The Commonwealth of Massachusetts

Construction and Traffic Standard Details

Massachusetts Highway Department

MASS HIGHWAY

Metric Edition

1996
The Commonwealth of Massachusetts

William F. Weld
Governor

Argo Cellucci
Lieutenant Governor

James J. Kerasiotes
Secretary of Transportation

Laurinda T. Bedingfield
Commissioner

MASS HIGHWAY

Prepared by
The Massachusetts Highway Department

1996
February 1996

Dear Reader:

The Massachusetts Highway Department serves one of the broadest and most important functions in state government. The highway and bridge program supports and promotes the growth of the Massachusetts economy in a variety of ways. We are committed to quality in all of our endeavors.

The 1996 Massachusetts Highway Department Construction and Traffic Standard Details - Metric Edition has been designed as part of the Weld - Cellucci Administration’s and MassHighway Department’s commitment that the Infrastructure of Massachusetts be retrofitted, revolutionary and ready to meet the challenges of the New World Economy as well as the needs of the 21st Century.

The new metric edition incorporates both construction and traffic details in one manual. These standard details have been revised to insure that the highest quality of important highway and traffic elements are attained in both design and construction. Please take special note that while signs must be designed and specified in metric units, all sign legends are to remain in English units.

I hope that every reader finds the Construction and Traffic Standard Details - Metric Edition to be a valuable tool and reference. Since Teamwork and Partnership are Standards of MassHighway, I invite you to participate, to comment and to be part of our Commonwealth’s continual improvement.

Sincerely,

Laurinda T. Bedingfield
Commissioner
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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DROP INLET
TYPE “A” CEMENT CONCRETE, TYPE “B” CONCRETE BLOCK
TYPE “AF” CEMENT CONCRETE, TYPE “BF” CONCRETE BLOCK FLUSH
TYPE THROATS
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3 METERS OR LESS IN DEPTH
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OVER 3 METERS IN DEPTH
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3 METERS OR LESS IN DEPTH
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MASS HIGHWAY CONSTRUCTION STANDARDS

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LIMIT AND PAYLINE FOR MUCK EXCAVATION WHEN REFERENCE SLOPE INTERSECTS VERTICAL LIMIT OF MUCK EXCAVATION OUTSIDE OF "B"

VERTICAL LIMIT OF MUCK EXCAVATION

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
**ROCK CUT SECTION**

**CONSTRUCTION STANDARDS**

**DRAWING NUMBER**

**DATING ISSUE** 9/7/95

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**Notes:**

1. Only rock actually removed is payable. No payment will be made beyond the rock payment line.

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**Top of Rock Shown on Const. Plans**

**Top of Rock in Field**

**IV - 6H Earth Slope**

**Allowable Field Extension of Slope on Construction Plans**

**Allowable Minimum**

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**EDGE OF TRAVELED WAY**

3.0 m

1.0 m

Varies

10 m

**SHOULDER**

300 mm

30 mm

**SLOPE TREATMENT**

**IV - 6H SLOPE**

**LEVEL**

**ROCK PAYMENT LIMIT LINE**

**OLD GROUND**

**SPECIAL BORROW**

**APPROXIMATE LOCATION OF SUBDRAINS**

**SURFACE**

**BINDER**

**BASE**

**CRUSHED STONE FOR SUBBASE (STANDARD SPECIFICATION M201.7)**

**GRAVEL**

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**Design:**

- $W = 3.5\ m$ for rock cuts of $6\ m$ or less
- $W = 5\ m$ for rock cuts $7.5\ m$ or more
- $W$ varies $3.5\ m - 5\ m$ for rock cuts between $6\ m - 7.5\ m$ determine proportionately

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**Notes:**

The extension of the design slope in the field is permissible within the limits shown (600 mm 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.
METHOD OF ROUNDING CUT SLOPES

1. WHEN 'D1' IS '500 m' OR MORE ROUND as shown in table above.
2. WHEN 'D1' IS LESS THAN 500 m 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 ASPHALT CONCRETE OVER THE EXISTING JOIN EXCEEDS 112 mm, a 4 mm SAWCUT SHALL BE INCLUDED IN THE JOINT AS SHOWN TO A MINIMUM DEPTH OF 62 mm.
2. PRIOR TO PLACING THE OVERLAY, ALL JOINTS SHALL BE LOCATED AND REFERENCED.
NOTES:
2. ONLY EXPANSION JOINTS SHALL BE SAW-CUT AND SEALED.
**SCORED CONCRETE PAVEMENT AT RAMPS**

**DATE OF ISSUE**

**DRAWING NUMBER**

**1052.0**

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**CONTRACTION JOINT**

**DRAWING NUMBER**

**1052.0**

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**CONTRACTION JOINT DETAIL**

**DETAIL OF CORRUGATIONS**

**SECTION A - A**

---

**NOTES:**

1. **CONTRACTION JOINTS ARE TO BE SPACED AT A MAXIMUM OF 6 M 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.**

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**THE DEPTH OF THE GRAVEL IS TO BE SUCH THAT ITS BOTTOM LINE MEETS THE BOTTOM OF THE GRAVEL LINE OF THE CONTIGUOUS PAVEMENT.**
For modified berm the slope remains constant at 1 (V) to 12.5 (H).

* This dimension varies with the thickness of the top course and slope of shoulder.

** See typical sections for project.
VERTICAL BACK OPTIONAL

R = 150 mm
75°

25 mm

FACE
R=50 mm
45°

75°

150 mm

225 mm

50 mm

100 mm

50 mm

200 mm

150 mm

SHOULDER

LEVEL

TOP COURSE

CURB

BINDER

BASE

SUBBASE

METHOD OF SETTING-TYPICAL FOR ALL TYPES

* SEE TYPICAL SECTIONS FOR PROJECT.

NOTE:
1. SEE DRAWING 106.1.0 FOR BITUMINOUS CONCRETE BERM.
The procedure described herein is applicable only if curb is to be set after base and/or binder courses are in place. Otherwise, concrete will be eliminated and gravel brought up to bottom of base course. For description, materials, and construction method, see standard specifications.

**Notes:**

1. Cut neat line 150mm from curb line and remove binder, base, and stone, replace with cement concrete.

2. Any designated cement concrete that is acceptable to the Dept. under Section M4 of the standard specifications; all test requirements are waived. Bituminous concrete is not to be used as a substitute.

3. Payment for cement concrete will be included in the price per meter of curbing.
NOTES:

1. ANY DESIGNATED CEMENT CONCRETE THAT IS ACCEPTABLE TO THE DEPARTMENT UNDER SECTION M4 OF THE STANDARD SPECIFICATIONS; ALL TEST REQUIREMENTS ARE WAIVED. BITUMINOUS CONCRETE IS NOT TO BE USED AS A SUBSTITUTE.

2. PAYMENT FOR CEMENT CONCRETE WILL BE INCLUDED IN THE PRICE PER METER OF PRE-CAST OR GRANITE EDGING.

3. THE REVEAL IS TO BE 100 mm UNDER ALL CONDITIONS.
1. SIDEWALK CROSS SLOPES, AS INDICATED IN STANDARD SPECIFICATIONS, WILL BE 1.6% MAX., 1.5% PREFERRED FOR BRICK, CEMENT CONCRETE AND BITUMINOUS CONCRETE WITH EXCEPTION ONLY TO SIDEWALK CROSS SLOPES ON BRIDGES WHICH WILL BE 1%. (REFER TO STANDARD SPECIFICATIONS FOR HIGHWAY AND BRIDGES, SECTION 700.) IN NO INSTANCE SHALL THE SIDEWALK CROSS SLOPE EXCEED 2%.

2. AN UNOBSSTRUCTED PATH OF TRAVEL WITH A MINIMUM WIDTH OF 915 mm SHALL BE MAINTAINED. THE DESIRABLE WIDTH IS 1.0 METER.

3. THE WHEELCHAIR RAMP SLOPE AND SIDE SLOPES (TRANSITION), 8% MAX, 7.5% PREFERRED, MUST NOT EXCEED 1:12 (8.3%). HOWEVER, SLOPES MAY BE FLATTER WHEN WARRANTED BY SURROUNDING CONDITIONS.

4. WHERE THE ROAD PROFILE EXCEEDS 5% THE HIGH SIDE CURB TRANSITION LENGTH (Lth) SHALL BE 4.5 METERS.

5. IN NO CASE, WHERE A STOP LINE IS WARRANTED, SHALL A RAMP BE PLACED BEHIND THE STOP LINE.

6. FIXED OBJECTS (i.e. UTILITY POLES, HYDRANTS, ETC.) MUST NOT ENCROACH ON ANY PART OF A WHEELCHAIR RAMP.

7. AT NO TIME IS ANY PART OF THE WHEELCHAIR RAMP TO BE LOCATED OUTSIDE OF THE CROSSWALK AND IS TO BE CENTERED WHENEVER POSSIBLE.

8. CATCH BASINS WHICH ARE TO BE LOCATED IN THE VICINITY OF A WHEELCHAIR RAMP SHALL BE LOCATED UP-GRADE OF RAMP.

9. THE ENTRANCE OF A WHEELCHAIR RAMP SHALL BE FLUSH WITH THE ROADWAY.

10. TESTING SURFACE. WHEN TESTING WITH A STRAIGHTEDGE PLACED PARALLEL TO THE LINE OF SLOPE, THERE SHALL BE NO DEVIATION FROM A TRUE SURFACE IN EXCESS OF 6 mm.

11. MID-BRIDGE WHEELCHAIR RAMP SHOULD BE AVOIDED BECAUSE IT INTERRUPTS THE SIDEWALK REINFORCEMENT WHICH IS INTEGRAL TO THE STRENGTH OF THE RAILING/BARRIER SYSTEM AND BECAUSE THE STANDARD 200 mm CURB REVEAL WOULD RESULT IN EXCESSIVELY WIDE RAMPS. IF A MID-BRIDGE WHEELCHAIR RAMP IS UNAVOIDABLE, PRIOR APPROVAL OF THE BRIDGE ENGINEER MUST BE OBTAINED. SPECIAL DETAILING OF THE REINFORCEMENT AND CURB REVEAL WILL BE REQUIRED TO MAINTAIN THE PERFORMANCE OF THE RAILING/BARRIER SYSTEM. IN ALL CASES, ACCESSIBILITY WILL BE PROVIDED TO AND FROM THE BRIDGE SIDEWALK.

12. WHEN IT IS TECHNICALLY UNFEASIBLE TO CONSTRUCT WHEELCHAIR RAMPS IN COMPLIANCE WITH THE ARCHITECTURAL ACCESS BOARD'S RULES AND REGULATIONS, A REQUEST FOR A VARIANCE WILL NEED TO BE SUBMITTED. THE DEPARTMENT'S HANDICAPPED ACCESSIBILITY SECTION SHOULD BE CONTACTED FOR ASSISTANCE AND DOCUMENTATION.
LEGEND

HSL = HIGH SIDE FRONT TRANSITION LENGTH
(SEE 107.90)

Lsb = LOW SIDE BACK TRANSITION LENGTH
(SEE TABLE IIIa&b)

W = SIDEWALK WIDTH

W⊥ = PERPENDICULAR RAMP LENGTH

W∥ = PARALLEL RAMP LENGTH

CC = CEMENT CONCRETE

BC = BITUMINOUS CONCRETE

WHERE THE SIDEWALK WIDTH IS 2.3m OR
GREATER FOR BITUMINOUS CONCRETE
AND 2.4m OR GREATER FOR CEMENT
CONCRETE AND BRICK, THE BACK
TRANSITION LENGTHS (Lsb, Lh)
SHALL BE LESS THAN 3.4m. THEREFORE
THE DIAGONAL SCORE LINE SHALL
MEET THE BACK CORNERS OF THE
WHEELCHAIR RAMP. IT SHOULD BE
NOTED THAT THE RAMP SLOPE SHALL
BE LESS THAN 2.4% FOR CEMENT
AND BRICK (SEE TABLE IV)

SECTION A-A
NOTE:
The length of the area behind the wheelchair ramp length (vi) shall not be less than 1.22 m and shall increase as the sidewalk increases. If the curb reveal should be larger than 150 mm all wheelchair ramp dimensions must be computed.
In areas of brick sidewalk the ramp surface vi shall be constructed of cement concrete.

LEGEND
HSL = high side front transition length
(see 107.90)
W = sidewalk width
VI = parallel ramp length
CC = cement concrete
BC = bituminous concrete

SECTION C-C
1. In areas of brick sidewalks, or other architectural sidewalk treatments, cement concrete shall be used for all wheel chair ramp surfaces.

2. For wheel chair ramp details and dimensions see drawings for cement concrete wheel chair ramps.

3. For brick or other architectural walk surfaces, any variation exceeding 6 mm shall be corrected and brought to grade.

4. For brick walk surfaces joints shall be 8 mm to 10 mm wide and shall be mortared.
THE FOLLOWING CROSSWALK PLAN MUST BE USED FOR ALL INTERSECTIONS.

PAIRED WHEELCHAIR
RAMP CONDITION

DATE OF ISSUE
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107 5.0
WHEELCHAIR RAMP AREAS WITH ONE CONTINUOUS DIRECTION OF PEDESTRIAN TRAVEL

GRASS OR BUILDING, ETC.

* FOR TRANSITION LENGTH (HSL) SEE 107.9.0

1.22 m MIN.

1.22 m MIN.

2.0 m MINIMUM SEPARATION

FOR LIMITED RIGHT-OF-WAY AREAS

DATE OF ISSUE 5/16/96

DRAWING NUMBER 10760

7.5% PREFERRED 8% MAX

WHEELCHAIR RAMP

TRANSACTION LENGTH (HSL)
LEGEND

W = SIDEWALK WIDTH

SECTION A-A
### Analysis

**Equations and Definitions:*

- **$R$** = REVEAL IN mm
- **$G$** = ROADWAY PROFILE GRADE (% OR DECIMAL: m/m)
- **$TS$** = TRANSITION SLOPE (% OR DECIMAL: m/m)
- **$HSL$** = HIGH SIDE TRANSITION LENGTH (METERS)

**High Side Slope for Rounded Length (0.1 m):**

<table>
<thead>
<tr>
<th>ROADWAY PROFILE GRADE</th>
<th>HIGH SIDE TRANSITION LENGTH</th>
<th>HIGH SIDE SLOPE FOR ROUNDED LENGTH (0.1 m)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>HSL METERS TS=0.075</td>
<td>HSL METERS TS=0.080</td>
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<tr>
<td>% G</td>
<td>METERS</td>
<td>METERS</td>
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<td>0 0.00</td>
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<td>1 0.01</td>
<td>2.308</td>
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<td>2 0.02</td>
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<td>3 0.03</td>
<td>3.333</td>
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<tr>
<td>4 0.04</td>
<td>4.286</td>
<td>3.750</td>
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<td>5 0.05</td>
<td>6.000</td>
<td>5.000</td>
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</tbody>
</table>

**Formulas:**

- **$HSL = (R/1000)/(TS-G)$**
- **Actual Slope for Rounded Length = $(R/1000)/HSL+G$**

**Notes:**

- *Note the values above are rounded to the nearest 0.000 for clarity.*
<table>
<thead>
<tr>
<th>SIDEWALK WIDTH (METERS)</th>
<th>PERPENDICULAR RAMP LENGTH @0.00% SIDEWALK CROSS SLOPES</th>
<th>PARALLEL RAMP LENGTH @0.00% SIDEWALK CROSS SLOPES</th>
<th>PARALLEL RAMP LENGTH @7.50% SIDEWALK CROSS SLOPES</th>
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**DATE OF ISSUE**
5/16/96

**DRAWING NUMBER**
107.11.0

**CONSTRUCTION STANDARDS**

**RAMP LENGTH FOR SIDEWALK WIDTH AND PROFILE GRADE**

**1% GRADE**
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**MINIMUM LANDING WIDTH = 1.22 m**
R (CURB REVEAL) = 150 mm

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**G = 3.0%**

**RAMP LENGTH FOR SIDEWALK WIDTH AND PROFILE GRADE 3% GRADE**

**DATE OF ISSUE**
5/16/96

**DRAWING NUMBER**
107.13.0
<table>
<thead>
<tr>
<th>SIDEWALK WIDTH (METERS)</th>
<th>PERPENDICULAR RAMP LENGTH @ 0.0%</th>
<th>PARALLEL RAMP LENGTH @ 0.0%</th>
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MINIMUM LANDING WIDTH = 1.22 m
R (CURB REVEAL) = 150 mm

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DRAWING NUMBER: 107.14.0
<table>
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<th>SIDEWALK WIDTH (METERS)</th>
<th>PERPENDICULAR RAMP LENGTH @ 5.0% SLOPE CROSS SLOPES</th>
<th>PARALLEL RAMP LENGTH @ 7.50% SLOPE CROSS SLOPES</th>
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**RAMP LENGTH FOR SIDEWALK WIDTH AND PROFILE GRADE 5% GRADE**
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 1.0 m LEVEL PATH OF TRAVEL ALONG BACK OF SIDEWALK.
BASIN WITH CURB INLET

PLAN OF BASE

MINIMUM DEPTH OF SUMP TO BE 600 mm

NOTES:
1. WEEPHOLES SHALL BE 60 mm PIPE OPENING OR EQUIVALENT WITH 6 mm MESH 66 mm GALVANIZED WIRE SCREEN COVERING. 0.06 CUBIC METERS 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 201.60 - 201.11.0
5. FACE OF PIPE flush OR NOT TO PROJECT MORE THAN 100 mm FROM FACE OF WALL ALONG CENTERLINE OF PIPE.

MORTAR NOT REQUIRED IN VERTICAL JOINTS

KEYWAYS TO BE FILLED WITH CEMENT MORTAR

SECTION C-C

SOLID SECTION OR FILL HOLE WITH BRICKS AND MORTAR, 100 OR FILL, WITH 30 MPA - 40 mm - 335 kg/m³ 39 MPA - 20 mm - 390 kg/m³ CONCRETE. (IF CONCRETE IS HAND MIXED SEE LATEST SPECIFICATIONS.)

BLOCKS TO BE SET IN FULL BED OF CEMENT MORTAR

30 MPA - 40 mm - 325 kg/m³ OR 20 MPA - 20 mm - 390 kg/m³ CONC. CONC. OR PRECAST CONC. SECTIONAL PLATES. SEE ABOVE.

SECTION A-A

SECTION B-B
**FOR GRADE SEE DRAWING 201.7.0 - 201.11.0**

**FOR FRAME SEE DRAWING 201.6.0**

Bricks may be used for grade adjustments. Frame to be set in full bed of mortar.

See Drawing 202.4.0 for joint details.

Mortar all joints (opening to be precast in riser section).

Provide "V" openings.

Outside of pipe +50 mm clearance.

**VEEHOLE**

Opening to be precast in riser section.

**SEE NOTE #2**

Minimum depth of sump to be 600 mm.

*** When a curb inlet is installed, the opening is to be 610 mm x 25 mm x 685 mm x 25 mm.

**** Reinforcing steel based on a wall thickness of 125 mm.

---

**NOTES:**

1. Details not indicated above are to be similar to those shown on 201.3.0.

2. Face of pipe flush or not to project more than 100 mm 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.

---

**MASS HIGHWAY CONSTRUCTION STANDARDS**

**PRECAST CONCRETE CATCH BASIN**

**DATE OF ISSUE:**
9/22/95

**DRAWING NUMBER:**
201.4.0
FOR GRATE SEE DRAWINGS 201.7.0 - 201.11.0

FOR FRAME SEE DRAWING 201.6.0

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

150 mm MINIMUM

VARIABLE

OUTLET PIPE
PIPE TO BE SET IN FULL BED OF MORTAR

GRADE ADJUSTMENTS ARE TO BE MADE WITH CONCRETE BLOCK

200 mm DIAMETER HOLE IN CENTER OF BASE
HOLE TO BE FILLED WITH 30 MPa - 40 mm - 335 kg OR 30 MPa - 20 mm - 390 kg CONCRETE AFTER INSTALLATION

150 mm MINIMUM
125 mm MINIMUM

1.2 m ± 25 mm DIAMETER

50 mm

MINIMUM DEPTH OF SUMP TO BE 600 mm

WHEN A CURB INLET IS INSTALLED, THE OPENING IS TO BE 610 mm ± 25 mm x 685 mm ± 25 mm

NOTES:

1. DETAILS NOT INDICATED ABOVE ARE TO BE SIMILAR TO THOSE SHOWN ON DRAWING 201.3.0

2. FACE OF PIPE FLUSH OR NOT TO PROJECT MORE THAN 100 mm FROM FACE OF WALL ALONG CENTERLINE OF PIPE

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

4. ALL CONCRETE TO BE AIR ENTRAINMENT

PRECAST CEMENT CONCRETE CATCH BASIN TUB

DATE OF ISSUE
9/22/95

DRAWING NUMBER
201.5.0
NOTES:
1. MINIMUM FRAME MASS:
   - 4 FLANGE - 134 KILOGRAMS
   - 3 FLANGE - 120 KILOGRAMS
2. MATERIAL - CAST IRON, SEE STANDARD SPECIFICATIONS
3. TO BE USED WITH STANDARD GRATES TYPE A-1, A-3 AND MASSACHUSETTS CASCADE GRATE
NOTES:
1. THIS CATCH BASIN GRATE IS PATENTED. THE PATENT HOLDER GRANTS FREE LICENSE TO ANY COMPANY TO MANUFACTURE AND SUPPLY THIS GRATE FOR HIGHWAY PROJECTS ONLY IN MASSACHUSETTS. THE ABOVE TO BE NOTED ON THE CONSTRUCTION PLANS WHEN APPLICABLE.
2. THE DETAILS OF THE GRATE AS SHOWN ABOVE IS FOR A WATER FLOW COMING FROM THE RIGHT (DESIGNATED AS A RIGHT GRATE). WHEN THE FLOW IS FROM THE LEFT (DESIGNATED LEFT GRATE) IT IS TO BE "TURNED 180° FROM THE POSITION SHOWN ABOVE. THE DIRECTION OF FLOW SHOULD BE SHOWN ON THE DRAINAGE PLANS WHEN THE ABOVE GRATE IS USED.
3. THE GRATE IS NOT TO BE USED ON EXPRESSWAYS, FREEWAYS, ETC. IT IS ONLY PLACED ON FACILITIES WHERE CYCLE TRAVEL IS LEGALLY ALLOWED. THE LOCAL COMMUNITY SHOULD BE MADE AWARE OF THE USE OF THESE GRATES.
4. ON CHAPTER 90 PROJECTS, THEY MAY PREFER THEIR OWN STANDARD GRATE.
5. THE GRATE IS TO BE MADE OF CAST IRON (SEE STANDARD SPECIFICATIONS).
CASCADE BAR DESIGN
FOR MASSACHUSETTS CASCADE GRATE

1. ALL DIMENSIONS ARE THOSE OF FINISHED CASTING
2. NOTE NO. 1 ON DRAWING 201.7.0 APPLIES TO THE ABOVE.

DATE OF ISSUE
9/22/95

DRAWING NUMBER
201.8.0
NOTES:
1. THE MASSACHUSETTS STANDARD FRAME IS TO BE USED, DETAILS AND DIMENSIONS NOT SHOWN ABOVE ARE TO BE THE SAME AS THOSE SHOWN ON DRAWING 201.6.0
2. A THREE (3) FLANGE FRAME IS TO BE USED WHEN A CURB INLET IS REQUIRED
3. GRATE DETAILS ARE SHOWN ON DRAWING 201.7.0
4. THE GRATE AS PLACED ABOVE, IS FOR WATER COMING FROM THE RIGHT. TURN THE GRATE 180° FOR A WATER FLOW FROM THE LEFT. SEE NOTE NO. 2 ON DRAWING 201.7.0
5. THE GRATE IS ONLY SHOWN SCHEMATICALLY
NOTES:
1. MATERIAL—CAST IRON; SEE STANDARD SPECIFICATIONS
2. MINIMUM MASS — 95 kg

SECTION B-B

CATCH BASIN GRATE
TYPE A-1
FOR FREeways AND EXPRESSWAYS

DATE OF ISSUE
9/22/95.

DRAWING NUMBER
201.10.0
NOTES:
1. MATERIAL - CAST STEEL
2. MINIMUM MASS - 64 kg
3. FOR USE WITH CAST IRON FRAME
   AS SHOWN ON DRAWING 201.6.0

CATCH BASIN GRATE
TYPE A-3
FOR FREEWAYS AND EXPRESSWAYS

DATE OF ISSUE 9/22/95
DRAWING NUMBER 201.11.0
CATCH BASIN HOOD

NOTE:
1. HOODS TO BE GRAY CAST IRON AASHTO CLASS 30

DATE OF ISSUE
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DRAWING NUMBER
201.12.0
BRICKS MAY BE USED BETWEEN FRAME & TOP COURSE FOR GRADE ADJUSTMENT.

FLOOR OF STRUCTURE TO BE HEADERS LAID FLAT

FACE OF PIPE Flush OR NOT TO PROJECT MORE THAN 100 mm FROM FACE OF WALL ALONG CENTERLINE OF PIPE.

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

SECTION A-A

BRICK CHIPS AND MORTAR OR CEMENT CONCRETE 30 MPa - 40 mm - 335 kg/m³ AIR ENTRAINED CEMENT CONCRETE OR PRECAST CONCRETE SECTIONAL PLATES. SEE BELOW.

NOTE:
1. DESIGN SHOWN IS FOR MANHOLE OF 3.0 METERS OR LESS AND PIPE DIAMETER OF 750 mm OR LESS.
2. STANDARD MANHOLE DEPTH TO BE 2.0 METERS OR LESS

CONCRETE BLOCK MANHOLE
MANHOLE 3.0 METERS OR LESS IN DEPTH

DATE OF ISSUE
9/22/95

DRAWING NUMBER
20220
PIPE FLUSH OR NOT TD

PROJECT MORE THAN 100 mm
INSIDE FACE OF WALL ALONG
CENTERLINE [IF PIPE.

BLOCKS TO BE SET IN FULL
BED OF MORTAR

FLOOR OF STRUCTURE TO BE
HEADERS LAID FLAT

BASE TO BE 30 MPa - 40 mm - 335 kg
OR 30 MPa - 20 mm - 390 kg CEMENT
CONCRETE OR PRECAST CONCRETE
SECTIONAL PLATES. SEE BELOW.

BRICK CHIPS AND MORTAR OR CEMENT
CONCRETE CLASS 30 MPa - 20 - 390 kg
(IF CONCRETE IS HAND MIXED SEE LATEST
STANDARDS SPECIFICATIONS
ALL CONCRETE TO BE AIR ENTRAINED

SECTION A-A

PLAN OF BASE

SOLID SECTION, OR FILL HOLE WITH BRICKS AND
MORTAR, OR FILL WITH 30 MPa - 40mm - 335 kg
OR 30 MPa - 20 mm - 390 kg CONCRETE (IF CONCRETE
IS HAND MIXED SEE LATEST STANDARD SPECIFICATIONS)

NOTE:
1. MANHOLE DESIGN IS FOR PIPE DIAMETER OF 750 mm OR LESS

CONCRETE BLOCK MANHOLES
MANHOLES OVER 3.0 METERS IN DEPTH

DATE OF ISSUE 9/22/95
DRAWING NUMBER 202 3.0
PRECAST CONCRETE MANHOLES

3.0 METERS OR LESS IN DEPTH

NOTE:
1. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS, SEE LATEST STANDARD SPECIFICATIONS.
STANDARD COVER
FOR COVER DETAILS SEE DRAWING 202.8.0

TYPE - A FRAME
NOTES:
1. MINIMUM MASS - 120 kg
2. MATERIAL - CAST IRON

MANHOLE FRAME AND COVER

DATE OF ISSUE
9/22/95

DRAWING NUMBER
202.6.0
MANHOLE FRAME AND COVER

NOTES:
1. MINIMUM FRAME MASS 120 KG
2. MATERIAL - CAST IRON
MANHOLE COVER DETAILS

NOTES:
1. MATERIAL - CAST IRON SEE STANDARD SPECIFICATIONS.
2. MINIMUM COVER MASS - 91.0 KG
CONCRETE COLLARS

DATE OF ISSUE: 9/22/95

DRAWING NUMBER: 202.9.0

NOTES:
1. COLLARS TO BE 30 MPa – 40 mm – 335 kg CEMENT CONCRETE MASONARY REGULAR OR H.E.S. AS DIRECTED
   (IF HAND MIXED, SEE LATEST STANDARD SPECIFICATIONS).
2. NO CONCRETE REQUIRED IN CONCRETE PAVEMENT.
NOTES:
1. STANDARD PARALLEL BAR GRATES TO BE USED.
   SEE DETAILS ON DRAWINGS 201.10.0, 201.11.0
2. MINIMUM C.I. FRAME MASS - 93 kg EACH
3. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION
   METHODS SEE LATEST STANDARD SPECIFICATIONS
4. 30 MPa - 40 mm - 335 kg CEMENT CONCRETE
5. NOMINAL CONCRETE BLOCK DIMENSIONS
   HEIGHT, 100 mm TO 200 mm
   WIDTH, 200 mm
   LENGTH, 200 mm TO 400 mm
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 203.2.0
OUTSIDE FACE
AT TOP
AT BASE

INSIDE FACE
AT TOP
AT BASE
SEE NOTE #2

PLAN

102 mm CAST IRON FRAME
FULL BED OF MORTAR

250 mm

THROAT

TAPER IN 3 OR 4 COURSES

150 mm MIN
WEEPHOLE

MIN. DEPTH TO BE 600 mm

20 m STANDARD DEPTH

50 mm

100 mm

12 m DIA. MIN

150 mm

915 mm MAXIMUM

150 mm

50 mm

OUTLET PIPE

NOTE:
1. MINIMUM CAST IRON FRAME MASS - 93 kg
   SEE DETAIL ON DRAWING 203.1.0
2. STANDARD PARALLEL BAR GRATE TO BE USED.
   SEE DETAILS ON DRAWINGS 201.10.0, 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 203.4.0
5. SEE DRAWING 201.3.0 CONCRETE BLOCK
   CATCH BASIN FOR DETAILS

SECTION A-A

20 mPa - 20 m - 390 kg CEMENT CONCRETE
OR PRECAST CONCRETE SECTIONAL PLATES
SEE DRAWING 202.2.0

203.3.0

DATE OF ISSUE
9/22/95

DRAWING NUMBER
203.3.0

DROP INLET
TYPE - C
VEEPHOLE PLAN

1. MINIMUM CAST IRON FRAME MASS - 93 kg
   SEE DETAIL ON DRAWING 203.1.0

2. STANDARD PARALLEL BAR GRATE TO BE USED.
   SEE DETAILS DRAWINGS 201.10.0, 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 201.3.0 CONCRETE BLOCK
   CATCH BASIN FOR DETAILS

NOTES:

MINIMUM CAST IRON FRAME MASS - 93 kg
SEE DETAIL ON DRAWING 203.1.0

STANDARD PARALLEL BAR GRATE TO BE USED.
SEE DETAILS DRAWINGS 201.10.0, 201.11.0

FOR DESCRIPTION, MATERIALS, AND CONSTRUCTION
METHODS, SEE STANDARD SPECIFICATIONS.

TO BE USED IN MEDIANS AND DITCHES THAT
ARE WITHIN THE RECOVERY AREA.

SEE DRAWING 201.3.0 CONCRETE BLOCK
CATCH BASIN FOR DETAILS

DATE OF ISSUE 9/22/95
DRAWING NUMBER 203.4.0
* Minimum depth of sump to be 600 mm

NOTES:
1. DETAILS NOT INDICATED ABOVE ARE TO BE SIMILAR TO THOSE SHOWN ON DRAWING 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 203.6.0

MASS HIGHWAY CONSTRUCTION STANDARDS

PRECAST CONCRETE DROP INLET
TYPE - D

DATE OF ISSUE 9/22/95
DRAWING NUMBER 203.5.0
NOTES:
1. DETAILS NOT INDICATED ABOVE ARE TO BE SIMILAR TO THOSE SHOWN ON DRAWINGS 203.3.0 AND 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

* MINIMUM DEPTH OF SUMP TO BE 600 mm
Precast Concrete Throat

For use in Medians & Ditches with Types CF and DF Drop Inlets

Isometric of Precast Concrete Throat Opening

Plan

Section A-A

Section B-B

Drop Inlet Type 'C' or Type 'D'

20 Mpa - 40 mm - 385 kg
Cement Concrete

Full Bed Mortar

50 mm Concrete Paved Waterway

Proposed Ditch Grade

No. 10 Bars (3)
NOTES:

1. WHERE CURB INLET IS NOT USED THE INSIDE HORIZONTAL DIMENSIONS OF GUTTER INLET TO BE 600 mm x 600 mm, IN WHICH CASE AND UNLESS OTHERWISE DIRECTED, A STANDARD 4-FLANGE 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.

OUTLET PIPE

INVERT TO BE CONSTRUCTED OF BRICK AS SHOWN IN DETAILS FOR BRICK GUTTER INLET OF 30 mm - 20 mm - 390 kg CEMENT CONCRETE MASONRY (IF HANDMADE SEE STANDARD SPECIFICATIONS)

30 mm - 20 mm - 390 kg CEMENT CONCRETE OR PRECAST CONCRETE SECTIONAL PLATES
NOTES:

1. USE CASCADE GRATE WHERE BICYCLE TRAVEL IS LEGALLY ALLOWED. SEE DRAWINGS 201.7.0 - 201.9.0
2. BRICK WALL TO BE 200 mm 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.
1. **Use Cascade Grate** where bicycle travel is legally allowed. See drawings 201.7.0 - 201.9.0.

2. **Backfill for full depth of basin excavation** to be 13 mm crushed stone.

3. For description, materials, and method of construction see Standard Specifications.

4. **Face of pipe flush or not to project more than 100 mm 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 H4.05.1.

**Plan of Base**

**Section A-A**

- Bottom plates require 10 pieces per circle with 13 mm spacing between plates.
**TABLE OF MINIMUM WALL THICKNESS (mm)**

*(68 mm x 13 mm CORRUGATION)*

<table>
<thead>
<tr>
<th>DIA. (mm)</th>
<th>0.45-3.00</th>
<th>3.25-4.50</th>
<th>4.75-6.00</th>
<th>6.25-7.50</th>
<th>7.75-9.00</th>
<th>9.25-10.50</th>
<th>10.75-12.00</th>
<th>12.25-13.50</th>
<th>13.75-15.00</th>
<th>15.25-16.50</th>
<th>16.75-18.00</th>
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<tr>
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</table>

**NOTES:**

1. ALL PIPE BELOW SOLID LINE TO BE SHOP STRUTTED AS PER STATE SPECIFICATIONS
2. MINIMUM COVER IS TOP OF PIPE TO ROAD - 450 mm GRADE
# TABLE OF MINIMUM WALL THICKNESS (mm)

<table>
<thead>
<tr>
<th>MADE FROM PIPE OF DIA. (mm) OR (m)</th>
<th>SPAN (mm) OR (m)</th>
<th>RISE (mm) OR (m)</th>
<th>HEIGHT OF COVER ABOVE TOP OF PIPE ARCH (m)</th>
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<tr>
<td>1.52 m</td>
<td>1.83 m</td>
<td>1.12 m</td>
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</tbody>
</table>

**NOTES:**

1. MINIMUM COVER IS TOP OF PIPE TO ROAD GRADE - 450 mm
2. FOR HEAVIER FILLS USE STRUCTURAL PLATE
ACCM PIPE WITH
CONCRETE END

SLOPE OF FILL

600 mm MINIMUM COVER

DRAINAGE STRUCTURE

ROADWAY

ACCM PIPE WITH
METAL END

INTERMEDIATE COUPLINGS - 600 mm LONG

ELBOW COUPLINGS - 600 mm LONG

METAL ENDS WITH CONNECTOR SECTION
FOR DETAILS SEE DRAWING 206.9.0

TOE PLATE

600 mm COUPLING

ELBOW AND COUPLING DETAILS

600 mm COUPLING BAND

(5 ea.) 13 mm DIA X 130 mm GALVANIZED BOLTS

50x50x4.8 mm 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.
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.

CONCRETE CRADLE FOR PIPE CULVERTS
CONCRETE AND FIELD STONE
MASONRY ENDS FOR
200 mm TO 750 mm PIPE CULVERT
DATE OF ISSUE 9/22/95
DRAWING NUMBER 206.4.0
CONCRETE ENDS

FIELD STONE MASONRY ENDS

FIELDSTONES IMBEDDED IN MORTAR

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.

MASS HIGHWAY CONSTRUCTION STANDARDS

CONCRETE AND FIELDSTONE MASONRY COMBINATION ENDS FOR PIPES UP TO 750 mm

DATE OF ISSUE 9/22/95
DRAWING NUMBER 206.5.0
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.

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FIELD STONE MASONRY ENDS

ELEV. A-A  SECTION B-B  FRONT ELEVATION  SECTION C-C  ELEV. D-D
NOTE:
1. STONE TREATMENT OF PIPE ENDS SHALL NOT BE USED IN THE VEHICLE RECOVERY AREA.
2. MINIMUM MASS PER STONE = 25 kg; MAXIMUM MASS PER STONE = 60 kg.
3. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.
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.
ALTERNATE CONNECTIONS

FOR 300 mm TO 600 mm ONLY

FOR 750 mm AND 900 mm ONLY

NOTES:
1. TOE PLATE TO BE PUNCHED TO MATCH HOLES IN SKIRT LIP. 10 mm Ø GALVANIZED BOLTS TO BE FURNISHED. LENGTH OF TOE PLATE TO BE w+250 mm FOR 300 mm TO 750 mm DIA PIPE AND w+560 mm FOR 900 mm TO 1200 mm DIA.
2. SKIRT SECTION FOR 300 mm TO 600 mm DIA PIPE TO BE MADE IN ONE PIECE. SKIRT SECTION FOR 750 mm TO 1200 mm DIA PIPE MAY BE MADE FROM TWO SHEETS JOINED BY RIVETING OR BOLTING ON CENTER LINE WITH 10 mm 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.
1. Pipe shall conform to the requirements of AASHTO designation M170 M.

2. Pipe shall also conform to standard specifications.

3. Any joint system approved and accepted by AASHTO for R.C.C.P. will be acceptable.
EMME NO OF SURVEY @OF CHANNEl

25-m PREFORMED FILLER (TYP)

PLAN

CHANNEL PAVING, AS REQUIRED
BY VELOCITY OF WATER AND
RELATIVE STABILITY OF BANKS
TO RESIST EROSION.

ELEVATION

BOTTOM OF FOOTING SHOULD NOT BE
LESS THAN 1.2 m BELOW BED OF STREAM.

NOTES:
1. ENDS OF CULVERTS TO BE PARALLEL TO G OF CONSTRUCTION UP TO 3.00 m OF COVER
   WHERE HEIGHT OF COVER IS 3.00 m OR MORE, ENDS OF CULVERTS ARE TO BE SQUARE REGARDLESS OF SKEW
   OF CULVERT.
2. WHERE COVER MATERIAL IS LESS THAN 600 mm CONSULT MASS HIGHWAY DEPT. BRIDGE SECTION.
3. SEE BRIDGE MANUAL DRAWINGS 11.1.2 - 11.3.3.
DATE OF ISSUE 9/22/95

REINFORCED CONCRETE BOX CULVERT

SECTION OF CULVERT BARREL

NOTE:
MEMBRANE WATERPROOFING WITH A WATERPROOFING PROTECTIVE COURSE WHERE ROADWAY PAVEMENT IS DIRECTLY ON STRUCTURE AND ON ALL STRUCTURES WHERE CLEAR SPAN IS OVER 6.0 m. USE BITUMINOUS DAMP-PROOFING WHERE ROADWAY PAVEMENT IS NOT DIRECTLY ON THE STRUCTURE AND WHERE CLEAR SPAN IS LESS THAN 6.0 m.

REFER TO DRAWINGS 207.4.0 AND 207.5.0 FOR ADDITIONAL INFORMATION.

△ INDICATES 75 mm IF EXPOSED TO SALT WATER.
○ INDICATES 100 mm IF EXPOSED TO SALT WATER.
WHERE EXPOSED TO SALT WATER INCREASE THE THICKNESS OF THE SIDEWALLS 25 mm AND THE BOTTOM SLAB 50 mm.
EXPANSION AND CONSTRUCTION JOINTS

A. WHERE CULVERT IS MORE THAN 60 m IN LENGTH, EXP. AND CONST. JOINTS ARE TO BE CARRIED INTO FLOOR OF CULVERT.

B. WHERE CULVERT IS MORE THAN 30 m IN LENGTH WITH ROADWAY EMBANKMENT MORE THAN 3.0 m (MEASURED FROM ROOF TO ROADWAY SURFACE) AND THE FOUNDATION SUPPORT IS GRAVEL BORROW FOR BRIDGE FOUNDATION, EXP. AND CONST. JOINTS ARE TO BE CARRIED INTO FLOOR OF CULVERT.

C. IN ALL OTHER CASES, EXPANSION JOINTS ARE CARRIED INTO THE FLOOR OF THE CULVERT AND CONST. JOINTS ARE OMITTED IN THE FLOOR OF THE CULVERT.

D. EXPANSION JOINTS ARE AT 30 m AND CONST. JOINTS ARE AT 10 m.

* OR AN APPROVED BY MHD RESEARCH & MATERIALS EQUIVALENT.

COPING AND CURTAIN WALL

DATE ON COPING

(A Plan Sheet Will Be Furnished)
NOTE:
1) ALL PIPE DIAMETERS NOMINAL SIZE
NOTES:
1. FILTER MATERIAL TO BE DESIGNED IN ACCORDANCE WITH PROCEDURES OF FHWA REPORT FHWA-TS-80-224, HIGHWAY SUBGRADE DESIGN.
2. PIPE SHALL BE SET AT BOTTOM OF TRENCH FOR IMPERVIOUS BOTTOM

NOTES:
1. GEOTEXTILE FABRIC TO BE DESIGNED AND INSTALLED IN ACCORDANCE WITH PROCEDURES OF FHWA PUBLICATION HI-96-001 GEOTEXTILE DESIGN AND CONSTRUCTION GUIDELINES (APRIL 1996).
2. PIPE SHALL BE SET AT BOTTOM OF TRENCH FOR IMPERVIOUS BOTTOM.
DURING A CONSTRUCTION PROJECT, SOIL EROSION CAN BE A MAJOR CONTRIBUTING FACTOR TO ENVIRONMENTAL POLLUTION. IN ORDER TO MINIMIZE THE EFFECT OF SEDIMENTATION, SCOUR, TURBULENCE, WASHOUTS, ETC. DURING CONSTRUCTION OPERATIONS, TEMPORARY, AND UNDER SOME CONDITIONS PERMANENT, CONTROLS MUST BE BUILT.

THE FORM AND DESIGN OF THE CONTROLS WILL VARY WITH THE TYPE OF AREA THAT IS TO BE PROTECTED AND THE SPECIFIC CAUSE OF THE ENVIRONMENTAL DEGRADATION. THE PROTECTIVE STRUCTURES MAY CONSIST OF:

- SEDIMENTATION POOLS FOR THE PROTECTION OF RIVERS, LAKES, STREAMS AND PONDS
- TEMPORARY BERMS TO CONTROL HEAVY RUNOFF, THUS PREVENTION WASHOUTS
- DITCHES AT TOES OF SLOPES
- CHECK DAMS AT WATERWAY CROSSINGS
- FILTERS AT DRAIN INLETS
- ENERGY DISSIPATORS AT DRAIN OUTLETS (i.e. SPLASH PADS, BULK STONE DEPOSITS, ETC.) AT CULVERT ENDS.

IN MOST SITUATIONS THE TYPE AND LOCATION OF POLLUTION CONTROL DEVICES CAN BE DETERMINED DURING THE DESIGN STAGE OF THE PROJECT. HOWEVER, FIELD CONDITIONS MAY WARRANT ADDITIONAL MEASURES AND CHANGES DURING THE CONSTRUCTION PHASE.

MANY TYPES OF PROTECTIVE SCHEMES AND DESIGNS CAN BE ADAPTED TO MEET A PARTICULAR CONDITION; IN SOME CASES CERTAIN MEASURES MAY HAVE TO BE INNOVATED. GENERALLY, THE VARIOUS SCHEMES DETAILED IN THE BOOKLET ENTITLED "TEMPORARY EROSION AND POLLUTION CONTROL MEASURES" PREPARED BY THE FEDERAL HIGHWAY ADMINISTRATION CAN BE APPLIED.
DITCH CHECK DAMS
FOR EROSION CONTROL
DATE OF ISSUE
9/22/95
DRAWING NUMBER
210.2.0
FILTER FABRIC FOR EROSION CONTROL (STAKE FILTER FABRIC EVERY 300 mm)

HAY BALES FOR EROSION CONTROL
(2 STAKES PER BALE)

STAKED FILTER FABRIC FOR EROSION CONTROL

HAY BALE FOR EROSION CONTROL

X SECTION
UNIT LENGTHS IN MULTIPLES OF 610 mm UP TO MAX. OF 3.66 m

ANGLERS SET BACK 3 CORRUGATIONS FOR LAPPING UNITS

ACCM UNITS TO BE LAPPED IN DIRECTION OF FLOW AND FASTENED WITH TWO GALV. BOLTS M10 X 32 mm

FLOW

ACCM WATERWAY TO BE FASTENED TO STAKES WITH SPIKES

WOOD STAKES 50 mm X 150 mm NOMINAL SIZE

STAKES SPACED 1.75 m MAX. C. TO C.

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

1. CONTRACTION JOINTS ARE TO BE SPACED 5.0 m CENTER TO CENTER - FOR CEMENT CONC. SEE DRAWING 211.30
2. REINFORCING STEEL TO BE PLACED AS SHOWN ON DRAWING 211.30 - FOR CEMENT CONC.
3. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS, SEE LATEST STANDARD SPECIFICATIONS.
Bituminous Concrete

Cement Concrete

Details of Contraction Joints

Expansion Joints to Be Installed at Approaches to Structures

NOTES:
1. ON CURVED ALIGNMENT, WATERWAYS SHALL BE BANKED AS DIRECTED.
2. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS, SEE LATEST STANDARD SPECIFICATIONS.
NOTES:
1. 30 MPa - 40 mm - 335 kg CEMENT CONCRETE TO BE USED.
2. EXPANSION JOINTS TO BE PLACED 24.0 m O.C. MAXIMUM WITH INTERMEDIATE CONSTRUCTION JOINTS PLACED AT 8.0 m O.C. MAXIMUM.
3. ALL CONCRETE DIMENSIONS SHOWN ARE MINIMUM.
4. PAYMENTS WILL BE BASED ON TABLE BELOW.

<table>
<thead>
<tr>
<th>HEIGHTS A (mm) OR (m)</th>
<th>WIDTH T (m)</th>
<th>AREA W (mm) OR (m)</th>
<th>$\text{m}^2$</th>
<th>$\text{m}^3$ PER $\text{m}$</th>
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<td>1.00</td>
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COPING TO BE PRECAST CONCRETE OR GRANITE OF UNIFORM DEPTH FOR THE ENTIRE LENGTH. WIDTH OF CONCRETE TO BE 1/10 THE AVERAGE M" WITHIN THE LIMITS SHOWN. DEPTH OF GRANITE TO BE AS SHOWN ON THE PLANS, 150 mm OR 250 mm.

FOR CHAIN LINK FENCE ON TOP OF WALL, THE COPING SHALL BE CONCRETE CAST-IN-PLACE WITH A MINIMUM DEPTH OF 300 mm. THE LENGTH OF GALVANIZED PIPE SLEEVES FOR FENCE POSTS SHALL BE EQUAL TO THE DEPTH OF COPING.

NOTES:
1. COPING OVERHANG TO BE APPROXIMATELY 75 mm FOR WALLS 3.00 m OR MORE IN HEIGHT AND APPROXIMATELY 50 mm FOR WALLS LESS THAN 3.00 m IN HEIGHT. IN A CONTINUOUS WALL OF VARYING HEIGHT, THE OVERHANG WILL BE APPROXIMATELY 50 mm TO 75 mm FOR THE ENTIRE LENGTH.
2. ALL DIMENSIONS SHOWN ARE MINIMUM.
3. PAYMENT WILL BE BASED ON THE ACCOMPANYING TABLE.
SPECIAL SLOPE PAVING UNDER BRIDGES
30 MPa – 40 mm – 335 kg
REINFORCED CONCRETE SLAB
FRONT VIEW

GRADE OF SIDEWALK

TOP OF WALL AND SLOPE LINE

SLOPE
RISERS 150 mm
TREADS 300 mm

DESIGN A

NOTES:
1. WHERE GALV. STEEL PIPE IS REQUIRED SEE DRAWING 409.1.0
2. ALL CONCRETE DIMENSIONS SHOWN ARE MINIMUM EXCEPT RISERS AND TREADS WHICH HAVE 5 mm TOLERANCE.
3. FOR REINFORCING STEEL AND CONCRETE QUANTITIES SEE DRAWING 304.2.0
### DESIGN A

<table>
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<tr>
<th>STEP NOS.</th>
<th>QUANTITIES - m³</th>
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<th>REINF. STEEL kg</th>
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### DESIGN C

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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.

ALL CONCRETE SHALL BE 30 MPa - 40 mm - 335 kg.
TRAFFIC FLOW

OVERHEAD SIGN POST

EDGE OF SHOULDER

CIRCULAR CURVE 11.43 m
TANGENT 11.43 m

PLAN VIEW

TRAILING END

GROUND LINE

APPROACH SECTION

RAMP 11.43 m

ELEVATION VIEW

FACE OF FOOTING

GUARD RAIL WITH POST SPACING OF 1.905 m

FULL SPAN - 1V : 6H SLOPE

FULL SPAN - 1V : 4H SLOPE

SECTION A-A

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 DRAWINGS 401.1.0 AND 401.5.0 - 401.10.0.
3. FOR BACK UP PLATE DETAILS SEE CONSTRUCTION DRAWINGS 401.6.0 AND 401.8.0.
4. DETAILS SHOWN HEREIN ALSO APPLY TO THREE BEAM GUARD RAIL, EXCEPT AS OTHERWISE NOTED.
5. WHEN PLACED IN MEDIAN, CHANGE TO THREE BEAM & HEIGHT OF 725mm ± 25mm
6. POST TYPES SHALL NOT BE INTERCHANGED IN ANY CONTINUOUS RUN OF GUARD RAIL. BRACKETS SHALL SIMILAR TO POST.

* SEE TABLE ON DRAWING 401.3.0 FOR DIMENSIONS
** 15.24 m FOR THREE BEAM
*** STANDARD LENGTH POSTS SHALL BE USED IN RAMPED SECTIONS
**** STANDOFF LENGTH POSTS SHOWN.
***** 5.2 > I *1
<<<<<<<<<
### TYPICAL INSTALLATION

<table>
<thead>
<tr>
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<th>A</th>
<th>B</th>
<th>C</th>
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<tr>
<td></td>
<td>0.5 m±</td>
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**NOTE:** ALL MEASUREMENTS ARE FROM EDGE OF USABLE SHOULDER

### FOR OVERHEAD SIGN PROTECTION

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<tr>
<td></td>
<td>W SECTION</td>
<td>THRIE BEAM</td>
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<tr>
<td>1V : 2H SLOPE</td>
<td>457 mm±</td>
<td>991 mm±</td>
<td>1.98 m±</td>
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<tr>
<td>1V : 4H SLOPE</td>
<td>1.83 m±</td>
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<td>1V : 6H SLOPE</td>
<td>4.88 m±</td>
<td>5.41 m±</td>
<td>6.40 m±</td>
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</table>

* SEE DRAWING 401.1.0  
** SEE DRAWING 401.2.0
DOUBLE FACE BARRIER WHEN
DIMENSION "A" IS LESS THAN 9.14"

RAMP AS SHOWN ON
DRAWING 401.1.0

TERMINAL SECTION
"A"

HIGHWAY GUARD THRE BEAM

EDGE OF TRAVELED WAY
TANGENT, 19.05 m
CIRCULAR
NORMAL ALIGNMENT, 45.72 m

TOTAL LENGTH ALONG FACE OF HIGHWAY GUARD, 76.20 m

SEE TABLE BELOW

A | B | C
---|---|---
CURB | 229 mm | 762 mm | 2.67 m
EDGING | 457 mm | 991 mm | 2.90 m
TYPE A BERM | 610 mm | 1.14 m | 3.05 m

*FACE OF RAILING SET AS SHOWN ON SECTION Z-Z DRAWING 401.1.0
WHEN THERE IS EDGING, CURBING OR BERM ALONG THE EDGE OF THE SHOULDER.

NOTES:
1. THIS TYPE OF INSTALLATION IS ONLY APPLICABLE WHERE HIGHWAY GUARD IS NOT NORMALLY REQUIRED.
2. SEE DRAWINGS 401.1.0, 401.5.0, 401.6.0, 401.9.0, 401.10.0
3. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.
4. ALL POSTS TO BE SPACED 1.91 m CENTER TO CENTER.
5. FOR DETAILS OF CONNECTION TO WALL, SEE DRAWINGS 402.7.0 - 402.10.0
6. POST TYPES ARE NOT TO BE INTERCHANGED IN ANY CONTINUOUS RUN OF GUARD RAIL;
   BRACKETS ARE TO BE SIMILAR TO POSTS.
STEEL THRIE BEAM HIGHWAY GUARD
TYPE SS
POST AND OFFSET BRACKET DETAILS

DATE OF ISSUE
9/22/95
DRAWING NUMBER
401.6.0
STEEL BEAM GUARD RAIL
WITH "C" POSTS

DATE OF ISSUE
9/22/95

DRAWING NUMBER
401.9.0
* WHEN PLACED IN MEDIAN CHANGE TO THREE BEAM, AND CHANGE HEIGHT TO 775 mm±25 mm.

NOTES:
1. POST SPACING, APPROACH END & TRAILING ENDS ARE SIMILAR TO 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 401.6.0, 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 DRAWINGS 401.7.0 & 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 ANCHORAGE FOR DATE
HIGHWAY GUARD INSTALLATION
ON CONCRETE

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 254 mm DEEP. SWEDGE BOLTS TO BE SET IN EPOXY RESIN, AS APPROVED BY THE ENGINEER.
3. BASE PLATE IS TO BE SET ON 2 mm NEOPRENE.
4. DETAILS OF HIGHWAY GUARD ARE SHOWN ON DRAWINGS 401.1.0, 401.5.0 & 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 401.6.0
V 150 x 1235 STEEL POST OR 'C' POST

See Table

PLAN

W

SEE TABLE

L

EXISTING SURFACE

75 mm SAND CUSHION

UNDERGROUND UTILITY, BRIDGE FOOTING OR OTHER OBSTRUCTION

ELEVATION

25 MPa - 40 mm - 310 kg CEMENT CONCRETE TO MEET EXISTING SURFACE.

50 mm BITUMINOUS CONCRETE WALK SURFACE IF EXISTING SURFACE IS BITUMINOUS CONCRETE. OTHERWISE CONTINUE

HEIGHT OF EXISTING SURFACE ABOVE TOP OF SAND CUSHION

305 mm TO 457 mm

VARIES 305 mm TO 457 mm

762 mm

762 mm

457 mm TO 762 mm

VARIES 457 mm TO 762 mm

610 mm

610 mm

OVER 762 mm

762 mm

457 mm

457 mm

NOTE:

1. UP-SET BRACKETS ARE TO BE INSTALLED AND RAILS ARE TO BE MOUNTED AS SHOWN
ON DRAWINGS 401.1.0 AND 401.5.0 - 401.9.0
END ELEVATION *

REINFORCING DIAGRAM
SEE DRAWING NUMBER 401.13.1

LIFT HOLES

* FOR FOUNDATION DETAILS SEE DRAWING 401.15.0
FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHOD SEE
LATEST STANDARD SPECIFICATIONS.
FOR BARRIER DETAILS ON STRUCTURES, SEE BRIDGE MANUAL.

NOTES:
1. THE MAXIMUM OPENING BETWEEN SECTIONS TO BE NO GREATER
   THAN 6 mm.
2. A 15 mm PREMOULDED EXPANSION JOINT FILLER TO BE PLACED
   EVERY 12.0 m.

DATE OF ISSUE 9/22/95
DRAWING NUMBER 401.13.0
2-(15) LONGIT BAR CONTINUOUS FOR WHOLE BARRIER (SEE DRAWINGS 401.13.0 AND 401.15.0 FOR REINFORCING DIAGRAM)

AT LEAST 4-(15) BAR A AT 150 mm

6-(15)X1500 mm LNG LONGIT BARS

2-(15) LONGIT BAR CONTINUOUS FOR WHOLE BARRIER (SEE SECTION)
NOTES:
1. DOWELS TO BE GALVANIZED.
2. FOR ADDITIONAL DETAILS SEE DRAWING 40113.0
3. FOR BARRIER DETAILS ON STRUCTURES, SEE BRIDGE MANUAL.
SLAB BETWEEN 2 SINGLE FACE BARRIERS

SPECIAL BORROW

SPECIAL BORROW

TOP OF SURFACE

TOP OF SURFACE

GRAVEL

GRAVEL

SPECIAL BORROW

SPECIAL BORROW

SLAB BETWEEN 2 SINGLE FACE BARRIERS

* SAME DEPTH AS UNDER ROADWAY.
* FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHOD SEE LATEST STANDARD SPECIFICATIONS.
** FOR BARRIER DETAILS ON STRUCTURES, SEE BRIDGE MANUAL.

NOTES:
1. UNLESS OTHERWISE SPECIFIED, BARRIER WALLS ARE TO BE CONSTRUCTED IN 3.0 m SECTIONS.
2. THE MAXIMUM OPENING BETWEEN ADJACENT SECTIONS OF BARRIER WALL TO BE NO GREATER THAN 6 m.
3. A 13 mm PREMOLDED JOINT FILLER IS TO BE PLACED AT 120 m INTERVALS OF THE MEDIAN BARRIER AND THE LAP SEPARATOR.

DATE OF ISSUE: 9/22/95
DRAWING NUMBER: 401.150

PRE-CAST CONCRETE MEDIAN BARRIER WITH CONCRETE CAP SEPARATOR
NOTES:
1. ALL EDGES SHALL BE ROUNDED WITH A 25 mm RADIUS EXCEPT AS SHOWN
2. FOR DOWELL CONNECTION DETAILS SEE DWG. NO. 401.14.0.

F-SHAPE
MEDIAN BARRIER

DATE OF ISSUE: 9/22/95
DRAWING NUMBER: 401.17.0
NOTES:
1. THE TOTAL LENGTH OF THE BARRIER SHALL BE LESS THAN 60000 mm. A LENGTH OF 6000 mm IS THE MOST COMMON.
2. USE MINIMUM COVER OF 40 mm.
3. MATERIAL IS 30 MPa - 20 mm - 390 kg CONCRETE
NOTES:

1. ALL EDGES SHALL BE ROUNDED WITH A 25 mm RADIUS EXCEPT AS SHOWN.
2. THIS BARRIER DOES USE REINFORCEMENT STEEL.
3. BARRIER RESTS DIRECTLY ON COMPACTED GRAVEL. 75 mm THICK PAVEMENT OR COMPACTED GRAVEL LAYER PROVIDES LATERAL SUPPORT TO THIS BARRIER.

TALL-WALL MEDIAN BARRIER
7. SEE BRIDGE STANDARDS FOR DETAILS; LAP IN DIRECTION OF TRAVEL.

NOTE:
1. CONSTRUCTION DETAILS SHOWN ALSO APPLY TO CHARLEY (C) POST INSTALLATIONS.
2. THE DOUBLE RAIL ELEMENT IS TO CONSIST OF NESTING TWO (2) 2.7 mm THK RAIL ELEMENTS FOR A DISTANCE OF 7.62 m. THE SHORT RAIL (7.62 m) IS TO BE NESTED BEHIND THE CONTINUOUS RAIL.
3. BACK UP PLATE NOT REQUIRED WHERE RAIL IS TO BE NESTED.
4. BRACKET WILL BE USED ON NEW STRUCTURES WITH FLARED END POST OTHERWISE THE STANDARD GUARD RAIL POST WILL BE USED.

**SECTION B-B**

2 RAILS

**SECTION A-A**

22 mm x 76 mm SLOTS
22 mm x 64 mm POST
WELD STUD

**ELEVATION**

**METHOD OF PLACING GUARD RAIL TERMINAL CONNECTORS ON PROP. BRIDGE STRUCTURES**

(LEADING AND TRAILING ENDS W–RAIL)

**DATE OF ISSUE**

9/22/95

**DRAWING NUMBER**

402.1.0
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 991 mm 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) 2.7 mm THK RAIL ELEMENTS FOR A DISTANCE OF 7.62 m. THE SHORT RAIL (7.62 m) IS TO BE NESTED BEHIND THE CONTINUOUS RAIL. SEE SECTION B-B.
4. BACK UP PLATE NOT REQUIRED WHERE RAIL IS TO BE NESTED.

* SEE BRIDGE STANDARDS FOR DETAILS, LAD IN DIRECTION OF TRAVEL.
MASONRY BRACKET FOR TYPE SS HIGHWAY GUARD RAIL

END POST

GUARD RAIL POST SPACING 953 mm FOR 7.62 m

POST

BRACKET

TERMINAL SECTION

EDGES OF SHOULDER

PLAN

ABUTMENT FACE

END POST

M20 H.S. BOLTS
102 mm LONG

300 mm
150 mm

SEE NOTE #1

ABUTMENT FACE

END POST

7.62 m

NEST THE RAIL
(SEE NOTE #3)

SEE NOTE #3

GROUND LINE

POST W150 x 14
1980 mm LONG

FOOTING

ELEVATION

NOTES:

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

INSTALLATION OF STEEL BEAM GUARD RAIL (TRAILING END) AT EXISTING BRIDGE ABUTMENTS AND END POSTS (W-RAIL)
IF BOLT IS THRU EXISTING HWY. GD. RECESS THAT IS FILLED WITH CONCRETE
ADD THE DEPTH OF RECESS TO THE 102 mm LENGTH OF INSERT SIMILARLY TO M20 BOLT.

NOTES:
1. ALL EXISTING HWY. GD. RECESES TO BE FILLED WITH EPOXY CONCRETE.
2. ALL WELDING IS TO BE DONE IN THE SHOP AND ALL WELD DIMENSIONS SHOWN ARE IN MILLIMETERS.

MASS HIGHWAY CONSTRUCTION STANDARDS
MASONRY BRACKET FOR HIGHWAY GUARD TYPE SS ON ABUTMENTS AND END POSTS (TRAILING END - W-RAIL)
DATE OF ISSUE 9/22/95
DRAWING NUMBER 402.4.0
22 mm\(^2\) HOLES FOR M20 H.S. BOLTS

102 mm LONG STRUC. CONC. INSERT *

PLAN - BACK PLATE

19 mm\(^2\) HOLE FOR M16 H.S. BOLT FOR PLATE
ATTACHMENT & GD. RAIL ATTACHMENT

PLAN - FRONT PLATE

* IF BOLT IS THRU EXISTING HVY. GD. RECESS THAT IS FILLED WITH CONCRETE
ADD THE DEPTH OF THE RECESS TO THE 102 mm LENGTH OF INSERT AND SIMILARLY
TO M20 BOLT.
**NOTES:**

1. CONSTRUCTION DETAILS SHOWN ALSO APPLY TO CHARLEY (C) POST INSTALLATIONS.
2. THE DOUBLE RAIL ELEMENT IS TO CONSIST OF NESTING TWO (2) 2.7 mm THK RAIL ELEMENTS FOR A DISTANCE OF 7.62 m. THE SHORT RAIL (7.62 m) IS TO BE NESTED BEHIND THE CONTINUOUS RAIL.
3. BACK UP PLATE NOT REQUIRED WHERE RAIL IS TO BE NESTED.
4. BRACKET WILL BE USED ON NEW STRUCTURES WITH FLARED END POST OTHERWISE THE STANDARD GUARD RAIL POST WILL BE USED.

---

**METHOD OF PLACING THREE BEAM GUARD RAIL**

**TERMINAL CONNECTORS ON PROP. BRIDGE STRUCTURE**

(LEADING AND TRAILING ENDS)
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 991 mm, the post shall be cut and set on the footing in a cement concrete envelope as shown in detail "A" drawings 402.20 and 402.20.

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) 27 mm thick rail elements for a distance of 7.62 m. The short rail (7.62 m) is to be nested behind the continuous rail. See Section B-B.

4. Back up plate not required where rail is to be nested.
MASONRY BRACKET FOR TYPE SS HIGHWAY GUARD RAIL

ABUTMENT FACE
M20 H.S. BOLTS
102 mm LONG

102 mm MIN.

POST
BRACKET

TERMINAL SECTION
(MODIFIED)

EDGE OF SHOULDER

PLAN

DIRECTION OF TRAVEL

7.62 m

NEST THE RAIL

POST W150 X 14
1.980 m LONG

GROUND LINE

FOOTING

ELEVATION

MODIFIED TERMINAL END

SEE NOTE #1

NOTES:
1. FOR BRACKET DETAIL SEE DRAWINGS 402.9.0 AND 402.10.0
2. FOR NESTING SEE DRAWING 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 953 mm FOR 7.62 m.

INSTALLATION OF STEEL THRIE BEAM GUARD RAIL (TRAILING END) AT EXISTING BRIDGE ABUTMENTS AND END POSTS

DATE OF ISSUE
9/22/95

DRAWING NUMBER
402.8.0
END WALL

Typ. 6 mm
10 mm

SEE DETAIL "A"

L 152 mm X 102 mm X 9.5 mm 813 mm LONG

RAIL WASHER

CUT SQUARE FOR WELDING

L 152 mm X 102 mm X 9.5 mm

DETAIL "A"

M16 H.S. BOLT - ROW OF 4 - 19 mm HOLE - TYP.

M16 RAIL BOLT - ROW OF 4 - 19 mm HOLE

10 mm PLATE TO BE PLACED IN FIELD

194 mm

10 mm PLATE

L 152 mm X 102 mm X 9.5 mm 813 mm LONG

SEE DETAIL "A"

* IF BOLT IS THRU EXISTING HWY. GD. RECESS THAT IS FILLED WITH CONCRETE
ADD THE DEPTH OF RECESS TO THE 102 mm LENGTH OF INSERT SIMILARLY
TO M20 BOLT.

NOTES:
1. ALL EXISTING HWY. GD. RECESSES TO BE FILLED WITH EPOXY CONCRETE
2. ALL WELDING IS TO BE DONE IN THE SHOP AND ALL WELD DIMENSIONS
   SHOWN ARE IN MILLIMETERS.
PLAN - BACK PLATE

22 mm Ø HOLES FOR M20 H.S. BOLTS
102 mm LONG STRUC. CONC. INSERT *

PLAN - FRONT PLATE

19 mm 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 102 mm LENGTH OF INSERT AND SIMILARLY TO M20 BOLT.
DETAIL SHOWING LINE POST SET WITH DRIVE ANCHORS

DETAIL SHOWING LINE POST SET IN CONCRETE FOOTING

FASTENING SPRING TENSION WIRE TO LINE POST, 5 mm STEEL CLIPS

3 mm HOG RINGS EVERY 300 mm

FABRIC FLUSH WITH TOP OF 'H' BEAM

SPRING TENSION WIRE 4.5 mm - CORRUGATED HEAVILY GALVANIZED (475 Grams per Square Meter) OR ALUMINUM COATED 120 Grams per Square Meter.

CHAIN LINK FENCE WITH SPRING TENSION WIRE
(ALUMINUM COATED FENCE)

DETAIL OF AN ANCHOR CLAMP SHOWING POSITION OF THE ANCHOR
**Chain Link Fence with Spring Tension Wire**

**Ends, Corners**
- Fabric flush with top of "H" beam.
- 30 Mpa, 40 mm, 335 kg cement concrete.
- 300 mm min. dia.
- 250 mm min. dia.
- Slope:
  - 1 m
- 1/4 H max.
- 3.7 m max.
- Stretch Bar
- 10 mm truss rod with turnbuckle
- Spring tension wire
- Wire fasteners
- 300 mm
- 250 mm
- Bracing rail
- 10 mm truss rod with turnbuckle
- Spring tension wire
- Wire fasteners
- 300 mm

**Intermediate Post**
- 3.7 m max.
- 1 m
- 340 mm
- 30 Mpa, 40 mm, 335 kg concrete
- 150 mm min. dia.
- 250 mm min. dia.
- Slope:
  - 1 m

**Notes:**
1. Fabric for fences 1.2 m or less in height top selvage to have knuckled finish. Bottom selvage to have twisted and barbed finish unless otherwise noted. Fabric for fences 1.5 m 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 150 m.
4. Spacing of line post on curves, see drawing 404.4.0.
5. For description, materials and construction methods, see standard specifications.
6. Spring tension wire to be fastened to fabric with 3 mm hog rings at 300 mm intervals.
7. Spring tension wire to be fastened to line posts with 5 mm steel clips.
8. Line posts to be driven except where noted above.
NOTES:

1. FABRIC FOR FENCES 1.2 m OR LESS IN HEIGHT, TOP SELVAGE TO HAVE KNECKLED FINISH, BOTTOM SELVAGE TO HAVE TWISTED AND BARBED FINISH UNLESS OTHERWISE NOTED.

2. FABRIC FOR FENCES 1.5 m 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 3 m C. TO C. MAXIMUM EXCEPT ON CURVES WHERE THEY SHALL BE SPACED AS FOLLOWS:
   - CURVES 60 m TO 150 m RADIUS: 2.5 m C. TO C. MAXIMUM
   - CURVES 30 m TO 60 m RADIUS: 2.0 m C. TO C. MAXIMUM
   - CURVES LESS THAN 30 m RADIUS: 1.5 m C. TO C. MAXIMUM

5. FOR POST BASES AND CABLE ATTACHMENTS, SEE DRAWING 404.50

6. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.
NOTES:

1. TUBULAR GATE POSTS
   - SINGLE GATE OPENING: UP TO 1.85 m, 100 mm N.O.D., 75 mm O.D.
   - DOUBLE GATE OPENING: UP TO 3.70 m, 100 mm N.O.D., 75 mm O.D.
   - SINGLE GATE OPENING: 2.10 - 3.95 m, 100 mm N.O.D., 100 mm O.D.
   - DOUBLE GATE OPENING: 3.95 m - 8.00 m, 100 mm N.O.D., 100 mm O.D.
   - SINGLE GATE OPENING: 4.25 m - 5.50 m, 100 mm N.O.D., 170 mm O.D.
   - DOUBLE GATE OPENING: 8.20 m - 11.00 m, 100 mm N.O.D., 170 mm O.D.
   
   * THE ABOVE LIMITS OF THE OPENINGS ARE INCLUSIVE

2. GATE FRAMES & BRACES
   - SINGLE GATE FRAME UP TO 1.83 m: 40 mm N.O.D.
   - SINGLE GATE FRAME OVER 1.83 m: 50 mm N.O.D.
   - 3. TRUSS RODS
     - DIAMETER
     - STEEL: 10 mm
     - ALUMINUM: 10 mm

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

5. FOR GATE POST BASE, SEE DRAWING 404.5.0

6. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.
CANTILEVER FITTINGS FOR TRUSS TYPE CONSTRUCTION GATES

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

ROLLER ASSEMBLY

LATCH AND LOCKING ASSEMBLY

50 mm O.D. PIPE OFFSET FOR 3 STRAND BARBED WIRE

WELD

65 mm O.D. RAIL

50 mm O.D. FRAME

100 mm O.D. POST

50 mm O.D. FRAME

GROUNDS LINE

SPECIFICATIONS OF GATE FRAME

TOP AND BOTTOM MEMBER ——— 65 mm O.D. PIPE
UPRIGHT MEMBERS ——— 50 mm O.D. PIPE
HORIZONTAL AND DIAGONAL BRACES ——— 40 mm 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
ELEVATION

HIGHWAY GUARD THRIE BEAM

1.905 m (TYPICAL)

LINE POST

M16 x 75 mm HEX HEAD BOLTS AND NUTS WITH 30 mm WASHERS AND LOCK WASHERS (GALV.)

GROUND

LINE

LINE POST FOR GUARD RAIL POST

ELEVATION

G.R. POST

20 mm DIAM. HOLES

GROUND

150 mm

NOTE:
1. ALL POSTS (LINE, END, AND INTERMEDIATE) SHALL CONFORM TO DETAILS SHOWN ON DRAWING 404.10.
2. END BRACING TO CONFORM TO DETAIL SHOWN ABOVE. INTERMEDIATE BRACING SHALL BE IN CONFORMANCE TO DETAILS SHOWN ON DRAWING 404.20.
3. FOR DESCRIPTION, MATERIALS AND METHODS, SEE STANDARD SPECIFICATIONS.
CHAIN LINK FENCE
POST DETAILS
(C-POST)

DATE OF ISSUE
9/22/95

DRAWING NUMBER
404.10.0
ANODIZED ALUMINUM PANEL WITH ORANGE & WHITE REFLECTORIZED BARRICADE SHEETING. ATTACH WITH FOUR 25 mm NO. 14 PAN HEAD METAL SCREWS.

NOTES:
1. ALL PIPE SHALL BE WHITE, WHITE FITTINGS ARE PREFERRED BLACK MAY BE USED.
2. ALL JOINTS SHALL BE FREE TO SEPARATE UPON VEHICLE IMPACT.
3. SHADED CONDUIT TO BE TIED TOGETHER WITH ROPE THREADED INTO PIPE INTERIOR. USE 5 mm NO. 6 SOLID BRAIDED NYLON OR EQUIVALENT.
4. SANDBAGS SHALL BE USED TO WEIGH DOWN BARRICADE.
5. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHOD, SEE STANDARD SPECIFICATIONS.
FENCE PANEL WITH T-TYPE STEEL POSTS

GATE - MINIMUM HEIGHT 1.20 m. FRAME TO BE MADE OF GALVANIZED STEEL TUBING NOT LESS THAN 33 mm O.D. SHELL 2.4 mm THICK. VERTICAL BRACE NOT LESS THAN 25 mm DIAM.

NOTES:
1. ALL CEMENT CONCRETE DIMENSIONS ARE MINIMUMS
2. FOR MATERIALS AND CONSTRUCTION METHODS SEE STANDARD SPECIFICATIONS.
FENCE PANEL WITH POSTS OF STEEL TUBING

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

FENCE PANEL WITH WOOD POSTS

100 mm x 100 mm NOMINAL SIZE PRESSURE TREATED POST

DIAGRAM OF FENCE PANELS:
- Line posts to be galvanized steel tubing 45 mm O.D.
- 2.30 m long, 2 mm thick.
- Tie rod 10 mm dia.
- Brace 25 mm dia. min.
- Ground line 30 mPa - 40 mPa - 335 kg
- Cement concrete 460 mm dia. min.
- 920 mm
- 300 mm dia. min.
- 50 mm
- 3000 mm dia. min.
- 50 mm
**STOCK FENCE**

**ROLLED ANGLE SECTION FOR END, CORNER AND ANCHOR POSTS**

**WIRE SPACING**

- 203 mm
- 178 mm
- 152 mm
- 127 mm
- 114 mm
- 102 mm
- 89 mm
- 76 mm

**GROUND LINE**

**SECTION A-A**

- L64/64x6.4 mm ROLLED ANGLE SECTION-MIN. MASS 6.1 kg PER METER
- Holes for braces 16 mm DIA.
- L51x51x4.8 mm ANGLE SECTION-MIN. MASS 3.6 kg PER METER

**STUDDED 'T' SECTION LINE POST**

**METHOD OF SECURING WIRE STRANDS OF FENCE AT ENDS AND CORNER POSTS**

**NOTE:**

1. FOR DESCRIPTIONS, MATERIALS, AND CONSTRUCTION METHODS SEE STANDARD SPECIFICATIONS.
25 mm BLACK ANODIZED CHAIN LINK FENCE FABRIC
6 mm TACK WELD AT 300 mm ON TOP AND BOTTOM
RAILS AND ON END PICKETS

GALVANIZED STEEL PIPE HAND RAIL

NOTES:
1. WHEN USED ON A CURVE ALL RAILINGS TO BE CURVED TO LINE BEFORE ERECTION.
2. GALV. STEEL PIPE FENCE & HAND RAIL TO FOLLOW GRADE OF COPING OR STRUCTURE.
3. STANDARD OR SPECIAL FITTINGS ARE TO BE USED OR JOINTS MAY BE WELDED.
4. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.

25 mm BLACK ANODIZED CHAIN LINK FENCE FABRIC
6 mm TACK WELD AT 300 mm ON TOP AND BOTTOM
RAILS AND ON END PICKETS

SEE DETAIL "A"
MASS. DEPT. OF ENVIRONMENTAL PROTECTION
FILE NO. _____

COLORS

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

THE SIGN IS TO BE MOUNTED ON A MASSACHUSETTS HIGHWAY DEPARTMENT 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.
FOR NEW WALLS

PROPRIETARY WALL SYSTEMS: FOR SELECTION AND DESIGN OF NEW PROPRIETARY WALL SYSTEMS CONTACT THE GEOTECHNICAL SECTION OF THE MASSACHUSETTS HIGHWAY DEPARTMENT. NEW PROPRIETARY WALL SYSTEMS WILL BE SELECTED AND DESIGNED TO FIT SITE CONDITIONS.
NOTES:

1. THESE DEPTHS MAY VARY TO SUIT CONDITIONS.
2. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.

REPAIR TO EXISTING WALLS ONLY
NOTES:

1. THESE DEPTHS MAY VARY TO SUIT CONDITIONS.
2. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.

REPAIR TO EXISTING WALLS ONLY
METAL BIN-TYPE RETAINING WALL DESIGN "D"

DESIGN "D"

NOTES:
1. THESE DEPTHS MAY VARY TO SUIT CONDITIONS.
2. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION
   METHODS, SEE STANDARD SPECIFICATIONS.

REPAIR TO EXISTING WALLS ONLY

DATE OF ISSUE
9/22/95

DRAWING NUMBER
503.1.3
DESIGN "E"

NOTES:
1. THESE DEPTHS MAY VARY TO SUIT CONDITIONS.
2. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.

REPAIR TO EXISTING WALLS ONLY
DESIGN 'F'

REPAIR TO EXISTING WALLS ONLY

NOTES:
1. THESE DEPTHS MAY VARY TO SUIT CONDITIONS.
2. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.

METAL BIN-TYPE RETAINING WALL
DESIGN "F"

DATE OF ISSUE 9/22/95
DRAWING NUMBER 503.1.5
TABLE 1

LOADING CONDITION

\[ R = \frac{\text{WALL THICKNESS}}{\text{WALL HEIGHT}} = \frac{D}{H} \]

<table>
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<th>BATTER</th>
<th>LEVEL</th>
<th>SLIGHT WITH SUPERIMPOSED LOAD</th>
<th>SLOPING TO 3 X D</th>
<th>SLOPING ABOVE 3 X D</th>
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<td><img src="chart1" alt="Diagram" /></td>
<td><img src="chart2" alt="Diagram" /></td>
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**CHART A**

WALL HEIGHT

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<tr>
<td>1.20</td>
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WALL DESIGN

REPAIR TO EXISTING WALLS ONLY

DATE OF ISSUE: 9/22/95

DRAWING NUMBER: 503.1.6
REPAIR TO EXISTING WALLS ONLY

NOTES:
1. ALL NUTS AND BOLTS TO BE GALVANIZED.
2. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION
METHODS, SEE STANDARD SPECIFICATIONS.
REPAIR TO EXISTING WALLS ONLY

NOTES:
1. ALL NUTS & BOLTS TO BE GALVANIZED
2. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.

ALL OF THE ABOVE AND ADDITIONAL REQUIREMENTS IN THE MANUFACTURE AND ERECTION OF THE RETAINING WALL AS STATED IN THE STANDARD SPECIFICATIONS FOR SAME SHALL BE STRICTLY ADHERED TO.
NOTES:

1. LUMBER TO BE PLANED ON ALL FOUR SIDES TO FULL 50 mm x 150 mm SIZE TO FIT BOTTOM OF MAIL BOXES.
2. TO SET 38 mm GALVANIZED PIPE POST, USE DRIVING POINT OF SAME SIZE, THEN TAMPER 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.
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'.
2. THE STATION DESIGNATIONS ARE TO BE EVEN STATIONS (i.e., NO PLUS STATIONS).
3. THE PANELS FOR THE LEGEND ARE TO BE 2 mm 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 200 m INTERVALS ON UNDIVIDED ROADWAY STAGGER ON EACH SIDE. ON DIVIDED ROADWAY PLACE MARKERS OPPOSITE EACH OTHER.
8. SEE DRAWING TR-23 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
13mm \ SUNK LETTERS

STATE LINE

CITY OR TOWN CORNER

NOTES:
1. TOP AND 4 SIDES FOR A DISTANCE OF 300 mm 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.

STONE MONUMENTS
(BOUNDS)

DATE OF ISSUE
9/22/95
DRAWING NUMBER
506.2.0
TRAFFIC

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GENERAL NOTES

THE SIGNS, FOUNDATIONS, AND SUPPORTS SHALL BE FABRICATED AND ERECTED TO CONFORM WITH THE FOLLOWING:


THE DEPARTMENT'S MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (Current edition of the MUTCD with subsequent amendments).

THE A.A.S.H.T.O. PUBLICATION ENTITLED "SPECIFICATIONS FOR DESIGN AND CONSTRUCTION OF STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS". (Current edition)

THE DEPARTMENT HAS STANDARDIZED CERTAIN SIGNS AND SUPPORTS, PAVEMENT MARKINGS, AND OTHER DELINEATION. THE DESIGN, PLACEMENT, ETC. OF THESE AS SHOWN HEREIN SHALL BE USED ON ALL CONTRACTS AS NEEDED.

ALL STIFFENERS, BOLTS, NUTS, CLAMPS AND ANGLES (STEEL OR ALUMINUM) MUST BE DESIGNED BY THE CONTRACTOR OR HIS AGENT TO WITHSTAND ALL DESIGN LOADS AND FORCES.

WHEN DESIGNS OTHER THAN THOSE SHOWN AS DEPARTMENT STANDARDS ARE RECOMMENDED, PERMISSION TO USE OTHER DESIGNS MUST BE OBTAINED FROM THE DEPARTMENT BEFORE FABRICATION OR ERECTION.
<table>
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<th>SIGN SIZES IN MILLIMETERS</th>
<th>NO. OF DIGITS</th>
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<td>600 X 600</td>
<td>1 OR 2</td>
<td>A: 600  B: 600  C: 300  D: 150  E: 150  F: 40  G: 10  H: 15</td>
</tr>
<tr>
<td>750 X 600</td>
<td>3</td>
<td>A: 750  B: 600  C: 300  D: 150  E: 150  F: 40  G: 10  H: 15</td>
</tr>
<tr>
<td>900 X 600</td>
<td>4</td>
<td>A: 900  B: 600  C: 300  D: 150  E: 150  F: 40  G: 10  H: 15</td>
</tr>
</tbody>
</table>
USE M8 DIA. HOT DIPPED GALVANIZED BUTTON HEAD BOLT WITH A SLOT IN HEAD AND NUT WITH LOCKWASHER, WITH A MINIMUM OF 6 mm OF THREADS BEYOND NUTS ON ALL SIGNS AFTER THEY ARE SECURELY FASTENED.

USE M10 DIA. HOT DIPPED GALVANIZED BUTTON HEAD BOLT WITH A SLOT IN HEAD AND NUT WITH LOCKWASHER, WITH A MINIMUM OF 6 mm OF THREADS BEYOND NUTS ON ALL SIGNS AFTER THEY ARE SECURELY FASTENED.

TYPICAL INSTALLATION FOR SIGNS WITH AREA UP TO AND INCLUDING 1.0 SQ. METER SIGNS WITH A WIDTH OF 1.2 METERS AND OVER SHALL REQUIRE TWO POSTS.

TYPICAL INSTALLATION FOR SIGNS WITH AREA OVER 1.0 SQ. METER UP TO AND INCLUDING 2.0 SQ. METERS.
GROUND INSTALLATION

METHOD OF INSTALLATION

STEP 1: Drive Sign Post Anchor To Within 75 mm Or 100 mm Of Surface.

STEP 2: Pre-cut Anchor Sleeve So That The Holes Will Match And
Still Be Flush With Top Of Sign Post Anchor, Drive Anchor
Sleeve Until Holes Match As Noted Above, Then Drive Both
The Sign Post Anchor And Anchor Sleeve Until One Hole Is
Exposed Above Ground For Bolt Connection.

STEP 3: Insert Sign Post And Bolt In Place.

NOTE: DRIVING CAPS MUST BE USED TO DRIVE POST.
RETAIN 1.2m DEPTH TO REACH THEORETICAL FROST LINE.

GENERAL NOTES

BREAKAWAY SIGN SUPPORTS SHALL BE FABRICATED FROM
STEEL AND SHALL CONFORM TO THE BREAKAWAY DESIGN SHOWN ON
THIS DRAWING OR ON DRAWING TR.1.2 AND THE MASS.
HIGHWAY DEPARTMENT STANDARD SPECIFICATIONS FOR HIGHWAYS
AND BRIDGES.

THE STEEL POSTS SHALL CONFORM TO ASTM-A366. THE
CROSS SECTION OF THE POST SHALL BE SQUARE TUBE FORMED
OF 2.7 mm COLD-ROLLED CARBON STEEL SHEETS WHICH
HAVE BEEN ZINC COATED (35.4 g) CONFORMING TO ASTM-A525,
CAREFULLY ROLLED TO SIZE AND WELDED DIRECTLY IN THE
CORNER BY HIGH FREQUENCY RESISTANCE WELDING OR
EQUAL AND EXTERNALLY SCARFED TO AGREE WITH CORNER RADIUS.
STANDARD OUTSIDE CORNER CORNER RADIUS SHALL BE 4 mm
PLUS OR MINUS 0.4 mm.

ALL BOLTS SHALL CONFORM TO ASTM-A307, CLASS A.
ALL BOLTS, NUTS, AND WASHERS SHALL BE GALVANIZED AS
PER ASTM-A153.

<table>
<thead>
<tr>
<th>SIGN SIZE</th>
<th>TELESCOPIC POST SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 Sq.m. And Under</td>
<td>1-44.5 mm x 44.5 mm</td>
</tr>
<tr>
<td>Over 0.5 Sq.m. Up To 1 Sq.m.</td>
<td>1-50.8 mm x 50.8 mm</td>
</tr>
<tr>
<td>Over 1 Sq.m. Up To 2 Sq.m.</td>
<td>2-50.8 mm x 50.8 mm</td>
</tr>
</tbody>
</table>

METHOD OF INSTALLATION

STEP 1: Sign post anchor can be driven through black top surface without
first making a hole. In concrete, however, breaking a hole will be
necessary. Drive sign post anchor to within 75 mm or 100 mm of surface.

STEP 2: Pre-cut anchor sleeve so that holes will match and still be flush
with top of sign post anchor. Drive anchor sleeve until holes match
as noted above, then drive both the sign post anchor and anchor
sleeve until one hole is exposed above ground for bolt connection.

STEP 3: Insert sign post and bolt in place.

NOTES:
1. DRIVING CAPS MUST BE USED TO DRIVE POSTS.
2. SIGNS WITH A WIDTH OF 1.2 m OR GREATER REQUIRE 2 POSTS.
3. THIS ERECTION PROCEDURE APPLIES TO UNISTRUT SUPPORTS.
   OTHER P-5 SQUARE TUBE SMALL SIGN SUPPORTS ON THE
   APPROVED PRODUCT LISTS, SUCH AS ALLIED QUICK PUNCH
   AND ALLIED POSTMATE, MAY DEViate FROM THIS PROCEDURE.
   IN THOSE CASES, THE MANUFACTURER’S RECOMMENDATIONS
   SHALL BE FOLLOWED.
NOTES: IF MILE-MARKER PANEL HEIGHT IS 900 mm THE EMBEDMENT WILL BE 750 mm. IF PANEL HEIGHT IS 1.2 m, THE EMBEDMENT WILL BE 900 mm.

- OPTICALLY CENTER NUMERAL ABOUT VERTICAL CENTERLINE

BACKGROUND—GREEN REFLECTORIZED
NUMBERS—WHITE REFLECTORIZED
PIN & BOLT HEADS TO BE PAINTED SAME COLOR AS PANEL BACKGROUND
NUMBERS TO BE SERIES "C"

ALL DIMENSIONS SHOWN IN MILLIMETERS

<table>
<thead>
<tr>
<th>EXPWY-FWY USE</th>
<th>CONVENTIONAL USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>300</td>
</tr>
<tr>
<td>B</td>
<td>600</td>
</tr>
<tr>
<td>C</td>
<td>15</td>
</tr>
<tr>
<td>D</td>
<td>75</td>
</tr>
<tr>
<td>E</td>
<td>100C</td>
</tr>
<tr>
<td>F</td>
<td>75</td>
</tr>
<tr>
<td>G</td>
<td>250C</td>
</tr>
<tr>
<td>H</td>
<td>---</td>
</tr>
<tr>
<td>J</td>
<td>100</td>
</tr>
<tr>
<td>K</td>
<td>40</td>
</tr>
<tr>
<td>L</td>
<td>117</td>
</tr>
<tr>
<td>M</td>
<td>124</td>
</tr>
</tbody>
</table>
TYPICAL TENTH-OF-MILE MARKER INSTALLATION D10-9

COLOR - BLACK
NUMBERS TO BE SERIES "C"
BACKGROUNDS SHALL BE SILVER - FOR UNDIVIDED HIGHWAYS
YELLOW - FOR DIVIDED HIGHWAYS

NOTES: ALL MILE - MARKERS AND TENTH OF MILE - MARKERS SHALL BE FABRICATED WITH TYPE III OR TYPE IV REFLECTIVE SHEETING (SECTION M9.30.0)
**Table**

<table>
<thead>
<tr>
<th>No.</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1-4</td>
<td>Single White Delineator</td>
</tr>
<tr>
<td>H1-7</td>
<td>Double White Delineator</td>
</tr>
<tr>
<td>H1-8</td>
<td>Single Amber Delineator</td>
</tr>
</tbody>
</table>

**Note:**
- See current edition of manual on uniform traffic control devices for delineator spacing.

**Legend:**
- ■ = Mile Marker
- • = 10" of a Mile Marker
- □ = 1 White Delineator
- □ = 2 White Delineator
- □ = 1 Amber Delineator

**Typical Elevation for Delineations**

**Method of Attaching Delineator to P-9 Post**

- 1 m min. from edge of shoulder or curb line
- 1.2 m above ground level
- P-9 post (Galvanized steel or approved alternate)

**Typical P-9 Posts**

- 25.4 mm, 25.4 mm, 25.4 mm
- 9.5 mm dia., 25.4 mm C to C

**Weight:**
- 1.67 kg/meter
- Finish—Hot Dipped Galvanized

**Date of Issue:** 5/13/95

**Drawing Number:** TR.2.3
TYPICAL REFLECTORIZED WARNING SIGN

MOUNTING HEIGHT SHALL BE 1.2 m TO BOTTOM OF SIGN

DIRECTION OF TRAFFIC

10 mm MOUNTING HOLE

YELLOW REFLECTORIZING BUTTONS

YELLOW NON-REFLECTIVE

THICKNESS 2 mm
ALUMINUM OR GALVANIZED STEEL

1.30 mm
1.70 mm
600 mm
170 mm
170 mm
600 mm
75 mm

1.30 mm
1.70 mm
600 mm
170 mm
170 mm
600 mm
75 mm

DATE OF ISSUE
5/13/95

DRAWING NUMBER
TR.2.4
MATERIAL: 2 mm THICK SHEET ALUMINUM

COLORS:
- ALTERNATE YELLOW AND BLACK STRIPES
- YELLOW STRIPES TO BE REFLECTORIZED
- ALTERNATE WHITE AND ORANGE STRIPES FOR CONSTRUCTION AND MAINTENANCE OPERATIONS, BOTH REFLECTORIZED

* OR GREATER TO CLEAR GUARD RAIL BY MAXIMUM OF 150 mm
The striping is to be mounted on 0.8 mm aluminum panel using alternating black and white stripes sloping down at an angle of 45°. The aluminum panel shall be in accordance with ASTM B209 Alloy 6061-T6. The silver reflective sheeting shall be in accordance with MHD Specification M9.30.0 Type III or Type IV reflective sheeting. Paint for black stripes shall be in accordance with the sheeting manufacturer's specification for black silk screen ink for H1-10A, H1-10B, & H1-10C.

NOTE: The striping is to be mounted on 0.8 mm aluminum panel using alternating black and white stripes sloping down at an angle of 45°. The aluminum panel shall be in accordance with ASTM B209 Alloy 6061-T6. The silver reflective sheeting shall be in accordance with MHD Specification M9.30.0 Type III or Type IV reflective sheeting. Paint for black stripes shall be in accordance with the sheeting manufacturer's specification for black silk screen ink for H1-10A, H1-10B, & H1-10C.
6083-T6 ALUMINUM

1. THE FIRST FULL HEIGHT POST ENCOUNTERED IN THE DIRECTION OF TRAVEL SHALL BE MARKED BY A "RED" DELINATOR AND THE LAST FULL HEIGHT END POST IN THE SECTION SHALL BE MARKED BY A "GREEN" DELINATOR.
2. DELINATORS SHALL BE FABRICATED FROM TYPE III OR TYPE IV REFLECTIVE SHEETING (M9.30.0)
3. P9 POSTS SHALL BE ERECTED WITHIN 150 mm PERPENDICULAR TO THE WEB OF GUARDRAIL POST.
**GENERAL NOTES**

THE CONTRACTOR MAY SELECT ANY STRUCTURAL SIGN SUPPORT MEETING THE DESIGN CRITERIA OF THE CURRENT EDITION OF THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS "SPECIFICATIONS FOR DESIGN AND CONSTRUCTION OF STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS" AND SECTION 828 OF THE STANDARD SPECIFICATIONS.

REINFORCED CONCRETE FOUNDATIONS FOR SIGN SUPPORTS SELECTED SHALL CONFORM TO THE APPLICABLE TABULATION REQUIREMENTS BASED ON THE SECTION MODULUS AT THE BOTTOM OF THE SIGN SUPPORT POST.

THE FOUNDATIONS LISTED ARE INTENDED FOR A SINGLE POLE IN THE DIRECTION NORMAL TO THE SIGN, BUT THE NUMBER OF POLES PARALLEL TO THE SIGN SHALL CONFORM WITH THE CONSTRUCTION DRAWINGS. IF IT IS DESIRED TO USE OTHER THAN SINGLE POLE SUPPORTS, THE CONTRACTOR SHALL DESIGN THE FOUNDATIONS FOR SAME AND SUBMIT DESIGN CALCULATIONS WITH SKETCHES.

ACCEPTANCE OF THE DESIGNS OF THE SIGN SUPPORTS AND SIGN SUPPORT FOUNDATIONS WILL BE CONTINGENT ON THE DEPARTMENT'S REVIEW AND APPROVAL OF DESIGN CALCULATIONS AND SHOP DRAWINGS SUBMITTED BY THE CONTRACTOR. THE INFORMATION GIVEN ABOVE IS TO BE USED IN CONJUNCTION WITH THE TABLE ON DRAWING TR.3.2.

THESE TABLES ARE NOT TO BE USED FOR THE DESIGN OF CANTILEVER SIGN FOUNDATIONS.

SEE CONSTRUCTION STANDARDS DRAWING 401.2.0 FOR INSTALLATION FOR TYPE SS HIGHWAY GUARD RAIL FOR PROTECTION OF OVERHEAD SIGN POSTS.
<table>
<thead>
<tr>
<th>SECTION MODULUS AT BOTTOM OF SUPPORT (x10^3 mm^2)</th>
<th>B (mm)</th>
<th>D (m)</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.55 mm WALL THICKNESS</td>
<td>347.41 to 476.91</td>
<td>670</td>
<td>2.0</td>
</tr>
<tr>
<td>6.35 mm WALL THICKNESS</td>
<td>490.11 to 539.11</td>
<td>915</td>
<td>2.4</td>
</tr>
<tr>
<td>7.94 mm WALL THICKNESS</td>
<td>476.91 to 565.41</td>
<td>760</td>
<td>2.3</td>
</tr>
<tr>
<td>9.11 mm WALL THICKNESS</td>
<td>508.01 to 580.01</td>
<td>760</td>
<td>2.4</td>
</tr>
</tbody>
</table>

**NOTES:**
1. The section moduli listed above are to be used for steel sign support poles with an allowable working stress of 343 Mpa. If poles of an alternate material are used, the section moduli of the poles shall be multiplied by the ratio: [allowable working stress]/343.
2. Minimum distance from center of the anchor bolts to the face of the concrete shall be 125 mm.
3. The actual depth of the foundation will be the "D" dimension above plus the 15 mm reveal.
4. The wall thicknesses listed above refer to the steel sign support poles.

**DATE OF ISSUE:** 5/13/95
**DRAWING NUMBER:** TR.3.2
ENLARGED DETAIL OF
TOP OF CONNECTING ANGLE

90 mm x 64 mm x 8 mm ANGLE

<table>
<thead>
<tr>
<th>B</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>173 mm</td>
<td>1.2 m</td>
</tr>
<tr>
<td>225 mm</td>
<td>1.8 m</td>
</tr>
<tr>
<td>289 mm</td>
<td>2.5 m</td>
</tr>
</tbody>
</table>

14 mm WIDE SLOT TYP.

13 mm U-BOLT WITH FLAT
AND LOCK WASHERS
AND HEX NUTS
STAINLESS OR
GALVANIZED STEEL

U-BOLT DETAIL

13 mm DIA. STAINLESS
OR GALVANIZED STEEL
U-BOLT WITH HEX.
NUTS AND FLAT AND
LOCK WASHERS.

50 mm MIN.

MASS HIGHWAY
SIGNS & SUPPORTS

TYPICAL PANEL ATTACHMENT
TO OVERHEAD SUPPORT

DATE OF ISSUE
5/13/95

DRAWING NUMBER
TR.3.3
SAME HEIGHT AS SIGN

50.8 mm

THESE ARE PUNCHED ONLY IF SIGN HEIGHT ALLOWS

304.8 mm

17.5 mm WIDE x 57 mm
LG. PUNCHED FOR SIGN
BRACKET ANGLE FASTENER TYP.

552.5 mm

7.9 mm WIDE x 12.7 mm
LG. PUNCHED FOR SIGN
FASTENERS TYP.

10.7 mm

101.6 mm x 77.8 mm x 6.4 mm
Z BAR ALUMINUM

10.7 mm

304.8 mm

14.3 mm WIDE x 50.8 mm
LG. PUNCH FOR U-BOLT TYP.

14.3 mm

304.8 mm

114.3 mm

304.8 mm

114.3 mm

38.1 mm

114.3 mm

38.1 mm

SAME AS ABOVE

10.7 mm

283.4 mm

152.4 mm

10.7 mm

TYPE B
VERTICAL MEMBER FOR SIGN WITH
152.4 mm PANEL, OTHERWISE SAME AS ABOVE

42.7 mm
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 DRAWINGS 401.1.0 AND 401.5.0 - 401.10.0
3- FOR BACK UP PLATE DETAILS SEE CONSTRUCTION DRAWINGS 401.6.0 AND 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 775 mm + 25 mm
6- POST TYPES SHALL NOT BE INTERCHANGED IN ANY CONTINUOUS RUN OF GUARD RAIL. BRACKETS SHALL BE SIMILAR TO POST.
FULL SPAN - 1V : 2H SLOPE & CANTILEVER STRUCTURES

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>W</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1V : 2H SLOPE</td>
<td>460 mm±</td>
<td>1.0 m±</td>
<td>2.0 m±</td>
</tr>
<tr>
<td>1V : 4H SLOPE</td>
<td>1.8 m±</td>
<td>2.4 m±</td>
<td>3.4 m±</td>
</tr>
<tr>
<td>1V : 5H SLOPE</td>
<td>4.9 m±</td>
<td>5.4 m±</td>
<td>6.4 m±</td>
</tr>
</tbody>
</table>

TABLE OF OFFSETS FOR GUARDRAIL FLARED ENDS
- THESE TABLES APPLY TO DRAWING TR.3.5

TABLE FOR TYPICAL INSTALLATION

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>W</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>VERTICAL CURB</td>
<td>230 mm±</td>
<td>1.8 m±</td>
<td>2.1 m±</td>
</tr>
<tr>
<td>SLOPED EDGING</td>
<td>460 mm±</td>
<td>2.0 m±</td>
<td>2.3 m±</td>
</tr>
<tr>
<td>TYPE &quot;A&quot; BERM</td>
<td>610 mm±</td>
<td>2.1 m±</td>
<td>2.5 m±</td>
</tr>
</tbody>
</table>
GENERAL NOTES

BREAKAWAY SIGN SUPPORTS SHALL BE FABRICATED FROM STRUCTURAL STEEL AND SHALL CONFORM TO THE BREAKAWAY DESIGN SHOWN ON THESE PAGES FOR STANDARD GROUND MOUNTED SIGN SUPPORTS BREAKAWAY DESIGN AND TO THE APPLICABLE REQUIREMENTS OF THE MASSACHUSETTS HIGHWAY DEPARTMENT "STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES."

STEEL

DESIGN CONFORMS WITH "AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY SIGNS, LUMINAIRS, AND TRAFFIC SIGNALS."

ALL STRUCTURAL STEEL SHALL CONFORM TO ASTM—A36. FLANGE HOLES FOR FUSE BOLTS SHALL BE DRILLED.

ALL HIGH STRENGTH BOLTS, NUTS, AND WASHERS SHALL CONFORM TO ASTM—A325. TIGHTEN THE HIGH STRENGTH BOLTS IN THE BASE PLATE CONNECTION ONLY TO THE TORQUE SHOWN IN THE TABLE. DO NOT OVER TIGHTEN.

NOTCHED STEEL FUSE PLATES SHALL CONFORM TO THE REQUIREMENTS OF ASTM A36. ALL HOLES SHALL BE DRILLED, ALL PLATE CUTS SHALL BE SAW CUTS.

ALL BOLTS OTHER THAN HIGH STRENGTH BOLTS SHALL CONFORM TO ASTM—A307 CLASS A. ALL BOLTS, NUTS, AND WASHERS SHALL BE GALVANIZED AS PER ASTM—A135. STRUCTURAL STEEL SHALL BE GALVANIZED AS PER ASTM—A125 AFTERT FABRICATION EXCEPT AS NOTED.

IN ALL CASES THE BOTTOM OF THE FOOTING SHALL BE PLACED TO THE DESIGN DEPTH.

ALUMINUM

PANELS, ATTACHMENTS, AND HARDWARE SHALL CONFORM TO THE REQUIREMENTS OF M.H.D. SPECIFICATIONS.
THICKNESS 3.2 mm
ALUMINUM SIGN PANEL (TYPE B)
ALUMINUM ALLOY 6063-T6
ASTM-B221M

PANEL BOLTS ASTM-B211M
ALUMINUM ALLOY 2024-T4
9.5 mm x 20 mm LONG

NOTE: ALL EXTRUDED ALUMINUM PANELS SHALL HAVE SIDE MOULDING

NOTE: THE POST CLIP METHOD MAY BE USED WITH A TEE BEAM SECTION ON GROUND MOUNTED SIGNS ONLY.
THE POST CLIP MUST BE USED AT EACH ALUMINUM CHANNEL ATTACHED TO THE SIGN PANEL.
POST CLIPS SHALL NOT BE USED WITH "Z" BAR SECTIONS.
BOLTS MUST BE USED IF A "Z" BAR SECTION IS USED.

REAR ELEVATION
SHOWING ARRANGEMENT OF POST CLIPS (BOTH POSTS OR ALL POSTS) AND PANEL BOLTS.

SIGN HEIGHT
304.8 mm
304.8 mm
304.8 mm
304.8 mm
304.8 mm
152.4 mm OR 304.8 mm

NOTE: PANEL BOLTS TO BE PLACED SYMMETRICALLY ABOUT CENTER OF SIGN.
FOR POST CLIP AND BOLT DETAIL—SEE DRAWING TR.4.4

NOTE: EACH TEE BEAM SHALL BE ATTACHED BY 10 POST CLIPS —4 ON THE EXIT TAB AND 6 ON THE SIGN PANEL.

THICKNESS 3.2 mm ALUMINUM SIGN PANEL (TYPE B) ALUMINUM ALLOY 6063-T6 ASTM-B221M

POST CLIP

NOTE: THE POST CLIP METHOD MAY BE USED WITH A TEE BEAM SECTION ON GROUND MOUNTED SIGNS ONLY. THE POST CLIPS MUST BE USED AT EACH ALUMINUM CHANNEL ATTACHED TO THE SIGN PANEL. POST CLIPS SHALL NOT BE USED WITH "Z" BAR SECTIONS. BOLTS MUST BE USED IF A "Z" BAR SECTION IS USED.

CHANNELS

POST

POST CLIP

ISOMETRIC SHOWING METHOD OF ATTACHMENT FOR EXIT TAB (E5-2 TO SIGN PANEL)

ISOMETRIC SHOWING METHOD OF ATTACHMENT FOR EXIT TAB DRAWING NUMBER TR.4.3

ALUMINUM PANEL DETAILS METHOD OF ATTACHMENT FOR EXIT TAB

DATE OF ISSUE  5/13/95

DRAWING NUMBER  TR.4.3
**ALUMINUM PANEL DETAILS**

**DATE OF ISSUE**: 5/13/95

**DRAWING NUMBER**

FOR EXTRUDED ALUMINUM

---

**POST CLIP AND BOLT DETAIL**

**DRAWING NUMBER**

FOR EXTRUDED ALUMINUM

---

**CLIP**

- ALUMINUM ALLOY 356-T6 (SG70A)
- ASTM-B26

---

**SERRATED SURFACE**

- 25.4 mm
- 11.1 mm
- 9.1 mm
- 34.9 mm
- 26.6 mm
- 37.7 mm
- 55.2 mm

---

**BOLT**

- STAINLESS STEEL ALLOY 304
- ASTM-A-193-GRADE B8 OR
- ASTM-A-194-GRADE 8
- STAINLESS STEEL ALLOY 303
- ASTM-A-193-GRADE B8F OR
- ASTM-A-194-GRADE 8F

**FLAT WASHER**

- 19 mm DIA. x 1.6 mm
- WITH 10.3 mm DIA. HOLE ASTM-A-276 TYPE 302 (STAINLESS STEEL)

---

**LOCK NUT**

- 14.3 mm
- 5.6 mm
- 15.9 mm
- 9.5 mm

---

**DRAWING NUMBER**

TR.4.4

---

**DATE OF ISSUE**

5/13/95
TYPICAL EXIT TAB AND GORE SIGN

**DATE OF ISSUE**: 5/13/95

**HEIGHT OF SIGN - RADIUS**
- UP TO 600 mm: 75 mm
- 750 mm TO 1.2 m: 150 mm
- 1.3 m TO 1.8 m: 225 mm
- 1.9 m & OVER: 300 mm

THE MINIMUM DISTANCE FOR X SHALL BE 300 mm.

ONE DIGIT (EXIT 0) L=2.1 m
TWO DIGITS (EXIT 00) L=2.6 m
THREE DIGITS (EXIT 000) L=3.0 m
FOUR DIGITS (EXIT 0000) L=3.6 m

**LEGEND & BORDER**: WHITE (REFLECTIVE)
**BACKGROUND**: GREEN (REFLECTIVE)
**ARROW DESIGN**: "A"

TYPICAL EXIT TAB ATTACHED TO SIGN PANEL

**E1-5**

**E5-1A**
TYPICAL INSTALLATION FOR SIGNS WITH AREA OVER 2.0 SQUARE METERS UP TO 4.0 SQUARE METERS

NOTICE: EAST OF LONGITUDE 71°-41' USE S 130 x 15 POSTS. WEST OF LONGITUDE 71°-41' USE S 100 x 11 POSTS. SPACING OF POSTS AND FOUNDATION DETAIL AS SHOWN FOR SIGNS UP TO 1.5 m IN WIDTH OVER 1.5 m IN WIDTH SPACING BETWEEN POSTS = 0.6 x WIDTH. FOR BASE CONNECTION AND FUSE PLATE DATA SEE DRAWING TR.4.11

FURNISH 2-0.3 mm THICK AND 2-0.8 mm THICK SHIMS PER POST. SHIMS SHALL BE FABRICATED FROM BRASS SHIM STOCK OR SHIM CONFORMING TO ASTM-B26

SHIM DETAIL

FOUNDATION DETAILS

FOR SIGNS WITH AREA OVER 4.0 SQUARE METERS

#10-PLAIN SPIRAL

CONCRETE

DRILLED SHAFT (30 MPa - 40 mm - 335 kg)

STIFFENER PLATE DETAIL

SEE DRAWING TR.4.11 FOR DIMENSIONS
SIGN POST AND STUB POST FOR W SHAPE

STUB PROJECT (SEE TABLE ON DRAWING TR.4.11)

TOP OF FOUNDATION (SEE FOUNDATION DETAIL ON DRAWING TR.4.6)

HIGH STRENGTH BOLT WITH HEX HEAD, HEX NUT & 3 WASHERS WITH EACH BOLT. (SEE DRAWING TR.4.11 FOR BOLT DIAMETER AND TORQUE. SEE BOLTING PROCEDURE ON DRAWING TR.4.8)

STUB POST

REMOVE ALL GALVANIZING RUNS OR BEADS IN WASHER AREA.

(TYP.)

THICKNESS = 1.6 mm

NOTE:
WELD=FLANGE
THICKNESS = 1.6 mm

SECTION A-A
SECTION B-B

SEE TABLE ON DRAWING TR.4.11 FOR DIMENSIONS.
SECTIONS SHOWN ARE FOR INSTALLATIONS ON RIGHT SHOULDER AND IN GORE. FOR INSTALLATIONS ON LEFT SHOULDER, PLATE AND SLOT BEVELS ARE OPPOSITE HAND.

DATE OF ISSUE
5/13/95

DRAWING NUMBER
TR.4.7
STRENGTH BOLT WITH HEX HEAD, HEX NUT AND 3 WASHERS, WITH EACH BOLT. SEE DRAWING TR.4.11 FOR BOLT DIAMETER AND TORQUE, SEE BOLTING PROCEDURE BELOW.

STUB PROJECTION TOP OF FOUNDATION (SEE FOUNDATION DETAIL)

STUB POST

SECTION C-C

SECTION D-D

SECTIONS SHOWN ARE FOR INSTALLATIONS ON THE RIGHT SHOULDER AND IN GORE. PLATE SLOT BEVELS ARE OPPOSITE HAND FROM THAT SHOWN FOR INSTALLATION ON LEFT SHOULDER.

PROCEDURE FOR ASSEMBLY OF BASE CONNECTION

1. ASSEMBLE POST TO STUB WITH BOLTS AND WITH ONE FLAT WASHER ON EACH BOLT BETWEEN PLATES.
2. SHIM AS REQUIRED TO PLUMB POST.
3. TIGHTEN ALL BOLTS THE MAXIMUM POSSIBLE WITH 300 TO 380 mm WRENCH TO BED WASHERS AND SHIMS AND TO CLEAN BOLT THREADS, THEN LOOSEN EACH IN TURN AND RETIGHTEN IN A SYSTEMATIC ORDER TO THE PRESCRIBED TORQUE. (SEE TABLE ON DRAWING TR.4.11)
4. AFTER THE INITIAL TORQUING A SECOND NUT WILL BE USED TO INSURE THAT THE FIRST NUT WILL NOT BACK OFF.
5. THE CONTRACTOR TOGETHER WITH A DEPARTMENT INSPECTOR WILL RETURN TO THE SIGN FOR TWO INTERVALS OF 30+ DAYS FOR THE PURPOSE OF MAINTAINING THE PRESCRIBED TORQUE.
6. IMMEDIATELY AFTER THE SECOND RE-TORQUING, THE TOP NUT SHALL BE REMOVED AND THE THREAD SHALL BE BURRED JUST ABOVE THE FIRST NUT USING A CENTER PUNCH, IN ORDER TO ENSURE THAT THE PRESCRIBED TORQUE IS MAINTAINED.
POST SHALL BE SAW CUT AFTER GALVANIZING. SURFACE WILL THEN BE TREATED WITH AN APPROVED ZINC-RICH PAINT MEETING THE DEPT. SPEC. M7.04.12 (M11-P-21035).

NOTE:
CUT SURFACE WILL NOT BE TREATED UNTIL PLATE IS INSTALLED WITH ALL BOLTS FULLY TIGHTENED.

NOTE:
THE POST CLIP METHOD MAY BE USED WITH A TEE BEAM SECTION ON GROUND MOUNTED SIGNS ONLY. THE POST CLIPS MUST BE USED AT EACH ALUMINUM CHANNEL ATTACHED TO THE SIGN PANEL. POST CLIPS SHALL NOT BE USED WITH "Z" BAR SECTIONS. BOLTS MUST BE USED IF A "Z" BAR SECTION IS USED.

NOTE:
USE HIGH STRENGTH BOLTS WITH HEX. HEAD & HEX NUT, ONE FLAT WASHER UNDER EACH BOLT HEAD AND BEVEL OR FLAT WASHER (WHERE REQUIRED) UNDER NUT.

FUSE PLATE DETAIL
FLANGE HOLES FOR HINGE SHALL BE DRILLED OR SUB-PUNCHED & REAMED

CUT TO 1.6 mm FROM FILLET LEG

BEVELED WASHERS FOR S130x15 & S100x11 POSTS. FLAT WASHERS ON OTHERS.

FLAT WASHER

POST

FUSE PLATE (Install With Notches Toward Base.)

ASTM-A325M Bolts (For Bearing Type Connection.)

FIELD NOTE: ALL FUSE PLATE BOLTS SHALL BE 70 mm IN LENGTH AND HAVE 60 mm OF THREAD ON THE END OF THE BOLT. ALL FRICION FUSE BOLTS SHALL BE TIGHTENED IN THE PRESENCE OF THE DEPARTMENT'S REPRESENTATIVE IN THE FIELD AND IN ACCORDANCE WITH THE REQUIREMENTS OF ARTICLE 2.10.20, WITH A WRENCH CALIBRATED DAILY AT THE CONTRACTOR'S EXPENSE AT THE PROJECT SITE WITH A HYDRAULIC BOLT TENSION CALIBRATOR TO OBTAIN THE FOLLOWING TENSION IN EACH BOLT.

REFER TO BOLT SIZE TENSION
DRAWING 12.7 mm TENSIONS TO BE
TR.4.9 M16 FURNISHED LATER.
FUSE PLATE 19.0 mm TESTING IS CURRENTLY
DETAIL M22 UNDERWAY.

THIS INSTALLATION PROCEDURE SHALL COMPRISE THE INSPECTION REQUIRED BY THE ABOVE MENTIONED SPECIFICATION. FABRICATOR SHALL ASSEMBLE THE SIGNS IN THE SHOP WITH SUITABLE ERECTION BOLTS FOR SHIPMENT TO THE PROJECT WHEREUPON SAID BOLTS SHALL BE REPLACED WITH THE SPECIFIED HIGH-STRENGTH BOLTS AND TESTED TO THE VALUES SHOWN ABOVE. INSPECTION SHALL BE IN ACCORDANCE WITH THE ABOVE MENTIONED ARTICLE 2.10.20 EXCEPT THAT THE INSPECTION WRENCH SHALL BE A TORQUE WRENCH AND THAT ALL BOLTS INSTALLED ON THE VARIOUS FUSE PLATES SHALL BE INSPECTED.
### BASE CONNECTION DATA TABLE

<table>
<thead>
<tr>
<th>POST DIMENSION</th>
<th>BOLT SIZE &amp; TORQUE</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>D (mm)</th>
<th>E (mm)</th>
<th>T1 (mm)</th>
<th>T2 (mm)</th>
<th>W (mm)</th>
<th>R (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>W150 x 18</td>
<td>M16 x 80 mm with 45 mm thread torque*</td>
<td>127</td>
<td>51</td>
<td>32</td>
<td>70</td>
<td>29</td>
<td>19</td>
<td>13</td>
<td>6</td>
<td>8.5</td>
</tr>
<tr>
<td>W150 x 22</td>
<td>M20 x 100 mm with 50 mm thread torque*</td>
<td>152</td>
<td>57</td>
<td>35</td>
<td>89</td>
<td>32</td>
<td>25</td>
<td>19</td>
<td>8</td>
<td>10.5</td>
</tr>
<tr>
<td>W200 x 27</td>
<td>M20 x 100 mm with 50 mm thread torque*</td>
<td>203</td>
<td>70</td>
<td>41</td>
<td>140</td>
<td>32</td>
<td>25</td>
<td>19</td>
<td>5</td>
<td>13.5</td>
</tr>
<tr>
<td>S 100 x 11</td>
<td>M16 x 80 mm with 50 mm thread torque*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*TORQUE TO BE DETERMINED IATFR

### FUSE PLATE DATA TABLE

<table>
<thead>
<tr>
<th>POST DIMENSION</th>
<th>F (mm)</th>
<th>G (mm)</th>
<th>H (mm)</th>
<th>J (mm)</th>
<th>K (mm)</th>
<th>L (mm)</th>
<th>N (mm)</th>
<th>D1 (mm)</th>
<th>T3 (mm)</th>
<th>BOLT SIZE</th>
<th>WT. OF EACH FUSE(Kg) PL.</th>
</tr>
</thead>
<tbody>
<tr>
<td>W150 x 18</td>
<td>95</td>
<td>51</td>
<td>32</td>
<td>102</td>
<td>57</td>
<td>22</td>
<td>16</td>
<td>17</td>
<td>10</td>
<td>M16</td>
<td>0.73</td>
</tr>
<tr>
<td>W150 x 22</td>
<td>114</td>
<td>64</td>
<td>32</td>
<td>152</td>
<td>89</td>
<td>32</td>
<td>19</td>
<td>21</td>
<td>13</td>
<td>M20</td>
<td>1.70</td>
</tr>
<tr>
<td>W200 x 27</td>
<td>114</td>
<td>64</td>
<td>32</td>
<td>133</td>
<td>70</td>
<td>32</td>
<td>19</td>
<td>21</td>
<td>13</td>
<td>M20</td>
<td>1.48</td>
</tr>
<tr>
<td>W250 x 33</td>
<td>137</td>
<td>76</td>
<td>38</td>
<td>146</td>
<td>70</td>
<td>38</td>
<td>22</td>
<td>24</td>
<td>13</td>
<td>M22</td>
<td>2.15</td>
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<tr>
<td>W250 x 39</td>
<td>137</td>
<td>76</td>
<td>38</td>
<td>146</td>
<td>70</td>
<td>38</td>
<td>22</td>
<td>24</td>
<td>13</td>
<td>M22</td>
<td>2.17</td>
</tr>
<tr>
<td>W310 x 33</td>
<td>137</td>
<td>76</td>
<td>38</td>
<td>165</td>
<td>89</td>
<td>38</td>
<td>22</td>
<td>24</td>
<td>13</td>
<td>M22</td>
<td>2.46</td>
</tr>
<tr>
<td>W310 x 39</td>
<td>137</td>
<td>76</td>
<td>38</td>
<td>165</td>
<td>89</td>
<td>38</td>
<td>22</td>
<td>24</td>
<td>13</td>
<td>M22</td>
<td>2.46</td>
</tr>
<tr>
<td>W310 x 45</td>
<td>137</td>
<td>76</td>
<td>38</td>
<td>165</td>
<td>89</td>
<td>38</td>
<td>22</td>
<td>24</td>
<td>13</td>
<td>M22</td>
<td>2.46</td>
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<tr>
<td>W310 x 60</td>
<td>149</td>
<td>76</td>
<td>38</td>
<td>203</td>
<td>127</td>
<td>38</td>
<td>35</td>
<td>27</td>
<td>13</td>
<td>M24</td>
<td>2.78</td>
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<tr>
<td>S 100 x 11</td>
<td>79</td>
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<td>29</td>
<td>67</td>
<td>38</td>
<td>14</td>
<td>13</td>
<td>13</td>
<td>6</td>
<td>12.7 mm</td>
<td>0.29</td>
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<tr>
<td>S 130 x 15</td>
<td>79</td>
<td>38</td>
<td>29</td>
<td>67</td>
<td>38</td>
<td>14</td>
<td>13</td>
<td>13</td>
<td>6</td>
<td>12.7 mm</td>
<td>0.29</td>
</tr>
</tbody>
</table>

### FOUNDATION DATA

<table>
<thead>
<tr>
<th>POST DIMENSION</th>
<th>STUD LENGTH</th>
<th>STUD PROJ.</th>
<th>DR. SHAFT</th>
<th>BAR V SHOULD</th>
<th>DEPTH CONC.</th>
<th>DIA.</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>W150 x 18</td>
<td>0.61 m</td>
<td>75 mm</td>
<td>610 mm</td>
<td>#15</td>
<td>1.7 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W150 x 22</td>
<td>0.61 m</td>
<td>75 mm</td>
<td>610 mm</td>
<td>#15</td>
<td>2.0 m</td>
<td>635 mm</td>
<td>1.8 m</td>
</tr>
<tr>
<td>W200 x 27</td>
<td>0.76 m</td>
<td>75 mm</td>
<td>610 mm</td>
<td>#20</td>
<td>2.1 m</td>
<td>635 mm</td>
<td>1.8 m</td>
</tr>
<tr>
<td>W250 x 33</td>
<td>0.91 m</td>
<td>65 mm</td>
<td>610 mm</td>
<td>#25</td>
<td>2.9 m</td>
<td>760 mm</td>
<td>1.8 m</td>
</tr>
<tr>
<td>W250 x 39</td>
<td>0.91 m</td>
<td>65 mm</td>
<td>610 mm</td>
<td>#30</td>
<td>3.0 m</td>
<td>760 mm</td>
<td>1.8 m</td>
</tr>
<tr>
<td>W310 x 33</td>
<td>0.91 m</td>
<td>65 mm</td>
<td>610 mm</td>
<td>#35</td>
<td>3.2 m</td>
<td>915 mm</td>
<td>1.8 m</td>
</tr>
<tr>
<td>W310 x 39</td>
<td>0.91 m</td>
<td>65 mm</td>
<td>610 mm</td>
<td>#35</td>
<td>3.4 m</td>
<td>915 mm</td>
<td>1.8 m</td>
</tr>
<tr>
<td>W310 x 45</td>
<td>0.91 m</td>
<td>65 mm</td>
<td>610 mm</td>
<td>#35</td>
<td>3.7 m</td>
<td>915 mm</td>
<td>1.8 m</td>
</tr>
<tr>
<td>W310 x 60</td>
<td>0.91 m</td>
<td>65 mm</td>
<td>760 mm</td>
<td>#35</td>
<td>3.7 m</td>
<td>915 mm</td>
<td>1.8 m</td>
</tr>
<tr>
<td>S 100 x 11</td>
<td>0.46 m</td>
<td>90 mm</td>
<td>460 mm</td>
<td>#15</td>
<td>1.2 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S 130 x 15</td>
<td>0.46 m</td>
<td>90 mm</td>
<td>460 mm</td>
<td>#15</td>
<td>1.5 m</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*IF ROCK, LEDGE OR WATER ENCOUNTERED, ALTERNATE FOOTINGS MAY BE Employed ONLY WITH THE WRITTEN APPROVAL OF THE ENGINEER*

SEE DRAWING TR.4.7 AND DRAWING TR.4.8 FOR BASE PLATE ASSEMBLY

SEE DRAWING TR.4.9 FOR FUSE PLATE DETAILS
Sign post sizing chart for Wind Zone 1.

- **Two Posts**
  - Requires special design.

- **Three Posts**
  - 

**Note:**
- "X" equals the average height from the ground line to the bottom edge of the sign at post locations, maximum distance 3.65 m.
- These charts to be used where sign panels are over 4.0 square meters.

**Wind Zone 1 East of Longitude 71° - 41°**

\[ V = 145 \text{ km/h}, \quad P = 170 \text{ kg/m}^2 \times C_d \text{Ch} \]
SIGN POST SIZING CHART

NOTE: "X" EQUALS THE AVERAGE HEIGHT FROM THE GROUND LINE TO THE BOTTOM EDGE OF THE SIGN AT POST LOCATIONS. MAXIMUM DISTANCE 3.65 m.

NOTE: THESE CHARTS TO BE USED WHERE SIGN PANELS ARE OVER 4.0 SQUARE METERS.

WIND ZONE 2 WEST OF LONGITUDE 71° - 41°

V = 110 km/h, P = 103.5 kg/m² x Cd Ch

NOTE: WHEN THE DESIGN OF A STRUCTURE FALLS BETWEEN TWO LINES ON THE CHART, ALWAYS GO UP TO THE NEXT NEAREST LINE TO CHOOSE THE SIZE OF THE SECTION.
NOTES:

1. FOR SIGNS OVER 5 SQUARE METERS, CALCULATIONS MUST BE SUBMITTED FOR WIND LOAD AND POST SIZE.
2. USE 150 mm X 150 mm DOUGLAS FIR OR SOUTHERN YELLOW PINE.
1.5 m

1.5 m

6 mm SHEET ALUMINUM

6 mm SHEET ALUMINUM

127 mm (NOM.) STEEL PIPE - 21.76 kg/m LENGTH 3.35 m

SEE DRAWING TR.5.2 FOR SHIM DETAILS

EDGE OF SHOULDER OR CURB LINE

30 MPa - 40 mm - 335 kg CEMENT CONCRETE FOOTING

MAX. 150 mm

460 mm

2.1 m MIN.

1200 mm

600 mm Min.

750 mm To 1050 mm

75 mm

75 mm

1.5 m

1.7 m

1.5 m

2.1 m FOR TOWN LINE SIGN

DATE OF ISSUE
5/13/95

DRAWING NUMBER
TR.5.1
**DIRECTION OF TRAFFIC**

**SECTION A-A**
Sections shown are for installations on right shoulder and in core. Plate slot bevels are opposite hand from that shown for installations on left shoulder.

**SECTION B-B**

---

**BASE CONNECTION DATA TABLE**

<table>
<thead>
<tr>
<th>Nom. Pipe Size Dimension</th>
<th>Bolt Size &amp; Torque**</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>D (mm)</th>
<th>E (mm)</th>
<th>F (mm)</th>
<th>T (mm)</th>
<th>W (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>125 mm</td>
<td>M18 x 65 mm</td>
<td>165</td>
<td>240</td>
<td>32</td>
<td>102</td>
<td>22</td>
<td>203</td>
<td>25</td>
<td>11</td>
</tr>
</tbody>
</table>

*Plates for base connection shall conform with the requirements of ASTM-A36.
**Torque to be determined later.

---

**GENERAL NOTES**

Breakaway sign supports shall conform to the breakaway design shown on the sheets for ground mounted sign supports breakaway design for the D-6 and D-6 with D-8 sign and the Mass. Highway Dept. "Standard Specifications for Highways and Bridges."
The steel posts shall be seamless steel pipe and shall conform to the ASTM designation A53.

---

Furnish 2-0.30 mm² thick and 2-0.80 mm² thick shims per post. Shims shall be fabricated from brass shim stock or strip conforming to ASTM-B36.

---

All steel hardware shall be galvanized as per ASTM-A153.
Seamless steel pipe and base plates shall be galvanized as per ASTM-A123.
In all cases the bottom of the footing shall be placed to the design depth.
The legend and border for D-6 signs shall be Type III or Type IV reflective sheeting (M9.30.0)
125 mm POST CAP I.D.=146 mm - 6 mm WALL THICKNESS

8 mm FOR ALUMINUM PANEL

TOP VIEW

R=16 mm

BOLT WITH M14 x 40 mm HEX HEAD BOLTS & HEX NUTS 150 mm

6 mm PLATE WELDED TO TOP OF SLEEVE OR ENTIRE UNIT CAST.

DRILL BOTH WALLS IN ALIGNMENT FOR 11 mm HOLE & BOLT WITH M10 X 175 mm HEX HEAD BOLT & HEX NUT.

FRONT VIEW
ALL HOLES ABOVE 11.1 mm DIA.

9.5 mm x 38 mm HEX HEAD BOLT & HEX. NUT WITH LOCK WASHER.

NOTE:
FOR D-8 ATTACHMENT
USE 2 CLAMPS
FOR EACH SIGN
ARROW & ONLY = APPROX. 4.3 SQ. METERS OF PAINT

ARROW & LEGEND AREA

<table>
<thead>
<tr>
<th>Description</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight Arrow</td>
<td>1.10 m²</td>
</tr>
<tr>
<td>Right or Left Arrow</td>
<td>1.47 m²</td>
</tr>
<tr>
<td>Combination Arrow (L or R)</td>
<td>2.61 m²</td>
</tr>
<tr>
<td>&quot;Only&quot; Legend</td>
<td>2.75 m²</td>
</tr>
</tbody>
</table>

*NOTE: ALL ARROWS & LEGENDS SHALL BE WHITE*

PAVEMENT MARKINGS

<table>
<thead>
<tr>
<th>Description</th>
<th>100 MILLIMETER WHITE</th>
<th>200 MILLIMETER WHITE</th>
<th>300 MILLIMETER WHITE</th>
<th>100 MILLIMETER YELLOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edge Line (Right)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lane Line (One Way Traffic)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taper Line</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shoulder Line</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Channelizing Line</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

SEE ALTERNATE MARKINGS, MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES
SINGLE BROKEN YELLOW CENTER LINE (TWO WAY PASSING ZONE)— TWO WAY YELLOW/YELLOW MARKERS SHALL BE PLACED IN LINE WITH THE SINGLE BROKEN YELLOW CENTER LINE AT AN INTERVAL NO GREATER THAN 2N, WHERE N EQUALS THE LENGTH OF ONE LINE SEGMENT PLUS ONE GAP (N = 12 METERS). THE MARKER SHALL BE PLACED MIDWAY IN THE GAP BETWEEN SUCCESSIVE MARKINGS.

DOUBLE SOLID YELLOW CENTER LINE (TWO WAY NO PASSING ZONE)— TWO WAY YELLOW/YELLOW MARKERS SHALL BE PLACED IMMEDIATELY ADJACENT TO THE TWO LINES (ONE ON EACH SIDE OF DOUBLE SOLID LINE) AT AN INTERVAL NO GREATER THAN N.

SINGLE SOLID YELLOW WITH SINGLE BROKEN YELLOW CENTER LINE (ONE WAY NO PASSING ZONE)— ONE WAY YELLOW MARKERS SHALL BE PLACED IMMEDIATELY ADJACENT TO THE SOLID YELLOW LINE AT A SPACING NO GREATER THAN N. TWO WAY YELLOW/YELLOW MARKERS, ALTERNATING WITH ONE WAY YELLOW MARKERS, SHALL BE PLACED IN LINE WITH THE SINGLE BROKEN YELLOW LINE, MIDWAY IN THE GAP BETWEEN MARKINGS, AT AN INTERVAL NO GREATER THAN N.

BROKEN WHITE LANE LINES— ONE WAY WHITE MARKERS SHALL BE PLACED IN LINE WITH THE BROKEN WHITE LINE AT AN INTERVAL OF NO GREATER THAN 2N. THE MARKER SHALL BE PLACED MIDWAY IN THE GAP BETWEEN SUCCESSIVE MARKINGS. AN EXCEPTION TO THIS SHALL BE THAT AT ON AND OFF RAMPS TWO WAY WHITE/RED MARKERS SHALL BE USED IN PLACE OF ONE WAY WHITE MARKERS BETWEEN THE GORE AND A POINT NO LESS THAN 300 METERS IN ADVANCE OF THE GORE.

SOLID WHITE GORE LINES— ONE WAY WHITE MARKERS SHALL BE PLACED IMMEDIATELY ADJACENT TO THE GORE LINE ON THE MAINLINE SIDE AT AN INTERVAL OF NO GREATER THAN N/2. TWO WAY WHITE/RED MARKERS SHALL BE PLACED IMMEDIATELY ADJACENT TO THE GORE LINE ON THE RAMP SIDE AT AN INTERVAL OF NO GREATER THAN N/2.

SOLID YELLOW EDGE LINES— ONE WAY YELLOW MARKERS SHALL BE PLACED IMMEDIATELY ADJACENT TO THE YELLOW EDGE LINE OF A RAMP AT AN INTERVAL OF NO GREATER THAN N/2.

SOLID WHITE EDGE LINES— SOLID EDGE LINES GENERALLY SHOULD NOT BE SUPPLEMENTED BY RAISED PAVEMENT MARKERS. IF IT IS DETERMINED THAT THE USE OF RAISED PAVEMENT MARKERS IS DESIRABLE DUE TO SPECIAL CIRCUMSTANCES THEY SHOULD BE PLACED IMMEDIATELY ADJACENT TO THE WHITE EDGE LINE AT AN INTERVAL OF NO GREATER THAN N.
PAVEMENT MARKINGS SHALL BE IN CONFORMANCE WITH CURRENT M.U.T.C.D.

- WHITE/RED RAISED PAVEMENT MARKER
- ONE WAY WHITE RPM
- YELLOW/RED RPM

NOTE:
SEE DRAWING TR.5.1 FOR PAVEMENT MARKING TABLES

NOTE:
RED REFLECTOR IS FACED AWAY FROM ONCOMING TRAFFIC
DASHED LINE FOR ONE-HALF LENGTH OF FULL WIDTH ACCELERATION LANE
DOTTED LINE FOR REMAINDER OF LENGTH, CONNECTING TO EDGE LINE.

SHOULDER LINE

600 mm SEGMENTS WITH 1200 mm GAPS.

EDGE OF PAVEMENT

PAVEMENT MARKINGS SHALL BE IN CONFORMANCE WITH CURRENT M.U.T.C.D.

WHITE/RED RAISED PAVEMENT MARKER

ONE WAY WHITE RPM

YELLOW/RED RPM

NOTE:
SEE DRAWING TR.6.1 FOR PAVEMENT MARKINGS TABLE.
TYPICAL MARKINGS FOR TWO-LANE TWO-WAY ROADWAY.

TYPICAL MARKINGS FOR FOUR-LANE TWO-WAY ROADWAY.

NOTE: SEE DRAWING TR.6.1 FOR PAVEMENT MARKINGS TABLE.
NOTE: SEE DRAWING TR.6.1 FOR PAVEMENT MARKINGS TABLE.
* TAPER AS PER MHD
HIGHWAY DESIGN MANUAL

CREST OF
HILL

1 & 3 BEGINNING OF NO-PASSING ZONE.
2 & 4 END OF NO-PASSING ZONE.
2 & 3 BASED ON LIMITED SITE DISTANCE.
1 & 4 OPPOSITE BEGINNING OF CLIMBING LANE.

PAVEMENT MARKINGS AND
SIGNING FOR CLIMBING LANES

DATE OF ISSUE
5/13/95

DRAWING NUMBER
TR.6.7
UNDIVIDED 2 OR 3 LANE HIGHWAY

3 DAYS * 14 DAYS MORE THAN
OR LESS OR LESS 14 DAYS

UNDIVIDED MULTI-LANE HIGHWAY

14 DAYS MORE THAN
OR LESS 14 DAYS

DIVIDED MULTI-LANE HIGHWAYS

14 DAYS MORE THAN
OR LESS 14 DAYS

* MAY BE LONGER FOR LOW VOLUME ROADS.

NOTES

1) LOW VOLUME HIGHWAYS SHOULD BE DEFINED IN ACCORDANCE WITH STATEWIDE POLICY AS APPROVED BY THE FHWA DIVISION OFFICE. IT IS RECOMMENDED THAT UP TO 400-500 ADT BE CONSIDERED A LOW VOLUME ROAD.

2) SIGNS MAY BE USED INSTEAD OF PAVEMENT MARKINGS ON LOW VOLUME ROADS FOR UP TO 2 WEEKS, AFTER WHICH PERMANENT MARKINGS ARE REQUIRED.

3) ON OTHER THAN LOW VOLUME ROADS TEMPORARY OR PERMANENT MARKINGS SHALL BE IN PLACE BEFORE ROAD IS OPENED TO TRAFFIC.

4) EDGELINES ARE REQUIRED AFTER 14 DAYS ON ALL INTERSTATE AND RURAL MULTI-LANE HIGHWAYS, AND ON OTHER HIGHWAYS WHEN STATE POLICY CALLS FOR EDGELINES.

5) FOR MORE INFORMATION SEE CURRENT MUTCD.
ITEM #  DESCRIPTION

859. -- REFLECTORIZED DRUM

859.1 -- REFLECTORIZED DRUM WITH FLASHER (TYPE A) – Used to continually warn drivers that they are approaching or proceeding in a hazardous area (see current MUTCD)

859.2 -- REFLECTORIZED DRUM WITH LIGHT (TYPE C) – Steady burn device used to delineate the edge of the traveled way on lane closures, detour curves, lane changes and other similar conditions (see current MUTCD).

NOTES:

1. DRUM DESIGN AND APPLICATION SHALL BE AS PER THE CURRENT EDITION OF THE MUTCD.

2. DRUMS SHALL BE APPROXIMATELY 1 METER IN HEIGHT, HAVING A MINIMUM WALL THICKNESS OF 2.3 MILLIMETERS AND A MINIMUM DIAMETER OF 450 MILLIMETERS REGARDLESS OF ORIENTATION.

3. DRUM MATERIAL MUST BE APPROVED U.V. RESISTANT, LOW DENSITY, IMPACT RESISTANT LINEAR POLYETHYLENE (OR APPROVED EQUIVALENT). METAL DRUMS ARE PROHIBITED FROM USE ON ALL STATE HIGHWAY PROJECTS.

4. SHEETING SHALL BE APPROVED ORANGE AND WHITE TYPE VI REFLECTORIZED SHEETING CONFORMING TO M.9.30.0.

5. ALL DRUMS SHALL BE WELL MAINTAINED INCLUDING REMOVAL OF DUST OR ROAD FILM, SO AS TO NOT REDUCE REFLECTIVE EFFICIENCY, WHEN A DRUM LOSES TARGET VALUE IT SHALL BE REPLACED.

6. WHEN A DRUM IS NO LONGER NEEDED IT SHALL BE STORED IN A DRUM STORAGE AREA, UNLESS IT IS REQUIRED FOR FUTURE USE WITHIN A FIVE DAY PERIOD, IN WHICH CASE IT MAY BE STORED ON LOCATION.

PLASTIC DRUMS

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