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Above It All: Engineering, Fabrication and Construction of Overhead Signs

Tyler Nisbet, P.Eng.
Jeremy Drover, P.Eng.

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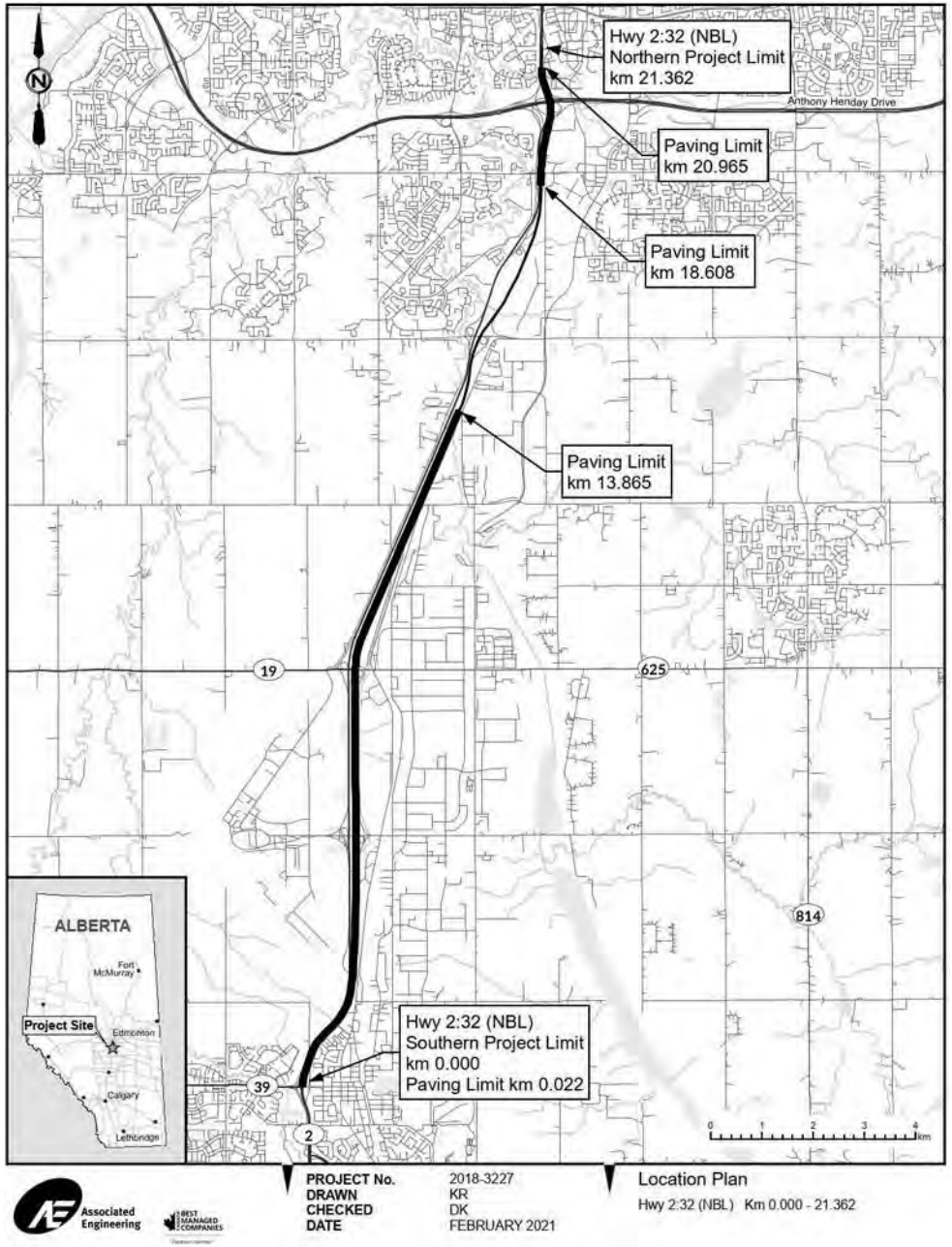
Agenda

- Introduction to Overhead Sign Structures
- Roles and Responsibilities (Consultant and Contractor)
- Design
- Fabrication
- Project Delivery and Contract Structure
- Construction
- Potential Innovations or Changes to Project Delivery

Introduction to Overhead Sign Structures

Introduction – Contract Award

- Contracted by Transportation and Economic Corridors (TEC) for a highway rehabilitation job on Hwy 2:32
- NB lanes between Leduc and Edmonton
- High traffic volumes required night work with specified lane closure times
- Mainly a mill and pave job
- Overhead sign work was added to the road contract during design
- Project Awarded to Ledcor
- Paving completed in 2022
- Overhead sign work is ongoing
- Various subs used



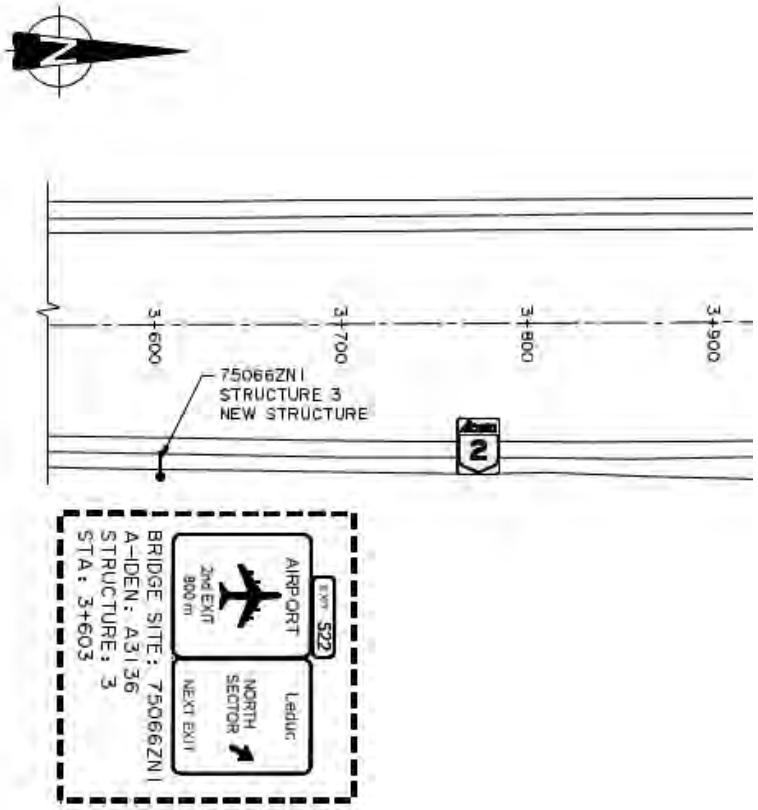
Introduction – Overhead Signs

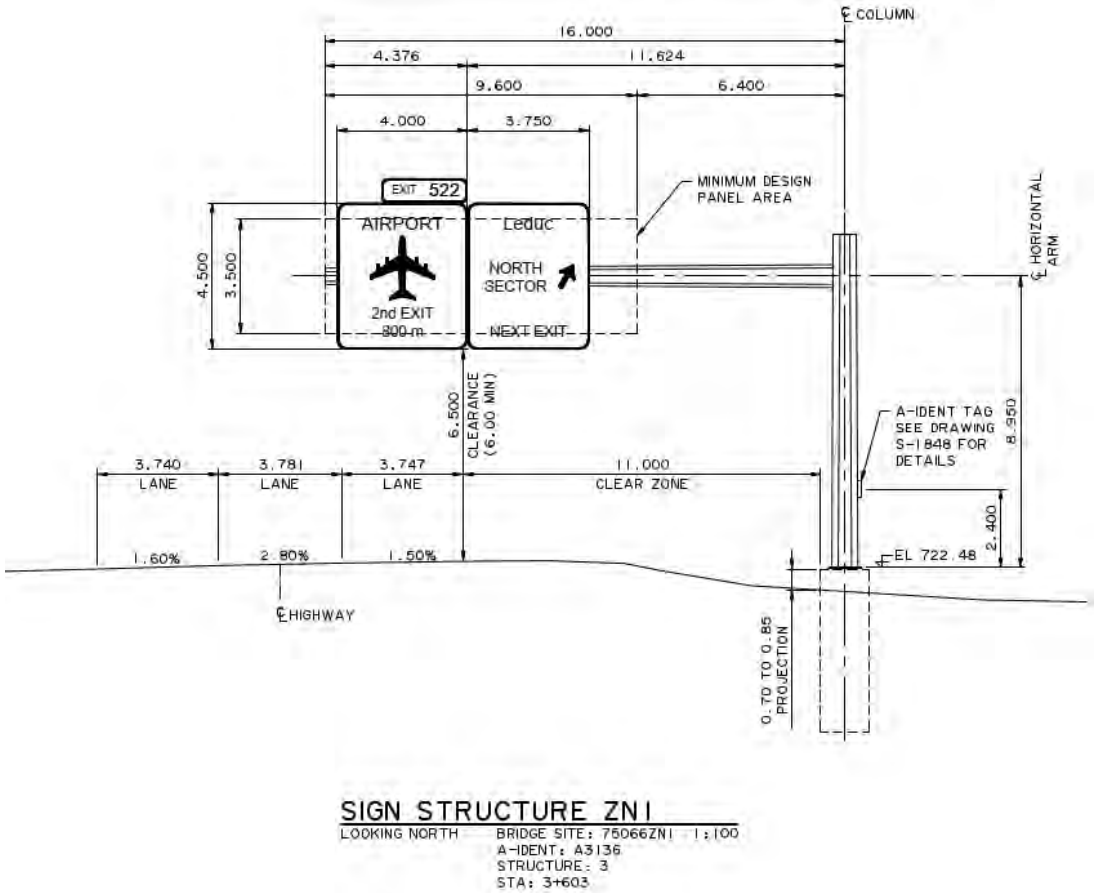
- Beneficial on highways when:
  - High traffic volumes
  - High rate of speed of traffic
  - Complex interchanges
  - Three or more lanes in each direction
  - Multi-lane exits
- Sign structures are over 4m^2 of area and fully or partially over the roadway.
- Structures are assigned a bridge file (BF) number
- Overhead sign structure have two subcategories:
  - Bridge & Cantilever
- Delivery method design build process.
- Structural component that are required to meet the Standard Specifications for Bridge Construction (SSBC). Still administered as a part of a roadway contract.

Roles and Responsibilities

Roles and Responsibilities – The Consultant

- Design – General arrangement considering site specific constraints, tender documents
- Fabrication – QA inspection, submittal review
- Construction – Resident site inspection, submittal review and contract administration



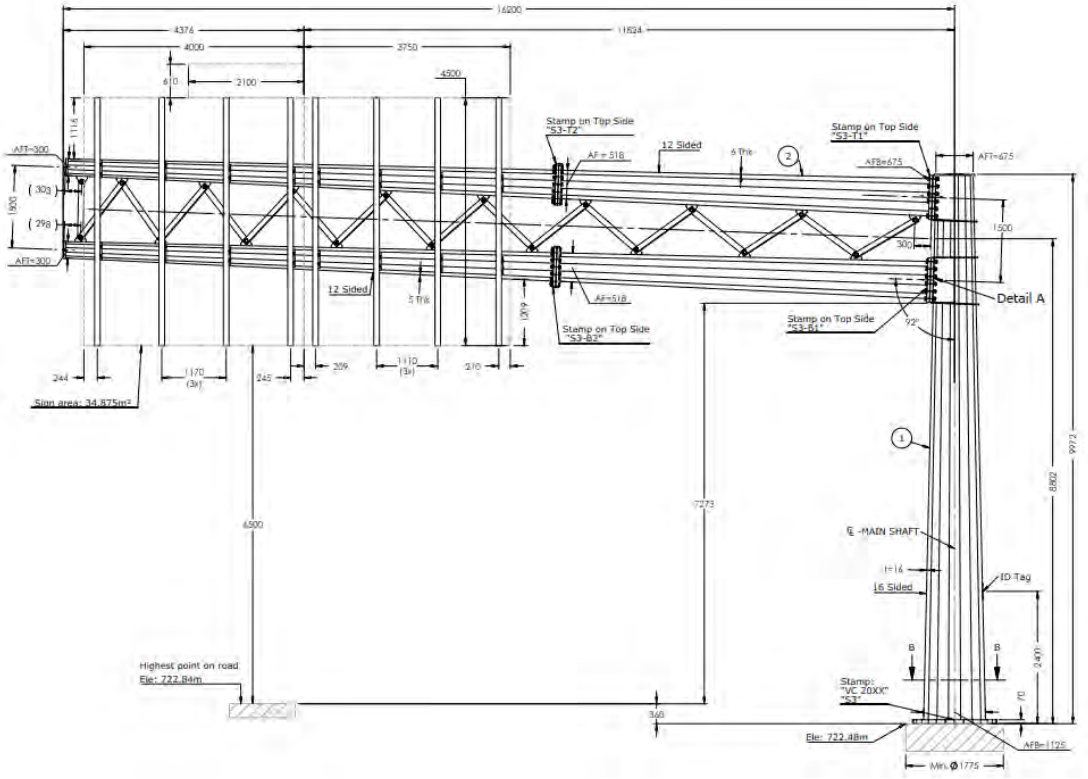


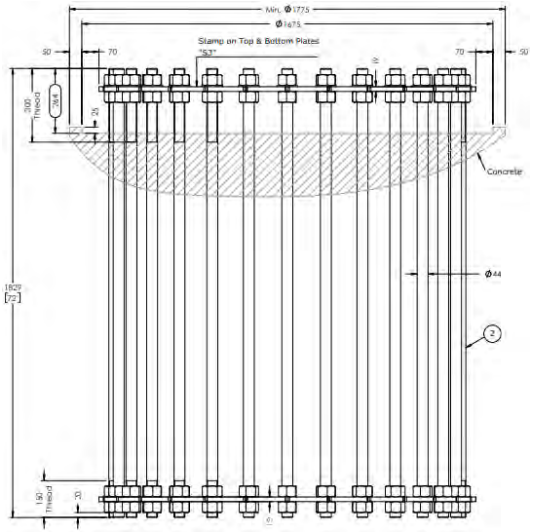
SIGN STRUCTURE ZN1

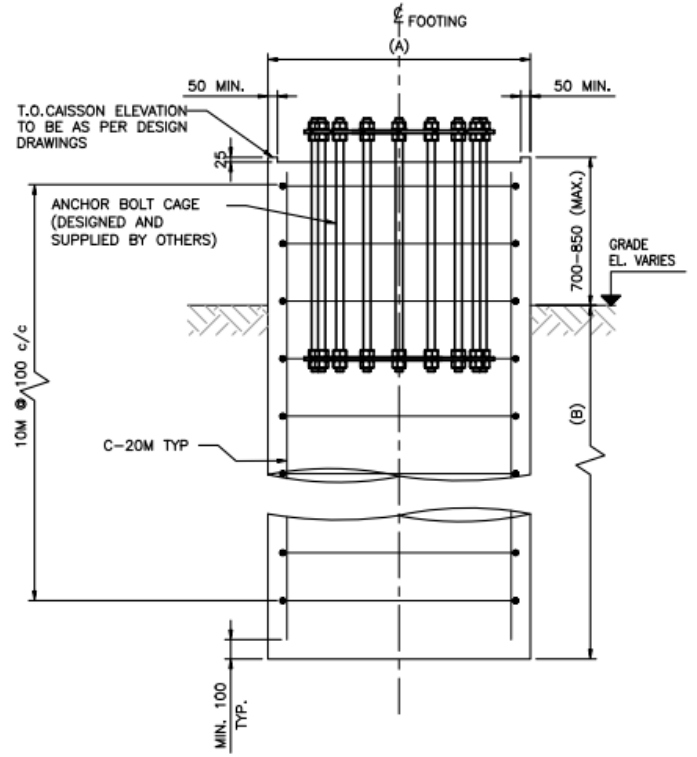
LOOKING NORTH — BRIDGE SITE: 75066ZN1 — 1:100
A-IDENT: A3136
STRUCTURE: 3
STA: 3+603

Roles and Responsibilities – The Contractor

- Design – Sign structure and foundations
- Fabrication – Specific requirements if fabrication occurs outside of North America
- Construction – Foundation construction, structure and sign panel erection, traffic accommodation







Project Delivery and Contract Structure

Project Delivery – The Contract

Contract Specifics:

- Separated completion dates of roadway work and overhead signs.
  - Roadwork - Oct 15, 2022
  - Overhead Signs – Aug 31, 2023
- Linked the roadway work warranty start date to the completion of the overhead sign work.

Execution:

- Contractor stayed involved with weekly check in meetings but was at the mercy of the fabricator.
- Long lead times for document submissions and lack of completeness caused most of the delays.
- Roadway warranty start date unlinked after mutual agreement.

Design

Design – Sign Structures

- Design is conducted in accordance with SSBC Section 24. Some key requirements include:
  - Design Code
  - Wind Loading
  - Ice Loading
  - Fatigue Category
  - Modifications to the AASHTO Standard Specification
  - Maximum span, deflection, camber and splices
  - Designer specifies the base reactions

BASE REACTIONS: (UNFACTORED)

Fx (kN)	Fy (kN)	Fz (kN)	Mx (kNm)	My (kNm)	Mz (kNm)
49.880	78.570	72.450	699.624	112.283	371.044

Design – Foundations

- Geotechnical site investigation is required to inform the foundation design
- Typical design is CIP concrete piles
- Important considerations:
  - Site and groundwater conditions
  - Casing requirements
  - Reinforcing cage detailing
  - Grout pad requirements

Fabrication

Fabrication – Inspection and Test Plan

- The Inspection and Test Plan should include at a minimum:
  - H – Backing bar CJP weld testing
  - H – Fitting of backing bar
  - H – Tube to flange/baseplate CJP weld testing
  - W – Visual weld inspection and NDT prior to shop pre-assembly
  - W – Pre-assembly and dimensional tolerance checks
  - W – Galvanizing
  - W – UT testing of CJP tube to flange/baseplate weld toes after galvanizing
  - W – Baseplate barrier coating application and testing
  - H – Verification testing and inspection of overhead sign structures if fabricated outside of Canada and the United States
  - H - Final Inspection

Visual Weld Inspection

Fit Up Verification

Fabrication Process

- **Shanghai, China**
  - Cutting
  - Drilling
  - Bending and forming of members
  - Shipping components to Canada for assembly

- Requires Contractor's QC and Consultants QA at the fabrication facility with the appropriate qualifications
- Requires Canadian Lab testing for materials

Components Received in Canada
(Left: Formed Shaft, Right: Flanges/Baseplates

- **Barrie, ON & Delta, BC**
  - Shop fit, assembly and welding (approved WPS/WPDS)
  - Inspection and testing
  - Galvanizing
  - Baseplate barrier coating

- Requires Contractor's QC and Consultants QA

Welding and Inspection Complete
(Longitudinal Seam & Baseplate Welds)

Construction

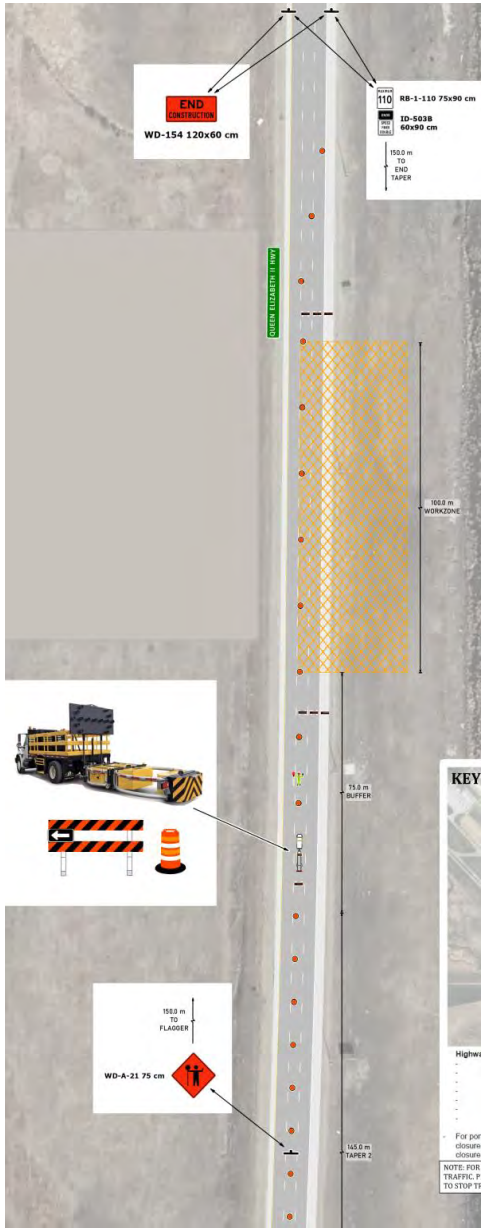
Construction – Traffic Accommodation

- Highway work and lane closures requires a Traffic Accommodation Strategy (TAS).
- Prime Contractor responsible for submission and ensuring sub is executing the TAS
- to the standard.
- Detailed drawings with placement of signs.
- Night work and lane closure time component.

- Sign lift requires a full lane closure across Hwy 2.
  - Detailed procedure to be submitted for review
  - 10 min max for closure between 2 am and 3 am

Coordination with Edmonton International Airport for crane lifts.

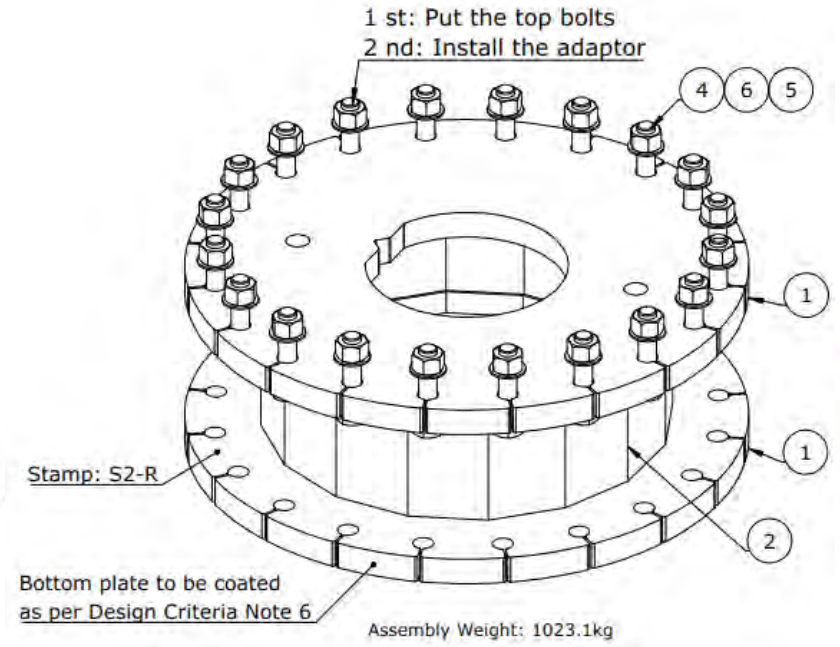
- Nav Canada and Transport Canada
  - Crane Land Use Proposal Submission Form
  - Aeronautical Assessment Form

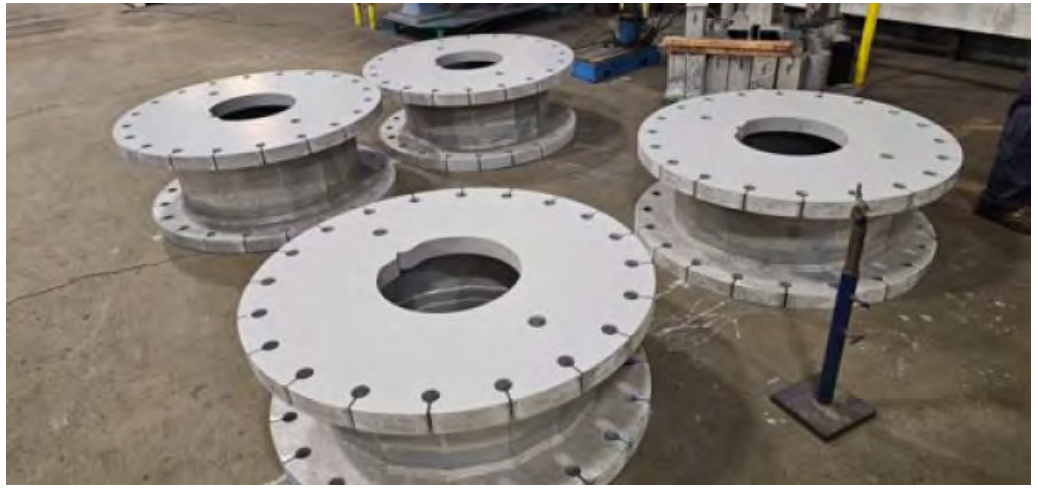


Construction – Foundations

Considerations

- Wet hole conditions encountered
  - Casing availability – resulting design changes, difficulties with anchor cage diameter and reinforcing cage diameter
  - CSL tube installation and conflict with anchor cages
- Grout pad formwork
- Clocking issues





Construction – Structures

Considerations

- Clearance from regulators near the airport
- Timeframe for full closure of Highway 2
- Bolting assemblies – MTR/ROCAP & PIV testing
  - Material traceability and installation timelines
- Consider timelines of erection following foundation casting

Commentary:
Pre-installation Verification Testing is essential for:

(1) Evaluating the suitability of the *bolting assembly*, including the lubrication that is applied by the *Manufacturer* or specially applied, to develop the specified minimum *pretension*;

Pre-installation verification testing shall be performed in compliance with all of the following:

(1) At the site of installation;
(2) Prior to the placement of *bolting assemblies* of verified lots in the work;
(3) On a sample of not fewer than three complete *bolting assemblies* of each combination of diameter, length, grade, and *lot* to be used in the work;
(4) Using *bolting assemblies* that are representative of the condition of those that will be *pretensioned* in the work;
(5) Using ASTM F436 washers positioned in accordance with Section 6.2; and
(6) In accordance with the test procedure in Section 7.2.

Supersedes the August 1, 2014
Specification for Structural Joints Using High-Strength Bolts

Bolting Assembly. An assembly of *bolting components* that is installed as a unit.

Bolting Component. Bolt, nut, washer, *direct tension indicator* or other element used as a part of a *bolting assembly*.

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Potential Innovations or Changes to Project Delivery

Innovations and Changes

- Separate the scope of work into overhead signs and roadway contracts.
- Tender as a bridge contract.
  - Experienced contractors will bid.
  - Place requirements in tender on past projects and experience.
  - Utilize fabrication company as a resource to set schedule expectations.
- Include fabrication company in weekly meetings.

Questions?

Tyler Nisbet, nisbett@ae.ca

Jeremy Drover, drover@ae.ca