Alex Fraser Bridge Improvement Project

Category B – Transportation
Year Completed: 2019
Location: Delta, BC
Owner/Client: BC Ministry of Transportation & Infrastructure
Prime Consultant: R.F. Binnie & Associates Ltd.
Other Consultants: PBX, COWI, Klohn Crippen Berger

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Project Summary

Project Summary

With 120,000 vehicles using the Alex Fraser Bridge daily, congestion was a growing problem. Binnie worked closely with the BC Ministry of Transportation & Infrastructure to improve conditions by adding a seventh lane, an innovative movable barrier counter-flow system, and 13 new dynamic message signs throughout the Vancouver area, resulting in travel time savings of 20 minutes in the afternoon and 10 minutes in the morning - all while minimizing the net additional roadway footprint.

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Project Highlights

Q1: Innovation

The design approach for the AFB Project was to maximize use of the existing available infrastructure and to keep the improvements within the existing roadway footprint as much as possible. This was achieved by converting the pre-existing 6-lane bridge to 7-lanes, and implementing a new movable barrier counter-flow system that took advantage of available residual traffic capacity in the off-peak direction of travel. The project also involved developing multi-stage construction tender packages, in order to maintain existing traffic along a highly congested corridor. Three separate tender packages were prepared: Package 1 was for the 7-lane bridge conversion; Package 2 was for the movable barrier counter-flow system; and Package 3 was for the Fraser River Advance Travel Information System (FRATIS), comprising 13 new dynamic message sign installations throughout Metro Vancouver.

The AFB Project represents the first application of a movable barrier counter-flow system in Western Canada. Unlike other existing counter-flow systems in the Metro Vancouver area, this system maximizes safety by physically separating opposing direction traffic – which also allows for higher posted/operating speeds and throughput capacity. The movable barrier counter-flow system comprises a barrier transfer machine (aka Zipper vehicle) that runs along a line of inter-locking median barriers and transfers the barriers across a distance of a lane width, while bridge traffic continues to travel unimpeded in both directions immediately next to the barrier transfer machine. The project also leverages use of the latest Intelligent Transportation System (ITS) technologies, through the application of dynamic message signs (DMS's), electronic warning signage and counterflow signal displays, and radar vehicle queue detection systems.

In recognition of the innovative approach adopted, the ***Daily Hive*** rated the AFB Project as one of its ***Top 20 Transportation Projects for 2019*** in its December 31, 2019 Vancouver Urbanized on-line publication.

Additionally, Binnie was the recipient of the ***2020 BC MOTI's Deputy Minister's Award of Excellence*** (under the Specialized Engineering Services category) for the AFB Project.

Binnie was extensively involved throughout this multi-year project since the Spring of 2016, being directly responsible for the early planning, business case development/funding application, detailed design and tender document preparation/implementation. This covered a full depth of technical expertise areas, including Transportation Planning, Traffic Engineering, Highway and Drainage Design, Project Management and Construction Services. Moreover, Binnie acted as the Owner's Engineer throughout the multi-year project, from project conception through to completion of construction.

Q2: Complexity

The AFB Project is highly complex and required innovative and non-conventional solutions in order to meet the project objectives and overcome the many challenges and constraints. This required a multi-disciplinary technical approach, which included Highways, Traffic, Drainage, Structural, ITS/Electrical and Geotechnical Engineers, led by Binnie as the prime consultant. Furthermore, traffic along this critical and highly congested corridor needed to be maintained throughout implementation and construction.

The AFB Project involved extensive interfacing with other adjacent, and on-going major BC MOTI projects, including the 72 Avenue/Highway 91 Interchange and Highway 91/17 Improvement Projects located at the south end of the bridge (both of which were also led by Binnie). The development of engineering solutions needed to recognize the physical and traffic capacity constraints of the existing Annacis Channel and Queensborough Bridges at the north end. Furthermore, the Ministry's need to incorporate a cable-stay snow and ice removal system as part of the first phase of construction, required fast-tracking the early tender package. Stakeholder inputs resulted in the inclusion of pedestrian and cycling improvements both approaching and across the bridge, and mitigating the pre-existing drainage impacts to the First Nations Heritage site located along the south foreshore immediately beneath the bridge – all of which resulted in additional scope and scheduling pressures.

Binnie was the lead Engineering consultant for the AFB Project, responsible for both Project and Engineering Management, from the early planning and business case/funding approval through to detailed design and implementation/construction.

Q3: Social and/or Economic Benefits

The AFB is a critical commuter and goods movement road network link, representing one of four Fraser River crossings connecting the north and south sides of the Vancouver Lower Mainland. Currently, the bridge accommodates approximately 120,000 vehicles per day on average (of which about 10% are trucks), and prior to the project its approaches experienced extensive traffic congestion with vehicular queues in excess of 3 km length during the weekday peak periods. Post-project implementation, traffic congestion has been significantly reduced, with approximately 10-minutes travel time savings realized during the AM peak period in the northbound direction, and approximately 20-minutes travel time savings realized during the PM peak period in the southbound direction (i.e. representing up to 30-minutes total two-way travel time savings for typical commuters).

As noted by ***Honourable Catherine McKenna, Federal Minister of Infrastructure and Communities*** during the December 12, 2019 project news release:

> *"The Alex Fraser Bridge project shows how we are working closely with our partners to build the modern transportation infrastructure needed to keep people safe and support long-term economic growth. Together, we are helping communities make positive changes to improve people's lives, keep our businesses competitive and reduce carbon emissions for our children and grandchildren."*

Q4: Environmental Benefits

The AFB Project promotes sustainability by maximizing the use of existing infrastructure within the existing roadway footprint – it involves converting the pre-existing 6-lane bridge to 7-lanes, and implementing a movable barrier counter-flow system that utilizes the residual traffic capacity available in the off-peak direction of travel. The project also incorporated Climate Change resilience by improving the existing rainfall run-off drainage systems, both across the bridge and along the approach roadways – and with due consideration for mitigating impacts to sensitive run-off receivers such as the Fraser River and Burns Bog Conservation area. Consultation with First Nations groups was also carried out, in order to develop measures to mitigate pre-existing impacts to their important Heritage site situated

along the south foreshore immediately beneath the AFB Bridge (e.g. through the implementation of a bridge downspout splash dissipation system and enclosing drainage run-off through piping).

In addition, the project scope included pedestrian and cycling improvements, by widening pre-existing narrowed path locations along the bridge and at on-shore locations along both of the approaches. This involved structural widenings on the bridge, and at the on-shore approaches that included retaining wall construction. These improvements help to encourage active transportation modes of travel.

Q5: Meeting Client's Needs

The Alex Fraser Bridge (AFB) is a critical commuter and goods movement road network link, representing one of four Fraser River crossings connecting the north and south sides of the Vancouver Lower Mainland (the others being the Port Mann Bridge, George Massey Tunnel and Pattullo Bridge). Currently, the bridge accommodates approximately 120,000 vehicles per day on average, and prior to the project its approaches experienced extensive traffic congestion with queues in excess of 3 km length during the weekday peak periods.

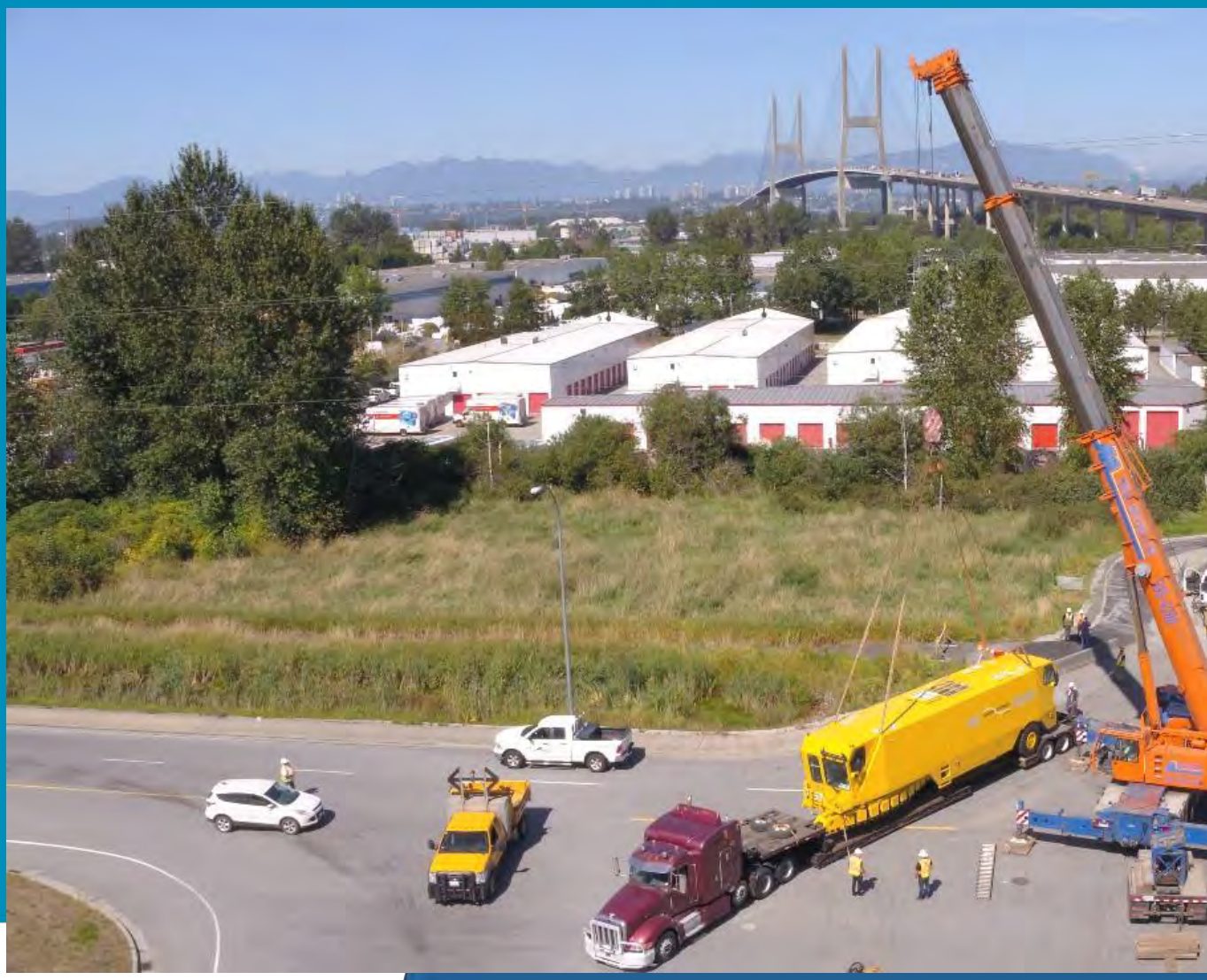
The BC Ministry of Transportation and Infrastructure's (MOTI) objectives for the AFB Project included:

- Reducing traffic congestion and travel times for both commuters and goods movers along this critical crossing corridor;
- Promoting economic development in a sustainable manner, while respecting local environmental and socio-community sensitivities.

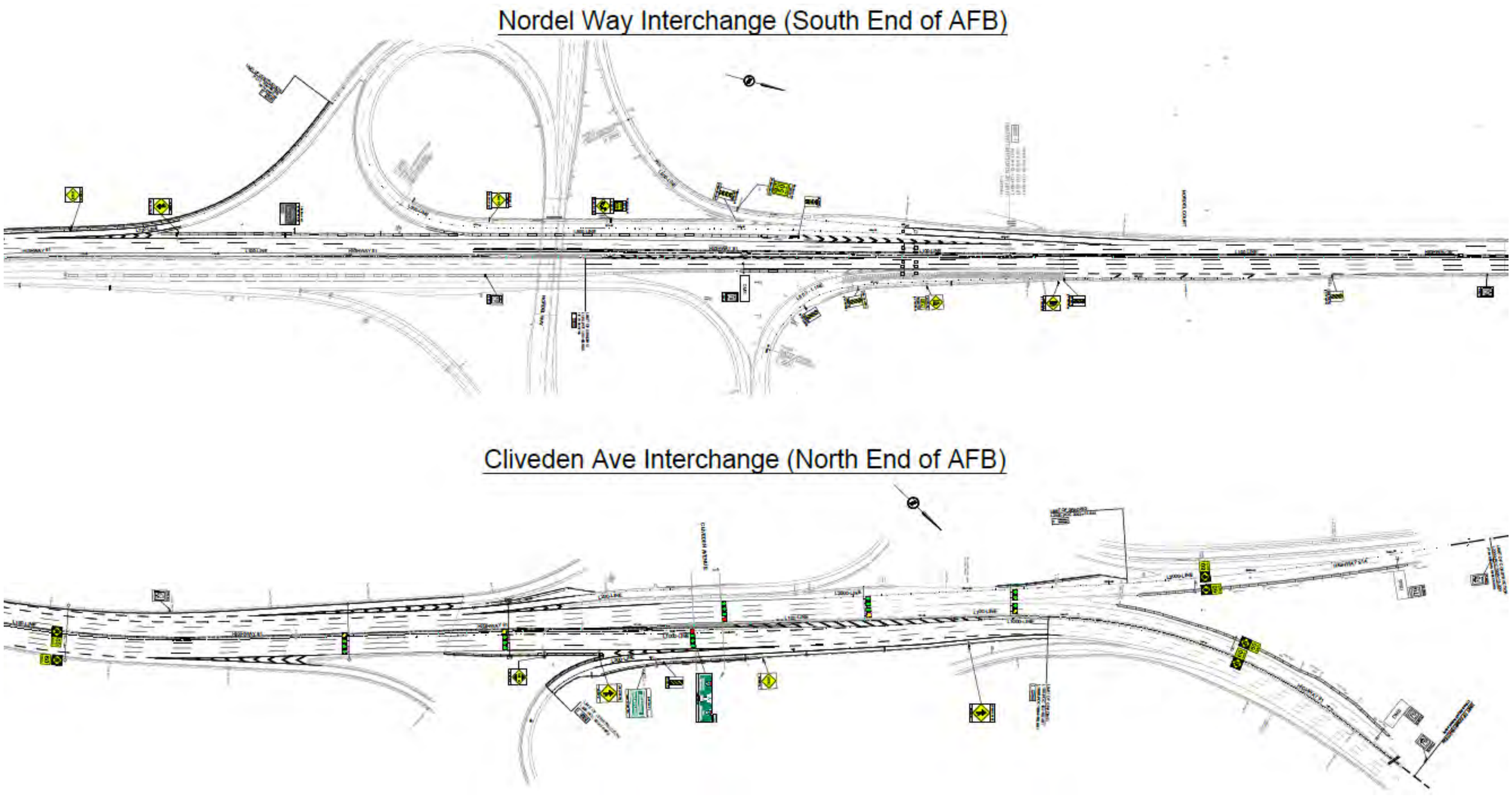
The AFB Project sought to fulfill these objectives through solutions that involved the following scope of work:

- Adding a seventh lane to the existing bridge to improve capacity and reduce traffic congestion;
- Adding an innovative movable barrier counter-flow system to take advantage of available residual traffic capacity in the off-peak direction of travel during peak periods;
- Installing 13 new dynamic message signs throughout Metro Vancouver, to inform motorists of estimated delays at the four major Fraser River crossings;
- Improving cycling/pedestrian and drainage provisions approaching and along the bridge.

Drawings/Photos



Sketches/Drawings



Project Photos

Photo 1: Alex Fraser Bridge new 7-lane cross-section

Photo 2: Nordel Way northbound on-ramp converted to 2-lanes

Photo 3: Barrier Transfer Machine (aka Zipper Vehicle)

Photo 4: Zipper vehicle during AM peak counter-flow at north end of Alex Fraser Bridge

Photo 5: Delivery of one of two new Zipper vehicles

Photo 6: One of 13 new Dynamic Message Signs (as part of the Fraser River Advance Traveller Information System)

Photo 7: First Nations Heritage Site located beneath the south approach of Alex Fraser Bridge

Photo 8: Improved Cycling/Pedestrian pathway at the south approach of Alex Fraser Bridge