Bridge 4 Replacement on Highway 10X: A Modern Truss Bridge on a Historic Corridor

Introduction

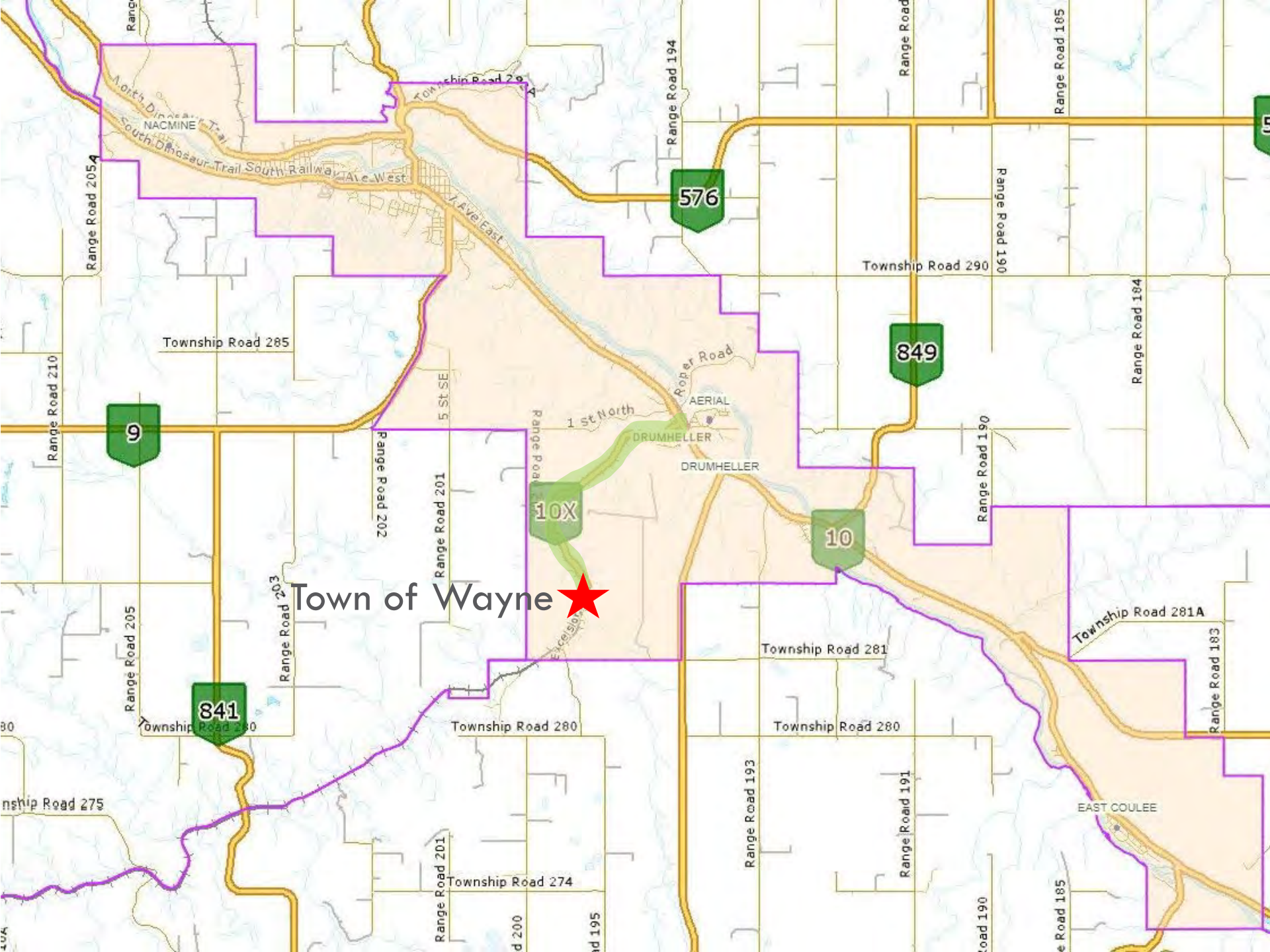
- Project Team
- Area History and Site Context
- Project Process
- Project Objectives and Constraints
- Why a Truss?
- Project Sequence, Challenges and Solutions
- Final Thoughts
- Questions?

Project Team

- **Owner:** Alberta Transportation
  - Project Sponsor: Donald Saunders
  - Project Manager: John Umlah
- **Bridge Design / Project Management:** LEX3 Engineering
- **General Contractor:** Alberco Construction
- **Survey and Road Design:** RoadsWest Engineering
- **Environmental:** Ghostpine Environmental
- **Geotechnical:** Thurber Construction
- **Hydrotechnical:** Terrace Engineering
- **Architecture:** Rockliff Pierzchajlo Kroman Architects

Area History and Site Context

- Bridge 4 is located over the Rosebud River on Highway 10X, a 6 km highway extending from Rosedale to Wayne.
- Wayne once a coal mining hub and home to 2,500 people at its peak.
- Last coal mine was closed in 1979.
- Population of Wayne now < 30.
- 11 truss bridges cross the river on Highway 10X!
- Abandoned CNR tracks, once used to haul coal, also cross the river seven times over the stretch from Wayne to Rosedale.
- The Rosebud River valley is steep and confined. The river is meandering and features widely variable flows with impressive events during spring runoff.


Town of Wayne
576
849
9
10X
10
841
Township Road 285
Township Road 290
Township Road 281
Township Road 281A
Township Road 280
Township Road 274
Township Road 275
Range Road 205A
Range Road 210
Range Road 205
Range Road 203
Range Road 202
Range Road 201
Range Road 200
Range Road 195
Range Road 194
Range Road 193
Range Road 191
Range Road 190
Range Road 185
Range Road 184
Range Road 183
Range road 190
1 St North
5 St SE
1 Ave East
Roper Road
Excelsior
South Dinosaur Trail
North Dinosaur Trail
Railway Ave West
NACMINE
DRUMHELLER
AERIAL
EAST COULEE

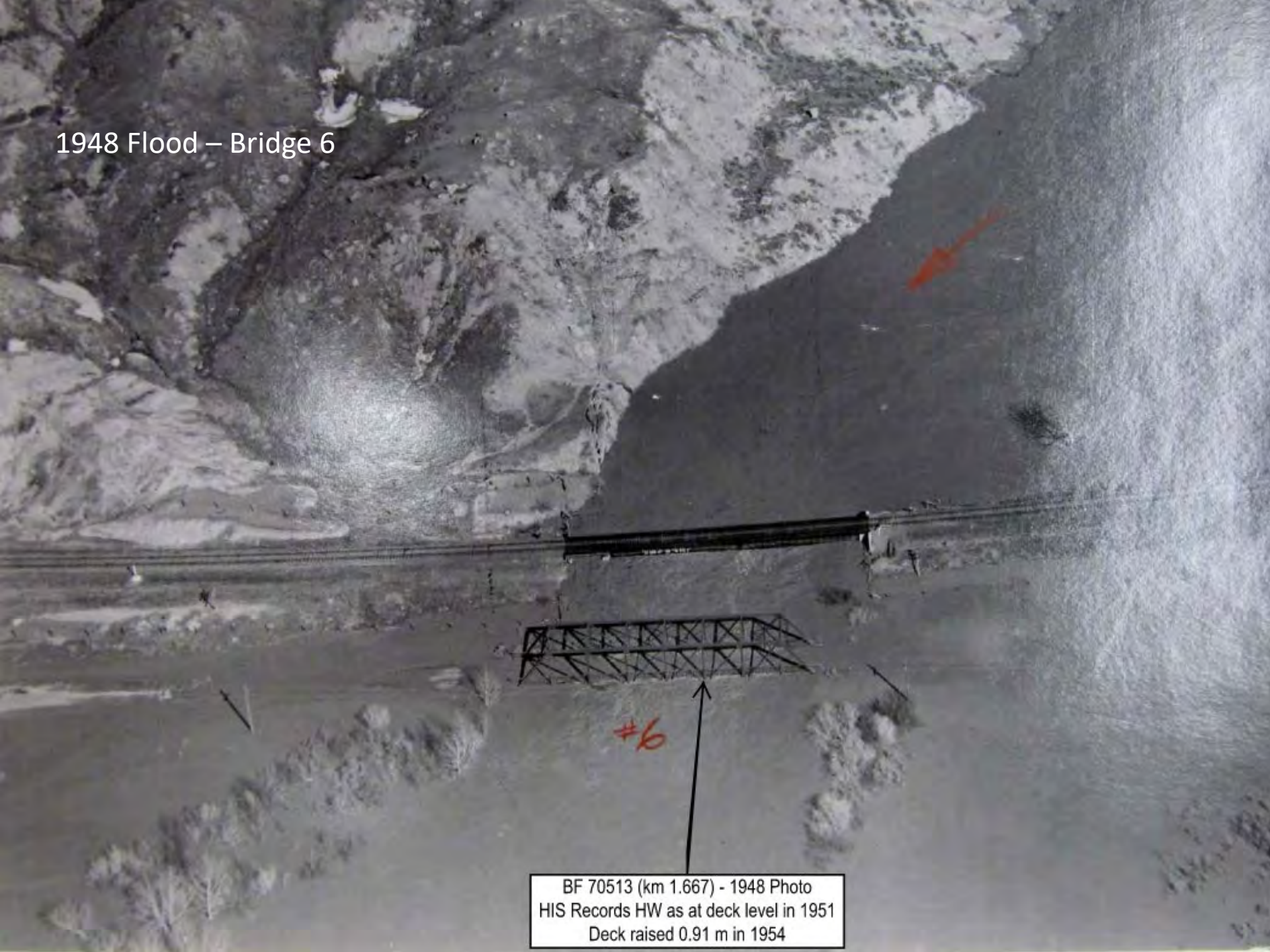

Bridge 4
Town of Wayne
Range Road 200
1 St North
Centre St
2 Ave S
AERIAL
DRUMHELLER
7329-1
74796-1
8719-1
70510-1
70817BGR-2
70511-1
70512-2
70773-1
70513-1
70774-1
70514-1
79251-1
10


Wayne - Alta.


ROSEDEER-HOTEL.
LAST CHANCE SALOON
OPEN
HOTEL

South Bridge Elevation

East Approach Looking West


1948 Flood – Bridge 6
#6
BF 70513 (km 1.667) - 1948 Photo
HIS Records HW as at deck level in 1951
Deck raised 0.91 m in 1954

Project Process

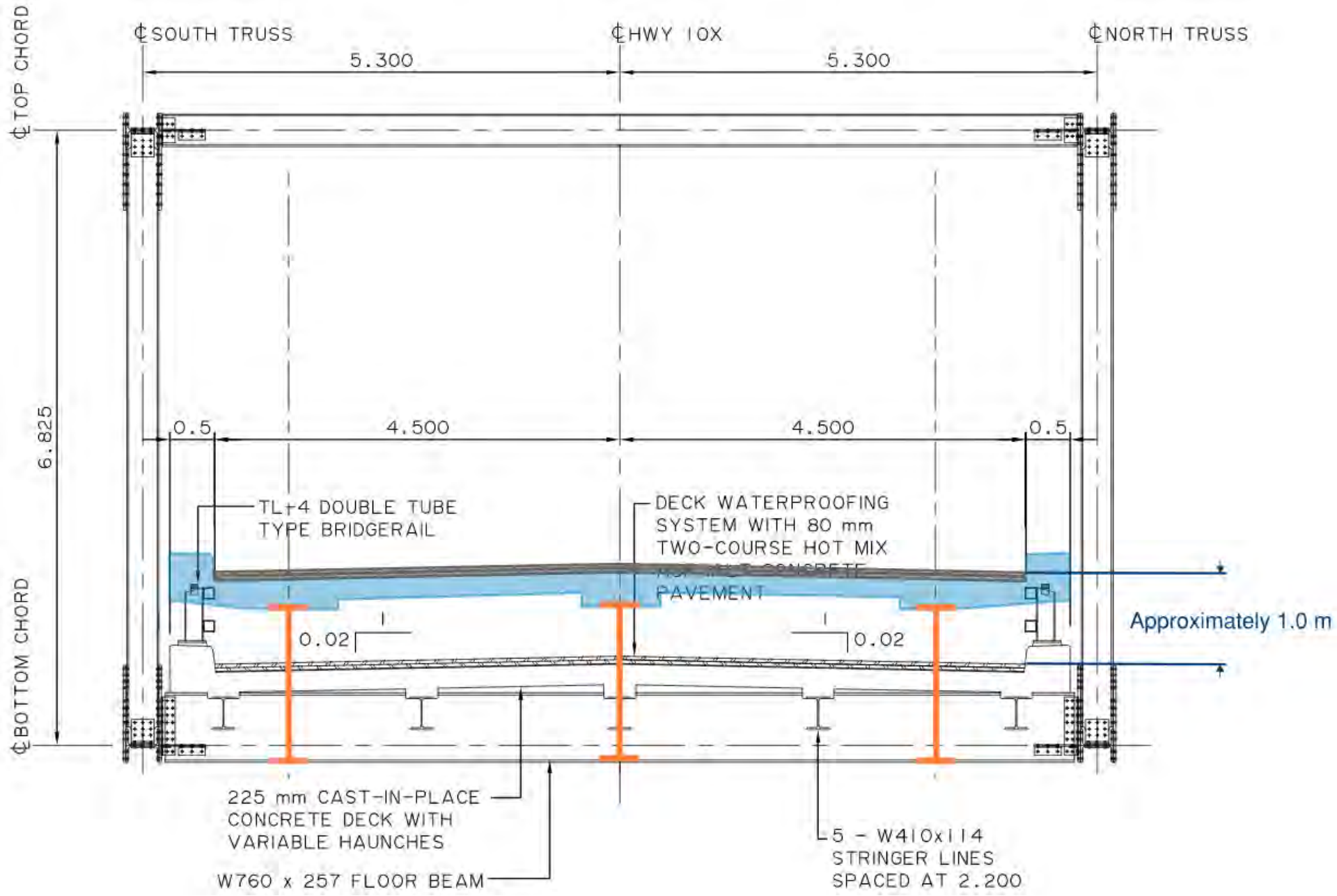
- **Bridge Planning:** Define hydrotechnical design parameters and identify the the most suitable solution for the roadway to cross the river.
- **Structure Alternatives:** Document the decision-making process used to arrive at a recommendation on what type of structure should be carried forward to the detailed design phase.
- **Detailed Engineering:** Preparation of drawings, specifications and tender documents.
- **Contractor Prequalification:** Shortlist qualified contractors for eligible to bid on the project.
  - First time conducting a Contractor Prequalification for Alberta transportation.
  - Completed during Detailed Design once clarity on project direction was established.
  - Evaluation criteria included corporate profile, project team, construction methodology, relevant experience, and team.
  - De-risked project from a contractor competency standpoint while still promoting competitive bidding (i.e. 5 contractors shortlisted).
- **Tendering:** Select a Contractor among the shortlist to perform the work through a competitive bid process.
- **Construction:** Oversee the fabrication and construction activities of the successful Contractor ensuring the work is performed in alignment with the drawings and specifications.

Project Objectives and Constraints

- Objectives:
  - Replace the bridge with modern structure in accordance with Alberta Transportation guidelines and standards.
  - Address functional deficiencies (hydrotechnical capacity, clear width, vertical clearance, load capacity).
  - Minimize environmental, utility, and land impacts.
  - Minimize roadwork.
  - Improve safety.
- Constraints
  - Very narrow right-of-way (20 m) adjacent to private residences unwilling to sell land.
  - Hydrotechnical demands necessitate a significant increase in of roadway profile and footprint to accommodate appropriate freeboard.
  - Load restricted bridges along the corridor from either approach complicated heavy equipment access.
  - Strong stakeholder desire to protect historical context of the area.

Why a Truss Bridge?

- Shallower structure depth = reduced roadwork
- Shallower structure depth = reduced land impacts
- Maintains historical character = Happy stakeholders
- Light individual elements open opportunities for creative assembly and erection strategies = Lower loads coming to site (compared to girders and the large cranes required for erection)
- Project costs very comparable between girder bridge and truss bridge


℄TOP CHORD
℄SOUTH TRUSS
℄HWY 10X
℄NORTH TRUSS
5.300
5.300
6.825
0.5
4.500
4.500
0.5
TL-4 DOUBLE TUBE TYPE BRIDGERAIL
DECK WATERPROOFING SYSTEM WITH 80 mm TWO-COURSE HOT MIX
PAVEMENT
0.02
0.02
Approximately 1.0 m
℄BOTTOM CHORD
225 mm CAST-IN-PLACE CONCRETE DECK WITH VARIABLE HAUNCHES
W760 x 257 FLOOR BEAM
5 - W410x114 STRINGER LINES SPACED AT 2.200

Construction Sequence, Challenges and Solutions

- General Contractor: Alberco
  - Truss Fabrication and Erection: Canam (Quebec)
  - Truss Coatings: Peinture D'Hauterive (Quebec)
  - Bearing Fabrication: LCL – Bridge (Quebec)
  - Joint Fabrication: LCL – Bridge (Quebec)
  - Rail Fabrication: Outrider Steelworks
  - Truss Demolition: Franklin's Excavating and Heavy Demolition
  - Piling: Red Deer Piling
  - Concrete Supply: Tanas Concrete
  - Waterproofing: Place-Crete Systems Inc.
  - Paving: Brooks Asphalt and Aggregates

Truss Fabrication!

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Challenges and Solutions

- **Challenge:** Full truss fit up is not practical in a shop setting.
- **Solution:** Individual fit up of each truss line, floor and roof systems.


QUALITE


PR-407 CAP 50T IMP


212 B
212

Shop Coatings!

Alberta

LEX3 ENGINEERING

Challenges and Solutions

- **Challenge:** Steel above road surface in spray zone.
  - Weathering steel not appropriate in environments exposed to de-icing salts.
- **Solution:** Truss members metalized and coated.
  - Not typical in Alberta but common in other jurisdictions (i.e. Quebec).
  - Metalizing (7 mils), mist coat (sealer – not on faying surfaces), intermediate Macropoxy (5 – 10 mils), topcoat Acrolon (3 – 6 mils).
  - Chloride testing completed on arrival and washing completed as required with Clor-Rid™ solution.


mils/thou
elcometer®


723
723 PSI


2 Tonnes

Detour!

Challenges and Solutions

- **Challenge :** Minimizing risk associated with spring runoff / ice events.
  - Later than anticipated mobilization meant detour operation would overlap with spring runoff / ice events.
- **Solution :** Construct detour with appropriate freeboard for potential spring event.


STOP
IF ONCOMING
TRAFFIC ON
BRIDGE


STOP
ONCOMING
TRAFFIC ON
BRIDGE

Demolition


5.1 m
DOOSAN


51 m


RED DEER

Piling and Abutments

Alberta

LEX3 ENGINEERING


Bobcat

Truss Assembly and Erection

Challenges and Solutions

- **Challenge:** Minimizing risk associated with spring runoff / ice events.
  - Original erection plan included use of temporary shoring frames positioned on the bed / banks of the river.
  - Later than anticipated mobilization meant erection operations would overlap with spring runoff / ice events.
- **Solution:** Launch the bridge!
  - Construct launch runway.
  - Perform truss assembly and connection coatings on runway.
  - Perform launch using a combination of Hydra-Slide™ hydraulic skidding system , back-end counter weighting and leading end crane assist.


RENTALS


MYSHAK
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MYSHAK
RENTALS
SKYJACK SJ45T
800-UR-RENTS


RENTALS

Deck Pour!

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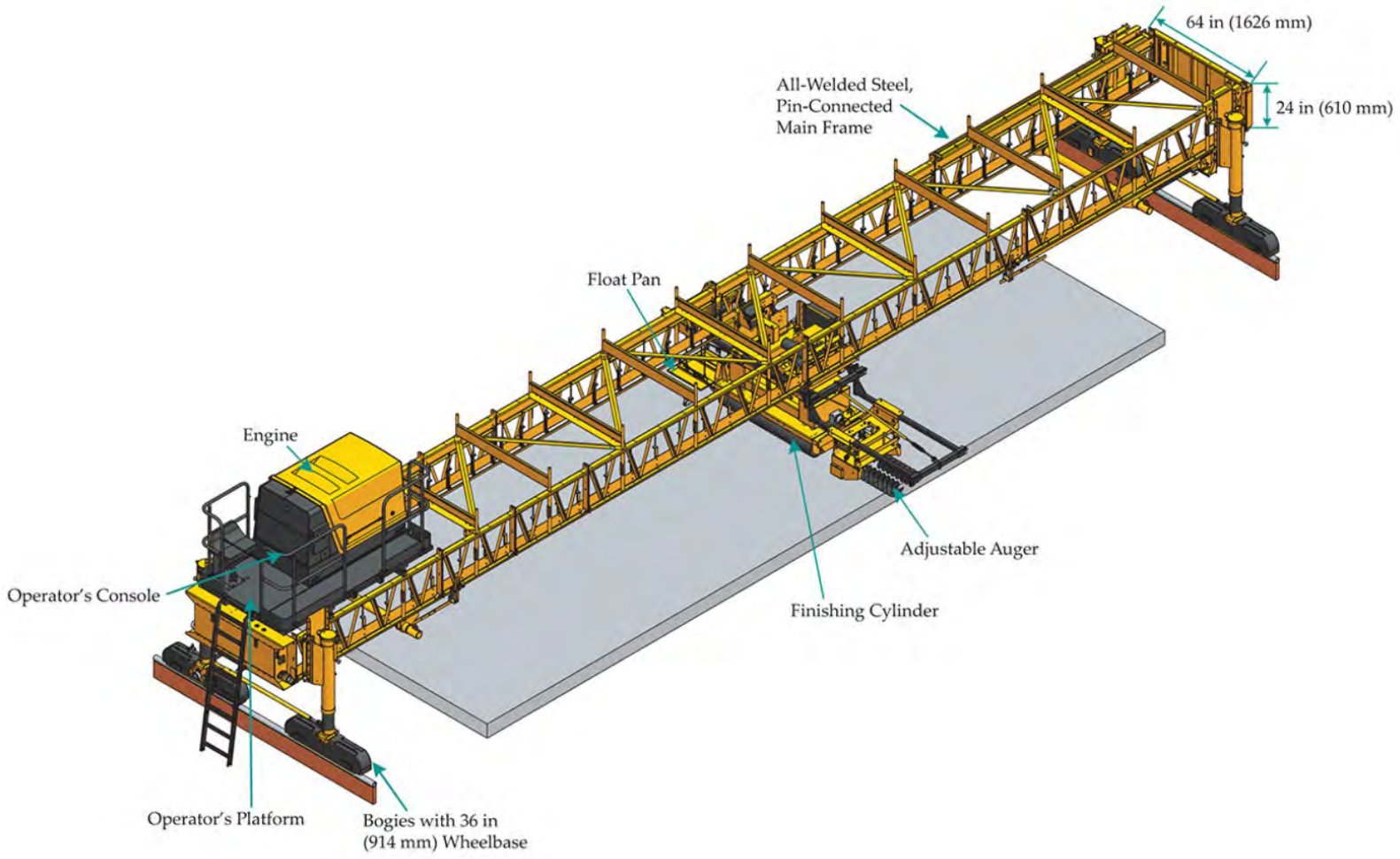
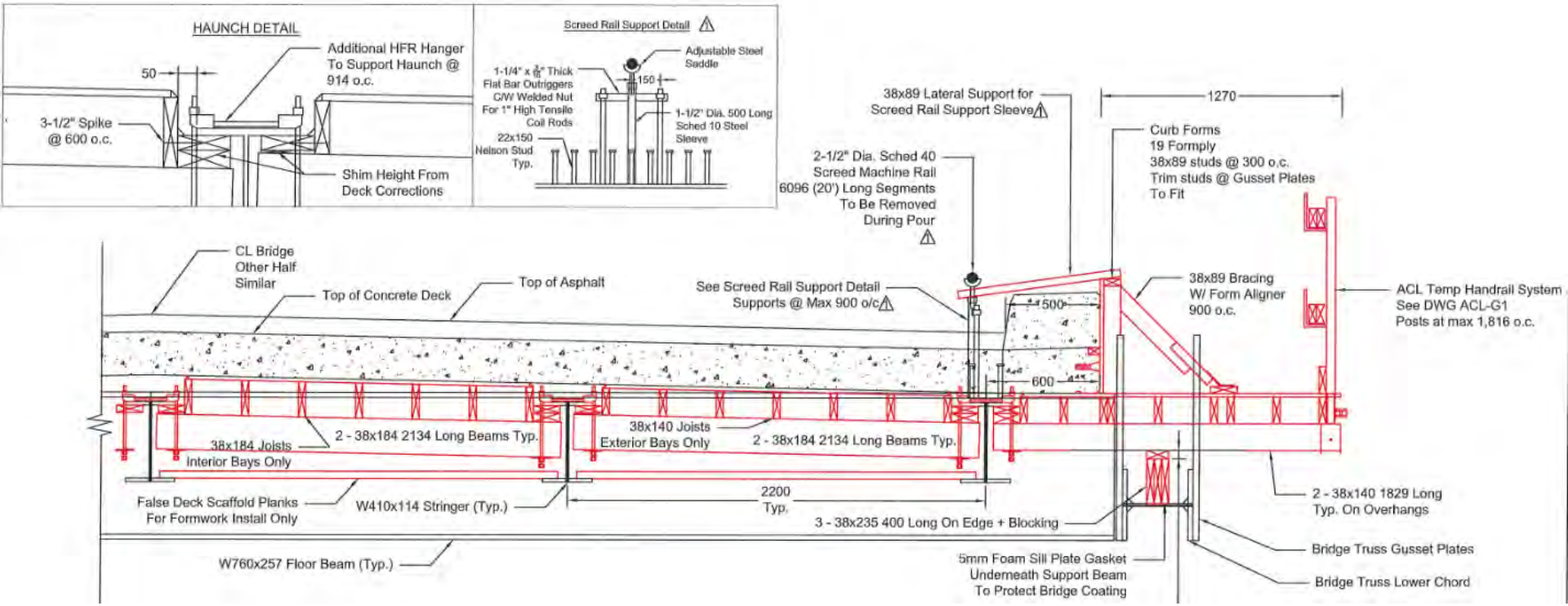
Challenges and Solutions

- **Challenge:** Truss elements impede traditional set-up of mechanical screed to place/finish concrete the entire width of deck.
- **Solution:** Strategically place stringers, plan for consecutive removal of screed rail and supports and allow minor amount of controlled hand finishing.


64 in (1626 mm)
24 in (610 mm)
All-Welded Steel,
Pin-Connected
Main Frame
Float Pan
Engine
Operator's Console
Adjustable Auger
Finishing Cylinder
Operator's Platform
Bogies with 36 in
(914 mm) Wheelbase


HAUNCH DETAIL
Additional HFR Hanger To Support Haunch @ 914 o.c.
50
3-1/2" Spike @ 600 o.c.
Shim Height From Deck Corrections
Screed Rail Support Detail
Adjustable Steel Saddle
1-1/4" x 3/8" Thick Flat Bar Outriggers C/W Welded Nut For 1" High Tensile Coil Rods
150
1-1/2" Dia. 500 Long Sched 10 Steel Sleeve
22x150 Nelson Stud Typ.
38x89 Lateral Support for Screed Rail Support Sleeve
1270
2-1/2" Dia. Sched 40 Screed Machine Rail 6096 (20') Long Segments To Be Removed During Pour
Curb Forms 19 Formply 38x89 studs @ 300 o.c. Trim studs @ Gusset Plates To Fit
CL Bridge Other Half Similar
Top of Concrete Deck
Top of Asphalt
See Screed Rail Support Detail Supports @ Max 900 o/c
500
38x89 Bracing W/ Form Aligner 900 o.c.
ACL Temp Handrail System See DWG ACL-G1 Posts at max 1,816 o.c.
600
38x184 Joists Interior Bays Only
2 - 38x184 2134 Long Beams Typ.
38x140 Joists Exterior Bays Only
2 - 38x184 2134 Long Beams Typ.
False Deck Scaffold Planks For Formwork Install Only
W410x114 Stringer (Typ.)
2200 Typ.
3 - 38x235 400 Long On Edge + Blocking
2 - 38x140 1829 Long Typ. On Overhangs
Bridge Truss Gusset Plates
Bridge Truss Lower Chord
5mm Foam Sill Plate Gasket Underneath Support Beam To Protect Bridge Coating
W760x257 Floor Beam (Typ.)


COMACO

Finishing Up!


5.2 m


4


MAMMOET


Before


After


5.1 m


5.2 m
4
4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Thanks for listening!