

COLORADO DEPARTMENT OF TRANSPORTATION STAFF BRIDGE BRIDGE DETAIL MANUAL	Chapter: 13.3 Effective: May 31, 2023 Supersedes: March 15, 2021
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

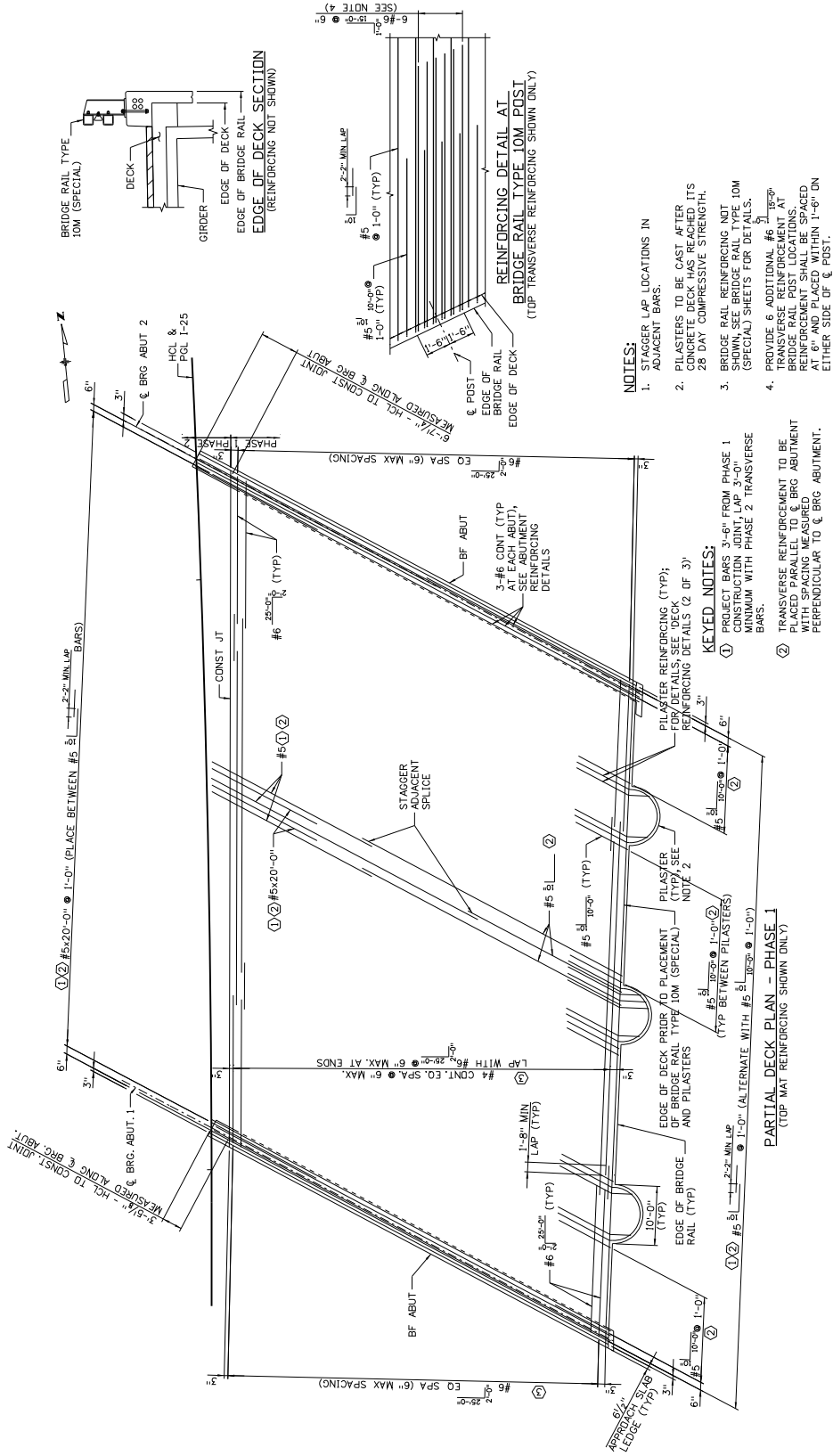
### 13.3.12 TITLE BLOCK

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.

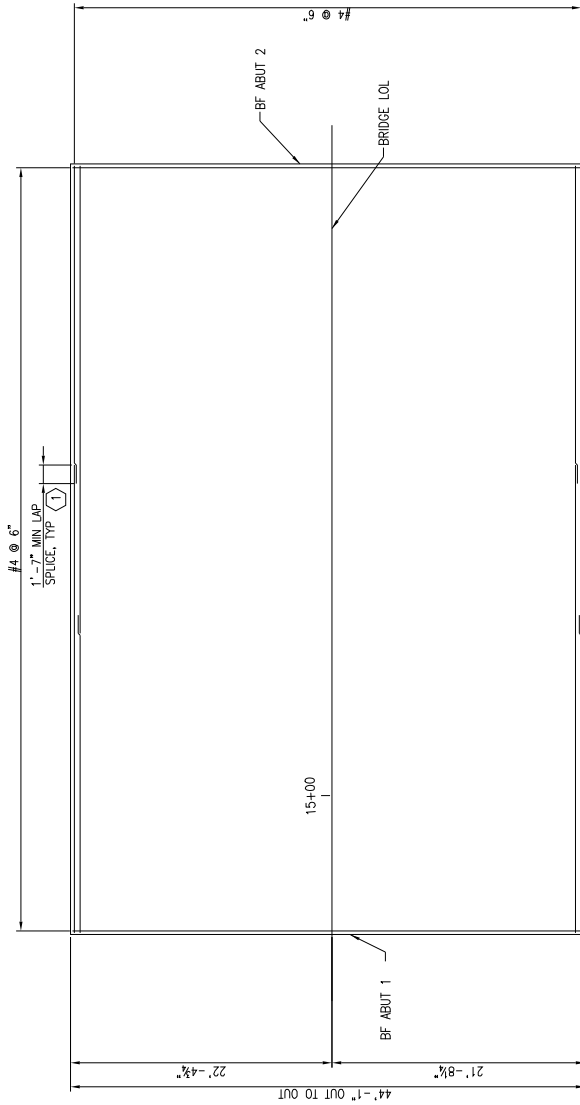


EXAMPLE 13.3.1 –Deck Plan



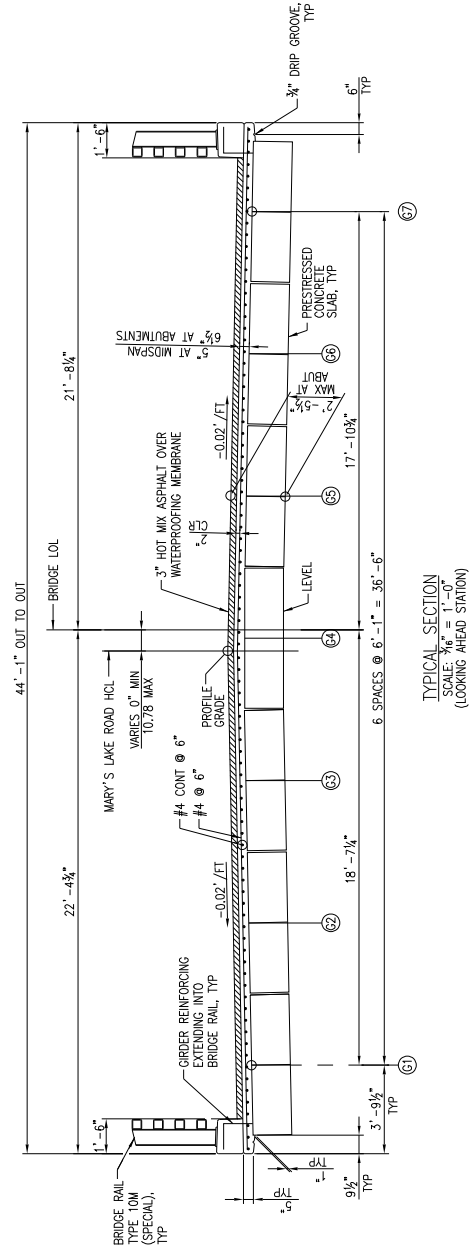






**DECK REINFORCING PLAN**

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



**KEYED NOTES**

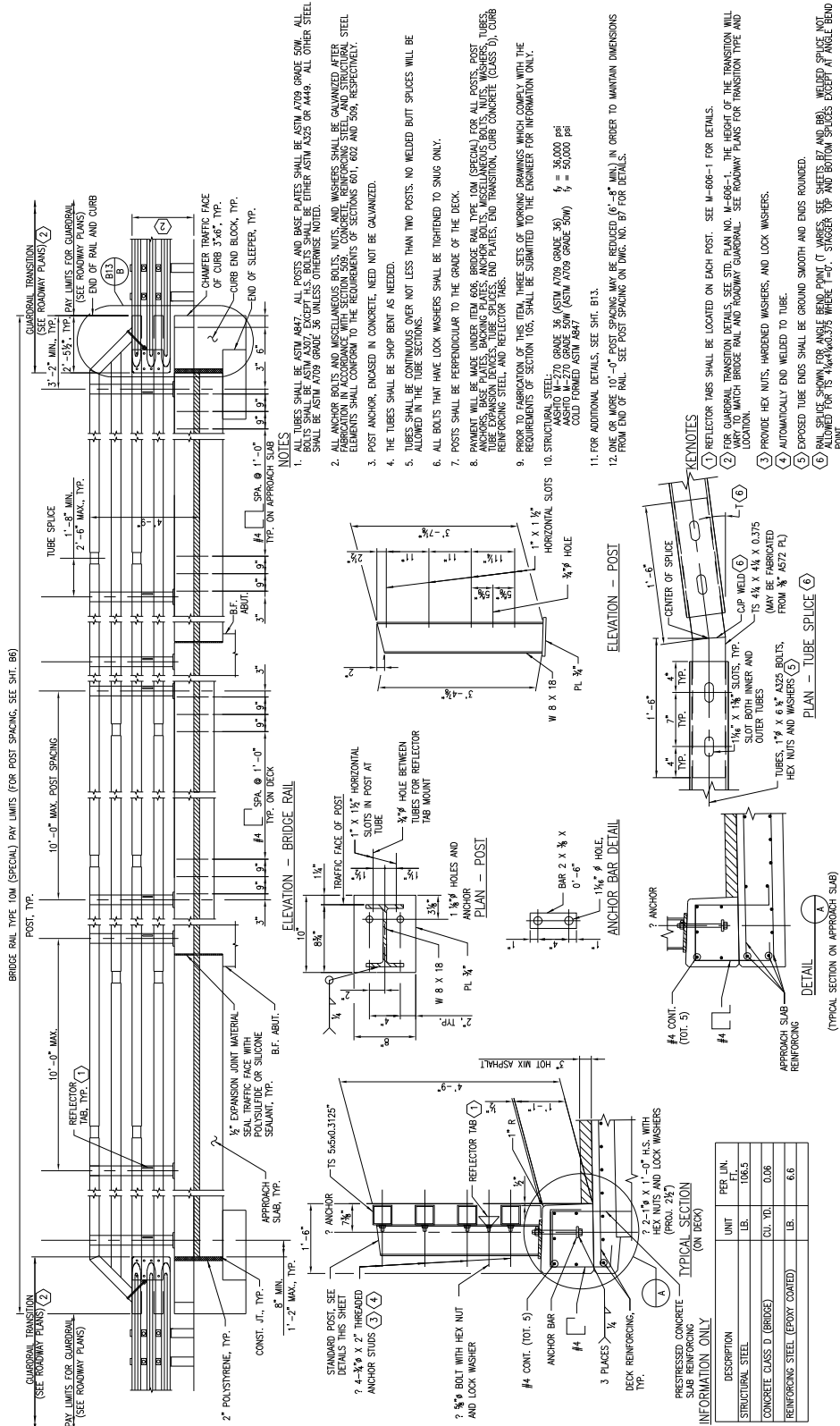
① STAGGER SPICES AS SHOWN.

**NOTES**

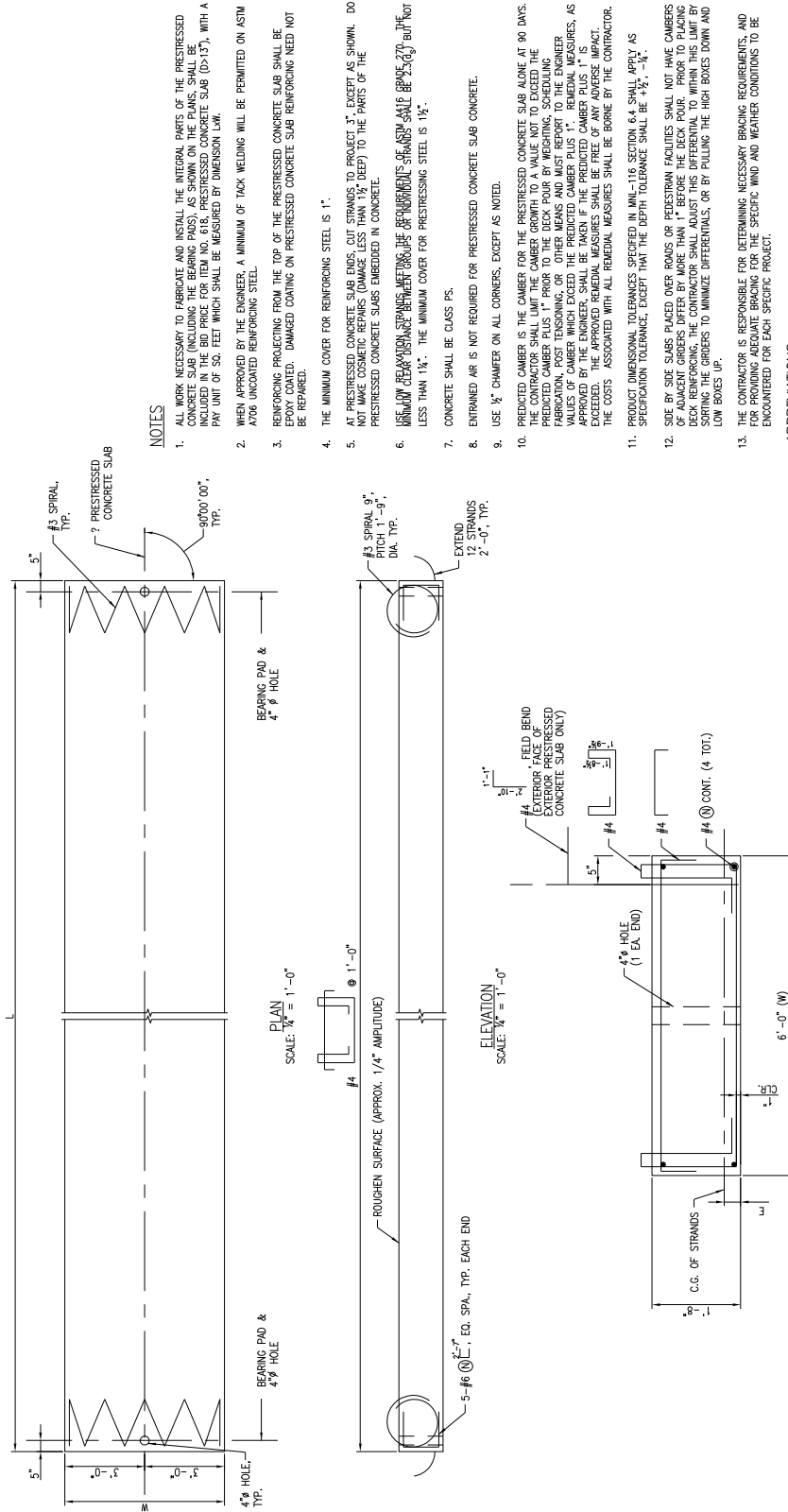
1. CONCRETE SHALL BE CONCRETE CLASS S40.
2. FOR BRIDGE RAIL DETAILS, SEE DWGS B12 AND B13.

**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 IN ACCORDANCE WITH THE PRESTRESSED CONCRETE SLAB (D-137), WITH A PAY UNIT OF 50 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 1/2" 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(C<sub>s</sub>) BUT NOT LESS THAN 1 1/4". THE MINIMUM COVER FOR PRESTRESSING STEEL IS 1 1/2".
7. CONCRETE SHALL BE CLASS FS.
8. ENTRAINED AIR IS NOT REQUIRED FOR PRESTRESSED CONCRETE SLAB CONCRETE.
9. USE 1/2" CAMBER 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. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE CAMBER GROWTH MEASUREMENTS, AS APPROVED BY THE ENGINEER, SHALL BE TAKEN AT THE PREDICTED CAMBER PLUS 1" AS SHOWN. 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 SPECIFIED IN TABLE 13.3 SECTION 8.6 SHALL APPLY AS SPECIFICATION TOLERANCE, EXCEPT THAT THE DEPTH TOLERANCE SHALL BE 1/4", 1/4", 1/4".
12. SIDE BY SIDE SLABS PLACED OVER ROADS OR PEDESTRIAN FACILITIES SHALL NOT HAVE CAMBERS OF ADJACENT GRIDDERS 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 GRINDING OR GRADING TO MINIMIZE DIFFERENTIALS, OR BY PULLING THE HIGH BORDS DOWN AND LOW BORDS 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**

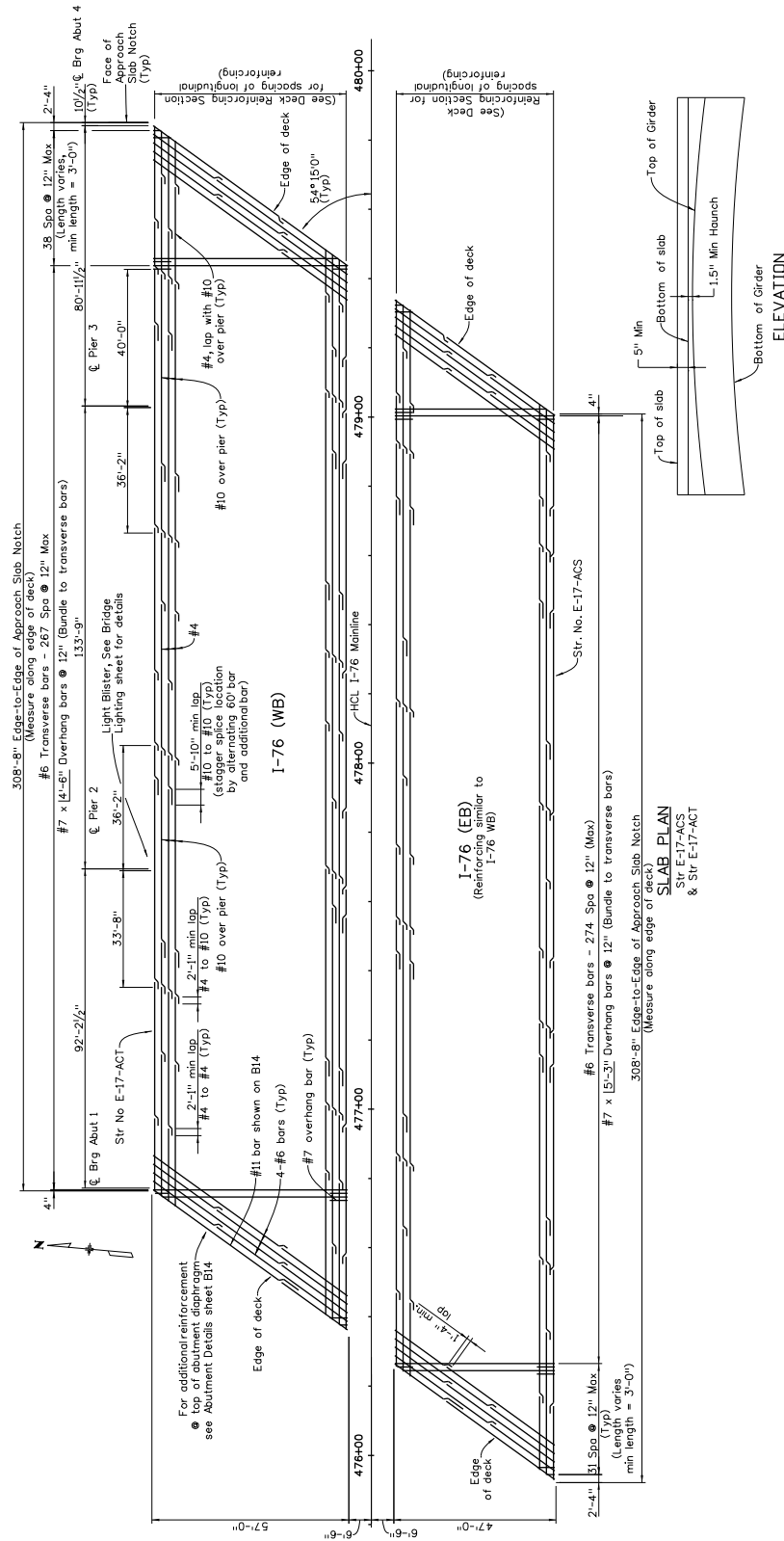
- A<sub>s</sub> = MINIMUM AREA OF THE PRESTRESSING STEEL
- d<sub>s</sub> = NOMINAL STRAND DIAMETER
- F<sub>i</sub> = JACKING FORCE PER PRESTRESSED CONCRETE SLAB
- F<sub>f</sub> = FINAL FORCE PER PRESTRESSED CONCRETE SLAB AFTER ALL LOSSES
- f<sub>pe</sub> = REQUIRED CONCRETE STRENGTH AT RELEASE OF PRESTRESS FORCE
- f<sub>cr</sub> = REQUIRED CONCRETE STRENGTH AT 28 DAYS OF AGE
- L = LENGTH OF PRESTRESSED CONCRETE SLAB ALONG THE GRADE OF THE BRIDGE
- W = WIDTH OF THE PRESTRESSED CONCRETE SLAB
- Δ = DEFLECTION AT CENTERLINE OF SPAN DUE TO CAST-IN-PLACE SLAB, DAMPHRAGMS, ASPHALT, CURBS, AND RAILS

**PRESTRESSED CONCRETE SLAB SCHEDULE**

GRIDER NO.	L (FEET)	A <sub>s</sub> SQUARE (INCH)	E (INCH)	F <sub>i</sub> (KIPS)	F <sub>f</sub> (KIPS)	CONCRETE STRENGTH		PREDICTED CAMBER (INCH)	DEBOND STRANDS (%)
						f <sub>pe</sub> (KSI)	f <sub>cr</sub> (KSI)		
⑥ TO ⑥	64.50	10.416	3.92	2109	1796	5.70	6.50	0.90	2.38
									25

**EXAMPLE 13.3.7 – Prestressed Concrete Slab**





**NOTES:**

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

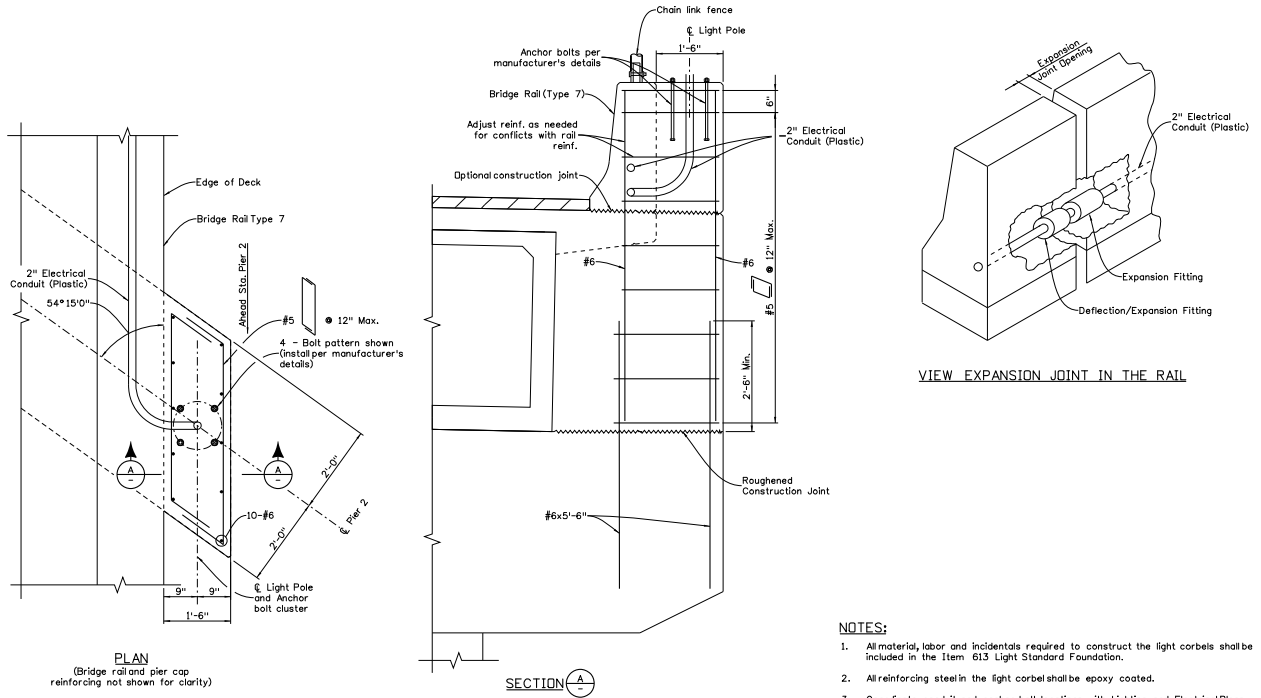
**GIRDER CAMBER/DEFLECTIONS**

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 Tolerances.

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.

**EXAMPLE 13.3.9 – Prestressed Concrete Box and Deck Reinforcing**



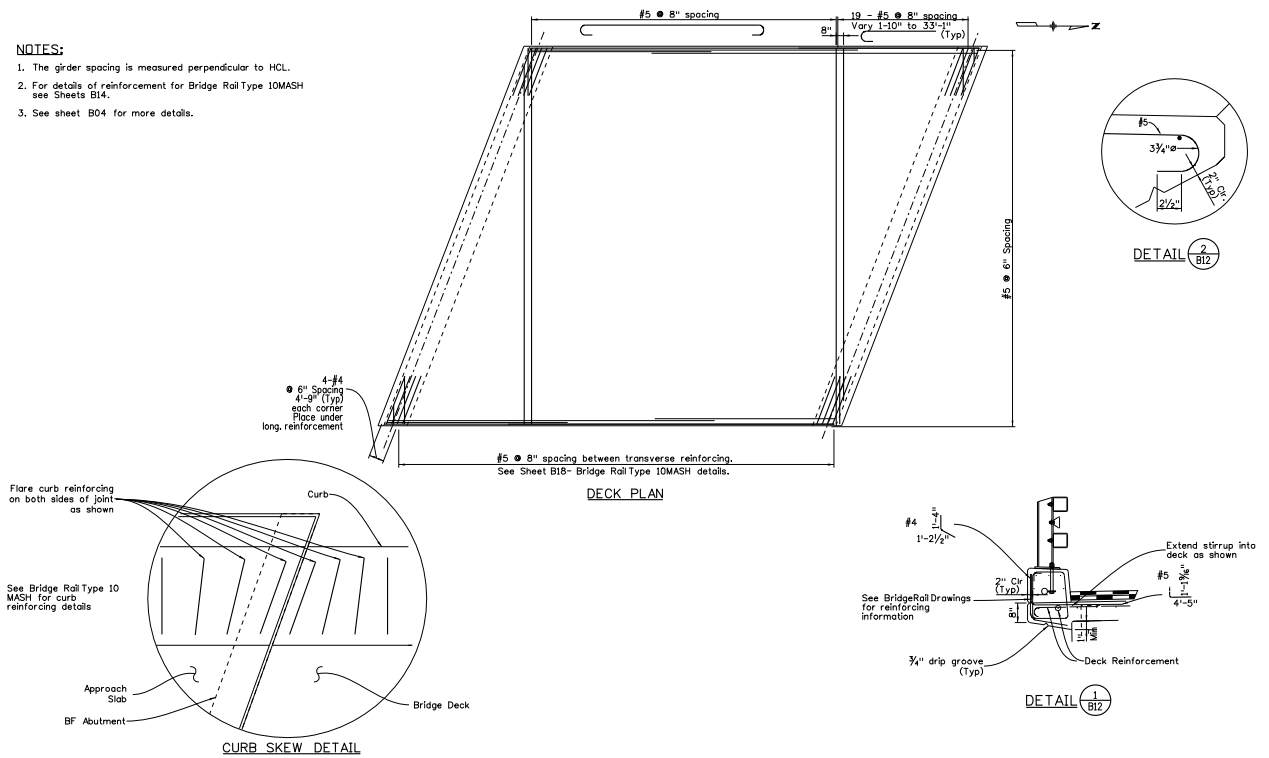


- NOTES:**
1. All material, labor and incidentals required to construct the light corbels shall be included in the Item 613 Standard Foundation.
  2. All reinforcing steel in the light corbel shall be epoxy coated.
  3. Coordinate conduit and anchor bolt locations with Lighting and Electrical Plans.

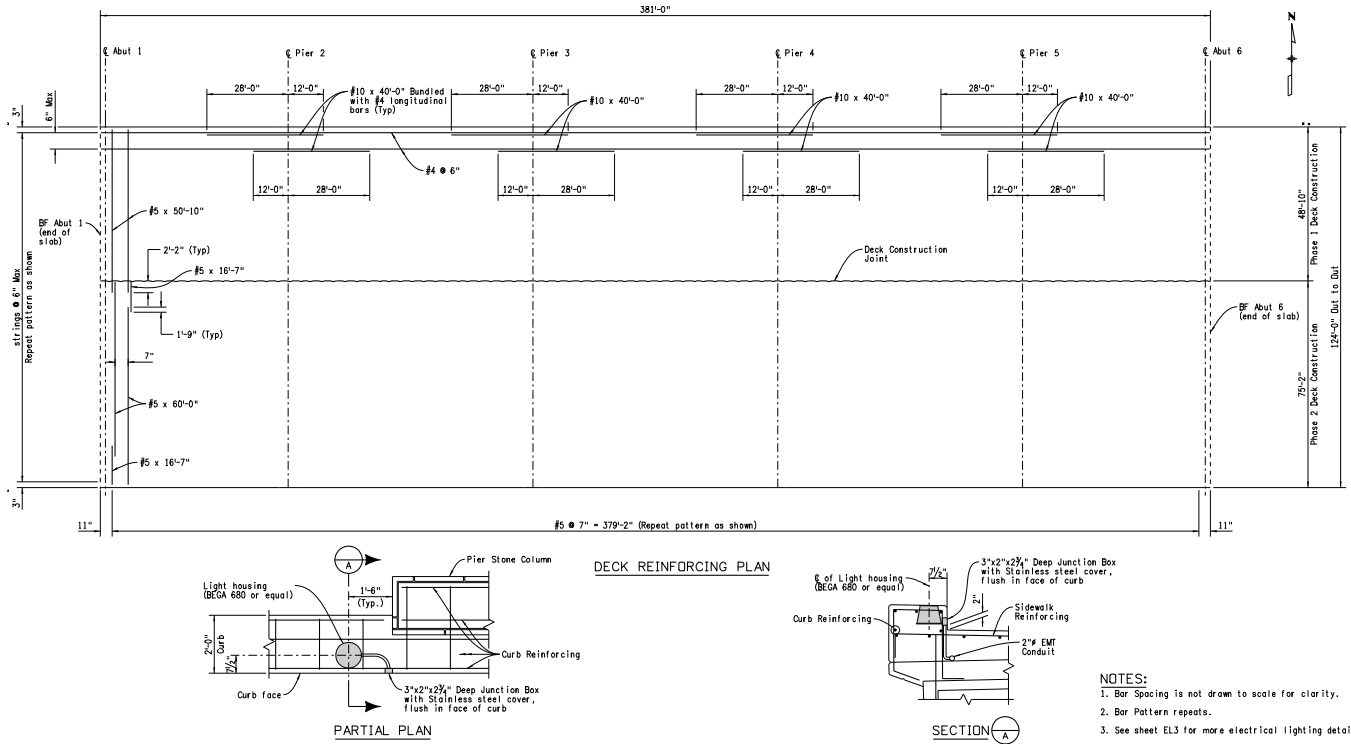
**EXAMPLE 13.3.11**

**NOTES:**

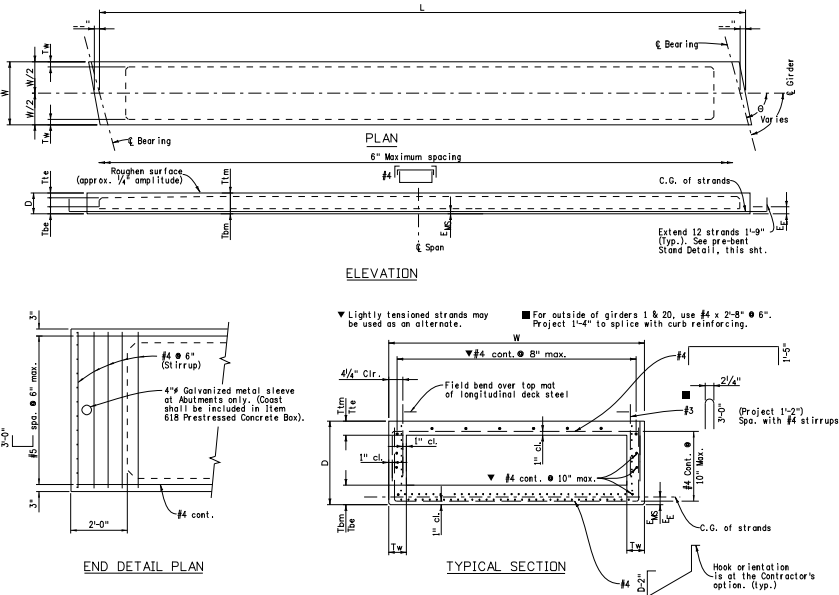
1. The girder spacing is measured perpendicular to HCL.
2. For details of reinforcement for Bridge Rail Type 10MASH see Sheets B14.
3. See sheet B04 for more details.



**EXAMPLE 13.3.12**

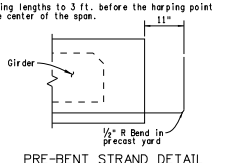


EXAMPLE 13.3.13

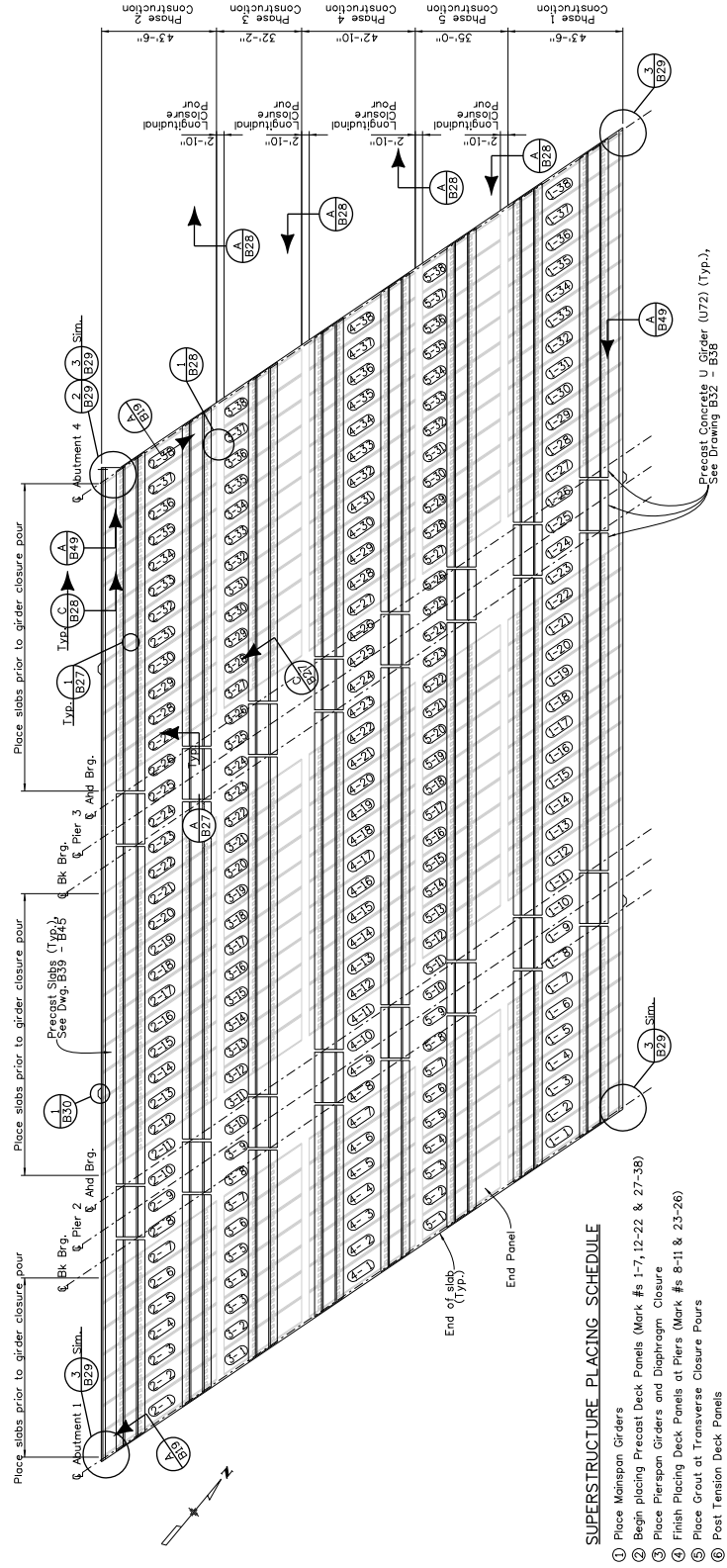


GIRDER SCHEDULE													
Span No.	Girder No.	L (Feet)	W (Inch)	D (Inch)	Θ (Deg.)	T <sub>1</sub> (Inch)	T <sub>2</sub> (Inch)	T <sub>3</sub> (Inch)	T <sub>4</sub> (Inch)	A <sub>n</sub> <sup>2</sup> (Square Inch)	Debonded Strands (percent)	E <sub>g</sub> (Inch)	F <sub>1</sub> (KIPS)
1 & 5	All	62.583	72	30	90	6	6	4	6	5.21	25	3.25	3.25
2 - 4	All	82.833	72	30	90	6	6	4	6	7.38	23.5	3.19	3.19
													1494
													1292.1
													6,500
													8,500
													0.663
													1.163
													1.29
													2.23

DEBONDING TABLE							
Span No.	Girder No.	Row	y (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



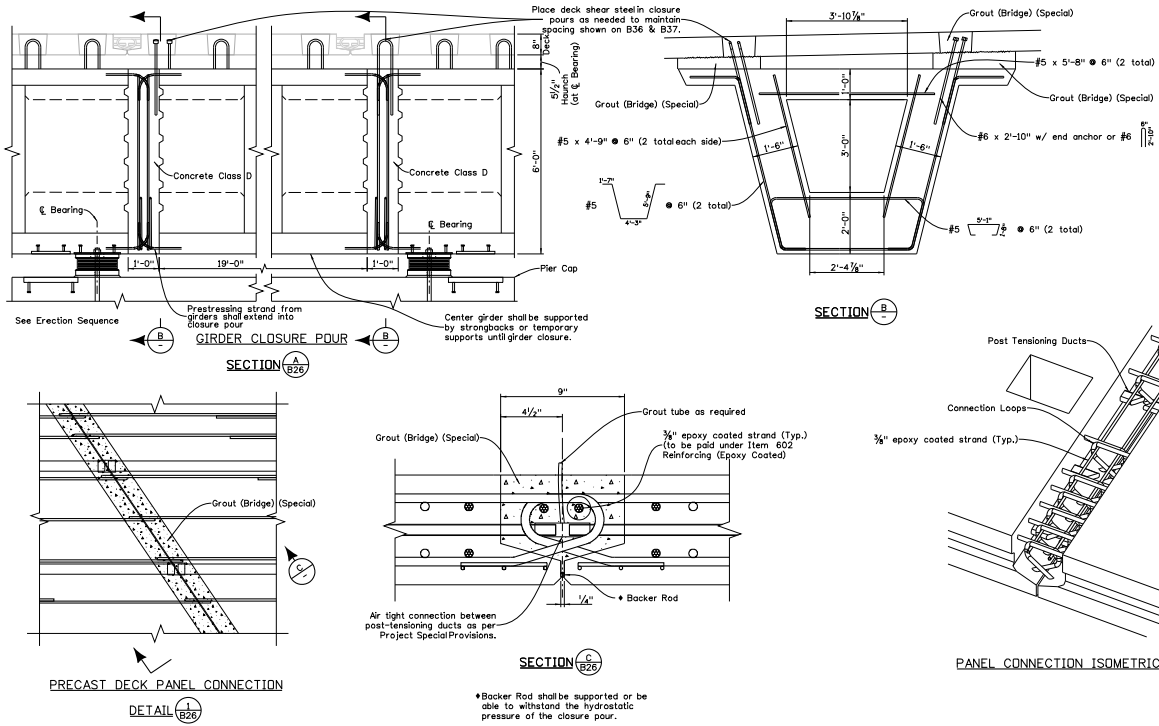
EXAMPLE 13.3.14



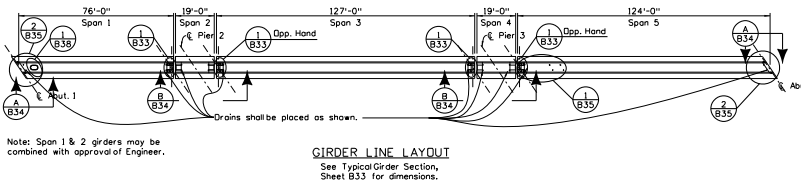
- SUPERSTRUCTURE PLACING SCHEDULE**
- 1 Place Mainspan Girders
  - 2 Begin placing Precast Deck Panels (Mark #s 1-7, 12-22 & 27-38)
  - 3 Place Pierspan Girders and Diaphragm Closure
  - 4 Finish Placing Deck Panels at Piers (Mark #s 8-11 & 23-26)
  - 5 Place Grout at Transverse Closure Pours
  - 6 Post Tension Deck Panels
  - 7 Place Grout at Shear Blocks & Haunches
  - 8 Place Concrete at Abutments
  - 9 Place Concrete at Longitudinal Closure Pours (Ph. 3, 4, & 5)

**EXAMPLE 13.3.15 – Precast Prestressed Concrete Deck Details**





**EXAMPLE 13.3.16 – Precast Prestressed Deck Details**



**NOTES:**

- All work necessary to fabricate and install the integral parts of the girder (including the interdiaphragms, if any, and leveling pods, as shown on the plans) shall be included in the bid price for Item No. 618, Precast Concrete U Girder (U2) (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 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 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 2.3(d) but not less than 1 1/4". The minimum cover for prestressing steels is 1 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 sides of the end of the web parallel to the harped strands such that there is no space greater than 1'-0".

**PHASE 1, 2 & 4 GIRDER SCHEDULE - GIRDERS A, B, D, E, G & H**

Span No.	L (Ft.)	F <sub>w</sub> (In.)	D (In.)	θ (Deg.)	T <sub>w</sub> (In.)	T <sub>b</sub> (In.)	L <sub>b</sub> (Ft.)	A <sub>s</sub> (In <sup>2</sup> )	Debond Strands (percent)	E <sub>s</sub> (In.)	E <sub>w</sub> (In.)	F <sub>i</sub> (KIPS)	F <sub>u</sub> (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	8750/9000	0.31	0.47	0.83
2	19	32	72	90	7.5	8.1	-	2.604	0	33.88	33.88	527.3	489.4	8750/9000	0.01	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	8750/9000	2.27	2.71	4.78
4	19	32	72	90	7.5	8.1	-	2.604	0	33.88	33.88	527.3	489.4	8750/9000	0.01	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	8750/9000	2.13	2.81	4.98

**PHASE 3 & 5 GIRDER SCHEDULE - GIRDERS C & F**

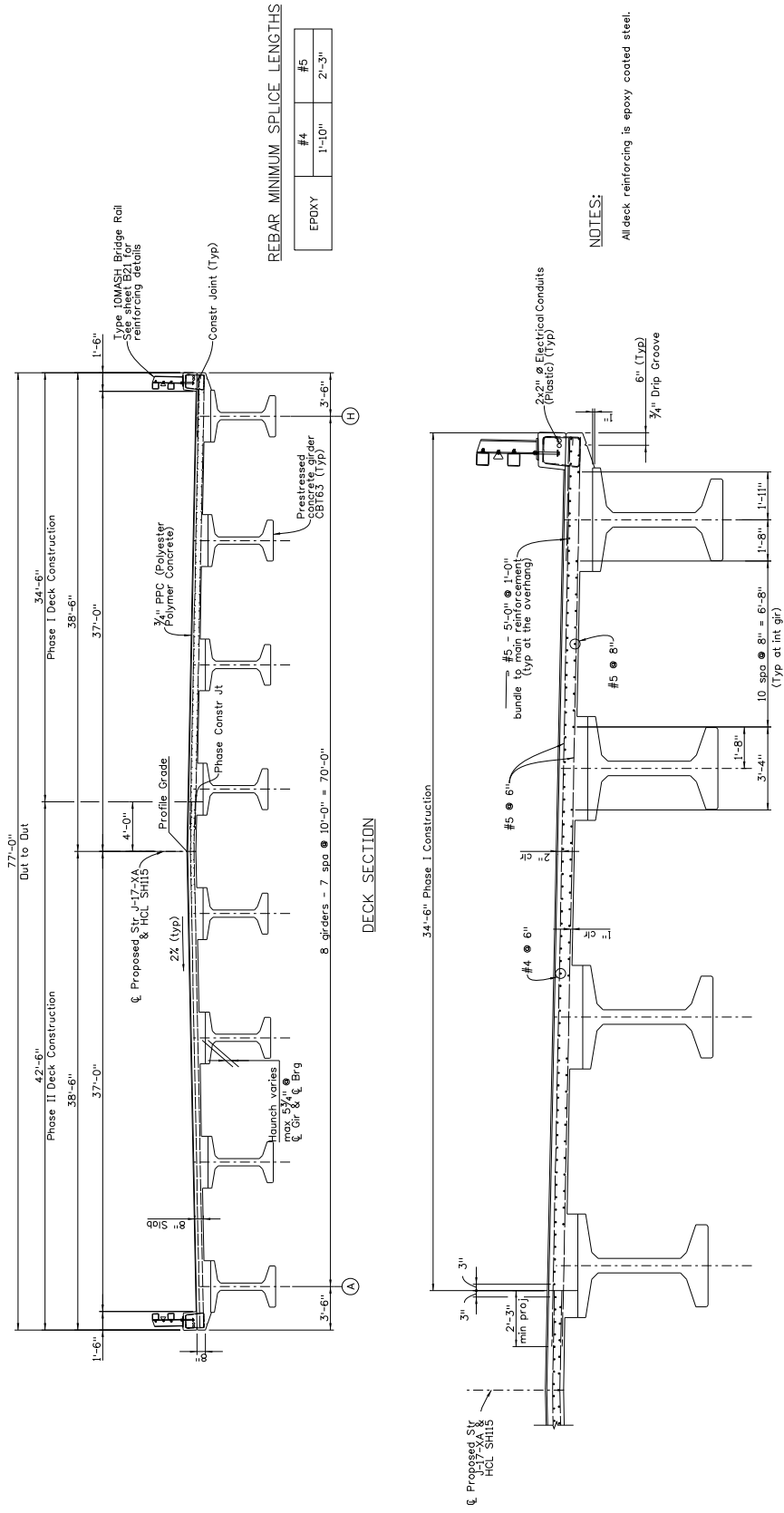
Span No.	L (Ft.)	F <sub>w</sub> (In.)	D (In.)	θ (Deg.)	T <sub>w</sub> (In.)	T <sub>b</sub> (In.)	L <sub>b</sub> (Ft.)	A <sub>s</sub> (In <sup>2</sup> )	Debond Strands (percent)	E <sub>s</sub> (In.)	E <sub>w</sub> (In.)	F <sub>i</sub> (KIPS)	F <sub>u</sub> (KIPS)	Concrete Strength (PSI)	Δ (In.)	Predicted 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	8750/9000	0.37	0.47	0.83
2	19	32	72	90	7.5	8.1	-	2.604	0	33.88	33.88	527.3	489.4	8750/9000	0.01	0.0	0.0
3	127	32	72	90	7.5	8.1	19.1	16.662	14.0	13.78	4.79	3779.1	3132.4	8750/9000	2.71	3.16	5.61
4	19	32	72	90	7.5	8.1	-	2.604	0	33.88	33.88	527.3	489.4	8750/9000	0.01	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	8750/9000	2.55	3.06	5.43

- \* 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.
- ① Debonded strands shall be in area required by access hatch. See Section A on B38.
- \* In the third row from bottom, debond 2 strands for 8 feet.

- ✦ In the bottom row, debond 3 strands for 8 feet. In the third row from bottom, debond 3 strands for 16 feet. In the third row from bottom, debond 5 strands for 16 feet, 4 strands for 24 feet.
- ▲ In the bottom row, debond 6 strands for 8 feet, 1 strand for 16 feet. In the third row from bottom, debond 5 strands for 16 feet, 4 strands for 24 feet.

**EXAMPLE 13.3.17 – Prestressed Concrete Girder Details**





REBAR MINIMUM SPLICE LENGTHS

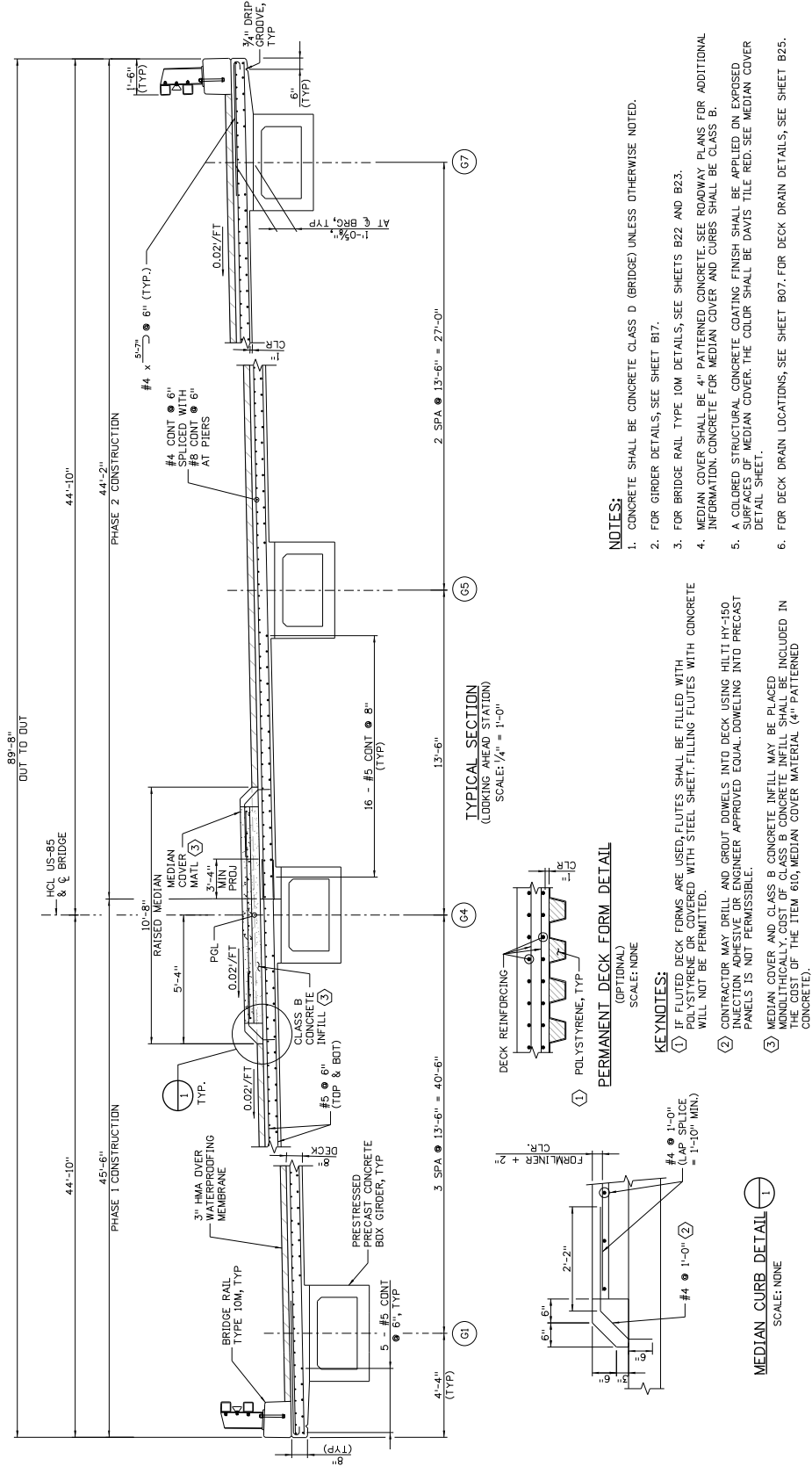
EPOXY	#4	#5
	1'-10"	2'-3"

NOTES:

All deck reinforcing is epoxy coated steel.

EXAMPLE 13.20 – Prestressed Concrete CBT Girder

DECK REINFORCING DETAIL



EXAMPLE 13.3.21 – Prestressed Concrete Box Girder