

Prefabricated Connections for Accelerated Bridge Construction

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Highway for LIFE

- Accelerated construction is a major portion of this FHWA program
- “Get in, get out, stay out

Roadblocks to Accelerated Construction

- The primary concerns that owner agencies have with respect to adopting accelerated construction techniques are:
 - Need for Quality Details
 - Durability
 - Design Methodologies and Training
 - Construction Methodologies

“Connections for Prefabricated Bridge Elements and Systems”

- FHWA has initiated a project to develop this manual
- This publication is intended to provide information that will go a long way to answering all four of the previous concerns.
- Focus on details that have been used in the past.

Connection Details for Prefabricated Bridge Elements and Systems

Project Goals

- Gather details of **Connections** that have been used on accelerated bridge construction projects
- Investigate transfer of technology from other markets into the bridge market
 - Parking Garages
 - Stadiums
 - Buildings

All details needs to pass a critical test before being published in the document:

- Does the connection result in a rapid construction process?
- Does the connection transmit the forces between elements effectively?
- Is the connection durable?
- Has it performed well under traffic and in an exposed environment?
- Is it cost effective and easy to construct?
- If a process or connection is proprietary, can it be incorporated into numerous projects without producing contracting issues?

Source of Data

- State DOT's
 - Questionnaires sent via e-mail
- Federal Agencies
- International Organizations
- Researchers (previous and current)
- Producers
 - Questionnaires sent via e-mail

Forward
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Manual Organization

Connection Data Sheets

Connection Details for Prefabricated Bridge Elements Federal Highway Administration

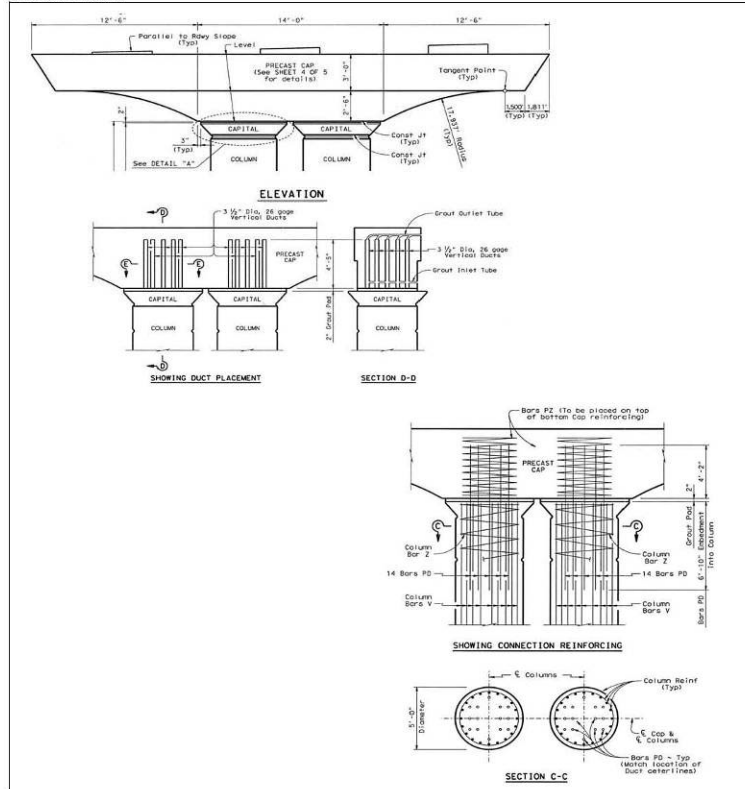
Organization:
 Contact Name: Phone Number:
 Address:

 E-mail:

Components Connected to

Name of Project where the detail was used

Connection Details:



Connection Details for Prefabricated Bridge Elements Federal Highway Administration

Organization:
 Contact Name: Phone Number:
 Address:

 E-mail:

Components Connected to

Name of Project where the detail was used

Description, comments, specifications, and special design procedures (attach additional sheets if necessary)



What forces are the connection designed to transmit? (place x in appropriate boxes)

Shear Moment Compression Tension Torsion

What year was this detail first used? Condition at last inspection (if known)

How many times has this detail been used? Year of last inspection

Would you use it again? (yes/no/maybe)

On a scale of 1 to 10, how would you rate the performance of this connection in the following categories?

Speed of Construction (0 very slow, 10 very fast) When compared to conventional construction

Constructability (0 difficulty making connection, 10 went together easily)

Cost (0 expensive, 10 cost effective) When compared to other connection methods

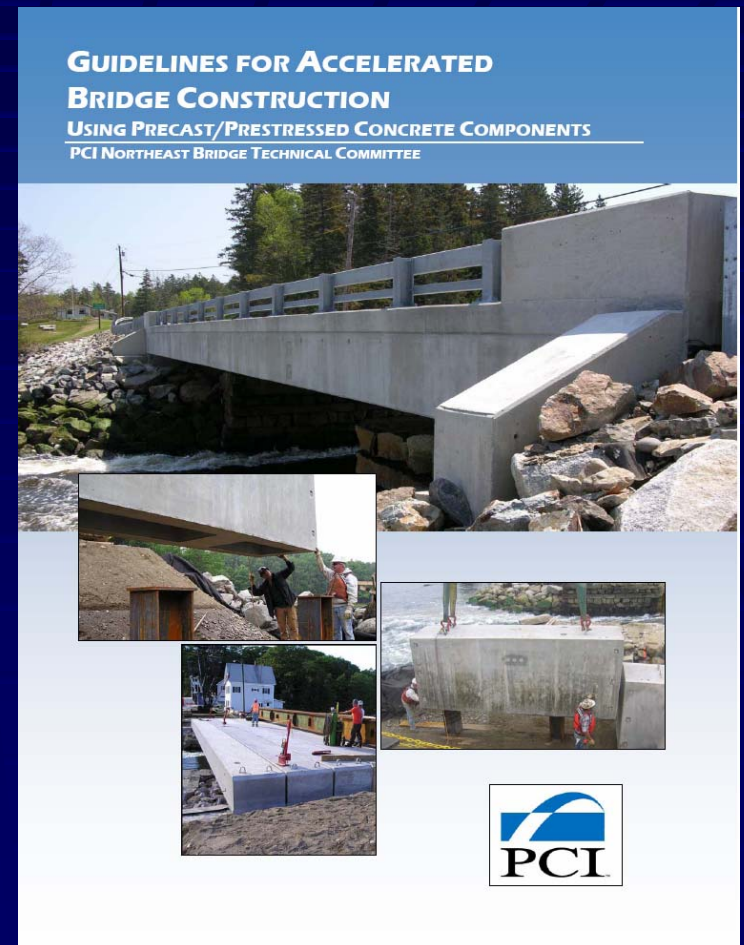
Durability (0 not durable, 10 very durable)

Inspection Access (0 not visible, 10 easily inspected)

Future Maintenance (0 will need maintenance, 10 no maintenance anticipated)

Some Information that is available today

- PCI Northeast Bridge Technical Committee
 - Guidelines for Accelerated Bridge Construction
 - Available at www.pcine.org
- FHWA
 - Framework for Prefabricated Bridge Elements and Systems (PBES) Decision-Making
 - Manual on Use of Self-Propelled Modular Transporters to Move Bridges

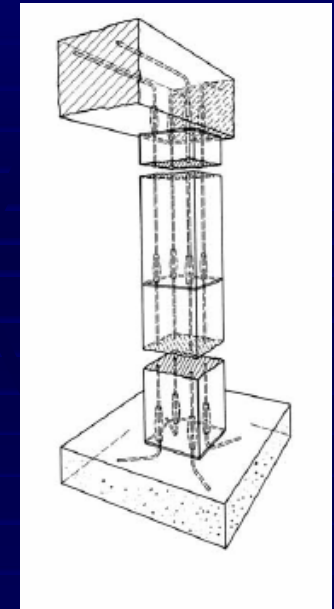


PCI Northeast Document

- Focuses on the use of precast concrete
- Written by the PCI Northeast Bridge Technical Committee
 - Northeast State DOT's
 - PCI Fabricators
 - Consultants
- Includes footings
- Based on ACI Emulation Design
- Includes design, detailing, and construction information
- Recommends the use of grouted splice connectors

Grouted Splice Connectors

- Emulates a reinforcing steel lap splice
- Three companies – non-proprietary
- Used in precast parking garages and stadiums



Sample Page

- Guidelines and commentary
- Illustrations and photos

Guidelines

Commentary



Figure 3.2.1.2-2 Completed footing.

3.2.1.3 Construction on Piles

Construction on piles will in general follow the guidelines for construction on soil. A concrete sub-footing may be used, or the footing can be temporarily supported on load distribution plates on soil.

Provisions should be made in the footing design for grouting of the areas around the pile tops. Grout placement is demonstrated in Figure 3.2.4.2.1-1 with an integral abutment section. A footing slab would be similar.

3.2.1.3.1 Construction Clearances

Provide clearance around each pile to account for driving tolerances.

See Section 3.2.1 commentary.

Six inches minimum clearance is recommended. Refer to state standards for additional guidance.

3.2.1.4 Leveling Devices

Leveling devices are critical in maintaining proper vertical grade control on precast concrete substructures. Cast-in embedded leveling devices should be used to allow for adjustment of the footing grade and elevation during installation.

A minimum of four leveling devices should be specified for each spread footing component. Each device should be designed to support half the self weight of the footing component.

Experience has shown that these leveling devices provide fast and easy grade adjustment at a minimal cost. The use of leveling shim packs is discouraged since there is no way to adjust the grades without removing the component.

During installation, there is a tendency for the piece to rock on the diagonal corner supports, therefore each device should be designed to support half the weight of the component.

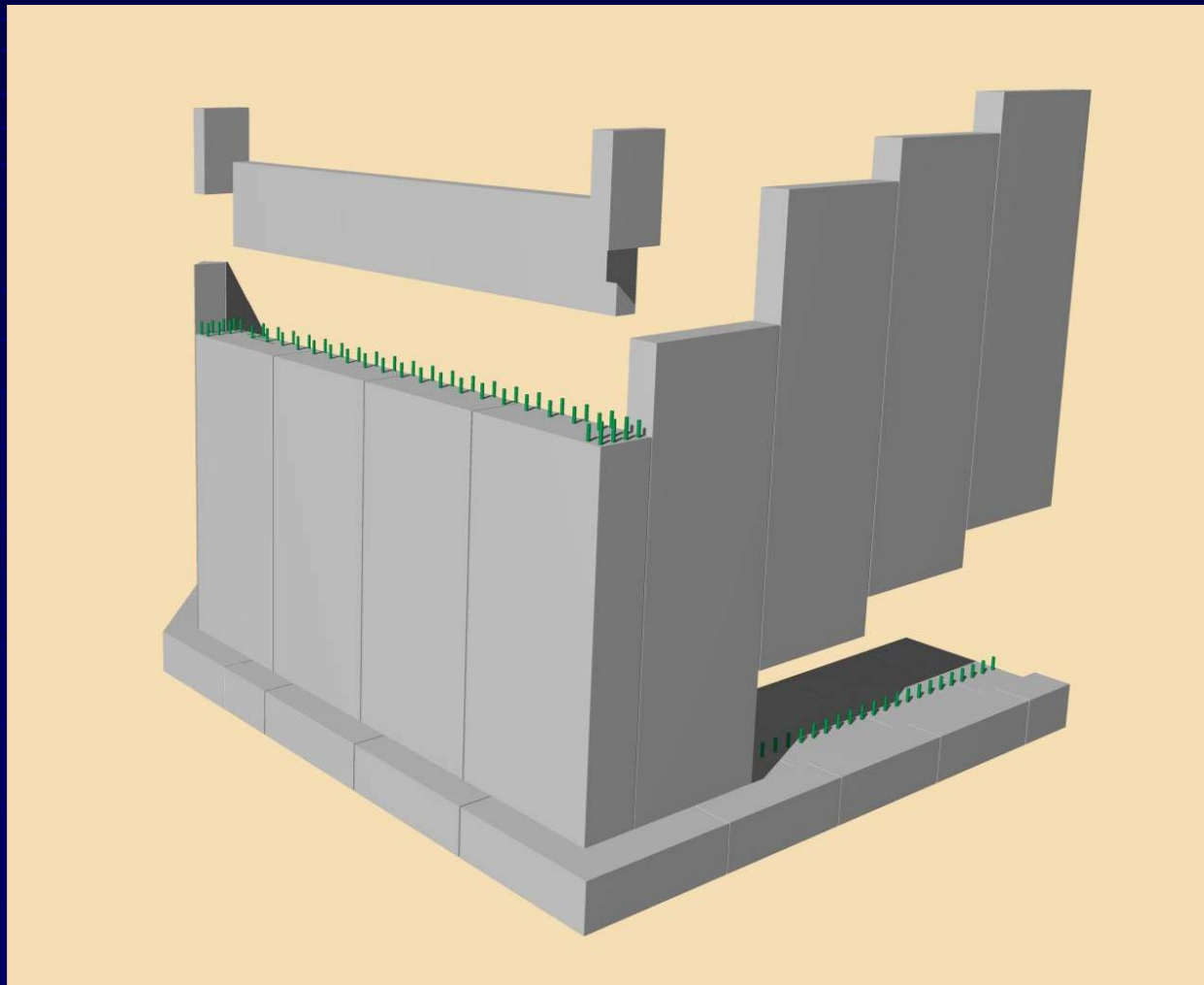
The component should be leveled prior to release of the piece from the crane. A thorough greasing of the leveling device is recommended.

The effort to adjust the leveling devices is greatly reduced if the component is partially supported by the crane, or if it is greased.

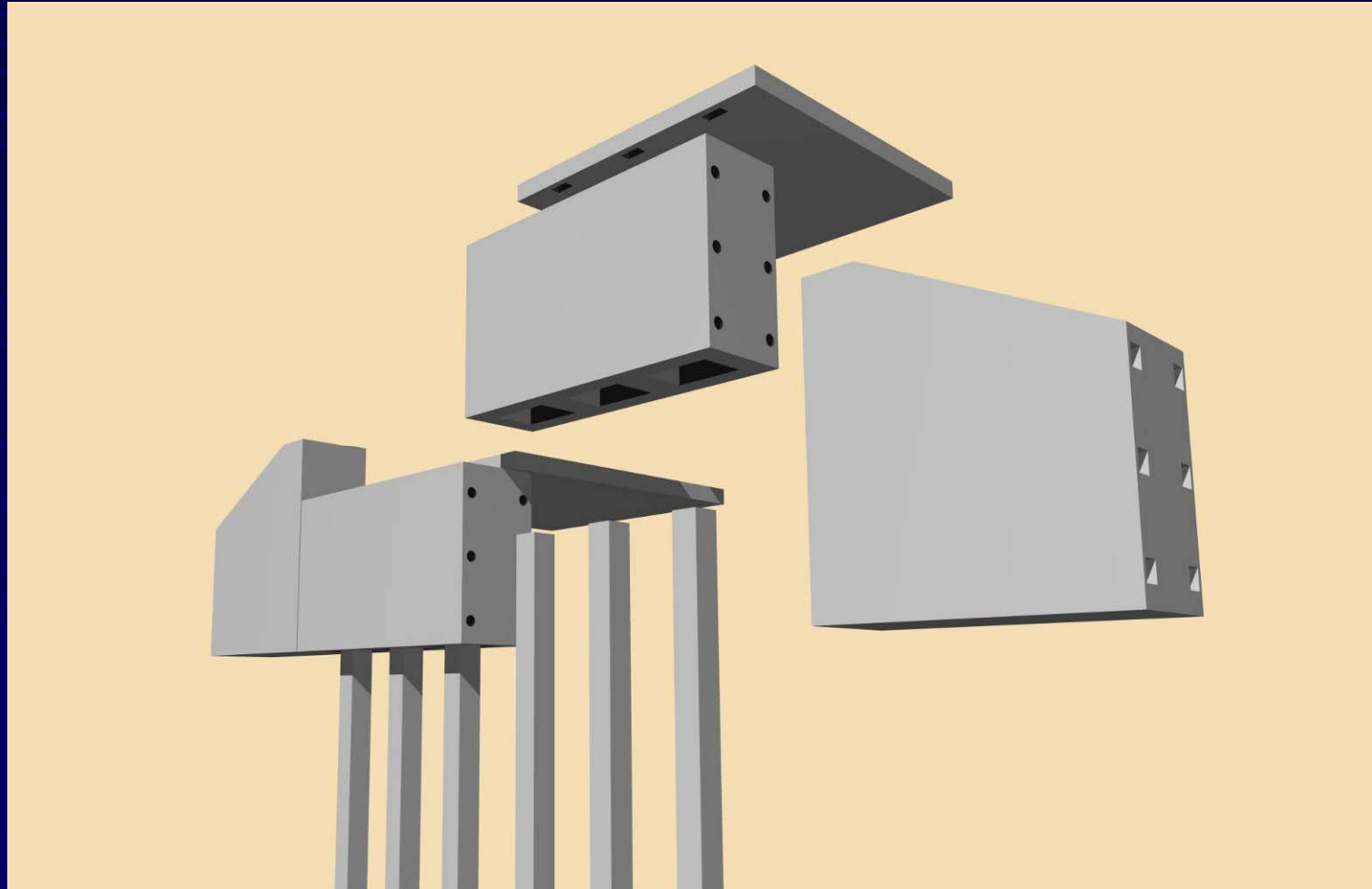
Figure 3.2.1.4-1 shows a leveling screw detail.

Once the installation of the component is

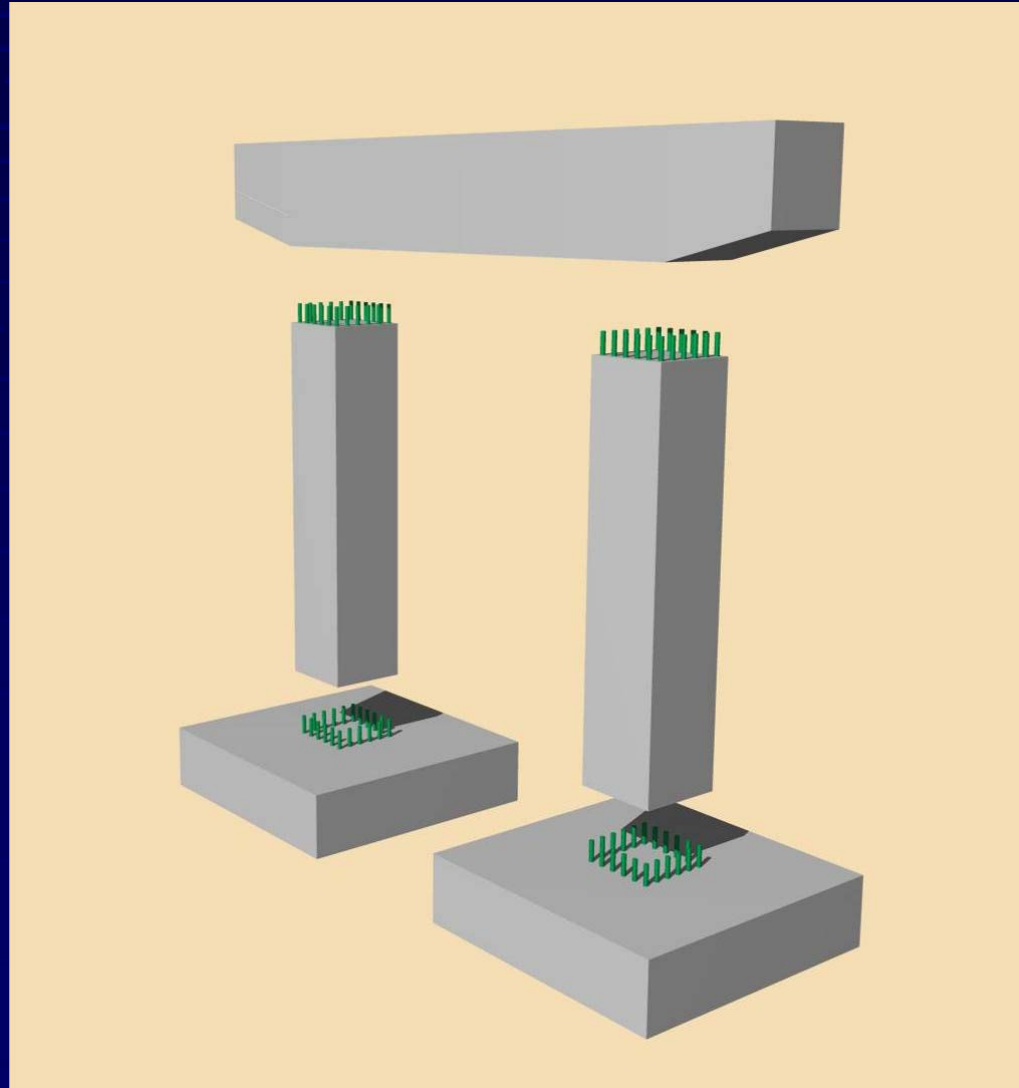
Precast Abutments



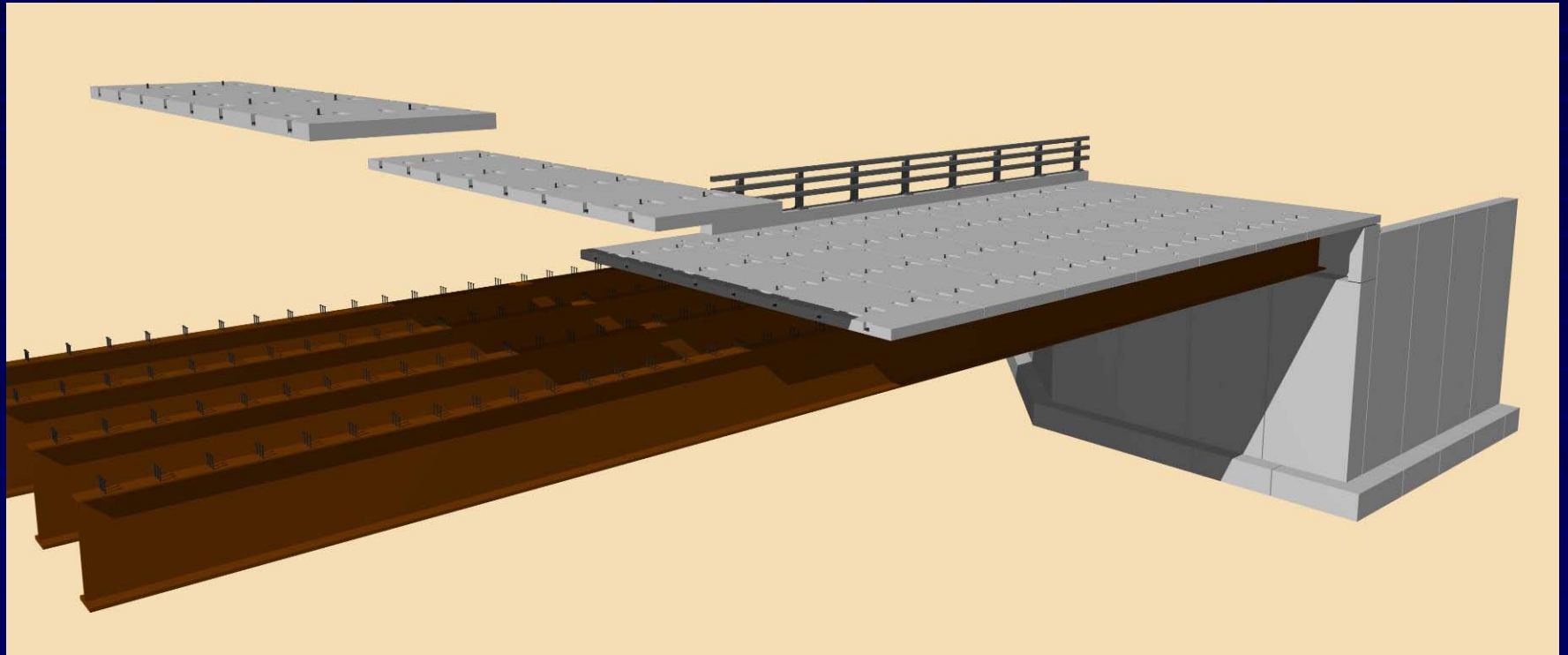
Precast Abutments



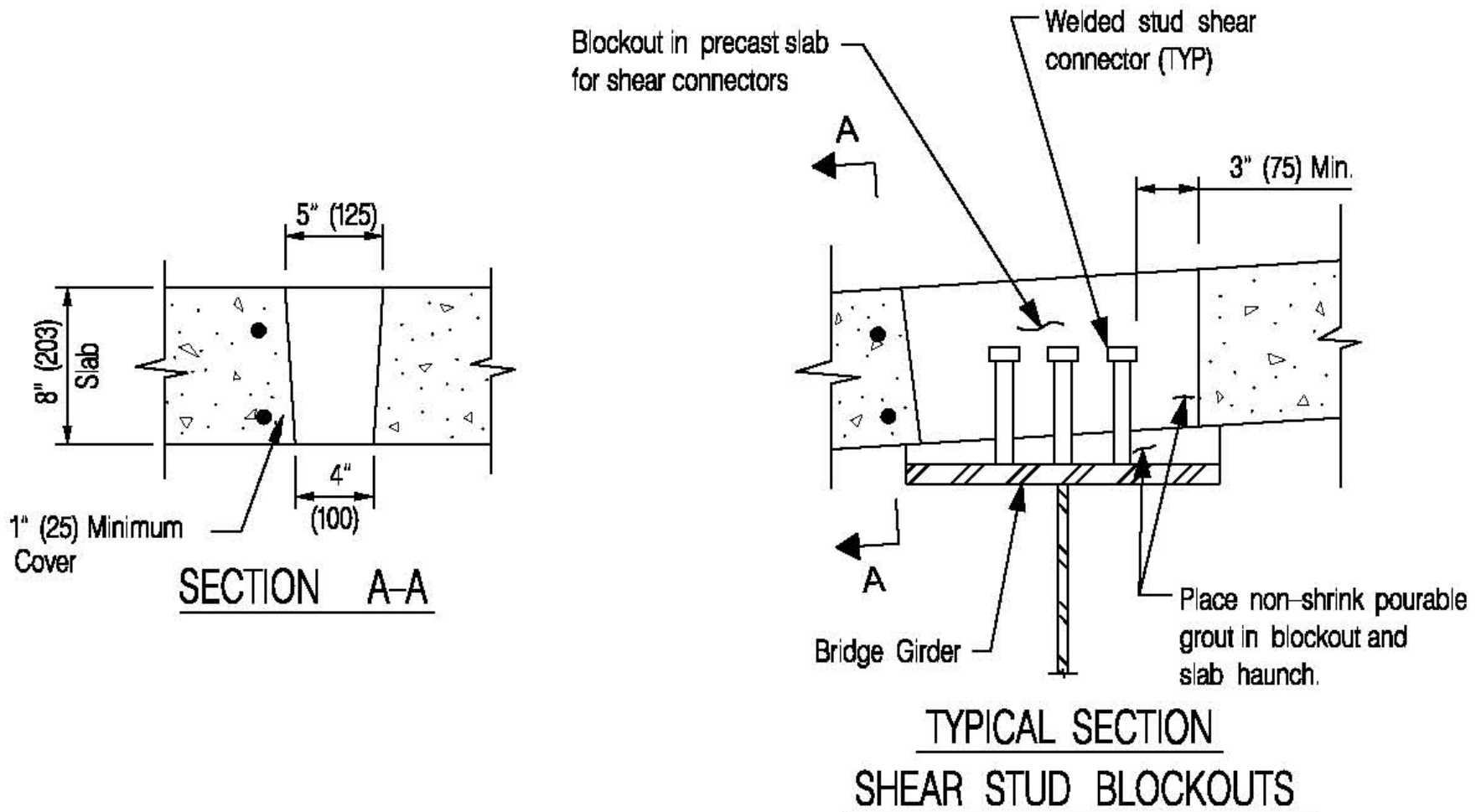
Precast Piers



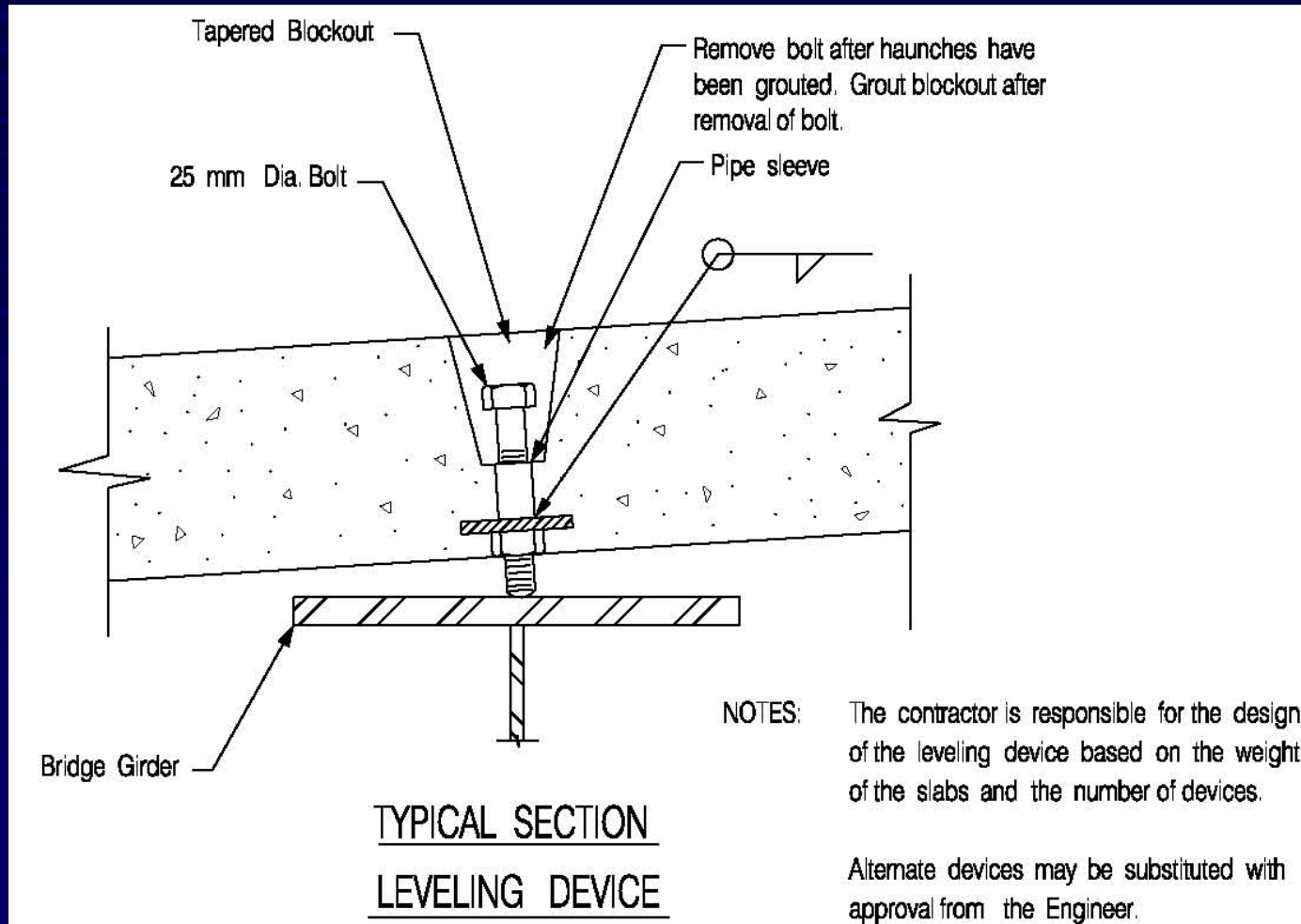
Precast Decks on Steel Framing



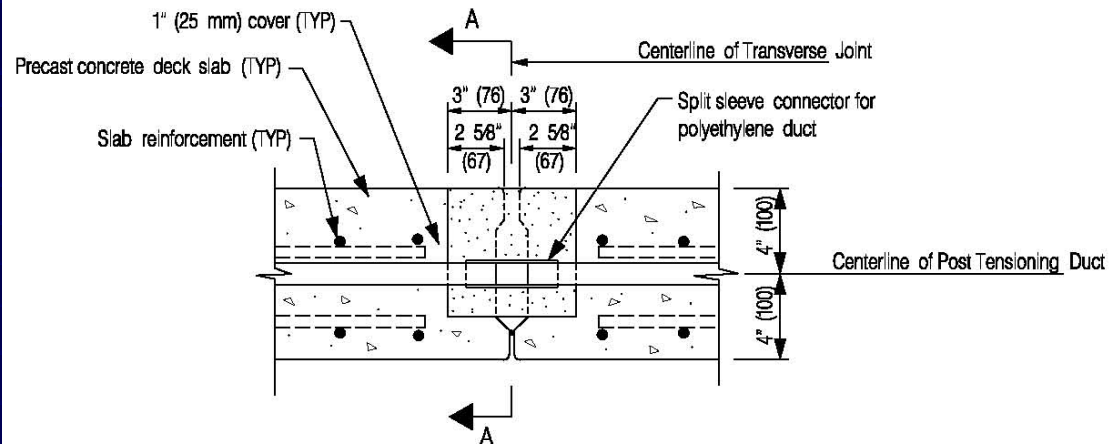
Precast Decks on Steel Framing



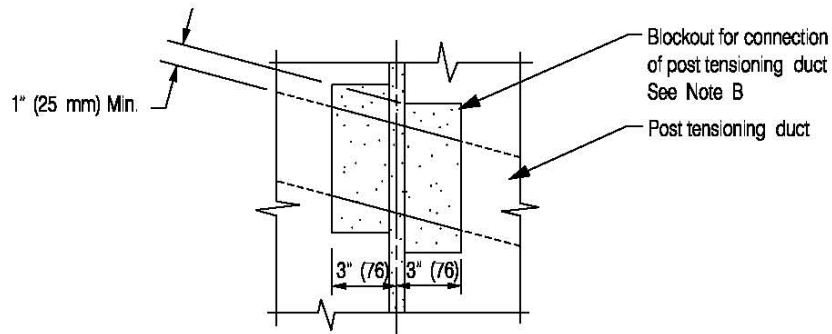
Precast Decks on Steel Framing



Precast Decks on Steel Framing

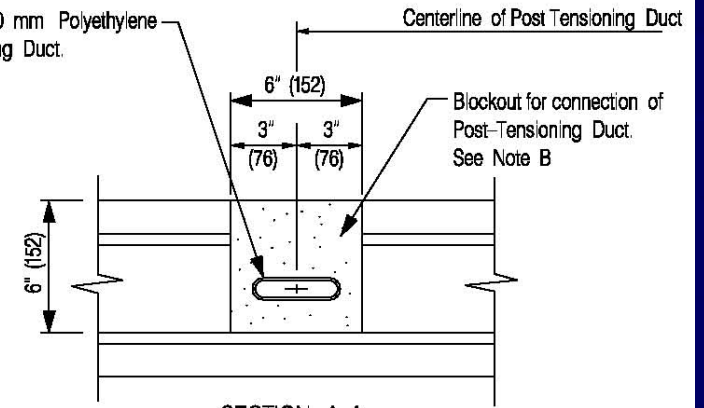


TYPICAL SECTION – TRANSVERSE DECK JOINT AT POST TENSIONING DUCT

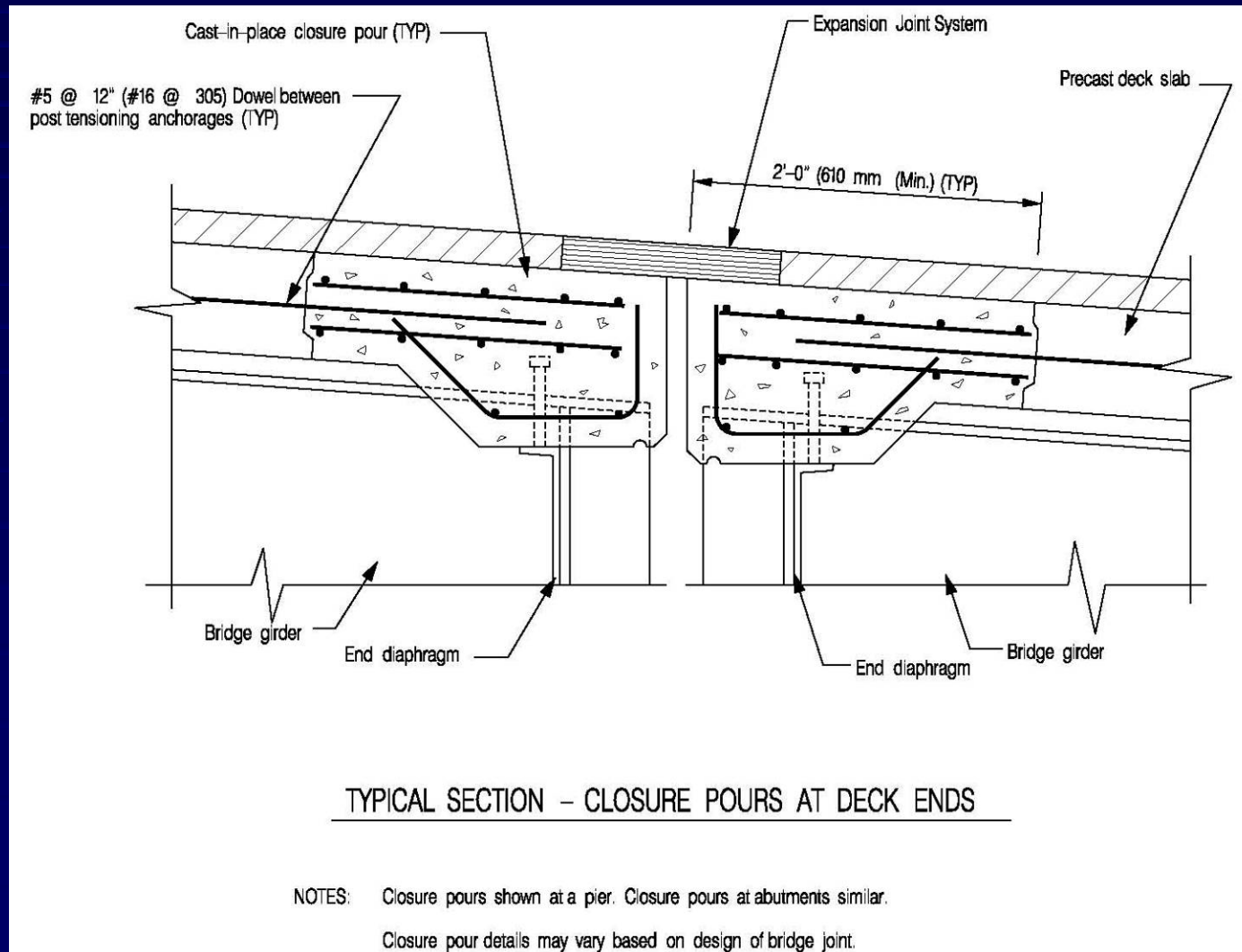


PLAN – BLOCKOUT FOR POST-TENSIONING DUCT

25 mm x 100 mm Polyethylene Post Tensioning Duct. See Note A



Precast Decks on Steel Framing

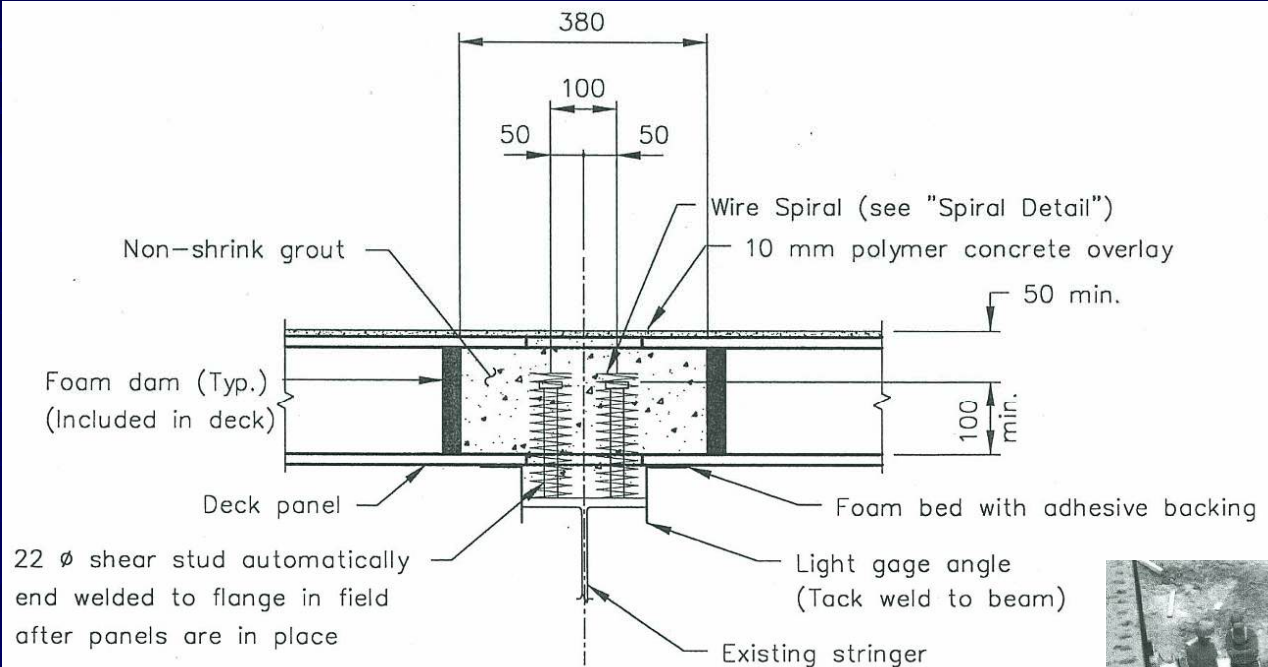


Precast Decks

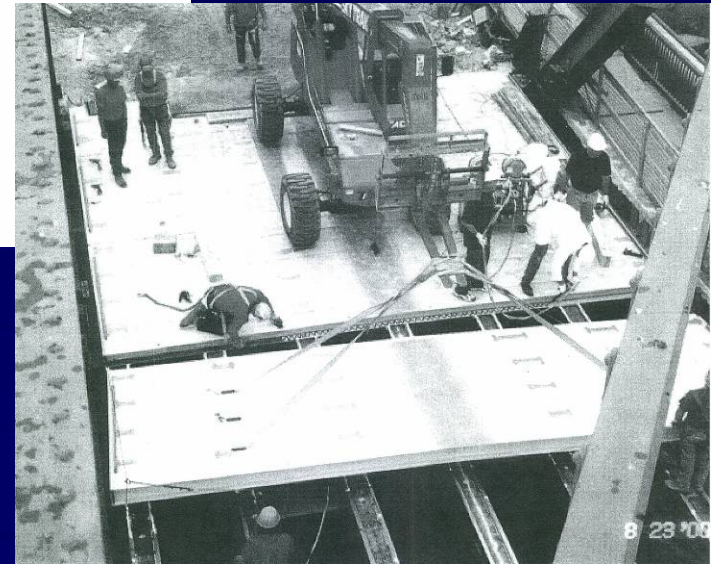


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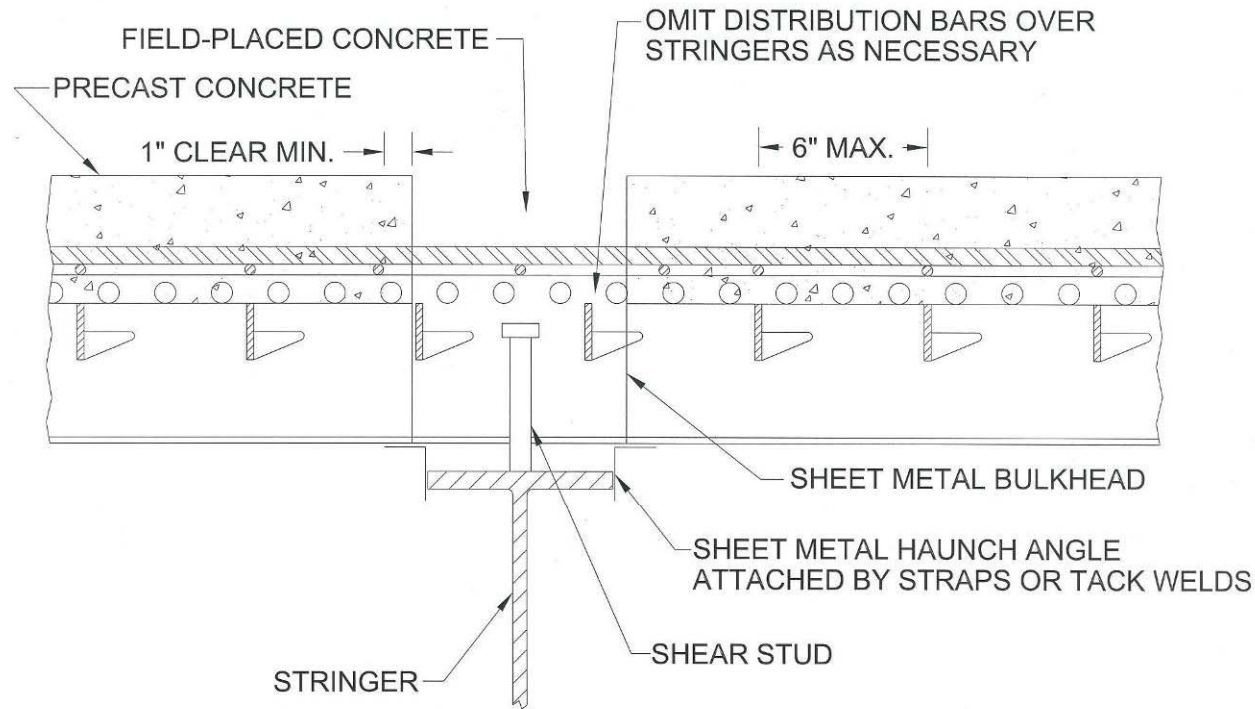
FRP Decks on Steel Framing



Section A-A



Grid Decks on Steel Framing



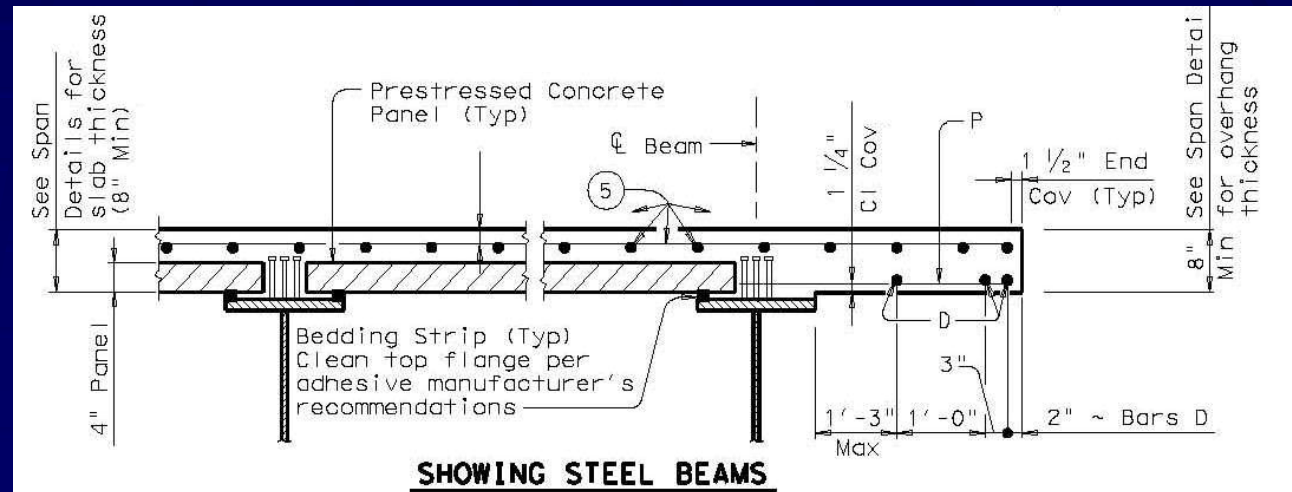
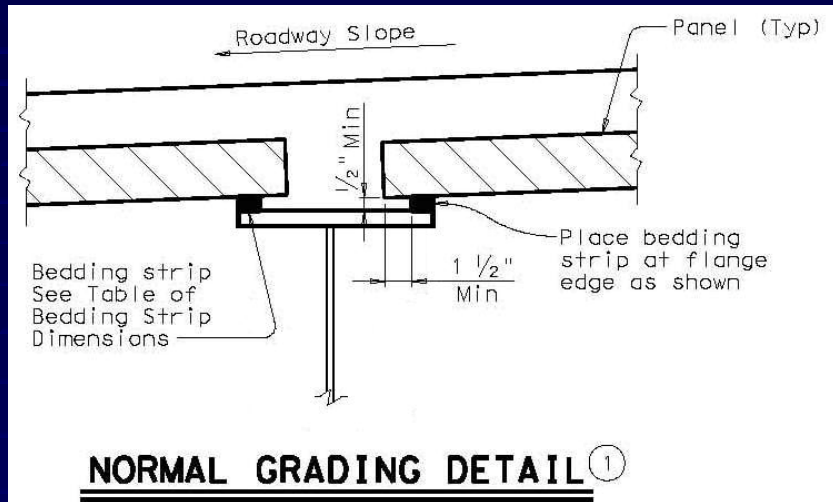
PRECAST EXODERMIC DECK

CONNECTION TO STRINGER

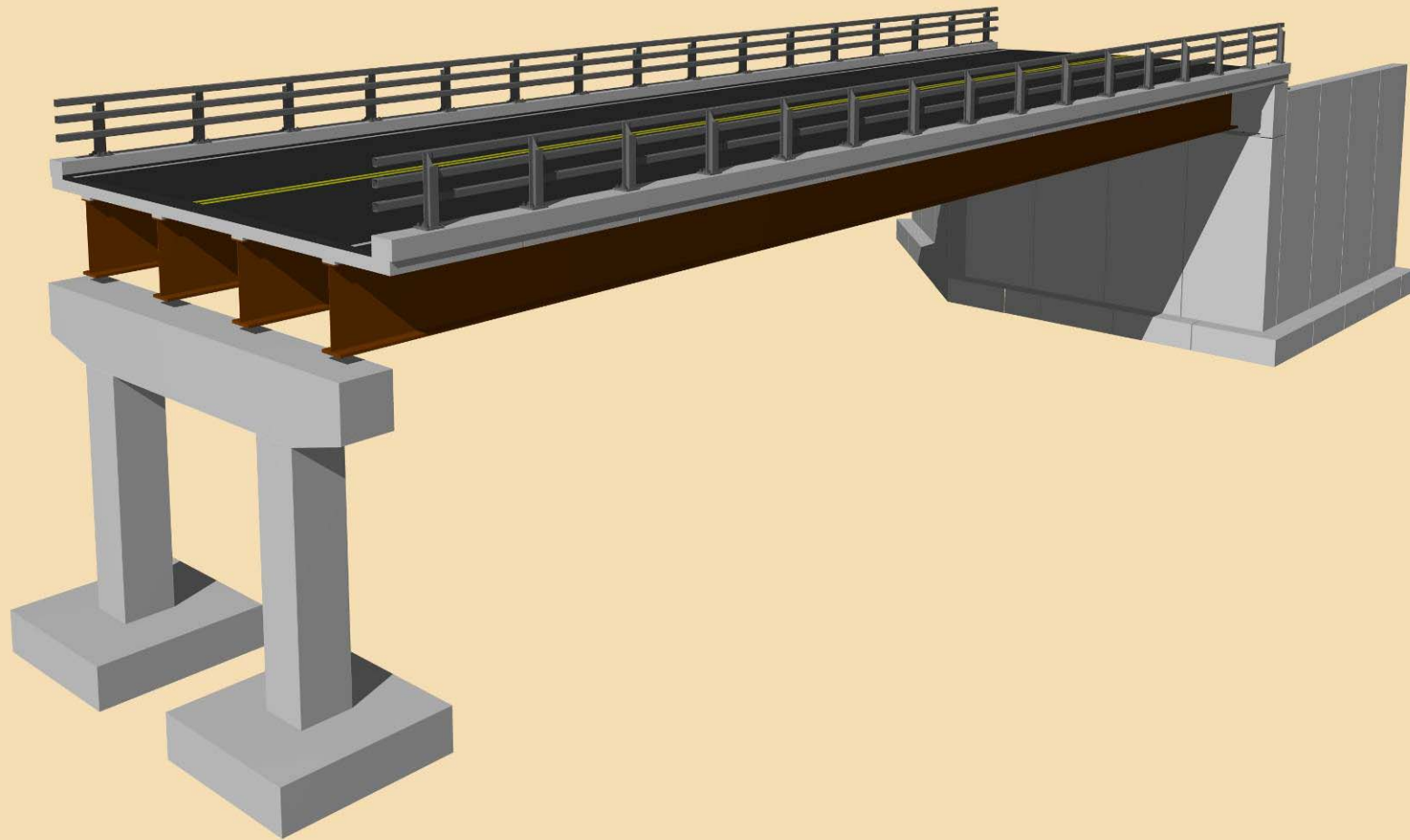
OTHER HAUNCH FORMING OPTIONS POSSIBLE

NOTE: OMIT DISTRIBUTION BARS OVER STRINGERS AS NECESSARY TO PROVIDE CLEARANCE FOR SHEAR STUDS AND LEVELING BOLTS (NOT SHOWN).

Partial Depth Deck Forms



Total Bridge Prefabrication



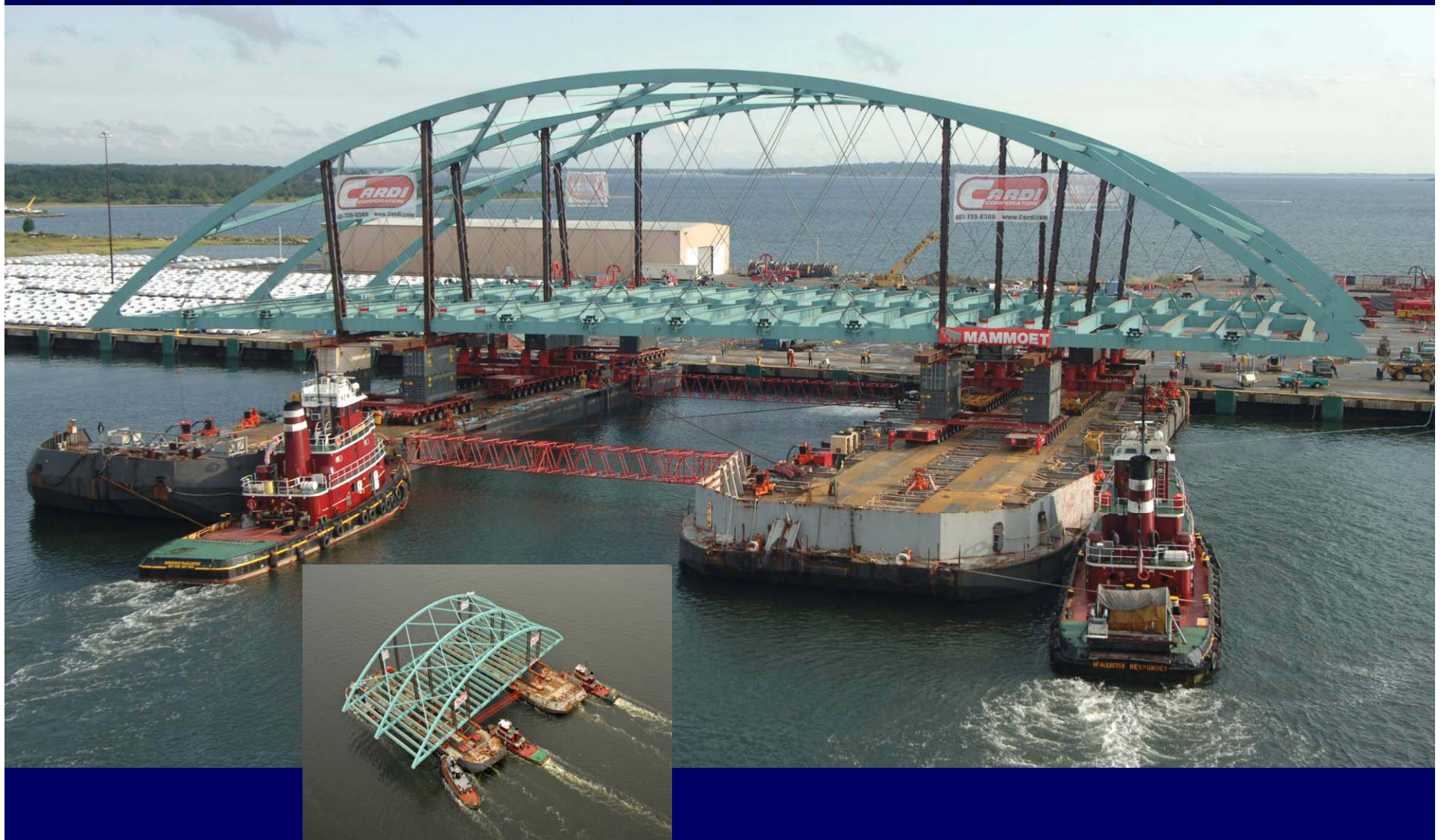
Examples: Epping NH



Epping Bridge Prefabrication



Superstructure Prefabrication



Project Schedule

- Gather information
 - Fall 2006 through Spring 2007
- Visit states that are leaders in accelerated bridge construction
 - Winter 2007
- Develop manual
 - Summer/Fall 2007
- Complete Manual
 - Spring 2008

Project Delivery

- The document will be available for all owners and designers for use in future accelerated bridge projects
 - Website will be established on the FHWA Highways for Life Website

www.fhwa.dot.gov/hfl/



Questions?

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