	117.00	4.333
21.5			37.65	1.394	122.50	4.537
22.0			38.40	1.422	128.13	4.745
22.5			39.15	1.450	133.88	4.958
23.0			39.90	1.478	139.75	5.176
23.5			40.65	1.506	145.75	5.398
24.0			41.40	1.533	151.88	5.625
24.5			42.15	1.561	158.13	5.856
25.0			42.90	1.589	164.50	6.093
25.5			43.65	1.617	171.00	6.333
26.0			44.40	1.644	177.63	6.579
26.5			45.15	1.672	184.38	6.829



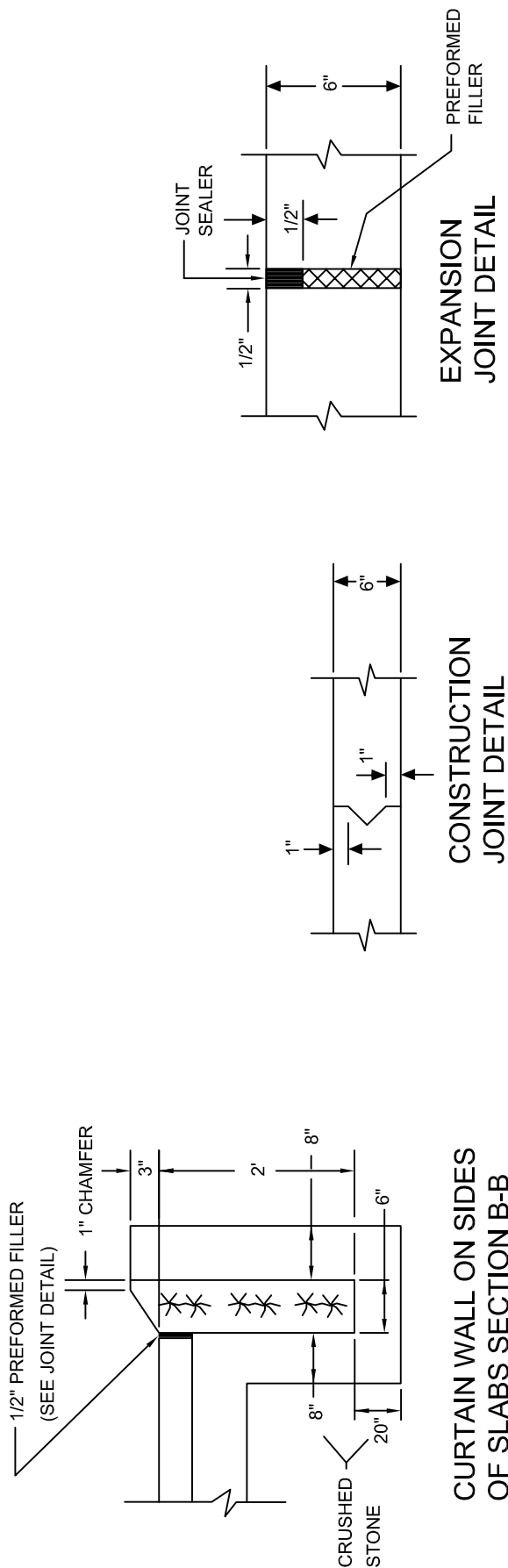
COPING TO BE PRECAST CONCRETE OR GRANITE OF UNIFORM DEPTH FOR THE ENTIRE LENGTH. DEPTH OF CONCRETE TO BE 1/12 THE AVERAGE "H" WITHIN THE LIMITS SHOWN. DEPTH OF GRANITE TO BE AS SHOWN ON THE PLANS, 6" OR 9".

FOR CHAIN LINK FENCE ON TOP OF WALL, THE COPING SHALL BE CONCRETE CAST-IN-PLACE WITH A MINIMUM DEPTH OF 12". THE LENGTH OF GALVANIZED PIPE SLEEVES FOR FENCE POSTS SHALL BE EQUAL TO THE DEPTH OF COPING.

NOTES:

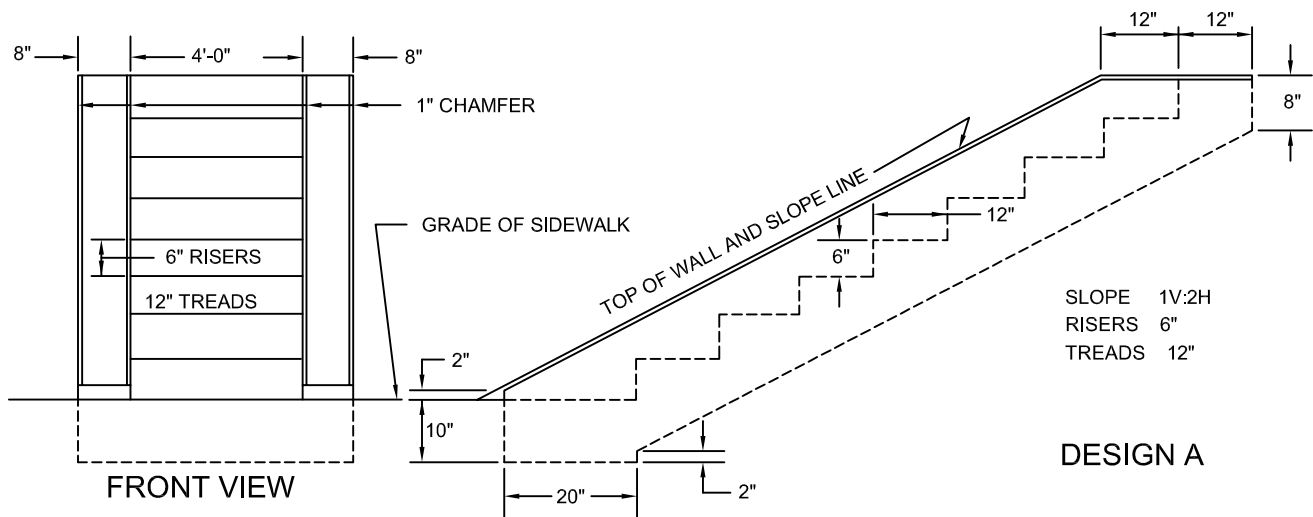
1. COPING OVERHANG TO BE APPROXIMATELY 3" FOR WALLS 10' OR MORE IN HEIGHT AND APPROXIMATELY 2" FOR WALLS LESS THAN 10' IN HEIGHT; IN A CONTINUOUS WALL OF VARYING HEIGHT THE OVERHANG WILL BE APPROXIMATELY 2" TO 3" FOR THE ENTIRE LENGTH.
2. ALL DIMENSIONS SHOWN ARE MINIMUM.
3. PAYMENT WILL BE BASED ON THE ACCOMPANYING TABLE.
4. TO BE FOUNDED ON SUITABLE SOIL



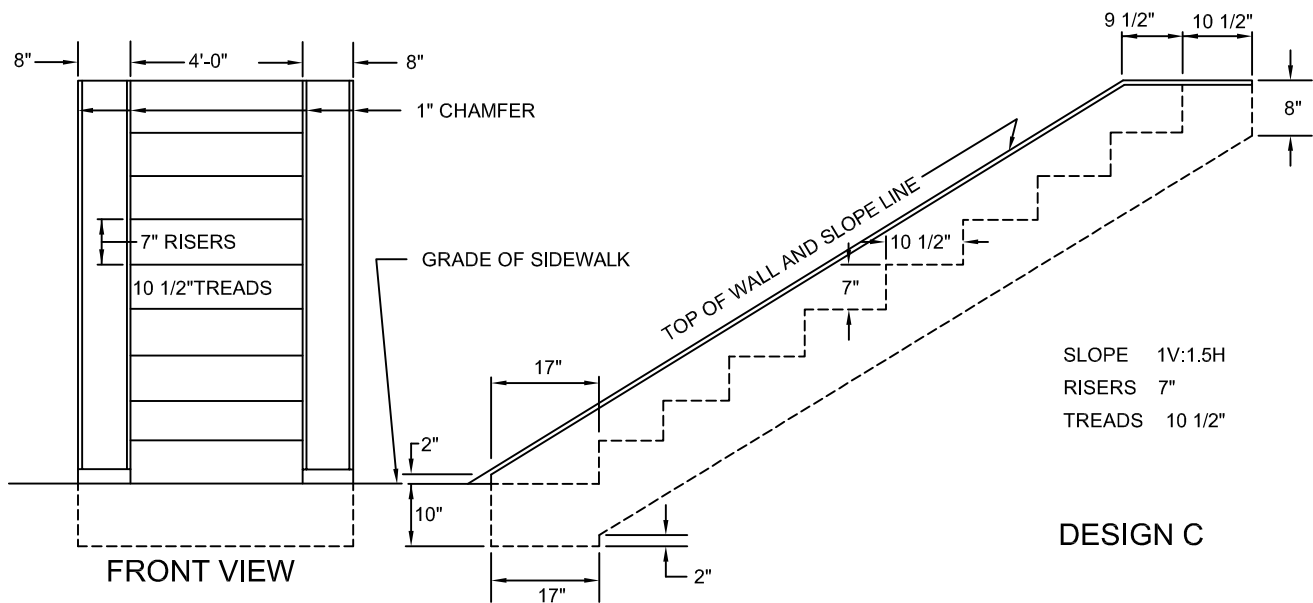


NOTES:

1. WIRE FABRIC TO HAVE 12" MINIMUM LAP AT SPLICE AND SHOULD EXTEND WITHIN 3" OF ALL EDGES
2. SLAB SHALL BE GROOVED PARALLEL TO AND NORMAL TO THE CURTAIN TOE WALL AT APPROXIMATELY 6' GRIDS. THE GROOVE DEPTH SHALL BE 1"
3. FOR LIMITS OF SLOPE PAVING SEE BRIDGE MANUAL.
4. CONCRETE SHALL BE 4,000 PSI (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)
5. EXTEND GEOTEXTILE FABRIC BENEATH CRUSHED STONE FROM TOP OF CONCRETE CURTAIN TOE WALL TO FACE OF ABUTMENT.
6. SEE E 303.1.0 FOR SLAB PLAN AND SECTION.



PLEASE NOTE: DESIGN B HAS BEEN DISCONTINUED



NOTES:

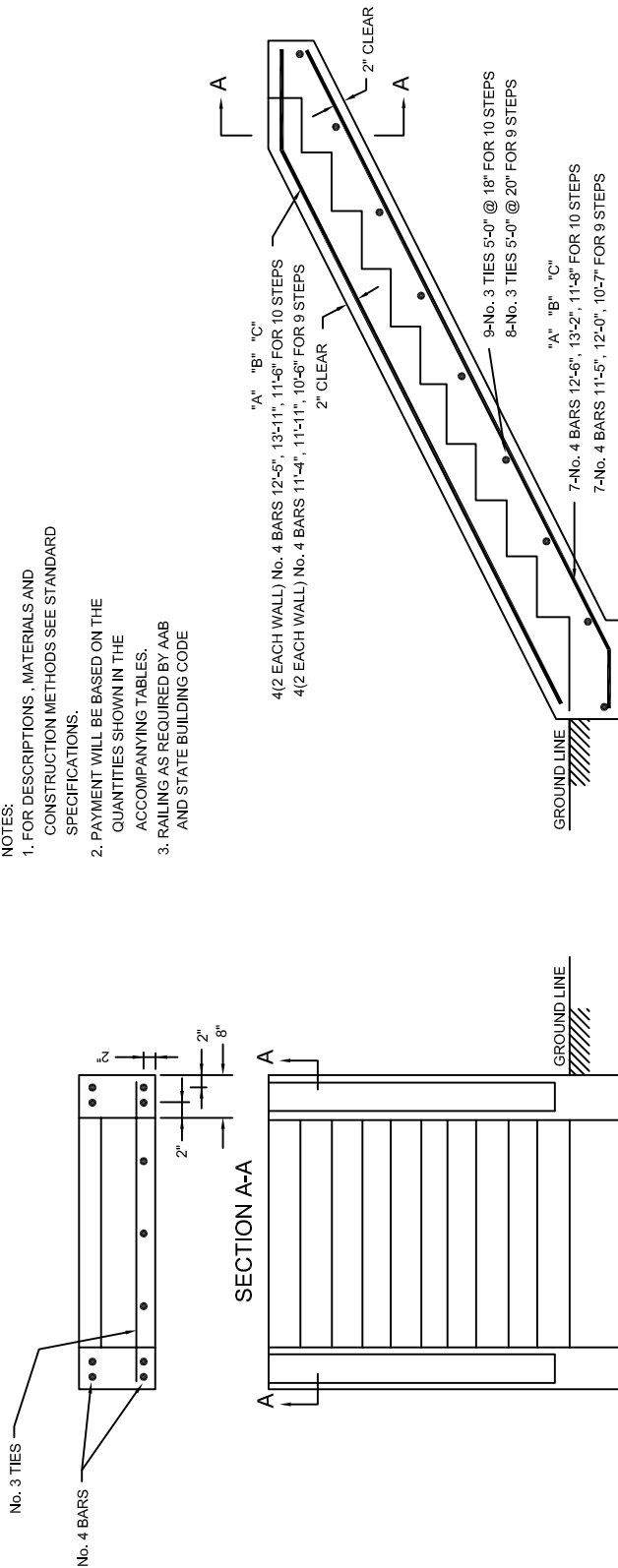
1. ALL CONCRETE DIMENSIONS SHOWN ARE MINIMUM EXCEPT RISERS AND TREADS WHICH HAVE 1/4" TOLERANCE.
2. FOR REINFORCING STEEL AND CONCRETE QUANTITIES SEE DRAWING E 304.2.0

CEMENT CONCRETE STEPS

2/2

NOTES:

1. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS SEE STANDARD SPECIFICATIONS.
2. PAYMENT WILL BE BASED ON THE QUANTITIES SHOWN IN THE ACCOMPANYING TABLES.
3. RAILING AS REQUIRED BY AAB AND STATE BUILDING CODE



FRONT VIEW

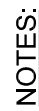
SIDE VIEW

FOR DESIGNS "A", "B" AND "C" SEE DRAWING E 304.1.0

		DESIGN A					DESIGN C					
STEP NOS.	QUANTITIES - CU. FT.				TOTAL C.Y.	REINF. STEEL LBS	QUANTITIES - CU. FT.				TOTAL C.Y.	REINF. STEEL LBS
	BASE	STEPS	2-WALLS	TOTAL			BASE	STEPS	2-WALLS	TOTAL		
2	5.55	7.33	6.26	19.15	0.71	--	4.72	6.71	5.65	17.08	0.63	--
3	5.55	11.00	8.48	25.03	0.93	--	4.72	10.06	7.69	22.48	0.83	--
4	5.55	14.66	10.70	30.92	1.15	--	4.72	13.42	9.73	27.87	1.03	--
5	5.55	18.33	12.92	36.81	1.36	--	4.72	16.77	11.78	33.27	1.23	--
6	5.55	22.00	15.15	42.70	1.58	--	4.72	20.12	13.82	38.66	1.43	--
7	5.55	25.66	17.37	48.59	1.80	--	4.72	23.48	15.86	44.06	1.63	--
8	5.55	29.33	19.59	54.47	2.02	--	4.72	26.83	17.90	49.46	1.83	--
9	5.55	33.00	21.81	60.36	2.24	99	4.72	30.19	19.94	54.85	2.03	92
10	5.55	36.66	24.03	66.25	2.45	109	4.72	33.54	22.00	60.25	2.23	102

PLEASE NOTE: DESIGN B HAS BEEN DISCONTINUED

ALL CONCRETE SHALL BE 4,000 PSI (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)



- TOP OF FOOTING



massDOT
Massachusetts Department of Transportation
Highway Division

**CONSTRUCTION
STANDARDS**

TYPICAL CANTILEVER RETAINING WALL SECTION

DATE OF ISSUE	JUNE 2014
---------------	-----------

DRAWING NUMBER
E 305.1.0

CANTILEVER RETAINING WALLS DENSE FOUNDATION SOILS, SLOPING BACKFILL

TABLE OF DIMENSIONS AND REINFORCING STEEL

H	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0	30.0
W	8.500	9.000	10.000	10.500	11.000	12.000	12.500	13.000	13.500	14.000	15.000	15.500	16.500	17.500	18.000	19.000	20.000
T	2.000	2.000	2.000	2.000	2.000	2.000	2.500	2.500	3.000	3.000	3.500	3.500	4.000	4.000	4.500	4.500	5.000
A	1.500	1.500	2.000	2.000	1.500	2.000	2.000	2.000	2.000	2.000	2.500	2.500	3.000	3.500	4.000	4.500	5.000
B	2.500	2.583	2.667	2.750	2.833	2.917	2.958	3.042	3.083	3.167	3.208	3.292	3.333	3.417	3.458	3.542	3.583
C	4.500	4.917	5.333	5.750	6.667	7.083	7.542	7.958	8.417	8.833	9.292	9.708	10.167	10.583	10.542	10.958	11.417
L	3.600	3.900	5.600	6.000	8.000	8.500	8.750	9.250	9.500	12.000	12.300	12.900	13.200	13.800	14.100	14.700	15.000
M	1.917	2.500	3.167	4.083	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000
N	1.000	1.000	1.000	1.000	1.250	1.250	1.250	1.250	1.250	1.500	1.500	1.500	1.917	1.917	1.917	1.917	1.917
P	1.000	1.000	1.250	1.250	1.000	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.500	1.917	1.917	2.500	2.500
HOOK	1.000	1.167	1.167	1.333	1.333	1.583	1.583	1.833	1.833	1.833	2.000	2.000	1.583	1.583	1.583	1.583	1.833
A bars	6 @ 12	7 @ 12	7 @ 12	8 @ 12	8 @ 12	9 @ 12	9 @ 12	10 @ 12	10 @ 12	10 @ 12	11 @ 12	11 @ 12	9 @ 6	9 @ 6	9 @ 6	9 @ 6	10 @ 6
B bars	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12
C bars	7 @ 18	8 @ 18	9 @ 18	10 @ 18	11 @ 17	11 @ 14	11 @ 15.5	11 @ 13	11 @ 13.5	11 @ 12	11 @ 12	11 @ 10.5	11 @ 10.5	11 @ 9.5	11 @ 10.5	11 @ 9.5	11 @ 9.5
D bars	4 @ 18	4 @ 18	4 @ 18	4 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	6 @ 18	6 @ 18	6 @ 18	7 @ 18	7 @ 18	7 @ 18	7 @ 18	7 @ 18
E bars	4 @ 18	4 @ 18	5 @ 18	5 @ 18	4 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	6 @ 18	7 @ 18	7 @ 18	8 @ 18	8 @ 18

Quantities of Materials

Stem Concrete (yd ³ /ft)	0.9	1.0	1.1	1.2	1.3	1.4	1.4	1.6	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4
Footings Concrete (yd ³ /ft)	0.6	0.7	0.7	0.8	0.8	0.9	1.2	1.2	1.5	1.6	2.0	2.0	2.5	2.6	3.0	3.2	3.7
Steel (lb/ft)	98	117	152	171	200	233	243	280	292	399	454	470	488	510	524	550	631

Maximum Soil Bearing Pressure

Q _{max} (psf)	5123	5663	5432	5954	7019	6759	7346	7886	8482	9033	8817	9355	9178	8984	9103	8948	8892
------------------------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

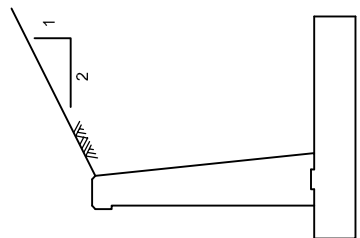
Notes:

1. All dimensions are in feet, unless specified otherwise.
2. Spacings of reinforcing bars are in inches.
3. Designer must confirm design parameters with Geotechnical Engineer prior to selecting wall for site.

ASSUMED DESIGN PARAMETERS

DENSE FOUNDATION SOIL, SLOPING BACKFILL

1. BACKFILL LOADING CONDITIONS:
2H:1V SLOPING BACKFILL
2. BACKFILL SOIL PROPERTIES:
TYPE: GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES
Ø = ANGLE OF INTERNAL FRICTION = 37°
δ = ANGLE OF WALL FRICTION = 22°
γ = EFFECTIVE UNIT WEIGHT = 120 pcf
3. FOUNDATION SOIL PROPERTIES:
q_f = FACTORED BEARING CAPACITY = 9400 psf
FRICTION FACTOR = 0.57
Ø_{SLIDING} = PERFORMANCE FACTOR FOR SLIDING = 0.80
4. SEISMIC LOADING:
A = 0.17g (Max.)
K_h = 0.085
K_v = 0
5. REINFORCED CONCRETE:
F'_c = 4000 psi
F_y = 60000 psi
(SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)



CANTILEVER RETAINING WALLS DENSE FOUNDATION SOILS, LEVEL BACKFILL, SURCHARGE

DATE OF ISSUE
JUNE 2014

DRAWING NUMBER
E 305.3.0

TABLE OF DIMENSIONS AND REINFORCING STEEL

H	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0	30.0
W	7.000	7.500	8.000	8.500	9.000	9.000	9.500	10.000	10.500	11.000	11.000	11.500	12.000	12.500	13.000	13.000	13.500
T	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.500	2.500
A	2.500	2.500	2.500	2.500	3.000	3.000	3.000	3.000	3.500	3.500	3.500	4.000	4.000	4.000	4.500	4.500	4.500
B	2.500	2.583	2.667	2.750	2.833	2.917	3.000	3.083	3.167	3.250	3.333	3.417	3.500	3.583	3.667	3.708	3.792
C	2.000	2.417	2.833	3.250	3.167	3.083	3.500	3.917	3.833	4.250	4.167	4.083	4.500	4.917	4.833	4.792	5.208
L	2.400	2.600	4.200	4.500	6.400	6.800	7.200	9.500	10.000	10.500	11.000	13.800	14.400	15.000	15.600	15.900	16.500
M	1.000	1.000	1.000	1.250	1.250	1.250	1.500	1.917	1.917	2.500	2.500	2.500	3.167	4.083	4.083	3.167	4.083
N	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.250	1.250	1.250	1.250	1.250	1.250
P	1.250	1.250	1.250	1.250	1.500	1.500	1.917	1.917	2.500	2.500	2.500	3.167	4.083	4.083	5.000	4.083	4.083
HOOK	0.833	1.000	1.000	1.000	1.000	1.167	1.333	1.333	1.333	1.583	1.583	1.833	1.833	1.833	1.833	2.000	2.000
A bars	5 @ 12	6 @ 12	6 @ 12	6 @ 12	6 @ 12	7 @ 12	8 @ 12	8 @ 12	8 @ 12	9 @ 12	9 @ 12	10 @ 12	10 @ 12	10 @ 12	10 @ 12	11 @ 12	11 @ 12
B bars	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12
C bars	4 @ 18	4 @ 18	4 @ 16	5 @ 18	5 @ 18	5 @ 18	6 @ 18	7 @ 18	7 @ 18	8 @ 18	8 @ 18	8 @ 18	9 @ 18	10 @ 18	10 @ 18	9 @ 18	10 @ 18
D bars	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18
E bars	5 @ 18	5 @ 18	5 @ 18	5 @ 18	6 @ 18	6 @ 18	7 @ 18	7 @ 18	8 @ 18	8 @ 18	8 @ 18	9 @ 18	10 @ 18	10 @ 18	11 @ 18	10 @ 18	10 @ 18

Quantities of Materials

Stem Concrete (yd ³ /ft)	0.9	0.9	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	2.0	2.1	2.2	2.4	2.5	2.6	2.7
Footings Concrete (yd ³ /ft)	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.2	1.3
Steel (lb/ft)	76	86	96	104	118	133	161	182	198	233	240	307	340	360	388	412	438

Maximum Soil Bearing Pressure

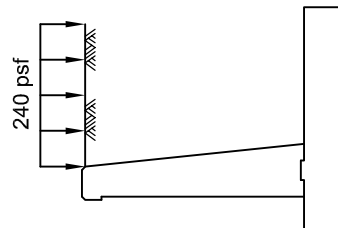
Q _{max} (psf)	4071	4328	4591	4860	4811	5491	5752	6018	5945	6208	6917	6833	7090	7352	7271	8079	8332
------------------------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

Notes:

1. All dimensions are in feet, unless specified otherwise.
2. Spacings of reinforcing bars are in inches.
3. Designer must confirm design parameters with Geotechnical Engineer prior to selecting wall for site.

ASSUMED DESIGN PARAMETERS

DENSE FOUNDATION SOIL, LEVEL BACKFILL, SURCHARGE



1. BACKFILL LOADING CONDITIONS:

LEVEL BACKFILL:
240 psf LIVE LOAD SURCHARGE.

2. BACKFILL SOIL PROPERTIES:

TYPE: GRAVEL BORROW FOR
BACKFILLING STRUCTURES AND PIPES
Ø = ANGLE OF INTERNAL FRICTION = 37°
δ = ANGLE OF WALL FRICTION = 22°
γ = EFFECTIVE UNIT WEIGHT = 120 pcf

3. FOUNDATION SOIL PROPERTIES:

q_f = FACTORED BEARING CAPACITY = 9400 psf
FRICTION FACTOR = 0.57

Ø_{SLIDING} = PERFORMANCE FACTOR FOR SLIDING = 0.80

4. SEISMIC LOADING:

A = 0.17g (Max.)
Kh = 0.085
Kv = 0

5. REINFORCED CONCRETE:

F_c = 4000 psi
F_y = 60000 psi
(SEE MASSDOT SPECIFICATIONS
FOR DESIGN REQUIREMENTS)

CANTILEVER RETAINING WALLS LOOSE FOUNDATION SOILS, SLOPING BACKFILL

TABLE OF DIMENSIONS AND REINFORCING STEEL																
H	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0	27.0	28.0	30.0
W	10.000	11.000	11.500	13.000	14.000	15.000	15.500	16.500	17.500	18.500	20.000	20.500	22.000	23.000	24.000	26.000
T	2.000	2.000	2.000	2.500	2.500	3.000	3.000	3.500	3.500	4.000	4.000	4.500	4.500	5.000	5.500	6.000
A	1.000	1.000	1.000	2.000	2.500	2.500	2.500	3.000	3.500	4.000	5.000	5.000	6.000	6.500	7.000	8.000
B	2.500	2.583	2.667	2.708	2.792	2.833	2.917	2.958	3.042	3.083	3.167	3.208	3.292	3.333	3.375	3.500
C	6.500	7.417	7.833	8.292	8.708	9.667	10.083	10.542	10.958	11.417	11.833	12.292	12.708	13.167	13.625	14.500
L	3.600	3.900	5.600	5.800	6.200	6.400	8.500	8.750	9.250	9.500	10.000	10.250	10.750	11.200	13.500	14.400
M	4.083	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000
N	1.000	1.250	1.250	1.250	1.500	1.500	1.500	1.917	1.917	1.917	1.917	1.917	2.500	2.500	3.167	3.167
P	1.000	1.000	1.000	1.000	1.250	1.000	1.250	1.250	1.500	1.500	1.917	1.917	2.500	2.500	2.500	3.167
HOOK	1.000	1.167	1.167	1.167	1.333	1.333	1.583	1.583	1.833	1.833	2.000	2.000	2.000	1.583	1.583	1.583
A bars	6 @ 12	7 @ 12	7 @ 12	7 @ 12	8 @ 12	8 @ 12	9 @ 12	9 @ 12	10 @ 12	10 @ 12	11 @ 12	11 @ 12	11 @ 12	9 @ 6	9 @ 6	9 @ 6
B bars	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12
C bars	10 @ 18	11 @ 15.5	11 @ 13	11 @ 14.5	11 @ 12.5	11 @ 11.5	11 @ 10.5	11 @ 10.5	11 @ 9	11 @ 9	11 @ 8.5	11 @ 8.5	11 @ 7.5	11 @ 7.5	11 @ 6.5	11 @ 6.5
D bars	4 @ 18	5 @ 18	5 @ 18	5 @ 18	6 @ 18	6 @ 18	6 @ 18	7 @ 18	7 @ 18	7 @ 18	7 @ 16	7 @ 16	8 @ 18	8 @ 18	9 @ 18	9 @ 18
E bars	4 @ 18	4 @ 18	4 @ 18	4 @ 18	5 @ 18	4 @ 18	5 @ 18	5 @ 18	6 @ 18	6 @ 18	7 @ 16	7 @ 16	8 @ 18	8 @ 18	9 @ 18	9 @ 18

Quantities of Materials

Stem Concrete (yd ³ /ft)	0.9	1.0	1.1	1.1	1.1	1.2	1.3	1.4	1.4	1.6	1.6	1.7	1.8	1.9	2.0	2.2
Footing Concrete (yd ³ /ft)	0.7	0.8	0.9	1.2	1.3	1.7	1.7	1.7	2.1	2.3	2.7	3.0	3.4	3.7	4.3	5.1
Steel (lb/ft)	126	158	173	189	219	309	351	379	422	440	500	516	557	588	625	664

Maximum Soil Bearing Pressure

Q _{max} (psf)	4918	5231	5737	5084	4998	5371	5816	5814	5771	5807	5387	5847	5473	5567	5667	5797
------------------------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

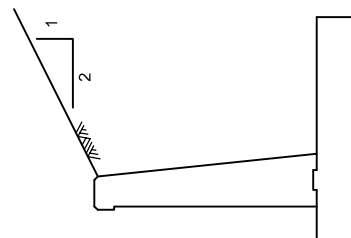
Notes:

- All dimensions are in feet, unless specified otherwise.
- Spacings of reinforcing bars are in inches.
- Designer must confirm design parameters with Geotechnical Engineer prior to selecting wall for site.

ASSUMED DESIGN PARAMETERS

LOOSE FOUNDATION SOIL, SLOPING BACKFILL

- BACKFILL LOADING CONDITIONS:
2H:1V SLOPING BACKFILL
- BACKFILL SOIL PROPERTIES:
TYPE: GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES
Ø = ANGLE OF INTERNAL FRICTION = 37°
δ = ANGLE OF WALL FRICTION = 22°
γ = EFFECTIVE UNIT WEIGHT = 120 pcf
- FOUNDATION SOIL PROPERTIES:
q_l = FACTORED BEARING CAPACITY = 6000 psf
FRICTION FACTOR = 0.50
Ø_{SLIDING} = PERFORMANCE FACTOR FOR SLIDING = 0.80
- SEISMIC LOADING:
A = 0.17g (Max.)
Kh = 0.085
Kv = 0
- REINFORCED CONCRETE:
F'_c = 4000 psi
F_y = 60000 psi
(SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)



CANTILEVER RETAINING WALLS LOOSE FOUNDATION SOILS, LEVEL BACKFILL, SURCHARGE

TABLE OF DIMENSIONS AND REINFORCING STEEL

H	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0	30.0
W	7.500	8.000	8.000	8.500	9.000	9.500	10.000	10.500	11.000	11.500	12.000	13.000	13.500	14.000	15.000	15.500	16.000
T	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.500	2.500	2.500	2.500
A	1.500	1.500	1.750	2.000	2.500	2.500	2.500	3.000	3.000	3.500	3.750	4.250	4.500	5.000	5.500	5.500	6.000
B	2.500	2.583	2.667	2.750	2.833	2.917	3.000	3.083	3.167	3.250	3.333	3.417	3.500	3.542	3.625	3.750	3.875
C	3.500	3.917	3.583	3.750	3.667	4.083	4.500	4.417	4.833	4.750	4.917	5.333	5.500	5.458	5.875	6.250	6.125
L	2.400	2.600	4.200	4.500	6.400	6.800	7.200	9.500	10.000	10.500	11.000	11.500	14.400	14.700	15.300	15.900	16.500
M	1.250	1.500	1.500	1.500	1.500	1.917	2.500	2.500	3.167	3.167	3.167	4.083	4.083	3.167	4.083	5.000	5.000
N	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.250	1.250	1.250	1.250	1.500	1.250	1.500	1.500	1.500
P	1.000	1.000	1.000	1.000	1.250	1.250	1.500	1.917	1.917	2.500	2.500	3.167	4.083	3.167	4.083	4.083	5.000
HOOK	0.833	0.833	1.000	1.000	1.167	1.167	1.167	1.333	1.333	1.583	1.583	1.583	1.833	1.833	2.000	2.000	2.000
A bars	5 @ 12	5 @ 12	6 @ 12	6 @ 12	7 @ 12	7 @ 12	7 @ 12	8 @ 12	8 @ 12	9 @ 12	9 @ 12	9 @ 12	10 @ 12	10 @ 12	11 @ 12	11 @ 12	11 @ 12
B bars	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12
C bars	5 @ 18	6 @ 18	6 @ 18	6 @ 18	6 @ 18	7 @ 18	8 @ 18	8 @ 18	8 @ 18	9 @ 18	9 @ 18	10 @ 18	10 @ 16	9 @ 16	10 @ 18	11 @ 18	11 @ 18
D bars	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	6 @ 18	5 @ 18	6 @ 18	6 @ 18	6 @ 18
E bars	4 @ 18	4 @ 18	4 @ 18	4 @ 18	5 @ 18	5 @ 18	6 @ 18	7 @ 18	7 @ 18	8 @ 18	8 @ 18	9 @ 18	10 @ 18	9 @ 18	10 @ 18	10 @ 18	11 @ 18

Quantities of Materials

Stem Concrete (yd ³ /ft)	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	2.0	2.1	2.1	2.3	2.4	2.6	2.7
Footing Concrete (yd ³ /ft)	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.3	1.4	1.4	1.5
Steel (lb/ft)	79	86	101	106	130	141	157	191	211	246	257	287	365	343	435	463	492
Q _{max} (psf)	4318	4614	5111	5210	5133	5412	5693	5616	5893	5824	5929	5558	5670	5733	5440	5695	5687

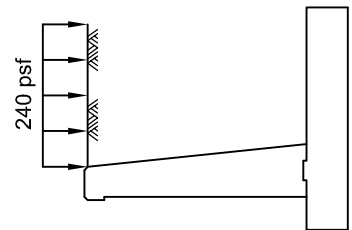
Maximum Soil Bearing Pressure

Notes:

1. All dimensions are in feet, unless specified otherwise.
2. Spacings of reinforcing bars are in inches.
3. Designer must confirm design parameters with Geotechnical Engineer prior to selecting wall for site.

ASSUMED DESIGN PARAMETERS

LOOSE FOUNDATION SOIL, LEVEL BACKFILL, SURCHARGE



1. BACKFILL LOADING CONDITIONS:

LEVEL BACKFILL;
240 psf LIVE LOAD SURCHARGE.

2. BACKFILL SOIL PROPERTIES:

TYPE: GRAVEL BORROW FOR
BACKFILLING STRUCTURES AND PIPES

ϕ = ANGLE OF INTERNAL FRICTION = 37°

δ = ANGLE OF WALL FRICTION = 22°

γ = EFFECTIVE UNIT WEIGHT = 120 pcf

3. FOUNDATION SOIL PROPERTIES:

q_t = FACTORED BEARING CAPACITY = 6000 psf

FRICTION FACTOR = 0.5

$\phi_{SLIDING}$ = PERFORMANCE FACTOR FOR SLIDING = 0.80

4. SEISMIC LOADING:

A = 0.17g (Max.)

K_h = 0.085

K_v = 0

5. REINFORCED CONCRETE:

F_c = 4000 psi

F_y = 60000 psi

(SEE MASSDOT SPECIFICATIONS
FOR DESIGN REQUIREMENTS)

CANTILEVER RETAINING WALLS ROCK FOUNDATION, SLOPING BACKFILL

TABLE OF DIMENSIONS AND REINFORCING STEEL

H	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0	30.0
W	8,500	9,000	9,000	9,500	10,000	10,500	11,000	11,500	12,000	13,000	13,500	14,000	14,500	15,000	15,500	16,000	16,500
T	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,500	2,500	2,500	2,500	2,500	2,500	3,000	3,000	3,500
A	1,500	2,000	2,500	3,000	3,000	3,500	3,500	4,000	4,500	4,500	4,500	5,000	5,000	5,500	5,500	6,000	6,000
B	2,500	2,583	2,667	2,750	2,833	2,917	3,000	3,083	3,125	3,208	3,292	3,375	3,458	3,542	3,583	3,667	3,708
C	4,500	4,417	3,833	3,750	4,167	4,083	4,500	4,417	4,375	5,292	5,708	5,625	6,042	5,958	6,417	6,333	6,792
L	3,600	3,900	5,600	6,000	8,000	8,500	9,000	11,400	11,700	12,300	12,900	13,500	16,450	17,150	17,500	18,200	18,550
M	1,917	1,917	1,917	1,917	1,917	1,917	2,500	2,500	1,917	3,167	4,083	4,083	5,000	5,000	5,000	5,000	5,000
N	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,250	1,000	1,250	1,250	1,250	1,250	1,250	1,500	1,250	1,500
P	1,000	1,000	1,250	1,917	1,917	2,500	2,500	3,167	3,167	3,167	4,083	4,083	5,000	5,000	5,000	5,000	5,000
HOOK	1,000	1,167	1,167	1,333	1,333	1,583	1,583	1,833	1,833	2,000	2,000	1,583	1,583	1,833	1,833	1,833	1,833
A bars	6 @ 12	7 @ 12	7 @ 12	8 @ 12	8 @ 12	9 @ 12	9 @ 12	10 @ 12	10 @ 12	11 @ 12	11 @ 12	9 @ 6	9 @ 6	10 @ 6	10 @ 6	10 @ 6	10 @ 6
B bars	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12
C bars	7 @ 18	7 @ 18	7 @ 18	7 @ 18	7 @ 18	7 @ 17	8 @ 18	8 @ 18	7 @ 17	9 @ 18	10 @ 18	10 @ 18	11 @ 18	11 @ 18	11 @ 18	11 @ 18	11 @ 18
D bars	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	5 @ 18	4 @ 18	5 @ 18	5 @ 18	5 @ 17	5 @ 18	5 @ 16	6 @ 18	5 @ 15	6 @ 17
E bars	4 @ 18	4 @ 18	5 @ 18	7 @ 18	7 @ 18	8 @ 18	8 @ 18	9 @ 18	9 @ 18	9 @ 18	10 @ 18	10 @ 17	11 @ 18	11 @ 16	11 @ 18	11 @ 15	11 @ 17

Quantities of Materials

Stern Concrete (yd ³ /ft)	0.9	0.9	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.3	2.4	2.5	2.7
Footing Concrete (yd ³ /ft)	0.6	0.7	0.7	0.7	0.7	0.8	0.8	0.9	1.1	1.2	1.3	1.3	1.3	1.4	1.7	1.8	2.1
Steel (lb/ft)	98	120	125	148	164	197	213	272	276	342	379	382	446	503	543	558	580

Maximum Soil Bearing Pressure

Q _{max} (psf)	5123	5161	5481	5530	6053	6103	6626	6677	6838	7053	7562	7625	8134	8197	8802	8870	9475
------------------------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

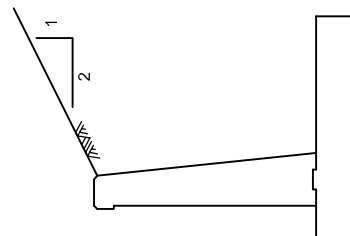
Notes:

1. All dimensions are in feet, unless specified otherwise.
2. Spacings of reinforcing bars are in inches.
3. Designer must confirm design parameters with Geotechnical Engineer prior to selecting wall for site.

ASSUMED DESIGN PARAMETERS

ROCK FOUNDATION, SLOPING BACKFILL

1. BACKFILL LOADING CONDITIONS:
2H:1V SLOPING BACKFILL
2. BACKFILL SOIL PROPERTIES:
TYPE: GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES
Ø = ANGLE OF INTERNAL FRICTION = 37°
δ = ANGLE OF WALL FRICTION = 22°
γ = EFFECTIVE UNIT WEIGHT = 120 pcf
3. FOUNDATION SOIL PROPERTIES:
q_f = FACTORED BEARING CAPACITY = 20000 psf
FRICTION FACTOR = 0.70
Ø_{SLIDING} = PERFORMANCE FACTOR FOR SLIDING = 0.80
4. SEISMIC LOADING:
A = 0.17g (Max.)
Kh = 0.085
Kv = 0
5. REINFORCED CONCRETE:
F'_c = 4000 psi
F_y = 60000 psi
(SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)



CANTILEVER RETAINING WALLS ROCK FOUNDATION, LEVEL BACKFILL, SURCHARGE

DATE OF ISSUE
JUNE 2014

DRAWING NUMBER
E 305.7.0

TABLE OF DIMENSIONS AND REINFORCING STEEL

	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0	30.0
H																	
W	7,000	7,500	8,000	8,500	9,000	9,000	9,500	10,000	10,500	11,000	11,000	11,500	12,000	12,500	13,000	13,000	13,500
T	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,500	2,500
A	2,500	2,500	2,500	2,500	3,000	3,000	3,000	3,000	3,500	3,500	3,500	4,000	4,000	4,000	4,500	4,500	4,500
B	2,500	2,583	2,667	2,750	2,833	2,917	3,000	3,083	3,167	3,250	3,333	3,417	3,500	3,583	3,667	3,708	3,792
C	2,000	2,417	2,833	3,250	3,167	3,083	3,500	3,917	3,833	4,250	4,167	4,083	4,500	4,917	4,833	4,792	5,208
L	2,400	2,600	4,200	4,500	6,400	6,800	7,200	9,500	10,000	10,500	11,000	13,800	14,400	15,000	15,600	15,900	16,500
M	1,000	1,000	1,000	1,250	1,250	1,250	1,500	1,917	1,917	2,500	2,500	2,500	3,167	4,083	4,083	3,167	4,083
N	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,250	1,250	1,250	1,250	1,250	1,250
P	1,250	1,250	1,250	1,250	1,500	1,500	1,917	1,917	2,500	2,500	2,500	3,167	4,083	4,083	5,000	4,083	4,083
HOOK	0.833	1,000	1,000	1,000	1,000	1,167	1,333	1,333	1,333	1,583	1,583	1,833	1,833	1,833	2,000	2,000	2,000
A bars	5 @ 12	6 @ 12	6 @ 12	6 @ 12	6 @ 12	7 @ 12	8 @ 12	8 @ 12	8 @ 12	9 @ 12	9 @ 12	10 @ 12	10 @ 12	10 @ 12	10 @ 12	11 @ 12	11 @ 12
B bars	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12
C bars	4 @ 18	4 @ 18	4 @ 16	5 @ 18	5 @ 18	5 @ 18	6 @ 18	7 @ 18	7 @ 18	8 @ 18	8 @ 18	8 @ 18	9 @ 18	10 @ 18	10 @ 18	9 @ 18	10 @ 18
D bars	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18
E bars	5 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	6 @ 18	7 @ 18	7 @ 18	8 @ 18	8 @ 18	8 @ 18	9 @ 18	10 @ 18	10 @ 18	11 @ 18	10 @ 18	10 @ 18

Quantities of Materials

Stem Concrete (yd³/ft)	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	2.0	2.1	2.2	2.4	2.5	2.6	2.7
Footing Concrete (yd³/ft)	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.2	1.3
Steel (lb/ft)	76	85	96	104	118	133	176	182	198	233	240	307	340	360	388	412	438

Maximum Soil Bearing Pressure

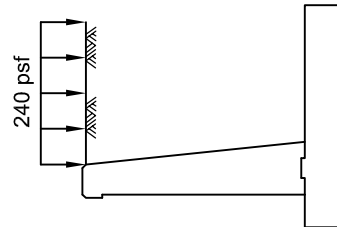
Q_{max} (psf)	4071	4328	4591	4860	4811	5491	5752	6018	5945	6208	6917	6833	7090	7352	7271	8079	8332
------------------------------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

Notes:

1. All dimensions are in feet, unless specified otherwise.
2. Spacings of reinforcing bars are in inches.
3. Designer must confirm design parameters with Geotechnical Engineer prior to selecting wall for site.

ASSUMED DESIGN PARAMETERS

ROCK FOUNDATION, LEVEL BACKFILL, SURCHARGE



1. BACKFILL LOADING CONDITIONS:

LEVEL BACKFILL;
240 psf LIVE LOAD SURCHARGE.

2. BACKFILL SOIL PROPERTIES:

TYPE: GRAVEL BORROW FOR
BACKFILLING STRUCTURES AND PIPES
Ø = ANGLE OF INTERNAL FRICTION = 37°

δ = ANGLE OF WALL FRICTION = 22°

γ = EFFECTIVE UNIT WEIGHT = 120 pcf

3. FOUNDATION SOIL PROPERTIES:

q_l = FACTORED BEARING CAPACITY = 20000 psf

FRICTION FACTOR = 0.70

Ø_{SLIDING} = PERFORMANCE FACTOR FOR SLIDING = 0.80

4. SEISMIC LOADING:

A = 0.17g (Max.)

Kh = 0.085

Kv = 0

5. REINFORCED CONCRETE:

F'_c = 4000 psi

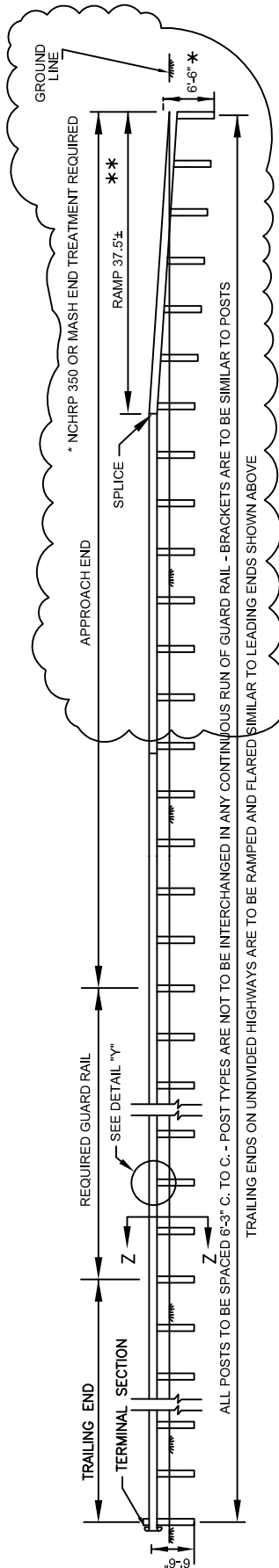
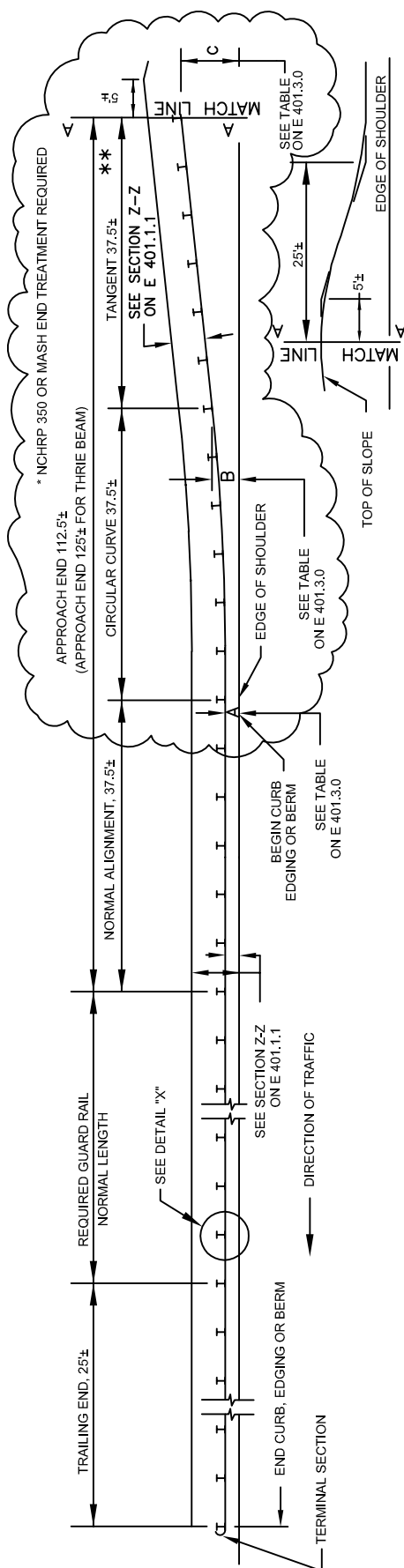
F_y = 60000 psi

(SEE MASSDOT SPECIFICATIONS
FOR DESIGN REQUIREMENTS)

STEEL W BEAM HIGHWAY GUARD

DATE OF ISSUE
JUNE 2014

DRAWING NUMBER
E 401.1.0

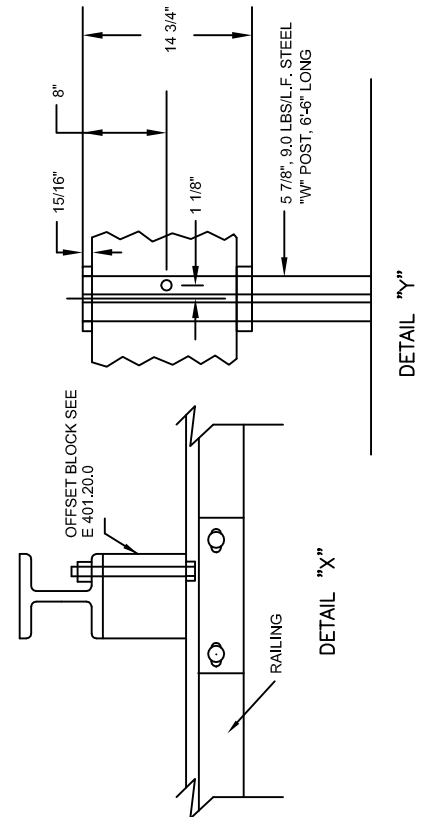


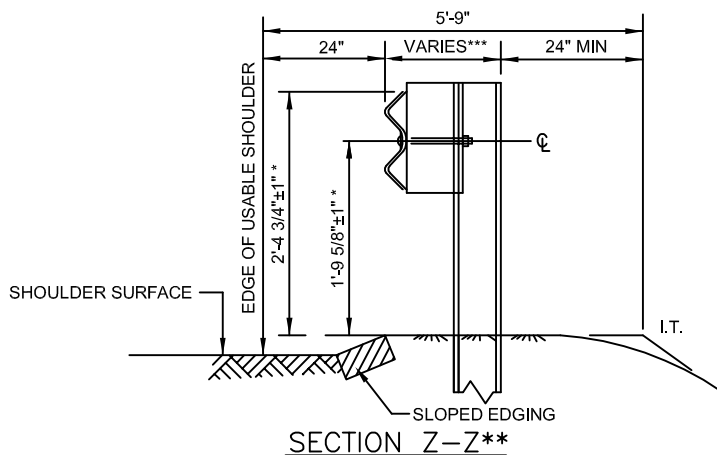
NCHRP 350 TEST LEVEL 3 OR MASH COMPLIANT GUARDRAIL
TERMINAL SECTIONS ON ALL ROADWAYS WITH DESIGN
SPEED OF 50 MPH OR GREATER.
BURIED ENDS ONLY FOR ROADWAYS WITH SPEEDS LESS
THAN 50 MPH.

* STANDARD LENGTH POST TO BE USED IN RAMPED SECTIONS.
** 50' FOR THRIE BEAM.

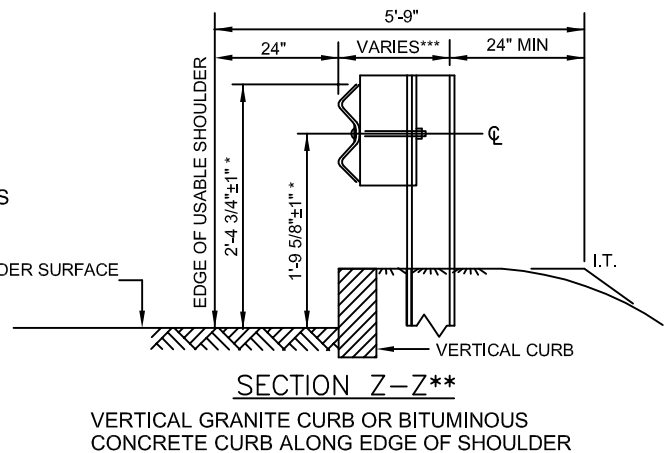
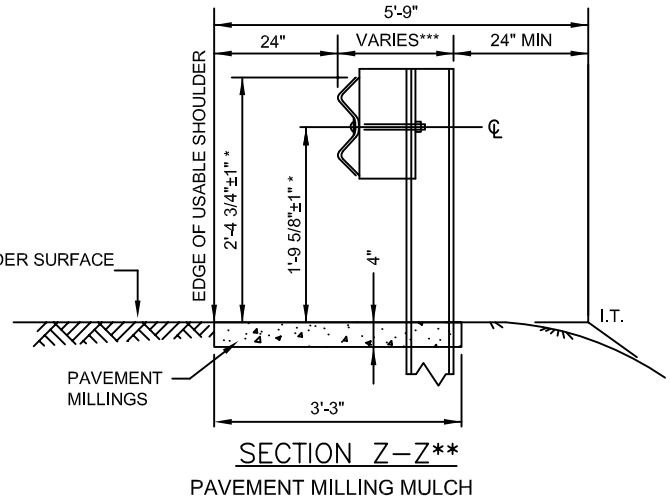
NOTES:

1. THIS METHOD OF INSTALLATION IS APPLICABLE WHEN THE EMBANKMENT SLOPE ADJACENT TO THE ROADWAY IS 1V:2H OR STEEPER.
2. WHEN PLACED IN MEDIAN, CHANGE TO THRIE BEAM AND HEIGHT 2-8 1/2"±1". FOR SECTION Z-Z, (NOTE 5 HEIGHT IS ALWAYS 21 1/2")
3. LENGTHS OF HIGHWAY GUARD SHOWN ARE MEASUREMENTS ALONG THE FACE OF THE RAILING.
4. OTHER DETAILS ARE SHOWN ON E 401.5.0 - E 401.10.0
5. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHODS SEE STANDARD SPECIFICATIONS.
6. DETAILS SHOWN HERE ALSO APPLY TO THRIE BEAM GUARD RAIL EXCEPT AS OTHERWISE NOTED.

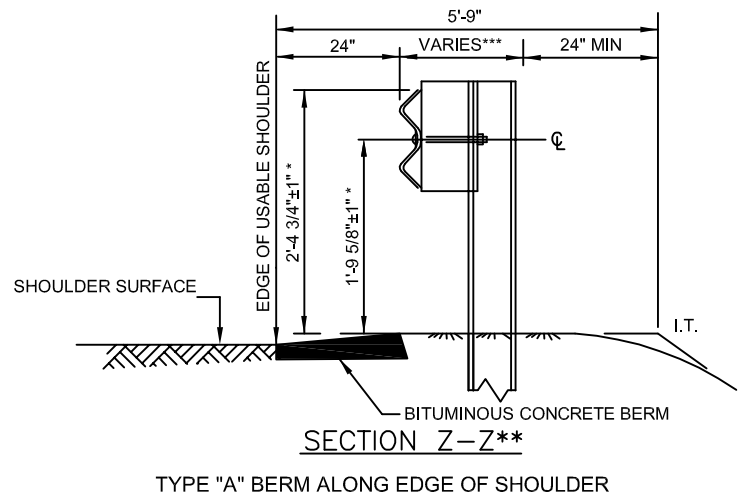




SLOPED EDGING ALONG EDGE OF SHOULDER AND RAMP
SEE E 106.5.0 FOR DETAILS OF SETTING SLOPED EDGING



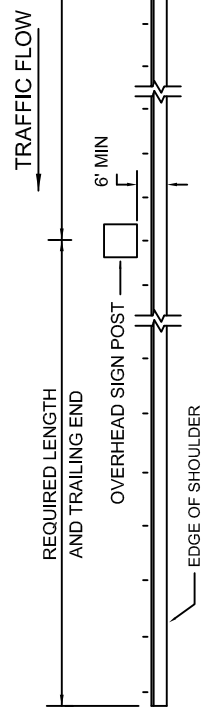
- * WHEN PLACED IN MEDIAN, CHANGE TO
THREE BEAM AND HEIGHT TO TOP OF RAIL TO
2'-8 1/2" ± 1".
- ** SEE E 401.1.0 FOR SECTION Z-Z LOCATION
- *** VARIES ACCORDING TO POST MATERIAL



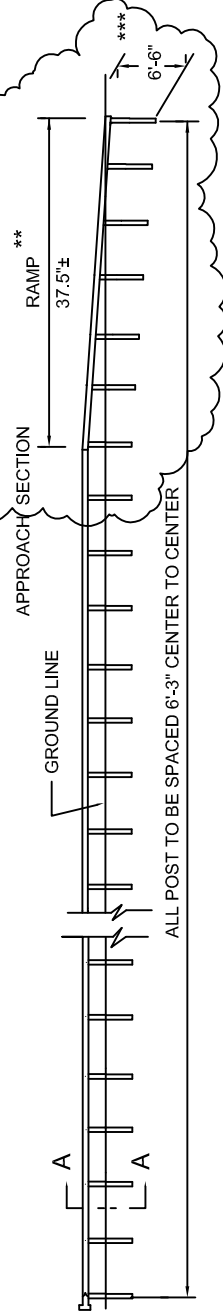
INSTALLATION FOR STEEL W BEAM HIGHWAY GUARD FOR SIGN PROTECTION

DATE OF ISSUE
JUNE 2014

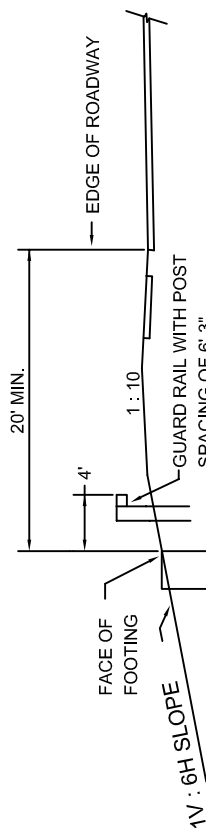
DRAWING NUMBER
E 401.2.0



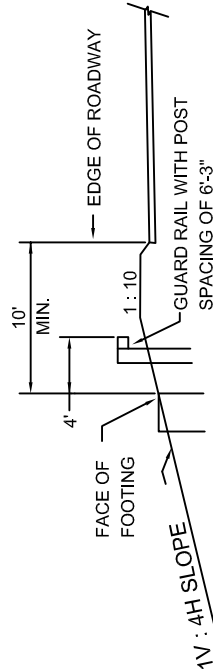
PLAN VIEW



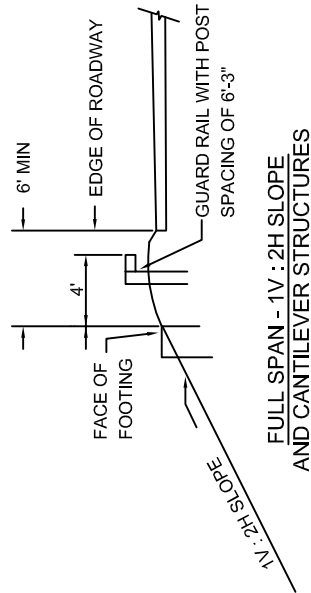
ELEVATION VIEW



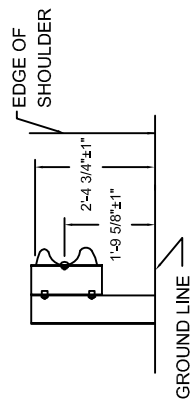
FULL SPAN - 1V : 6H SLOPE



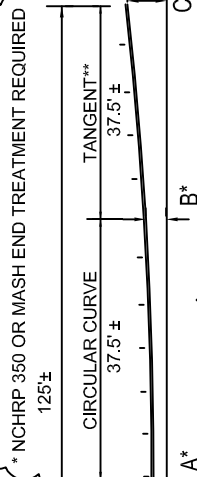
FULL SPAN - 1V : 4H SLOPE



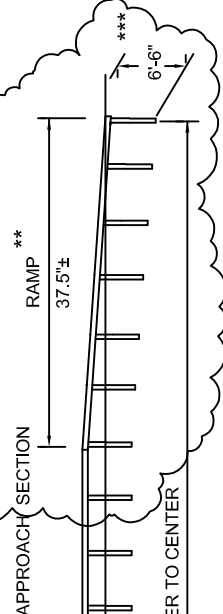
FULL SPAN - 1V : 2H SLOPE
AND CANTILEVER STRUCTURES



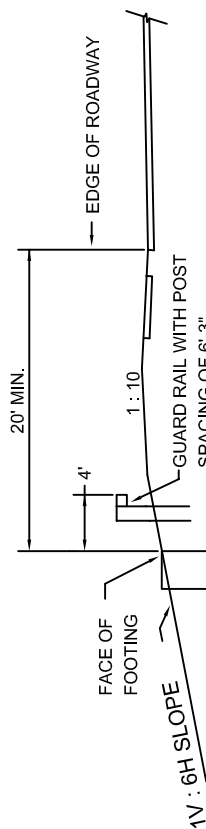
SECTION A-A



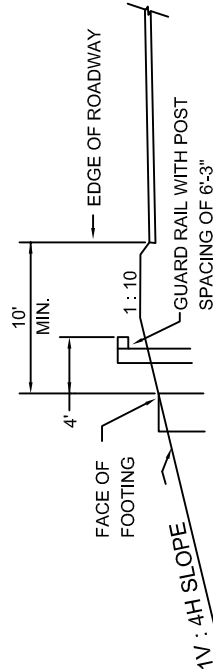
PLAN VIEW



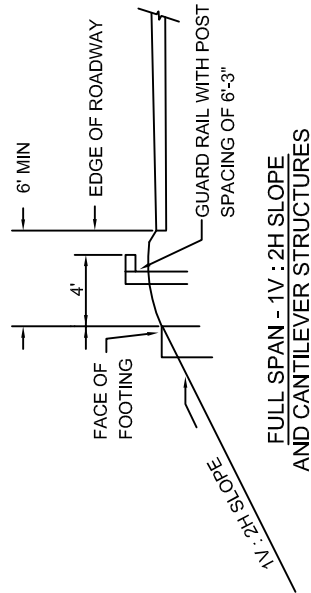
ELEVATION VIEW



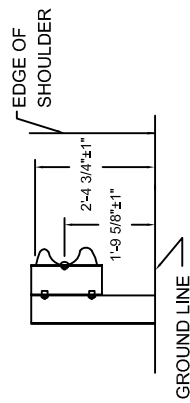
FULL SPAN - 1V : 6H SLOPE



FULL SPAN - 1V : 4H SLOPE



FULL SPAN - 1V : 2H SLOPE
AND CANTILEVER STRUCTURES



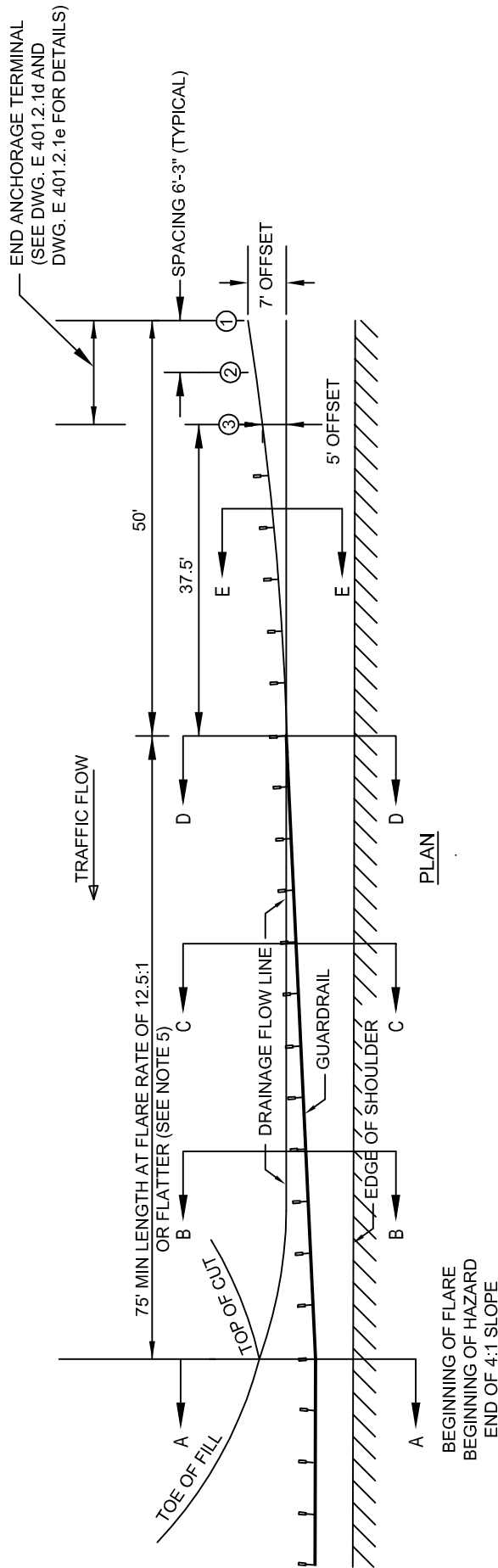
SECTION A-A

- * SEE TABLE ON E 401.3.0 FOR DIMENSIONS
- ** 50' FOR THRIE BEAM
- *** STANDARD LENGTH POSTS SHALL BE USED IN RAMPED SECTIONS

NOTES:

1. LENGTHS OF HIGHWAY GUARD SHOWN ARE MEASUREMENTS ALONG FACE OF RAILING.
2. FOR DESCRIPTIONS, MATERIAL AND AND CONSTRUCTION METHODS, SEE THE STANDARD SPECIFICATIONS AND CONSTRUCTION E 401.1.0 AND E 401.5.0 - E 401.10.0.
3. DETAILS SHOWN HEREIN ALSO APPLY TO THRIE BEAM GUARD RAIL, EXCEPT AS OTHERWISE NOTED.
4. WHEN PLACED IN MEDIAN, CHANGE TO THRIE BEAM & HEIGHT OF 2'-6 1/2" ± 1"

STEEL W BEAM HIGHWAY GUARD BURIED IN BACK-SLOPE PLAN VIEW

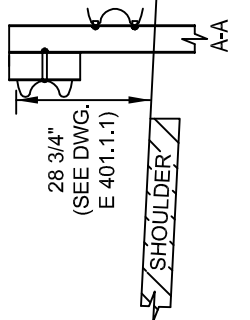


NOTES:

1. THE BOTTOM RAIL SHALL BE TUCKED BEHIND AND BOLTED TO POST A-A USING TWO (2) 5/8" DIA. X 1 1/2" LONG HEX. HEAD BOLT THROUGH THE UPPER AND LOWER PORTION OF THE RAIL.
2. THE BOTTOM RAIL SHALL BE BOLTED TO THE REMAINING POSTS (OTHER THAN POST 1, 2, & 3) WITH A SINGLE 5/8" DIA. X 1 1/2" LONG HEX. HEAD BOLT THROUGH THE MIDDLE OF THE RAIL ELEMENT. (FOR ATTACHMENT TO POST 3 DETAILS SEE DWG. E 401.2.1e)
3. OFFSET BLOCKS ARE NOT REQUIRED FOR THE BOTTOM RAIL.
4. MAINTAIN HEIGHT OF TOP RAIL RELATIVE TO EDGE OF SHOULDER UNTIL A MAXIMUM HEIGHT OF 45" ABOVE GROUND IS REACHED, THEN TOP OF GUARD RAIL BECOMES PARALLEL TO GROUND.
5. LOW SPEED (45 MPH OR LESS) INSTALLATIONS REQUIRE 50' OF GUARDRAIL USING A 9:1 FLARE RATE.
6. THIS END TREATMENT IS ONLY APPLICABLE WHERE THERE IS A 1:4 OR FLATTER FORE-SLOPE BETWEEN THE ROADWAY AND THE CUT-SLOPE.

4:1 OR STEEPER

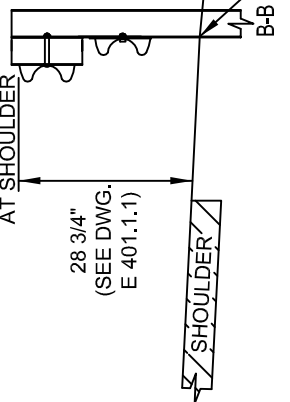
FLARE BEGINS AT
POST A-A ADD 2ND RAIL
AND USE 8' POSTS (EXCEPT POSTS 1, 2, AND 3)



SECTION A-A

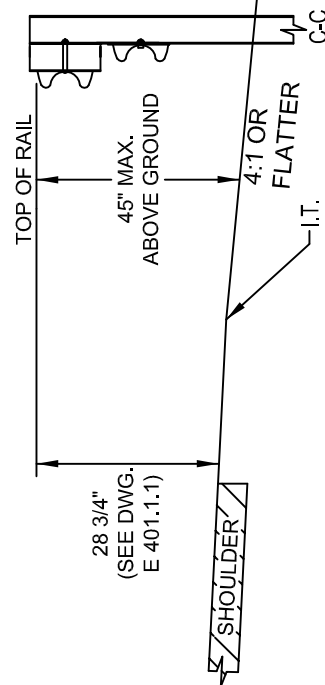
4:1 OR STEEPER

TOP OF RAIL
LESS THAN 45"
ABOVE GROUND



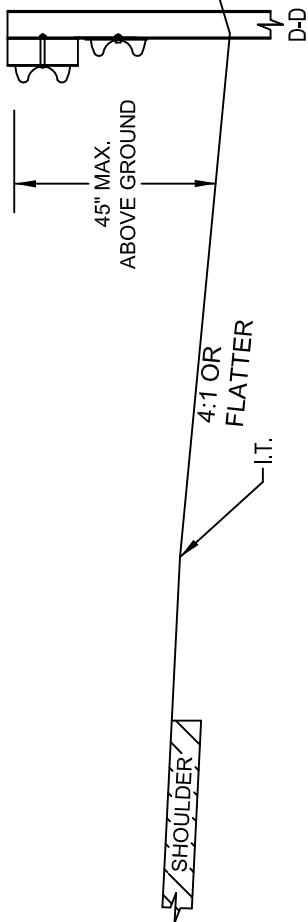
SECTION B-B

4:1 OR STEEPER



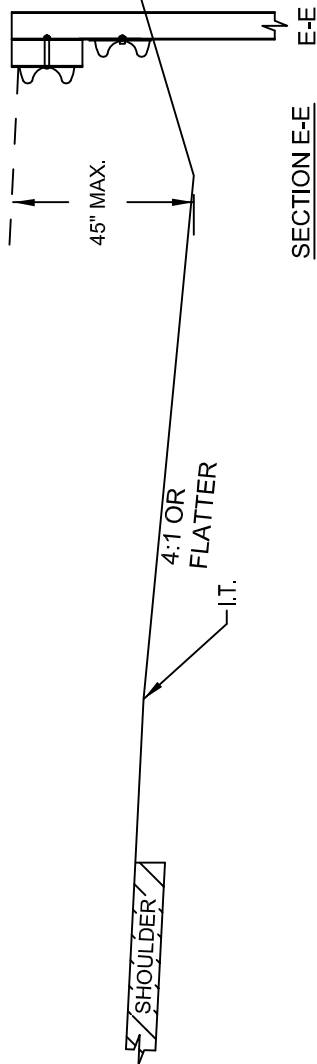
SECTION C-C

4:1 OR STEEPER



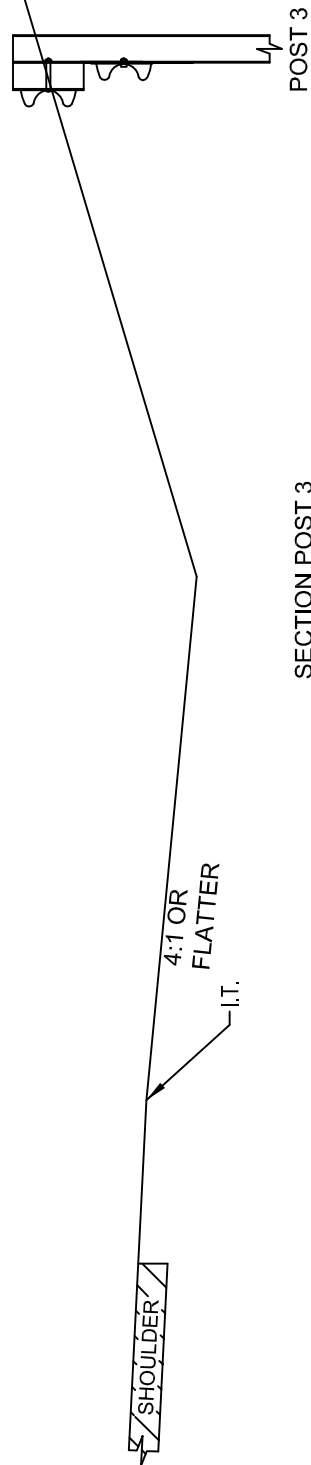
SECTION D-D

4:1 OR STEEPER

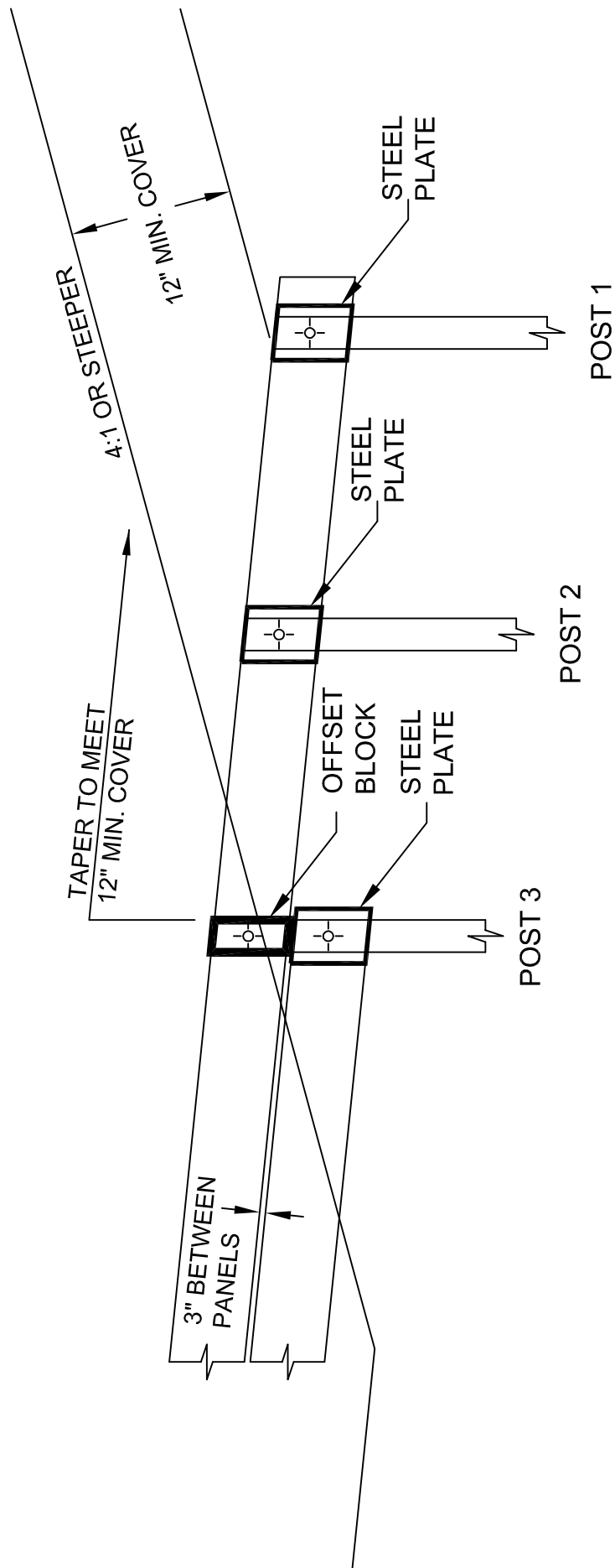


SECTION E-E

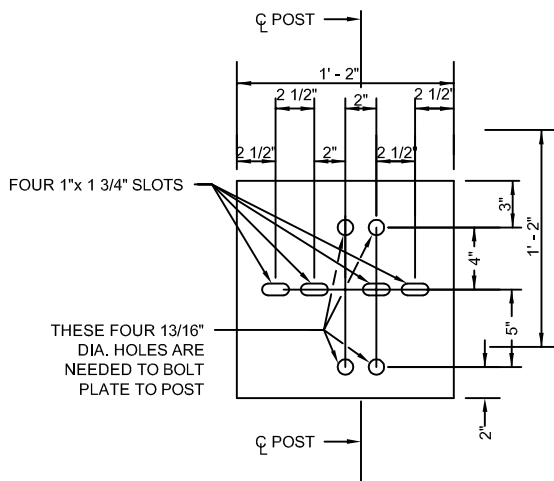
4:1 OR STEEPER



SECTION POST 3

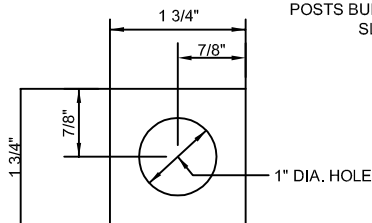


NOTE: FOR BOLTING AND PLATE DETAILS SEE DWG. E 401.2.1e



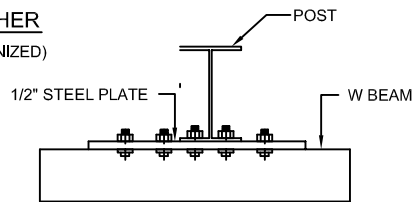
1/2" STEEL PLATE VIEW

(GALVANIZED)
BOLTED TO THE LAST THREE
POSTS BURIED IN BACK
SLOPE



SQUARE WASHER

(3/16" THICK GALVANIZED)



PLAN VIEW

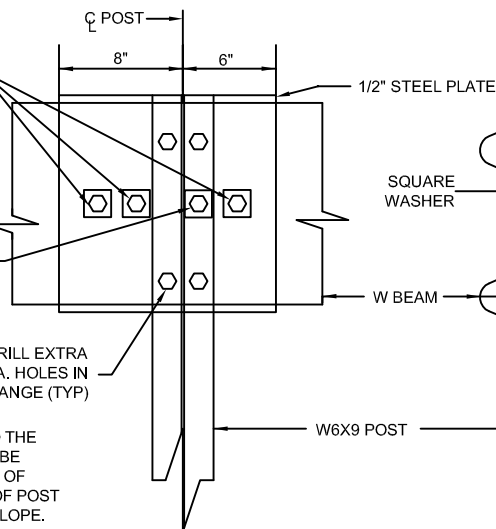
(BOLTED)

ALL BOLTS, NUTS AND WASHERS
ARE TO BE GALVANIZED

THREE 1" DIA. HOLES TO BE
FIELD DRILLED IN W BEAM
ELEMENT AND ATTACHED WITH
5/8" DIA. HEX. HEAD BOLTS 2"
LONG EACH WITH ONE SQUARE
WASHER AND HEX NUT

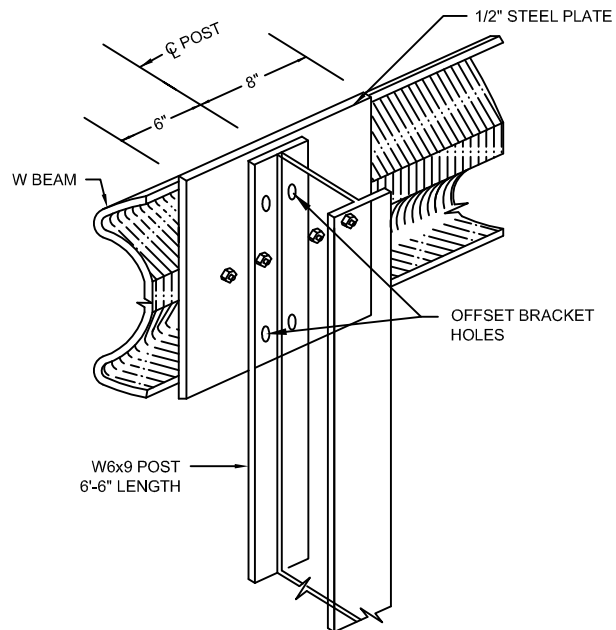
1" DIA. HOLE TO BE FIELD DRILLED
THROUGH W BEAM AND THROUGH
POST FLANGE. ALL BOLTS
ATTACHING PLATE TO FLANGE
WILL BE 5/8" DIA. HEX. HEAD BOLT
2 1/4" LONG WITH ONE SQUARE
WASHER AND HEX. NUT

DRILL EXTRA
13/16" DIA. HOLES IN
POST FLANGE (TYP)

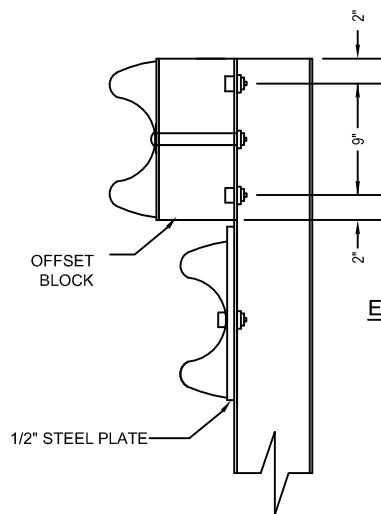


FRONT VIEW

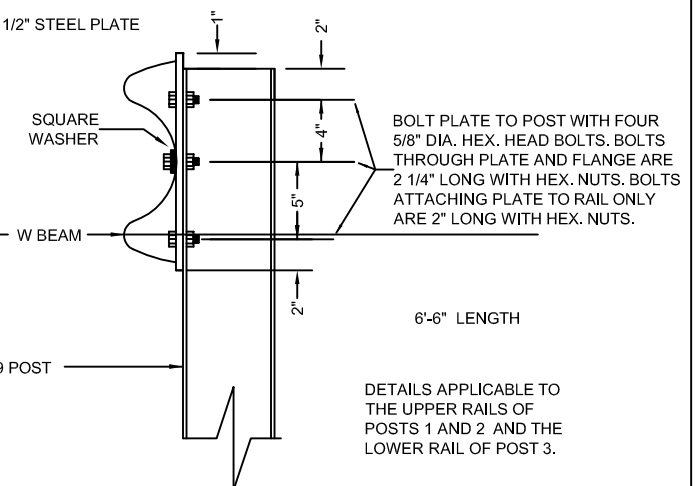
1/2" STEEL PLATE BOLTED TO POST



1/2" STEEL PLATE ATTACHED TO POST



END VIEW OF POST 3



END VIEW

DETAILS APPLICABLE TO
THE UPPER RAILS OF
POSTS 1 AND 2 AND THE
LOWER RAIL OF POST 3.

NOTES:

1. THE 1/2" STEEL PLATE SHALL CONFORM TO THE REQUIREMENTS OF A-36. THE PLATE SHALL BE BOLTED TO THE POST FOR THE UPPER RAIL OF POSTS 1 AND 2 AND FOR THE LOWER RAIL OF POST 3. POSTS 1 AND 2 ARE BURIED IN THE CUT SLOPE.
2. FIELD DRILLED HOLES SHALL BE COATED WITH ZINC RICH PAINT.

TYPICAL INSTALLATION*

	A	B	C	
			W SECTION	THRIE BEAM
ALL GUARDRAIL CONFIGURATION SHOWN ON E 401.1.1 SECTION Z-Z	24" ±	3'-3" ±	6'-6" ±	7'-7" ±

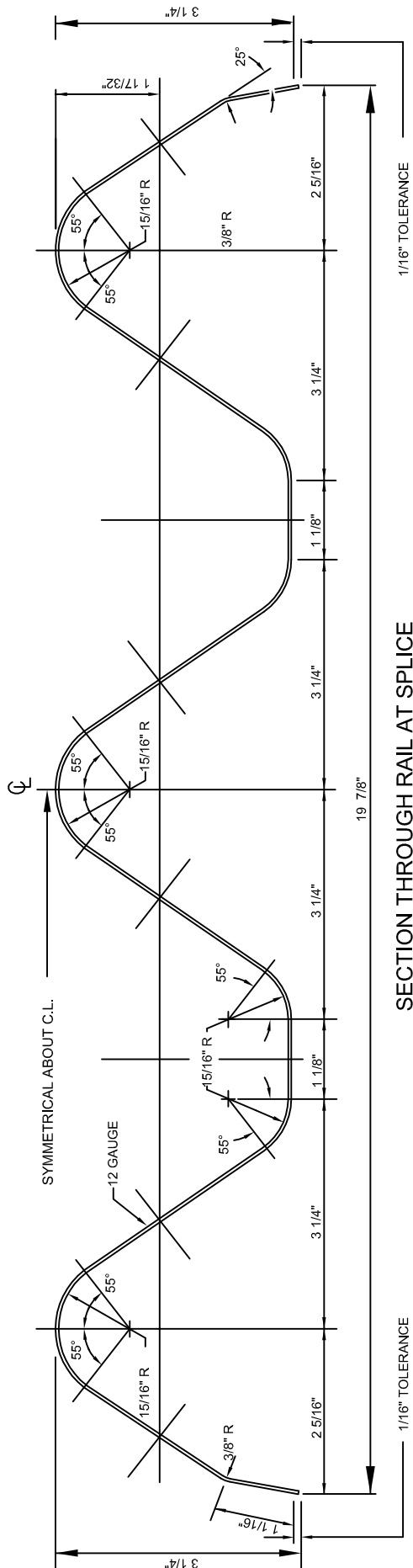
NOTE: ALL MEASUREMENTS ARE FROM EDGE OF USABLE SHOULDER

FOR OVERHEAD SIGN PROTECTION**

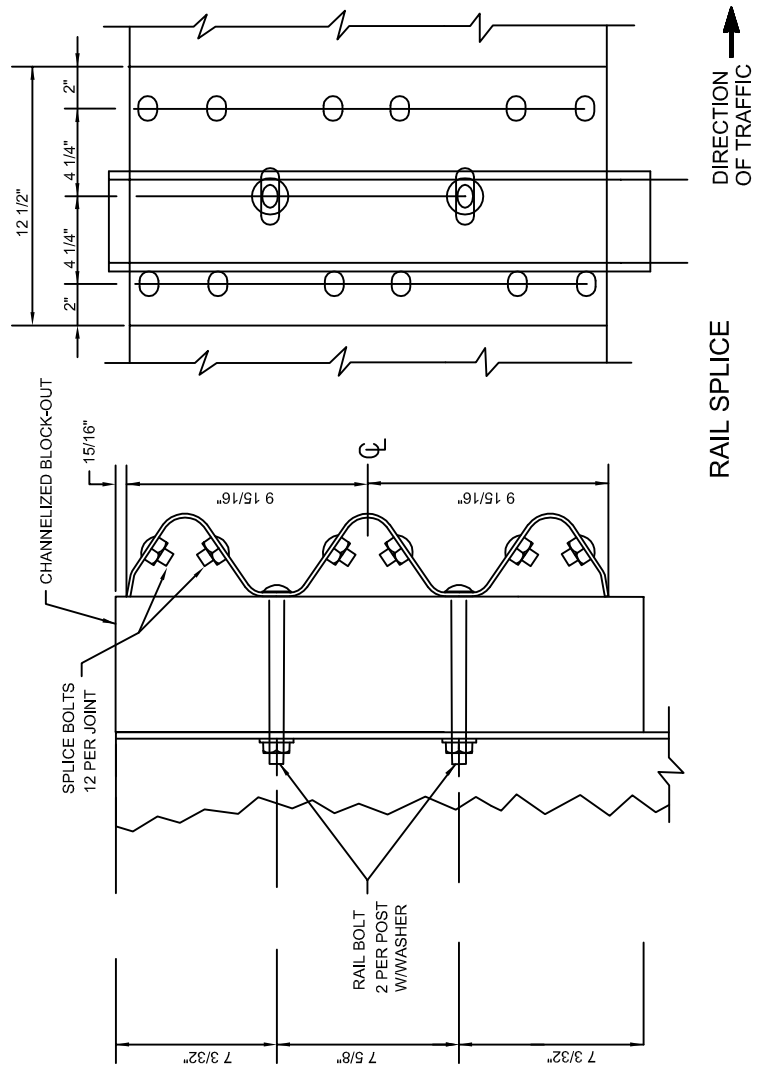
	A	B	C	
			W SECTION	THRIE BEAM
1V : 2H SLOPE 2:1 SLOPE	24" ±	3'-3" ±	6'-6" ±	7'-7" ±
1V : 4H SLOPE 4:1 SLOPE	6'-0" ±	7'-9" ±	11'-0" ±	12'-1" ±
1V : 6H SLOPE 6:1 SLOPE	16'-0" ±	17'-9" ±	21'-0" ±	22'-1" ±

* SEE E 401.1.0

** SEE E 401.2.0



SECTION THROUGH RAIL AT SPLICE

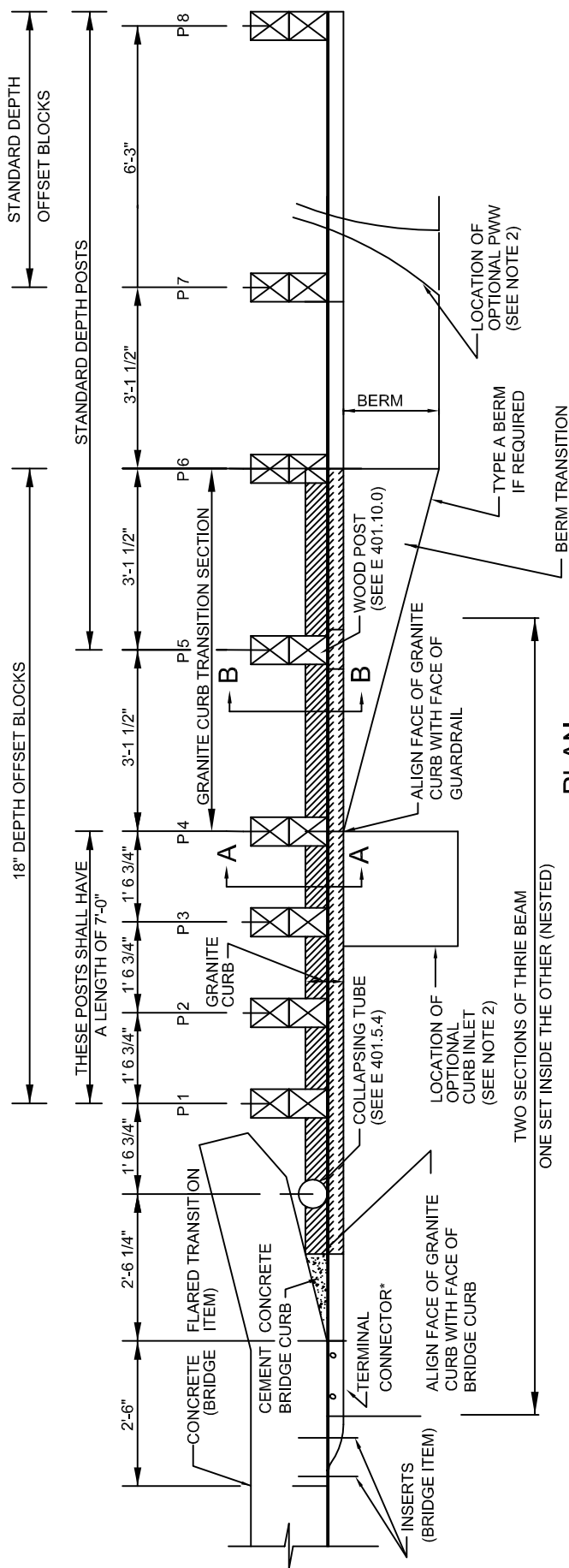


- NOTES:
1. FOR POST & BLOCK-OUT DETAILS
SEE E 401.6.0R AND E 401.21.0
 2. FOR HARDWARE DETAILS
SEE E 401.7.0R
 3. LAP DOWN STREAM IN
DIRECTION OF TRAFFIC

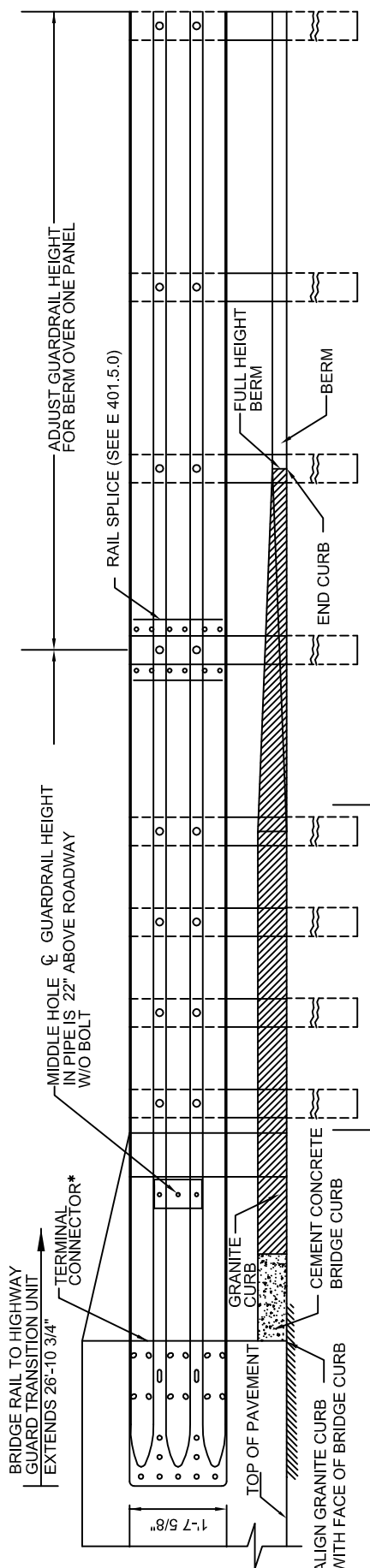
BRIDGE RAIL TO HIGHWAY GUARD TRANSITION

DATE OF ISSUE
JUNE 2014

DRAWING NUMBER
E 401.5.1



PLAN



ELEVATION

THESE POSTS SHALL HAVE A LENGTH OF 7'-0"

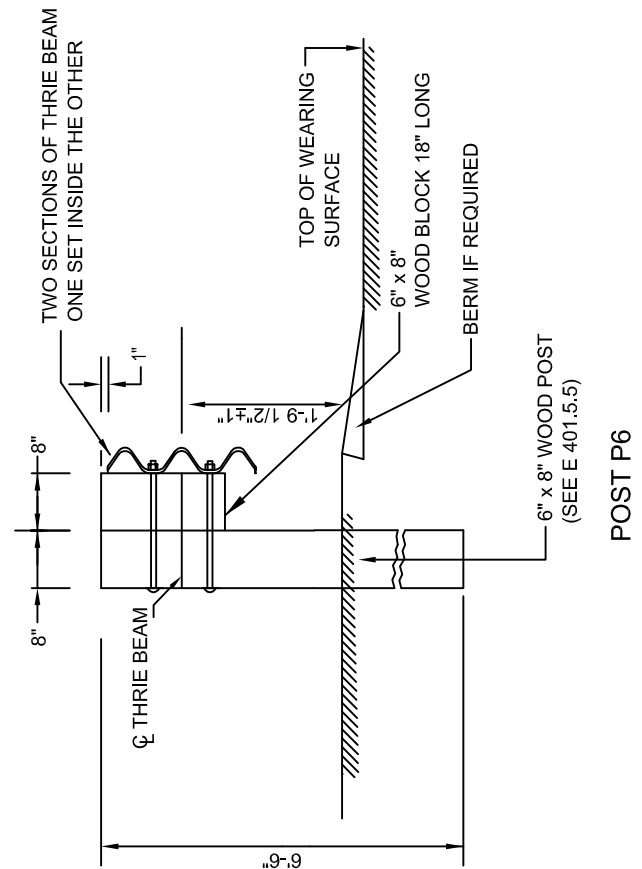
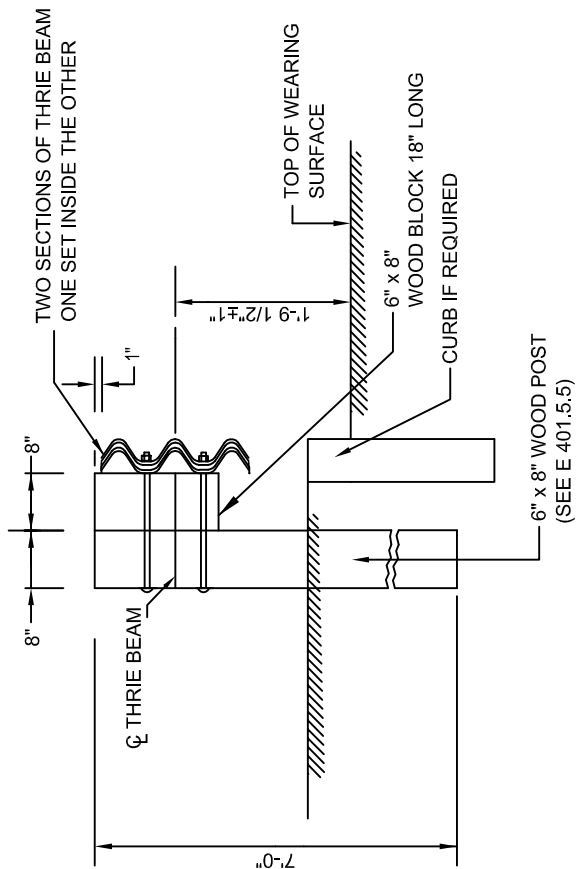
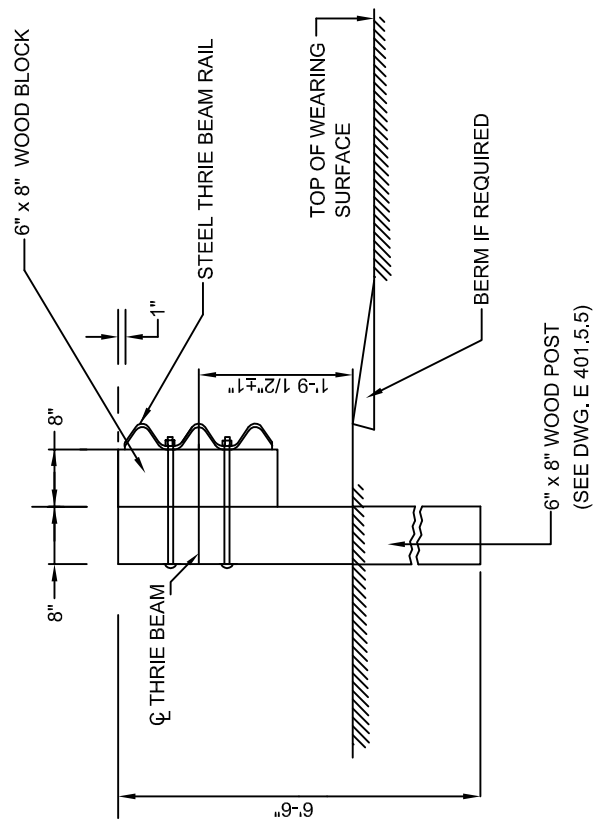
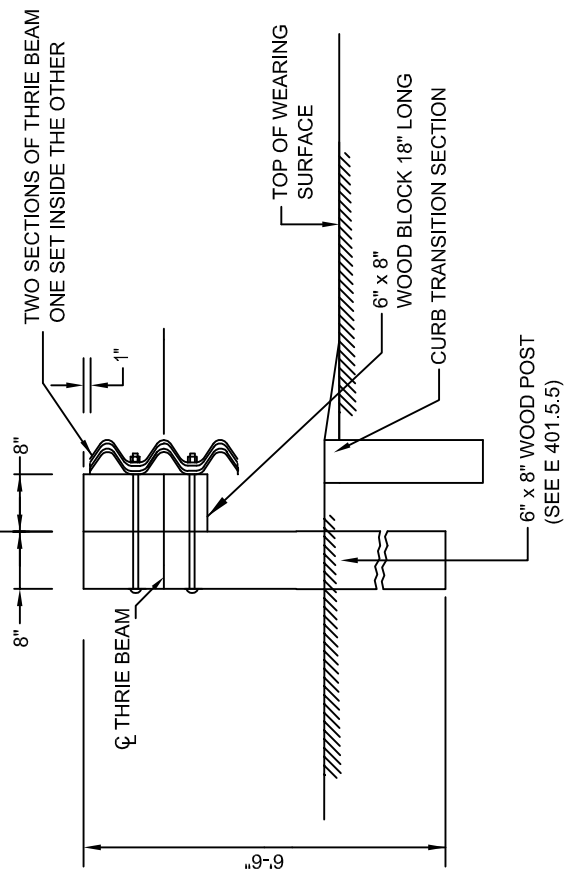
NOTES: 1. CURB INLET OR PWMW OPTIONAL
BASED ON GENERAL PLAN REQUIREMENTS

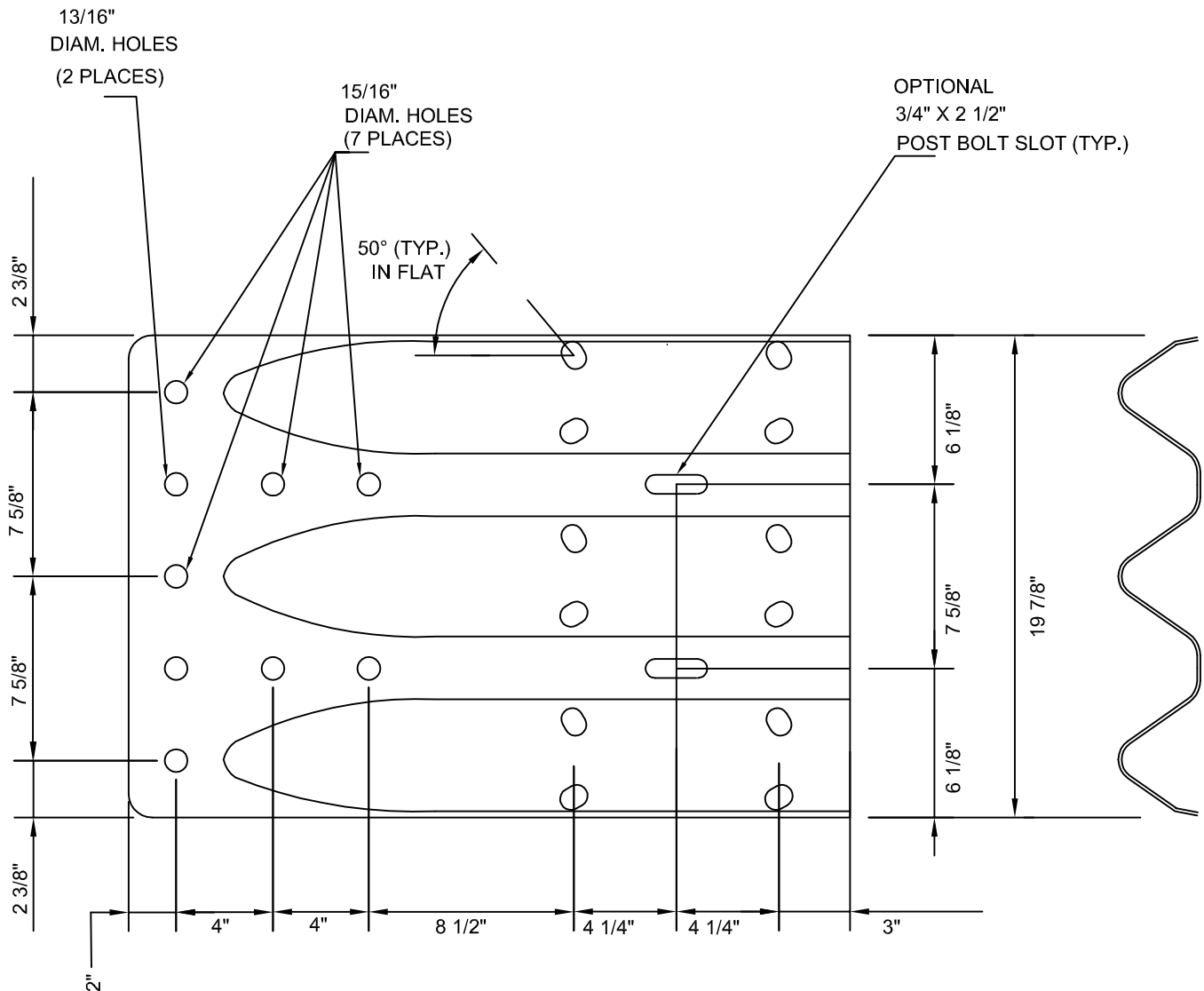
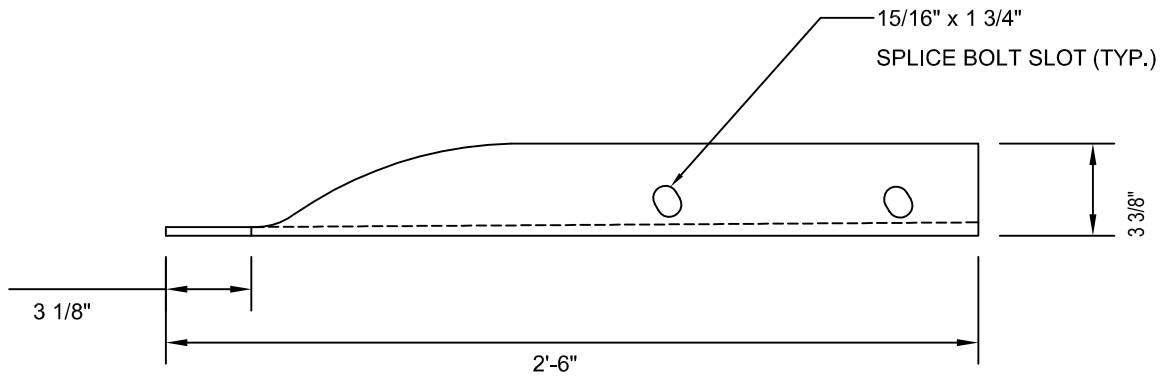
2. FOR SECTIONS A-A AND B-B, SEE E 401.5.2

3. THRIE BEAM TO W BEAM TRANSITION RAIL (SEE E401.6.1) IS
TYPICALLY PLACED OUTSIDE BRIDGE RAIL TO HIGHWAY GUARD
TRANSITION UNIT LENGTH, (26'-10 3/4") AT OR BEYOND POST P8.

4. TRANSITION FROM THRIE BEAM IS ALLOWED FROM P5 TO P7 IF REQUIRED BY SITE CONSTRAINTS.
PAYMENT FOR THE TRANSITION ELEMENT IS INCLUDED IN THIS ITEM IN THAT CASE.

* SEE E 401.5.3 FOR TERMINAL
CONNECTOR DIMENSIONS AND DETAILS

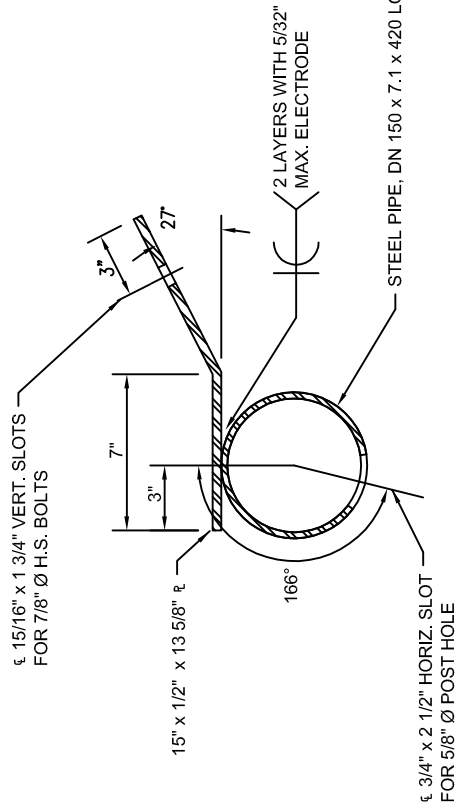




NOTES: 1. BASE METAL THICKNESS = 1/8" (10 GAGE)
2. SEE E 401.4.1

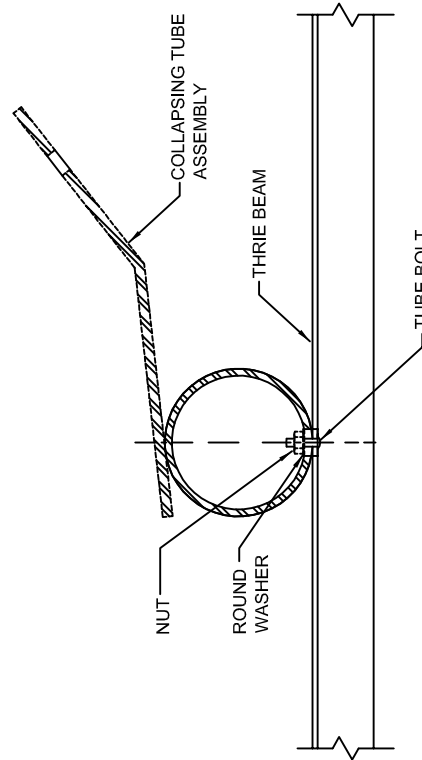
15/16" x 1 3/4" VERT. SLOTS
FOR 7/8" Ø H.S. BOLTS

15/16" x 1 3/4" VERT. SLOTS
FOR 7/8" Ø H.S. BOLTS

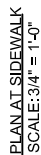


NOTE:
BENT PLATE/PIPE ASSEMBLY SHALL
BE HOT DIP GALVANIZED

COLLAPSING TUBE ASSEMBLY



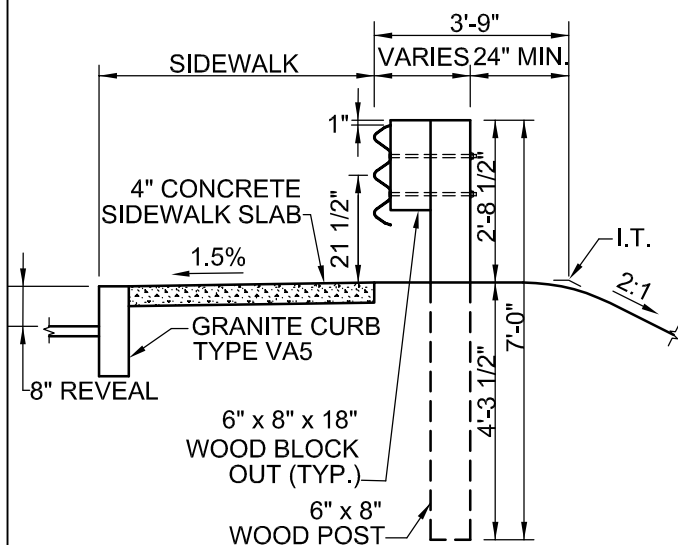
RAIL/TUBE CONNECTION



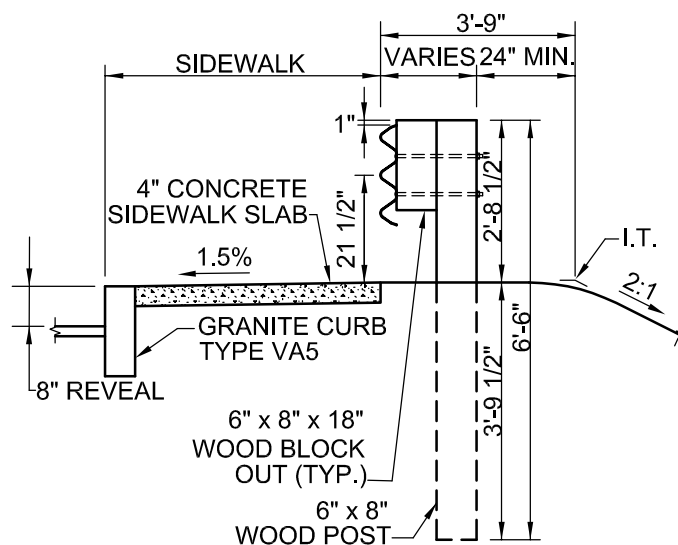
ELEVATION AT SIDEWALK
SCALE: 3/4" = 1' - 0"



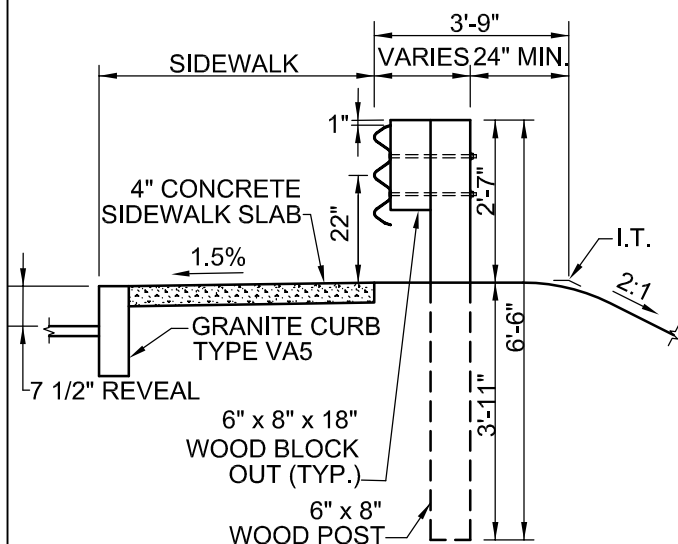
DATE OF ISSUE	JUNE 2014
DRAWING NUMBER	E 401.5.5



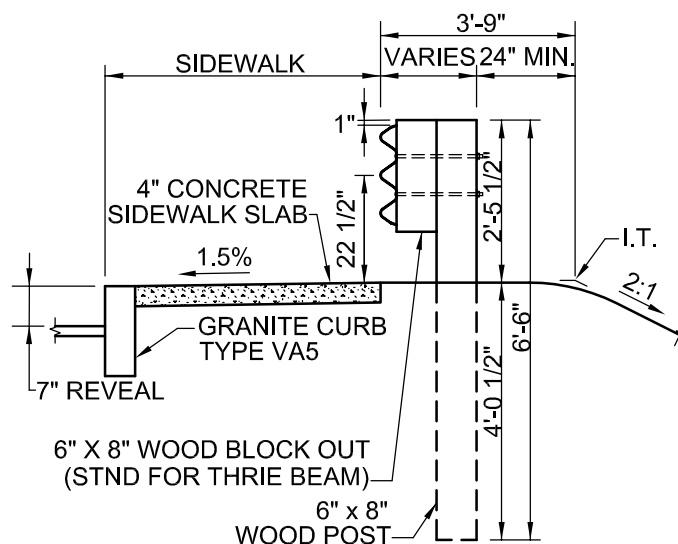
THRIE BEAM POSTS 1-4



THRIE BEAM POST 5



W TO THRIE BEAM TRANSITION POST 6

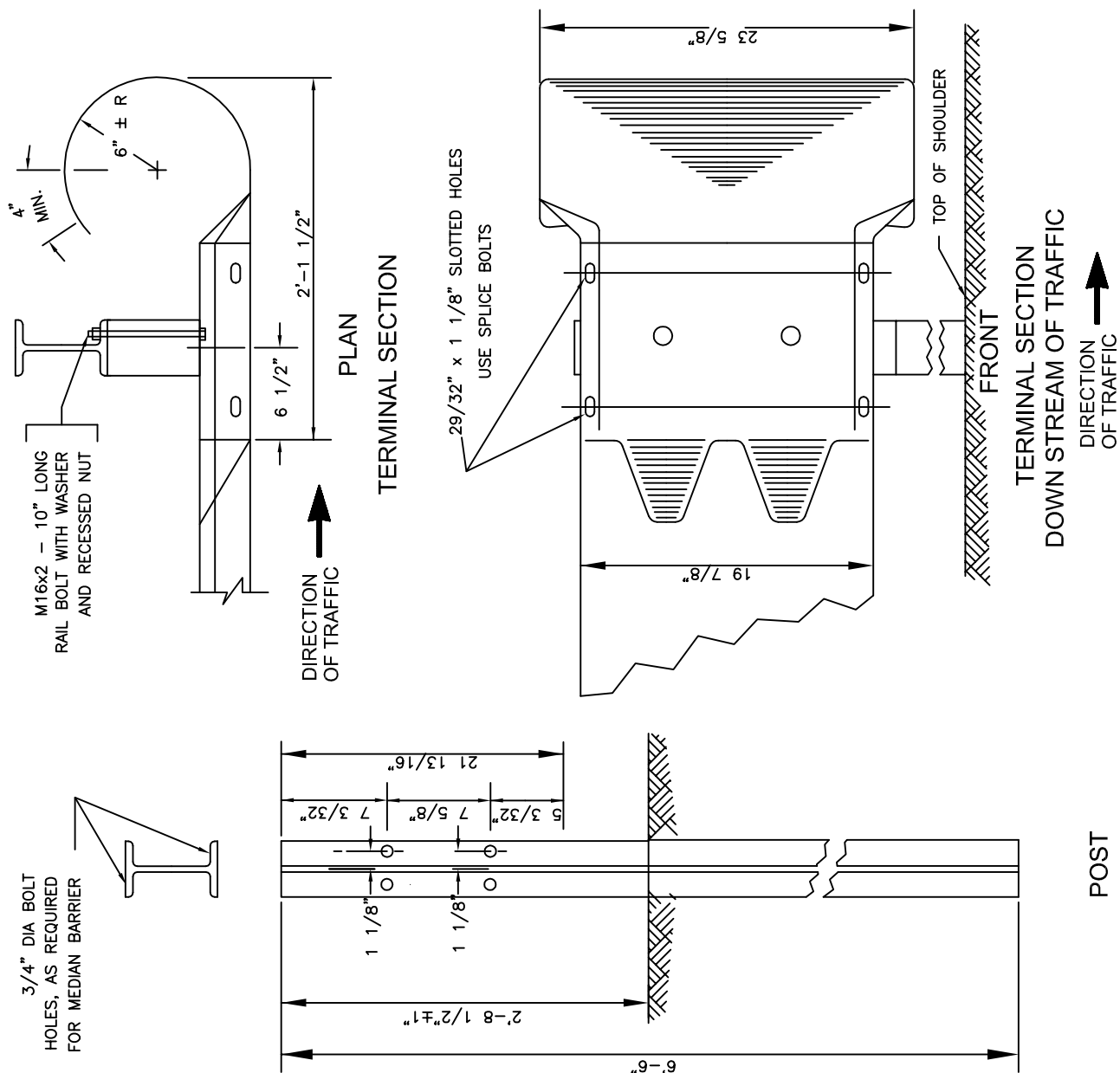


W-BEAM POST 7

STEEL THRIE BEAM HIGHWAY GUARD DETAILS

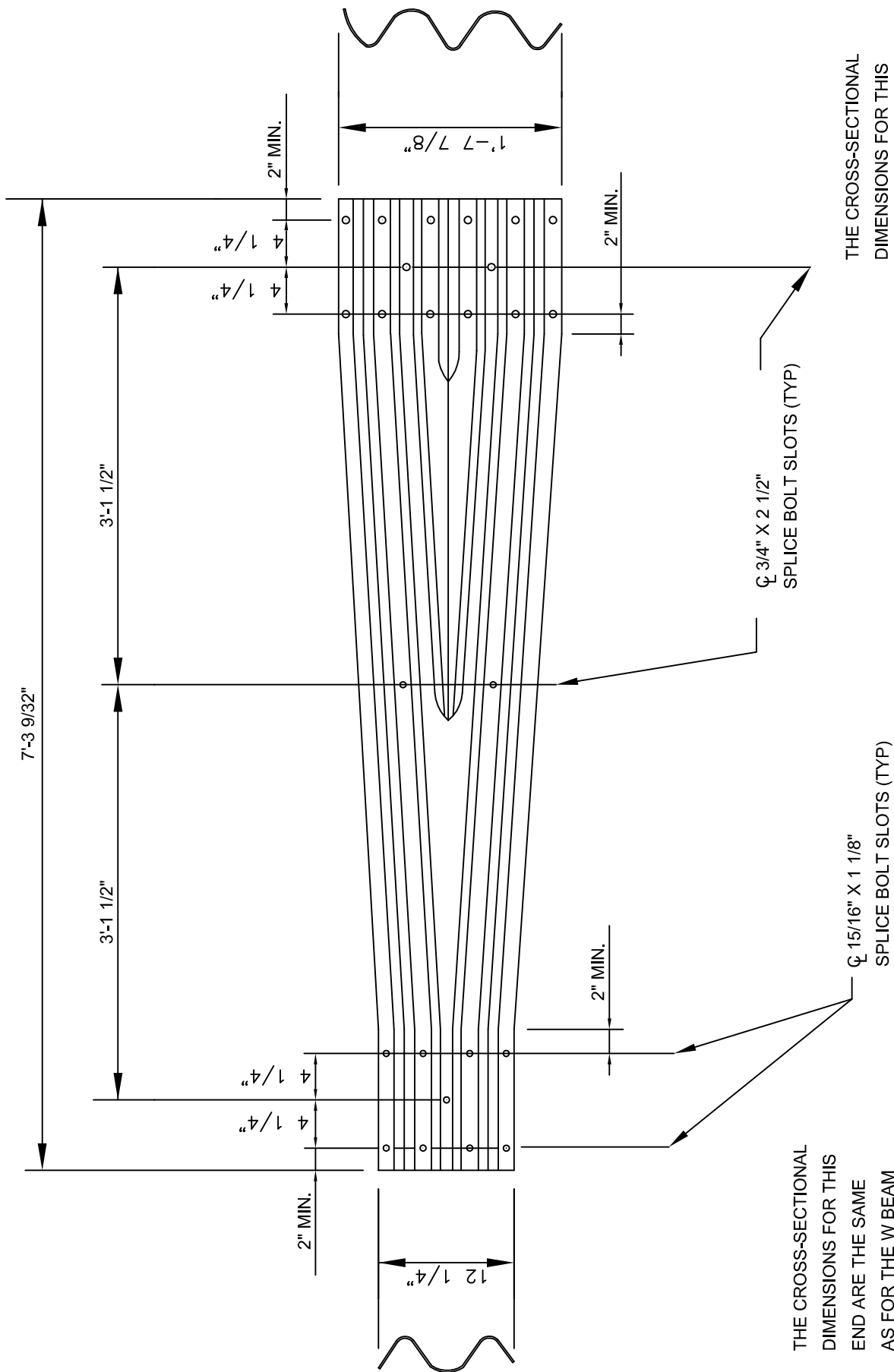
DATE OF ISSUE
JUNE 2014

DRAWING NUMBER
E 401.6.0



NOTES:

1. POST TO BE FABRICATED FROM W6"x9"
STEEL SECTIONS AS SHOWN.
2. POST TO BE 3/4" DIA. (STD GALV WASHERS
TO BE USED AT THESE CONNECTIONS).
3. FOR RAIL BOLT SLOT DETAILS SEE E 401.7.0.
4. FOR BLOCK-OUT DETAILS SEE E 401.21.0.



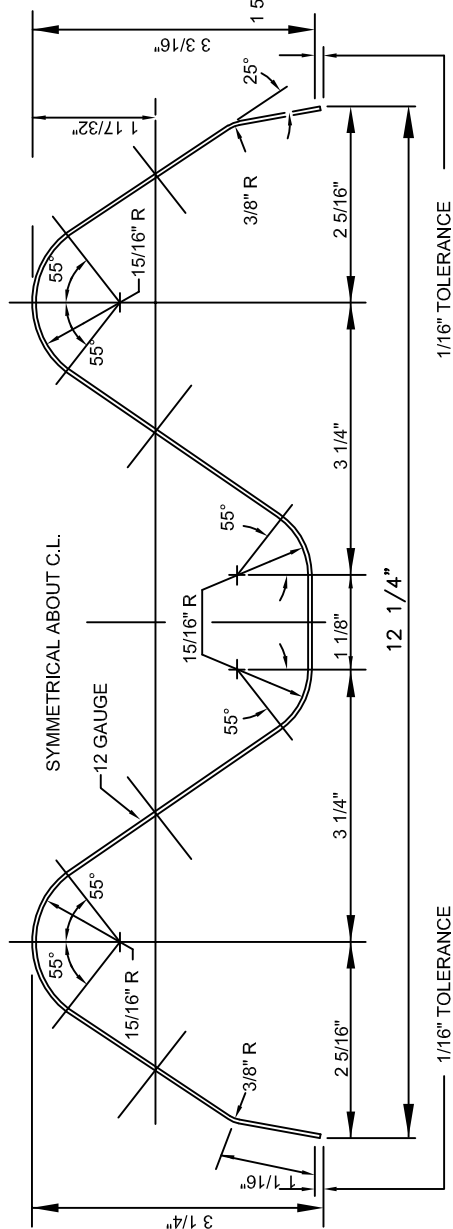
THE CROSS-SECTIONAL
DIMENSIONS FOR THIS
END ARE THE SAME
AS FOR THE THRIE BEAM

THE CROSS-SECTIONAL
DIMENSIONS FOR THIS
END ARE THE SAME
AS FOR THE W BEAM

NOTE: BASE METAL THICKNESS = 12 GAUGE

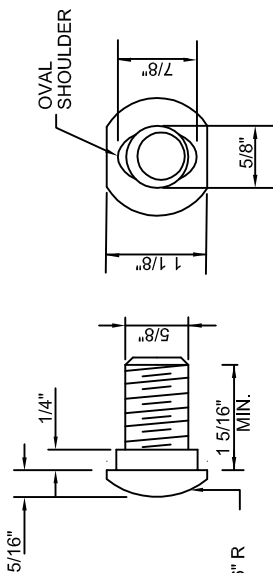
STEEL W BEAM HIGHWAY GUARD RAIL DETAILS

SECTION THROUGH RAIL

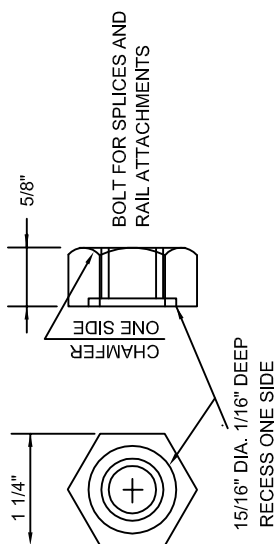


SPLICE BOLT

M16x2 - 1 5/16" LONG

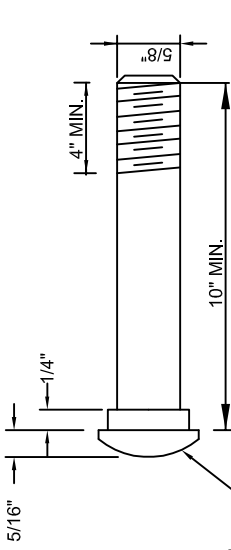


ALL BOLTS AND NUTS TO BE GALV.

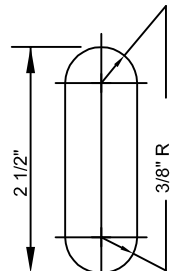


RAIL BOLT

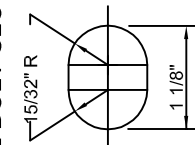
M16x2 - 10" LONG



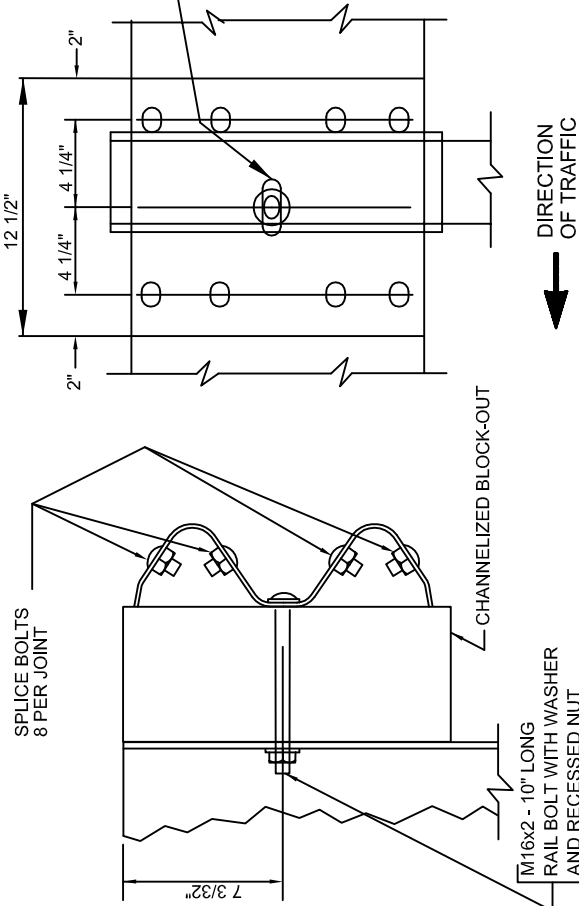
RAIL BOLT SLOT



SPLICE BOLT SLOT



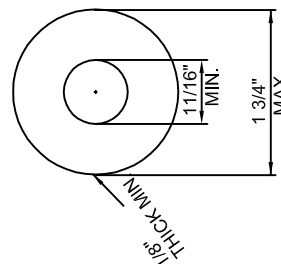
RAIL SPLICE

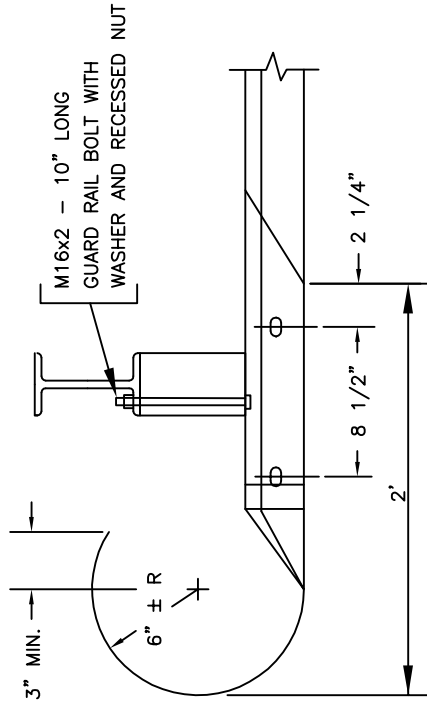


NOTES:

1. FOR POST AND BLOCK-OUT DETAILS SEE E 401.8.0 AND E 401.20.0
2. LAP DOWNSTREAM IN DIRECTION OF TRAFFIC.

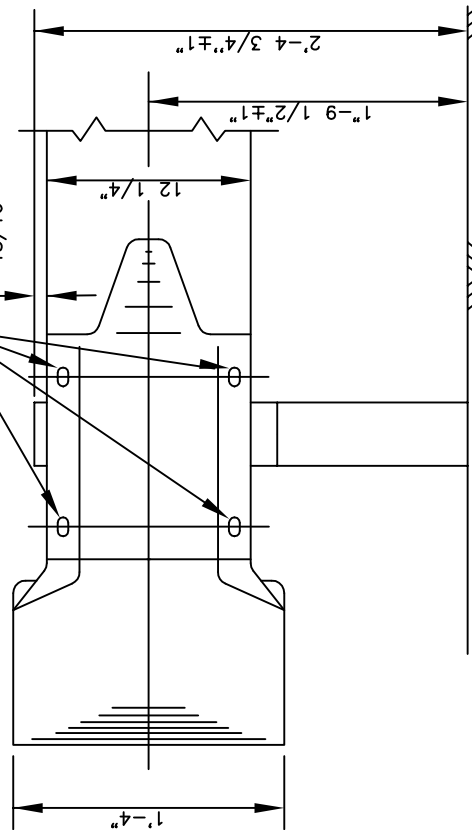
PLAIN ROUND WASHER





PLAN
TERMINAL SECTION

15/16" x 1 1/8"
SLOTTED HOLES. USE SPLICE BOLTS.



FRONT
TERMINAL SECTION

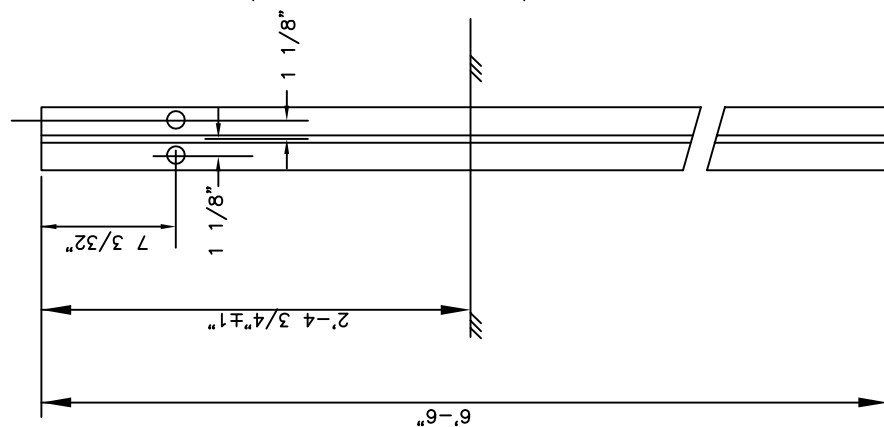
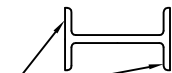
DIRECTION
OF TRAFFIC



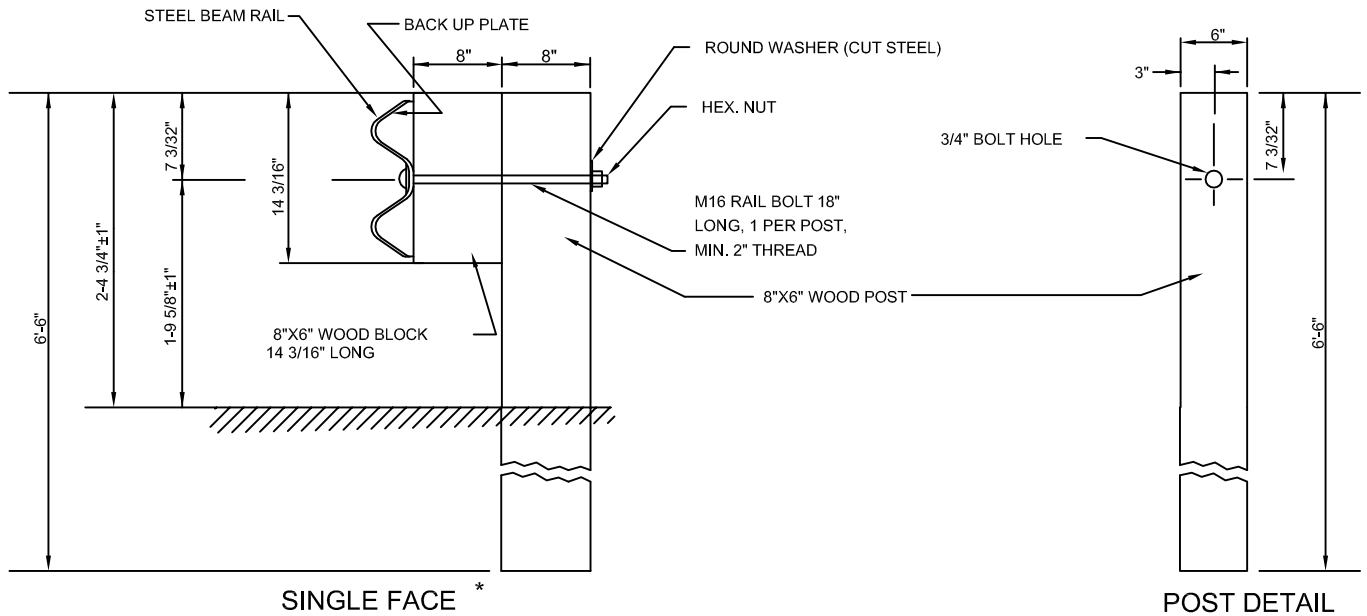
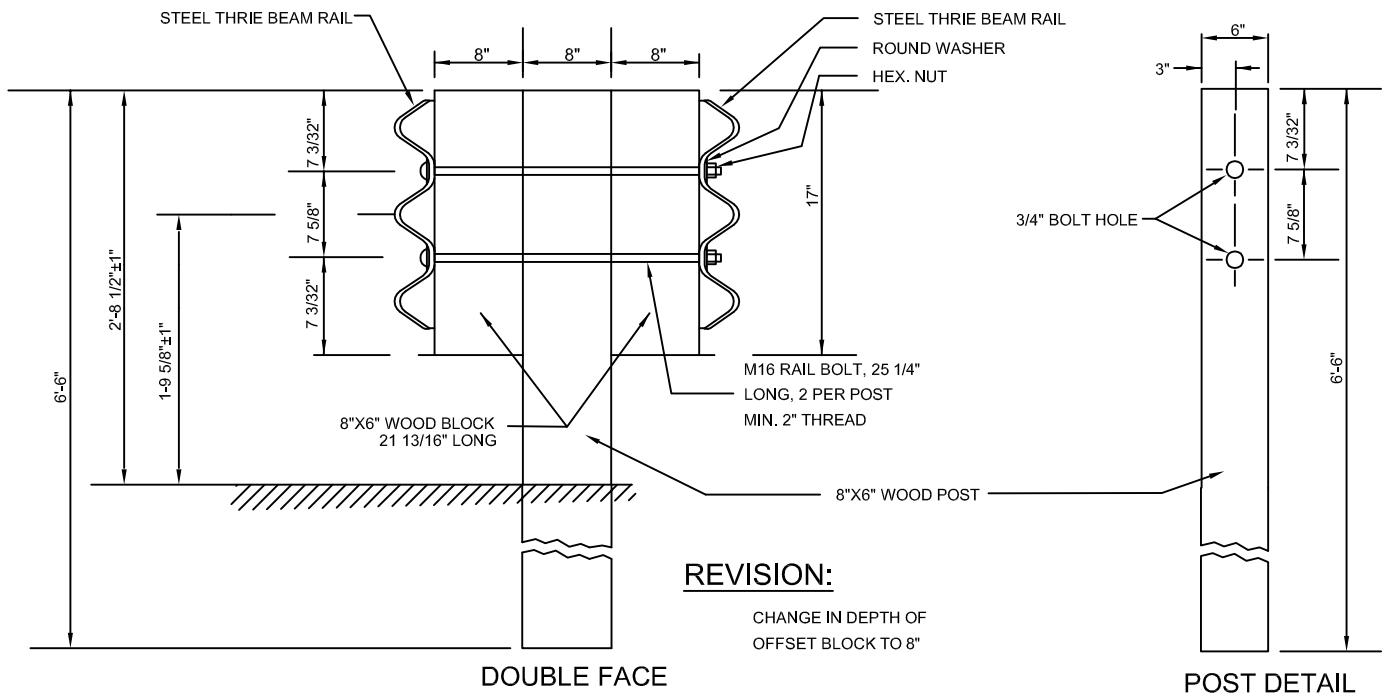
NOTES:

1. POST TO BE FABRICATED FROM W6"x9"
STEEL SECTIONS AS SHOWN.
2. POST TO BE 3/4" DIA. (STD GALV WASHERS
TO BE USED AT THESE CONNECTIONS).
3. FOR BLOCK-OUT DETAILS SEE E 401.20.0.

3/4" DIA BOLT
HOLES, AS REQ'D
FOR MEDIAN BARRIERS



POST



* WHEN PLACED IN MEDIAN CHANGE TO THRIE BEAM, AND CHANGE HEIGHT TO 2'-8 1/2"±1".

NOTES:

1. POST SPACING, APPROACH END & TRAILING ENDS ARE THE SAME AS THOSE SHOWN FOR STEEL "H" POSTS.
2. ALL NUTS, BOLTS & WASHERS ARE TO BE GALVANIZED.
3. ALL MATERIALS & DIMENSIONS OF FITTINGS NOT SHOWN ABOVE ARE TO BE SIMILAR TO THE CORRESPONDING ELEMENTS SHOWN FOR STEEL "H" POSTS.
4. TERMINAL SECTIONS FOR DOUBLE FACE & SINGLE FACE GUARD RAIL ARE SHOWN ON DRAWINGS E 401.6.0, E 401.8.0
5. ALL SPLICES ARE TO BE MADE AT POSTS.
6. FOR THE TYPE OF WOOD & WOOD TREATMENT, OTHER MATERIALS & METHODS OF CONST., SEE STANDARD SPECIFICATIONS & SPECIAL PROVISIONS.
7. FOR DETAILS OF SLOT IN BACK-UP PLATE SEE E 401.7.0 & E 401.8.0
8. BACK-UP PLATE IS PLACED BEHIND RAIL ELEMENTS AT INTERMEDIATE POSTS, i.e. NON SPLICE LOCATION.
9. STEEL POSTS ARE TO BE SUBSTITUTED AT THE SAME BID PRICE, FOR CERTAIN WOOD POSTS IN A WOOD POST RUN WHEN CEMENT CONCRETE EMBEDMENT IS REQUIRED.

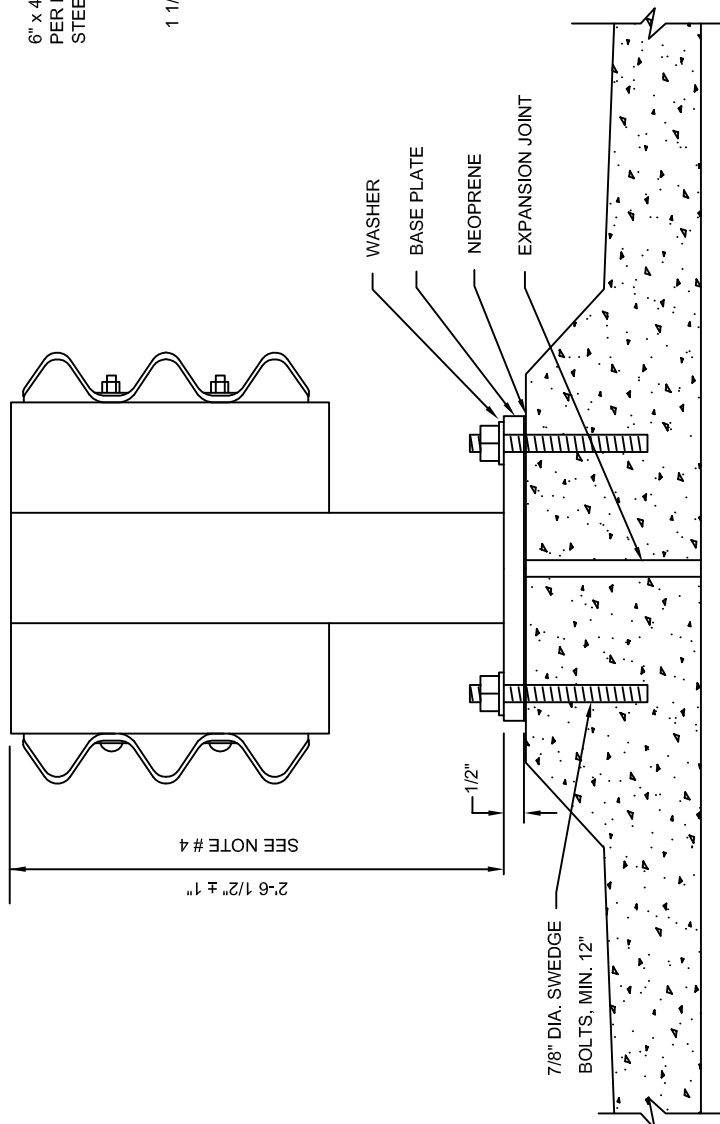
SPECIAL BASE ANCHOR FOR HIGHWAY GUARD INSTALLATION ON CONCRETE

DATE OF ISSUE

JUNE 2014

DRAWING NUMBER

E 401.11.0

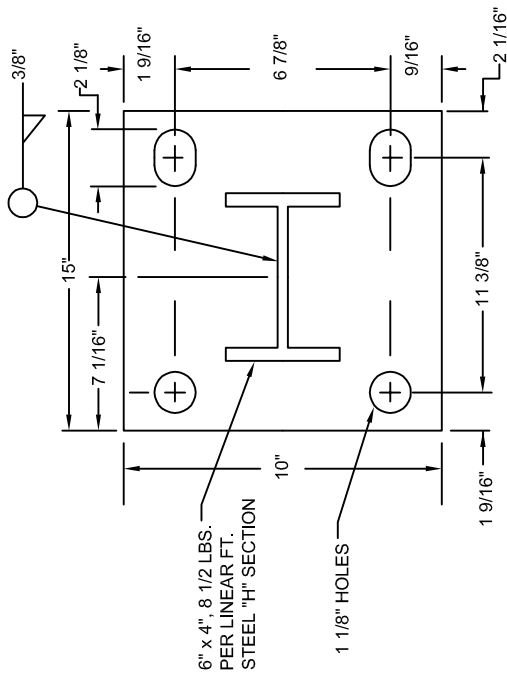


DETAIL OF POST OVER EXPANSION JOINT

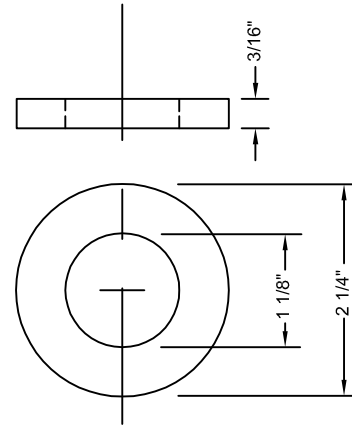
SEE NOTE # 5 WHEN THERE IS NO EXPANSION JOINT.

NOTES:

1. SWEDGE BOLTS, NUTS AND WASHERS ARE TO BE GALVANIZED.
2. HOLES FOR SWEDGE BOLTS SHALL BE 10" DEEP. SWEDGE BOLTS TO BE SET IN EPOXY RESIN, AS APPROVED BY THE ENGINEER.
3. BASE PLATE IS TO BE SET ON 3/32" NEOPRENE.
4. DETAILS OF HIGHWAY GUARD ARE SHOWN ON DRAWINGS E 401.1.0, E 401.5.0 & E 401.6.0
5. THE BASE PLATE AND CONSTRUCTION METHOD SHOWN ABOVE ARE ALSO USED WHEN THERE ARE NO EXPANSION JOINTS IN THE CEMENT CONCRETE.
6. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL FIELD MEASUREMENTS.
7. MAXIMUM OF TWO (2) POSTS IN A ROW OF GUARDRAIL.



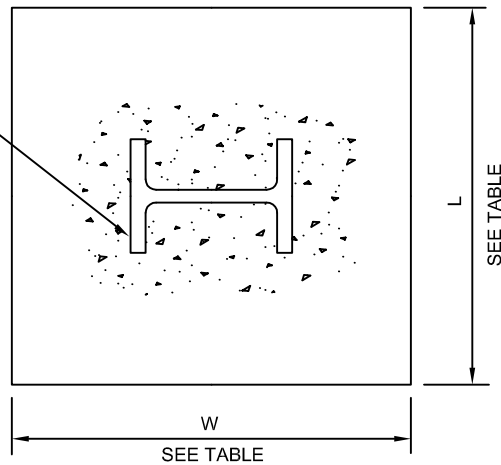
DETAIL OF BASE PLATE



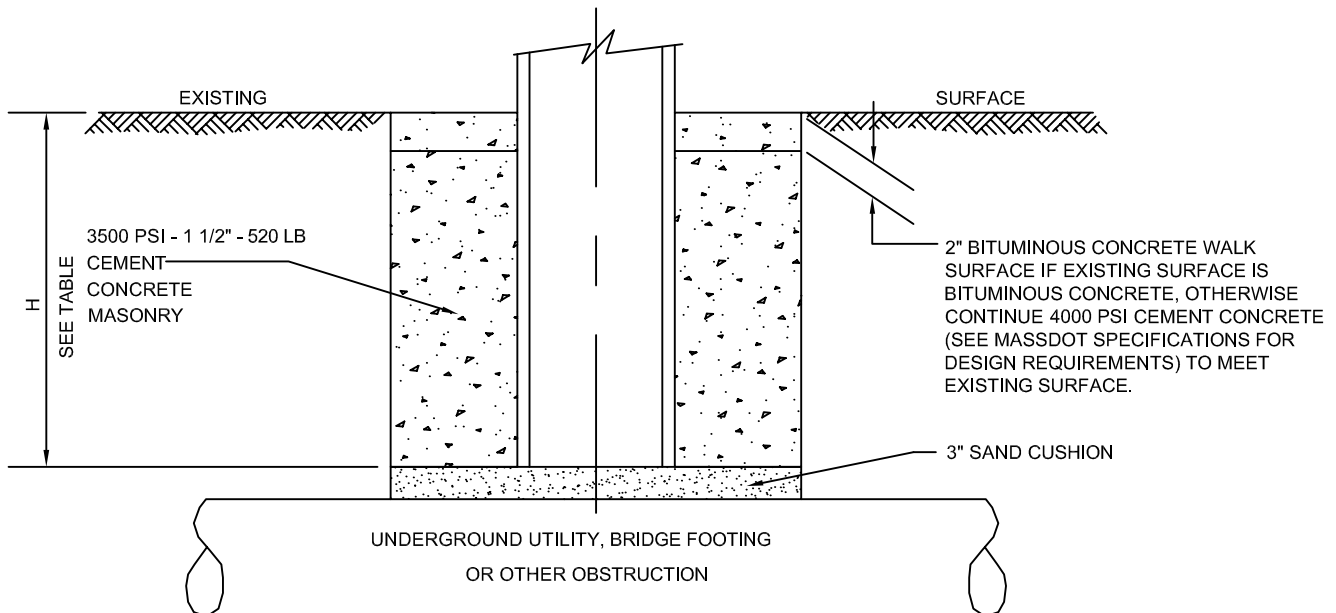
DETAIL OF WASHER

GALVANIZED

6" x 4", 8.5LBS/L.F
STEEL "H" POSTS
OR "C" POST



PLAN



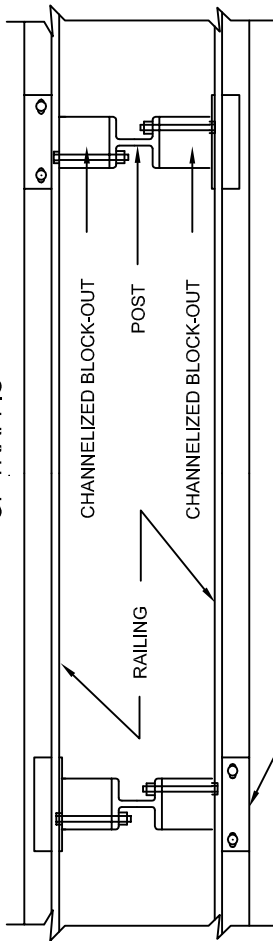
ELEVATION

HEIGHT OF EXISTING SURFACE ABOVE TOP OF SAND CUSHION	DIMENSION OF CONCRETE ENVELOPE		
	H HEIGHT OF SURFACE ABOVE SAND CUSHION	W	L
1'-0" - 1'-6"	VARIES 1'-0" TO 1'-6"	2'-6"	2'-6"
1'-6" - 2'-6"	VARIES 1'-6" TO 2'-6"	2'-0"	2'-0"
OVER 2'-6"	2'-6"	1'-6"	1'-6"

NOTE:

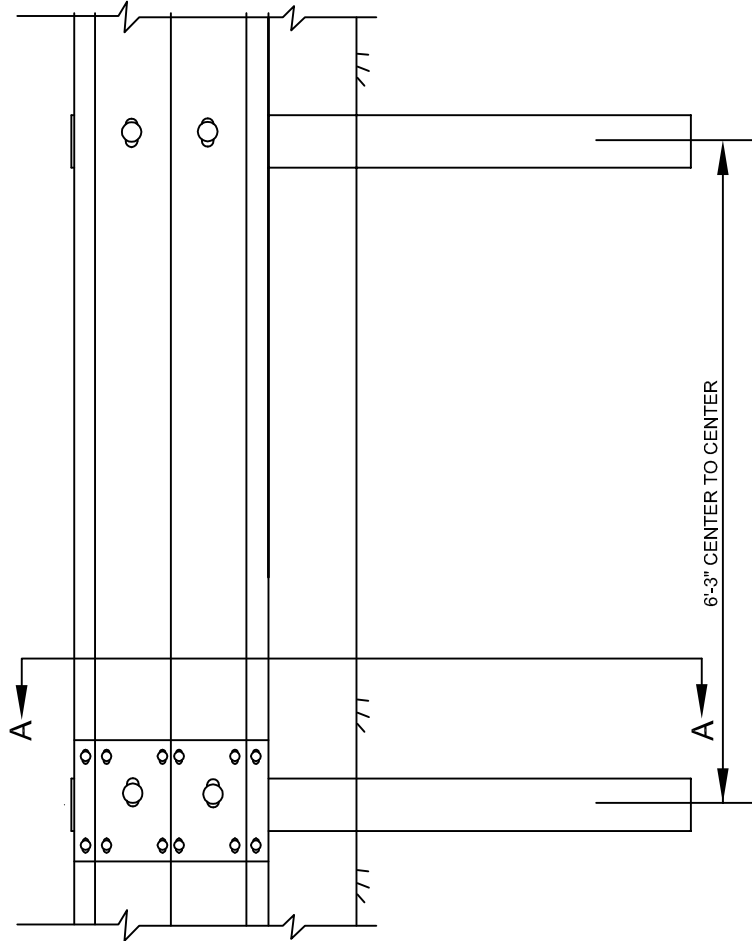
1. OFFSET BRACKETS ARE TO BE INSTALLED AND RAILS ARE TO BE MOUNTED AS SHOWN
ON DRAWINGS E 401.1.0 AND E 401.5.0 - E 401.9.0
2. NOT TO BE USED ON MORE THAN 2 POSTS IN A ROW.

DIRECTION
OF TRAFFIC



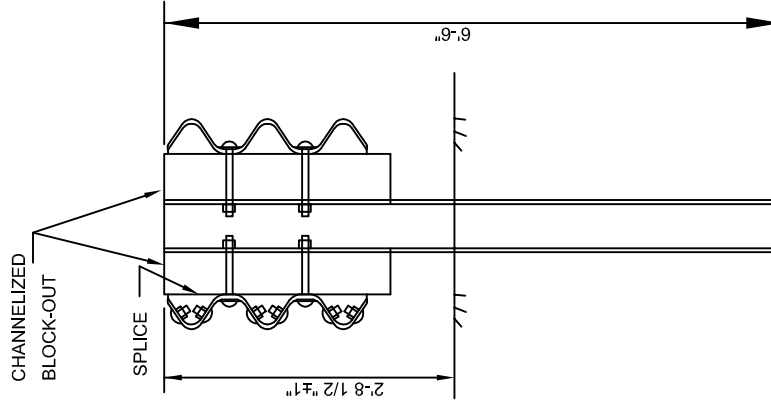
SPLICE; LAP IN DIRECTION OF TRAFFIC

DIRECTION
OF TRAFFIC



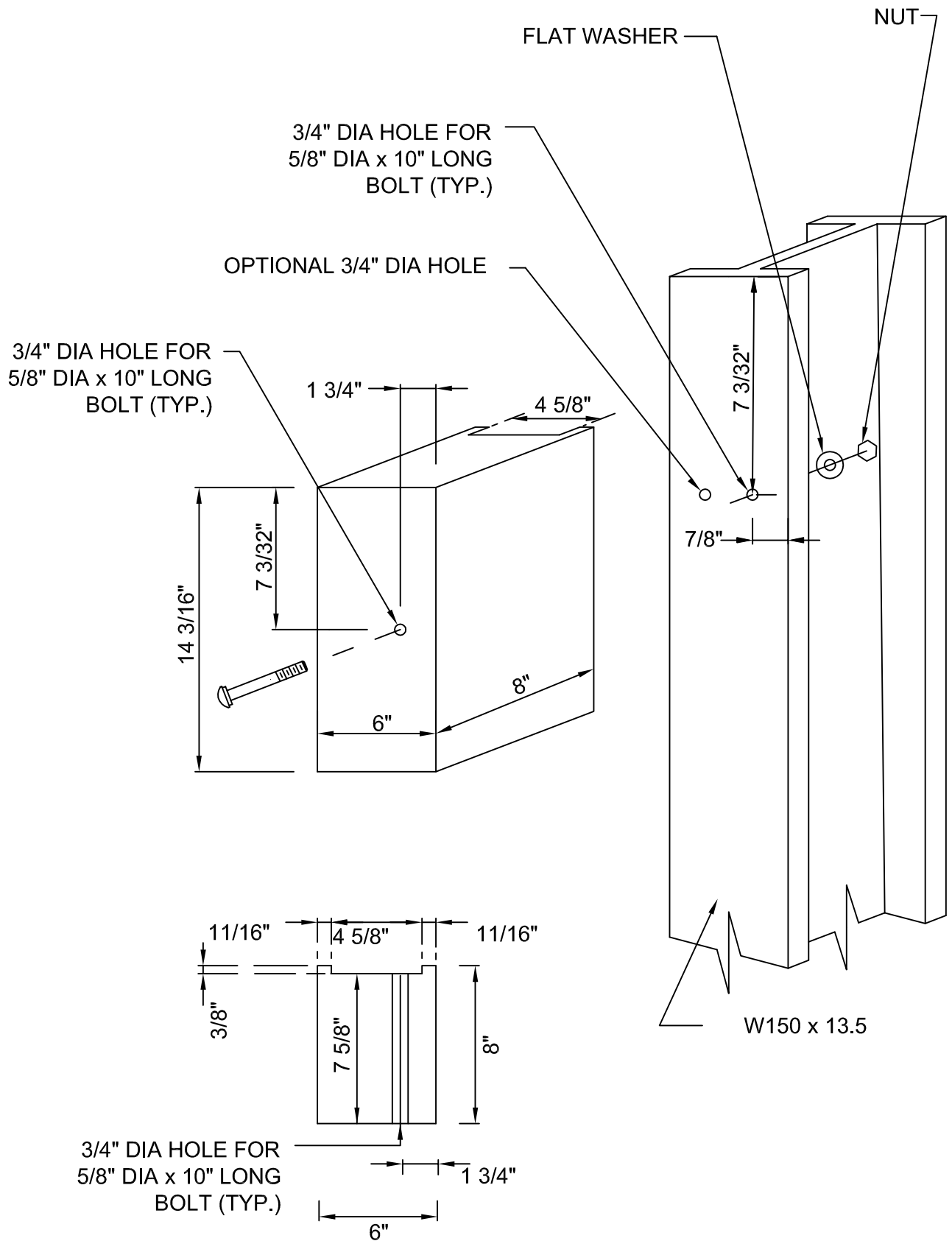
6'-3" CENTER TO CENTER

SECTION A-A



NOTES:

1. ALL POSTS TO BE SPACED 6'-3" CENTER TO CENTER
2. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHODS SEE STANDARD SPECIFICATIONS.
3. FOR DETAILS OF BARRIER COMPONENTS SEE E 401.5.0 AND E 401.6.0.
4. RAIL SPLICES ON DOUBLE FACED HIGHWAY GUARD ARE TO BE STAGGERED. (i.e. SPLICES) ARE NOT TO BE MADE ON BOTH SIDES OF THE SAME POST.



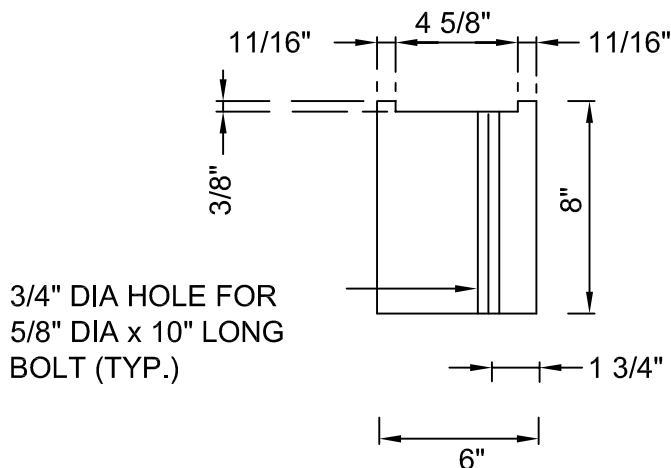
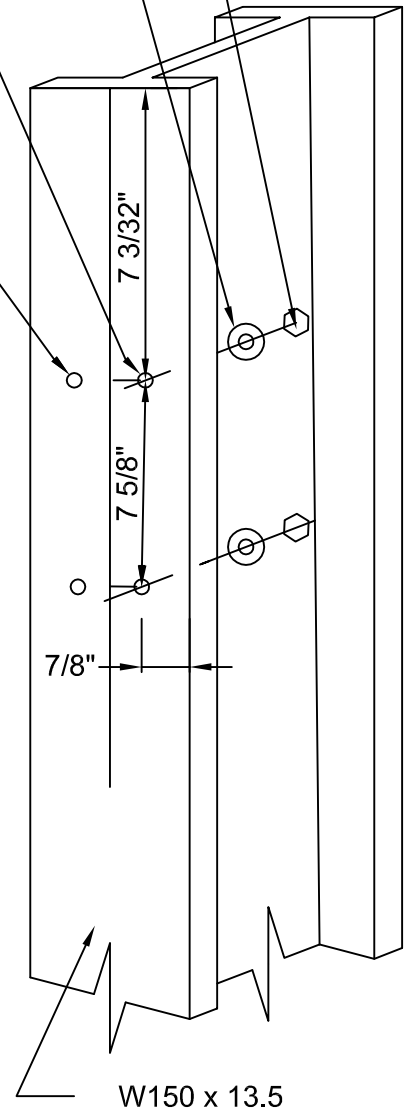
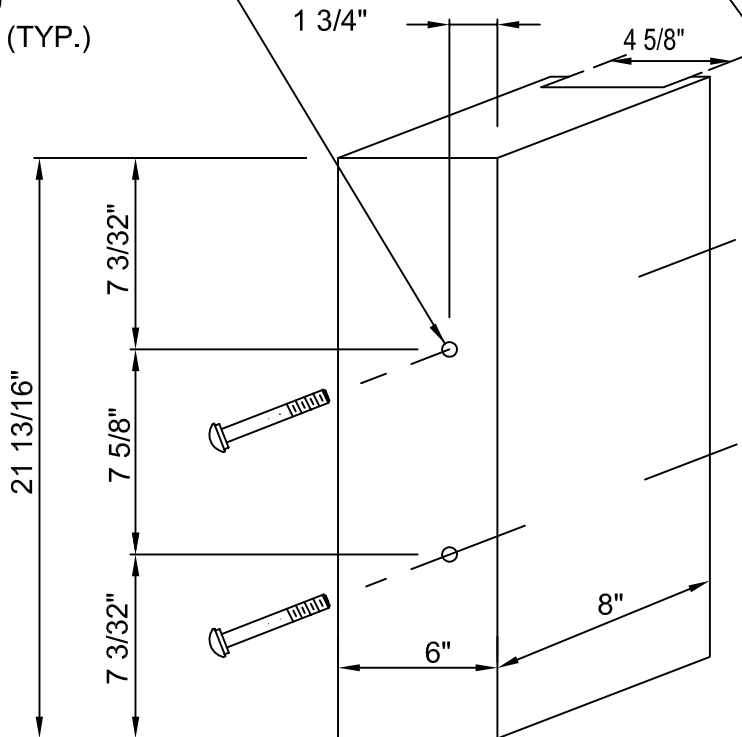
3/4" DIA HOLE FOR
5/8" DIA x 10"
LONG BOLT (TYP.)

3/4" DIA HOLE FOR
5/8" DIA x 10"
LONG BOLT (TYP.)

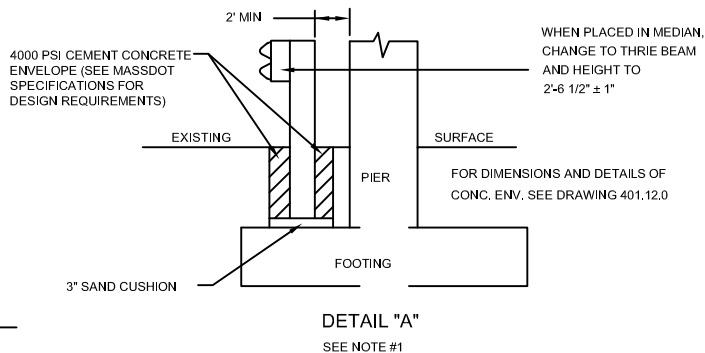
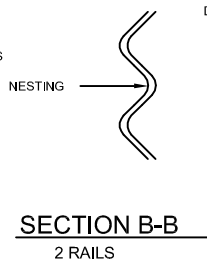
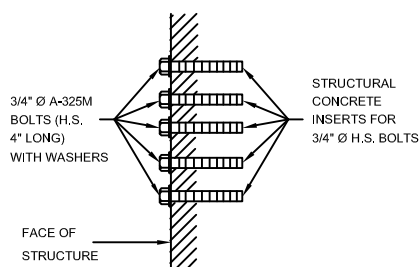
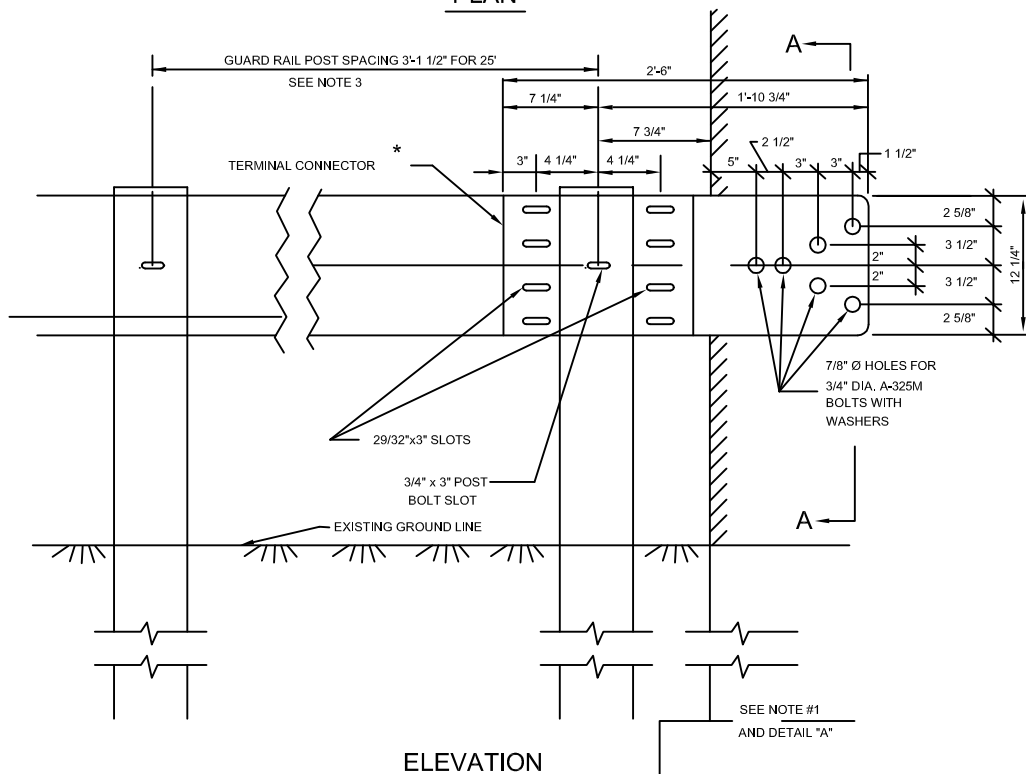
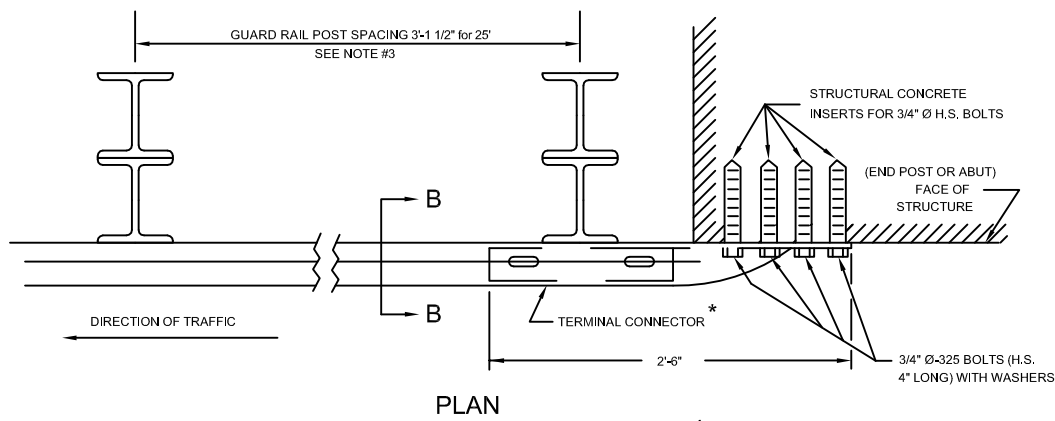
OPTIONAL 3/4"
DIA HOLE (TYP.)

FLAT WASHER (TYP.)

NUT (TYP.)



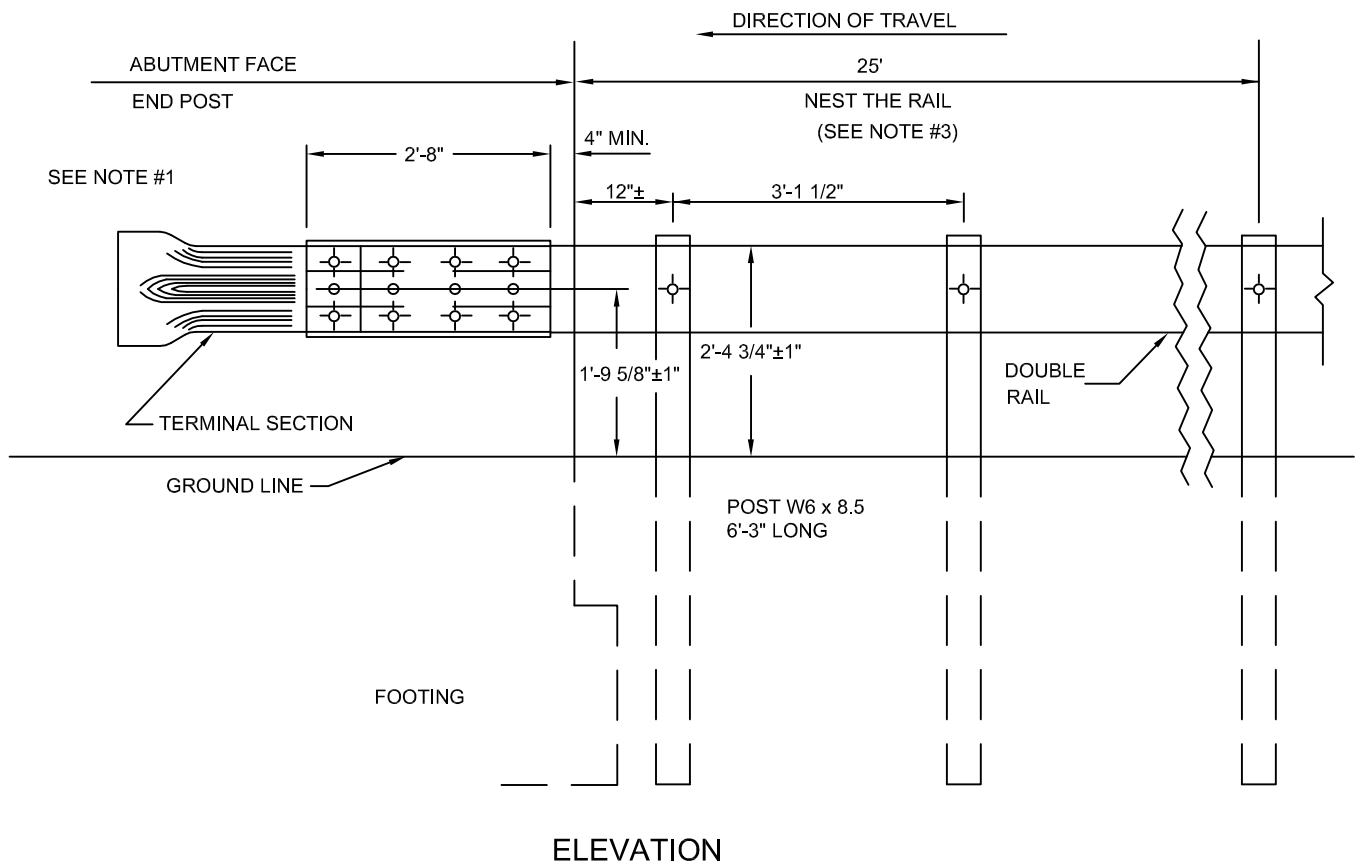
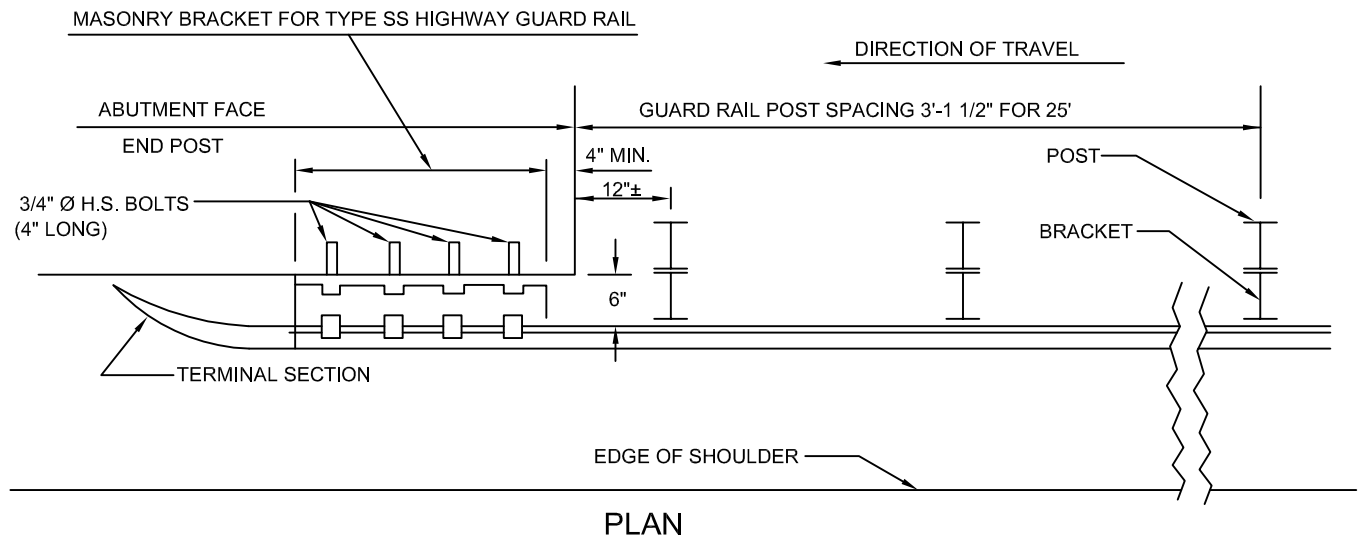
3/4" DIA HOLE FOR
5/8" DIA x 10" LONG
BOLT (TYP.)



* SEE BRIDGE STANDARDS FOR DETAILS; LAP IN DIRECTION OF TRAVEL.

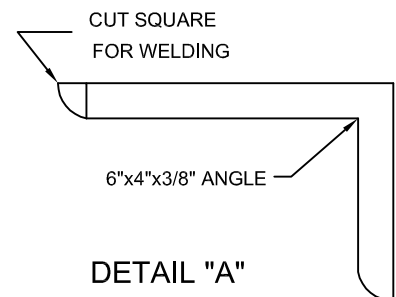
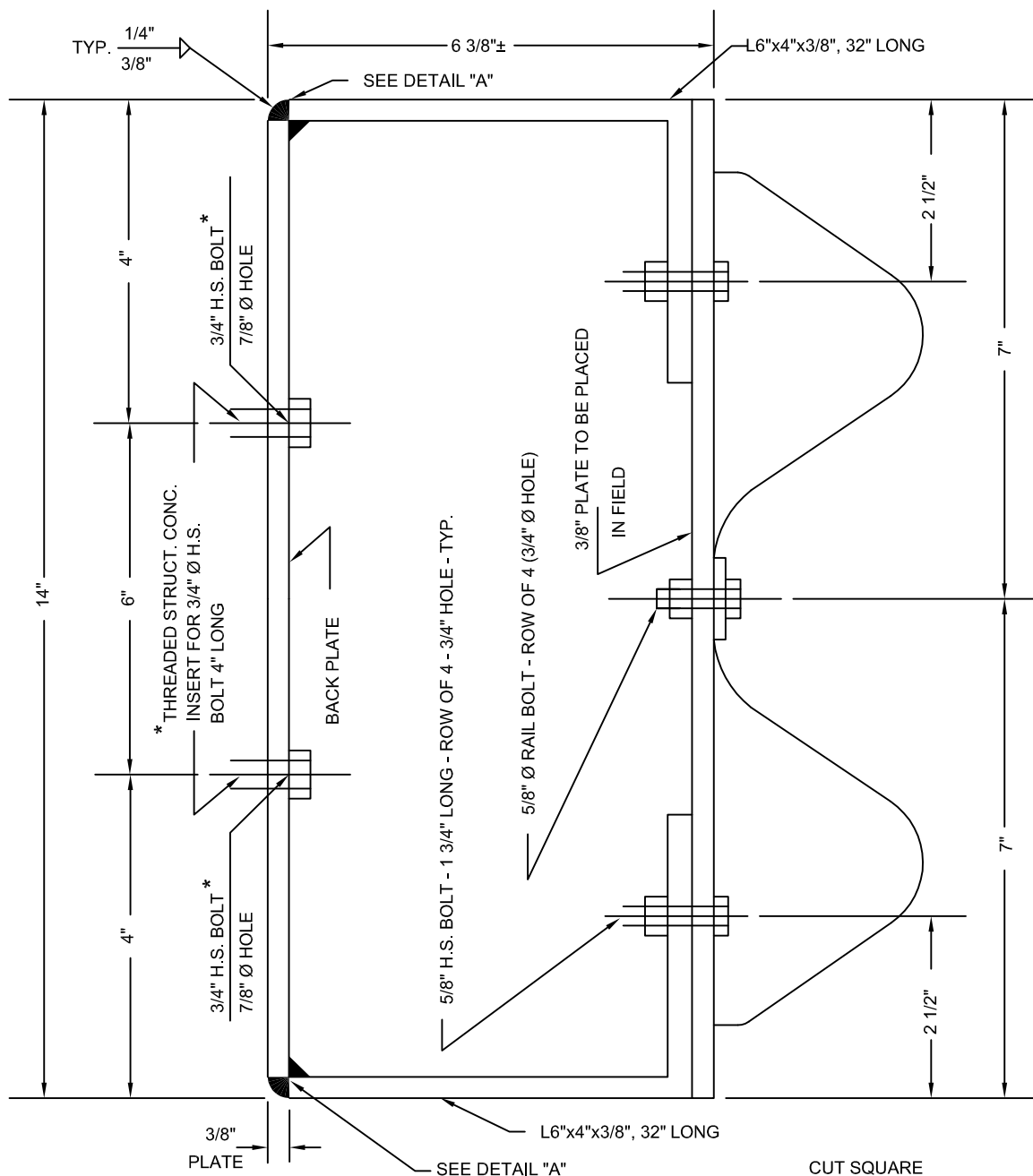
NOTES:

1. WHEN THE HIGHWAY GUARD POST FALLS ON THE FOOTING OF THE STRUCTURE AND THE DISTANCE FROM THE SURFACE TO THE TOP OF THE FOOTING IS LESS THAN 3'-3" THE POST SHALL BE CUT AND SET ON THE FOOTING IN A CEMENT CONCRETE ENVELOPE AS SHOWN IN DETAIL "A".
2. CONSTRUCTION DETAILS SHOWN ALSO APPLY TO WOOD AND CHARLEY (C) POST INSTALLATIONS.
3. THE DOUBLE RAIL ELEMENT IS TO CONSIST OF NESTING TWO (2) 12 GAUGE RAIL ELEMENTS FOR A DISTANCE OF 25', THE SHORT RAIL (25') IS TO BE NESTED BEHIND THE CONTINUOUS RAIL, SEE SECTION B-B.
4. BACK UP PLATE NOT REQUIRED WHERE RAIL IS TO BE NESTED.



NOTES:

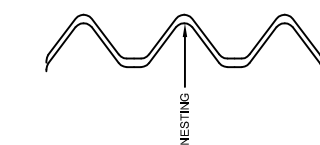
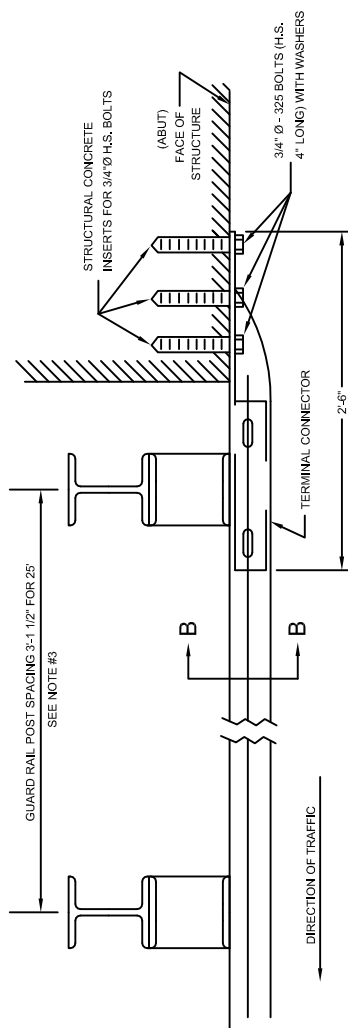
1. FOR BRACKET DETAIL SEE DRAWINGS E 402.4.0 AND E 402.5.0
2. FOR NESTING DETAIL SEE DRAWING E 402.2.0
3. BACK UP PLATE NOT REQUIRED WHERE RAILING IS NESTED, SEE SECTION B-B DRAWING E 402.2.0



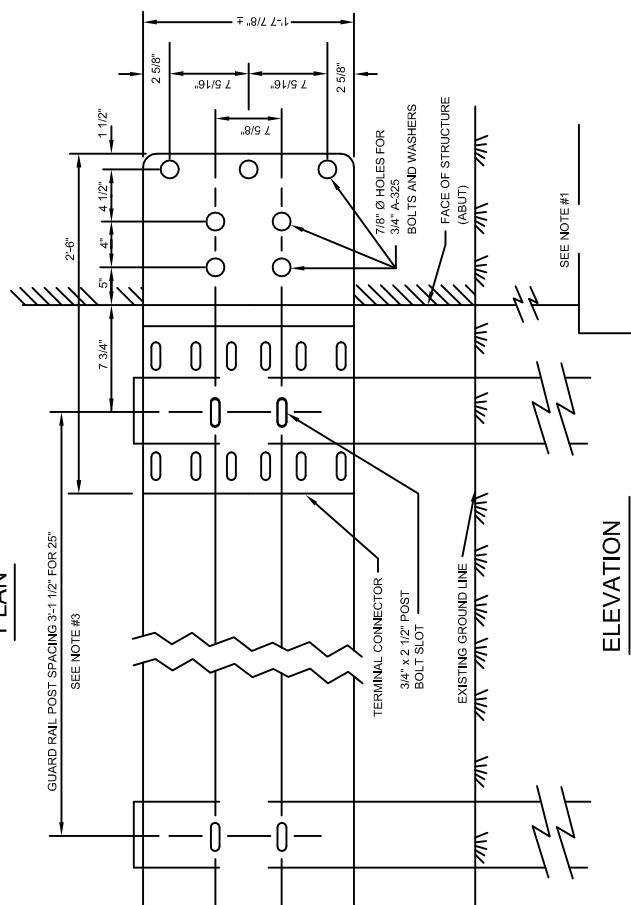
- * IF BOLT IS THRU EXISTING HWY. GD. RECESS THAT IS FILLED WITH CONCRETE
ADD THE DEPTH OF RECESS TO THE 4" LENGTH OF INSERT SIMILARLY
TO 3/4" BOLT.

NOTES:

1. ALL EXISTING HWY. GD. RECESSES TO BE FILLED WITH EPOXY CONCRETE.
2. ALL WELDING IS TO BE DONE IN THE SHOP

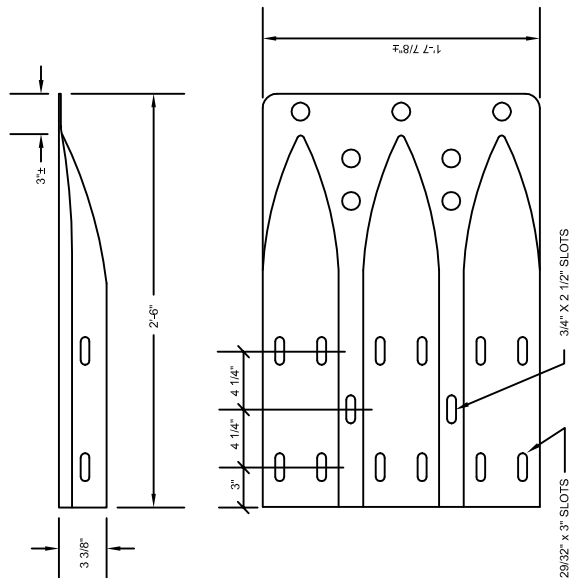


SECTION B-B
(2 RAILS)



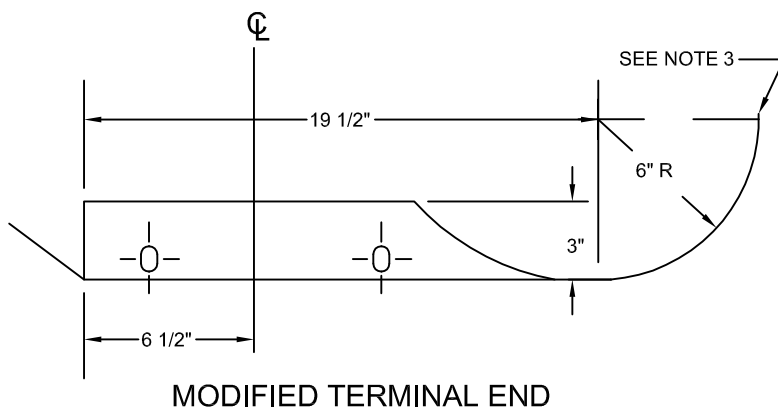
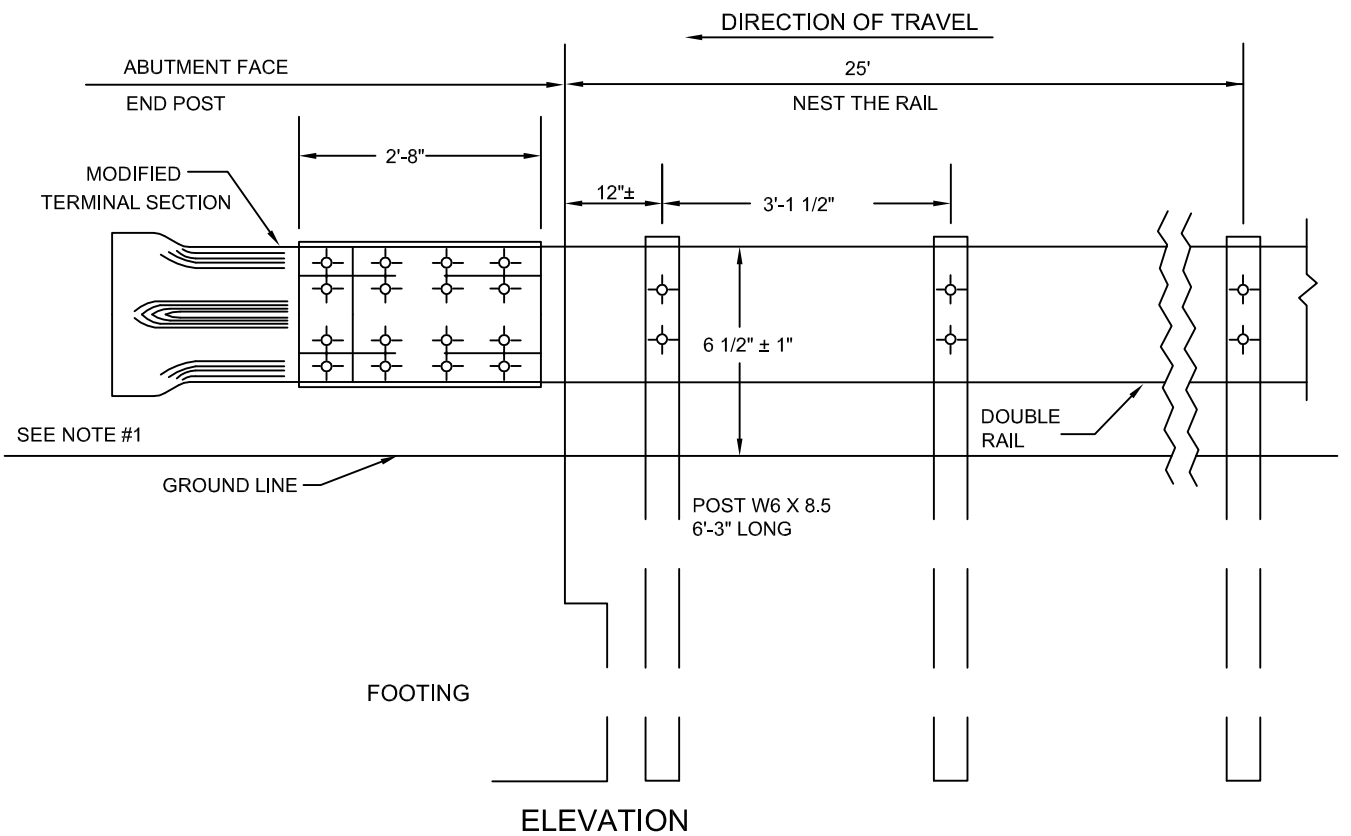
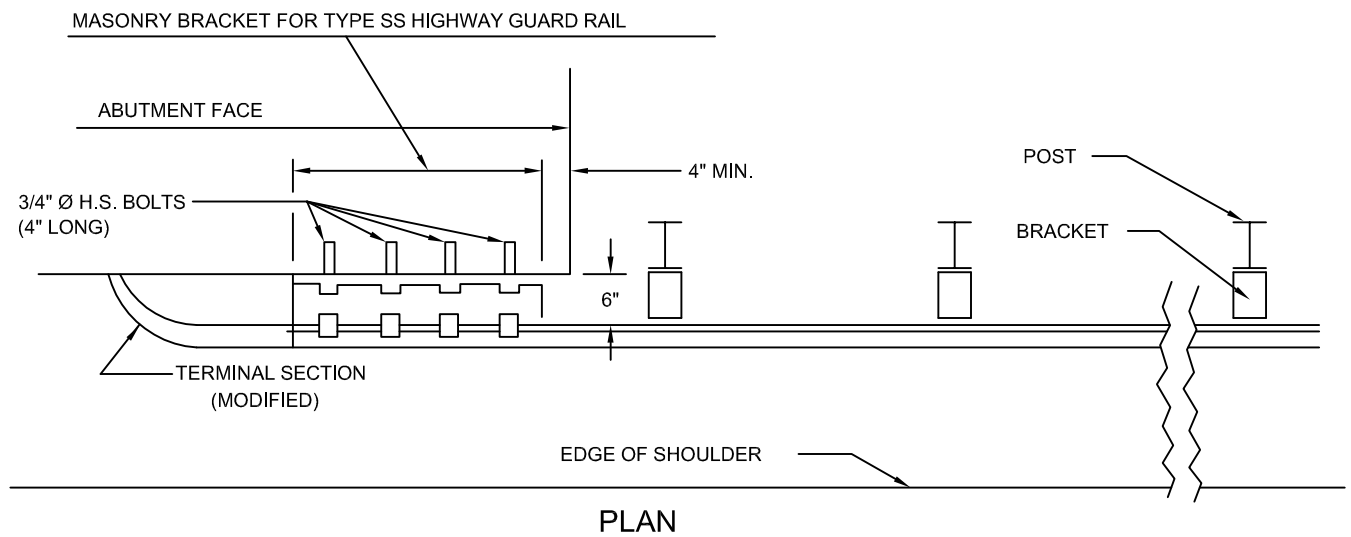
ELEVATION

TERMINAL CONNECTOR



NOTES:

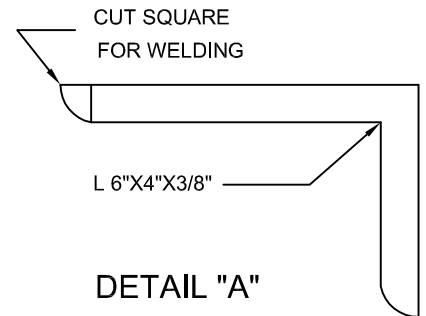
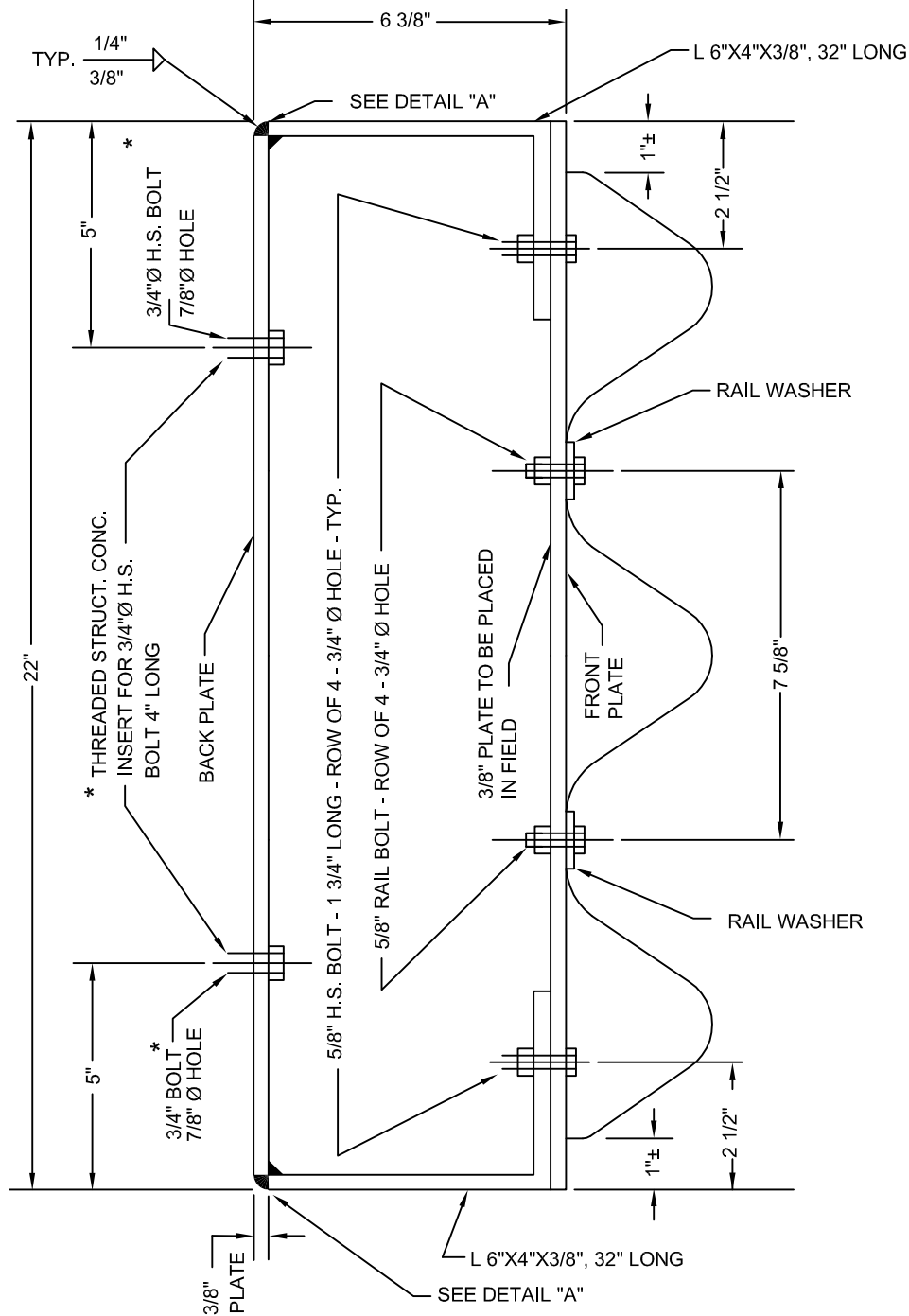
1. WHEN THE HIGHWAY GUARD POST FALLS ON THE FOOTING OF THE STRUCTURE AND THE DISTANCE FROM THE SURFACE TO THE TOP OF THE FOOTING IS LESS THAN 3'-3\"/>



NOTES:

1. FOR BRACKET DETAIL SEE DRAWINGS E 402.9.0 AND E 402.10.0
2. FOR NESTING SEE DRAWING E 402.7.0
3. STANDARD TERMINAL END MAY BE CUT AND FINISHED IN ACCORDANCE WITH STANDARD SPECIFICATIONS.
4. BACKUP PLATE NOT REQUIRED WHEN RAILING IS NESTED.
5. GUARD RAIL POST SPACING 3'-1 1/2" FOR 25 FEET.

END WALL



* IF BOLT IS THRU EXISTING HWY. GD. RECESS THAT IS FILLED WITH CONCRETE
ADD THE DEPTH OF RECESS TO THE 4" LENGTH OF INSERT SIMILARLY
TO 3/4" BOLT.

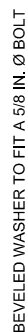
NOTES:

1. ALL EXISTING HWY. GD. RECESSES TO BE FILLED WITH EPOXY CONCRETE
2. ALL WELDING IS TO BE DONE IN THE SHOP

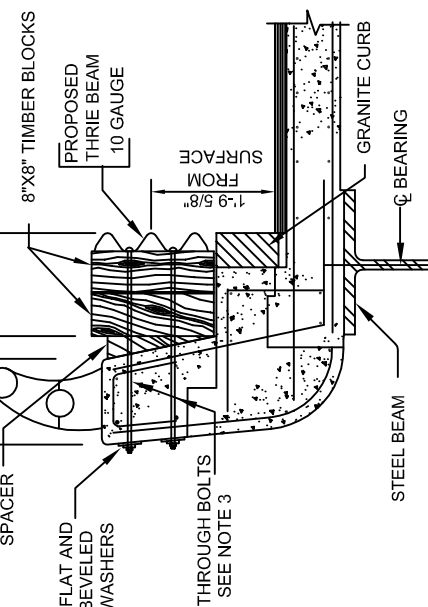




DIMENSIONS H, h D AND d WILL VARY
FIELD MEASURE PRIOR TO FABRICATION.
WOOD OR COMPOSITE TIMBER
BLOCKS AND SPACERS SHALL BE
USED.



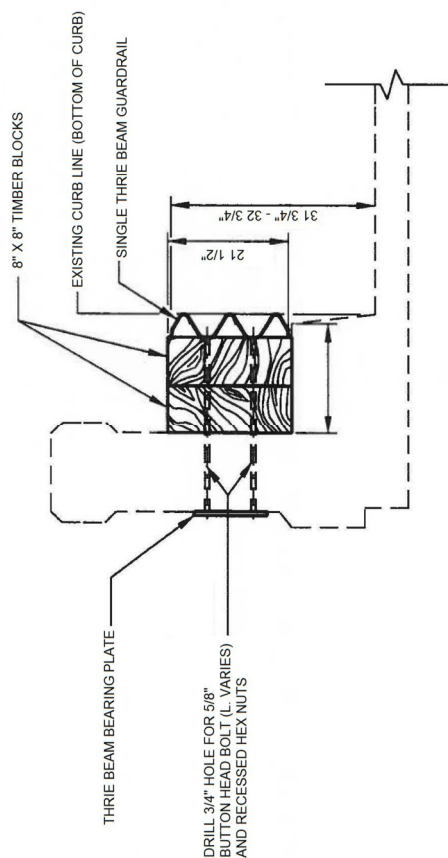
WASHER DETAILS



SECTION A-A

THROUGH CONCRETE PARAPET WALL

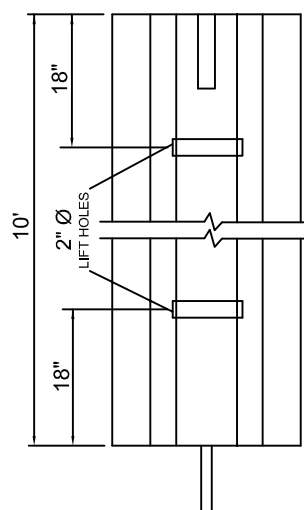
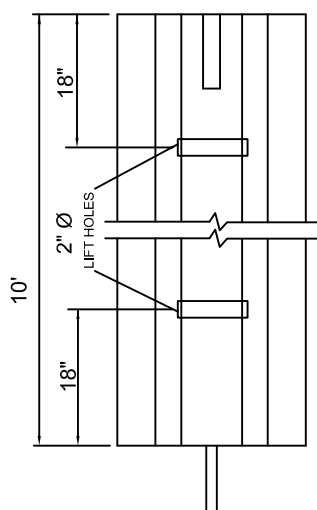
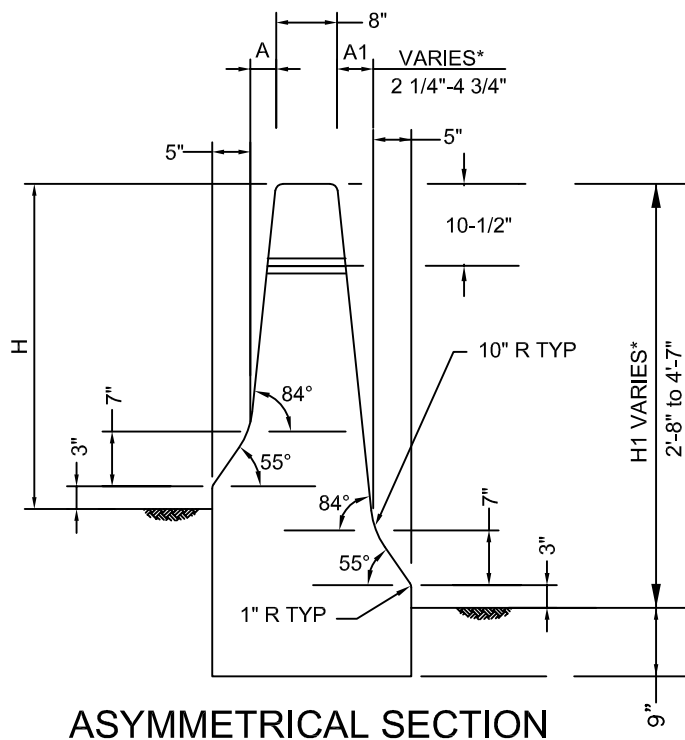
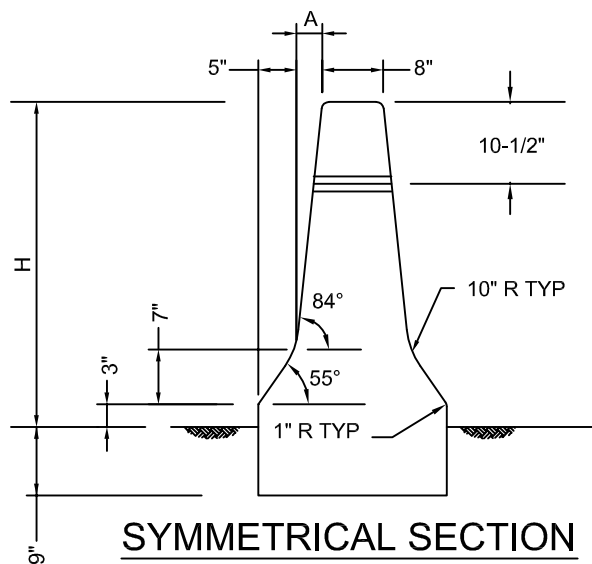
NOT TO SCALE



SECTION A-A

NOTES:

1. THIS INSTALLATION SHALL BE USED WHEN THE EXISTING SAFETY WALK IS 18" OR LESS.
2. TIMBER BLOCKS AND SPACERS SHALL BE SPACED AT 6'-3" OR LESS ON CENTERS. A MAXIMUM OF TWO NON-STANDARD POST SPACES FROM 6'-3" TO 2'-6" MAY BE USED TO ADJUST THE RAIL INSTALLATION TO MATCH THE BRIDGE LENGTH. PLACE NON-STANDARD POST SPACES ADJACENT TO EACH OTHER WITH ODD PANEL LENGTHS IN THE CENTER OF THE BRIDGE.
3. ATTACH THE PROPOSED THRIE BEAM RETROFIT TO THE EXISTING PARAPET WITH TWO 5/8"Ø ASTM A307 THREADED BOLTS, NUTS, WASHERS, TIMBER BLOCKS AND SPACERS BY DRILLING HOLES THROUGH THE PARAPET. ALL HARDWARE ITEMS SHALL BE GALVANIZED.
4. THE CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS, FURNISH AND INSTALL THE RETROFIT GUARDRAIL WITH THE TIMBER BLOCKS, SPACERS AND WASHERS AS REQUIRED TO THE PARAPET IN ACCORDANCE WITH THE TRAFFIC STANDARDS AND ALIGN THE FACE OF THE GUARDRAIL WITH THE FACE OF CURB (1/4"±).
5. "THRIE BEAM EXPANSION SECTIONS" SHALL BE INSTALLED AT EACH BRIDGE EXPANSION JOINT.
6. INSTALL A DEMOUNTABLE REFLECTORIZED DELINEATOR (GUARDRAIL) IN THE UPPER VALLEY OF THE THRIE BEAM AT EACH FIFTH POST.
7. THE EXIT END APPLICATION SHALL ONLY BE USED ON DIVIDED HIGHWAYS. FOR ALL OTHER APPLICATIONS, THE ENTRANCE END APPLICATION SHALL BE USED AT BOTH ENDS OF BRIDGE PARAPET.
8. WITHIN THE LENGTH OF THE APPROACH AND DEPARTURE TRANSITIONS THE GUARDRAIL SHALL EXTEND IN A STRAIGHT LINE FROM THE BRIDGE WITH NO KINKS OR ANGLES VISIBLE. WHERE TAPERING IS NECESSARY TO MATCH THE OFFSET OF THE EXISTING GUARDRAIL IT SHALL BE DONE BEYOND THE APPROACH AND DEPARTURE TRANSITIONS AND HAVE A 15:1 TAPER RATE.
9. WOOD OR COMPOSITE OFFSET BLOCKS SHALL BE INSTALLED WITH NEW AND RESET SECTIONS OF GUARD RAIL.



SYSTEM	A	H
NORMAL	2 1/4"	2'-8"
TALL	3 1/4"	3'-6"

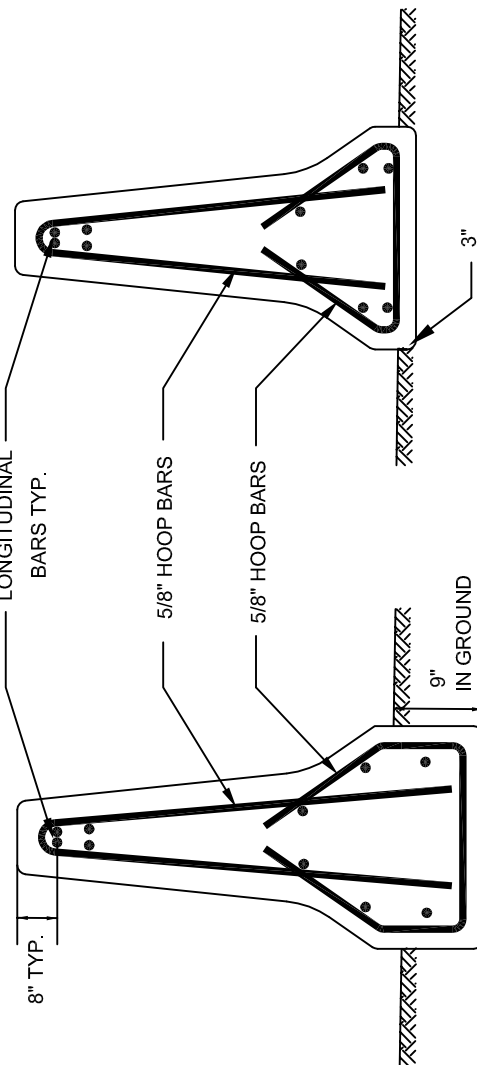
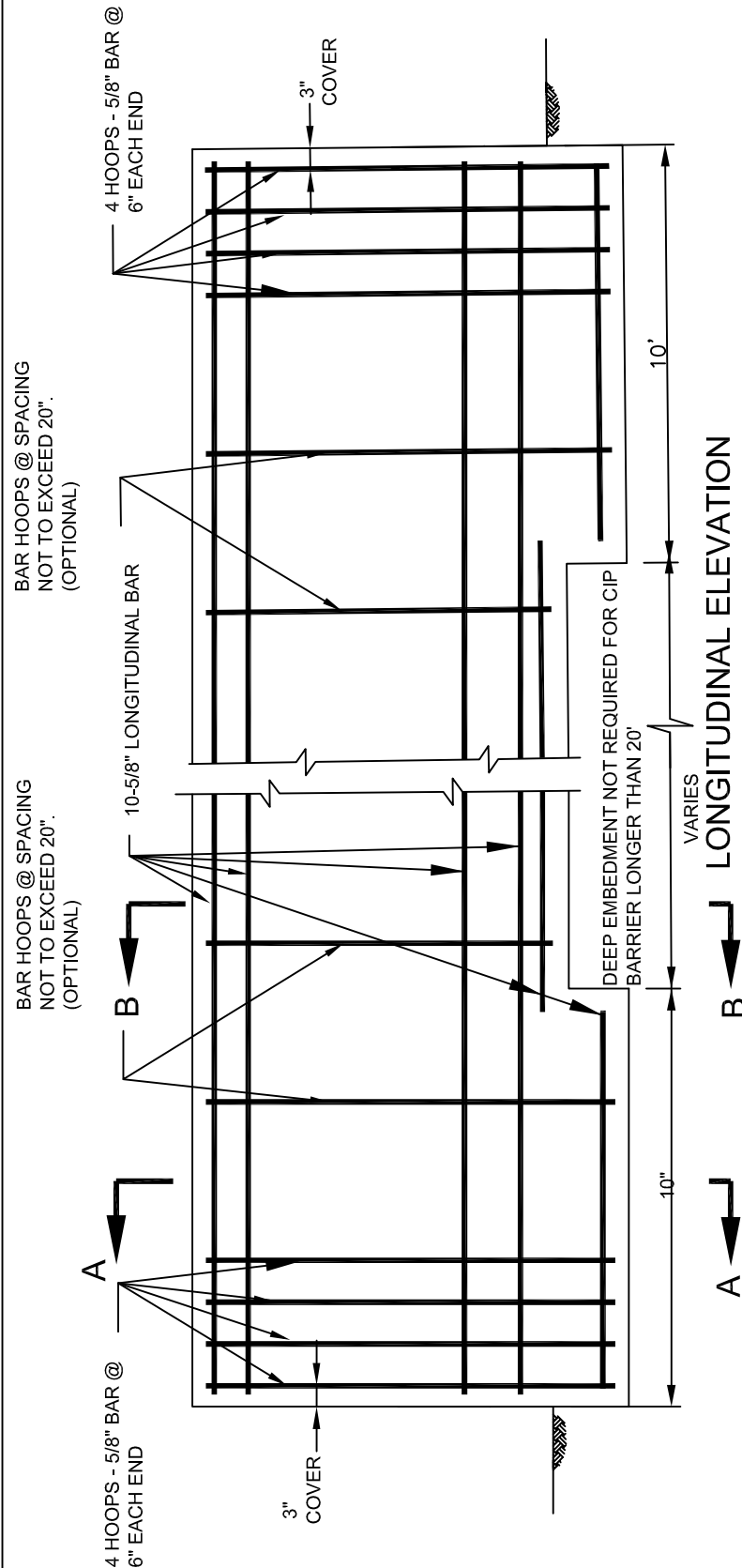
NOTES:

1. ALL EDGES SHALL BE ROUNDED WITH A 1" RADIUS EXCEPT AS SHOWN
 2. FOR DOWEL CONNECTION DETAILS SEE E 402.13.0.
 3. FOR REINFORCING SEE E 402.11.0 FOR SYMMETRICAL SHAPE AND E 401.12.0 FOR ASYMMETRICAL SHAPE.
 4. ALL CONCRETE IS TO BE FIELD COATED AFTER FINAL INSTALLATION WITH A CONCRETE PENETRANT/SEALER. CAST IN PLACE CONCRETE SHALL CURE NOT LESS THAN 28 DAYS PRIOR TO COATING.
 5. LIFT HOLES USED ONLY ON PRECAST BARRIERS 13' AND LESS.
- * VARY "A1" RELATIVE TO "H1" WHILE MAINTAINING 55° AND 84° BARRIER ANGLES. A1=4-3/4" MAX., H1=4'-7" MAX.

F SHAPE CONCRETE BARRIER SYMMETRICAL SECTION REINFORCING DETAILS

DATE OF ISSUE
JUNE 2014

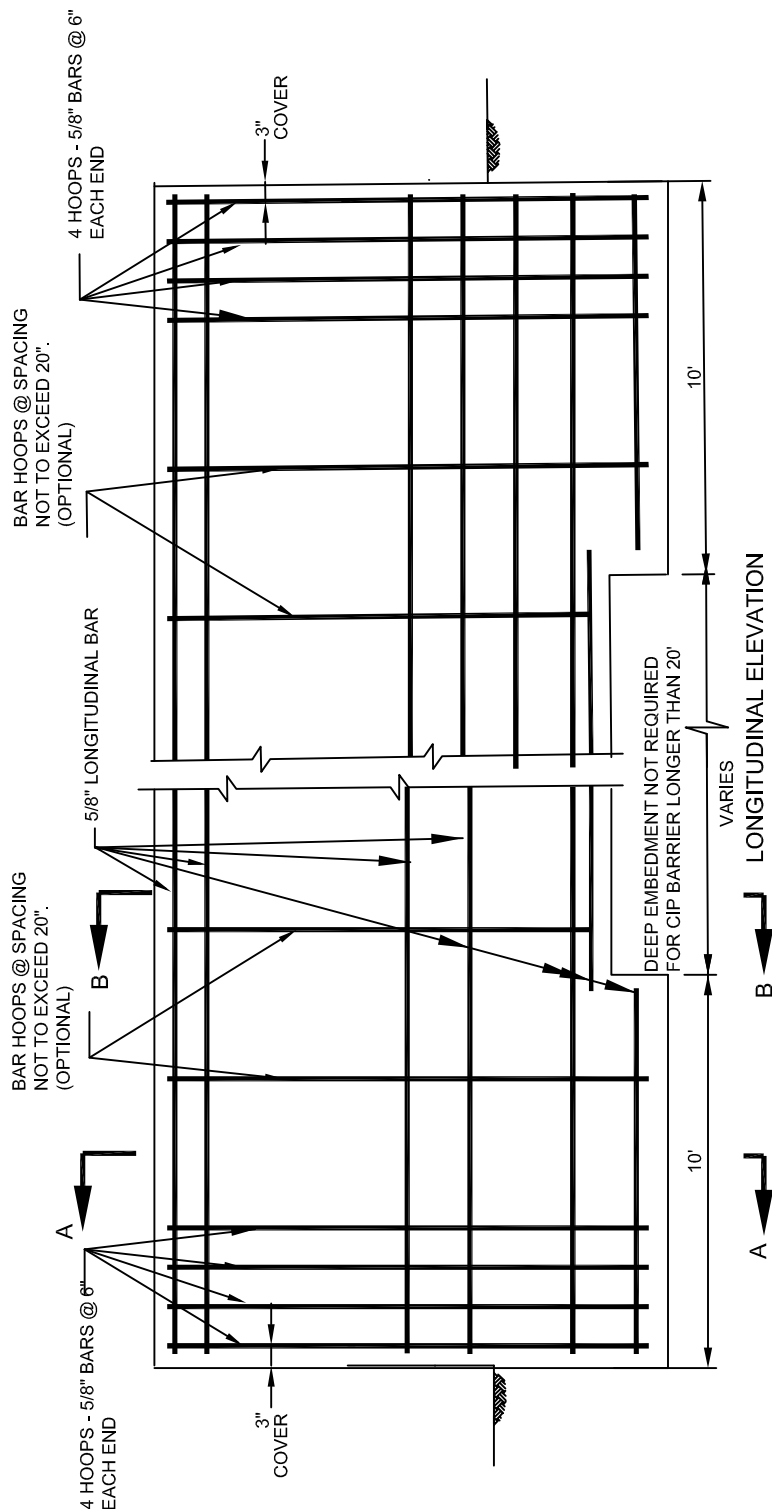
DRAWING NUMBER
E 402.11.0



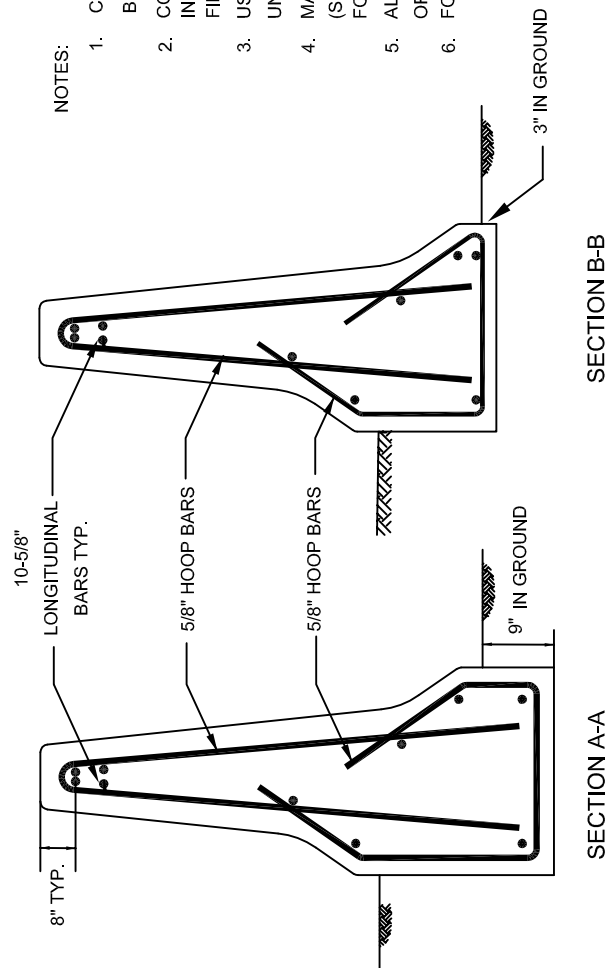
NOTES:

1. CAST IN PLACE NOT TO EXCEED 200' BETWEEN EXPANSION JOINTS.
2. CONSTRUCTION JOINTS REQUIRED AT 40' INTERVALS (1/2" PREMOULDED JOINT FILLER REQUIRED FOR PRECAST BARRIERS).
3. USE MINIMUM COVER OF 1 1/2", UNLESS OTHERWISE INDICATED.
4. MATERIAL IS 4000 PSI CEMENT CONCRETE. (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)
5. ALL STEEL REINFORCING TO BE GALVANIZED OR EPOXY COATED, AASHTO-M31, GRADE 60.
6. ALL LONGITUDINAL BARS ARE TO BE CONTINUOUS FOR BOTH PRECAST AND CAST IN PLACE BARRIERS.
7. FOR DIMENSIONS SEE E 402.10.0

F SHAPE CONCRETE BARRIER ASYMMETRICAL SECTION REINFORCING DETAILS

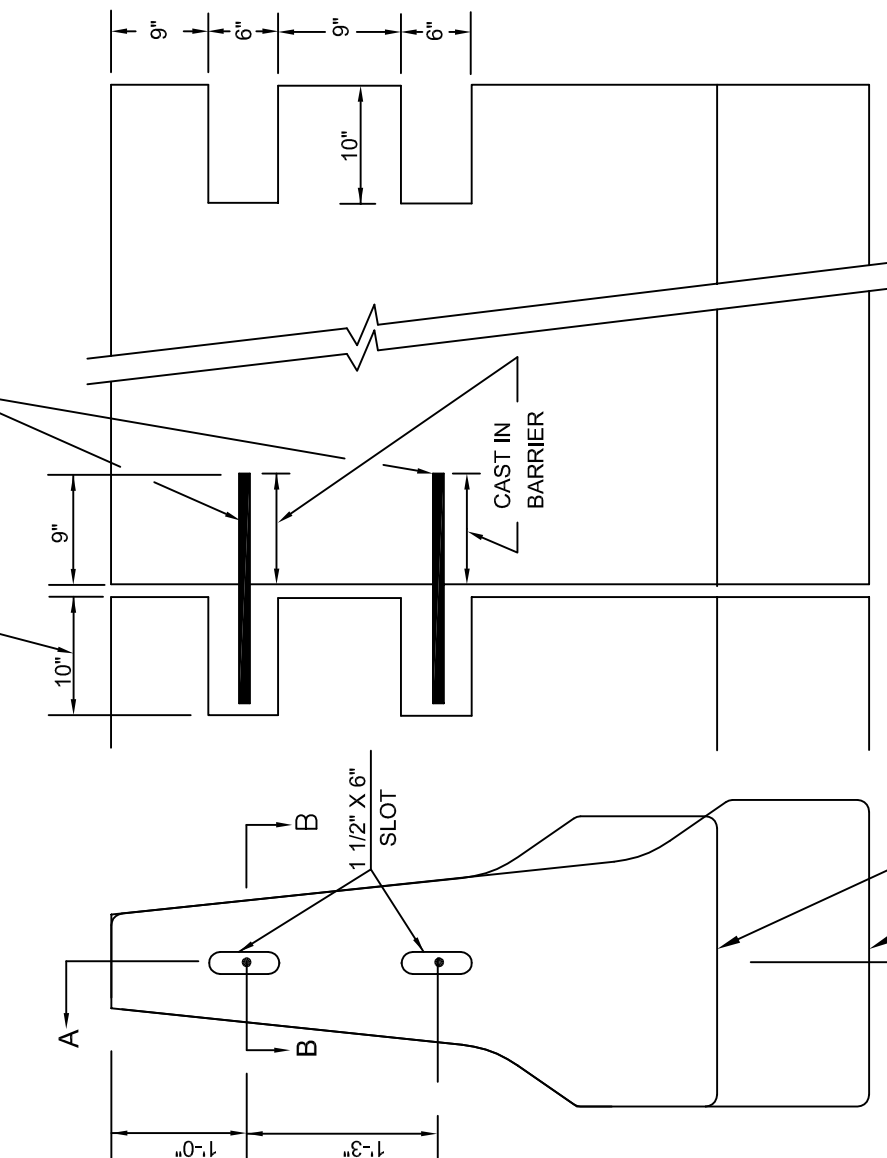


- NOTES:
1. CAST IN PLACE NOT TO EXCEED 200' BETWEEN EXPANSION JOINTS.
 2. CONSTRUCTION JOINTS REQUIRED AT 40' INTERVALS (1/2" PREMOULDED JOINT FILLER REQUIRED FOR PRECAST BARRIERS).
 3. USE MINIMUM COVER OF 1 1/2", UNLESS OTHERWISE INDICATED.
 4. MATERIAL IS 4000 PSI CEMENT CONCRETE. (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)
 5. ALL STEEL REINFORCING TO BE GALVANIZED OR EPOXY COATED, AASHTO-M31, GRADE 60.
 6. FOR DIMENSIONS SEE E 402.10.0



1-1/2" X 6" SLOT 10" DEEP

1" Ø PLAIN SMOOTH BAR DOWEL
18" LONG



SECTION B-B

SECTION A-A

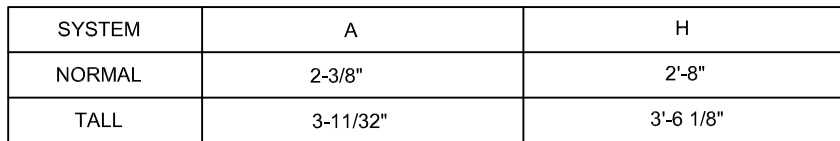
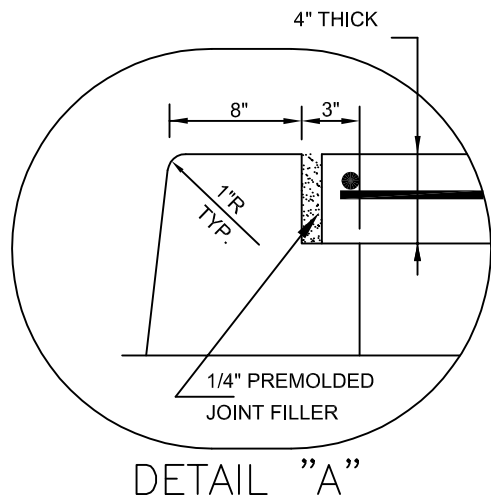
SYMMETRICAL SECTION

ASYMMETRICAL SECTION

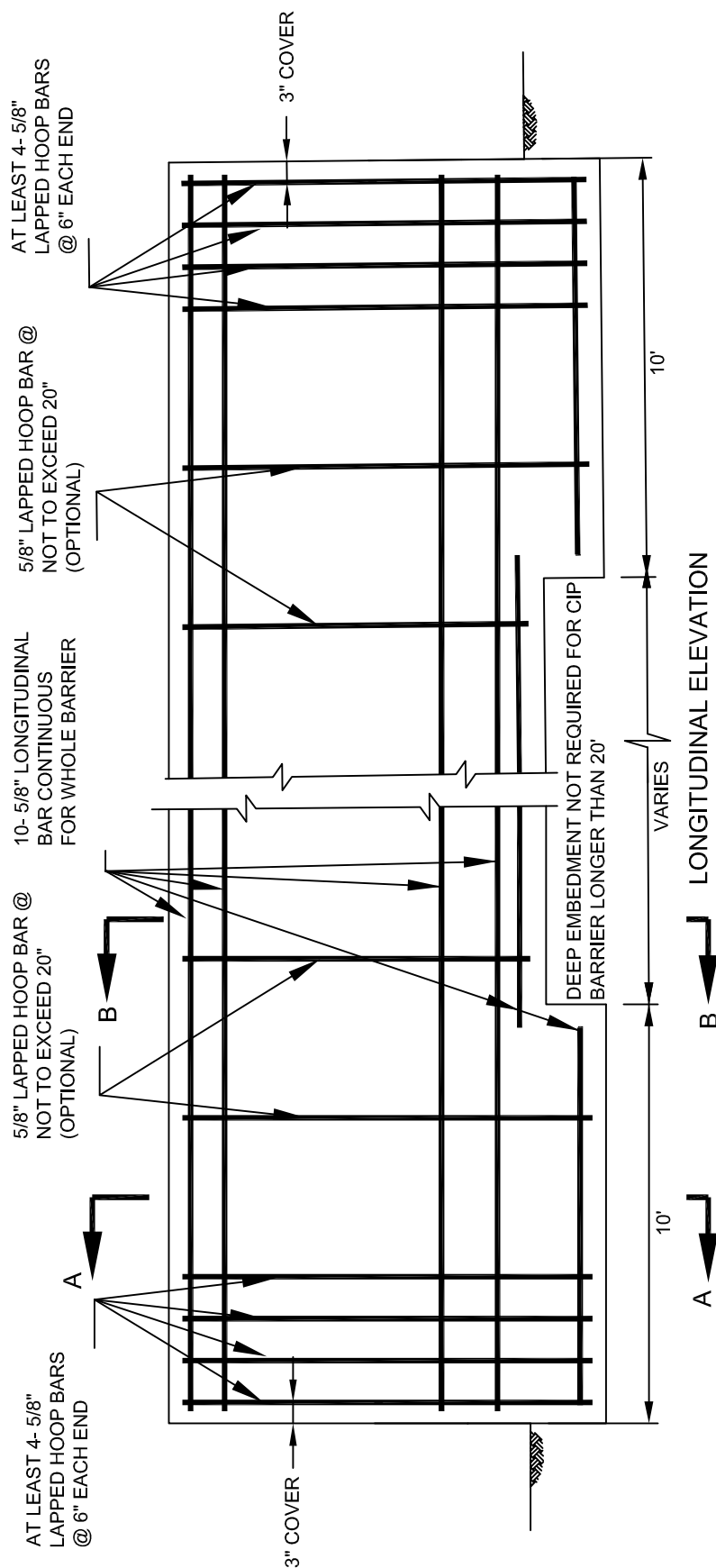
ELEVATION

NOTES:

1. DOWELS TO BE GALVANIZED, AASHTO-M31, GRADE 60.
2. FOR ADDITIONAL DETAILS SEE E 402.10.0

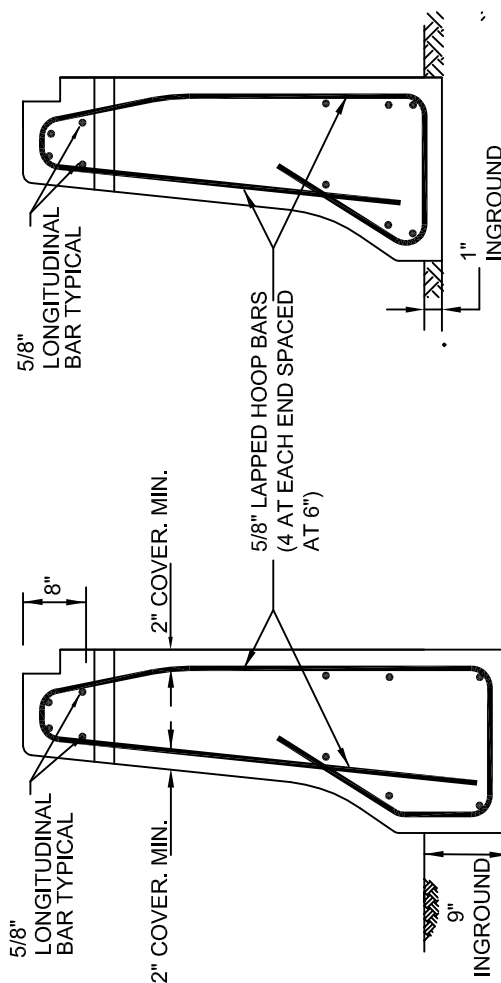


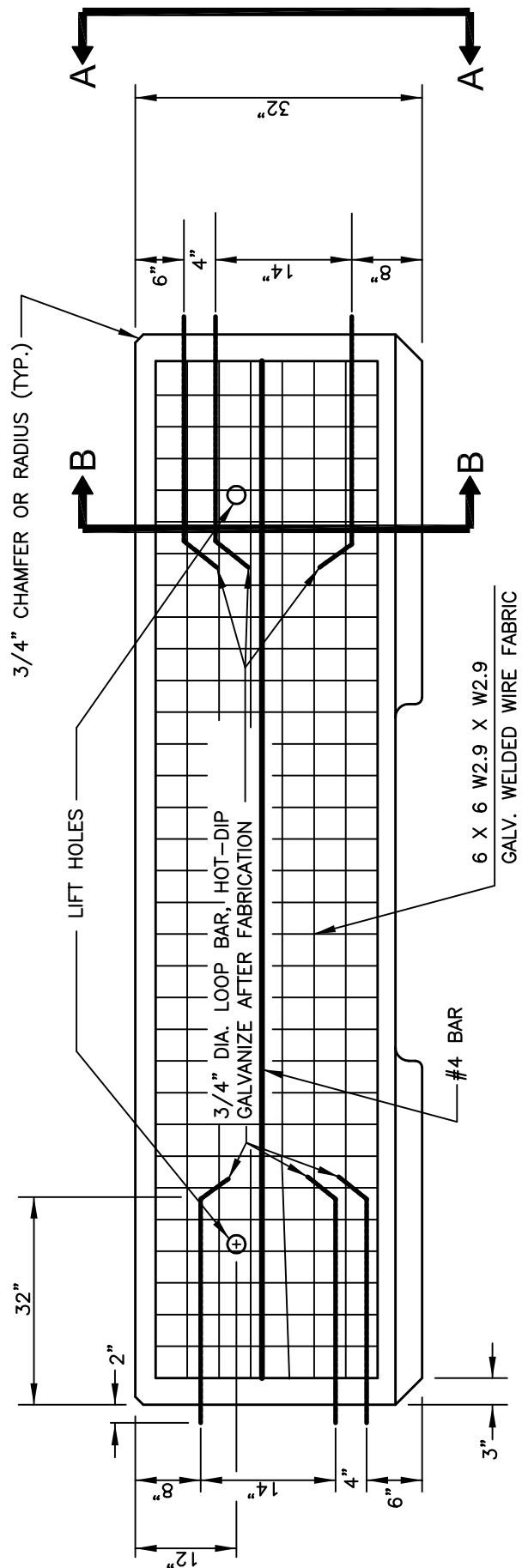
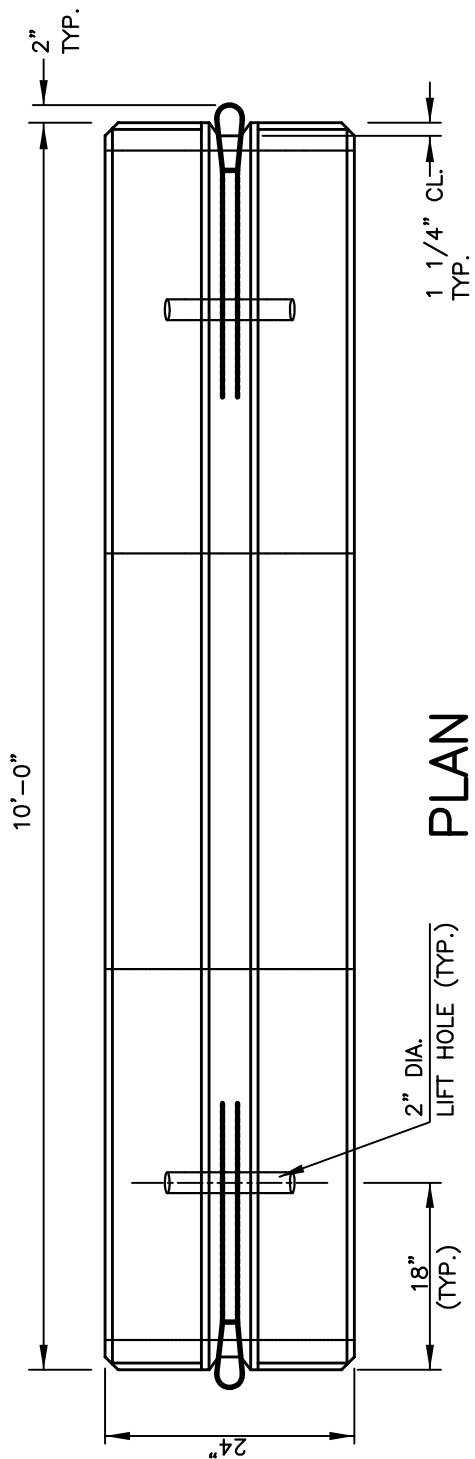
F SHAPE CONCRETE BARRIER WITH CONCRETE SEPARATOR REINFORCING DETAILS

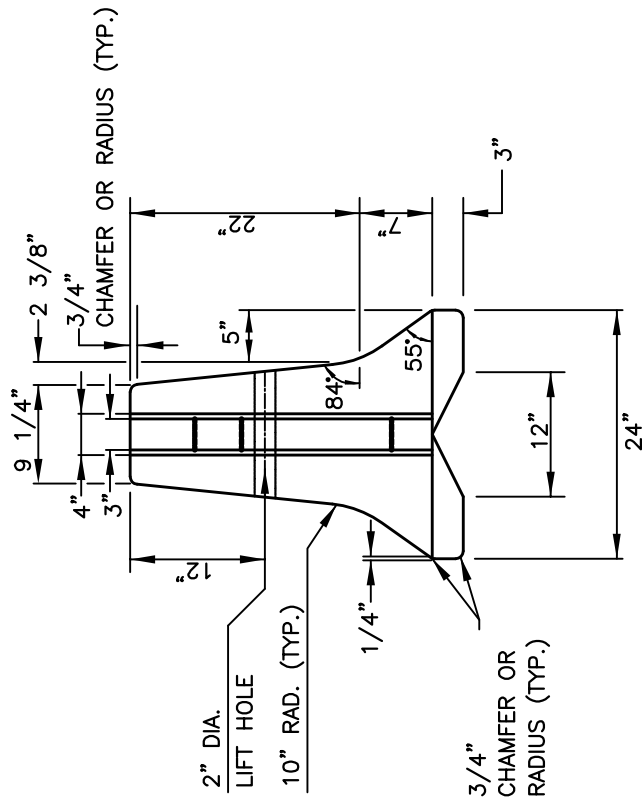


NOTES:

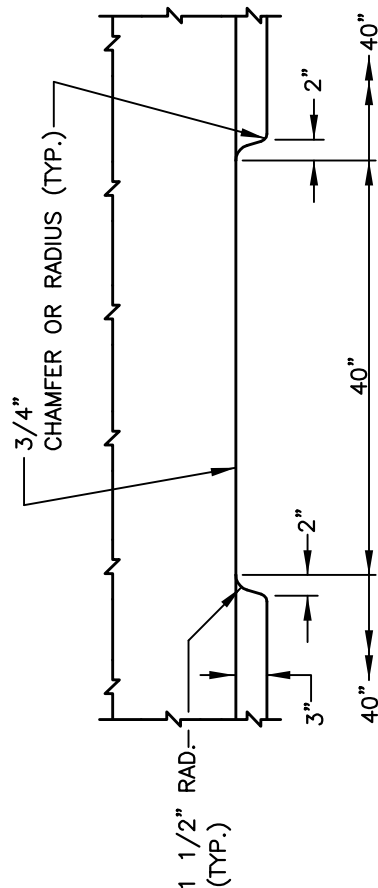
1. ALL LONGITUDINAL BARS ARE TO BE CONTINUOUS FOR BOTH PRECAST BARRIERS AND CAST IN PLACE BARRIERS.
2. USE MINIMUM COVER OF 1 1/2", UNLESS OTHERWISE INDICATED.
3. CAST IN PLACE (CIP) NOT TO EXCEED 200 FT BETWEEN EXPANSION JOINTS.
4. CONTRACTION JOINTS REQUIRED AT 40' INTERVALS (1/2" PREMOULDED JOINT FILLER REQUIRED FOR PRECAST BARRIERS).
5. ALL STEEL REINFORCING TO BE GALVANIZED OR EPOXY COATED, AASHTO-M31, GRADE 60.
6. FOR DIMENSIONS SEE E 401.20.0



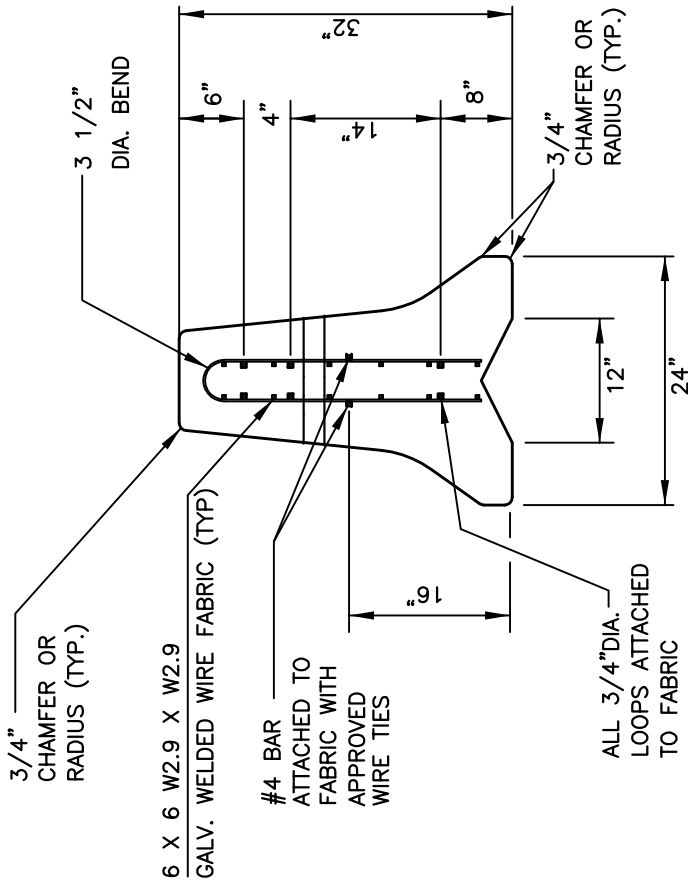




END VIEW A-A



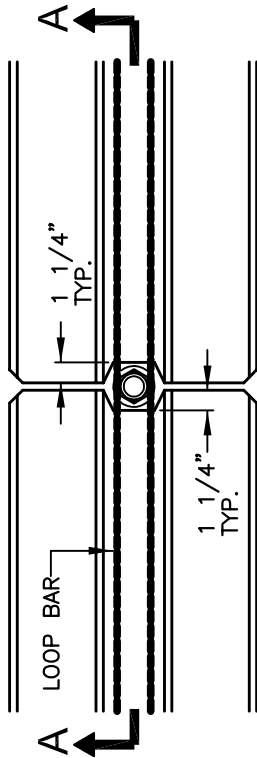
ELEVATION DETAIL OF DRAINAGE SLOT



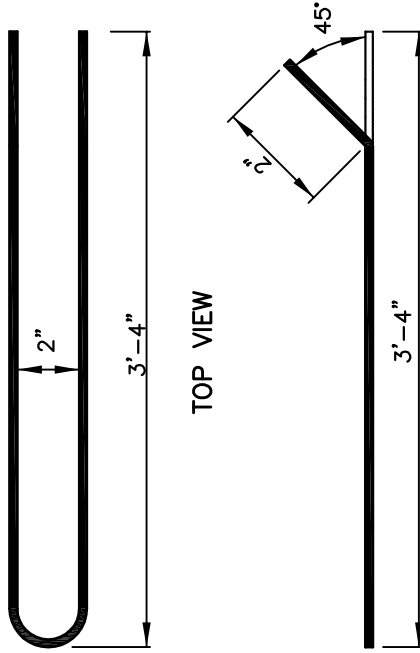
SECTION B-B

GENERAL NOTES

1. ALL WELDED WIRE FABRIC, BARS, HOOP BARS AND PIN ASSEMBLIES ARE TO BE HOT-DIP GALVANIZED AFTER FABRICATION.
2. HOT-DIP GALVANIZED TREATMENTS ARE TO CONFORM TO MASSACHUSETTS HIGHWAY STANDARD SPECIFICATIONS M7.10.0 AND AASHTO M111.
3. CEMENT CONCRETE IS TO CONFORM TO MASSACHUSETTS HIGHWAY STANDARD SPECIFICATIONS M4.02.00. CEMENT CONCRETE IS TO BE 5000 PSI (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS).



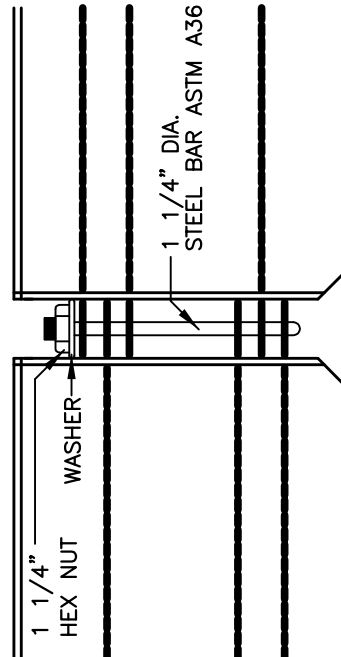
PLAN OF CONNECTION



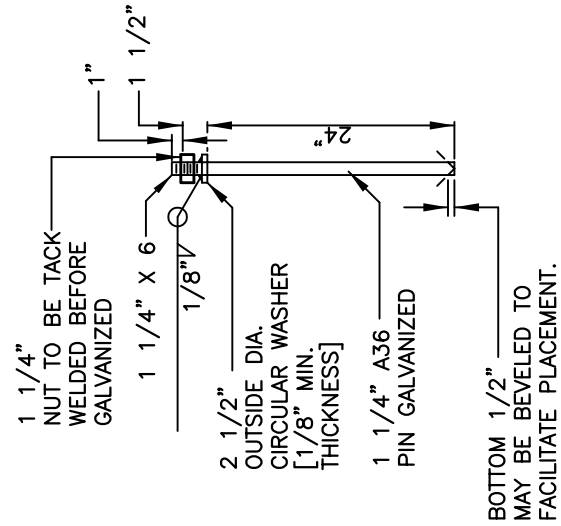
TOP VIEW

**SIDE VIEW
LOOP BAR
3/4" DIA. A36**

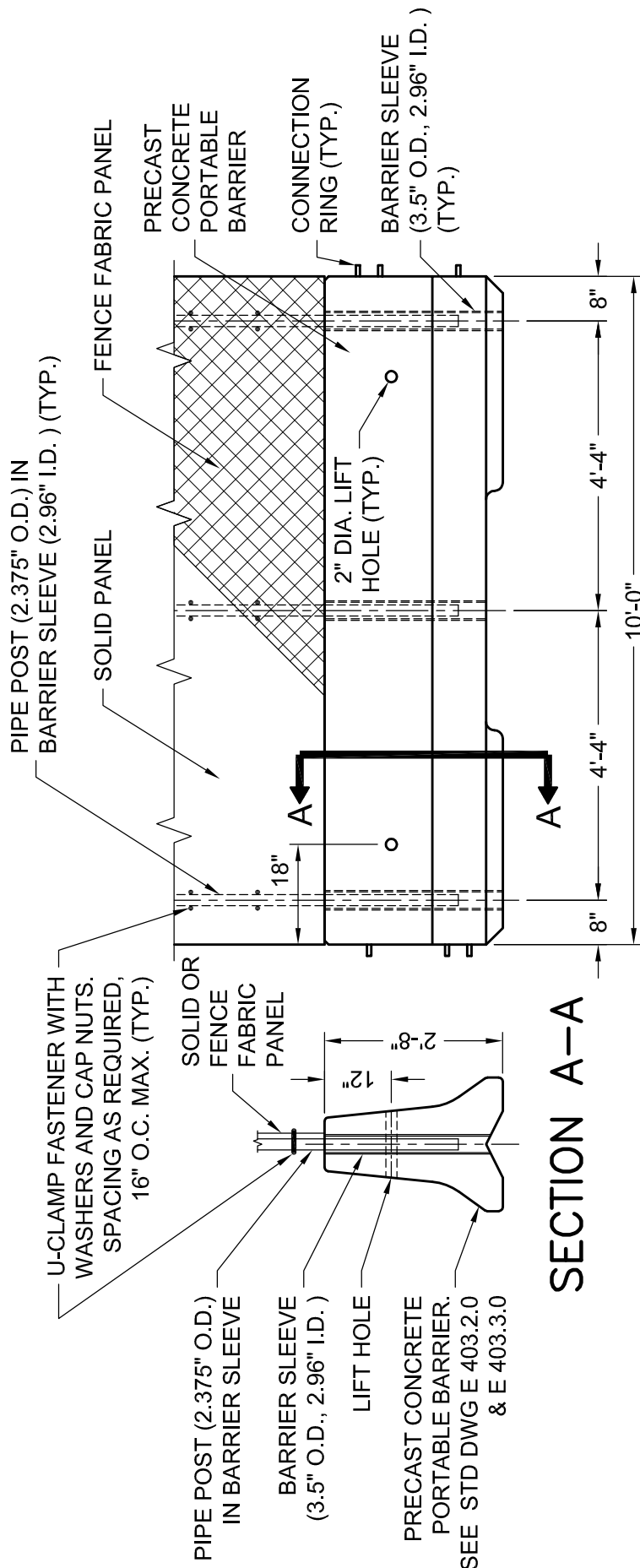
REINFORCEMENT DETAIL



SECTION A--A



**CONNECTOR PIN
ASSEMBLY**

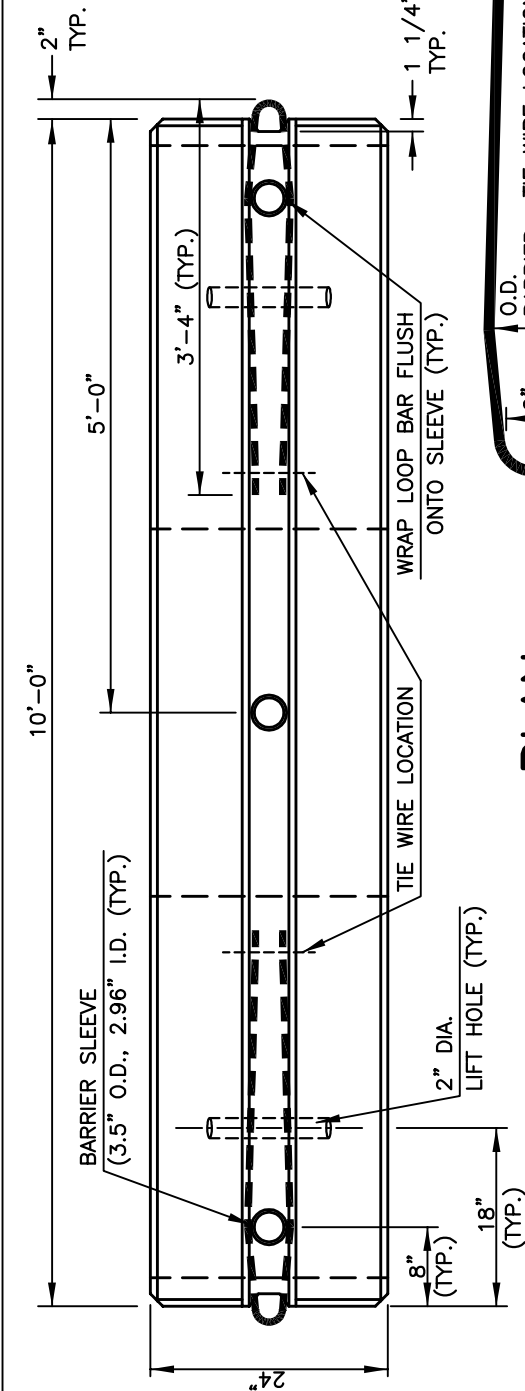


SECTION A-A

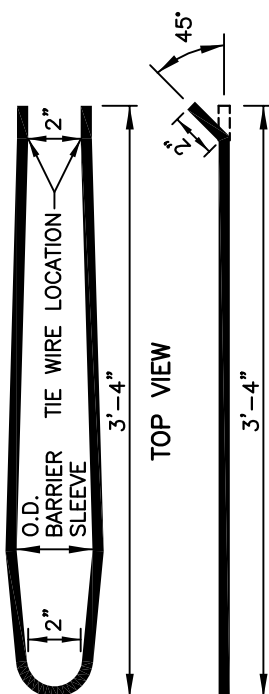
ELEVATION

NOTES:

1. BACK SIDE OF FENCES AND BARRICADES SHALL FACE CONSTRUCTION SITE. FRONT SIDE SHALL FACE PUBLIC AREA.
2. FASTENER SIDE OF LINE POST TIES SHALL BE ON BACK SIDE OF FENCES AND BARRICADES.
3. CHAIN LINK MESH SHALL BE 9 GAUGE CORE WIRE SIZE 2" MESH, SELVAGES SHALL BE KNUCKLED.
4. ANTI-DUST FABRIC SCREEN SHALL BE ATTACHED TO FENCE MESH WITH PLASTIC ZIP TIES.

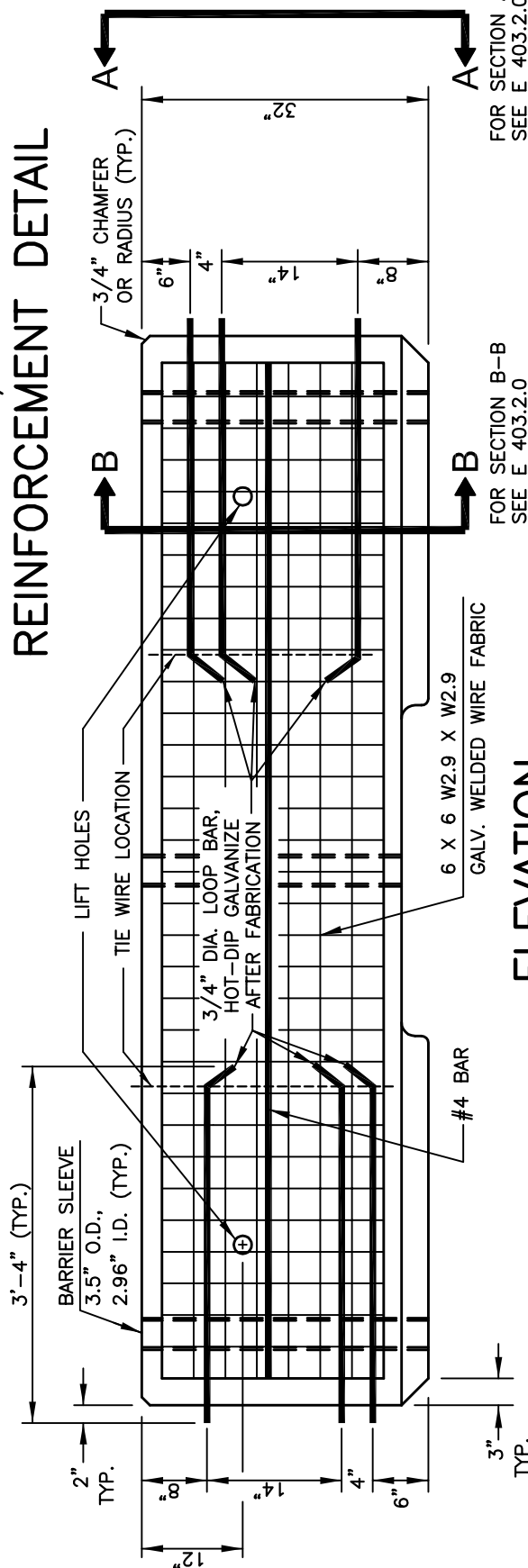


PLAN



NOTES:
FOR ADDITIONAL BARRIER DETAILS
SEE E 403.2.0
FOR PLAN OF CONNECTION AND
CONNECTOR PIN ASSEMBLY DETAILS
SEE E 403.3.0

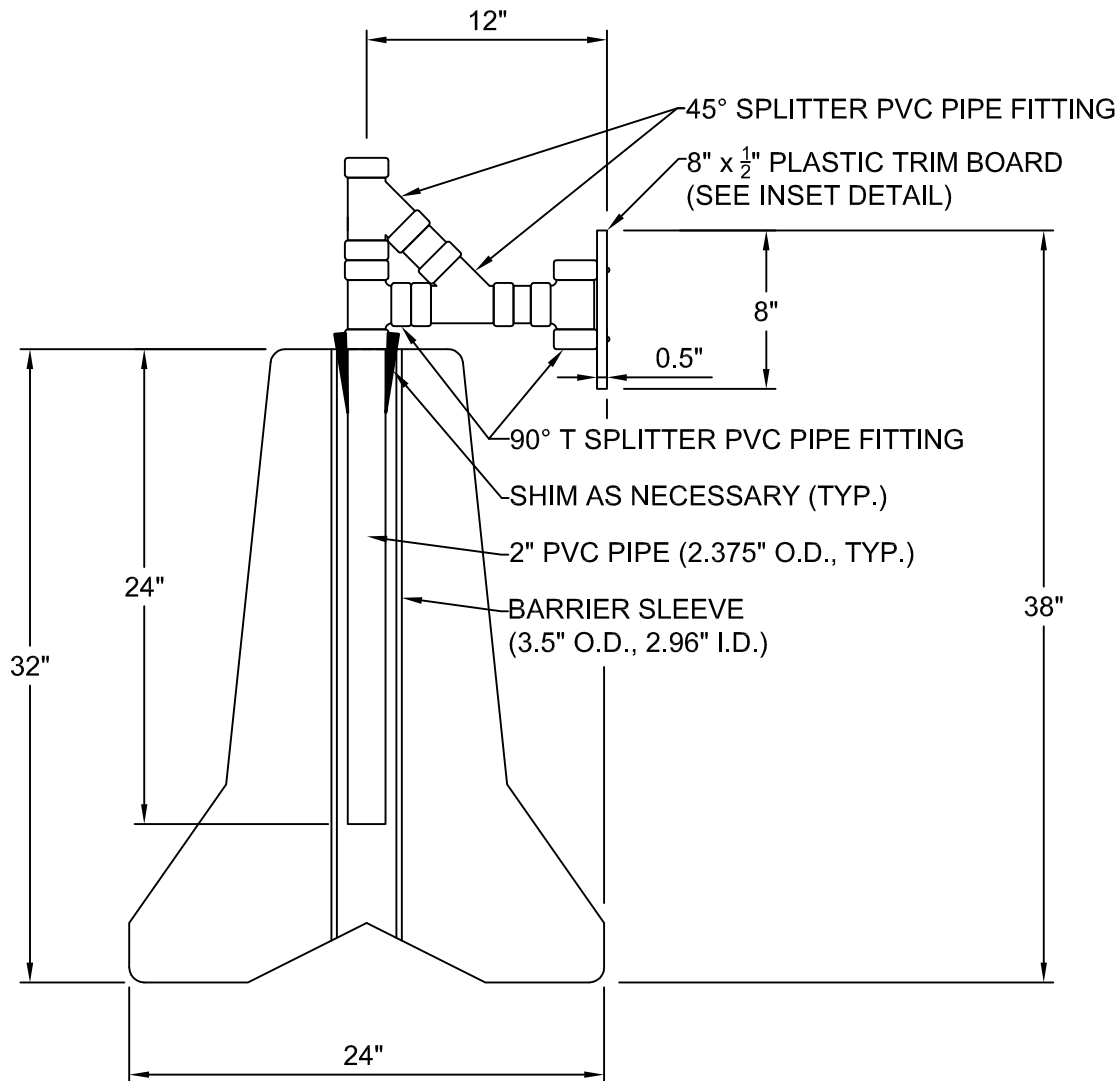
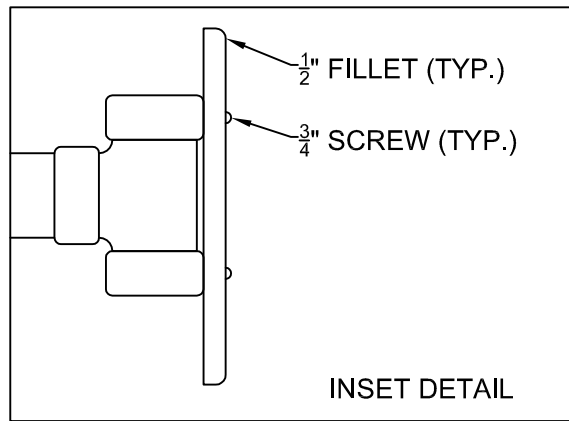
REINFORCEMENT DETAIL
SIDE VIEW
LOOP BAR 3/4" DIA. A36



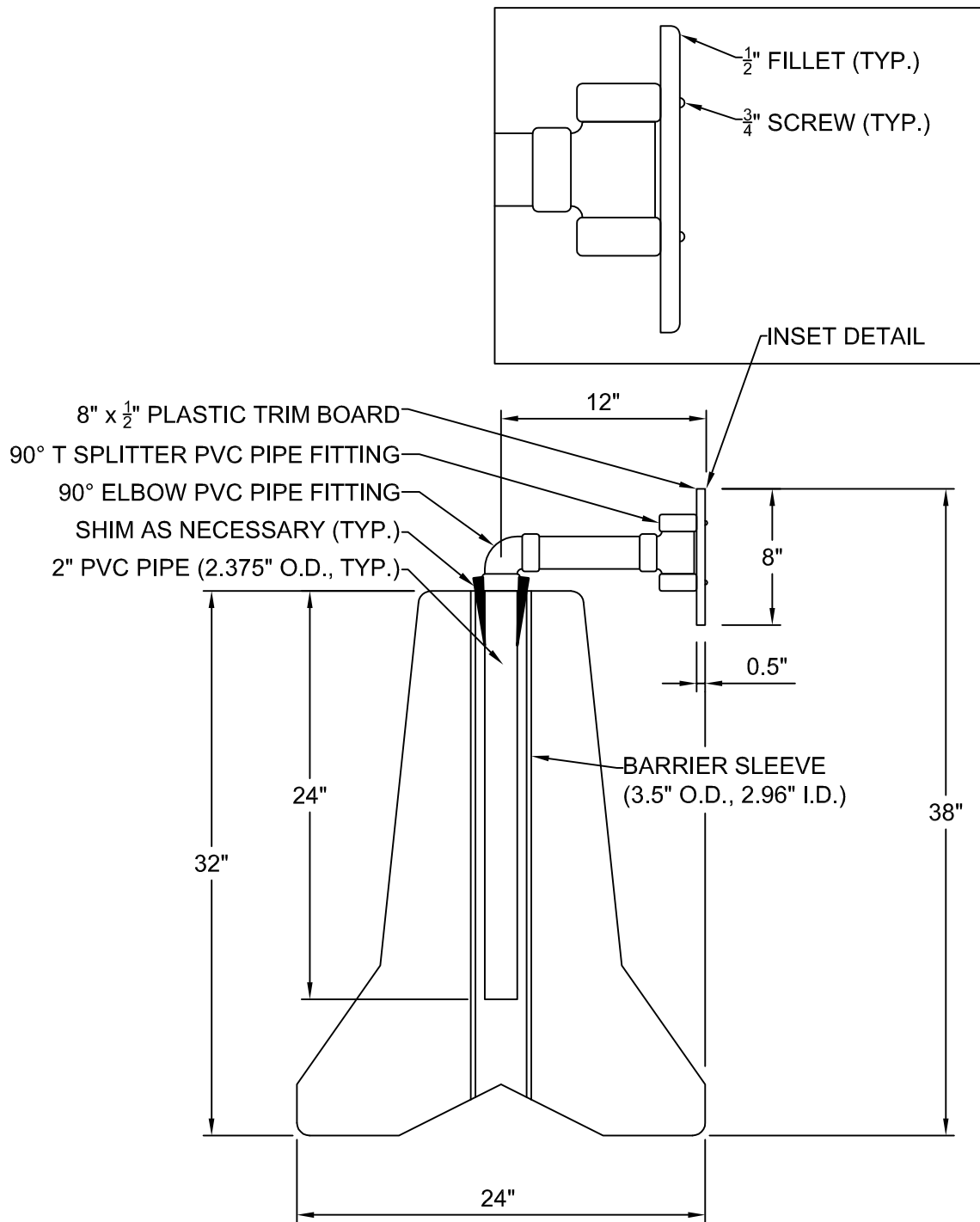
ELEVATION

FOR SECTION B-B
SEE E 403.2.0

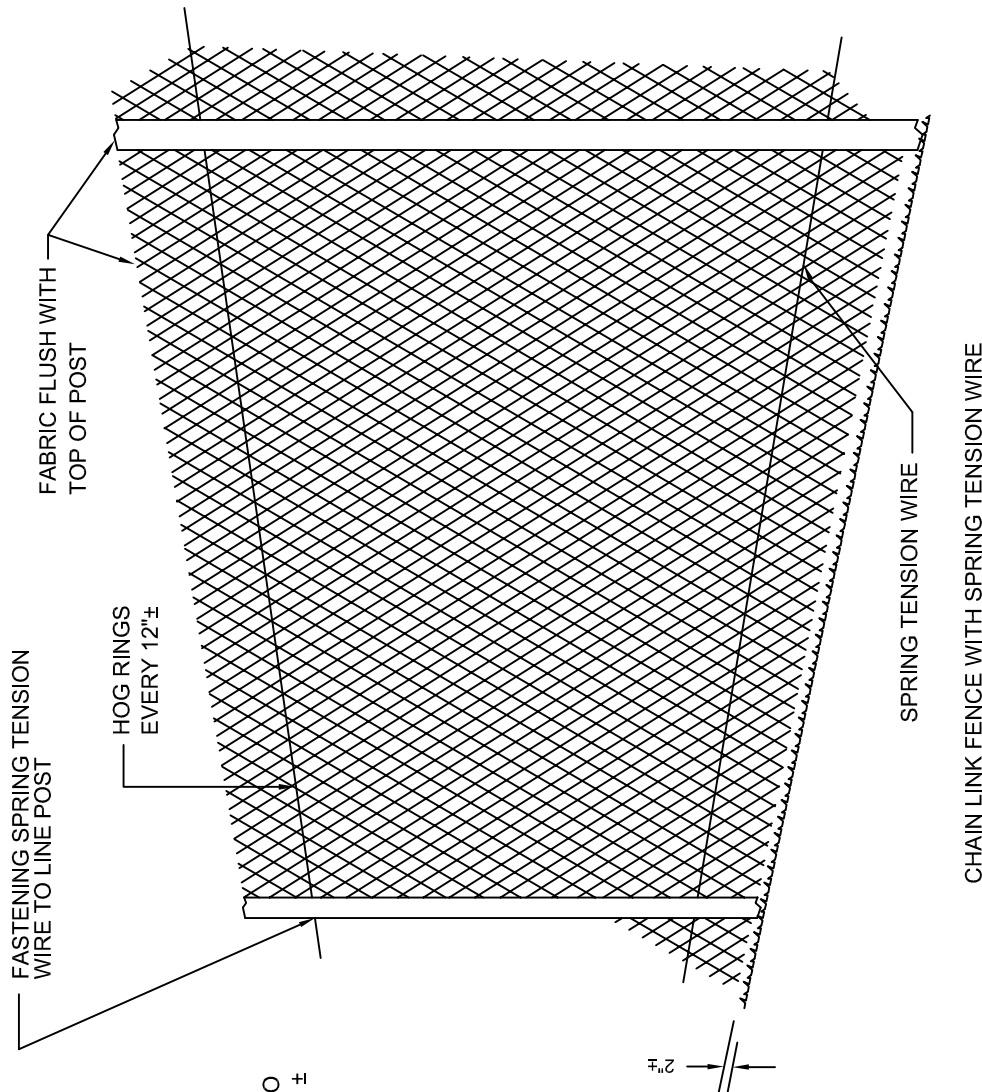
FOR SECTION A-A
SEE E 403.2.0



TYPICAL PEDESTRIAN RAIL SECTION



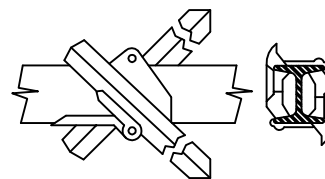
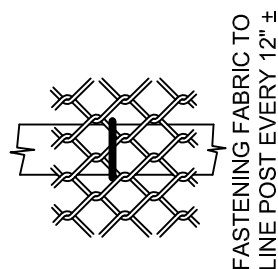
TYPICAL MODIFIED PEDESTRIAN RAIL SECTION



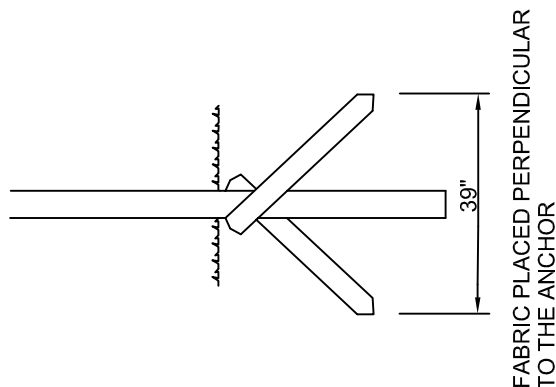
LINE POSTS TO BE SPACED 10'-0" C. TO C. MAXIMUM EXCEPT ON CURVES WHERE THEY SHALL BE SPACED AS FOLLOWS:

CURVES 200' TO 500' RADIUS	8'-0" C. TO C. MAXIMUM
CURVES 100' TO 200' RADIUS	6'-0" C. TO C. MAXIMUM
CURVES LESS THAN 100' RADIUS	5'-0" C. TO C. MAXIMUM

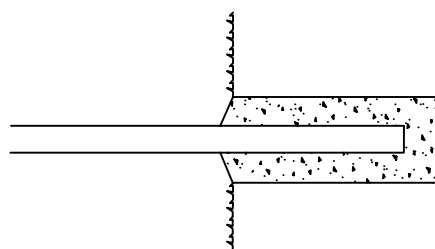
LINE POST SPACING



DETAIL OF AN ANCHOR CLAMP

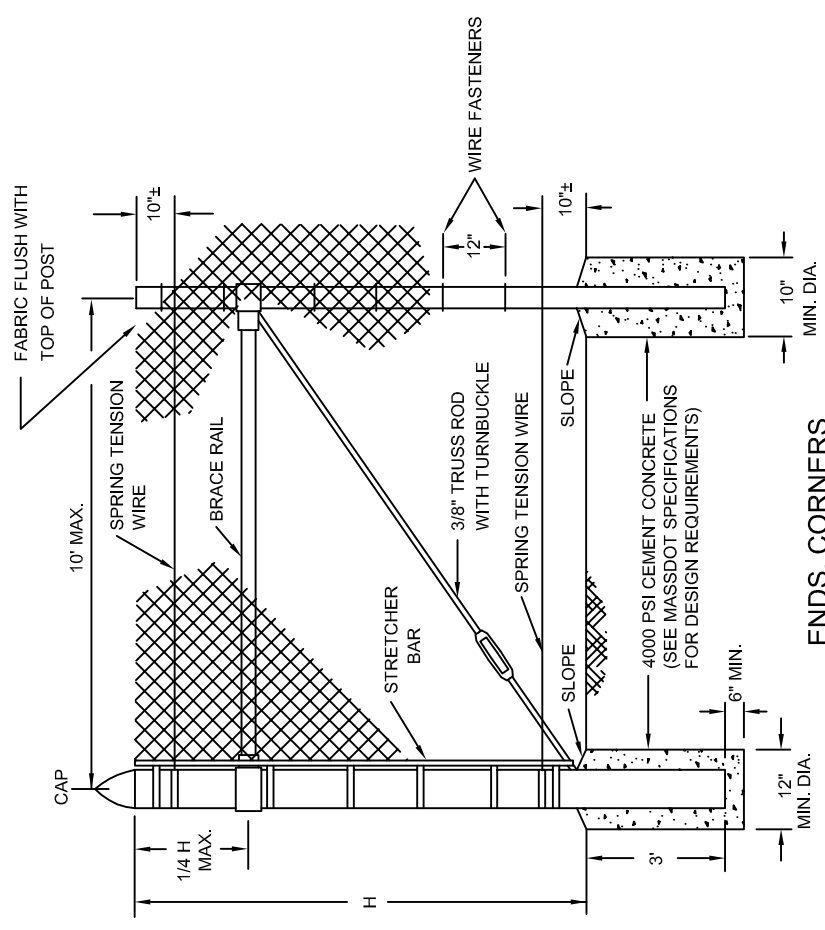


DETAIL SHOWING LINE POST SET WITH DRIVE ANCHORS

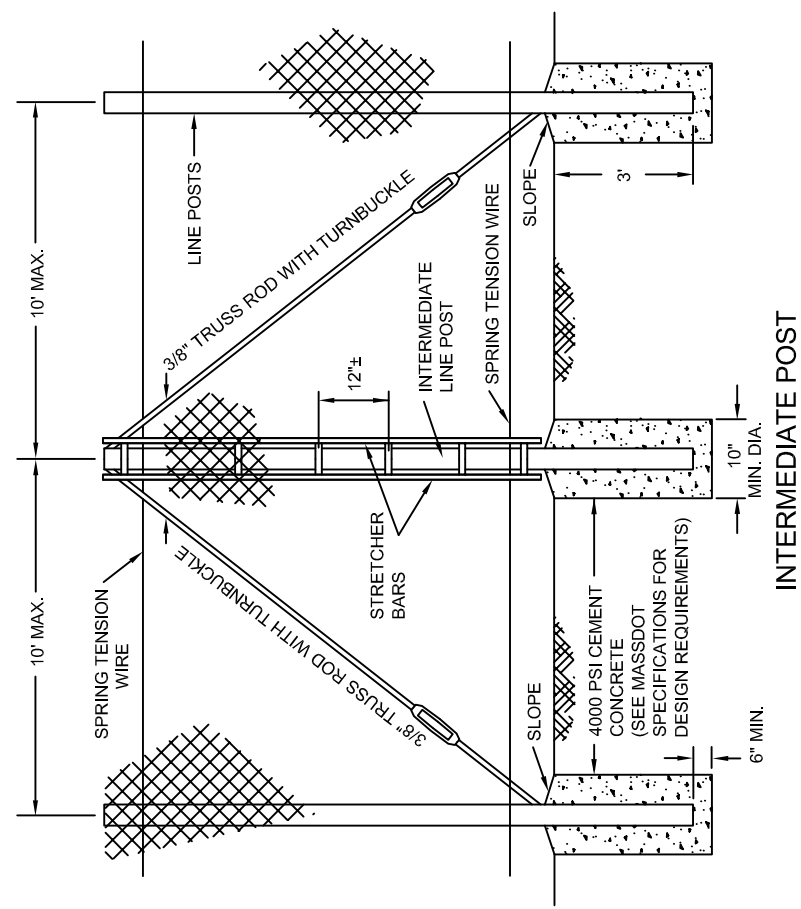


DETAIL SHOWING LINE POST SET IN CONCRETE FOOTING FOR DIMENSIONS SEE 404.5.0

CHAIN LINK FENCE (SPRING TENSION WIRE)



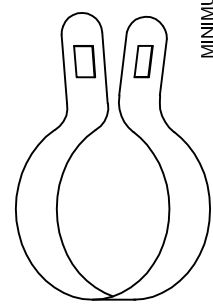
ENDS, CORNERS



INTERMEDIATE POST

NOTES:

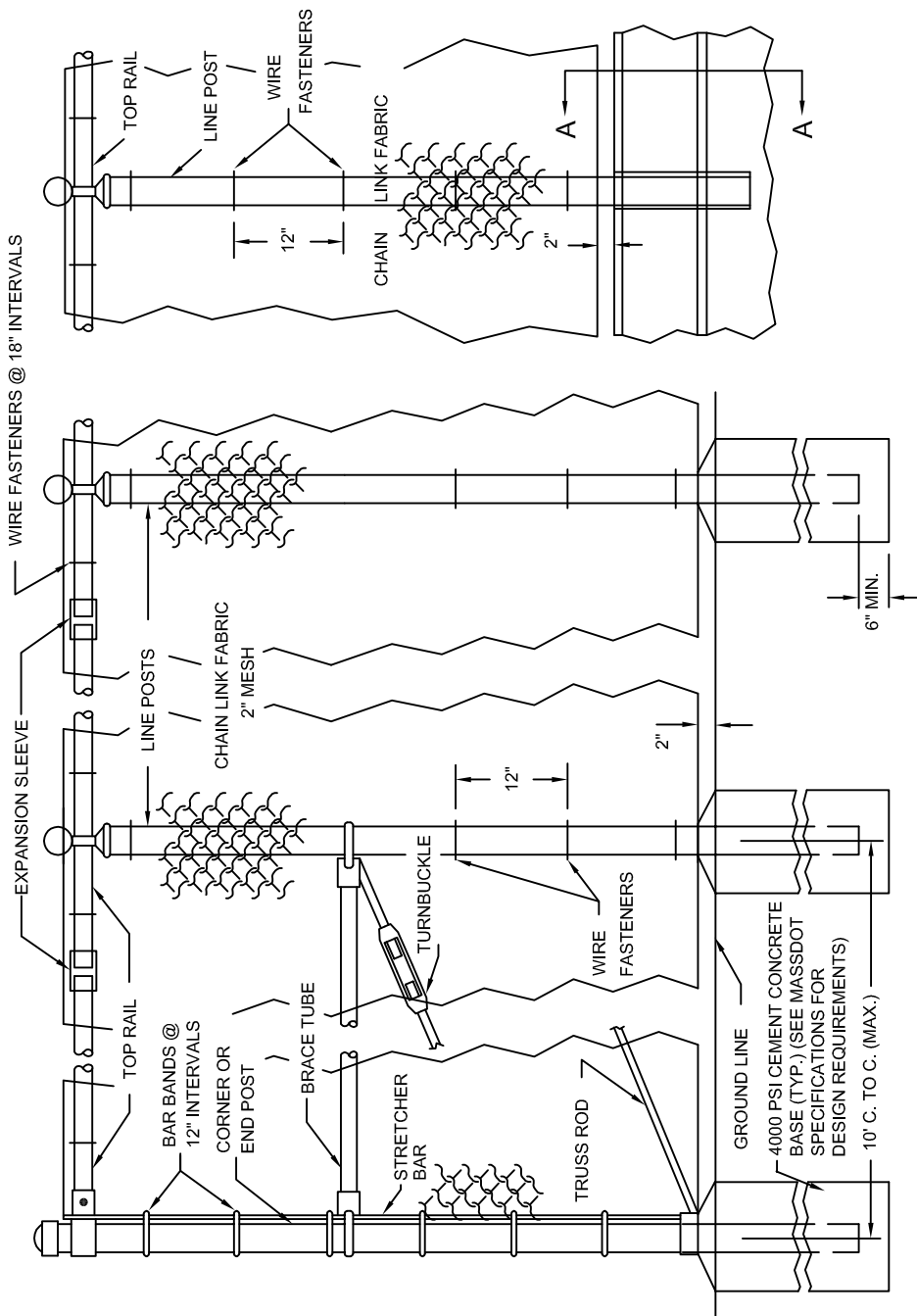
1. FABRIC FOR FENCES 4' OR LESS IN HEIGHT; TOP SELVAGE TO HAVE KNUCKLED FINISH. BOTTOM SELVAGE TO HAVE TWISTED AND BARBED FINISH UNLESS OTHERWISE NOTED. FABRIC FOR FENCES 5' OR OVER IN HEIGHT; BOTH TOP AND BOTTOM SELVAGE TO HAVE TWISTED AND BARBED FINISH UNLESS OTHERWISE NOTED.
2. GRADE OF FENCE TO BE PARALLEL WITH THE GRADE OF SIDEWALKS, CURBING, GROUND OR TOP OF WALL.
3. INTERMEDIATE POST INTERVALS NOT TO EXCEED 500 FEET.
4. SPACING OF LINE POST ON CURVES. SEE DRAWING E 404.1.0
5. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.
6. SPRING TENSION WIRE TO BE FASTENED TO FABRIC WITH 11 GAUGE HOG RINGS AT 1' INTERVALS.
7. SPRING TENSION WIRE TO BE FASTENED TO LINE POSTS WITH CLIPS.
8. LINE POSTS TO BE DRIVEN EXCEPT WHERE NOTED ABOVE.



END BAND

SPRING TENSION WIRE
MINIMUM OF (5) TURNS AROUND THE
SPRING TENSION WIRE TO END INSTALLATION.
ALL BANDS SHALL BE ROUND ON ROUND POSTS.

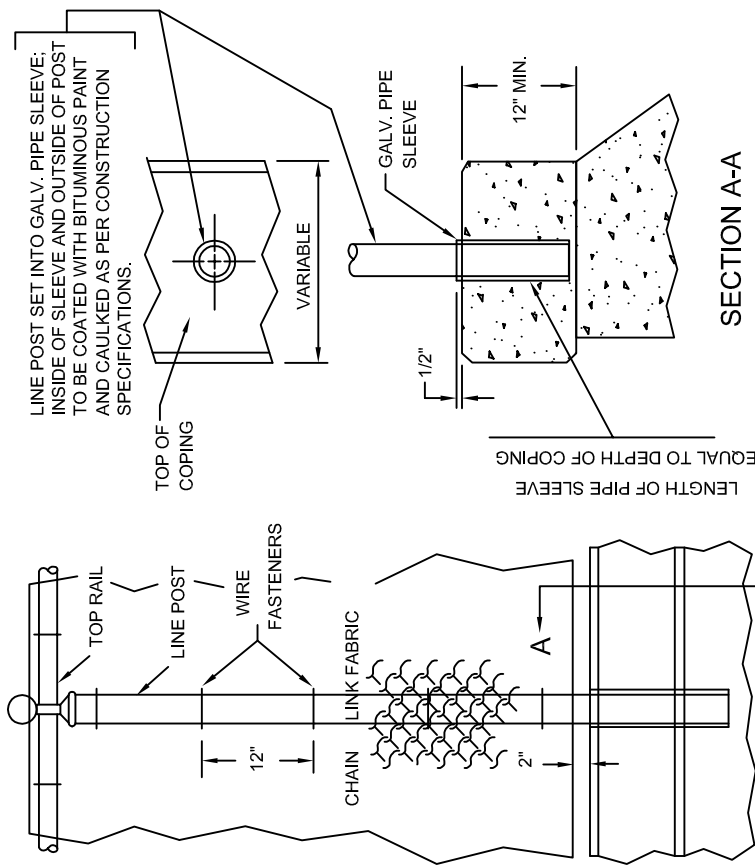
CHAIN LINK FENCE (PIPE TOP RAIL)



FENCE ON GROUND

NOTES:

- FABRIC FOR FENCES 4' OR LESS IN HEIGHT. TOP SELVAGE TO HAVE KNUCKLED FINISH. BOTTOM SELVAGE TO HAVE TWISTED AND BARBED FINISH UNLESS OTHERWISE NOTED. FABRIC FOR FENCES 5' OR OVER IN HEIGHT. BOTH TOP AND BOTTOM SELVAGE TO HAVE TWISTED AND BARBED FINISH UNLESS OTHERWISE NOTED. THE HEIGHT OF FENCE TO BE AS SPECIFIED.
- GRADE OF FENCE TO BE PARALLEL WITH THE GRADE OF SIDEWALKS, CURBING, GROUND OR TOP OF WALL.

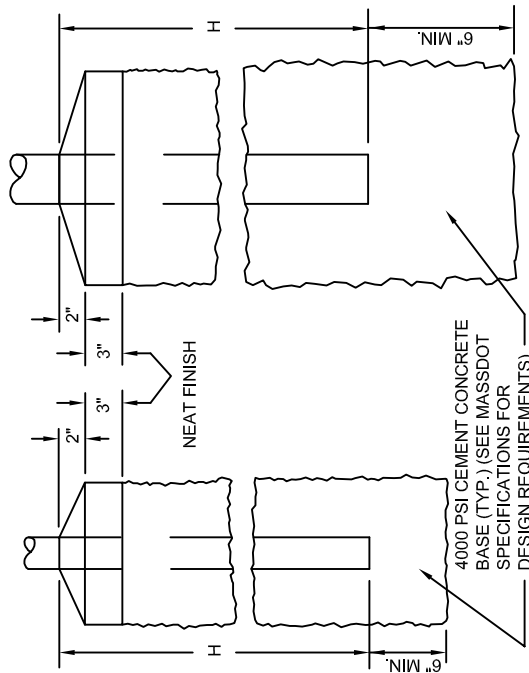
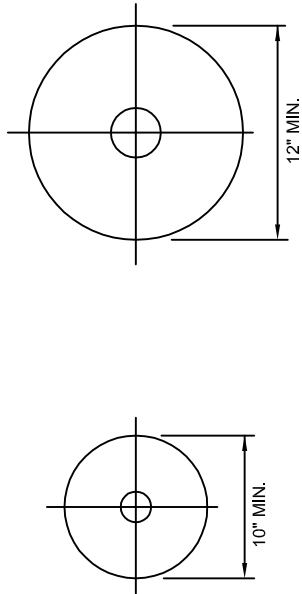


FENCE ON CONCRETE WALL

- LINE POSTS TO BE SPACED 10'-0" C. TO C. MAXIMUM EXCEPT ON CURVES WHERE THEY SHALL BE SPACED AS FOLLOWS:
CURVES 200' TO 500' RADIUS 8'-0" C. TO C. MAXIMUM
CURVES 100' TO 200' RADIUS 6'-0" C. TO C. MAXIMUM
CURVES LESS THAN 100' RADIUS 5'-0" C. TO C. MAXIMUM
- FOR POST BASES AND CABLE ATTACHMENTS, SEE DRAWING E 404.5.0
- FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.

CHAIN LINK FENCE DETAILS OF CABLE ATTACHMENTS AND POST BASES

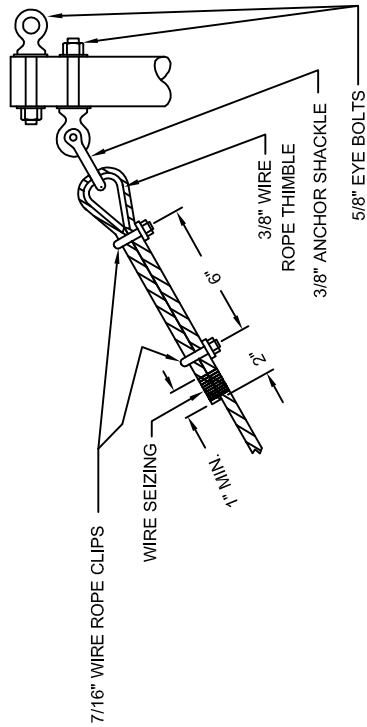
POST BASES



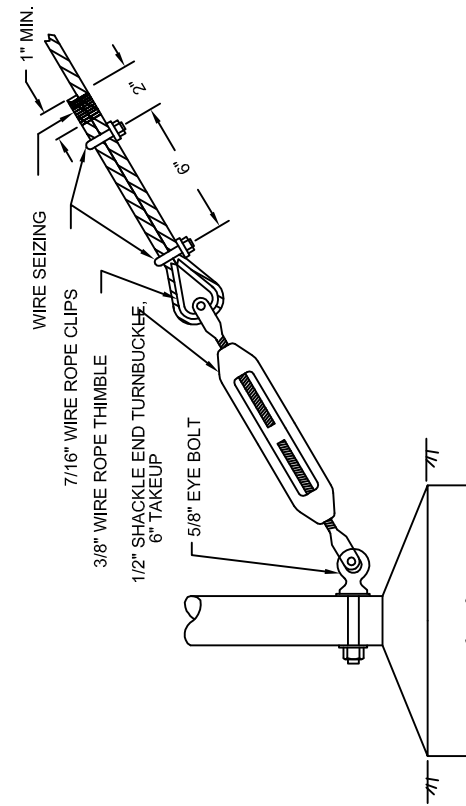
FOR GATE POSTS

FOR CORNER, END LINE AND PULL POSTS

FENCE HEIGHT	MIN. H
5' OR LESS	2'-6"
OVER 5'	3'-0"



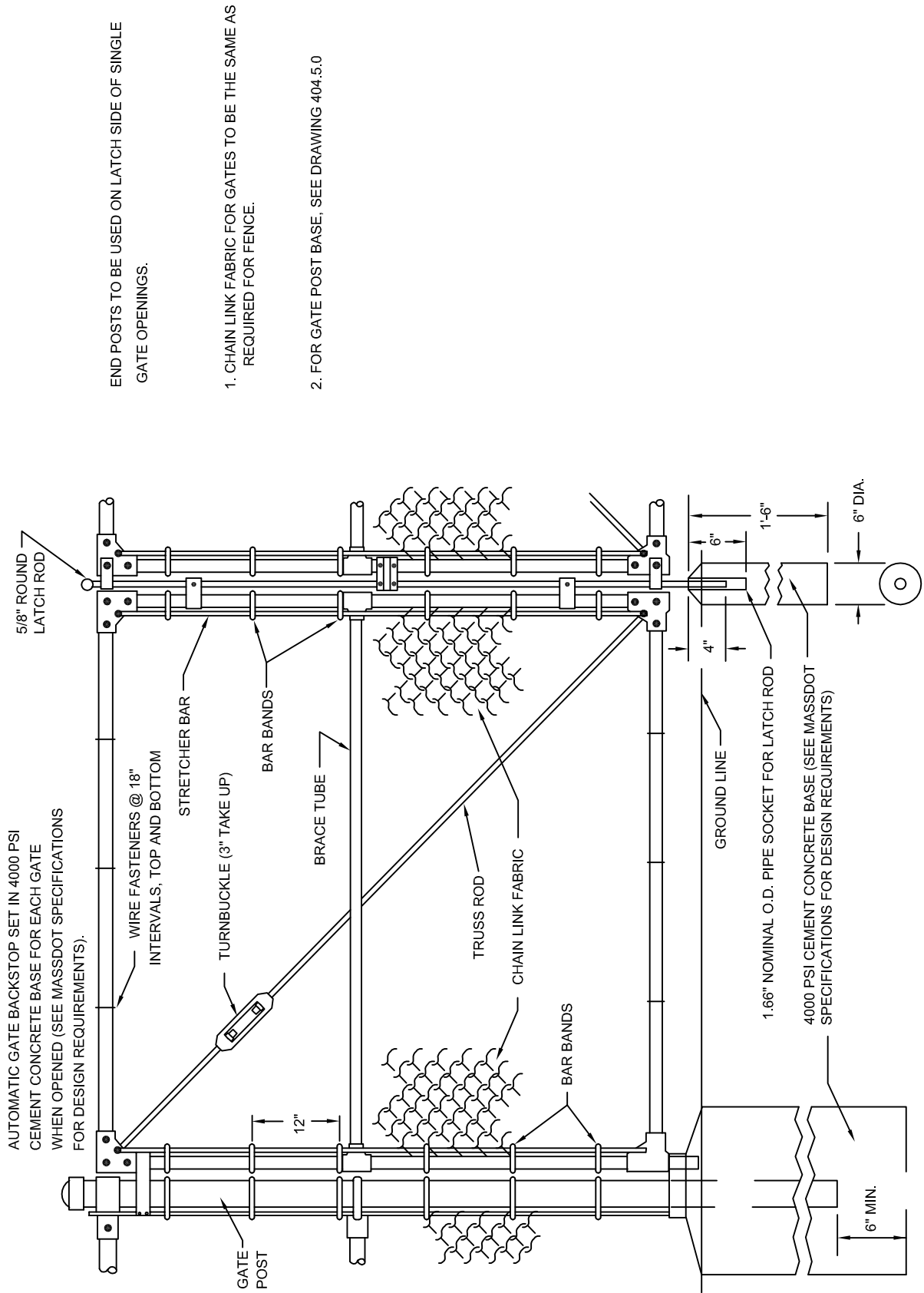
FOR END PULL POST



FOR FASTENING TO BASE OF POST

NOTE:
1. FOR EYE BOLT INSTALLATION THROUGH PIPE SECTIONS, USE
2 WASHERS ON "SHOULDER SIDE" AND 1 WASHER WITH LOCK
WASHER ON "NUT SIDE" OF POSTS.

DETAILS OF CABLE ATTACHMENTS

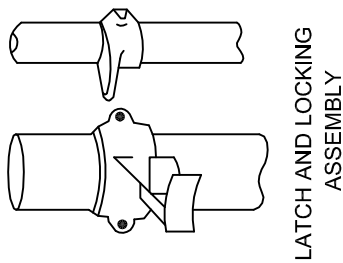
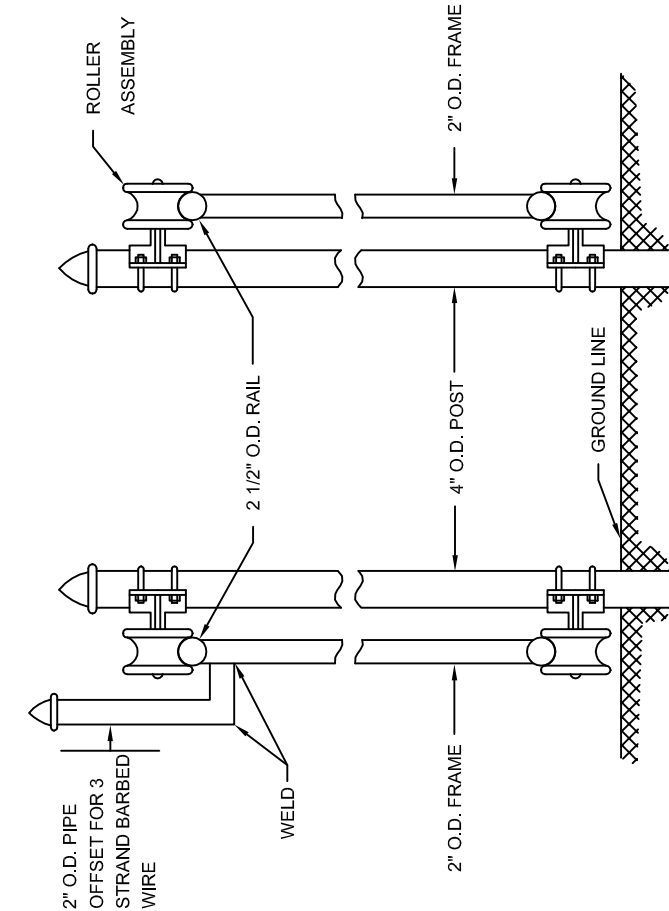


END POSTS TO BE USED ON LATCH SIDE OF SINGLE GATE OPENINGS.

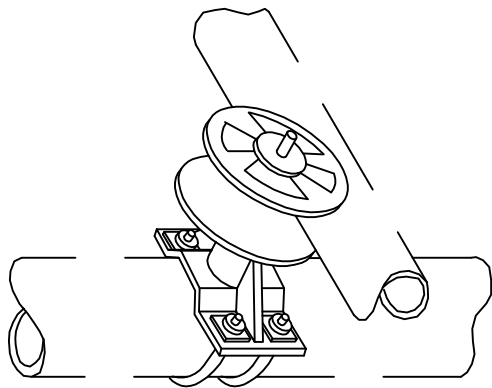
1. CHAIN LINK FABRIC FOR GATES TO BE THE SAME AS REQUIRED FOR FENCE.

2. FOR GATE POST BASE, SEE DRAWING 404.5.0

DOUBLE GATES



LATCH AND LOCKING ASSEMBLY

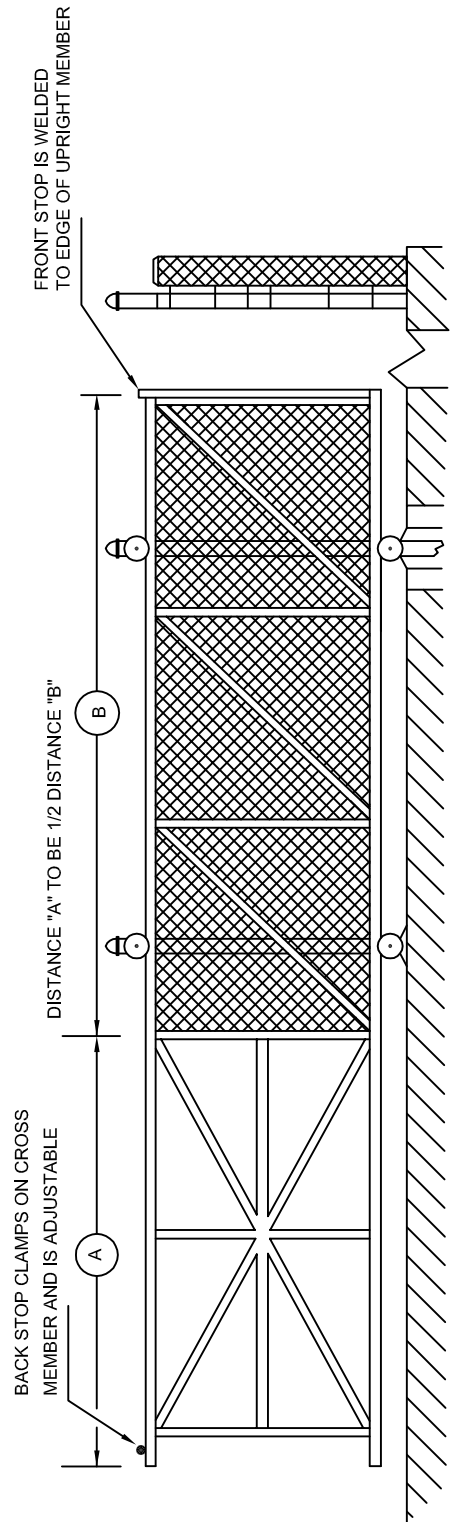


WHEEL EQUIPPED WITH ROLLER BEARINGS AND LUBRICATION FITTING.
MASSIVE MALLEABLE CONSTRUCTION.
4 ASSEMBLIES NEEDED PER SECTION.

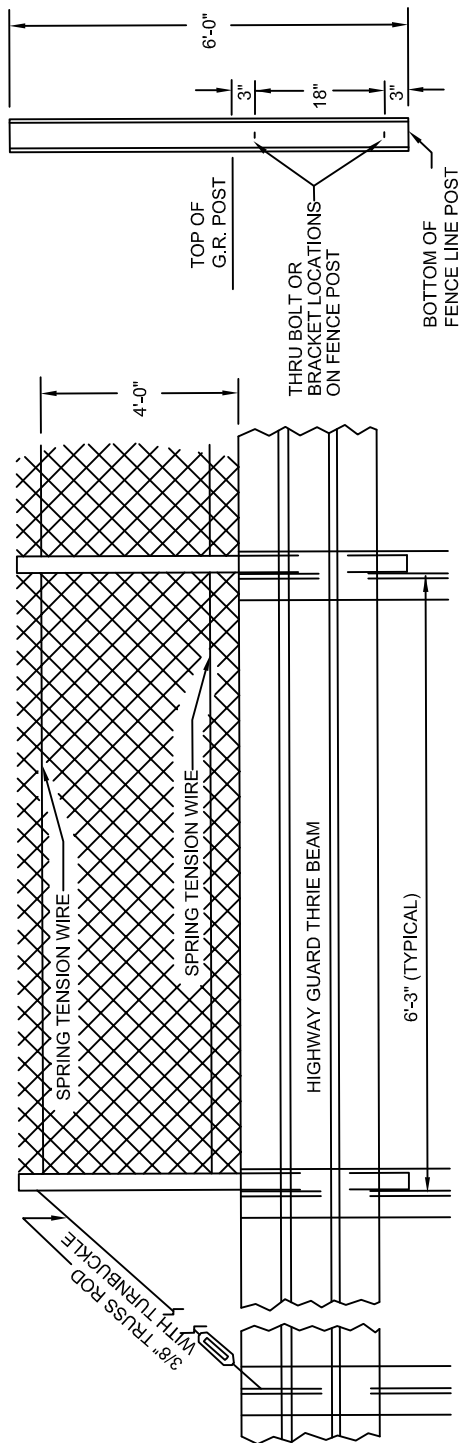
ROLLER ASSEMBLY

SPECIFICATIONS OF GATE FRAME
TOP AND BOTTOM MEMBER----- 2 1/2" O.D. PIPE
UPRIGHT MEMBERS----- 2" O.D. PIPE
HORIZONTAL AND DIAGONAL BRACES----- 1 5/8" O.D. PIPE

SIDE VIEW SHOWING TRUSS TYPE CONSTRUCTION

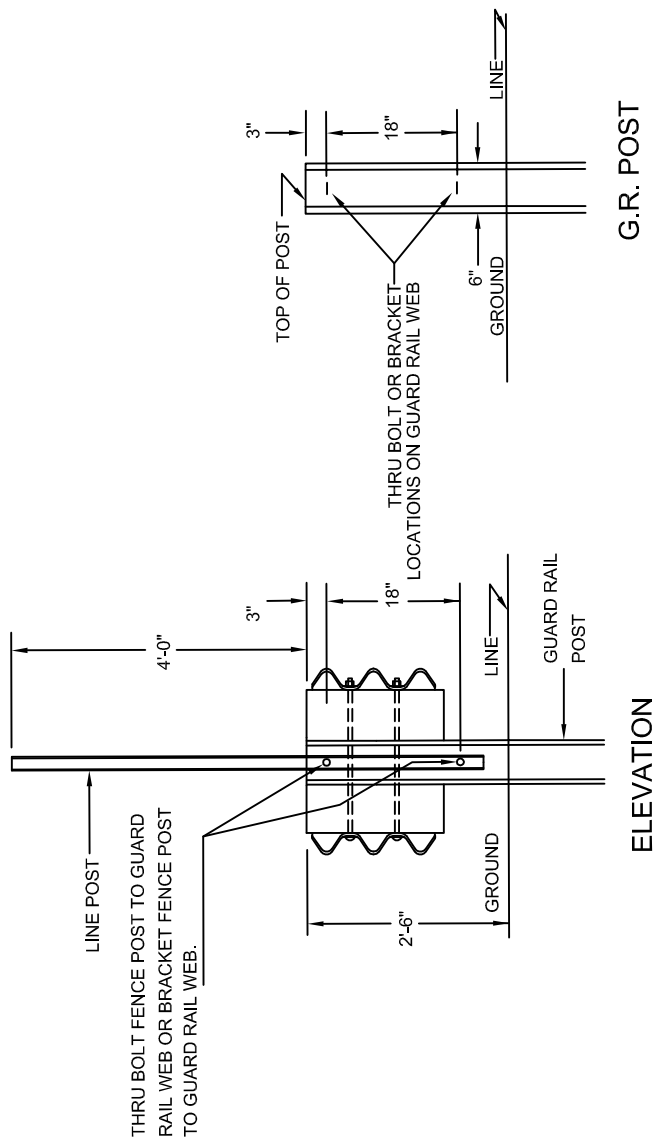


CHAIN LINK FENCE MOUNTED ON GUARD RAIL



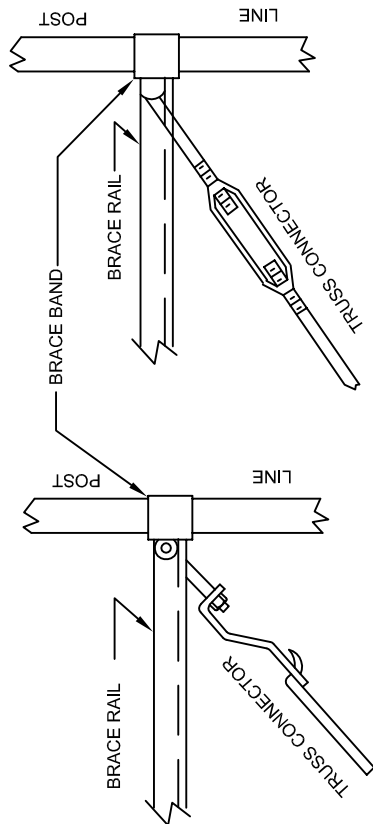
ELEVATION

CHAIN LINK FENCE POST

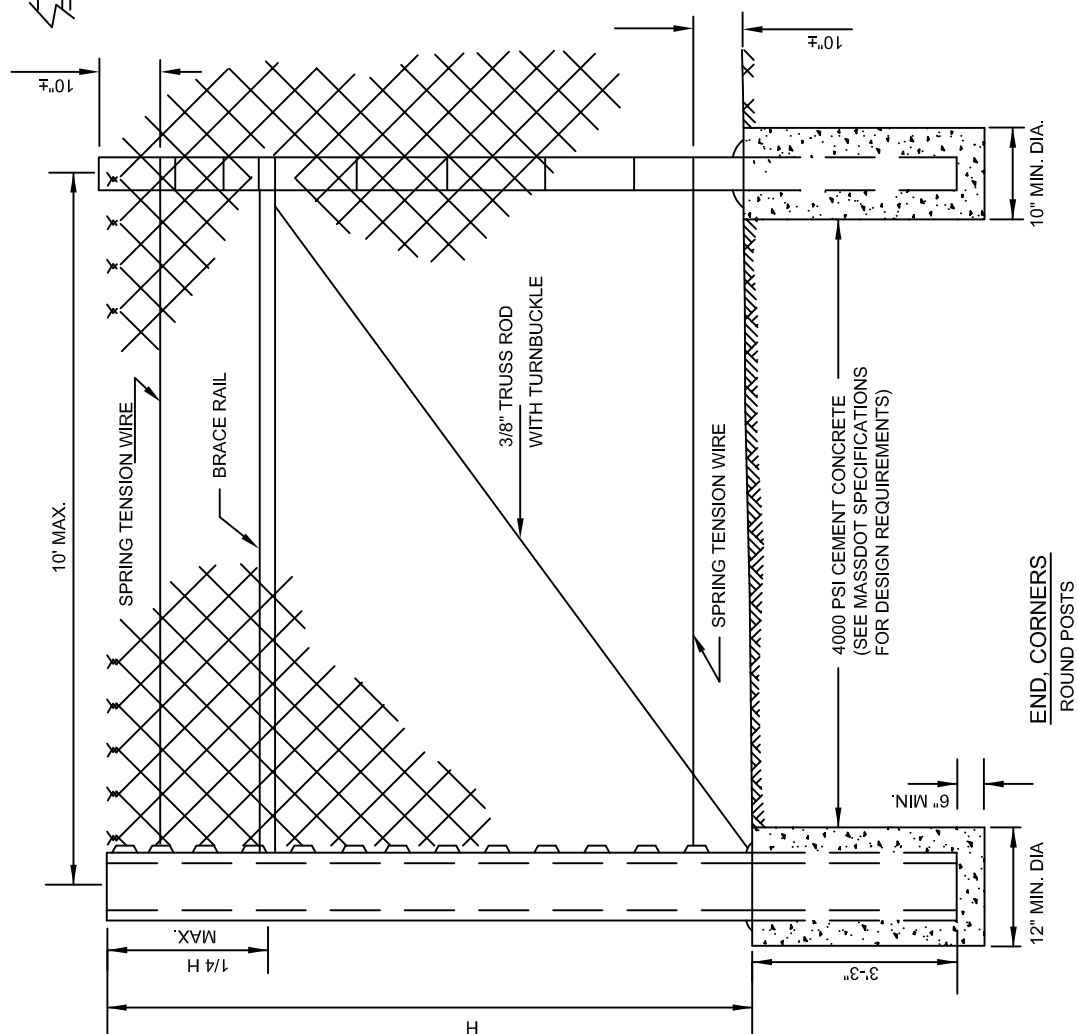


NOTES:

1. ALL POSTS (LINE, END, AND INTERMEDIATE) SHALL CONFORM TO DETAILS SHOWN ON DRAWING E 404.1.0
2. END BRACING TO CONFORM TO DETAIL SHOWN ABOVE. INTERMEDIATE BRACING SHALL BE IN CONFORMANCE TO DETAILS SHOWN ON DRAWING E 404.2.0
3. FOR DESCRIPTION, MATERIALS AND METHODS, SEE STANDARD SPECIFICATIONS.
4. SHALL USE A ROUND OR C FENCE POST

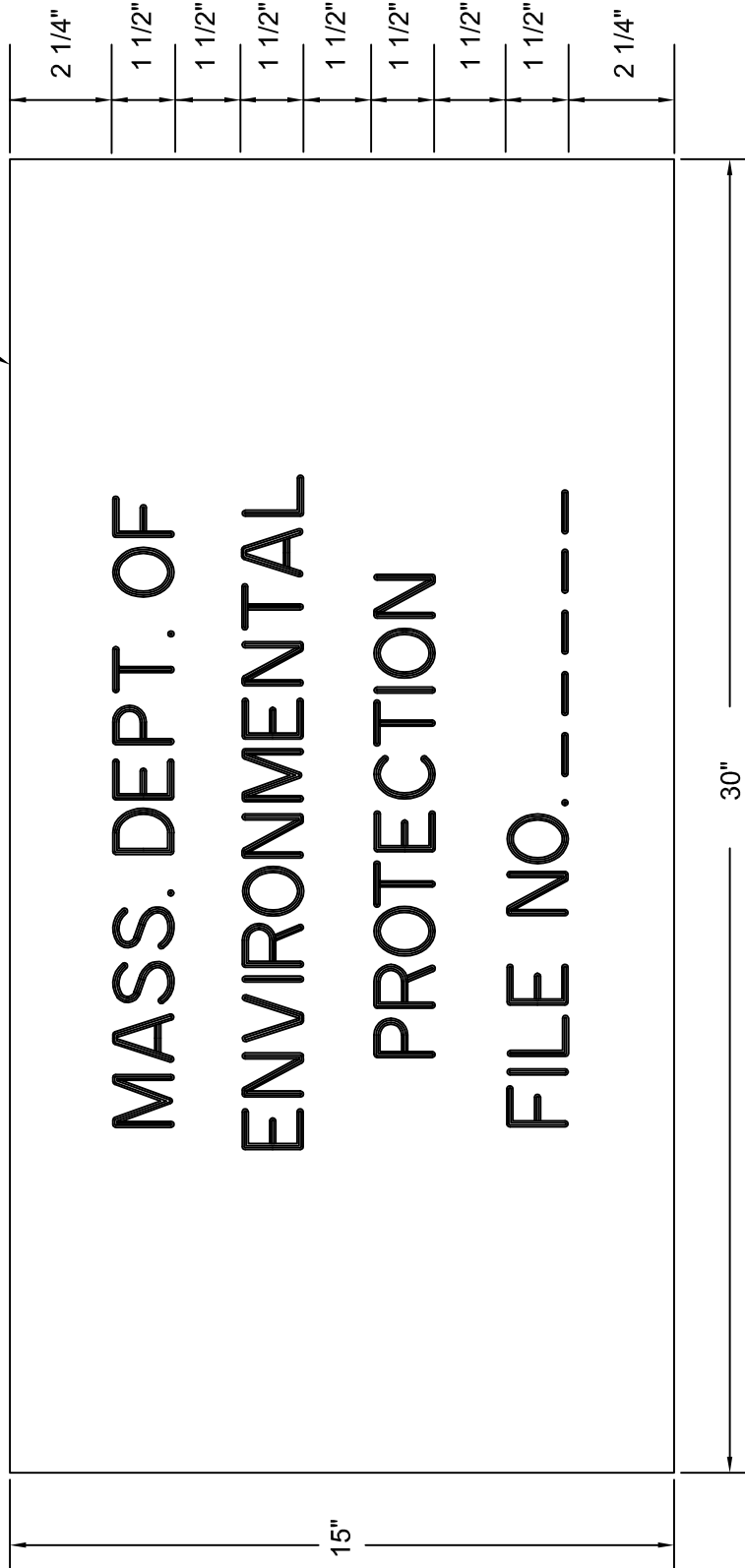


BRACE & TRUSS CONNECTIONS



WETLANDS PROTECTION ACT SIGN

0.080" SHEET ALUMINUM



COLORS ——— LEGEND - BLACK (NON-REFLECTORIZED)
BACKGROUND - WHITE (REFLECTORIZED)

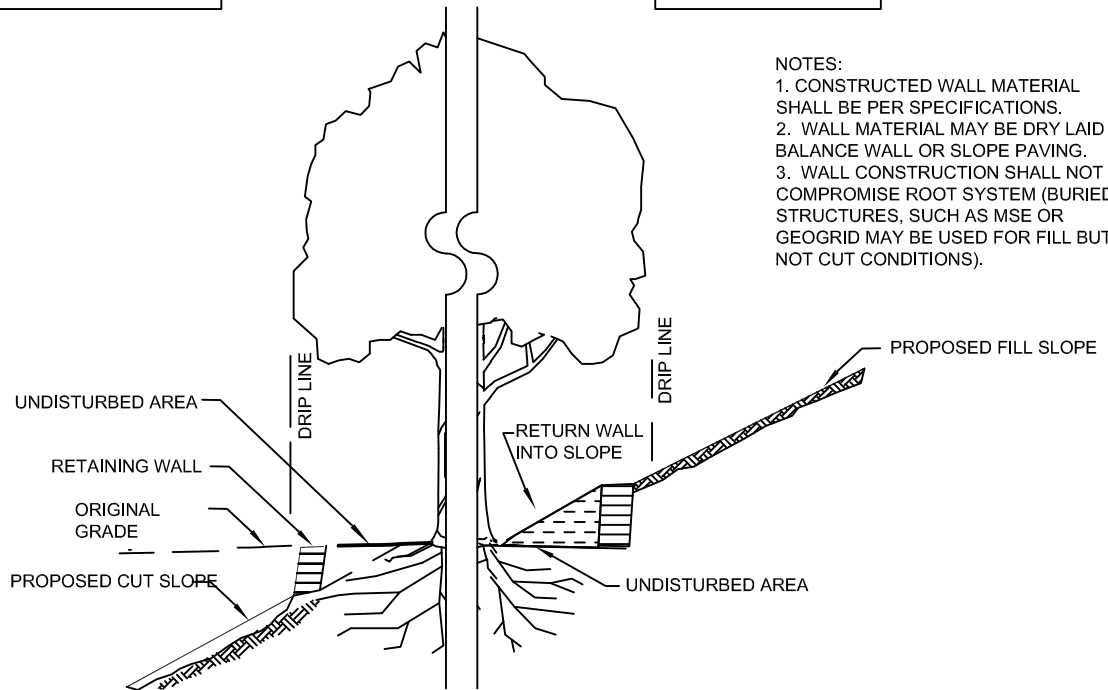
THE SIGN IS TO BE MOUNTED ON A MASSDOT
HIGHWAY DIVISION STANDARD "P-5" POST

NOTES:

1. THE SIGN IS PLACED ON ALL PROJECTS SUBJECT TO THE PROVISIONS OF THE MASSACHUSETTS WETLANDS PROTECTION ACT.
2. THE LOCATION OF THE SIGN IS TO BE DETERMINED BY THE ENGINEER.
3. SEE SPECIAL PROVISIONS FOR THE MANUFACTURE, MAINTENANCE, ERECTION AND REMOVAL RESPONSIBILITIES.
4. USE SERIES "D" FOR LETTERING.

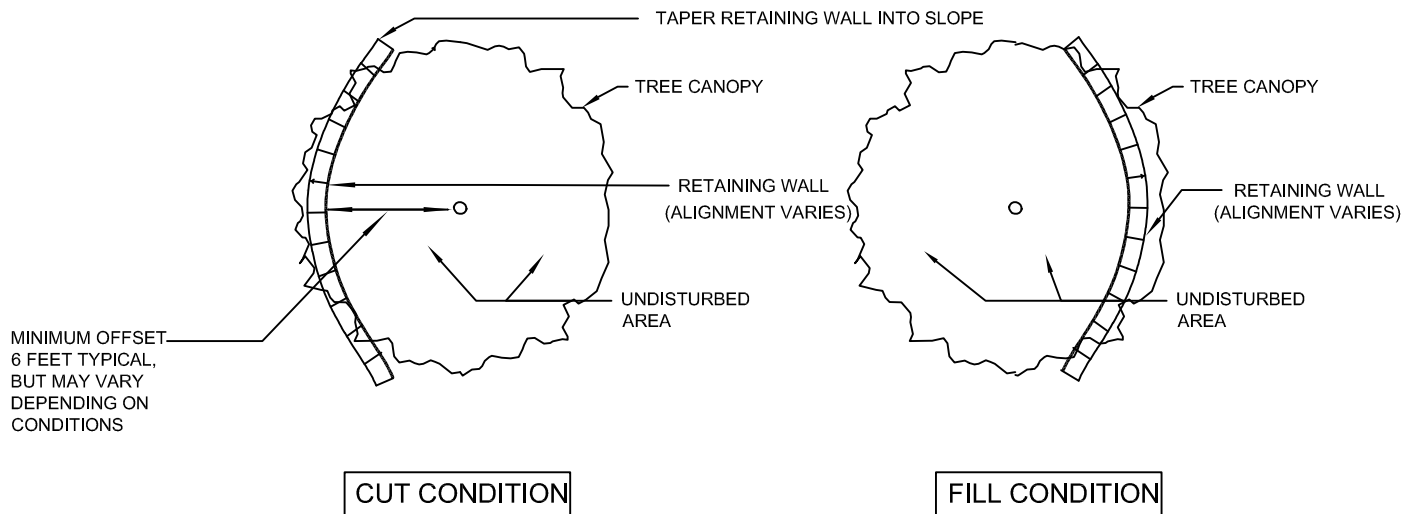
CUT CONDITION

FILL CONDITION

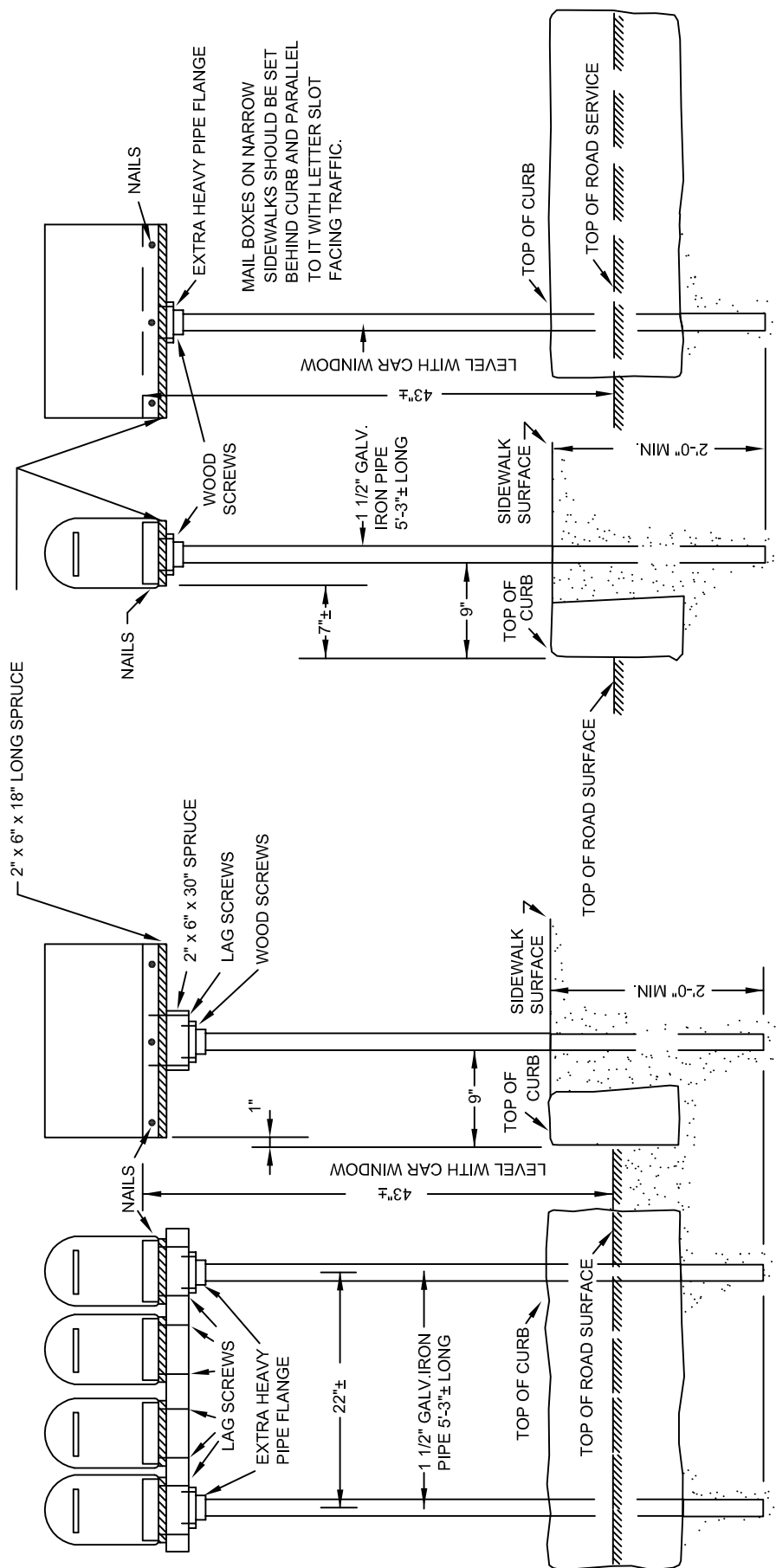


- NOTES:
1. CONSTRUCTED WALL MATERIAL SHALL BE PER SPECIFICATIONS.
 2. WALL MATERIAL MAY BE DRY LAID BALANCE WALL OR SLOPE PAVING.
 3. WALL CONSTRUCTION SHALL NOT COMPROMISE ROOT SYSTEM (BURIED STRUCTURES, SUCH AS MSE OR GEOGRID MAY BE USED FOR FILL BUT NOT CUT CONDITIONS).

SECTION VIEW



PLAN VIEW

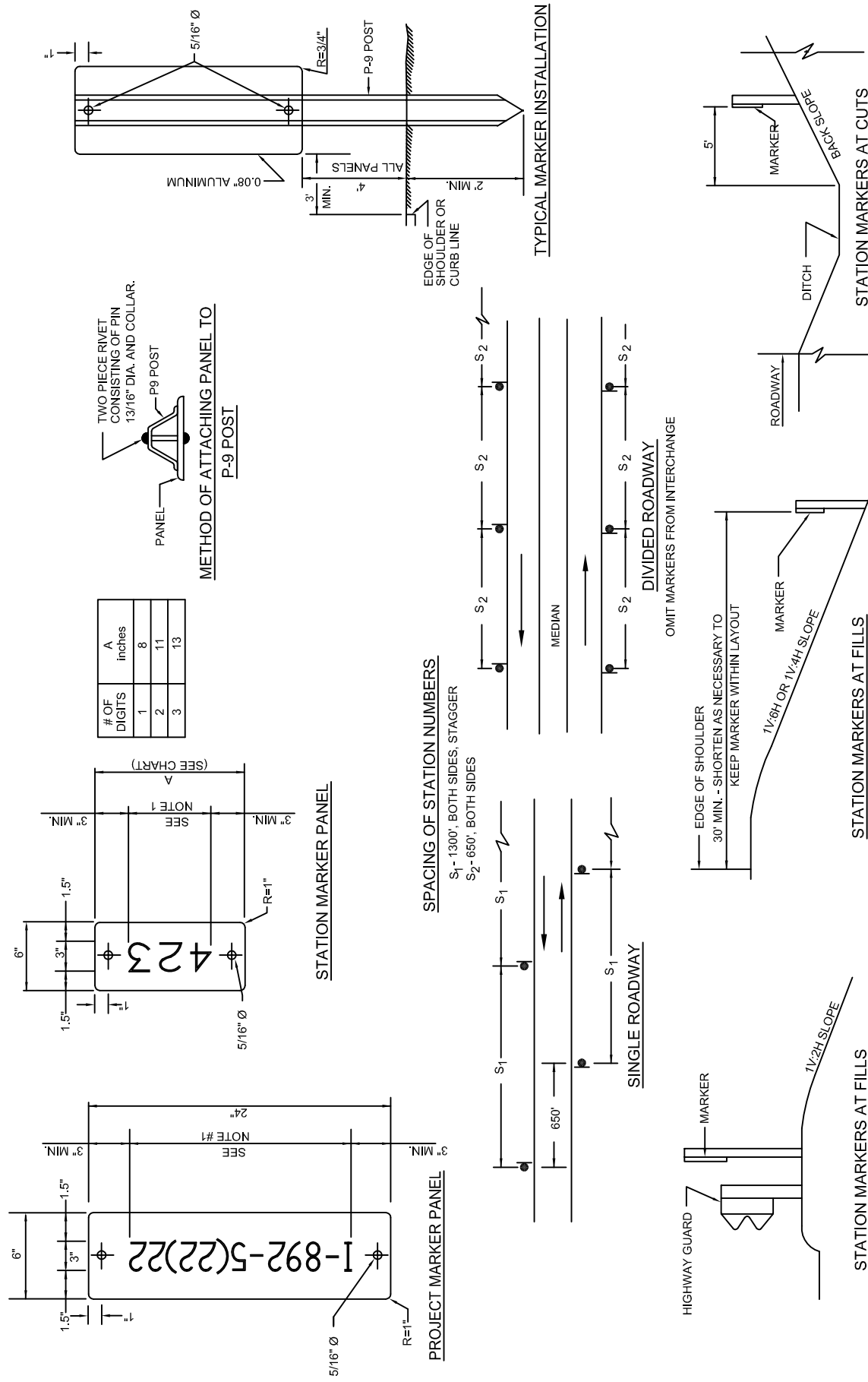


NOTES:

1. LUMBER TO BE PLANED ON ALL FOUR SIDES TO FULL 2" x 6" SIZE TO FIT BOTTOM OF MAIL BOXES.
2. TO SET 1 1/2" GALVANIZED PIPE POST, USE DRIVING POINT OF SAME SIZE, THEN TAMP POST INTO PLACE SO AS TO BE PLUMB BOTH WAYS.
3. ALL FITTINGS (PIPE FLANGES, PIPE, SCREWS, NAILS, ETC.) ARE TO BE GALVANIZED.
4. FOR DESCRIPTIONS, MATERIALS, AND CONSTRUCTIONS METHODS SEE STANDARD SPECIFICATIONS.
5. A 4" X 4" PRESSURE TREATED WOOD POST MAY BE SUBSTITUTED FOR A PIPE POST.



DATE OF ISSUE	JUNE 2014
DRAWING NUMBER	E 505.1.0

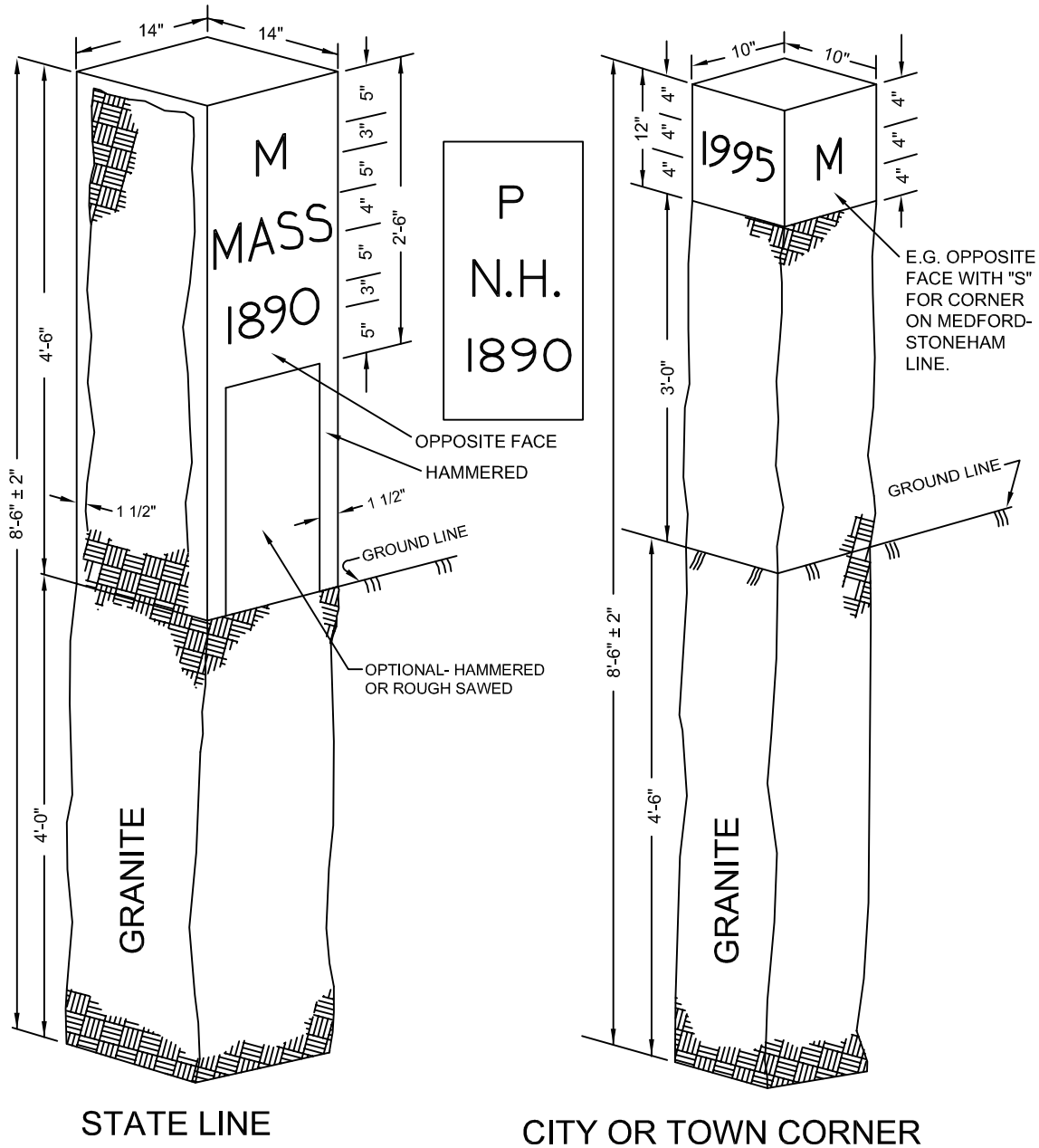


NOTES:

1. THE LEGEND IS TO BE CENTERED AND THE SPACING OF THE CHARACTERS IS TO CONFORM TO THE FEDERAL HIGHWAY ADMINISTRATION RECOMMENDATION FOR SERIES "C" TYPE LETTERING.
2. THE STATION DESIGNATIONS ARE TO BE EVEN STATIONS I.E. NO PLUS STATIONS.
3. THE PANELS FOR THE LEGEND ARE TO BE 0.08" SHEET ALUMINUM, FABRICATED AND FINISHED ACCORDING TO THE STANDARD SPECIFICATIONS.
4. THE LETTERS AND NUMERALS AND METHOD OF APPLICATIONS ARE DESCRIBED IN THE STANDARD SPECIFICATIONS.
5. ALL PANELS ARE TO BE MOUNTED ON NEW P-9 POST IN THE MANNER DESCRIBED IN THE STANDARD SPECIFICATIONS.
6. ONE MARKER IS TO BE PROVIDED AT CULVERT END, WHERE NO GUARD RAIL IS INSTALLED IT IS TO BE LOCATED AT THE NEAR BACK CORNER OF THE END IN THE DIRECTION OF TRAFFIC.
7. MARKERS ARE TO BE PLACED AT 650' INTERVALS; ON UNDIVIDED ROADWAY STAGGER ON EACH SIDE, ON DIVIDED ROADWAY PLACE MARKERS OPPOSITE EACH OTHER.
8. SEE DRAWING E TR.2.3 FOR P-9 POST DIMENSIONS.

REPLACEMENT OF BOUND BROKEN OR LOST WILL BE INSCRIBED WITH THE YEAR BOUND POINT WAS ESTABLISHED.
 BOUNDS LOCATING NEW CORNERS WILL BE INSCRIBED WITH THE YEAR NEW CORNER WAS ESTABLISHED.

ALL LETTERING TO BE
 1/2" V SUNK LETTERS



NOTES:

1. TOP AND 4 SIDES FOR A DISTANCE OF 12" TO BE HAMMERED SMOOTH.
2. IN SPECIFIED LOCATIONS, MONUMENTS MAY BE HAMMERED SMOOTH ON TOP AND 4 SIDES ABOVE GROUND LINE.
3. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS SEE STANDARD SPECIFICATIONS.