

Colorado Department Of Transportation Staff Bridge Bridge Detail Manual	Chapter: 13.3 Effective: June 30, 2024 Supersedes: May 31, 2023
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Prestressed Concrete Superstructure Details

13.3.1 Purpose

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

13.3.2 Responsibility

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

13.3.3 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.

13.3.4 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.

13.3.5 Horizontal Control Line

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

13.3.6 Order Of Sheets

As with the rest of the set, the sheets are provided in the order of construction. The Precast Girder Worksheets (slabs, tubs, CBTs, boxes, etc. as appropriate) 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.

13.3.7 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.

13.3.8 Girder Worksheets

The precast Girder worksheets (slabs, tubs, CBTs, boxes) shall be provided with additions as required to show the appropriate design in the Girder Schedule Table. 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. Debonding length schedules and which strands are expected to be debonded shall be provided in this drawing as well. Debonding may be shown in section view as well. Locations of inserts such as PVC should be shown as to avoid reinforcing and prestressing strands. Lifting loops and overhang details are provided by the fabricator during the shop drawing process.

Leveling pad or bearing information should be placed on previous sheets but any bearing items needed in the precast girder should be shown. Shims to address rocking issues are typically shown in these drawings as well.

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

Any reinforcing for the barrier that extends into the girders shall be shown in the girder sheets so they can be placed at the fabrication plant.

13.3.9 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. For side by side box overhangs a minimum slope of 1/2% should be used to tie into the box should be considered. Since camber is variable, details should be considered at minimum and maximum camber to identify any issues
- D) Drip groove shall be shown in details.
- E) Bottom longitudinal reinforcing in the overhang shall match the curb stirrups as shown on the curb details.
- F) Haunches between the slab and girder shall be the width of the top flange for composite designs. The depth of the haunch shall be from the bottom of the slab to the bottom of the top flange and noted on the plans "Haunch varies " ____ " at Centerline Bearing and Centerline Girder."

13.3.10 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.

Provide partial depth precast panel worksheets if they are an acceptable work method. If they are optional, their cost is included in the work otherwise they shall be paid for separately. If full depth precast panels are used, provide all required details.

13.3.11 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
- G) Jacking force

- H) Area of prestressing steel
- I) Minimum concrete strength at jacking and at 28 days
- J) Center of gravity of prestressing force path
- K) Final force
- L) Dead load deflection
- M) Expected cambers (release and before deck pour)
- N) Estimated haunch at midspan (estimated deck thickness for side-by-side box girders)
- O) Debonding schedule

13.3.12 Title Block

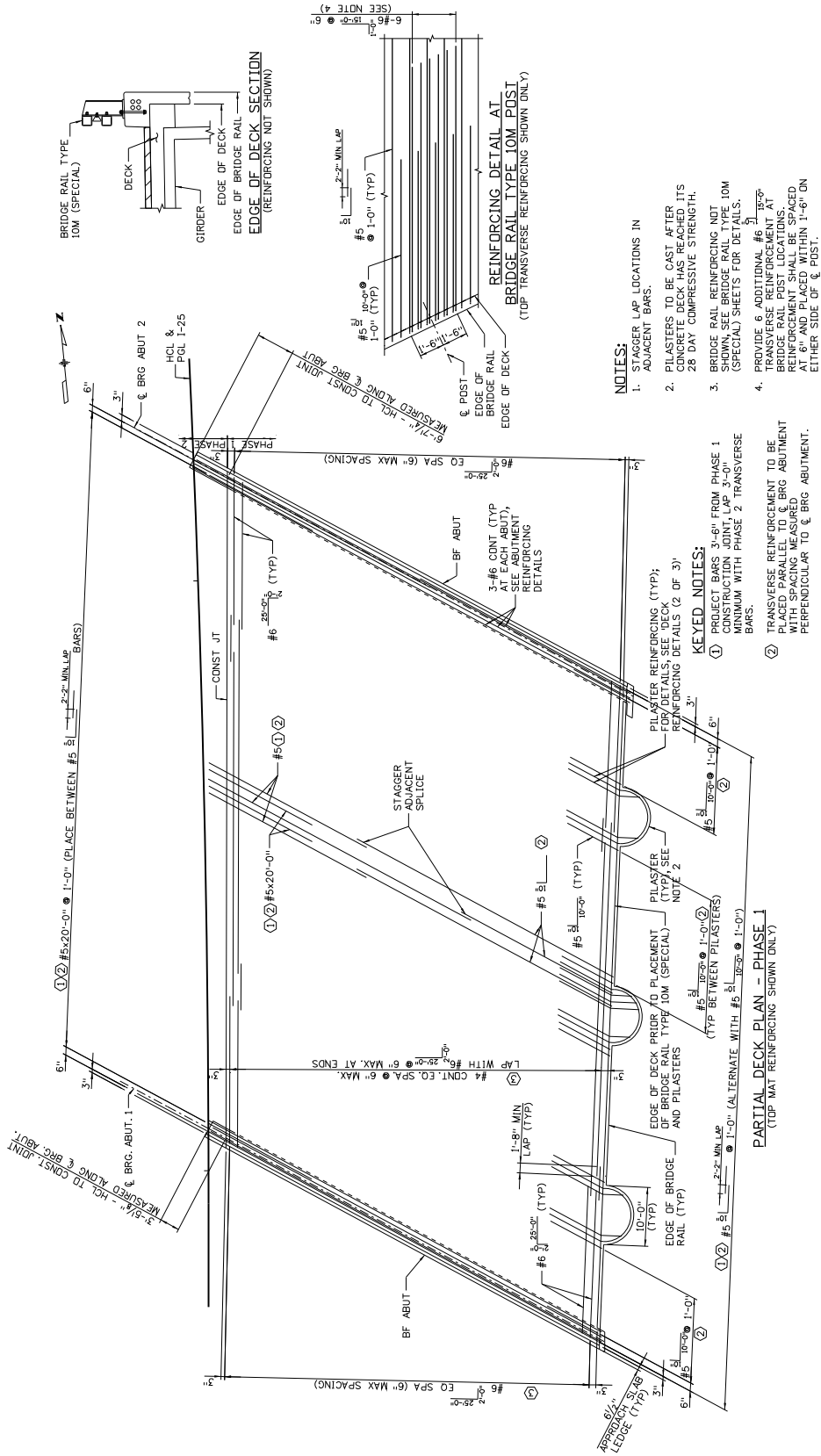
This drawing is titled “DECK REINFORCING DETAILS” or similar and shall be so indicated in the title block.

If other details are combined on this drawing, they shall be indicated in the title.

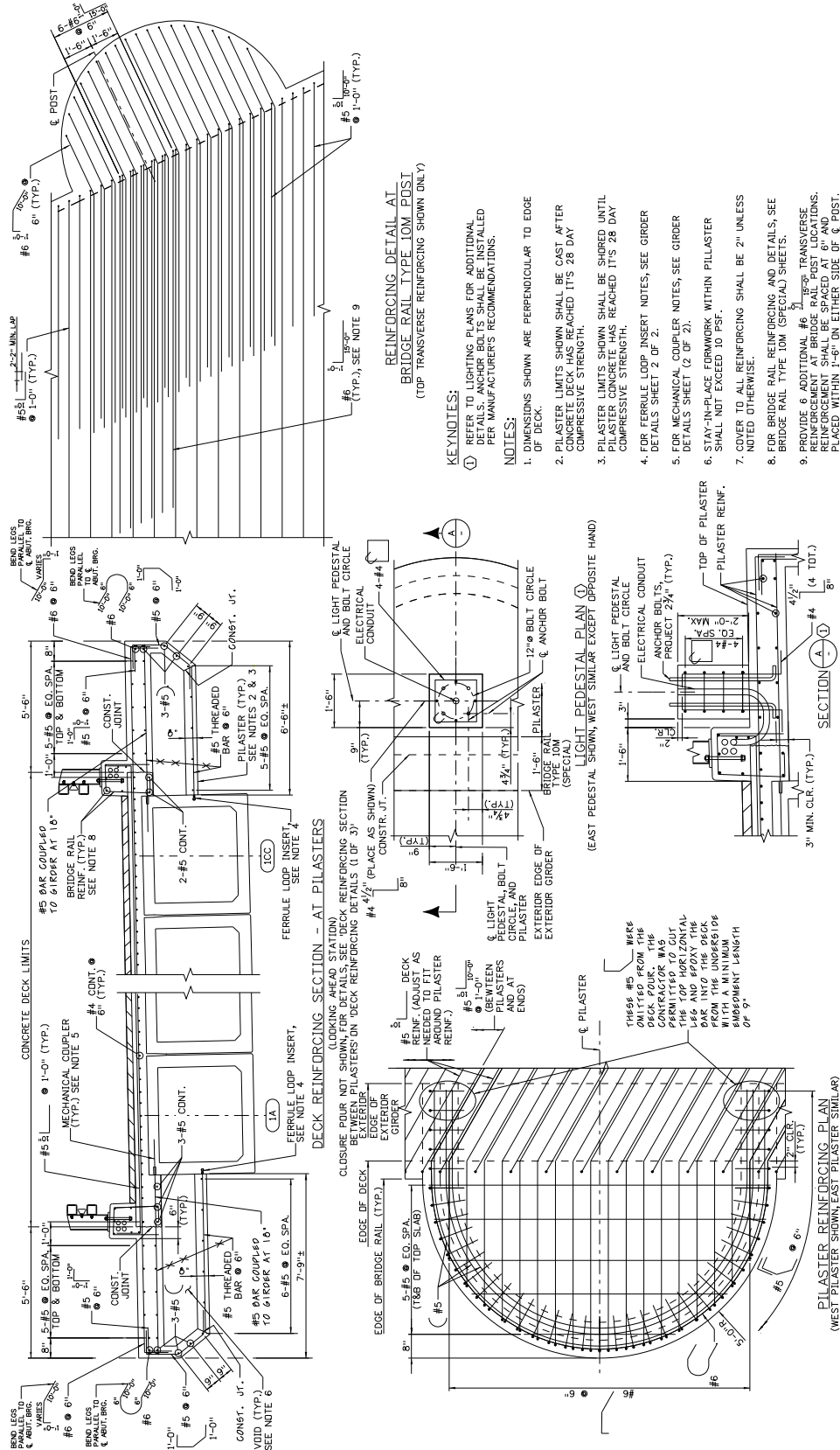
Example: If the “Barrier Details” are placed on this drawing with the “Deck Details”, the title shall be “DECK DETAILS - BARRIER DETAILS”.

13.3.13 Examples

Examples may contain old styles of girders, barrier and other details. All plan sets for new bridges shall use the latest worksheets and standards available.



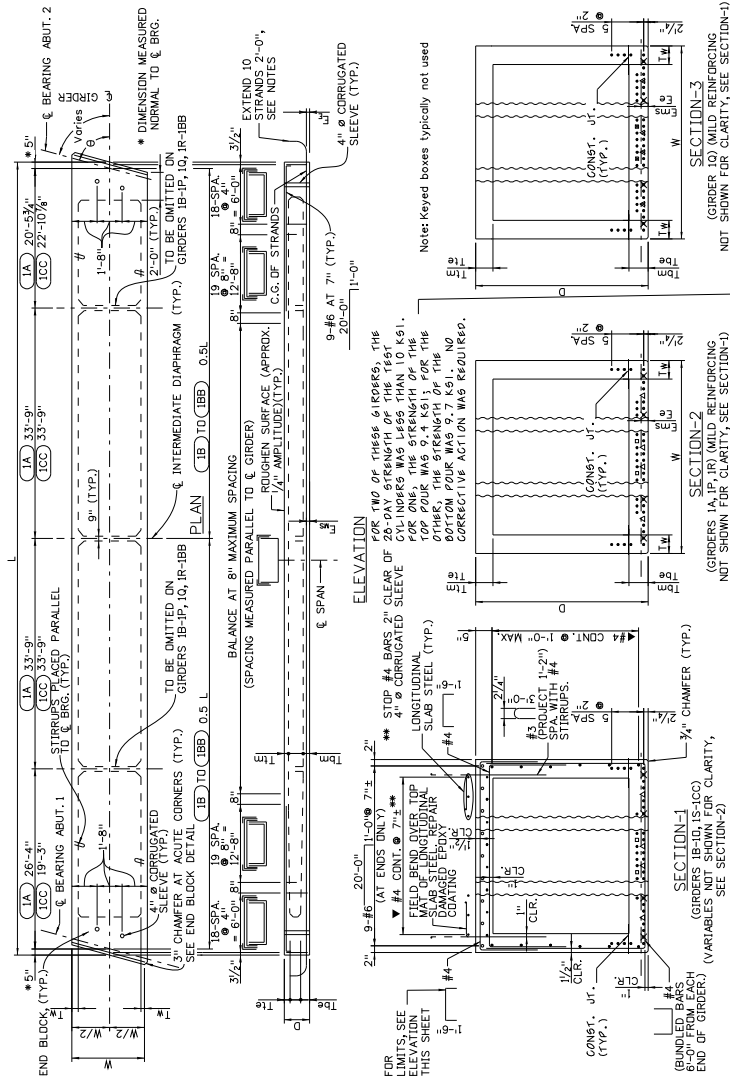
Example 13.3.1 –Deck Plan



Example 13.3.2 –Reinforcing Details

NOTES:
 WHEN APPROVED BY THE ENGINEER, A MINIMUM OF TACK WELDING WILL BE PERMITTED ON ASTM A706 UNGRADED REINFORCING STEEL.
 REINFORCING PROJECTING FROM THE TOP OF THE GIRDER AND REINFORCING WITHIN COATED END BLOCKS SHALL BE PROTECTED WITH AN APPROVED EPOXY COATED DAMAGED COATING ON GIRDER REINFORCING NEED NOT BE REPAIRED. THE MINIMUM COVER FOR REINFORCING STEEL IS 1".
 AT GIRDER ENDS NOT EMBEDDED IN CONCRETE, DIAPHRAGMS, CUT STRANDS OFF 1" BELOW THE SURFACE OF THE CONCRETE AND FINISH WITH AN APPROVED EPOXY COATED DAMAGED COATING ON GIRDER REINFORCING. REPAIRS TO CONCRETE SHALL BE TAKEN AS SHOWN, DO NOT MAKE COSMETIC REPAIRS (DAMAGE LESS THAN 1" DEEP) TO THE PARTS OF THE GIRDERS EMBEDDED IN CONCRETE.
 USE LOW RELAXATION STRANDS MEETING THE REQUIREMENTS OF ASTM A-416 GRADE 270. THE MINIMUM CLEAR DISTANCE BETWEEN GROUPS OF INDIVIDUAL STRANDS SHALL BE 1" () BUT NOT LESS THAN 1". THE MINIMUM COVER FOR PRESTRESSING CONCRETE SHALL BE CLASS PS.

ENTRAINED AIR IS NOT REQUIRED FOR GIRDER CONCRETE.
 END BLOCKS SHALL BE USED ON ALL GIRDERS UNLESS OTHERWISE NOTED.
 USE 1" CHAMFER ON ALL CORNERS, EXCEPT AS NOTED.
 PREDICTED GIRDER FINAL CAMBER IS THE CAMBER FOR THE GIRDER ALONE AT 90 DAYS AFTER CASTING. THE CAMBER SHALL BE ADJUSTED TO THE DECK POUR BY WEIGHTING, SCHEDULING FABRICATION, POST-TENSIONING, OR OTHER MEANS AND MUST REPORT TO THE ENGINEER. THE CONTRACTOR SHALL TAKE THE NECESSARY MEASURES TO ACHIEVE THE PREDICTED CAMBER PLUS 1" IS EXCEEDED. THE APPROVED REMEDIAL MEASURES SHALL BE TAKEN IF THE PREDICTED CAMBER PLUS 1" IS EXCEEDED. THE APPROVED REMEDIAL MEASURES SHALL BE TAKEN IF THE CONTRACTOR SIDE BY SIDE BOXES WITH THE SAME STRAND PATTERN PLACED OVER ROADS OR PEDESTRIAN FACILITIES SHALL NOT HAVE CAMBERS OF ADJACENT BOXES DIFFER BY MORE THAN 1" BEFORE THE DECK POUR. PRIOR TO PLACING DECK REINFORCING, THE CONTRACTOR SHALL TAKE THE NECESSARY MEASURES TO MINIMIZE THE DIFFERENTIALS, OR BY PULLING THE HIGH BOXES DOWN AND LOW BOXES UP.
 THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING NECESSARY BRACING REQUIREMENTS AND FOR PROVIDING ADEQUATE BRACING FOR THE SPECIFIC WIND AND WEATHER CONDITIONS TO BE ENCOUNTERED FOR EACH SPECIFIC PROJECT.
 DEBENDING OF STRANDS SHALL EXTEND FROM GIRDER ENDS, SEE SYMBOLS BELOW FOR DEBENDING LENGTH.
 $X = 10 \text{ FEET}$ $\Delta = 6 \text{ FEET}$ $\phi = 2 \text{ FEET}$
 EXTERIOR STRAND SHALL NOT BE DEBENDED AND STIRRUPS BE PLACED ADJACENT TO ANCHOR STRIPS.
 L = MINIMUM AREA OF THE PRESTRESSING STEEL.
 F_u = ULTIMATE STRENGTH OF PRESTRESSING STEEL.
 F_y = YIELDING STRENGTH OF PRESTRESSING STEEL.
 F_c = FINISHING FLEXURE OF GIRDER AFTER ALL LOSSES.
 f_c = REQUIRED CONCRETE STRENGTH AT RELEASE.
 f'_c = REQUIRED CONCRETE STRENGTH AT 28 DAYS OF AGE.
 L = LENGTH OF GIRDER.
 Δ = GIRDER ALONG THE GRADE OF
 θ = IMMEDIATE DEFLECTION AT CENTERLINE
 ASPHALT CURBS AND RAILS.
 θ = BRIDGE SKEW ANGLE
 E_{ms} = DISTANCE MEASURED FROM BOTTOM OF GIRDER TO TOP OF SPAN
 E_{ms} = DISTANCE MEASURED FROM BOTTOM OF GIRDER TO TOP OF SPAN
 x = DEBENDING STRAND SLE NOTES FOR
 ▶ BE USED AS AN ALTERNATE.



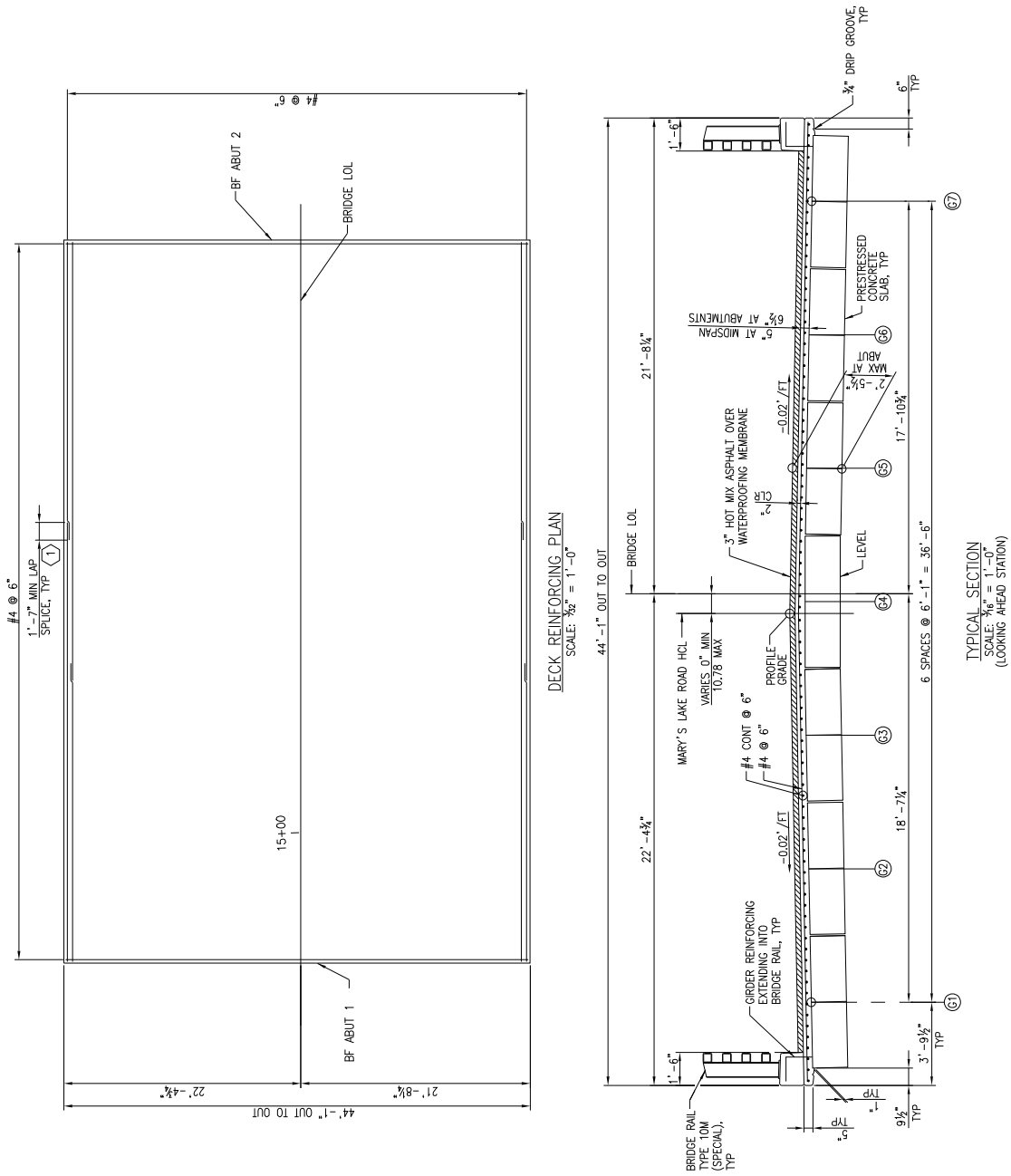
GIRDER SCHEDULE

(GIRDERS 1A, 1P, 1R) (MILD REINFORCING NOT SHOWN FOR CLARITY, SEE SECTION-1)

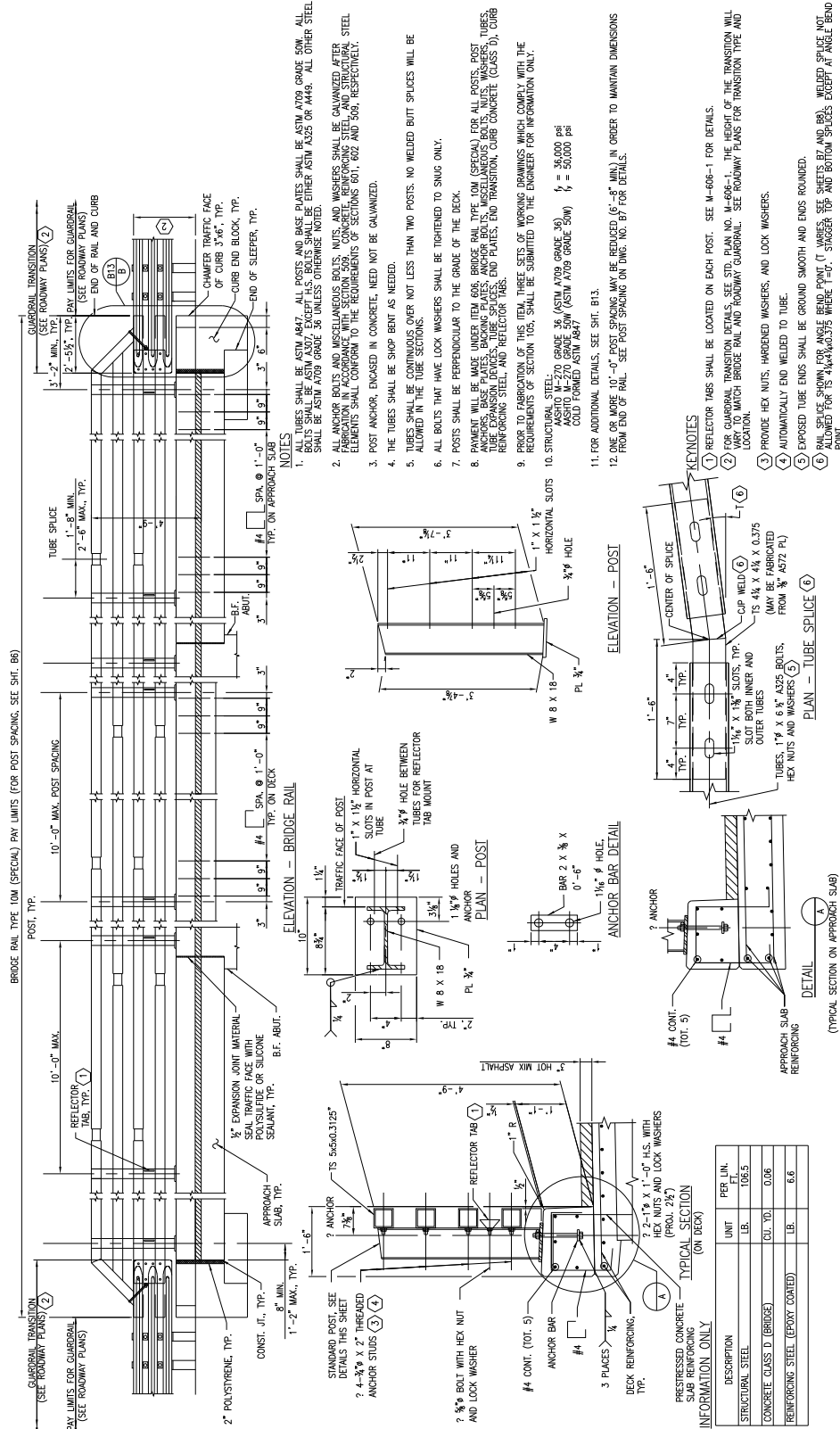
SPAN GIRDER NO.	L (FT)	W (IN)	D (IN)	θ (DEG)	T_{wm} (IN)	T_{tm} (IN)	T_{be} (IN)	T_{te} (IN)	L _t (FT)	A _s (SQ IN)	PERCENTED STRANDS (IN)	E _g (KIP/IN)	E _g (KIP/IN)	F _i (KIP/IN)	F _i (KIP/IN)	F _i (KIP/IN)	CONCRETE STRENGTH (PSI)	f _c (PSI)	f _c (PSI)	PREDICTED GIRDER FINAL CAMBER (IN)	Δ _i (IN)
1 1A, 1P	115'-3/4"	60"	54"	59°59'58"	6"	6"	5 1/2"	6"	0	9.98	21.7	4.08	4.08	2021	1610	6,000	10,000	1.64	2.27	4.55	4.55
1 1B-10	115'-3/4"	60"	54"	59°59'58"	6"	6"	5 1/2"	6"	0	9.11	23.8	4.06	4.06	1845	1496	6,000	10,000	1.02	1.92	3.78	3.78
1 1Q	112'-10"	60"	54"	62°13'24"	6"	6"	5 1/2"	6"	0	10.85	20.00	4.09	4.09	2197	1721	6,000	10,000	1.86	2.63	5.38	5.38
1 1S-1CC	110'-6 3/4"	60"	54"	64°32'32"	6"	6"	5 1/2"	6"	0	9.11	23.8	4.06	4.06	1845	1496	6,000	10,000	0.79	1.93	3.86	3.86
1 1R	110'-6 3/4"	60"	54"	64°32'32"	6"	6"	5 1/2"	6"	0	9.98	21.7	4.08	4.08	2021	1610	6,000	10,000	1.32	2.27	4.61	4.61

(GIRDERS 1A, 1P, 1R) (MILD REINFORCING NOT SHOWN FOR CLARITY, SEE SECTION-1)

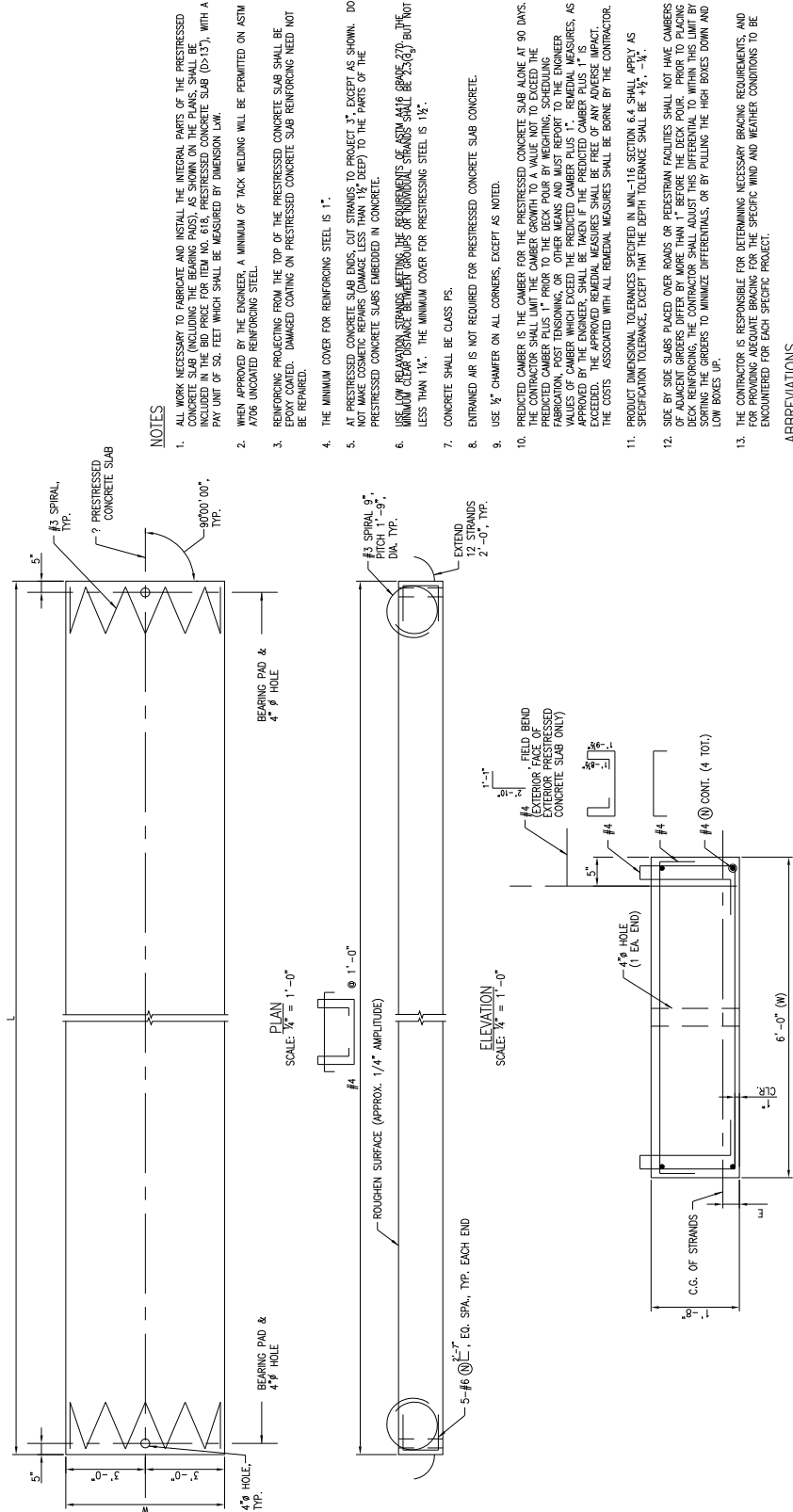
Example 13.3.4 – Prestressed Girder



Example 13.3.5



Example 13.3.6



- NOTES**
1. ALL WORK NECESSARY TO FABRICATE AND INSTALL THE INTEGRAL PARTS OF THE PRESTRESSED CONCRETE SLAB SHALL BE INCLUDED IN THE BID PRICE FOR ITEM NO. 610. PRESTRESSED CONCRETE SLAB (7D-13), WITH A PAY UNIT OF SQ. FEET WHICH SHALL BE MEASURED BY DIMENSION LAW.
 2. WHEN APPROVED BY THE ENGINEER, A MINIMUM OF TACK WELDING WILL BE PERMITTED ON ASTM A706 UNCOATED REINFORCING STEEL.
 3. REINFORCING PROJECTING FROM THE TOP OF THE PRESTRESSED CONCRETE SLAB SHALL BE EPOXY COATED. DAMAGED COATING ON PRESTRESSED CONCRETE SLAB REINFORCING NEED NOT BE REPAIRED.
 4. THE MINIMUM COVER FOR REINFORCING STEEL IS 1".
 5. AT PRESTRESSED CONCRETE SLAB ENDS, CUT STRANDS TO PROJECT 3", EXCEPT AS SHOWN. DO NOT MAKE COSMETIC REPAIRS (DAMAGE LESS THAN 1/4" DEEP) TO THE PARTS OF THE PRESTRESSED CONCRETE SLABS EMBEDDED IN CONCRETE.
 6. USE LOW RELAXATION STRANDS MEETING THE REQUIREMENTS OF ASTM A416 GRADE 270. THE MINIMUM CLEAR DISTANCE BETWEEN GROUPS OF INDIVIDUAL STRANDS SHALL BE 2.5(r_s) BUT NOT LESS THAN 1 1/4". THE MINIMUM COVER FOR PRESTRESSING STEEL IS 1 1/2".
 7. CONCRETE SHALL BE CLASS PS.
 8. ENTRAINED AIR IS NOT REQUIRED FOR PRESTRESSED CONCRETE SLAB CONCRETE.
 9. USE 1/8" CHAMFER ON ALL CORNERS, EXCEPT AS NOTED.
 10. PREDICTED CAMBER IS THE CAMBER FOR THE PRESTRESSED CONCRETE SLAB ALONE AT 90 DAYS. THE CONTRACTOR SHALL LIMIT THE CAMBER GROWTH TO A VALUE NOT TO EXCEED THE PREDICTED CAMBER PLUS 1" PRIOR TO THE DECK POUR BY WEIGHING, SCHEDULING FABRICATION, POST TENSIONING, OR OTHER MEANS AND MUST REPORT TO THE ENGINEER. APPROXIMATE CAMBER SHALL BE THE PREDICTED CAMBER PLUS 1". CAMBER MEASURES, AS APPLIED TO THE SLAB, SHALL BE MEASURED FROM THE CENTERLINE OF THE SLAB TO THE EXCEED. THE APPROVED REMEDIAL MEASURES SHALL BE FREE OF ANY ADVERSE IMPACT. THE COSTS ASSOCIATED WITH ALL REMEDIAL MEASURES SHALL BE BORNE BY THE CONTRACTOR.
 11. PRODUCT DIMENSIONAL TOLERANCES DESCRIBED IN MW-116 SECTION 6.4 SHALL APPLY AS SPECIFICATION TOLERANCE, EXCEPT THAT THE DEPTH TOLERANCE SHALL BE 1/8", ±4".
 12. SIDE BY SIDE SLABS PLACED OVER ROADS OR PEDESTRIAN FACILITIES SHALL NOT HAVE CAMBERS OF ADJACENT GIRDERS DIFFER BY MORE THAN 1" BEFORE THE DECK POUR. PRIOR TO PLACING DECK REINFORCING, THE CONTRACTOR SHALL ADJUST THIS DIFFERENTIAL TO WITHIN THIS LIMIT BY CHANGING THE POSITION OF THE PRESTRESSING STRANDS TO MINIMIZE DIFFERENTIALS, OR BY PULLING THE HIGH BOXES DOWN AND LOW BOXES UP.
 13. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING NECESSARY BRACING REQUIREMENTS, AND FOR PROVIDING ADEQUATE BRACING FOR THE SPECIFIC WIND AND WEATHER CONDITIONS TO BE ENCOUNTERED FOR EACH SPECIFIC PROJECT.

ABBREVIATIONS

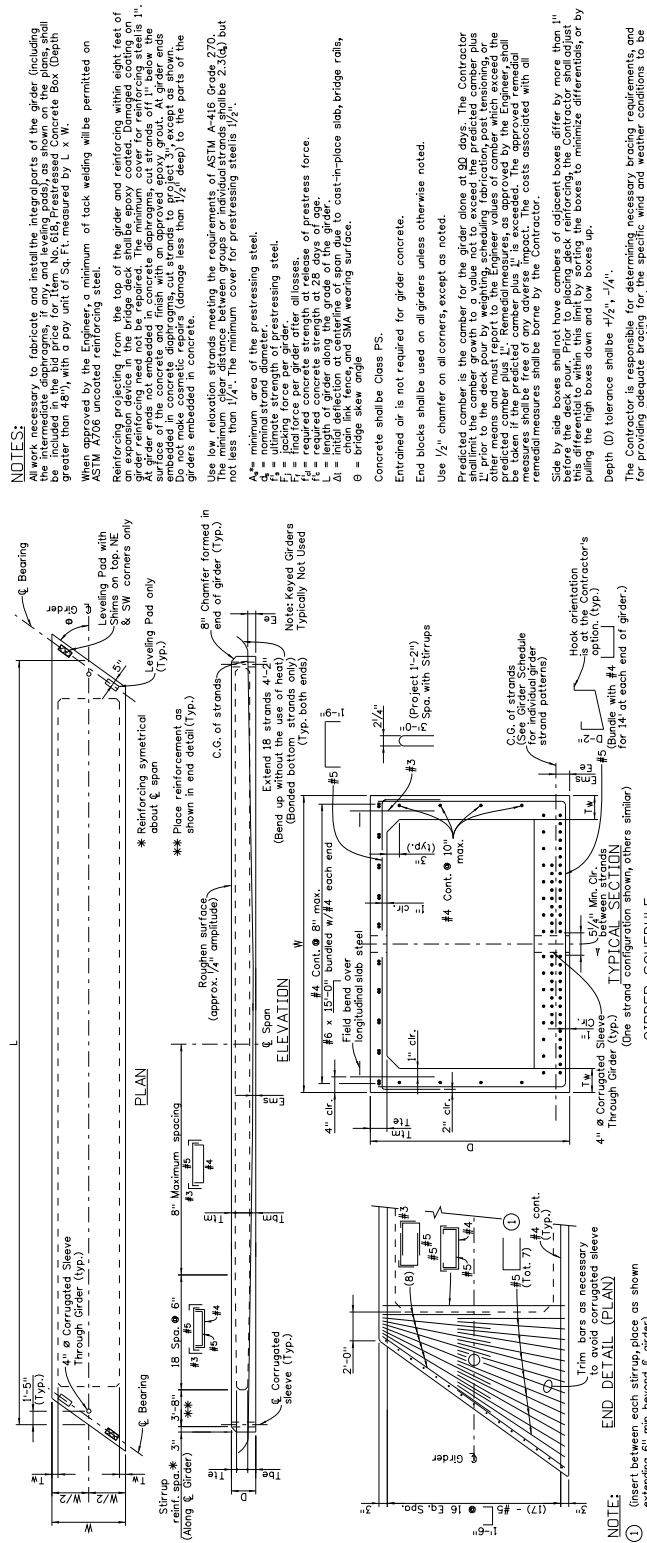
- A_s = MINIMUM AREA OF THE PRESTRESSING STEEL
- F_j = JACKING FORCE PER PRESTRESSED CONCRETE SLAB
- F₁ = FINAL FORCE PER PRESTRESSED CONCRETE SLAB AFTER ALL LOSSES
- F_{1s} = REQUIRED CONCRETE STRENGTH AT RELEASE OF PRESTRESS FORCE
- L = LENGTH OF PRESTRESSED CONCRETE SLAB ALONG THE GRADE OF THE GIRDERS
- W = WIDTH OF THE PRESTRESSED CONCRETE SLAB
- A = DEFLECTION AT CENTERLINE OF SPAN DUE TO CAST-IN-PLACE SLAB, DIAPHRAGMS, ASPHALT, CURBS, AND RAILS

PRESTRESSED CONCRETE SLAB SCHEDULE

GIRDER NO.	L (FEET)	A _s (SQ. INCH)	E (INCH)	F ₁ (KIPS)	F _j (KIPS)	CONCRETE STRENGTH		A (INCH)	PREDICTED CAMBER (INCH)	DEBOND STRANDS (%)
						f' _{cd} (KSI)	f' _{cs} (KSI)			
⑤ TO ⑥	64.50	10.416	3.92	2109	1796	5.70	6.50	0.90	2.38	25

TYPICAL SECTION
SCALE: 3/4" = 1'-0"

Example 13.3.7 – Prestressed Concrete Slab



NOTE:
1) Insert between each stirrup, place as shown extending 6" min. beyond $\bar{\xi}$ girder.

Span No.	Girder No.	L (Feet)	W (Inch)	D (Inch)	θ (Deg.)	Tw (Inch)	Tm (Inch)	Tb (Inch)	Tc (Inch)	A _{ps} * (Square Inch)	Debonded Strands	E _E (Inch)	E _{is} (Inch)	F _i (KIPS)	F _u (KIPS)	f _u (PSI)	f _c (PSI)	Concrete Strength	Δ l (Inch)	Predicted Release Camber (Inch)
1	1-15	91.80	72	54	54.25	6	8	6	6	7.278	N/A	3.07	3.07	1494	1328	6500	6500	0.40	1.35	1.54
1	2-8	91.80	72	54	54.25	6	8	6	6	7.278	N/A	3.07	3.07	1494	1324	6500	6500	0.36	1.35	1.54
1	11-15	91.80	72	54	54.25	6	8	6	6	7.278	N/A	3.07	3.07	1494	1325	6500	6500	0.36	1.35	1.54
2	1-9	131.90	72	54	54.25	6	8	6	6	13.888	SEE TABLE	3.81	3.81	2812	2387	6500	6500	1.65	4.05	4.49
2	2-4	131.90	72	54	54.25	6	8	6	6	13.888	SEE TABLE	3.81	3.81	2812	2376	6500	6500	1.43	4.05	4.49
2	10-16	131.90	72	54	54.25	6	8	6	6	14.796	SEE TABLE	3.80	3.80	2885	2530	6500	6500	1.83	4.60	5.16
3	1-3	80.55	72	54	54.25	6	8	6	6	6.076	SEE TABLE	3.11	3.11	1230	1103	6500	6500	0.21	0.93	1.07
3	2-4	80.55	72	54	54.25	6	8	6	6	6.076	N/A	3.11	3.11	1230	1107	6500	6500	0.27	0.93	1.07
3	10-16	80.55	72	54	54.25	6	8	6	6	6.076	N/A	3.11	3.11	1230	1101	6500	6500	0.21	0.93	1.07
3	11-15	80.55	72	54	54.25	6	8	6	6	6.076	N/A	3.11	3.11	1230	1101	6500	6500	0.21	0.93	1.07

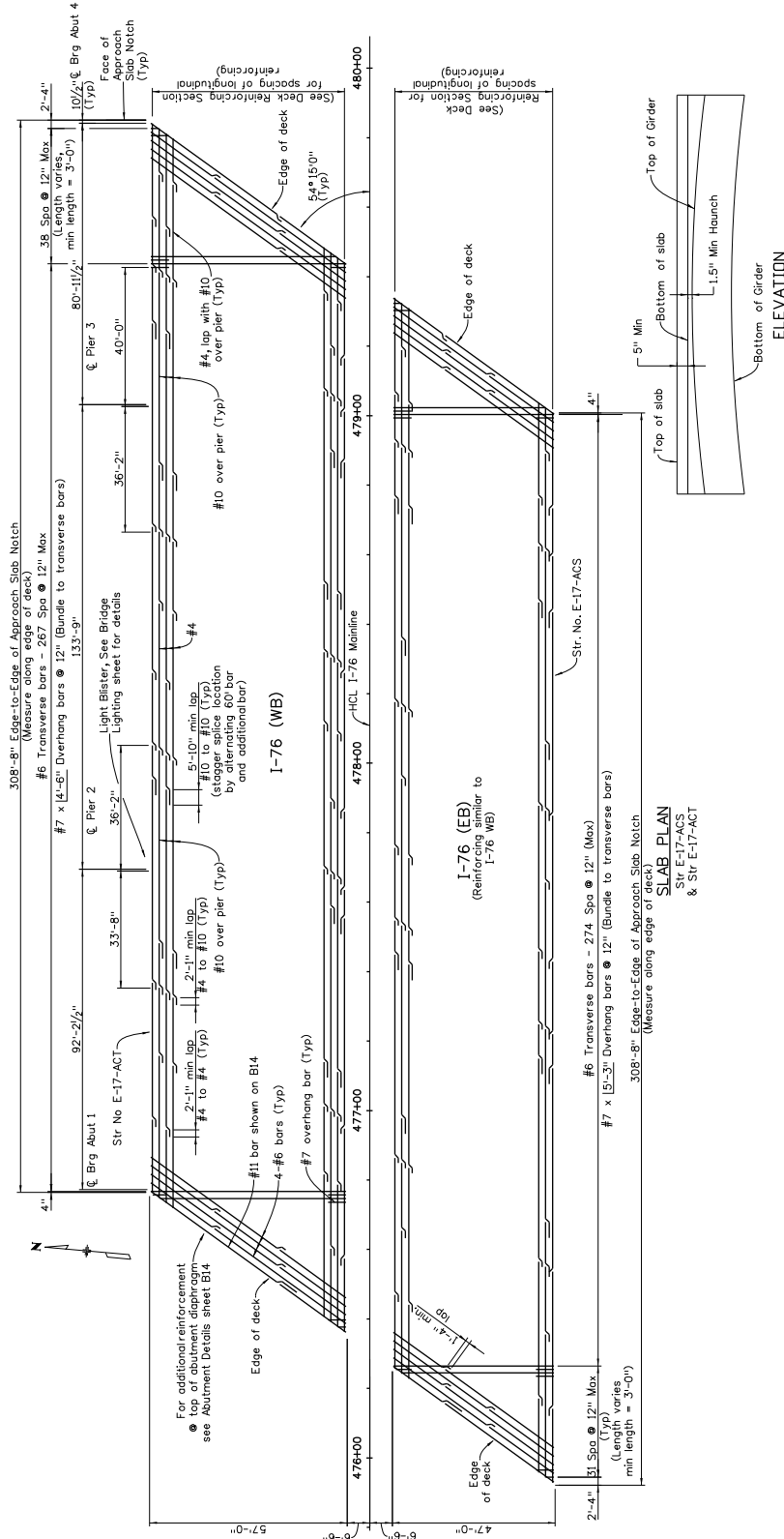
DEBONDING TABLE

Span	Girder No.	Row	Total No. Debonded Strands Each			
			Y ₀ 0'-6"	2 ft 4 ft 6 ft		
1-9	1	1	2,25	30	2	4
		2	5,25	10		
		3	2,25	30	2	4
10,16	2	1	2,25	20		
		2	4,25	20		
		3	6,25	18		

Y₀ = location of center of gravity of strands of row considered from bottom of precast girder.

NOTES:
 All work necessary to fabricate and install the integral parts of the girder (including the intermediate diaphragms, if any, and leveling pads), as shown on the plans shall be included in the bid price for Item No. 613, Prestressed Concrete Box. (Depth greater than 48"), with a pay unit of Sq. Ft. measured by L x W.
 When approved by the Engineer, a minimum of tack welding will be permitted on ASTM A706 uncoated reinforcing steel.
 Reinforcing projecting from the top of the girder and reinforcing within eight feet of girder reinforcing need not be repaired. The minimum cover for reinforcing steel is 1".
 The concrete shall be placed in the appropriate and approved manner below the surface of the concrete. The concrete shall be placed and struck out of the ends and embedded in concrete diaphragms cut strands to project 3", except as shown. The ends of the strands shall be cut at an angle of 45 degrees to the axis of the girder.
 Use low relaxation strands meeting the requirements of ASTM A-418, Grade 270. The minimum clear distance between groups or individual strands shall be 2.3(A) but not less than 1/A". The minimum cover for prestressing steels 1/2".
 A_{ps} = minimum area of the prestressing steel.
 d = nominal strand diameter.
 F_i = jacking force per girder.
 F_u = final force per girder after losses.
 f_u = required concrete strength at 28 days of age.
 L = length of girder along the grade of the girder.
 θ = chain link fence, and SMA wearing surface.
 θ = bridge skew angle.
 Concrete shall be Class FS.
 Entrained air is not required for girder concrete.
 End blocks shall be used on all girders, except as noted.
 Use 1/2" chamfer on all corners, except as noted.
 Predicted camber is the camber for the girder alone at 30 days. The Contractor shall limit the camber growth to a value not to exceed the predicted camber plus other means and must report to the Engineer values of camber which exceed the predicted camber plus 1". Remedial measures, as approved by the Engineer, shall be taken to correct camber growth. Remedial measures shall be free of any adverse impact. The costs associated with all remedial measures shall be borne by the Contractor.
 Side by side boxes shall not have combers of adjacent boxes differ by more than 1" before the deck pour. Prior to placing deck reinforcing, the Contractor shall adjust pulling the high boxes down and low boxes up.
 Depth (D) tolerance shall be +1/2" -1/4".
 The Contractor is responsible for determining necessary bracing requirements, and bracing shall be provided for specific wind and weather conditions to be encountered for each specific project.
 All slabs shall be Tack-welded together in a shim stack.

Example 13.3.8 – Prestressed Concrete Box



ELEVATION

Bridge Girder Seat Elevations were calculated using Design Cambers of Girders plus dead load deflections of slab and adjustments for vertical curve of slab, if any, so that top of girder will be a minimum of 1.5 inch below bottom of slab at any one point in the span, allowing for Girder Depth and Girder Camber Tolerance.

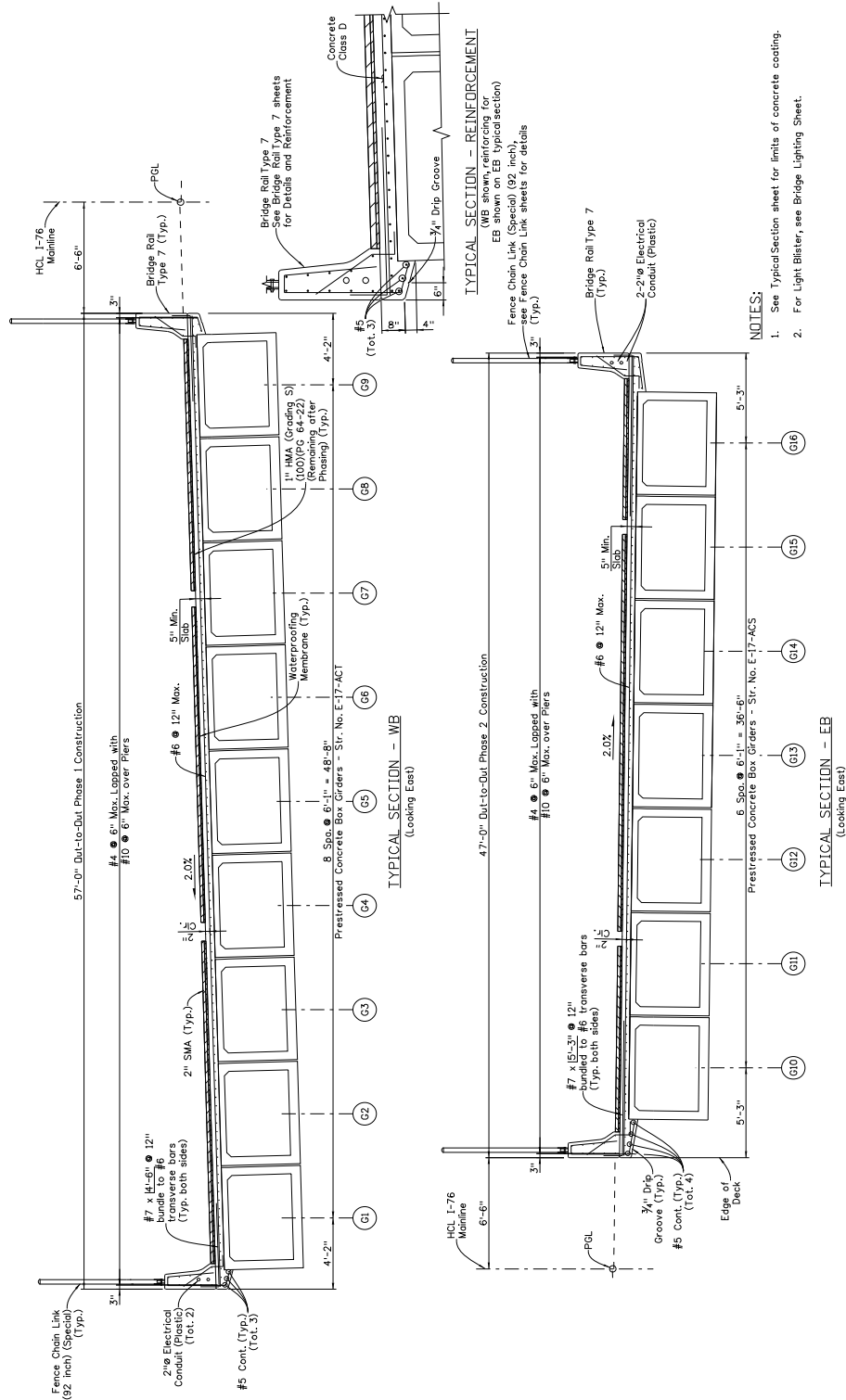
Deck Elevations were calculated based on anticipated long-term deflections due to creep of concrete. As a result, the constructed deck will initially be higher in some locations than the theoretical finished grade.

GIRDER CAMBER/DEFLECTIONS

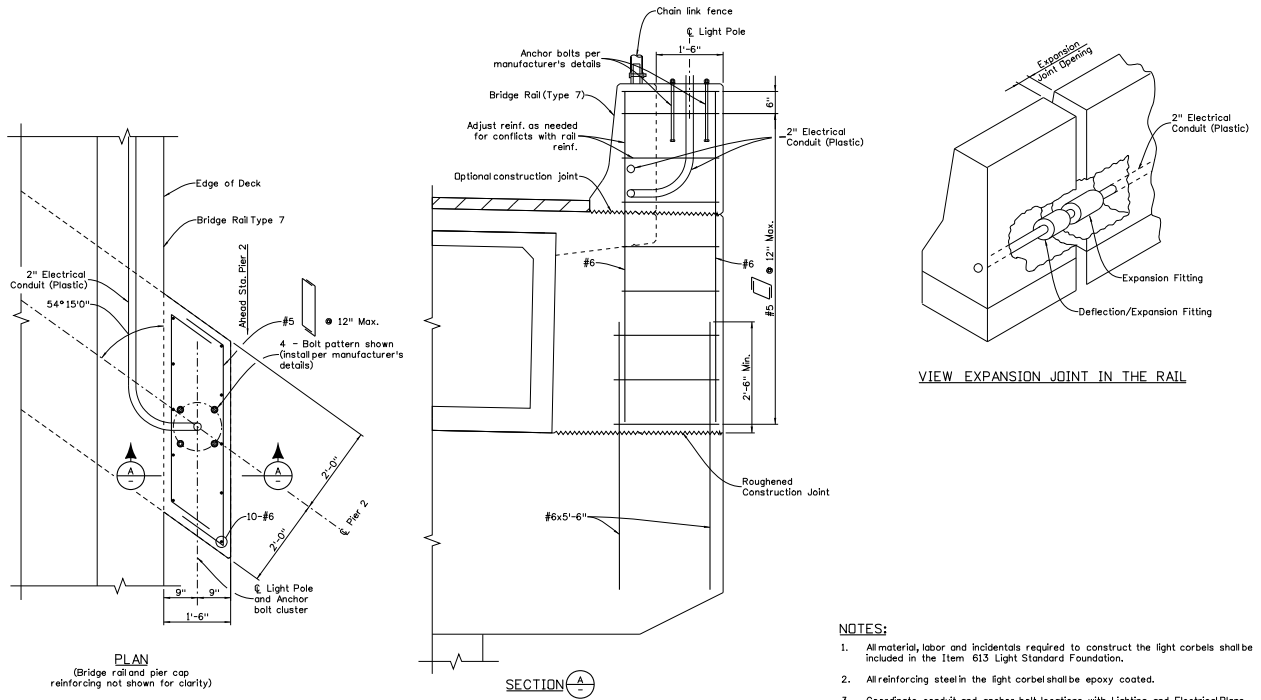
NOTES:

1. Concrete Class D shall be used for deck slab.
2. Refer to bridge railsheets for railreinforcing.
3. Alternate lap splice locations in adjacent bars.

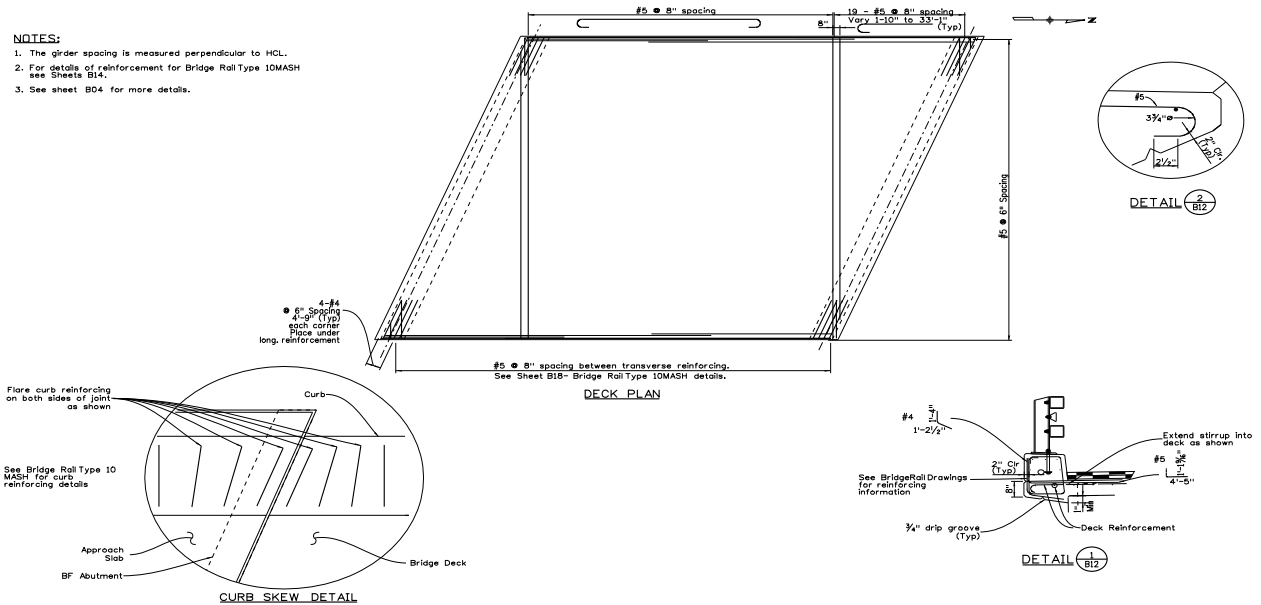
Example 13.3.9 – Prestressed Concrete Box and Deck Reinforcing



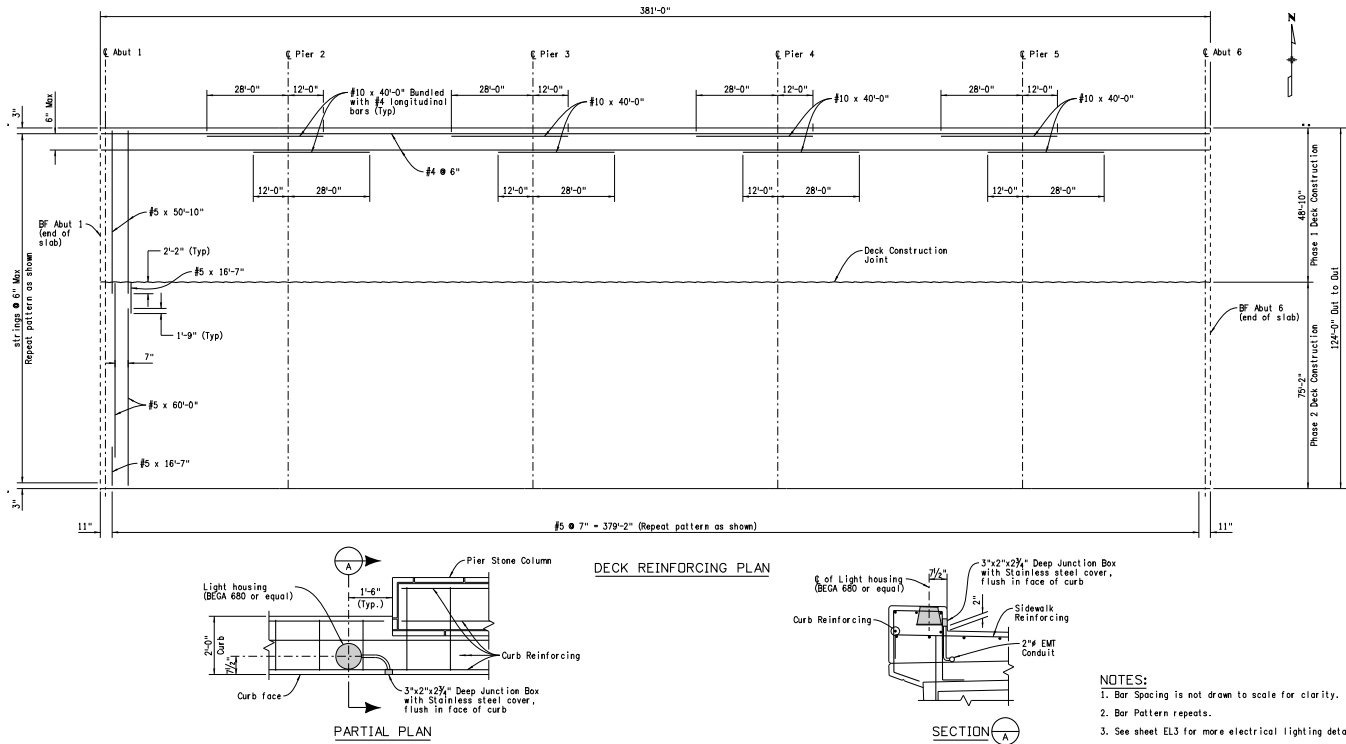
Example 13.3.10



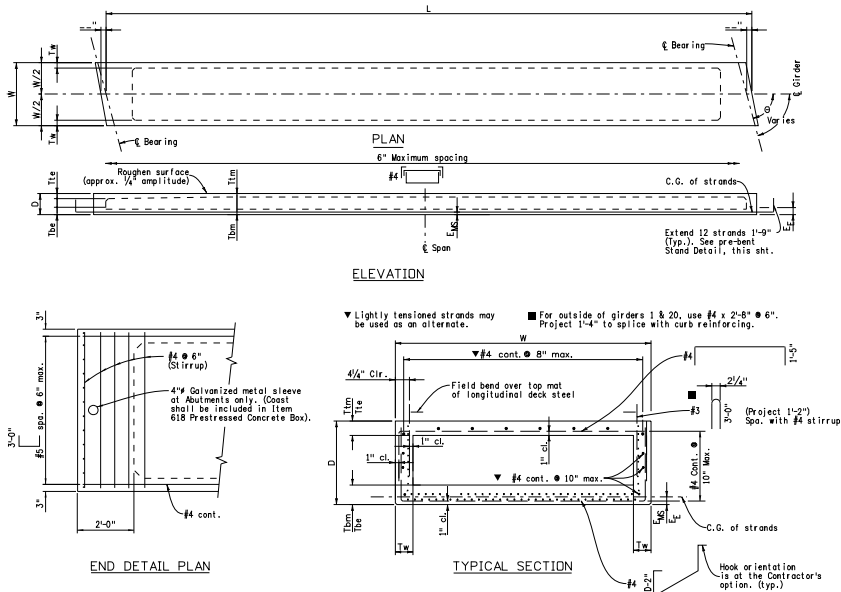
Example 13.3.11



Example 13.3.12

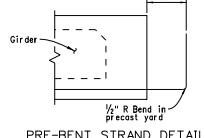


Example 13.3.13

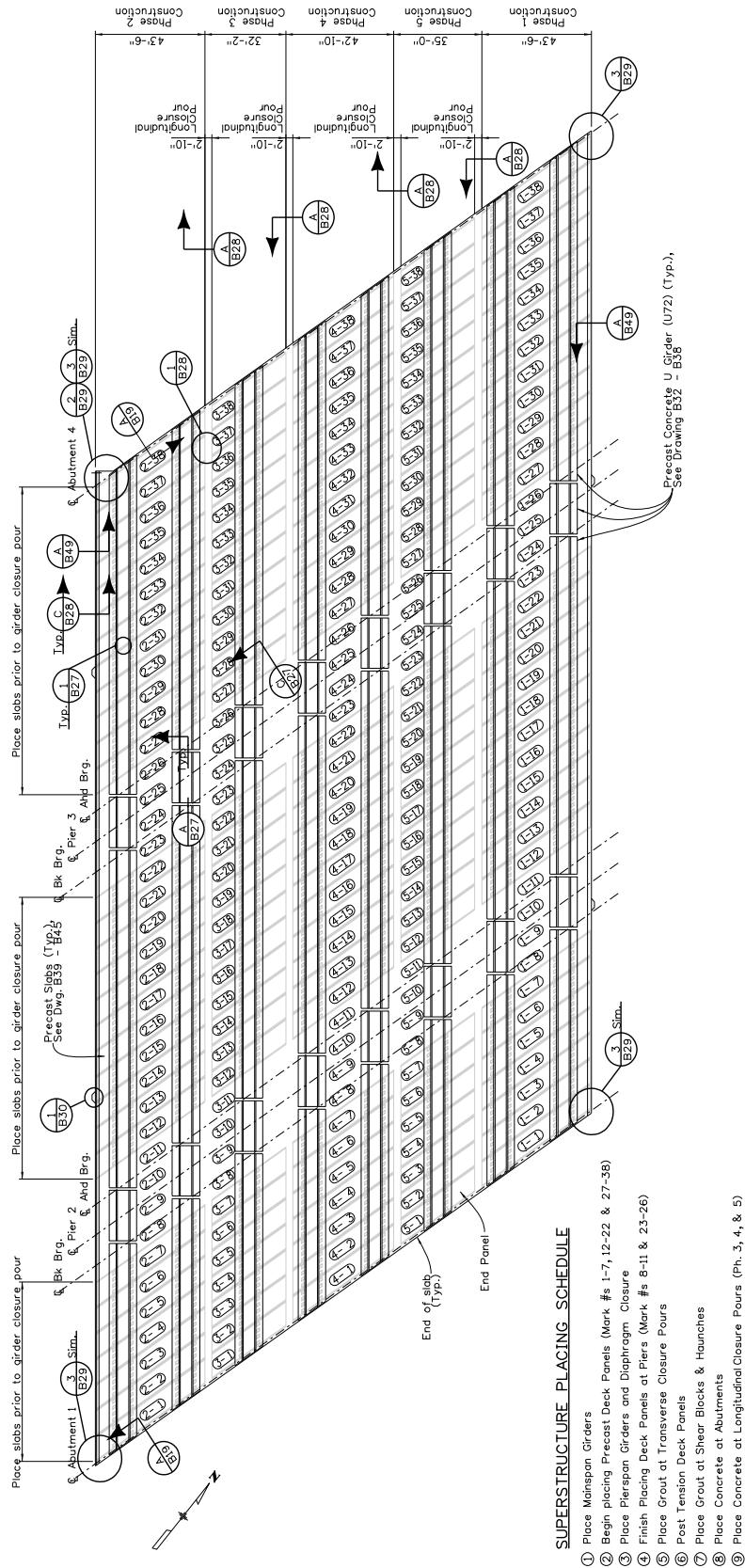


GIRDER SCHEDULE																					
Span No.	Girder No.	L (feet)	W (inch)	D (inch)	θ (Deg.)	T _w (inch)	T _{bm} (inch)	T _{lm} (inch)	T _{be} (inch)	T _{te} (inch)	A _s (Square Inch)	Debonded Strands (percent)	E _c (inch)	F ₁ (KIPS)	F ₂ (KIPS)	f ₁ (PSI)	f ₂ (PSI)	Concrete Strength	Predicted Release Camber (inch)	Predicted Camber (inch)	
1 & 5	All	62.583	72	30	90	6	6	4	6	4	5.21	25	3.25	3.25	1054.6	933.8	6,500	8,500	0.663	1.163	1.163
2-4	All	82.833	72	30	90	6	6	4	6	4	7.38	23.5	3.19	3.19	1494	1292.1	6,500	8,500	1.29	2.23	2.23

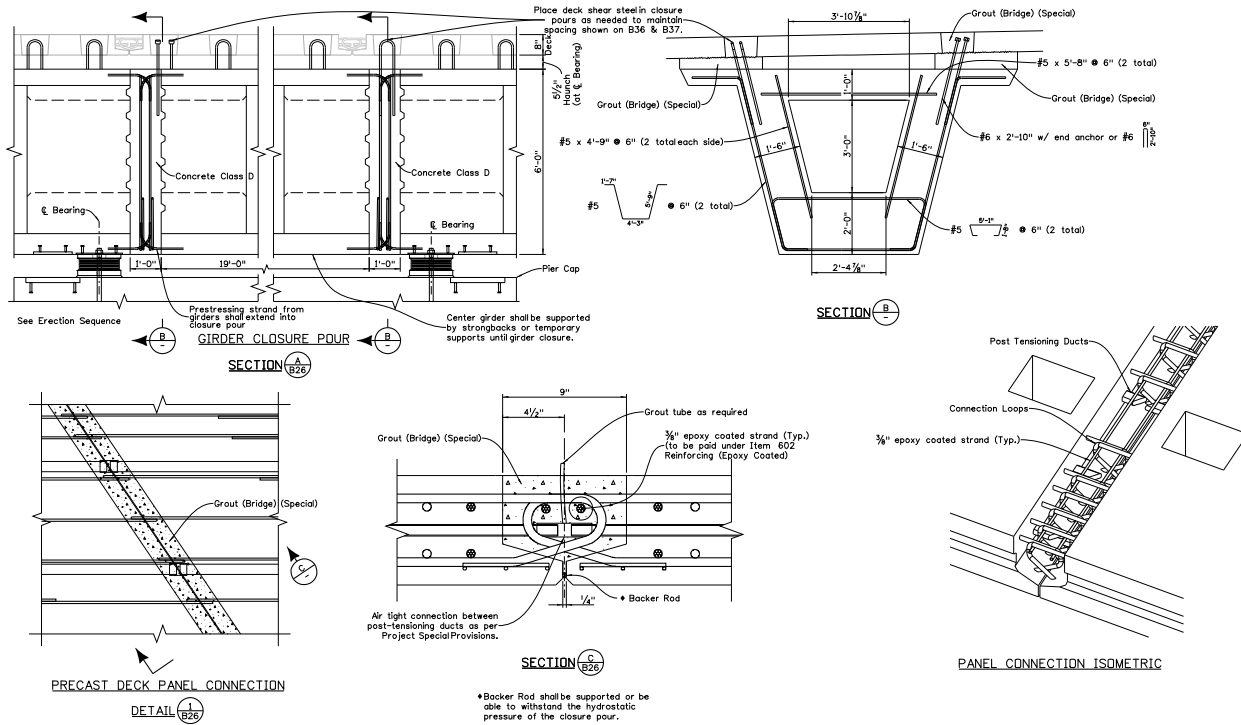
DEBONDING TABLE							
Span No.	Girder No.	Row	Y _c (inches)	Total No. 0.6" Strands	No. Debonded Strands Each		
					2 ft	4 ft	6 ft
1 & 5	All	1	2.25	30	2	4	4
1 & 5	All	1	4.25	18	2	4	4
2-4	All	1	2.25	34	2	4	4
2-4	All	1	4.25	32	2	4	4



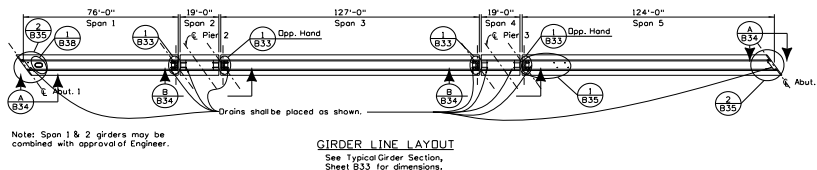
Example 13.3.14



Example 13.3.15 – Precast Prestressed Concrete Deck Details



Example 13.3.16 – Precast Prestressed Deck Details



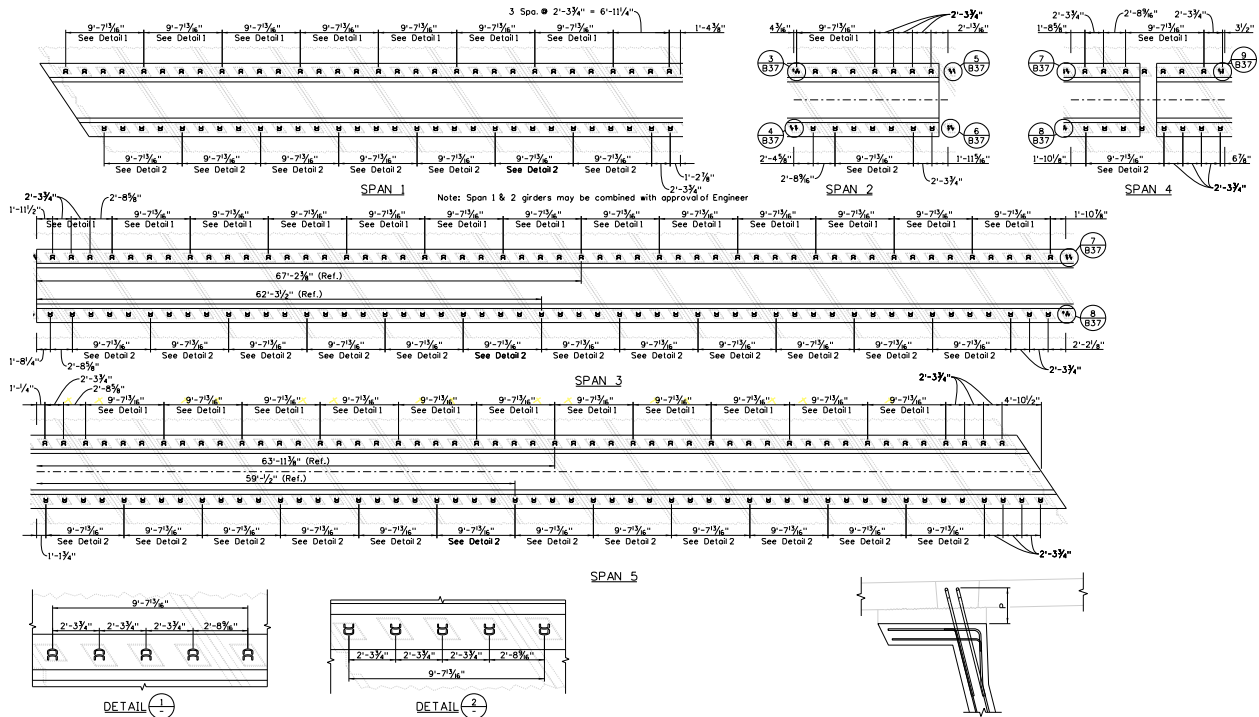
NOTES:
Always necessary to fabricate and install the integral parts of the girder (including the internal diaphragms, if any, and leveling posts), as shown on the plans, shall be included in the bid price for Item No. 616, Precast Concrete U Girder (U22) (Pre-tensioned) with a pay unit of Lin. Ft. measured by the dimension L.
When approved by the Engineer, a minimum of tack welding will be permitted on ASTM A706 uncoated reinforcing steel.
Reinforcing projecting from the top of the girder and reinforcing within eight feet of an expansion device in the bridge deck shall be epoxy coated. Damaged coating on girder reinforcing need not be repaired. The minimum cover for reinforcing steels 1".
At girder ends not embedded in concrete diaphragms, cut strands off 1" below the surface of the concrete and finish with an approved epoxy grout. At girder ends embedded in concrete diaphragms, cut strands to project 3" except as shown. Do not make cosmetic repairs (damage less than 1/2" deep) to the parts of the girders embedded in concrete.
Use low relaxation strands meeting the requirements of ASTM A-416, Grade 270. The minimum clear distance between groups or individual strands shall be 2.5d, but not less than 1 1/4". The minimum cover for prestressing steels 1/2".
A minimum of two harping points shall be used per girder. Harped strands shall be well distributed at the girder ends, starting within 4" of the top of the girder and distributed such that there is no space between strands greater than 1'-0" at the end of the girder. As an alternate the Contractor may place #4 x 10'-0" in the slots of the end of the web parallel to the harped strands such that there is no space greater than 1'-0".
A_p = minimum area of the prestressing steel.
d = nominal strand diameter.
f_u = ultimate strength of the prestressing steel.
F_i = jacking force per girder.
F_e = required concrete strength at release of prestress force.
f_c = required concrete strength at 28 days of age.
L = length of girder along the grade of the girder.
Δ = deflection at centerline of span due to precast slot, diaphragms, asphalt, curbs, ribs, and walls.
P = Projection: 7/8" in the middle 1/3 of the member varying to the specified haunch at the bearing plus 5".
θ = bridge skew angle.
E = strand eccentricity at end of panel.
E* = strand eccentricity at midspan.
Concrete shall be Class PS.
Entrained air is not required for girder concrete.
End diaphragms shall be installed prior to transfer on all girders unless otherwise noted. All permanent diaphragms not embedded in concrete shall be gowned.
Use 1/2" chamfer on all corners, except as noted.
Predicted camber is the camber for the girder alone at 90 days. The Contractor shall limit the camber to a value not to deviate from the predicted camber by more than (0.0005 x L + 0.5") at the time of the deck pour by weighing, scheduling fabrication, post tensioning, changing storage support points, or other means and must report to the Engineer values of camber which exceed the predicted camber plus this tolerance. Remedial measures, as approved by the Engineer, shall be taken if the predicted camber plus the allowed tolerance is exceeded. The approved remedial measures shall be free of any adverse impact. The costs associated with all remedial measures shall be borne by the Contractor.
Dimensional tolerances for precast "U" girders shall be those tolerances specified in MN-116 as shown for I girders with the following exceptions: Flange widths and widths between flanges 3/4" ft width, 3/16" minimum. Variation from specified pan end squareness or skew, 3/16" ft width of each flange or overall width.
When used, debonding shall extend in uniformly varying lengths to 3 ft. before the harping point shown, but not closer than 17 ft. to the center of the span.
All formwork used to form haunches, diaphragms, etc. shall be removed from the girders at the conclusion of work. Removal and cleanup shall be included in the cost of the work.
Final force in girders does not include losses for Elastic Shortening (Transformed Properties).
Span 1 girders exceed the maximum debonding defined in the AASHTO code. This is acceptable per proposed Design Manual changes.

PHASE 1, 2 & 4 GIRDER SCHEDULE - GIRDERS A, B, D, E, G & H																		
Span No.	L (Ft.)	F _w (In.)	D (In.)	θ (Deg.)	T _w (In.)	T _b (In.)	L _H (Ft.)	A _p (In ²)	Debond Strands (percent)	E _i (In.)	E _w (In.)	F _j (KIPS)	F _i (KIPS)	Concrete Strength (PSI)	Δ (In.)	Predicted Release Camber (Inch)	Predicted Camber (Inch)	
1	76	32	72	56/90	7.5	8.1	-	6.51	33.3	3.46	3.46	1318.3	1193.2	6750/9000	0.31	0.47	0.83	0.0
2	19	32	72	90	7.5	8.1	-	2.604	0	33.88	33.88	527.3	489.4	6750/9000	0.01	0.0	0.0	0.0
3	127	32	72	90	7.5	8.1	19.1	16.492	2.6	14.82	4.64	3339.6	2819.0	6750/9000	2.27	2.71	4.78	2.71
4	19	32	72	90	7.5	8.1	-	2.604	0	33.88	33.88	527.3	489.4	6750/9000	0.01	0.0	0.0	0.0
5	124	32	72	90/56	7.5	8.1	18.6	16.492	2.6	14.82	4.64	3339.6	2825.9	6750/9000	2.13	2.81	4.98	2.81

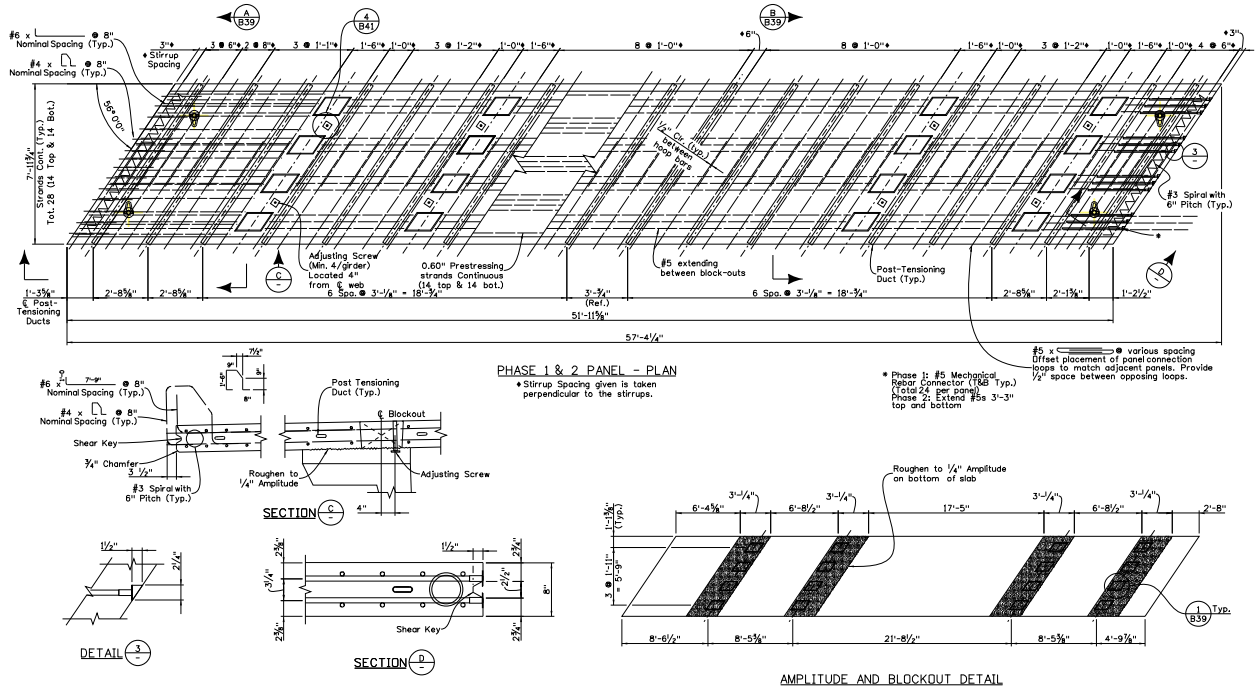
PHASE 3 & 5 GIRDER SCHEDULE - GIRDERS C & F																		
Span No.	L (Ft.)	F _w (In.)	D (In.)	θ (Deg.)	T _w (In.)	T _b (In.)	L _H (Ft.)	A _p (In ²)	Debond Strands (percent)	E _i (In.)	E _w (In.)	F _j (KIPS)	F _i (KIPS)	Concrete Strength (PSI)	Δ (In.)	Predicted Release Camber (Inch)	Predicted Camber (Inch)	
1	76	32	72	56/90	7.5	8.1	-	6.51	33.3	3.46	3.46	1318.3	1197.6	6750/9000	0.37	0.47	0.83	0.0
2	19	32	72	90	7.5	8.1	-	2.604	0	33.88	33.88	527.3	489.4	6750/9000	0.01	0.0	0.0	0.0
3	127	32	72	90	7.5	8.1	19.1	18.662	14.0	13.76	4.79	3779.1	3132.4	6750/9000	2.71	3.16	5.61	3.16
4	19	32	72	90	7.5	8.1	-	2.604	0	33.88	33.88	527.3	489.4	6750/9000	0.01	0.0	0.0	0.0
5	124	32	72	90/56	7.5	8.1	18.6	18.228	20.2	12.74	4.56	3691.2	3081.8	6750/9000	2.55	3.06	5.43	3.06

- * In the bottom row, debond 2 strands for 10 feet, 2 strands for 11 feet, 2 strands for 12 feet and 2 strands for 14 feet. In the second row from bottom, debond 2 strands for 10 feet.
- ⊕ In the bottom row, debond 3 strands for 8 feet. In the third row from bottom, debond 3 strands for 16 feet, 4 strands for 24 feet and 2 strands for 32 feet.
- ⊙ Debonded strands shall be in area required by access hatch. See Section A on B38.
- ▲ In the bottom row, debond 6 strands for 8 feet. In the third row from bottom, debond 5 strands for 16 feet, 4 strands for 24 feet.
- * In the third row from bottom, debond 2 strands for 8 feet.

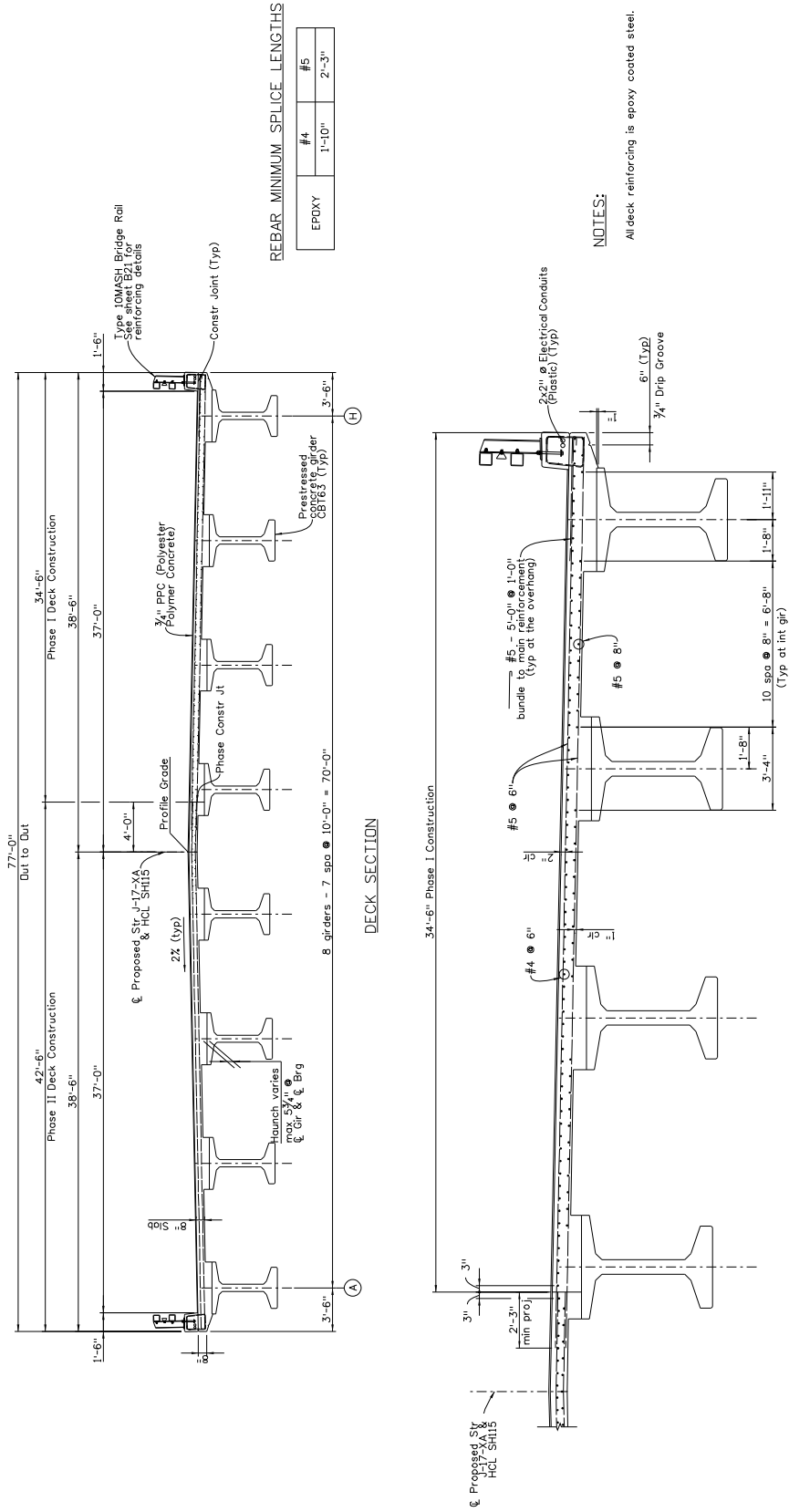
Example 13.3.17 – Prestressed Concrete Girder Details



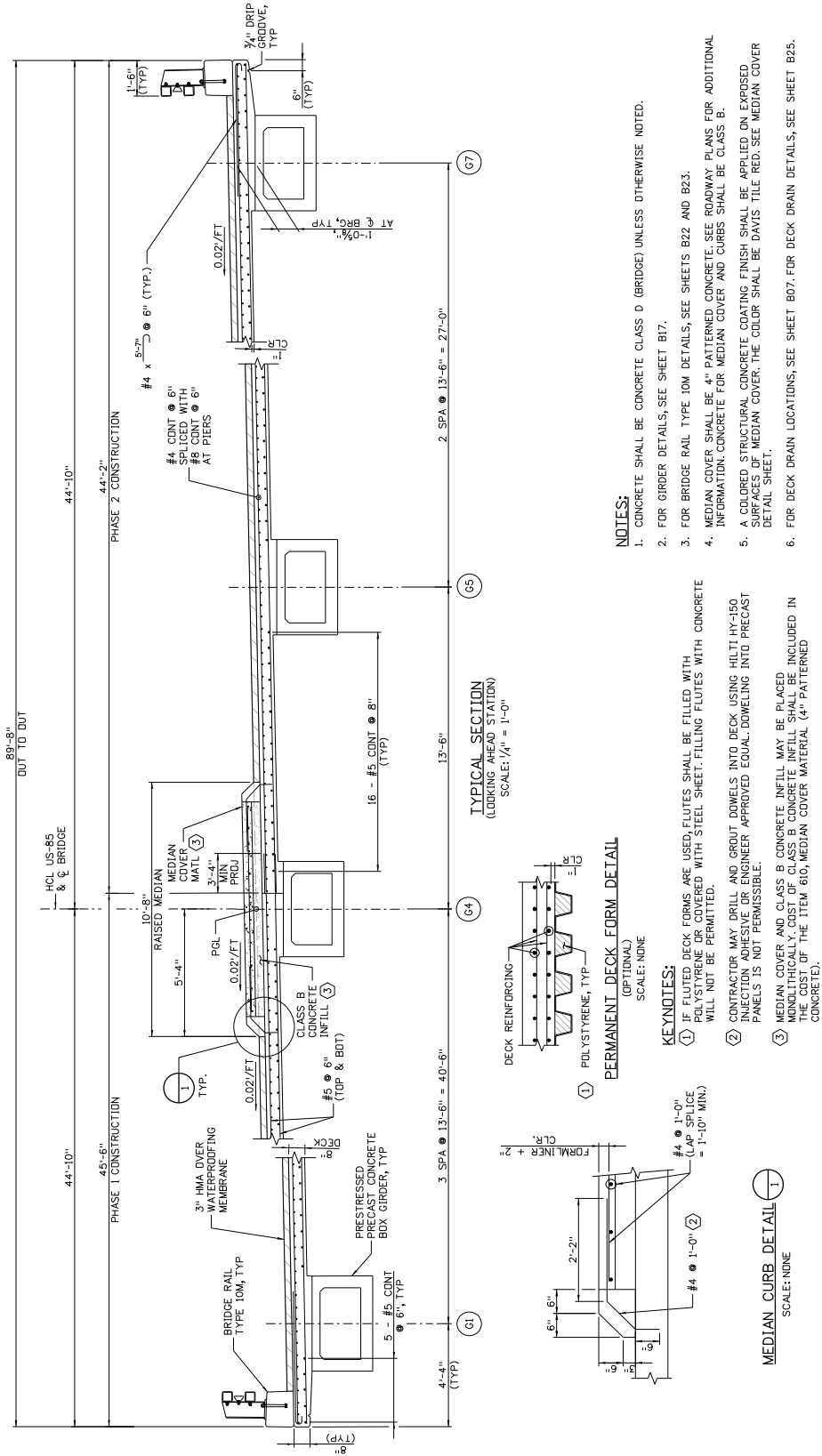
Example 13.3.18 – Prestressed Concrete Girder Details



Example 13.3.19 – Prestressed Concrete Details



Example 13.3.20 – Prestressed Concrete CBT Girder



- NOTES:**
1. CONCRETE SHALL BE CONCRETE CLASS D (BRIDGE) UNLESS OTHERWISE NOTED.
 2. FOR GIRDER DETAILS, SEE SHEET B17.
 3. FOR BRIDGE RAIL TYPE 10M DETAILS, SEE SHEETS B22 AND B23.
 4. MEDIAN COVER SHALL BE 4" PATTERNED CONCRETE; SEE ROADWAY PLANS FOR ADDITIONAL INFORMATION. CONCRETE FOR MEDIAN COVER AND CURBS SHALL BE CLASS B.
 5. A COLORED STRUCTURAL CONCRETE COATING FINISH SHALL BE APPLIED ON EXPOSED SURFACES OF MEDIAN COVER. THE COLOR SHALL BE DAVIS TILE RED. SEE MEDIAN COVER DETAIL SHEET.
 6. FOR DECK DRAIN LOCATIONS, SEE SHEET B07. FOR DECK DRAIN DETAILS, SEE SHEET B25.

- KEYNOTES:**
- ① IF FLUTED DECK FORMS ARE USED, FLUTES SHALL BE FILLED WITH POLYSTYRENE OR COVERED WITH STEEL SHEET. FILLING FLUTES WITH CONCRETE WILL NOT BE PERMITTED.
 - ② CONTRACTOR MAY DRILL AND GROUT DOWELS INTO DECK USING HILTI HY-150 INJECTION ADHESIVE OR ENGINEER APPROVED EQUAL. DOWELING INTO PRECAST PANELS IS NOT PERMISSIBLE.
 - ③ MEDIAN COVER AND CLASS B CONCRETE INFILL MAY BE PLACED IN THE COST OF THE ITEM 610, MEDIAN COVER MATERIAL (4" PATTERNED CONCRETE).

Example 13.3.21 – Prestressed Concrete Box Girder