

9th Avenue (Inglewood) Bridge Replacement

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Session Description



- WSP was retained as Prime Consultant to City of Calgary
- Managed the preliminary and detailed design, construction and project close out
- Success of project was the communication and relationships built with the City and Contractor
- Showcase the numerous challenges of the project and how they were overcome

Project Overview



- Existing Bridge was built in 1909
- Single span Parker-Camelback through truss
- Carried three lanes of traffic and two sidewalks
- Required upgrading due to age, load restrictions, safety, flood levels and improvements to the community

Site Description



- Along 9th Avenue SE, Calgary, adjacent to the communities of Inglewood and Ramsey
- Main artery between downtown Calgary and the SE communities
- Situated over Elbow River, with Bow River 175 m to the north
- Historical buildings Fort Calgary and Deane House north of the bridge
- Statue Park southeast of the bridge
- A Canadian Pacific Railway bridge is just south of site
- Calgary Riverwalk pathways are throughout the site

Introduction

Disciplines Involved

WSP Canada (Prime Consultant)

- Project Management
- Tender Coordination
- Construction Administration
- Bridge Structural Design (Independent Design Reviewer)
- Municipal Roadway Design
- Construction Staging Design
- Utilities Coordination
- Traffic Management
- Landscape Architecture Design
- Noise & Vibration Attenuation

COWI North America

- Existing Bridge Assessment
- Bridge Structural Design
- Construction Staging Design

Maskell Plenzik & Partners

- Bridge Lighting Design
- Streetlighting Design

Tetra Tech Canada

- Geotechnical Coordination
- Hydrotechnical Design
- Regulatory Approvals
- Contamination Management
- Ecology Restoration

Sturgess Architecture

- Bridge Architectural Design

W Architecture

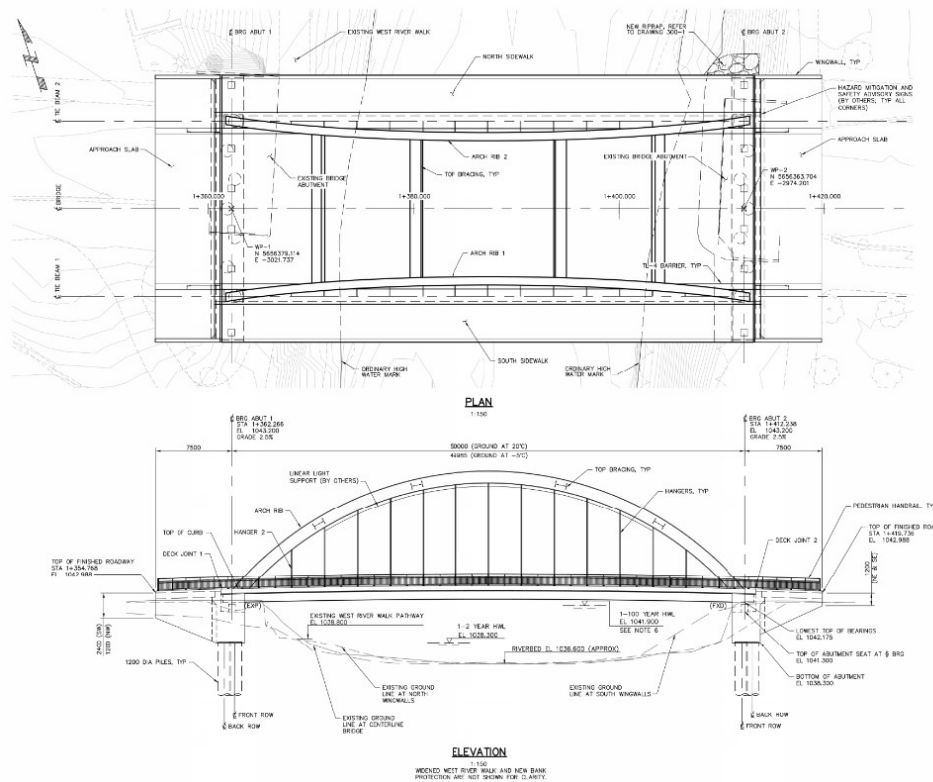
- Landscape Architecture Design
- Urban Integration

Donald Luxton & Associates

- Heritage Interpretation



New Bridge Design Features



- Tied arch bridge
- Fracture critical superstructure elements
- Minimal deck profile
- Sufficient 1:100 year flood clearance
- Adjustable hanger rods
- Aesthetic 1:8 canted profile

Major Construction Scope Items

- Temporary Detour Roadway and Structure
- Existing Bridge Demolition
- Replacement Bridge Foundations and Substructure
- Replacement Bridge Superstructure Erection
- Sidewalk Retaining Structures
- Rip Rap Installation
- Stormwater Drainage System Upgrades
- 9th Avenue Roadway Upgrades
- Streetlighting Upgrades and Bridge Lighting
- Fort Calgary Parking Lot Upgrades
- Landscaping and Statue Park Upgrades
- Heritage Commemoration
- 9th Avenue Cycle Track (Post-IFC Scope Addition)



Project Management

Project Metrics

Construction: April 2019 to June 2022

Contractor: PCL Construction

Number of Subcontractors: 21

Number of Unique Steel Elements: 325



Project Management

Project Metrics

Number of Change Orders: 57

Number of Change Directives: 18

Number of Submittals & Shop Drawings: 199

Number of RFIs: 248

Number of NCRs: 69



Project Challenges

1 Existing Utilities and Unknown Ground Conditions

- Old infrastructure not documented
- Contaminated areas due to CPR and previous land use

3 Winter Concreting

- Due to schedule changes, multiple concrete pours (abutments and deck) were completed in winter
- More considerations for concreting in cold weather

2 COVID and Supply Chain Disruptions

- COVID shutdowns began one year into construction & offsite fabrication
- Supply chain disruptions caused materials to become unavailable or very expensive

4 Steel Fabrication, Testing and Erection

- Bridge arch members (arch ribs and tie beams) are classified as fracture critical
- Fabrication and testing requirements for fracture critical members is more stringent than normal members

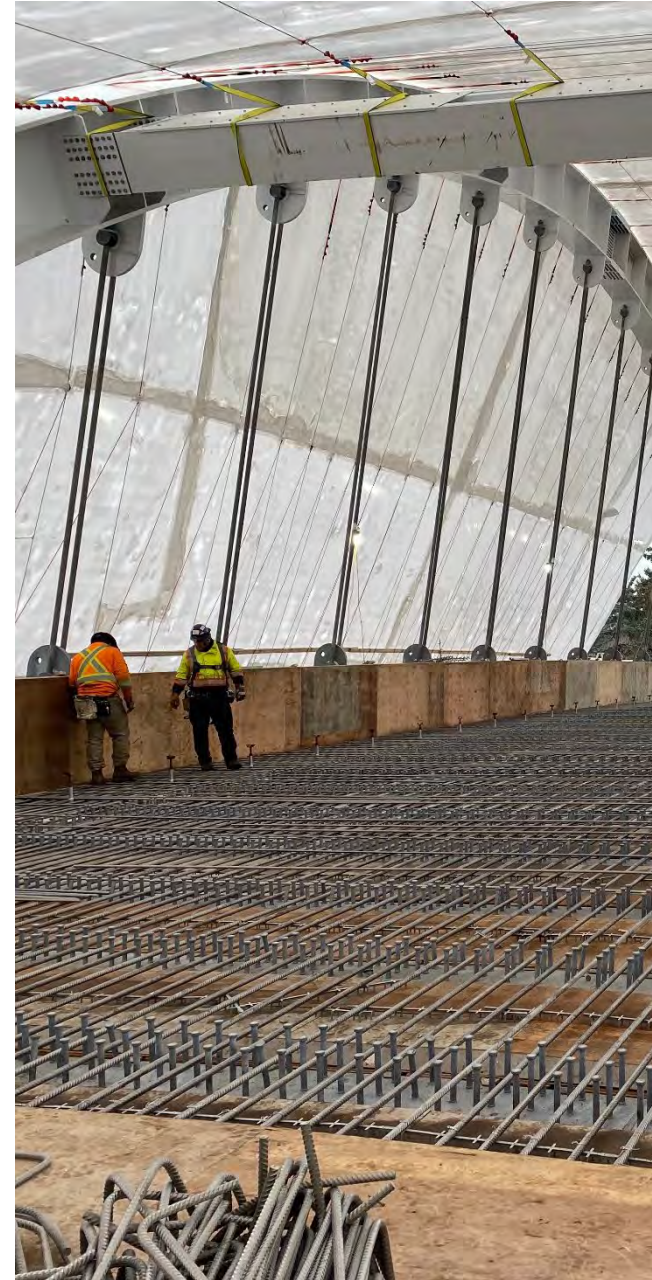
Existing Utilities and Unknown Ground Conditions

- Existing utilities lead to modifications to the roadway structure, the east abutment, and the retaining wall in front of Deane House
- Storm water design had to be modified during the installation based on onsite conditions due to unforeseen utility conflicts
- Required close coordination with PCL utility sub-trade and design team to ensure that the design intent was still being executed
- Team maintained focus on technical problem solving and meeting schedule rather than disputes and assigning blame
- Modified design met expectations of interfacing utility stakeholders and Fort Calgary



COVID and Supply Chain Disruptions

- PCL had to reassess working conditions to ensure the safety of all workers onsite and in offsite fabrication shops
- Meetings were switched to virtual and photographs and reports became vital communication tool between all parties
- Open communication with the City, PCL, and Consultant team was required to discuss acceptable substitutions to original fabrication materials and impact to schedule and budget
- Schedule was shifted to suit the delivery of fabricated elements, resulting in additional winter concrete work



Winter Concreting

- All of the large concrete pours (piles, abutments, and deck) were completed in winter conditions
- The piles and abutments were mass pours and subject to additional temperature control measures
- Deck pour required adjustments to superelevation at select locations to suit falsework and screed layout
- PCL had to develop specific heating and hoarding methods to ensure cold weather concrete was protected during curing
- Consultant team included materials engineering specialists to ensure proposed pour and curing procedures aligned with CSA and City of Calgary requirements



Steel Fabrication and Testing

- Original fabrication and erection subcontractor became financially distressed in March 2020 and entered into receivership
- City and PCL had strategically segregated all 9th Avenue bridge elements into separate storage (avoid asset seizure)
- PCL worked to find a replacement fabricator and resume work on the remaining members arch members
- Reduced productivity at replacement fabrication shop due to COVID social distancing measures
- Faced lingering supply chain issues (order and receive remaining billets in a timely manner) or acceptance of equivalent materials
- Agreed to metalize select remaining members in lieu of galvanizing in order to regain lost schedule



Steel Erection

- Bridge hanger rods designed to allow for flexibility of deck elevation, limited play in transverse dimension
- PCL completed a full 3D scan of the substructure and the steel members to identify and mitigate any fit-up issues prior to superstructure erection
- Scan revealed that select hangers plates would be out of alignment, team pre-emptively developed an acceptable heat straightening procedure with the additional splice and filler plates where appropriate
- Conducted further straightening where necessary after the erection of main arch ribs and prior hanger rod installation
- Hanger rods designed with adjustable top and bottom thread details to allow for “fine-tuning” to suit final deck elevation



Lessons Learned



- Schedule can slip because of both foreseeable and unforeseeable issues (i.e. COVID, fabrication disruption, utilities, etc.), but project teams should remain focused on problem-solving
- Tendering for complex signature steel bridges needs to include explicit requirements for fabrication fit-up
- Consider prequalification of critical trades where appropriate (i.e. offsite fabrication)
- Capture as much laydown and staging space as possible in constrained brownfield sites

Lessons Learned



June 2022 Bridge Opening Ceremony

- Clear and open communication is key
- Heavy involvement of Consultant team during submittal review and troubleshooting minimized issues
- Submittals and RFIs were reviewed every progress meeting so that there was quick turnover
- Partnership between City, PCL, and Consultant remained respectful and positive throughout challenges
- Team members at the site level remained focused on quality and planning, and let the difficult conversations happen at higher levels



Questions?



Thank you



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