PHASED CONSTRUCTION RECOMMENDATIONS FOR BRIDGES

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BRG Webinar July 30, 2012
PHASED CONSTRUCTION
RECOMMENDATIONS FOR BRIDGES

- Will be posted to the TxDOT Website
  - http://www.dot.state.tx.us/business/contractors_consultants/bridge/default.htm
DO NOT use standard detail sheets for slabs, abutments, or bents.
Superstructure

- Geometric Constraints
- Structural Analysis
- Software
Consider traffic needs and the placement of any temporary barriers. If the clear distance between the back of the barrier and the edge of the slab is less than 2 feet, anchor the barrier to the deck.
Superstructure - Geometric

- When building next to an existing structure (such as for phased replacements), provide enough space between the existing structure and the new construction to accommodate splicing of the deck reinforcement, the portion of the beam that extends beyond the edge of slab, the portion of bent or abutment that extends past the beam edge, and form work.
Slab Reinforcement

Bar laps, where required, will be as follows:
Uncoated: #4 - 1'-5"
#5 - 1'-9"
Epoxy Coated: #4 - 2'-1"
#5 - 2'-1"
Superstructure - Geometric

- If the completed slab corners require a breakback, breakback the corners of the phase line.
Superstructure - Geometric

- Do not place a phase line in the middle or at the edge of a precast panel.
- Do not place a phase line within the top flange of a slab beam or adjacent box beam.
Superstructure - Geometric

- For TxGirders, place the phase line a minimum of 4 inches past the centerline of the girder, so that the horizontal interface reinforcement is cast into the initial construction phase of the slab. The phase line may be placed up to 12 inches past the centerline of the girder and accommodate PCP placement in the next phase.
PHASING FOR TX GIRDERS

PREFERRED

Alternate Phase Const Jt

PHASE 1

NO PCP’S ALLOWED IN THIS BAY

PHASE 2

S <= 6’

ALTERNATE
Superstructure - Geometric

- For adjacent slab or box beam superstructures, place the phase line at the edge of the beam.
PHASING FOR SLAB BEAMS

PHASING FOR BOX BEAMS
For U-beam and X-Beams, consider placing the phase line between two beams. Treat the slab between the beam and the phase line as an overhang. Do not allow the use of panels in this space. Alternately, place the phase line along the top flange of the beam. If the phase line is located along the top flange of the beam, the majority of the beam will be under the initial phase of construction. Do not place the phase line closer than 6 1/2 inches from the beam edge for U-beams and 10 inches for X-Beams, to allow for the use of precast panels in the future phase.
PHASING FOR U BEAMS

PREFERRED

Preferred Phase Const Jt

PHASE 1

$6 \frac{1}{2}^\text{in.}$ min.

PHASE 2

$S$

ALTERNATE

Alternate Phase Const Jt

PHASE 1

NO PCP's ALLOWED IN THIS BAY

PHASE 2

$S \leq 13^\circ$
Preferred Phase Const Jt

PHASE 1

10" min.

PHASE 2

S

PREFERRED

Alternate Phase Const Jt

PHASE 1

NO PCP's ALLOWED IN THIS BAY

PHASE 2

S ≤ 8'

ALTERNATE

PHASING FOR X BEAMS
Superstructure - Geometric

- If a full depth open longitudinal joint is used at the phase line, the bridge is considered 2 structures and should have 2 NBI numbers.
1" JOINT
Superstructure - Geometric

- Phased superstructures may require variable spacing of beams.
Superstructure - Analysis

- When designing the beams, consider all temporary loading such as temporary rails as permanent loads for that phase. Design beams so that they meet all requirements for all phases of construction.
BRIDGE SECTION - PHASE I CONSTRUCTION

BRIDGE SECTION - PHASE II CONSTRUCTION
The beam located under the phase line will have less dead load deflection than the other beams constructed at the same time.

This beam will not deflect additionally when the remainder of the slab is cast, due to the added stiffness of the cured slab.

When calculating haunch for the beam along the phase line, use the dead load deflection from the initial slab weight. Do not use the full dead load deflection due to the full slab weight (initial and final).
Superstructure - Analysis

- Consider lowering the bearing seat elevations of later phases to account for the potential for higher than predicted cambers.
- There is no way to adjust the roadway grade in subsequent phases to accommodate high camber girders.
Superstructure - Software

- Model phasing in PGSuper by using separate files.
Substructure

- Geometric Constraints
- Structural Analysis
- Software
Substructure - Geometric

- In most cases, the phase line in an abutment or interior bent will be offset from the phase line for the slab.
- The phase line should not be under a beam or within a bearing seat.
- Extend the abutment or interior bent past the slab phase line in order to provide support for the beam or girder. Preferably, the phase line should be a minimum of 4 inches from the bearing seat or edge of beam, whichever is greater. At a minimum, the phase line will need to be at the edge of the bearing seat or beam.
Substructure - Geometric

- When phasing an abutment or interior bent, consider providing enough space between the existing structure and the new construction to accommodate splicing of the reinforcement and formwork.
Edge of Cap can be 2 feet past the phase line.
Side reinforcement extends about 1.5 feet past the end of the cap and about 3.5 feet past the phase line.

Slab splice controls gap needed.
Bottom reinforcement extends about 9 feet past the end of the cap and about 11 feet past the phase line.

Bottom reinforcement extends about 9 feet past the end of the cap.
Top reinforcement extends about 12.5 feet past the end of the cap and about 14.5 feet past the phase line.

Top reinforcement extends about 12.5 feet past the end of the cap.
Substructure - Geometric

- Consider how the next phase of construction will be impacted by the placement of phase lines and reinforcement that extends beyond the phase line.
Piles and drilled shaft for the next phase may lie within the length necessary for splicing. Avoid having splices that overlap pile or drilled shaft locations in order to facilitate construction.
Substructure - Geometric

- If unable to provide enough room to splice the reinforcement through traditional overlapping, use welded splices or mechanical couplers. Extend reinforcement that will be spliced by welds or mechanical couplers beyond the end of the cap by at least 1-foot.
Mechanical couplers need about 1 foot past the end of the cap and about 3 feet past the phase line.

Mechanical couplers need about 1 foot past the end of the cap. Slab splice controls gap needed.
PLAN
(SHOWING ABUT NO. 1, ABUT NO. 3 OPPOSITE HAND)

Bars V Spa = 3" 18 Eq Spa = 19 Bars V at 12" Max Spa 28 Eq Spa = 27 Bars V at 12" Max Spa

Parallel to Road Surface

Bars S Spa = 9" 3'-0" 7 Eq Spa = 6'-6" 3'-3" 4 Eq Spa = 3'-9"
2 Eq Spa = 1'-9"

ELEVATION

1. The Contractor will splice Bars A & B by using Mechanical Couplers in accordance with the current special provision to Item 403: "Connecting Steel."
The Contractor will splice Bars A & H by using Mechanical Couplers in accordance with the current Special Provision to Item 440, "Reinforcing Steel."

The Contractor will splice Bars A, Bars B and Bars T by welding in accordance with Item 448 "Structural Field Welding" or by using mechanical couplers in accordance with Item 440 "Reinforcing Steel."
PHASE 3-A CONSTRUCTION

ELEVATION

See Bridge Layout for foundation type. See FD sheet for details.
Substructure - Geometric

- As alternative to splicing or welding the reinforcement, a full depth joint may be used at the phase line.
- For abutments, if a full depth joint is used, limit the space between abutments to 1-inch. Use bituminous fiber to fill the gap between the phases. Use a PVC waterstop across the space along the full height of the cap and backwall.
Use PVC Waterstop full height of Cap and Backwall. See "PVC WATERSTOP DETAIL" (SHEET 2 OF 2)
Use PVC Waterstop full height of Cap & Backwall. See 'PVC WATERSTOP DETAIL' (SHEET 2 OF 2)

1. Begin Bridge
   2'-3" 2'-3"

2. 1/4"
   5.000'
   4.000'

3. 1/2" Premolded Expansion Joint Material. Install in accordance with Item 420.2.E.

4. PVC Waterstop shall be considered susidiary to Class "C" Concrete. (Abut)

PVC WATERSTOP DETAIL

Note: Dimensions and shapes may vary slightly depending on manufacturer.
Substructure - Geometric

- For bent caps, the full depth open joint at the phase line should be at least 1-foot wide to allow for forming of the adjacent phases. Individual bent caps would support each phase. If the lower roadway/finished grade allows, use at least two columns per phase.
PLAN

2 Eq Spa = 1' - 3 1/2''
Bars S = 1' - 2 1/2''

Spacing

18 Eq Spa = 12' - 0''

Uniform Slope between Brgs (Typ)

Const Jt (Typ)

V = #9 (Ext 2' - 3''
Minimum into Cap)

2 3' Spiral at 6'' Pitch
(One flat turn top & bott)

ELEVATION

SECTION A-A
When selecting column or drilled shaft/pile spacing, try to keep the distance from face of column or drilled shaft/pile to the phase line between 0.5 and 4 feet.

Overhangs greater than 4 feet can result in high negative moments and permanent deflection of the overhang under loading. The construction of additional phases will not remove this deflection.
Substructure - Geometric

- Phased construction of abutments or bents may require that columns or drilled shafts be spaced at irregular intervals.
Substructure - Geometric

- Offset old bent lines and new bents by at least 5 feet, if possible, to keep from fouling foundations on the existing structure.
Substructure - Analysis

- When designing bents and abutments to be continuous after phasing, consider all stages of construction (including temporary loads) and the final configuration. Select flexural and shear reinforcement so that loading in all phases can be supported.
**BRIDGE SECTION - PHASE I CONSTRUCTION**

**BRIDGE SECTION - PHASE II CONSTRUCTION**

- **Portable Concrete Traffic Barrier**
- **Remove Existing Structure Prior to Phase II Construction**
Substructure - Analysis

- Design bents and abutments that have full depth joints at the phase line as individual components.
Substructure - Software

- Use **CAP18** with a modified input file adjusted for LRFD (see design examples). Use [this spreadsheet](#) for shear design.
- Will likely result in multiple input files.
QUESTIONS?

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