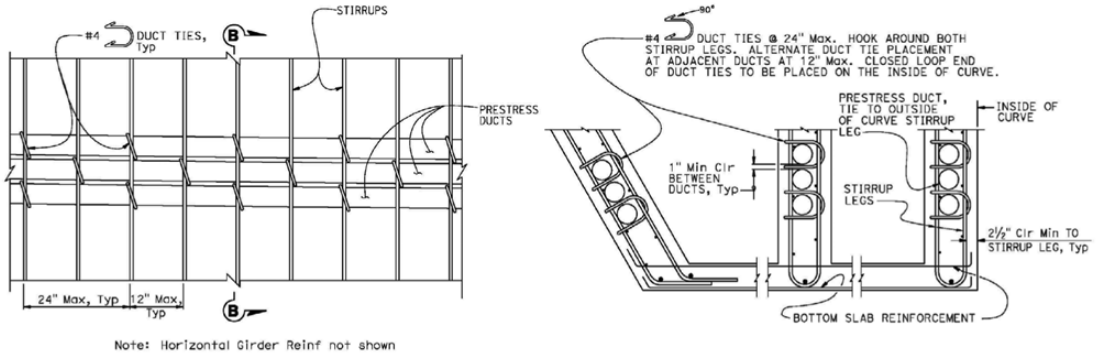
Bridge Design Details 9.1 January 2023

The GIRDER LAYOUT sheet provides specific details for the girder layout, camber diagram and end diaphragm section. For more details regarding girders and end diaphragms, see *Bridge Design Details*: 14 Prestressed Post-Tensioned Concrete.

Plan

1. Orient the PLAN view the same as the GENERAL PLAN. Combine the GIRDER LAYOUT and TYPICAL SECTION sheets when possible.
2. Preferred scale ⅛" = 1'-0"; on larger structures 1" = 20' may be used to show line diagram type GIRDER LAYOUT sheets. For widenings it may be necessary to use larger ¼" = 1'-0" scale to show additional details.
3. Show North Arrow. If several GIRDER LAYOUT sheets are used, such as in long curved structure, show North Arrow on all layouts.
4. Do not show stations and layout information given on GENERAL PLAN or FOUNDATION PLAN.
5. Dimension girder spacing along centerline of support from station line to centerline of exterior girders, but do not show intermediate girder spacing unless it differs from the TYPICAL SECTION.
6. Show centerlines of girders. Designate girders with lettered callouts (Ⓐ, Ⓑ, Ⓒ, etc.).
7. Show the bearing layout of the girders, do not repeat alignment layout information shown elsewhere. Lengths of precast girders are tabulated on precast girder standard detail sheets.
8. Show girders with solid lines (main view is of concrete section including girders, bent caps, end diaphragms, and hinges prior to deck placement). If edge of deck is shown use dashed line.
9. Show portion of transverse deck reinforcement on skewed bridges, see *Bridge Design Details*: 8.8 Typical Transverse Reinforcement. Not required for skews less than 20 degrees. Label epoxy-coated reinforcement.
10. Detail deck corners on skewed bridge abutments or hinges, see *Bridge Design Details*: 8.9 Skewed Deck Corner Reinforcement. Label epoxy-coated reinforcement.
11. Show intermediate diaphragms parallel to transverse deck reinforcement in concrete box girders. Intermediate diaphragms in concrete box girders are uncommon and locations should be specified by Designer, if required. For precast girders intermediate diaphragms should be normal, skewed, or staggered depending on girder length and skew.

12. Dimension locations of the field splices of precast or steel girders.
13. Dimension locations and spacing of lateral bracings, cross frames, and diaphragms along the layout line or centerline of structure.
14. Show locations of bearing stiffeners and spacing of intermediate stiffeners along the centerline of steel girders. Also show thickness and widths of bearing and intermediate stiffeners.
15. Show concrete box girder flare lengths and stem thickness at both ends of flares.
    i. Sloped exterior girders must be flared to 18” web thickness at the end diaphragms over a minimum of 16-foot length. Designate girder width symbol (12) in inches.
16. Place “DETAIL A” for curved box girders on TYPICAL SECTION sheet. “DETAIL A” can also be placed on GIRDER LAYOUT sheet if there is not enough room on TYPICAL SECTION. For “DETAIL A”, see *Bridge Design Memo* 5.27.



17. Show soffit slab flare locations.
18. Show vertical fillets (not required for skews less than 20 degrees).
19. Show utility opening and future utility locations and call out type per *Standard Plan*: B7-10 Utility Openings Box Girder or *Standard Plan*: B6-10 Utility Openings T-Beam.
20. Show location of soffit and deck access openings, see *Standard Plan*: B14-5 Water Supply Line (Details) (Pipe Sizes Less Than 4”). A minimum of one opening per span should be placed for bays that contain utilities for future access. Dimension from centerline of support.
21. Show deck drain locations and drainpipes. Additional DECK DRAINAGE sheet may be used to provide additional drainage details.
22. Show concrete box vents and call out *Standard Plan*: B7-1 Box Girder Details (Detail V-1). Soffit vents should be placed per notes on standard details.
23. Do not show prestressing ducts or duct vents.

Longitudinal Section

1. Draw LONGITUDINAL SECTION not to scale. Typically place as a projection from the PLAN view. Exaggerate vertically to show details more clearly.
2. Show stirrup spacing. Combine callouts on similar girders to save space.
    i. Provide stirrups at no more than 12-inch spacing for a minimum of 8 feet at supports and anchor ends.
3. Show soffit flare thickness and lengths. Show non-typical soffit and deck thickness along the bridge LONGITUDINAL SECTION (e.g., soffit thickness near in-span hinge seat).
4. Show cable path for prestressed bridges. Note control dimensions to center of gravity of prestressing force at centerline of supports and locate inflection points of cable path. Dimension high points, low points, points of inflection and cable ends from bottom of soffit. The cable path should be labeled as parabolic between points shown.
5. Add standard cell for PRESTRESSING NOTES.
    i. Give type of strands (e.g., 270 ksi low relaxation strands).
    ii. Specify P_{jack} (kips) and the number of girders for which it applies.
    iii. Include all assumptions for prestress losses (assumed K and μ as well as assumed long term loss stress).
    iv. Include the final force ratio allowed between any two girders.
    v. Clearly identify the physical location of the point of no movement along the cable path in the LONGITUDINAL SECTION view. Indicate the force coefficient at the point of no movement ☒ in decimal form (rounded to nearest 0.001). Add symbol description to LEGEND.
    vi. Specify either one end or two end stressing. If one end stressing, specify which end is to be the stressing end.
    vii. Give concrete strength (ksi) at 28 days f'_c and at time of stressing f'_{ci}.

Camber Diagram

1. Draw proportionally correct, but not to scale.
2. Add note: “Does not include allowance for falsework settlement”.
3. Use one diagram for all girders except unusual conditions.
4. Avoid negative camber values especially in conjunction with flat bridge profiles
5. Camber units shown in feet and to the nearest 0.01’.
    i. Camber values for precast girders are tabulated on precast girder standard detail sheets.
    ii. Camber values for steel girders should be detailed on GIRDER DETAIL sheets.

End Diaphragm Section

1. Use scale ½” = 1’-0” minimum.
2. END DIAPHRAGM section should be taken from PLAN view on the GIRDER LAYOUT sheet. SECTION may be shown on TYPICAL SECTION sheet if space is limited.
3. Show width of diaphragm.
4. Show approximate prestress blockout location. For prestressing Grillage, reference *Standard Plan B8-5*. For reinforcement, see *Bridge Design Memo 5.26*
5. Label all reinforcement. Show limits of transverse deck reinforcement.
6. Show sealed joint (MR ≤ 2”) or joint seal blockout (MR > 2”).
7. Only show lines that intersect the section cut plane (do not show lines and reinforcement that are beyond the section cut plane).
8. In some cases, multiple SECTIONS may be required. If multiple SECTIONS are required, then consider adding END DIAPHRAGM DETAILS sheet.

Figure 9A.A.1 Girder Layout Detailing Example 1

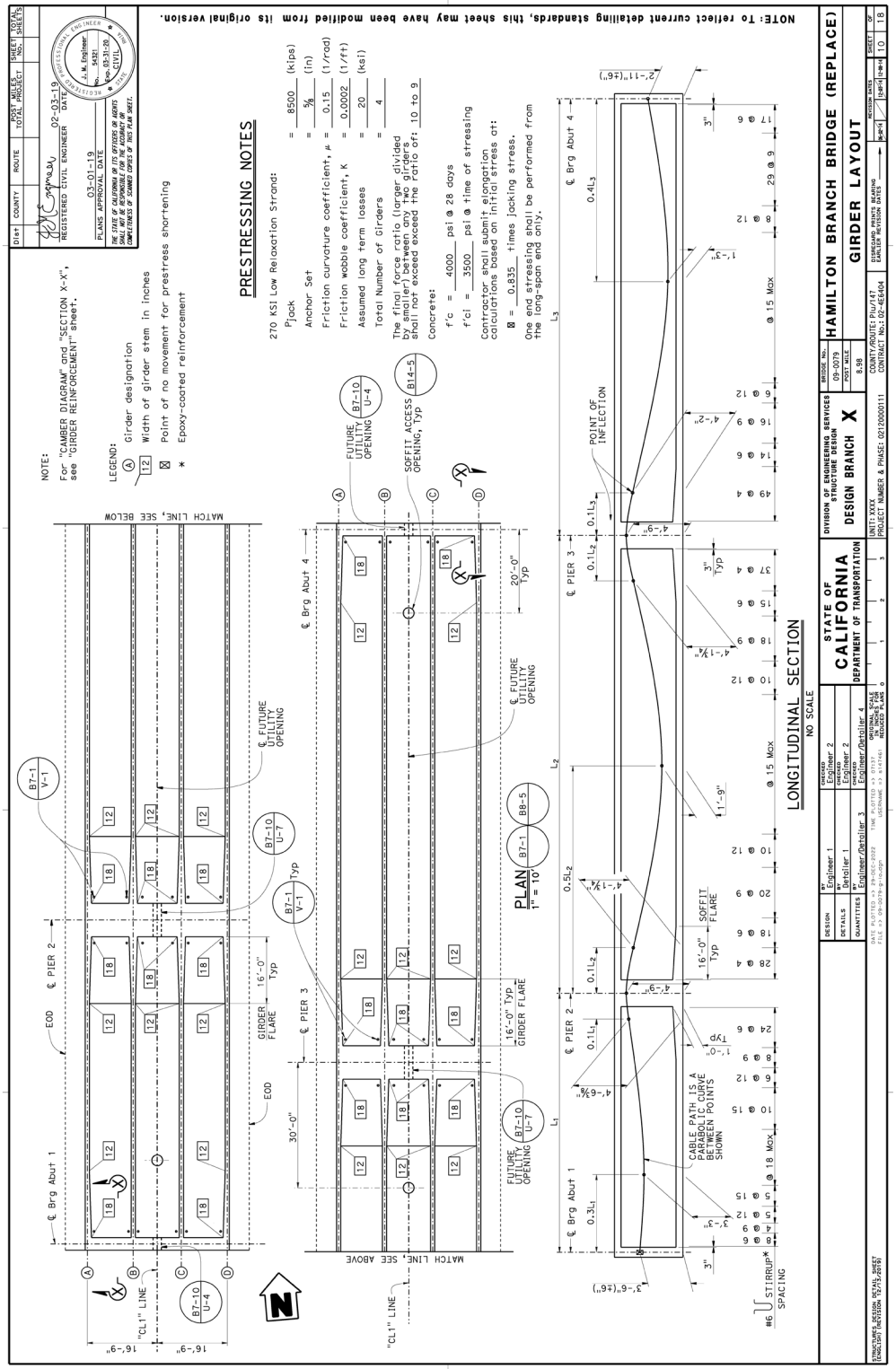


Figure 9A.A.2 Girder Layout Detailing Example 2

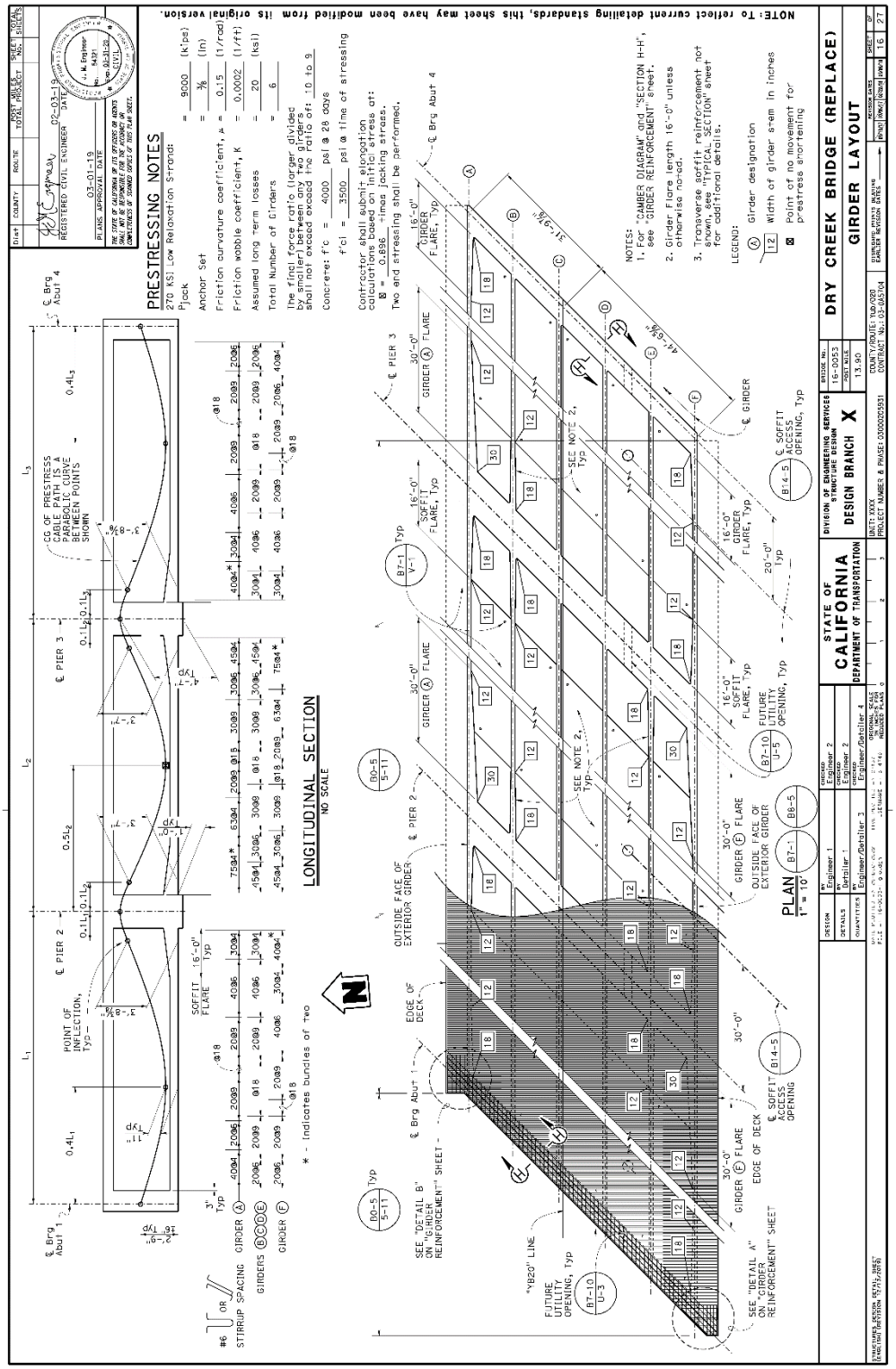


Figure 9A.A.3 Girder Layout Detailing Example 3

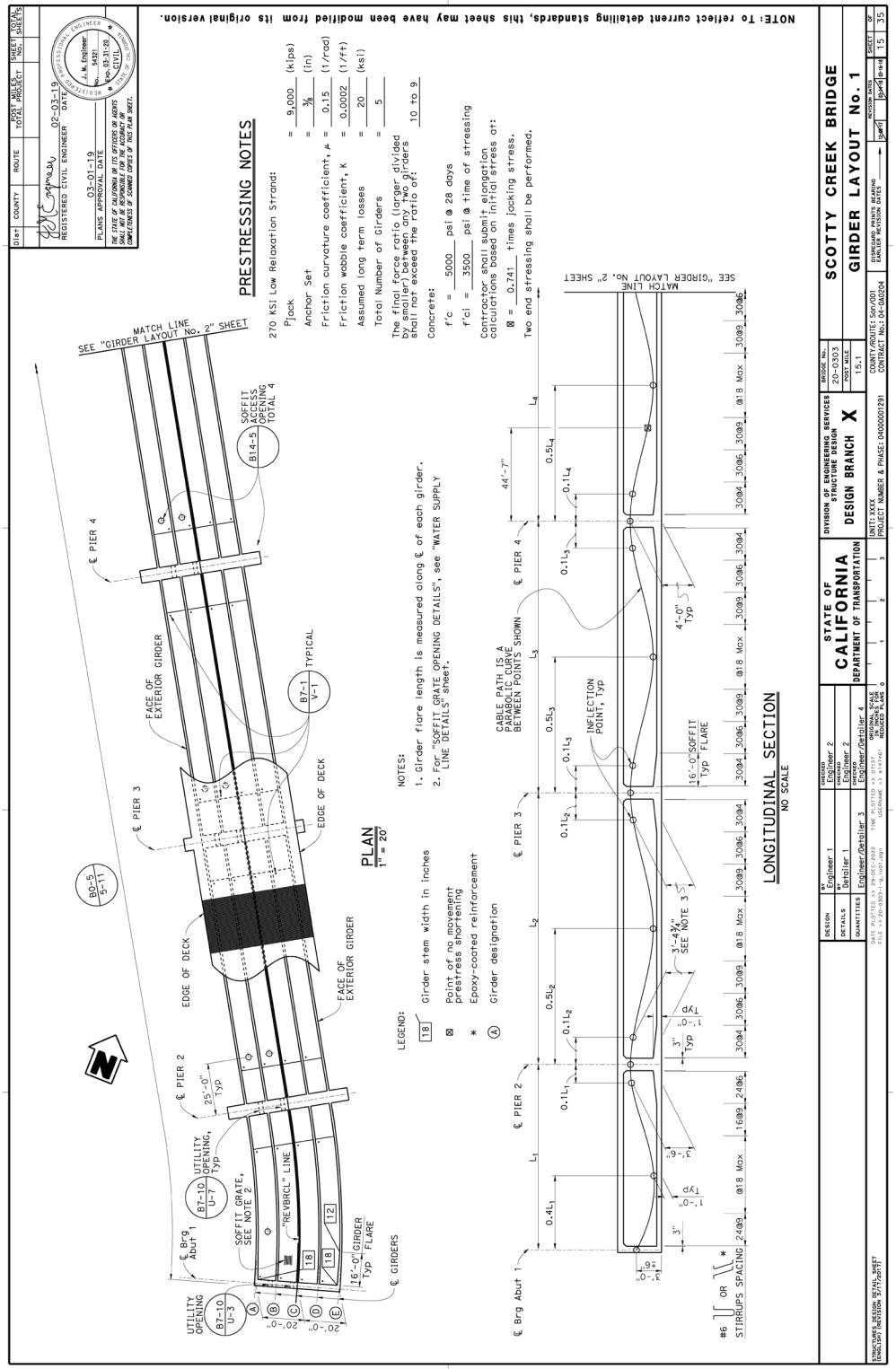


Figure 9A.A.4 Girder Layout Detailing Example 4

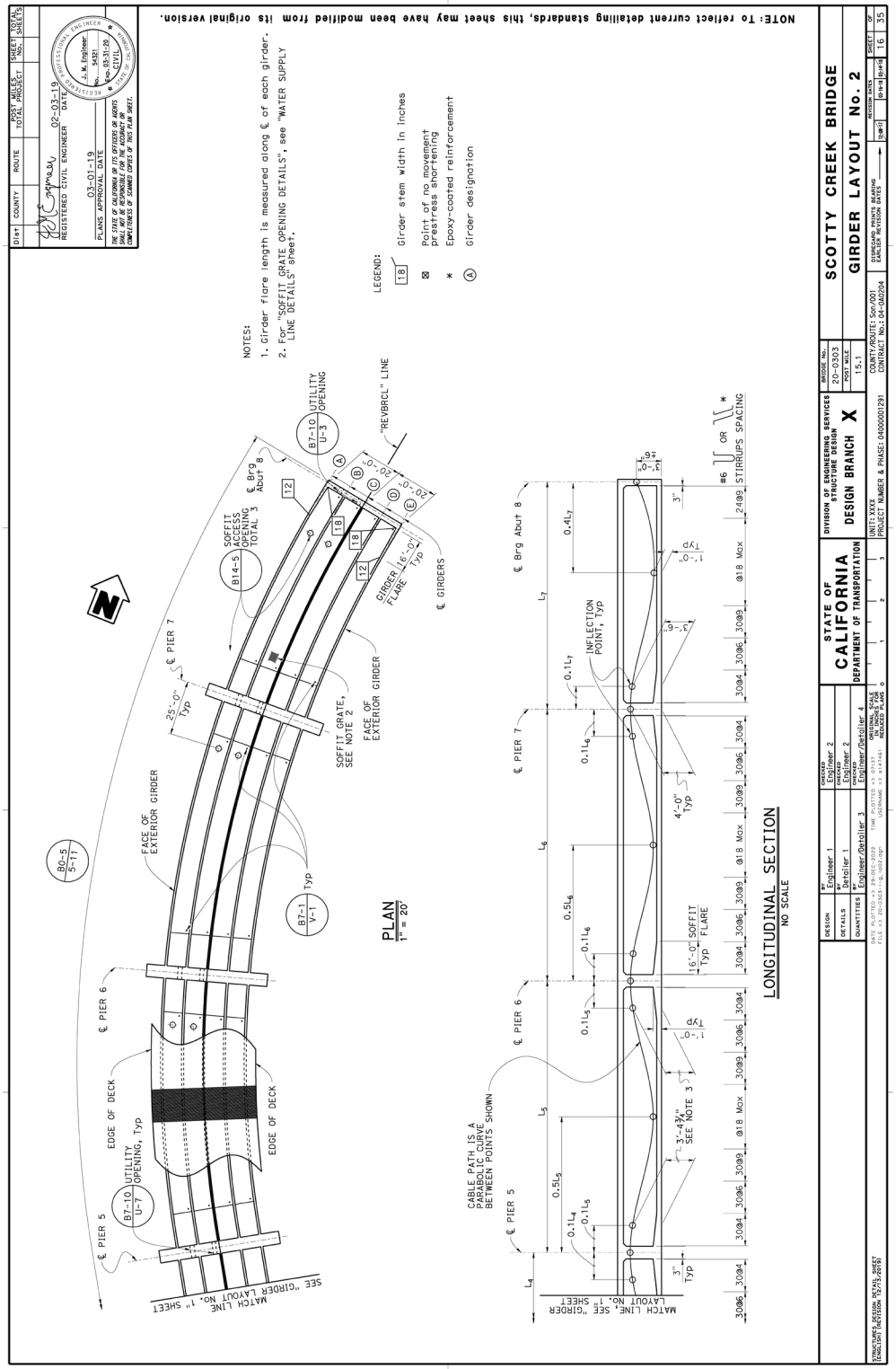


Figure 9A.A.5 Girder Layout Detailing Example 5

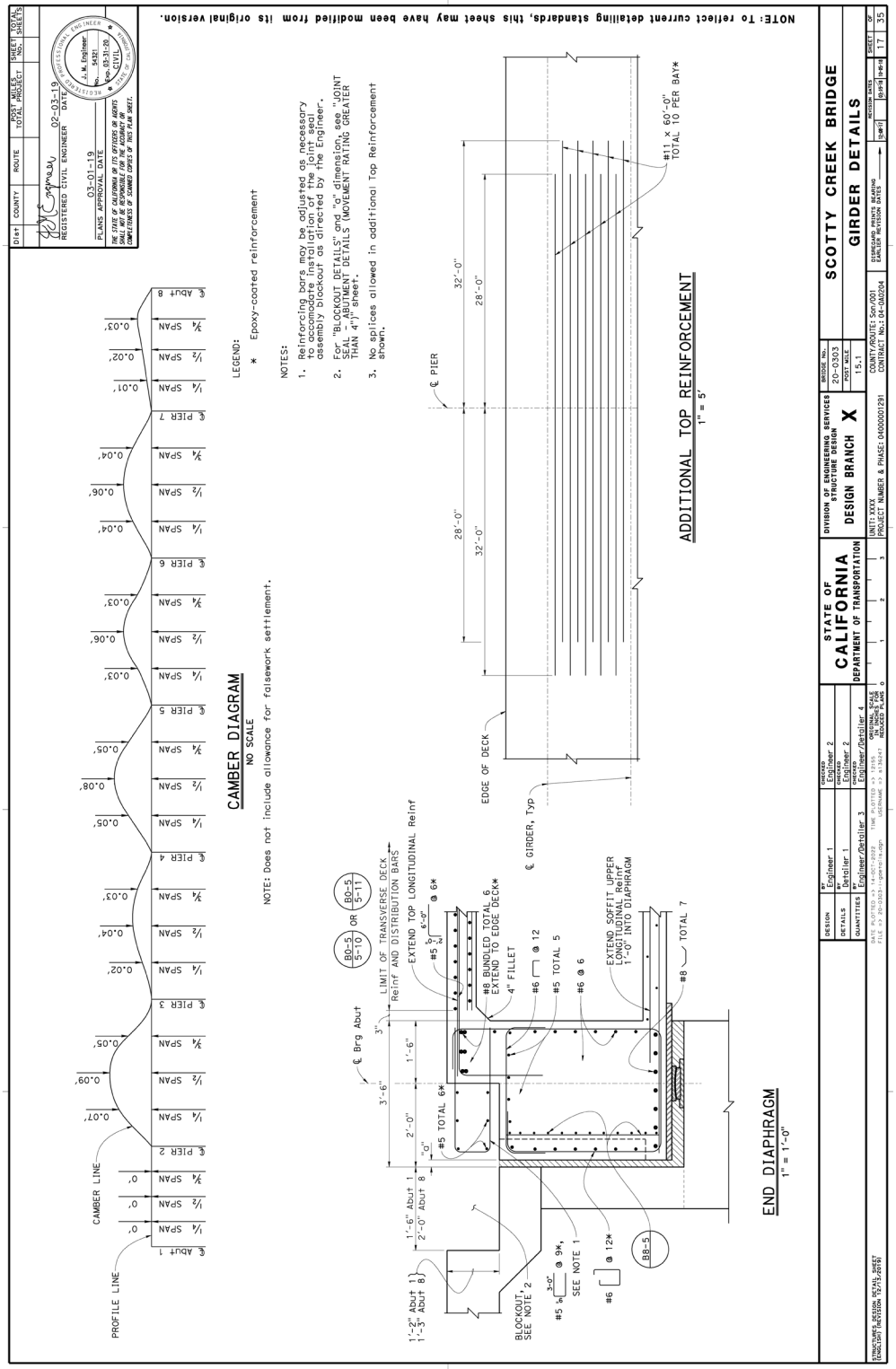


Figure 9A.A.6 Girder Layout Detailing Example 6

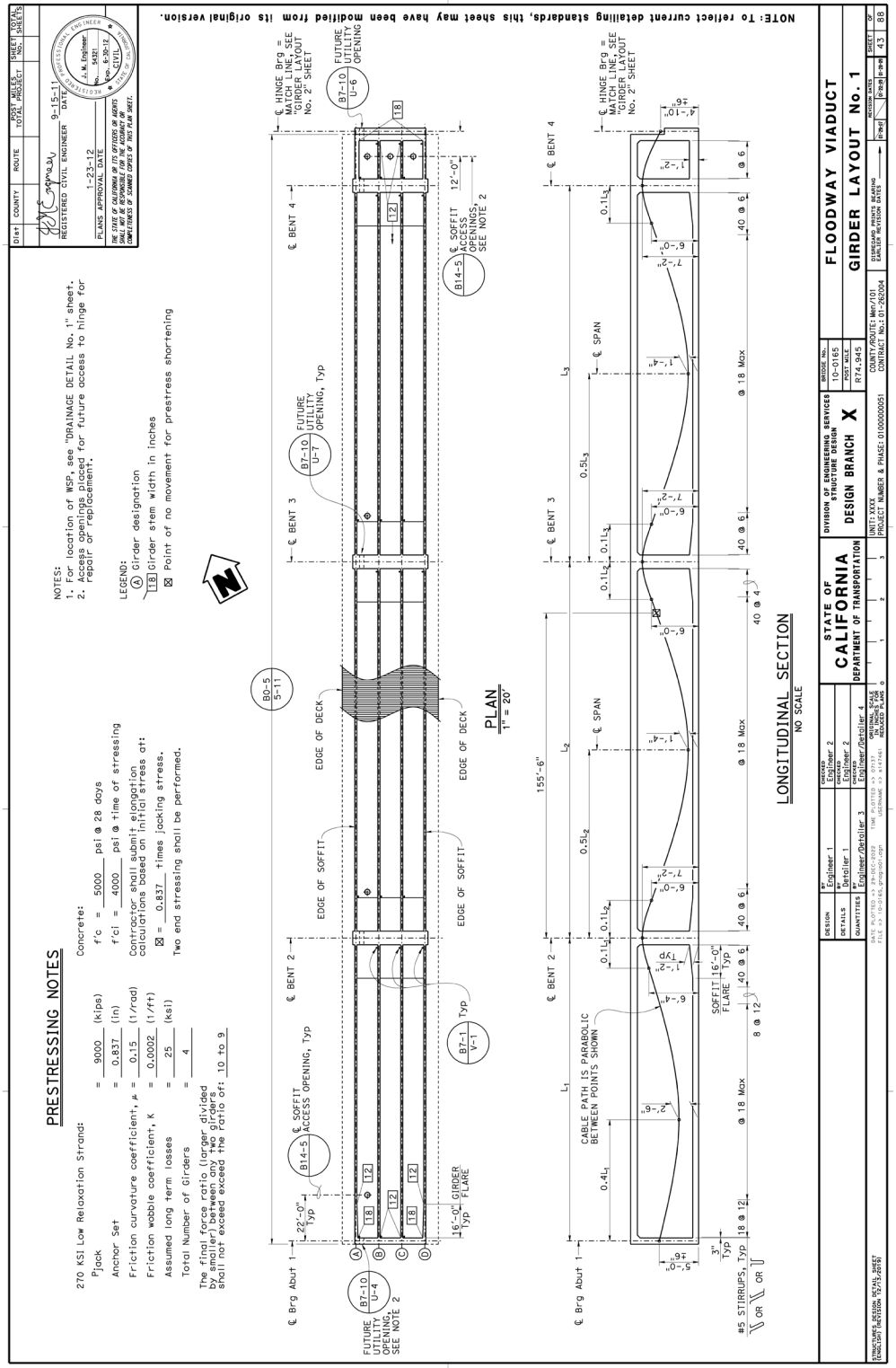


Figure 9A.A.7 Girder Layout Detailing Example 7

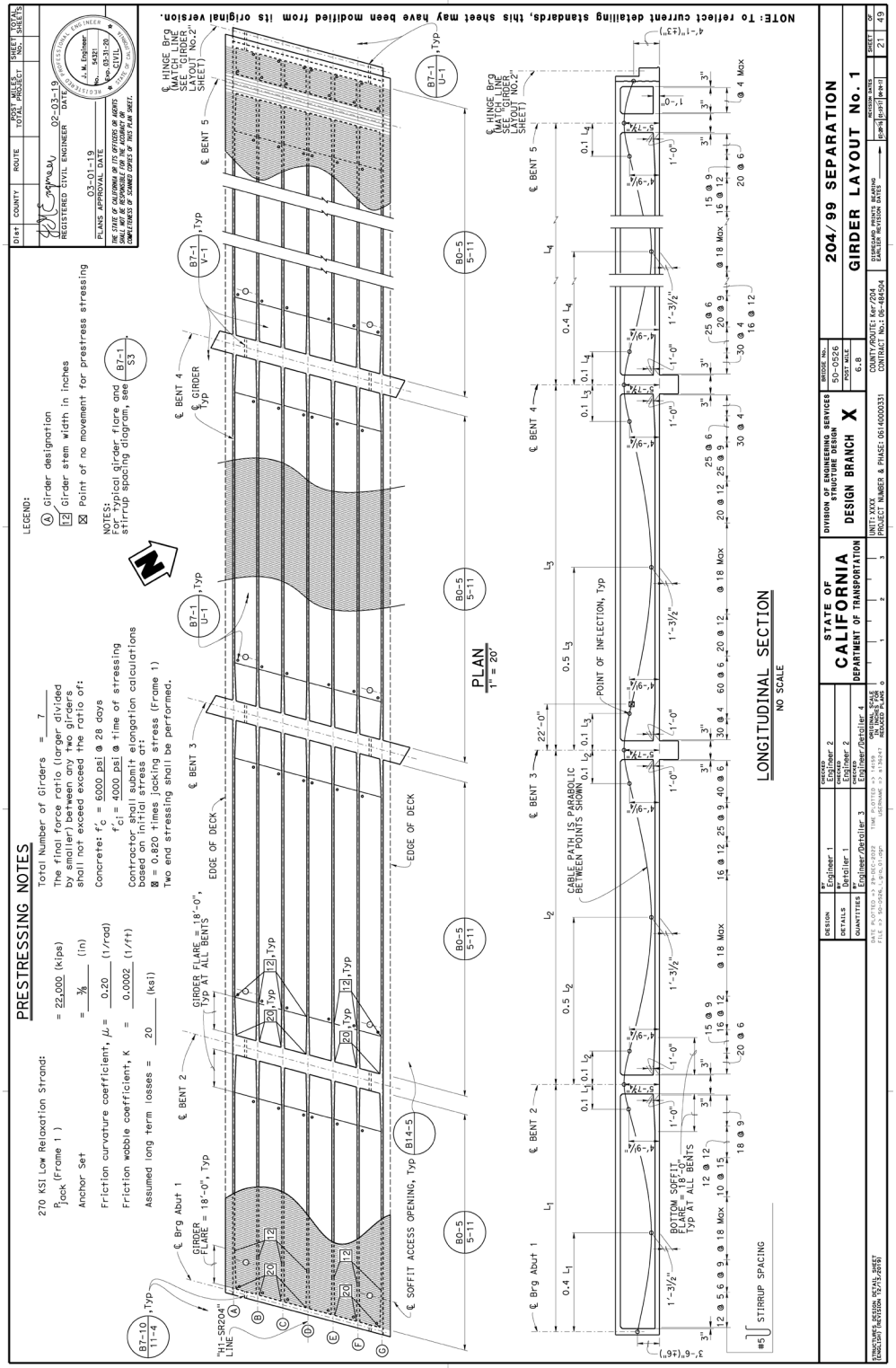


Figure 9A.A.8 Girder Layout Detailing Example 8

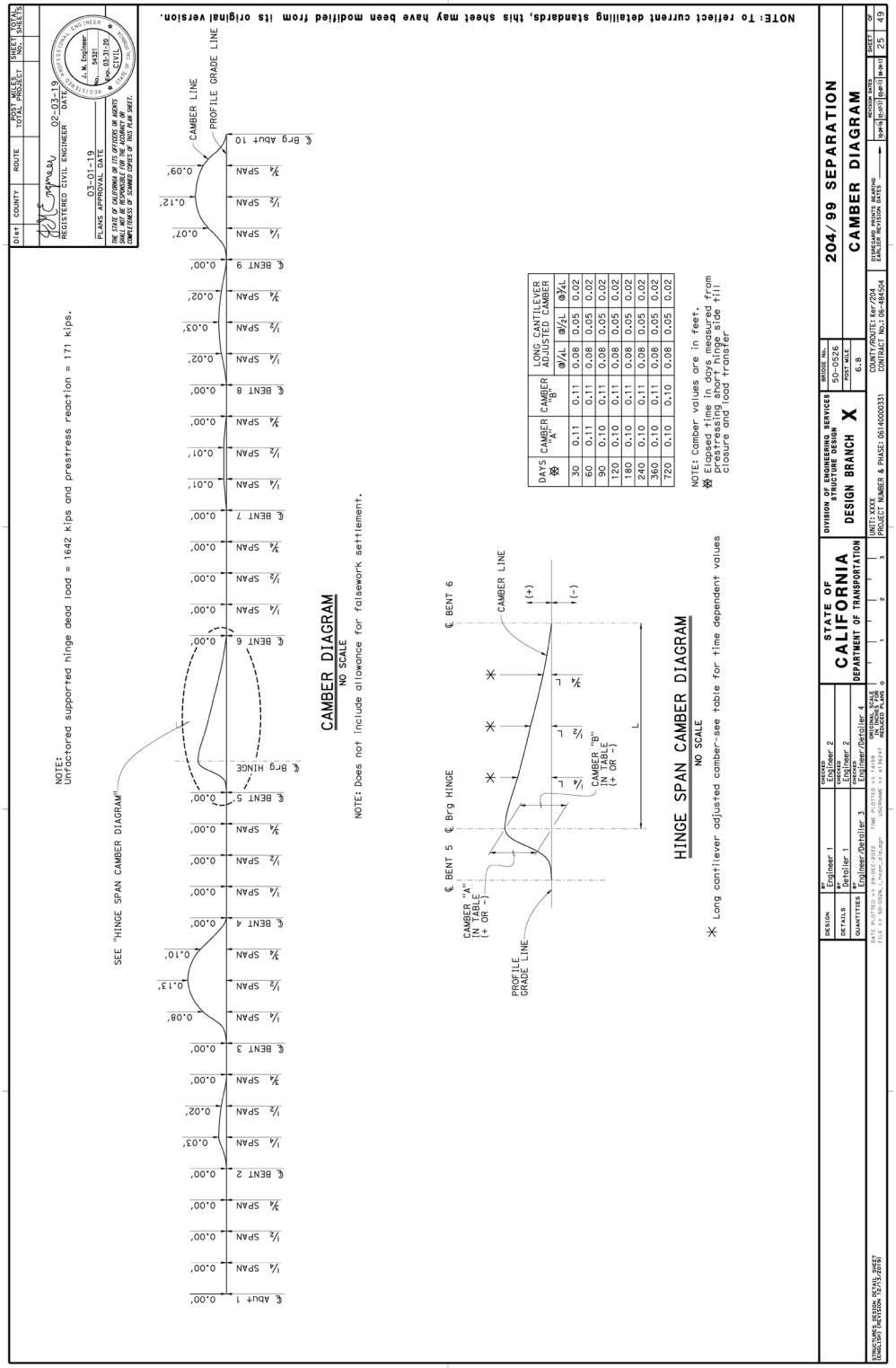


Figure 9A.A.9 Girder Layout Detailing Example 9

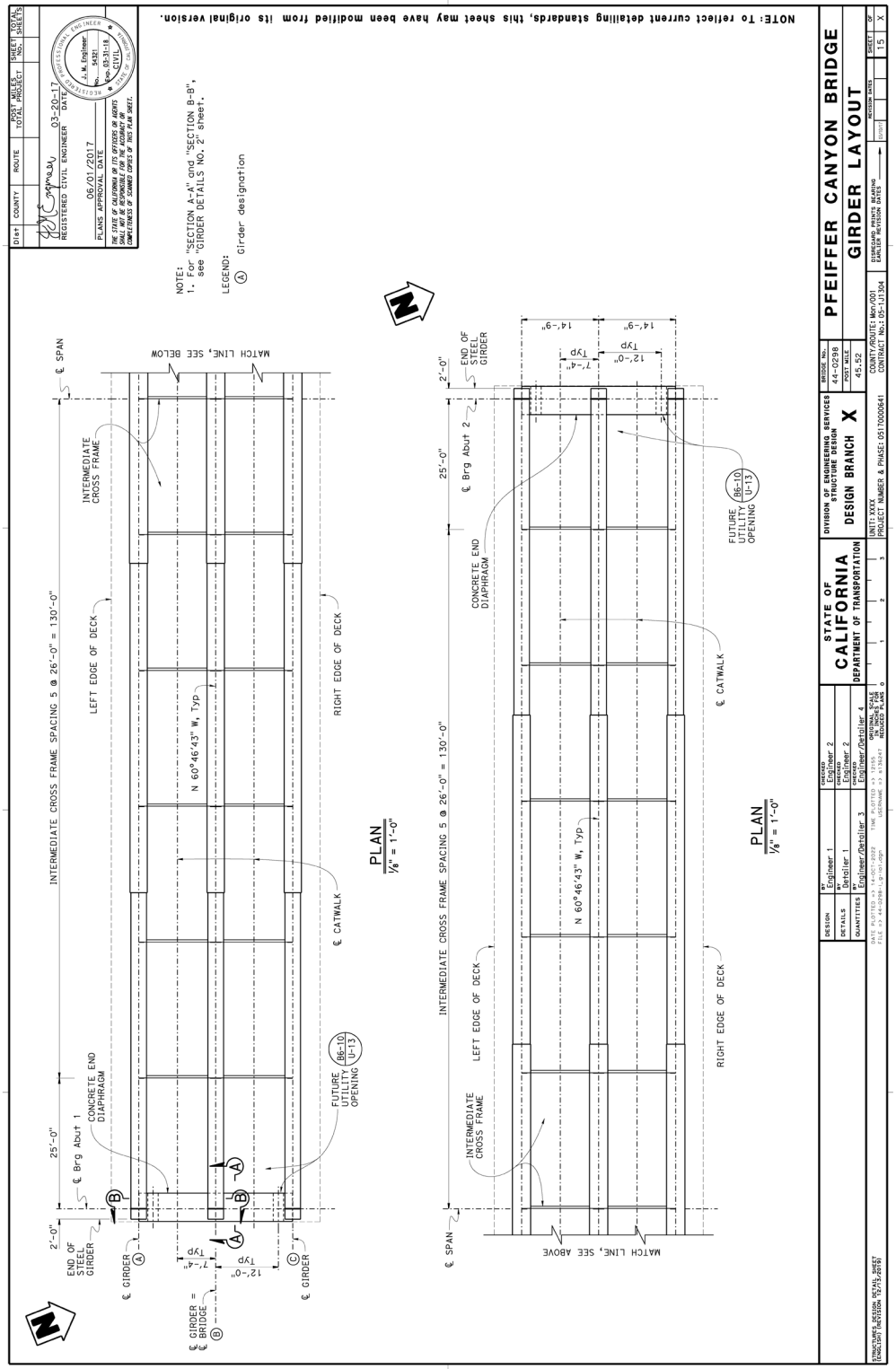


Figure 9A.A.10 Girder Layout Detailing Example 10

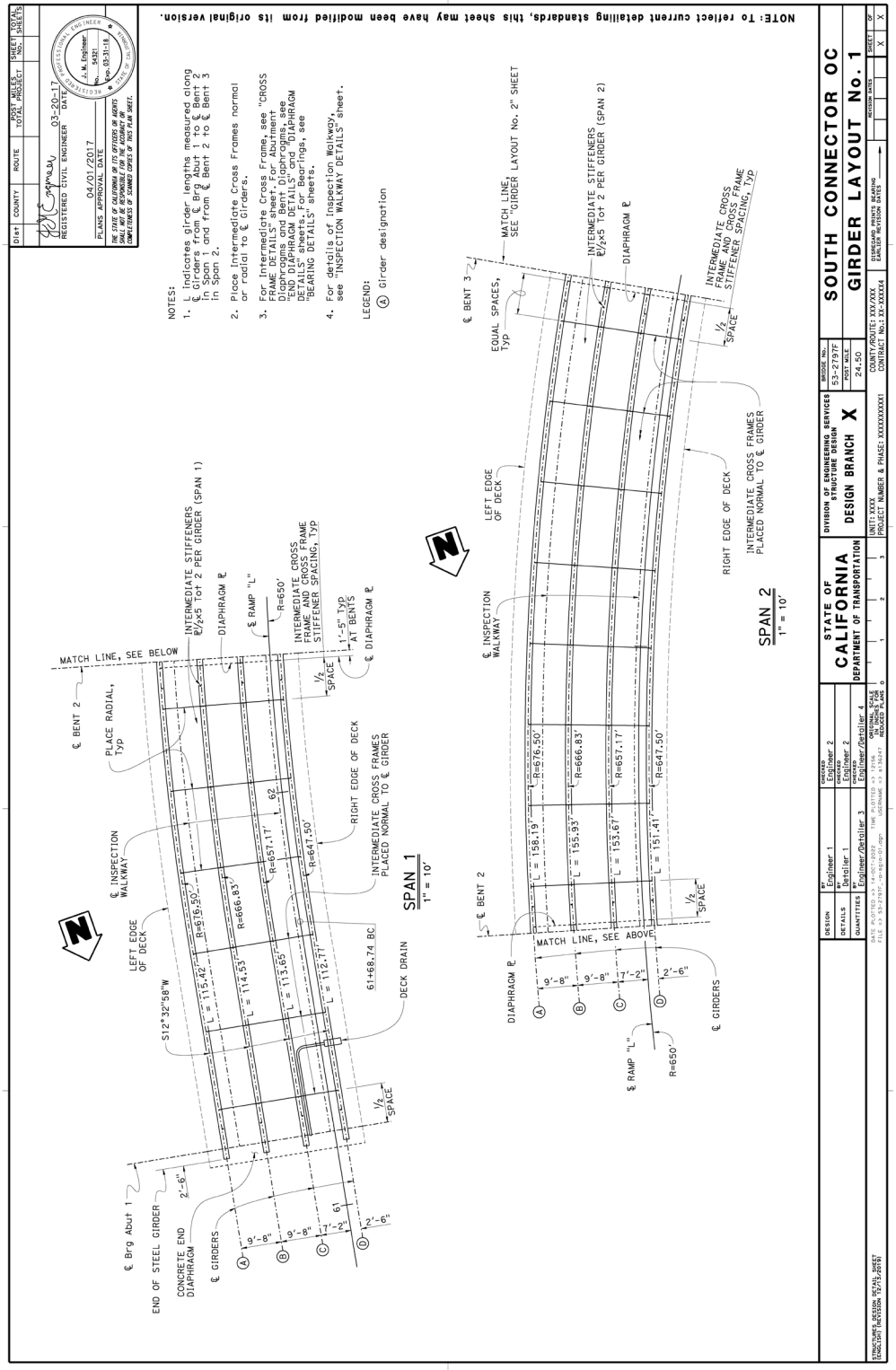


Figure 9A.A.11 Girder Layout Detailing Example 11

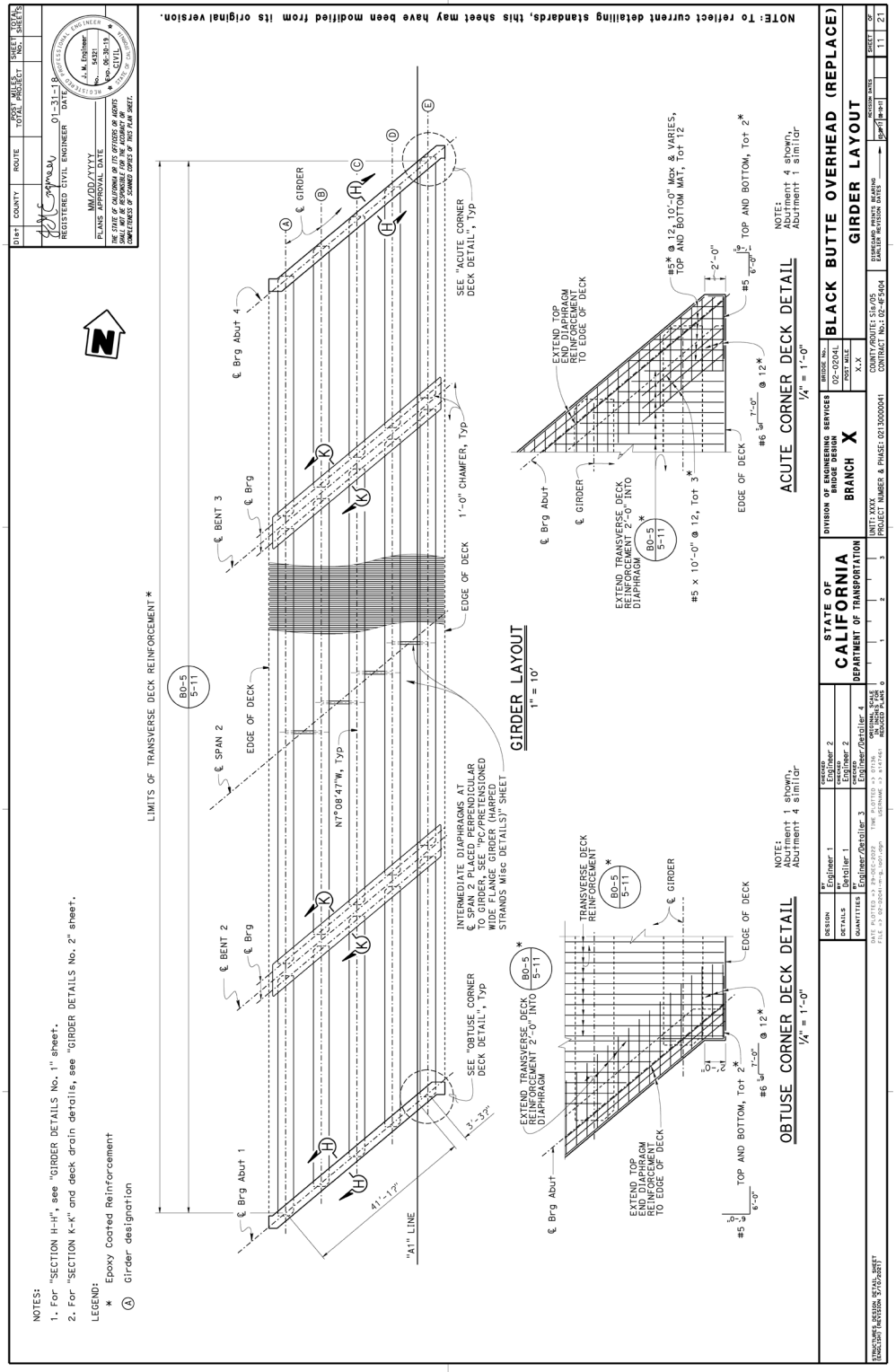


Figure 9A.A.12 Girder Layout Detailing Example 12

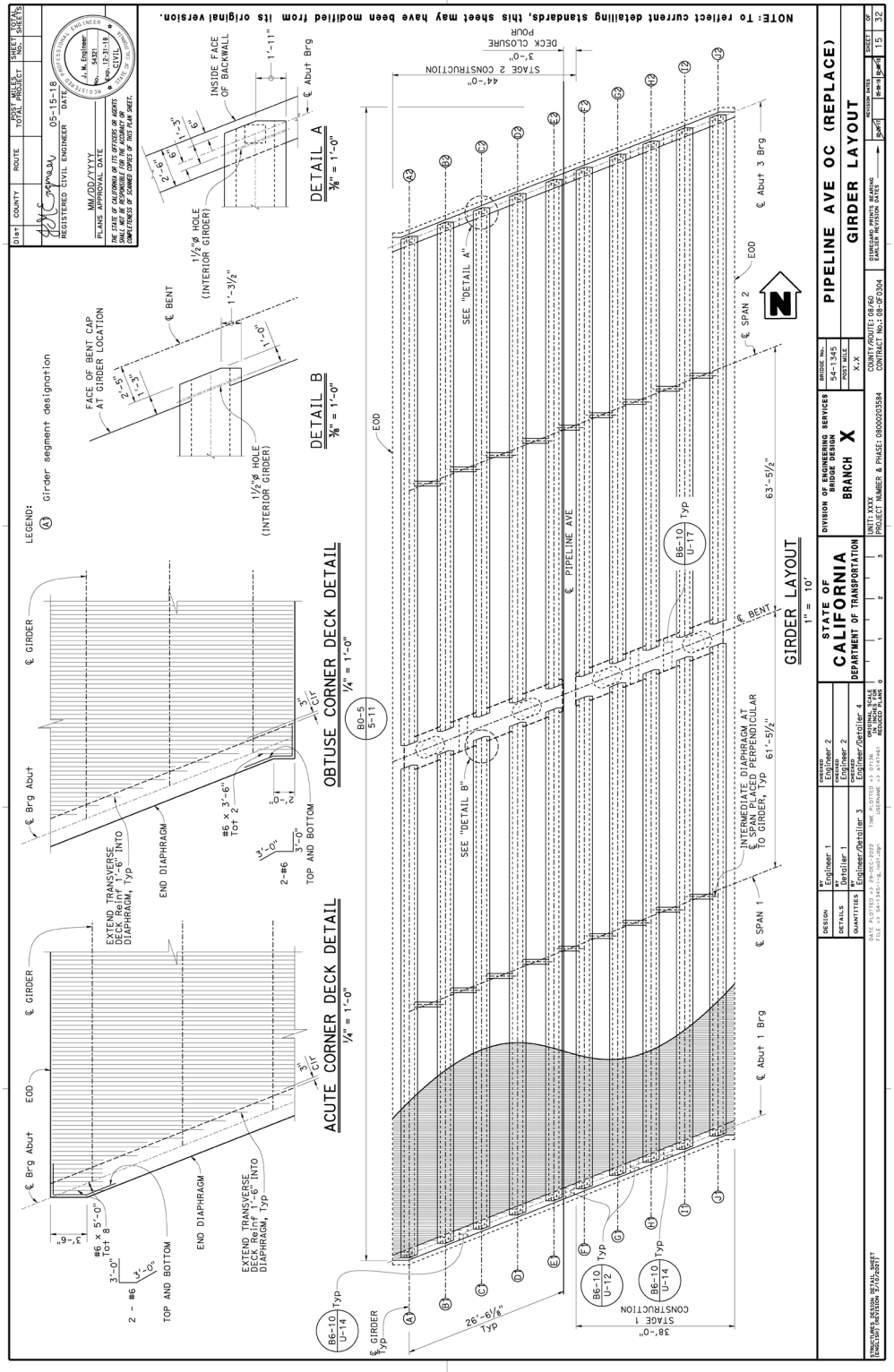
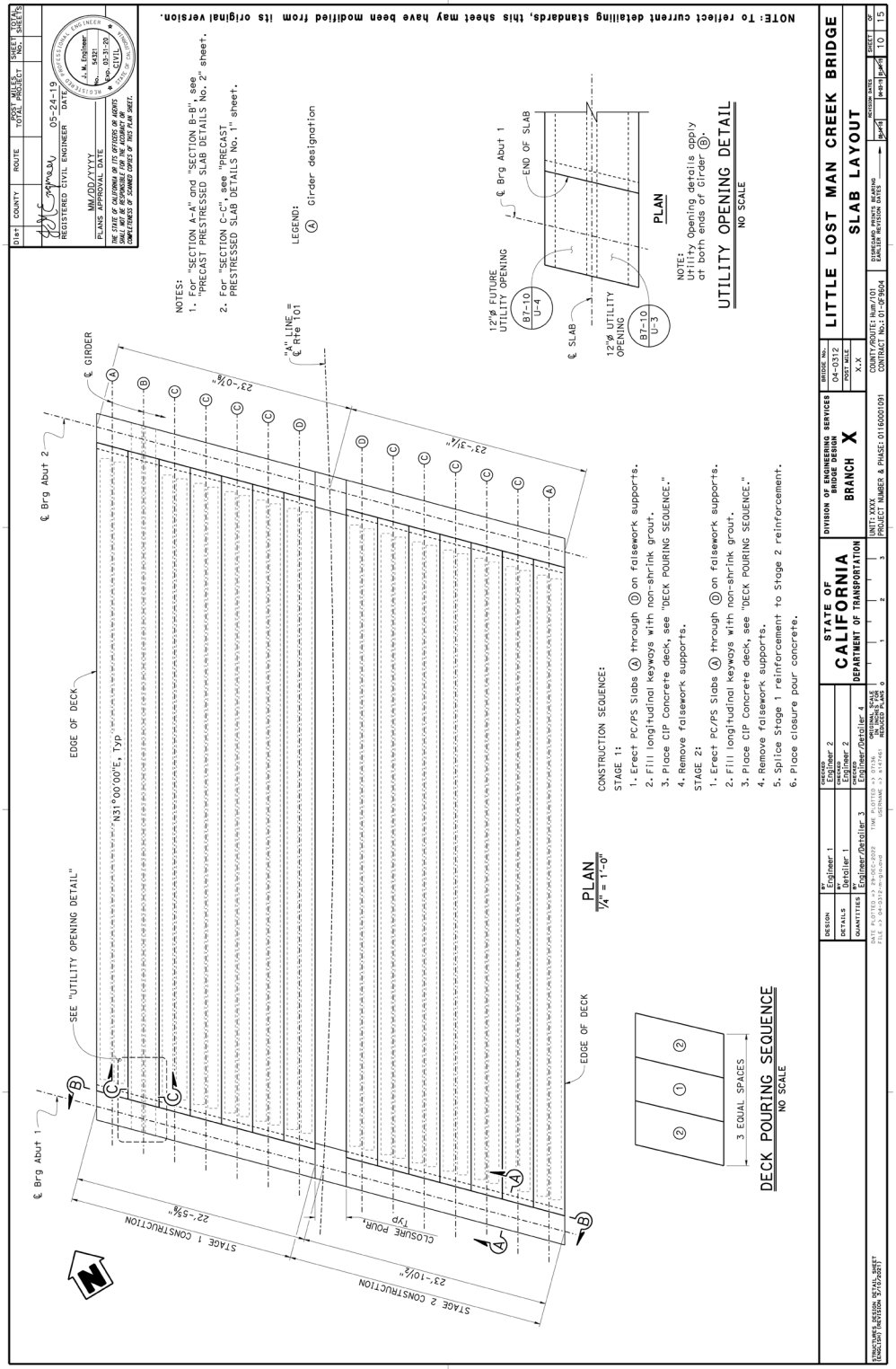


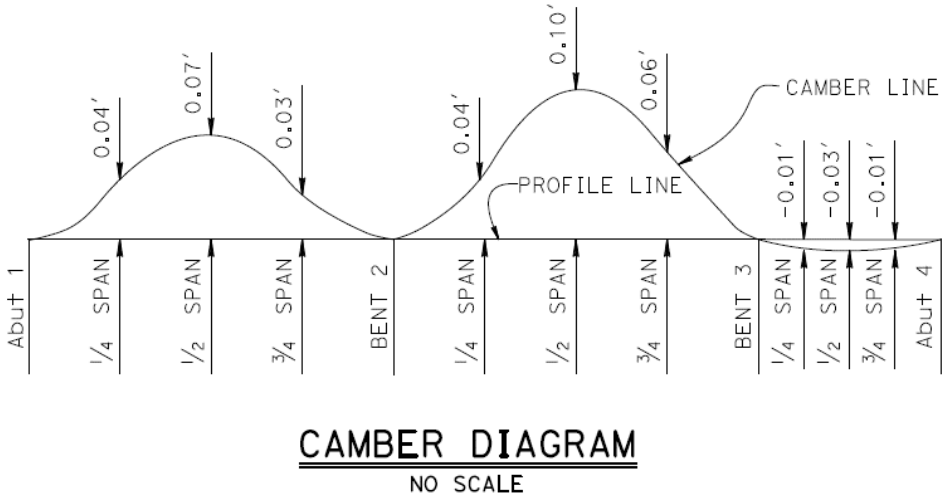
Figure 9A.A.13 Girder Layout Detailing Example 13



Bridge Design Details 9.2 January 2023

Camber Diagrams for Cast-In-Place Concrete Girders

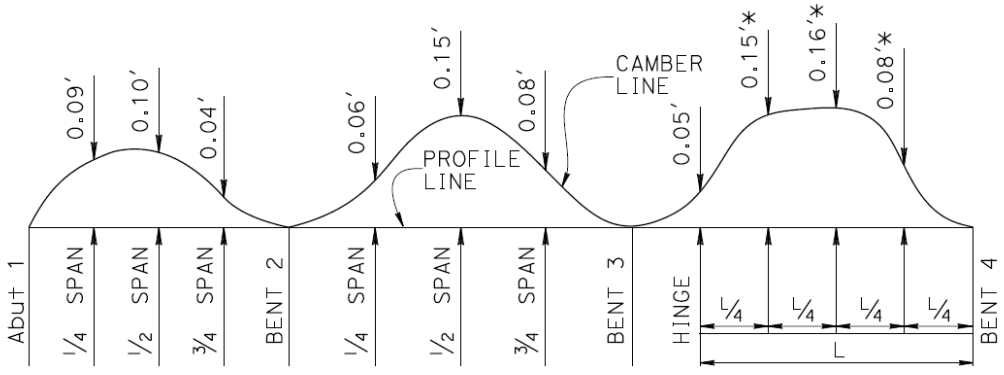
For steel girder camber diagram details, see *Bridge Design Details*: 11 Steel Girders.



CAMBER DIAGRAM
NO SCALE

Note : Does not include allowance for falsework settlement.

Figure 9.2.1 Three-Span Camber Diagram



CAMBER DIAGRAM
NO SCALE

Note: Does not include allowance for falsework settlement.
* - Long cantilever adjusted camber (time dependent)

Figure 9.2.2 Three-Span with Hinge Camber Diagram

Bridge Design Details 9.3 January 2023

Center of Gravity of Prestressing Force Diagram

On multiple span continuous prestressed bridges, utilizing two-end stressing may be more economical. Use similar center of gravity (CG) diagram for both one and two-end stressing and dimension the location of the theoretical point of no movement in all cases. For additional details, see *Bridge Design Details*, 14.2 Longitudinal Section. Provide directions in the plans regarding stressing sequence assumed for design, using a note similar to the following: “NOTE: Two end stressing shall be performed.” Or “NOTE: One end stressing shall be performed from Abutment X side.”

Actual dimensions should be shown for single span bridges or bridges with equal length spans.

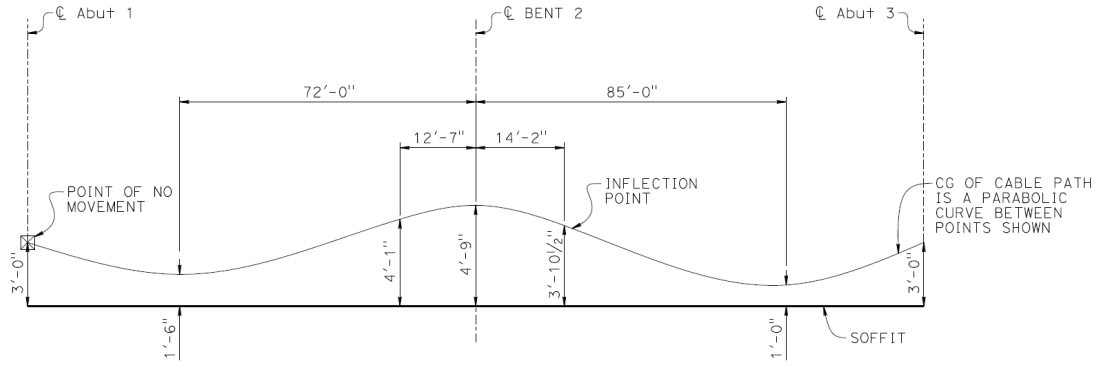


Figure 9.3.1 Equal Span Bridge Path of CG of Prestressing Force

On bridges with variable span lengths or bridges with a radius, the span dimensions should be indicated as below. Girders on radius will have different lengths.

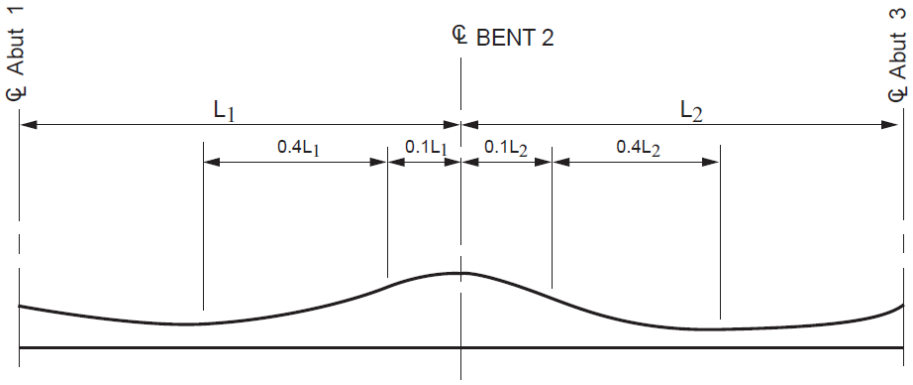
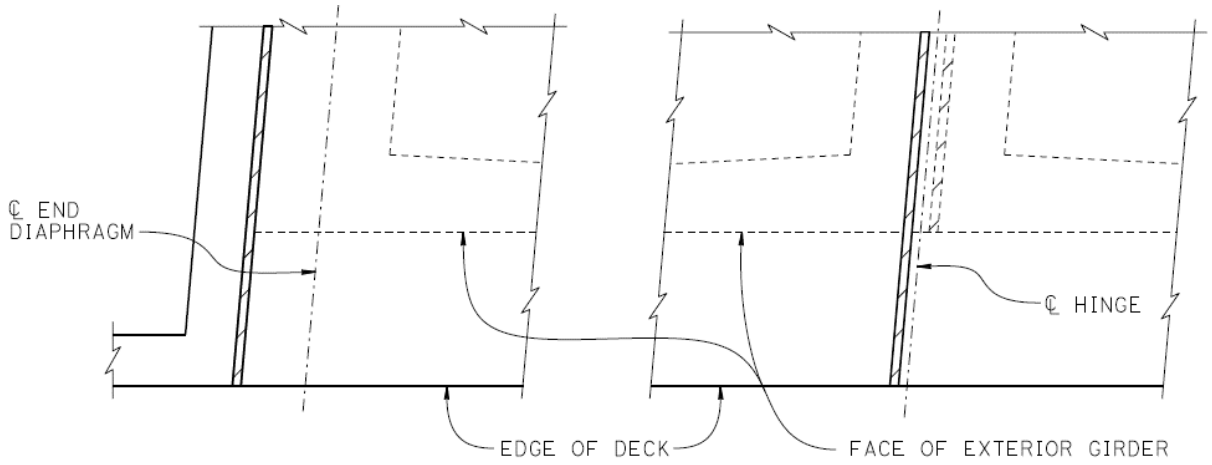


Figure 9.3.2 Variable Span Bridge Path of CG of Prestressing Force

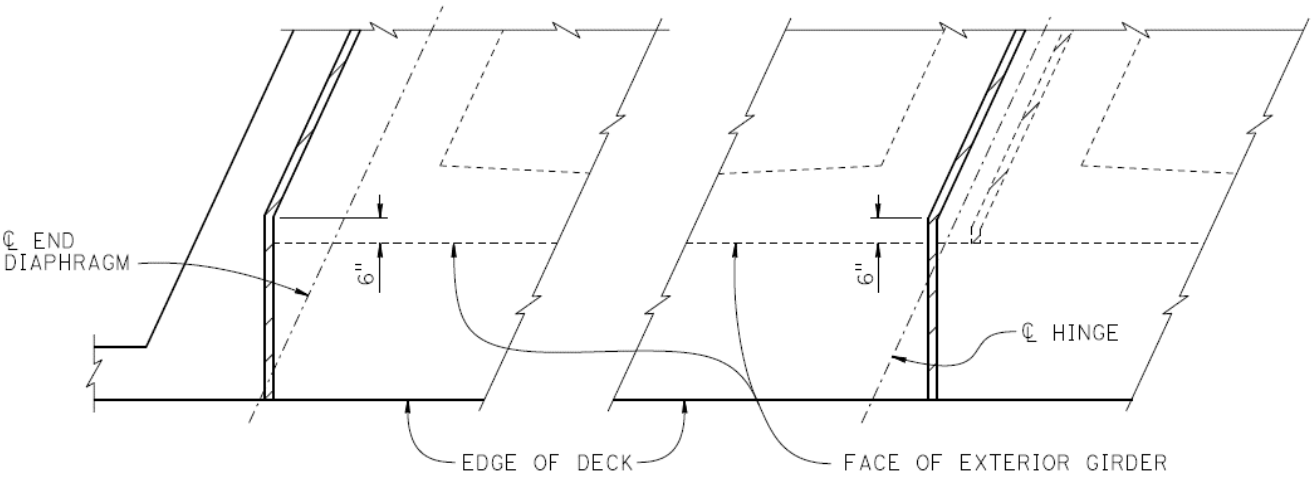
Bridge Design Details 9.4 January 2023

Deck Joints Cast-in-Place Concrete Girder



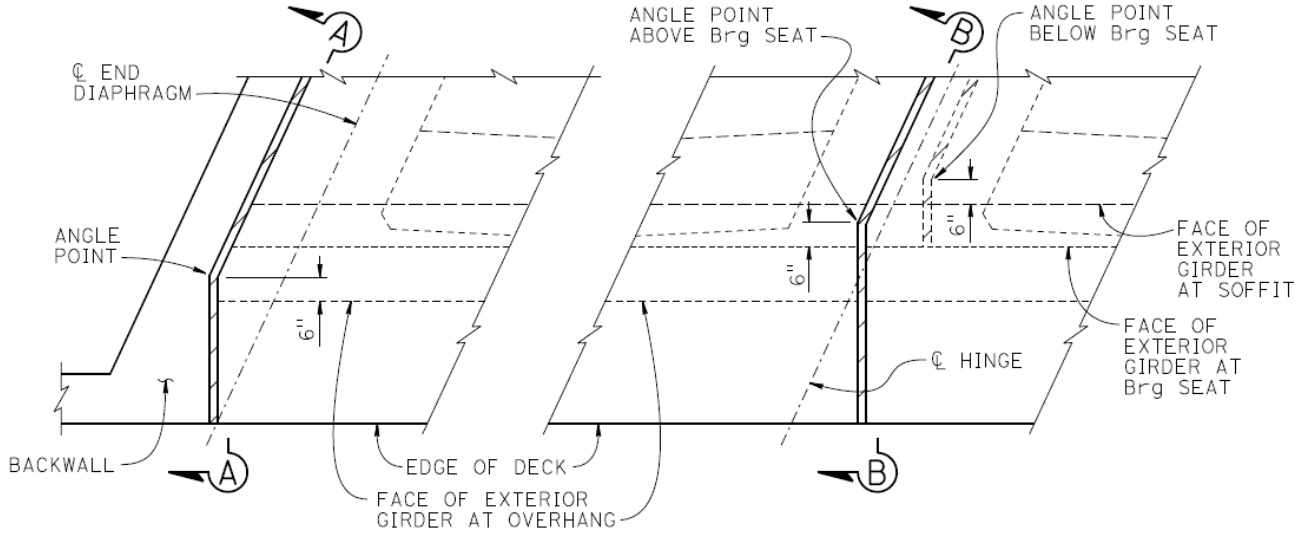
PLAN AT ABUTMENT PLAN AT HINGE

Figure 9.4.1 Deck Joints at Vertical or Sloping Exterior Girders (Skew 0° to 20°)



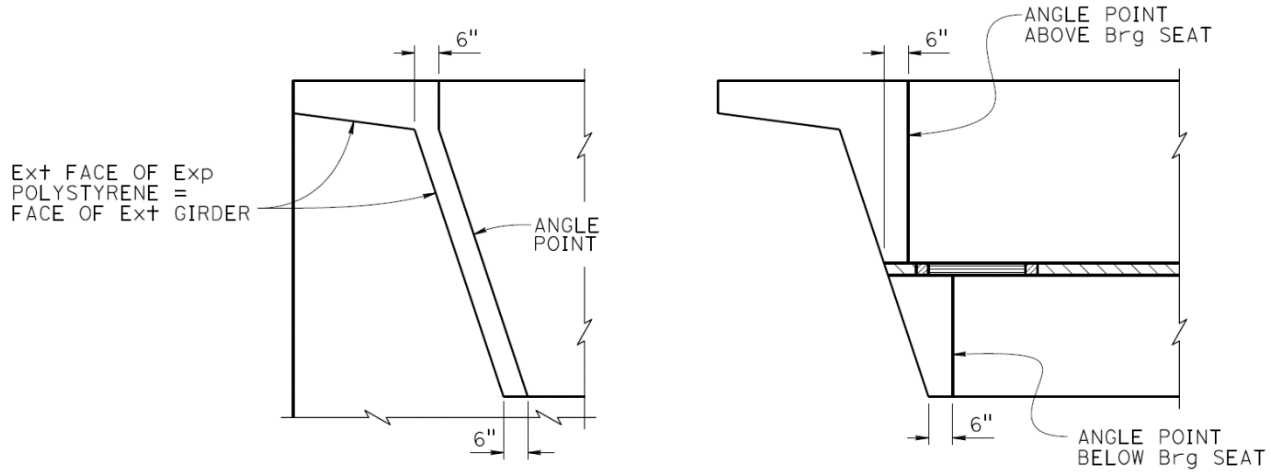
PLAN AT ABUTMENT PLAN AT HINGE

Figure 9.4.2 Deck Joints at Vertical Exterior Girders (Over 20° Skew)



PLAN AT ABUTMENT

PLAN AT HINGE



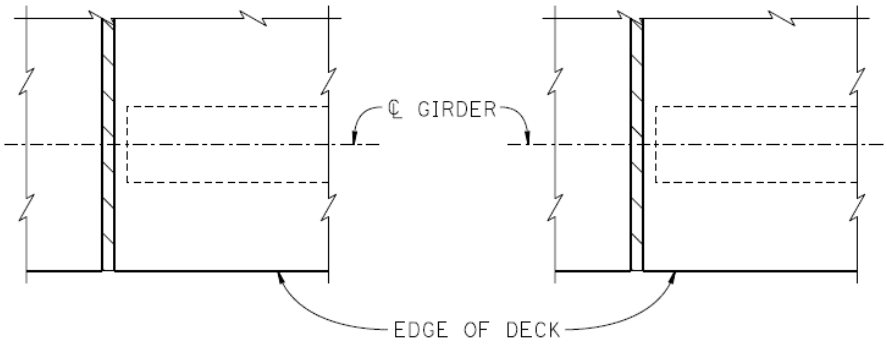
SECTION A-A

SECTION B-B

Figure 9.4.3 Deck Joints at Sloping Exterior Girders (Over 20° Skew)

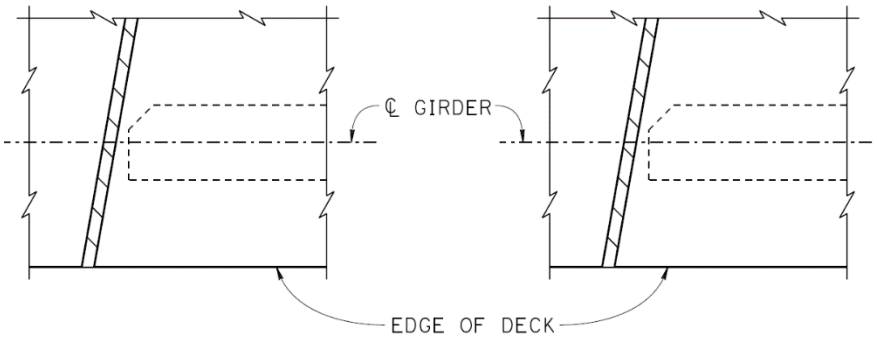
Bridge Design Details 9.5 January 2023

Deck Joints Precast Concrete or Steel Girders



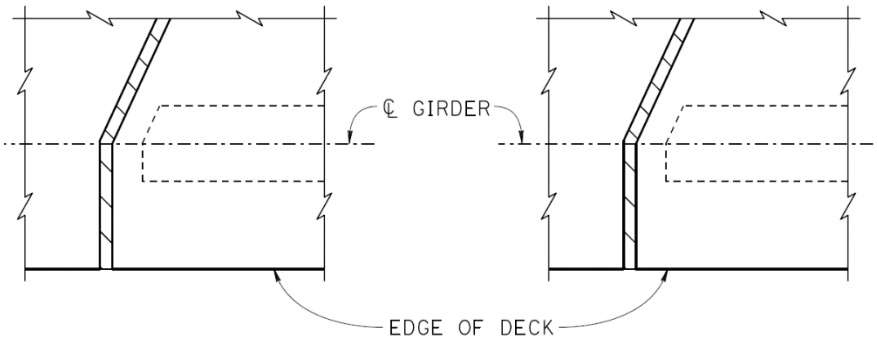
STEEL GIRDER PRECAST CONCRETE GIRDER

Figure 9.5.1 Deck Joints at Girders (No Skew)



STEEL GIRDER PRECAST CONCRETE GIRDER

Figure 9.5.2 Deck Joints at Girders (Skew 0° to 20°)



STEEL GIRDER PRECAST CONCRETE GIRDER

Figure 9.5.3 Deck Joints at Girders (Over 20° Skew)

Bridge Design Details 9.6 January 2023

Stirrup Reinforcement at Abutments

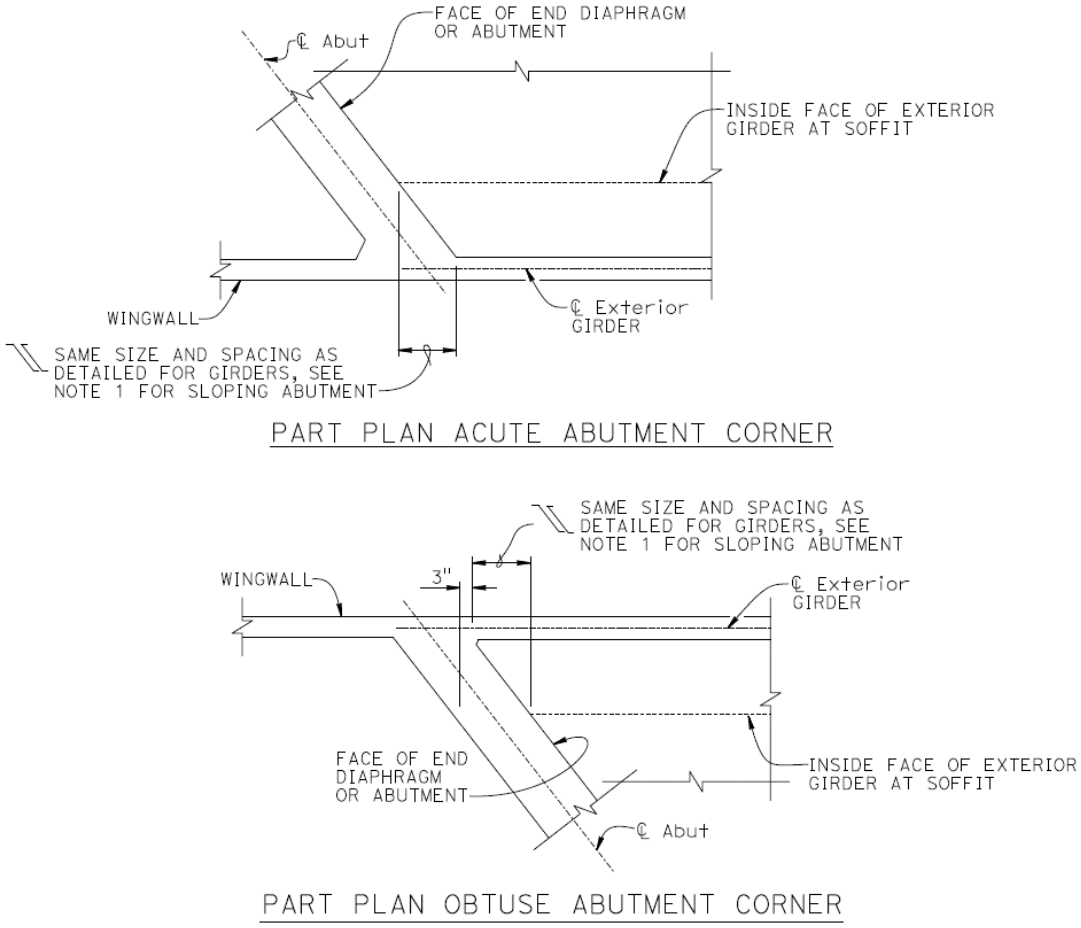


Figure 9.6.1 Stirrup Reinforcement at Abutments (Sloping Exterior Girder)

Notes:

1. Additional stirrups or equivalent reinforcement may be required for sloping abutment face.
2. Considerations should be given to potential conflicts when accommodating prestressing flares and assemblies.
3. The details above should be shown in addition to the details on *Standard Plan*: B6-1 T-Beam Details and *Standard Plan*: B7-1 Box Girder Details.

Bridge Design Details 9.7 January 2023

Soffit Reinforcement (Skews > 20°)

At the junction of the bottom slab and end diaphragm of seat-type abutments, for skews greater than 20º, rebar clearance problems may be encountered. The slab thickness may not be adequate to accommodate the “stacking” of longitudinal and transverse slab bars, diaphragm stirrups, and diaphragm bottom bars.

Use in conjunction with *Bridge Design Details*: 8.8 Typical Transverse Reinforcement and *Bridge Design Details*: 14.5 Level Abutment Seat.

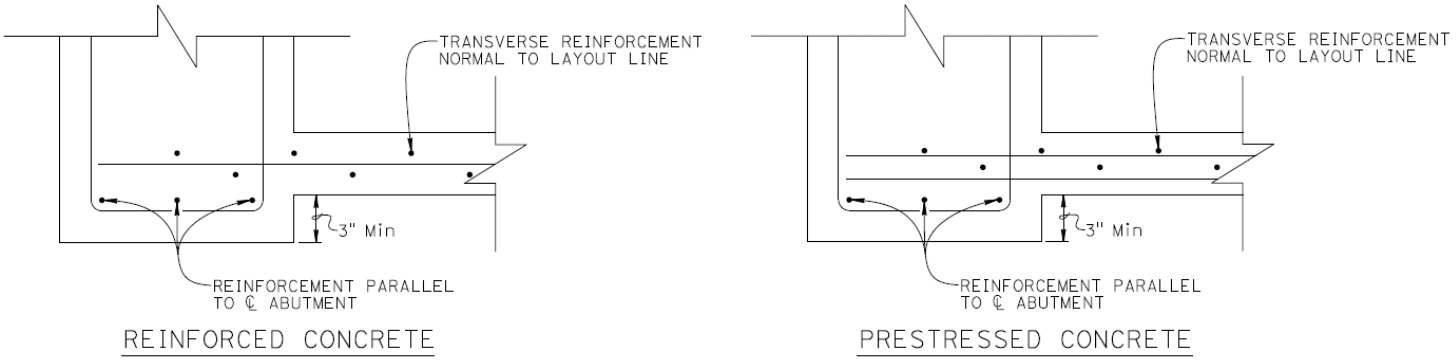


Figure 9.7.1 Drop Diaphragm Alternative

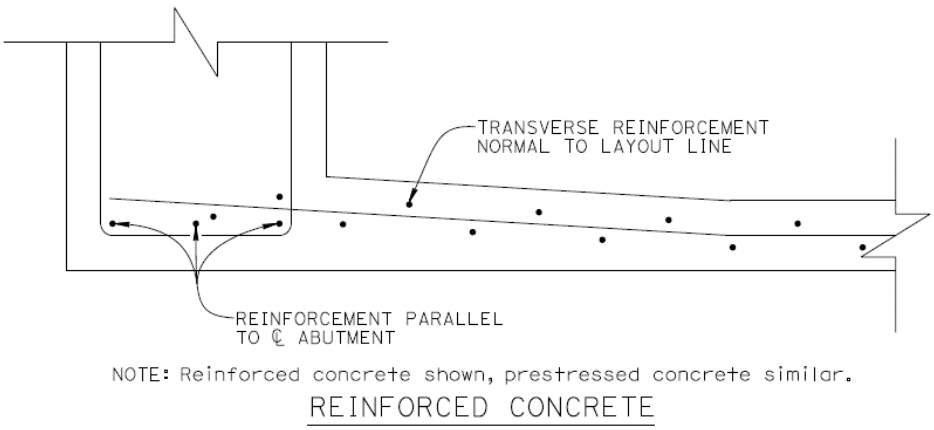


Figure 9.7.2 Flared Soffit Alternative

Bridge Design Details 9.8 January 2023

Concrete Strength and Type Limits

The plans and/or specifications must clearly define the pay limits for all concrete. The *Standard Specifications* state that all concrete not otherwise designated by strength on the plans will be paid for as STRUCTURAL CONCRETE, BRIDGE; likewise, the limits for all high strength concrete must be shown on the plans. These limits can be shown by the use of a CONCRETE STRENGTH AND TYPE LIMITS diagram, or by providing the information directly on the detail drawings of the various elements.

All bents or piers are not required to be shown if they have the same type and strength of concrete. Precast girder limits should be shown on the diagram but reference the detail sheets for strengths and other details. Approach slab concrete limits should not be shown.

To avoid confusion, avoid using cross hatching whenever possible. If necessary, cross hatching may be used to describe seal course or concrete pile concrete limits. Do not show the specific days to which strength should be obtained (e.g., f'c at 28 days).

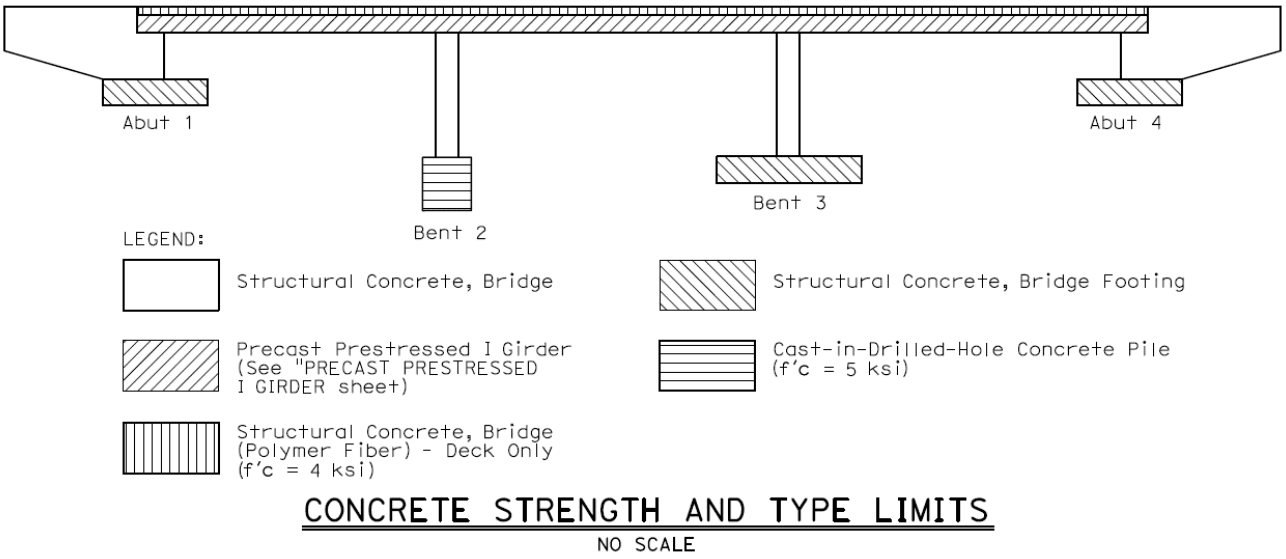


Figure 9.8.1 Concrete Strength and Type Limits Diagram
Precast Prestressed Girder Bridge

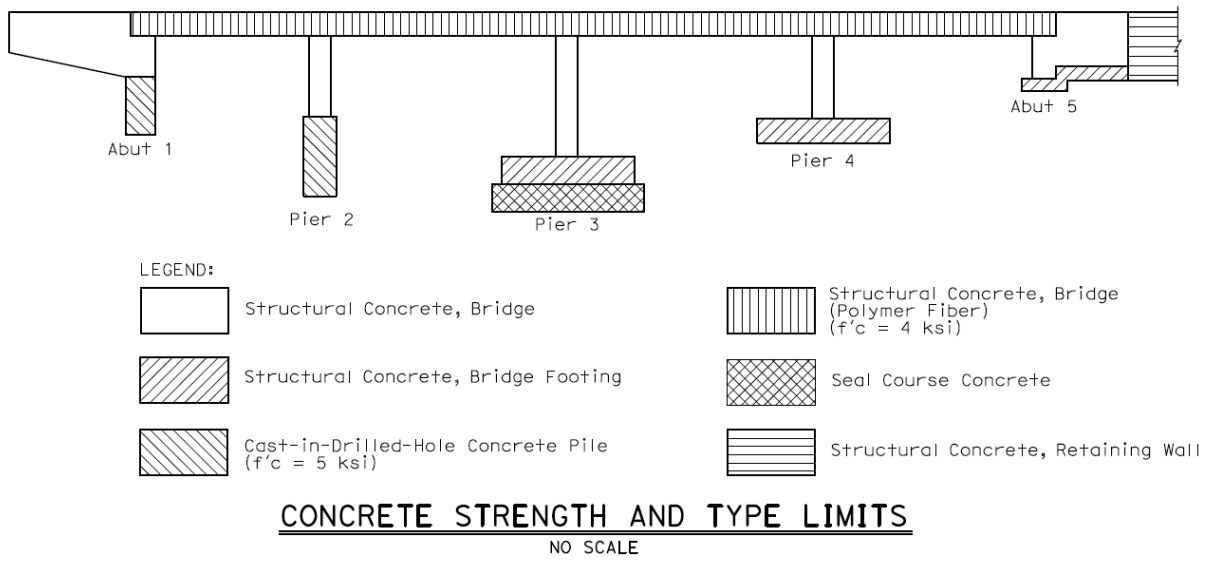


Figure 9.8.2 Concrete Strength and Type Limits Diagram
Reinforced Concrete Slab Bridge

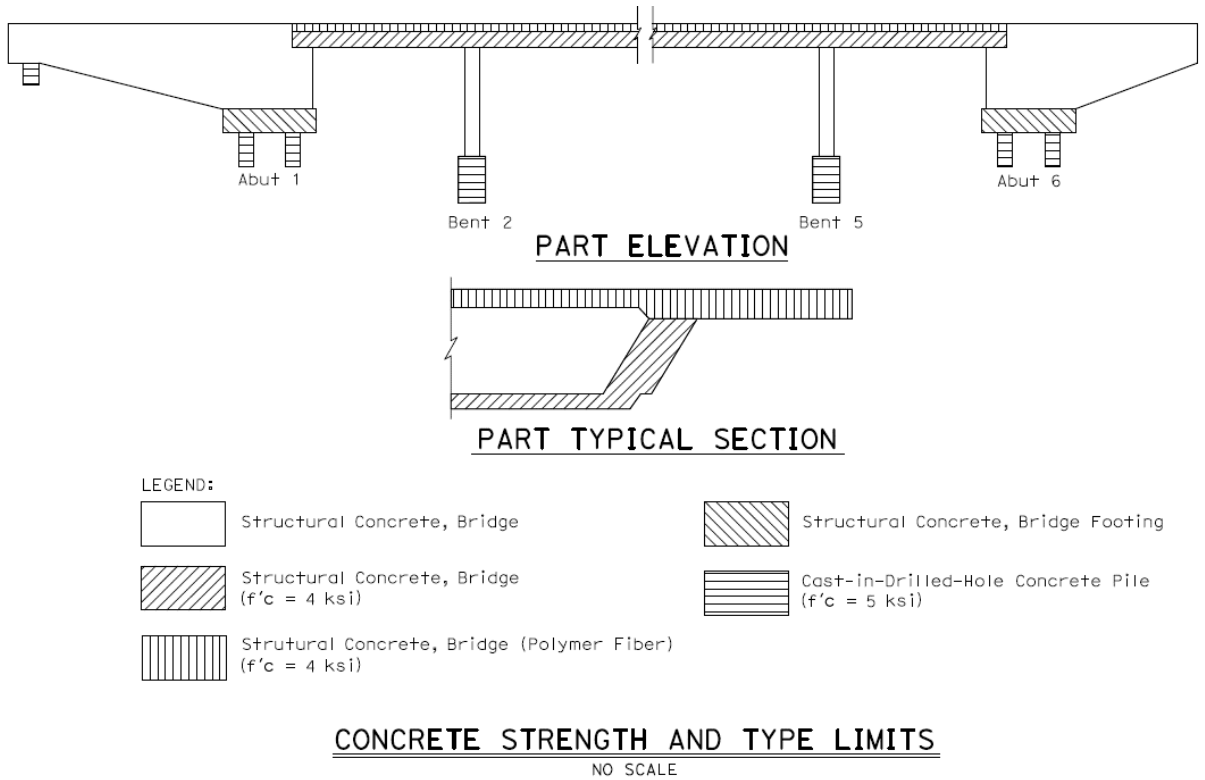


Figure 9.8.3 Concrete Strength and Type Limits Diagram
Cast-in-Place Prestressed Box Girder Bridge