PCI Gulf South
A Chapter of the Precast/Prestressed Concrete Institute

Precast/Prestressed Concrete Deck Panels

Accelerated Bridge Construction

David Tomley, P.E. (GCP/TCP-Chief Engineer)

TCP TEXAS CONCRETE PARTNERS

GCP GULF COAST PRE-STRESS PARTNERS

Precast/Prestressed Deck Panels

- TxDOT’s use of precast/prestressed deck panels
- Fabrication
- MDOT project 101838/301000 STBG-0064-00(020)
  - SR149 bridge at STA. 71+64.90 over Sellers Creek-No. 128.2
  - SR149 bridge at STA. 09+91.00 over Strong River-No. 128.6

Brian Merrill, P.E. (TxDOT) provided a presentation in 2002 at the Concrete Bridge Conference on TxDOT's use of precast concrete forms

TEXAS' USE OF PRECAST CONCRETE STAY-IN-PLACE FORMS FOR BRIDGE DECKS

Brian D. Merrill, P.E. Texas Department of Transportation

ABSTRACT

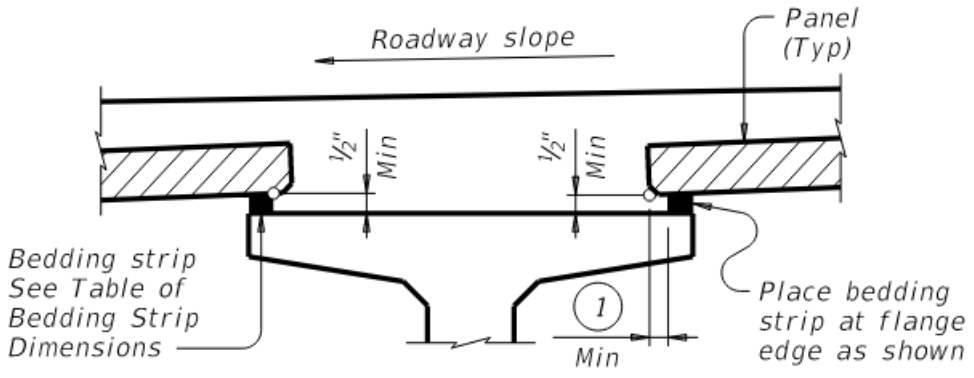
In 1963, TxDOT developed a bridge deck construction method that allows approximately half of the deck to be precast. Precast, prestressed concrete panels span concrete or steel girders, supporting the weight of the cast-in-place top half of the deck. This method generated little interest until the early 1980's; however, standard details and specifications have greatly increased its use, and today, approximately 85% of all bridges built in Texas use this forming method. The method speeds up bridge deck construction while lowering costs and improving safety during construction. This paper addresses the following aspects of the use of this method: design, fabrication, construction, research, advantages and limitations on its use.

TxDOT's use of precast/prestressed deck panels

- Revised bid item & specs in 1983 from CY to SF to allow contractor's the option for either
  - Removable forms
  - SIP metal deck forms
  - Precast prestressed concrete panels
- TxDOT's Bridge Division unified requirements & standard details for PCP across TX in response to construction requirements, research, and materials
- Bridge decks have been constructed in virtually every area of TX including areas where high concentrations of deicing chemicals are applied to bridge decks

TxDOT's use of precast/prestressed deck panels (how the system works)

- PCP used in between interior girders, conventional forming of overhangs
- Option to form the ends of the span (4-5 ft) using conventional forming for thickened end slab details, skews, or variable width girder spacings
- Deck thickness 8" or 8.5" with panel thickness of 4" leaving 4" or 4.5" of CIP concrete with 1-layer or reinforcing
- Support requirements
  - Panels placed on bedding strips with min. thickness = 0.50"
  - 2" overhang from edge of panel to face of bedding strip

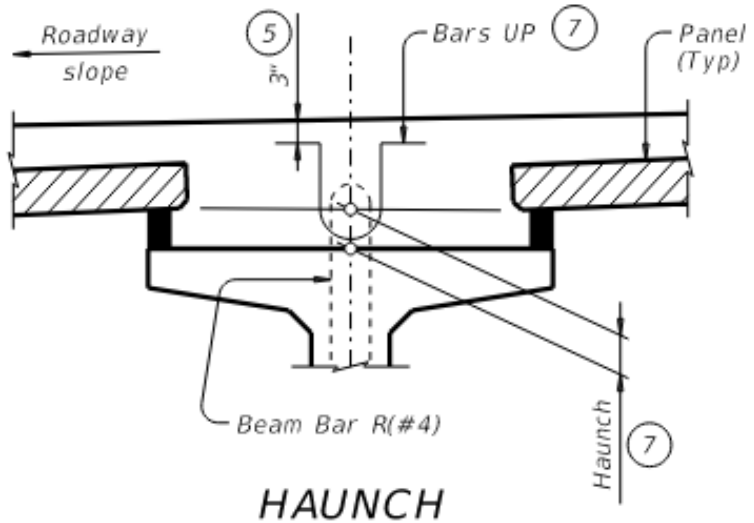


NORMAL GRADING DETAIL (3)

Showing prestressed concrete I-girders. (Other beam types similar)

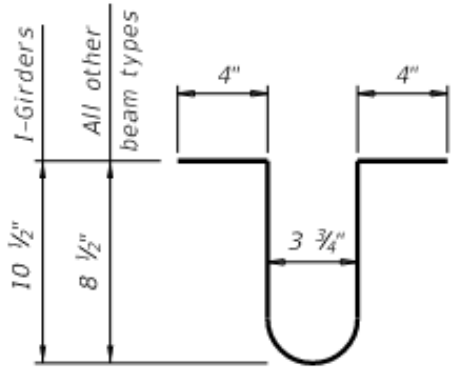
TxDOT's use of precast/prestressed deck panels (how the system works)

- Variations in haunch thickness are handled by adding additional reinforcing when the measured haunch thickness exceed 3-1/2" with I-girders and 3" for all other beam types



HAUNCH REINFORCING DETAIL

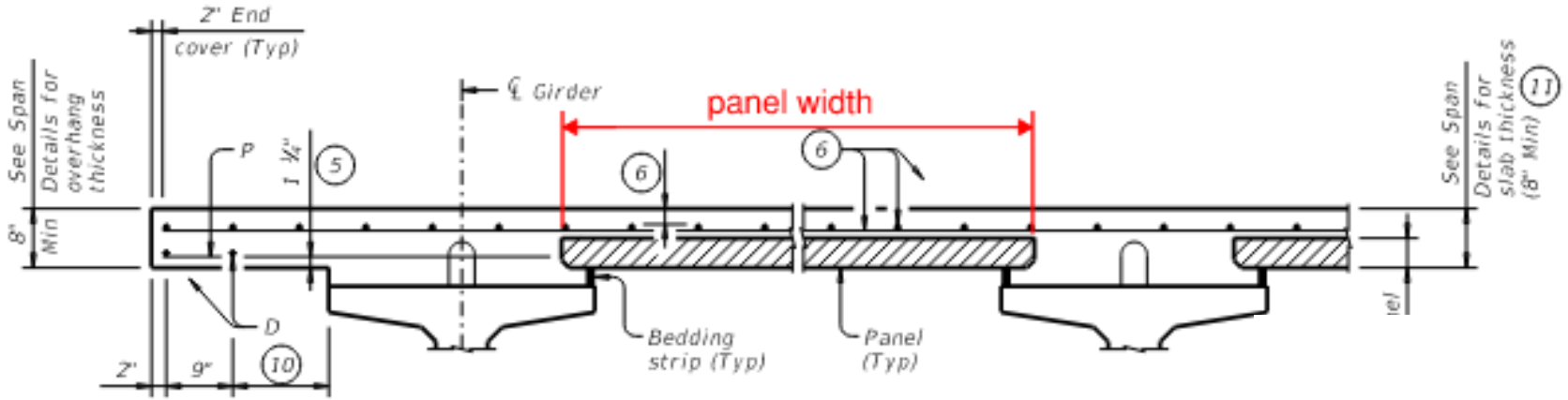
Showing prestressed concrete I-girders. (Other beam types similar)



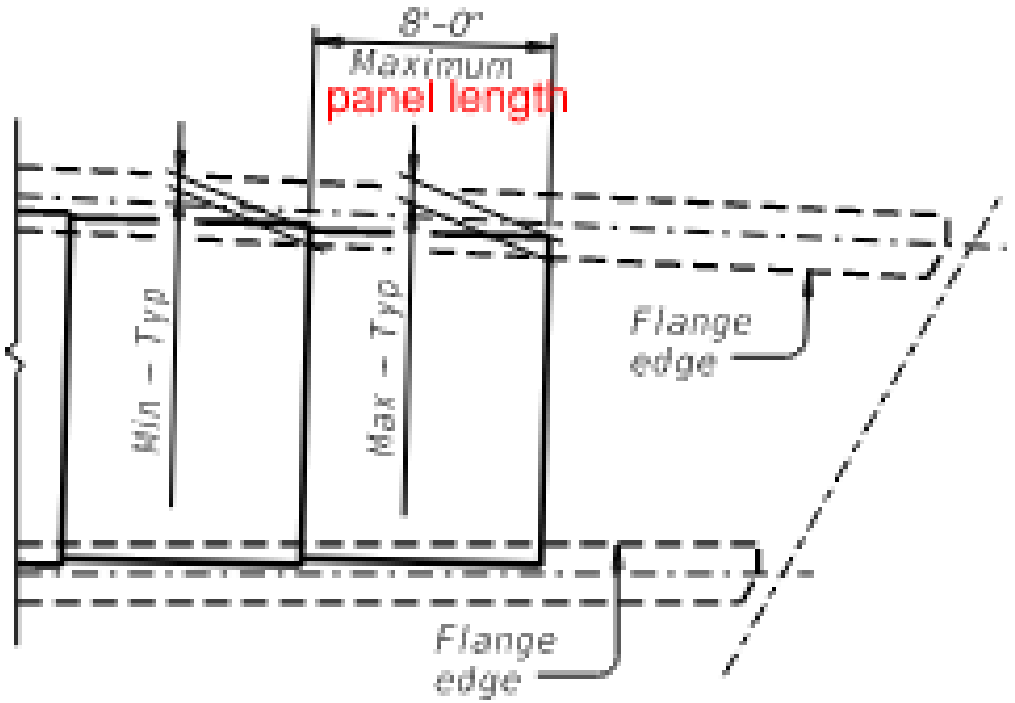
BARS UP (#4) 7

7 Space Bars UP(#4) with Beam Bars R(#4) in all areas where measured haunch exceeds 3 ½" with I-girders, and 3" for all other beam types. Epoxy coating for Bars UP is not required.

TxDOT's use of precast/prestressed deck panels (how the system works)

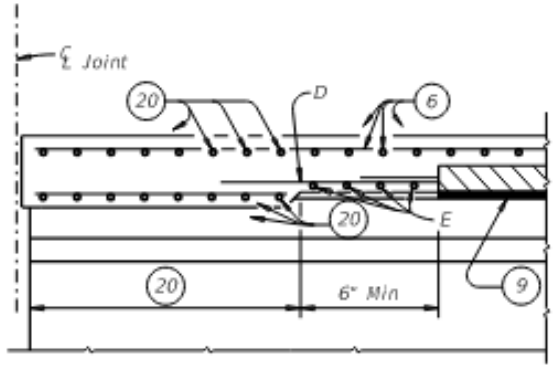


PRESTRESSED CONCRETE I-GIRDERS

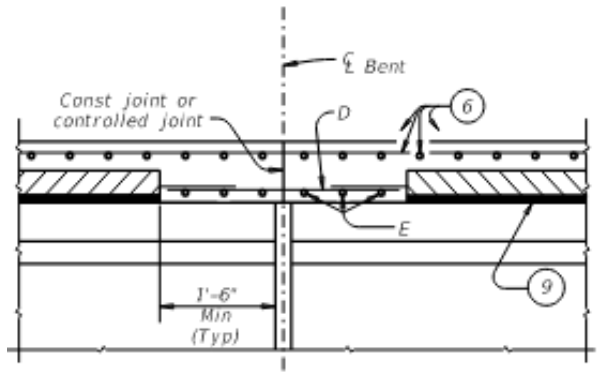


TxDOT's use of precast/prestressed deck panels (how the system works)

- Option 1 – extend strand into connection with CIP slab

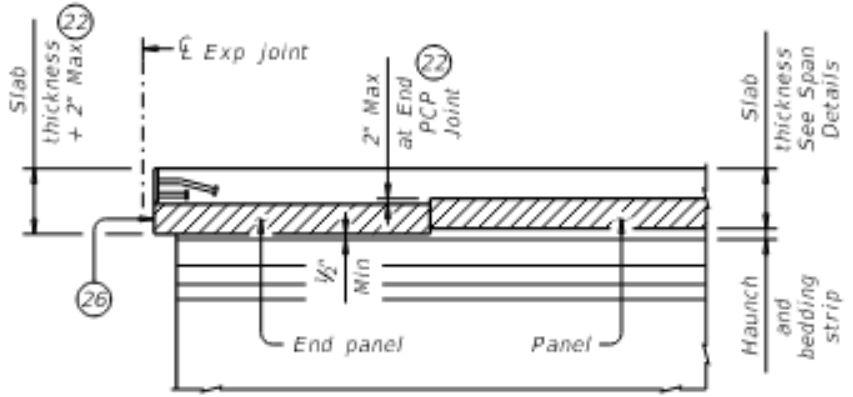


AT THICKENED SLAB ENDS FOR PRESTR CONC I-BMS AND STEEL BMS



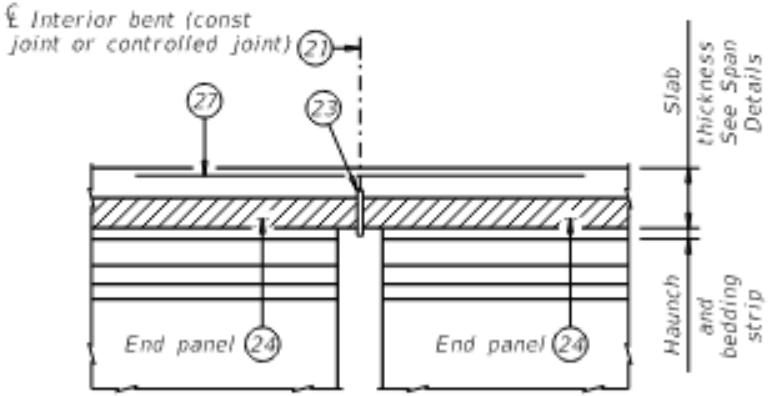
AT SLAB CONTINUOUS OVER CONVENTIONAL INTERIOR BENTS FOR ALL SIMPLE SPAN BMS

- Option 2 – use all panels



JOINTS (BETWEEN BEAMS/GIRDERS OR AT INV-T STEM)

For SEJ-A, SEJ-S(0), AJ, and Type A expansion joints only.



CONVENTIONAL INTERIOR BENT

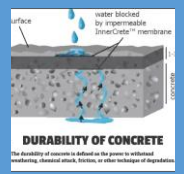
Panel against panel between beams/girders.

TxDOT’s use of precast/prestressed deck panels (advantages)

Speed

Cost savings

Safety



durability

TxDOT's use of precast/prestressed deck panels (advantages-speed)

- PCP's accelerated construction of bridge decks
- PCP's reduce construction time for entire project
- Experienced contractors can set panels on entire bridge deck in a few days
- Time required to tie reinforcing is reduced since only 1-mat is required
- Allows for larger bridge decks to be poured in one operation
- Using a single pour for the entire bridge translates to opening the bridge to traffic sooner

TxDOT's use of precast/prestressed deck panels (advantages-cost savings)

- Contractors who use PCP realize significant cost savings to other forming systems
- Time required to set and grade panels is less
- Reductions in setting time can also reduce time that lanes must be closed when working over traffic, cost savings not only to the contractor but also to the traveling public
- Labor costs for placing reinforcing are cut in half; savings offset by panel fabrication cost
- PCPs require no form removal costs that translates to cost savings
- Insurance premiums can be lower when using PCPs due to inherent safety of the system

TxDOT's use of precast/prestressed deck panels (advantages-safety)

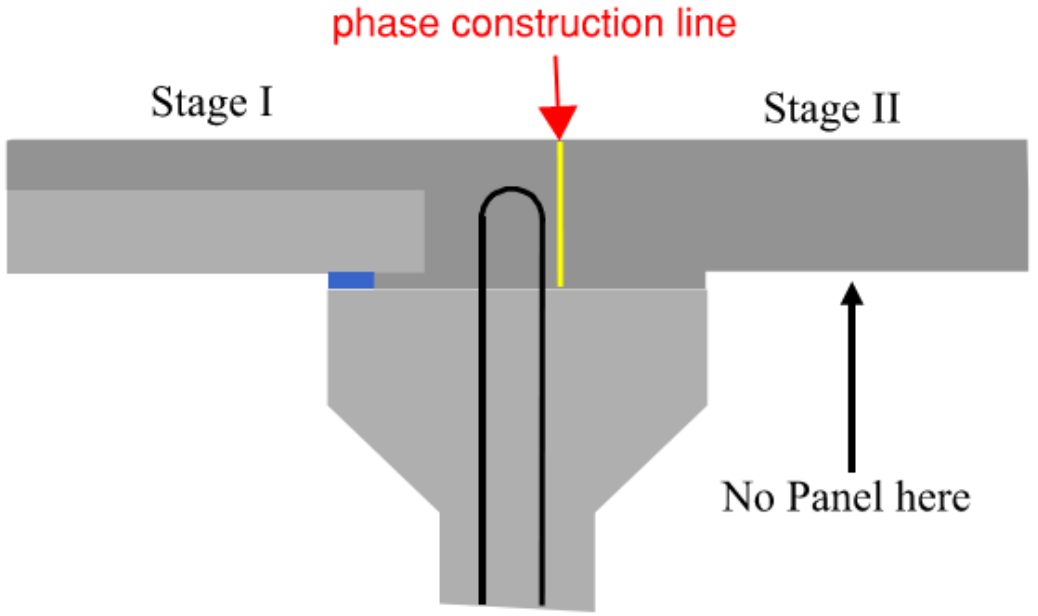
- Panels weight approx. 2000-3000 lbs and cannot blow off girders in high winds
- PCP provide stable and safe work platform for laborers
- PCPs are wider than the gap between adjacent girder flanges so it is unlikely that panels can fall between the girders
- Safety is increased with respect to not requiring form removal compared to other forming systems that require removal especially when working over or near traffic
- Other deck forming systems have failed during concrete placement resulting in specification changes to material thicknesses

TxDOT's use of precast/prestressed deck panels (advantages-durability)

- Panel system gives ability to incorporate prestressing in the positive moment area of the deck which improves long-term durability of bridge decks
- High quality of prefabrication of PCP
- Panel fabricators use high quality materials that translate to increase in deck durability

TxDOT's use of precast/prestressed deck panels (limitations)

- PCP's not used in the overhang portion of the bridge deck
- PCP's not allowed with curved steel girder bridges
- Bridge widenings & phased construction; PCP's not allowed in bay adjacent to the existing structure and not allowed in bay adjacent to previously placed deck
- PCP's not allowed on steel girders with narrow flanges (< 12")



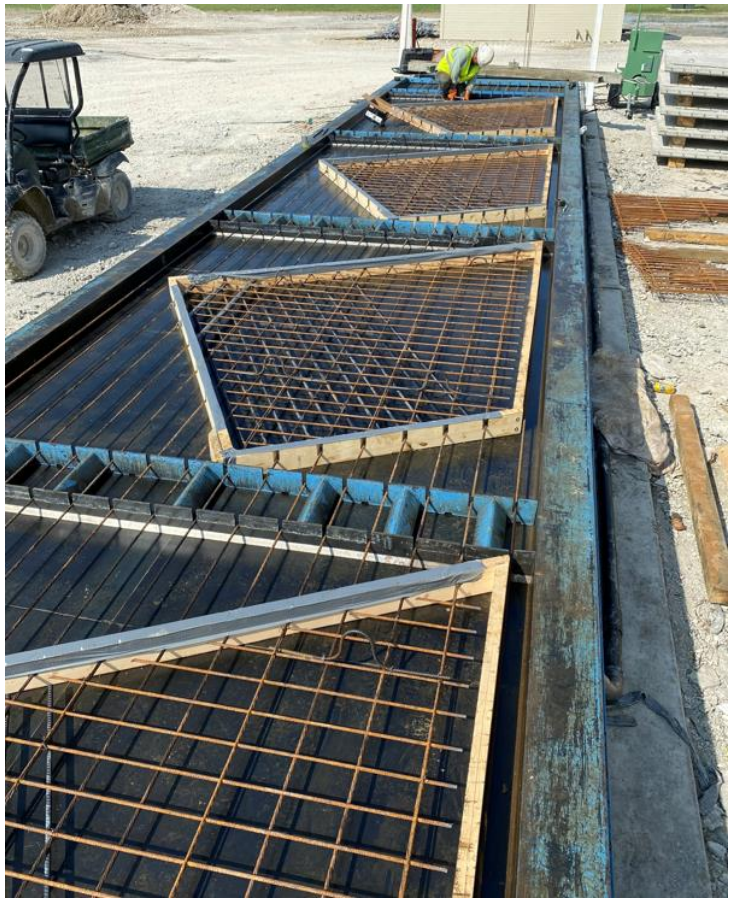
TxDOT's use of precast/prestressed deck panels (construction)

- PCP's greatly simplify and speeds bridge deck forming and grading since almost half the deck is precast
- Factors that affect overall performance of the completed bridge deck include:
  - Fabrication
  - Setting & grading of panels
  - Concrete placement
- PCP bridge deck forming system is the most popular used by contractors in Texas.
- Speed of construction is the primary advantage as well as its simplicity because it is derived from standard details and specifications

PCP Fabrication

Prestressed Deck Panels

casting bed with custom/skewed panel layout

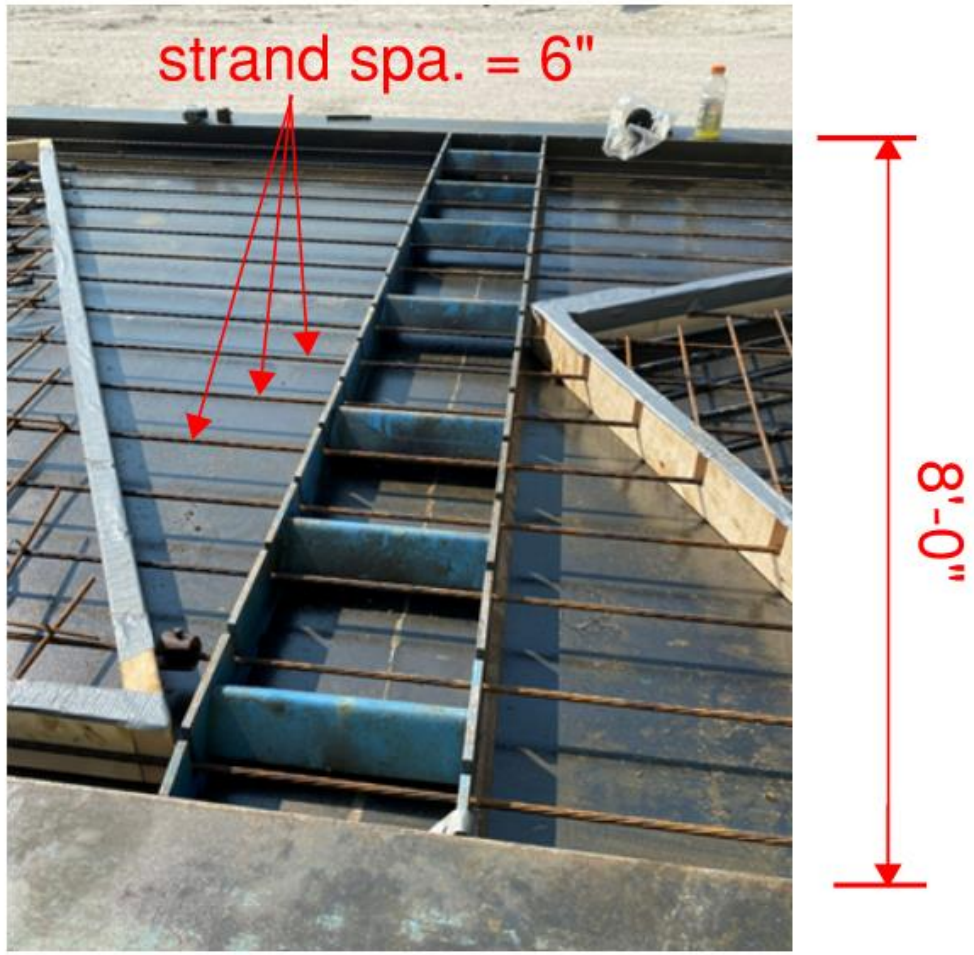


casting bed with typical standard panel layout

Prestressed Deck Panels

Storage/stacking

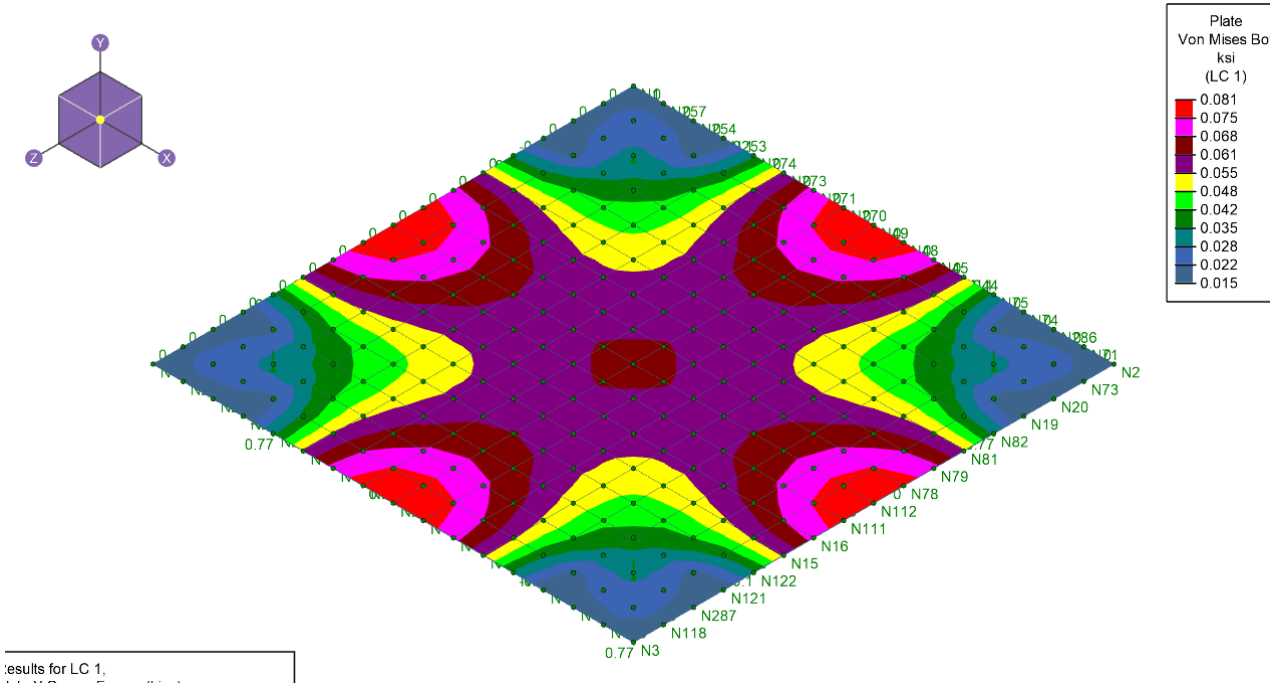
Intermediate headers



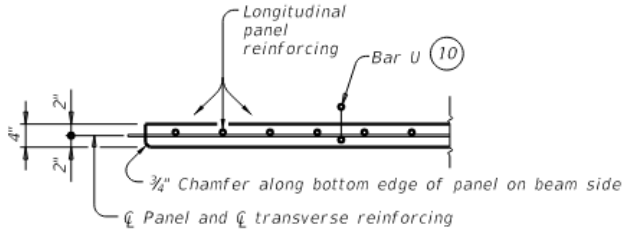
Prestressed Deck Panels

Lifting stresses on a 8’x8’ panel with lifting points located 12” in from each edge.

Maximum stress = 81 psi.

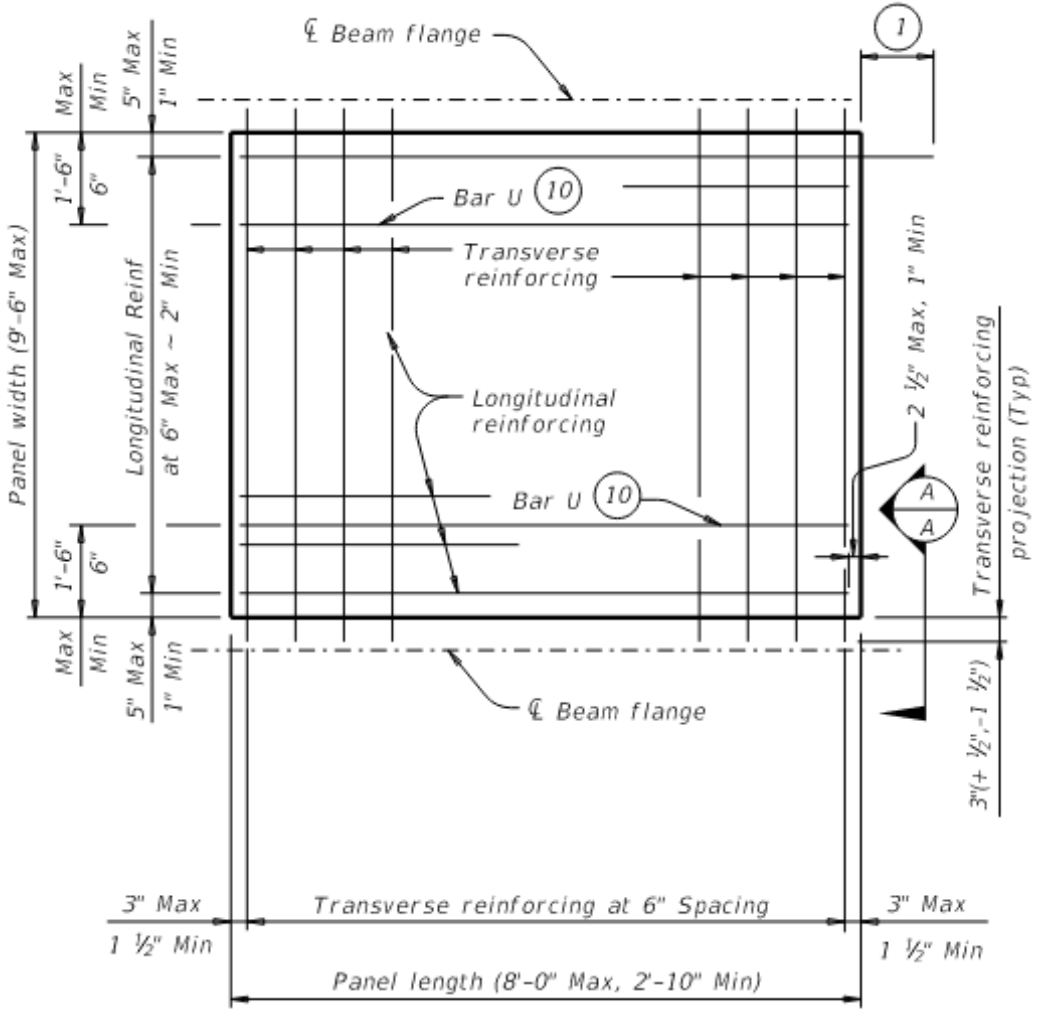


TxDOT STD DWGs

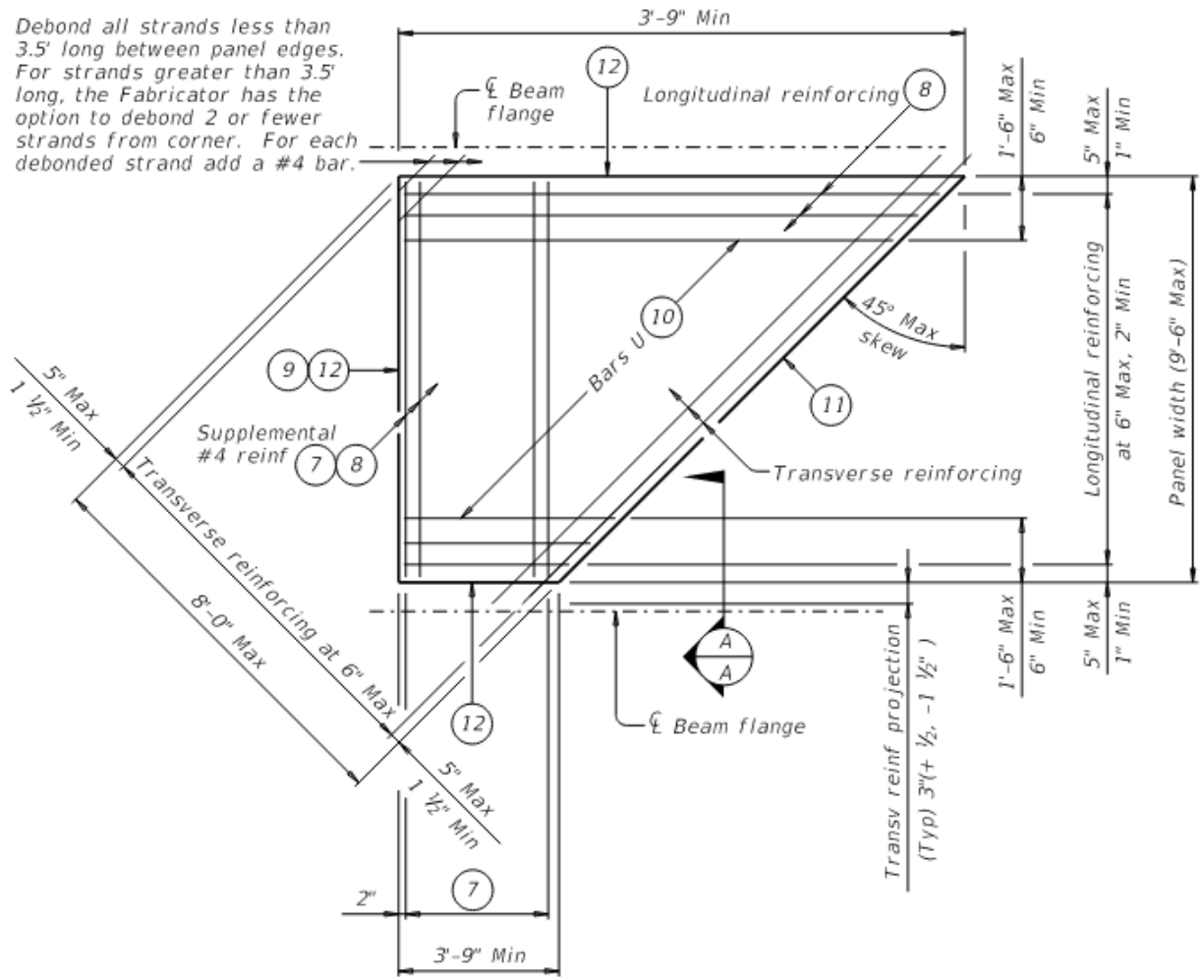


SECTION A-A

(Not showing supplemental #4 bars for skewed end panels.)



TYPICAL NON-SKEWED PANEL PLAN



TYPICAL SKEWED END PANEL PLAN

Prestressed Deck Panels

- Minimum panel length = 2’-10” along beam length
- Maximum panel length = 8’-0” along beam length
- Maximum width = 9’-6” (perpendicular to beam top flanges)

Prestressed Deck Panels

- Skewed end panel at project site

MDOT Project 101838/301000 STBG-0064-00(020)

SR149 bridge at STA. 71+64.90 over Sellers Creek-No. 128.2

SR149 bridge at STA. 09+91.00 over Strong River-No. 128.6

Owner: Mississippi Department of Transportation

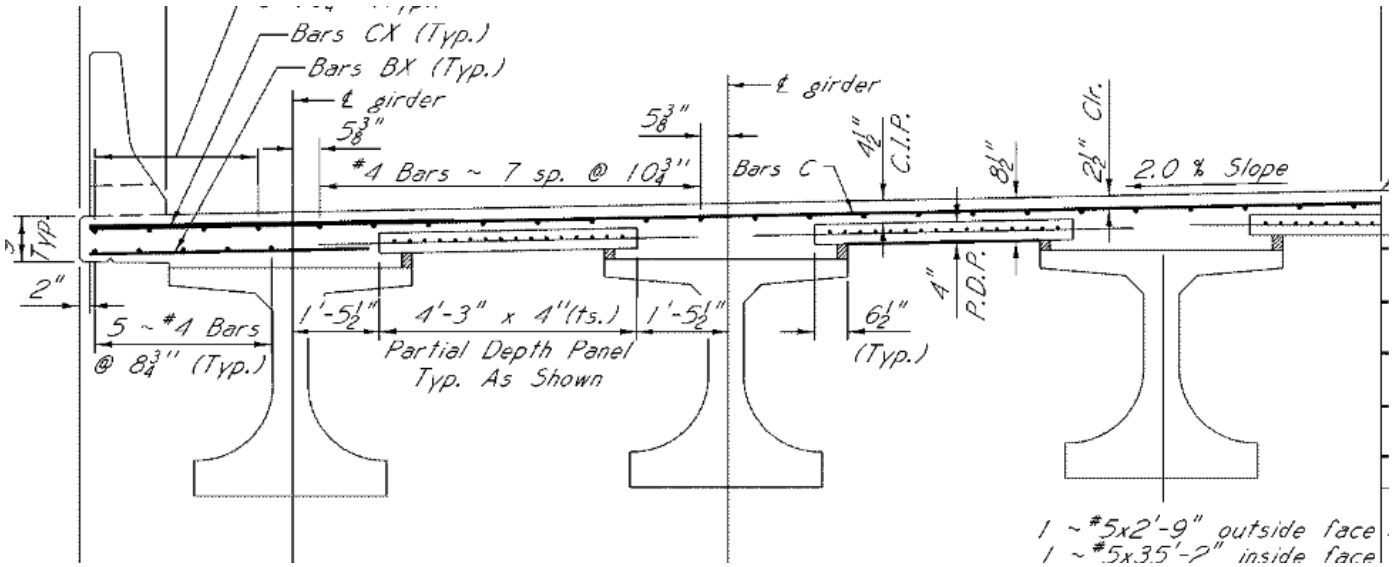
Engineer: Gresham Smith

Contractor: T.L. Wallace Construction

Fabricator: Jackson Precast (subcontractor to GCP)

Bridge No. 128.2-SR149 over Sellers Creek

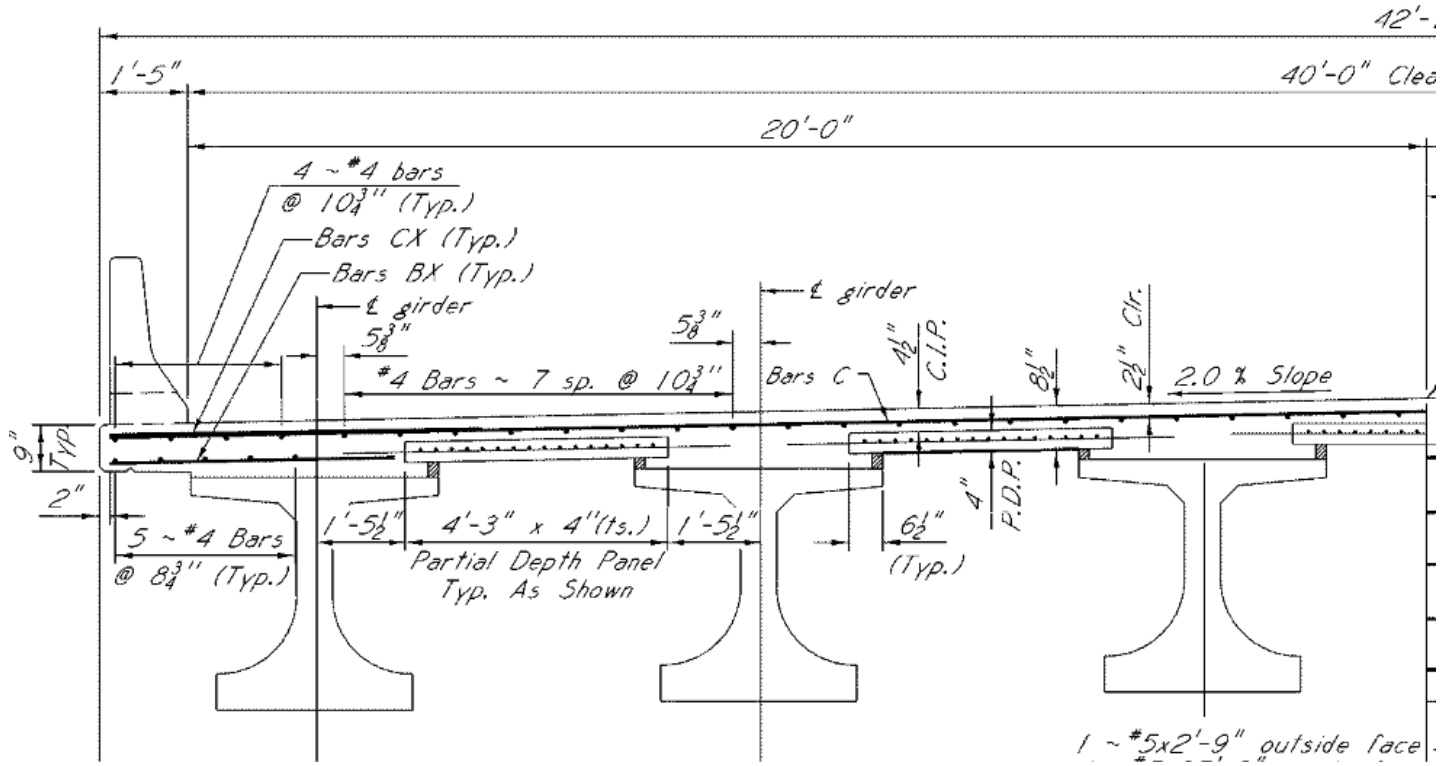
- 5 spans @ 110-130-110-110-110 ft.
- FIB45s used in the 110 ft. spans
- FIB54s used in the 130 ft. span
- Constant girder spacing = 7’-2”
- 6 girders per span
- No skew



Part bridge section near midspan

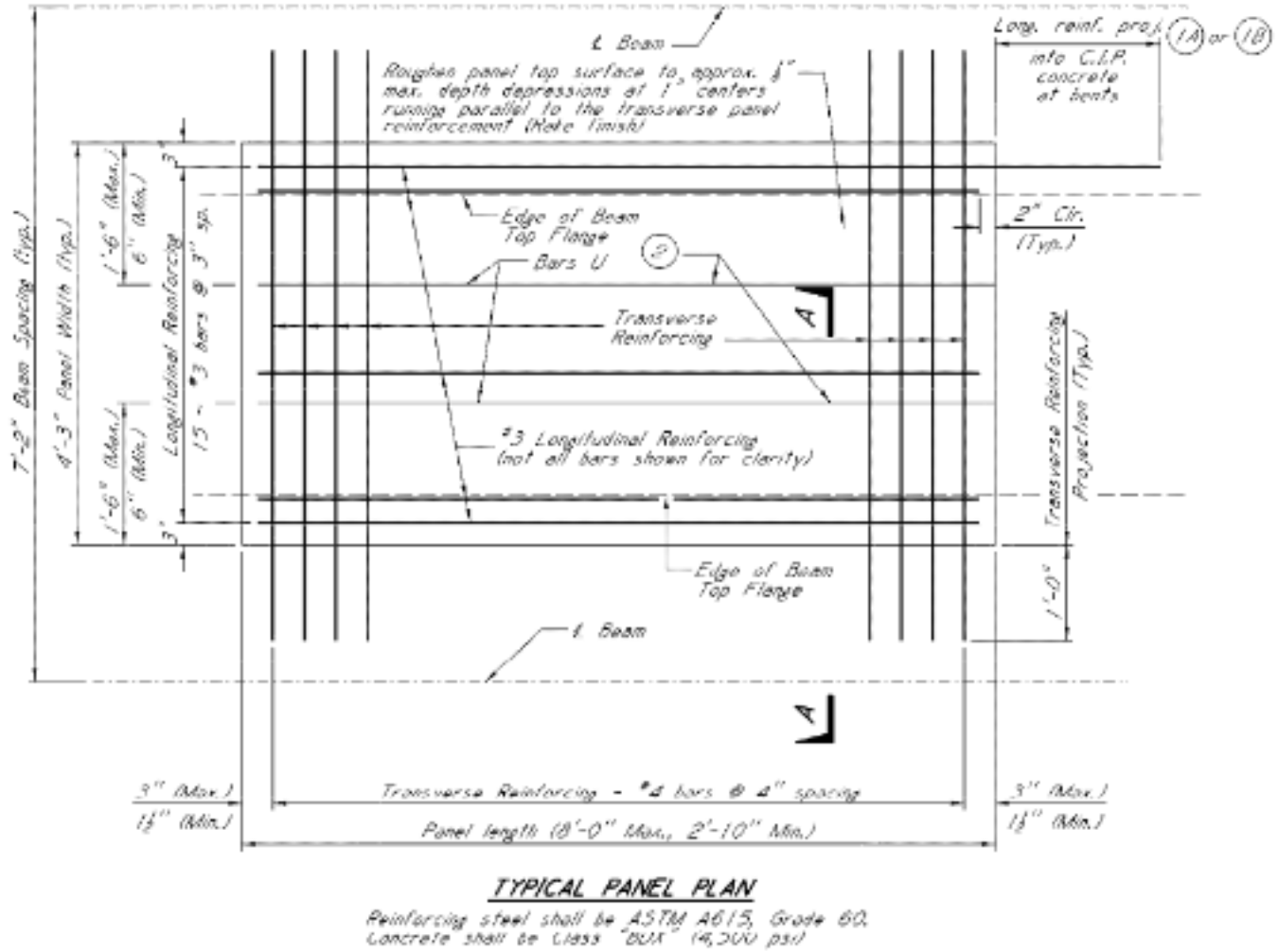
Bridge No. 128.6-SR149 over Strong River

- 10 spans 7 @ 110-150-2 @ 110 ft.
- FIB45s used in the 110 ft. spans
- FIB63s used in the 150 ft. span
- Constant girder spacing = 7’-2”
- 6 girders per span
- No skew



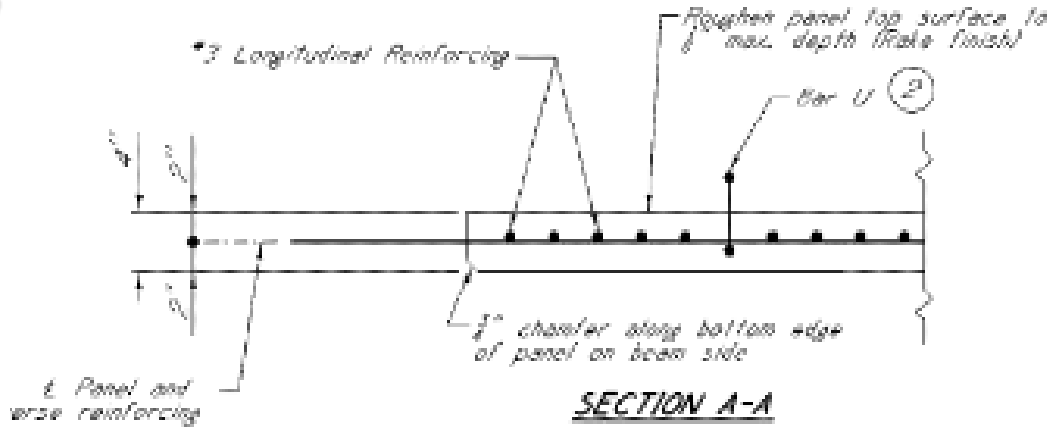
Part bridge section near midspan

MDOT Partial-Depth Deck Panel Details working drawing number PDP-BR-1

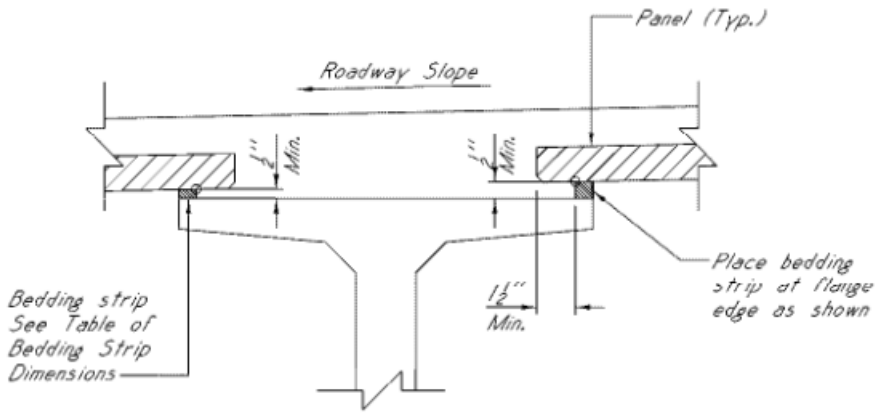


TYPICAL PANEL PLAN

Reinforcing steel shall be ASTM A615, Grade 60. Concrete shall be Class "DUA" (4,200 psi)

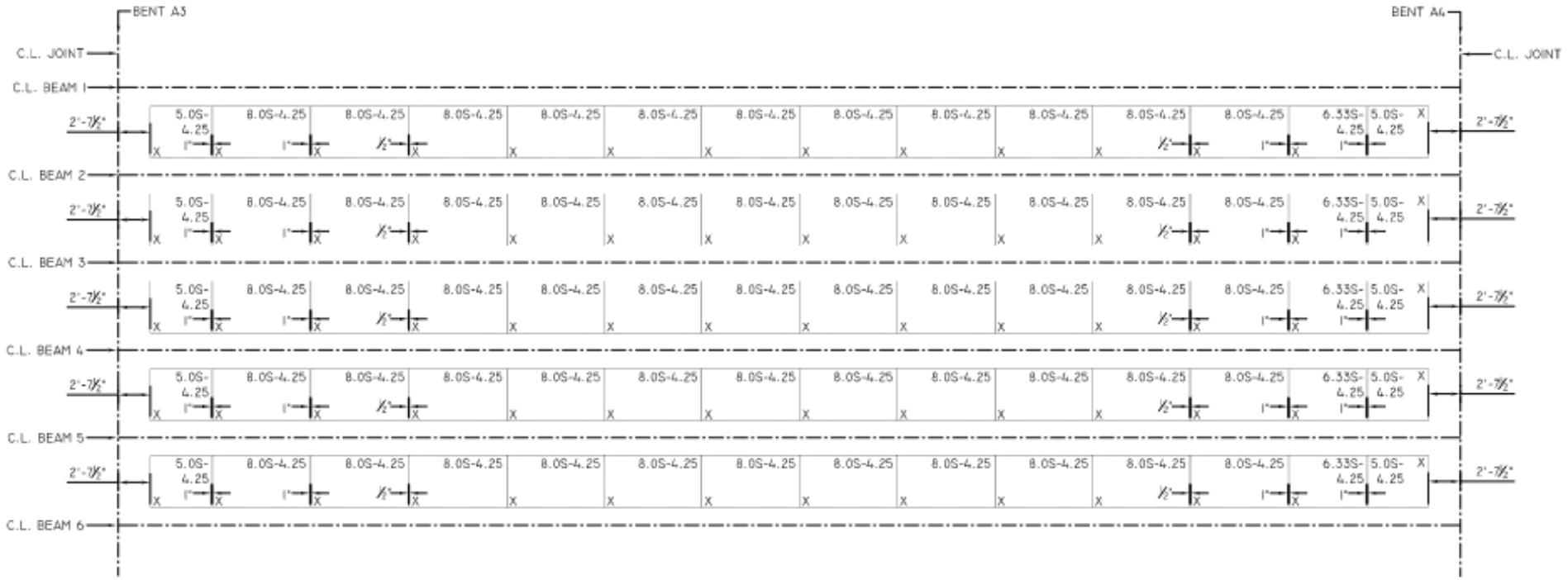


SECTION A-A



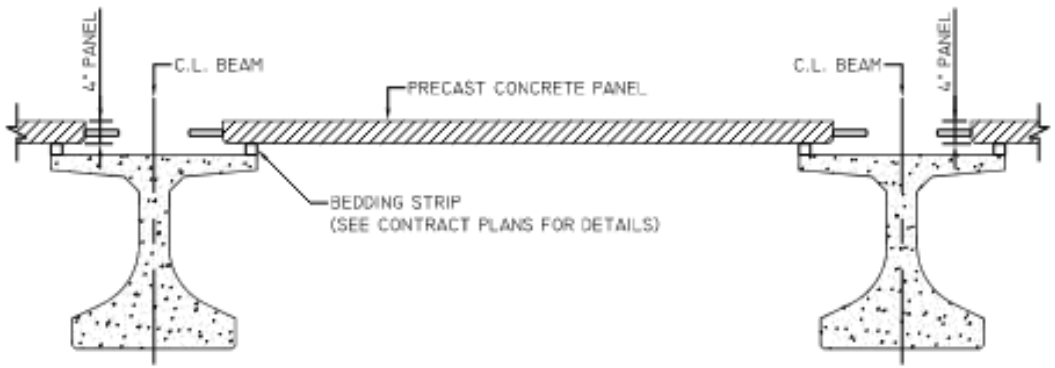
GRADING DETAIL (3)

PCP shop drawings-erection sheet



Span A3-Sellers Creek Bridge

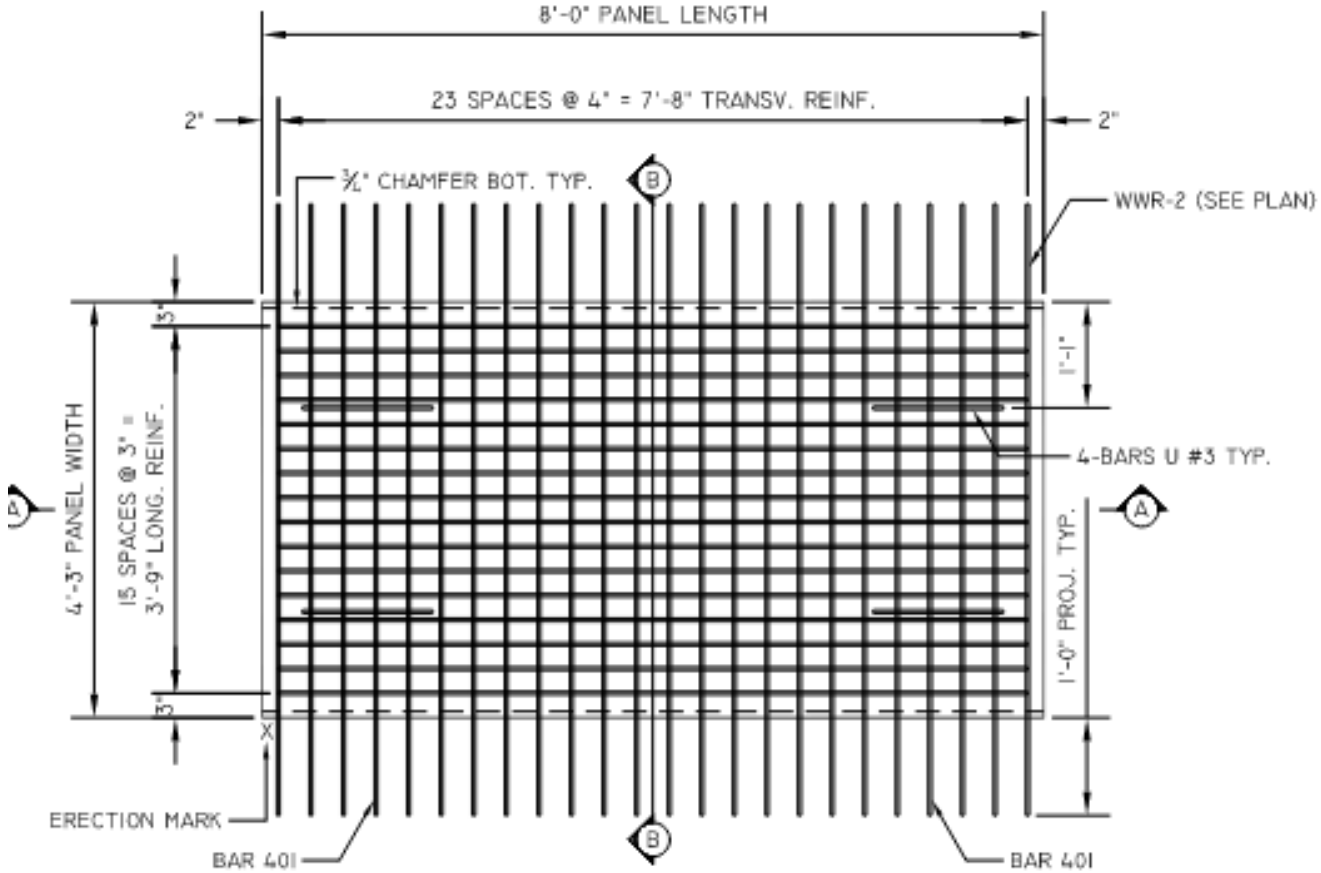
PCP shop drawings- panel details



TYPICAL TRANSVERSE SECTION
(NOT TO SCALE)

Sellers Creek Bridge

L (ft)	W (ft)	Qnty
4.66	4.25	10
5.00	4.25	40
6.25	4.25	10
6.33	4.25	10
8.00	4.25	290



TYPICAL NON-SKEWED PANEL
PLAN VIEW

PCP fabrication
started week of 11/13/23

JACKSON PRECAST INC.
architectural precast concrete
A PCI CERTIFIED PLANT

PCP fabrication
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