



McElhanney



ASSOCIATION OF CONSULTING
ENGINEERING COMPANIES
BRITISH COLUMBIA

CANADIAN CONSULTING
engineer

Highway 1 Keith Road / Mt Seymour Parkway Interchange

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Entering Firm: McElhanney Ltd.

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1. 75-Word Project Summary

The Highway (Hwy) 1 Keith Rd / Mt Seymour Parkway Interchange Project & Lynn Creek Connectivity Improvement Program addressed congestion, road safety, and municipal connectivity needs for the North Shore. The Project had a constrained timeline tied to funding with no room for budget overruns. McElhanney successfully delivered this project for the Ministry of Transportation and Infrastructure (MoTI) using innovative design and scheduling strategies, while incorporating additional environmental and active transportation benefits to the region.



Hwy 1 Keith Rd / Mt Seymour Parkway Improvements – \$98 million investment completed on-time and on-budget.



2. Project Highlights

Q1. INNOVATION

As one of the most complex to projects undertaken by MoTI to tackle congestion and road safety, McElhanney developed innovative solutions to address technical challenges and budget and timeline constraints.

ACCELERATED SCHEDULE AND TIMELINE REDUCTION

Understanding that this project was under intense public scrutiny and a highly constrained schedule tied to funding, McElhanney's key innovative strategy was accelerating the design schedule from 15 months down to six months. The time saved to

complete the design provided MoTI with an additional construction season to ensure that the project was completed on time. To do this, McElhanney had three bridge and three highway design teams working simultaneously, in parallel with the geotechnical, drainage, hydrotechnical, utilities, and multi-use path teams in a fully integrated way. Additionally, our team of environmental specialists were able to secure the required regulatory permits within a short four months, enabling MoTI to release an advance works package to install bridge piles and riprap in Lynn Creek during the in-stream fisheries work window one year ahead of MoTI expectations.



Project location and importance to people and goods movement and municipal connectivity.



INNOVATIVE BRIDGE ENGINEERING

All four bridge sites on Hwy 1 had liquefiable soils in areas of high seismicity. McElhanney developed a staged construction plan for the new bridges (Lynn Creek and Keith / Seymour Underpass) and highway, roadways, and utilities, reducing traffic impacts on the adjacent bridge while maintaining traffic movement and utility services. Pile foundations with consideration of liquefaction and lateral deformation were required for the Lynn Creek bridges. The geotechnical and structural engineers collaborated to incorporate springs in the overall structural model to simulate and estimate the lateral behaviour of the bridge and piles under the design seismic hazards, including liquified conditions. In addition, incorporating cast in place parapets on the

Lynn Creek structure retrofit added 30 years to the service life of this aging infrastructure and allowed for simplified traffic detouring during construction.

A STAGED APPROACH

To mitigate the differential settlement of the geotechnically challenging soils, the project was built in a staged manner with the approach fills built early in the project. This strategy allowed the traffic to be detoured onto the new bridges and highway for one to two years before the top lift asphalt was installed. This provided “additional insurance” to the province – should additional settlement occur, the top lift paving would smooth out any differential settlement. The result is a smooth highway that is resilient to differential settlement in the long-term.

“I believe the key to the success of this design assignment was how McElhanney understood the magnitude of the cost and schedule challenges of the project from the beginning and kept the team focused on those issues throughout the design. I was particularly impressed how McElhanney addressed the Value Engineering Design Review in the same manner, genuinely seeking ideas and input from industry experts. Not only was McElhanney instrumental in the development of this project but they can take pride for getting it to construction within budget and on time. The team went over and beyond to ensure the ministry’s vision and objectives were achieved.”

— Jay Porter, MoTI Senior Project Manager



New and upgraded Lynn Creek bridges.



Intersection and traffic signal improvements, Mt Seymour Parkway and Lillooet Road.

Q2. COMPLEXITY

At \$98 million, this is one of the largest and most complex design-bid-build projects the MoTI has undertaken and required innovative solutions to reduce traffic congestion, improve safety, and enhance active transportation, while meeting tight completion and funding deadlines. Part of the larger \$198 million Lower Lynn Improvement Program, the project was designed to reduce public frustration over one of British Columbia's most congested sections of highway. McElhanney had to overcome the challenge of working within a suburban, constrained corridor that included fish-bearing habitat, parks, residences, and commercial properties. This project involved many technical and project management challenges, including:

- No ability to close the highway or detour traffic during construction
- Working in liquefiable soils in areas of high seismicity
- Public sensitivity and the need to gain consensus from multiple stakeholders including the District of North Vancouver, environmental regulatory agencies, and local First Nations

- Integration with the two other Lower Lynn Improvement Program projects on either side
- Constructing the Keith / Seymour Bridge immediately adjacent to the existing Keith Rd Overpass required staged construction and traffic detours, including partial removal of the existing approach embankment, and constructing the new abutments in two phases
- Working within and adjacent to sensitive watercourses, potentially enhancing existing environmental resource value
- Retaining wall structures to accommodate the grade separations associated with complex interchange designs

The project also included a network of multi-use paths, a pedestrian tunnel, and sound walls incorporating artwork from local Indigenous artists to create a unique finished product.

Q3. SOCIAL AND / OR ECONOMIC BENEFITS

The benefits of this project may be described in the following five (5) categories:



TRAFFIC

McElhanney used the Regional Transportation Model to determine traffic time savings for both highway and municipal road users. We also built a project specific VISSIM model to test traffic operations, develop the proof of concept, and optimize the detailed design, providing the most efficient geometry maximizing traffic time savings.



MULTI-MODAL TRAVEL

With the addition of 3.5 km of new bike paths, sidewalks, trails, and other active transportation features, McElhanney was able to promote active transportation use along this corridor. Cyclists, pedestrians, and transit users now experience increased access.



TRANSIT

Through coordination with the new Phibbs Transit Exchange, McElhanney worked to include additional bus bays and increase transit access along the corridor to encourage greater use of public transit and further reduce the impact of traffic congestion.



NOISE REDUCTION

McElhanney prepared the general arrangement and design of the required sound walls, which showcased the artwork from local Indigenous artists, reducing noise impacts to surrounding residents while beautifying the space for all users. These walls use a Mechanically Stabilized Earth (MSE) retainer for a green approach that blends into the surrounding nature.



SAFETY

Through upgrades to the highway ramps to meet current standards and widened shoulders, as well as development of the collector-distributor road system within the context of multiple closely spaced highway interchanges, it is expected this corridor will achieve a 25-45% reduction in collisions, improving overall road safety.

Q4. ENVIRONMENTAL BENEFITS

The Project required constructed road and bridge improvements that impacted environmental and fisheries resources in Lynn Creek and Keith Creek. To minimize and mitigate environmental impacts and identify potential opportunities for net environmental benefits, the project required an integrated team of hydrologists, civil engineers, and biologists to develop a new creek alignment for Keith Creek and obtain the regulatory approvals, under the Fisheries Act and Water Sustainability Act, within a very tight and constrained work schedule. Early studies included a watershed hydrotechnical analysis, a fisheries habitat assessment, and new habitat design, completed before the engineering design and submitted to provincial and federal regulatory agencies for works within the least risk fisheries window. Challenges

included coordinating engineering and environmental plans to provide continuity with the adjacent upstream and downstream phases of the overall project conducted by other engineers and environmental professionals.

The ultimate redesign of the Keith Creek channel incorporated instream and riparian habitat elements that supported existing salmonid species in the system. Ultimately, an increase of 70 metres of fish spawning habitat was created in Keith Creek, which amounted to an additional 24% of high value habitat.

This project also promoted sustainability through reduced travel time and congestion, enhanced active transportation options, and improved transit infrastructure and access.



New Keith Creek channel with fisheries habitat enhancements.

Q5. MEETING OWNER'S NEEDS

McElhanney's team worked to fulfill MoTI's greatest need, which was to complete the project within a constrained timeline to meet the funding requirements of three levels of government. During conceptual design of the entire Lower Lynn Improvement Program, the project came up against strong public and political pressure, as some funding partners felt that the \$150 million funding did not go far enough to resolve congestion. Instead, they believed an eight-lane collector-distributor, developed by others and estimated that \$265.5 million, was needed.

McElhanney assessed whether an alternative solution existed that would meet all stakeholder needs while maintaining schedule and reducing the funding uplift required. Within three months,

McElhanney developed an alternative, innovative \$198 million solution (+\$48 million in funding) that was unanimously approved by all stakeholders, funding partners, and local First Nations and saved the Province \$67 million while maintaining the program schedule. With commitment to a shortened timeline and lowered budget, there was no room for overrun in the project.

MoTI also wished to improve connectivity, congestion, and safety along this important corridor. Ultimately, McElhanney was able to increase capacity by widening Hwy 1 from six to 12 lanes, allowing for greater flow of traffic, as well as providing increased road safety, adding needed municipal connectivity and active transportation components, and enhancing fisheries habitat.



Improvements to municipal connectivity, active transportation, and transit.



