The Commonwealth of Massachusetts

Deval L. Patrick
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massDOT
Massachusetts Department of Transportation
Highway Division

Prepared by
The Massachusetts Department of Transportation
Highway Division

2010
EXAMPLE: DRAWING NUMBER- 201.1.0

SECTION NUMBER (1,2,3,4 OR 5)

(100, 200, 300, 400 OR 500 SERIES)

SECTION 1 (100 SERIES)

HIGHWAY DESIGN AND PAVEMENT DETAILS

SECTION 2 (200 SERIES)

DRAINAGE

SECTION 3 (300 SERIES)

CEMENT CONCRETE, MASONRY STANDARDS

SECTION 4 (400 SERIES)

HIGHWAY GUARD RAIL AND FENCES

SECTION 5 (500 SERIES)

MISCELLANEOUS

CATEGORY IN SERIES:

01 FOR CATCH BASINS

02 FOR MANHOLES

03 FOR DROP INLETS, ETC.

DRAWING NUMBER IN EACH CATEGORY

AUXILIARY DRAWING NUMBER:

A NUMBER OTHER THAN ZERO WILL APPEAR IN THIS
POSITION WHEN IT IS SUBSEQUENTLY NECESSARY TO INSERT
ONE OR MORE ADDITIONAL DRAWINGS BETWEEN TWO EXISTING
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<tr>
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<td>E 401.11.0</td>
</tr>
<tr>
<td>MODIFIED HIGHWAY GUARD POST INSTALLATION WHERE STANDARD EMBEDMENT IS NOT FEASIBLE</td>
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</tr>
<tr>
<td>STEEL THRIE BEAM HIGHWAY GUARD MEDIAN - BARRIER</td>
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<tr>
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<tr>
<td>OFFSET BLOCKS FOR STEEL THRIE BEAM HIGHWAY GUARD</td>
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<tr>
<td>STEEL W BEAM HIGHWAY GUARD TERMINAL CONNECTORS ON EXIST.</td>
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<tr>
<td>BRIDGE W-RAIL LEADING END AT ABUTMENTS &amp; END POSTS</td>
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</tr>
<tr>
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</tr>
<tr>
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<tr>
<td>MASONRY BRACKET FOR STEEL W BEAM HIGHWAY GUARD ON ABUTMENTS AND END POSTS</td>
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<tr>
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<td>E 402.4.0</td>
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<tr>
<td>MASONRY BRACKET FOR STEEL W BEAM HIGHWAY GUARD ON ABUTMENTS AND END POSTS</td>
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<tr>
<td>(TRAILING END)</td>
<td>E 402.5.0</td>
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<tr>
<td>STEEL THRIE BEAM HIGHWAY GUARD (TRAILING END) AT EXISTING BRIDGE ABUTMENTS AND END POSTS</td>
<td>E 402.8.0</td>
</tr>
<tr>
<td>MASONRY BRACKET FOR STEEL THRIE BEAM HIGHWAY GUARD ON ABUTMENTS AND END POSTS (TRAILING END)</td>
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<td>GUARDRAIL RETROFIT ON BRIDGES (PLAN VIEW)</td>
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<td>REINFORCING DETAILS</td>
<td>E 402.20.0</td>
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<tr>
<td>F SHAPE CONCRETE BARRIER WITH CONCRETE SEPARATOR</td>
<td>E 402.21.0</td>
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<tr>
<td>REINFORCING DETAILS</td>
<td>E 402.22.0</td>
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<tr>
<td>F SHAPE CONCRETE BARRIER WITH CONCRETE SEPARATOR</td>
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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**

\[
W = \begin{cases} 
12' & \text{for rock cuts of 20' or less} \\
17' & \text{for rock cuts 25' or more} \\
\text{varies 12' - 17'} & \text{for rock cuts between 20' - 25'; determine proportionately} 
\end{cases}
\]

**NOTE:**

- **NOTES:**
  1. Only rock actually removed is payable. No payment will be made beyond the rock payment line.
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 CUT SLOPES

<table>
<thead>
<tr>
<th>D FEET</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 3</td>
<td>1'</td>
<td>2'</td>
</tr>
<tr>
<td>&gt;3 TO 20</td>
<td>D/3</td>
<td>2/3D</td>
</tr>
<tr>
<td>&gt; 20</td>
<td>7'</td>
<td>14'</td>
</tr>
</tbody>
</table>

* SIDE SLOPE 21'
* MEDIAN SLOPE 24'

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.
LOCATION OF SAW CUT FOR TRANSVERSE JOINTS AT BRIDGE ABUTMENT

NOTES:
2. ONLY EXPANSION JOINTS SHALL BE SAW-CUT AND SEALED.
3. ONLY REQUIRED WITH A CONTINUOUS BITUMINOUS CONCRETE SURFACE FROM ROADWAY TO BRIDGE.

SAW CUT
SEE E 104.1.1

HMA WEARING COURSES
HMA BINDER COURSES
HMA BASE COURSES
GRAVEL
APPROACH SLAB
CONCRETE DECK SLAB
EXPANSION BEARING
ABUTMENT
* THE DEPTH OF THE GRAVEL IS TO BE SUCH THAT ITS BOTTOM LINE MEETS THE BOTTOM OF THE GRAVEL LINE OF THE CONTIGUOUS PAVEMENT.

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; 3/4"-705 lb/Cu.Yd.
6. TROUGH FLUSH WITH OR ABOVE ADJACENT PAVEMENT FOR DRAINAGE.
HOT MIX ASPHALT BERM
TYPE A

NOTE:
1. THIS DIMENSION VARIES WITH THE THICKNESS OF THE TOP COURSE AND SLOPE OF BINDER
2. SEE E.401.1 FOR TYPICAL SECTION AT GUARDRAIL LOCATIONS
3. SEE TYPICAL SECTIONS FOR PROJECT

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

DATE OF ISSUE
AUGUST 2010
DRAWING NUMBER
E 106.1.0
VERTICAL BACK OPTIONAL

TYPE - 1

R = 6"

75°

6°

10°

VERTICAL BACK OPTIONAL

TYPE - 2

FACE

R = 2"

45°

75°

6°

9°

VERTICAL BACK OPTIONAL

TYPE - 3

R = 1"

6°

2"

4"

2"

8"

SHOULDER

* VARIES

LEVEL

* VARIES

TOP COURSE

CURB

BINDER

BASE

TREATMENT VARIES

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 AND/OR BINDER COURSES ARE IN PLACE.

2. CUT NEAT LINE 6" FROM CURB LINE AND REMOVE BINDER, 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.

4. PAYMENT PER FOOT OF CURB IS INCLUSIVE OF ALL ITEMS OF WORK REQUIRED TO COMPLETE PROPER INSTALLATION OF THE CURB.
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 TO BE USED AS A SUBSTITUTE.

2. PAYMENT FOR CEMENT CONCRETE WILL BE INCLUDED IN THE PRICE PER FOOT OF EDGING.

3. 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.
LEGEND

HSL = HIGH SIDE TRANSITION LENGTH (SEE E 107.9.0)
W = SIDEWALK WIDTH
W_d = PERPENDICULAR RAMP LENGTH
CC = CEMENT CONCRETE
* = TOLERANCE FOR CONSTRUCTION ±0.5%

USABLE SIDEWALK WIDTH PER AAB = W-W_c
RAMP LENGTH, W_1 = W-4'-0" MIn

SECTION A-A
"LEVEL LANDING" WITH DETECTABLE WARNING PANEL (SEE E 107.6.5)
1.5%* SLOPE FOR DRAINAGE

SIDEWALK

INDENTATION

HSL
HIGH SIDE TRANSITION

LOW SIDE TRANSITION
MIN.
6'-6"
5'-0"
24"
7.5%*

GRANITE CURB
EDGE OF ROADWAY

ROADWAY DOWNGRADE

LIMITS OF CEMENT CONCRETE RAMP

PLAIN CEMENT CONCRETE

ROADWAY

LEGEND
HSL = HIGH SIDE TRANSITION LENGTH
(SEE E 107.9.0)
W = SIDEWALK WIDTH
CC = CEMENT CONCRETE
* = TOLERANCE FOR CONSTRUCTION ±0.5%

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

W = SIDEWALK WIDTH
CC=4"
1.5%*
8"

EXAMINATION

SIDEWALK

FOUNDERATION

SECTION A-A

WEIGHT RAMP ON NARROW SIDEWALK WITH DETECTABLE WARNING PANEL

DATE OF ISSUE
AUGUST 2010

DRAWING NUMBER
E 107.2.1

MASSDOT HIGHWAY ADMINISTRATION OF MASSACHUSETTS
LEGEND

HSL = HIGH SIDE TRANSITION LENGTH
SEE E 107.9.0
*TOLERANCE FOR CONSTRUCTION ±0.5%
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.
LEVEL LANDING
1.5%
SLOPE FOR DRAINAGE

TRANITION

MIN
4.7'

TRANITION

LANDSCAPING STRIP

GRANITE CURB

LANDSCAPING STRIP

GRANITE CURB

LEGEND

*=TOLERANCE FOR CONSTRUCTION ±0.5%

**=SEE E 107.9

***=NON-WALKING SURFACE

WHEELCHAIR RAMP WITH LANDSCAPING STRIP
LEGEND
HSL = HIGH SIDE TRANSITION LENGTH. SEE E 107.9.0
W = SIDEWALK WIDTH
* = TOLERANCE FOR CONSTRUCTION ±0.5%
CC = CEMENT CONCRETE
HMA = HOT MIX ASPHALT
LEGEND

HSL = HIGH SIDE TRANSITION LENGTH
W = SIDEWALK WIDTH
* = TOLERANCE FOR CONSTRUCTION ±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 (± 0.5% CONSTRUCTION TOLERANCE)
<table>
<thead>
<tr>
<th>ROADWAY PROFILE GRADE</th>
<th>*HIGH SIDE TRANSITION LENGTH</th>
</tr>
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<tbody>
<tr>
<td>%</td>
<td>ENGLISH UNITS</td>
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<tr>
<td>=0%</td>
<td>6'-6&quot;</td>
</tr>
<tr>
<td>&gt;0% TO 1%</td>
<td>7'-8&quot;</td>
</tr>
<tr>
<td>&gt;1% TO 2%</td>
<td>9'-0&quot;</td>
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<tr>
<td>&gt;2% TO 3%</td>
<td>11'-0&quot;</td>
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<td>&gt;3% TO 4%</td>
<td>14'-0&quot;</td>
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<tr>
<td>&gt;4% TO 5%</td>
<td>15'-0&quot; Max</td>
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</tbody>
</table>

**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. WEEP HOLES SHALL BE 4" PIPE OPENING OR EQUIVALENT WITH 1/4" MESH, 23 GAGE GALVANIZED WIRE SCREEN COVERING. 2 CUBIC FEET OF CRUSHED STONE SHALL BE PLACED AROUND EACH WEEP HOLE.
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.

**PLAN OF BASE**

- **SECTION C-C**
  - SOLID SECTION, OR FILL HOLE WITH 4000 PSI - 1 1/2" - 565.8 LBF OR 4000 PSI - 3 1/4" - 610 LBF (IF CONCRETE IS HAND MIXED SEE LATEST SPECIFICATIONS.)
  - BLOCKS TO BE SET IN FULL BED OF CEMENT MORTAR
  - 4000 PSI - 1 1/2" - 565 LBF OR 4000 PSI - 3 1/4" - 610 LBF CEMENT CONCRETE OR PRECAST CONCRETE SECTIONAL PLATES. SEE ABOVE.

**SECTION A-A**

- **PLAN OF BASE**
  - TAPER IN 3 OR 4 COURSES
  - 6" MIN.
  - 2 1/2" MAX
  - 3/4" MORTAR
  - KEYWAYS TO BE FILLED WITH CEMENT MORTAR

**SECTION B-B**

- **PLAN OF BASE**
  - TAPER IN 3 OR 4 COURSES
  - 6" MIN.
  - 2" MAX
  - 3/4" MORTAR

BASIN WITH CURB INLET

BASIN WITH 4 FLANGE INLET
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 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 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

**DATE OF ISSUE**
AUGUST 2010

**DRAWING NUMBER**
E 201.5.0
GUTTER SIDE

NOTE - FOUR FLANGE FRAME SHOWN. MAY ALSO BE SUPPLIED AS THREE FLANGE FRAME WITH THIS FLANGE REMOVED

NOTE - ALL CORNERS ARE RECESSSED AND BELOW MACHINED SEAT

MACHINE TOLERANCES:
- MACHINED SEATS (4) REQUIRED
- FLAT AND IN PLANE WITHIN .010"
- TOTAL INDICATOR READING

CLASSIFICATION:
- ASTM A48 CLASS 30B GRAY CAST IRON
- WITH NO BLACK ASPHALT COATING ALLOWED

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

CASTING TOLERANCES:
- SHALL CONFORM TO AASHTO M306

AASHTO HS 20 LOAD RATED

DATE OF ISSUE
AUGUST 2010

DRAWING NUMBER
E 201.6.0
GUTTER SIDE

SECTION C-C

CLASSIFICATION:
ASTM A48 CLASS 30B GRAY CAST IRON
WITH NO BLACK ASPHALT COATING ALLOWED

CAST BACK FACE WITH MOLD DATE AND PART NO.

WEIGHT: 285 LBS. MIN
AASHTO HS 20 PROOF LOAD

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

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.

TUMBLER SHOULDN'T 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.

LOCK TUMBLER ASSEMBLY:
(1) REQUIRED - CONSISTS OF:
5/8" X 5" STL. BOLT
5/8" STL. FLAT WASHER
CAST IRON TUMBLER
ST. STL. CAPTURE NUT
STAINLESS STEEL GRADE 304

FLOW FROM LEFT
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.

LOCK TUMBLER ASSEMBLY
(1) REQUIRED-CONSISTS OF:
5/8" x 6" ST. STL. BOLT
5/8" ST. STL. FLAT WASHER
CAST IRON TUMBLER
ST. STL. CAPTURE NUT
STAINLESS STEEL GRADE 304

WEIGHT: 265 LBS. MIN
AASHTO HS 20 PROOF LOAD

CLASSIFICATION:
ASTM A48 CLASS 30B
GRAY CAST IRON
WITH NO BLACK ASPHALT
COATING ALLOWED

CASTING TOLERANCES:
SHALL CONFORM TO AASHTO M306

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

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

HOOK LOCK CASCADE GRATE
FLOW FROM RIGHT

DATE OF ISSUE
AUGUST 2010
DRAWING NUMBER
E 201.7.1
FLOW

33" MIN.

GUTTER SIDE

33" MIN.

A

A

B

MM/DD/YYYY CL XXX

N.T.S.

SECTION A-A

24 1/4"

23 7/8"

8" 1/2"

1 1/16"

15/16"

22"

24" MIN

1 1/4"

15/16"

25 3/4"

1 1/4"

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:
ASTM A48 CLASS 30B GRAY CAST IRON
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

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

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
FRAME AND HOOK LOCK CASCADE
GRATE – FLOW FROM RIGHT
ASSEMBLY DETAILS

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 & GRATRES TO BE CAST WITH FRAME AND GRATE

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

Once grate is set in frame, torque bolt ¼ 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

DATE OF ISSUE
AUGUST 2010

DRAWING NUMBER
E 201.9.1
HOOK LOCK BAR GRATE

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 1/4 turn past snug.

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:
ASTM A48 CLASS 30B GRAY CAST IRON WITH NO BLACK ASPHALT COATING ALLOWED

Machine tolerances:
Surfaces noted \( \checkmark \) must be machined flat and in-plane within .010"
Total Indicator Reading

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.

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

CASTING TOLERANCES:
SHALL CONFORM TO AAASHTO M306

CLASSIFICATION:
ASTM A48 CLASS 30B GRAY CAST IRON
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 ½ turn past snug.

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

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E 201.10.1
SECTION A-A

SECTION B-B

NOTES:
1. MATERIAL-CAST IRON; SEE STANDARD SPECIFICATIONS
2. MINIMUM MASS - 210 LBS.
BRICKS MAY BE USED BETWEEN FRAME & TOP COURSE FOR GRADE ADJUSTMENT.

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

INVERT TO BE INVERTED ARCH WITH BRICKS LAID ON EDGE AS STRETCHERS.

FOOT OF STRUCTURE TO BE HEADERS LAID FLAT.

BASE TO BE OF 4000 PSI - 1 1/2" - 560 lb OR 4200 PSI - 3/4" - 610 lb CEMENT CONCRETE OR PRECAST CONCRETE SECTIONAL PLATES. SEE BELOW.

BRICK CHIPS AND MORTAR OR CEMENT CONCRETE 4000 PSI - 1 1/2" - 560 lb (IF CONCRETE IS HAND MIXED SEE LATEST STANDARDS SPECIFICATIONS.) ALL CONCRETE TO BE AIR ENTRAINED.

SECTION A-A

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

PLAN OF BASE

SOLID SECTION; OR FILL HOLE WITH BRICKS AND MORTAR; OR FILL 4000 PSI - 1 1/2" - 560 lb OR 4000 PSI - 3/4" - 610 lb CONCRETE
(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
BRICKS MAY BE USED BETWEEN FRAME AND TOP COURSE FOR GRADE ADJUSTMENT. FRAME TO BE SET IN FULL BED OF CEMENT MORTAR.

18" - 24", TAPER IN 3 OR 4 COURSES

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

BLOCKS TO BE SET IN FULL BED OF MORTAR

FLOOR OF STRUCTURE TO BE HEADERS LAYED FLAT

BASE TO BE OF 4000 PSI - 1 1/2" - 565 LB OR 4000 PSI - 3/4" - 610 LB CEMENT CONCRETE OR PRECAST CONCRETE SECTIONAL PLATES. SEE BELOW.

BRICK CHIPS AND MORTAR OR CEMENT CONCRETE 4000 PSI - 1 1/2" - 565 LB (IF CONCRETE IS HAND MIXED SEE LATEST STANDARDS SPECIFICATIONS.)

ALL CONCRETE TO BE AIR ENTRAINED

INVERTED ARCH WITH BRICKS LAID ON EDGE AS STRETCHERS.

SECTION A-A

KEYWAYS TO BE FILLED WITH CEMENT MORTAR.

MORTAR NOT REQUIRED IN VERTICAL JOINTS.

PLAN OF BASE

SOLID SECTION; OR STRIP HOLE WITH BRICKS AND MORTAR; OR FILL 4000 PSI - 1 1/2" - 565 LB OR 4000 PSI - 3/4" - 610 LB CONCRETE (IF CONCRETE IS HAND MIXED SEE LATEST STANDARD SPECIFICATIONS.)

NOTE:
1. MANHOLE DESIGN IS FOR PIPE DIAMETER OF 30" OR LESS
STANDARD MANHOLE FRAME AND COVER SEE DRAWINGS E 202.6.0-E 202.8.0

BRICKS MAY BE USED FOR GRADE ADJUSTMENTS. FRAME TO BE SET IN FULL BED OF MORTAR

HEIGHT OF RISER SECTIONS VARY FROM 1'-4" TO 18'-24"

48" ± 1" DIAMETER

5" MIN.

2" CLEAR

30" MAX.

DIAMETER PIPE

1-#3 BAR AROUND OPENINGS FOR PIPES 10" DIAMETER AND OVER, 1" COVER

FLOOR OF STRUCTURE TO BE HEADERS LAID FLAT

INVERTED ARCH WITH BRICKS LAID ON EDGE

PROVIDE "V" OPENINGS PIPE OPENINGS TO BE PRECAST IN RISER SECTION

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

PRECAST CONCRETE MANHOLES
9' OR LESS IN DEPTH

DATE OF ISSUE
AUGUST 2010

DRAWING NUMBER
E 202.4.0
CAST IRON FRAME AND COVER
SEE STANDARDS DRAWING E 202.8.0 - E 202.8.0
WALLS 8" THICK EVERY FIFTH COURSE TO BE HEADERS
WHERE DEPTH OF BRICKWORK IS OVER 9'-0" THE WALLS BELOW THAT DEPTH TO BE 12" THICK.

OUTSIDE OF MANHOLE TO BE PLASTERED WITH CEMENT MORTAR, 1/2" COAT.

SET FRAME CASTING IN FULL BLD OF MORTAR

TRANVERSE BARS

36" TO 42" DIAM. R.C. PIPE
SECTION B-B

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

SIZE OF PIPE
WIDTH "F"
HEIGHT "G"
HEIGHT "H"

8-10"/15.7 16-23.7 24.0/AJP

T  W  T  W  T  W  T  W

36"  4'-0"  5'-0"  8"  10"  8"  12"  9"  12"
42"  4'-0"  5'-0"  8"  10"  8"  12"  9"  12"
48"  4'-0"  5'-0"  8"  10"  8"  12"  9"  12"
54"  4'-0"  5'-0"  8"  10"  8"  12"  10"  12"
60"  5'-0"  5'-0"  8"  10"  9"  12"  11"  12"
72"  6'-0"  6'-0"  9"  10"  10"  12"  12"  12"
84"  7'-0"  7'-0"  10"  10"  11"  12"  13"  12"

SECTION A-A

SECTION B-B

48" TO 84" DIAM. R.C. PIPE

4000 PSI - 3/4" - 610 LB CONCRETE

#4 BARS

FLOW LINE

TRANSVERSE BARS

#6 BARS

#4 BARS

#4 BARS

#4 BARS

#4 BARS

#6 BARS

#6 BARS

48" TO 84" DIAM. R.C. PIPE
SECTION B-B
STANDARD COVER
FOR COVER DETAILS SEE DRAWING E 202.8.0

NOTES:
1. MINIMUM MASS - 265 LBS.
2. MATERIAL - CAST IRON
MANHOLE FRAME AND COVER—B FRAME

NOTES:
1. MINIMUM FRAME MASS 265 LBS.
2. MATERIAL: CAST IRON

DATE OF ISSUE
AUGUST 2010

DRAWING NUMBER
E 202.7.0
MANHOLE COVER FOR TYPE A & B FRAMES

NOTES:
1. MATERIAL - CAST IRON: SEE STANDARD SPECIFICATIONS.
2. MINIMUM COVER MASS - 200 LBS.
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 - 1 1/2" - 565 LB

TYPE "B"
5. NOMINAL CONCRETE BLOCK DIMENSIONS
   HEIGHT, 4" TO 8"
   WIDTH, 6" 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
NOTES:
1. FOR DETAILS OF PRECAST THROAT SEE DRAWING E 203.7.0
2. SEE DRAWING 203.1.0 FOR DETAILS NOT SHOWN
**DROP INLET TYPE C**

**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

**SECTION A-A**

- **4000 PSI - 3/4" - 610 LB CEMENT CONCRETE OR PRECAST CONCRETE SECTIONAL PLATES**
- **SEE DRAWING E 202.2.0**

**PHASED DRAWING:**

- **HIGHER DRAWING:**
  - **FULL BED OF MORTAR**
  - **THROAT**
  - **OUTLET PIPE**
  - **WEEPHOLE**
  - **4" CAST IRON FRAME**
  - **FACE OF PIPE FLUSH OR NOT TO PROJECT MORE THAN 4" FROM FACE OF WALL ALONG CENTERLINE OF PIPE.**
  - **MIN. DEPTH TO BE 2"**

**DIMENSIONS:**

- **2"**
- **6"**
- **20" MAXIMUM**
- **THROAT 1-10" TO 21"**
- **6" MIN.**
- **6"**
- **10"**
- **4"**
- **4.4" DIA. MIN.**

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**DRAWING NUMBER**

E 203.3.0
PLAN

OUTSIDE FACE
AT TOP

AT BASE

INSIDE FACE
AT TOP

AT BASE
SEE NOTE #2

THROAT

WEENPOLE

WEENPOLE

4" CAST IRON FRAME

FULL BED OF MORTAR

BRICKS MAY BE USED BETWEEN FRAME AND TOP COURSE FOR GRADE ADJUSTMENT. FRAME TO BE SET IN FULL BED OF MORTAR.

PRECAST CONCRETE THROAT.
SEE DRAWING E 203.7.0

TAPER IN 3 OR 4 COURSES

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

MIN. DEPTH TO BE 2'

SECTION A-A

4000 PSI - 3/4" - 610 LB CEMENT CONCRETE 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

DROP INLET TYPE CF

DATE OF ISSUE
AUGUST 2010

DRAWING NUMBER
E 203.4.0
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'
*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 MEDIAN AND DITCHES THAT ARE WITHIN THE RECOVERY AREA
NOTES:
1. WHERE CURB INLET IS NOT USED THE INSIDE HORIZONTAL DIMENSIONS OF GUTTER INLET TO BE 24" x 11" X 24" ± 1" IN WHICH CASE AND UNLESS OTHERWISE DIRECTED, A STANDARD 4-FRAME FRAME IS TO BE USED.
2. BRICKS MAY BE USED BETWEEN TOP COURSE AND FRAME FOR GRADE ADJUSTMENT.
3. A CASCADE GRATE IS TO BE USED WHERE BICYCLE TRAVEL IS ALLOWED.
4. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.
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 6" 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
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**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.
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<th>RISE (IN.)</th>
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**NOTES:**
1. MINIMUM COVER IS TOP OF Pipe TO ROAD GRADE - 18”
2. FOR HEAVIER FILL USE STRUCTURAL PLATE
ELBOW AND COUPLING DETAILS

(5) 1/2" DIA X 5" GALVANIZED BOLTS

2"x2"x3/16" GALV ANGLE IRON RIVETED TO COUPLING BAND

NOTES:
1. A TOE PLATE IS REQUIRED FOR ALL METAL ENDS.
2. ALL METAL END UNITS AND ELBOWS TO BE SHOP FABRICATED.
CONCRETE CRADLE FOR PIPE CULVERTS

CEMENT CONCRETE
4000 PSI-1 1/2"-565 lb/Cu.Yd.
ONLY TO BE USED WHERE SPECIFIED

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
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ENGLISH UNITS

TRENCH EXCAV. LBS. CONC. OR F.S.M. CU. YDS.
DEPTH FT. DEPTH FT.

30.35 33.25 37.63 42.00 47.25 50.75 59.50
27.40 30.35 33.25 37.63 42.00 47.25 50.75

DATE OF ISSUE
AUGUST 2010

DRAWING NUMBER
E 206.4.1

QUANTITY TABLES FOR
CONCRETE AND FIELD STONE
MASS DOT MASONRY PIPE ENDS
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.
NOTES:
1. STONE TREATMENT OF PIPE ENDS SHALL NOT BE USED IN THE VEHICLE RECOVERY AREA.
2. MINIMUM MASS PER STONE = 50 LBS; MAXIMUM MASS PER STONE = 125 LBS.
3. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.

* SEE TYPICAL SECTIONS.
TABLE
[ALL DIMENSIONS ARE inches OR feet]

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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.
**STANDARD METAL END**

**ALTERNATE CONNECTIONS**

**NOTES:**

1. TOE PLATE TO BE PUNCED 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 30" 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.
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

DATE OF ISSUE
AUGUST 2010
DRAWING NUMBER
E 209.1.0
SECTION A-A

STAKE (TYP.)

FILTER FABRIC FOR EROSION CONTROL (STAKE FILTER FABRIC EVERY 1ft)

SECTION X-X

STAKE (TYP.)

STAKED FILTER FABRIC FOR EROSION CONTROL

FLOW

6" X 6" TRENCH LAY FILTER FABRIC IN TRENCH END UP SLOPE AND BACK FILL

HAY BALES FOR EROSION CONTROL
(2 STAKES PER BALE)

HAY BALES AND SILT FENCES
FOR EROSION CONTROL

DATE OF ISSUE
AUGUST 2010

DRAWING NUMBER
E 210.3.0
NOTES:
1. ON CURVED ALIGNMENT, WATERWAYS SHALL BE BANKED AS DIRECTED.
2. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS, SEE LATEST STANDARD SPECIFICATIONS.

DATE OF ISSUE
AUGUST 2010

PAVED WATERWAYS

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**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 FOUND ON SUITABLE SOIL.
6" 4,000 PSI-1 1/2" .565 lb./Cu.Yd.
REINFORCED CONCRETE SLAB

TOP OF OUTSIDE FACE OF
CONCRETE CURTAIN TOE WALL

EXPANSION JOINT

SLOPE VARIES

FINISHED GRADE

3"

8" CRUSHED STONE (TYPICAL)

6" X 8" X 1/4" DIA
WIRE FABRIC 5.2 lb./SY

CONCRETE CURTAIN
TOE WALL

INSTALL SUBDRAIN
SEE E 209.1.0

303.1.0

SECTIONS A-A

* SEE E 303.1.1 FOR SECTION B-B AND
CONSTRUCTION AND EXPANSION JOINTS DETAILS.
CURTAIN WALL ON SIDES OF SLABS SECTION B-B

CONSTRUCTION JOINT DETAIL

EXPANSION JOINT DETAIL

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 4000 psi-1 1/2"-565 lbf/Cu.Yd.
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.
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
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**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

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

**ALL CONCRETE SHALL BE 4000 PSI - 1 1/2" - 565 LB**
TYPICAL CANTILEVER RETAINING WALL SECTION

NOTES:
1. MEMBRANE WATERPROOFING AND 4" x 8" x 2", 4000 PSi, 1 1/2", 555 LB CEMENT CONCRETE BLOCKS Laid in mortar, or other WATERPROOFING PROTECTIVE COURSE, min. 2" thick as specified in the standard specifications.
2. 4" D WEEP HOLES 10'-0" O.C. (JUST ABOVE PROTECTIVE COURSE).
3. EXTEND EVERY THIRD BAR FULL LENGTH AS SHOWN.

3" MIN.

20"

6"

2" CHAMFER (TYP.)

12"

2" CL.

#4 @ 12"

1/2 STEM

2" CL.

#4 @ 18"

#BARS

FORM LINER

BITUMINOUS DAMP-PROOFING

1 C.Y.
CRUSHED STONE
(TYP.)

18"

SEE NOTE 2

SEE NOTE 1

12" Min.

VARIES

A BARS

A

B

C

L

T

TOP OF FOOTING

3" CL. (TYP.)

#4 @ 18"

#5 DOWELS @ 18"
3'-0" LONG

C BARS (SEE NOTE 3)

#5 DOWELS @ 18"
3'-0" LONG

C BARS (SEE NOTE 3)

* CONSTRUCTION JOINT
12" x 2" KEY

DATE OF ISSUE
AUGUST 2010

DRAWING NUMBER
E 305.1.0
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**Table of Dimensions and Reinforcing Steel**

**Quantities of Materials**

| Stem Concrete (yd² ft) | 0.9 | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 | 2.1 | 2.2 | 2.3 | 2.4 |
|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Footing Concrete (yd² ft) | 0.6 | 0.7 | 0.7 | 0.8 | 0.9 | 0.9 | 1.2 | 1.2 | 1.5 | 1.5 | 1.6 | 2.0 | 2.0 | 2.5 | 2.6 | 3.0 | 3.2 | 3.7 |

**Steel (lbs/ft)**

98
117
152
171
200
233
243
260
292
399
454
470
483
510
524
550
631

**Maximum Soil Bearing Pressure**

\( Q_{\text{max}} \) (psf) = 5123, 5663, 5432, 5954, 7019, 6759, 7346, 7836, 8482, 9033, 8817, 9355, 9178, 8984, 9183, 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
   \( \phi = \text{ANGLE OF INTERNAL FRICTION} = 37^\circ \)
   \( \delta = \text{ANGLE OF WALL FRICTION} = 22^\circ \)
   \( \gamma = \text{EFFECTIVE UNIT WEIGHT} = 120 \text{pcf} \)

3. **FOUNDATION SOIL PROPERTIES:**
   \( q_f = \text{FACTORED BEARING CAPACITY} = 9400 \text{ psf} \)
   \( f_{c} = 4000 \text{ psi} \)
   \( f_{I} = 60000 \text{ psi} \)
   \( F_{f} = 0.57 \)
   \( r = 0.80 \)

4. **SEISMIC LOADING:**
   \( \gamma = 0.17 \) (Max.)
   \( K_0 = 0.095 \)
   \( K_1 = 0 \)
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### Maximum Soil Bearing Pressure

| Q_max (psf) | 4071 | 4332 | 4591 | 4860 | 5401 | 5752 | 6018 | 5945 | 6208 | 6817 | 6833 | 7090 | 7352 | 7271 | 8079 | 8332 |

### Notes:
1. All dimensions are in feet, unless specified otherwise.
2. Spacings of reinforcing bars are inches.
3. Designer must confirm design parameters with Geotechnical Engineer prior to selecting well 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
   - $\theta = \text{Angle of Internal Friction} = 37^\circ$
   - $\delta = \text{Angle of Wall Friction} = 22^\circ$
   - $\gamma = \text{Effective Unit Weight} = 120 \text{ psf}$

3. **Foundation Soil Properties:**
   - $q = \text{Factored Bearing Capacity} = 9400 \text{ psf}$
   - Friction Factor = 0.57

4. **Seismic Loading:**
   - $A = 0.37g \text{ (Max.)}$
   - $K_n = 0.085$
   - $K_v = 0$

5. **Reinforced Concrete:**
   - $f' = 4000 \text{ psi}$
   - $f'' = 60000 \text{ psi}$
### Table of Dimensions and Reinforcing Steel

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### Quantities of Materials

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### Stem Concrete (yd³/ft)

- 0.9
- 1.0
- 1.1
- 1.2
- 1.3
- 1.4
- 1.5
- 1.6
- 1.7
- 1.8
- 1.9
- 2.0

### Footing Concrete (yd³/ft)

- 0.7
- 0.8
- 0.9
- 1.2
- 1.3
- 1.7
- 2.3
- 2.7
- 3.0
- 3.4
- 3.7
- 4.3
- 4.9
- 5.1

### Steel (lb/ft)

- 126
- 158
- 173
- 189
- 219
- 309
- 351
- 379
- 422
- 440
- 500
- 516
- 557
- 588
- 625
- 653
- 664

### Maximum Soil Bearing Pressure

\[ Q_{max} = 4818 \text{ psi} \]

### 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, Sloping Backfill**

1. **Backfill Loading Conditions:**
   - \( 2H:1V \) Sloping Backfill
2. **Backfill Soil Properties:**
   - Type: Gravel Borrow for Backfilling Structures and Pipes
     - \( \theta = \text{Angle of Internal Friction} = 37^\circ \)
     - \( \delta = \text{Angle of Wall Friction} = 22^\circ \)
     - \( \gamma = \text{Effective Unit Weight} = 120 \text{pcf} \)
3. **Foundation Soil Properties:**
   - \( q_u = \text{Factored Bearing Capacity} = 6000 \text{ psi} \)
   - Friction Factor = 0.50
4. **Seismic Loading:**
   - \( A = 0.1 \gamma \text{ (Max.)} \)
   - \( K_h = 0.985 \)
   - \( K_v = 0 \)
5. **Reinforced Concrete:**
   - \( f_y = 4000 \text{ psi} \)
   - \( f_y = 6000 \text{ psi} \)
### TABLE OF DIMENSIONS AND REINFORCING STEEL

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**A bars**

| A bars | 5 @ 12 | 5 @ 12 | 6 @ 12 | 6 @ 12 | 7 @ 12 | 7 @ 12 | 7 @ 12 | 7 @ 12 | 8 @ 12 | 9 @ 12 | 9 @ 12 | 9 @ 12 | 10 @ 12 | 10 @ 12 | 11 @ 12 | 11 @ 12 | 11 @ 12 |

**B bars**

| 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**

| C bars | 5 @ 18 | 6 @ 18 | 6 @ 18 | 6 @ 18 | 6 @ 18 | 6 @ 18 | 6 @ 18 | 6 @ 18 | 6 @ 18 | 6 @ 18 | 6 @ 18 | 6 @ 18 | 6 @ 18 | 6 @ 18 | 6 @ 18 | 6 @ 18 | 6 @ 18 |

**D bars**

| D bars | 4 @ 18 | 4 @ 18 | 4 @ 18 | 4 @ 18 | 4 @ 18 | 4 @ 18 | 4 @ 18 | 4 @ 18 | 4 @ 18 | 4 @ 18 | 4 @ 18 | 4 @ 18 | 4 @ 18 | 4 @ 18 | 4 @ 18 | 4 @ 18 | 4 @ 18 |

**E bars**

| E bars | 4 @ 18 | 4 @ 18 | 4 @ 18 | 4 @ 18 | 5 @ 18 | 5 @ 18 | 5 @ 18 | 5 @ 18 | 5 @ 18 | 5 @ 18 | 5 @ 18 | 5 @ 18 | 5 @ 18 | 5 @ 18 | 5 @ 18 | 5 @ 18 | 5 @ 18 |

**Stem Concrete (yd³/ft³):**

| 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 |

**Footer Concrete (yd³/ft³):**

| 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 | 355 | 343 | 435 | 463 | 492 |

**Maximum Soil Bearing Pressure**

| Qmax (psf) | 4318 | 4514 | 5111 | 5210 | 5133 | 5412 | 5693 | 5916 | 5983 | 5824 | 5929 | 5558 | 5707 | 5733 | 5440 | 5695 | 5687 |

### 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:
   - GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES
   - Type: Gravel borrow
   - Internal Friction Angle: 37°
   - Wall Friction Angle: 22°
   - Effective Unit Weight: 120 psf
3. Foundation soil properties:
   - Factored bearing capacity: 6000 psf
   - Friction Factor: 0.5
   - Performance Factor for Siding: 0.80
4. Seismic loading:
   - Kρ = 0.17g (Max.)
   - Kρv = 0.085
5. Reinforced concrete:
   - P = 4000 psi
   - γ = 6000 psi
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### Quantities of Materials

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<td>7 18</td>
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### Maximum Soil Bearing Pressure

| Q_max (psf) | 5123 | 5161 | 5481 | 5530 | 6053 | 6103 | 6262 | 6677 | 6833 | 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:
   - q = Factored Bearing Capacity = 20000 psf
   - Friction Factor = 0.70
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:**
   - Friction Factor = 0.70
   - Performance Factor for Sliding = 0.80
4. **Seismic Loading:**
   - A = 0.17g (Max.)
   - Kn = 0.085
   - Kv = 0
**TABLE OF DIMENSIONS AND REINFORCING STEEL**

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**Quantities of Materials**

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| Steel (lb/ft) | 76 | 85 | 96 | 104 | 118 | 133 | 176 | 182 | 198 | 233 | 240 | 307 | 340 | 360 | 388 | 412 | 438 |

| Qₘₐₓ (psf) | 4071 | 4328 | 4581 | 4860 | 4811 | 5491 | 5752 | 6018 | 5945 | 6208 | 6917 | 6833 | 7090 | 7352 | 7271 | 8079 | 8332 |

**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**

**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
   - θ = ANGLE OF INTERNAL FRICTION = 37°
   - δ = ANGLE OF WALL FRICTION = 22°
   - γ = EFFECTIVE UNIT WEIGHT = 120 pcf
3. **FOUNDATION SOIL PROPERTIES**: qₙ = FACTORED BEARING CAPACITY = 20000 psi
   - FRICTION FACTOR = 0.70
4. **SEISMIC LOADING**: A = 0.17g (Max.)
   - Kᵥ = 0.085
5. **REINFORCED CONCRETE**: Fᵥ = 4000 psi
   - Fᵥ = 60000 psf

1. 240 psf
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 4. 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.
** SECTION Z-Z**

**SLOPED EDGING ALONG EDGE OF SHOULDER AND RAMPS**

SEE E 106.5.0 FOR DETAILS OF SETTING SLOPED EDGING

* WHEN PLACED IN MEDIAN, CHANGE TO THRIE BEAM AND HEIGHT TO 2'-4 1/2" ± 1'.

(Note: Height of rail is always 1'-8 5/8" ± 1')

** SEE E 401.1.0 FOR SECTION Z-Z LOCATION

*** VARIES ACCORDING TO POST MATERIAL

** SECTION Z-Z**

**VERTICAL GRANITE CURB OR BITUMINOUS CONCRETE CURB ALONG EDGE OF SHOULDER**

** SECTION Z-Z**

**TYPE "A" BERM ALONG EDGE OF SHOULDER**
**ELEVATION VIEW**

**FACE OF FOOTING**

**EDGE OF ROADWAY**

**GUARD RAIL WITH POST**

**SPACING OF 6'-3"**

---

**FULL SPAN - 1V : 6H SLOPE**

---

**FACE OF FOOTING**

**EDGE OF ROADWAY**

**GUARD RAIL WITH POST**

**SPACING OF 6'-3"**

---

**FULL SPAN - 1V : 4H SLOPE**

---

**SCHEMATIC**

**OVERHEAD SIGN POST**

**EDGE OF SHOULDER**

**TRAFFIC FLOW**

**25' ±**

**120' ±**

---

**CIRCULAR CURVE**

**TANGENT**

---

**NCHRP 350 OR MASH END TREATMENT REQUIRED**

---

**NOTES:**

1. LENGTHS OF HIGHWAY GUARD SHOWN ARE MEASUREMENTS ALONG FACE OF RAILING.
2. FOR DESCRIPTIONS, MATERIAL AND CONSTRUCTION METHODS, SEE THE STANDARD SPECIFICATIONS AND CONSTRUCTION E 401.0 AND E 401.5.0 - E 401.10.3.
3. FOR BACK UP PLATE DETAILS SEE CONSTRUCTION DRAWINGS E 401.6.0 AND E 401.8.0.
4. DETAILS SHOWN HEREIN ALSO APPLY TO THRIE BEAM GUARD RAIL, EXCEPT AS OTHERWISE NOTED.
5. WHEN PLACED IN MEDIAN, CHANGE TO THRIE BEAM & HEIGHT OF 2-6 1/2"x1".
6. POST TYPES SHALL NOT BE INTERCHANGED IN ANY CONTINUOUS RUN OF GUARD RAIL. BRACKETS SHALL SIMILAR TO POST.

---

**SECTION A-A**

**SEE SECTION ABOVE**

---

**GROUND LINE**

**BACK UP PLATE**

**EDGE OF SHOULDER**

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

---

**FULL SPAN - 1V : 6H SLOPE**

---

**FULL SPAN - 1V : 4H SLOPE**

---

**SEE TABLE ON E 401.3.0 FOR DIMENSIONS**

**± 50 FOR THRIE BEAM**

**± STANDARD LENGTH POSTS SHALL BE USED IN RAMPED SECTIONS**
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.
FLARE BEGINS AT
POST A-A ADD 2ND RAIL
AND USE 8" POSTS (EXCEPT POSTS 1, 2, AND 3)

SECTION A-A

LEVEL WITH
DESIGN HEIGHT
AT SHOULDER

TOP OF RAIL
LESS THAN 45"
ABOVE GROUND

SECTION B-B

TOP OF RAIL

45" MAX.
ABOVE GROUND

SECTION C-C
STEEL W BEAM HIGHWAY GUARD BURIED IN BACK-SLOPE END ANCHORAGE
DETAILS FOR POSTS 1, 2 AND 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.

DATE OF ISSUE: AUGUST 2010
DRAWING NUMBER: E 401.2.1e
### TYPICAL INSTALLATION

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<td>24(^{\circ}) ±</td>
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**NOTE**: ALL MEASUREMENTS ARE FROM EDGE OF USABLE SHOULDER

### FOR OVERHEAD SIGN PROTECTION

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<td>THRIE BEAM</td>
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<tr>
<td>1V : 2H SLOPE 2:1 SLOPE</td>
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<td>3'-3&quot; ±</td>
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* SEE E 401.1.0
** SEE E 401.2.0
NOTES:
1. CURB AND BERM OPTIONAL
   SEE GENERAL HIGHWAY PLANS AND/OR BRIDGE PLANS
2. CURB INLET OR PWW OPTIONAL
   BASED ON GENERAL PLAN REQUIREMENTS
3. FOR SECTIONS A-A AND B-B, SEE E 401.5.2
4. ONE PAIR OF POSTS AT THE STANDARD SPACING OF 6'-3"
   USING SINGLE PANEL THRIE BEAM RAIL IS PART OF THE
   TRANSITION UNIT BEFORE CHANGE TO W BEAM OR THRIE BEAM GUARDRAIL.
5. FOR POST SEE E 401.10.0

*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
BRIDGE RAIL TO HIGHWAY GUARD COLLAPSING TUBE

NOTE:
BENT PLATE PIPE ASSEMBLY SHALL BE NOT DIP GALVANIZED

STEEL PIPE: DN 150 x 7.1 x 420 L.G. (AS GR. B)

1 1/2" HORIZ. SLOT FOR 5/8" Ø POST BOLT

1" Ø H.S. BOLTS

2 LAYERS WITH 5/32" WAX ELECTRODE

1 1/2" VERT. SLOTS FOR 7/8" Ø H.S. BOLTS

6" Ø SCHEDULE 40 PIPE

1/2" THICK BENT "R"
STEEL THRIE BEAM HIGHWAY GUARD DETAILS

DATE OF ISSUE
AUGUST 2010

DRAWING NUMBER
E 401.6.0

POST TO BE FABRICATED FROM W6.9.

STEEL SECTIONS AS SHOWN.

POST TO BE 3/4" DIA. (STD GALV WASHERS TO BE USED AT THESE CONNECTIONS). BACK UP PLATE TO BE PLACED BEHIND RAIL POST.

USE RAIL BOLTS FOR BACKUP PLATE. FOR RAIL BOLT DETAILS SEE E 401.10.

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

M16x2 - 10" LONG GUARD RAIL BOLT WITH WASHER AND RECESSED NUT

PLAN TERMINAL SECTION

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

FRONT TERMINAL SECTION

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. BACK UP PLATE TO BE PLACED BEHIND RAIL ELEMENT ON POSTS WHERE NO SPlice OCCURS. FOR RAIL BOLT SLOT DETAILS SEE E 401.7.0. USE RAIL BOLTS FOR BACKUP PLATE.
4. FOR BLOCK-OUT DETAILS SEE E 401.20.0.
STEEL BEAM HIGHWAY GUARD
WITH WOOD 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 401.8.2 & 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 401.9.0
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.
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. FOR BACK-UP PLATE DETAIL SEE DRAWING E 401.6.0
8. MAXIMUM OF TWO (2) POSTS IN A ROW OF GUARDRAIL.
6" x 4", 8.5LBS/LF
STEEL "H" POSTS
OR "C" POST

PLAN

EXISTING

3500 PSI - 1 1/2" - 520 LB
CEMENT
CONCRETE
MASONRY

SURFACE

2" BITUMINOUS CONCRETE WALK
SURFACE IF EXISTING SURFACE
IS BITUMINOUS CONCRETE,
OTHERWISE CONTINUE
3500 PSI - 1 1/2" - 520 LB
CEMENT CONCRETE TO MEET
EXISTING SURFACE.

3" SAND CUSHION

UNDERGROUND UTILITY, BRIDGE FOOTING
OR OTHER OBSTRUCTION

ELEVATION

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<td>2'-6&quot;</td>
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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.
OFFSET BLOCKS FOR STEEL W BEAM HIGHWAY GUARD

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.)

FLAT WASHER

NUT

W150 x 13.5

DATE OF ISSUE AUGUST 2010
DRAWING NUMBER E 401.20.0
**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 29', 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.

DETAIL "A"
7/8" Ø HOLES FOR M20 H.S. BOLTS

4" LONG STRUC. CONC. INSERT *

3/4"Ø HOLE FOR M16 H.S. BOLT FOR PLATE
ATTACHMENT & GD. RAIL ATTACHMENT

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

MASONRY BRACKET FOR STEEL W BEAM
HIGHWAY GUARD ON ABUTMENTS AND
END POSTS
(TRAILING END)
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" DRAWINGS E 402.2.0 AND E 401.12.0
2. CONSTRUCTION DETAILS SHOWN ALSO APPLY TO WOOD AND CHARLEY (C) POST INSTALLATIONS.
3. THE DOUBLE RAIL ELEMENT IS TO CONSTITUTE OF NESTING TWO (2) 12 GAUGE RAIL ELEMENTS FOR A DISTANCE OF 25 FEET, THE SHORT RAIL (27) IS TO BE NESTED BEHIND THE CONTINUOUS RAIL, SEE SECTION B-B.
4. BACKUP PLATE NOT REQUIRED WHERE RAIL IS TO BE NESTED.
**END WALL**

TYP. 1/4" 3/8"

SEE DETAIL "A"

L 6"X4"X3/8", 32" LONG

5/8" RAIL BOLT - ROW OF 4 - 3/4" Ø HOE - TYP.

5/8" RAIL BOLT - 1 3/4" LONG - ROW OF 4 - 3/4" Ø HOE - TYP.

2 1/2"

3/4" H.S. BOLT - 7/8" Ø HOLE

3/4" H.S. BOLT - 7/8" Ø HOLE

3/8" PLATE

5" 22"

3/4" PLATE

1/2"

CUT SQUARE FOR WELDING

L 6"X4"X3/8"

DETAIL "A"

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

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

MASSDOT HIGHWAY GUARD ON ABUTMENTS AND END POSTS (TRAILING END)
TYPICAL GUARDRAIL OR APPROPRIATE END TREATMENT

LIMIT OF PAYMENT

THREE BEAM GUARDRAIL (10 GAUGE) WITH WOOD POSTS SPACED AT 6'-3"

SEE NOTE 2

EXISTING BRIDGE PARAPET

10"x10"x8'-6" LG. TIMBER POSTS

END OF SAFETY WALK

6"x6" TIMBER BLOCKS

6'-3" TIMBER BLOCKS

OFFSET BLOCK (TYP)

WIND POST (TYP)

2'-0" TIMBER BLOCKS (TYP)

9"x8" TIMBER BLOCKS (TYP)

2'-0"

EXIT END

APPLICATION

DIRECTION OF TRAFFIC

3'-12"

3'-12"

6'-3"

6'-3"

6'-3"

5'-12"

3'-12"

TWO SECTIONS OF THREE BEAM, ONE NESTED INSIDE THE OTHER

ENTRY END APPLICATION (SEE NOTE 7)

PLAN

NOT TO SCALE
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 THREE 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.


5. "THREE BEAM EXPANSION SECTIONS" SHALL BE INSTALLED AT EACH BRIDGE EXPANSION JOINT.

6. INSTALL A DEMOUNTABLE REFLECTORIZED DELINEATOR (GUARDRAIL) IN THE UPPER VALLEY OF THE THREE 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.
SYMMETRICAL SECTION

ASYMMETRICAL SECTION

PLAN

PLAN

<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>A</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORMAL</td>
<td>2 1/4&quot;</td>
<td>2-8&quot;</td>
</tr>
<tr>
<td>TALL</td>
<td>3 1/4&quot;</td>
<td>3-6&quot;</td>
</tr>
</tbody>
</table>

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.
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-3/4"-610 lb/Cu.Yd. CONCRETE.

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
VARIABLES

1/4" PREMOLDED JOINT FILLER
4" SLAB CAST IN PLACE

CEMENT CONC.
1/2" BARS @ 12" E.W.

2" Ø LIFT HOLE
ON BARRIERS 13' OR LESS

1" Ø PLAIN BAR DOWEL
SEE DRAWING E 402.22.0

CEMENT CONCRETE
4000 psi-3/4"-610 lb/c.y.

GRAVEL BORROW

GRAVEL
SPECIAL BORROW


SYSTEM | A | H
-------|---|---
NORMAL | 2-3/8" | 2'-8"
TALL | 3-11/32" | 3'-6 1/8"

* SAME DEPTH AS UNDER ROADWAY.
** BARRIER CAP BUILT USING 4000 psi-3/4"-610 lb/c.y. CEMENT CONCRETE.

NOTES:
1. ALL LONGITUDINAL BARS TO BE CONTINUOUS FOR BOTH PRECAST BARRIERS AND CAST IN PLACE BARRIERS.
2. USE MINIMUM COVER OF 1 1/2", UNLESS OTHERWISE INDICATED.
3. ALL CONCRETE IS TO BE FIELD COATED AFTER FINAL INSTALLATION WITH A CONCRETE PENETRANT/SEALER.
   CONCRETE SHALL CURE NOT LESS THAN 28 DAYS PRIOR TO COATING.
4. FOR REINFORCING DETAILS SEE E 402.21.0
5. FOR DOWEL DETAILS SEE E 402.22.0
6. TAR PAPER TO BE PLACED INSIDE LIFT HOLES AND BARRIER JOINTS.

DATE OF ISSUE
AUGUST 2010

DRAWING NUMBER
E 402.20.0
AT LEAST 4 - 5/8" LAPPED HOOP BARS @ 6" EACH END

5/8" LAPPED HOOP BAR @ NOT TO EXCEED 20" (OPTIONAL)

10- 5/8" LONGITUDINAL BAR CONTINUOUS FOR WHOLE BARRIER

5/8" LAPPED HOOP BAR @ NOT TO EXCEED 20" (OPTIONAL)

AT LEAST 4 - 5/8" LAPPED HOOP BARS @ 6" EACH END

DEEP EMBEDMENT NOT REQUIRED FOR CIP BARRIER LONGER THAN 20'

LONGITUDINAL ELEVATION

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" PREMOLDED 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
F SHAPE CONCRETE BARRIER WITH CONCRETE SEPARATOR DOWEL DETAILS

NOTES:
1. DOWELS TO BE GALVANIZED, AASHTO M-31, GRADE 60.
2. FOR ADDITIONAL DETAILS SEE E 402.20.0
ELEVATION DETAIL OF DRAINAGE SLOT

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 ASHTO M111.

3. CEMENT CONCRETE IS TO CONFORM TO MASSACHUSETTS HIGHWAY STANDARD SPECIFICATIONS M4.02.00. CEMENT CONCRETE IS TO BE 5000 PSI, 3/4" CONCRETE.
CHAIN LINK FENCE WITH SPRING TENSION WIRE

FASTENING SPRING TENSION WIRE TO LINE POST

FACTOR FLUSH WITH TOP OF POST

HOG RINGS EVERY 12” ±

FASTENING FABRIC TO LINE POST EVERY 12” ±

FABRIC PLACED PERPENDICULAR TO THE ANCHOR

DETAIL SHOWING LINE POST SET WITH DRIVE ANCHORS

DETAIL OF AN ANCHOR CLAMP

SPRING TENSION WIRE

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

LIN1E POST SPACING
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.

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.
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.

2. **Fabric for Fences 5' or over in height.** Both top and bottom selvage to have twisted and barbed finish unless otherwise noted.

3. The height of fence to be as specified.

4. 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

5. For post bases and cable attachments, see drawing E 404.5.0

6. For description, materials and construction methods, see standard specifications.
POST BASES

FOR CORNER, END LINE AND PULL POSTS

FOR GATE POSTS

4000 PSI - 1 1/2" - 565 LB CONCRETE

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

<table>
<thead>
<tr>
<th>FENCE HEIGHT</th>
<th>MIN. H</th>
</tr>
</thead>
<tbody>
<tr>
<td>5' OR LESS</td>
<td>2'-5&quot;</td>
</tr>
<tr>
<td>OVER 5'</td>
<td>3'-5&quot;</td>
</tr>
</tbody>
</table>
DOUBLE GATES

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

2. FOR GATE POST BASE, SEE DRAWING 404.5.0
CHAIN LINK FENCE
CANTILEVER GATE

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

ROLLER ASSEMBLY

LATCH AND LOCKING ASSEMBLY

2" O.D. PIPE OFFSET FOR 3 STRAND BARBED WIRE

2 1/2" O.D. RAIL

2" O.D. FRAME

4" O.D. POST

2" O.D. FRAME

GROUND LINE

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

BACK STOP CLAMPS ON CROSS MEMBER AND IS ADJUSTABLE

DISTANCE "A" TO BE 1/2 DISTANCE "B"

FRONT STOP IS WELDED TO EDGE OF UPRIGHT MEMBER

DRAWING NUMBER E 404.7.0
DATE OF ISSUE AUGUST 2010
CHAIN LINK FENCE POST

DETAILS

1/4 H MAX.

10' MAX.

SPRING TENSION WIRE

BRACE RAIL

3/8" TRUSS ROD WITH TURNBUCKLE

SPRING TENSION WIRE

4000 PSI - 1 1/2" - 565 LB CEMENT CONCRETE

3'-6" MIN.

12" MIN. DIA.

END CORNERS

ROUND POSTS

10" MIN. DIA.

BRACE & TRUSS CONNECTIONS

POST

LINE

BRACE BAND

BRACE RAIL

TRUSS CONNECTOR

TRUSS CONNECTOR
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 (burlapped structures, such as MSE or geogrid may be used for fill but not cut conditions).

SECTION VIEW

PLAN VIEW

TREE WELLS
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 TAMBO 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.
STATION MARKER PANEL

METHOD OF ATTACHING PANEL TO P-9 POST

SPACING OF STATION NUMBERS
S1 - 1500' 500', BOTH SIDES, STAGGER
S2 - 650', BOTH SIDES

SINGLE ROADWAY

DIVIDED ROADWAY

OMIT MARKERS FROM INTERCHANGE

EDGE OF SHOULDER OR CURB LINE

TYPICAL MARKER INSTALLATION

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 APPLICATION 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 600' 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.
.getBounds 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.