Proven Practices for Incremental Launching of Steel Girder Bridges

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Launches in North America

Major launches completed in Canada in the past 5 years:

- Park Bridge (2007)
- Athabasca Bridge (2008)
- Cameron Street Bridge (2009)
- Coast Meridian Overpass (2009)
- Capilano River Bridge (2011)
- Deh Cho Bridge (2011)
- Autoroute A30 (2012 - pending)

Launches completed in the US:

- US 20 Iowa River Bridge (2001/2002)
- Belleair Beach Causeway Bridge (Concrete – 2009)

Presentation Outline

1) Site Constraints - Reviewing the layout of bridge site

2) Bridge Design - Adequacy of permanent bridge superstructure for temporary launching demands

3) Launch Equipment - Function of systems typically used

4) "Jack Down" - Transfer of bridge superstructure from temporary supports to permanent bearings

Site Constraints

Site Obstacles:

- Rivers, and other bodies of water
- Vehicle and rail traffic
- Uneven terrain and steep slopes
- Environmental regions where access not allowed

Other Potential Challenges:

- Wind in narrow canyon and flat, open regions
- Isolated areas
- Locations for cranes
- Weather & temperature

Site Constraints – Park Bridge

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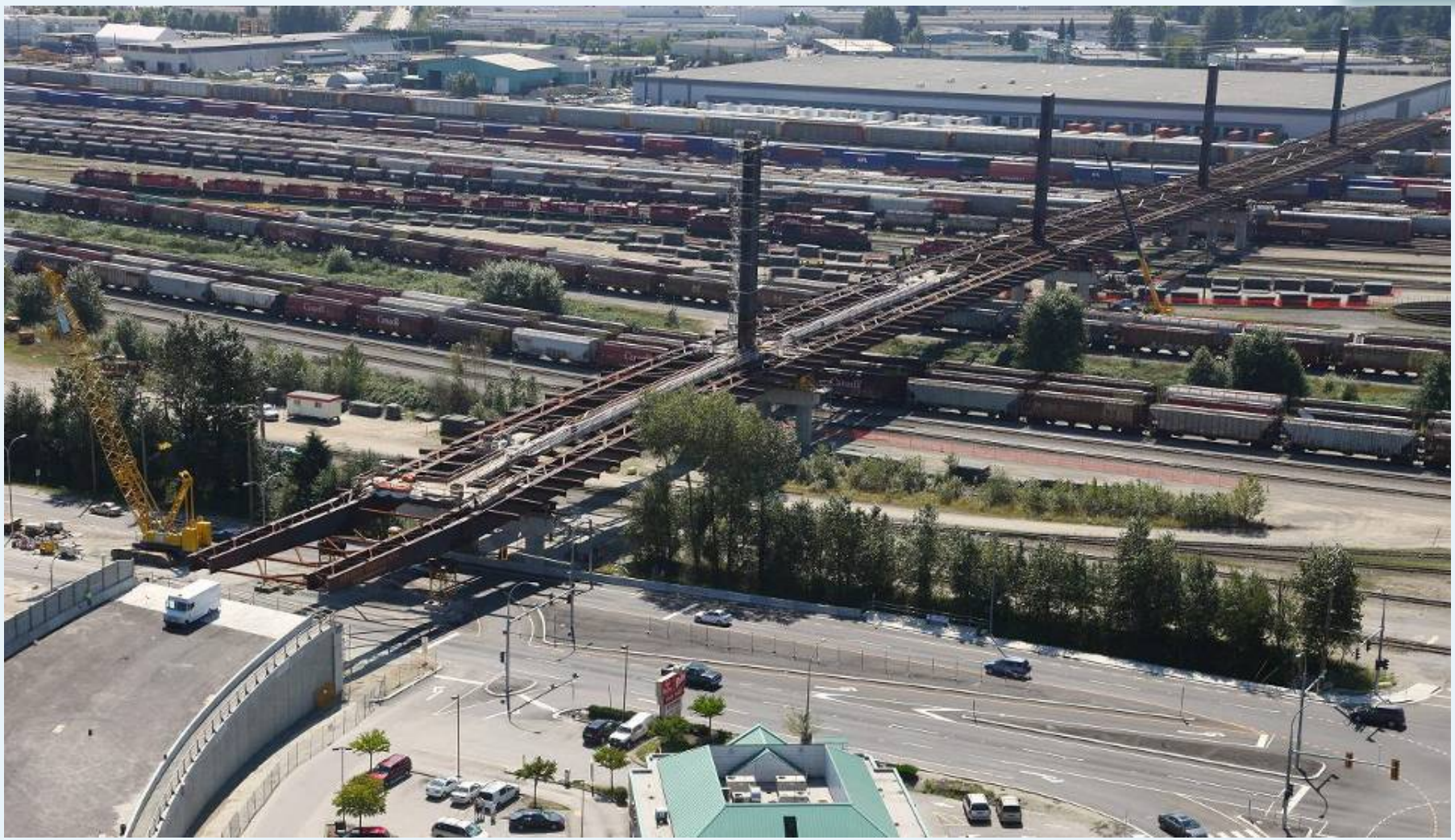
Site Constraints – Coast Meridian



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Bridge Design for Launching

Bridge designed to AASHTO LRFD with separate “launch criteria” with load cases for the temporary launching demands.

Superstructure designed for permanent load cases and checked and modified as necessary for launch load cases. Most efficient if these are completed concurrently.

2-D beam models (typical cases) and 3-D FE models (governing cases w/transverse loads) used to check structure for launching.

Bridge Design for Launching

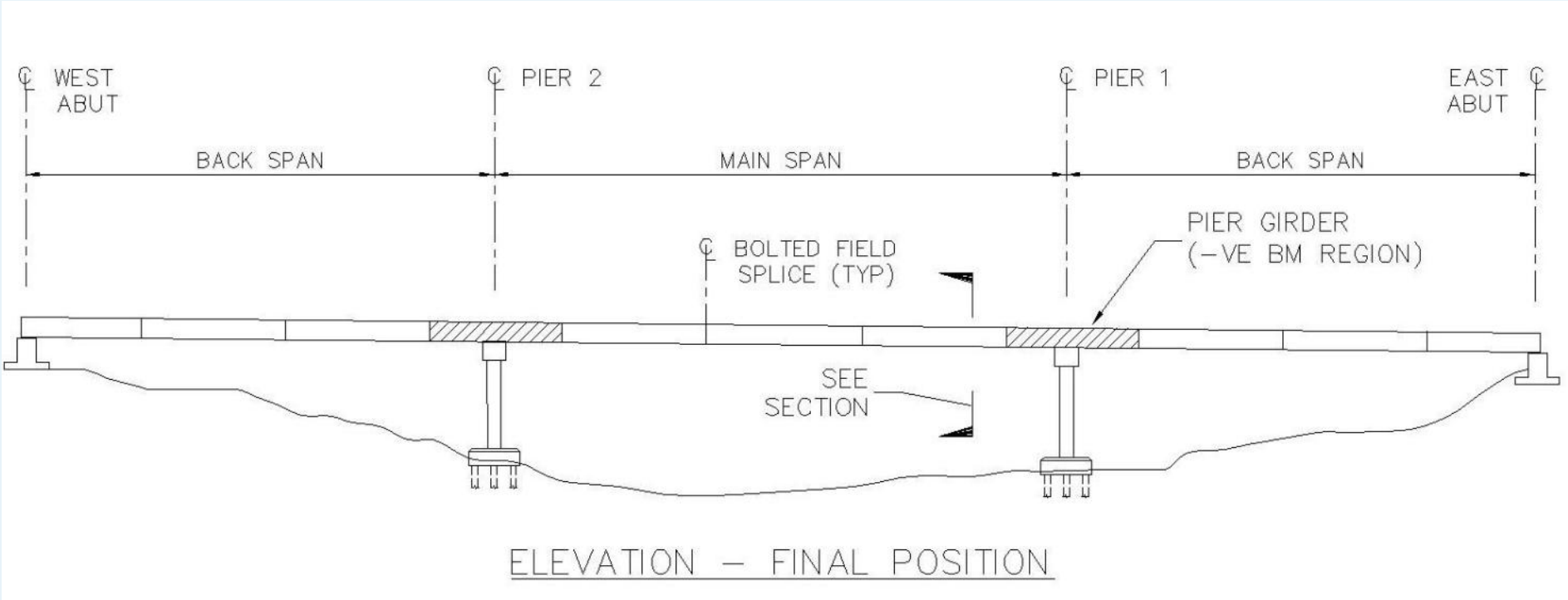
Superstructure:

- Girder non-composite bending moment
- Bolted field splices
- Localized web buckling at support using BS EN 1993-1-5:2006
- Wind loads
- Concentrated transverse loads
- Jack Down loads

Piers & Abutments:

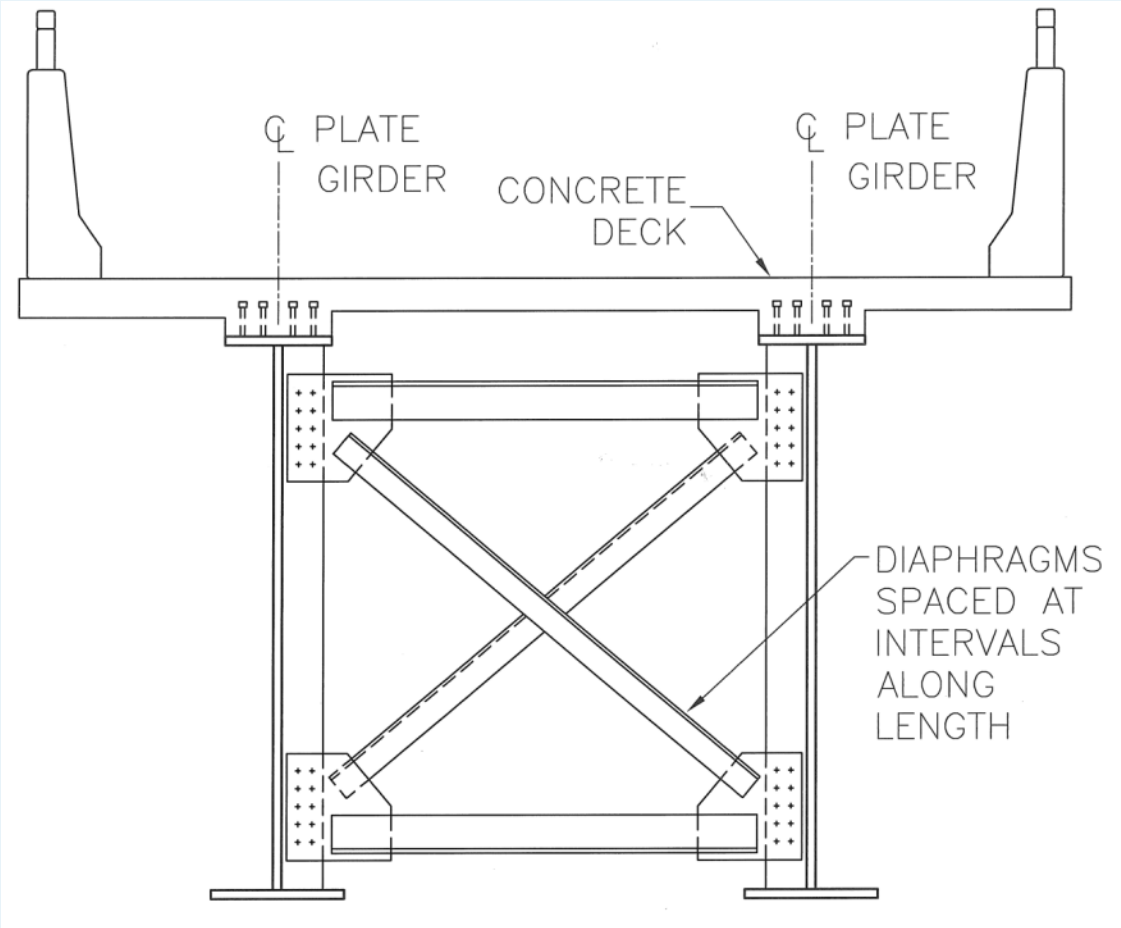
- Longitudinal and transverse reactions at Pier Equipment
- Jack Down loads

Bridge Design for Launching



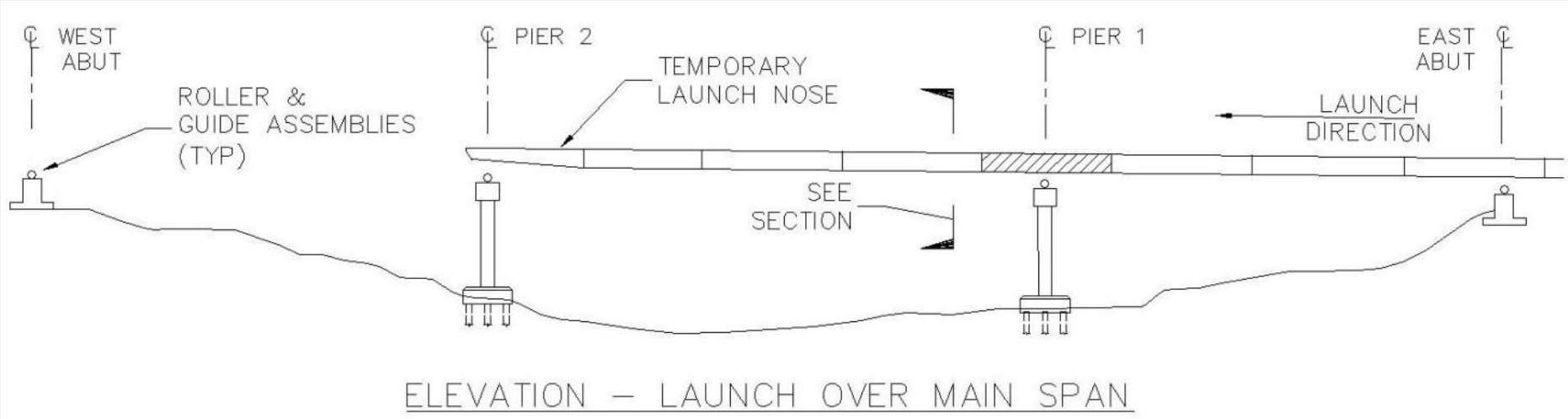
Example bridge for launching

Bridge Design for Launching



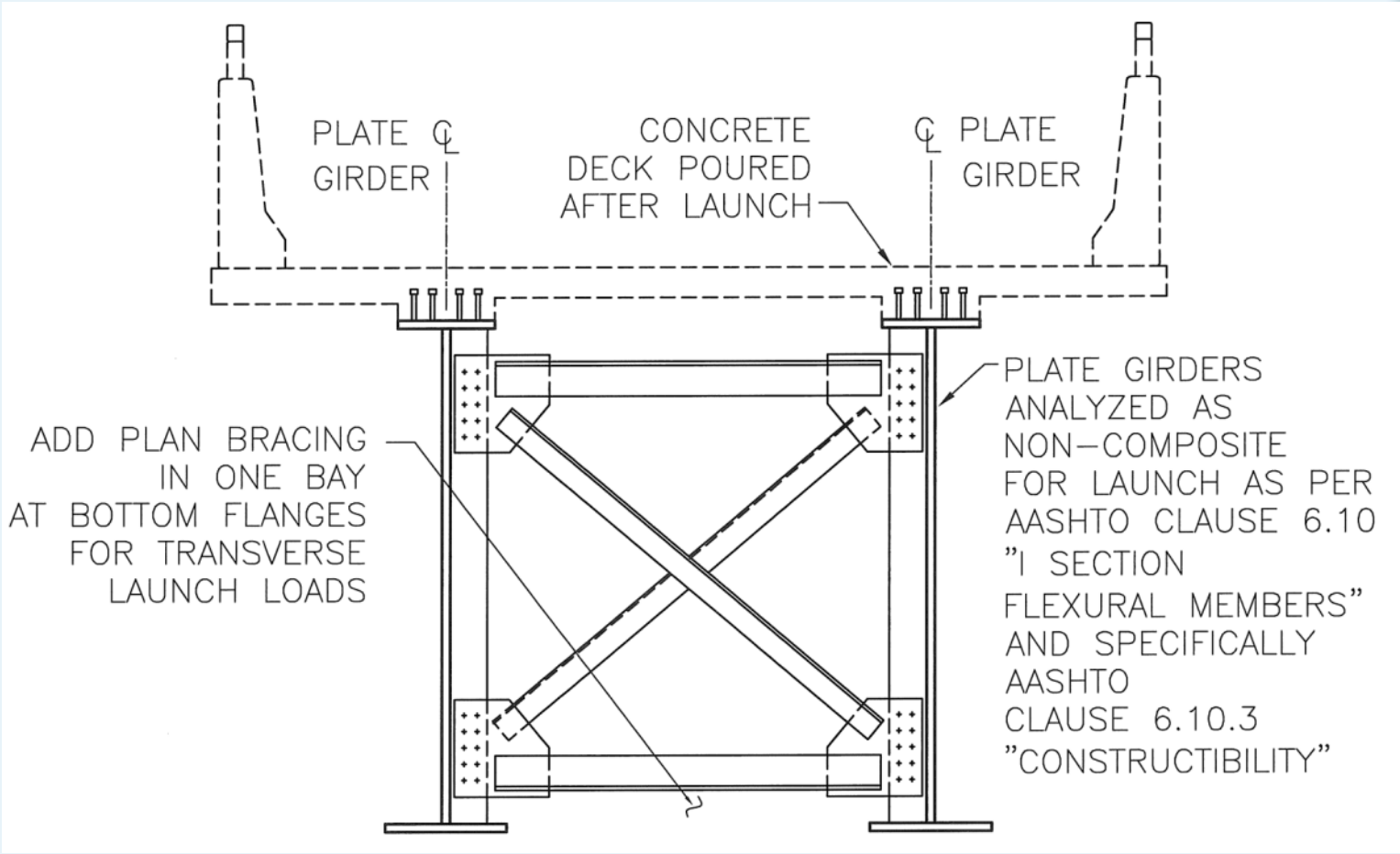
Typical bridge cross section

Bridge Design for Launching



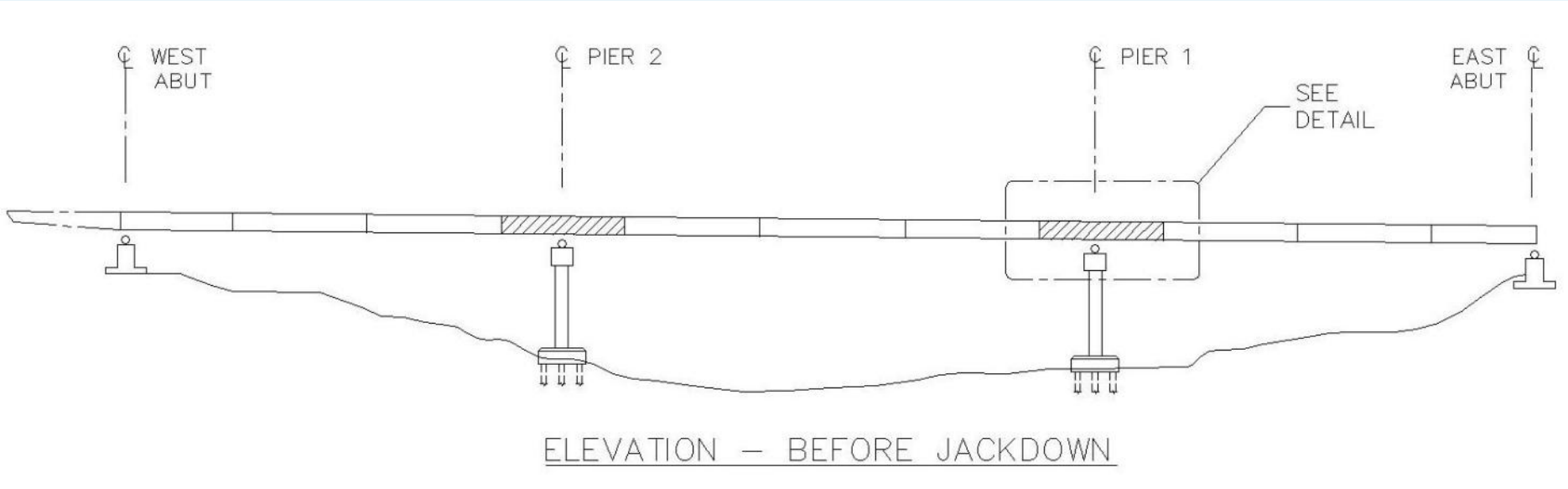
Example bridge for launching

Bridge Design for Launching



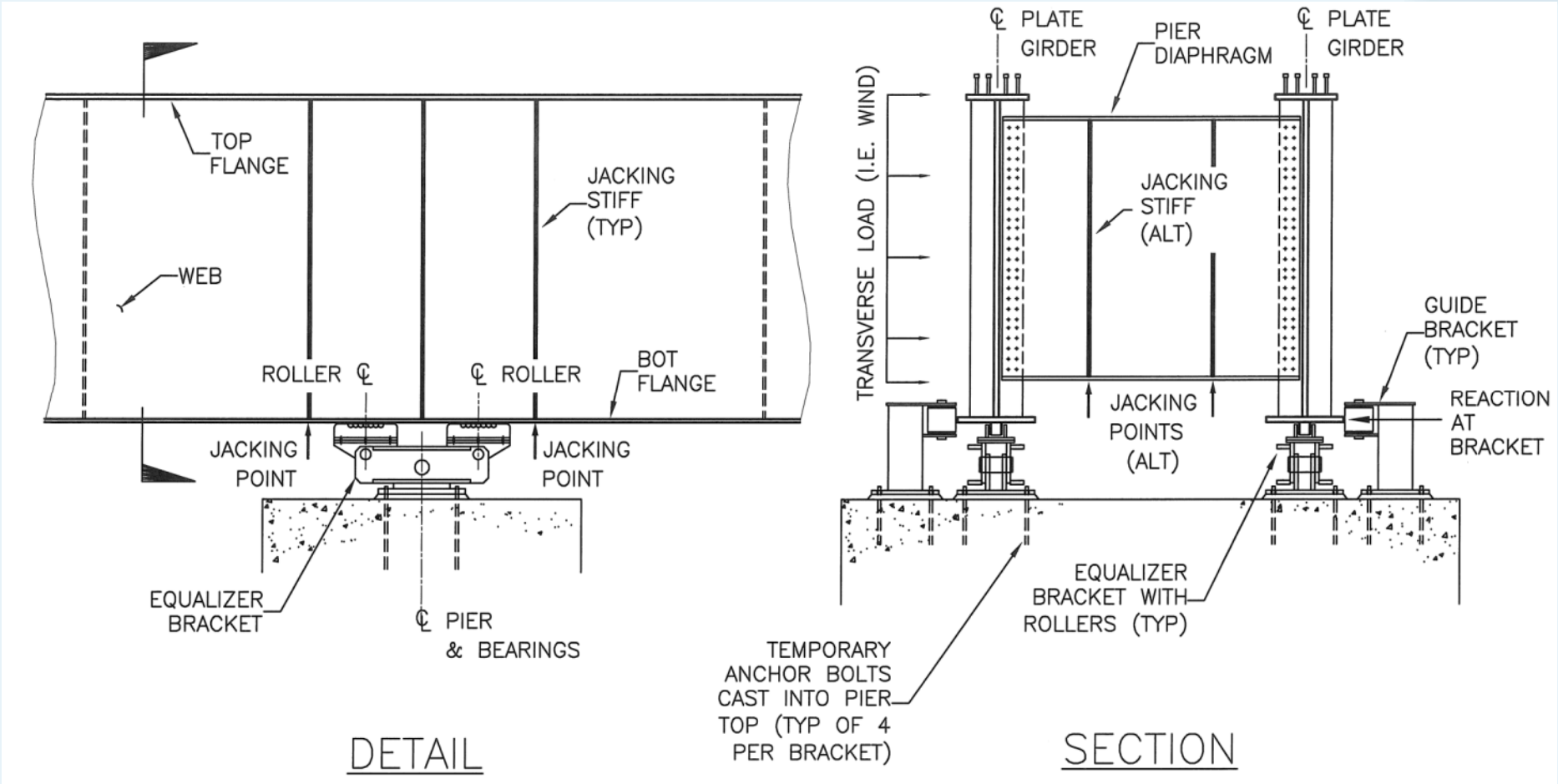
Launching cross section

Bridge Design for Launching



Example bridge for launching

Bridge Design for Launching



Jack Down at Piers

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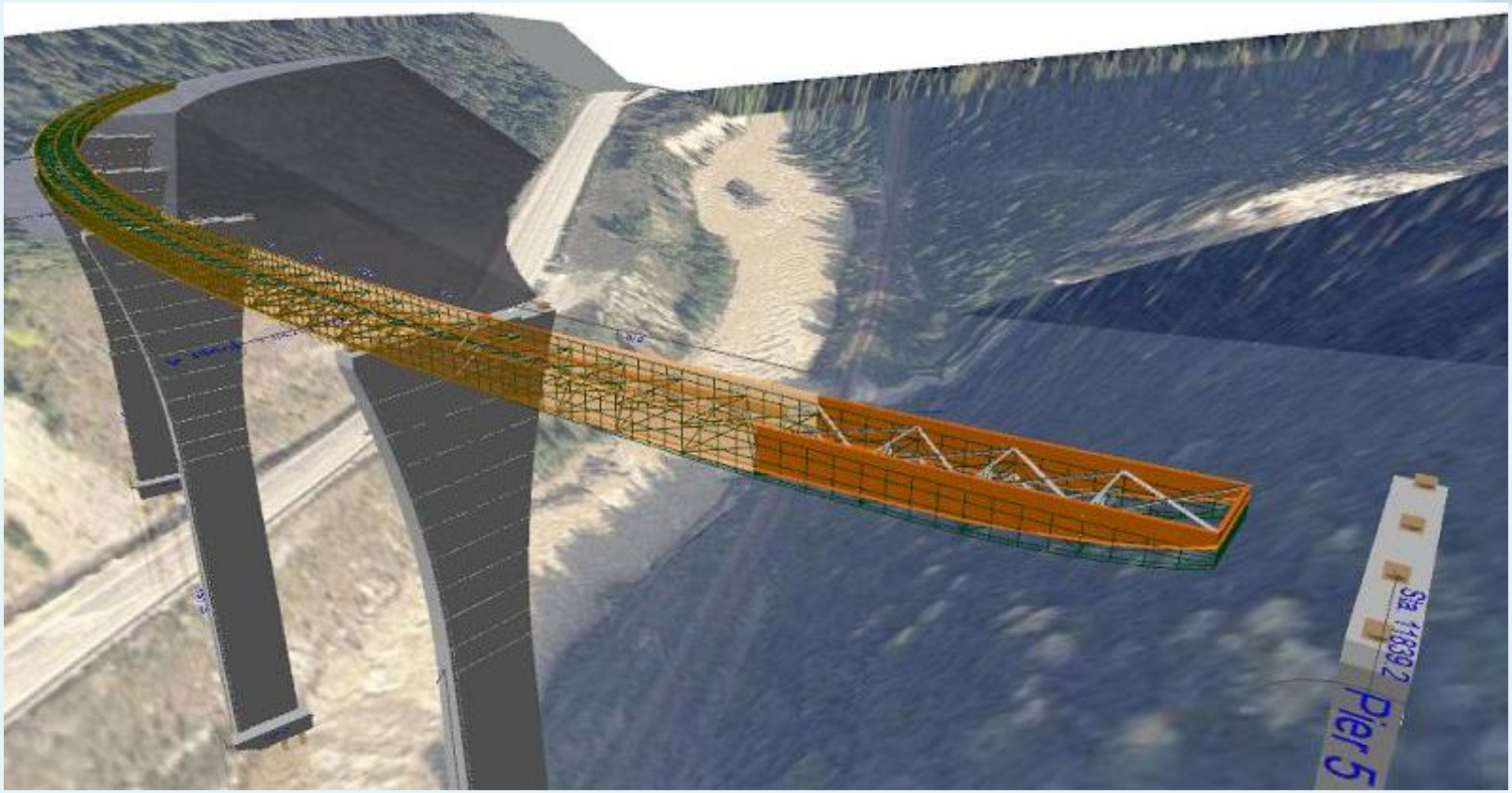
Bridge Design for Launching



Use span to depth ratio not greater than about 25

Superstructure weight increase less than 10% for launching reinforcement

Bridge Design for Launching

Flush bottom flange to allow roller to move on leveled surface

Constant width for guiding

Bridge Design for Launching

Bolted field splices allow passage of roller

Launch Equipment – Assembly Bed

Need adequate room to assemble girders

Launch Equipment – Assembly Bed

200-Ton crane squeezes between box girders

Launch Equipment – Assembly Bed

Girders assembled in "no-load" state, notice temporary supports

Launch Equipment – Nose

Temporary nose girders attached to leading end of bridge girder. Sloped up to tip for cantilever deflection.

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Launch Equipment – Nose

Temporary nose is lighter using truss - but more detailed fabrication

Launch Equipment – Nose

Simple temporary nose using rolled beams

Launch Equipment – Nose

Wind guys for long spans to lessen deflection and dampen vibration

Launch Equipment – On Piers

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Launch Equipment – On Piers

Note bearings preset on tops of piers for later installation

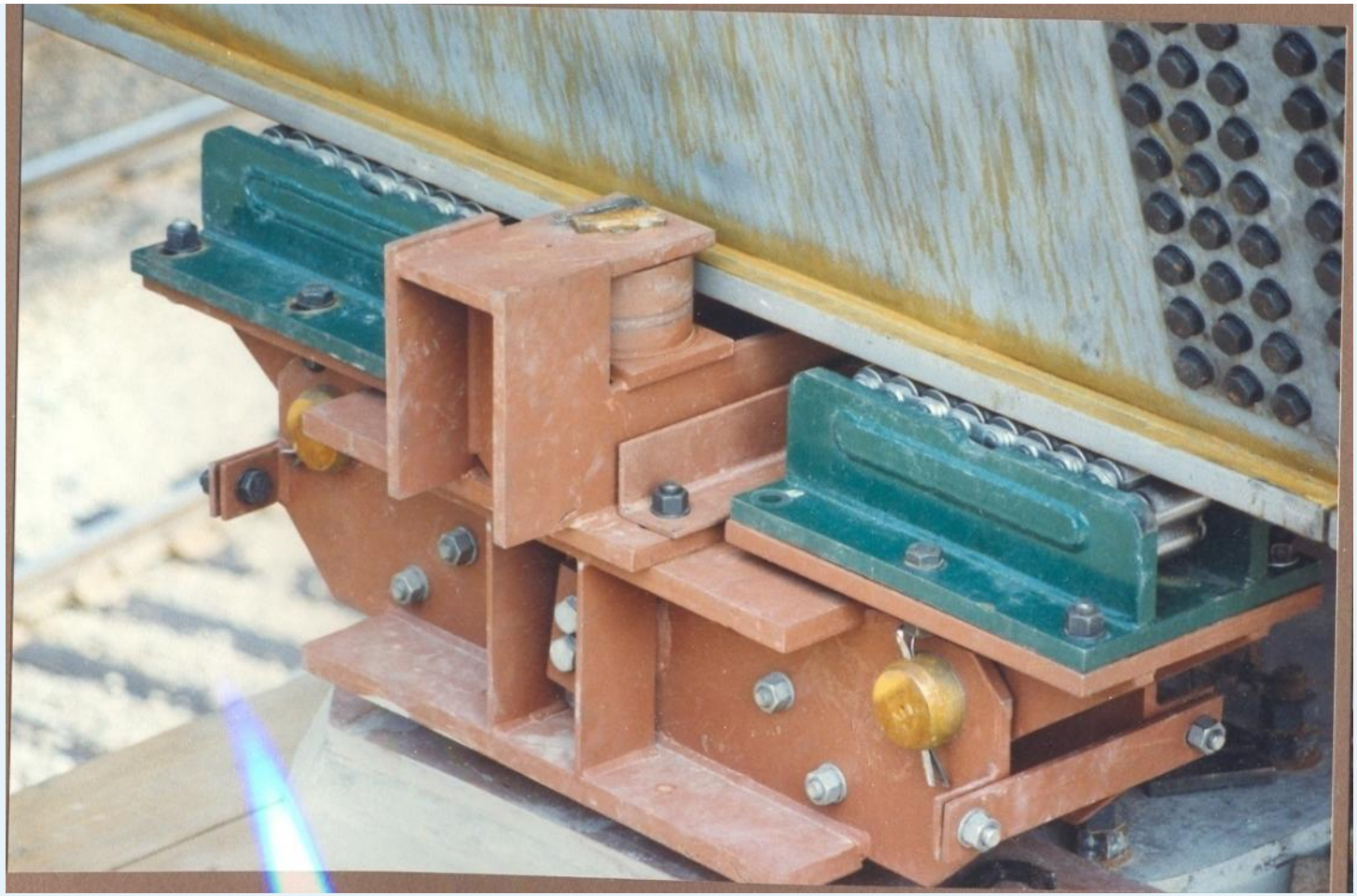
Launch Equipment – On Piers

Nose about to touchdown on rollers

Launch Equipment – On Piers

Close-up of rollers (green) and guide wheel

Launch Equipment – On Piers



Roller Assembly with integral guide system

Launch Equipment – On Piers

Roller assembly need certain amount of space on pier top

Launch Equipment – Moving

Hydraulic rams with clamping jaws

Launch Equipment – Moving

Winching can either pull directly from front or from back using equalizer

Launch Equipment – Moving

Launch system using two linked strand jacks pulling from abutment

Launch Equipment – Moving

Using multiple linked strand jacks on steel rails behind abutment

Launch Equipment – Temporary Stays

Used to lessen deflections for long launches

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Jack Down at Piers

4-ft Jack Down with 700 tons load

Jack Down at Piers

Remove temporary rollers

Slide-in permanent bearing

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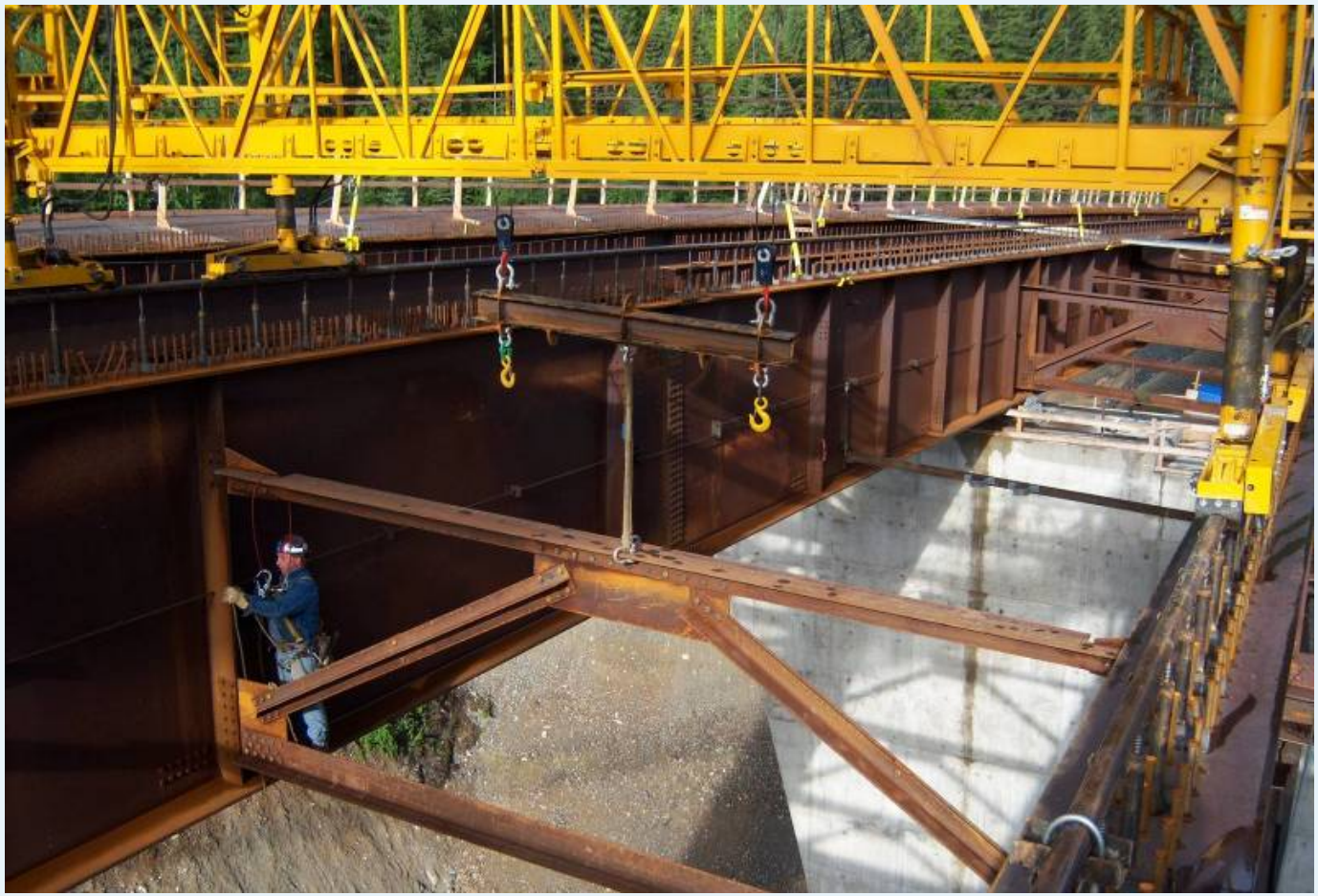
Jack Down at Piers

Bearing in position

Bearing installed

Jack Down – Cross Frame Install



Cross frames detailed for dead load installation with o/s holes.

Summary – What to Remember

Launch must be straight or constant curve

Launching is a viable option for regions of:
- Steep or inaccessible terrain below
- obstacles or heavy vehicle traffic below

Design girders for permanent and temporary launching loads

Design elements of superstructure for launching (splices, bottom flange, plan bracing, jacking stiffeners)

An assembly bed that is wide enough for crane accessibility and long enough to bolt together enough girders to safely reach the pier

Reference Document

BRIDGE CONSTRUCTION PRACTICES USING INCREMENTAL LAUNCHING

Requested by:

American Association of State Highway and Transportation Officials (AASHTO)

Highway Subcommittee on Bridge and Structures

Acknowledgements

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Thank-you !!

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