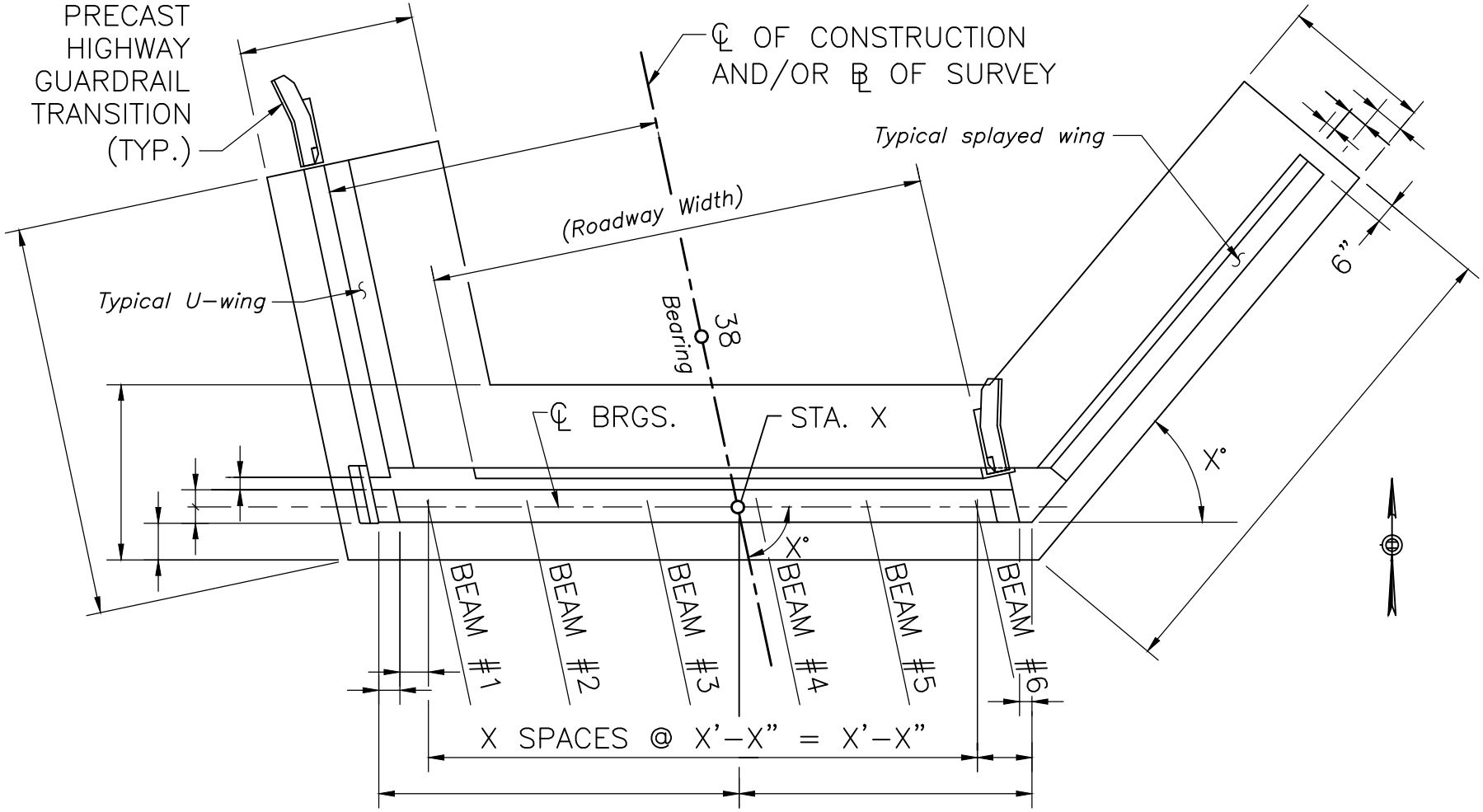
TYPICAL PLAN VIEW

ABUTMENT DETAILS



PLAN

SCALE: $\frac{1}{4}$" = 1'–0"

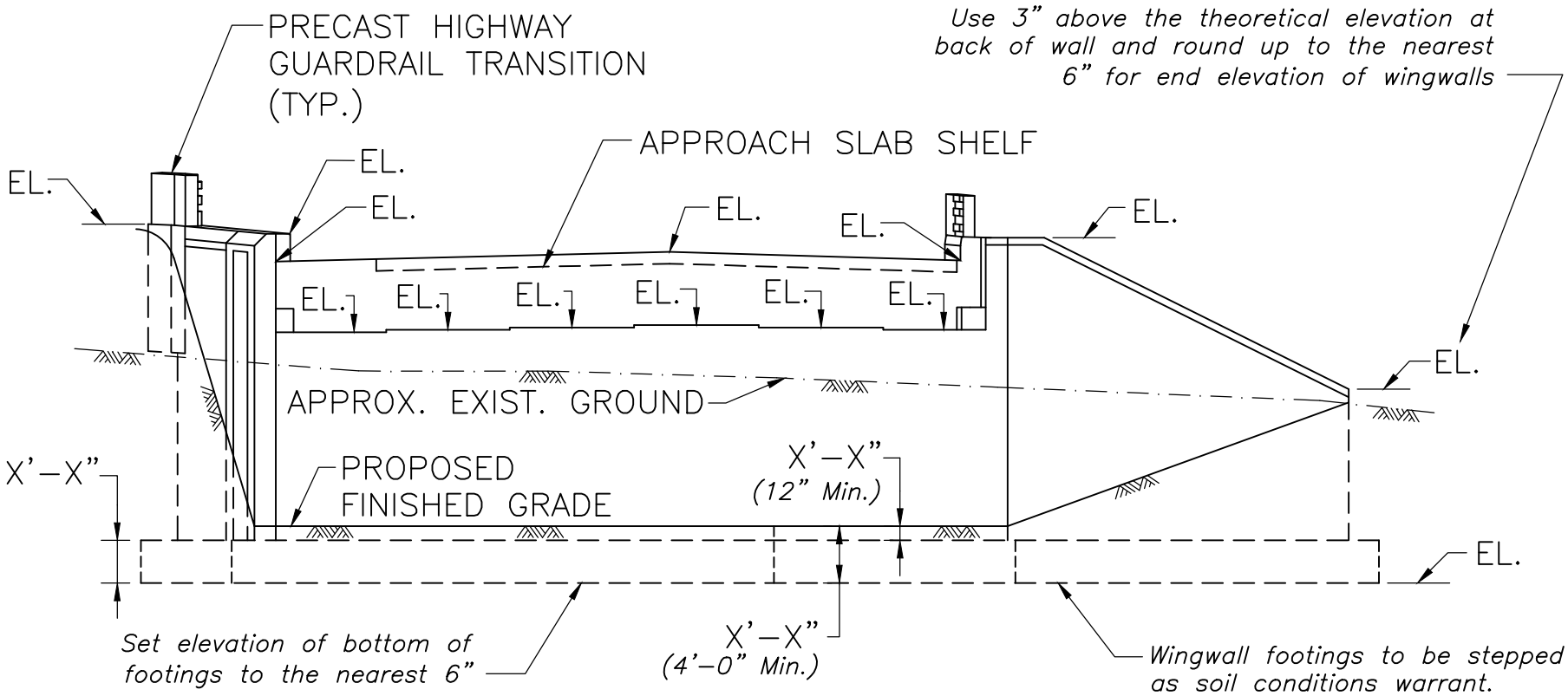
NOTES:

1. *Expansion and Construction joints in the walls shall be located on the plan view on the Construction Drawings.*
2. *On the Construction Drawings, the plan view of each abutment shall be shown above and aligned with its elevation view.*
3. *For those bridges with East and West abutments, the beams shall be numbered consecutively starting from the Southern most beam to the Northern most and the spans shall be numbered consecutively from the West abutment to the East abutment. For those bridges with North and South abutments, the beams shall be numbered consecutively starting from the Western most beam to the Eastern most and the spans shall be numbered consecutively from the South abutment to the North abutment.*

DATE OF ISSUE
JUNE 2013

TYPICAL ELEVATION VIEW

ABUTMENT DETAILS



ELEVATION

SCALE: $\frac{1}{4}$" = 1'–0"

NOTES:

1. *Show and label all expansion and construction joints.*
2. *Bridge seat elevations are to be figured to the bottom of the bearing assemblies, and so noted on the Construction Drawings.*

DATE OF ISSUE
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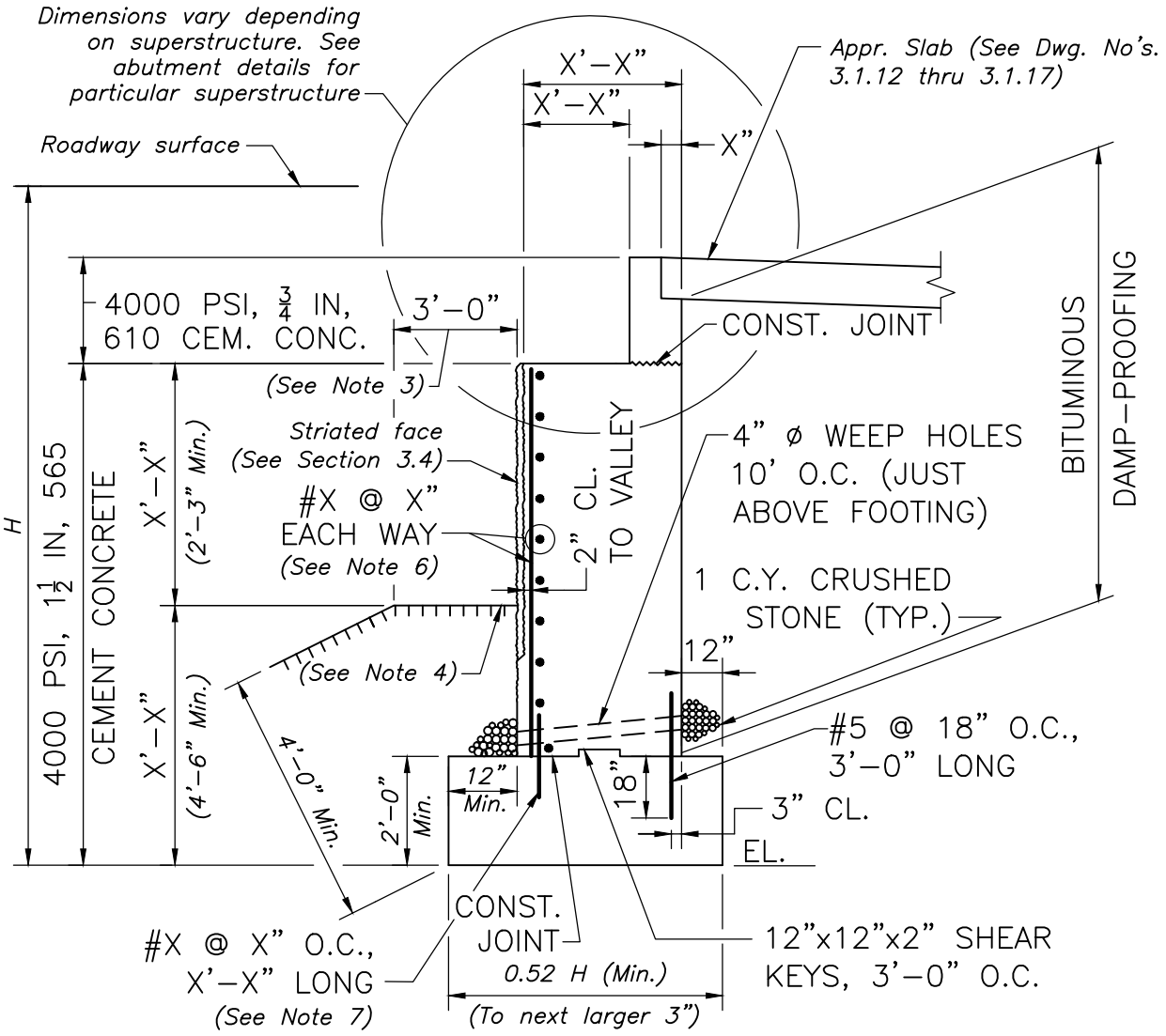
DRAWING NUMBER
3.1.2



TYPICAL ABUTMENT SECTION

SCALE: ¼" = 1'–0"

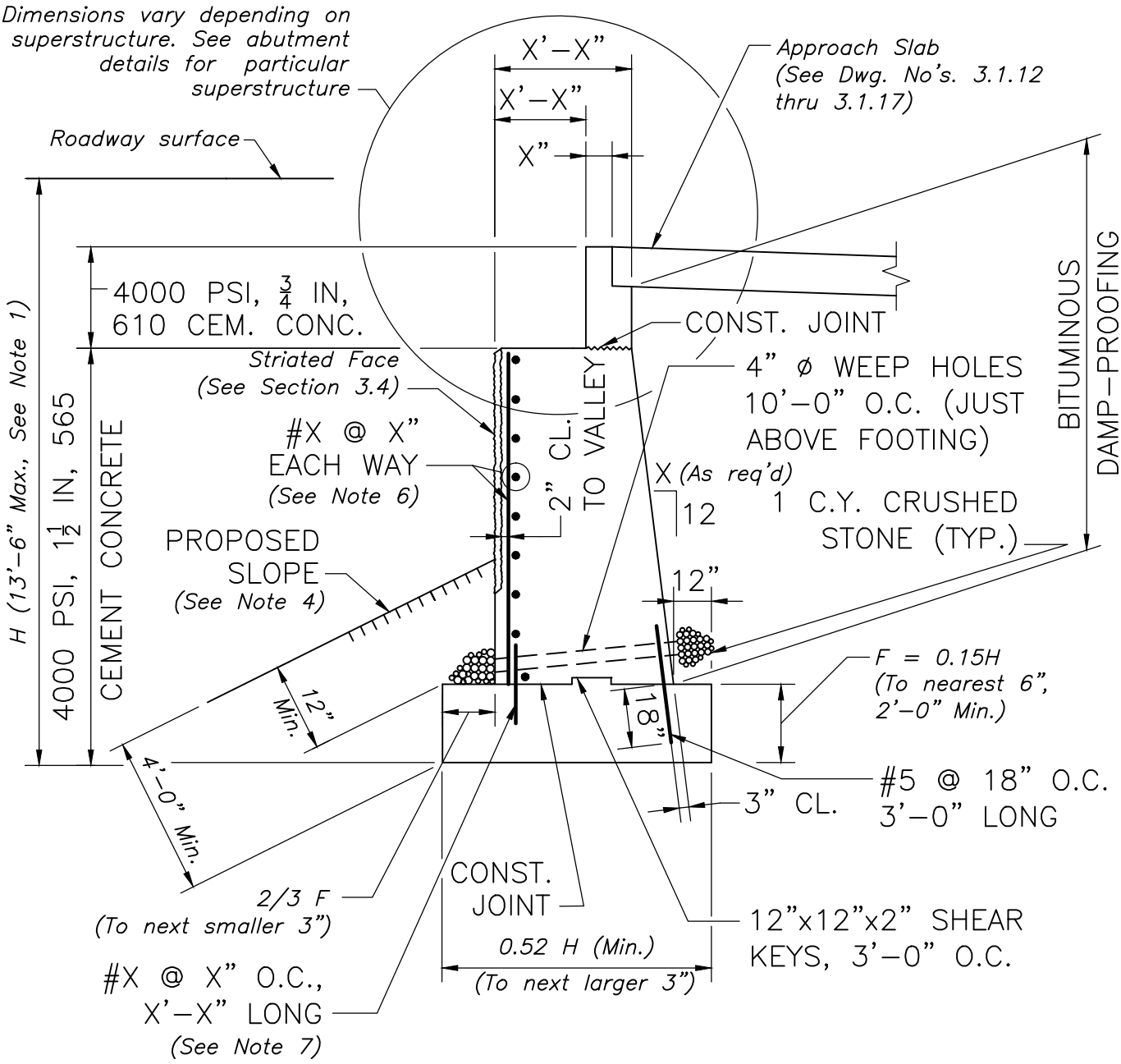
NOTES:

1. Provide applicable pile/spread footing capacity notes from Dwg. No. 3.1.6.
2. If piles are required see relevant portions of Section 3.6.
3. All dimensions are for square sections.
4. Show appropriate slope treatment.
5. See Dwg. No. 3.1.6 for Construction Notes.
6. Provide required Temperature and Shrinkage Reinforcement as follows:

Abutment/Wall Thickness, t, (in.)	Bar Size	Spacing (in.)
t≤18"	#4	12"
18"<t≤24"	#5	12"
24"<t≤42"	#6	12"
42"<t≤48"	#7	12"

7. Match size and spacing of vertical bars in stem. Provide length of these reinforcing bars as follows:
   - for #4 and #5 bars – 2'–0"
   - for #6 bars – 2'–6"
   - for #7 bars – 2'–10"

   One–half of the specified bar length shall be embedded into the footing.



TYPICAL ABUTMENT SECTION

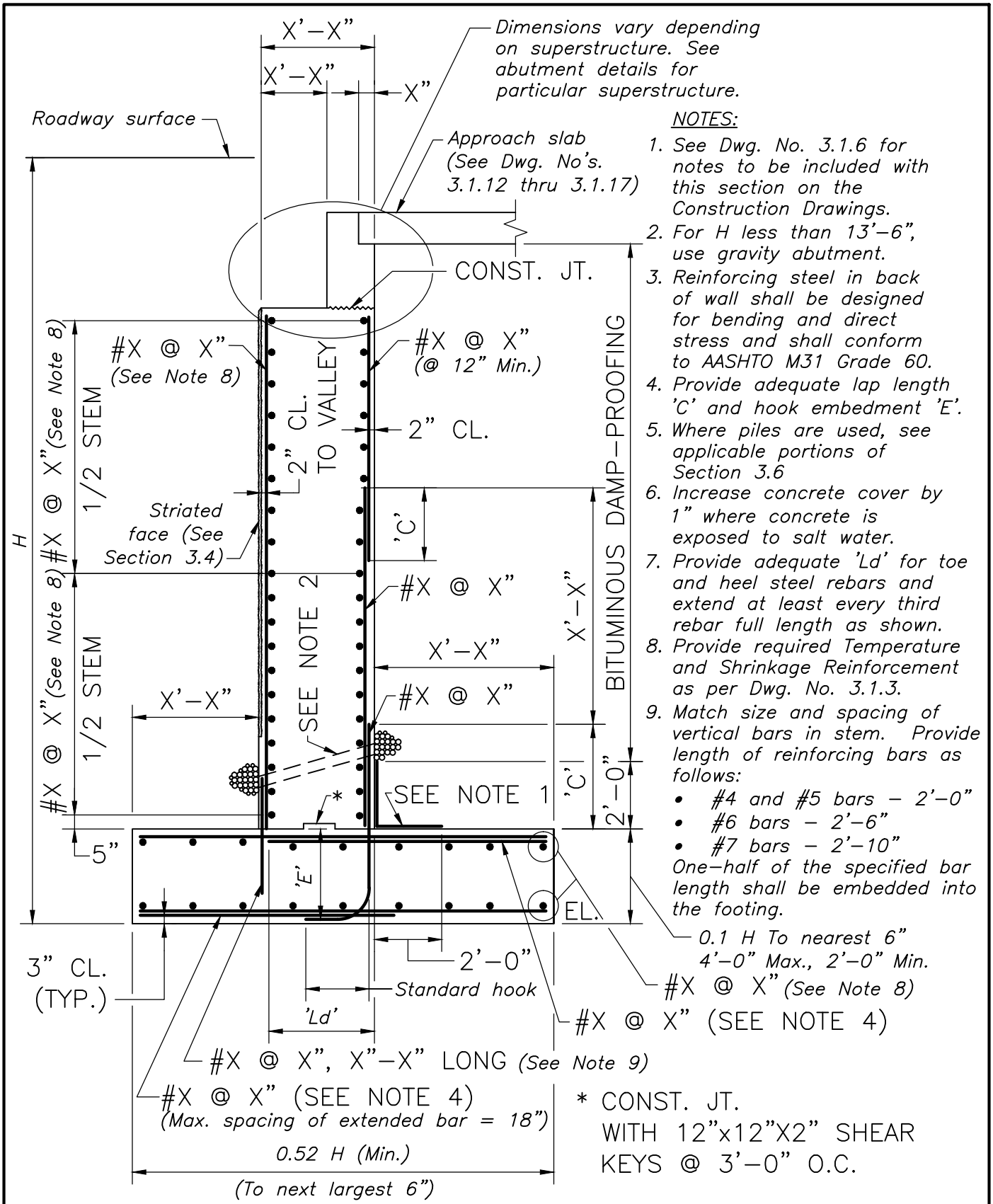
SCALE: ¼" = 1'–0"

NOTES:

1. *Provide applicable pile/spread footing capacity notes from Dwg. No. 3.1.6.*
2. *If piles are required see relevant portions of Section 3.6.*
3. *All dimensions are for square sections.*
4. *Show appropriate slope treatment.*
5. *See Dwg. No. 3.1.6 for Construction Notes.*
6. *Provide required Temperature and Shrinkage Reinforcement as per Dwg. No. 3.1.3.*
7. *Match size and spacing of vertical bars in stem. Provide length of reinforcing bars as follows:*
   - *for #4 and #5 bars – 2'–0"*
   - *for #6 bars – 2'–6"*
   - *for #7 bars – 2'–10"*

   One–half of the specified bar length shall be embedded into the footing.

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	TYPICAL GRAVITY ABUTMENT SECTION ABUTMENT DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.1.4**



NOTES:

1. See Dwg. No. 3.1.6 for notes to be included with this section on the Construction Drawings.
2. For H less than 13'–6", use gravity abutment.
3. Reinforcing steel in back of wall shall be designed for bending and direct stress and shall conform to AASHTO M31 Grade 60.
4. Provide adequate lap length 'C' and hook embedment 'E'.
5. Where piles are used, see applicable portions of Section 3.6
6. Increase concrete cover by 1" where concrete is exposed to salt water.
7. Provide adequate 'Ld' for toe and heel steel rebars and extend at least every third rebar full length as shown.
8. Provide required Temperature and Shrinkage Reinforcement as per Dwg. No. 3.1.3.
9. Match size and spacing of vertical bars in stem. Provide length of reinforcing bars as follows:
   - #4 and #5 bars – 2'–0"
   - #6 bars – 2'–6"
   - #7 bars – 2'–10"

   One–half of the specified bar length shall be embedded into the footing.

TYPICAL ABUTMENT SECTION

SCALE: $\frac{1}{4}$" = 1'–0"

massDOT Highway Division LRFD BRIDGE MANUAL, PART II	TYPICAL CANTILEVER ABUTMENT SECTION ABUTMENT DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.1.5**

NOTES: *(Include these notes with section shown on Dwg. No. 3.1.5. Include applicable capacity notes with sections shown on Dwg. No's. 3.1.3 and 3.1.4)*

1. MEMBRANE WATERPROOFING AND 8"x16"x2", 4000 PSI, $\frac{3}{4}$ IN, 610 CEMENT CONCRETE BLOCKS LAID IN MORTAR OR OTHER WATERPROOFING PROTECTIVE COURSE, MIN. 2" THICK AS SPECIFIED IN MHD STANDARD SPECIFICATIONS.
2. 4" ø WEEP HOLES 10'–0" O.C. (JUST ABOVE PROTECTIVE COURSE). PROVIDE 1 CUBIC YARD OF CRUSHED STONE AT EACH END OF WEEP HOLE.
3. ALL CONCRETE SHALL BE 4000 PSI, $1\frac{1}{2}$ IN, 565 CEMENT CONCRETE EXCEPT THE BACKWALL, WHICH SHALL BE 4000 PSI, $\frac{3}{4}$ IN, 610 CEMENT CONCRETE.
4. EXTEND EVERY X^{th} BAR FULL LENGTH AS SHOWN.
   (specify X as req'd by design)

For Spread Footings:

5. THE FACTORED BEARING PRESSURE = XXX KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION. *(Designer to specify the Limit State and the Group Load Combination that produce the highest pressure)*

   FACTORED BEARING RESISTANCE = XXX KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.XX.

For Piles:

5. THE FACTORED AXIAL DESIGN LOAD PER PILE IS X KIPS AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION. *(Designer to specify the Limit State and the Group Load Combination that produce the highest axial load)*

   THE FACTORED STRUCTURAL RESISTANCE PER PILE IS X KIPS AND IS THE PRODUCT OF THE NOMINAL STRUCTURAL RESISTANCE OF X KIPS AND A RESISTANCE FACTOR OF 0.XX.

6a. THE FACTORED GEOTECHNICAL PILE RESISTANCE IS X KIPS AND IS THE PRODUCT OF THE NOMINAL GEOTECHNICAL RESISTANCE OF X KIPS AND A RESISTANCE FACTOR OF 0.XX. THE ESTIMATED TIP ELEVATION IS XXX FEET.

(Use this note only when the Factored Geotechnical Pile Resistance controls the pile axial resistance, such as from friction or friction and end bearing as specified in the Geotechnical Report.)

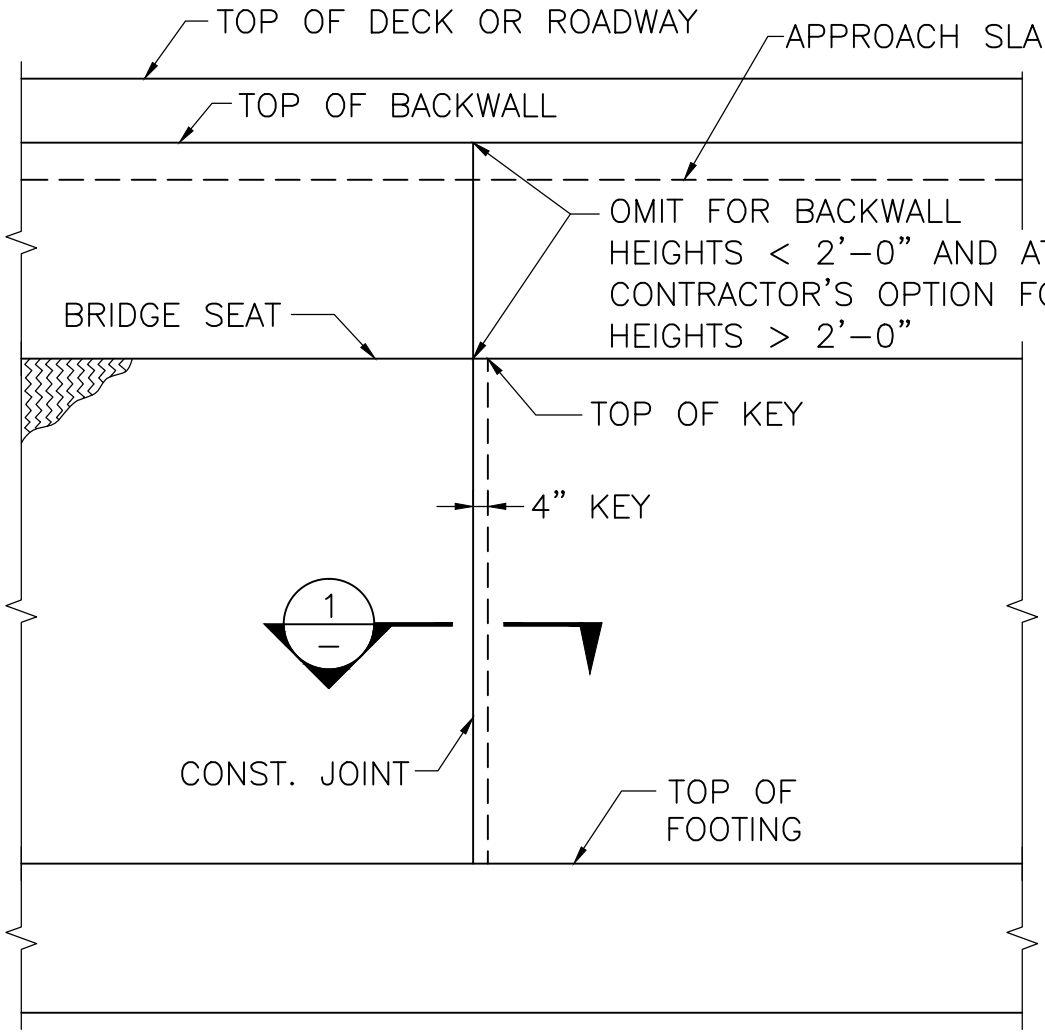
6b. THE MINIMUM TIP ELEVATION IS XXX FEET.
(Use this note only when the required pile length is not determined by the required axial resistance, i.e., lateral loading, scour resistance, or other factors, as recommended in the Geotechnical Report, determine the pile length.)

6c. PILES SHALL BE DRIVEN TO BEDROCK WITH AN ESTIMATED TIP ELEVATION OF XXX FEET. HEAVY DUTY PILE SHOES SHALL BE INSTALLED ON THE TIPS OF ALL PILES. PREFABRICATED PILE SHOES MAY BE USED IF APPROVED BY THE ENGINEER.
(Include this note only when the Factored Structural Resistance controls the pile axial resistance due to end bearing on rock as specified in the Geotechnical Report.)

7. DETERMINATION OF THE DRIVEN PILE RESISTANCE, PILE DRIVING CRITERIA, AND PILE INTEGRITY SHALL BE PERFORMED USING THE XX *(Designer to specify the Formula Method, WEAP, PDA, Static–Cyclic (Express) Load Test, Static Load Test, or other method, as recommended in the Geotechnical Report.)*

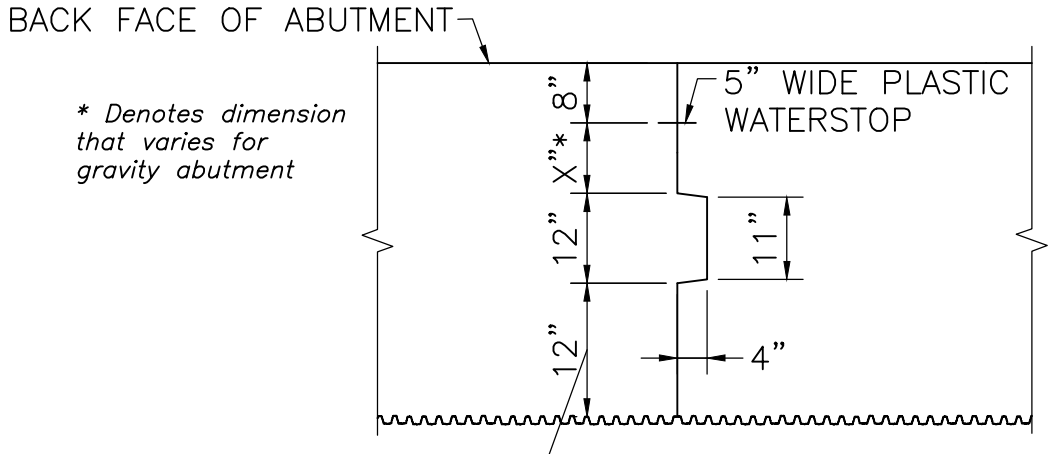
   DRIVING/TESTING METHOD WITH A RESISTANCE FACTOR OF 0.XX. PILES SHALL BE INSTALLED TO ACHIEVE A FACTORED DRIVEN RESISTANCE EQUAL TO OR GREATER THAN THE FACTORED AXIAL DESIGN LOAD.

8. THE CONTRACTOR SHALL SUBMIT A PILE SCHEDULE, PILE INSTALLATION, AND PILE DRIVING/TESTING PLAN FOR REVIEW AND APPROVAL OF THE ENGINEER.



ELEVATION OF ABUTMENT

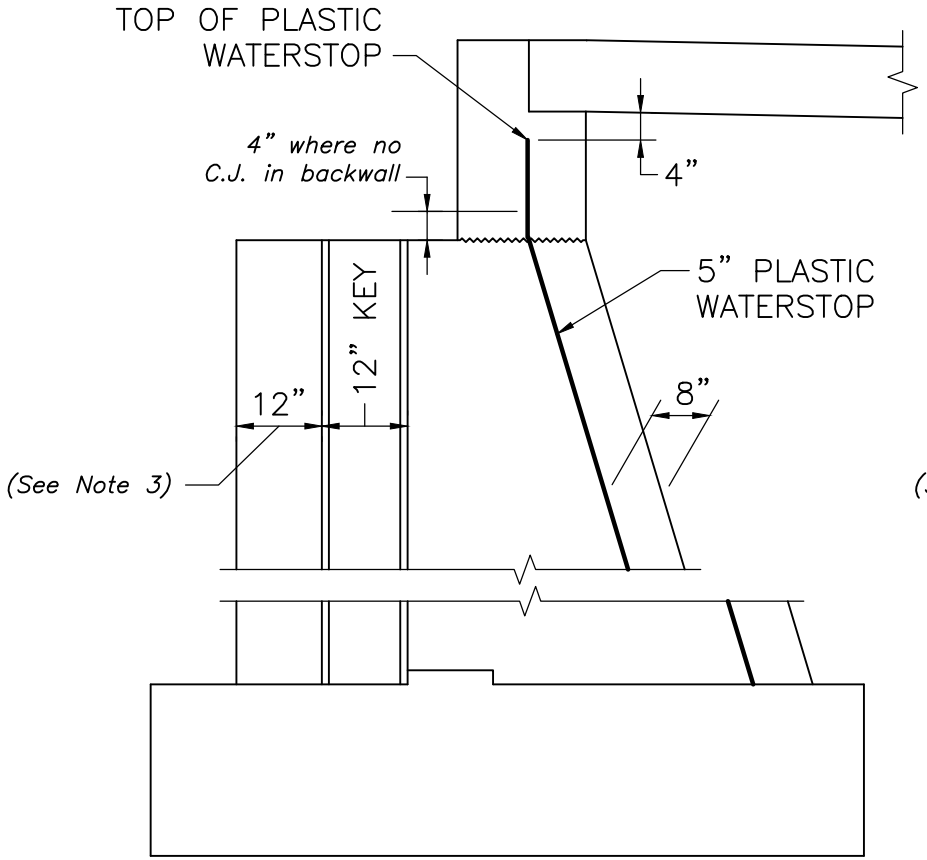
SCALE: $\frac{1}{4}$" = 1'-0"



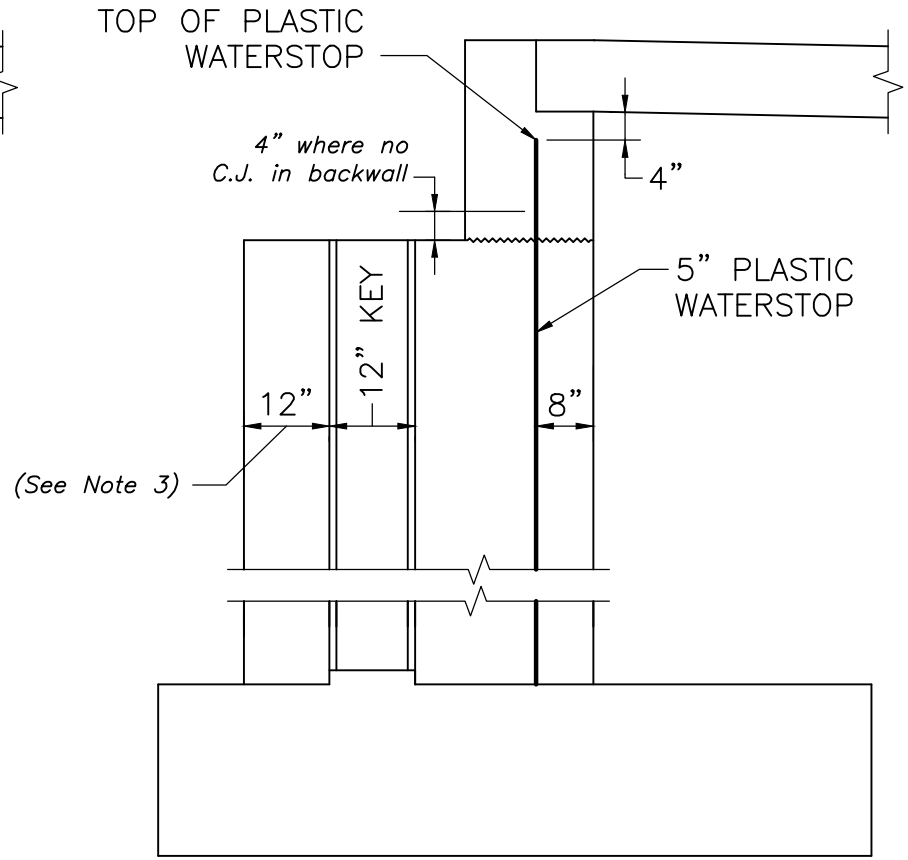
SECTION 1

SCALE: $\frac{1}{2}$" = 1'-0"

massDOT Highway Division LRFD BRIDGE MANUAL, PART II	CONSTRUCTION JOINT DETAILS ABUTMENT DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.1.7**



GRAVITY ABUTMENT



CANTILEVER ABUTMENT

NOTE:
REINFORCEMENT SHALL BE CONTINUOUS THRU CONSTRUCTION JOINTS.

VERTICAL SECTION THRU CONSTRUCTION JOINT

SCALE: $\frac{1}{2}$" = 1'–0"

NOTES:

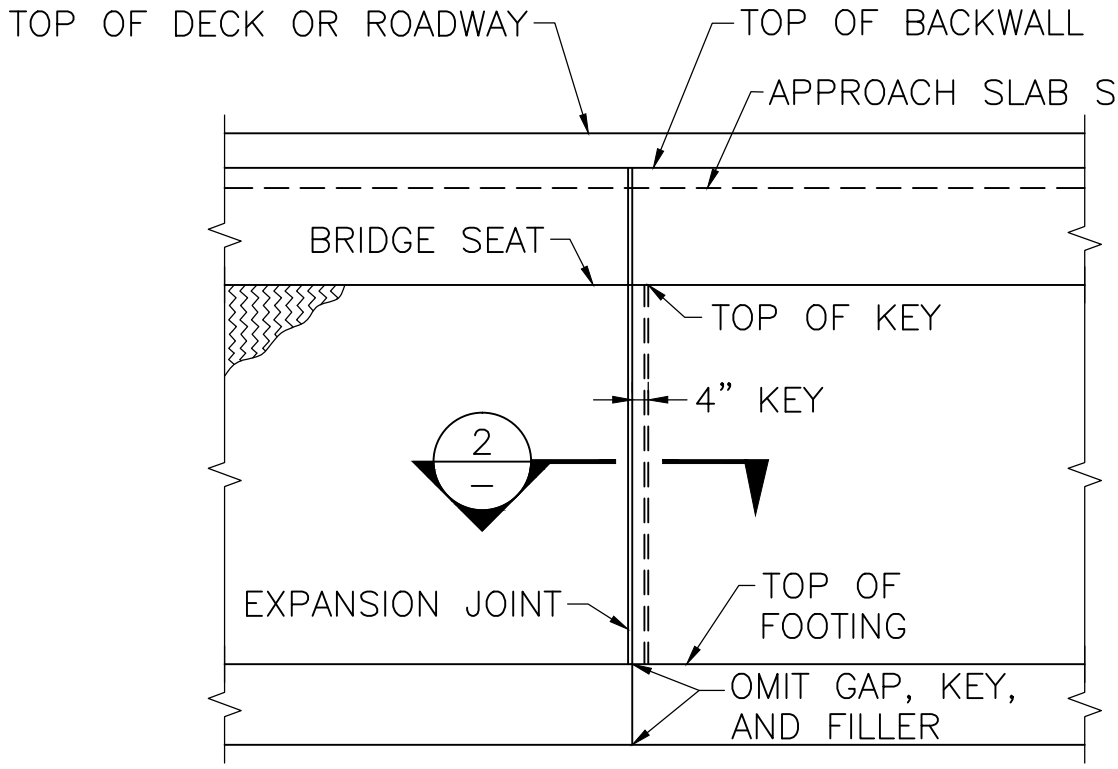
1. *Construction joints shall be located at intervals of not more than 24'.*
2. *Locate construction joints by dimensions on Construction Drawings.*
3. *If 12" clearance cannot be achieved by placing end of 12" key at face of backwall, place key farther back to achieve the 12" clearance.*

VERTICAL SECTION THRU CONSTRUCTION JOINT

ABUTMENT DETAILS

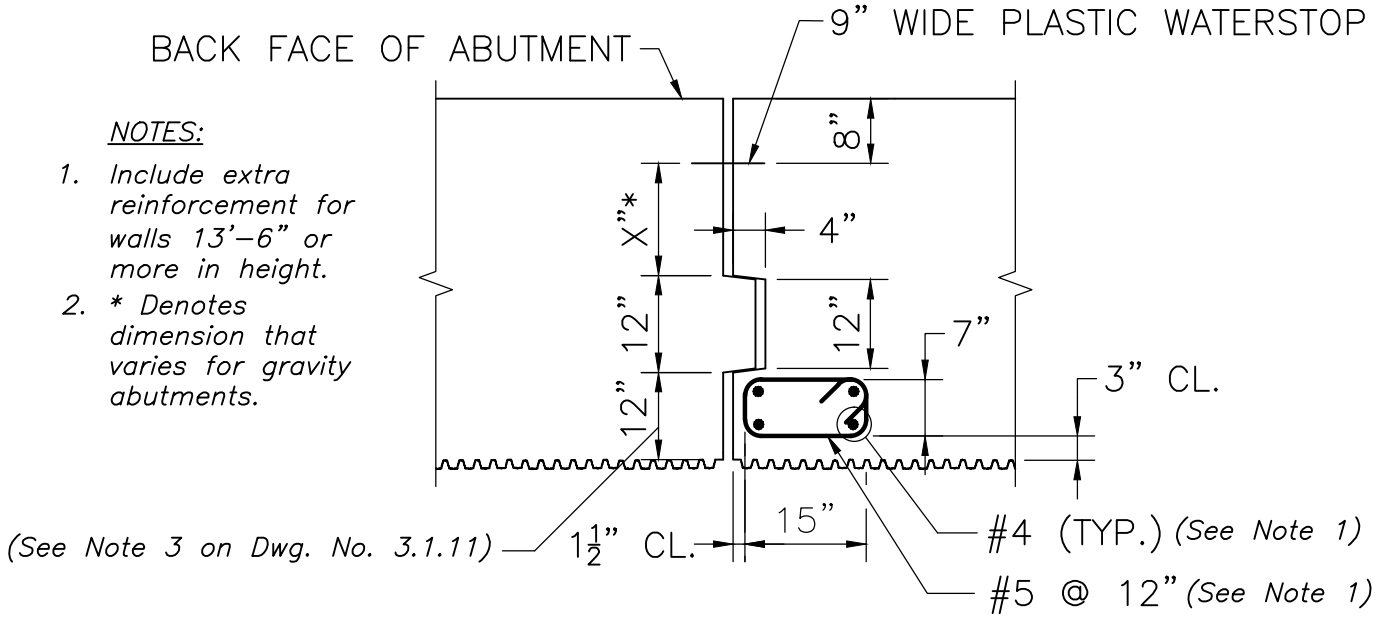
DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.1.8



ELEVATION OF ABUTMENT

SCALE: $\frac{1}{4}$" = 1'–0"



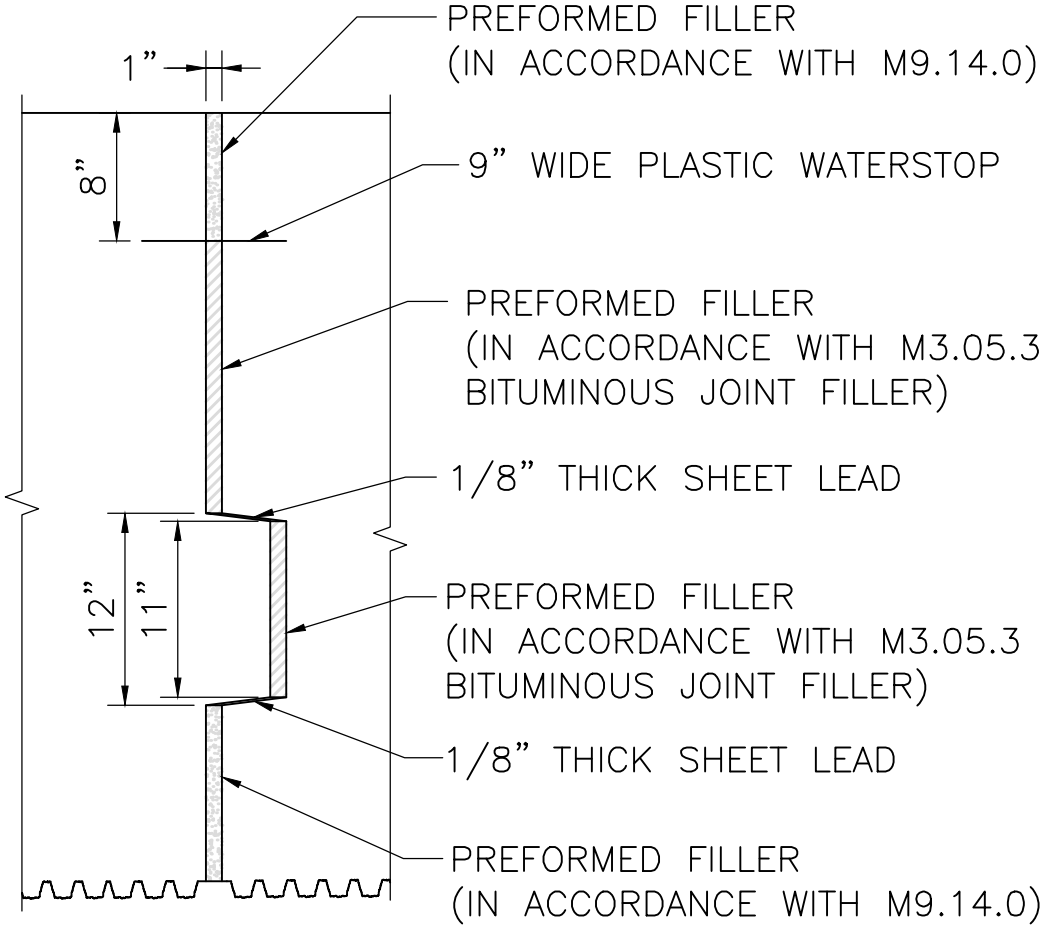
NOTES:

1. *Include extra reinforcement for walls 13'–6" or more in height.*
2. ** Denotes dimension that varies for gravity abutments.*

SECTION 2

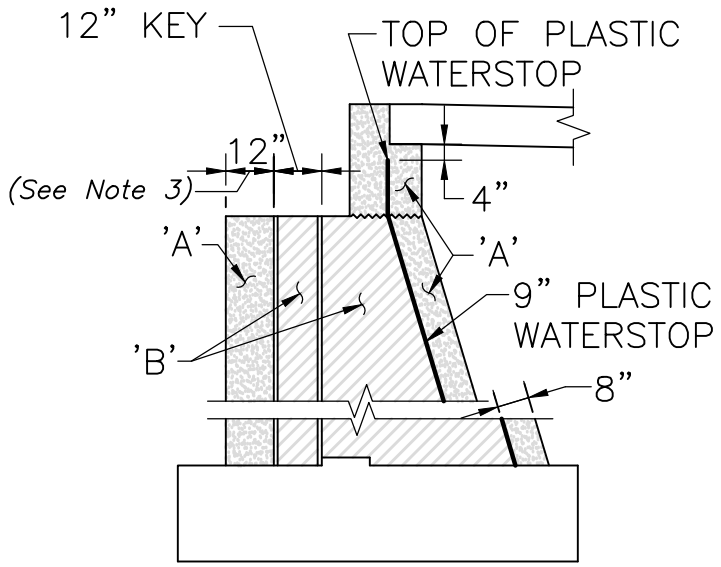
SCALE: $\frac{1}{2}$" = 1'–0"

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	EXPANSION JOINT DETAILS ABUTMENT DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.1.9**

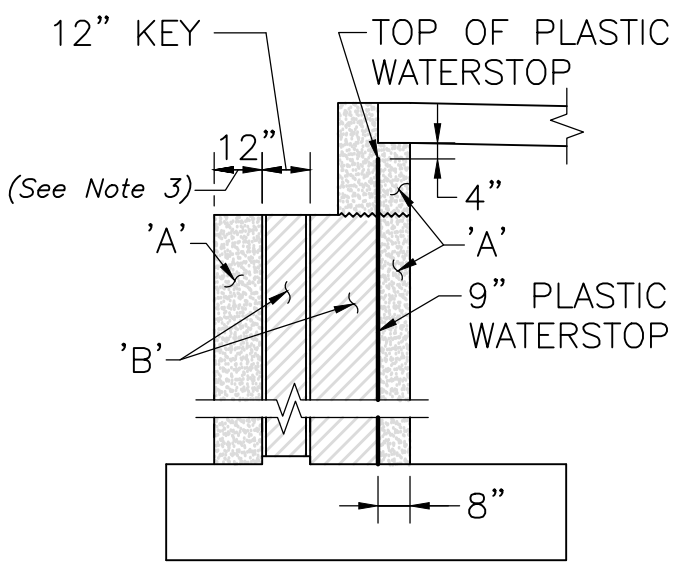


LIMITS OF PREFORMED FILLER

SCALE: 1" = 1'–0"



GRAVITY ABUTMENT



CANTILEVER ABUTMENT

NOTES:

1. LONGITUDINAL REINFORCEMENT SHALL END 2" CLEAR OF EXPANSION JOINT.
2. 'A' – PREFORMED FILLER (IN ACCORDANCE WITH M9.14.0)
   'B' – PREFORMED FILLER (IN ACCORDANCE WITH M3.05.3 BITUMINOUS JOINT FILLER)
3. FILLER MATERIAL SHALL BE FASTENED SECURELY TO ONE SIDE OF JOINT.

VERTICAL SECTION THRU EXPANSION JOINT

SCALE: $\frac{1}{4}$" = 1'–0"

NOTES:

1. *Expansion joints shall be located at intervals not more than 72'. In the case of long walls, the first joint in the wing from the corner of the abutment is expansion.*
2. *Locate expansion joints by dimensions on the Construction Drawings.*
3. *If 12" clearance can not be achieved by placing end of 12" key at face of backwall, place key farther back to achieve the 12" clearance.*

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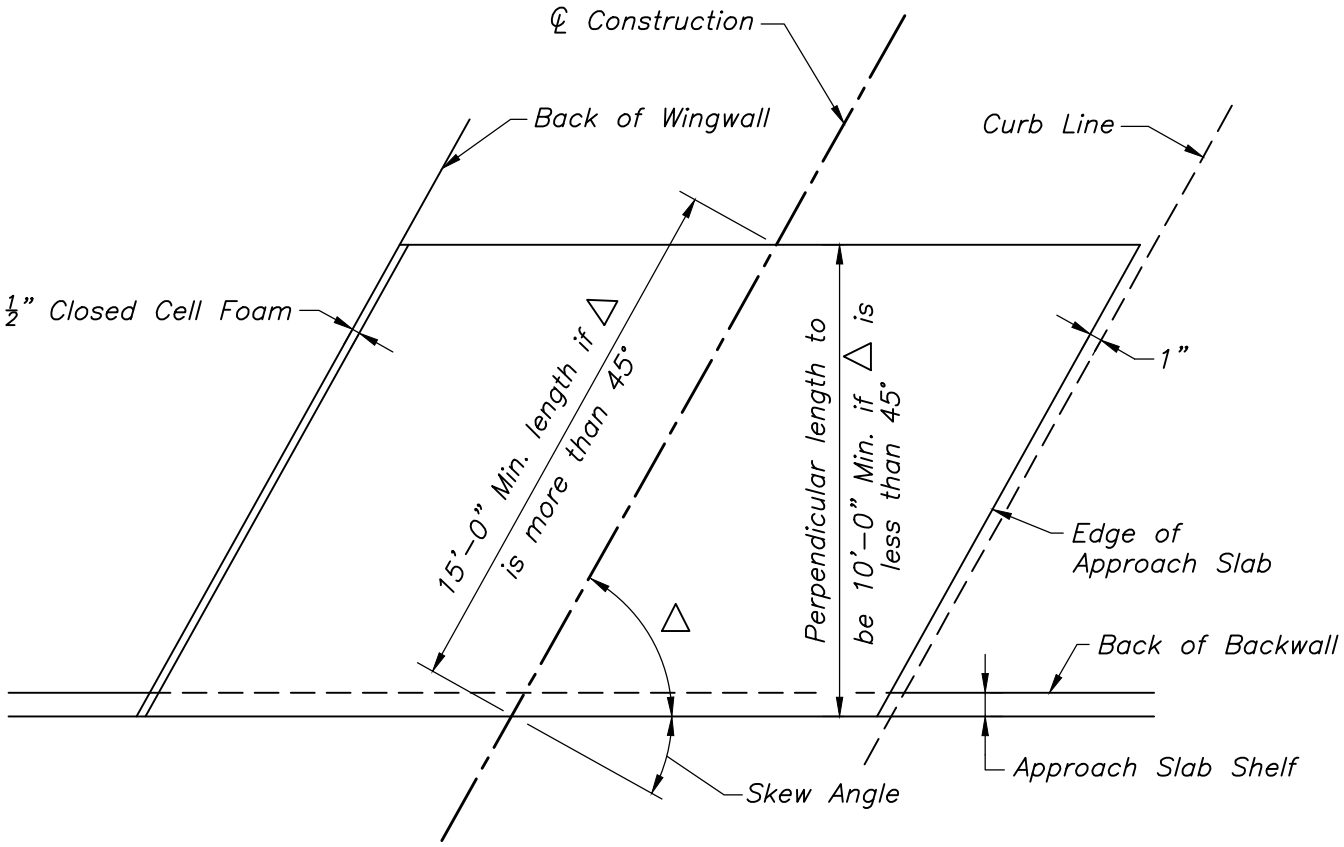


U–WINGWALLS WITH SAFETY CURBS

SPLAYED WINGWALLS U–WINGWALLS WITH SIDEWALKS

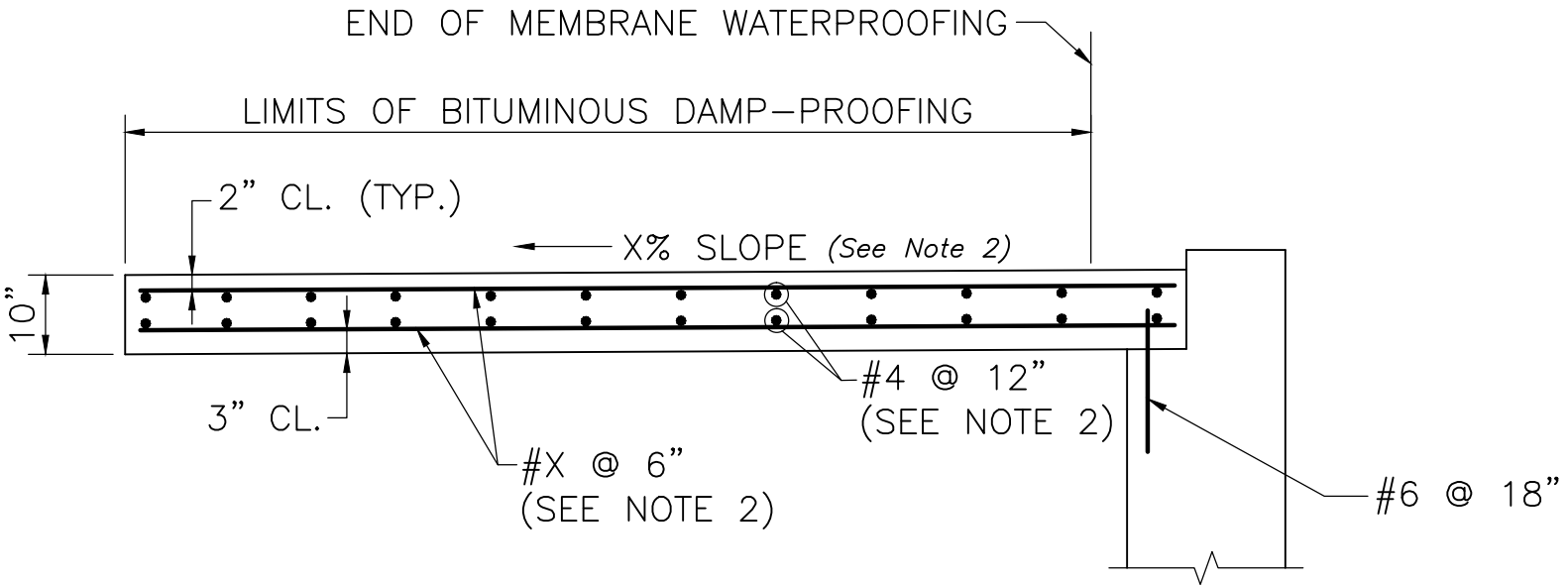
PLAN

NOT TO SCALE

NOTES:

1. Where angle △ is greater or equal to 45°: length of 10" thick slab along center line of construction is 15'–0" and main reinforcement is #7 @ 6" top and bottom parallel to centerline of construction.
2. Where angle △ is less than 45° : length of 10" thick slab perpendicular to abutment is 10'–0" minimum and main reinforcement is #6 @ 6" top and bottom perpendicular to abutment.
3. If removable panel is used, place steel parallel to centerline of construction and design approach slab accordingly.
4. Place #4 @ 12" top and bottom parallel to abutment and between main reinforcement.
5. Width of approach slab may have to be reduced if it interferes with utilities.

massDOT Highway Division LRFD BRIDGE MANUAL, PART II	APPROACH SLAB DETAIL ABUTMENT DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.1.12**



NOTES:

1. APPROACH SLAB TO BE 4000 PSI, $1\frac{1}{2}$ IN, 565 CEMENT CONCRETE.
2. PLACE LONGITUDINAL REINFORCEMENT *(Specify orientation per Dwg. No. 3.1.12).* PLACE TRANSVERSE REINFORCEMENT PARALLEL TO ABUTMENT.

APPROACH SLAB DETAILS

SCALE: $\frac{1}{2}$" = 1'-0"

NOTES:

1. *See Roadway Section drawings for abutment details and dimensions not shown here.*
2. *If approach roadway slopes down and away from the abutment at greater than 2%, change slope of approach slab to approach roadway grade plus 1%, rounded up to the nearest 1%. Otherwise set slope at 2%.*

APPROACH SLAB TYPE I

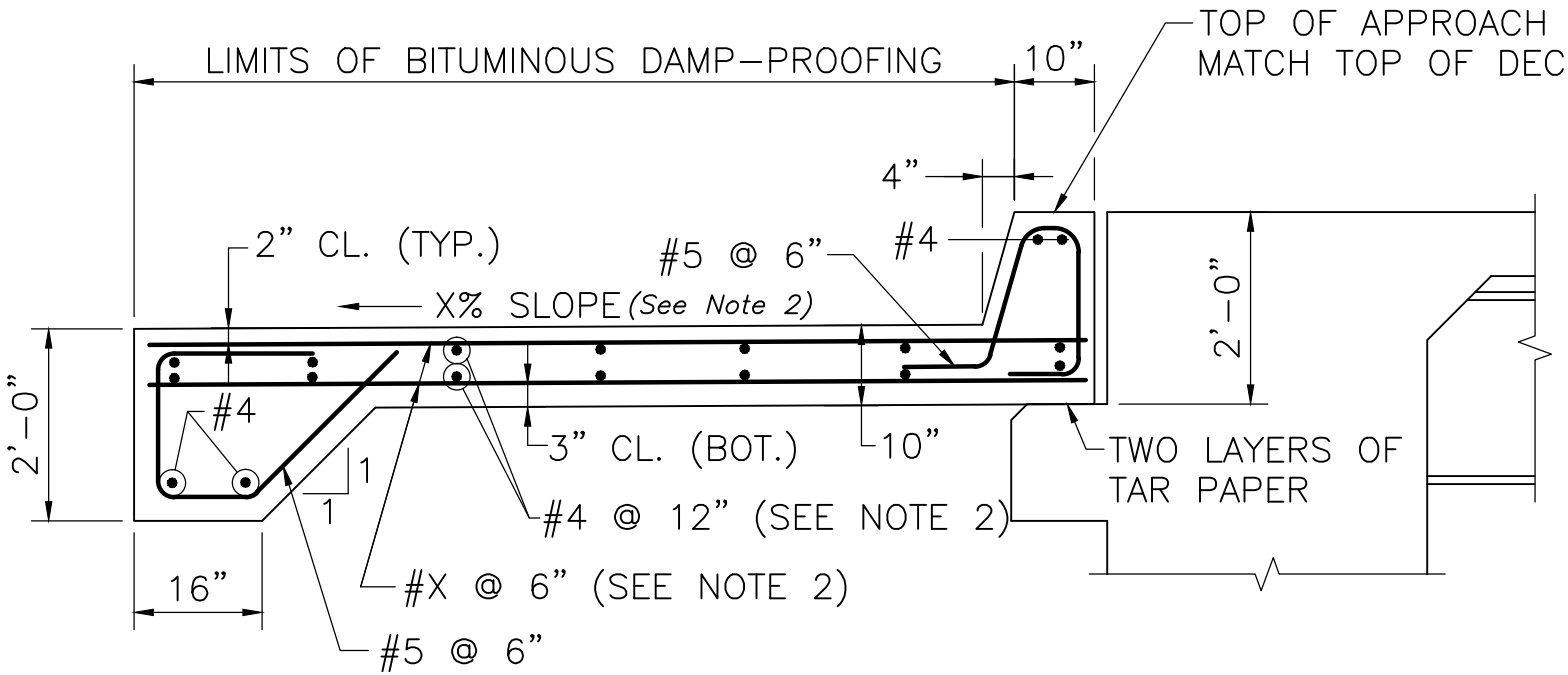
ABUTMENT DETAILS

DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.1.13

APPROACH SLAB TYPE II

ABUTMENT DETAILS



NOTES:

1. APPROACH SLAB TO BE 4000 PSI, $1\frac{1}{2}$ IN, 565 CEMENT CONCRETE.
2. PLACE LONGITUDINAL REINFORCEMENT *(Specify orientation per Dwg. No. 3.1.12).* PLACE TRANSVERSE REINFORCEMENT PARALLEL TO ABUTMENT.

APPROACH SLAB DETAILS

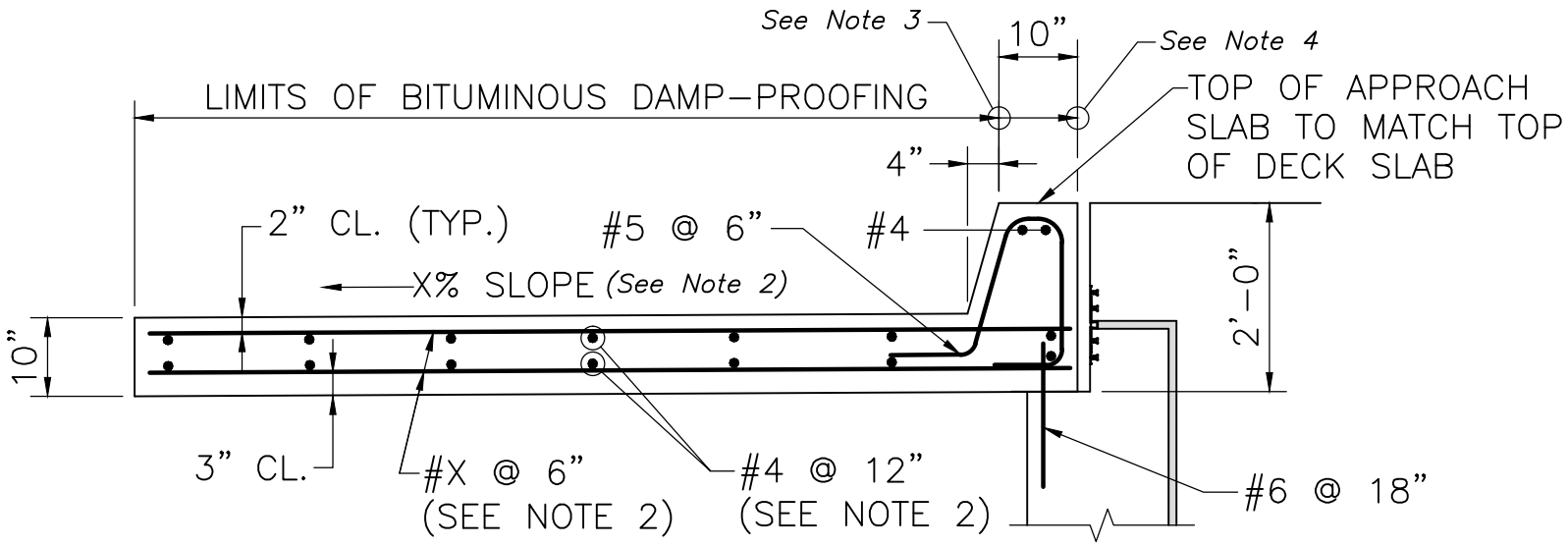
SCALE: $\frac{1}{2}$" = 1'-0"

NOTES:

1. *See Roadway Section drawings for abutment details and dimensions not shown here.*
2. *If approach roadway slopes down and away from the abutment at greater than 2%, change slope of approach slab to approach roadway grade plus 1%, rounded up to the nearest 1%. Otherwise set slope at 2%.*

DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.1.14



NOTES:

1. APPROACH SLAB TO BE 4000 PSI, $1\frac{1}{2}$ IN, 565 CEMENT CONCRETE.
2. PLACE LONGITUDINAL REINFORCEMENT *(Specify orientation per Dwg. No. 3.1.12).* PLACE TRANSVERSE REINFORCEMENT PARALLEL TO ABUTMENT.

APPROACH SLAB DETAILS

SCALE: $\frac{1}{2}$" = 1'-0"

NOTES:

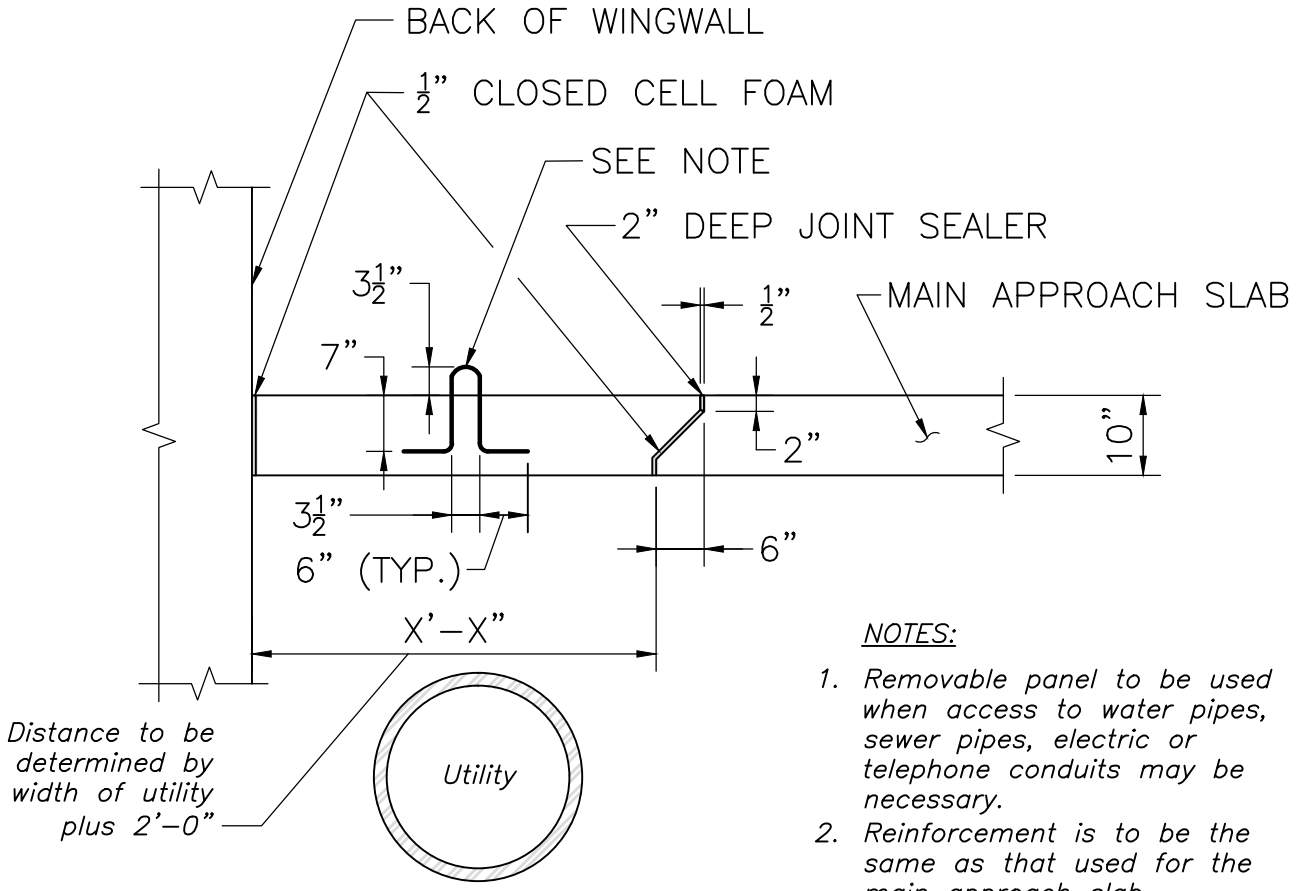
1. *See Roadway Section drawings for abutment details and dimensions not shown here.*
2. *If approach roadway slopes down and away from the abutment at greater than 2%, change the slope of approach slab to approach roadway grade plus 1%, rounded up to the nearest 1%. Otherwise set slope at 2%.*
3. *End Bituminous damp-proofing here when using Asphaltic Bridge Joints.*
4. *End Bituminous damp-proofing here when using armored joints.*

APPROACH SLAB TYPE III

ABUTMENT DETAILS

DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.1.15



NOTES:

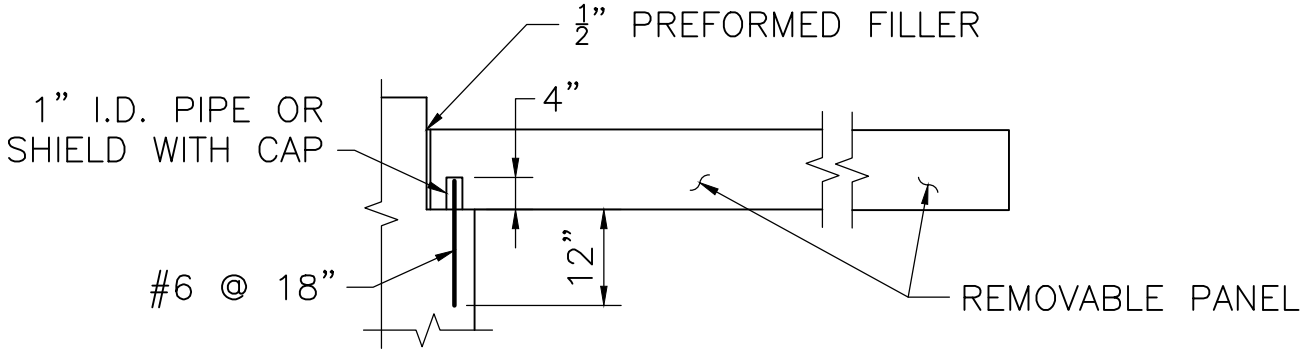
1. *Removable panel to be used when access to water pipes, sewer pipes, electric or telephone conduits may be necessary.*
2. *Reinforcement is to be the same as that used for the main approach slab.*

NOTE:

2 LIFT HOOKS REQUIRED. USE #5 COATED REBAR AT QUARTER POINTS.

SECTION 1

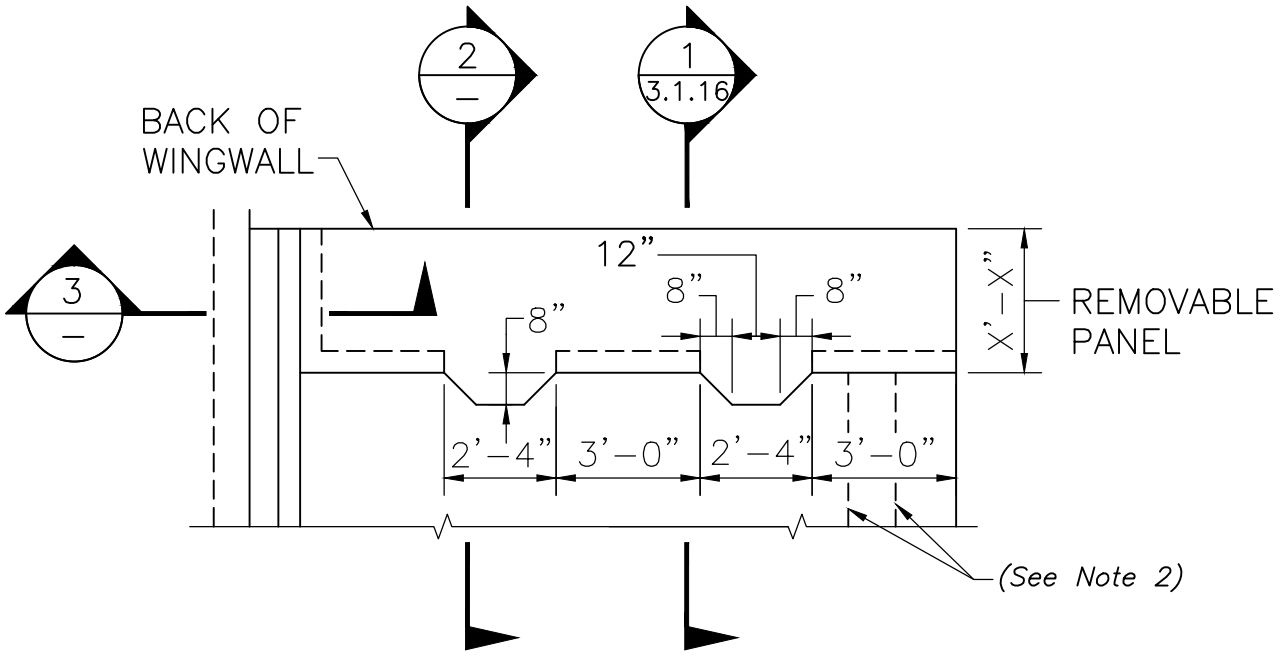
SCALE: ½" = 1'–0"



PANEL DETAIL AT ABUTMENT

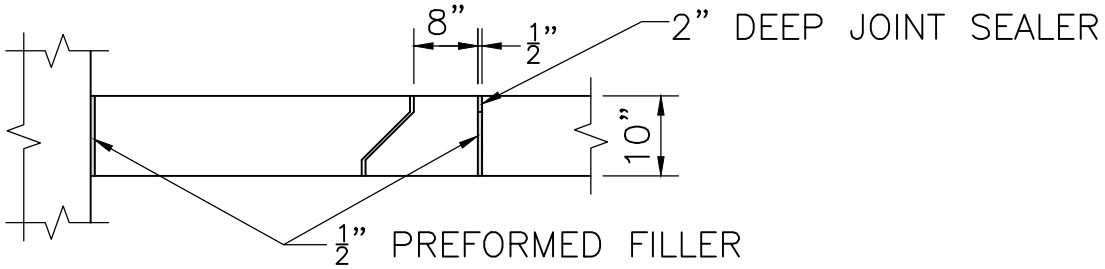
SCALE: ½" = 1'–0"

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	REMOVABLE PANEL FOR APPROACH SLAB TYPE I ABUTMENT DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.1.16**



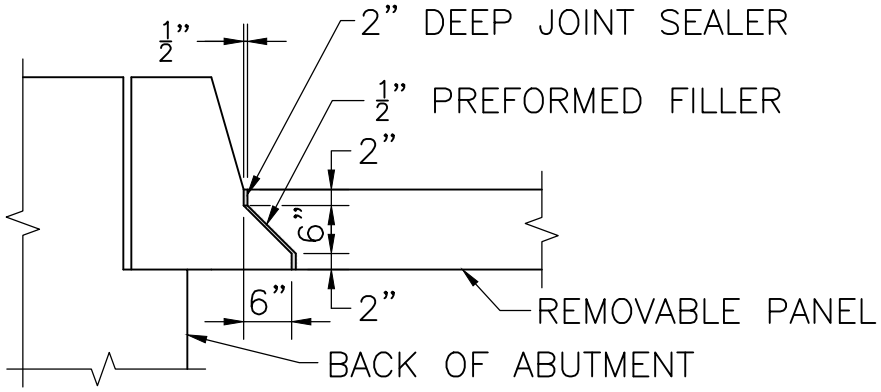
PLAN OF REMOVABLE PANEL

SCALE: $\frac{1}{4}$" = 1'-0"



SECTION 2

SCALE: $\frac{1}{2}$" = 1'-0"



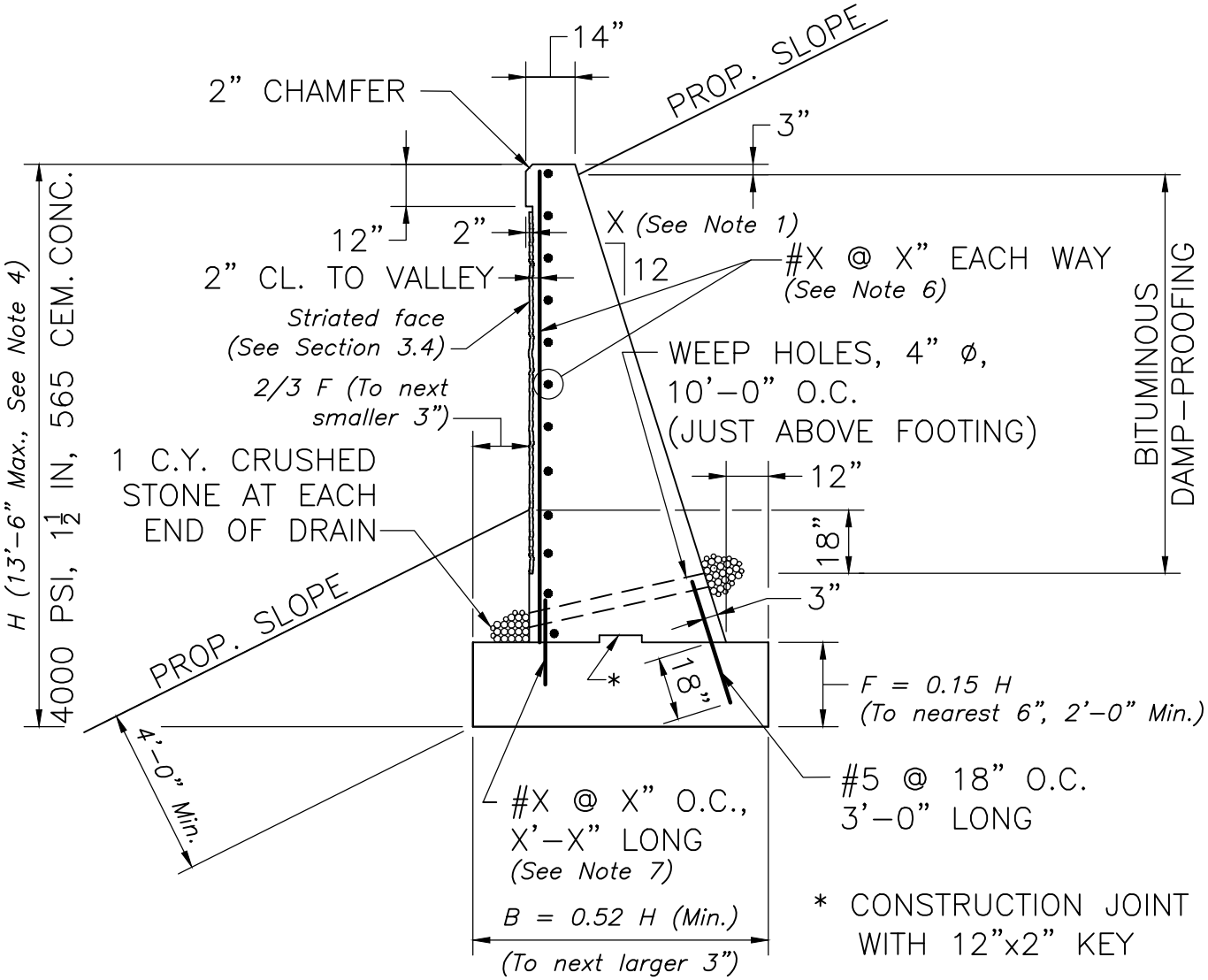
SECTION 3

SCALE: $\frac{1}{2}$" = 1'-0"

NOTES:

1. *Use Section thru Removable Panel on Dwg. No. 3.1.16 for Section 1 and for additional guidelines not shown here.*
2. *Show key for Approach Slab Type II. Omit key on removable panel.*

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	REMOVABLE PANEL FOR APPR. SLAB TYPES II & III ABUTMENT DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.1.17**



FOR RETAINING WALLS OR SPLAYED WINGWALLS

TYPICAL SECTION

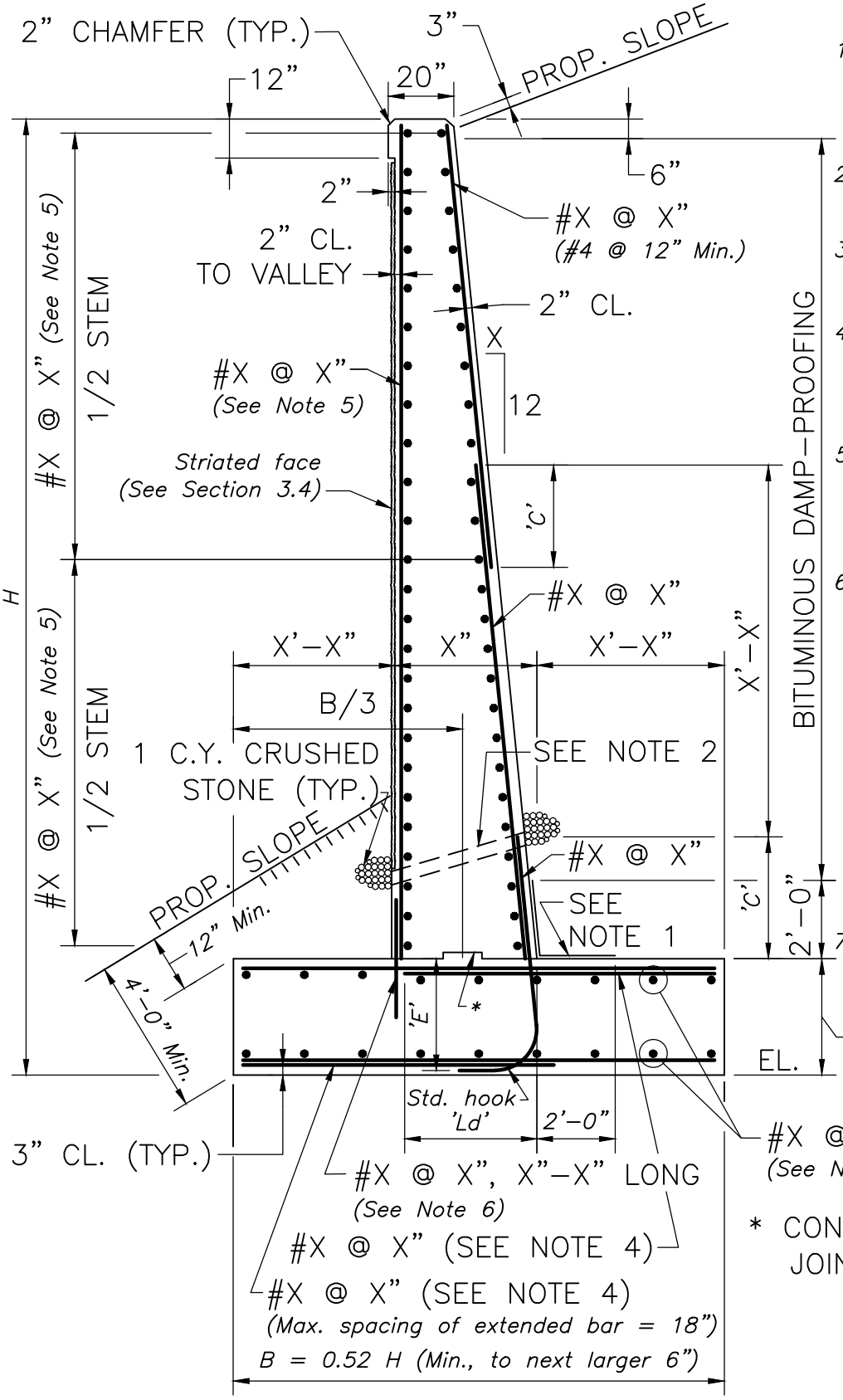
SCALE: ¼" = 1'-0"

NOTES:

1. The back batter shall be constant and shall be determined by the highest section contained between expansion joints.
2. Show maximum factored toe pressure or pile load, if on piles.
3. If piles are required, see Section 3.6.
4. Footing to be omitted when founded on ledge. For typical section see Dwg. No. 3.6.4.
5. Design base width including any live load surcharge and include the effects of sloping backfills where applicable.
6. Provide required Temperature and Shrinkage Reinforcement as per Dwg. No. 3.1.3.
7. Match size and spacing of vertical bars in stem. Provide length of reinforcing bars as follows:
   - for #4 and #5 bars – 2'-0"
   - for #6 bars – 2'-6"
   - for #7 bars – 2'-10"

   One-half of the specified bar length shall be embedded into the footing.

massDOT Highway Division LRFD BRIDGE MANUAL, PART II	TYPICAL GRAVITY RETAINING WALL SECTION WINGWALL DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.2.1**



NOTES:

1. See Dwg. No. 3.2.3 for notes to be included with this section on the Construction Drawings.
2. For H less than 13'-6", use gravity retaining wall.
3. Provide adequate lap lengths 'C' and hook embedments 'E'.
4. Provide adequate 'Ld' for toe and heel steel rebars and extend at least every third rebar full length as shown.
5. Provide required Temperature and Shrinkage Reinforcement as per Dwg. No. 3.1.3.
6. Match size and spacing of vertical bars in stem. Provide length of reinforcing bars as follows:
   - #4 and #5 bars - 2'-0"
   - #6 bars - 2'-6"
   - #7 bars - 2'-10"

   One-half of the specified bar length shall be embedded into the footing.
7. See Dwg. No. 3.2.3 for continuation of these Designer Notes.

* CONSTRUCTION JOINT WITH X"x2" KEY

TYPICAL SECTION

SCALE: $\frac{1}{4}$" = 1'-0"

FOR RETAINING WALLS OR SPLAYED WINGWALLS

massDOT Highway Division LRFD BRIDGE MANUAL, PART II	TYPICAL CANTILEVER RETAINING WALL SECTION WINGWALL DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.2.2**

NOTES: *(Include these notes with section shown on Dwg. No. 3.2.2)*

1. MEMBRANE WATERPROOFING AND 8"x16"x2", 4000 PSI, $\frac{3}{4}$ IN, 610 CEMENT CONCRETE BLOCKS LAID IN MORTAR OR OTHER WATERPROOFING PROTECTIVE COURSE, MIN. 2" THICK AS SPECIFIED IN MHD STANDARD SPECIFICATIONS.

2. 4" ø WEEP HOLES 10'–0" O.C. (JUST ABOVE PROTECTIVE COURSE). PROVIDE 1 CUBIC YARD OF CRUSHED STONE AT EACH END OF WEEP HOLE.

3. ALL CONCRETE SHALL BE 4000 PSI, $1\frac{1}{2}$ IN, 565 CEMENT CONCRETE.

4. EXTEND EVERY X^{th} BAR FULL LENGTH AS SHOWN. *(specify X as req'd by design)*

For Spread Footings:

5. THE FACTORED BEARING PRESSURE = XXX KSF AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION. *(Designer to specify the Limit State and the Group Load Combination that produce the highest pressure)*

   FACTORED BEARING RESISTANCE = XXX KSF. FACTORED BEARING RESISTANCE IS THE PRODUCT OF THE NOMINAL BEARING RESISTANCE AND A RESISTANCE FACTOR OF 0.XX.

For Piles:

5. THE FACTORED AXIAL DESIGN LOAD PER PILE IS X KIPS AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION. *(Designer to specify the Limit State and the Group Load Combination that produce the highest axial load)*

   THE FACTORED STRUCTURAL RESISTANCE PER PILE IS X KIPS AND IS THE PRODUCT OF THE NOMINAL STRUCTURAL RESISTANCE OF X KIPS AND A RESISTANCE FACTOR OF 0.XX.

6a. THE FACTORED GEOTECHNICAL PILE RESISTANCE IS X KIPS AND IS THE PRODUCT OF THE NOMINAL GEOTECHNICAL RESISTANCE OF X KIPS AND A RESISTANCE FACTOR OF 0.XX. THE ESTIMATED TIP ELEVATION IS XXX FEET.
(Use this note only when the Factored Geotechnical Pile Resistance controls the pile axial resistance, such as from friction or friction and end bearing as specified in the Geotechnical Report.)

6b. THE MINIMUM TIP ELEVATION IS XXX FEET.
(Use this note only when the required pile length is not determined by the required axial resistance, i.e., lateral loading, scour resistance, or other factors, as recommended in the Geotechnical Report, determine the pile length.)

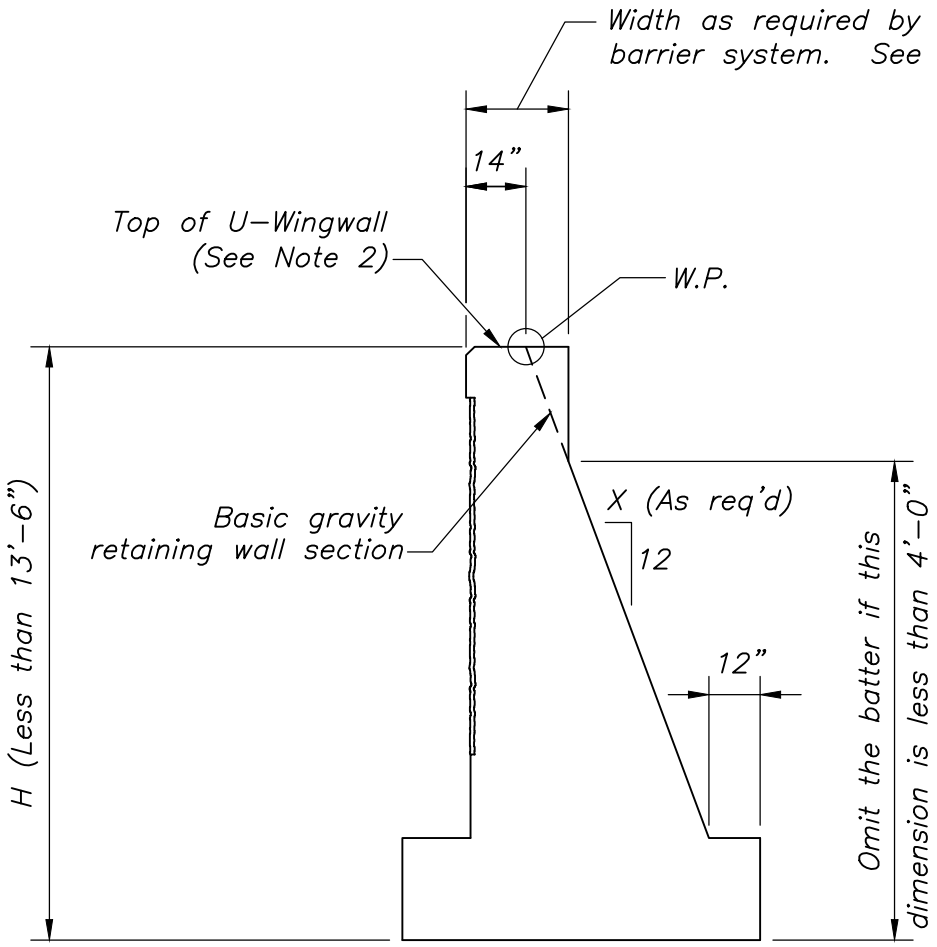
6c. PILES SHALL BE DRIVEN TO BEDROCK WITH AN ESTIMATED TIP ELEVATION OF XXX FEET. HEAVY DUTY PILE SHOES SHALL BE INSTALLED ON THE TIPS OF ALL PILES. PREFABRICATED PILE SHOES MAY BE USED IF APPROVED BY THE ENGINEER.
(Include this note only when the Factored Structural Resistance controls the pile axial resistance due to end bearing on rock as specified in the Geotechnical Report.)

7. DETERMINATION OF THE DRIVEN PILE RESISTANCE, PILE DRIVING CRITERIA, AND PILE INTEGRITY SHALL BE PERFORMED USING THE XX *(Designer to specify the Formula Method, WEAP, PDA, Static–Cyclic (Express) Load Test, Static Load Test, or other method, as recommended in the Geotechnical Report.)* DRIVING/TESTING METHOD WITH A RESISTANCE FACTOR OF 0.XX. PILES SHALL BE INSTALLED TO ACHIEVE A FACTORED DRIVEN RESISTANCE EQUAL TO OR GREATER THAN THE FACTORED AXIAL DESIGN LOAD.

8. THE CONTRACTOR SHALL SUBMIT A PILE SCHEDULE, PILE INSTALLATION, AND PILE DRIVING/TESTING PLAN FOR REVIEW AND APPROVAL OF THE ENGINEER.

NOTES: (Continued from Dwg. No. 3.2.2)

8. *Reinforcing steel in back of wall shall be designed for bending and direct stress and shall conform to AASHTO M 31 Grade 60.*
9. *Where piles are used, see Section 3.6.*
10. *Consult the Director of Bridges and Structures for concrete protection strategies in marine environments.*
11. *Design base width including any live load surcharge and the effects of sloping backfill.*
12. *Where design height H is greater than 30 feet, consider a counterfort design.*
13. *Where height of walls varies between expansion joints, the design of that segment of retaining wall may be based on the geometry of a section taken through the 1/4 point of the segment adjacent to the highest end of the wall.*

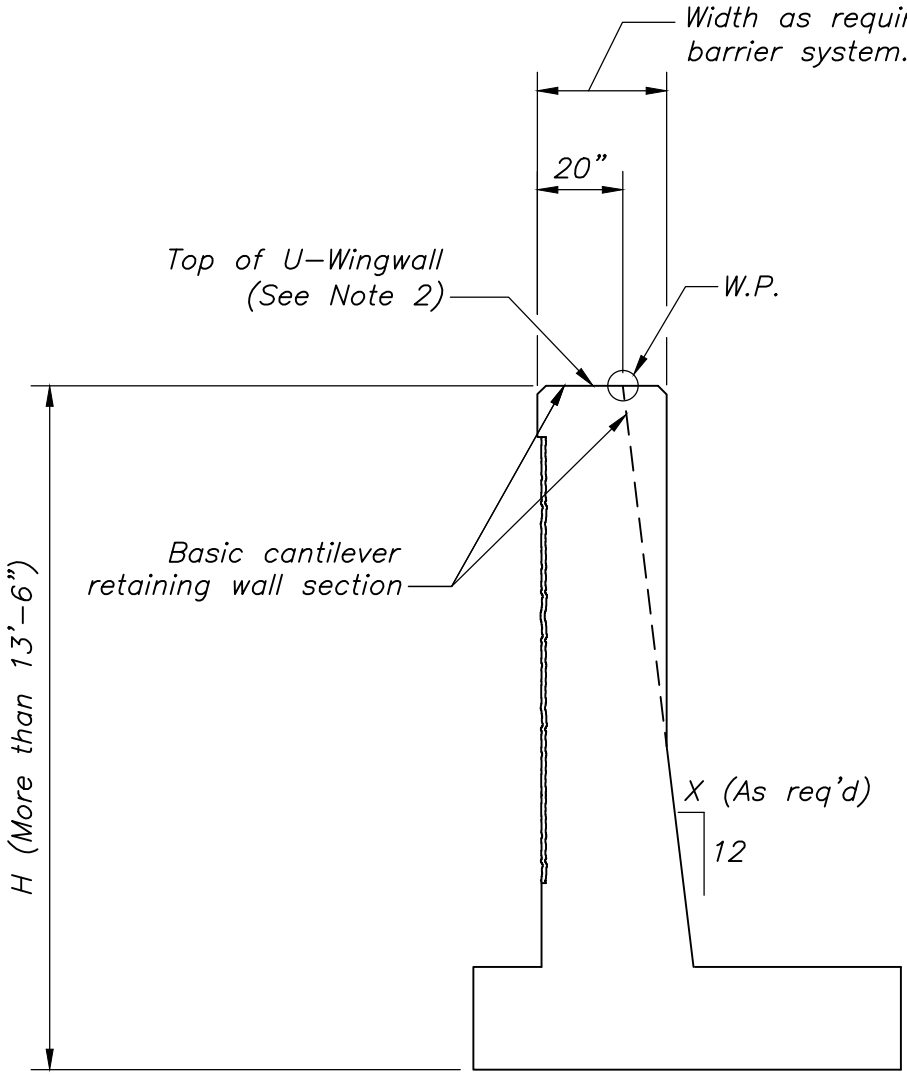


TYPICAL GEOMETRY

NOT TO SCALE

NOTES:

1. For the Typical Section through a gravity U–wingwall, see Dwg. No. 3.2.1 and modify the geometry as shown above and as specified in Note 2.
2. The top of U–Wingwall may fall above or below the top of roadway depending on the type of railing/traffic barrier system. See Top of U–Wingwall Details shown in Chapter 9 under the appropriate railing. Match any construction joints and additional reinforcement shown in the detail.

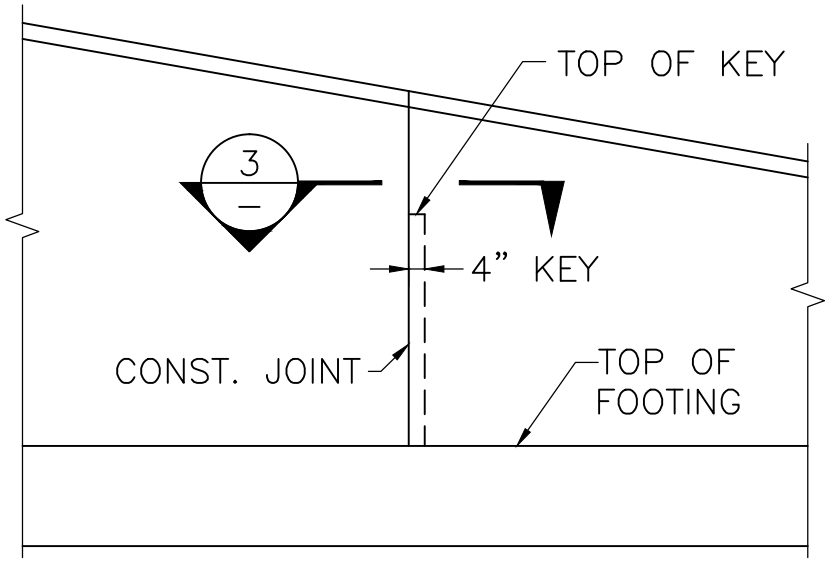


TYPICAL GEOMETRY

NOT TO SCALE

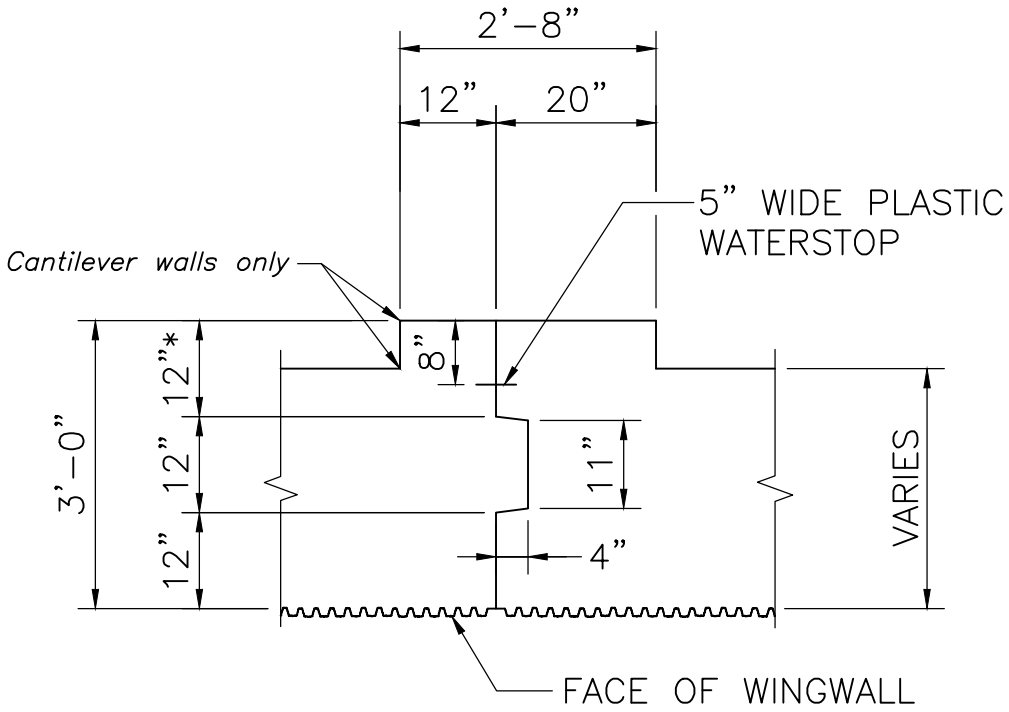
NOTES:

1. For the Typical Section through a cantilever U–wingwall, see Dwg. No. 3.2.2 and modify the geometry as shown above and as specified in Note 2.
2. The top of U–Wingwall may fall above or below the top of roadway depending on the type of railing/traffic barrier system. See Top of U–Wingwall Details shown in Chapter 9 under the appropriate railing. Match any construction joints and additional reinforcement shown in the detail.



WINGWALL ELEVATION

SCALE: $\frac{1}{2}$" = 1'–0"



** Denotes dimensions that vary for gravity wall.*

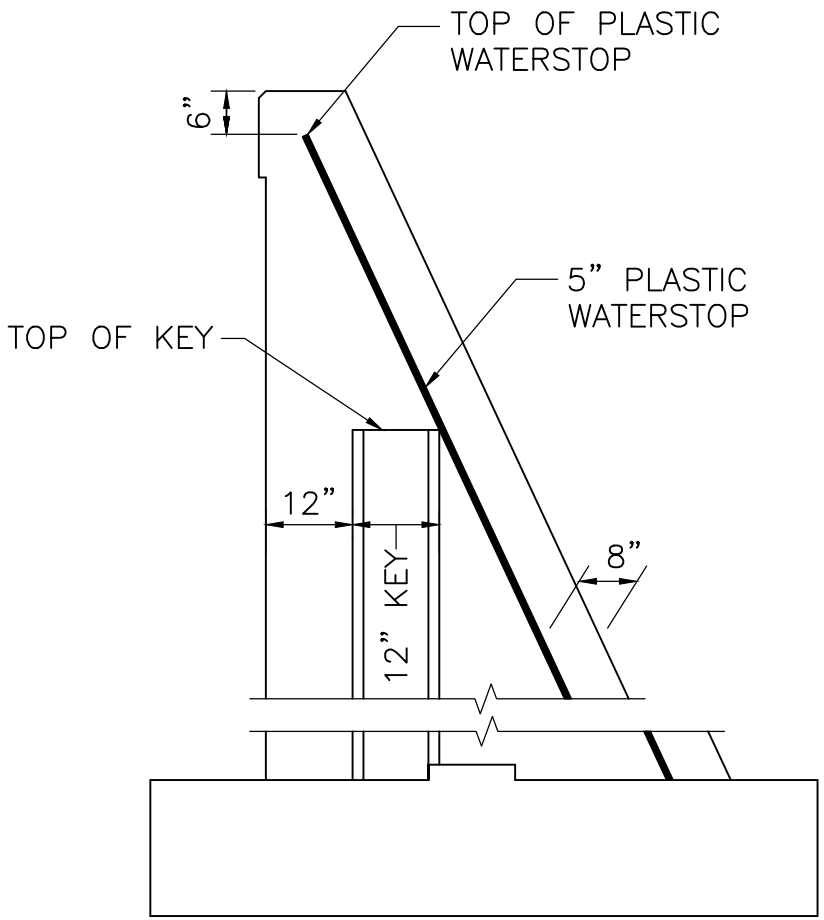
SECTION 3

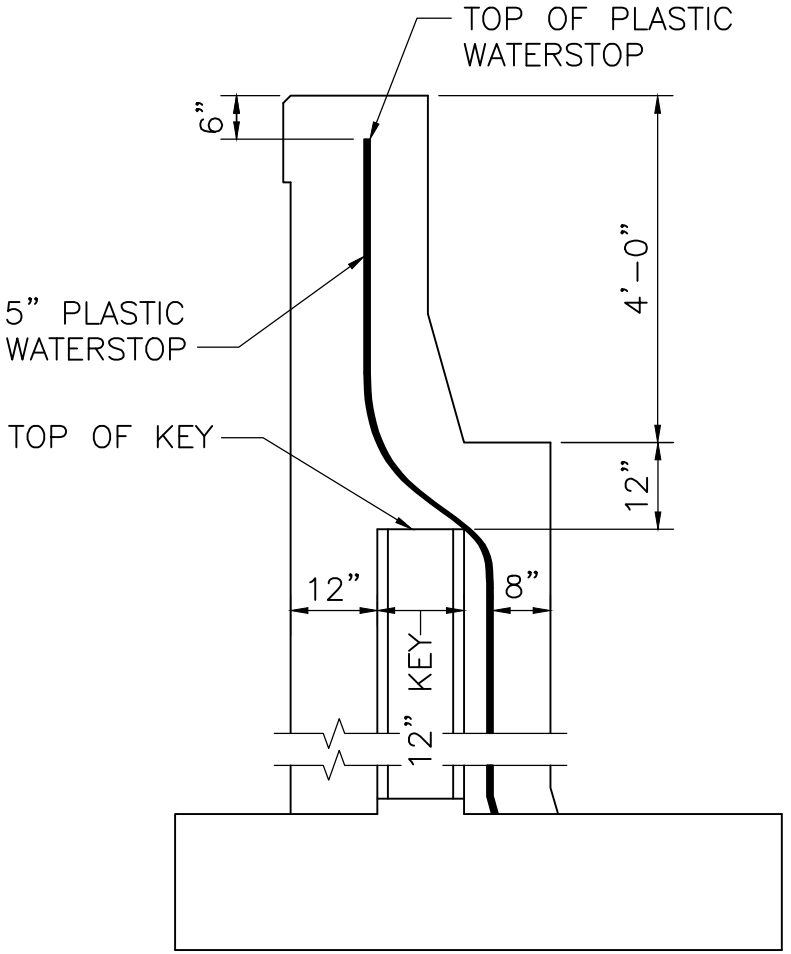
SCALE: $\frac{1}{2}$" = 1'–0"

massDOT Highway Division LRFD BRIDGE MANUAL, PART II	CONSTRUCTION JOINT DETAILS WINGWALL DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.2.6**

VERTICAL SECTION THROUGH CONSTRUCTION JOINT

WINGWALL DETAILS





NOTE:

REINFORCEMENT SHALL BE CONTINUOUS THROUGH CONSTRUCTION JOINTS.

GRAVITY WINGWALL *CANTILEVER WINGWALL*

VERTICAL SECTION THROUGH CONSTRUCTION JOINT

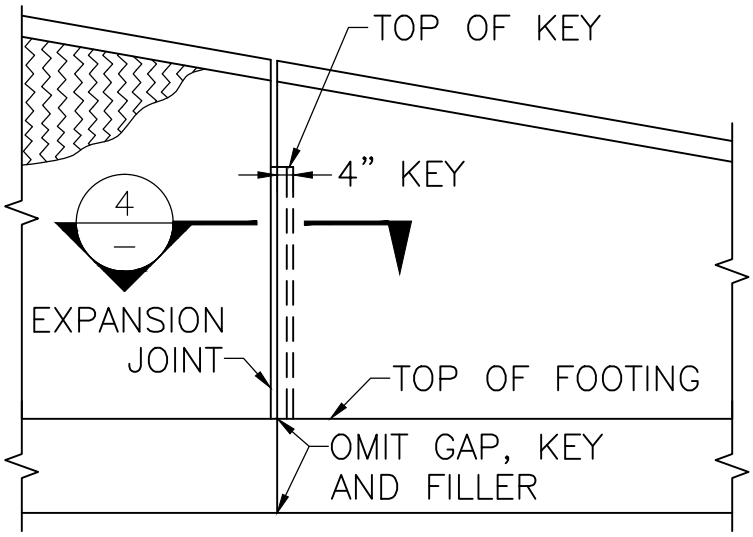
SCALE: $\frac{1}{2}$" = 1'-0"

NOTES:

1. *Construction joints shall be located at intervals of not more than 24'.*
2. *Locate construction joints by dimensions on Construction Drawings.*

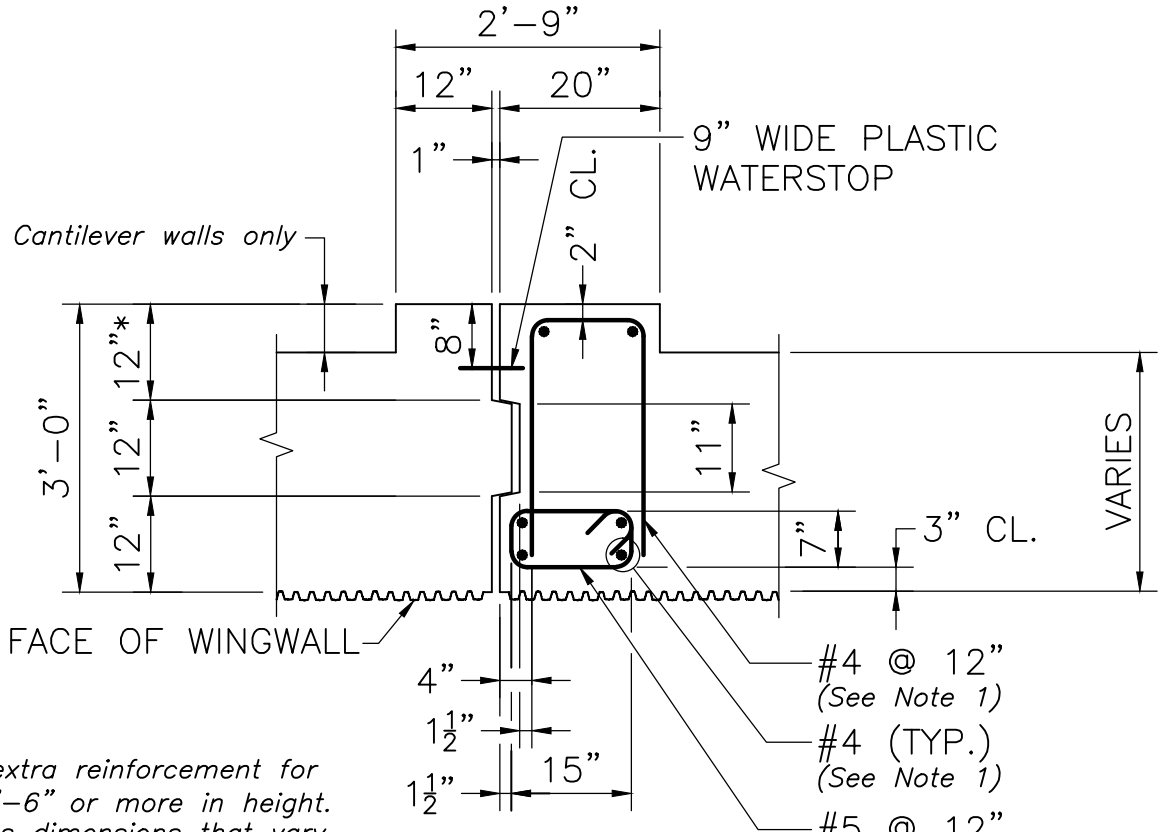
DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.2.7



WINGWALL ELEVATION

SCALE: $\frac{1}{4}$" = 1'–0"



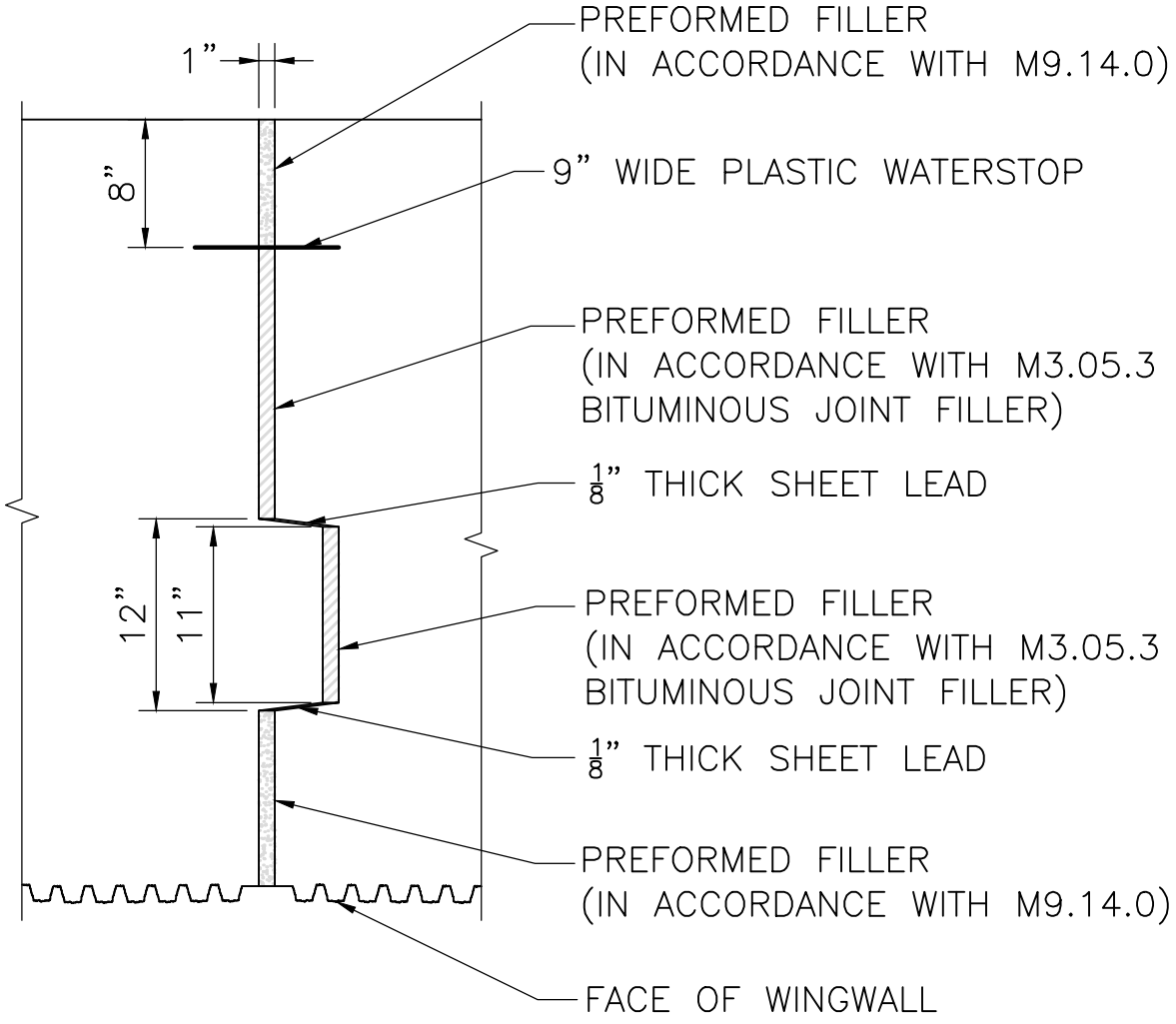
NOTES:

1. *Include extra reinforcement for walls 13'–6" or more in height.*
2. ** Denotes dimensions that vary for gravity walls.*

SECTION 4

SCALE: $\frac{1}{2}$" = 1'–0"

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	EXPANSION JOINT DETAILS WINGWALL DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.2.8**



LIMITS OF PREFORMED FILLER

SCALE: 1" = 1'–0"

massDOT Highway Division

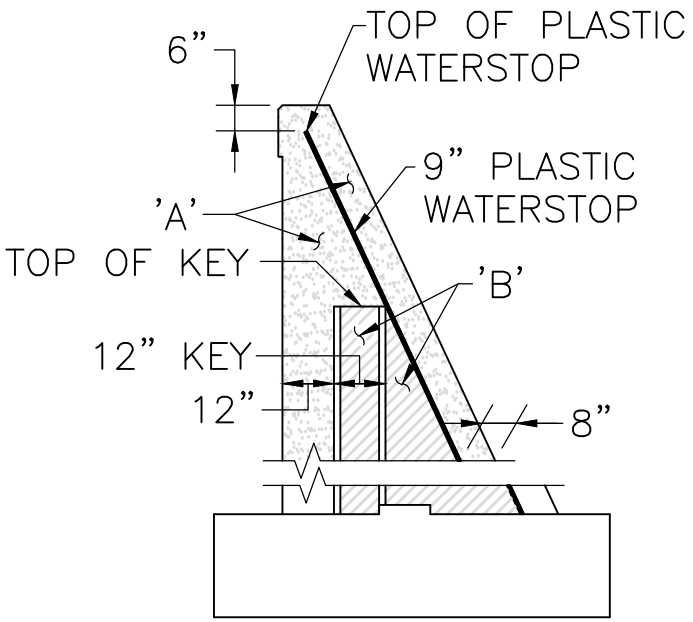
LRFD BRIDGE MANUAL, PART II

PREFORMED FILLER IN EXPANSION JOINTS

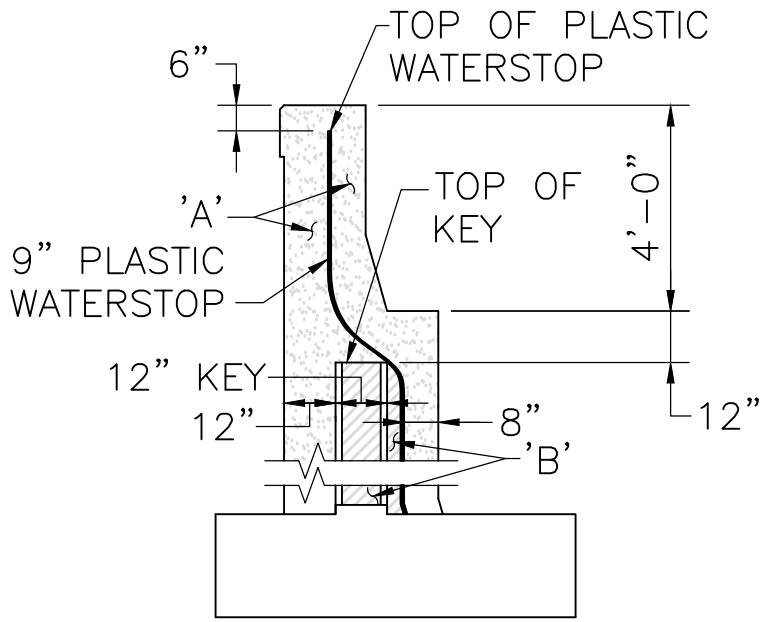
WINGWALL DETAILS

DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.2.9



GRAVITY WINGWALL



CANTILEVER WINGWALL

NOTES:

1. LONGITUDINAL REINFORCMENT SHALL END 2" CLEAR OF EXPANSION JOINT.
2. 'A' – PREFORMED FILLER (IN ACCORDANCE WITH M9.14.0).
   'B' – PREFORMED FILLER (IN ACCORDANCE WITH M3.05.3 BITUMINOUS JOINT FILLER).
3. FILLER MATERIAL SHALL BE FASTENED SECURELY TO ONE SIDE OF JOINT.

VERTICAL SECTION THRU EXPANSION JOINT

NOT TO SCALE

NOTES:

1. *Expansion joints shall be located at intervals not more than 72'. In the case of long wingwalls, the first joint in the wing from the corner of the abutment is expansion.*
2. *Locate expansion joints by dimensions on Construction Drawings.*

VERTICAL SECTION THROUGH EXPANSION JOINT

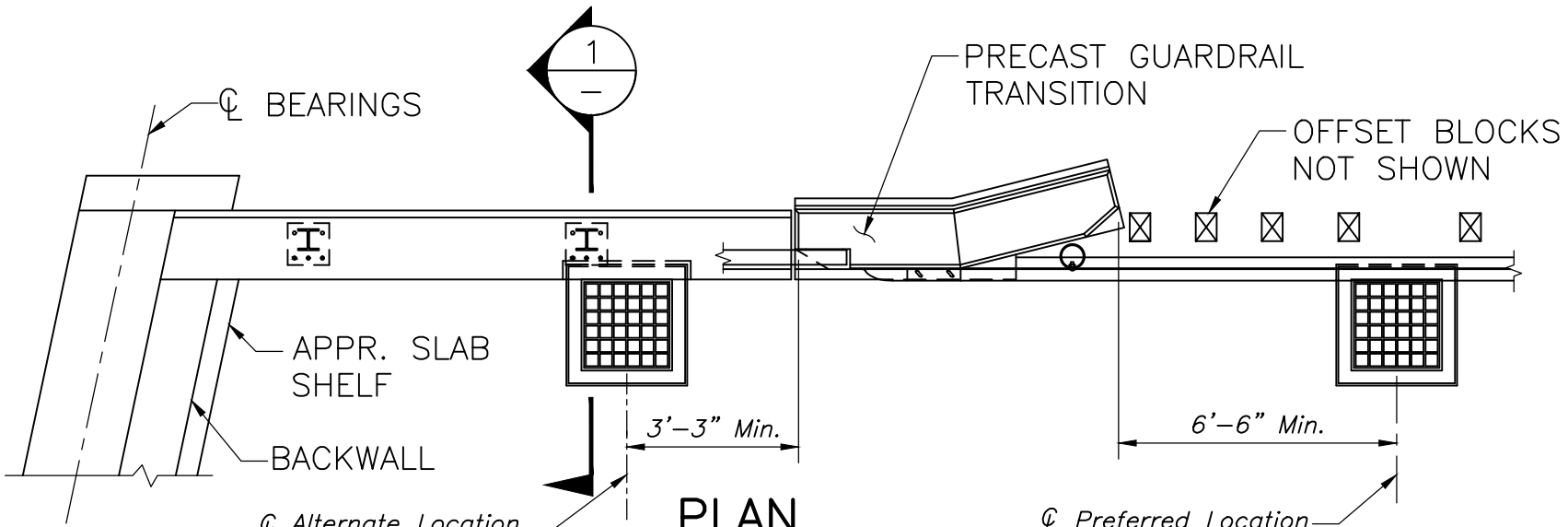
WINGWALL DETAILS

DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.2.10

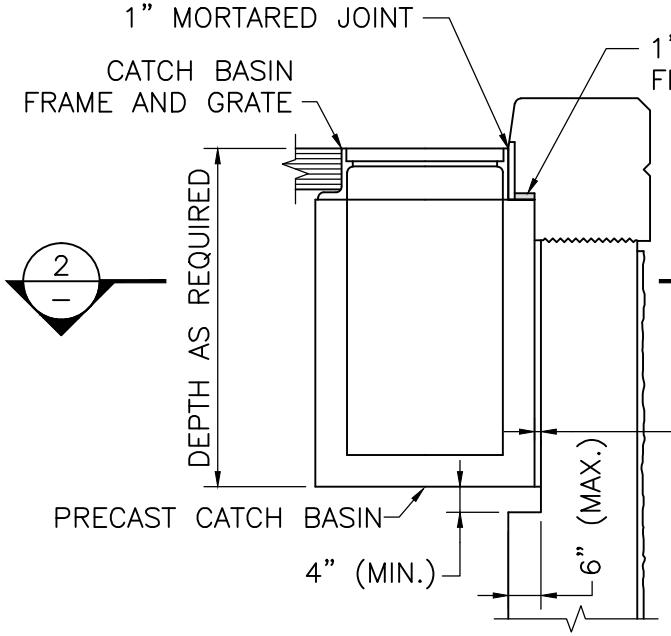
CATCH BASIN AT U-BACK WINGWALL

WINGWALL DETAILS



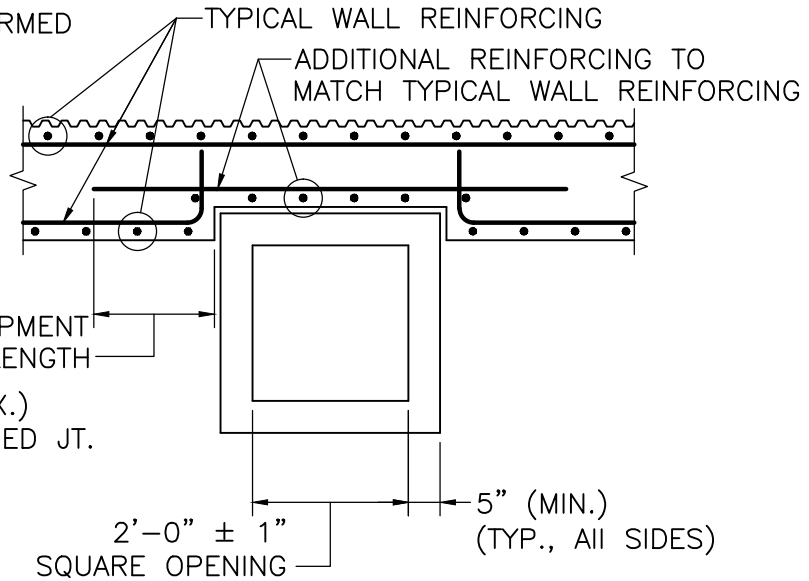
PLAN

SCALE: $\frac{1}{4}$" = 1'-0"



SECTION 1

SCALE: $\frac{1}{2}$" = 1'-0"



SECTION 2

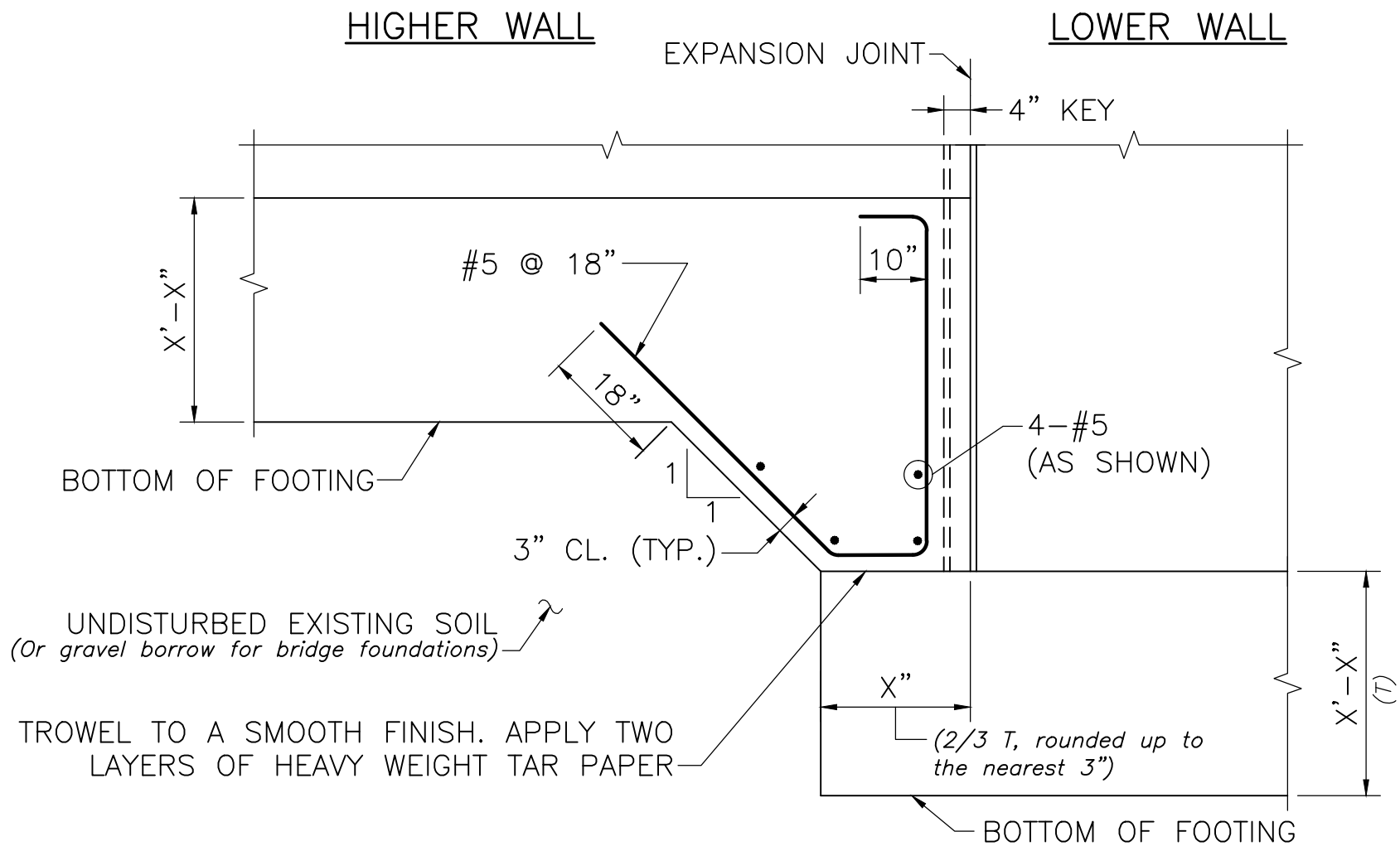
SCALE: $\frac{1}{2}$" = 1'-0"

DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.2.11

EXPANSION JOINT AT STEP

STEPPED–UP FOOTING



STEPPED–UP FOOTING DETAIL

SCALE: $\frac{1}{2}$" = 1'–0"

NOTES:

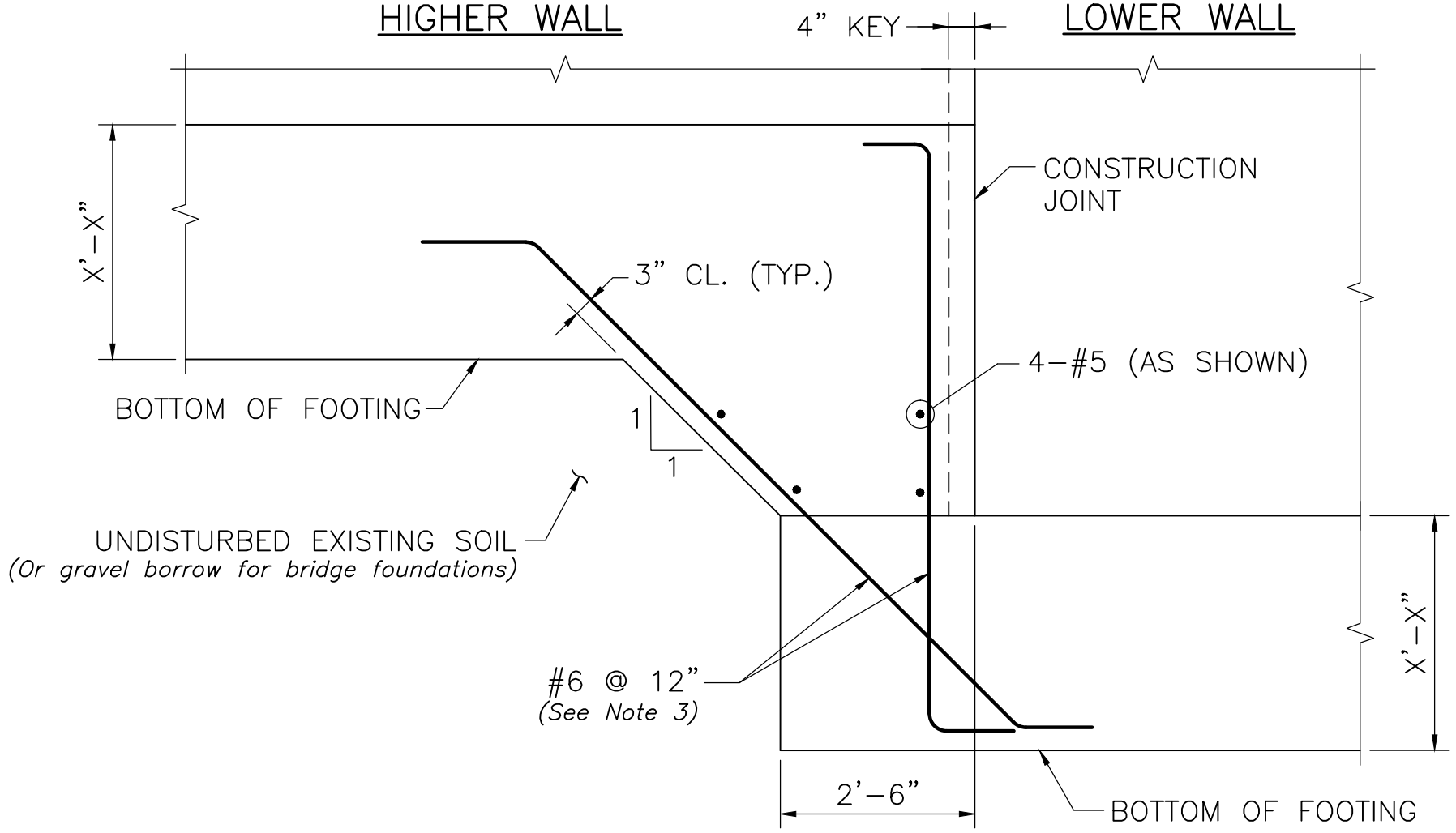
1. *This detail may be used for cantilever or gravity walls or a combination of cantilever and gravity walls.*
2. *Height of step from bottom of higher footing to bottom of lower footing shall not be excessive. A step height of about 5'–0" is reasonable.*

DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.3.1

CONSTRUCTION JOINT AT STEP

STEPPED–UP FOOTING



STEPPED–UP FOOTING DETAIL

SCALE: $\frac{1}{2}$" = 1'–0"

NOTES:

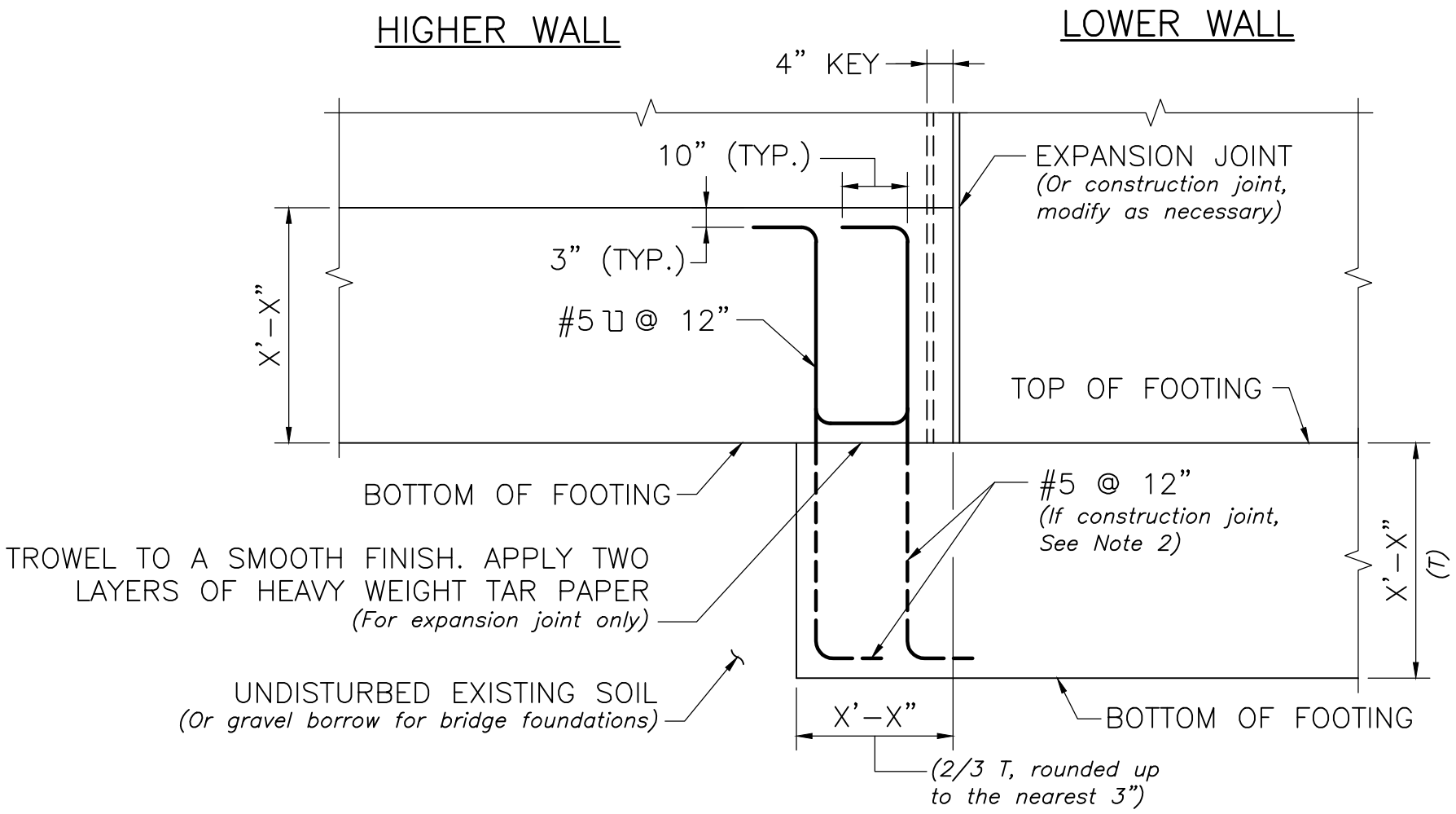
1. *This detail may be used for cantilever or gravity walls or a combination of cantilever and gravity walls.*
2. *Height of step from bottom of higher footing to bottom of lower footing shall not be excessive. A step height of about 5'–0" is reasonable.*
3. *Provide proper embedment lengths and clearances for #6 @ 12" on the Construction Drawings.*

DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.3.2

UPPER FOOTING ON LOWER FOOTING

STEPPED–UP FOOTING



STEPPED–UP FOOTING DETAIL

SCALE: $\frac{1}{2}$" = 1'–0"

NOTES:

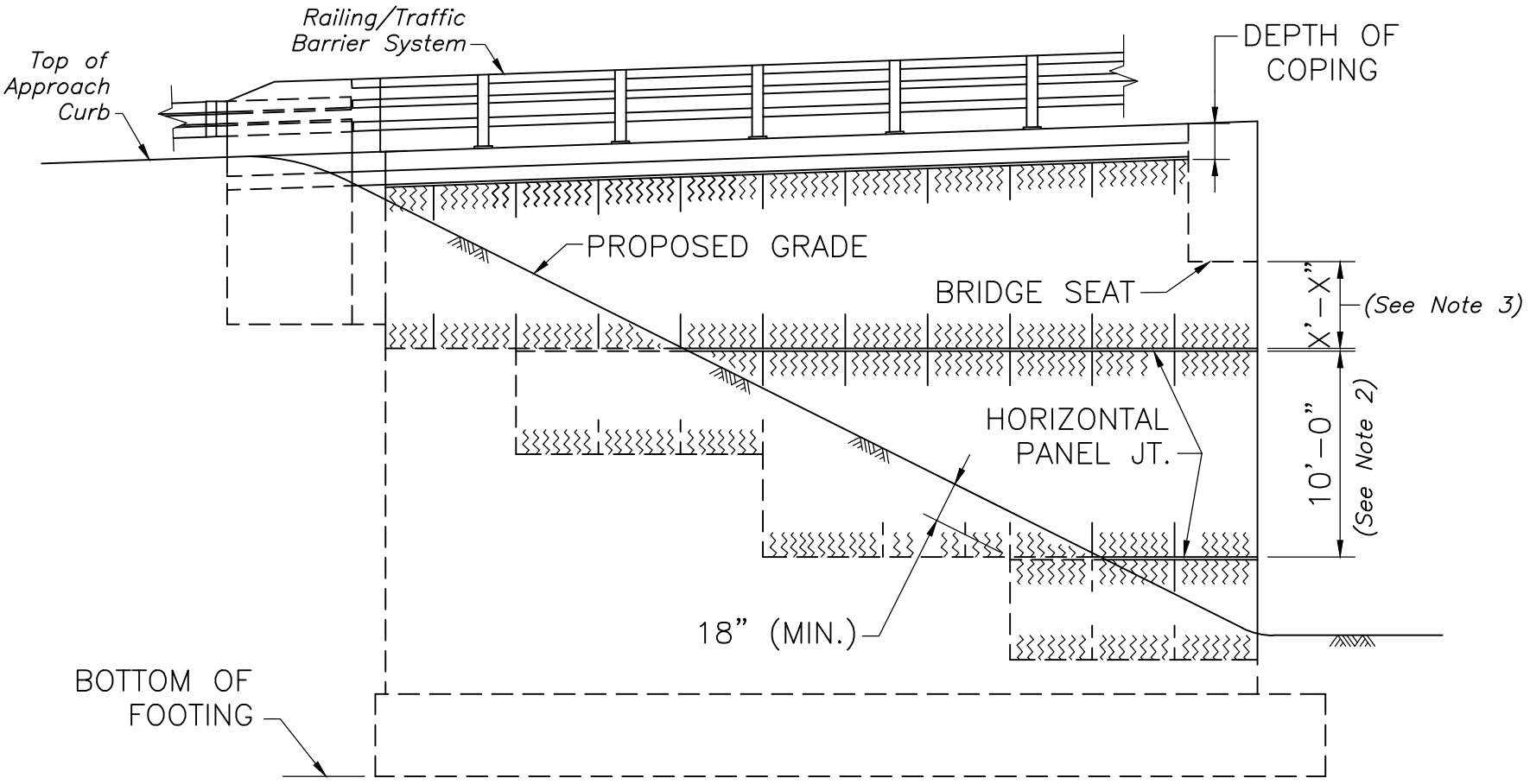
1. *This detail may be used for cantilever or gravity walls or a combination of cantilever and gravity walls.*
2. *For construction joints only, extend #5 @ 12" bars from higher footing into lower wall footing when cantilever walls are used. Provide proper embedment lengths on the Construction Drawings.*

DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.3.3

U-WINGWALLS

STRIATION DETAILS



NOTE:
HORIZONTAL PANEL JOINTS SHALL BE LEVEL.

ELEVATION

SCALE: $\frac{1}{8}$" = 1'-0"

NOTES:

1. *A detailed elevation view of the abutment and wingwalls shall be drawn to scale, without breaks, and shall include the above information and depiction of the striations. In addition it shall include all other relevant dimensions and elevations. See elevation view of splayed wingwalls for abutment details.*
2. *The nominal size of a typical striation form liner panel is 4'-0" W x 10'-0" H. These dimensions should be used as a guide in laying out the location of the construction, expansion, and horizontal panel joints.*
3. *Set horizontal panel joint a minimum of 4'-0" below the lowest point of the bridge seat. All other horizontal panel joints shall be dimensioned from this one. All joint lines shall be continuous across wingwalls and abutments.*

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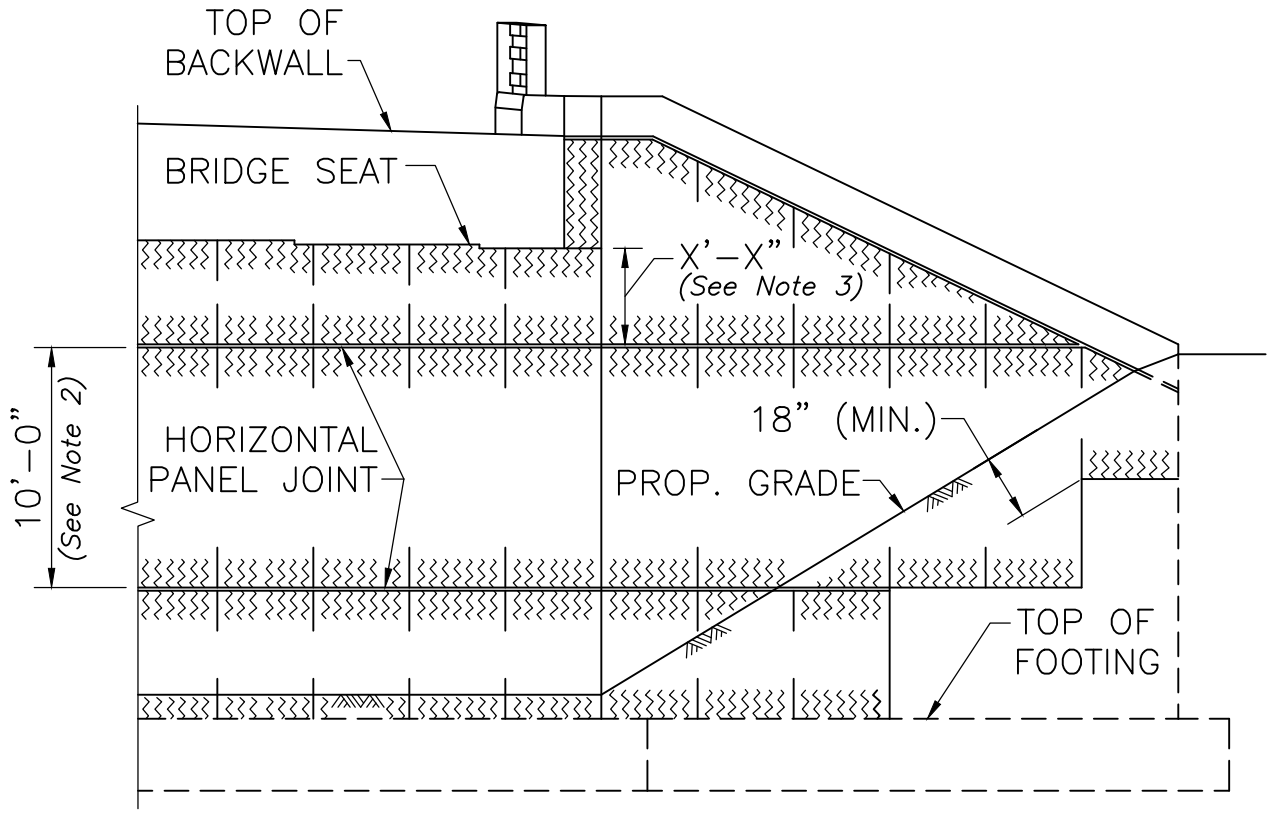
DRAWING NUMBER
3.4.1



NOTE:

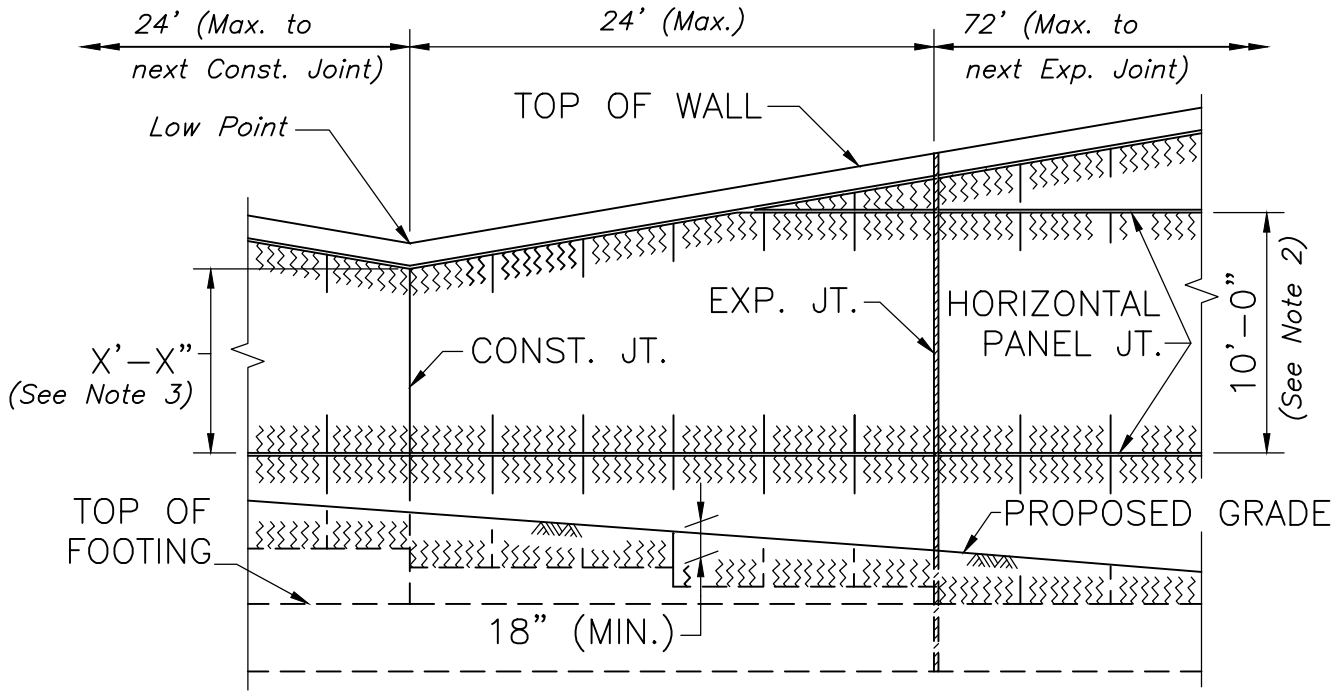
HORIZONTAL PANEL JOINTS SHALL BE LEVEL.

ELEVATION

SCALE: $\frac{1}{8}$" = 1'–0"

NOTES:

1. *A detailed elevation view of the abutment and wingwalls shall be drawn to scale, without breaks, and shall include the above information and depiction of the striations. In addition it shall include all other relevant dimensions and elevations.*
2. *The nominal size of a typical striation form liner panel is 4'–0" W x 10'–0" H. These dimensions should be used as a guide in laying out the location of the construction, expansion, and horizontal panel joints.*
3. *Set horizontal panel joint a minimum of 4'–0" below the lowest point of the bridge seat. All other horizontal panel joints shall be dimensioned from this one. All joint lines shall be continuous across wingwalls and abutment.*



NOTE:

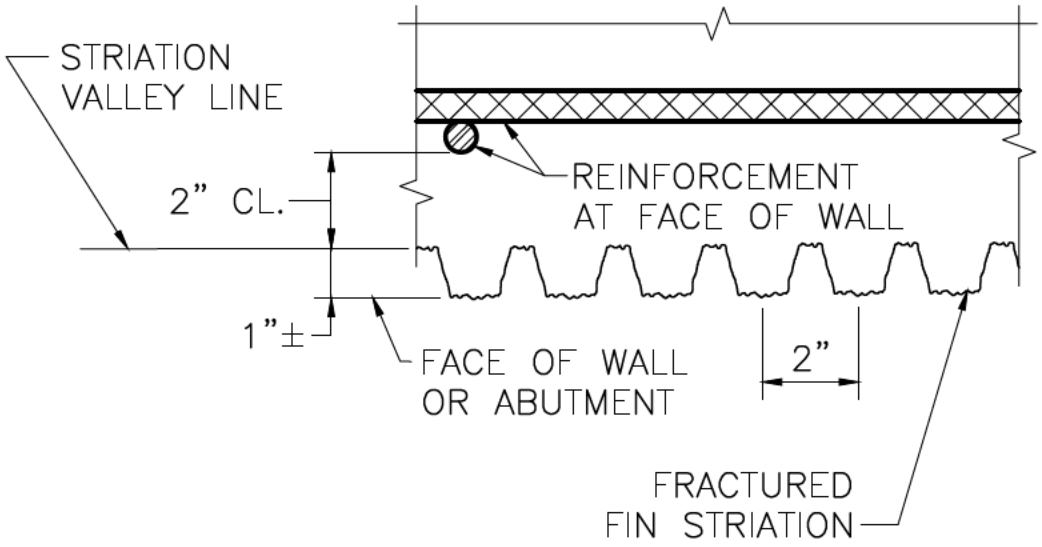
HORIZONTAL PANEL JOINTS SHALL BE LEVEL.

ELEVATION

SCALE: $\frac{1}{8}$" = 1'-0"

NOTES:

1. *A detailed elevation view of a retaining wall shall be drawn to scale and shall include the above information and depiction of the striations. In addition, it shall include all other relevant dimensions and elevations.*
2. *The size of a nominal typical striation form liner panel is 4'-0" W x 10'-0" H. These dimensions should be used as a guide in laying out the location of the construction, expansion, and horizontal panel joints.*
3. *When a horizontal panel joint will not intercept the top of wall coping, set this horizontal joint a minimum of 4'-0" below the lowest point on the wall. Any smaller dimensions may cause the sloping coping lines to clash visually with the level hoizontal joint.*
4. *If a long retaining wall abuts or extends from a bridge abutment or wingwall, the horizontal joints should be continuous through all striated wall surfaces.*



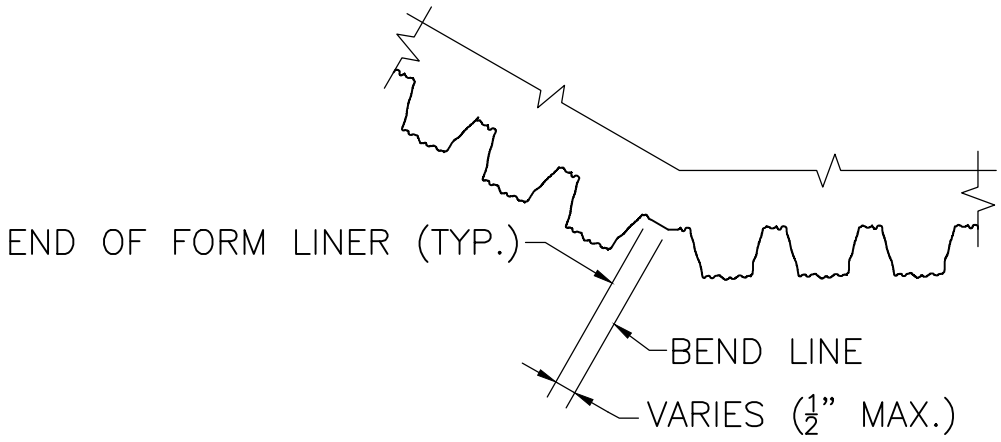
NOTES:

1. THE CONTRACTOR SHALL MAKE SURE THAT THE STRIATION FINS ARE PLUMB AND LINED UP VERTICALLY FROM PANEL TO PANEL FOR THE FULL HEIGHT OF THE WALL.

2. THE HORIZONTAL JOINT MAY BE OMITTED IF THE CONTRACTOR CAN DEMONSTRATE THAT THE FORM LINER PANELS CAN BE INSTALLED END TO END WITHOUT CREATING A VISIBLE SEAM IN THE FINAL CAST CONCRETE.

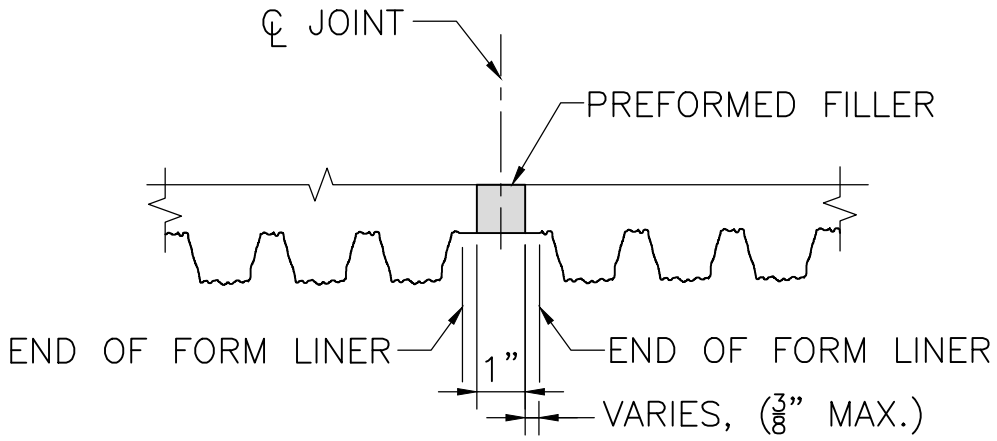
TYPICAL STRIATION DETAIL

SCALE: 3" = 1'-0"



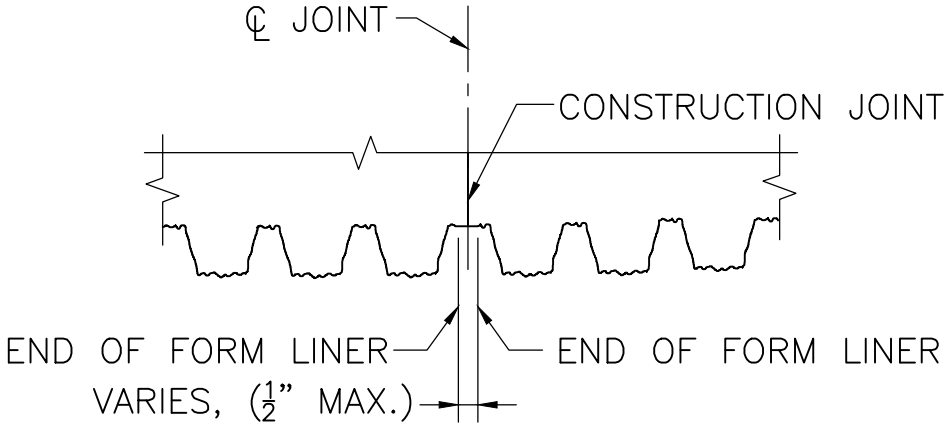
DETAIL AT WALL CORNER

SCALE: 3" = 1'–0"



EXPANSION JOINT

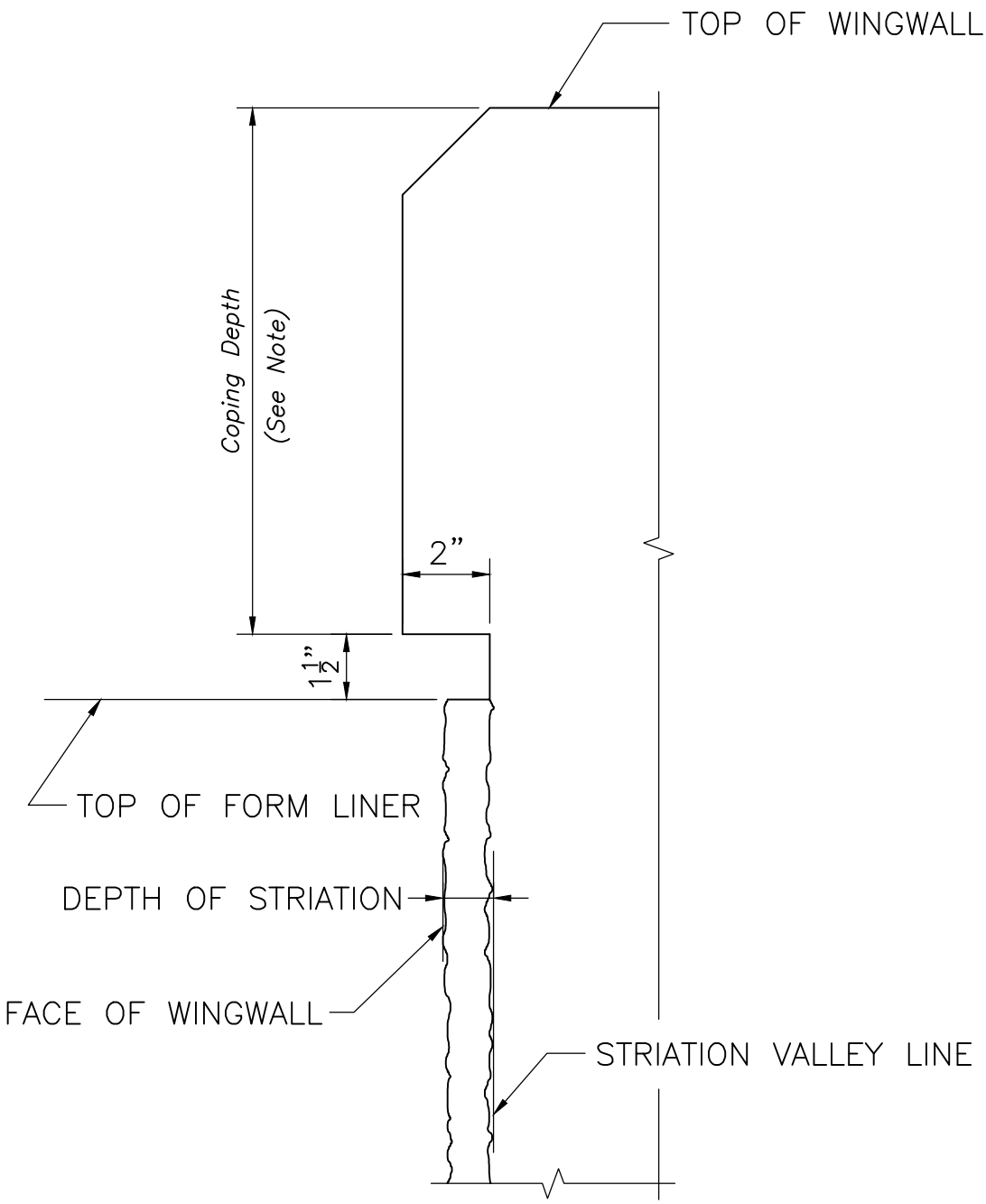
SCALE: 3" = 1'–0"



CONSTRUCTION JOINT

SCALE: 3" = 1'–0"

massDOT Highway Division LRFD BRIDGE MANUAL, PART II	DETAILS AT CORNERS AND JOINTS STRIATION DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.4.5**

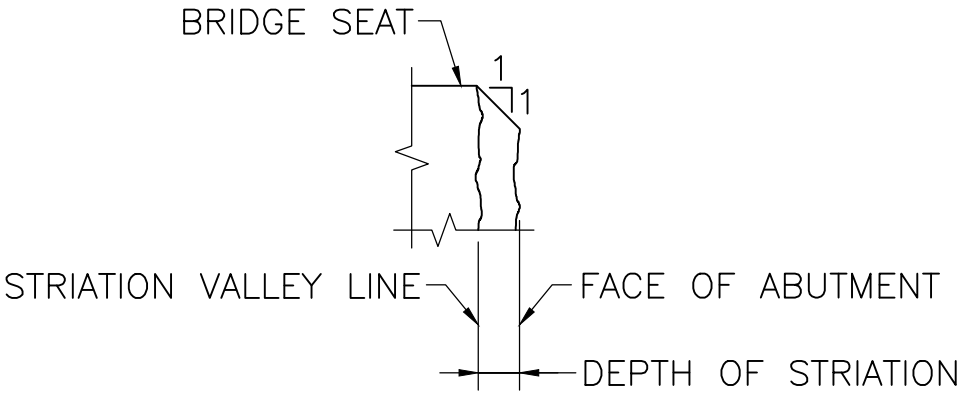


DETAIL AT TOP OF WINGWALL

SCALE: 3" = 1'–0"

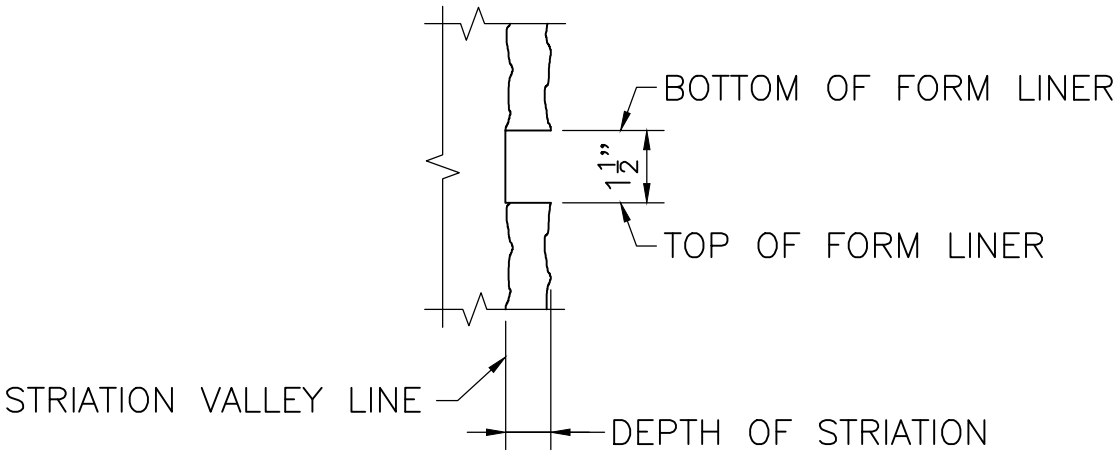
NOTE:

For Splayed Wingwalls, coping depth is 12" with 2" chamfer at the top. For U–Wingwalls, match the detail shown in the Top of Wingwall Details (Chapter 9, Railing/Traffic Barrier Systems) for the type of bridge rail used.



DETAIL AT BRIDGE SEAT

SCALE: 3" = 1'–0"

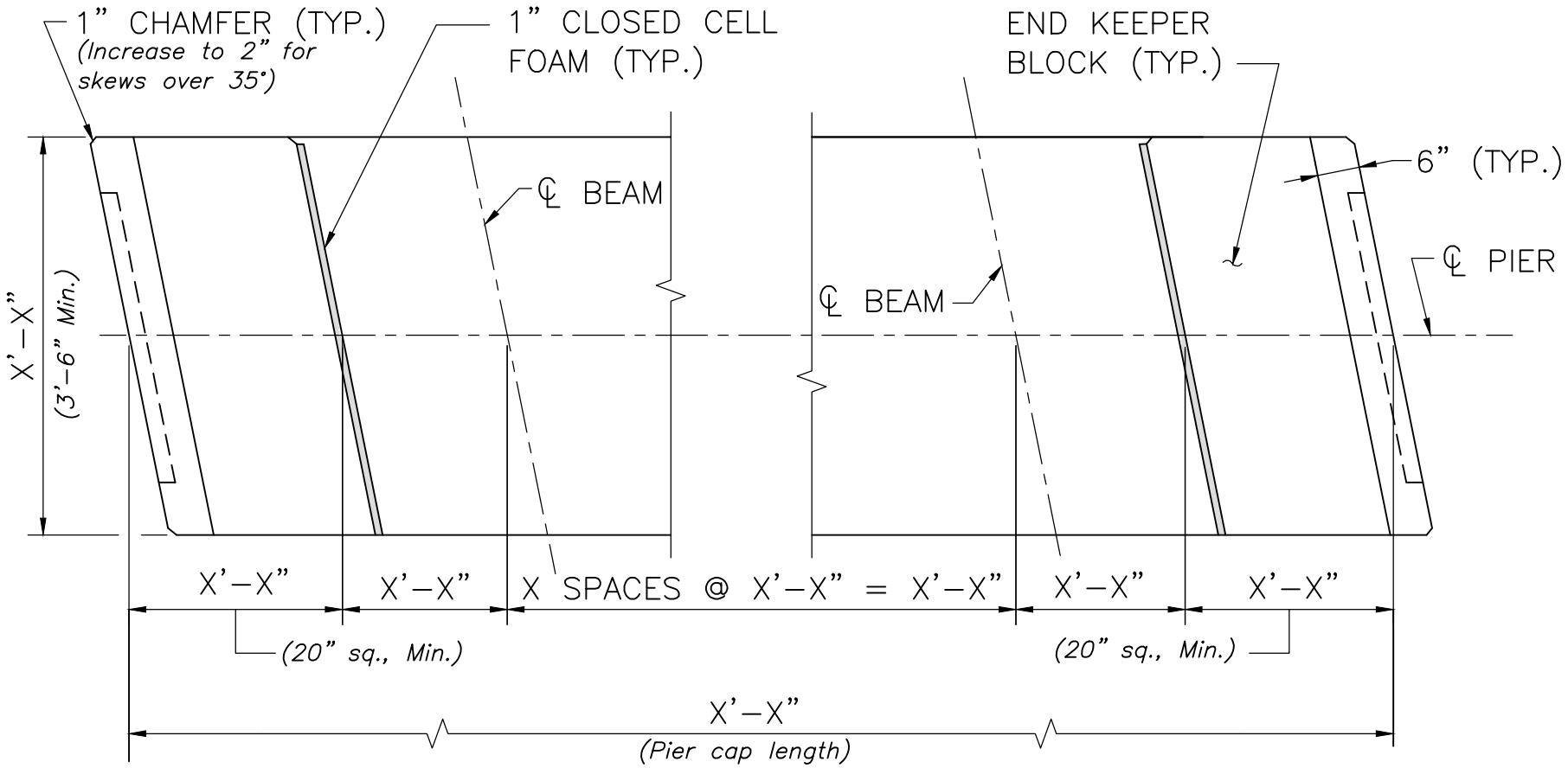


HORIZONTAL PANEL JOINT

SCALE: 3" = 1'–0"

TYPICAL PLAN

PIER DETAILS



PLAN OF PIER

SCALE: $\frac{1}{2}$" = 1'-0"

NOTES:

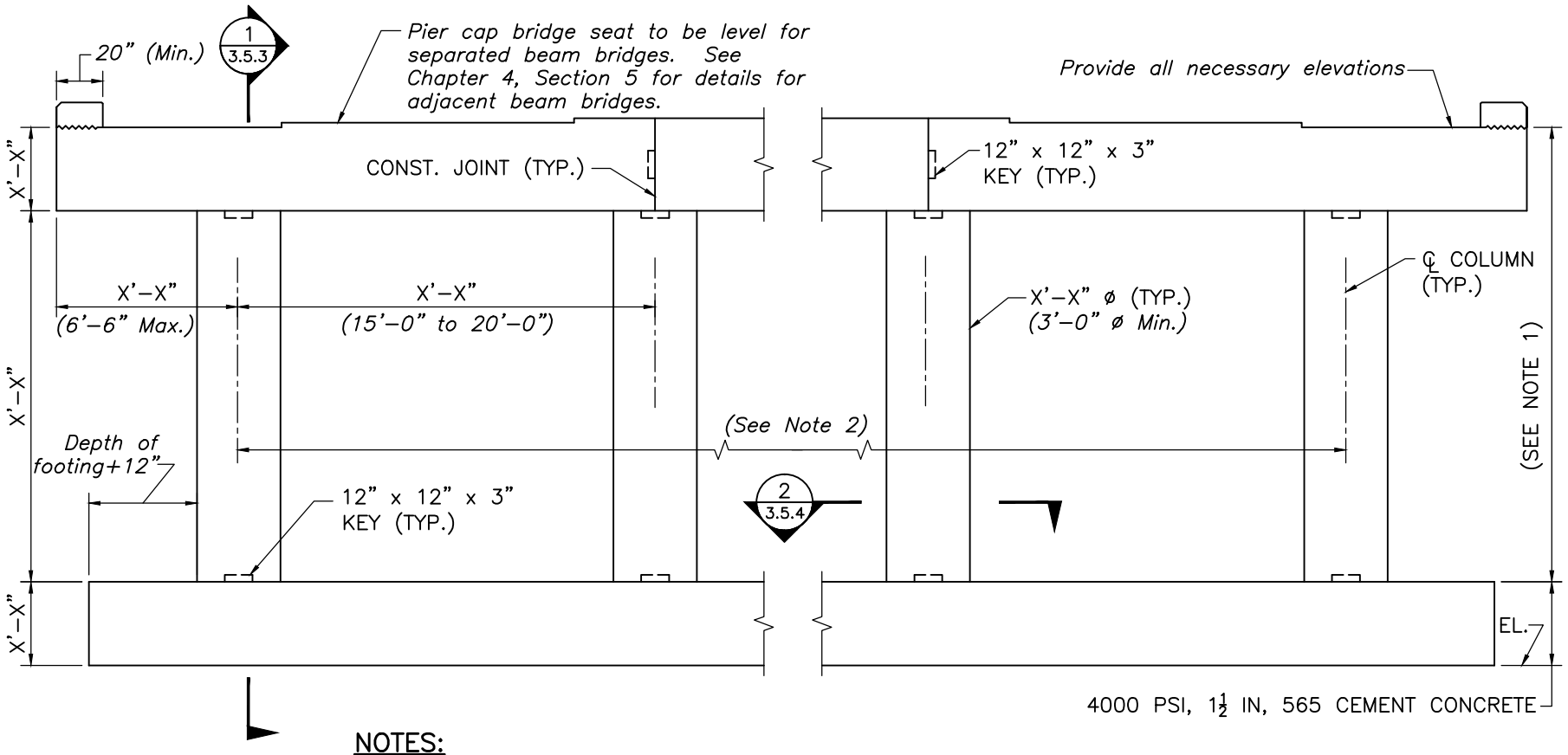
1. *General plan view of pier shown. See Chapters 4, 5 & 6 for details.*
2. *Plan view of pier shall be drawn without breaks and to scale on the Construction Drawings. Include footing and all relevant dimensions, angles, survey information and North Arrow.*

DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.5.1

TYPICAL TRANSVERSE SECTION

PIER DETAILS



NOTES:

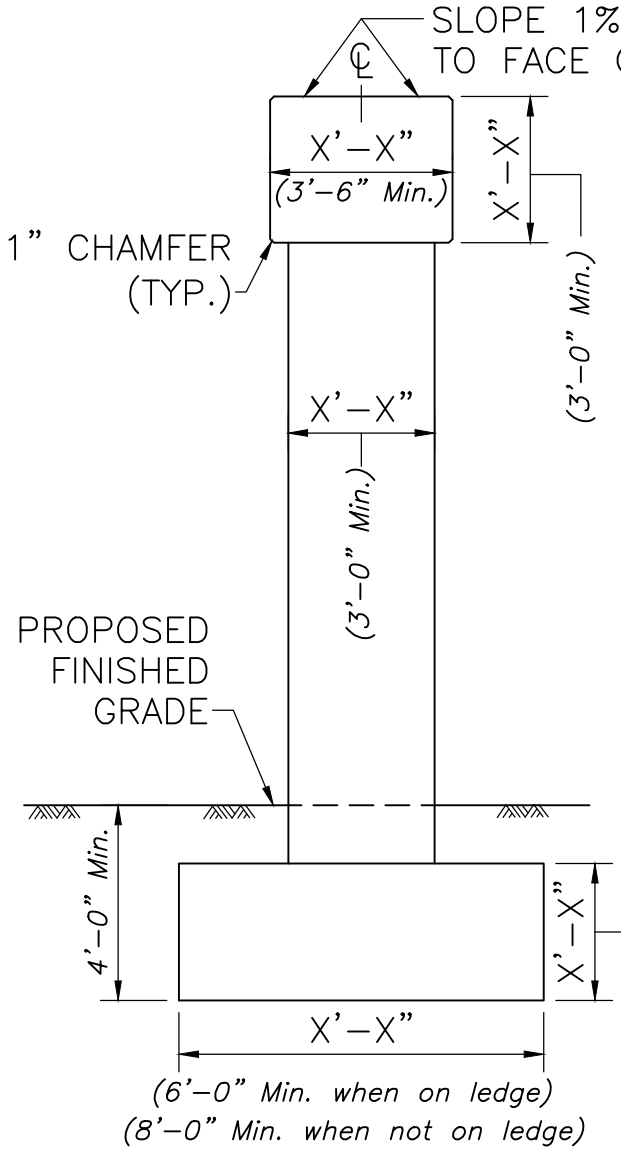
1. 4000 PSI, ¾ IN, 585 HP CEMENT CONCRETE. *(corrosive environments)*
   4000 PSI, ¾ IN, 610 CEMENT CONCRETE. *(non-corrosive environments)*
2. ALL KEYS TO BE SLIGHTLY TAPERED.

TRANSVERSE SECTION OF PIER

SCALE: ¼" = 1'-0"

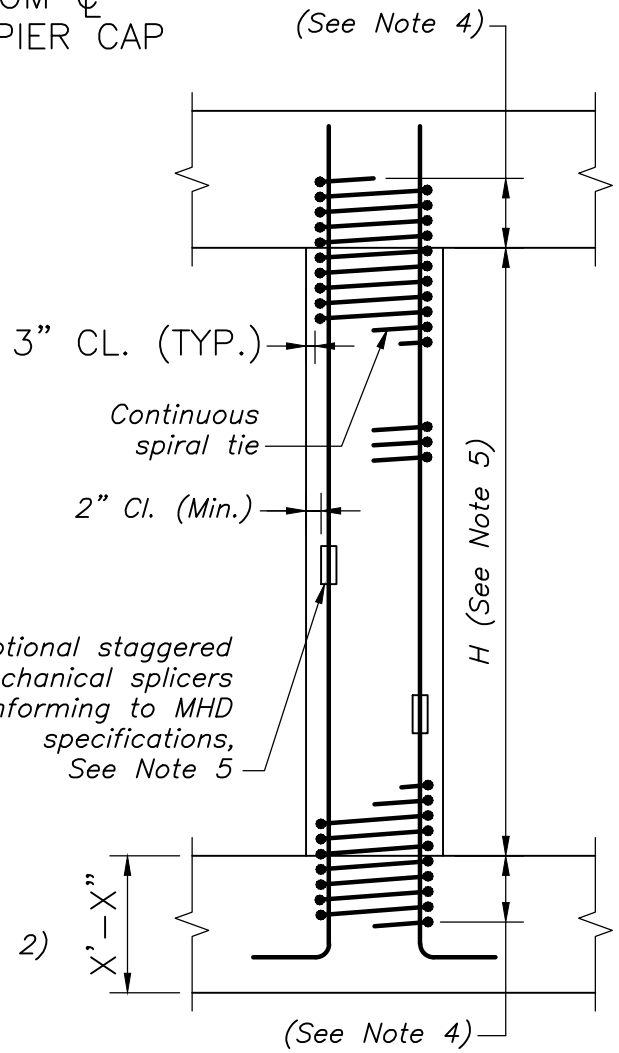
NOTES:

1. *The transverse section shall be drawn without breaks and to scale on Construction Drawings and all pier cap and footing reinforcement shall be included. Locate this section under the plan view of the pier.*
2. *If the dimension from center line to center line of exterior columns exceeds 80'-0", provide two (2) separate pier caps on continuous footing.*
3. *Provide crash wall or solid pier where required by railroad or hydraulics.*
4. *Bottom of pier cap should be level. However, if the height of one end of the pier cap exceeds 1.5 times the height of the other end, bottom of the pier cap may be sloped to stay within these limits.*



SECTION 1

SCALE: $\frac{1}{4}$" = 1'–0"



TYPICAL REINFORCEMENT

SCALE: $\frac{1}{4}$" = 1'–0"

NOTES:

1. *The vertical column section shall be included on the construction plans with all reinforcement labeled. Provide proper embedment lengths.*
2. *Maximum depth of footing shall be 3'–0" for footings on subsoil, 3'–6" for footings on piles, and 2'–6" for footings on ledge.*
3. *Use continuous footings where footing is on subsoil or piles. Use individual footings where footing is on ledge.*
4. *Extend spirals into footing and pier cap as required by AASHTO Seismic Design Specifications.*
5. *For H less than 30'–0", no lap splice is allowed. For H of 30'–0" or more splices are allowed in center half of column and shall conform to AASHTO Seismic Design Specifications. If mechanical splicers are used their effect on the column capacity should be accounted for in the column design.*

massDOT Highway Division

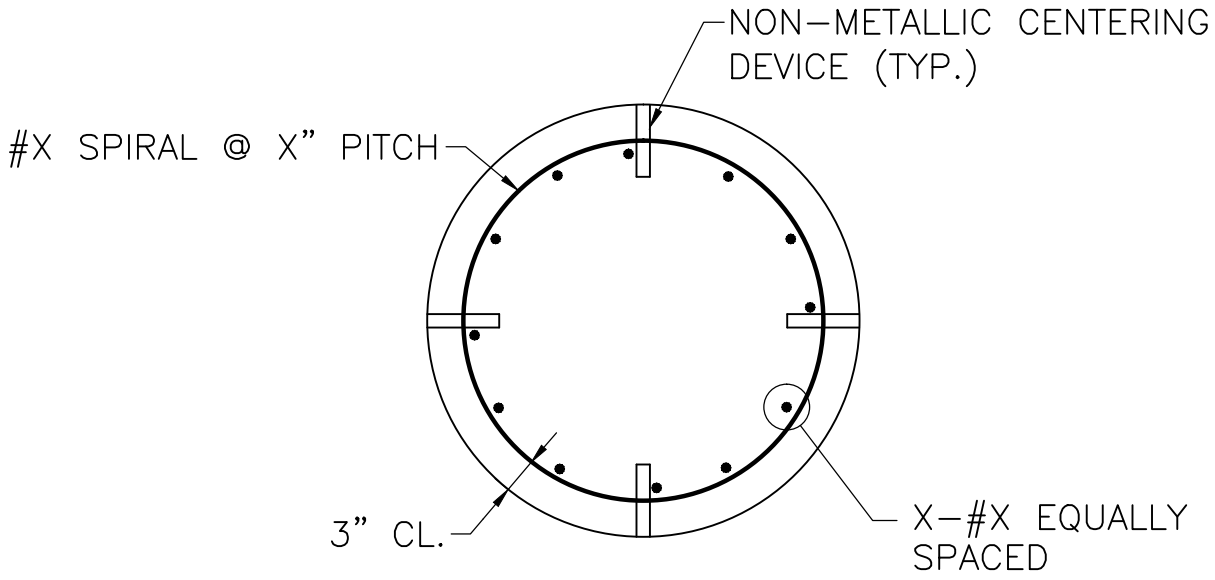
LRFD BRIDGE MANUAL, PART II

TYPICAL COLUMN VERTICAL SECTION

PIER DETAILS

DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.5.3



NOTE:

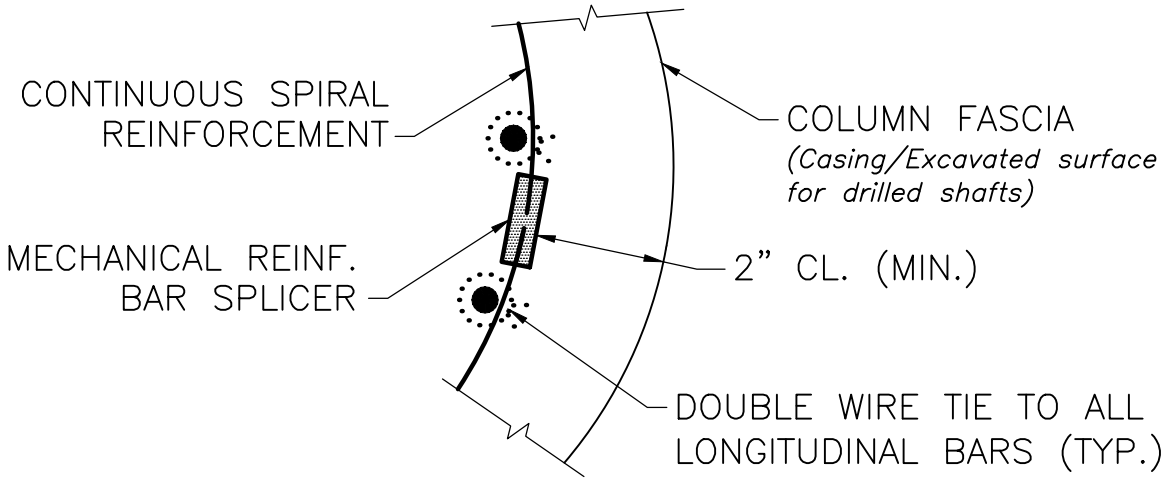
NON–METALLIC CENTERING DEVICES TO BE PLACED AT 1/4 POINTS IN COLUMN. DETAILS OF ALTERNATIVE CENTERING DEVICES MUST BE SUBMITTED TO AND APPROVED BY THE DIRECTOR OF BRIDGES AND STRUCTURES.

NOTE:

Include non–metallic centering device detail from Dwg. No. 3.6.10 on Construction Drawings.

SECTION 2

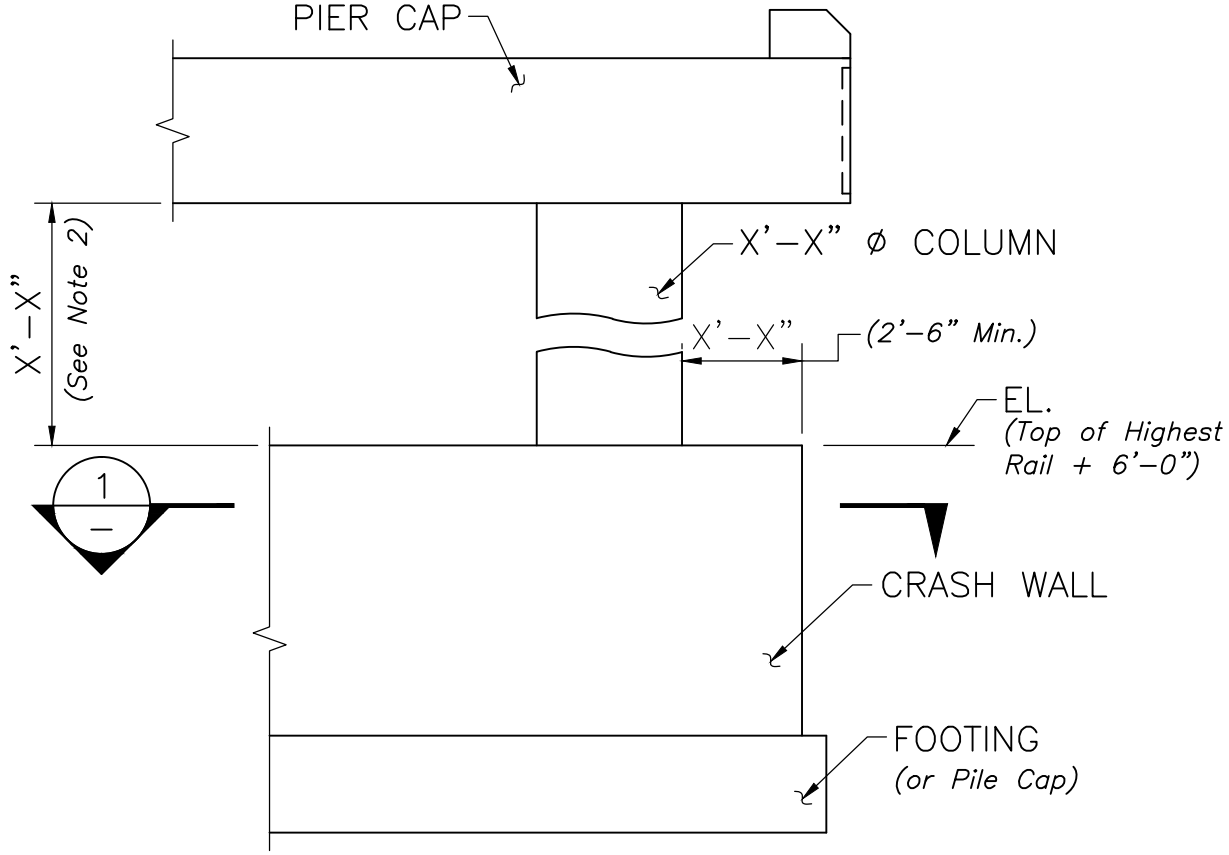
SCALE: $\frac{3}{4}$" = 1'–0"



SPIRAL REINFORCEMENT SPLICE DETAIL

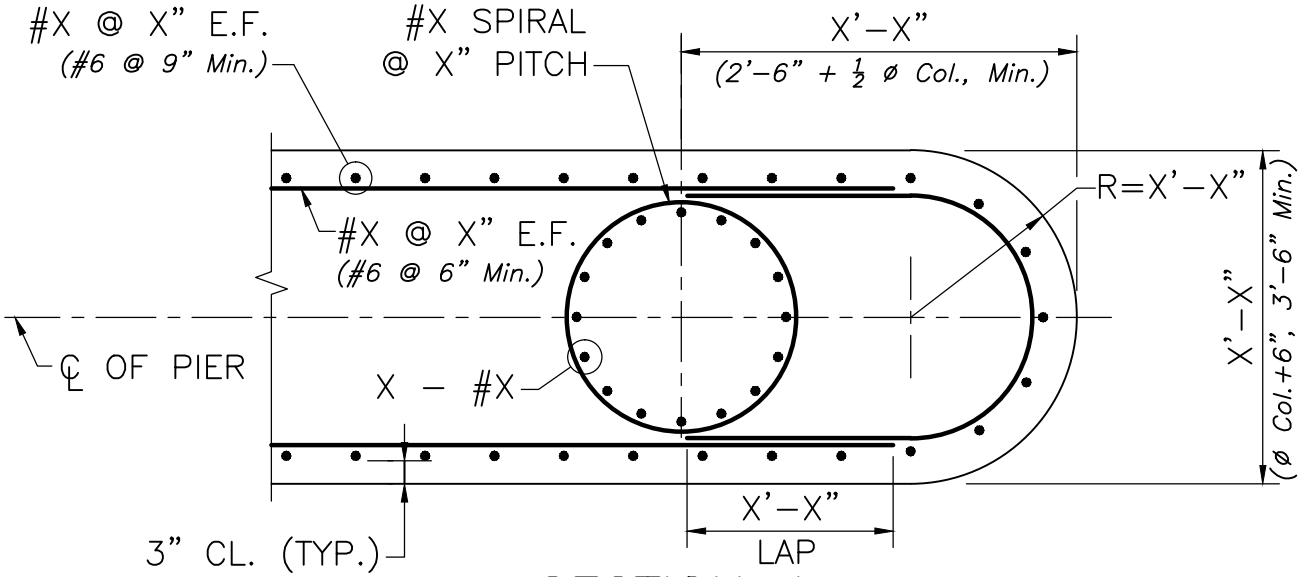
NOT TO SCALE

NOTE:
This detail is also applicable to the drilled shafts.
(See Note 9 on Dwg. No. 3.6.11)



ELEVATION OF PIER

SCALE: $\frac{1}{4}$" = 1'–0"



SECTION 1

SCALE: $\frac{1}{2}$" = 1'–0"

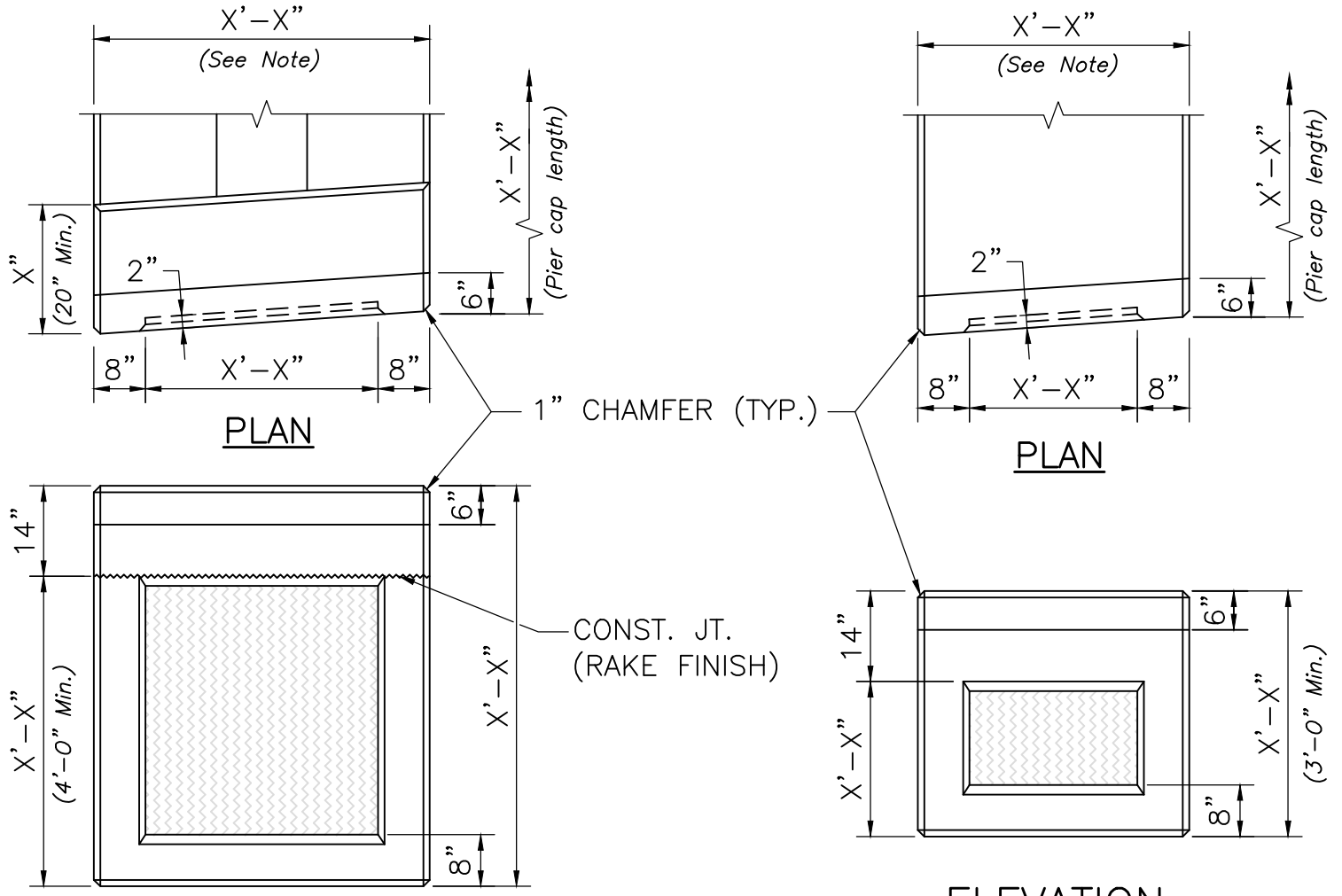
NOTES:

1. *Details shown above shall be included with all other information shown on Dwg. No. 3.5.2.*
2. *The height of the columns shall be 10' minimum. Otherwise, solid type pier shall be used.*

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	CRASH WALL DETAILS PIER DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.5.5**

PIER CAP ENDS

PIER DETAILS



PIER CAP ENDS

SCALE: $\frac{1}{2}$" = 1'–0"

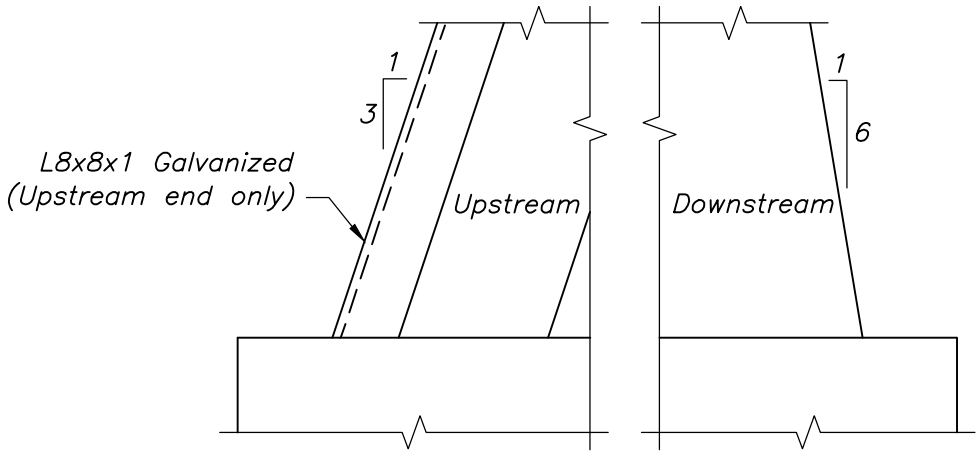
NOTE:

This dimension shall be as follows:

- *4'–4" (Min.) for NEBT beams, separated Box beam and NEXT F Beam superstructures.*
- *3'–6" (Min.) for Steel beam superstructures.*

DATE OF ISSUE
JUNE 2013

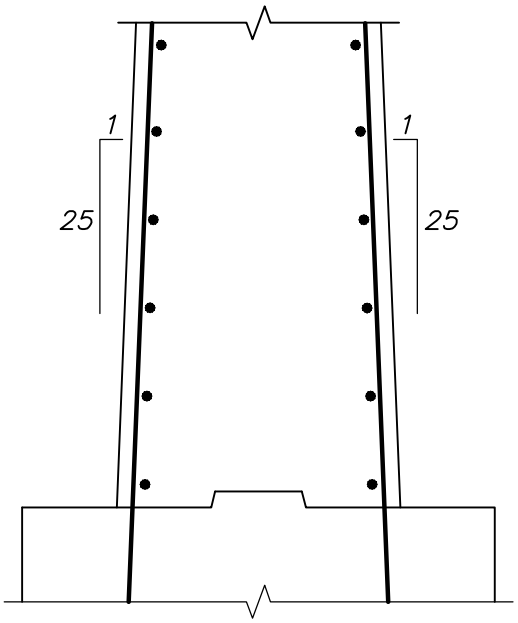
DRAWING NUMBER
3.5.6



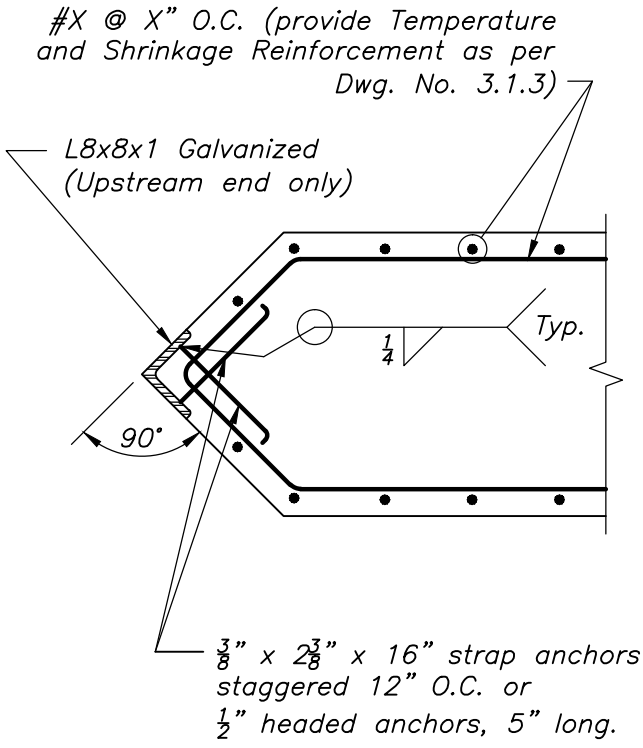
NOTE:

Upstream noses to have galvanized steel L8x8x1 from footing to 2'–0" above design flood water.

ELEVATION



SECTION

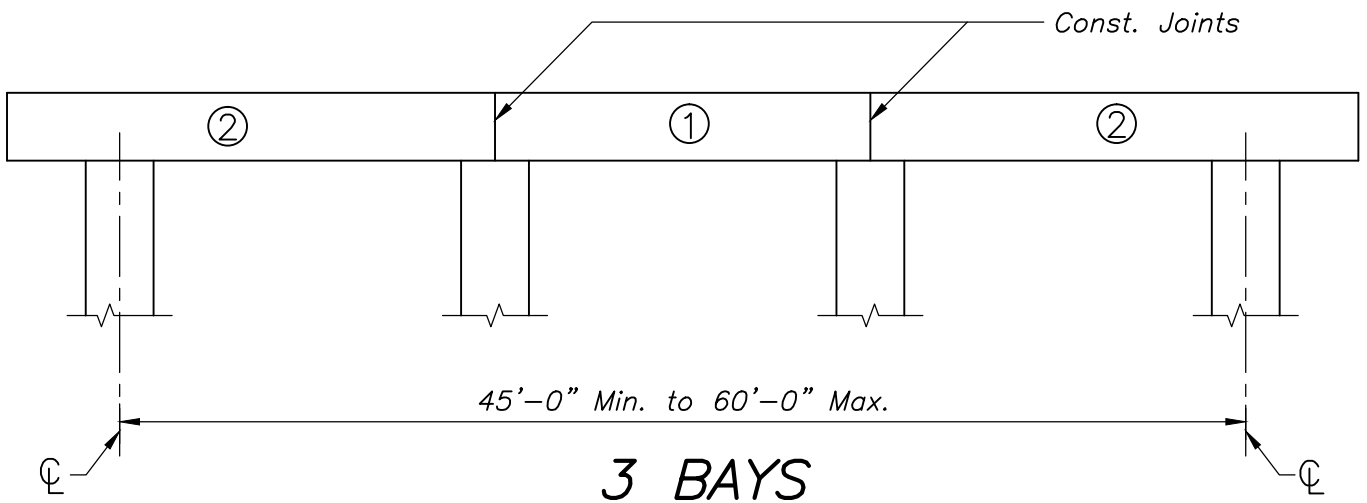


NOSE DETAIL

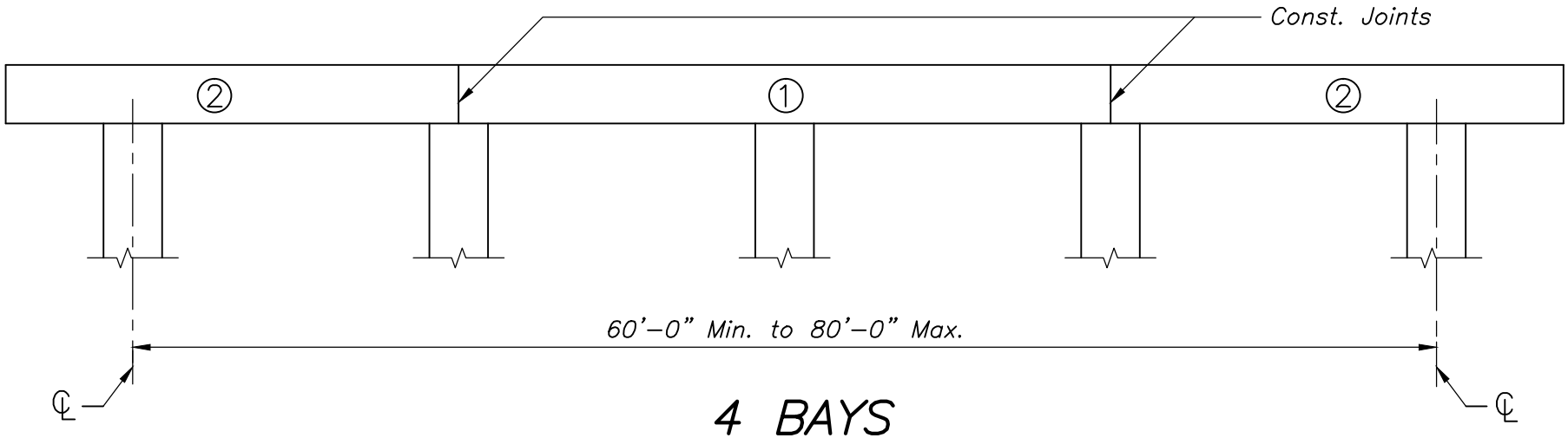
MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	MODIFICATIONS FOR RIVER PIERS PIER DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.5.7**

PIER CAP PLACEMENT SEQUENCE

PIER DETAILS



3 BAYS



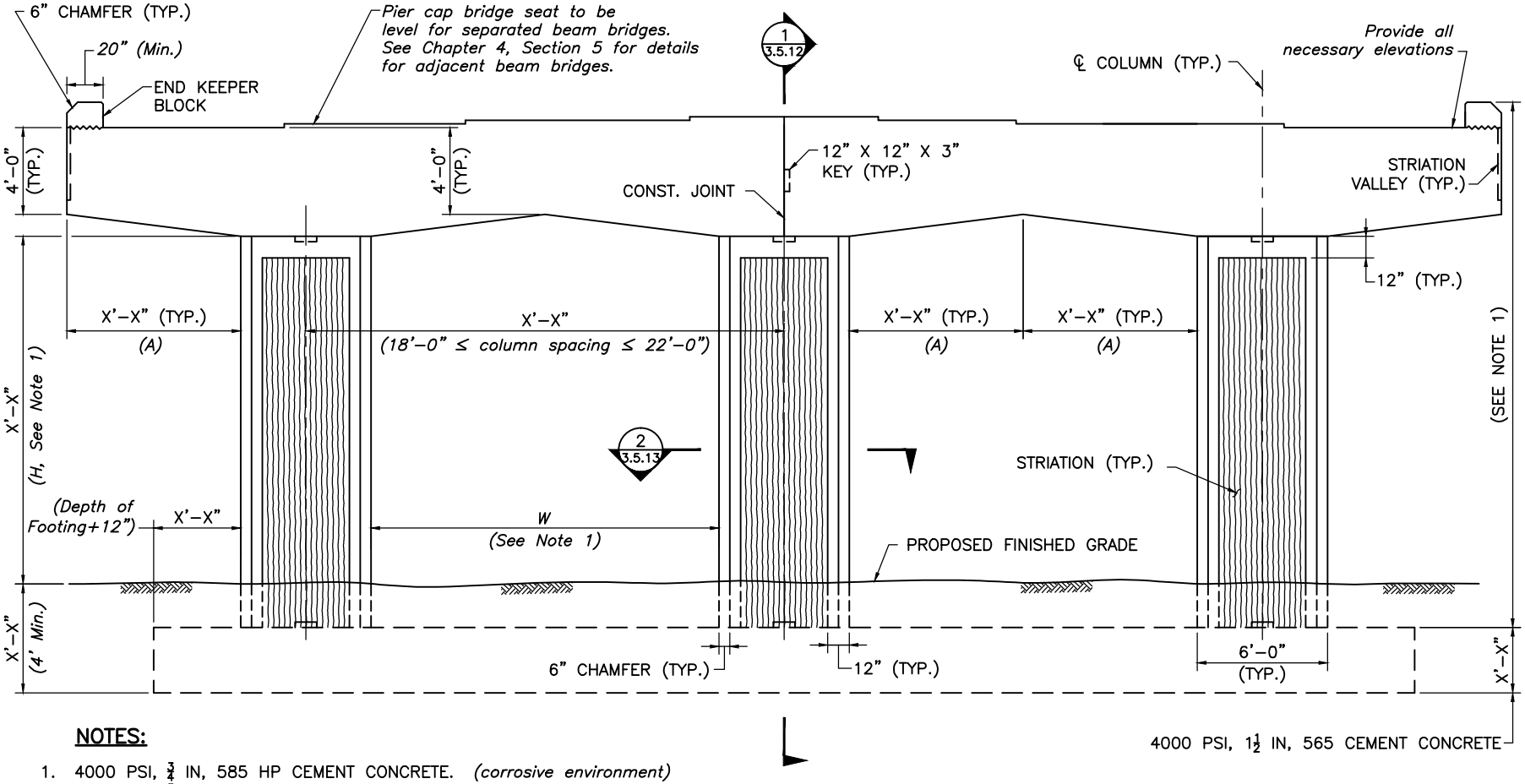
4 BAYS

NOTES:

1. Place segments (1) first. Place segments (2) not less than 24 hours after the completion of placement segments (1). Forms to be stripped as prescribed in the specifications. Note the placement sequence and 24 hour minimum set time on the construction plans.
2. For 5 or more bays over 80'–0", see Note 2 on Dwg. No. 3.5.2.

DATE OF ISSUE
JUNE 2013

AESTHETIC PIER – TYPICAL TRIPLE COLUMN ELEVATION
18'–0" ≤ COLUMN SPACING ≤ 22'–0"
PIER DETAILS



NOTES:

1. 4000 PSI, ¾ IN, 585 HP CEMENT CONCRETE. *(corrosive environment)*
   4000 PSI, ¾ IN, 610 CEMENT CONCRETE. *(non–corrosive environment)*
2. ALL KEYS TO BE SLIGHTLY TAPERED.

(18'–0" ≤ COLUMN SPACING ≤ 22'–0")

TYPICAL TRIPLE COLUMN PIER ELEVATION

SCALE: ¼" = 1'–0"

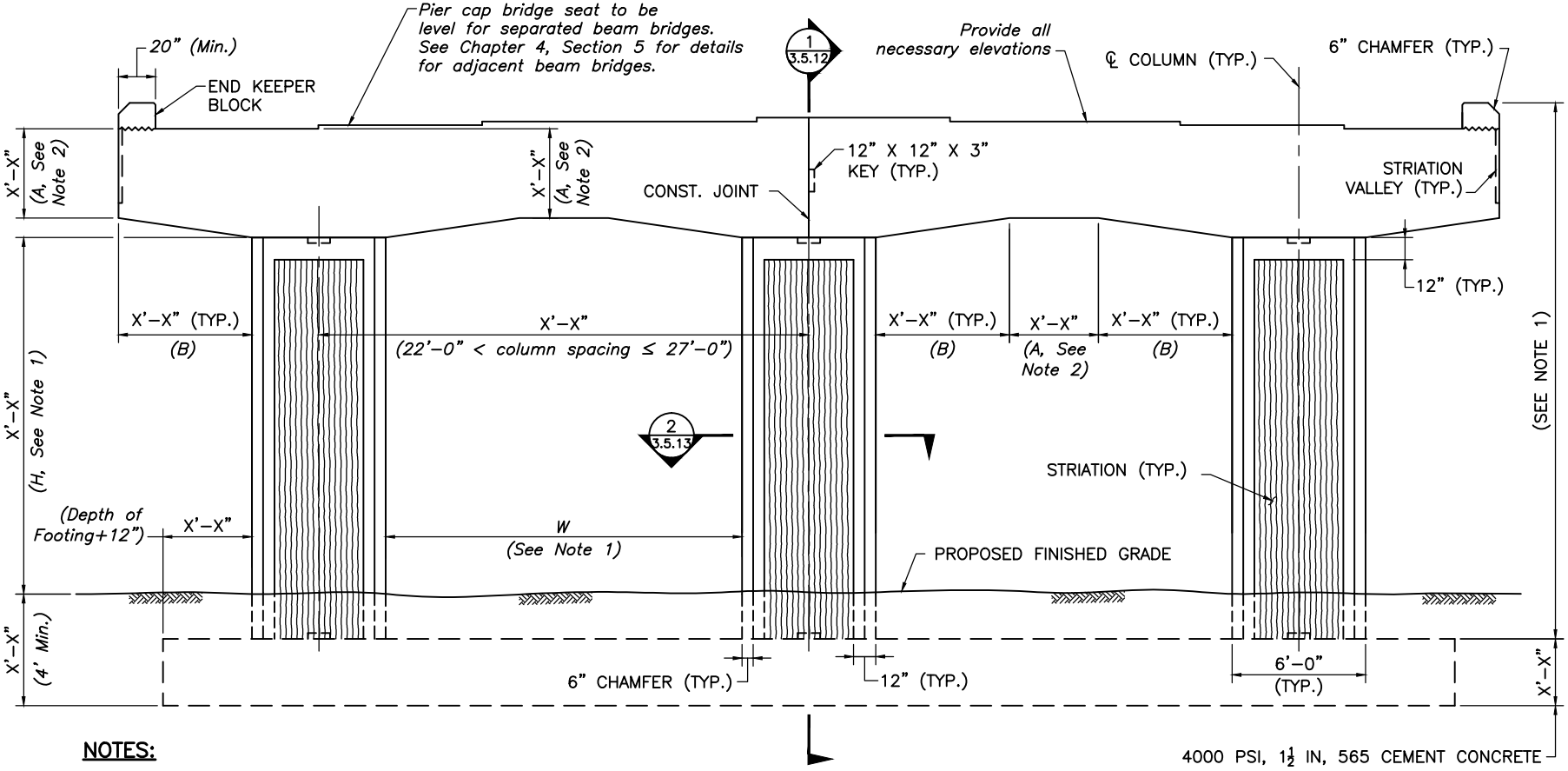
NOTES:

1. *W ≤ H ≤ 1.5W*
2. *A = Varies from 6'–0" to 8'–0".*
3. *Provide crash wall or solid pier where required by railroad or hydraulics.*
4. *Use continuous footings where footing is on subsoil or piles. Use individual footings where footing is on ledge.*

DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.5.9

AESTHETIC PIER – TYPICAL TRIPLE COLUMN ELEVATION
22'–0" < COLUMN SPACING ≤ 27'–0"
PIER DETAILS



NOTES:

1. 4000 PSI, ¾ IN, 585 HP CEMENT CONCRETE. *(corrosive environment)*
   4000 PSI, ¾ IN, 610 CEMENT CONCRETE. *(non–corrosive environment)*
2. ALL KEYS TO BE SLIGHTLY TAPERED.

(22'–0" < COLUMN SPACING ≤ 27'–0")

TYPICAL TRIPLE COLUMN PIER ELEVATION

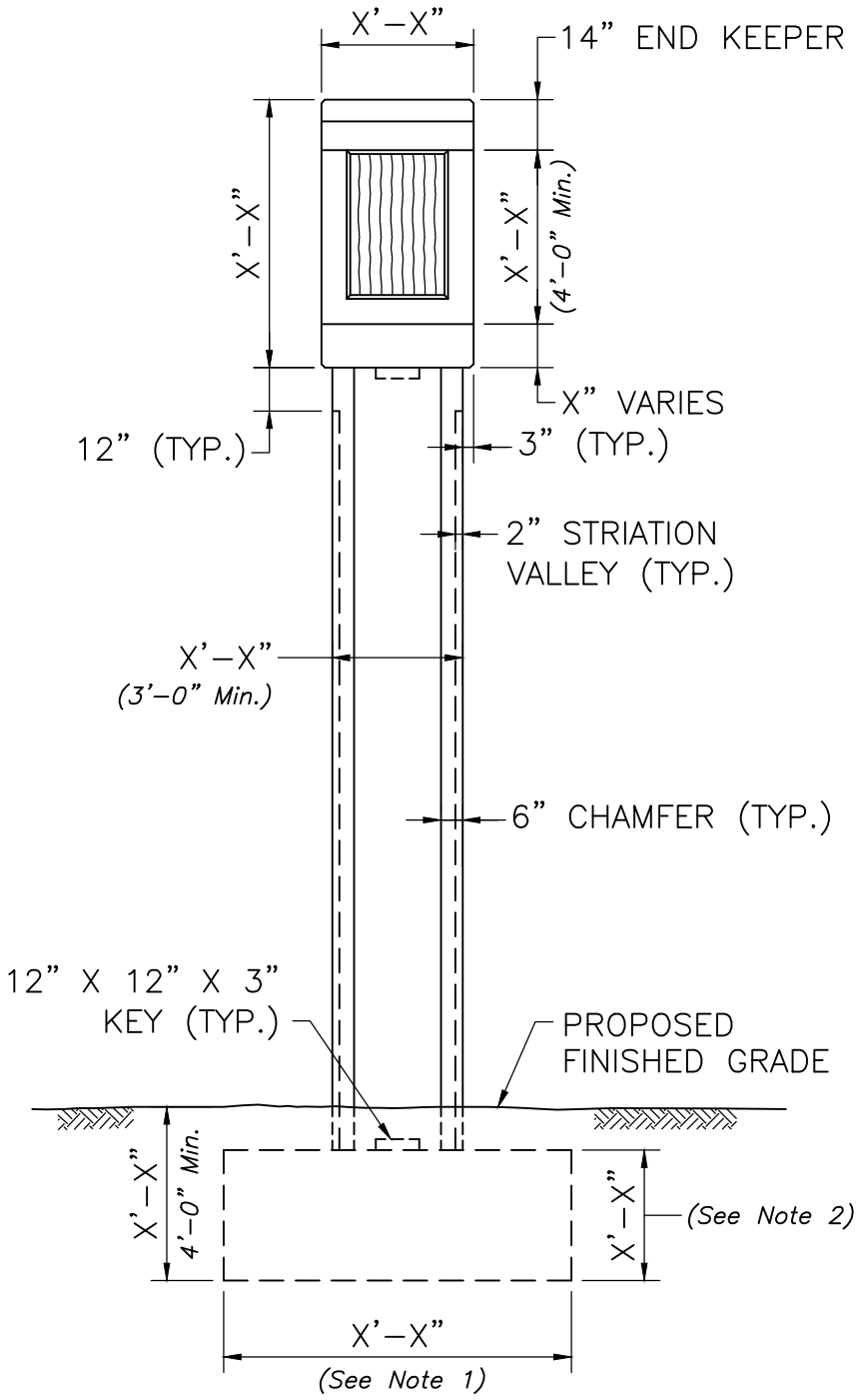
SCALE: ¼" = 1'–0"

NOTES:

1. *H ≤ W ≤ 1.5H*
2. *A = 4'–0" for 22'–0" < column spacing ≤ 25'–0".*
   A = 5'–0" for 25'–0" < column spacing ≤ 27'–0".
3. *Provide crash wall or solid pier where required by railroad or hydraulics.*
4. *Use continuous footings where footing is on subsoil or piles. Use individual footings where footing is on ledge.*

DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.5.10



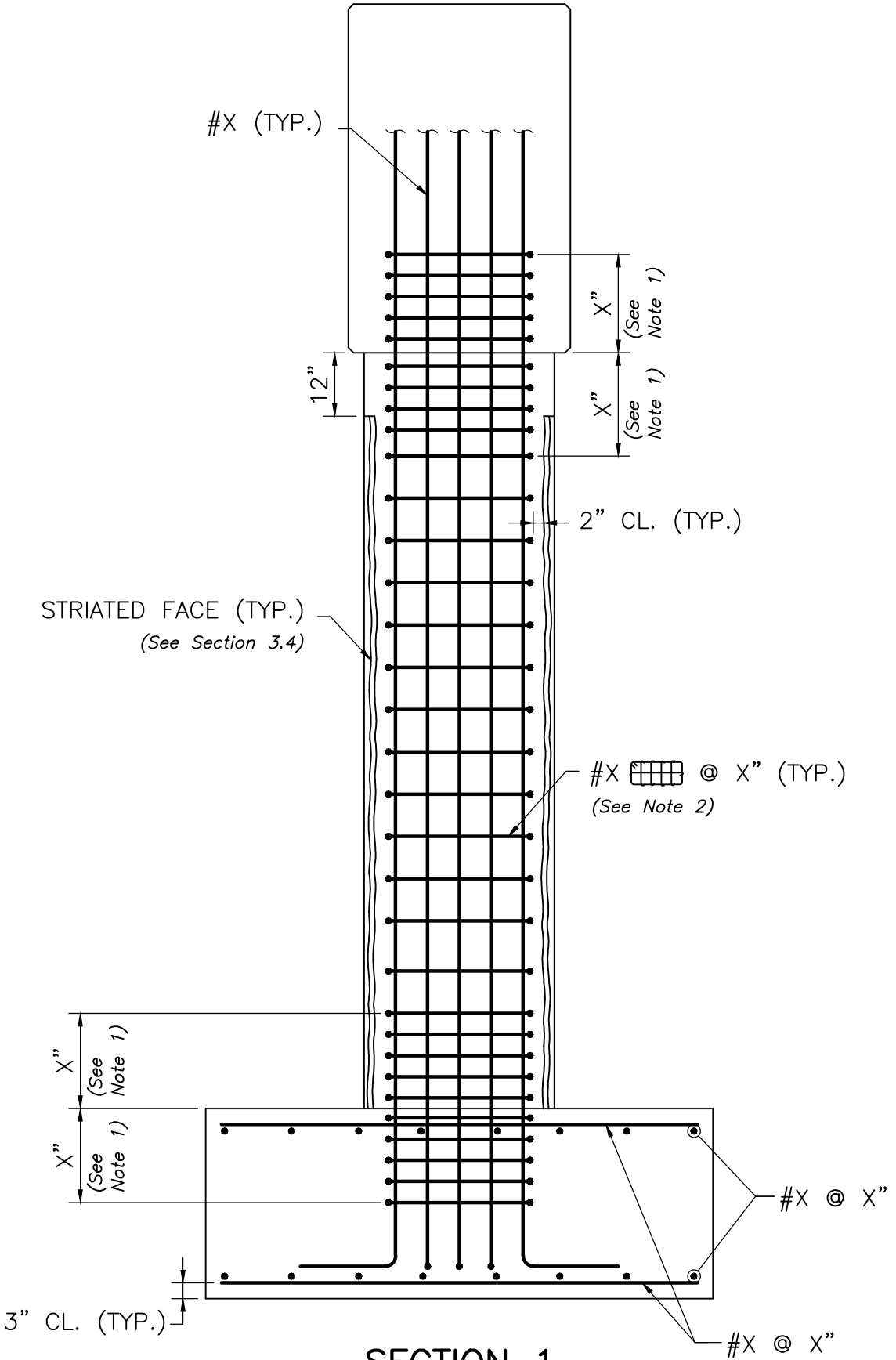
TYPICAL PIER SIDE ELEVATION

SCALE: $\frac{1}{4}$" = 1'–0"

NOTES:

1. *6'–0" minimum when on ledge and 8'–0" minimum when not on ledge.*
2. *Maximum depth of footing shall be 3'–0" for footings on subsoil, 3'–6" for footings on piles, and 2'–6" for footings on ledge.*
3. *Use continuous footings where footing is on subsoil or piles. Use individual footings where footing is on ledge.*
4. *For pier cap end details, see Dwg. No. 3.5.14.*

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	AESTHETIC PIER TYPICAL SIDE ELEVATION PIER DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.5.11**

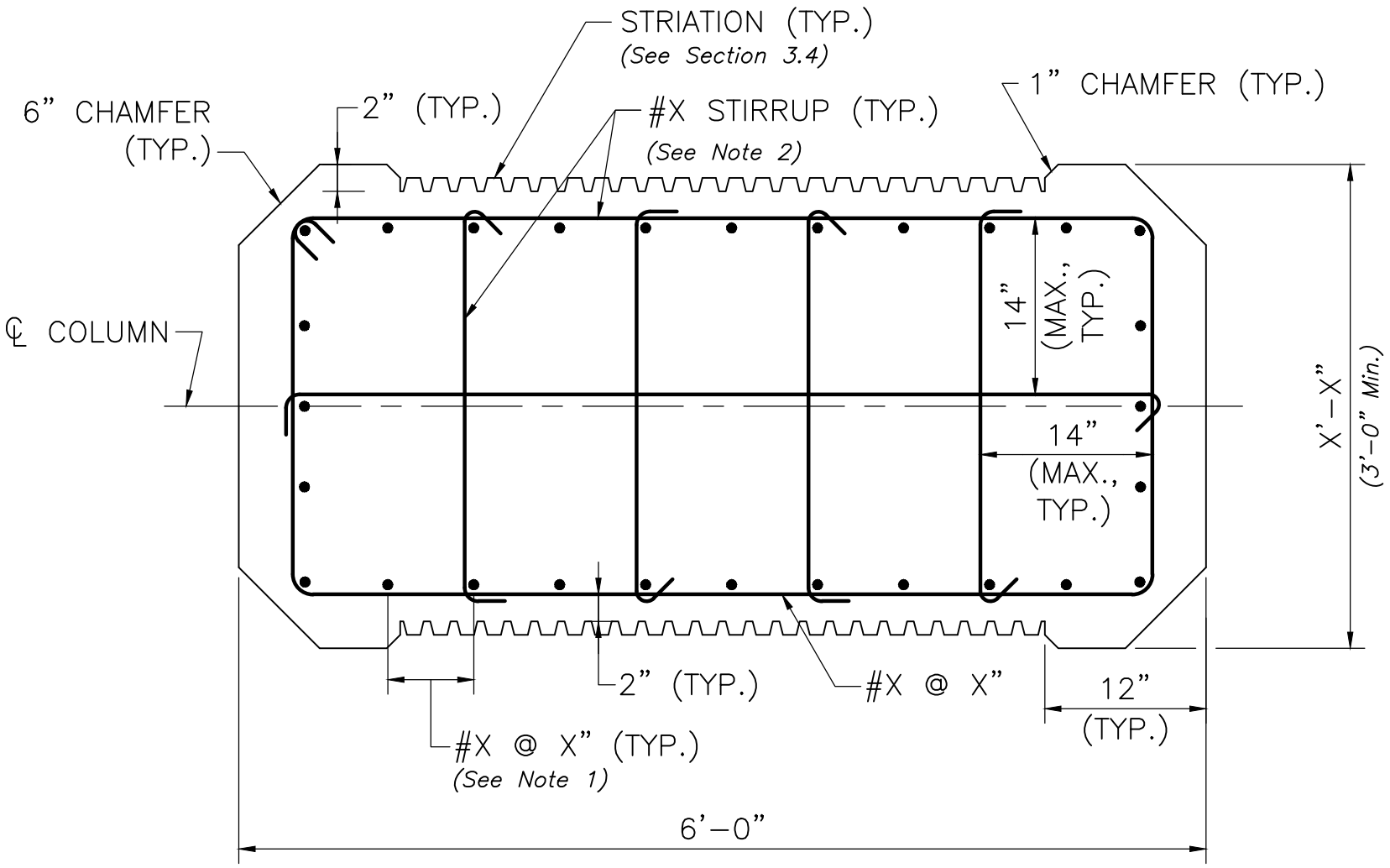


SECTION 1

SCALE: $\frac{1}{2}$" = 1'–0"

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	AESTHETIC PIER – TYPICAL VERTICAL COLUMN SECTION PIER DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.5.12**

AESTHETIC PIER
TYPICAL COLUMN SECTION
PIER DETAILS



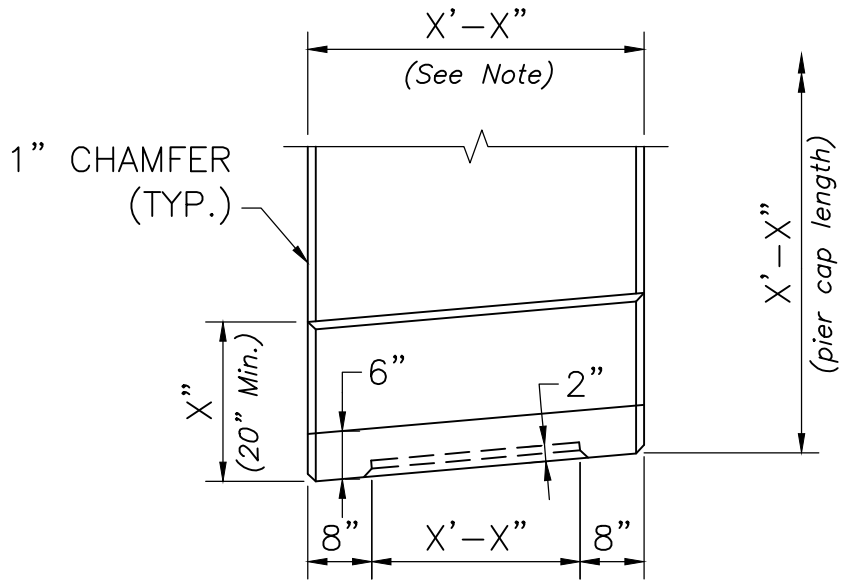
SECTION 2
SCALE: 1" = 1'–0"

NOTES:

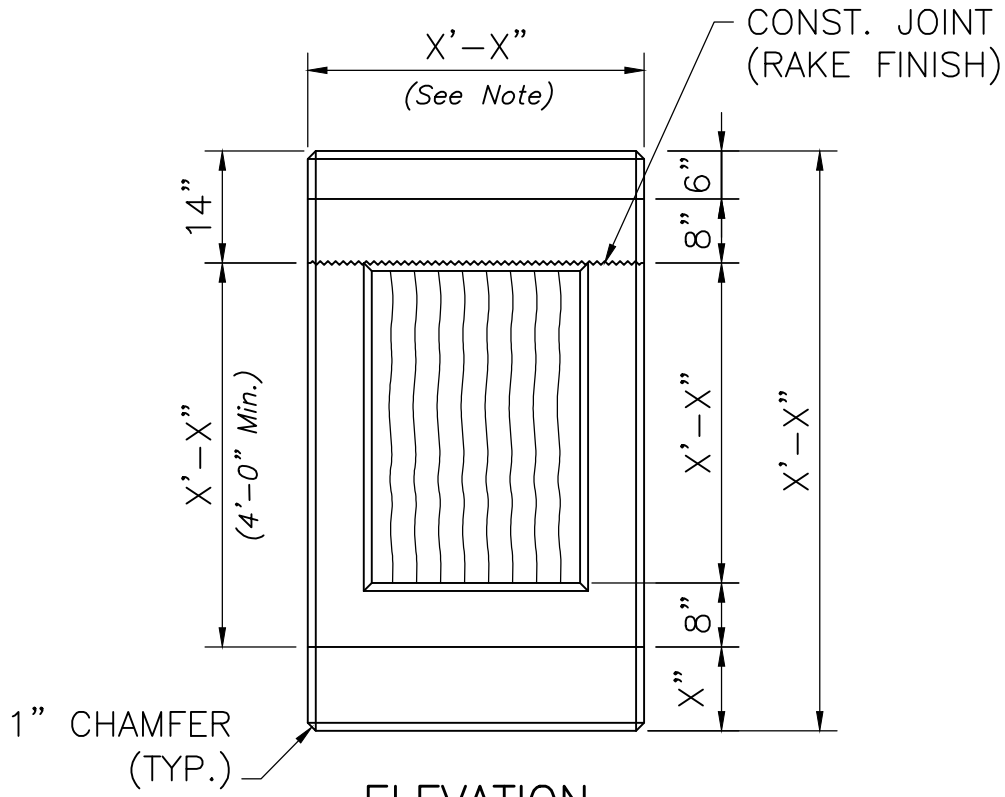
1. *Bars size and spacing shall be designed and detailed to satisfy SDC B and up.*
2. *The reinforcement configuration shown is conceptual. The Designer shall designed and modify the arrangement as required by AASHTO LRFD Seismic Design Specifications.*

DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.5.13



PLAN



ELEVATION

PIER CAP ENDS

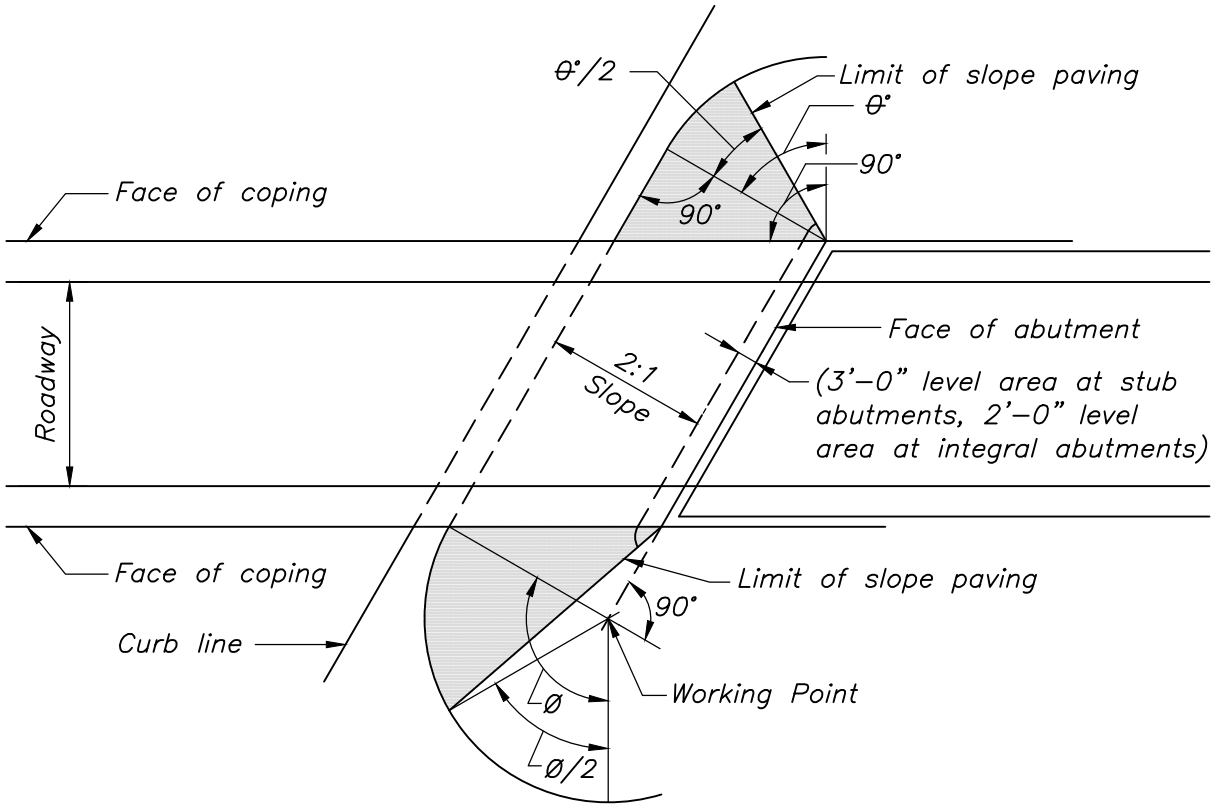
SCALE: $\frac{1}{2}$" = 1'–0"

NOTE:

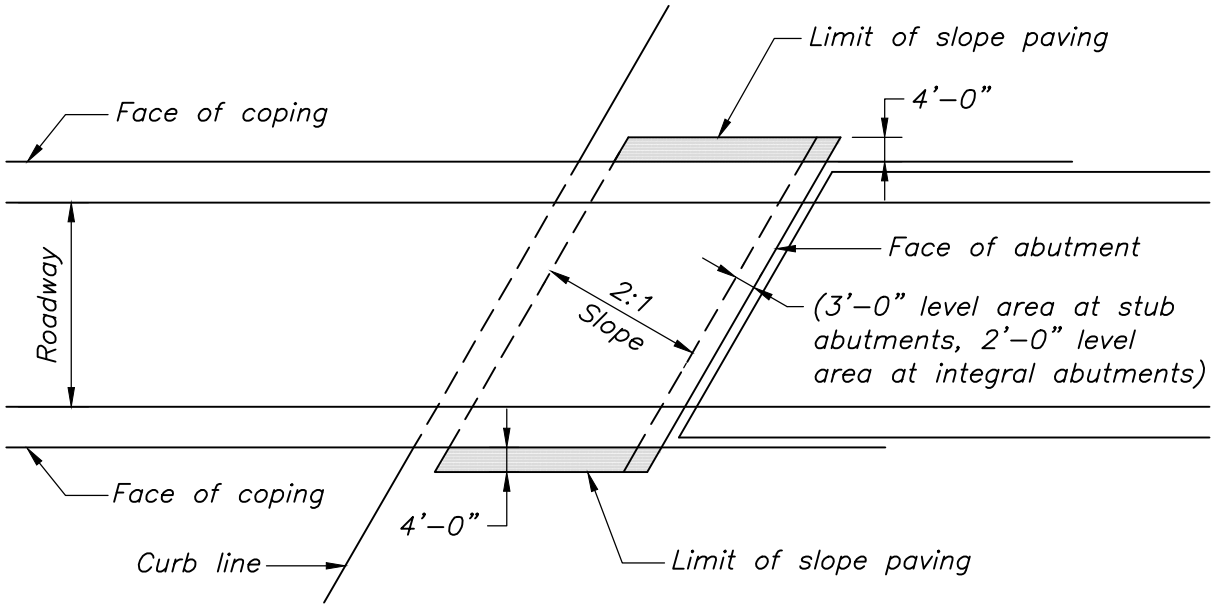
This dimension shall be as follows:

- *4'–4" (Min.) for NEBT beams, separated Box beam and NEXT F Beam superstructures.*
- *3'–6" (Min.) for Steel beam superstructures.*

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	AESTHETIC PIER CAP ENDS PIER DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.5.14**



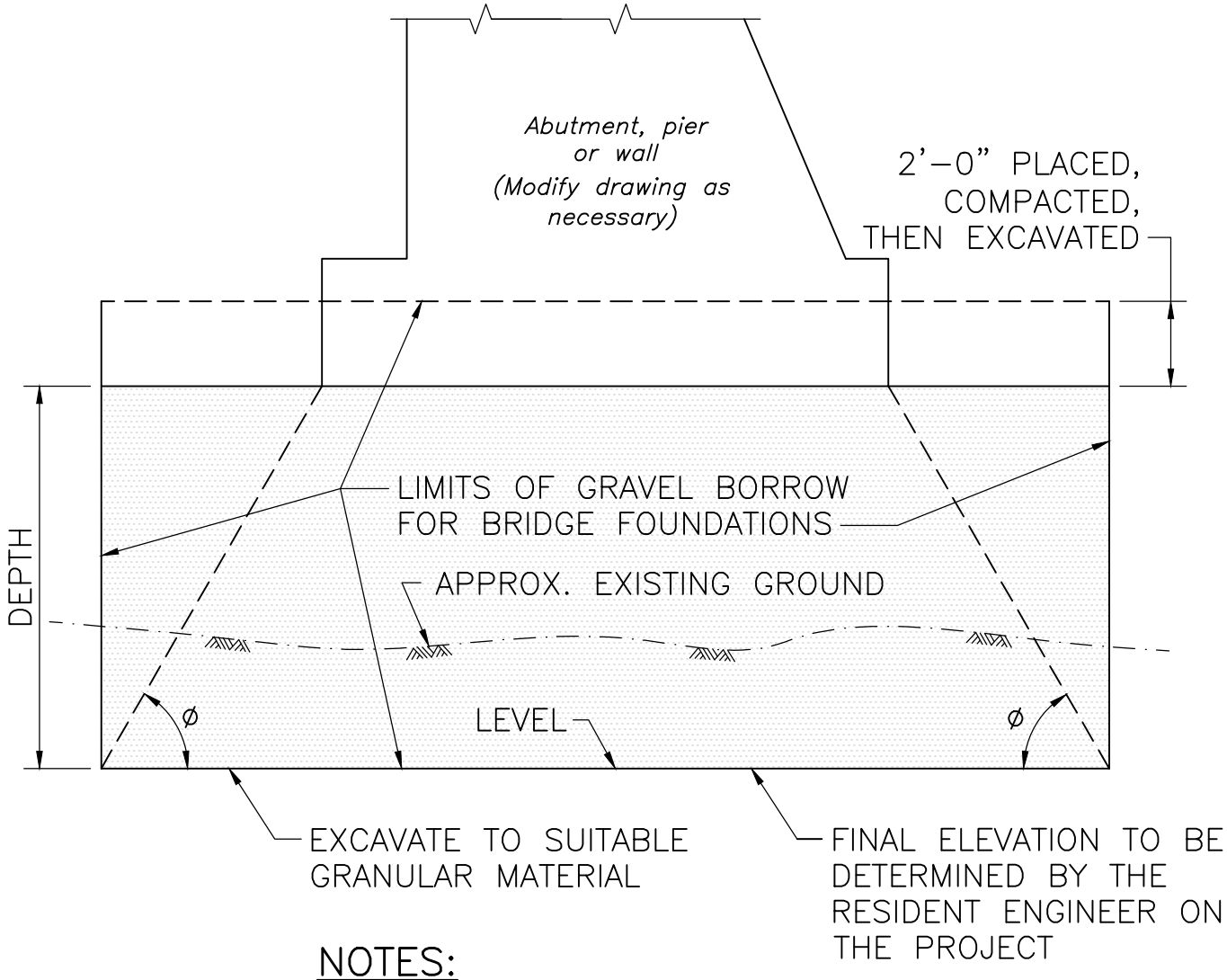
BRIDGE ROADWAY ON FILL SECTION



BRIDGE ROADWAY OVER CUT SECTION

NOTE:
Include the limits of special slope paving on the Construction Drawings where applicable.

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	LIMITS OF SPECIAL SLOPE PAVING FOUNDATIONS AND FILL	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.6.1**



NOTES:

1. ø = 45° FOR DEPTH OF 5'–0" OR LESS.
   ø = 60° FOR DEPTH OVER 5'–0".

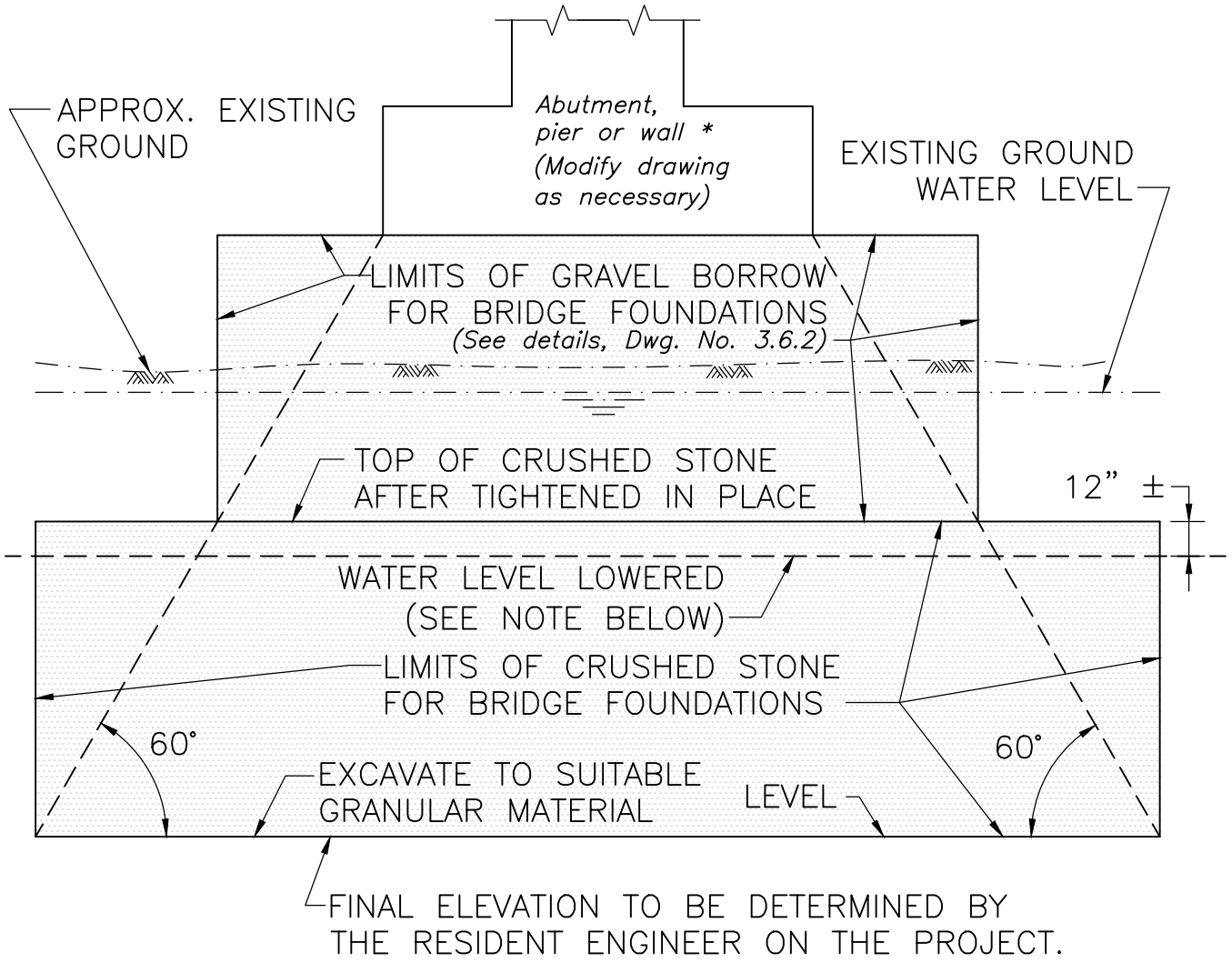
2. SAME TREATMENT IS TO BE USED AT ENDS OF WALLS, PIERS, AND ABUTMENTS.

LIMITS OF GRAVEL BORROW FOR BRIDGE FOUNDATIONS

NOT TO SCALE

NOTES:

1. *Do not use where bridge abutment or retaining wall is subjected to unprotected stream flow.*
2. *Refer to Bridge Manual Part I, Section 3.2.5, for direction regarding Bearing Resistance.*
3. *Gravel Borrow For Bridge Foundations must be installed in the dry. Use water control where required.*



NOTE:

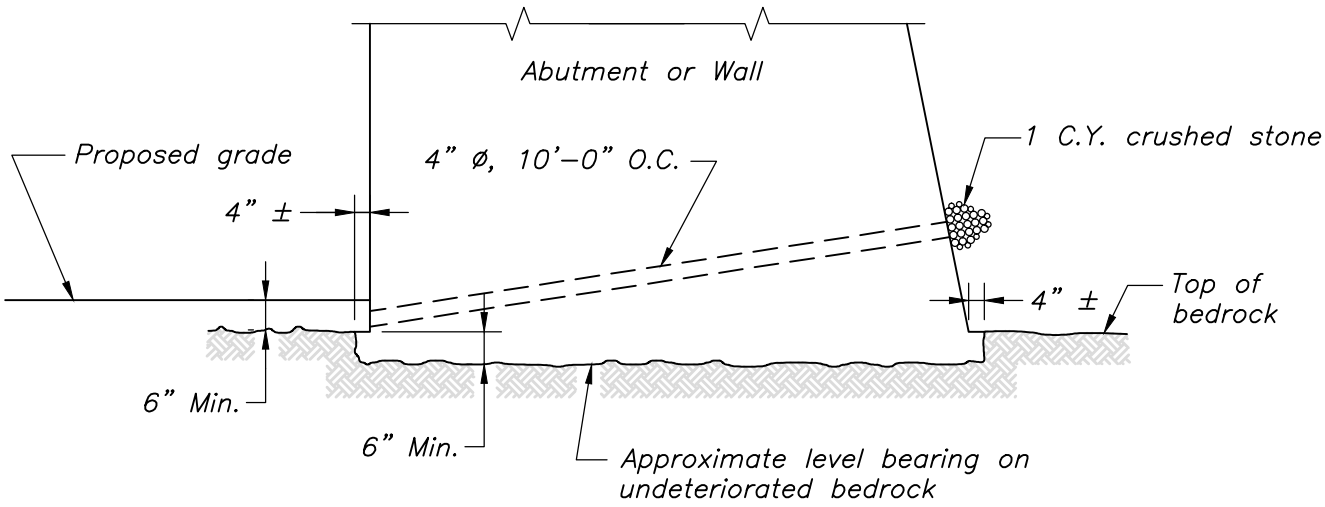
LOWER WATER LEVEL AS MUCH AS POSSIBLE WITHOUT DISTURBING THE GRANULAR SOIL (SIDES AND BOTTOM) AND TIGHTEN THE CRUSHED STONE IN PLACE (SEE STANDARD SPECIFICATIONS).

LIMITS OF CRUSHED STONE FOR BRIDGE FOUNDATIONS

NOT TO SCALE

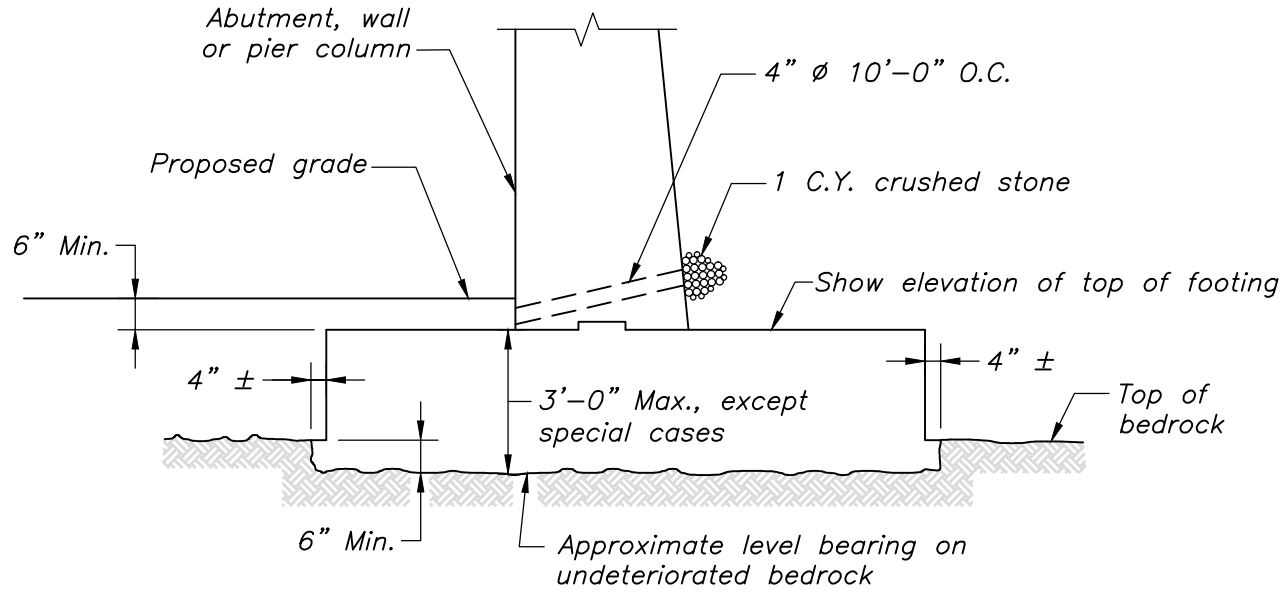
NOTES:

1. ** Do not use for water crossing.*
2. *Indicate maximum factored soil pressure below crushed stone.*
3. *The pressure on the granular material below the crushed stone will govern.*



GRAVITY ABUTMENT OR GRAVITY WALL

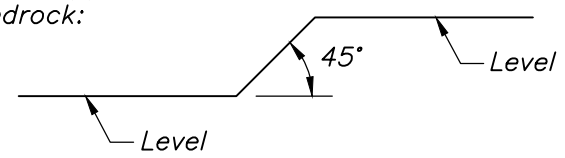
NOT TO SCALE



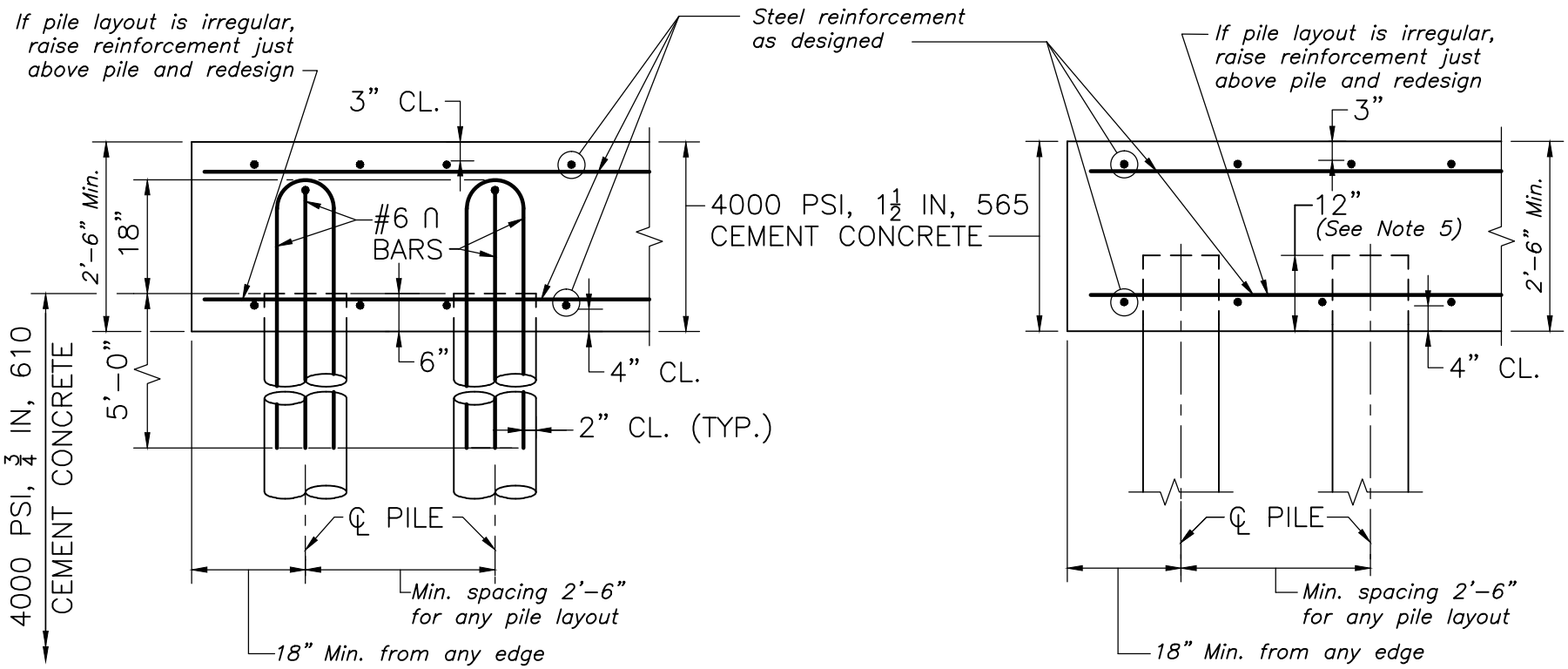
CANTILEVER ABUTMENT OR CANTILEVER WALL

NOT TO SCALE

NOTE:
Bottom of abutment or wall shall be stepped along its length to conform with bedrock:



PILE DETAILS
LONGITUDINAL LAYOUT
FOUNDATIONS AND FILL



FOOTING WITH CAST-IN-PLACE CONCRETE PILES AND PIPE PILES FILLED WITH CONCRETE

FOOTING WITH TIMBER OR STEEL PILES

(See Dwg. No. 3.1.6 for Construction Notes)

PILE LAYOUT
SCALE: ½" = 1'-0"

NOTES:

1. *Show and note total number of piles in plan view of pile layout for each substructure.*
2. *Note the estimated pile tip elevations on the Construction Drawings.*
3. *Maximum spacing of piles is 10'-0".*
4. *Provide at least 18" of concrete above the top of each pile.*
5. *Embedment of piles may exceed 12", if required.*

DATE OF ISSUE
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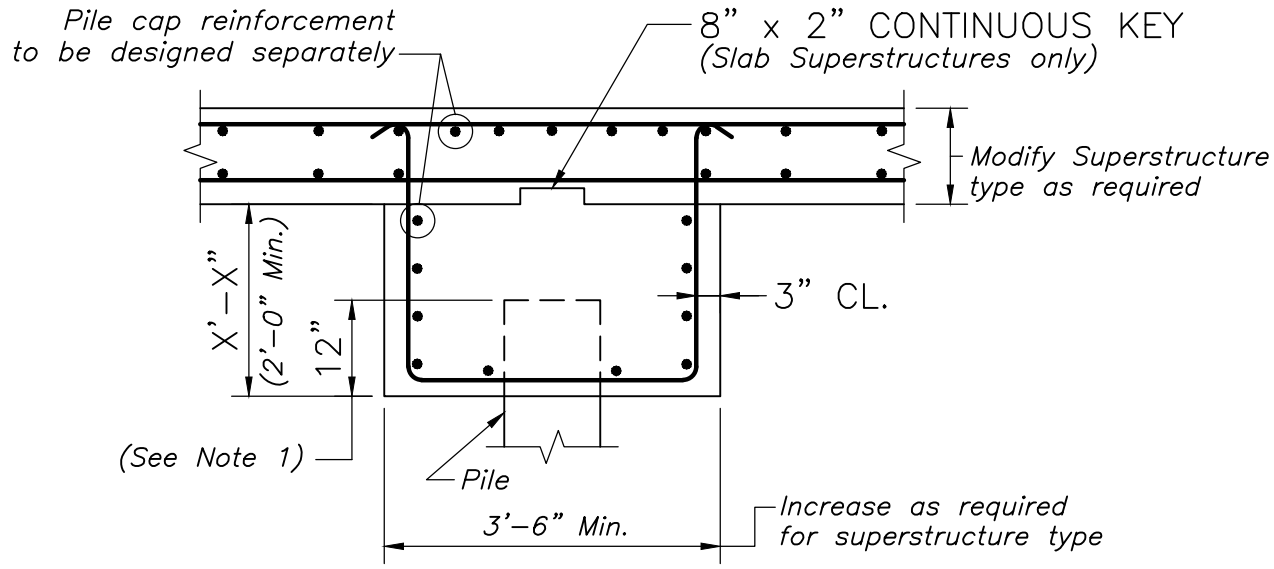
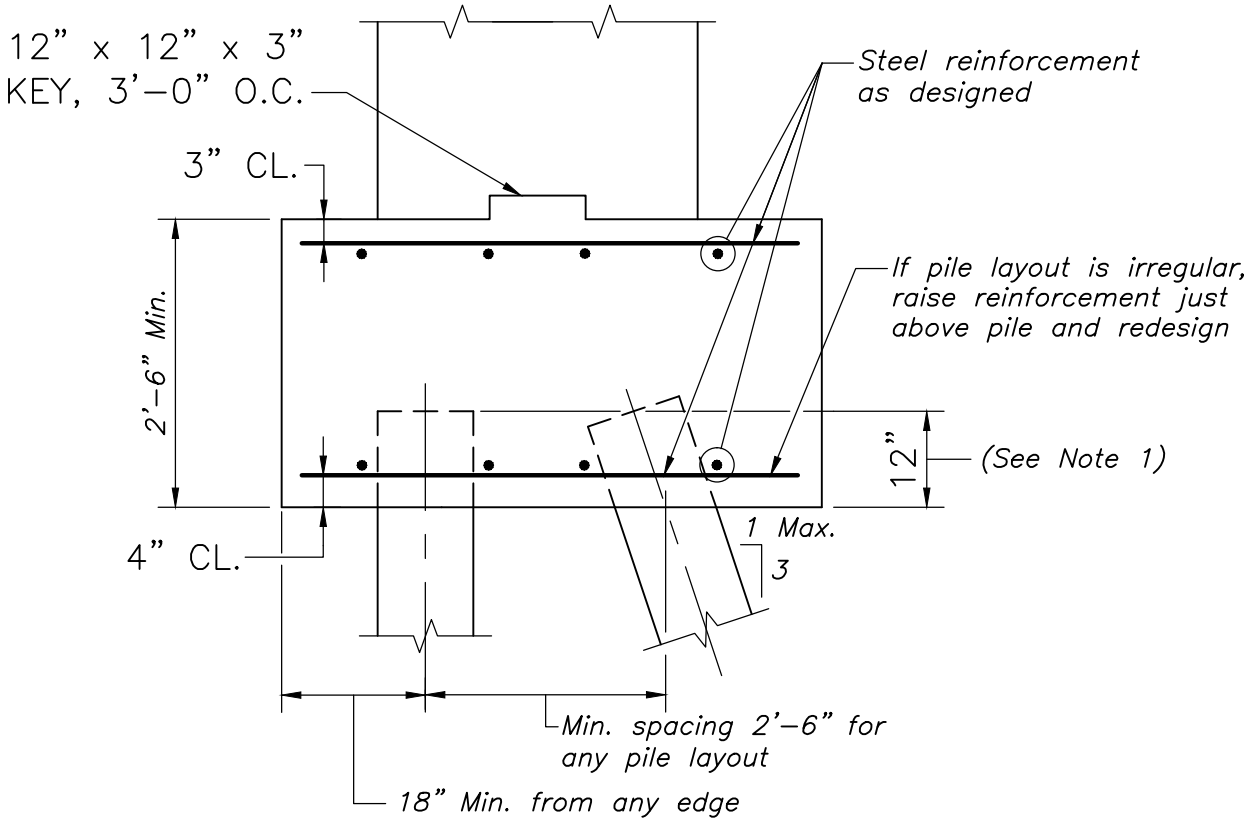
DRAWING NUMBER
3.6.5



PILE CAP FOR PILE BENT



FOOTING WITH BATTERED PILES

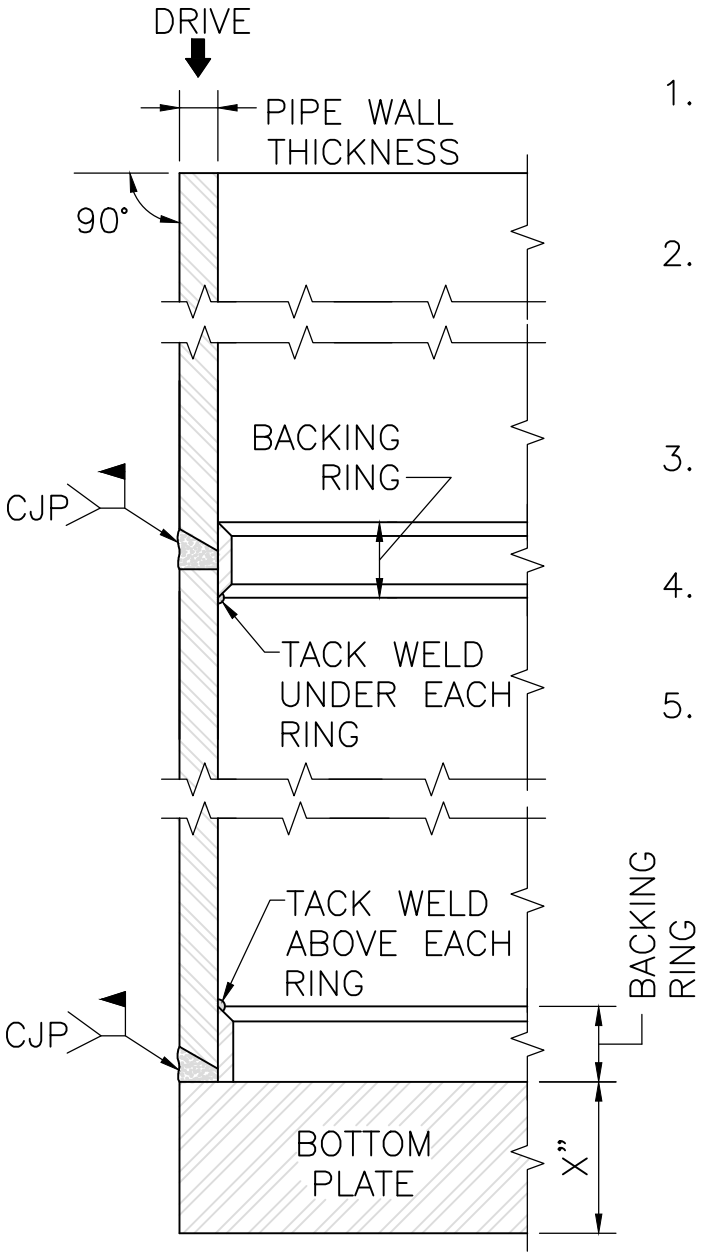
PILE LAYOUT

SCALE: $\frac{1}{2}$" = 1'-0"

NOTES:

1. Embedment of piles may exceed 12", if required.
2. Provide at least 18" of concrete above the top of each pile.
3. Maximum spacing of piles is 10'-0".

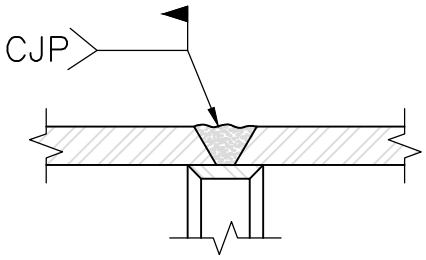
MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	PILE DETAILS TRANSVERSE LAYOUT FOUNDATIONS AND FILL	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.6.6**



PILE SECTION

NOTES:

1. BACKING RING DETAILS SHALL BE CONSISTENT WITH APPROVED WELDING PROCEDURE SPECIFICATIONS.
2. ROOT BASE SHALL BE DEPOSITED TO WITHIN 1" OF BACKING RING SPACER PINS. SPACER PINS SHALL THEN BE REMOVED AND PASS COMPLETED.
3. ALL WELDS SHALL BE SMOOTH. REINFORCEMENT SHALL NOT EXCEED $\frac{1}{8}$".
4. WELDING SHALL CONFORM TO THE AWS D1.1 STRUCTURAL WELDING CODE – STEEL.
5. FOR FLAT WELD POSITION USE THE FOLLOWING WELD:

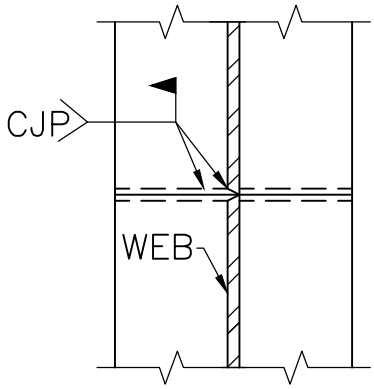


PILE SPLICE AND BOTTOM PLATE DETAILS

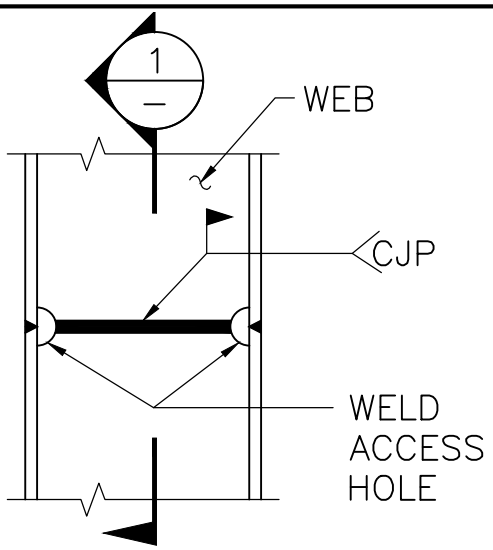
NOT TO SCALE

NOTE:
For piles subject to significant bending moment, add the following note on the Construction Drawings:

IF THE SPLICE LOCATION OCCURS WITHIN X FEET FROM THE BOTTOM OF ABUTMENT (*modify location as required*), ALL WELDS SHALL BE INSPECTED USING ULTRASONIC TESTING IN ACCORDANCE WITH THE BRIDGE WELDING CODE, ANSI/AASHTO/AWS D1.5. WELDS IN THIS LOCATION WILL BE CONSIDERED TO BE IN TENSION. TECHNICIANS PERFORMING THE TESTING SHALL HAVE PASSED THE PRACTICAL EXAM ADMINISTERED BY THE NEW YORK STATE DEPARTMENT OF TRANSPORTATION.



SECTION 1



ELEVATION

NOTES:

1. ALL WELDS SHALL BE COMPLETE PENETRATION AND SHALL CONFORM TO THE ANSI/AASHTO/AWS BRIDGE WELDING CODE, D1.5.

2. WELDING PROCEDURE SPECIFICATIONS MUST BE APPROVED BY THE ENGINEER PRIOR TO WELDING.

3. WHENEVER POSSIBLE ALL PILES SHALL BE SPLICED ON THE GROUND IN THE FLAT POSITION.

4. WEB SHALL BE COPED TO ALLOW FOR COMPLETE PENETRATION WELDING OF FLANGES.

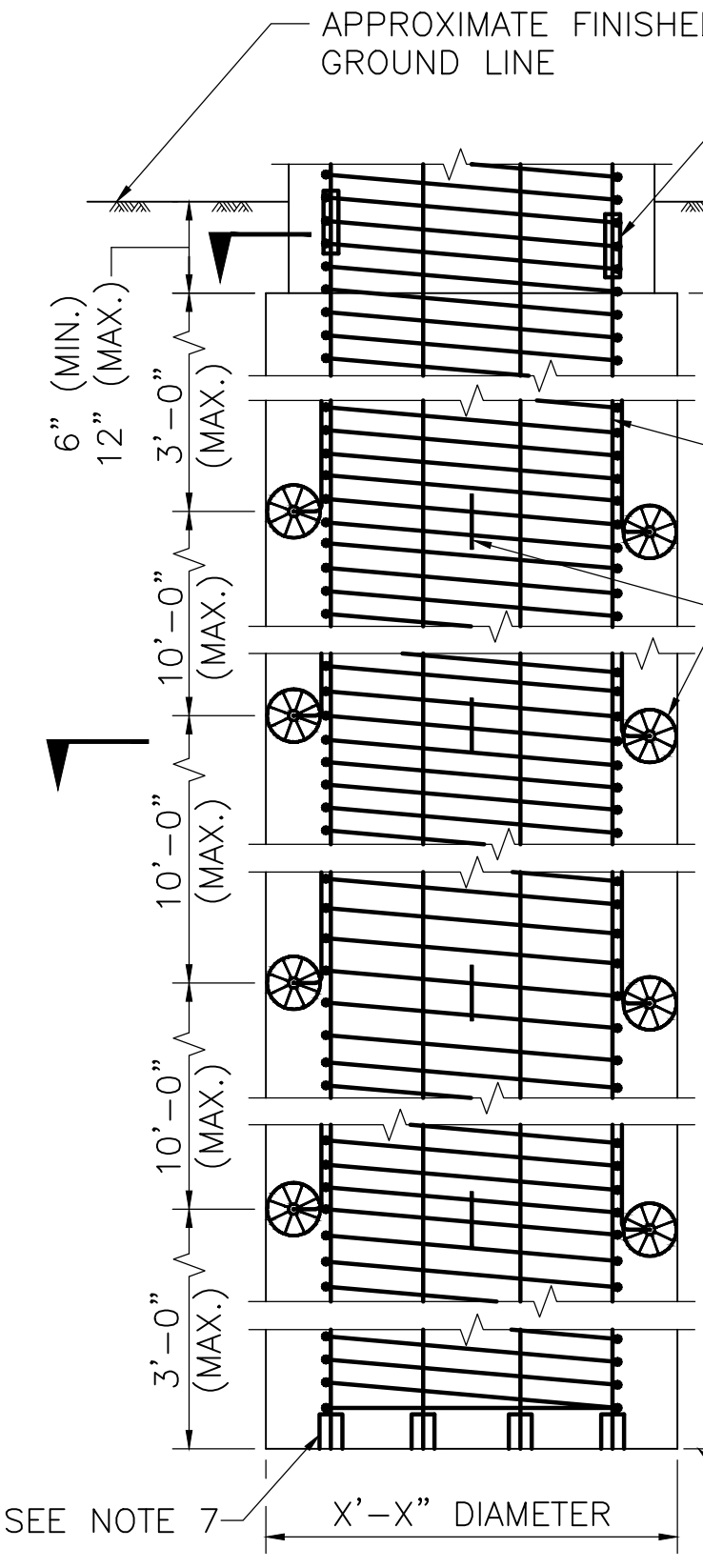
5. WELDED MECHANICAL PILE SPLICERS MAY BE USED PROVIDED THAT COMPLETE DETAILS AND WELDING PROCEDURES HAVE BEEN REVIEWED AND APPROVED BY THE ENGINEER.

H–PILE SPLICE DETAILS

NOT TO SCALE

NOTES:

1. *For piles subject to significant bending moment, add the following note on the plans:* IF THE SPLICE LOCATION OCCURS WITHIN X FEET FROM THE BOTTOM OF THE ABUTMENT (*modify location as required*), ALL WELDS SHALL BE INSPECTED USING ULTRASONIC TESTING IN ACCORDANCE WITH THE BRIDGE WELDING CODE, ANSI/AASHTO/AWS D1.5. WELDS IN THIS LOCATION WILL BE CONSIDERED TO BE IN TENSION. TECHNICIANS PERFORMING THE TESTING SHALL HAVE PASSED THE PRACTICAL EXAM ADMINISTERED BY THE NEW YORK STATE DEPARTMENT OF TRANSPORTATION.
2. *Pile splice details shall be shown on Construction Drawings of all bridges requiring steel piles.*



NOTE:

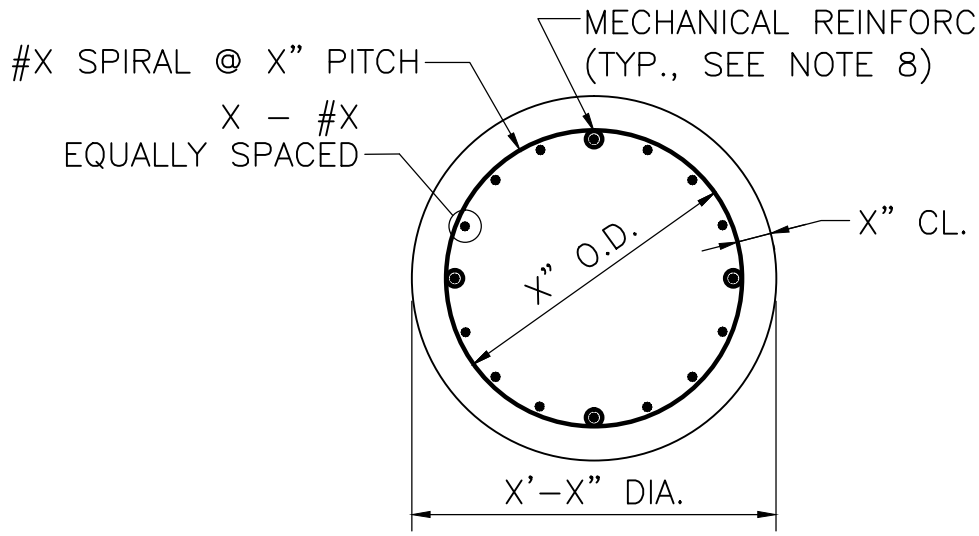
See Dwg. No. 3.6.11 for notes to be included on Construction Drawings.

NOTES:

1. *Label length and diameter of Rock Socket, if required by design.*
2. *Label length, thickness and diameter of permanent casing if required due to site conditions.*
3. *Designer shall specify outside diameter of spiral in order to satisfy 5" minimum cover requirement in shaft. Refer to Standard Nomenclature for standard shaft diameters. In general, the same outside diameter of spiral shall be maintained in the pier column above.*
4. *Where required, revise to show footing. Longitudinal bars shall not end with 90° outward oriented hooks in shafts with temporary casings.*
5. *Maximum spiral size shall be #6.*

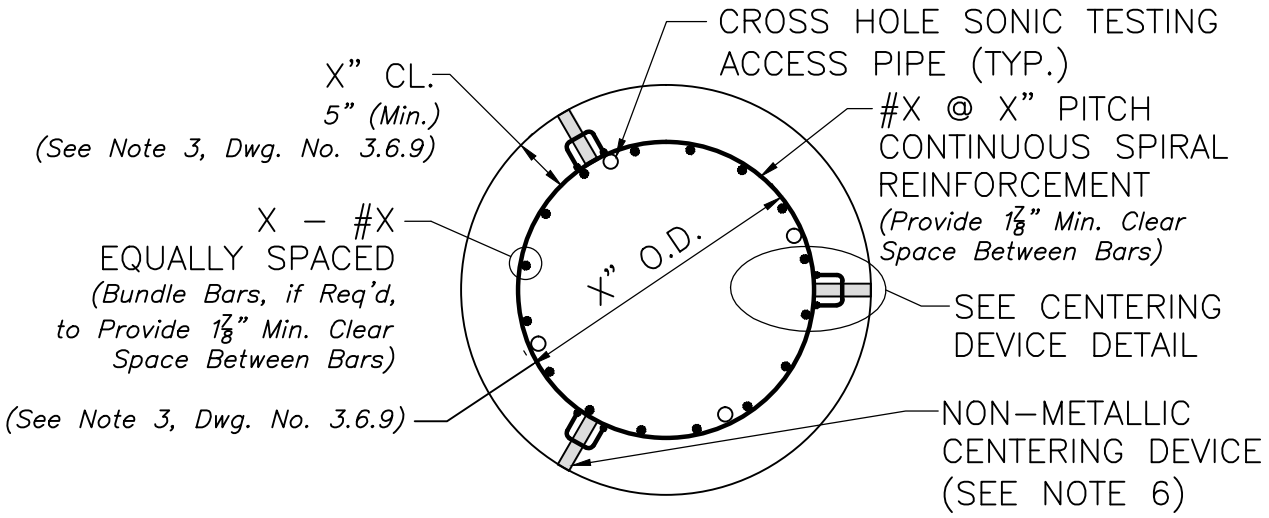
DRILLED SHAFT – VERTICAL SECTION

SCALE: $\frac{3}{4}$" = 1'-0"



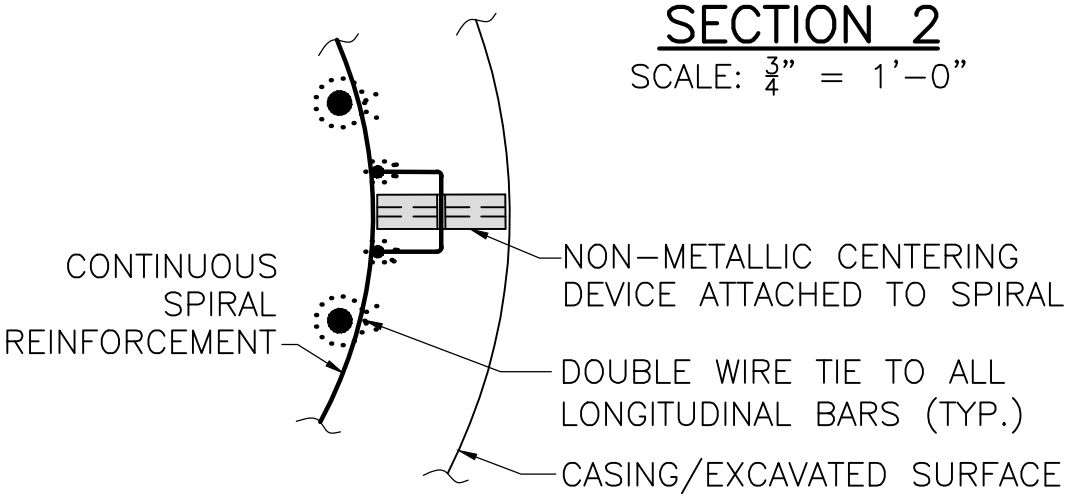
SECTION 1

SCALE: $\frac{3}{4}$" = 1'–0"



SECTION 2

SCALE: $\frac{3}{4}$" = 1'–0"



CENTERING DEVICE DETAIL

NOT TO SCALE

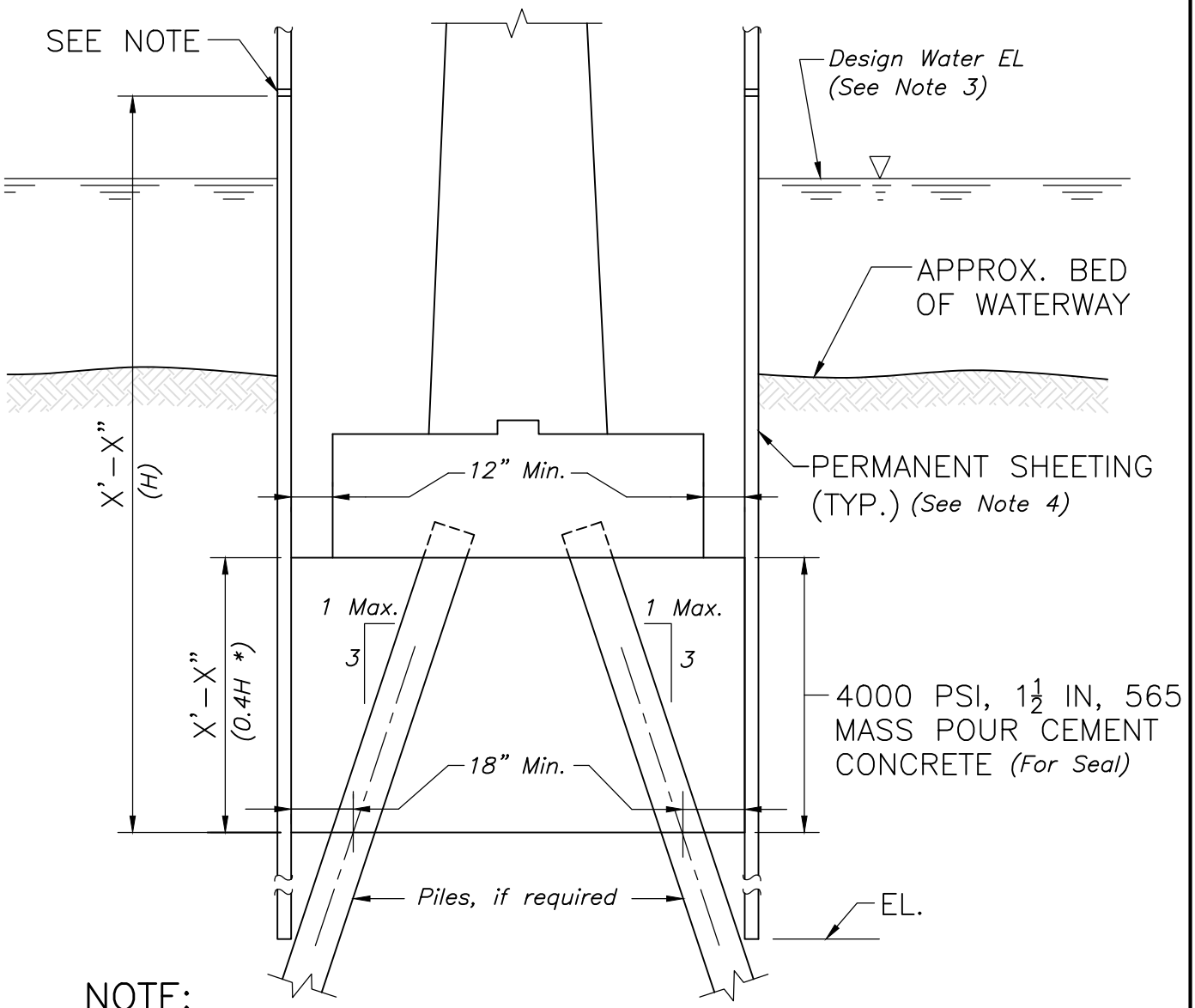
massDOT Highway Division LRFD BRIDGE MANUAL, PART II	DRILLED SHAFT SECTIONS AND DETAILS FOUNDATIONS AND FILL	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.6.10**

NOTES:

1. DRILLED SHAFT CONCRETE SHALL BE 4000 PSI, $\frac{3}{8}$ IN, 660 CEMENT CONCRETE. *(Drilled shaft concrete shall have the same compressive strength as the pier column concrete. Modify as required.)*

   THE CLEAR SPACING BETWEEN STEEL REINFORCEMENT BARS SHALL BE AT LEAST $1\frac{7}{8}$".
2. THE FACTORED GEOTECHNICAL SHAFT RESISTANCE IS X KIPS AND IS THE PRODUCT OF THE NOMINAL GEOTECHNICAL RESISTANCE OF X KIPS AND A RESISTANCE FACTOR OF 0.XX. THE FACTORED DESIGN AXIAL LOAD PER SHAFT IS X KIPS AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION. *(Designer to specify the Limit State and Group Load Combination that produce the highest axial load)*

   THE FACTORED STRUCTURAL SHAFT RESISTANCE IS X KIPS AND IS THE PRODUCT OF THE NOMINAL STRUCTURAL RESISTANCE OF X KIPS AND A RESISTANCE FACTOR OF 0.XX.
3. CENTERING DEVICES SHALL BE CONSTRUCTED OF AN APPROVED NON–METALLIC DURABLE MATERIAL.
4. THE NON–METALLIC CENTERING DEVICES SHALL BE OF ADEQUATE SIZE TO INSURE A MINIMUM 5" ANNULAR SPACE BETWEEN THE OUTSIDE OF THE REINFORCEMENT CAGE AND THE SIDES OF THE EXCAVATED HOLE OR INSIDE OF CASING.
5. THERE SHALL BE A MINIMUM OF 3 GROUPS OF NON–METALLIC CENTERING DEVICES FOR SHAFTS LESS THAN 26'–0" IN LENGTH.
6. NON–METALLIC CENTERING DEVICES SHALL BE PLACED AT A MAXIMUM SPACING OF 2'–6" AROUND THE CIRCUMFERENCE OF THE SHAFT.
7. EACH LONGITUDINAL BAR SHALL BE SUPPORTED BY A 3" HIGH BOLSTER OF APPROVED NON–METALLIC DURABLE MATERIAL.
8. SPLICES IN THE LONGITUDINAL REINFORCEMENT SHALL BE MADE WITH MECHANICAL REINFORCING BAR SPICERS AND SHALL BE STAGGERED A MINIMUM OF 2'–0".
9. IF SPLICING OF SPIRAL REINFORCEMENT IS NECESSARY, A MINIMUM OF 2" CLEARANCE SHALL BE PROVIDED BETWEEN THE OUTSIDE SURFACE OF MECHANICAL REINFORCING BAR SPLICERS AND THE DRILLED SHAFT CASING OR EXCAVATED SURFACE. *(Refer to Dwg. No. 3.5.4 and provide spiral splice detail on the Construction Drawings)*
10. WELDING OF LONGITUDINAL REINFORCEMENT SHALL NOT BE PERMITTED. WELDING OF OTHER REINFORCING BARS MAY BE PERMITTED WITH THE WRITTEN APPROVAL OF THE ENGINEER.



NOTE:

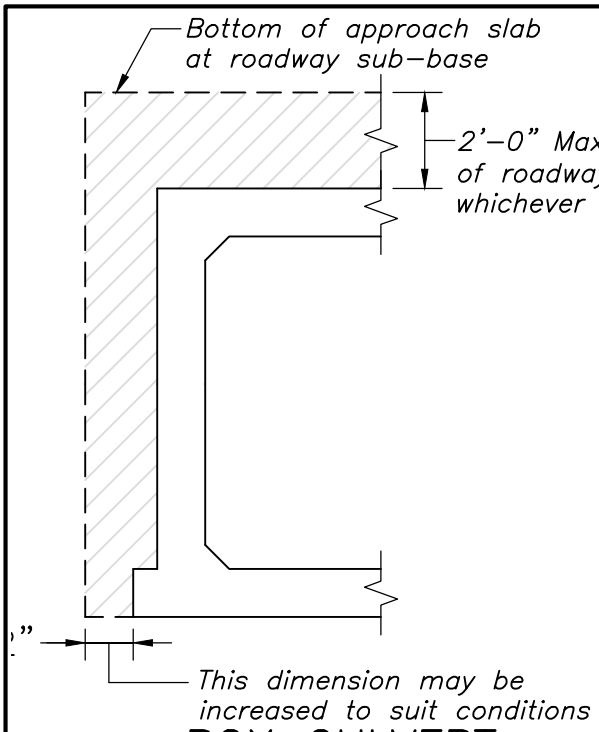
CONTRACTOR SHALL PROVIDE PRESSURE RELIEF PORTS LOCATED 2'–0" ABOVE DESIGN WATER LEVEL.

SEAL FOR COFFERDAM

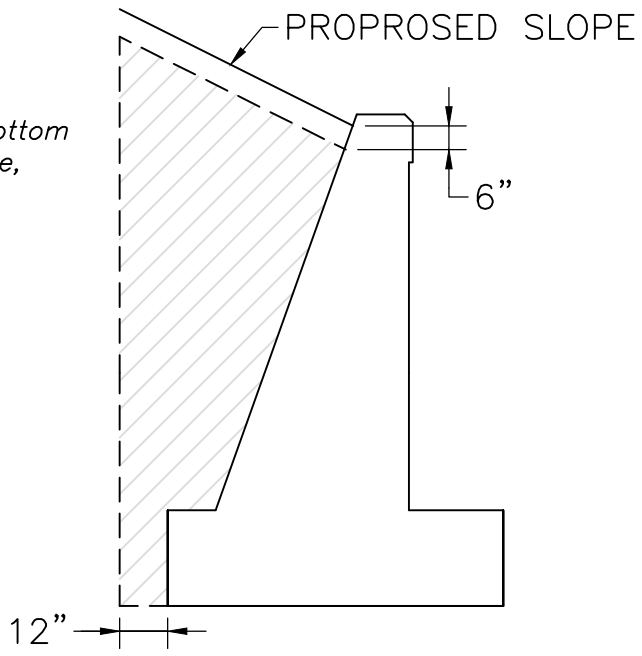
SCALE: ¼" = 1'–0"

NOTES:

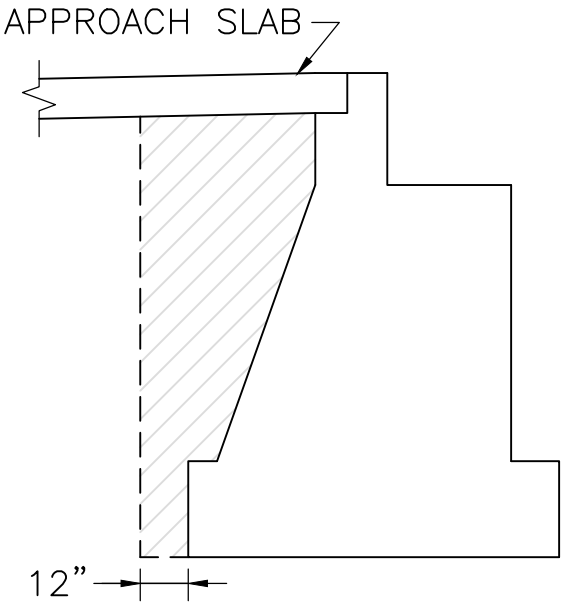
1. ** Denotes thickness of concrete seal based on hydraulic uplift figured to bottom of seal. Can reduce thickness by weight of piles and pile friction.*
2. *When piles are not required or when scouring is probable, steel sheeting shall be left in place and anchored to seal with Z bars. Indicate the elevation of where the sheeting shall be cut off on the plans.*
3. *For tidal areas, use the average of observed high tides for seal design.*
4. *Adequate embedment shall be provided below the bottom of seal to prevent boiling. Engineer shall check for interference between cofferdam sheeting and battered piles.*
5. *Mass pour concrete requires a Special Provision.*



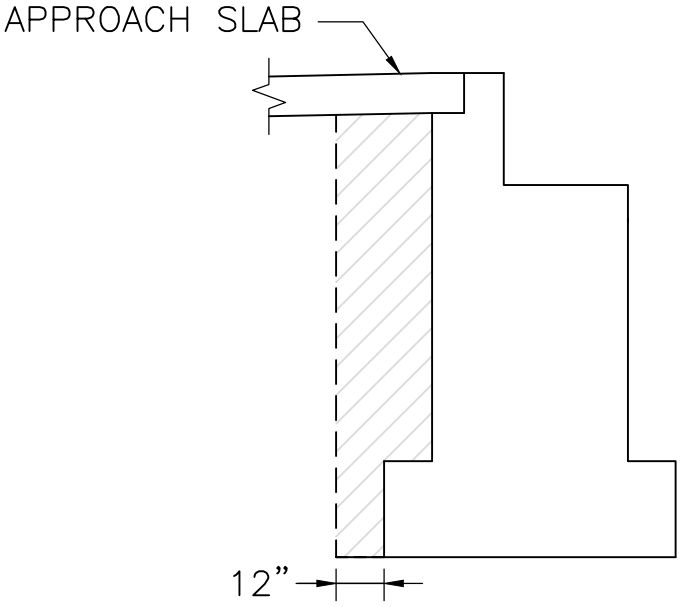
BOX CULVERT
(OR FRAME)



WINGWALL



ABUTMENT



STUB ABUTMENT

NOTE:
HATCHED AREA INDICATES LIMITS OF GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES.

LIMITS OF GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES

SCALE: $\frac{1}{4}$" = 1'-0"

NOTE:
See Drawing No. 12.4.2 for Integral Abutments.

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	LIMITS OF GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES FOUNDATIONS AND FILL	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.6.13**

NOTES:

1. PRE–DRILL X" DIAMETER HOLES TO THE SPECIFIED ELEVATIONS. PRE–DRILLED HOLES SHALL BE WITHIN 2% OF PLUMB.

2. DRILL X" DIAMETER ROCK SOCKET INTO COMPETENT BEDROCK TO THE ESTIMATED TIP ELEVATIONS. THE MINIMUM LENGTH OF ROCK SOCKET IS X FEET.

3. PLACE, CENTRALIZE, AND SECURE PILE IN PRE–DRILLED HOLE WITHIN 3" OF PLAN POSITION IN THE HORIZONTAL PLANE AT THE TOP OF PILE ELEVATION.

4. PLACE 2500 PSI, $\frac{3}{4}$ IN, 470 CEMENT CONCRETE TO FILL THE ENTIRE X FEET OF ROCK SOCKET. AFTER PLACEMENT OF CONCRETE, FILL THE ANNULAR FROM TOP OF ROCK SOCKET TO BOTTOM OF ABUTMENT WITH THE APPROVED MATERIAL AS PER GEOTECHNICAL REPORT.

5. THE FACTORED AXIAL DESIGN LOAD PER PILE IS X KIPS AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION. *(Designer to specify the Limit State and the Group Load Combination that produce the highest axial load)*

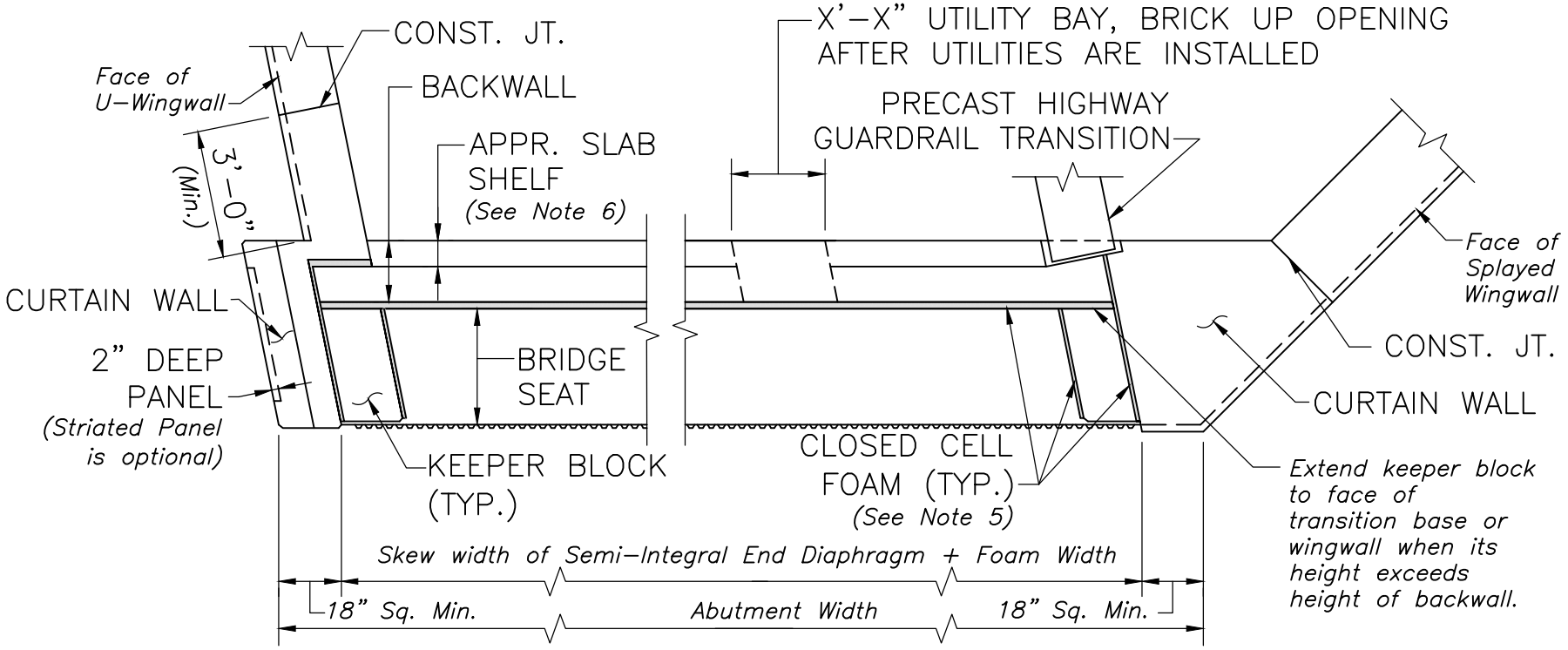
   THE FACTORED STRUCTURAL PILE RESISTANCE IS X KIPS AND IS THE PRODUCT OF THE NOMINAL STRUCTURAL RESISTANCE OF X KIPS AND A RESISTANCE FACTOR OF 0.XX.

6. THE FACTORED GEOTECHNICAL PILE RESISTANCE IS X KIPS AND IS A PRODUCT OF NOMINAL GEOTECHNICAL RESISTANCE OF X KIPS AND A RESISTANCE FACTOR OF 0.XX.

7. THE CONTRACTOR SHALL SUBMIT A PILE SCHEDULE AND PILE INSTALLATION PLAN FOR REVIEW AND APPROVAL OF THE ENGINEER.

TYPICAL ABUTMENT PLAN

BRIDGE SEAT DETAILS



BRIDGE WITHOUT UTILITY BAY
BRIDGE WITH U–WINGWALLS

BRIDGE WITH UTILITY BAY
BRIDGE WITH SPLAYED WINGWALLS

ABUTMENT PLAN

SCALE: $\frac{1}{4}$" = 1'–0"

NOTES:

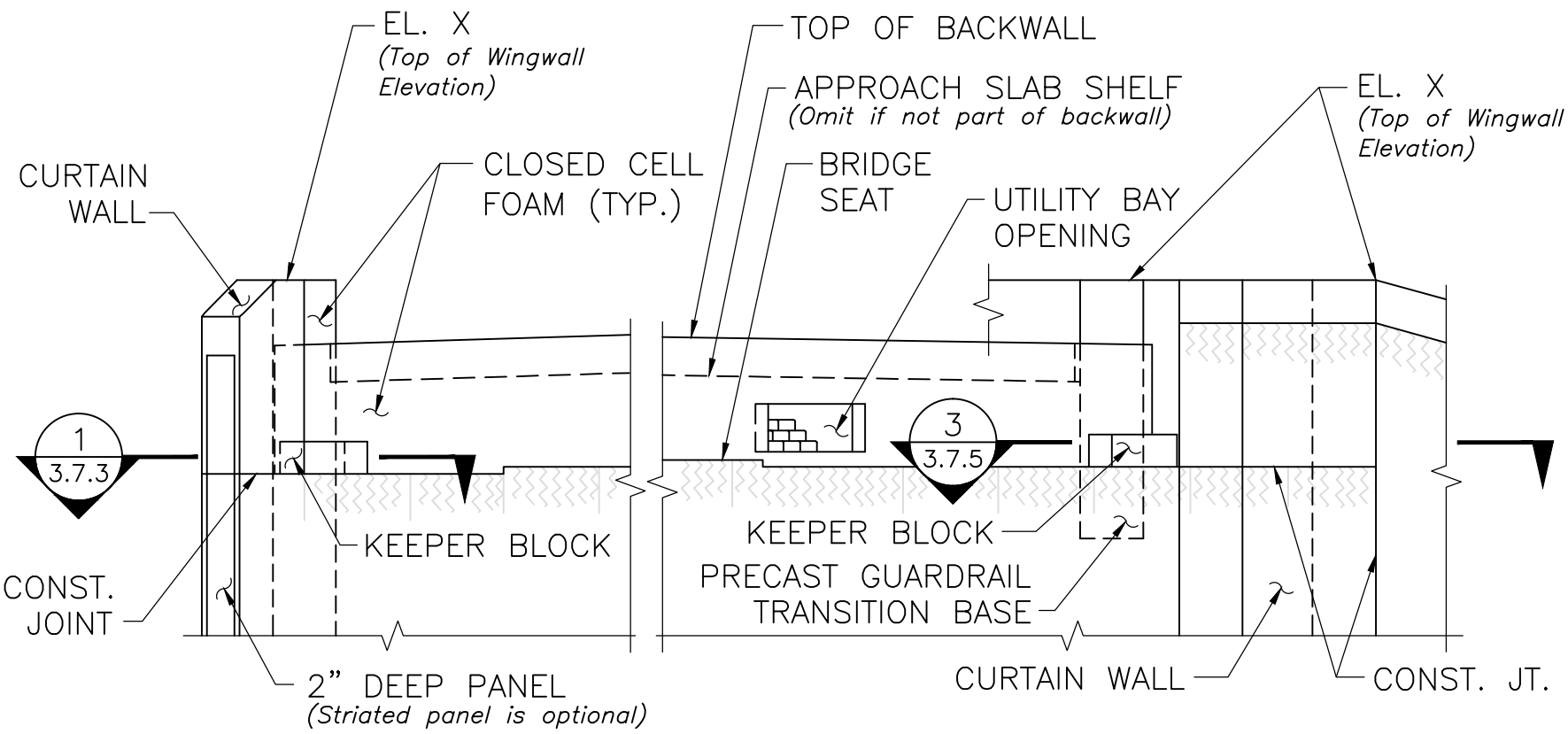
1. *Above drawing is based on the Abutment Details for stringer depths 3'–6" and less. Modify as required for the abutment type being used.*
2. *Utility bay may be used with either U–Wingwalls or Splayed Wingwalls.*
3. *Remainder of abutment has been omitted for clarity. See Dwg. No. 3.1.1 for additional required dimensions and details.*
4. *Abutment plan shall be drawn without breaks and to scale on the Construction Drawings. Include all relevant working points, dimensions, angles, survey information and North Arrow.*
5. *For required thickness of closed cell foam, refer to the Abutment Details for the type of end diaphragm being used. Specify thickness on the Abutment Plan.*
6. *The approach slab and approach slab shelf shall be omitted from the Abutment Plan View when they are incorporated into the End Diaphragm (See Abutment Details for stringer depths greater than 3'–6").*

DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.7.1

BRIDGE SEAT DETAILS

TYPICAL ABUTMENT ELEVATION



BRIDGE WITHOUT UTILITY BAY
BRIDGE WITH U–WINGWALLS

BRIDGE WITH UTILITY BAY
BRIDGE WITH SPLAYED WINGWALLS

ABUTMENT ELEVATION

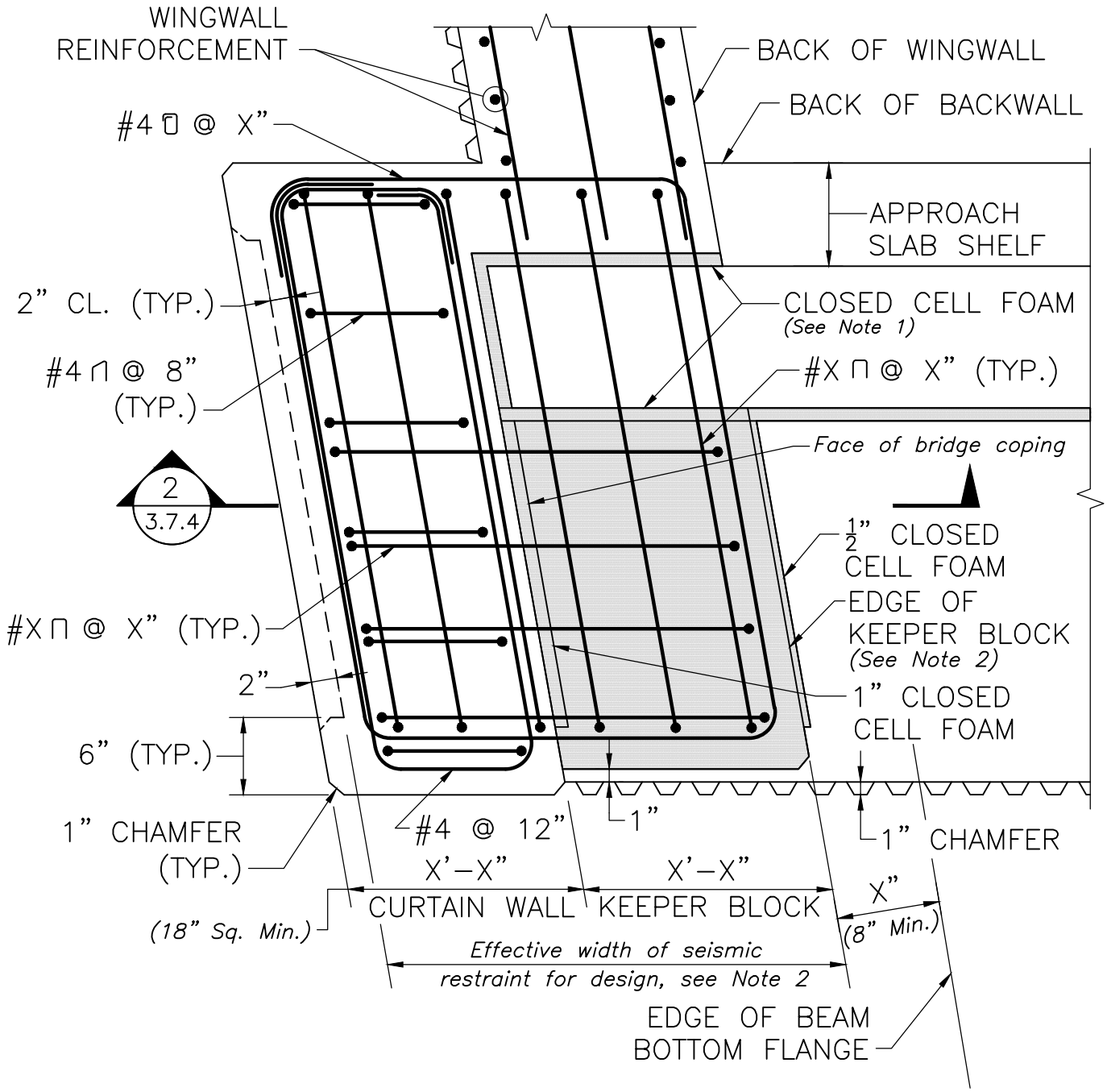
SCALE: $\frac{1}{4}$" = 1'–0"

NOTES:

1. *Above drawing is based on the abutments with pavement sawcut. Modify as required for the abutment type being used.*
2. *Utility bay may be used with either U–Wingwalls or Splayed Wingwalls.*
3. *Remainder of abutment has been omitted for clarity. See Dwg. No. 3.1.2 for additional required dimensions and details.*
4. *Abutment elevation shall be drawn without breaks and to scale on the Construction Drawings. Include all relevant elevations.*

DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.7.2



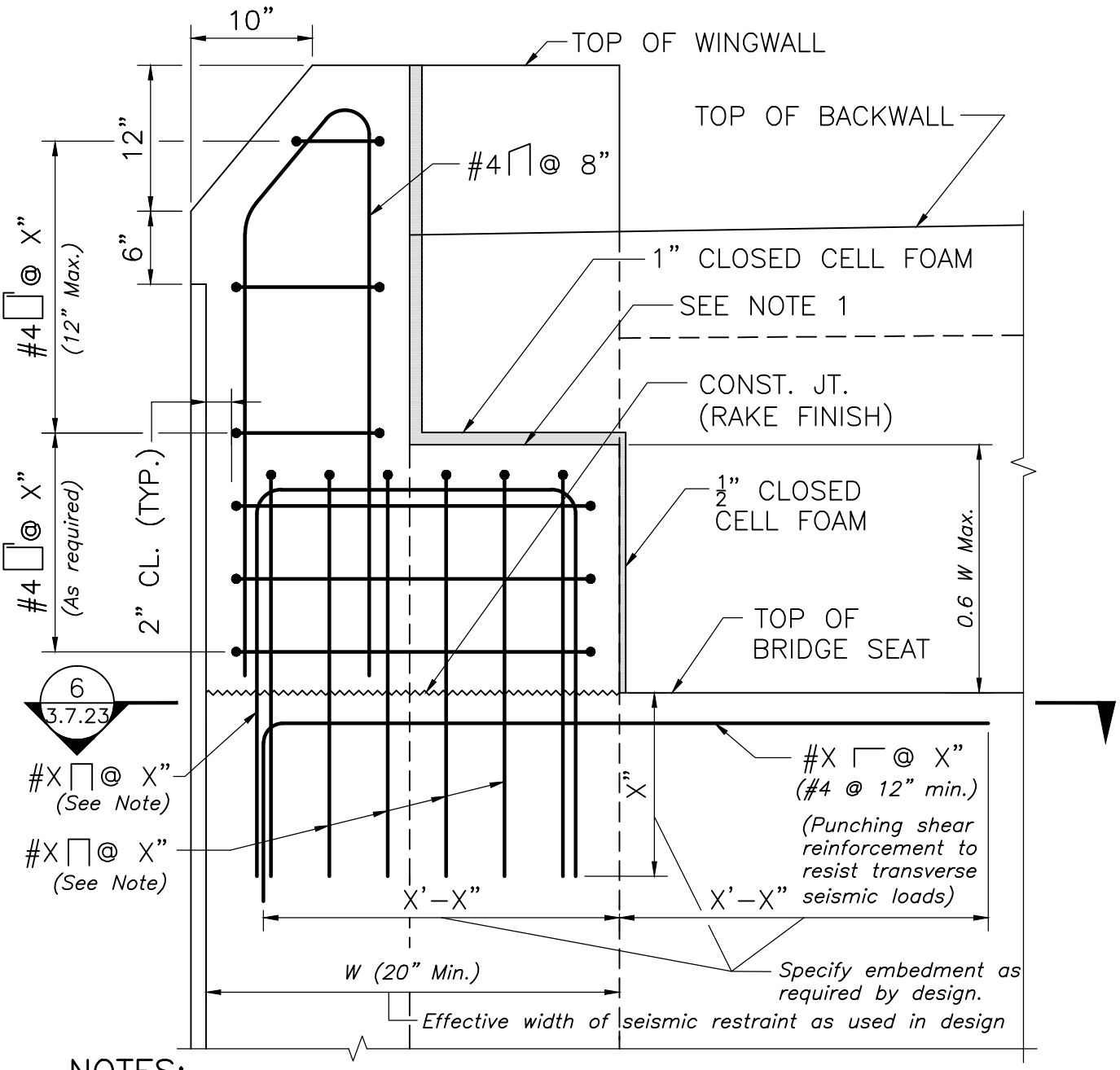
SECTION 1

SCALE: 1" = 1'-0"

NOTES:

1. *Detail shown is for abutments with pavement sawcut. Modify drawing and provide closed cell foam as required for the abutment type being used.*
2. *Edge of keeper block shall not extend beyond the line of the back of wingwall. The curtain wall and keeper block can be combined for the design of the seismic restraint. If the width is still not sufficient, use intermediate abutment keeper blocks.*

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	HORIZONTAL SECTION ABUTMENT W/ U-WINGWALL BRIDGE SEAT DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.7.3**



NOTES:

1. TOP OF KEEPER BLOCK SHALL BE TROWELED SMOOTH PARALLEL TO PROFILE GRADE.
2. ABUTMENT REINFORCEMENT BELOW CONSTRUCTION JOINT HAS BEEN OMITTED FOR CLARITY.

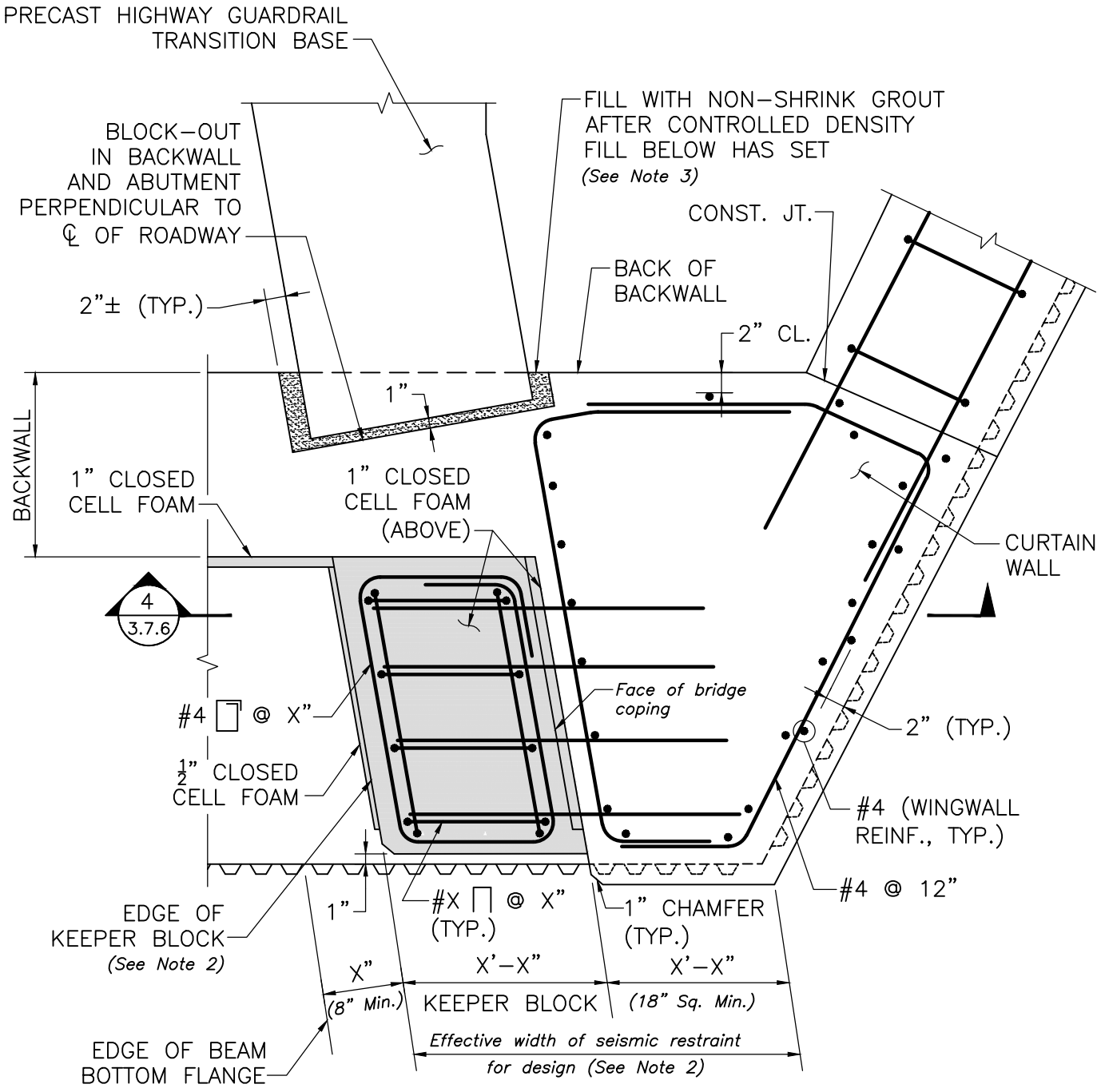
SECTION 2

SCALE: 1" = 1'–0"

NOTE:

Design as shear friction reinforcement to resist transverse seismic loads. Reinforcement configuration shown is conceptual. The Designer will modify the arrangement or add additional hoops as required by the actual design.

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	VERTICAL SECTION ABUTMENT W/ U–WINGWALL BRIDGE SEAT DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.7.4**



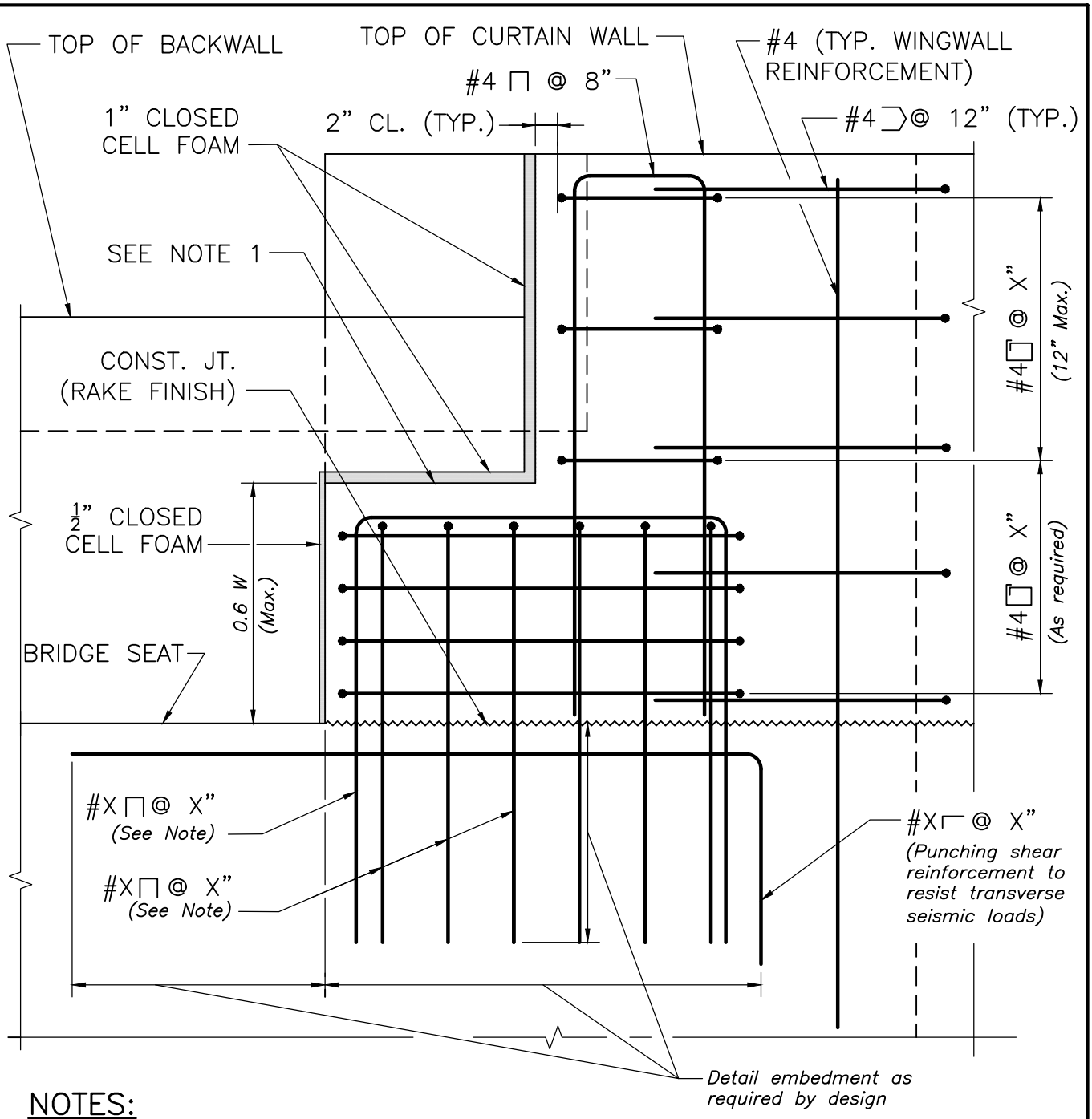
SECTION 3

SCALE: 1" = 1'–0"

NOTES:

1. *Detail shown is for abutments with pavement sawcut. Modify drawing and provide closed cell foam as required for the abutment type used.*
2. *Edge of keeper block shall not extend beyond the Highway Guardrail Transition base. The curtain wall and keeper block can be combined for the design of the seismic restraint. If the width is still not sufficient, use intermediate abutment keeper blocks.*
3. *See Chapter 3, Precast Highway Guardrail Transitions, for additional information and relevant details.*

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	HORIZONTAL SECTION AT SPLAYED WINGWALL BRIDGE SEAT DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.7.5**



NOTES:

1. TOP OF KEEPER BLOCK SHALL BE TROWELED SMOOTH PARALLEL TO PROFILE GRADE.
2. ABUTMENT REINFORCEMENT BELOW CONSTRUCTION JOINT HAS BEEN OMITTED FOR CLARITY.

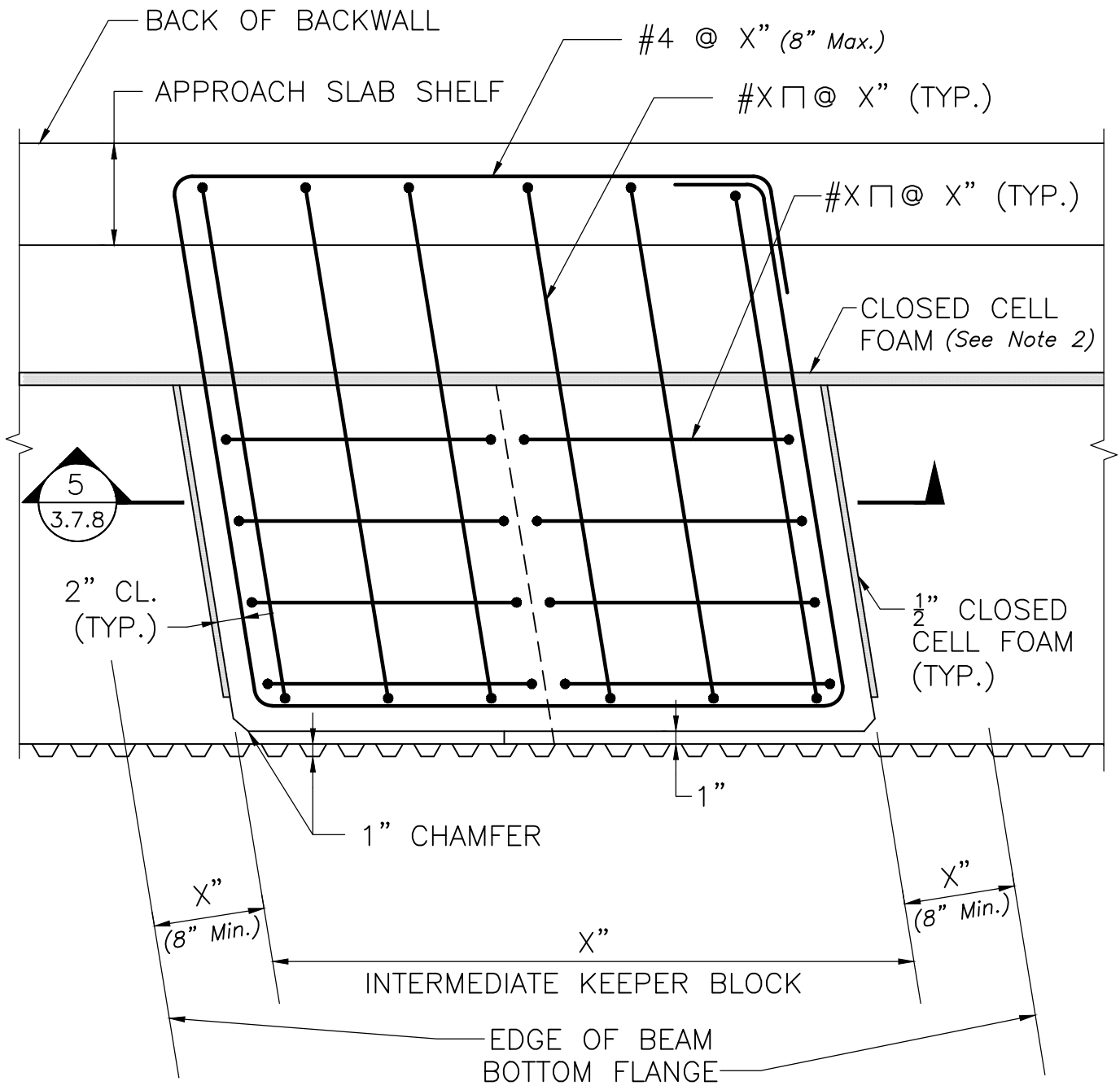
SECTION 4

SCALE: 1" = 1'–0"

NOTE:

Design as shear friction reinforcement to resist transverse seismic loads. Reinforcement configuration shown is conceptual. The Designer shall modify the arrangement or add additional hoops as required by the actual design.

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	VERTICAL SECTION AT SPLAYED WINGWALL BRIDGE SEAT DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.7.6**



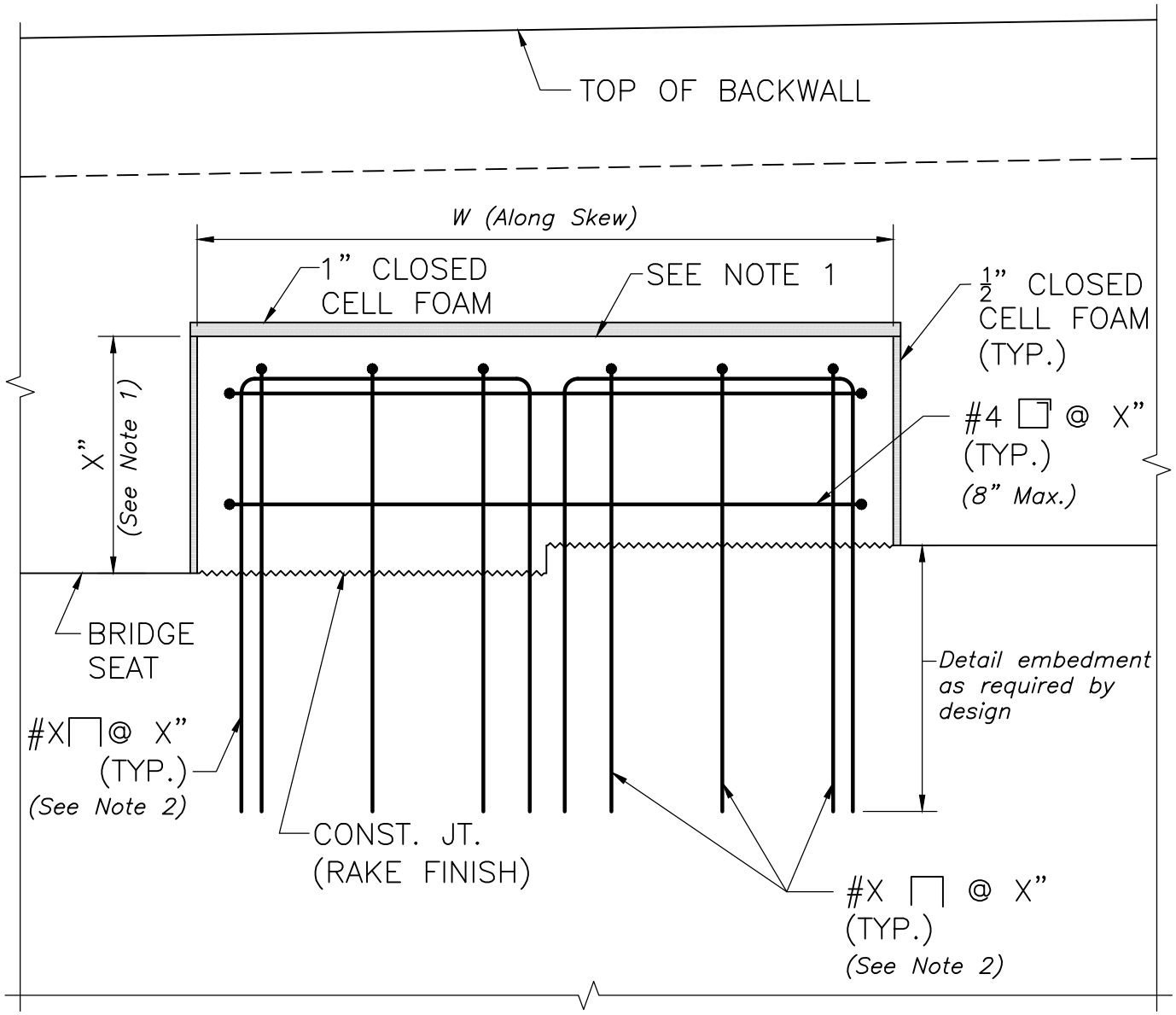
INTERMEDIATE ABUTMENT KEEPER BLOCK

SCALE: 1" = 1'–0"

NOTES:

1. *Intermediate keeper blocks are only used when the standard seismic restraints are insufficient. Avoid locating an intermediate keeper block in a utility bay. The sides of the intermediate keeper block are to be parallel with the adjacent beams.*
2. *Detail shown is for abutments with pavement sawcut. Modify drawing and provide closed cell foam as required for the abutment type used.*

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	INTERMEDIATE KEEPER BLOCK – PLAN SECTION BRIDGE SEAT DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.7.7**



NOTES:

1. TOP OF KEEPER BLOCK SHALL BE TROWELED SMOOTH PARALLEL TO PROFILE GRADE.

2. ABUTMENT REINFORCEMENT BELOW CONSTRUCTION JOINT HAS BEEN OMITTED FOR CLARITY.

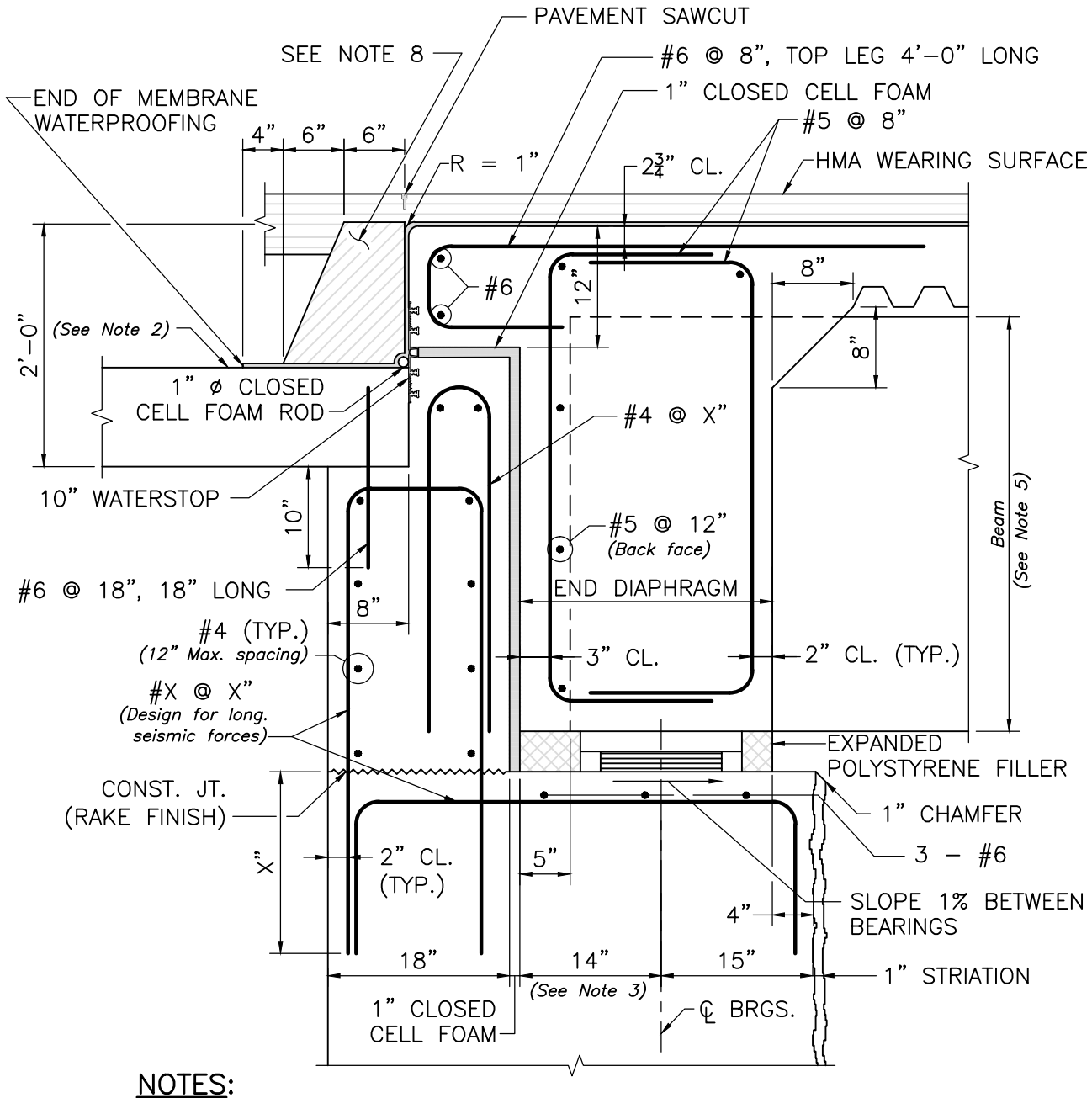
SECTION 5

SCALE: 1" = 1'–0"

NOTES:

1. *Height of keeper block: H ⩽ W/3*
2. *Design as shear friction reinforcement to resist transverse seismic loads. Reinforcement configuration shown is conceptual. The Designer shall modify the arrangement or add hoops as required by actual design.*

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	INTERMEDIATE KEEPER BLOCK – VERTICAL SECTION BRIDGE SEAT DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.7.8**



NOTES:

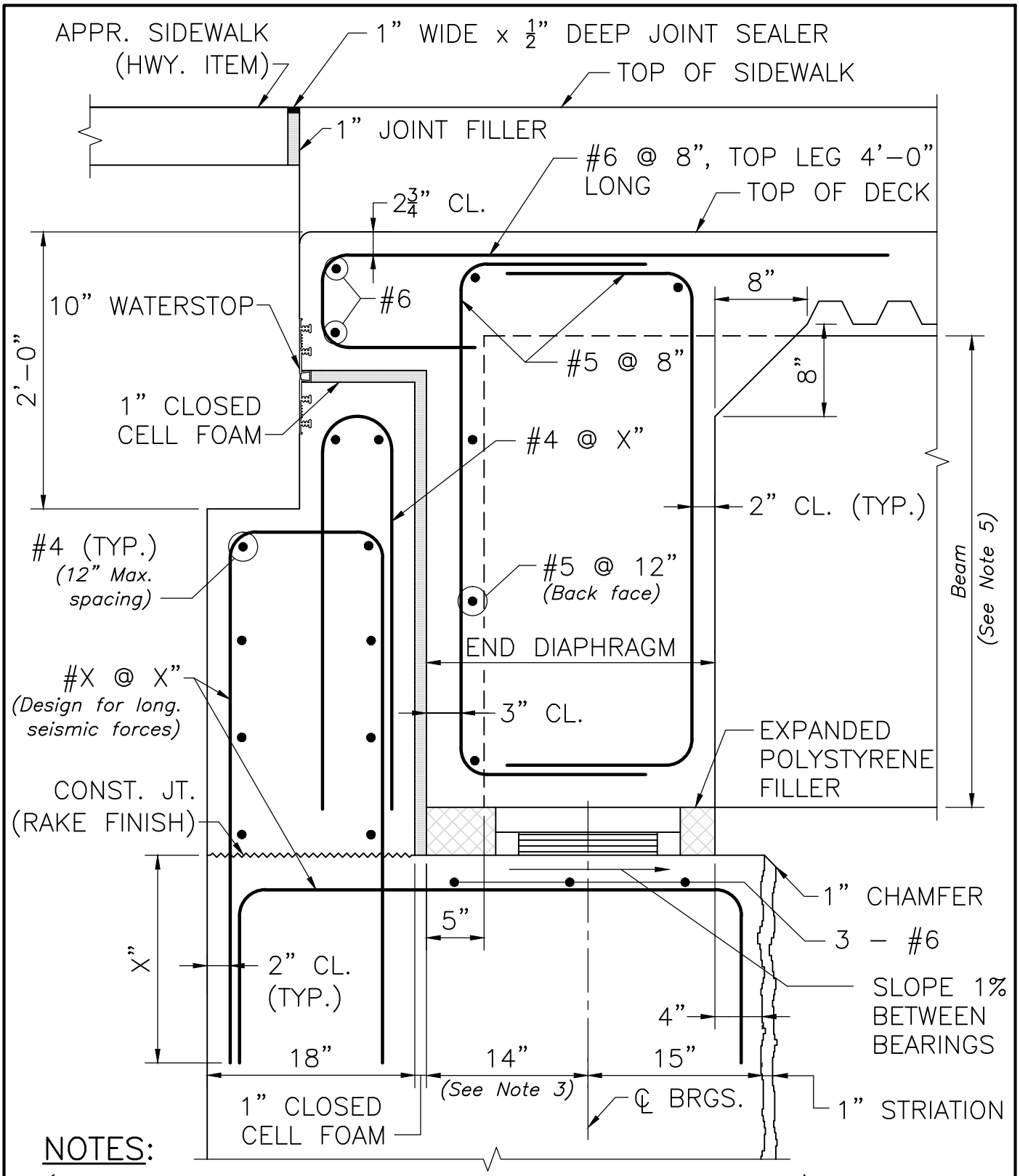
(See Dwg. No. 3.7.13 for Notes to be included on Construction Drawings)

DETAILS AT ABUTMENT – ROADWAY SECTION

SCALE: 1" = 1'–0"

NOTES:

1. *The use of Pavement Sawcut is limited to ½" of one way thermal movement. There is no skew angle limit. If movement exceeds ½", use Asphaltic Bridge Joint or Strip Seal Joint.*
2. *This detail is to be used with Approach Slab Type I.*
3. *If the bearing exceeds 16" in diameter, set this dimension equal to Bearing Dia./2 + 6". See Chapter 6 for additional modifications to this dimension required for the NEBT beams.*
4. *For bridges with exposed concrete decks, modify this detail as shown on Dwg. No. 3.7.12.*
5. *Modify above detail for the beam type used.*



NOTES:

(See Dwg. No. 3.7.13 for notes to be included on Construction Drawings)

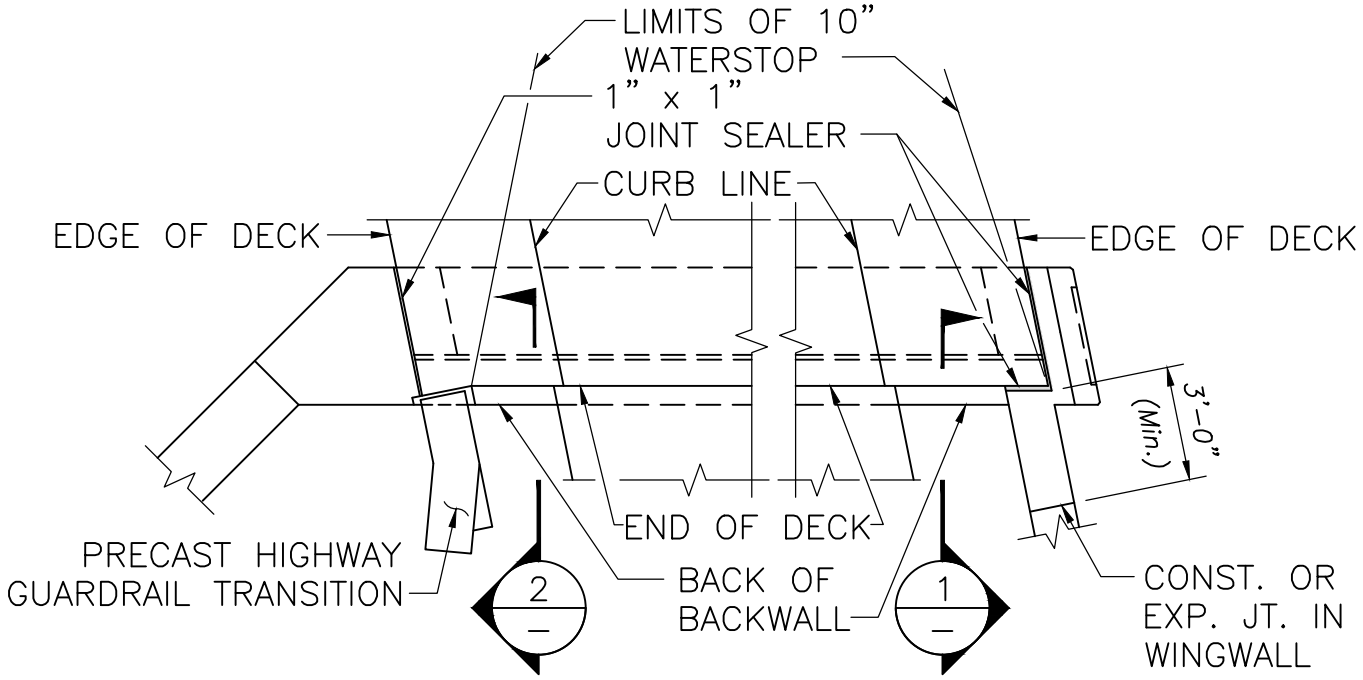
DETAILS AT ABUTMENT – SIDEWALK SECTION

SCALE: 1" = 1'-0"

NOTES:

See Dwg. No. 3.7.9 for Designer Notes.

massDOT Highway Division LRFD BRIDGE MANUAL, PART II	SIDEWALK SECTION WITH PAVEMENT SAWCUT END OF DECK DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.7.10**

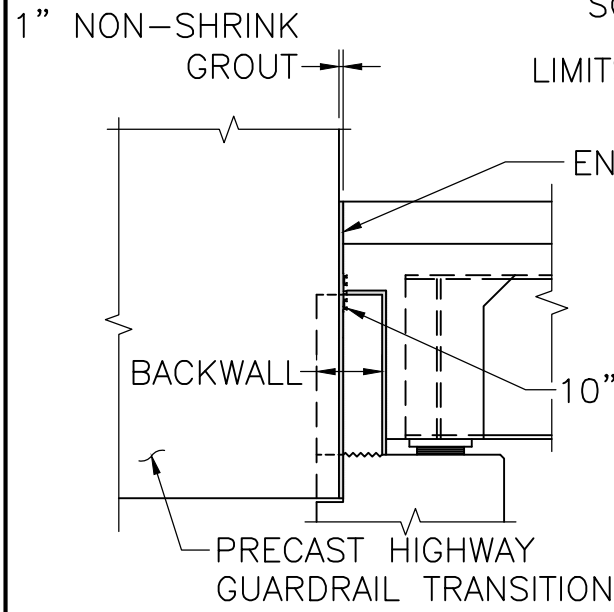


BRIDGE WITH SPLAYED WINGWALLS

BRIDGE WITH U–WINGWALLS

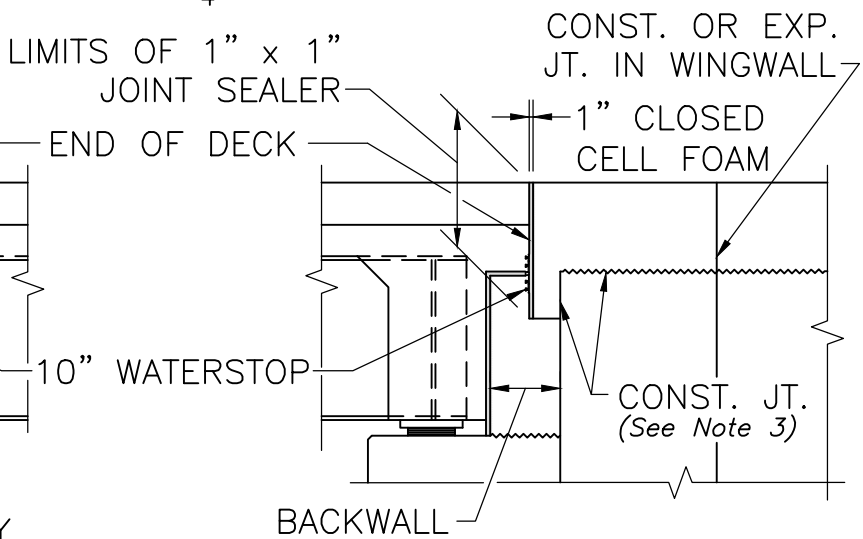
END OF DECK PLAN

SCALE: $\frac{1}{4}$" = 1'–0"



SECTION 2

SCALE: $\frac{1}{4}$" = 1'–0"



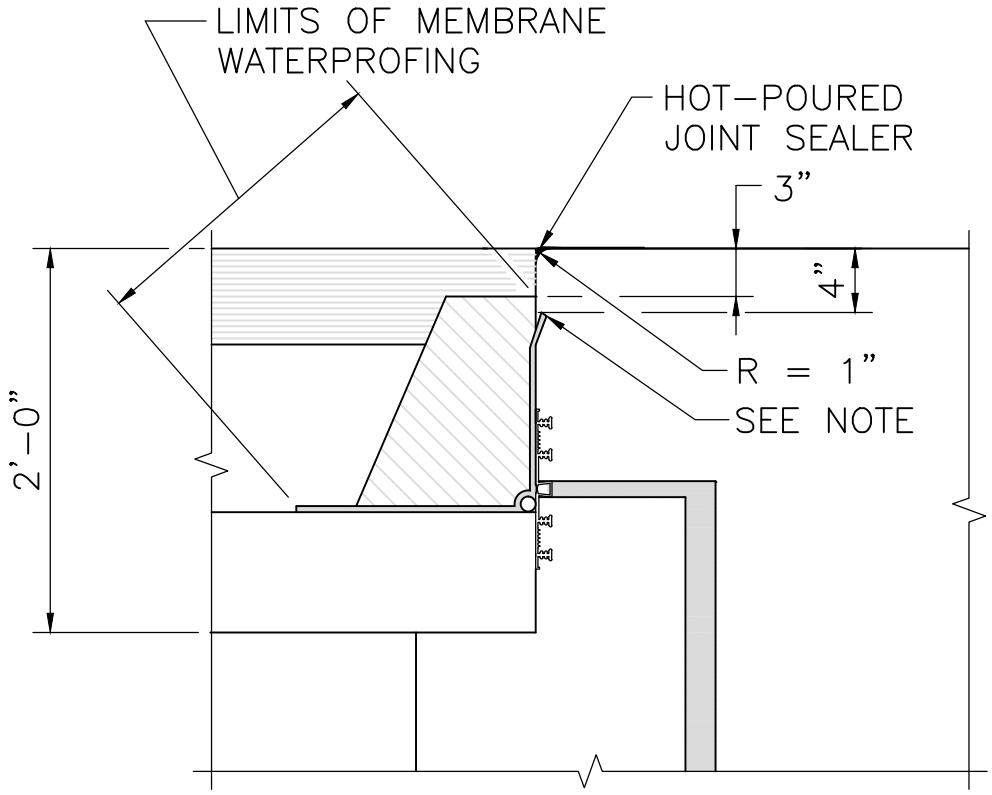
SECTION 1

SCALE: $\frac{1}{4}$" = 1'–0"

NOTES:

1. *Sidewalk details shown, Safety Curb is similar. Railing/barrier omitted for clarity.*
2. *The details shown in Section 2 above may be included with the Precast Highway Guardrail Transition Details.*
3. *For those copings where Chapter 9 does not specify a construction joint, set the construction joint at the top of the striation groove.*

massDOT Highway Division LRFD BRIDGE MANUAL, PART II	END OF DECK WITH PAVEMENT SAWCUT END OF DECK DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.7.11**



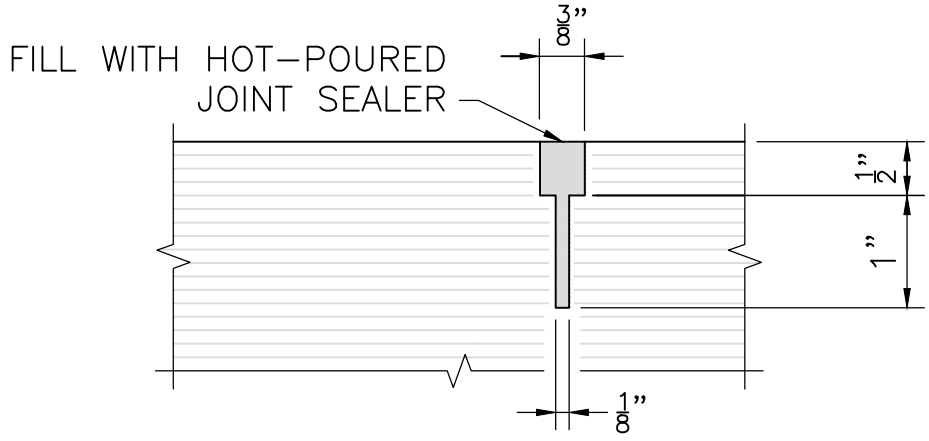
NOTE:

TUCK AND NAIL END OF MEMBRANE WATERPROOFING INTO A TAPERED $\frac{1}{2}$" DEEP x 2" HIGH POCKET. FILL POCKET WITH JOINT SEALER.

(Add this note to the other Details At Abutment Construction Notes)

DETAILS AT ABUTMENT FOR EXPOSED CONCRETE DECKS

SCALE: 1" = 1'–0"



PAVEMENT SAWCUT DETAIL

NOT TO SCALE

massDOT Highway Division LRFD BRIDGE MANUAL, PART II	EXPOSED DECK AND PAVEMENT SAWCUT DETAILS END OF DECK DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.7.12**

ROADWAY/SIDEWALK SECTION NOTES:

(Include these Notes with details shown on Dwg. No.'s 3.7.9 and 3.7.10)

1. ALL REINFORCEMENT SHOWN IN THIS DETAIL SHALL BE COATED EXCEPT FOR THE APPROACH SLAB REINFORCEMENT.

2. ALL BACKWALL CONCRETE ABOVE THE CONSTRUCTION JOINT LOCATED AT THE BRIDGE SEAT SHALL BE 4000 PSI, $\frac{3}{4}$ IN, 610 CEMENT CONCRETE. THE CONSTRUCTION JOINT SHALL BE GIVEN A RAKE FINISH WITH A $\frac{1}{4}$" MINIMUM AMPLITUDE.

3. TOP OF BACKWALL SHALL BE TROWELED SMOOTH PARALLEL TO THE PROFILE GRADE.

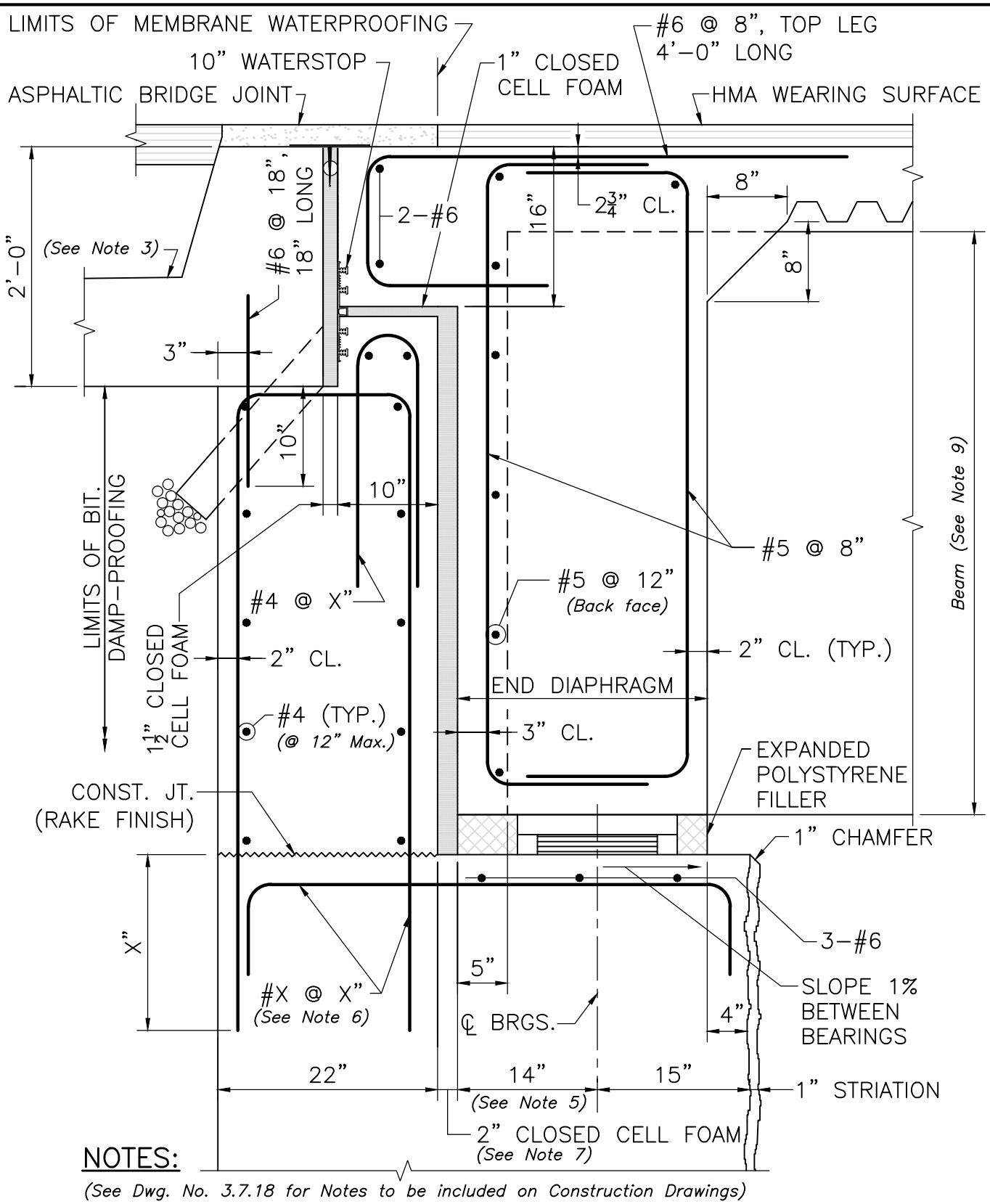
4. THE BACKWALL, KEEPER BLOCK, AND CURTAIN WALL CONCRETE MUST BE PLACED AND SUFFICIENTLY CURED PRIOR TO PLACING THE END DIAPHRAGM CONCRETE.

5. THE END DIAPHRAGM CONCRETE SHALL BE 4000 PSI, $\frac{3}{4}$ IN, 585 HP CEMENT CONCRETE AND SHALL BE PLACED MONOLITHICALLY WITH THE DECK.

6. PRIOR TO PLACING THE END DIAPHRAGM CONCRETE, CLOSED CELL FOAM OF THE SPECIFIED THICKNESSES SHALL BE ATTACHED WITH ADHESIVE TO ALL SURFACES OF THE BACKWALL, KEEPER BLOCKS, AND CURTAIN WALLS AS SHOWN ON THE PLANS. EXPANDED POLYSTYRENE FILLER SHALL BE PLACED UNDER THE BEAM BOTTOM FLANGE AND THE BOTTOM OF THE END DIAPHRAGM SHALL BE FORMED AS SPECIFIED. THE CONTRACTOR SHALL INSURE THAT ALL ABUTMENT CONCRETE IS PROPERLY LINED. END DIAPHRAGM CONCRETE MUST NOT COME IN DIRECT CONTACT WITH ABUTMENT CONCRETE.

7. DRAPE MEMBRANE WATERPROOFING OVER CLOSED CELL FOAM BACKER ROD.

8. PROTECTIVE COURSE TO BE SUPERPAVE BRIDGE PROTECTIVE COARSE (SPC–B–12.5), PLACED IN 2" LAYERS AND COMPACTED WITH A MECHANICAL HAND–GUIDED TAMPER WITHIN 12 HOURS AFTER PLACING MEMBRANE WATERPROOFING.



NOTES:

(See Dwg. No. 3.7.18 for Notes to be included on Construction Drawings)

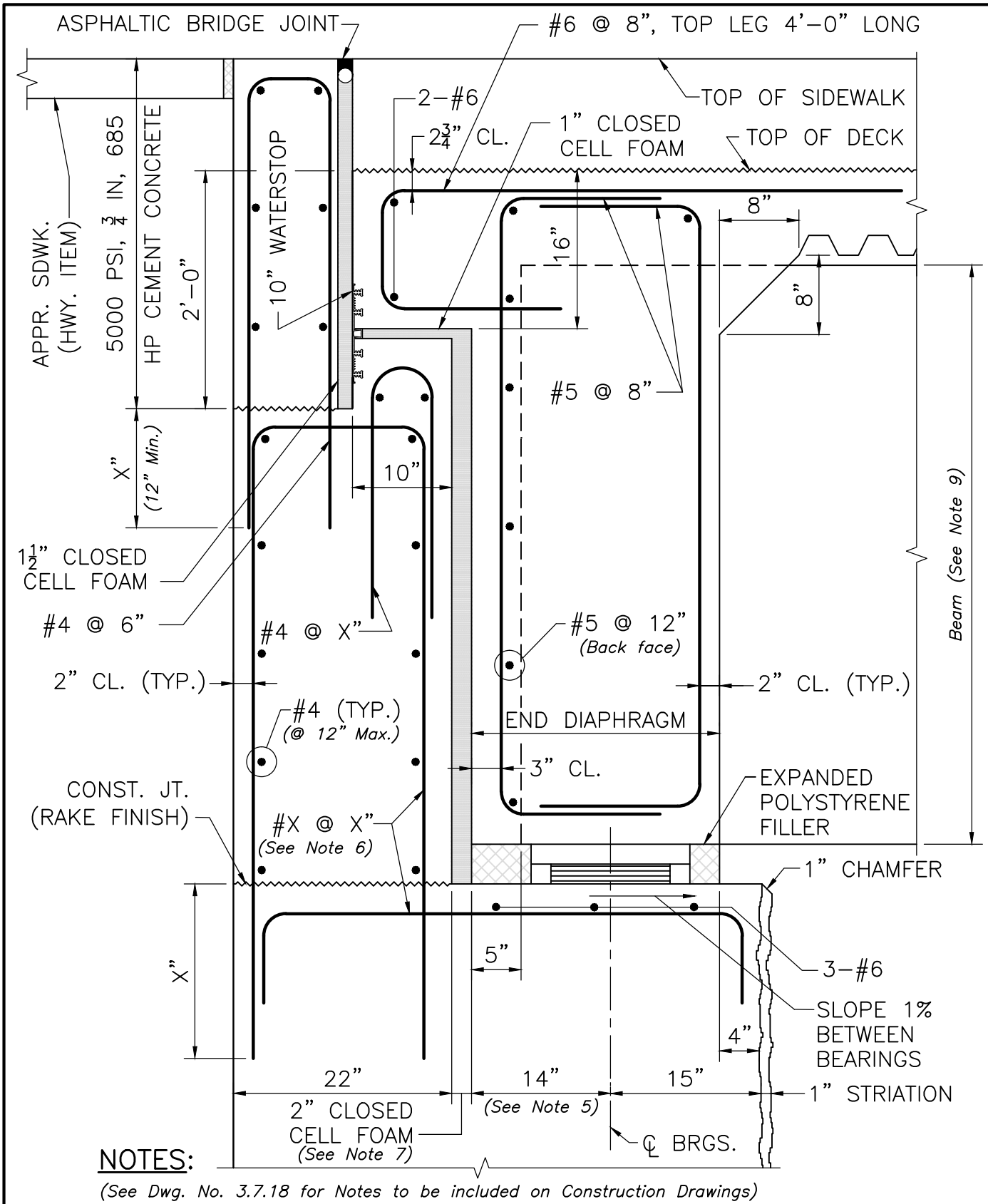
DETAILS AT ABUTMENT – ROADWAY SECTION

SCALE: 1" = 1'-0"

NOTES:

1. *This detail shall be used when one way thermal movement ≤ 1" and skew angle ≤ 30°.*
2. *See Dwg. No. 3.7.16 for Designer Notes.*

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	ROADWAY SECTION WITH ASPHALTIC BRIDGE JOINT END OF DECK DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.7.14**



NOTES:

(See Dwg. No. 3.7.18 for Notes to be included on Construction Drawings)

DETAILS AT ABUTMENT – SIDEWALK SECTION

SCALE: 1" = 1'–0"

NOTE:
See Dwg. No. 3.7.16 for Designer Notes.

massDOT Highway Division

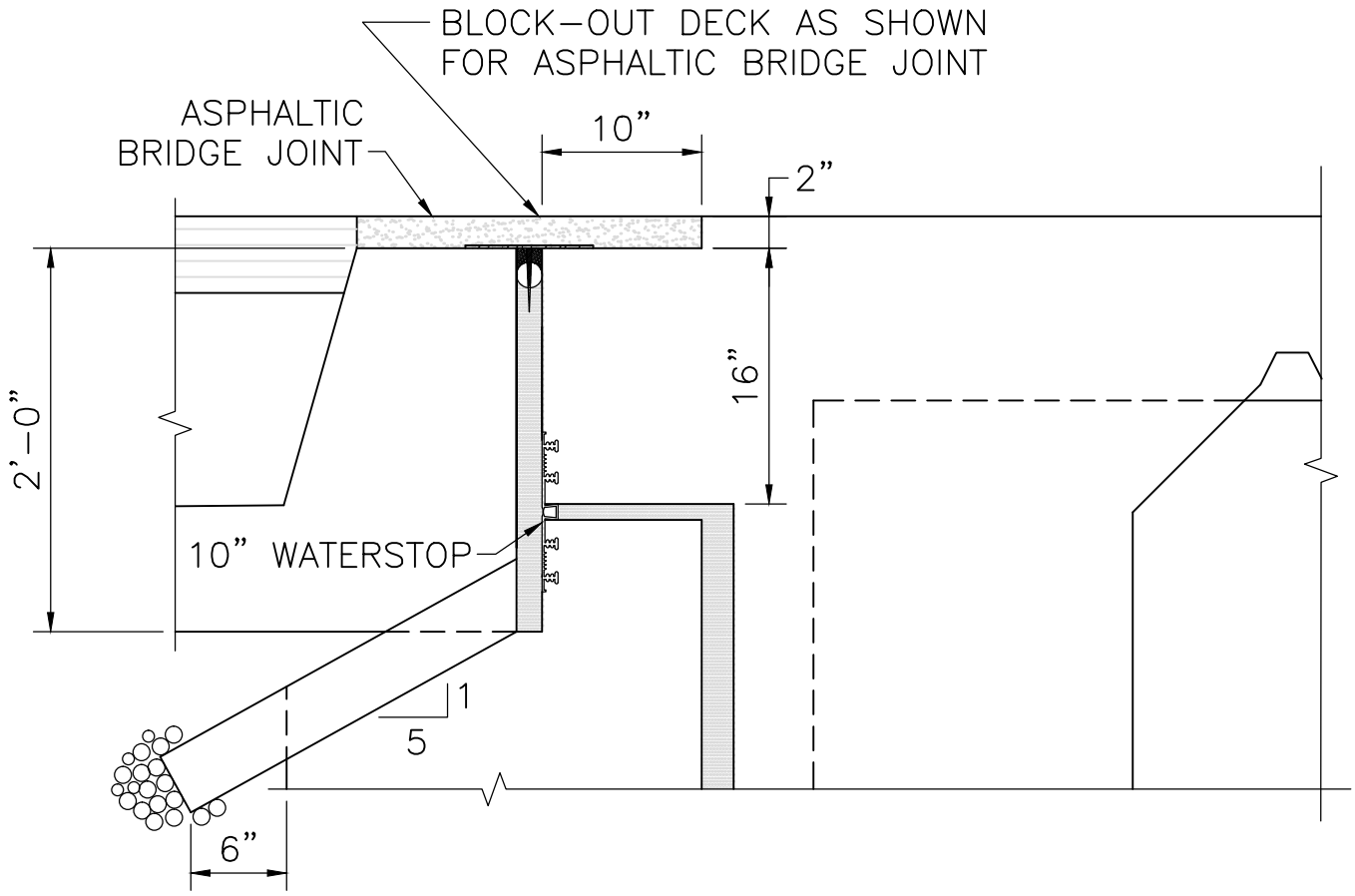
LRFD BRIDGE MANUAL, PART II

SIDEWALK SECTION WITH ASPHALTIC BRIDGE JOINT

END OF DECK DETAILS

DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.7.15



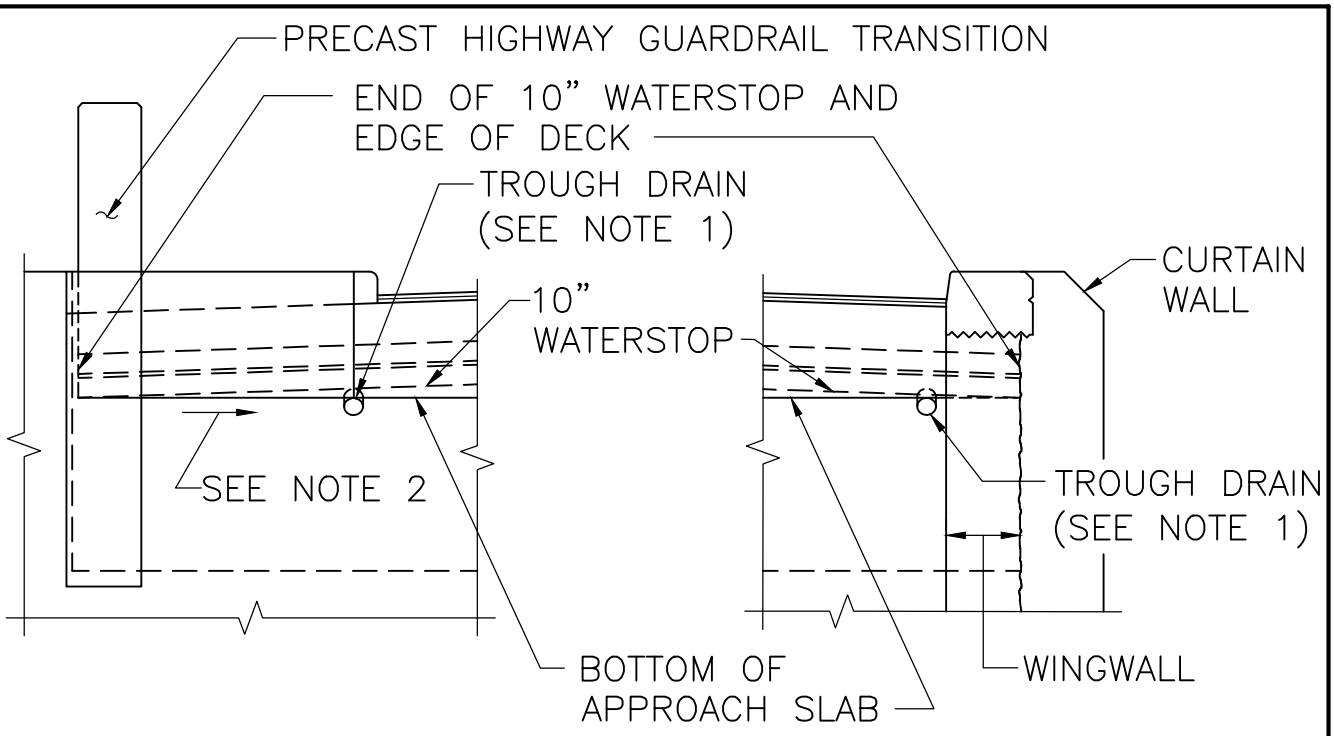
DETAILS AT ABUTMENT FOR EXPOSED CONCRETE DECKS

SCALE: 1" = 1'–0"

NOTES:

1. *Designer Notes listed here are for the details shown on Dwg. No's 3.7.14 and 3.7.15.*
2. *The Asphaltic Bridge Joint shall be used when the limits of the Pavement Sawcut details are exceeded. When the limits of the Asphaltic Bridge Joint as specified on Dwg. 3.7.14 are exceeded, use a Strip Seal Joint and modify this detail accordingly. If the thermal movement range of a strip seal is exceeded, consult with the Director of Bridges and Structures for an appropriate joint system.*
3. *This detail is to be used with Approach Slab Type III.*
4. *Bridges with HMA wearing surface require the use of deck drains.*
5. *If the bearing exceeds 16" in diameter, set this dimension equal to Bearing Dia./2 + 6". See Chapter 6 for additional modifications to this dimension required for the NEBT beams.*
6. *Design these bars for longitudinal seismic forces. Backwall reinforcement configuration shown is concptual. The Designer may modify the arrangement by adding additional hoops as required by the actual design.*
7. *This detail anticipates 1" of one–way thermal movement.*
8. *For bridges with exposed concrete decks, modify this detail as shown on Dwg. 3.7.16.*
9. *Modify the detail for the beam type used.*

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	EXPOSED CONCRETE DECK DETAILS & DESIGNER NOTES END OF DECK DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.7.16**



BRIDGES WITH SIDEWALK OR WITH SPLAYED WINGWALLS

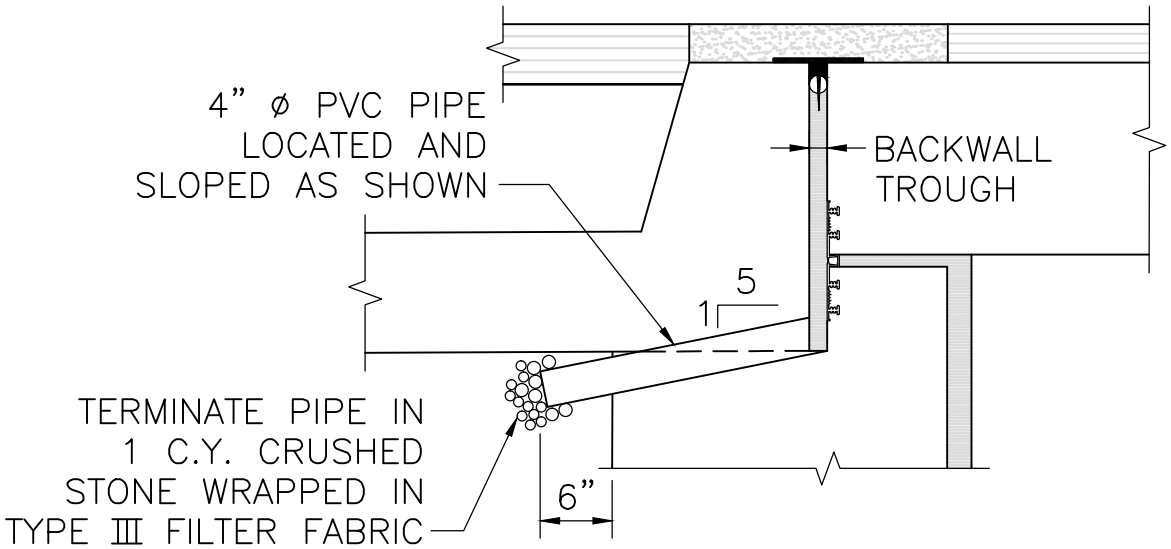
BRIDGES WITH SAFETY CURBS OR WITH U–WINGWALLS

NOTES:

1. PROVIDE BACKWALL TROUGH DRAINS AT LOW POINTS.
2. SLOPE BACKWALL TROUGH UNDER SIDEWALK 5% MIN. TOWARDS DRAIN.

END OF DECK ELEVATION

SCALE: $\frac{1}{4}$" = 1'–0"



TROUGH DRAIN DETAILS

SCALE: $\frac{3}{4}$" = 1'–0"

massDOT Highway Division LRFD BRIDGE MANUAL, PART II	END OF DECK ELEVATION TROUGH DRAIN DETAILS END OF DECK DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.7.17**

ROADWAY/SIDEWALK SECTION NOTES:

(Include these Notes with details shown on Dwg. No's. 3.7.14 and 3.7.15)

1. ALL REINFORCEMENT SHOWN IN THIS DETAIL SHALL BE COATED, EXCEPT FOR THE APPROACH SLAB REINFORCEMENT.

2. TOP OF BACKWALL SHALL BE TROWELED SMOOTH PARALLEL TO THE PROFILE GRADE.

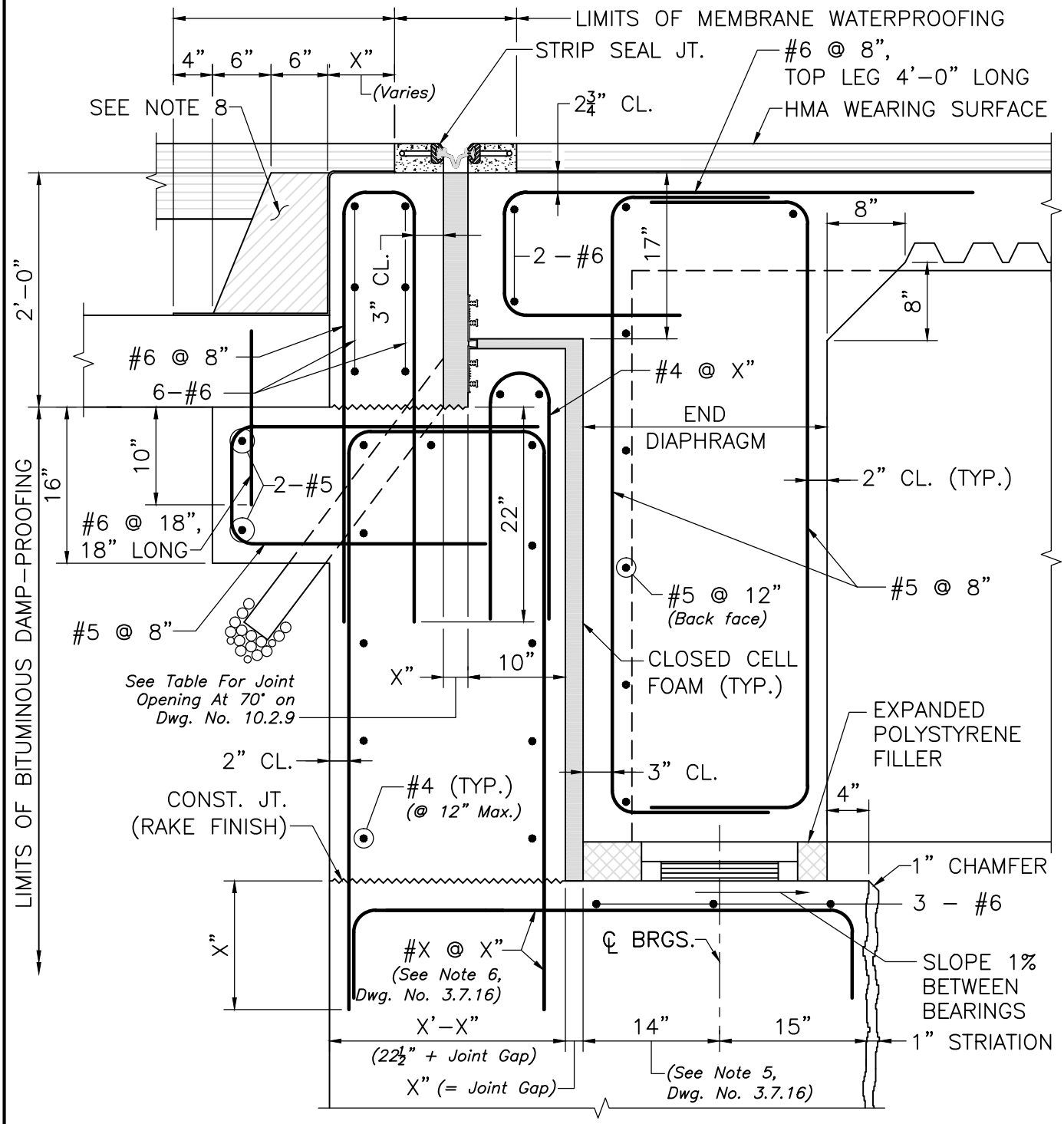
3. BACKWALL, KEEPER BLOCK AND CURTAIN WALL CONCRETE MUST BE PLACED AND SUFFICIENTLY CURED PRIOR TO PLACING THE END DIAPHRAGM CONCRETE.

4. THE END DIAPHRAGM CONCRETE SHALL BE 4000 PSI, $\frac{3}{4}$ IN, 585 HP CEMENT CONCRETE AND SHALL BE PLACED MONOLITHICALLY WITH THE DECK.

5. PRIOR TO PLACING THE END DIAPHRAGM CONCRETE, CLOSED CELL FOAM OF THE SPECIFIED THICKNESSES SHALL BE ATTACHED WITH ADHESIVE TO ALL SURFACES OF THE BACKWALL, KEEPER BLOCKS, AND CURTAIN WALLS AS SHOWN ON THE PLANS. EXPANDED POLYSTYRENE SHALL BE PLACED UNDER THE BEAM BOTTOM FLANGE AND THE BOTTOM OF THE END DIAPHRAGM SHALL BE FORMED AS SPECIFIED. THE CONTRACTOR SHALL INSURE THAT ALL ABUTMENT CONCRETE IS PROPERLY LINED. END DIAPHRAGM CONCRETE MUST NOT COME IN DIRECT CONTACT WITH THE ABUTMENT CONCRETE.

6. AFTER THE END DIAPHRAGM HAS CURED SUFFICIENTLY, PLACE THE APPROACH SLAB CONCRETE AND BACKWALL CONCRETE AT SIDEWALK. THE BACKWALL TROUGH WILL BE FORMED WITH CLOSED CELL FOAM AND CARE SHALL BE TAKEN TO INSURE THAT CONCRETE DOES NOT ENTER THE TROUGH DRAINS.

7. COVER THE BACKWALL TROUGH OPENING SECURELY TO KEEP DEBRIS OUT UNTIL READY TO INSTALL THE ASPHALTIC BRIDGE JOINT.



(See Dwg. No. 3.7.22 for Notes to be included on Construction Drawings)

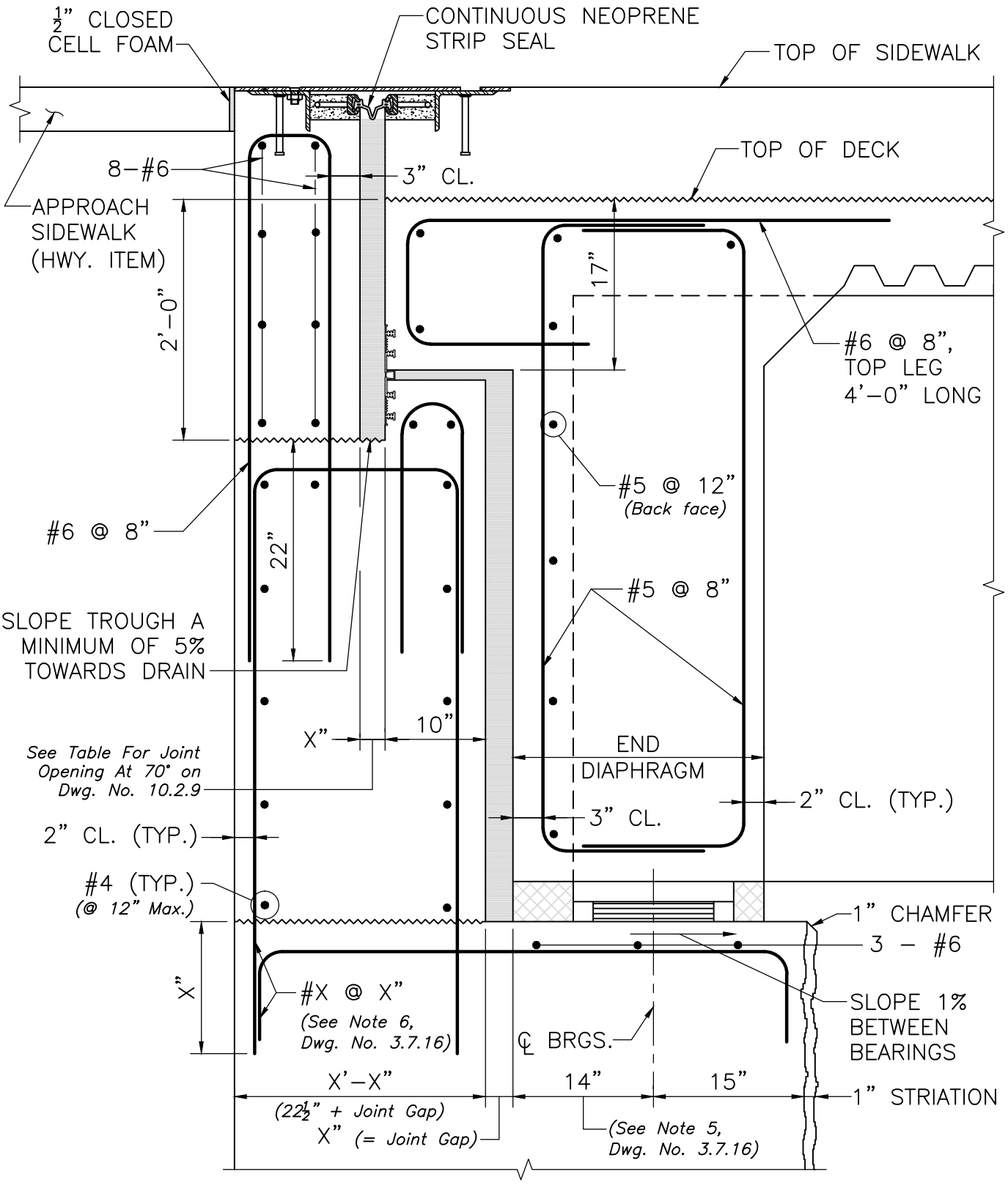
DETAILS AT ABUTMENT – ROADWAY SECTION

SCALE: 1" = 1'–0"

NOTES:

1. *This detail is to be used with approach slab Type I, modified as shown.*
2. *Bridges with HMA wearing surface require the use of deck drains.*
3. *For bridges with exposed concrete decks, modify this detail as shown on Dwg. No. 3.7.21.*

massDOT Highway Division LRFD BRIDGE MANUAL, PART II	ROADWAY SECTION WITH STRIP SEAL JOINT END OF DECK DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.7.19**



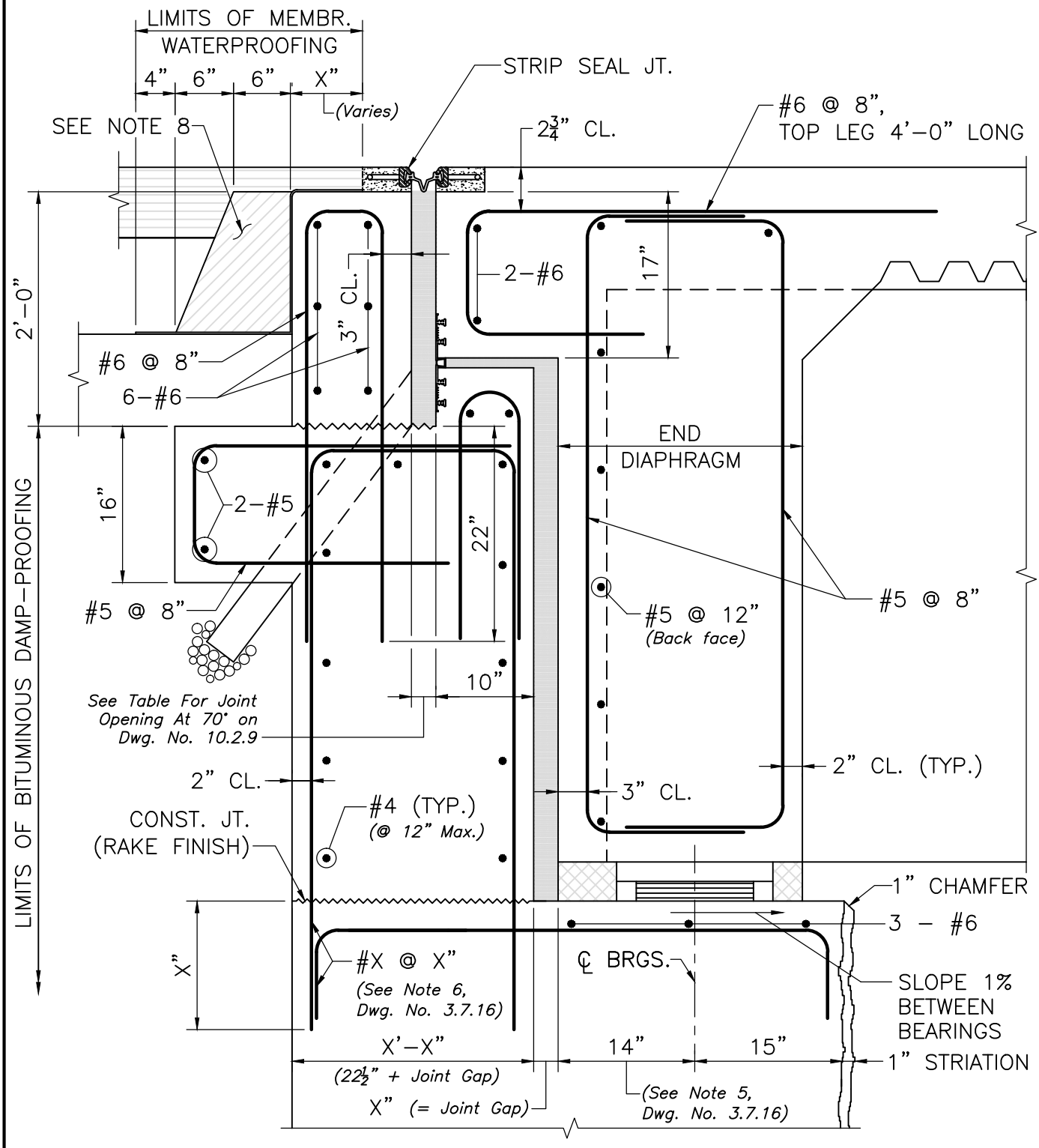
DETAILS AT ABUTMENT–SIDEWALK SECTION

SCALE: 1" = 1'–0"

NOTES:

1. See Dwg. No. 3.7.22 for Notes to be included on Construction Drawings.
2. Refer to Dwg. No. 3.7.19 for dimensions and information not shown here.

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	SIDEWALK SECTION WITH STRIP SEAL JOINT END OF DECK DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.7.20**



DETAILS AT ABUTMENT – EXPOSED CONCRETE DECK

SCALE: 1" = 1'–0"

NOTES:

1. *See Dwg. No. 3.7.22 for Notes to be included on Construction Drawings.*
2. *Refer to Dwg. No. 3.7.19 for dimensions and information not shown here.*
3. *This detail shall be used with Approach Slab Type I, modified as shown.*

massDOT Highway Division LRFD BRIDGE MANUAL, PART II	EXP. DECK RDWY. SECTION WITH STRIP SEAL JOINT END OF DECK DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.7.21**

ROADWAY/SIDEWALK SECTION NOTES:

(Modify the Construction Notes on Dwg. No. 3.7.18 as shown below for strip seal joints)

1. *(No modifications)*

2. *(No modifications)*

3. *(Substitute the following)* BACKWALL BELOW CONSTRUCTION JOINT, KEEPER BLOCK AND CURTAIN WALL CONCRETE MUST BE PLACED AND SUFFICIENTLY CURED PRIOR TO PLACING THE END DIAPHRAGM CONCRETE.

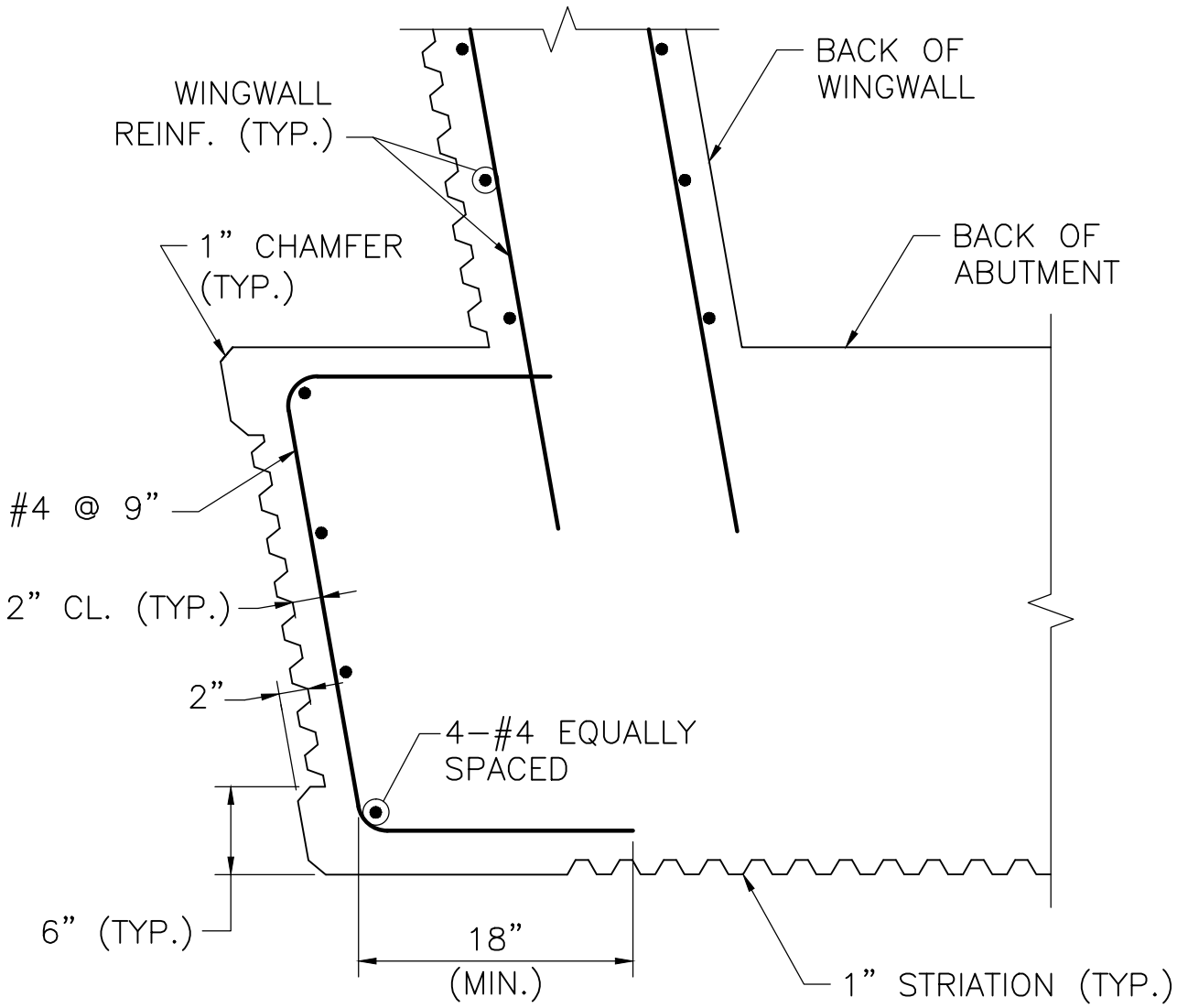
4. *(No modifications)*

5. *(No modifications)*

6. *(Substitute the following)* AFTER THE END DIAPHRAGM CONCRETE HAS CURED SUFFICIENTLY, PLACE THE APPROACH SLAB CONCRETE AND REMAINDER OF BACKWALL CONCRETE. THE BACKWALL TROUGH WILL BE FORMED WITH CLOSED CELL FOAM AND CARE SHALL BE TAKEN TO INSURE THAT CONCRETE DOES NOT ENTER THE TROUGH SUMP.

7. *(Substitute the following)* COVER THE BACKWALL TROUGH OPENING SECURELY TO KEEP DEBRIS OUT UNTIL READY TO INSTALL THE STRIP SEAL JOINT.

8. *(Add the following note)* PROTECTIVE COURSE TO BE HOT MIX ASPHALT DENSE BINDER COURSE FOR BRIDGES, PLACED IN 2" LAYERS AND COMPACTED WITH A MECHANICAL HAND-GUIDED TAMPER WITHIN 12 HOURS AFTER PLACING MEMBRANE WATERPROOFING.



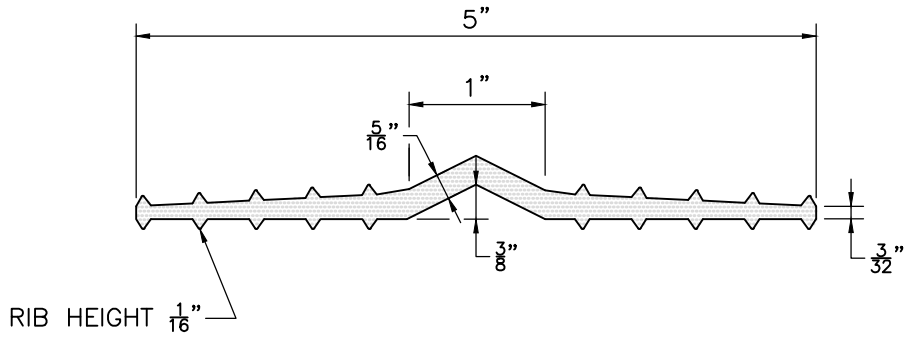
SECTION 6

SCALE: 1" = 1'-0"

NOTE:

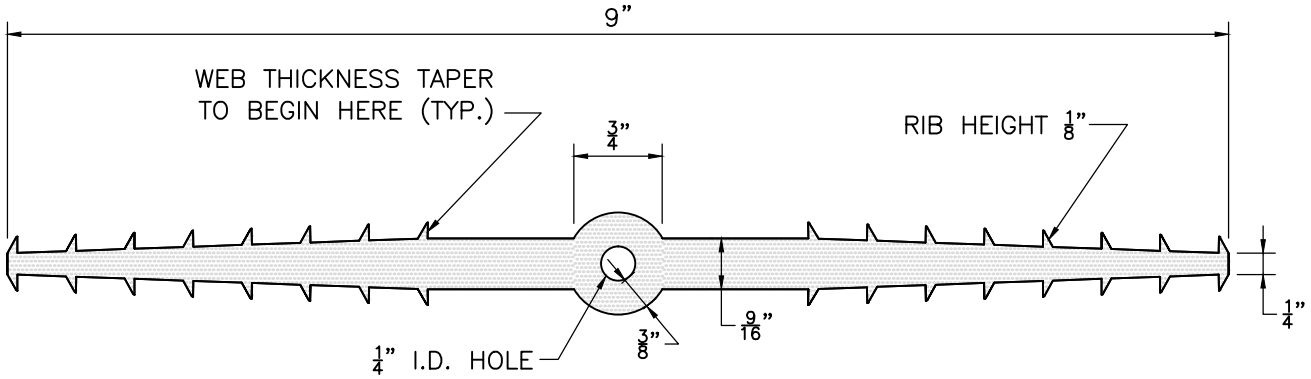
The Designer shall provide the rest of the abutment reinforcement in the section above and modify the detail for the type of abutment used.

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	HORIZONTAL SECTION ABUTMENT W/ U-WINGWALL END OF DECK DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.7.23**



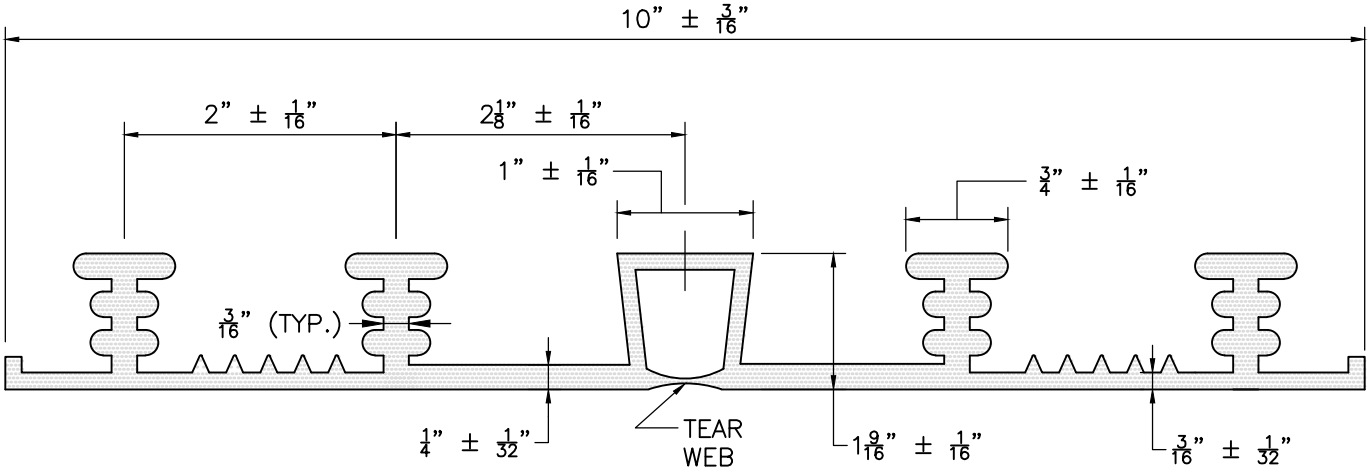
5” WATERSTOP

NOT TO SCALE



9” WATERSTOP

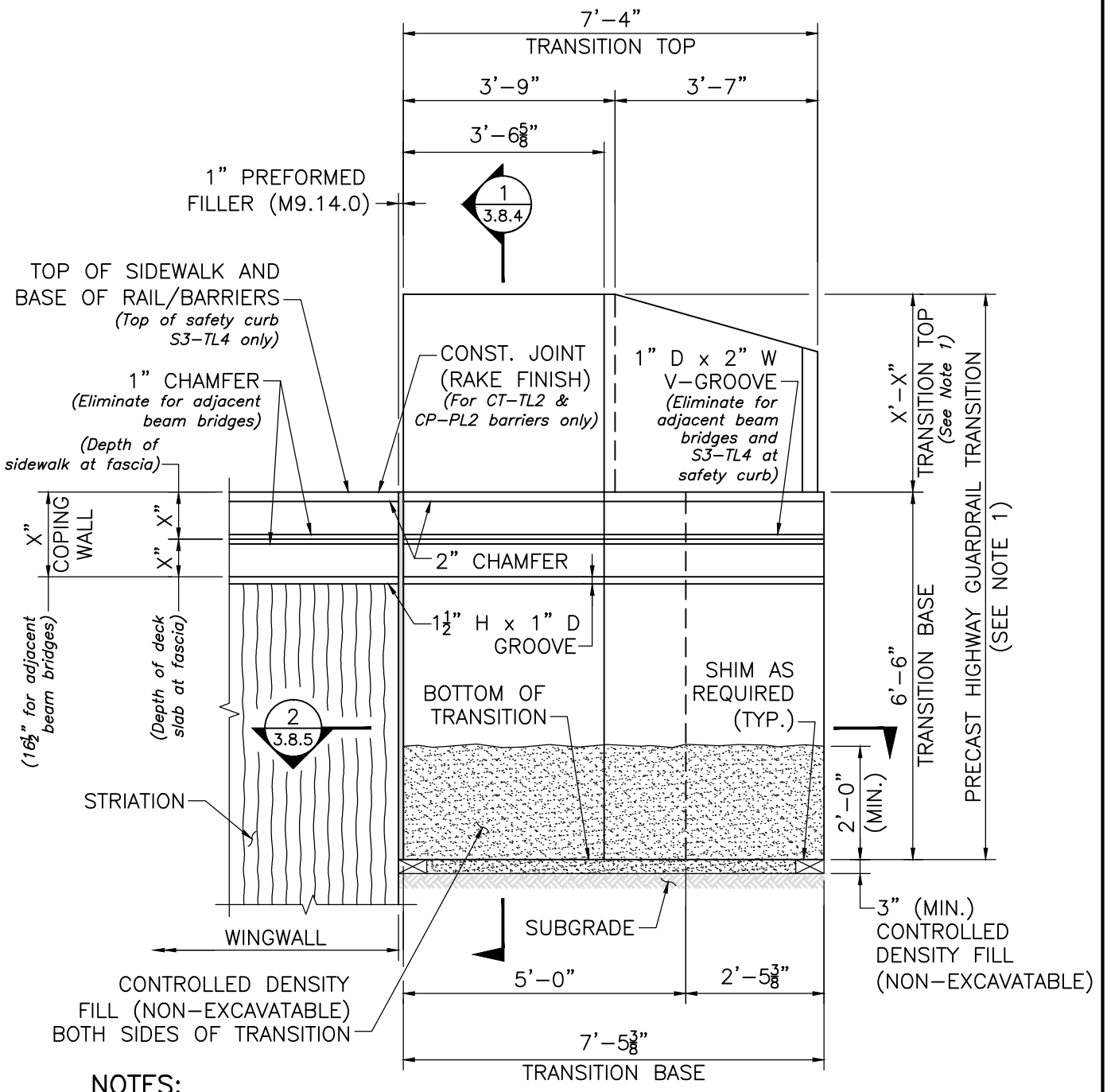
NOT TO SCALE



10” WATERSTOP

NOT TO SCALE

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	PLASTIC WATERSTOP DETAILS END OF DECK DETAILS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.7.24**



NOTES:

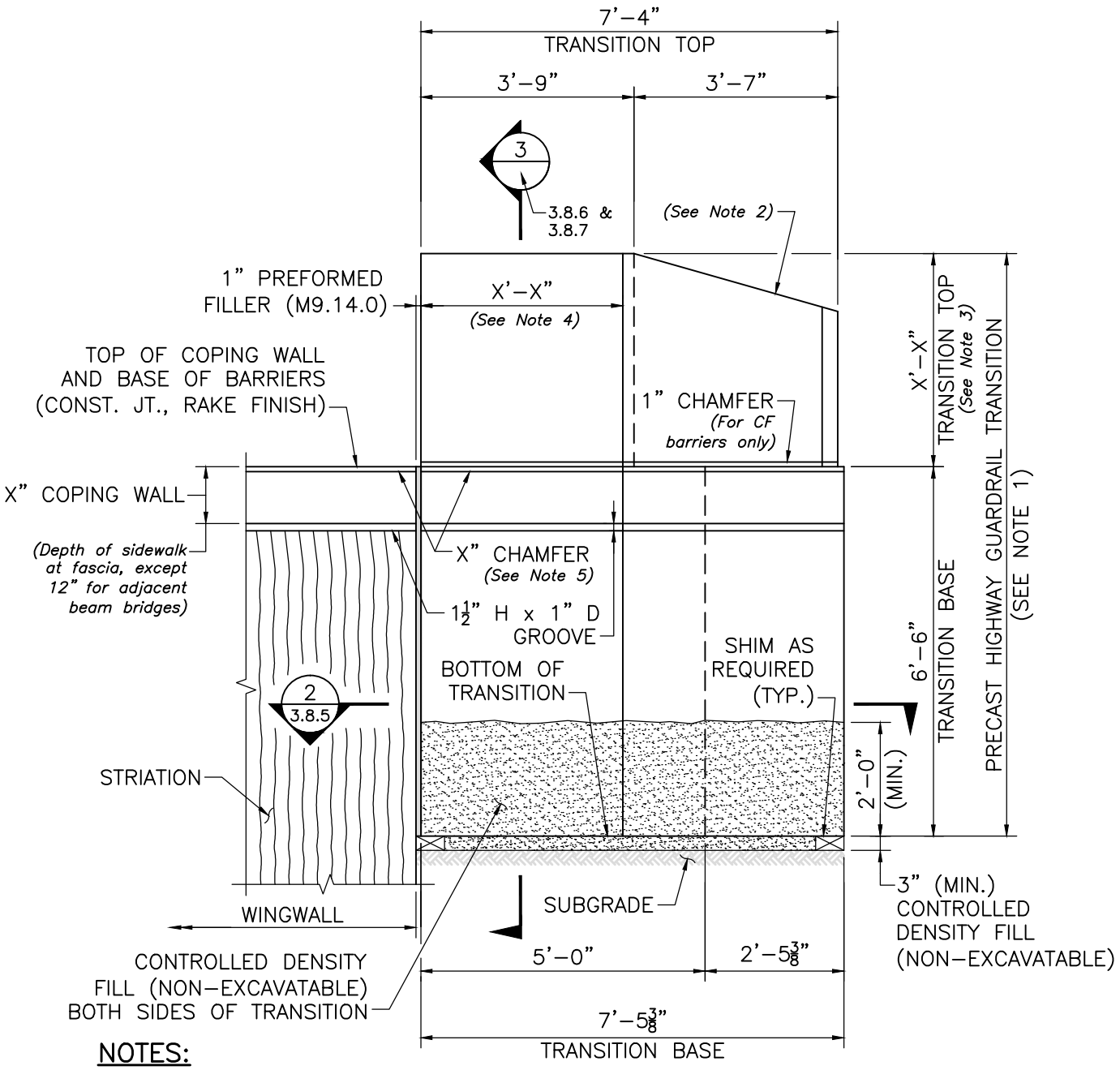
(See Dwg. No. 3.8.3 for notes to be included on Construction Drawings)

NOTE: For Designer Notes See Dwg. No. 3.8.3.

PRECAST GUARDRAIL TRANSITION ELEVATION AT U–WINGWALL

SCALE: 1/2" = 1'–0"

FOR S3–TL4 RAILING, CT–TL2 AND CP–PL2 BARRIERS AT SIDEWALK AND S3–TL4 RAILING AT SAFETY CURB



NOTES:

(See Dwg. No. 3.8.3 for notes to be included on Construction Drawings)

NOTE: For Designer Notes See Dwg. No. 3.8.3.

PRECAST GUARDRAIL TRANSITION ELEVATION AT U–WINGWALL

SCALE: ½" = 1'–0"

FOR CT–TL2 AND CP–PL2 AT SAFETY CURB AND CF BARRIERS

NOTES: *(Include these notes with details shown on Dwg. No's. 3.8.1, 3.8.2 & 3.8.8 thru 3.8.10)*

1. PRECAST GUARDRAIL TRANSITION SHALL BE 5000 PSI, $\frac{3}{4}$ IN, 685 HP CEMENT CONCRETE.

2. GRAVEL BORROW SHALL BE PLACED AND THOROUGHLY COMPACTED TO THE GRADE OF 3" (MIN.) BELOW THE INTENDED BOTTOM OF THE PRECAST GUARDRAIL TRANSITION BASE AND TO A HEIGHT OF 2'–0" (MIN.) ON ALL SIDES OF THE TRANSITION BASE TO FORM A TRENCH IN WHICH TO SET THE TRANSITION. WHERE NO GRAVEL BORROW IS REQUIRED BELOW THE BASE, IT SHALL BE PLACED ON UNDISTURBED SOIL.

3. CONTRACTOR SHALL SET THE PRECAST GUARDRAIL TRANSITION TO THE REQUIRED ELEVATION AND ALIGNMENT, AND BACKILL PRECAST GUARDRAIL TRANSITION WITH CONTROLLED DENSITY FILL (NON–EXCAVATABLE) TO THE ELEVATION SHOWN.

Add the following notes for splayed wingwalls only:

4. AFTER CONTROLLED DENSITY FILL (NON–EXCAVATABLE) HAS SET FILL THE GAPS BETWEEN GUARDRAIL TRANSITION AND BLOCK–OUT IN BACKWALL AND ABUTMENT WITH NON–SHRINK GROUT UP TO THE TOP OF BACKWALL.

5. THE REST OF REINFORCEMENT IS NOT SHOWN FOR CLARITY.

NOTES:

1. *The height of the transition top is 2'–10" for S3–TL4 railing at safety curb and 3'–6" for S3–TL4 railing, CT–TL2, and CP–PL2 barriers at sidewalk.*
2. *Modify the shape of the transition top as required for CF–PL2 barrier.*
3. *The height of the transition top is 2'–11" for CF–PL2 barrier and 3'–9" for CT–TL2, CP–PL2 and CF–PL3 barriers.*
4. *This dimension is equal to 3'–6$\frac{5}{8}$" for CT–TL2 and CP–PL2 barriers at safety curb and 3–6$\frac{3}{8}$" for CF barriers.*
5. *The chamfer is 2" for CT–TL2 and CP–PL2 barriers and 1" for CF barriers.*

MassDOT Highway Division

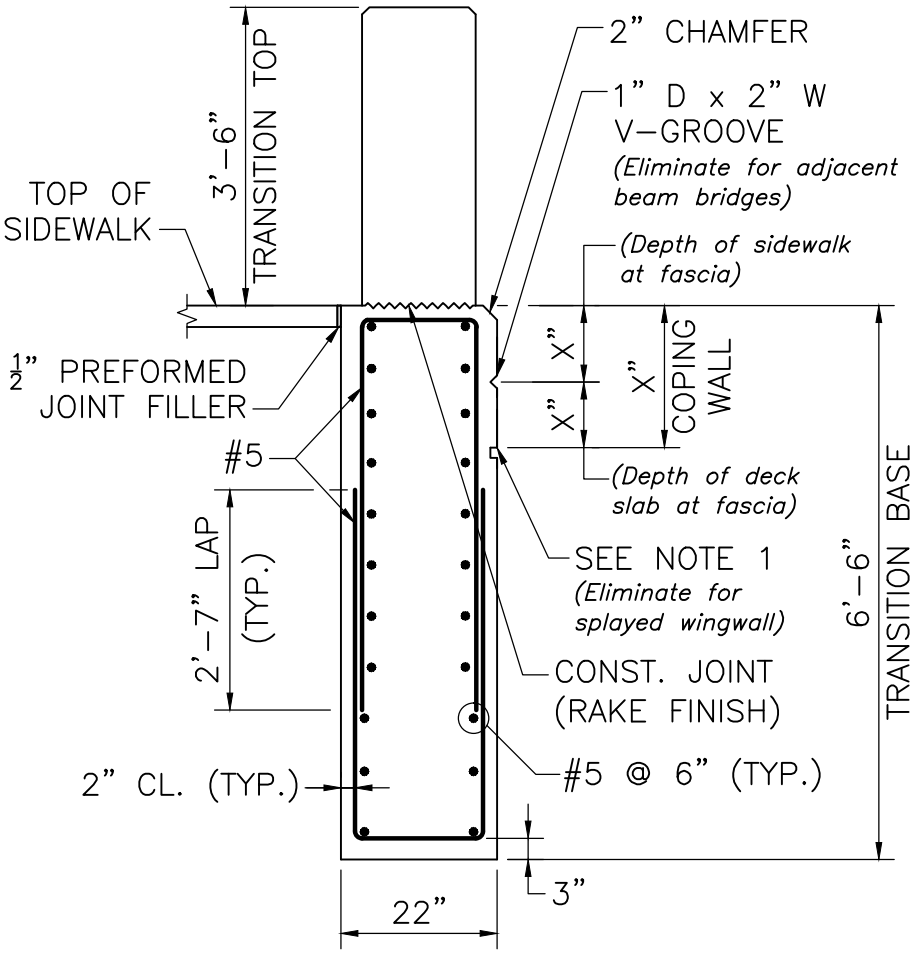
LRFD BRIDGE MANUAL, PART II

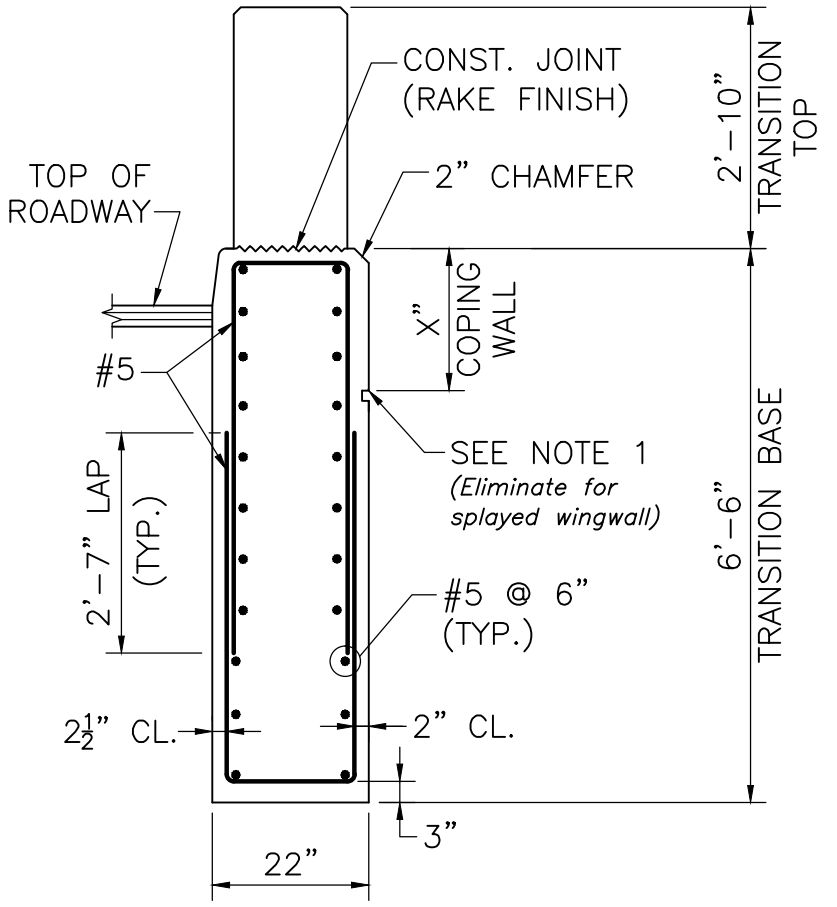
VERTICAL SECTIONS AT U-WINGWALL FOR S3-TL4, CT-TL2, CP-PL2 AT SIDEWALK AND S3-TL4 AT SAFETY CURB

PRECAST HIGHWAY GUARDRAIL TRANSITIONS

DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.8.4





NOTES:

1. 1½" H x 1" D GROOVE. ALIGN WITH GROOVE AT TOP OF STRIATIONS.
2. REINFORCEMENT OF THE TRANSITION TOP IS NOT SHOWN FOR CLARITY.

SECTION 1

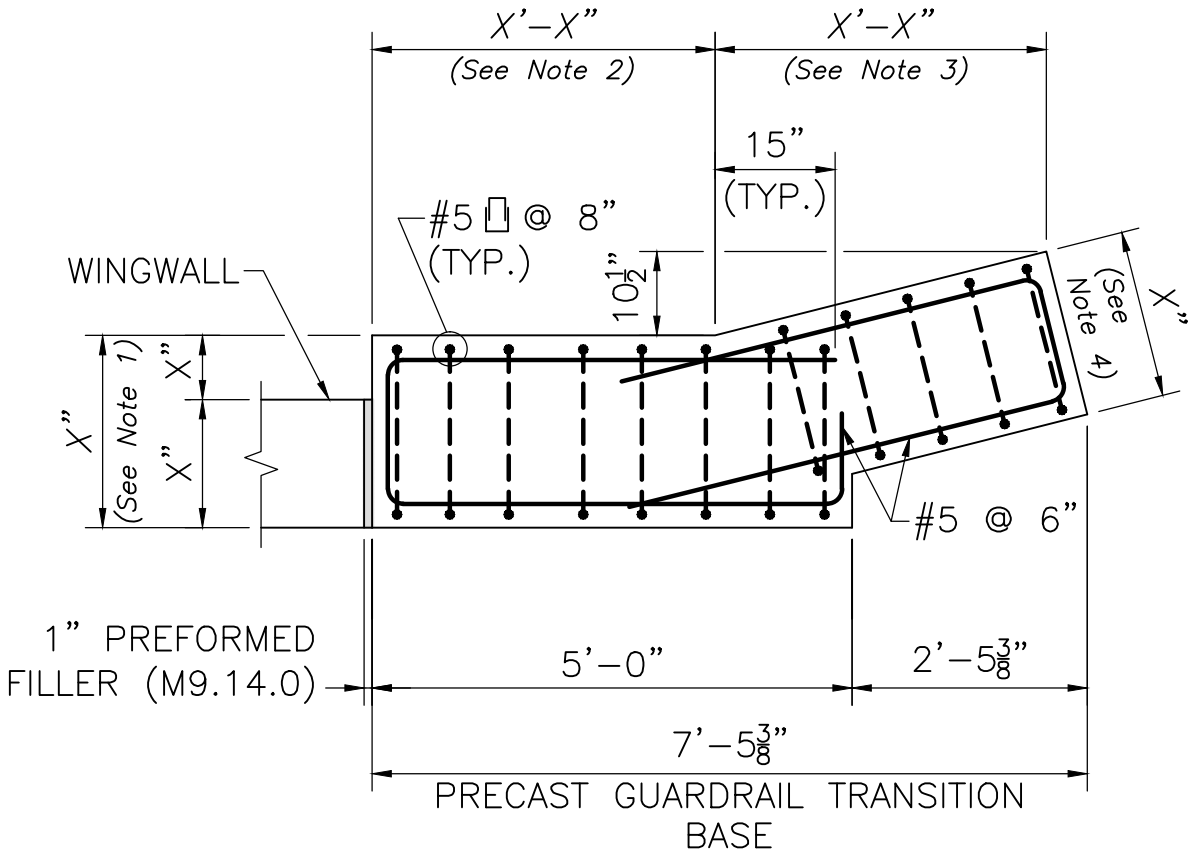
SCALE: ½" = 1'-0"

FOR S3-TL4 RAILING, CT-TL2 AND CP-PL2 BARRIERS AT SIDEWALK SIDE

SECTION 1

SCALE: ½" = 1'-0"

FOR S3-TL4 RAILING AT SAFETY CURB



NOTE:

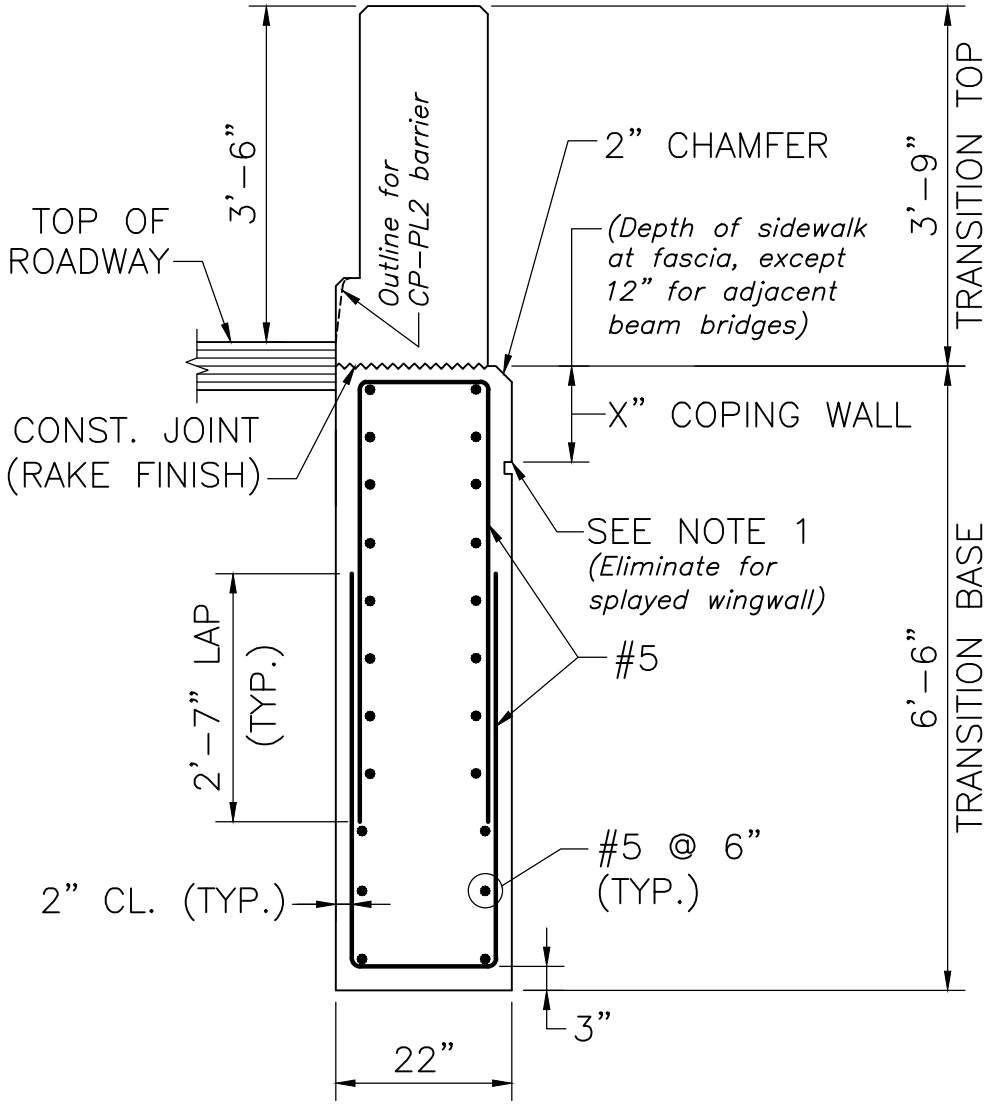
WINGWALL REINFORCEMENT AND STRIATIONS NOT SHOWN FOR CLARITY.

SECTION 2

SCALE: ½" = 1'–0"

NOTES:

1. *2'–0" for CF–PL3 Barrier and 22" for all other railing/barrier systems.*
2. *3'–6⅜" for CF–PL3 Barrier and 3'–6⅝" for all other railing/barrier systems.*
3. *3'–5⅞" for CF–PL3 Barrier and 3'–6⅛" for all other railing/barrier systems.*
4. *21" for CF–PL3 Barrier and 19" for all other railing/barrier systems.*



NOTES:

1. $1\frac{1}{2}$" H x 1" D GROOVE. ALIGN WITH GROOVE AT TOP OF STRIATIONS.

2. REINFORCEMENT OF THE TRANSITION TOP IS NOT SHOWN FOR CLARITY.

SECTION 3

SCALE: $\frac{1}{2}$" = 1'-0"

FOR CT-TL2 AND CP-PL2 BARRIERS AT SAFETY CURB

MassDOT Highway Division LRFD BRIDGE MANUAL, PART II	VERTICAL SECTION AT U-WINGWALL FOR CT-TL2 AND CP-PL2 BARRIERS AT SAFETY CURB PRECAST HIGHWAY GUARDRAIL TRANSITIONS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.8.6**

MassDOT Highway Division

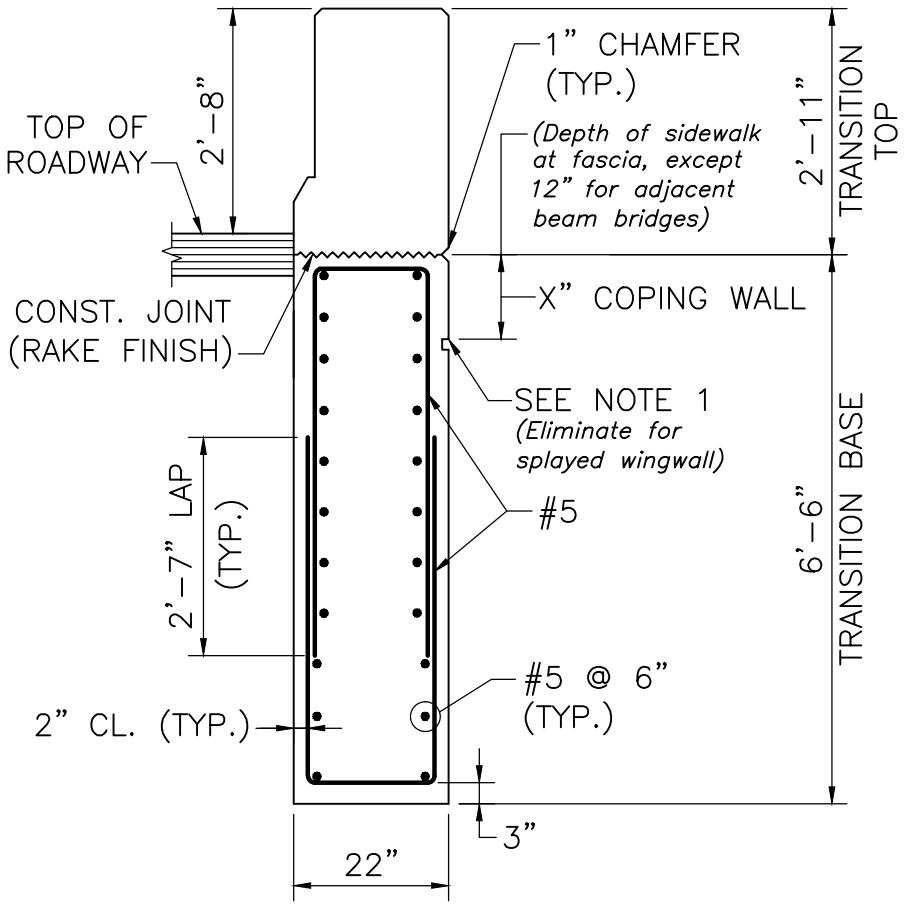
LRFD BRIDGE MANUAL, PART II

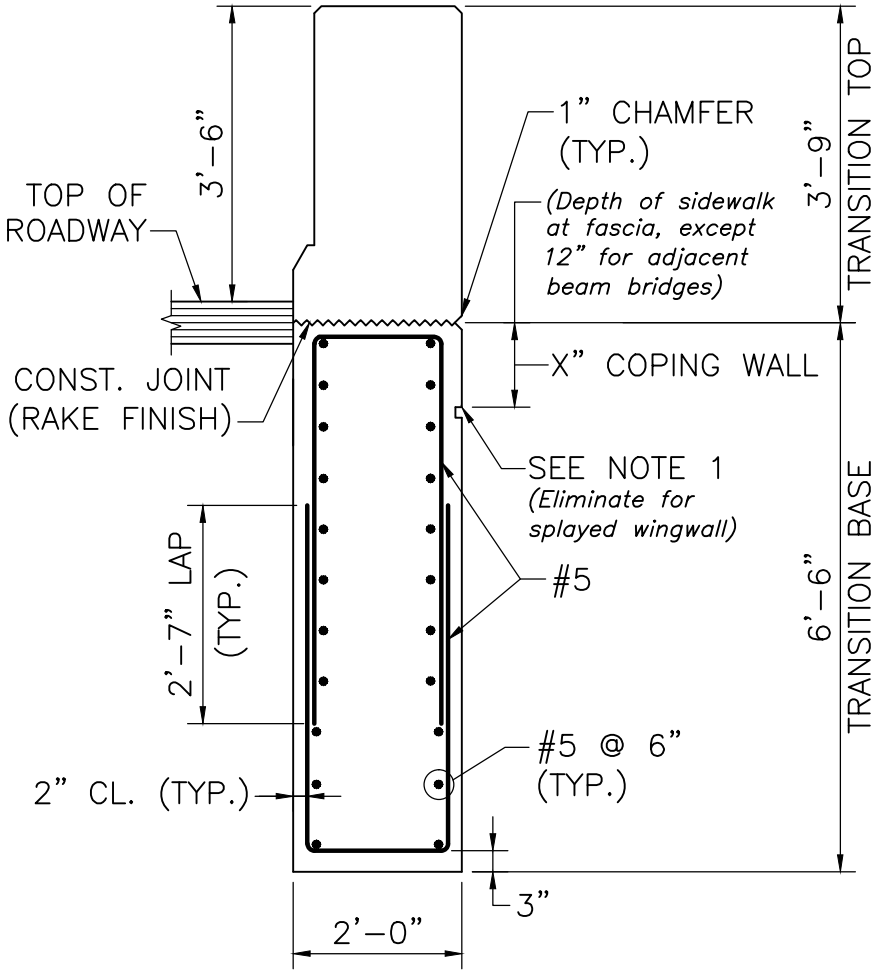
PRECAST HIGHWAY GUARDRAIL TRANSITIONS

VERTICAL SECTION AT U-WINGWALL FOR CF BARRIERS

DATE OF ISSUE JUNE 2013

DRAWING NUMBER **3.8.7**





NOTES:

1. $1\frac{1}{2}$" H x 1" D GROOVE. ALIGN WITH GROOVE AT TOP OF STRIATIONS.
2. REINFORCEMENT OF THE TRANSITION TOP IS NOT SHOWN FOR CLARITY.

SECTION 3

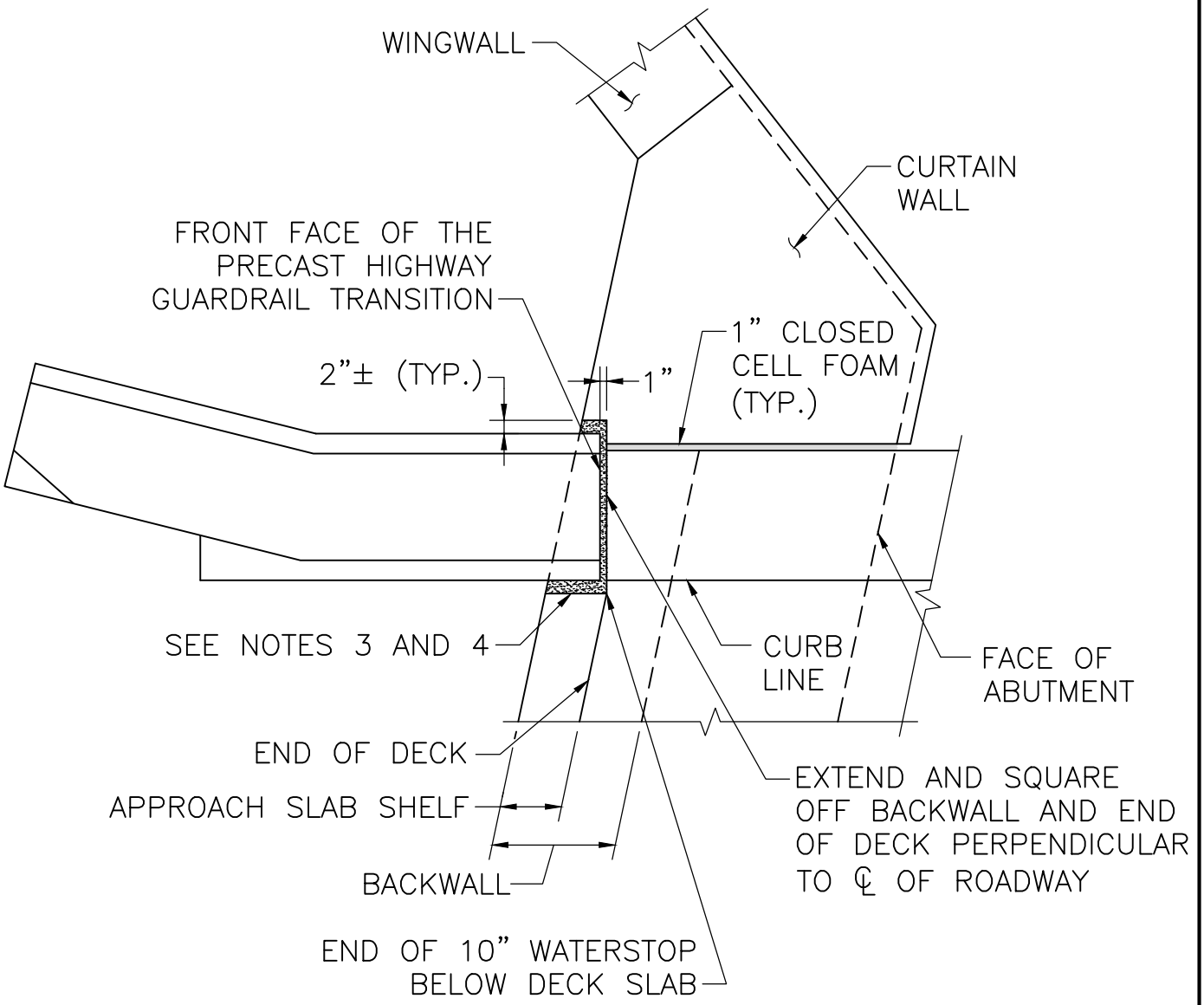
SCALE: $\frac{1}{2}$" = 1'-0"

FOR CF-PL2 BARRIER

SECTION 3

SCALE: $\frac{1}{2}$" = 1'-0"

FOR CF-PL3 BARRIER

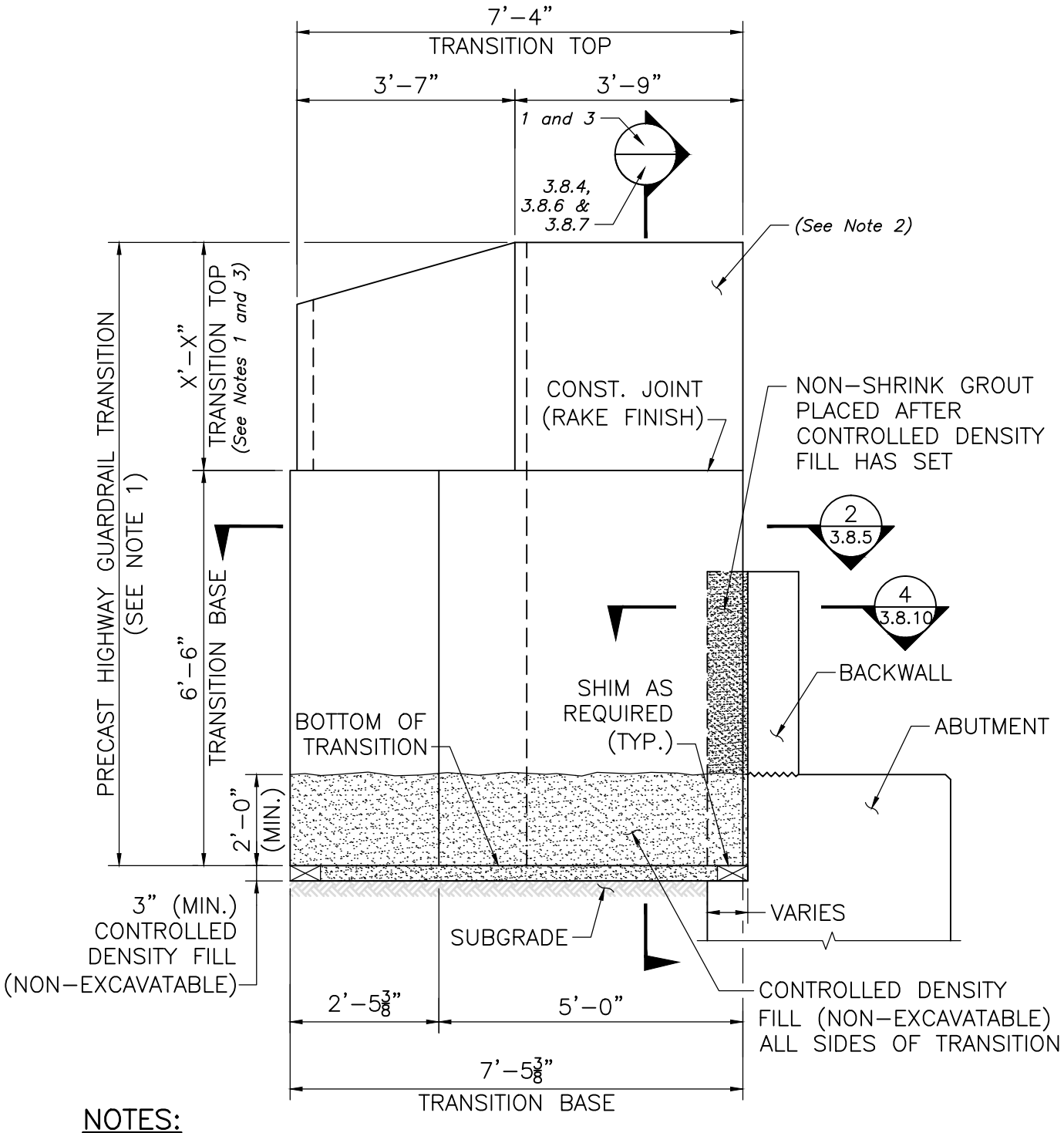


PRECAST GUARDRAIL TRANSITION PLAN AT SPLAYED WINGWALL

SCALE: $\frac{1}{2}$" = 1'–0"

NOTES:

1. *Bridge with Pavement Sawcut at safety curb shown. Modify the drawings as required for bridge with sidewalk and/or Asphaltic Bridge and Strip Seal Joints.*
2. *Striations not shown for clarity.*
3. *For Construction Notes see Dwg. No. 3.8.3.*



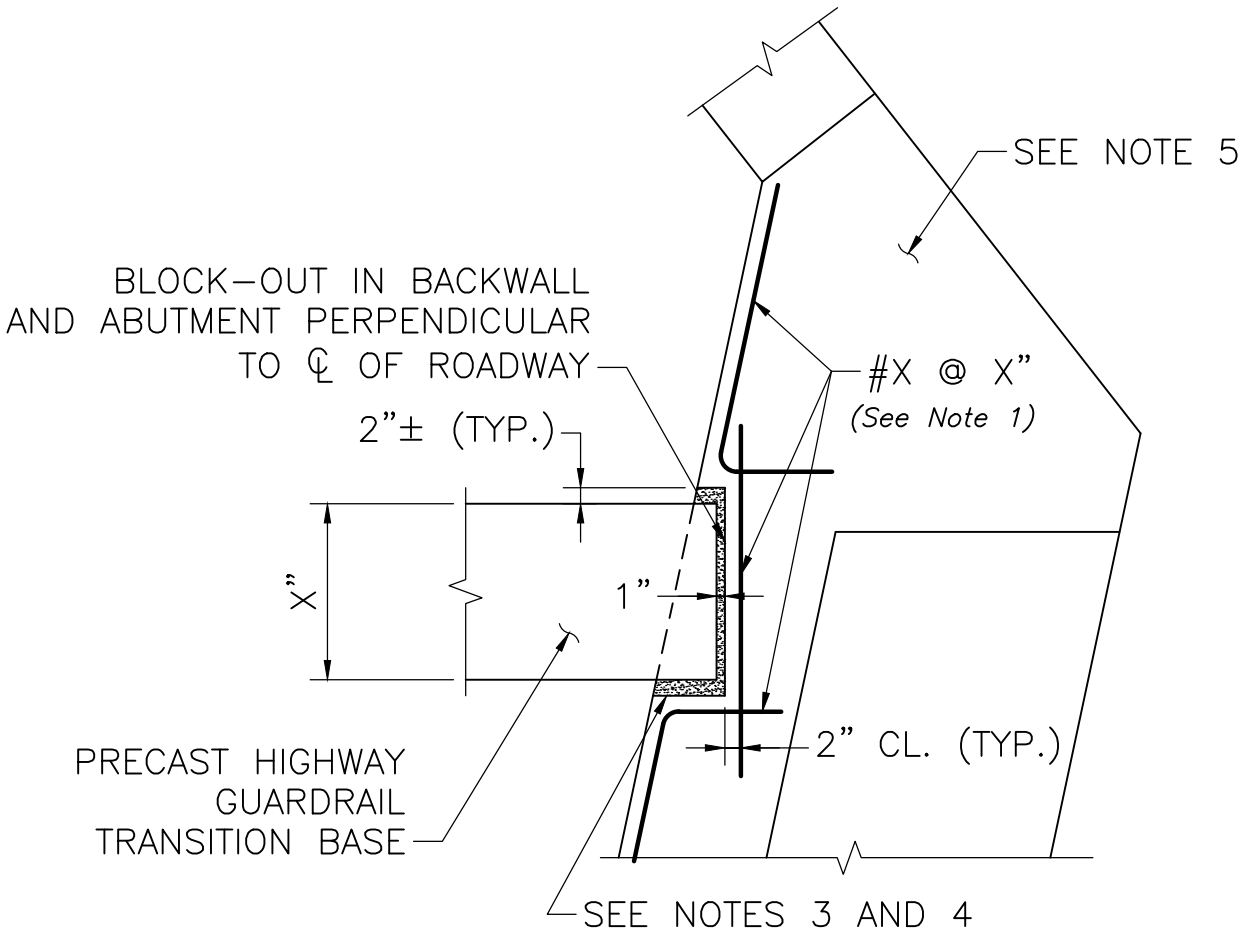
NOTES:

(See Dwg. No. 3.8.3 for notes to be included on Construction Drawings)

NOTE: For Designer Notes See Dwg. No. 3.8.3.

PRECAST GUARDRAIL TRANSITION ELEVATION AT SPLAYED WINGWALL

SCALE: $\frac{1}{2}$" = 1'–0"



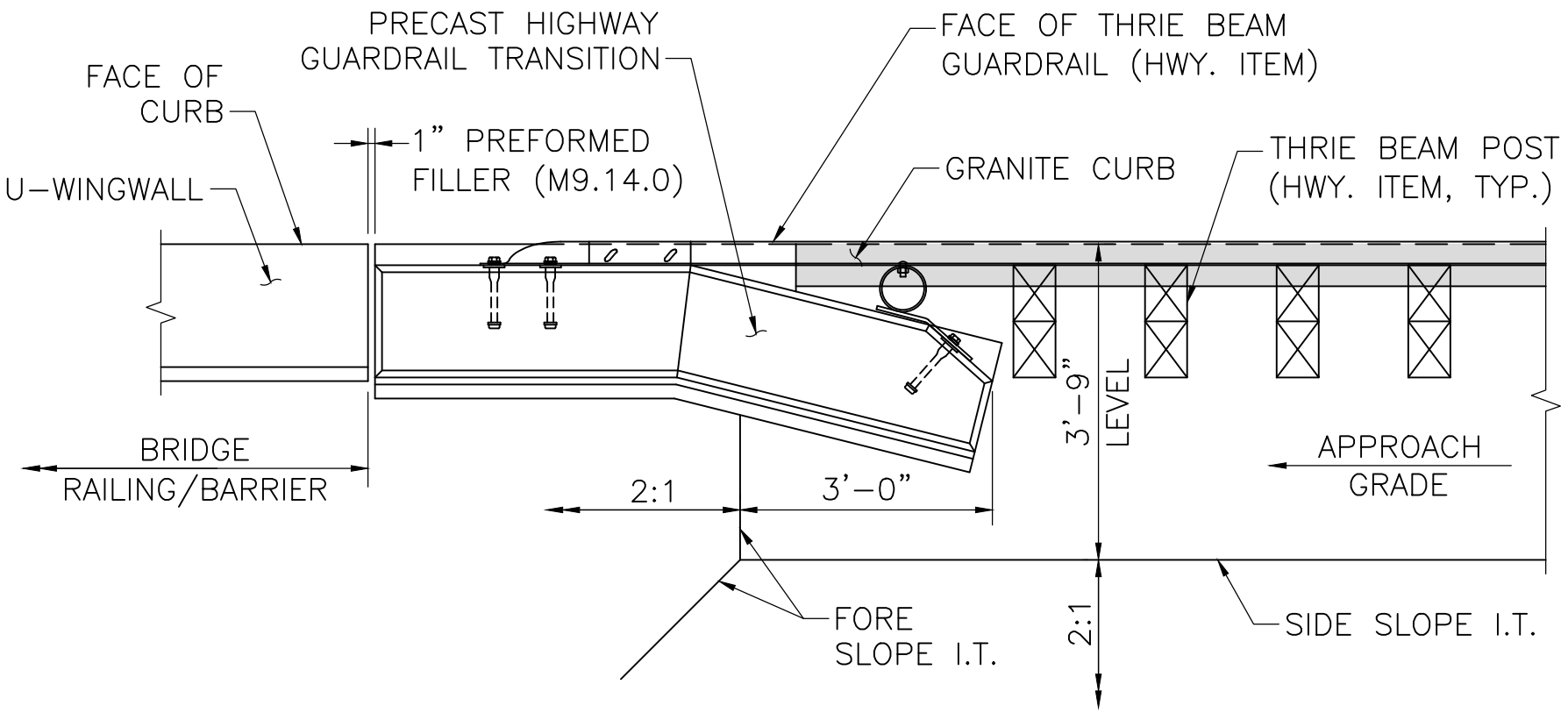
SECTION 4

SCALE: $\frac{1}{2}$" = 1'–0"

NOTES:

1. *Bar size and spacing shall be the same as the abutment and backwall reinforcement.*
2. *For Construction Notes see Dwg. No. 3.8.3.*

massDOT Highway Division LRFD BRIDGE MANUAL, PART II	HORIZONTAL SECTION AT SPLAYED WINGWALL PRECAST HIGHWAY GUARDRAIL TRANSITIONS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.8.10**



GRADING REQUIREMENTS PLAN

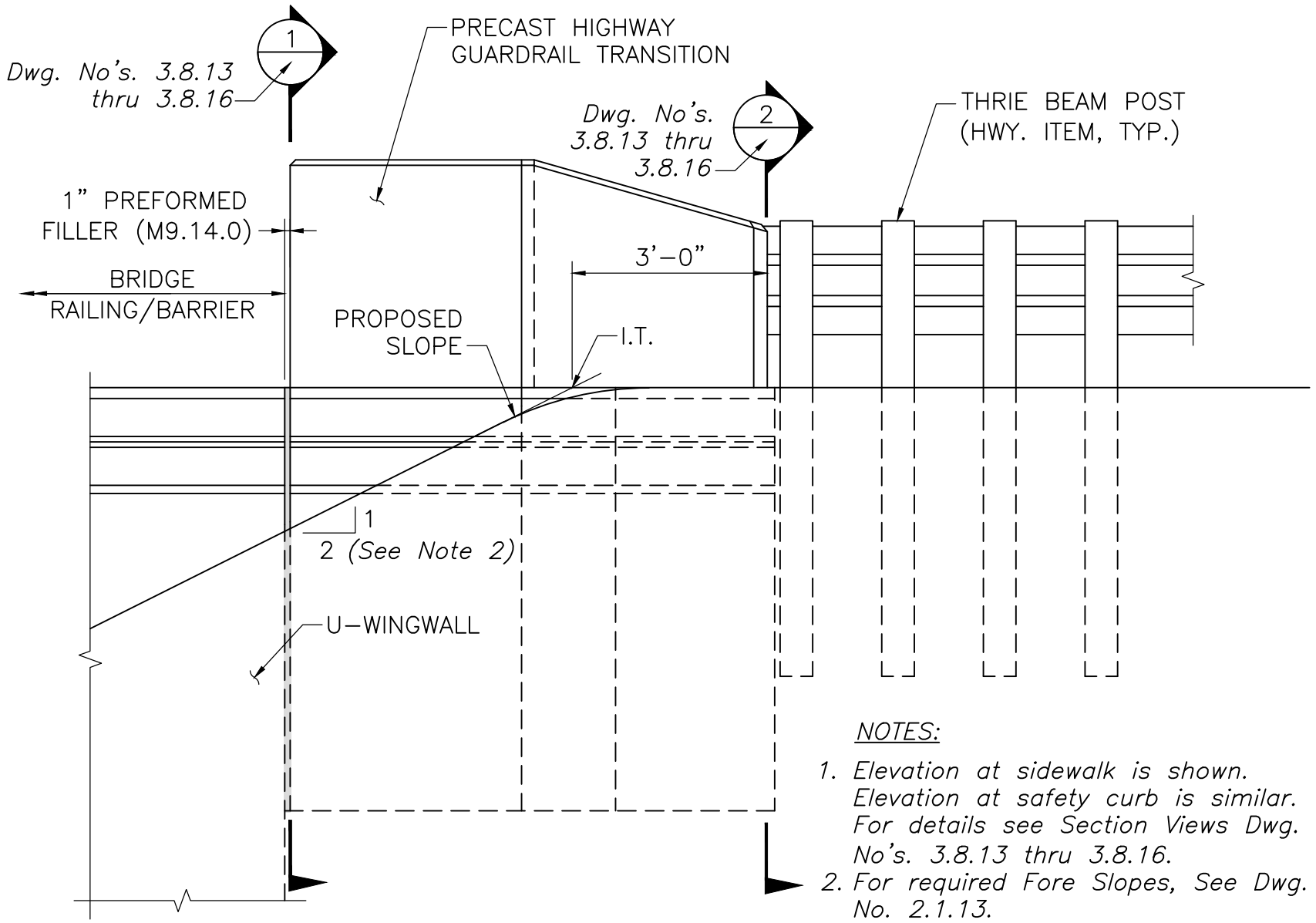
SCALE: $\frac{1}{2}$" = 1'-0"

NOTE:

Plan at safety curb is shown. Plan at sidewalk is similar.
For details see Section Views on Dwg. No's. 3.8.13 thru 3.8.16.

DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.8.11



NOTES:

1. Elevation at sidewalk is shown. Elevation at safety curb is similar. For details see Section Views Dwg. No's. 3.8.13 thru 3.8.16.
2. For required Fore Slopes, See Dwg. No. 2.1.13.

GRADING REQUIREMENTS ELEVATION

SCALE: $\frac{1}{2}$" = 1'-0"

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MassDOT Highway Division

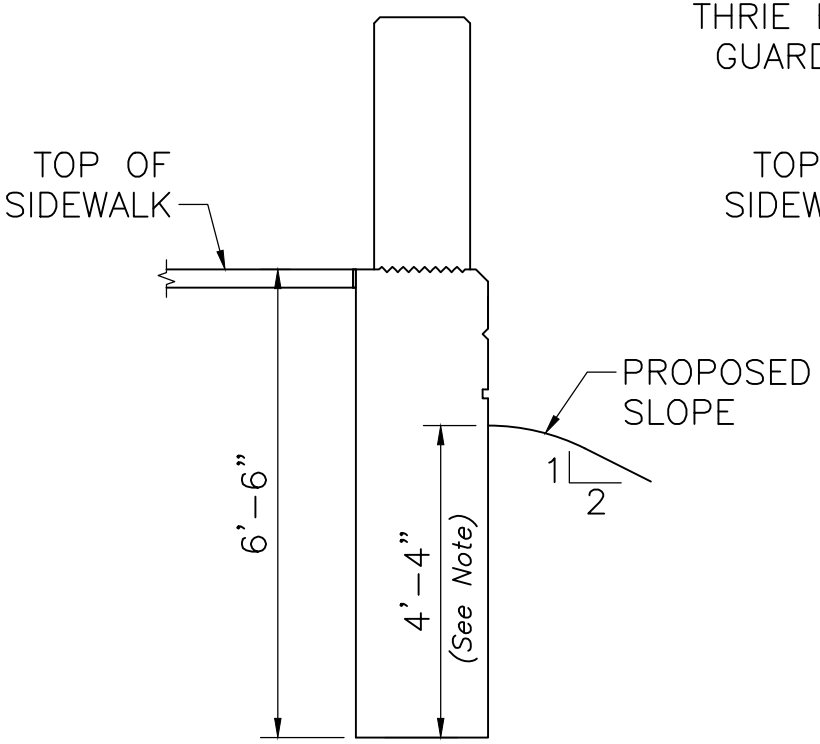
LRFD BRIDGE MANUAL, PART II

GRADING REQUIREMENTS – VERTICAL SECTION FOR S3–TL4 RAILING, CT–TL2 AND CP–PL2 BARRIERS AT SIDEWALK

PRECAST HIGHWAY GUARDRAIL TRANSITIONS

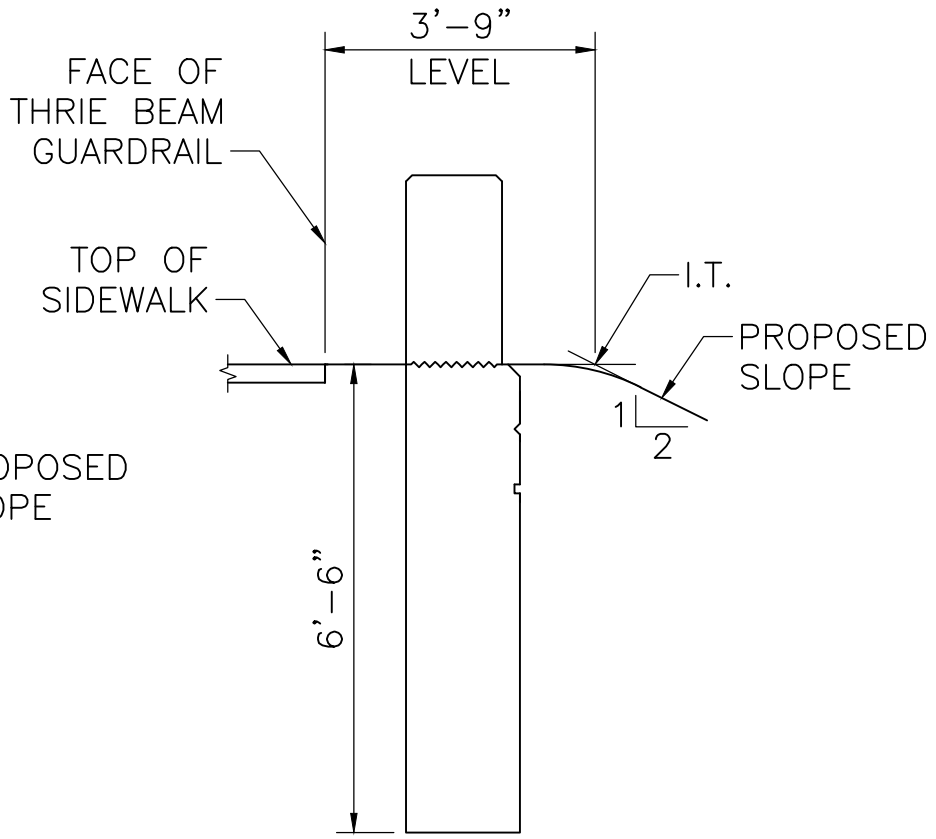
DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.8.13



SECTION 1

SCALE: $\frac{3}{8}$" = 1'–0"



SECTION 2

SCALE: $\frac{3}{8}$" = 1'–0"

FOR S3–TL4 RAILING, CT–TL2 AND CP–PL2 BARRIERS AT SIDEWALK

NOTE: *Dimension is based on 2:1 Fore Slope.*

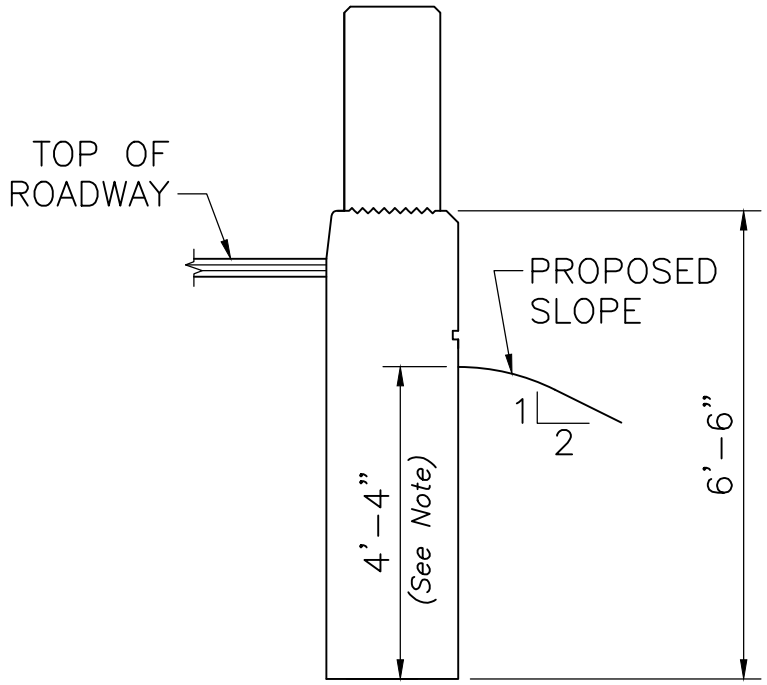
MassDOT Highway Division

LRFD BRIDGE MANUAL, PART II

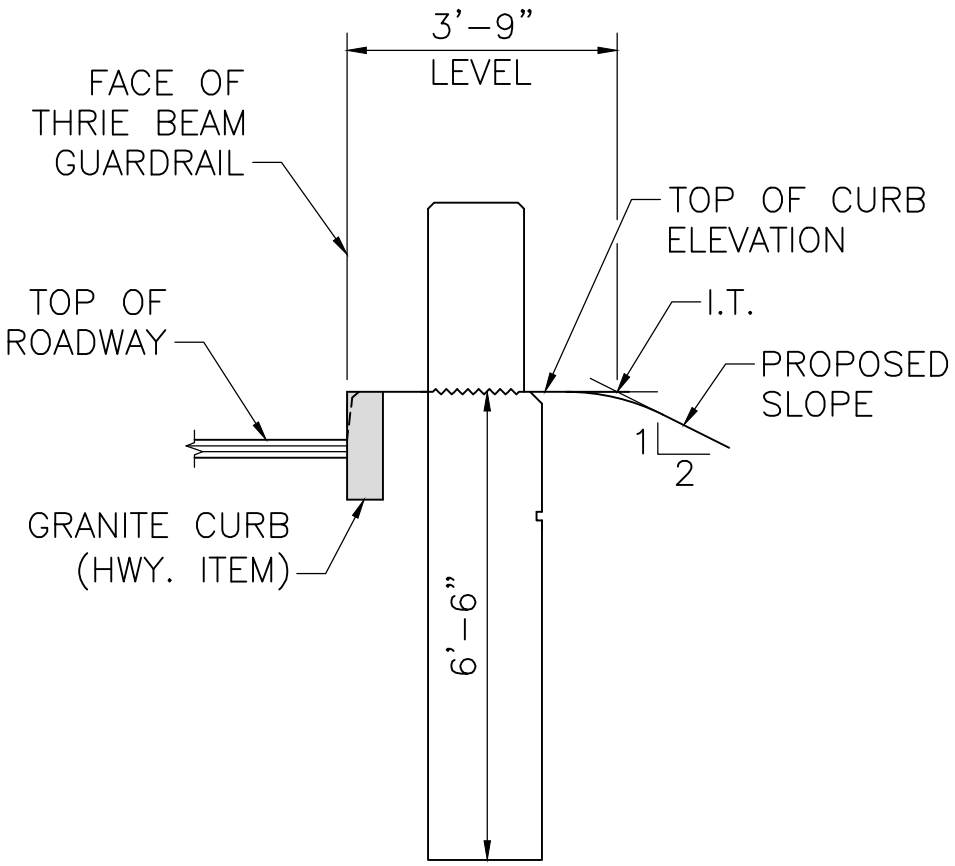
GRADING REQUIREMENTS
VERTICAL SECTION FOR S3–TL4 RAILING AT SAFETY CURB
PRECAST HIGHWAY GUARDRAIL TRANSITIONS

DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.8.14



SECTION 1
SCALE: $\frac{3}{8}$" = 1'–0"



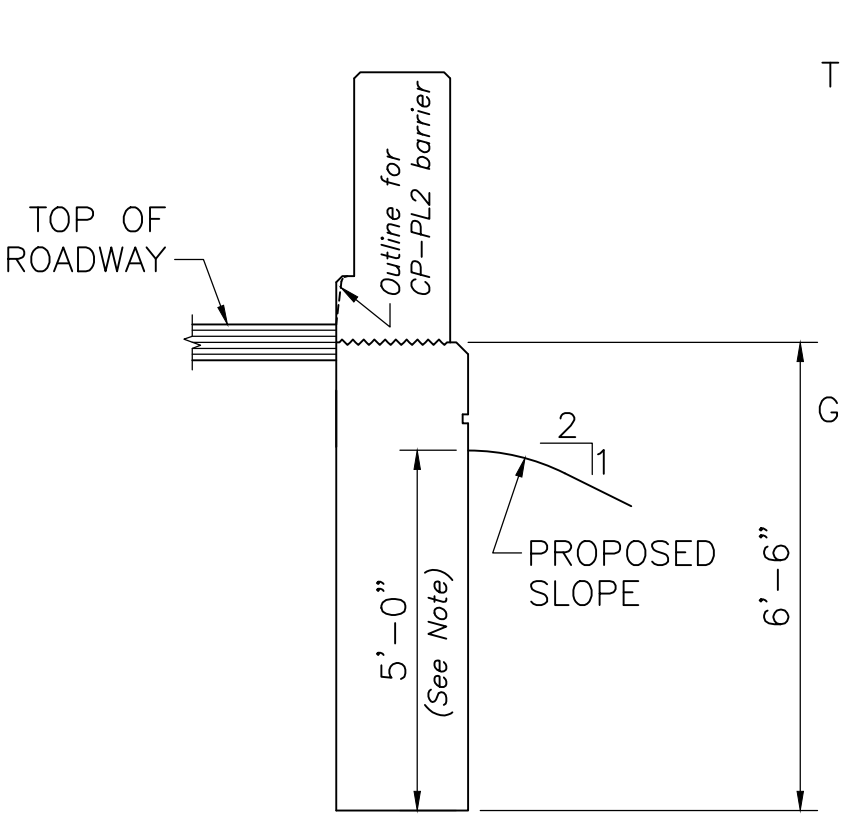
SECTION 2
SCALE: $\frac{3}{8}$" = 1'–0"

FOR S3–TL4 RAILING AT SAFETY CURB

NOTE: Dimension is based on 2:1 Fore Slope.

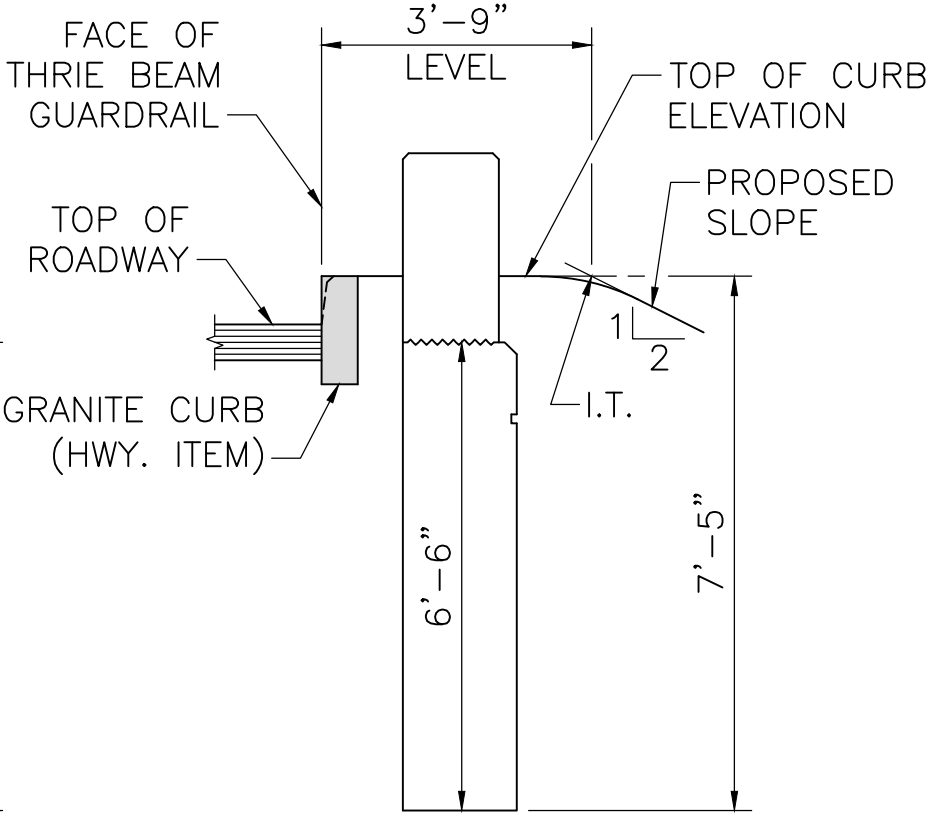
GRADING REQUIREMENTS – VERTICAL SECTION FOR CT–TL2 AND CP–PL2 BARRIERS AT SAFETY CURB

PRECAST HIGHWAY GUARDRAIL TRANSITIONS



SECTION 1

SCALE: 3/8" = 1'–0"



SECTION 2

SCALE: 3/8" = 1'–0"

FOR CT–TL2 AND CP–PL2 BARRIERS AT SAFETY CURB

NOTE: *Dimension is based on 2:1 Fore Slope.*

DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.8.15

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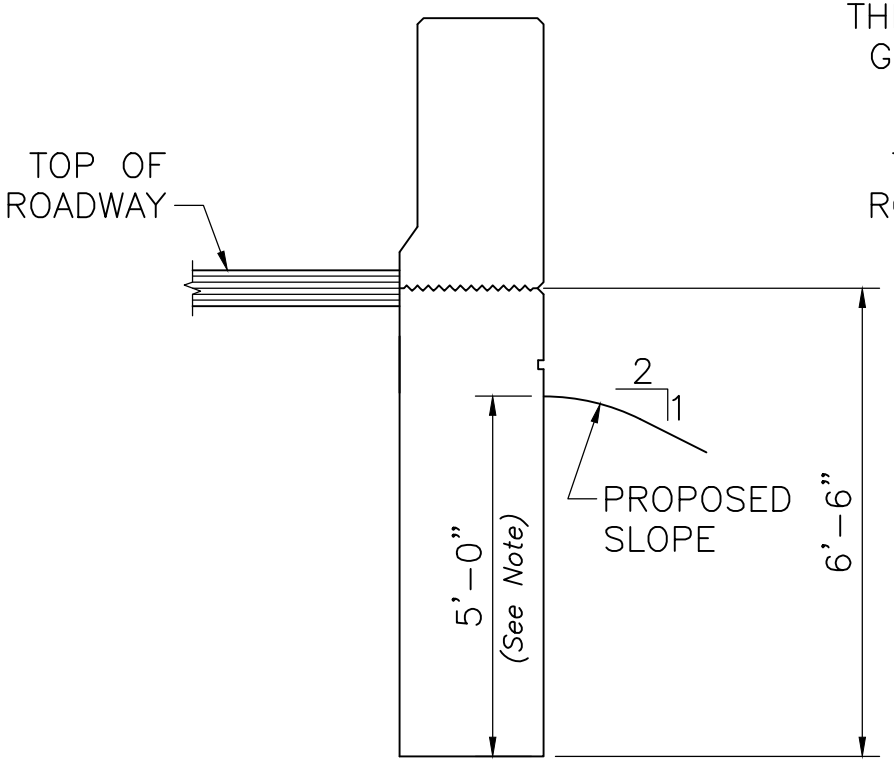
LRFD BRIDGE MANUAL, PART II

GRADING REQUIREMENTS – VERTICAL SECTION FOR CF BARRIERS

PRECAST HIGHWAY GUARDRAIL TRANSITIONS

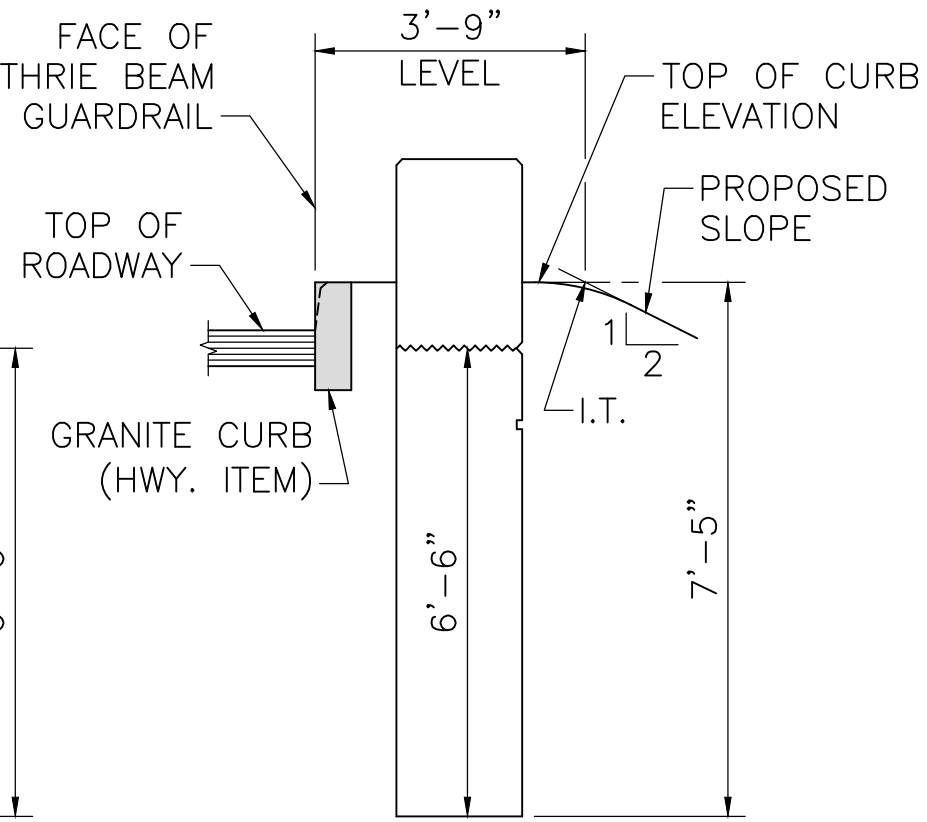
DATE OF ISSUE
JUNE 2013

DRAWING NUMBER
3.8.16



SECTION 1

SCALE: $\frac{3}{8}$" = 1'–0"

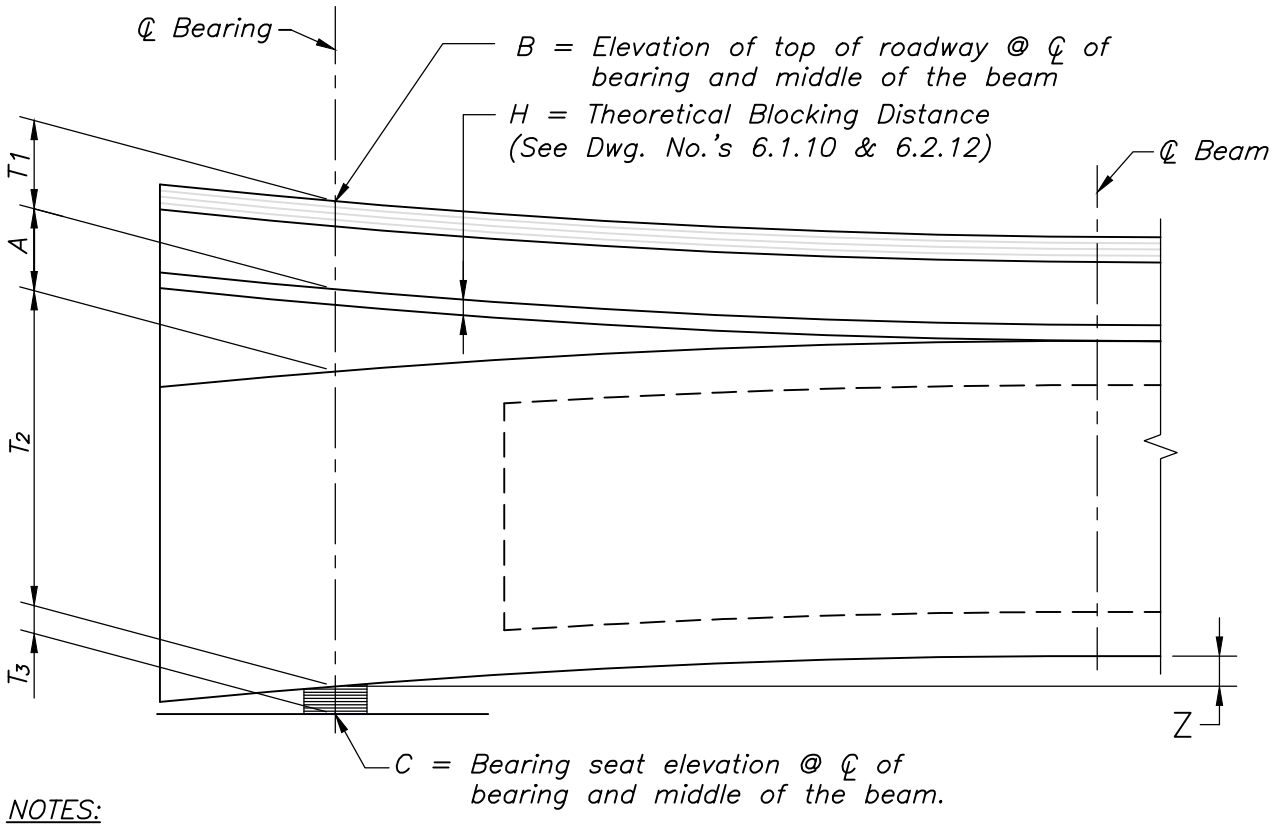


SECTION 2

SCALE: $\frac{3}{8}$" = 1'–0"

FOR CF BARRIERS

NOTE: *Dimension is based on 2:1 Fore Slope.*



NOTES:

1. Bridge Seat Elevations shall be determined as follows:

$C = B - (T + T + T + A)$, where:

T = Wearing surface + slab thickness
T = Depth of beam
T = Height of bearing pad
A = Blocking distance @ centerline of bearing = H or (H + Z −M), whichever is greater, where:

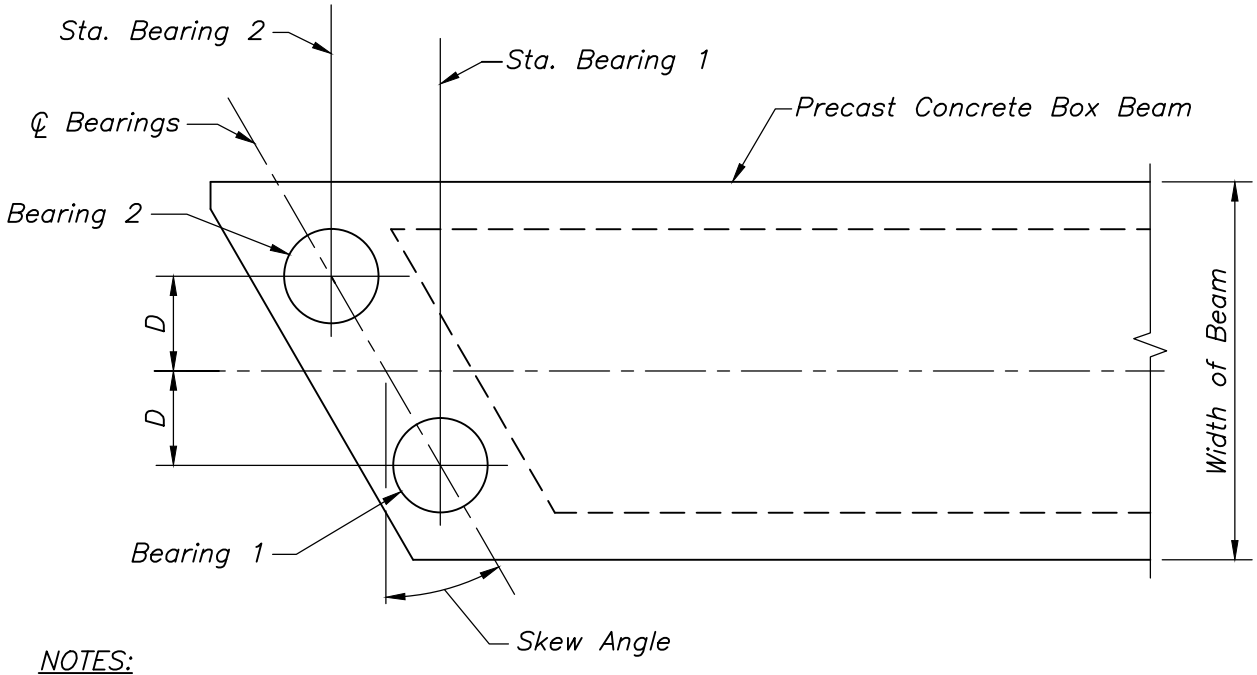
Z = Net upward camber at erection calculated using the PCI "at erection" multipliers for prestressing and selfweight, minus the unfactored elastic deflections from the weight of the slab, utilities, diaphragms, haunch, and superimposed dead load. Long term effects due to creep, shrinkage and live load shall be ignored for beam seat calculations.

$M = B2 - (B1 + B3)/2$, where:

B1 = Final top of roadway elevation @ C of Bearing @ Support No. 1
B2 = Final top of roadway elevation @ mid span of the beam
B3 = Final top of roadway elevation @ C of Bearing @ Support No. 2

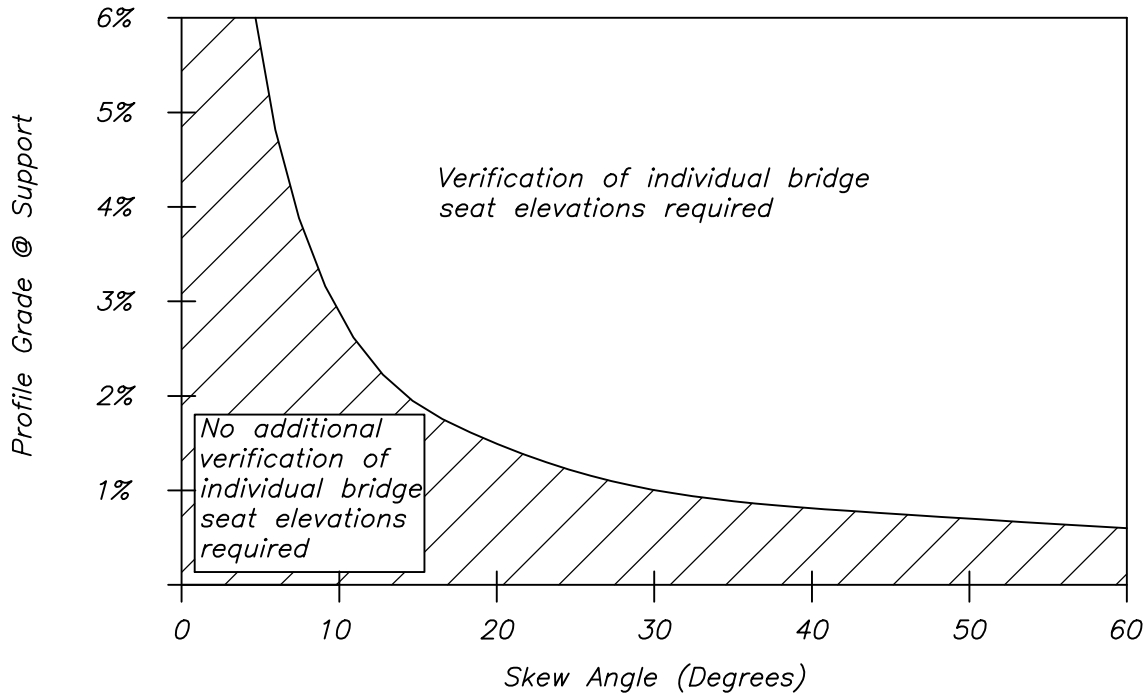
This method is limited to situations where the minimum haunch dimension occurs at either mid span or at the bearings. In cases where this is not so, (for example: the vertical curve starts or ends within the center lines of bearings) the designer shall use the other methods to determine the minimum haunch location along the length of the beam and adjust the beam seats accordingly so that the minimum haunch dimension is not violated at any point along the length of the beam.

For spread precast concrete box beams, refer to Dwg. No. 3.8.2 for additional details.

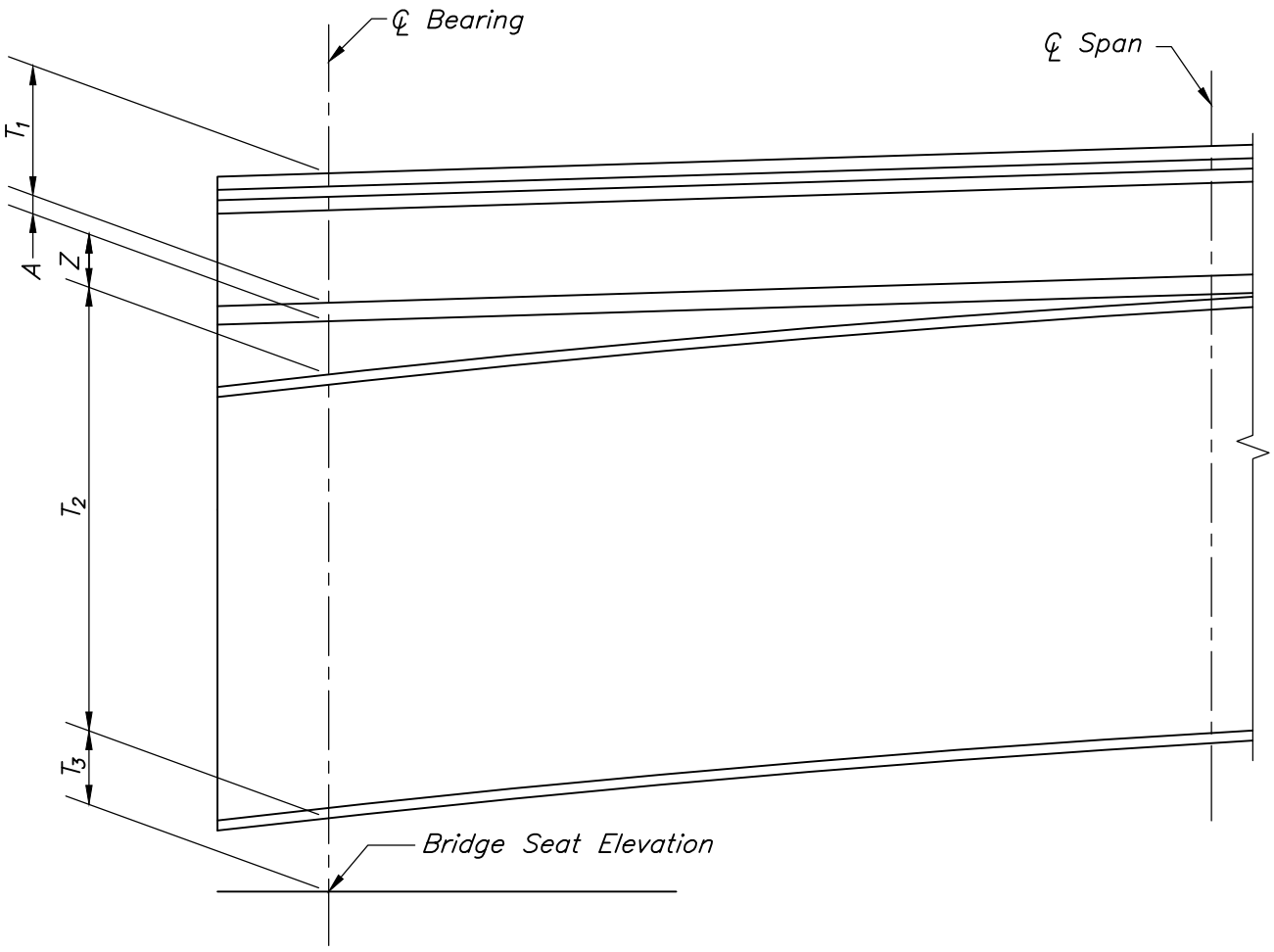


NOTES:

1. D = Width of Beam/4, rounded to the nearest $\frac{3}{8}$".
2. Because Spread Box Beam Bridges use two bearings, as the skew angle and profile grade increase, the longitudinal distance between bearing stations also increases. The chart below provides a guide for where individual bridge seat elevations would be required. Calculate bridge seat elevations as outlined on Dwg. No. 3.8.1 and provide seperate bridge seat elevations when the difference in elevation between the bearings is $\frac{1}{8}$" or greater. Do not use bearing pads of different thicknesses or specify shims or grout pads.



massDOT Highway Division LRFD BRIDGE MANUAL, PART II	ADDITIONAL CONSIDERATIONS SPREAD BOX BEAM BRIDGES BRIDGE SEAT ELEVATIONS	DATE OF ISSUE JUNE 2013 DRAWING NUMBER **3.9.2**



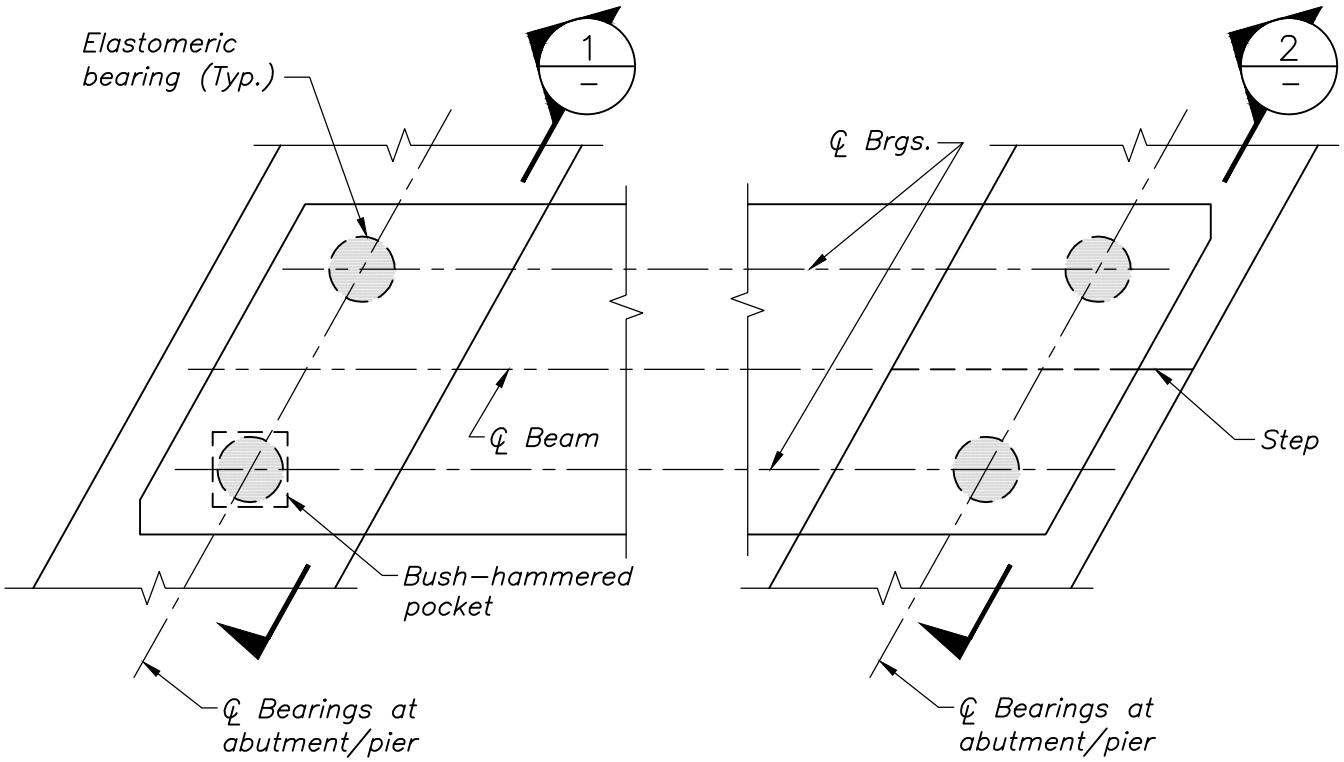
NOTES:

1. Bridge Seat Elevation is determined by the following:

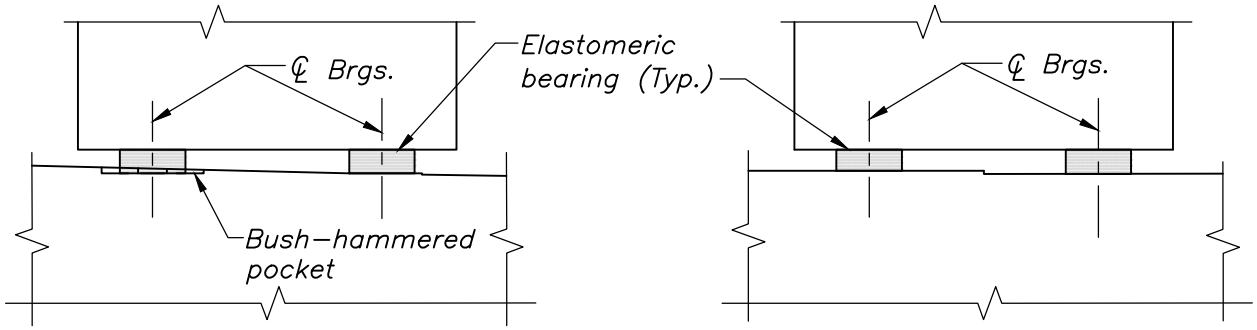
   Roadway Elev. − (T_1 + T_2 + T_3 + A + Z), where:

   T_1 = Wearing Surface + Slab Thickness
   T_2 = Depth of Stringer or Girder
   T_3 = Depth of Bearing
   A = Blocking Distance at maximum camber (See Dwg. No. 7.1.28)
   Z = Additional Camber (See Dwg. No. 5.6.1)

2. For a negative vertical curve, the middle ordinate of the curve should also be subtracted from the roadway elevation to get Bridge Seat Elevation.



PLAN



SECTION 1

SECTION 2

ADJUSTMENTS FOR UNEVEN BEAM SEAT ELEVATIONS FOR PRESTRESSED BEAM BRIDGES

NOT TO SCALE

NOTE:

The above adjustment details shall be used in case of uneven (non–parallel) bridge seat cross–slopes and/or longitudinal slopes between pairs of bearings, which may be a result of the bridge skew, profile grade, horizontal and/or vertical curvature, change of the cross–slope along the span length, etc. Use shallower slope and either bush–hammer bridge seat under one of the bearings or step the bridge seat if the change in elevation between bearings is greater than $\frac{3}{8}$", so that cross–slopes between bearings at both substructures and longitudinal slopes between pairs of bearings match.