

Colorado Department of Transportation Staff Bridge Bridge Detail Manual	Chapter: 11 Effective: June 30, 2024 Supersedes: November 17, 2022
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Abutment Details

11.1 Purpose

These drawings are to present graphically all pertinent information necessary in the field construction of this segment of the structure.

11.2 Responsibility

These drawings shall be prepared and checked in the design unit. The graphic presentation of information on these drawings shall be the responsibility of the individual preparing the drawings.

11.3 Scales

Scales shall be used that are suitable to make the details legible when the drawing is reduced. Suggested scales for presenting the details of the abutment are as follows:

- A) Plan and Elevations - 1"=10', 1"=20', 1"=30'.
- B) Sections and details - 1/8"=1'-0", 1/4" = 1'-0", 1/2"=1'-0", 3/4"=1'-0", etc.
- C) The Elevation of an opposite hand detail may be drawn to a smaller scale.

11.4 Orientation of Details

The PLAN of the abutment shall be placed, if possible, at upper left of the drawing, with the back face of the abutment toward the top of the sheet.

The ELEVATION of the abutment shall be projected below the PLAN. The ELEVATION view of Abutment 1 shall be shown as looking back station. When possible, the abutment TYPICAL SECTION shall be placed to the right of the abutment PLAN and ELEVATION. If space is limited, sections or auxiliary views may be shown on another sheet. Wingwall details shall be shown on another sheet.

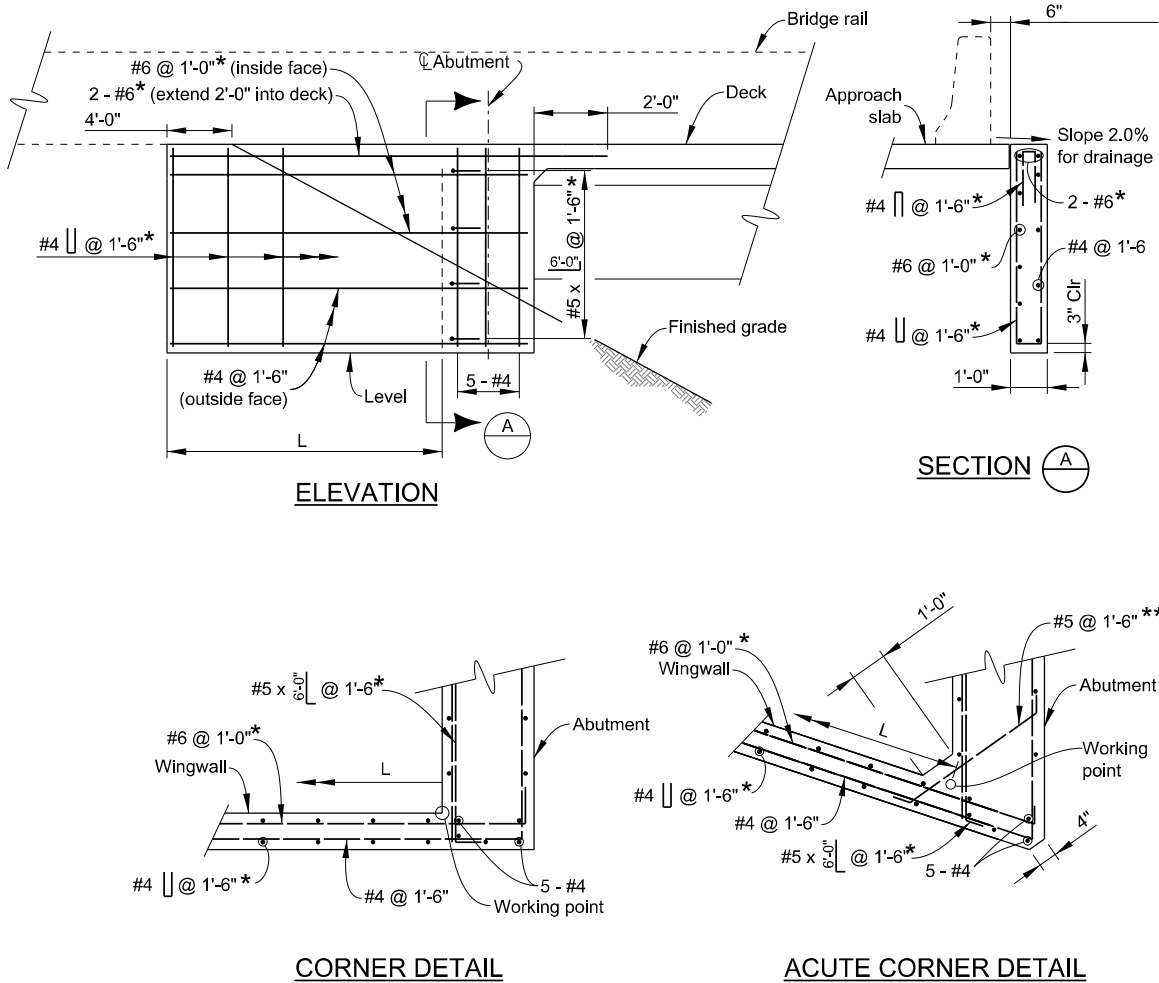
11.5 Opposite Hand Details

The reference to "opposite hand" or reverse details shall be avoided. Two preferred methods are as follows:

- A) Redetail opposite hand abutment.
- B) Detail the ELEVATION of the opposite hand abutment to a smaller scale.

11.6 Wingwall Length (U-Type)

The detailer shall check the elevation at the bottom of the footing and the wingwall length to ensure that it meets the criteria outlined in the ELEVATION view of Figure 11.6-1.



- * Reinforcing steel determined by design
- ** Where bar interferes with cast in girders, increase fillet or bend bar to fit.

Fig. 11.6-1 Wingwall Details

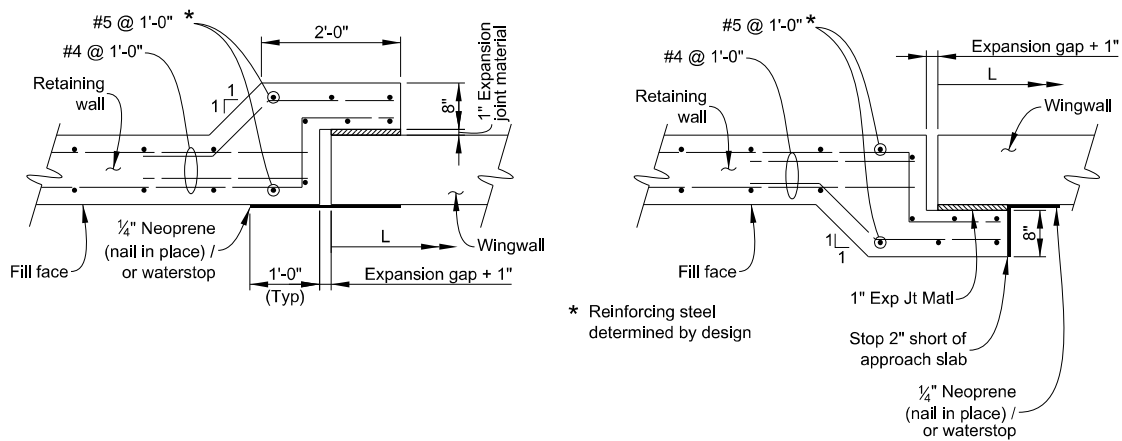


Fig. 11.6-2 Wingwall to Retaining Wall Connection Detail

11.7 Wingwall Designation

Wingwalls shall be designated with abutment number and as right and left, ie. Wingwall A1 right, Wingwall A17 left, etc. Right and left sides are determined by looking in the direction of increasing milepost from the centerline of bearing on Abutment 1. See figure 1.13-1 and 11.7-1 for more information.

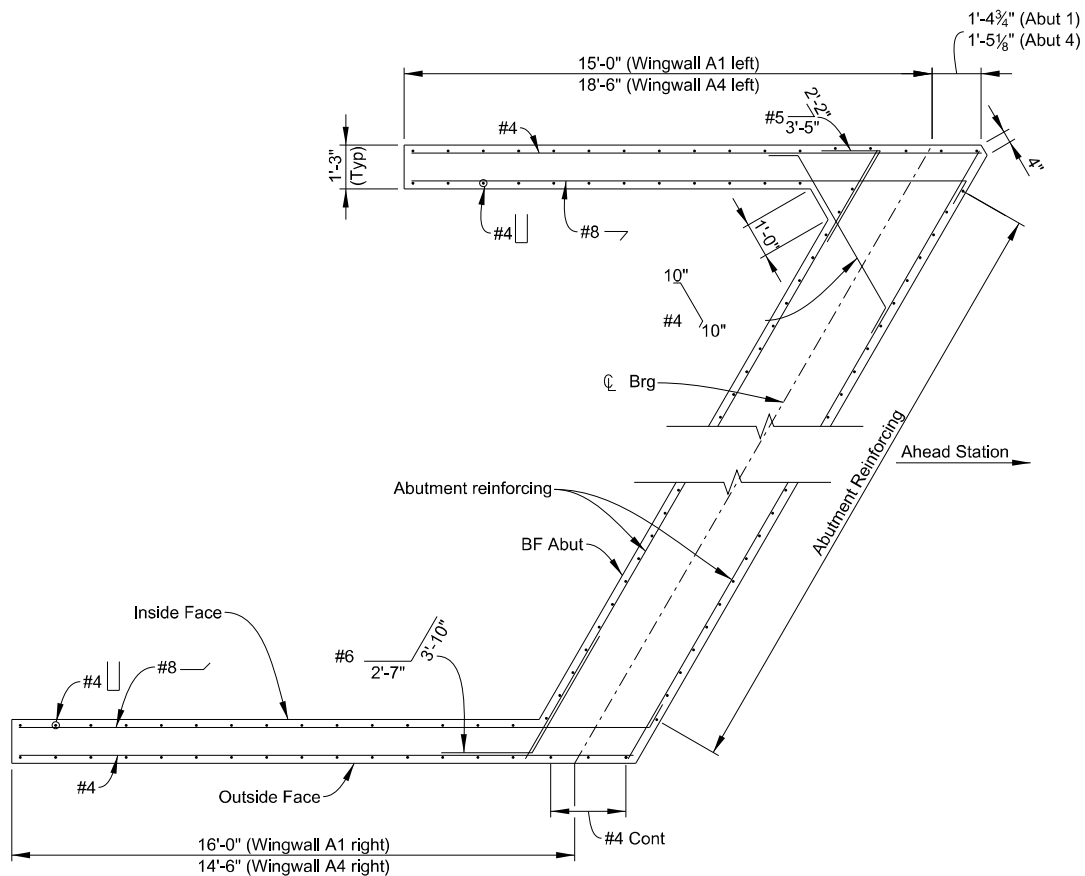


Fig. 11.7-1 Wingwall Designation

11.8 Size of Bearing Seat

The bearing seat is the shelf on the face of a bridge abutment that supports the end of the span. To avoid spalling of the concrete surface from heavy loads, the edge of the masonry plate or bearing/leveling pad shall be no closer than 3 inches to the vertical face of the concrete bearing seat.

Because it is important to maintain, as nearly as possible, 2 inches clear from the bearing seat to the reinforcing steel, the cap between bearing seats should be sloped rather than stepped.

Figure 11.8-1 shows the sloped cap and minimum clearances around bearing plates.

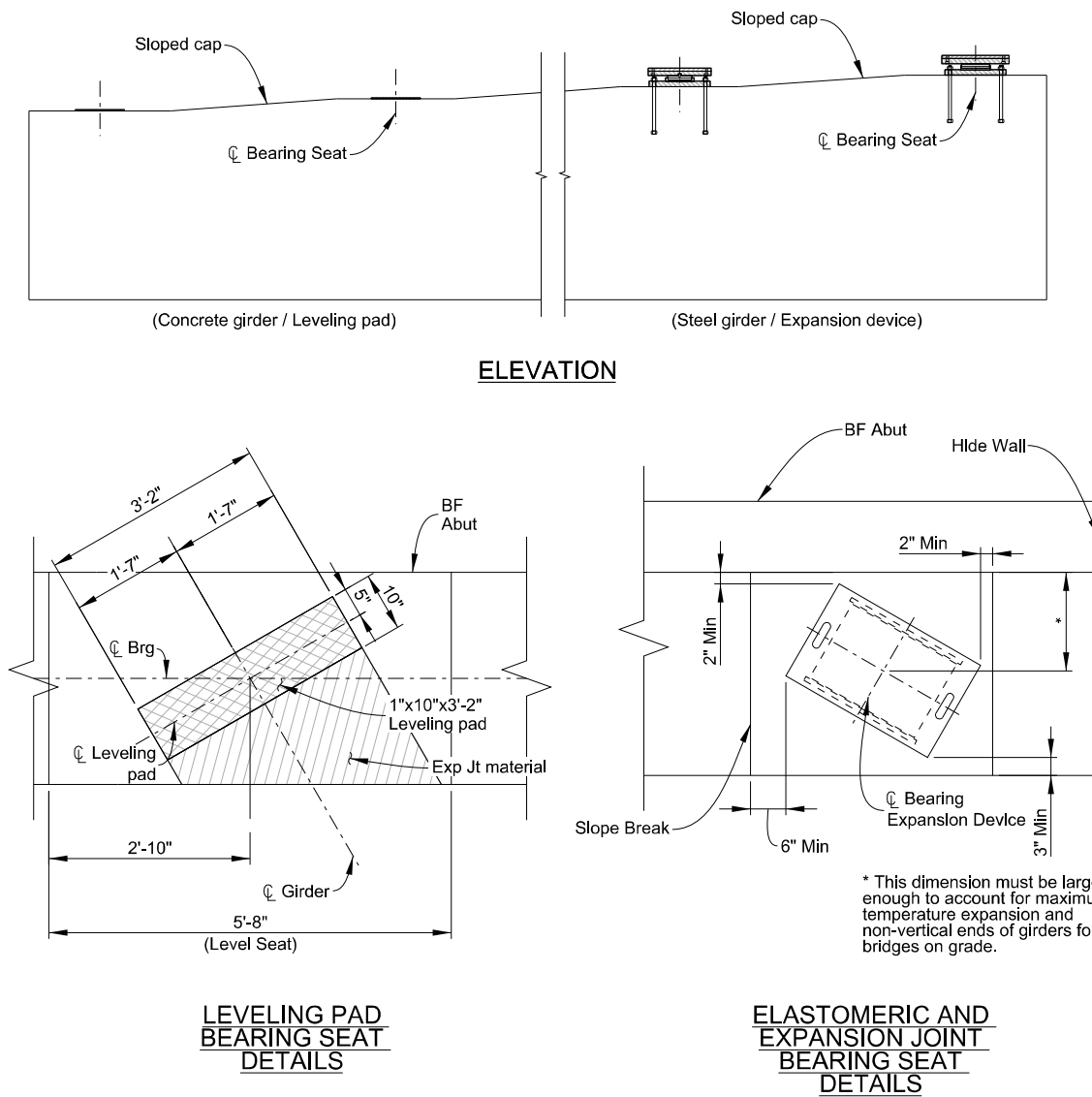


Fig. 11.8-1 Bearing Seat Details

11.9 Horizontal Control Line

The horizontal control line shall be shown on the PLAN and labeled consistently with the plans. Example: "HCL", "Survey Line," "Project Line," etc.

11.10 Layout Line

For structures on tangent, the layout line and the horizontal control line will coincide.

For structures located on a curve, the layout line shall be shown on the PLAN and labeled consistently with the plans. Example: "Tangent from TS Sta 31+41.08," "Chord from POC Sta 38+41.00 to PT Sta 39+78.00," "Tangent from POC Sta 382+10.00," etc.

11.11 Stationing

A station shall be placed at the intersection of the horizontal control line with the centerline of bearings.

All stations on the "Abutment Details" shall be given to two decimal places.

The direction of stationing shall be indicated on the plan view as "Station Ahead."

11.12 Centerlines

Centerlines shall be identified and shown as discussed in the following sections:

A) Location - Centerlines shall be shown at the following locations, when applicable:

1) Plan View

- a) Centerline of all girders
- b) Centerline of bearings
- c) Centerline of roadway
- d) Typical centerline of anchor bolts or bearing pads.

2) Section through Abutment

- a) Centerline of bearings
- b) Identification – The centerlines shown on the abutment details shall be identified in the following ways:

- i) Centerline of Girder – A circle containing the girder letter is placed at the end of each outside girder centerline, as shown in the PLAN views of the abutments in the graphic examples. If the bridge is a simple multi-span bridge, a circle containing the span number and girder letter is preferred, ie. 1A, 2D, 3C, etc. For continuous or single span bridges, a circle containing only the girder letter shall be used. These girder letters shall correspond to those shown on the "Construction Layout."
- ii) Other Centerlines - When it is applicable to identify some of the other centerlines, it should be done by using their particular names. Example: Centerline Bearings, Centerline Anchor Bolts, etc.

11.13 Elevations

All elevations shown on the “Abutment Details” shall be to two decimal places. Example: Elev 47.25, except bottom of footings, which shall be to one decimal place. Example: Elev 4647.3.

- A) Location - Elevations shall be shown on the ELEVATION view of the abutment at the following locations, when applicable:
- 1) Top of bearing seats, except cast-in-place girder.
 - 2) Bottom of abutment footing, bottom of wingwalls, and bottom of retaining wall footings, note if level. Except in extreme situations, the height of abutments and wingwalls shall be constant.

11.14 Dimensions

A sufficient number of dimensions shall be shown on the details to provide adequate information necessary in the checking of the plans and the construction of the abutment.

For clarification a work point may be accentuated by a small circle with a line extended through the work point or points.

All dimensions shall be given in feet and inches (to the nearest 1/8 inch) except as noted.

- A) Plan of Abutment
- 1) For structures on a curve, a reference shall be made to the intersection of the Layout Line and the centerline of abutment bearings. Example: “538.12’ back on tangent from TS Sta 31+41.08,” “143.69’ ahead on tangent from POC Sta 382+10.00,” etc.
 - 2) Outside of deck to outside of deck, along centerline of bearings.
 - 3) Horizontal Control Line to outside of deck, along centerline of bearings, for structures on tangent alignment.
 - 4) Layout Line to outside of deck, along centerline of bearings, for structures located on a curve.
 - 5) Horizontal Control Line to centerline of the adjacent girders, along centerline of bearings for structures on tangent alignment (nearest thousandth of a foot.)
 - 6) Layout Line to centerline of adjacent girders, along centerline of bearings, for structures located on a curve (nearest thousandth of a foot).
 - 7) Centerline of girder to centerline of girder, along centerline of bearings (nearest thousandth of a foot for steel girders and nearest hundredth of a foot for concrete girders).

- 8) Layout Line to Horizontal Control Line, along centerline of bearings, for structures located on a curve (nearest hundredth of a foot).
 - 9) Structures which are skewed or structures located on a curve, show the wingwall offset from outside of bridge deck at centerline of bearings to outside of bridge deck at the end of wingwalls, parallel to centerline of bearings.
 - 10) Locate abutment stirrups and give the spacing, along the centerline of bearings.
 - 11) Centerline of girder to centerline of anchor bolts, measured normal to the centerline of girder.
 - 12) Typical bearing seat width.
 - 13) Centerline of utility blockout to centerline of nearest girder and width of blockout, measured normal to the centerline of blockout. (Note: Utility blockouts are not used for future utilities)
 - 14) Length of wingwalls from centerline of bearing to end of wingwall, along outside of deck.
 - 15) Hidewall width.
- B) Elevation of Abutment
- 1) Bearing seat to centerline of utility blockout.
- C) Typical Section Through Abutment
- 1) Projection of piling into the concrete.
 - 2) The vertical distance, from the top of concrete deck to the bearing seat measured at the centerline of girder and centerline of bearings (to the nearest 1/16 inch).

Slab, haunch, bearing device, and cast-in-place girders shall be measured vertically.

Welded plate girders, wide flange girders, and precast girders, shall be measured normal to the girder.

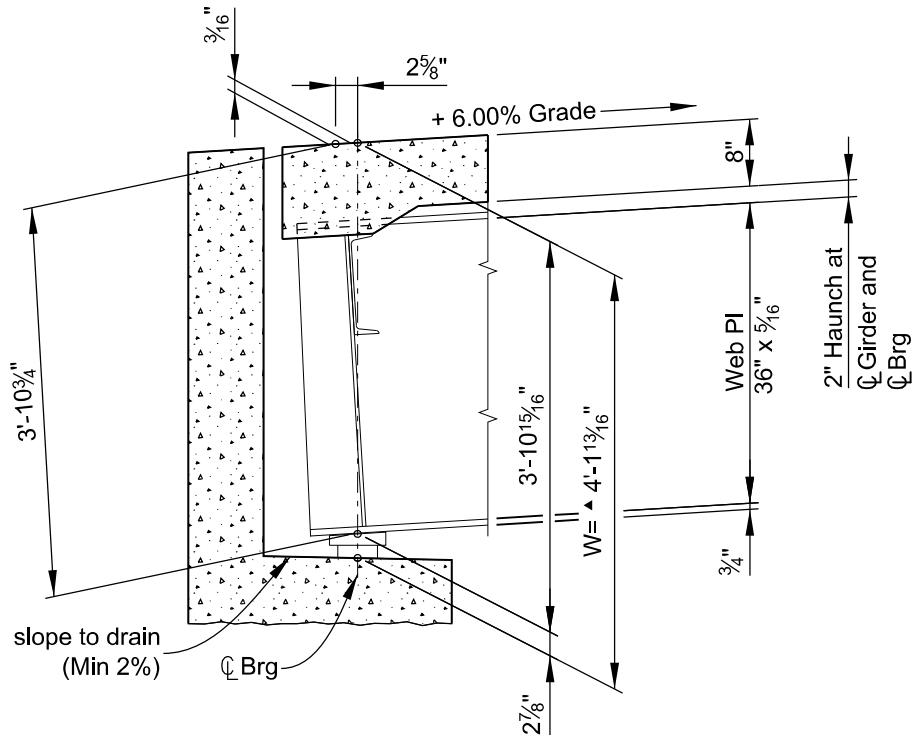
In some instances, the roadway grade may be severe enough to make a difference in the vertical dimension. If this difference is equal to or greater than 1/16 inch, it shall be included in the dimension.

An example of the preceding statements is shown in Figure 11.14-1.

When using elastomeric bearing pads which are greater than 1-1/2 inch, the designer shall calculate the vertical adjustment for dead load, which shall be reflected in the dimension *W*.

The following note is required if the compression of the pad is 1/8 inch or larger:

▲ “Dimension reflects 1/8 inch compression of the elastomeric bearing pad due to dead load deflection.”



▲ Dimension reflects $\frac{1}{8}$ inch compression of the elastomeric bearing pad due to dead load deflection

(other required details not shown for clarity)

Fig. 11.14-1 Dimensions with Bridge On Severe Grade

- 3) Width and depth of notch for approach slab
- 4) Abutment with constant width
 - a) Back face of abutment to centerline of bearing
 - b) Centerline of bearing to front face of abutment
 - c) Back face of abutment to front face of abutment
- 5) Abutment with spread footing
 - a) Back of footing to back face of abutment
 - b) Back face of abutment to front face of parapet
 - c) Front face of parapet to centerline of bearing
 - d) Centerline of bearing to front face of abutment

- e) Front face of abutment to front face of footing
 - f) Footing width
 - g) Footing thickness
 - 6) Minimum footing cover
 - 7) Minimum berm width
 - 8) Clearance to bottom reinforcing steel
- D) Wingwall Details
- 1) End of wingwall to centerline of abutment bearings along outside edge of deck
 - 2) Width of curb or concrete bridge rail
 - 3) Width of wingwall
 - 4) Width of deck cantilever
 - 5) Thickness of slab at outside of deck
 - 6) Fillet dimension at the acute wingwall of abutments where the skew angle is less than 70°
 - 7) Dimension from the end of wingwall to the intersection of slope; "4'-0" (Min)" generally
 - 8) Clearance to bottom reinforcing steel

11.15 Angles

The following angles shall be shown to the nearest second in the PLAN view of the abutment, when applicable:

- A) Skew angle (nearest second)
- B) Angles that the girders generate with the centerline for abutment bearings, if they are different than the skew angle (nearest minute)
- C) Angles that the wingwalls generates with the centerline of abutment bearings, if they are different than the skew angle (nearest minute)

11.16 Anchor Bolts

When applicable, anchor bolts shall be shown in the PLAN of the abutment or in a separate detail. The skew angle shall be shown to the nearest minute. See anchor bolt note.

11.17 Leveling Pads

Leveling pads are plain elastomeric pads used for locked-in-girder at integral substructures and will require an additional, enlarged detail showing the location of the

leveling pad and the limits of the expansion joint material around it. The skew angle shall be shown to the nearest minute. For additional information, see the CDOT Bridge Design Manual Section 14.5.7.

11.18 Piling

When applicable, piling shall be shown, but not dimensioned, in the PLAN, ELEVATION, and SECTION of the abutment.

11.19 Reinforced Concrete Details

The reinforced concrete details shall be made in accordance with the design notes and current standard practice. Wingwalls will generally be designed in accordance with the CDOT Bridge Design Manual Section 11.3.6.

As much of the reinforcing as possible should be called out in section and details shown to clearly indicate the location of the individual bars as required in the other views. It should be clear where the first bar starts and the last bar ends. The length of embedment or projection for dowels, and rebar splice lengths shall be determined by the designer and shown on the plans. All stirrups should be made the same length, making splices in legs over length.

All reinforcing steel in the abutment and wingwalls shall be epoxy coated, with the exception of reinforcing steel which is entirely within a spread footing. This steel may be non epoxy-coated and so indicated with the symbol (N).

The statements listed below are to be followed when applicable:

- A) Fit and clearance of reinforcing shall be carefully checked by calculations, large scale drawings, or other accurate means. Allowance should be made for the deformations (ridges) on the reinforcing steel.

Some of the common areas of interference are:

- 1) Slab reinforcing and abutment reinforcing
- 2) Wingwall reinforcing and abutment reinforcing
- 3) Wingwall reinforcing and girders, for structures with skews less than 70°

Skews will tend to aggravate problems of reinforcing fitting.

- B) Utility blockouts shall be shown and located in the PLAN and ELEVATION views of the abutment. An additional detail, showing the #5 stirrups spaced 6 inches

clear of the back face and 4 inches clear of the front face will be required. For additional information, see the CDOT Bridge Design Manual Section 2.8.

- C) On wingwall details “inside face” and “outside face” are preferred over “NF”, “FF” when calling out reinforcing.

Refer to the appropriate section of Chapter 4 for additional information concerning bar clearances, spacing, splicing, embedment, projections, etc.

11.20 Miscellaneous Concrete Details

The following details shall be shown on the drawing when applicable:

- A) The footings shall be shown in the PLAN, ELEVATION, and SECTION views of the abutment.
- B) Approach slabs will be required on all vehicular bridges, except bridges with GRS abutments that do not have an expansion device. The approach slab shall be anchored to the abutment and details shown accordingly. Approach slab notches shall be provided on all abutments, even if an approach slab will not be placed with the original construction. Check to see that there is adequate (2" Min) concrete cover between the notch for the approach slab and the end of girders, this problem is aggravated by the skew and the roadway grade. If a problem does occur, it can usually be solved by adding a corbel to the back face of the abutment.
- C) Sidewalks shall be continued beyond the abutments to the ends of wingwalls.
- D) Waterstop should be used between wingwalls and retaining walls.
- E) Avoid expansion devices when possible. If an expansion device is required it shall be designed between the end of the approach slab and the roadway approach, not at the abutment. For additional information, see Staff Bridge Structural Worksheet set B-518.
- F) A 1 1/2" x 1 1/2" fillet will be required at the back face of the abutment if the abutment concrete is at finished grade and there is no approach slab, or if there is no asphalt and no approach slab.
- G) The division of concrete classes shall be shown on the TYPICAL SECTION and on the wingwall retaining wall ELEVATION. If the division is shown on the wingwall section a note will be required to better define where this change occurs. “Construction joint is at the exterior bearing seat elevation.”

11.21 Check Items

Listed below is a summary of items that shall be checked and appear on the drawing, when applicable. Additional information shall appear, as required.

- A) Project number in proper location
- B) Horizontal Control Line, in the PLAN view
- C) Layout Line, in the PLAN view
- D) Stationing
- E) Location and identification of centerlines
- F) Elevations
- G) All necessary dimensions
- H) Skew angle of bridge and other pertinent angles
- I) Anchor Bolts or Leveling Pads
- J) Show footings in the PLAN view as well as in the ELEVATION and SECTION
- K) Check all intersecting planes of reinforcing steel for the proper clearances
- L) Check expansion device to insure that it fits properly at the abutment
- M) Check bearing plates, anchor bolts, and girders to insure that they fit properly at the abutment (See Figures 11.8-1 and 11.14-1)
- N) Title PLAN, ELEVATION, and SECTIONS in accordance with their particular conditions
- O) Label back face abutments in the PLAN and TYPICAL SECTION
- P) Label centerline of bearings
- Q) Check for typical notes
- R) Check title block for information
- S) Splice Lengths

11.22 Title Block

This drawing is titled "ABUTMENT DETAILS" and shall be so indicated in the title block. The abutment numbers shall be included in the title, such as "ABUTMENT 1 AND 3 DETAILS."

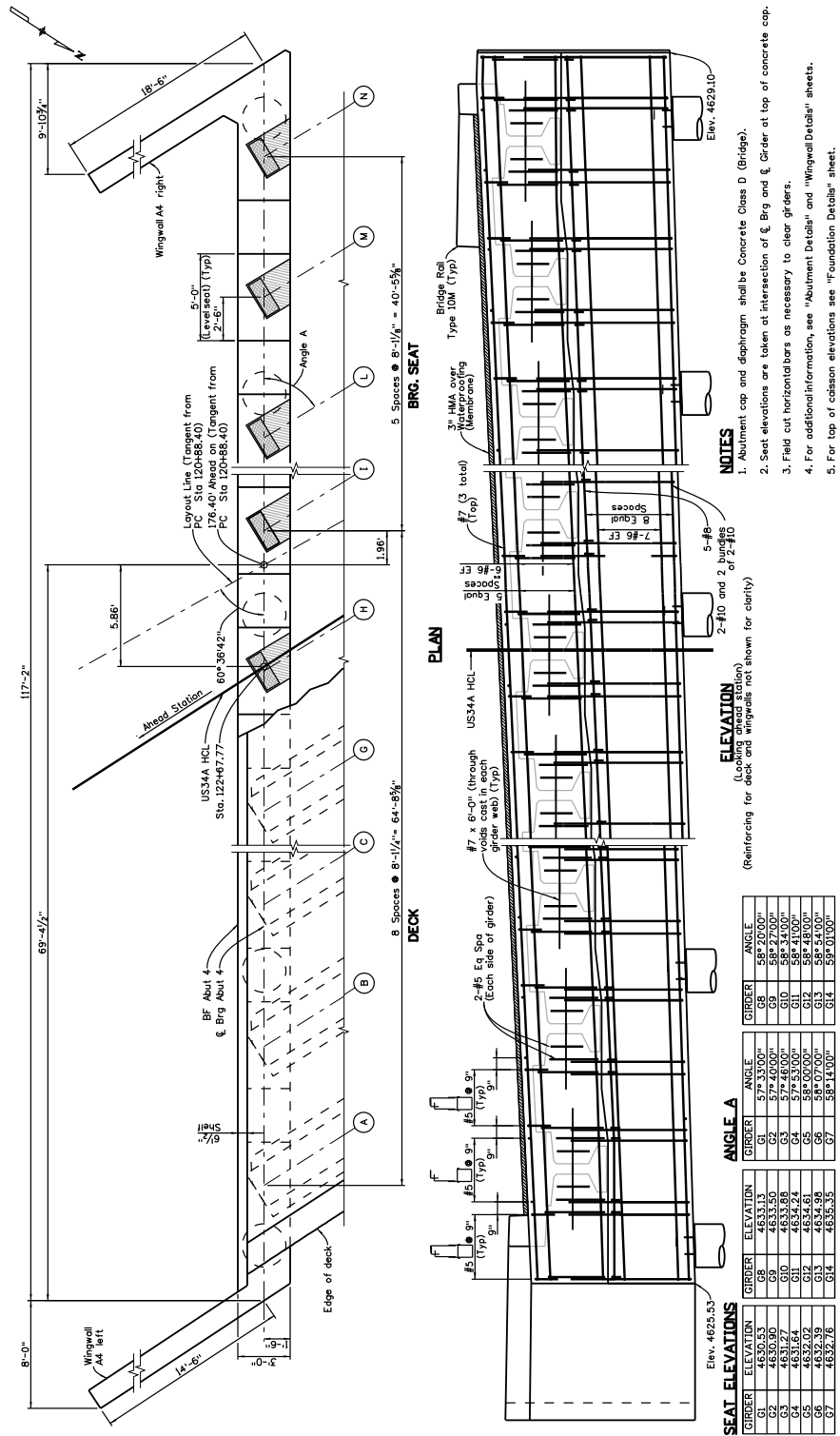
If other details are combined on this drawing, they shall be indicated in the title. Example: If the "Pier Details" are placed on this drawing with the "Abutment Details," the title shall be "ABUTMENT 1 AND 3 DETAILS - PIER 2 DETAIL."

The structure numbers and the first initial and last name of the designer and detailer shall be filled in on each sheet.

11.23 Typical Notes

The following notes shall appear on the drawing when applicable:

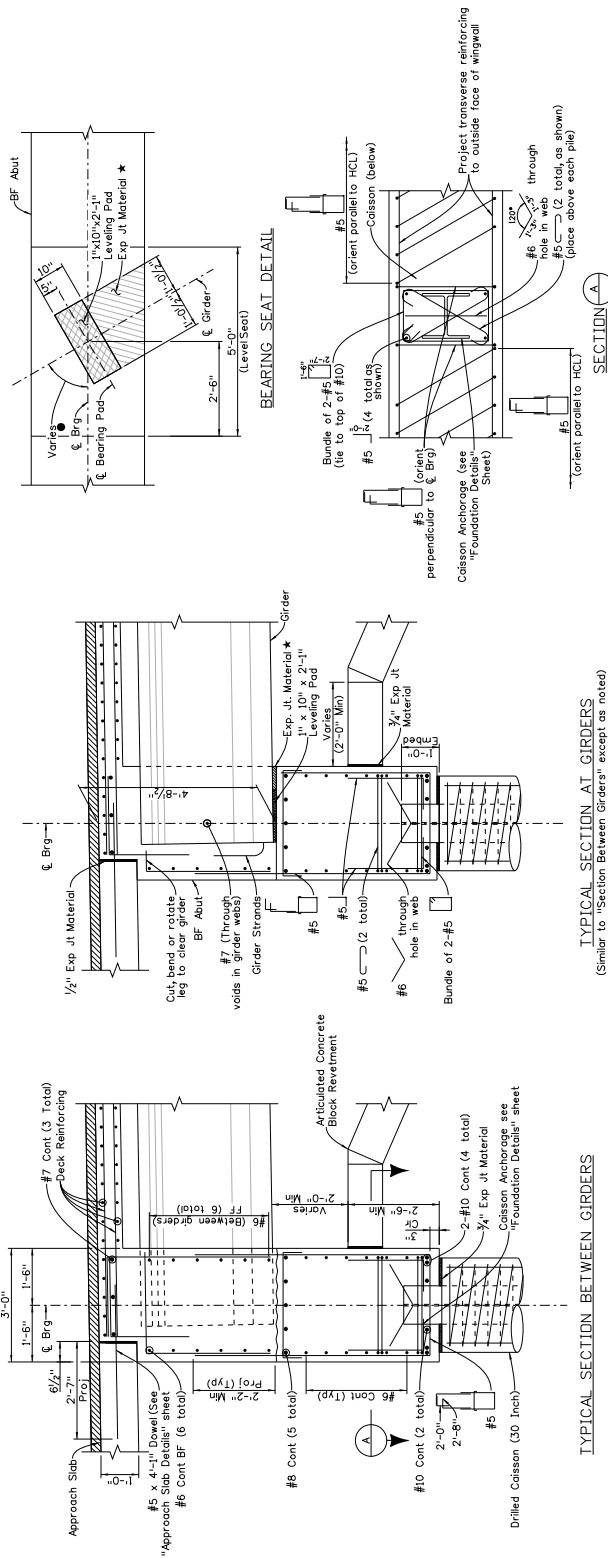
- A) Utility Blockout Note - "Centerline _____ X _____ Blockout. Cut longitudinal reinforcing and move stirrups to clear."
- B) Anchor Bolt Note - "Anchor Bolt _____" Ø X _____ Long (Project _____)"
- C) Abutments with expansion devices - "Concrete above the construction joint shall be placed after the slab has been poured. Top of abutment backwall to match slope and grade of the roadway.
For details of expansion device, see Dwg No B _____."
- D) Abutment with elastomeric bearing pads greater than 1 1/2" - "Dimension reflects _____, compression of the elastomeric bearing pad due to dead load deflection."
- E) Cast-in-place Post Tensioned Bridges "Slope paving in front of abutments to be placed after stressing."
- F) Precast girders
 - 1) "4" Fillet (Typ between girders)"
 - 2) "Field bend or cut reinforcing to provide 2" Clr at bearing seats"
 - 3) "Slab and portion of abutment above bearing seat to be poured monolithically"
- G) Wingwall Details
 - 1) "For details and reinforcing of Bridge Rail Type _____, see Dwg No B _____"
 - 2) "Match cantilever"
 - 3) "Construction joint is at the exterior bearing seat elevation"
- H) When a detail is shown on another sheet a note referencing to the sheet should be given
 - 1) "For wingwall details, see Dwg No B _____"
 - 2) "For bearing details, see Dwg No B _____"
 - 3) "For utility blockout details, see Dwg No B _____"
- I) Splice Lengths (Designer to show splice lengths per specification requirements)



- NOTES**
1. Abutment cap and diaphragm shall be Concrete Class D (Bridge).
 2. Seat elevations are taken at intersection of $\&$ Brg and $\&$ Girder at top of concrete cap.
 3. Field cut horizontal bars as necessary to clear girders.
 4. For additional information, see "Abutment Details" and "Wingwall Details" sheets.
 5. For top of caisson elevations see "Foundation Details" sheet.

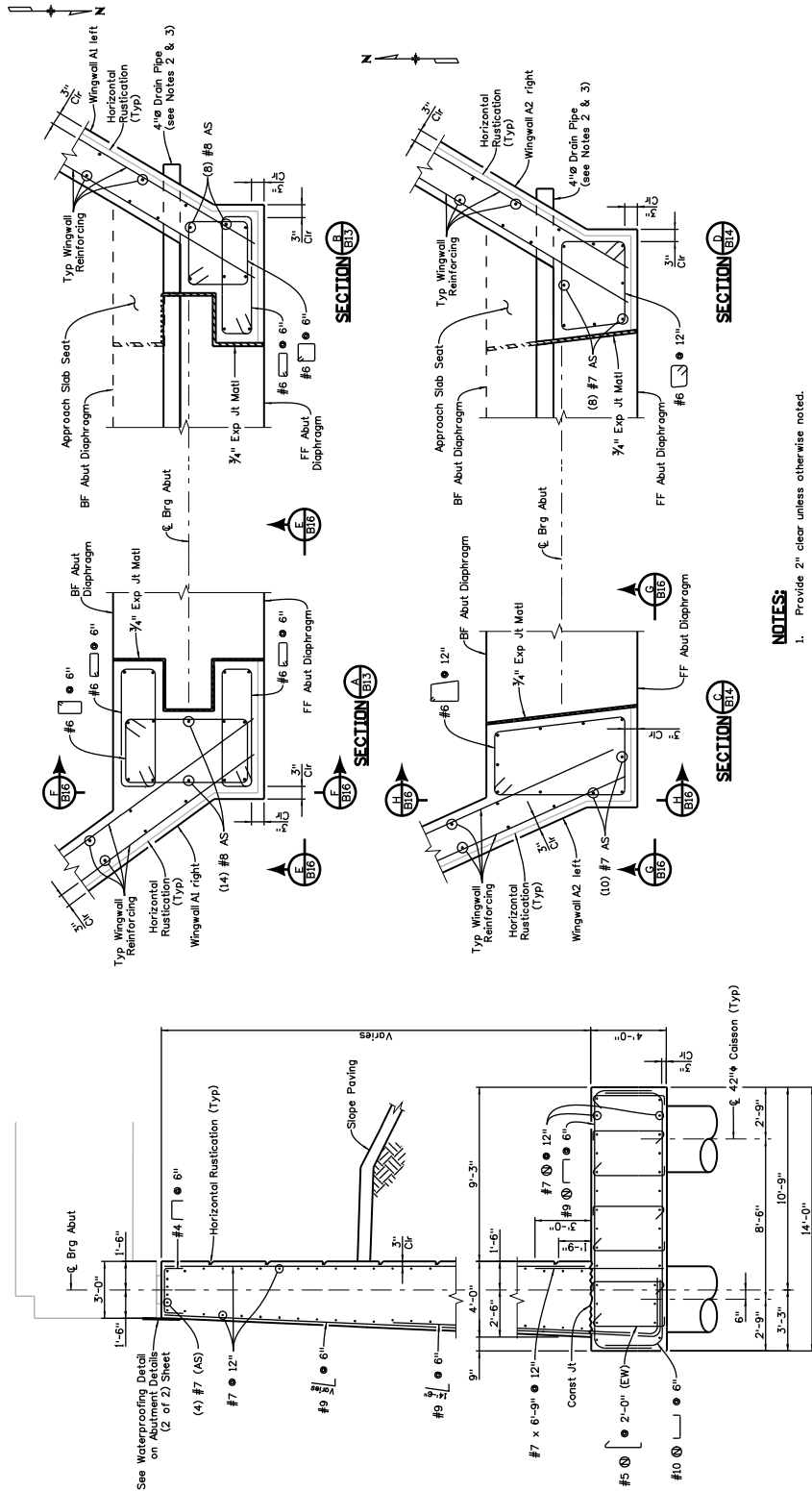
ABUTMENT 4

Example 11-1



Example 11-2

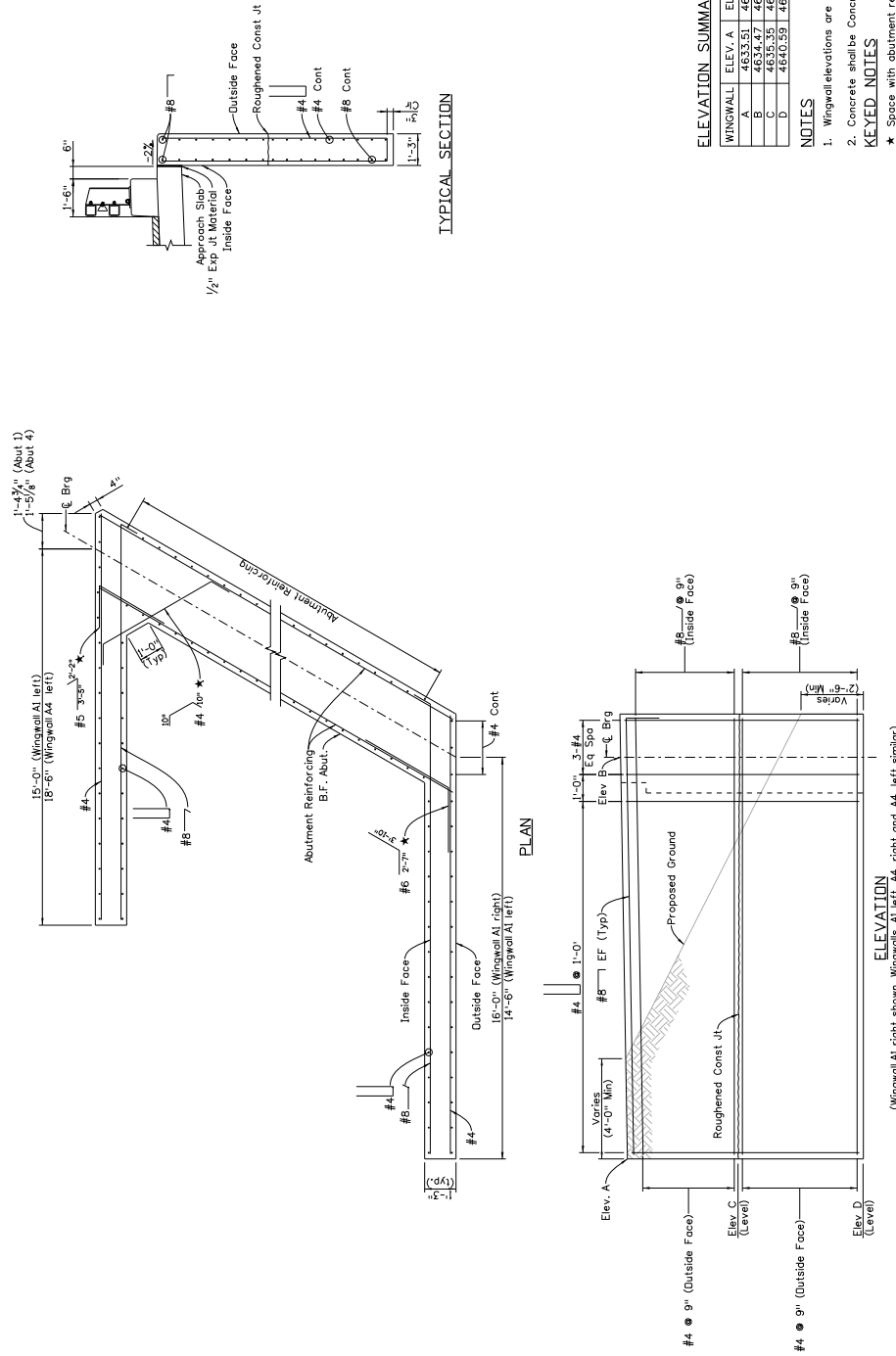
- NOTES**
- Deck and abutment diaphragm above the bearing seat shall be placed monolithically.
- KEYED NOTES**
- ★ Thickness varies. Adjust with layers of 1/4" thick expansion joint material prior to abutment diaphragm concrete placement, as shown. Expansion joint material shall be placed in the cap. Cost of expansion joint material to be included in the work.
 - See "Abutment 1" and "Abutment 4" sheets for dimension.



- NOTES:**
1. Provide 2" clear unless otherwise noted.
 2. Cast continuous half circle section of Schedule 60 HDPE pipe around the caisson. The bottom of the pipe shall be at the grade of the trough shall match the roadway crossfall.
 3. Extend 4" Trimm'd Plastic Pipe through the wingwall and extend 4" (Min) beyond outside face.

ABUTMENT DETAILS (1 OF 2)

Example 11-3



ELEVATION SUMMARY

WINGWALL	ELEV. A	ELEV. B	ELEV. C	ELEV. D
A	4633.51	4633.64	4626.77	4623.77
B	4634.47	4634.84	4626.93	4624.93
C	4635.43	4635.80	4627.09	4625.09
D	4640.53	4640.42	4635.35	4620.10

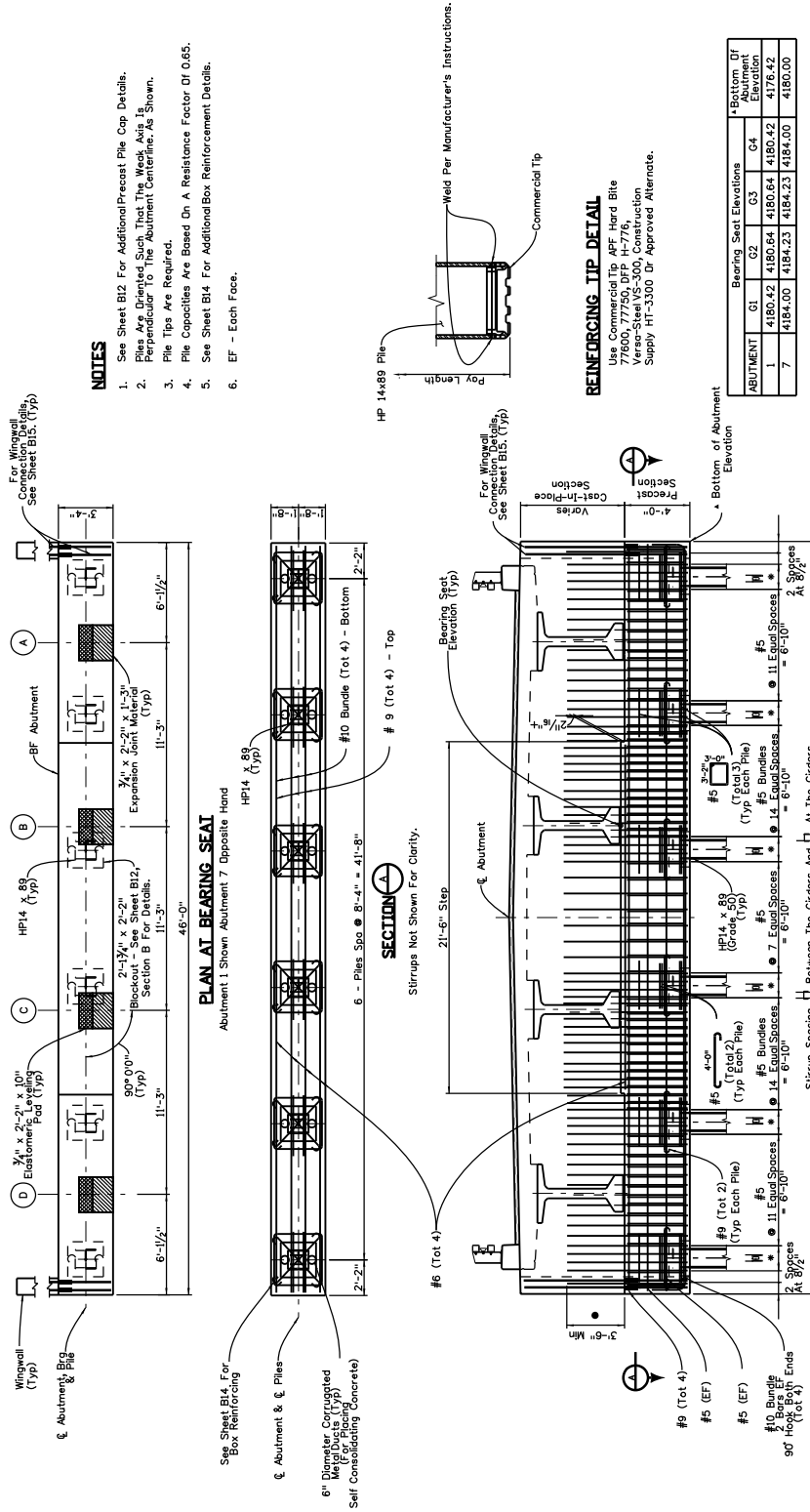
NOTES

1. Wingwall elevations are taken at Outside Face.
2. Concrete shall be Concrete Class D (Bridge).

KEYED NOTES

- ★ Space with abutment reinforcing.

Example 11-4

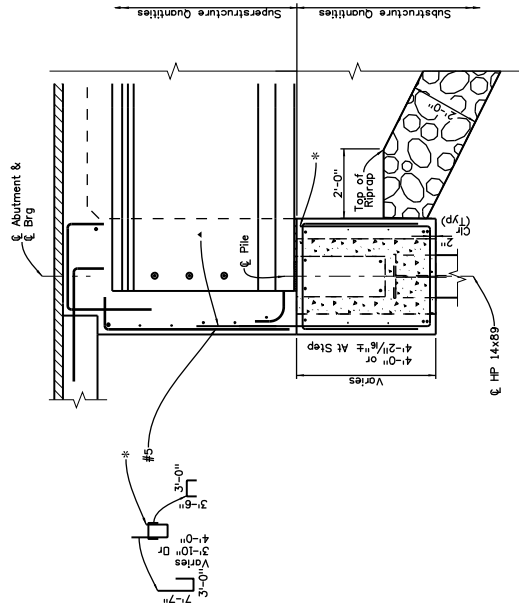


NOTES

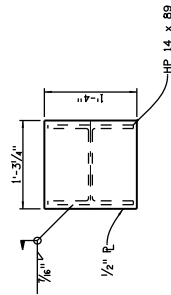
1. See Sheet B12 For Additional Precast Pile Cap Details.
2. Piles Are Oriented Such That The Weak Axis Is Perpendicular To The Abutment Centerline, As Shown.
3. Pile Caps Are Required.
4. Pile Capacities Are Based On A Resistance Factor Cf 0.65.
5. See Sheet B14 For Additional Box Reinforcement Details.
6. EF - Each Face.

**PRECAST ABUTMENT
PLAN & ELEVATION**

Example 11-5

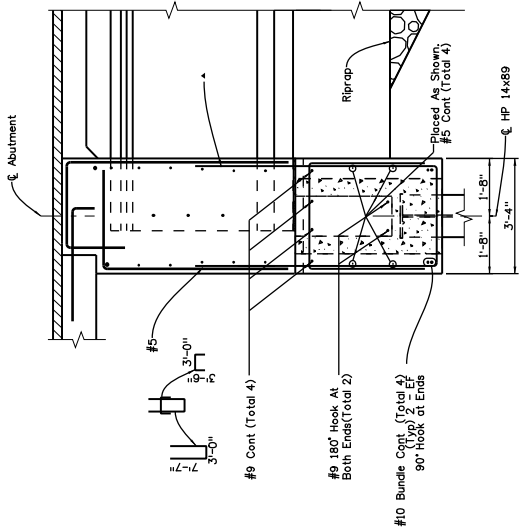


TYPICAL SECTION AT GIRDERS
For Diaphragm Reinforcing See Sheets B11 & B12

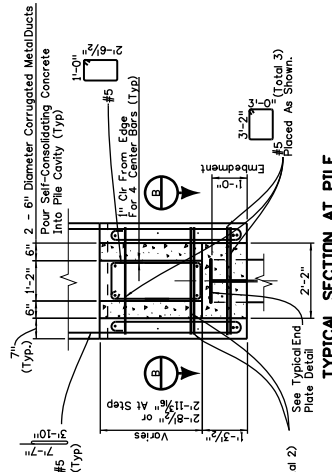


TYPICAL END PLATE DETAIL

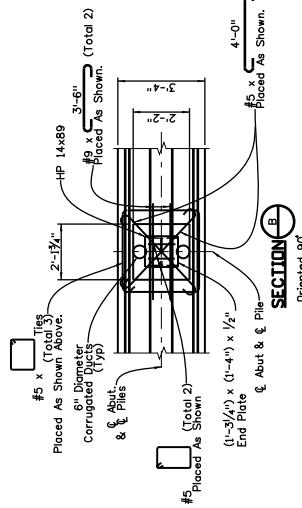
PRECAST ABUTMENT DETAILS



TYPICAL SECTION AT PILE
For Diaphragm Reinforcing See Sheets B11 & B12



TYPICAL SECTION AT PILE



SECTION B
Oriented 90°

NOTES

- The Contractor shall submit a leveling plan for all precast units to be approved by the Engineer two weeks prior to construction.
- Field welds in the end plates shall be inspected by a qualified inspector and approved by the Engineer prior to placing the pile cap.
- Wingwall connection details not shown for clarity. See Sheets B13 & B15 for Details.

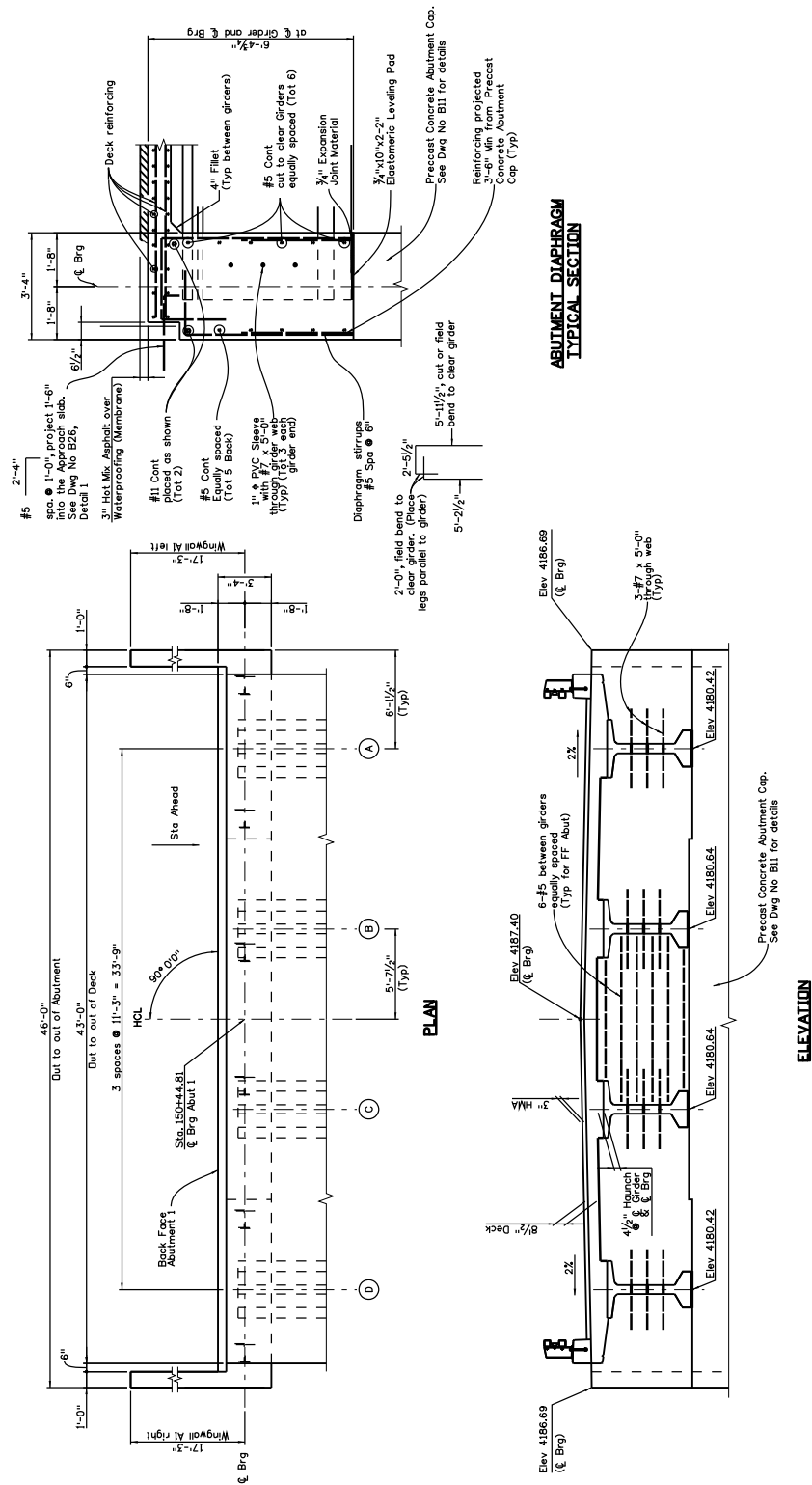
- * Clip as necessary to accommodate girders.
- ▲ Bar to protrude from precast into diaphragm, EF (Typ)

- EF - Each Face
- FF - Front Face
- BF - Back Face

Pile: HP - 14 x 89
Grade 50

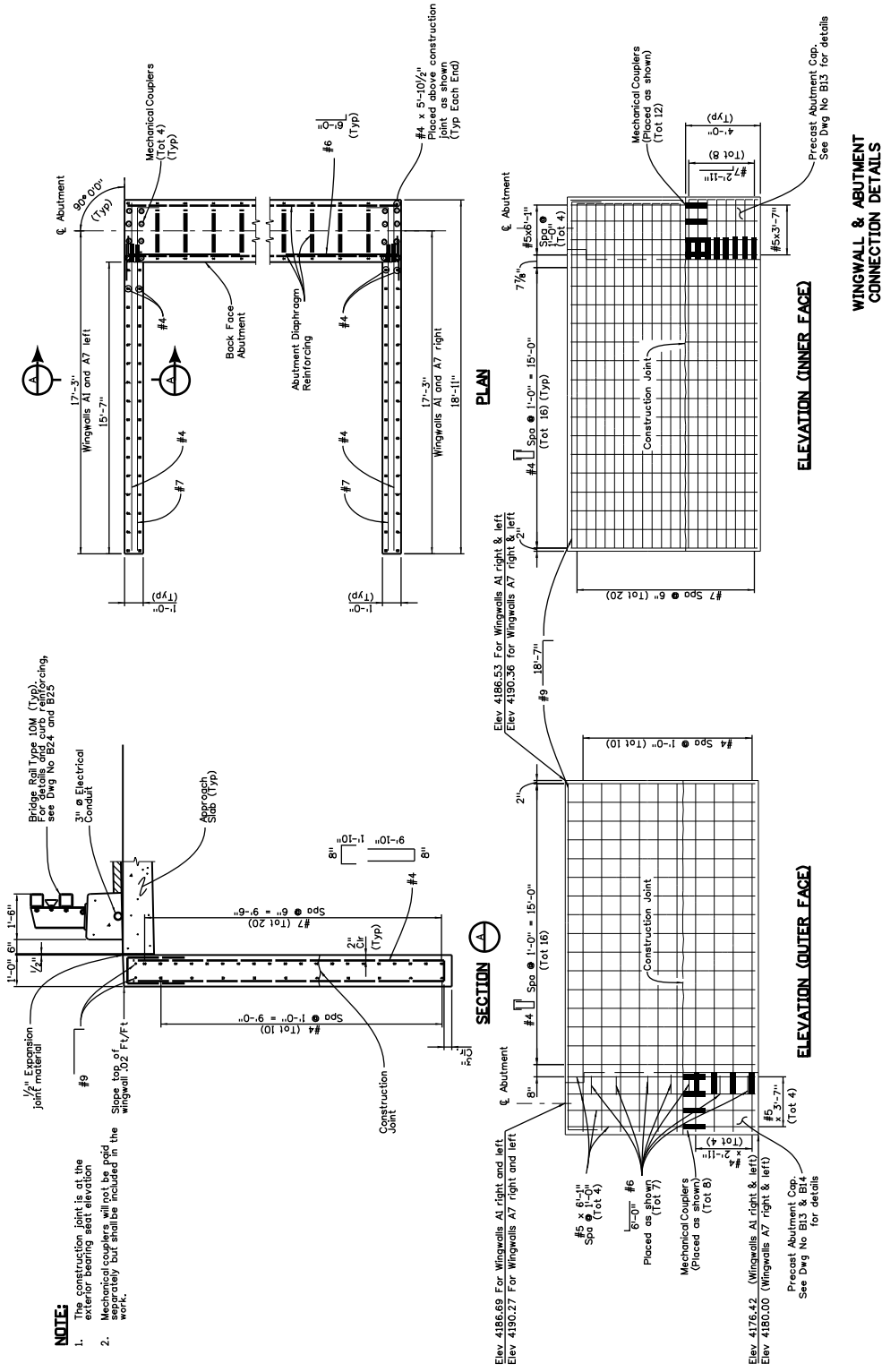
PILE TOLERANCE

The driven piles have a lateral installation tolerance of 5" in any direction. This tolerance is based on the gap between the edge of the pile end plate and the face of the voided blockout.

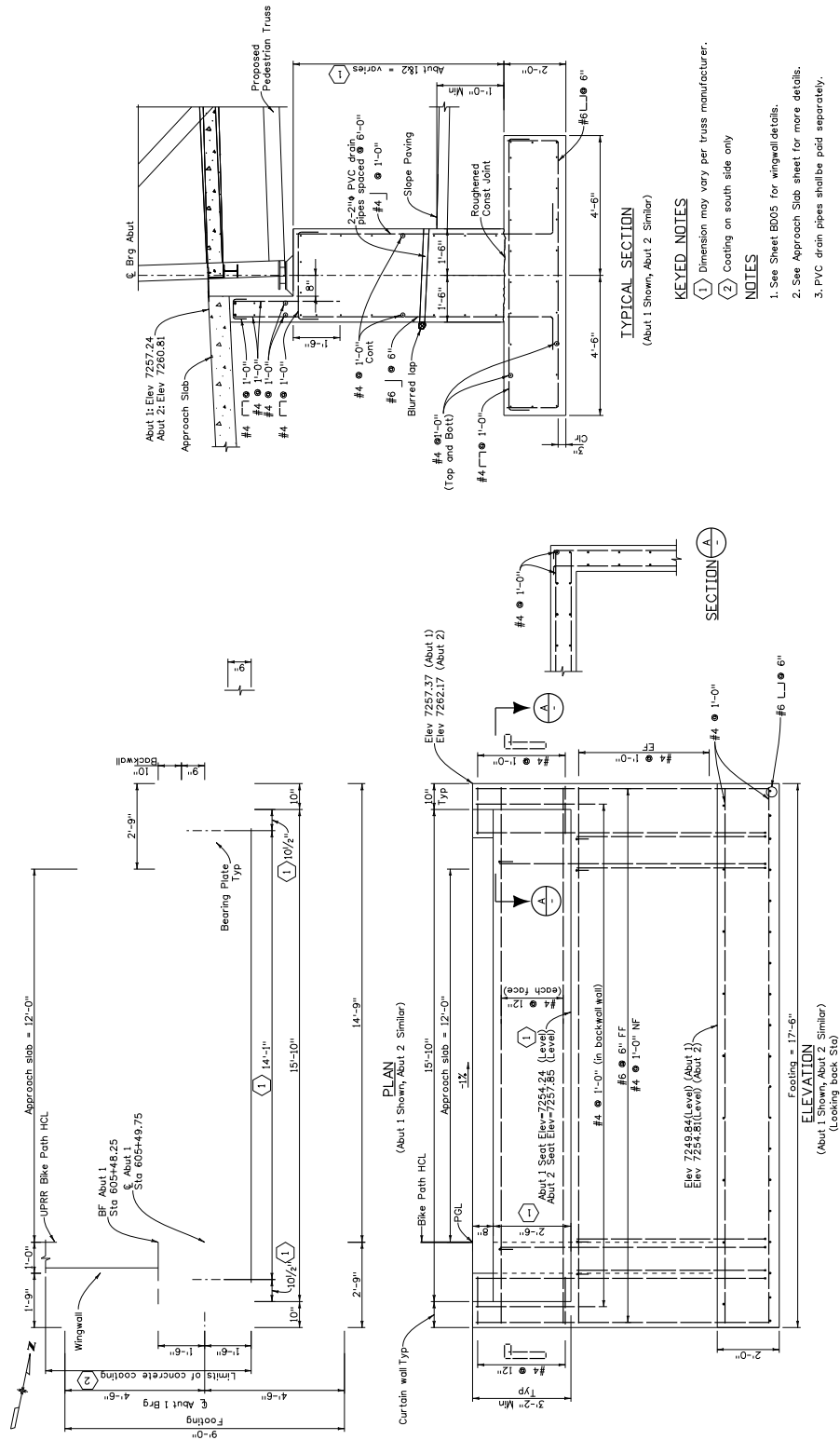


ABUTMENT 1 DIAPHRAGM DETAILS

Example 11-7



Example 11-8



Example 11-10