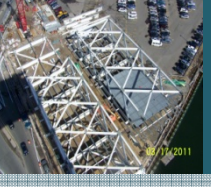
Innovations In Bridge Engineering
Chelsea Street Vertical Lift Drawbridge Erection

Jerry M. Pfuntner, P.E.
Principal and
Assistant Technical Director

Western Bridge Engineers' Seminar
Monday, September 25, 2011
10:30am – 12 Noon



Agenda

General Project Overview

Overall Project Scope

Bridge Towers

Planned Tower Construction Methods

Lifting Procedures and Design Considerations

Tower Construction and Machinery Installation

Bridge Liftspan

Liftspan Launch Overview

Launch Analysis and Design

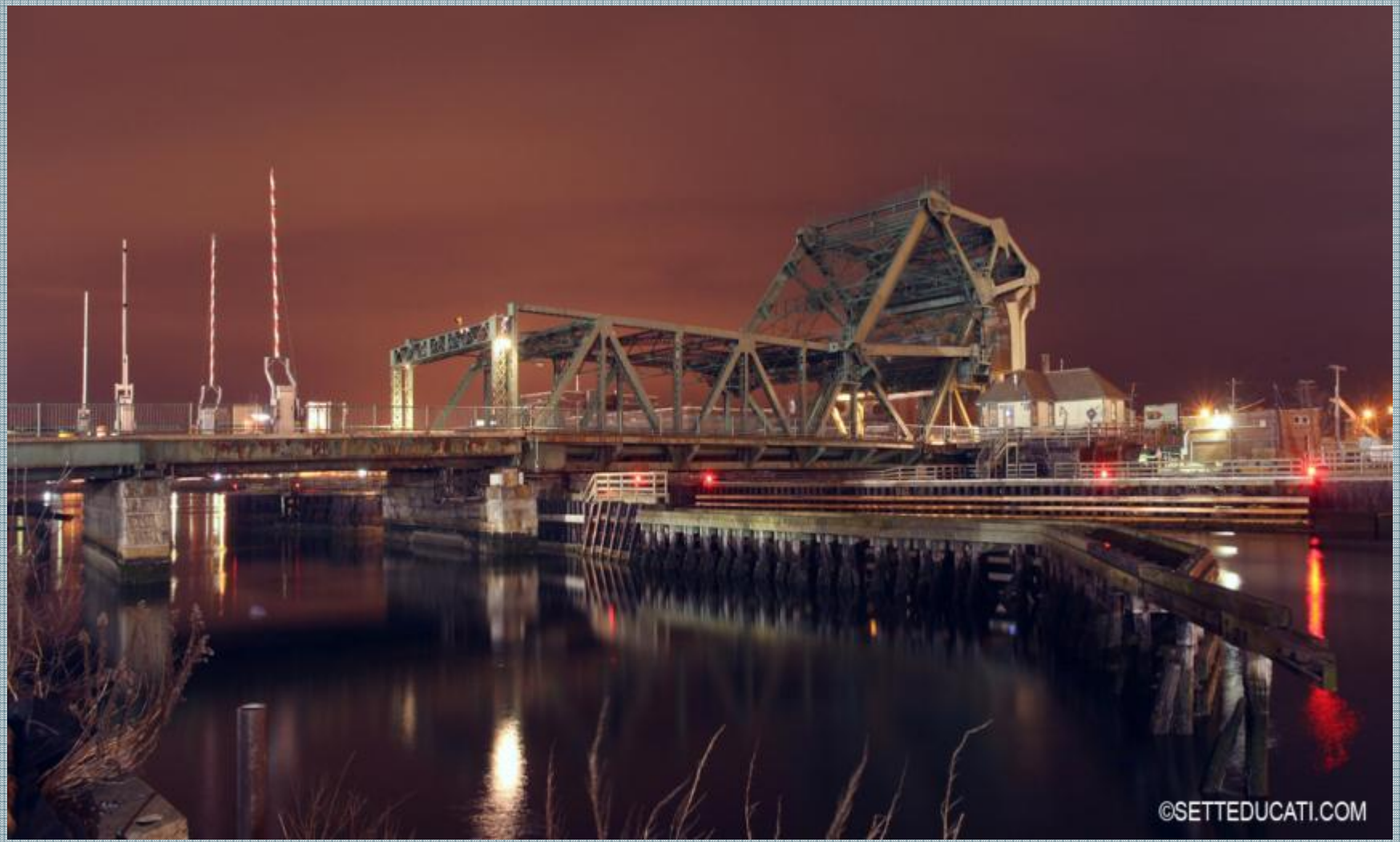
Launch Procedure

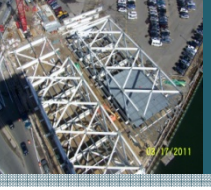
Liftspan Construction Methods

Project Overview

- **Replacement of 75-year old single leaf bascule bridge with Vertical Lift Drawbridge**
  - Existing Bascule span 98 ft long restricts shipping channel and hazard to navigation
  - Proposed vertical lift bridge designed by HNTB Corporation with 450ft long liftspan with 174 ft vertical clearance
  - Tower Height – 214 ft
    Tower Width – 26 ft
    Tower Depth – 8 ft meters
    Tower Mass – 910 tons

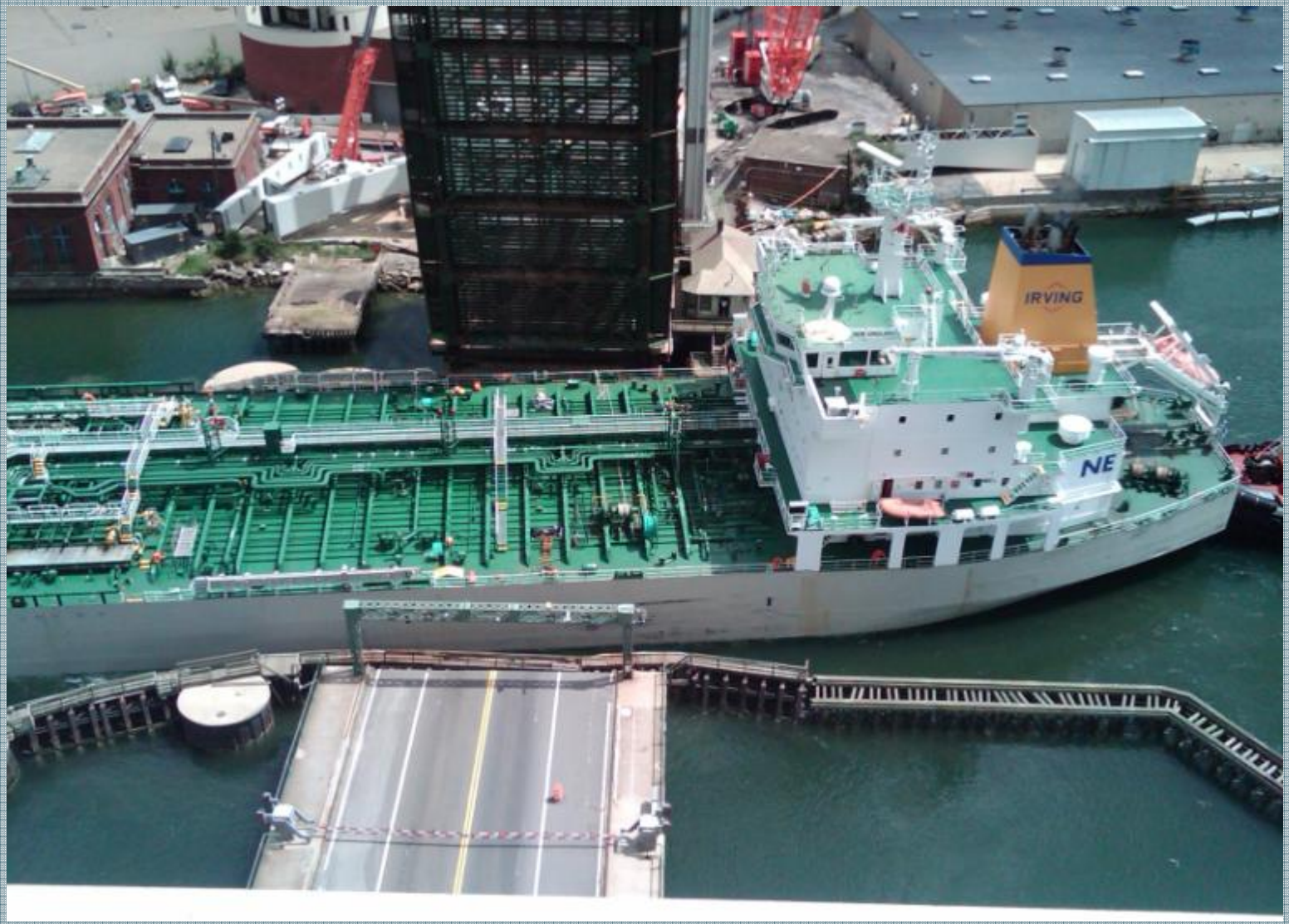
Existing Chelsea Street Bridge



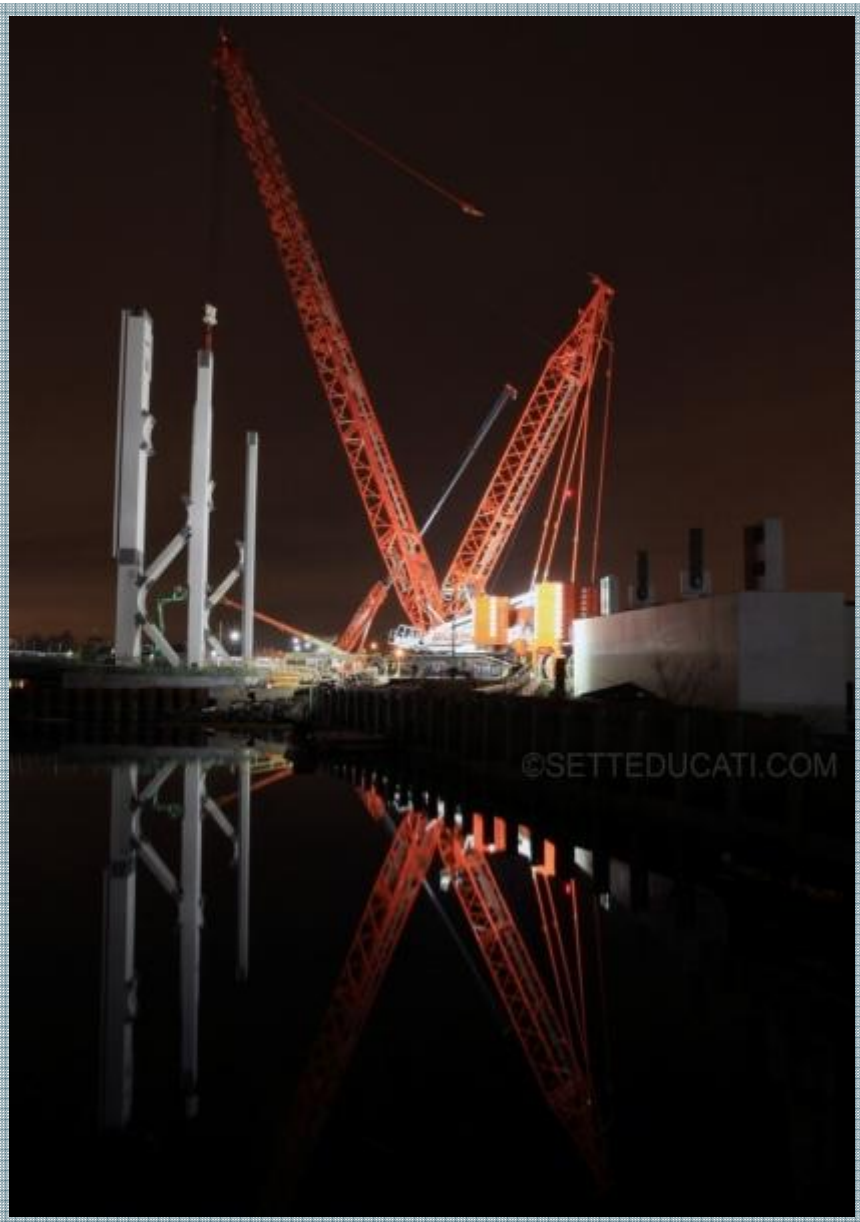


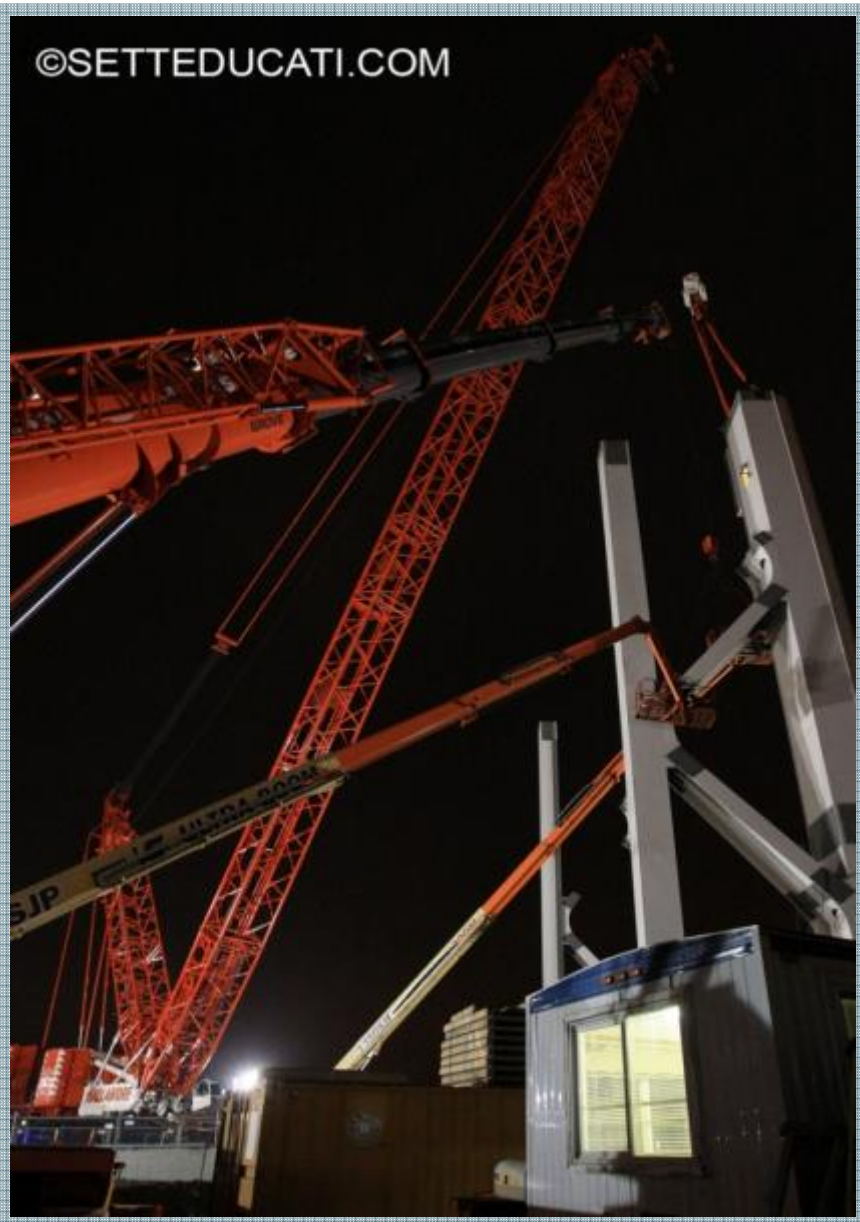
Project Location

Existing Channel Shipping Restriction

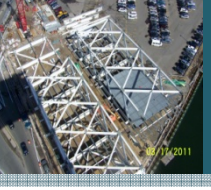


Member by Member Assembly to Midheight





Tower Structure to Midheight



NE Tower Tandem Crane Lift

NW Tower Tandem Lift

North Tower Machinery Room Installation

Tower Verticality Adjustment

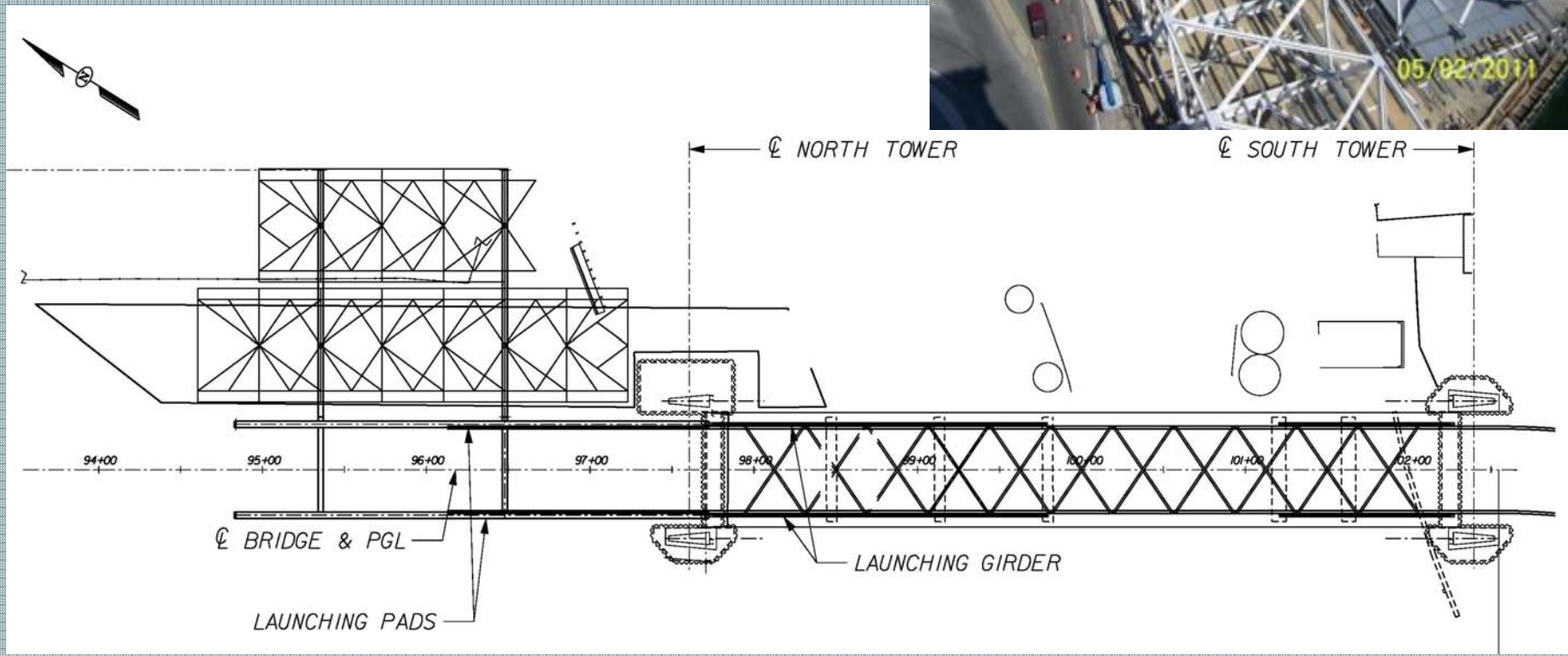
Bridge Machinery Sheaves

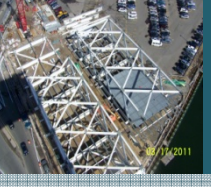
Counterweight Lift Using Strand Jacks

Counterweight Lift Using Strand Jacks

Launch Sequence

Truss Section Construction



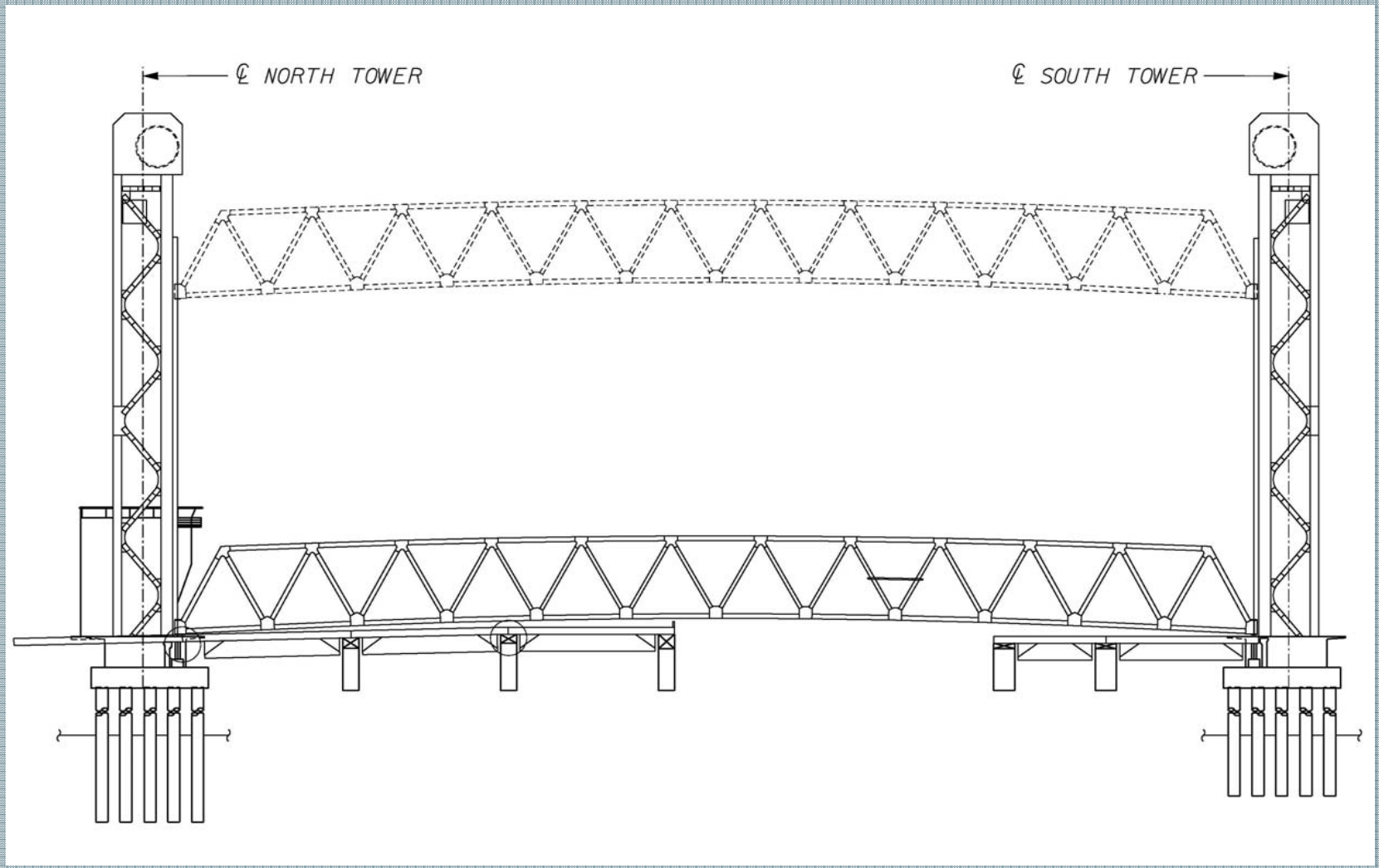


Longitudinal Rails

Rail Intersection

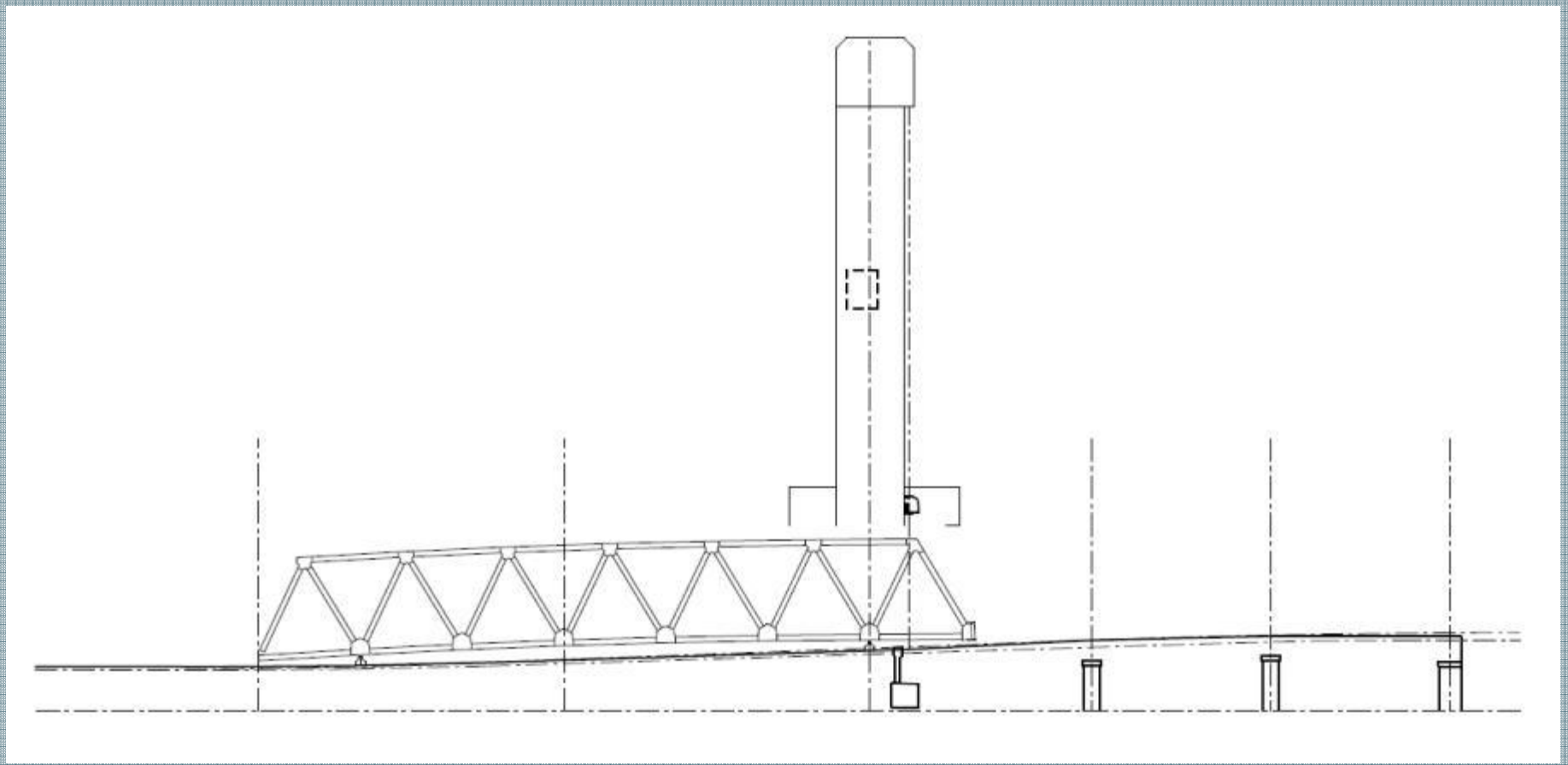
Launch Sequence

Final Truss Position



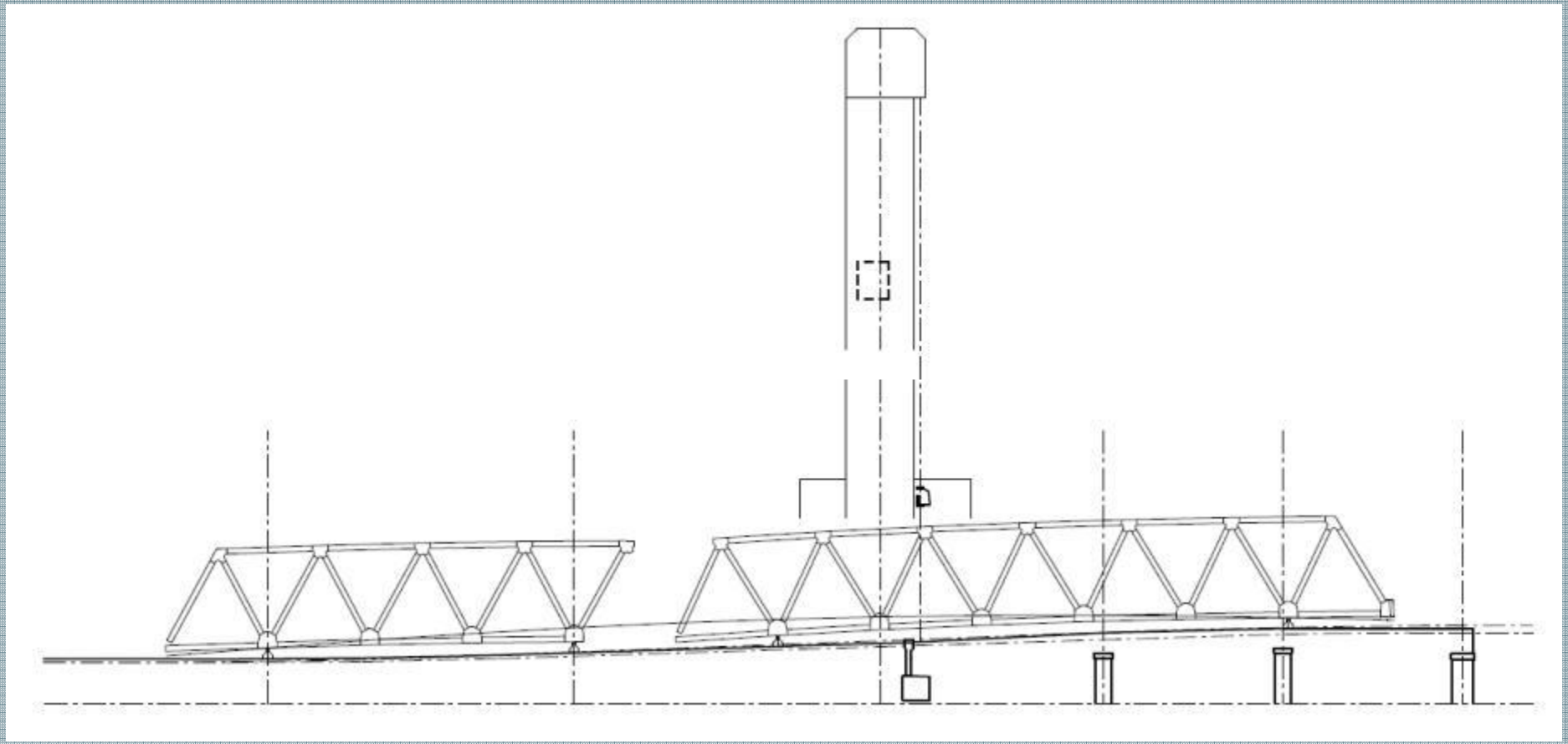
Launch Sequence

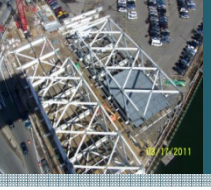
Side Launch Truss Sections



Launch Sequence

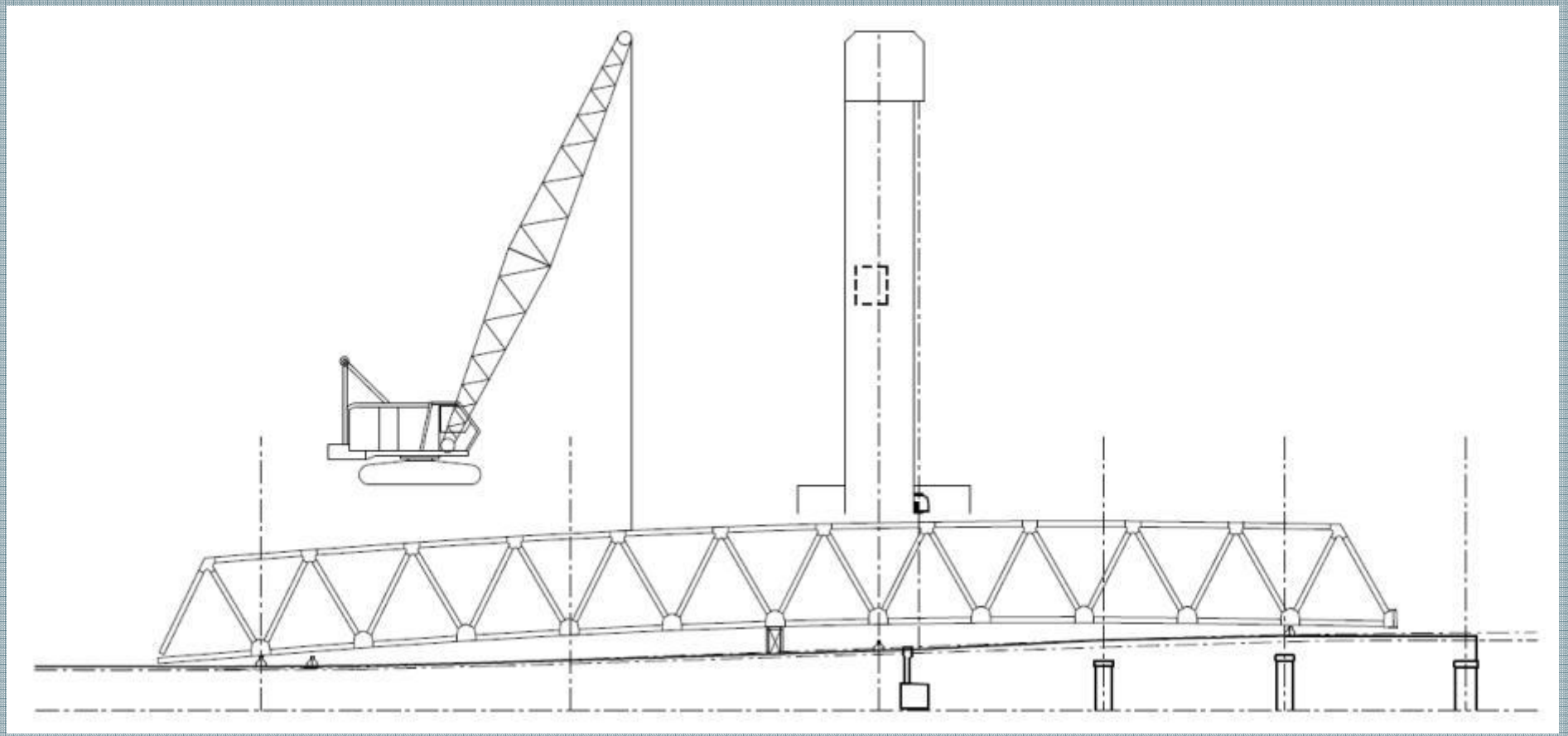
Truss Section Positioning





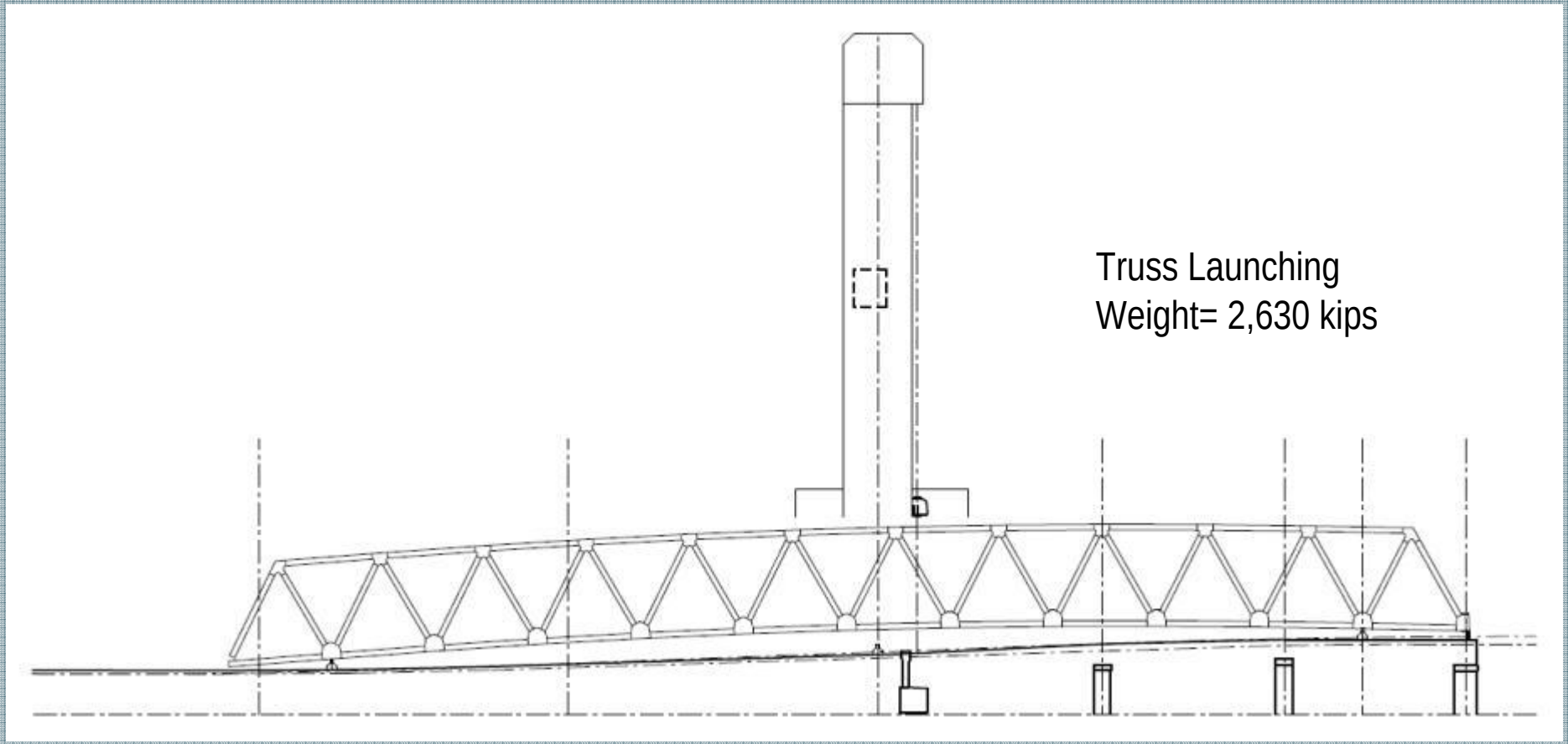
Launch Sequence

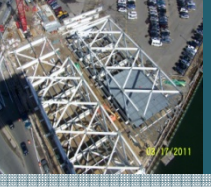
Truss Final Assembly



Launch Sequence

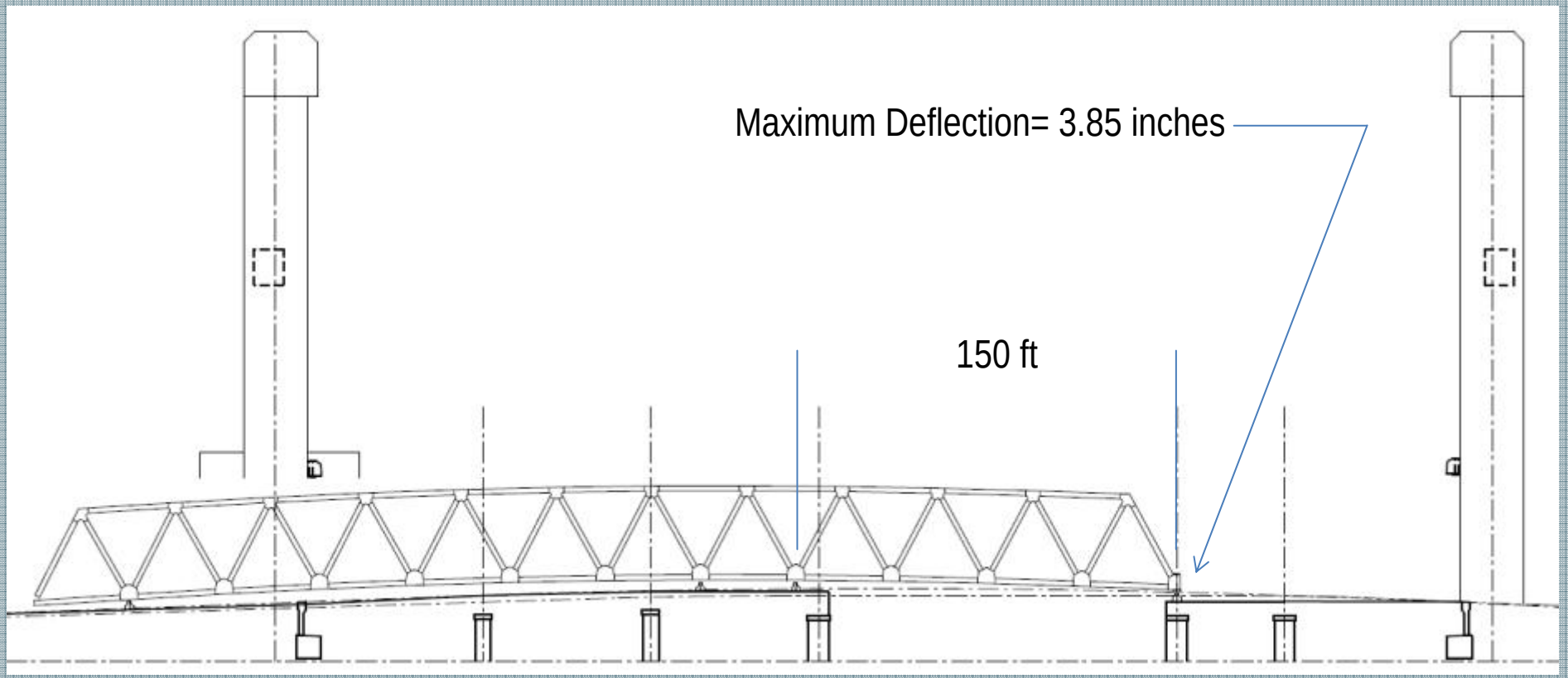
Launch Truss to Channel Opening





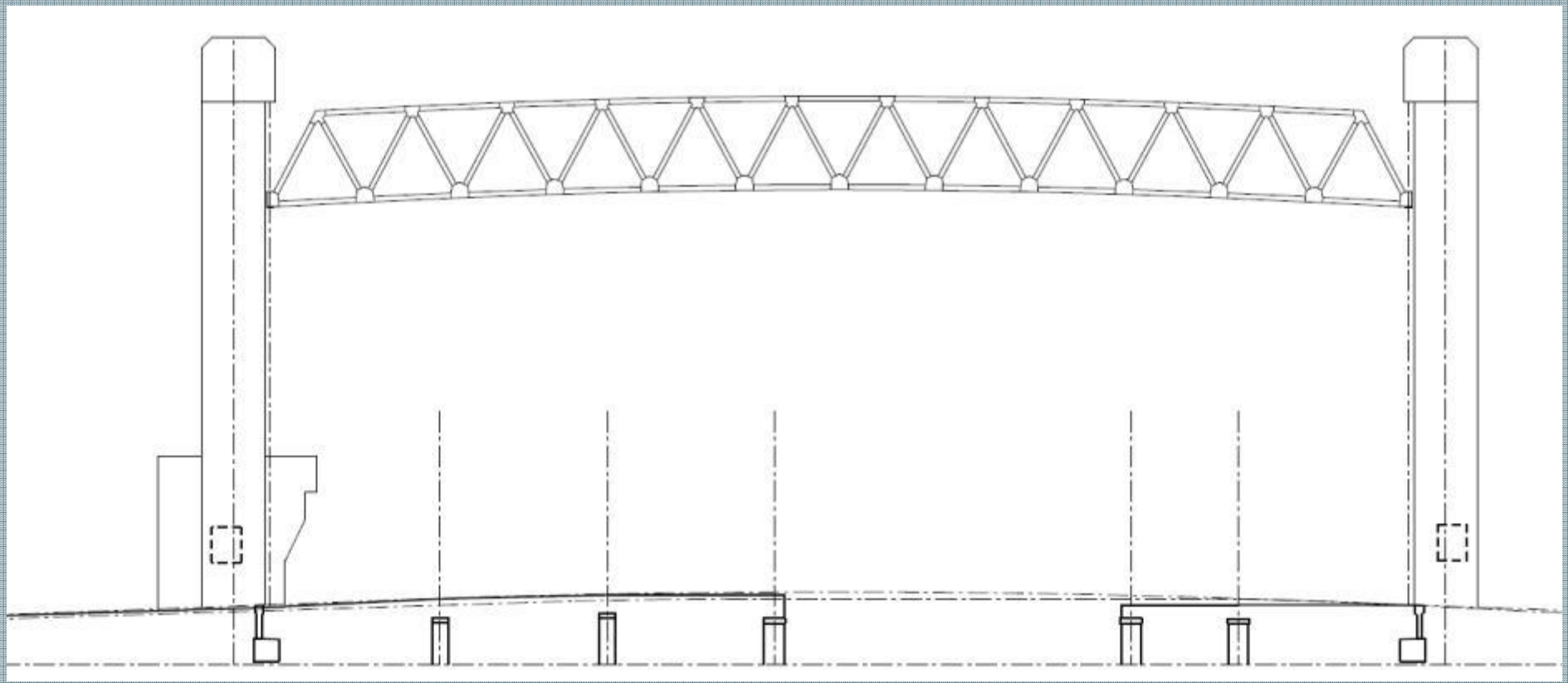
Launch Sequence

Launch Truss Across Channel



Launch Sequence

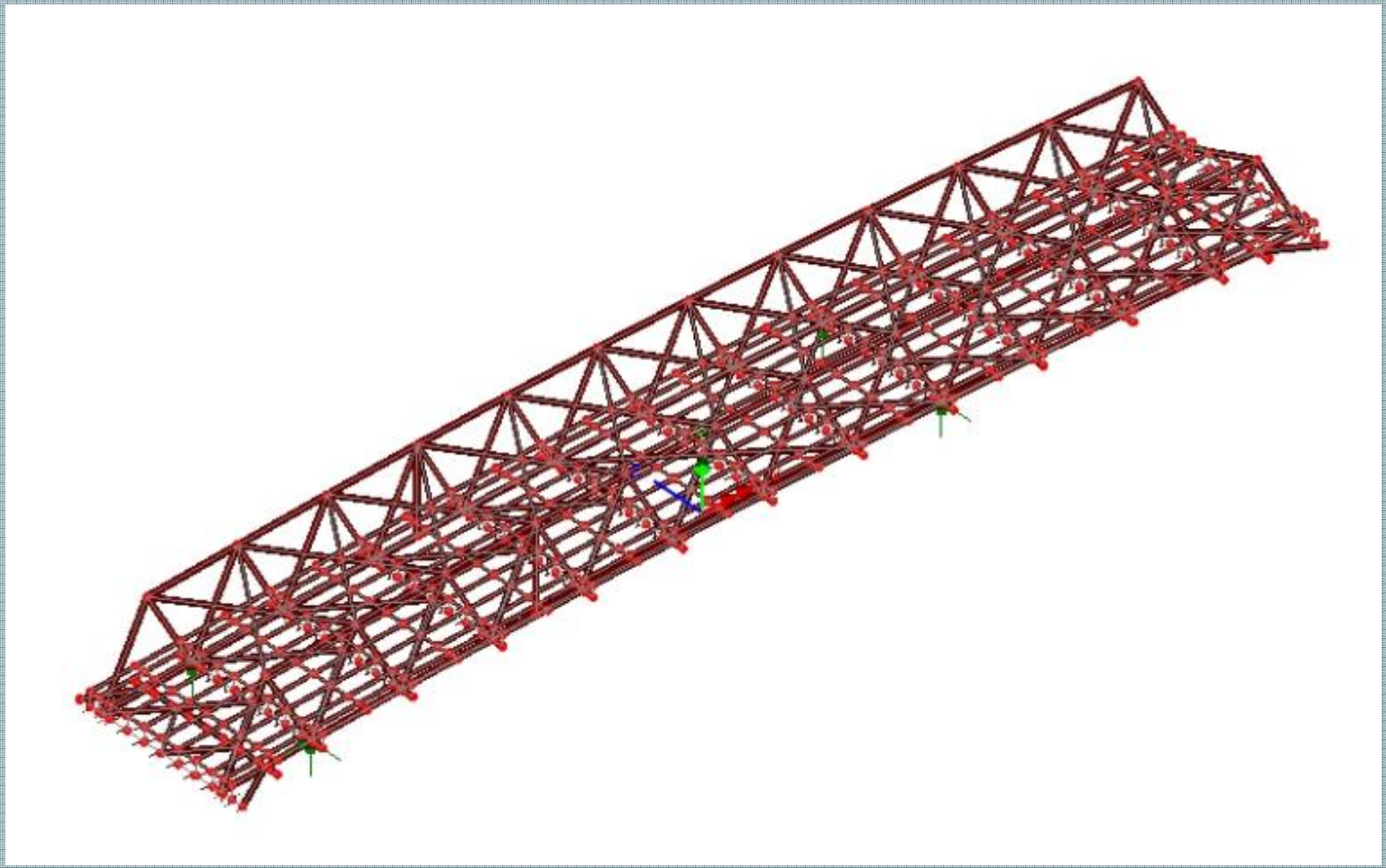
Raise Truss and Re-Open Channel



Launch Analysis

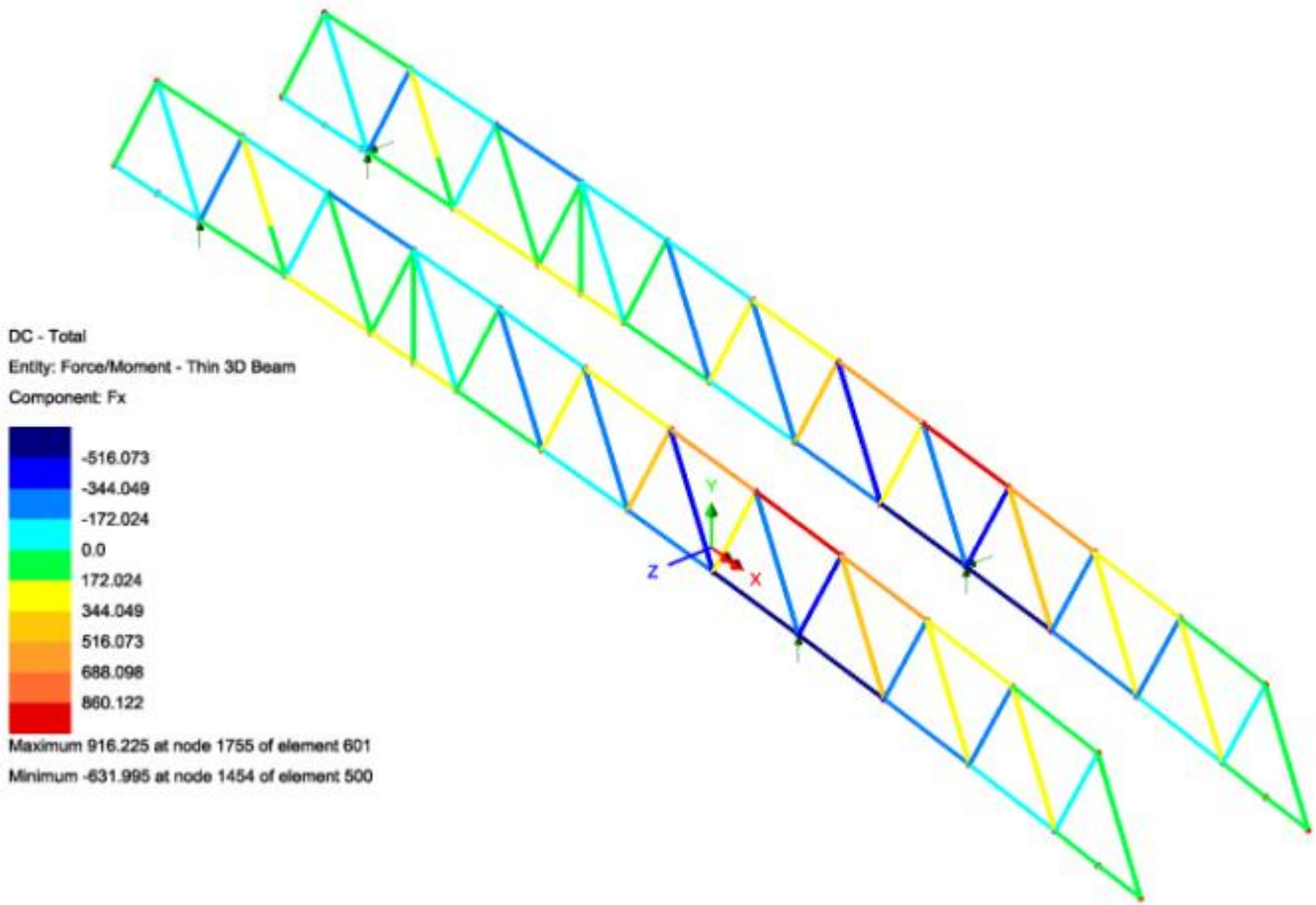
LUSAS Model Overview:

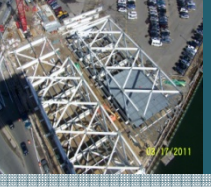
Analysis of truss through all launching



Launch Analysis

Deflection Analysis and Member Forces:





Launch Analysis

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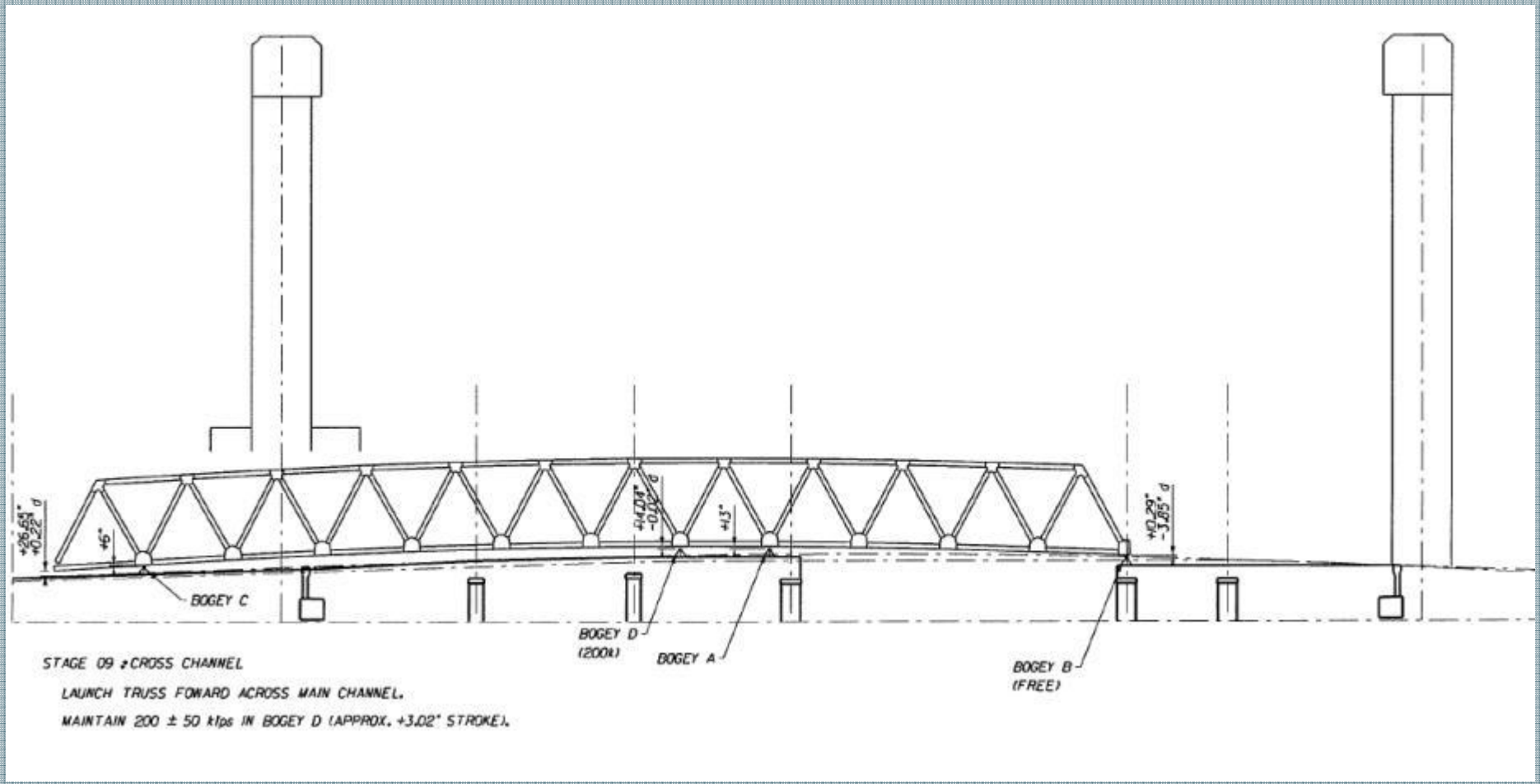
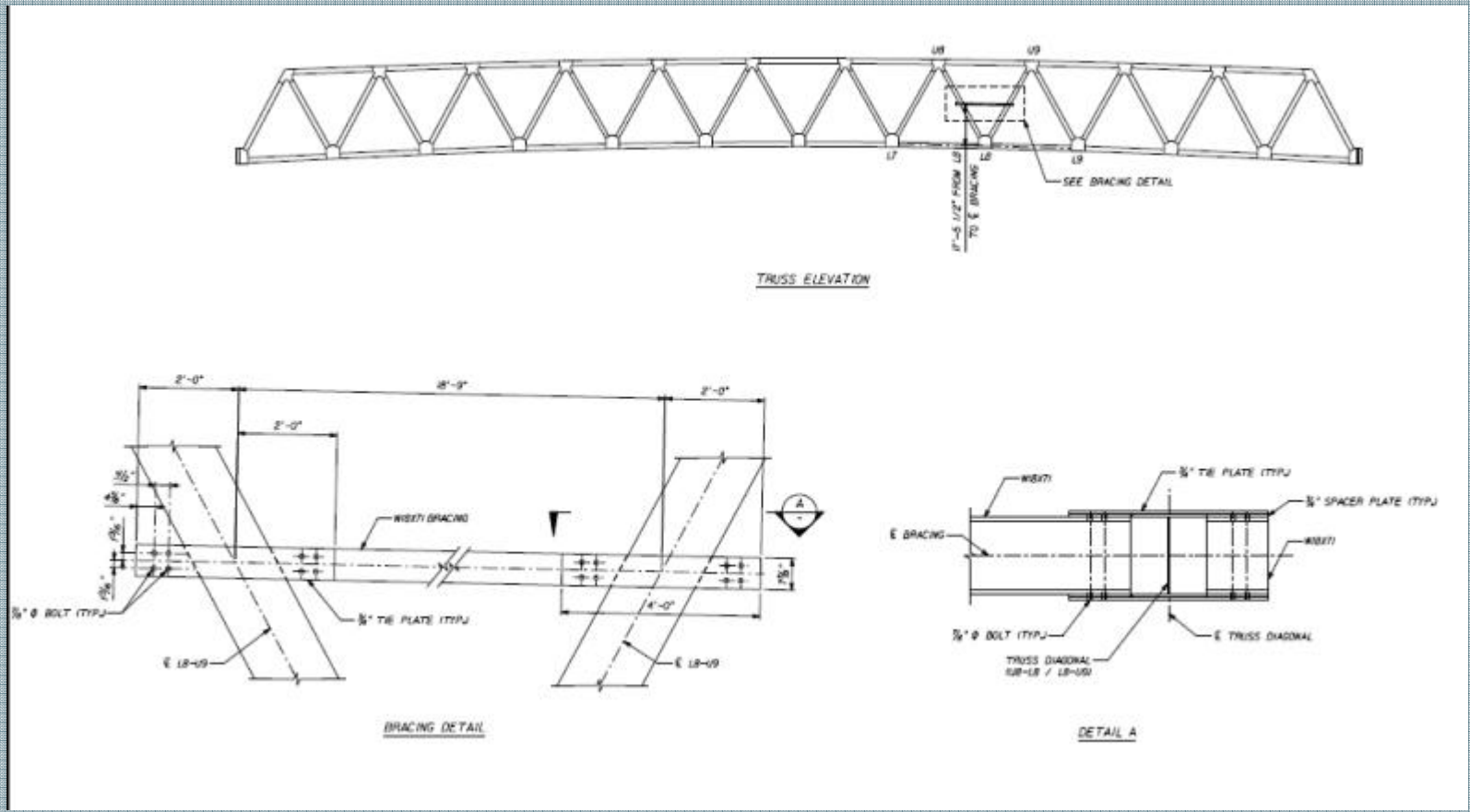


Launch Design

Truss Evaluation during Launch:

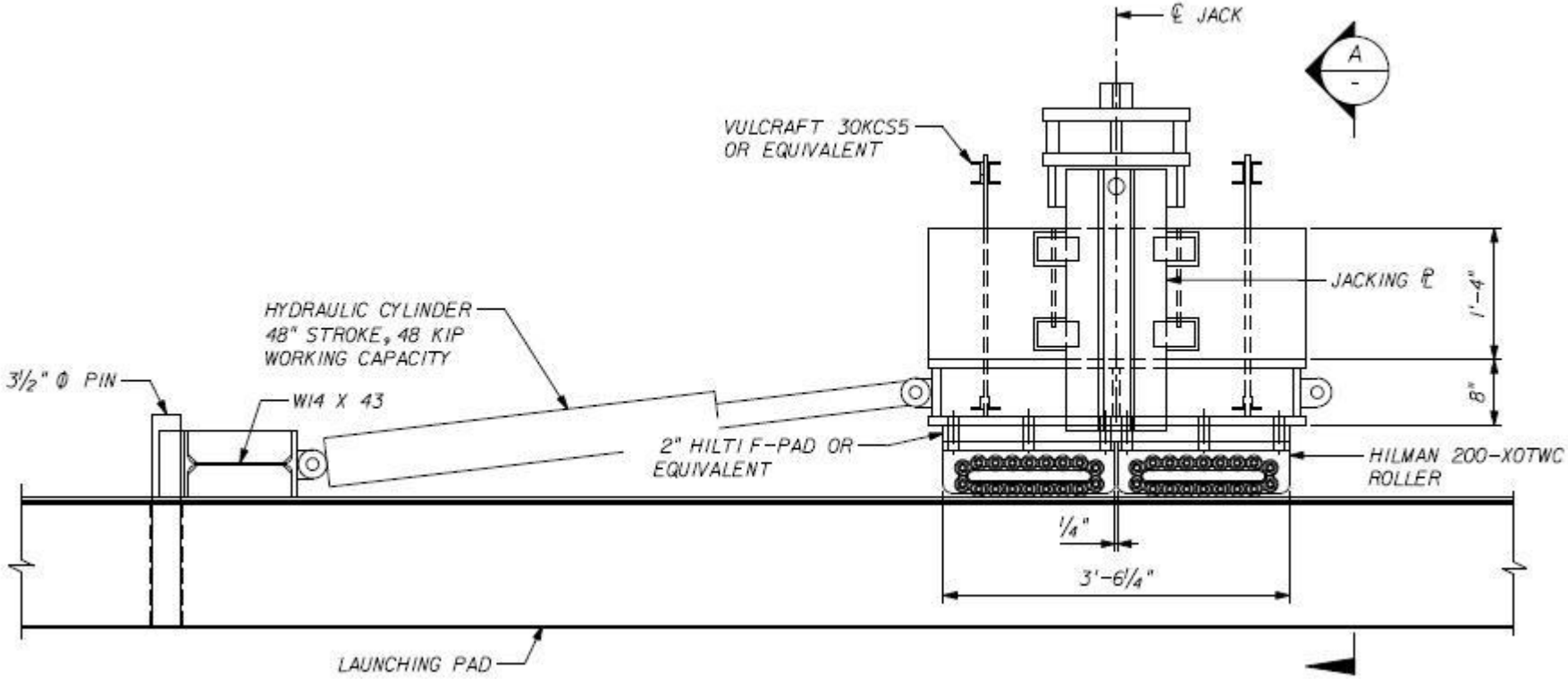
- **Truss Chords**
- **Diagonal Bracing Members**



Launch Design

Temporary Works:

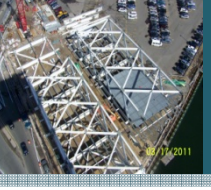
- **Launching Bogeys**



Launching Bogey System

Launching Bogey

Jacking System



Truss Support

Hydraulic Manifolding

Reaction Beam

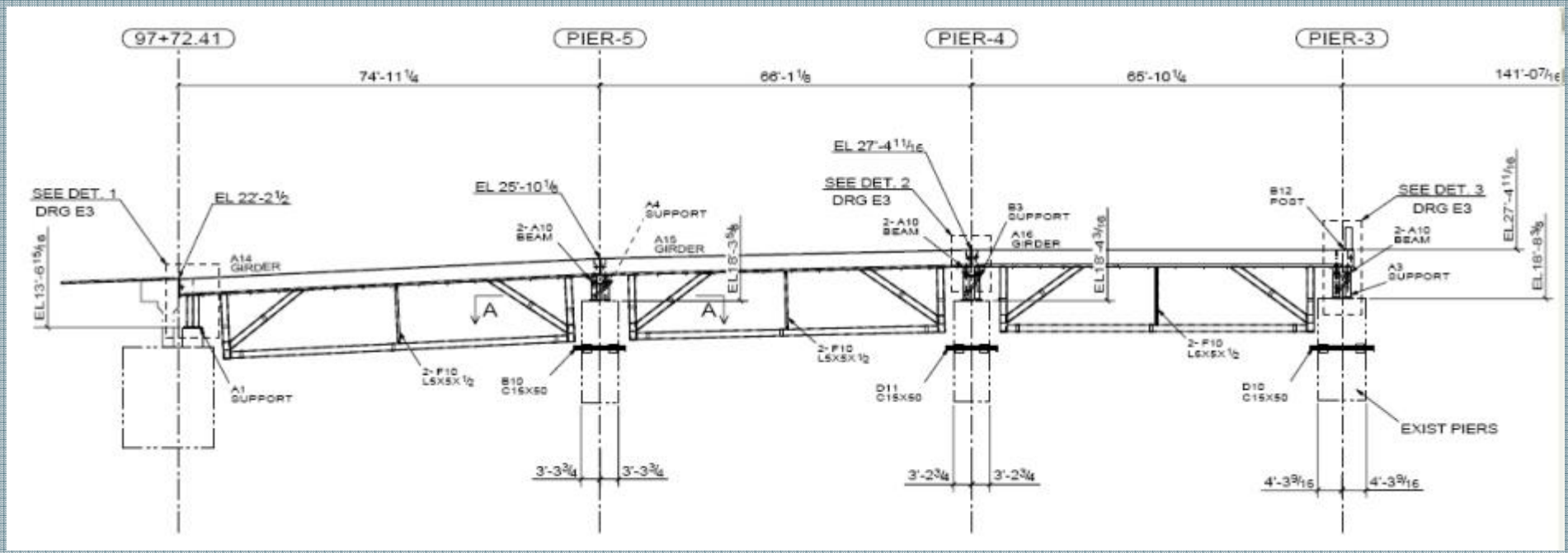
Truss Stability System

Ram Extension

Launch Design

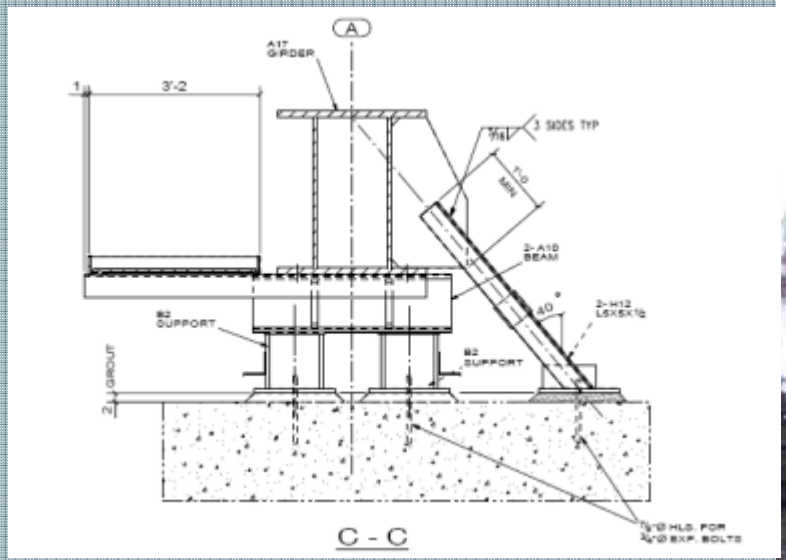
Temporary Works:

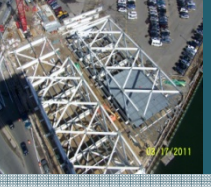
- **Launching Girders**



Launch Design

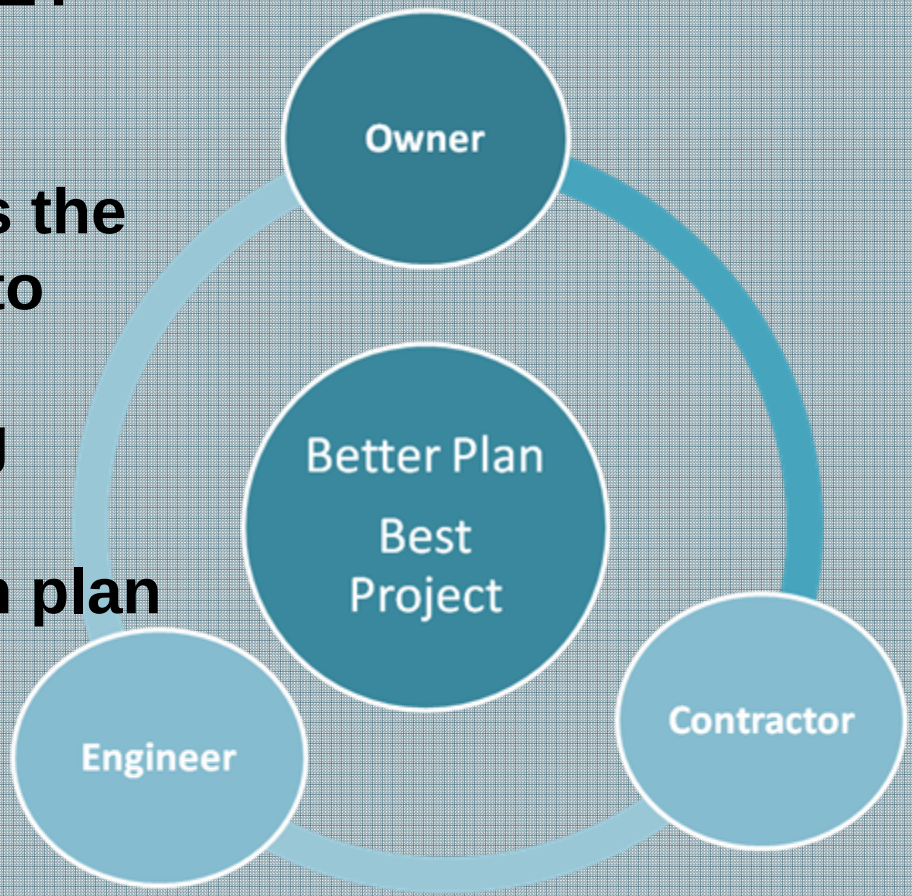
- **Use of Existing Bridge Piers:**
  - **Recently Retrofitted**
  - **Field Inspection/Condition Survey**
  - **Evaluation of Capacity for Launching Loads**





Conclusion

- **Early Communication**
  - **MassDOT/J.F. White/FINLEY**
- **Value Engineering**
  - **Create a design that takes the Contractor's strengths into account**
  - **Maximized use of existing structures**
  - **Reliable, efficient erection plan**
- **Better Plan ⟶ Best Project**



Questions and Answers

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