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| Colorado Department of Transportation<br>Staff Bridge<br>Bridge Detail Manual | Chapter: 13.1<br>Effective: June 30, 2024<br>Supersedes: May 31, 2023 |
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## Concrete Superstructure Details

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### 13.1.1 Purpose

These drawings are to present graphically all pertinent information needed by the Fabricator and Contractor for construction of the cast-in-place concrete deck and girders of the structure.

### 13.1.2 Responsibility

The graphic presentation of information on these drawings shall be the responsibility of the individual preparing the drawings in addition to the designer.

### 13.1.3 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 girders and deck are as follows:

- A) Plan, Elevation and Sections - 1"=10', 1"=20', 1"=30'.
- B) Details - 1/8"=1'-0", 1/4" = 1'-0", 1/2"=1'-0", 3/4"=1'-0", etc.

### 13.1.4 Orientation Of Details

The PLAN of the deck shall be placed, if possible, at upper left of the drawing.

The TYPICAL SECTION shall be placed below the deck PLAN. If space is limited, the sections or auxiliary views may be shown on another sheet.

Generally, sections should be taken from the PLAN rather than from auxiliary views or other sections.

### 13.1.5 Horizontal Control Line

The horizontal control line is not necessary for the plan view unless reinforcing is controlled by it.

### 13.1.6 Order Of Sheets

As with the rest of the set, the sheets are provided in the order of construction. The Girder Worksheets (post-tensioning details, etc.) will be first, followed by the Deck Reinforcing Plan with any required sections and details. Subsequent detail sheets and

worksheets for pier diaphragm, bridge rail, fencing, lighting, etc. shall be added after these sheets to complete the required details.

### **13.1.7 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 deck and associated details. Dimensions of reinforcing shall only be provided if not controlled by concrete limits, e.g. negative moment steel.

### **13.1.8 Girder Worksheets**

The Girder worksheets (post-tensioning, etc.) shall be provided with additions as required to show the appropriate design. Any changes to the default reinforcing shall be shown here as required by the design. Any item that is required for design of the girder or placement shall be shown in this sheet.

Leveling pad or bearing information should be placed on previous sheets but any bearing items needed in the cast in place girder should be shown.

Post-tensioning ducts shall be shown in the girders as required. Post-tensioning information should be shown in the deck/girder detail sheets.

### **13.1.9 Deck Reinforcing Details**

The information for laying out the reinforcing for the deck shall be provided. The Reinforcing Plan view may be schematic as true scale detailing is generally not possible. A section view of the deck is often helpful in describing the reinforcing in addition to the plan view.

Some points which may require additional attention:

- A) Special reinforcement may be required, especially in areas where the slab is in tension or in large skew areas.
- B) Reinforcement governed by outside concrete and clearance dimensions should not be dimensioned or totaled, e.g. 30 - #5 @ 3" spacing. This information would be too similar to bar tables which have been discontinued.
- C) The outside edges of the deck should be the same thickness as the interior deck, and the underside of the overhang tapered to one inch below the top of the girder.
- D) Drip groove shall be shown in details.

- E) Bottom longitudinal reinforcing in the overhang should be located to correspond with the bridge rail requirements.

### **13.1.10 Additional Deck Details**

Add additional deck details and worksheets as required to show all details for the completion of the deck pour and associated reinforcing. These sheets may include barrier worksheets, lighting, utility hanger, sidewalks, medians, deck drains, deck post-tensioning and other details. Since the pier and abutment diaphragm is typically poured monolithically with the deck, the required details shall be shown within the deck detail sheets or in prior sheets such as the abutment. Any required deck pour schedules or schemes would be shown in this section as well.

### **13.1.11 Checking**

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) Title PLAN and SECTION in accordance with their particular conditions
- B) Reinforcing Splice lengths provided
- C) Skew angle of bridge and other pertinent angles
- D) Barrier sections or references
- E) Drip groove shown and dimensioned
- F) Check title block for information

For post-tensioned structures, the following information shall be included:

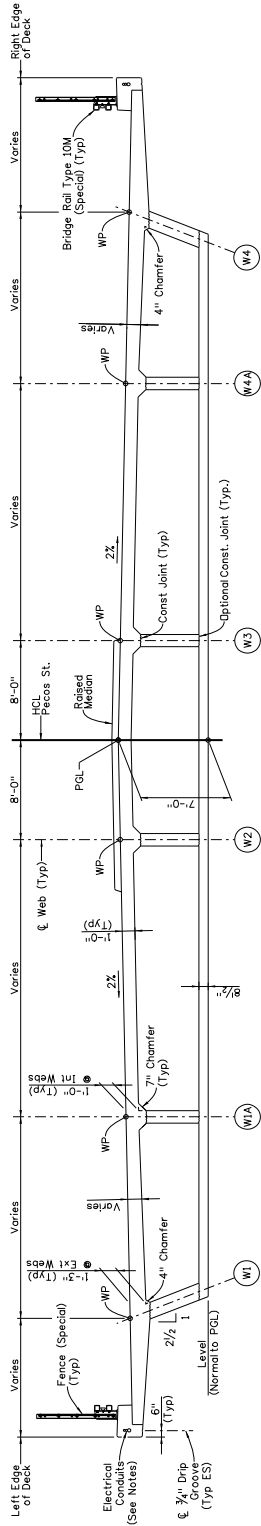
- A) Jacking force
- B) Area of prestressing steel
- C) Minimum concrete strength at jacking and at 28 days
- D) Center of gravity of prestressing force path
- E) Jacking ends
- F) Anchor sets
- G) Friction constants
- H) Long-term losses assumed in the design
- I) Strand and duct size assumed in the design
- J) Net long-term deflections and expected cambers
- K) Estimated haunches at midspans (for spliced girders only)

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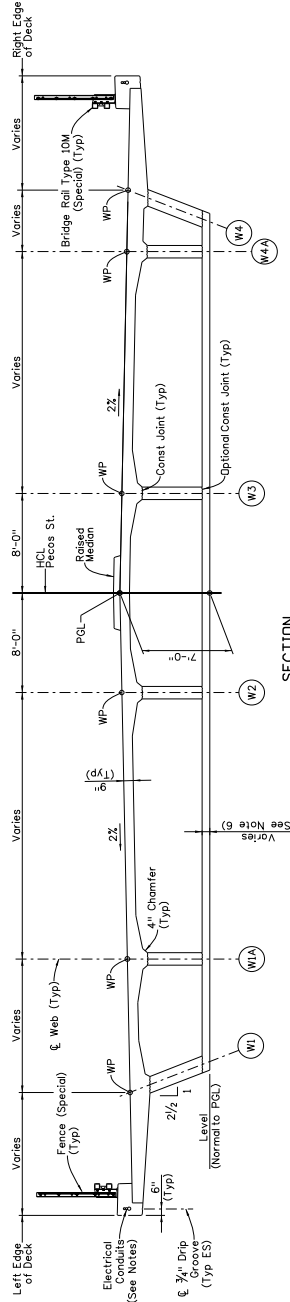
**13.1.12 Title Block**

This drawing is titled “DECK PLAN”, “DECK TYPICAL SECTION” , “SUPERSTRUCTURE DETAILS” or similar and shall be so indicated in the title block.

If other details are combined on this drawing, they shall be indicated in the title.  
Example: If the “Barrier Details” are placed on this drawing with the “Deck Details”, the title shall be “DECK DETAILS - BARRIER DETAILS”.



**SECTION**  
Abut 1 to Lifting Diaphragm 1  
(Taken Normal to HCL)



**SECTION**  
Lifting Diaphragm 1 to Sta. 15H4.33  
(Taken Normal to HCL)

**NOTES:**

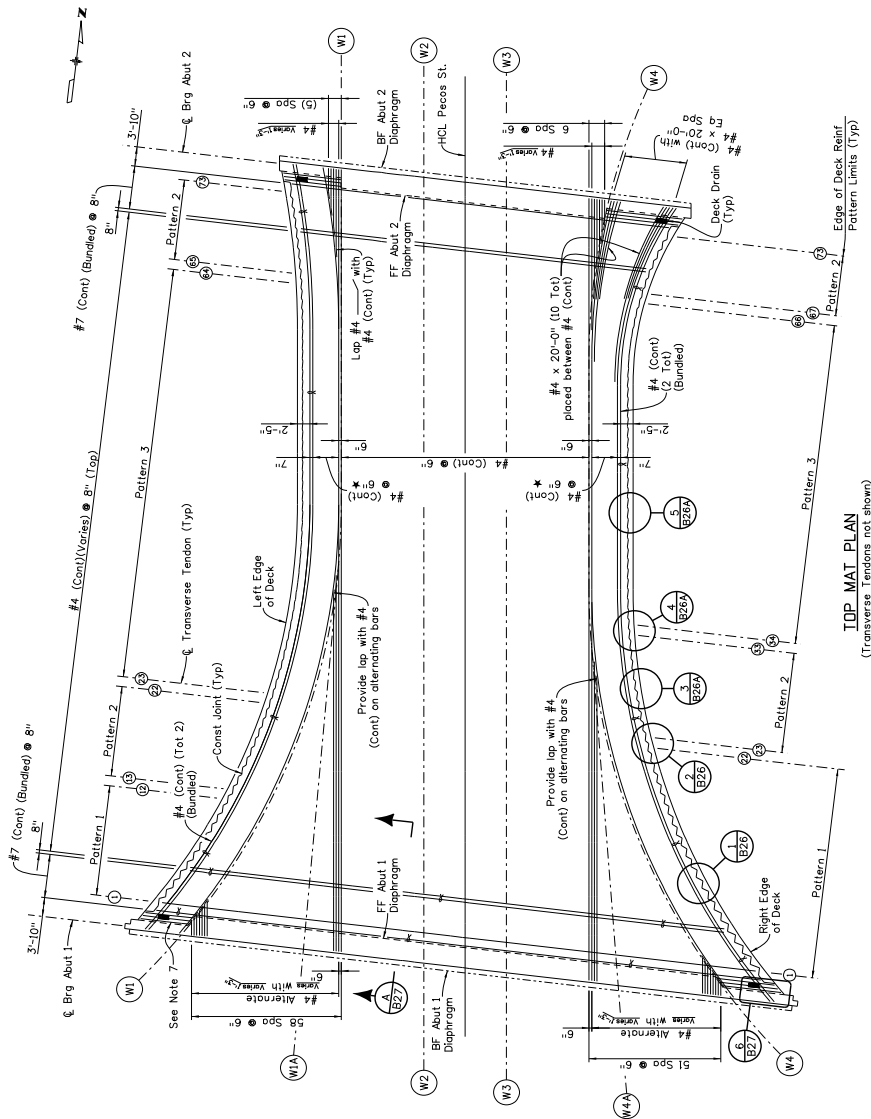
1. See Superstructure Details (3 of 3) for additional dimensions.
2. Work Point (WP) location =  $\xi$  Web at Top of Deck.
3. All transverse dimensions are taken normal to HCL and are horizontal unless noted otherwise.
4. See Construction Layout (1 of 2) for required electrical conduits.
5. See Roadway plans for median geometry.
6. See LongitudinalPT Layout (Internal) sheet for bottom slab thickness.

**SUPERSTRUCTURE  
DETAILS (1 OF 3)**

**Example 13.1-1**

**NOTES:**

1. All reinforcement not shown. See Deck Reinforcing Details for additional reinforcement at edges of deck.
  2. Place all transverse deck reinforcement parallel to  $\xi$  Bearing.
  3. Adjust location of transverse bars up to 2" as required to provide 2" minimum clear between transverse deck reinforcement and transverse tendons.
  4. See Deck Drain Details for deck drain locations.
  5. See Transverse Tendon Layout for transverse tendon locations.
  6. See Transverse Tendon Layout and Transverse PT Details (1 of 3) for Construction Joint details.
  7. See Abutment Diaphragm Details sheets for reinforcement projecting from diaphragm into deck.
  8. For Edge of Deck Reinforcing Patterns, see Deck Reinforcing Details sheets.
- ★ Place bars parallel to edge of deck except as shown in NE corner.



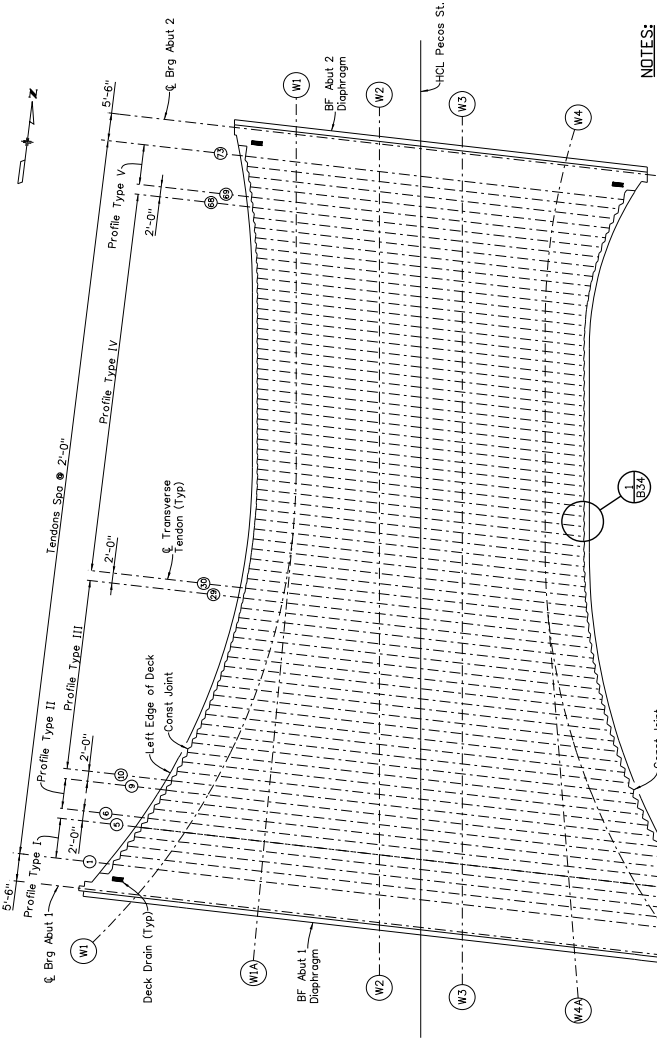
**TOP MAT PLAN**  
(Transverse Tendons not shown)

DECK REINFORCING  
TOP MAT PLAN

**Example 13.1-2**

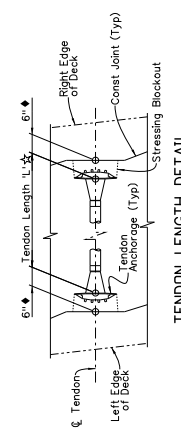
TRANSVERSE POST-TENSIONING SCHEDULE

| Tendon Number | Profile Type | Tendon Length (ft.) | Tendon Length (ft.) |
|---------------|--------------|---------------------|---------------------|
| 1             | I            | 116.10              | 116.10              |
| 2             | I            | 113.02              | 113.02              |
| 3             | I            | 110.07              | 110.07              |
| 4             | I            | 107.24              | 107.24              |
| 5             | I            | 104.53              | 104.53              |
| 6             | II           | 101.92              | 101.92              |
| 7             | II           | 99.43               | 99.43               |
| 8             | II           | 97.04               | 97.04               |
| 9             | II           | 94.74               | 94.74               |
| 10            | III          | 92.55               | 92.55               |
| 11            | III          | 90.45               | 90.45               |
| 12            | III          | 88.43               | 88.43               |
| 13            | III          | 86.51               | 86.51               |
| 14            | III          | 84.67               | 84.67               |
| 15            | III          | 82.92               | 82.92               |
| 16            | III          | 81.25               | 81.25               |
| 17            | III          | 79.66               | 79.66               |
| 18            | III          | 78.15               | 78.15               |
| 19            | III          | 76.71               | 76.71               |
| 20            | III          | 75.35               | 75.35               |
| 21            | III          | 74.07               | 74.07               |
| 22            | III          | 72.86               | 72.86               |
| 23            | III          | 71.72               | 71.72               |
| 24            | III          | 70.65               | 70.65               |
| 25            | III          | 69.65               | 69.65               |
| 26            | III          | 68.72               | 68.72               |
| 27            | III          | 67.86               | 67.86               |
| 28            | III          | 67.07               | 67.07               |
| 29            | III          | 66.34               | 66.34               |
| 30            | IV           | 65.68               | 65.68               |
| 31            | IV           | 65.08               | 65.08               |
| 32            | IV           | 64.55               | 64.55               |
| 33            | IV           | 64.09               | 64.09               |
| 34            | IV           | 63.69               | 63.69               |
| 35            | IV           | 63.35               | 63.35               |
| 36            | IV           | 63.08               | 63.08               |
| 37            | IV           | 62.87               | 62.87               |
| 38            | IV           | 62.72               | 62.72               |
| 39            | IV           | 62.60               | 62.60               |
| 40            | IV           | 62.52               | 62.52               |
| 41            | IV           | 62.47               | 62.47               |
| 42-58         | IV           | 62.45               | 62.45               |
| 59            | IV           | 62.50               | 62.50               |
| 60            | IV           | 62.61               | 62.61               |
| 61            | IV           | 62.82               | 62.82               |
| 62            | IV           | 63.11               | 63.11               |
| 63            | IV           | 63.49               | 63.49               |
| 64            | IV           | 63.97               | 63.97               |
| 65            | IV           | 64.53               | 64.53               |
| 66            | IV           | 65.19               | 65.19               |
| 67            | IV           | 65.94               | 65.94               |
| 68            | IV           | 66.78               | 66.78               |
| 69            | V            | 67.72               | 67.72               |
| 70            | V            | 68.76               | 68.76               |
| 71            | V            | 69.90               | 69.90               |
| 72            | V            | 71.14               | 71.14               |
| 73            | V            | 72.48               | 72.48               |



NOTES:

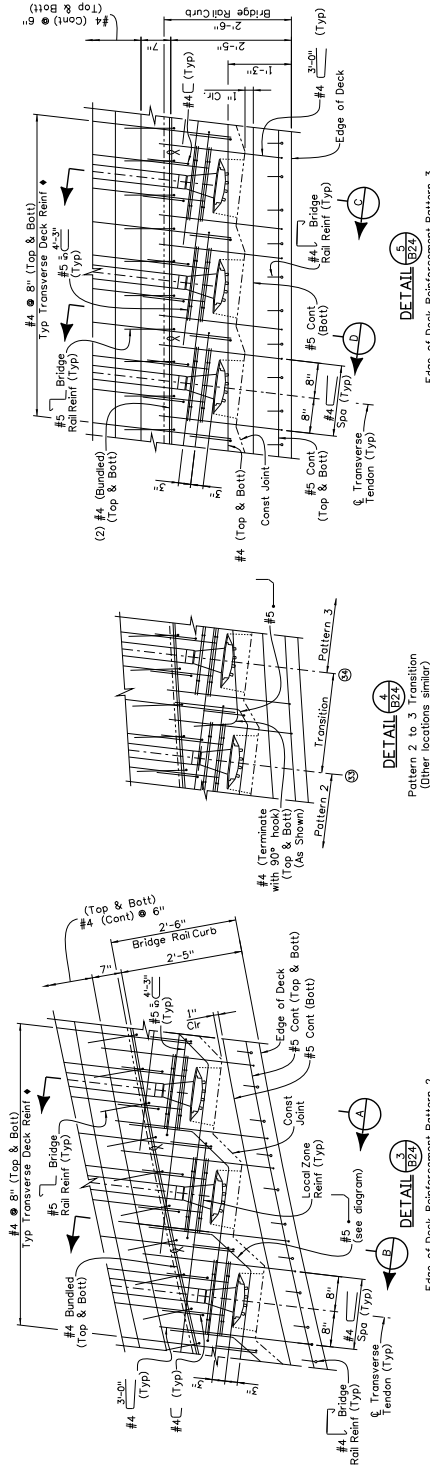
- Tendon lengths provided are for information only. The Contractor is responsible for verifying the tendon lengths required for transverse post-tensioning.
  - All transverse tendons shall be placed parallel to  $\xi$  Bearing.
  - See Transverse PT Details (1 of 3) for additional information.
  - See Transverse PT Details (2 of 3) and (3 of 3) for tendon profiles.
- ★ Tendon Length 'L' is measured in plan along  $\xi$  Tendon and does not account for additional length due to tendon profile.  
◆ Assumed depth of pocket former. Actual dimensions may vary.



TENDON LENGTH DETAIL

TRANSVERSE TENDON LAYOUT

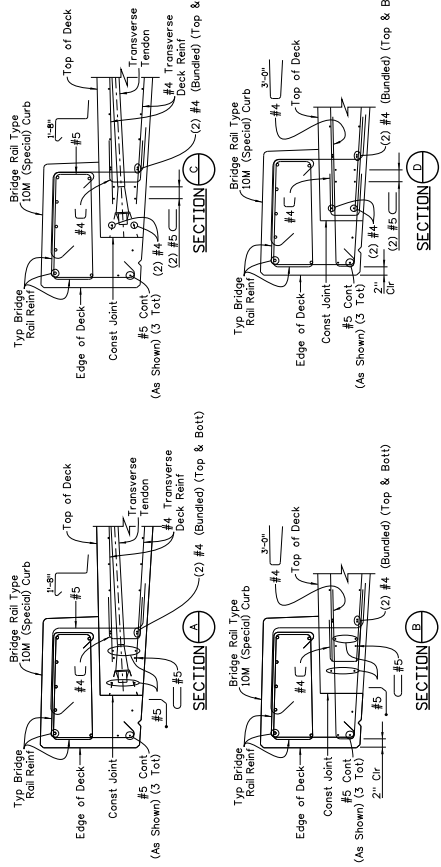
Example 13.1-3



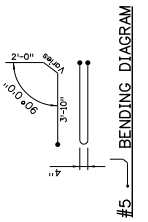
DETAIL 2  
Edge of Deck Reinforcement Pattern 2

DETAIL 3  
Edge of Deck Reinforcement Pattern 3

DETAIL 4  
Edge of Deck Reinforcement Pattern 4



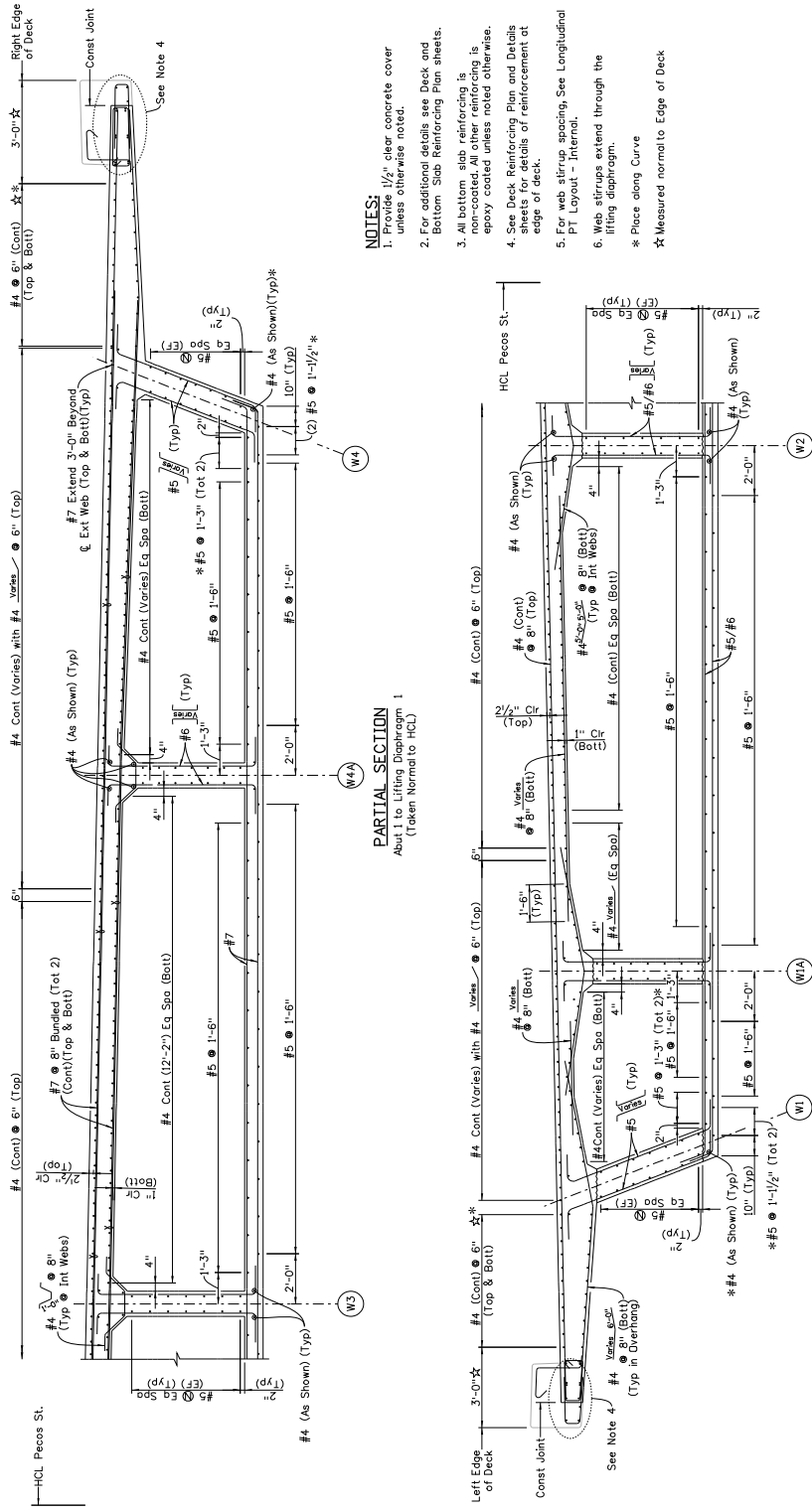
- NOTES:**
1. For local zone reinforcement, see Transverse PI Details (1 of 3).
  2. See Transverse Tendon Layout for transverse tendon locations.
  3. See Bridge Rail Type 10M (Special) sheets for typical bridge rail reinforcement.
- ◆ See Transverse Reinforcement Detail on Deck Reinforcing Details (1 of 3) sheet



DECK REINFORCING DETAILS  
(2 OF 3)

Example 13.1-4





**NOTES:**

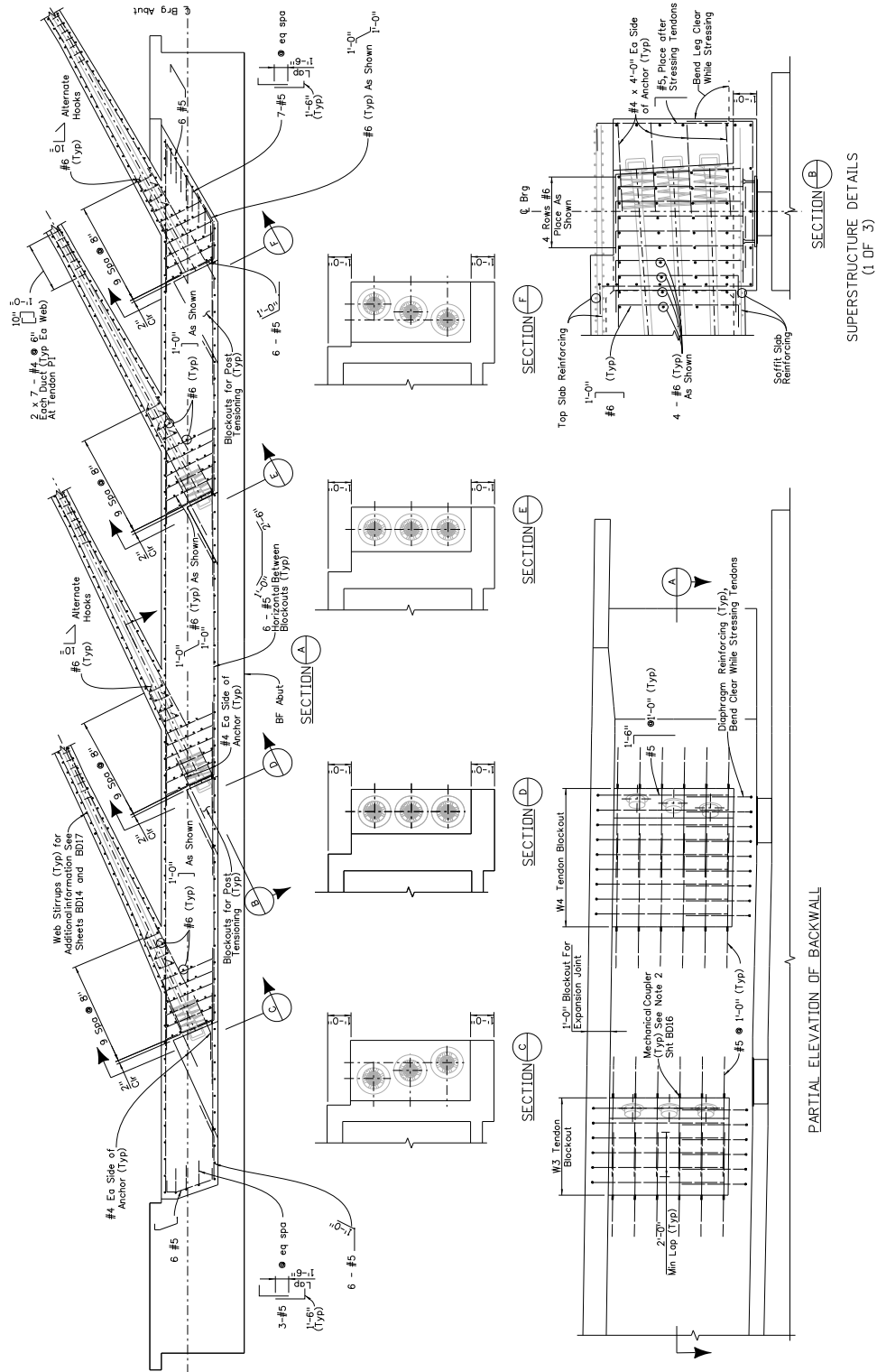
1. Provide 1/2" clear concrete cover unless otherwise noted.
  2. For additional details see Deck and Bottom Slab Reinforcing Plan sheets.
  3. All bottom slab reinforcing is non-coated. All other reinforcing is epoxy coated unless noted otherwise.
  4. See Deck Reinforcing Plan and Details sheets for details of reinforcement at edge of deck.
  5. For web stirrup spacing, See Longitudinal PT Layout - Internal.
  6. Web stirrups extend through the lifting diaphragm.
- \* Piece along Curve  
 ☆ Measured normal to Edge of Deck

**PARTIAL SECTION**  
 About 1 to Lifting Diaphragm 1  
 (Taken Normal to HCL)

**PARTIAL SECTION**  
 Lifting Diaphragm 1 to Slab U5+4.33  
 (Taken Normal to HCL)

**SUPERSTRUCTURE REINFORCING**  
 DETAILS (1 OF 3)

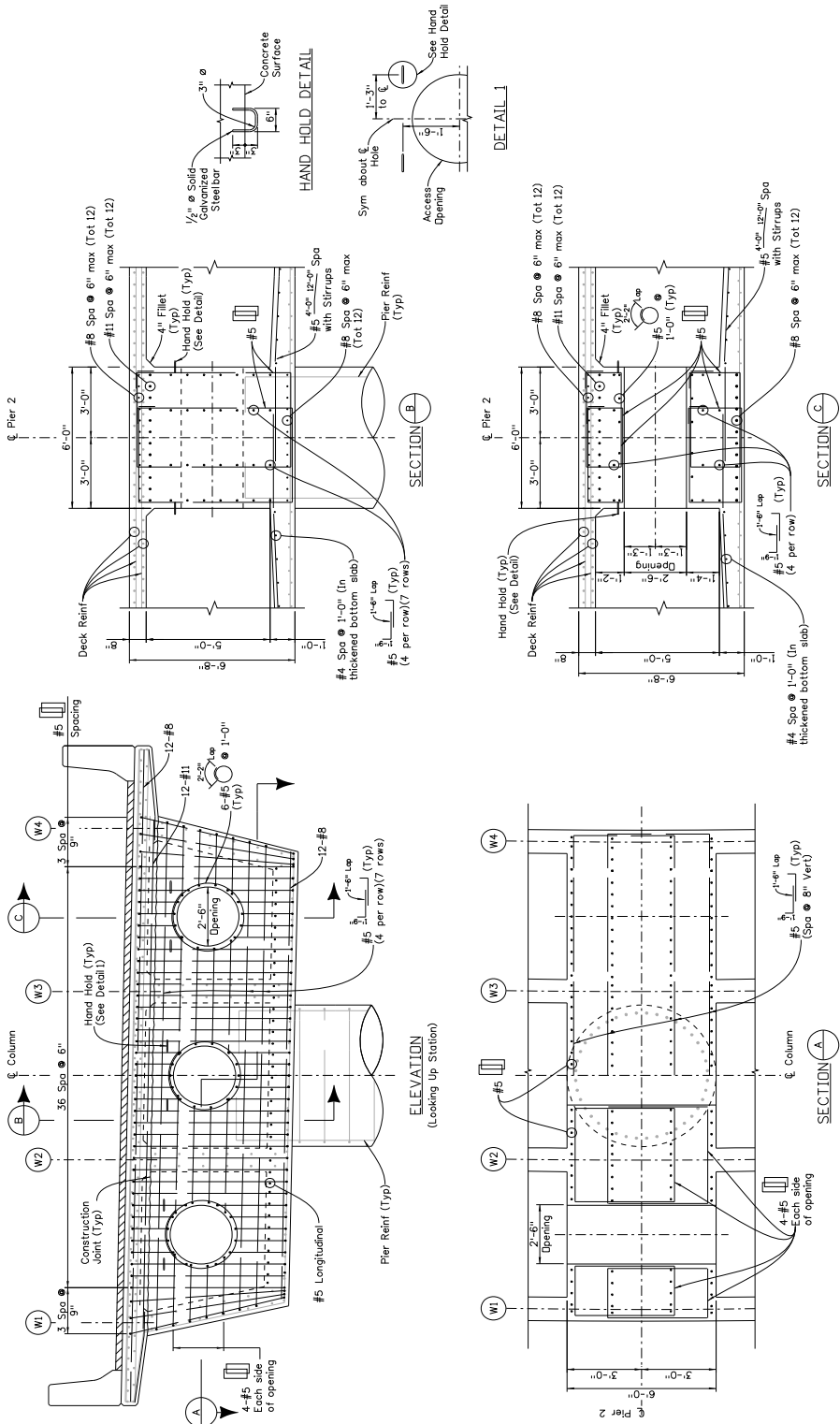
**Example 13.1-5**



Example 13.1-6

SUPERSTRUCTURE DETAILS  
(1 OF 3)

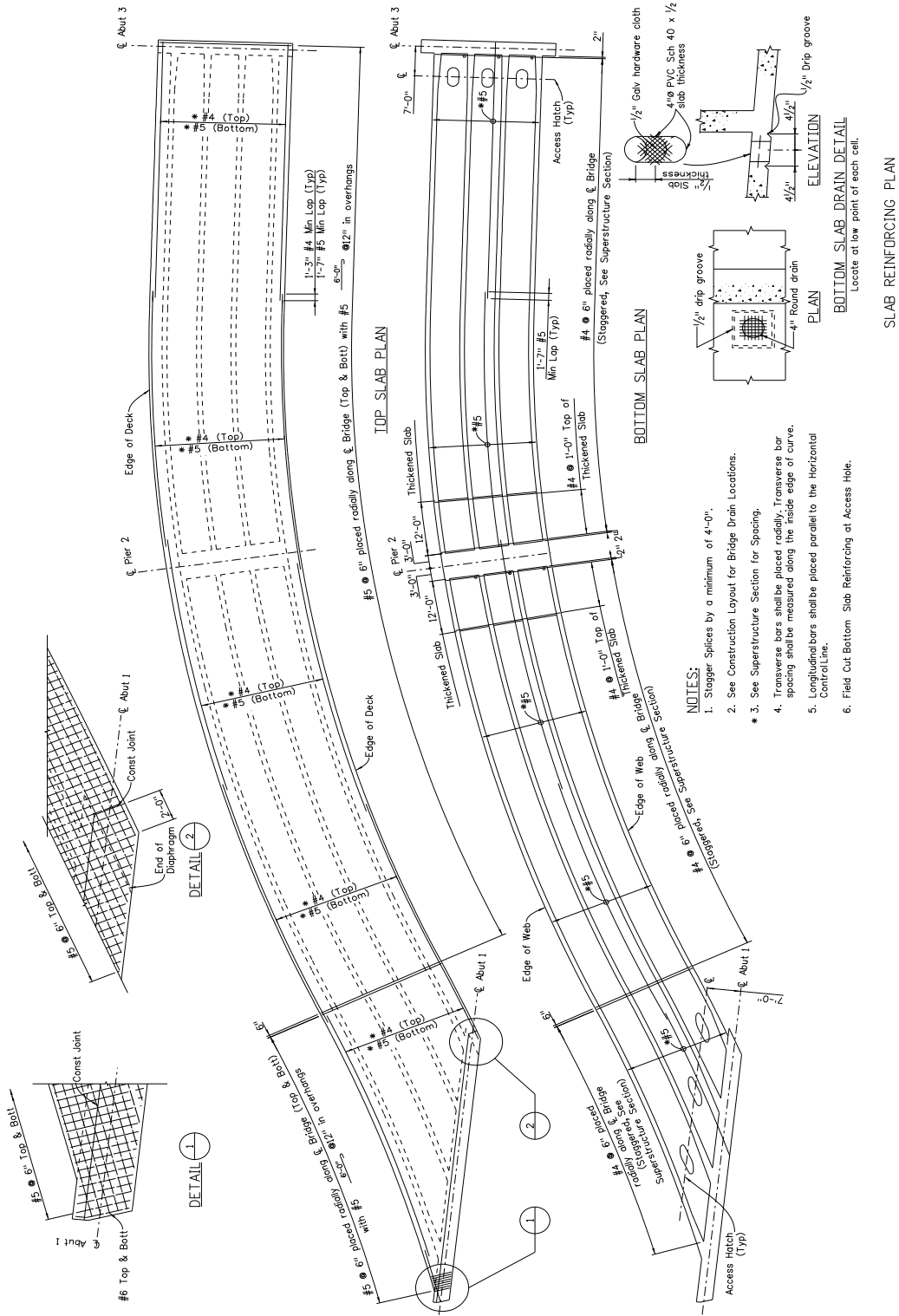
PARTIAL ELEVATION OF BACKWALL



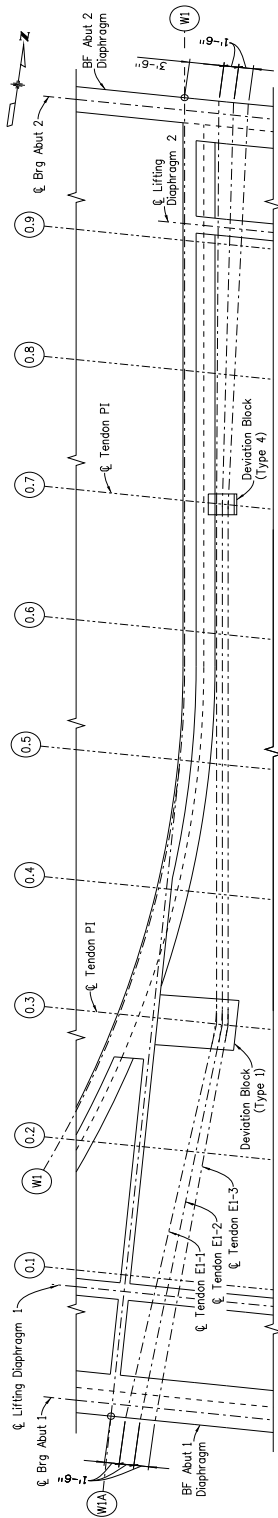
PIER 2 DIAPHRAGM DETAILS

Example 13.1-7

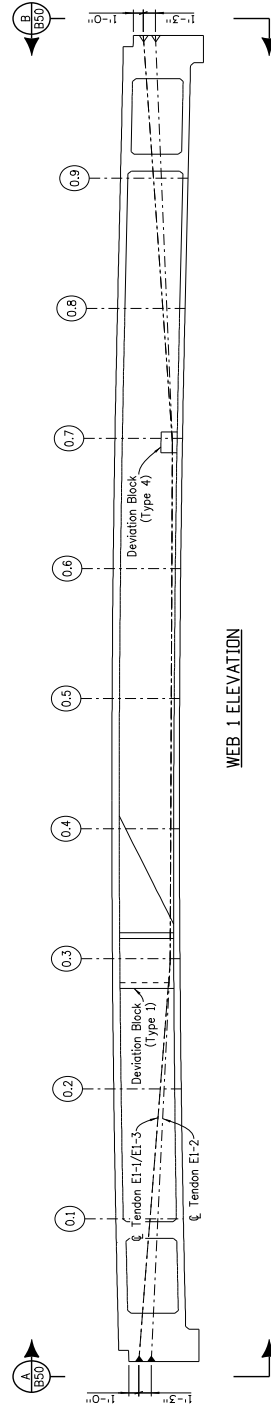
(Type web reinforcement not shown for clarity)



Example 13.1-8



WEB 1 PARTIAL PLAN



WEB 1 ELEVATION

**DESIGN:**

Design is based on  $K=0$  and  $\mu=0.25$ . P(FINAL) at the jacking ends includes friction loss of 0.37% elastic shortening, and provisions for an additional 27 ksi long term loss in stress.

- P(JACK) = 834.9 kips total at jacking end of each external tendon.
- $f_{ps}$  MINIMUM = 270 ksi square inches for each external tendon.
- $f_{ps}$  = 5800 psf at 28 days field compressive strength
- $f_{ps}$  = 4800 psf at stressing

The Contractor shall submit elongation and jacking calculations based on KL +  $\mu$  (including anchor set, if any) and initial stress (initial stress ratio times jacking stress before long term losses) at each tenth point.

**STRESSING SEQUENCE:**

All external longitudinal tendons shall be jacked from Abut. 1 and following abutment diaphragm PT bar stressing operations.

No more than 1/2 of the prestressing force associated with any web including external strands may be stressed before an equal percentage of force is stressed in the adjacent web.

At no time during the stressing operations will more than 1/6 of the total prestressing force be applied eccentrically about the centerline of the structure.

**LEGEND:**

- ▷ Non-Stressed Anchor
- ▶ Stressed Anchor
- E3-2 Tendon Number \*
- Associated Web
- E - External
- I - Internal

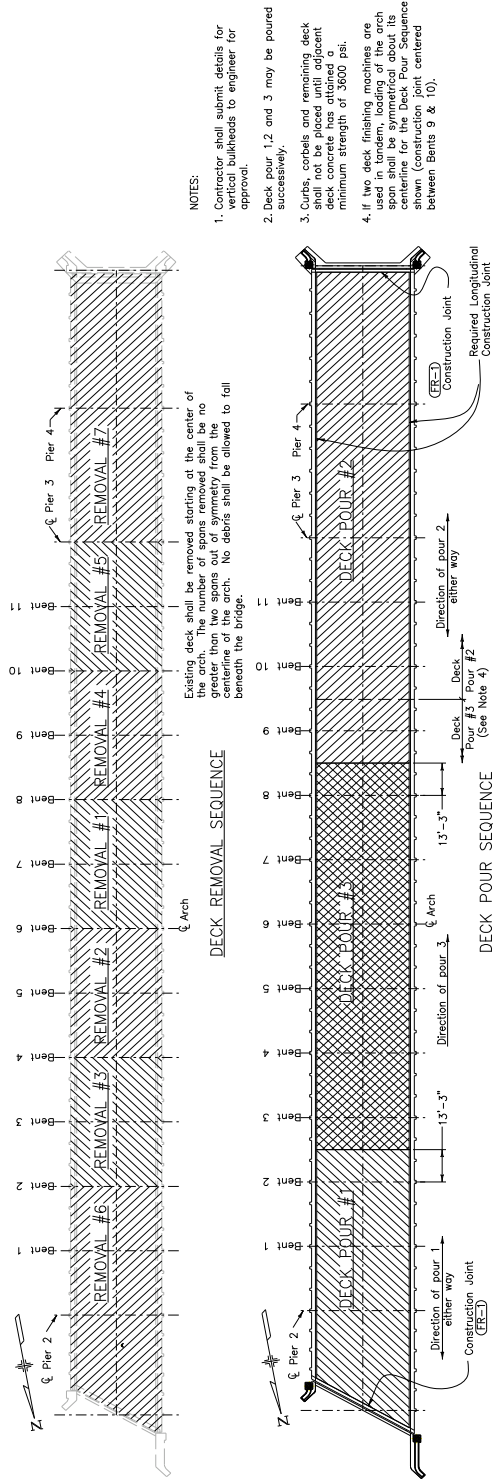
\* External tendons are numbered individually from left to right looking ahead station. Internal tendons are numbered individually, from bottom to top.

**NOTES:**

1. See Framing Plan sheet for tenth point and web locations.
2. See Longitudinal PT Details for anchorage information.
3. All external tendons shall be 19 strand 0.6" low-relaxation strand tendons.
4. External tendons shall be supported between diaphragms and deviation blocks to prevent sag or displacement of duct during placing, stressing, and grouting.

LONGITUDINAL PT LAYOUT  
EXTERNAL (1 OF 3)

Example 13.1-9



Example 13.1-10

CONSTRUCTION SEQUENCE DETAILS