

## APPENDIX D - DESCRIPTION OF THE CROSSING OPTIONS

This Appendix provides additional details regarding the two service delivery options evaluated during the Business Case phase.

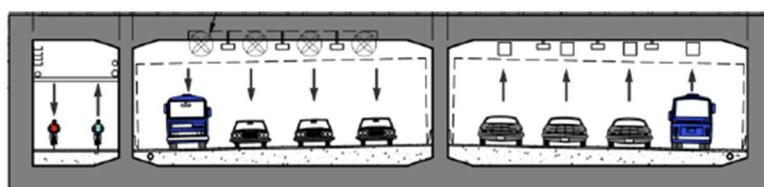
### OPTION 1 – NEW 8-LANE ITT WITH FULL REMOVAL OF THE EXISTING TUNNEL

The ITT option is a new eight-lane crossing with a navigational water draft comparable to the Existing Tunnel, which is nominally 11.5 m. The Ministry has confirmed with VFPA the water draft of the Existing Tunnel meets their current and future needs. A rendering and cross section of the ITT option are shown below in Figures D-1 and D-2, respectively.

**Figure D-1: Option 1 – Eight-Lane Immersed Tube Tunnel Crossing**



**Figure D-2: Option 1 Cross-Section**



The ITT crossing would require development of a casting basin for fabrication of tunnel elements, conducting upland and instream ground improvement to soil foundations to prevent liquefaction, immersing each element in a dredged trench, and then covering the new ITT with protective rockfill. Cut

and cover excavations are required to construct the north and south approaches to the new ITT. Lastly, a new bridge would be required through Deas Slough to connect the south approach to the Delta side of the crossing. Piers would be placed within Deas Slough, and ground improvement and piling would be required to support these piers.

Key elements of a new ITT option include the following:

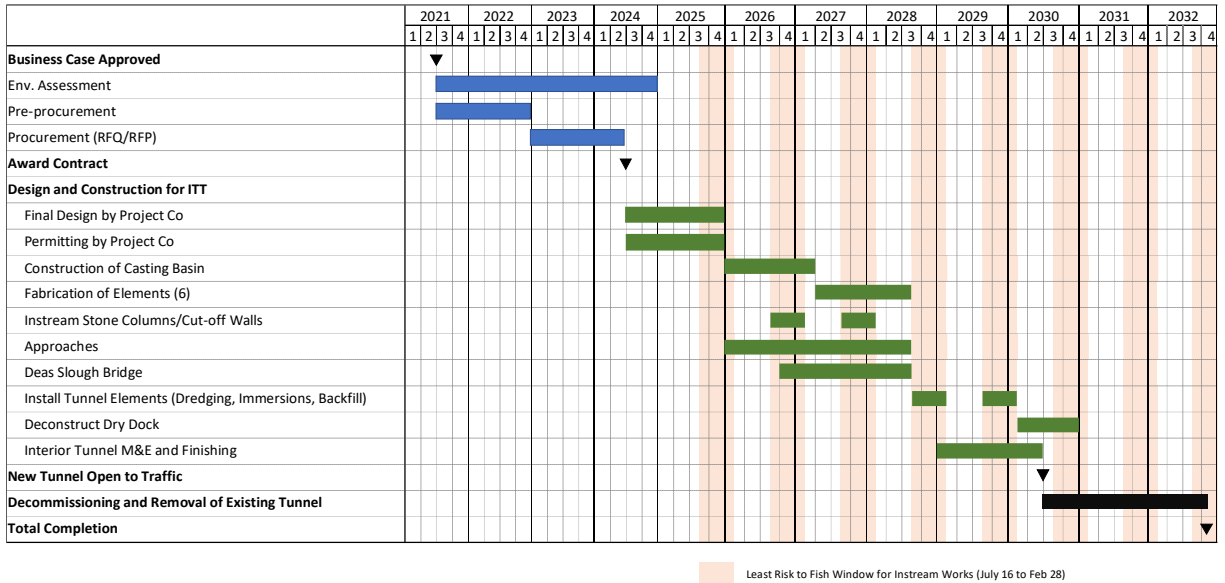
- Two four-lane roadway tubes (eight lanes total) with:
  - 3.7 m lane widths and 1.12 m shoulders in each direction, and
  - 5.0 m vertical clearance, and provisions for transportation of dangerous goods;
- Separate tube for a 5.0 m wide bi-directional MUP for active transportation;
- Designed and constructed to 1:2,475 year seismic standard;
- Meets VFPA's 11.5 m water draft requirements for the Fraser River Navigational Channel;
- Requires a new comprehensive environmental assessment review process and new EAC;
- Construction of a casting basin and fabrication of six tunnel elements, each element is approximately 45 m wide x 110 m long x 10 m high;
- Critical path constrained by least risk to fish windows and freshet (flow) timing for instream works, including ground improvements, dredging, immersion of tunnel elements, and placement of locking and protective fill; and
- Decommissioning of the Existing Tunnel through removal of all tunnel elements and backfilling of the onshore approaches.

Total excavation required is in the order of 1.25M m<sup>3</sup>, approximately 70% instream, and total backfill for the ITT and approaches is approximately 500,000 m<sup>3</sup>. An additional 1.125M m<sup>3</sup> of excavation is needed to develop an offsite casting basin, which is required for concurrent fabrication of all tunnel elements (six in total). It is expected that this casting basin would be backfilled upon completion if an end-use for the casting basin cannot be developed. Alternatives to an offsite casting basin include casting in the approaches, fabrication in an existing casting basin or dry-dock, or casting on a semi-submersible vessel.

The estimated schedule for the new ITT option with the recommended procurement option is show in Figure D-3. Instream stream works are constrained by time periods of least risk to fish in the Fraser River estuary, which are regulated by Fisheries and Oceans Canada. The Existing Tunnel is the boundary of two least risk windows, and it is assumed that the window adjacent and west of the site (shorter window, July 16 – February 28) would govern as upstream effects will flow downstream. In addition to this timing

constraint, instream works are further constrained by high flows during the annual freshet, which generally peaks in June and attenuates to the annual “low flow” period by August/September.

**Figure D-3: Option 1 Crossing Schedule**



## OPTION 2 – NEW 8-LANE BRIDGE WITH FULL REMOVAL OF THE EXISTING TUNNEL

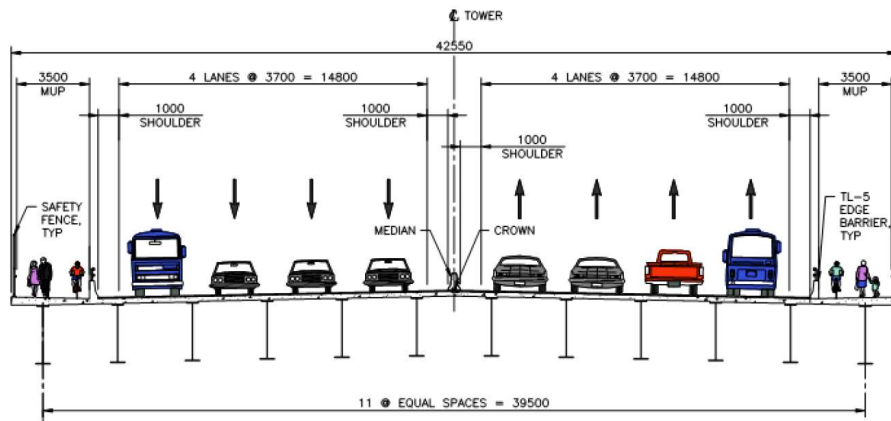
The bridge option features a new eight-lane bridge with a nominal 62.5 m air draft to provide for a reasonable clearance for current and future navigational needs on the Fraser River. The nominal air draft of the previous project (GMTR) was 57.0 m; however, since that time the VFPA have developed a cruise ship strategy for the Fraser River to accommodate future traffic that is constrained by conditions at the Lions Gate Bridge when transiting to the Cruise Ship Terminal in downtown Vancouver. With a nominal 62.5 m air draft for marine vessels, measured at the edges of the main navigation channel, the peak elevation of the bridge deck for users is approximately 80 m.

Navigational clearances are subject to approval by Transport Canada, which administers the Canadian Navigable Waters Act through the Navigation Protection Program, and GMTR had not received this approval. Although the VFPA's cruise ship strategy is in draft and has not been formalized, technical analysis completed by the Ministry concluded that a nominal air draft of 62.5 m could be achieved with a bridge at the crossing location without impacting the adjacent interchanges, and a due diligence review of vessel demand and air drafts, concluded that a nominal 62.5m air draft would accommodate 97.6% of the VFPA's target vessels. Follow-up to this study confirmed that 100% could be accommodated with tidal assist. A rendering and cross section of the bridge option are shown below in Figures D-4 and D-5, respectively.

**Figure D-4: Option 2 – Eight-Lane Bridge Crossing**



Figure D-5: Option 2 Cross-Section



Key elements of a new bridge option include the following:

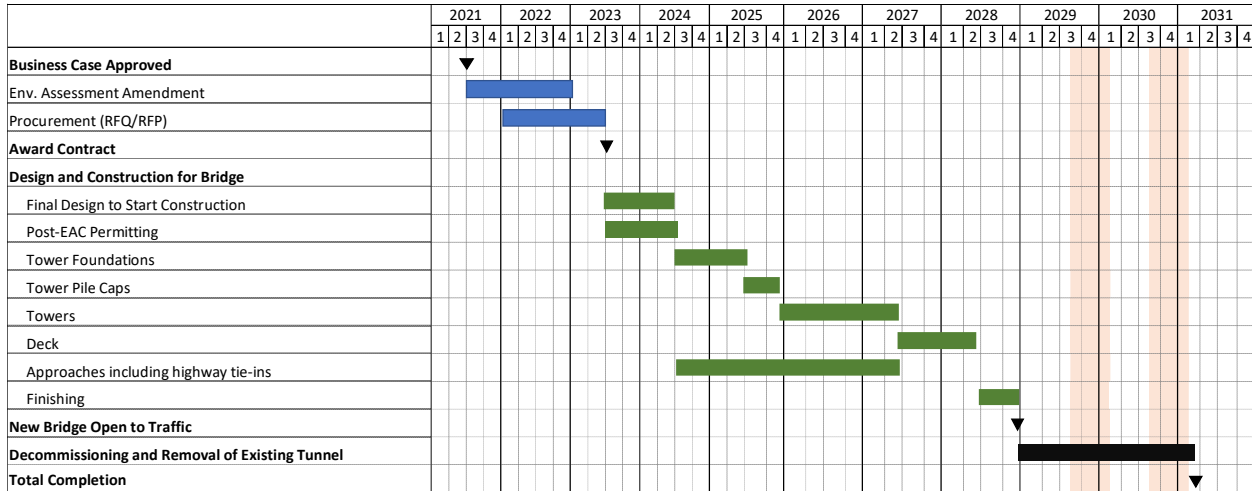
- Two four-lane roadways (eight lanes total) with 3.7 m lane widths and 1.0 m shoulders in each direction;
- Two 3.5 m wide MUPs, one each side of the bridge, for active transportation;
- No vertical clearance restriction, and provisions for transportation of dangerous goods;
- Designed and constructed to 1:2,475 year seismic standard;
- With tidal assist, the air draft meets VFPA's requirements for the Fraser River Navigational Channel.
- Requires an amendment to the GMTR EAC; and
- Decommissioning of the Existing Tunnel through removal of all tunnel elements and backfilling of the onshore approaches.

A new bridge crossing would consist of an open composite steel and concrete deck cable-stayed main span across the Fraser River with multi-girder composite bridges for the north and south approaches, including the approach over Deas Slough. Towers for the new crossing on are the order of 195 m in height, and foundations would consist of friction piles approximately 85 m in depth.

Based on recommendations from the ITR, the option of reducing the main span over the Fraser River by constructing piers within the river was explored; however, the instream foundations would need to be substantially larger to accommodate vessel impact design, and combined with the anticipated environmental effects for instream piers, it was determined that these impacts offset the costs associated with a short span and instream piers.

The estimated schedule for the bridge option is show in Figure D-6.

**Figure D-6: Option 2 Crossing Schedule**



Least Risk to Fish Window for Instream Works (July 16 to Feb 28)