The Bridge Design

Station 2

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Please provide your comments on the comments cards supplied at each station. Comment cards can be taken home and returned to the City or comments can be provided online via the project website.

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Design Changes

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Design Change Rational

Design review in consultation with various agencies has led to changes to the Main and Approach Spans, High Point of the Bridge and Piers as the design evolved from that presented during the conceptual design process, during the preliminary design and through to the current design. These design changes were necessitated by the following considerations:

1. Respect for the natural environment and cultural heritage
   a. Reduce the overall in-water footprint of the bridge
   b. Minimize the visual impact on the Rideau Canal

2. Design optimization
   a. No need for structural arch
   b. Able to reduce navigation span
   c. Simple span with under arch design
   d. Minimize long-term operation and maintenance costs

3. Price certainty
   a. Risk associated with steel pricing and 2018/2019 steel tariffs
   b. Concrete girders for approach, spans – stable pricing

4. Accelerated construction techniques optimized
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Plan Layout

Aerial view showing bridge alignment and pier locations
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Safety

Railings, barriers, and lighting will be designed to ensure safety of those travelling on or underneath the bridge.

Ontario Ministry of Transport standard concrete barriers, with embedded ducts for lighting, will be used for the roadway section of the bridge for driver safety, and will accommodate a railing fastened on top to protect cyclists. Lighting design will provide safe, effective illumination that is focused on the roadways, multi-use pathway and navigation channel (including the adjacent rowing lanes).

Stormwater Management

Stormwater management both on the bridge and at the approaches is an important aspect of bridge design, and something the City has heard is important to local residents.

Stormwater management will entail several water treatment measures, including:
- Grassed swales for quantity control of runoff
- Oil grit separators (e.g. stormceptors) for quality control at the outlet of swales
- Stormwater piping with rip rap protection conveying runoff from the approach and bridge to the enhanced grass swales
- Peak flow control where major event flows will flow overland to the Cataraqui River or dry pond facility
- Catch basins and sewers

All stormwater runoff from the bridge will be conveyed to either shore and treated before being discharged back to the River.

Bridge Maintenance

Snow and ice on the bridge will be managed according to the City of Kingston’s Winter Operations Level of Service Policy.

The Public Works department will strive to provide safe and passable winter road and sidewalk conditions for vehicles/cyclists and pedestrian traffic.

The City will apply pre-treatments in the form of Direct Liquid Application to roads in advance of snowfall events to prevent and/or treat ice formation.

The bridge design will incorporate the following:
- Bridge deck including shoulders adjacent to the vehicular lanes that will provide for temporary snow storage and drainage;
- Durable materials to withstand snow plow wear;
- No obstructions on the roadway or multi-use pathway to impede the efficient removal of snow from the bridge deck; and
- Multi-use pathway sloped towards the center barrier to facilitate the flow of snowmelt to the deck drains.
**Noise Provisions**

The use of sound barriers will achieve the required 5 dB reduction in traffic noise levels resulting from the operation phase.

**Considerations for layout and design**
- Effectiveness (meet the noise reduction requirements)
- Sight lines and visual appearance
- Safety
- Access to above and underground utility infrastructure
- Property lines, right of way and easements

**West side noise fence and east side from Point St. Mark Dr to Hwy 15**
- Wood design
- 2.3 metres high
- Engineer designed
- Same as noise wall on Montreal and John Counter Blvd.

**East side – Point St. Mark Dr. onto bridge**
- Engineer designed
- 100% recycled (recycled material and recycled hardwood and softwood fibres)
- Constructed of posts and panels
- Ability to modify texture and tint

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**Acoustic Environment**

Several noise studies have been performed for both the construction and the operation phases of the Project. The study area includes the regions immediately around each end of the bridge, as well as the bridge itself. Where required, permanent and temporary noise controls are proposed based on the anticipated construction zones; latest traffic models; detailed design process; and surrounding road modifications (such as the Highway 15 widening). These studies predict and evaluate the changes in the noise environment due to the Third Crossing Bridge at construction completion and into operation.

Upon applying a combination of proposed permanent and supplementary temporary barriers during the construction phase, the change in noise environment during construction will be minimized to the extent possible.

**Acoustic Assessment Mapping**

To address permanent noise control, two (2) acoustic barrier layout options have been proposed and evaluated. Both options are viable and will meet acoustic requirements.
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Geotechnical Investigations

Tulloch Engineering conducted a subsurface investigation to support the validation phase. The investigation consists of 11 marine boreholes for the bridge and 5 on-land boreholes for the west approach.

The geotechnical characteristics of the riverbed are consistent, in terms of water depth, peat layer thickness, clay overburden and rock profile, confirming the adequacy of the bridge foundation designs with respect to lateral capacity.

Kingston, Ontario is located in a stable continental region within the North American Plate and, consequently, has a relatively low rate of earthquake activity. The area of the proposed Project is not within a seismically active area.

The Third Crossing of the Cataraqui River at Kingston bridge and approach roadways have been designed in accordance with the Canadian Highway Bridge Design Code (CHBDC) and Canadian Standards Association and a site-specific seismic response analysis has been conducted to ensure design adequacy.

During the detailed design phase, a site-specific assessment of the ground, which includes a site-specific seismic response analysis, was conducted to estimate the seismic response of the site subjected to representative earthquake acceleration time histories for Eastern Canada, which has determined the seismic requirements and loads for this specific site. As part of industry best practice, certain bridge elements and connection details, although not required by the CHBDC, will be implemented to improve strength, durability and performance in the event of an earthquake.
Hydrotechnical Analysis

An analysis of river hydraulics was conducted by Hatch in 2019 to quantify potential changes specifically to water velocities, water depths, sediment erosion and transport, and river ice and spring flooding.

The analysis concluded the following:

- Wind is the primary driver of water movement with lake surge having a significant, yet secondary influence.
- Potential changes to water level and velocity are estimated to be relatively small under open water conditions during post-construction with little to no change in location and magnitude.
- Bed material is easily mobilized at very low velocities and the disturbance of bed material is equally likely with or without causeway or bridge in place owing to the very loose organic silty peat material occupying the bed surface.
- The presence of the causeway will temporarily change the hydraulic regime of the study area under open water conditions.
- Under design conditions, the presence of the causeway will increase velocity in the navigation channel beyond what is normally experienced and potentially increase erosion of the channel bed. The magnitude of these velocities is estimated to be small.
- Based on the low velocities and lack of supply ice due to Kingston Mills upstream, the potential for ice jam flooding during either the temporary works or post-construction cases is low.
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Design Changes

Municipal Class Environmental Assessment Bridge Design Concept (2013)

Preliminary Design (Refined Arch) (2017)
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Current Design

[Images of a bridge and kayaks]