Ontario

Ministry of Transportation

TRANSPORTATION ENVIRONMENTAL STUDY REPORT

Preliminary Design and Environmental Assessment for the Rehabilitation / Replacement of Ottawa Queensway Downtown Bridges from Metcalfe Street to Main Street

GWP 4170-13-00

City of Ottawa

May 2024



BT ENGINEERING

Transportation Environmental Study Report

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EXECUTIVE SUMMARY

E.1 Introduction

The Ministry of Transportation of Ontario (MTO) has undertaken a Preliminary Design and Environmental Assessment (EA) study (GWP 4170-13-00) for the rehabilitation / replacement of seven (7) bridges at four (4) locations along the Ottawa Queensway (Highway 417) between Metcalfe Street and Main Street in Ottawa, as shown in **Figure E1** and **Figure E2**. The study is being undertaken by MTO in partnership with BT Engineering Inc. (BTE).

This study is subsequent to GWP 663-93-00, Highway 417 (Ottawa Queensway) from Highway 416 easterly to Anderson Road Preliminary Design Study and Environmental Assessment (2007). The 2007 study was completed for the Queensway between Highway 416 and Anderson Road and examined opportunities to optimize the use of the existing Queensway. The approved 2007 EA study completed the "planning" phase of the Queensway corridor plan. This Downtown Bridges EA Study is for site specific improvements and to prepare a bridge management plan for seven bridges.

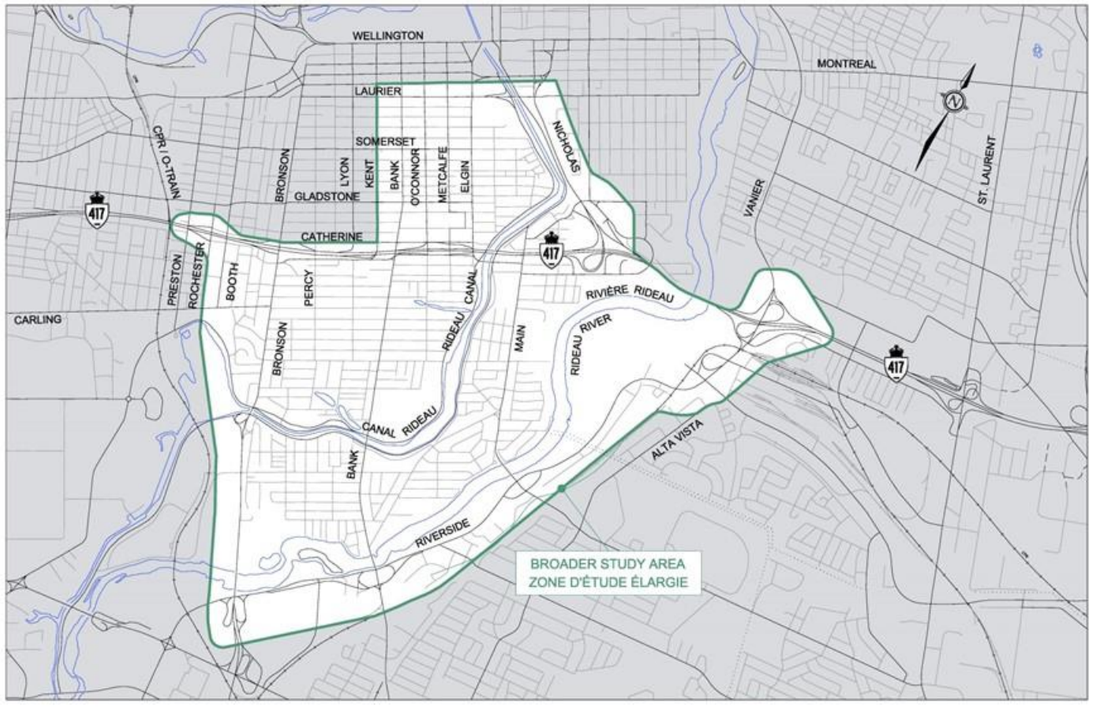

Figure E1: Project Broader Study Area

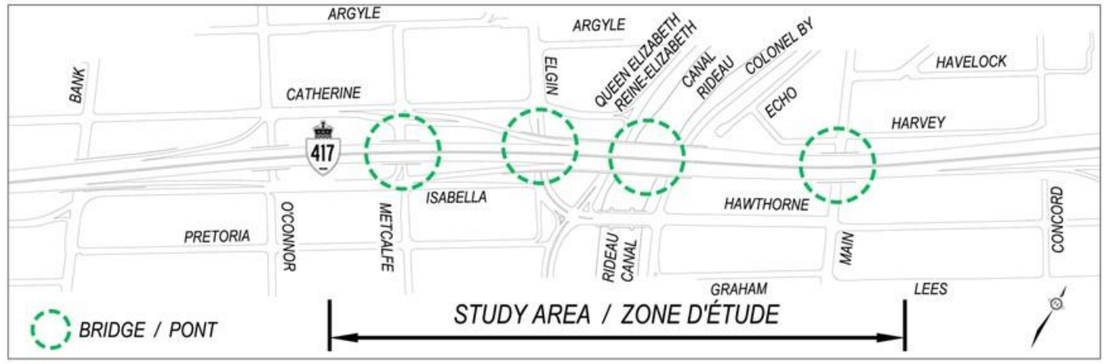

Figure E2: Project Local Study Area

This is a Preliminary Design study that has identified a bridge management strategy to address the structural needs of the following Queensway Downtown bridges:

- Site No. 3-065 Highway 417 Metcalfe Street Overpass
- Site No. 3-066.1 Highway 417 Eastbound Lanes (EBL) over Elgin Street
- Site No. 3-066.2 Highway 417 Westbound Lanes (WBL) over Elgin Street
- Site No. 3-067.1 Highway 417 EBL over Rideau Canal
- Site No. 3-067.2 Highway 417 WBL over Rideau Canal
- Site No. 3-068.1 Highway 417 EBL over Main Street
- Site No. 3-068.2 Highway 417 WBL over Main Street

E.2 Class Environmental Assessment Process

The Class Environmental Assessment for Provincial Transportation Facilities (2000) is an approved planning process that the MTO follows to satisfy the requirements of the *Ontario Environmental Assessment Act 2020 (OEAA).* This project has been assessed as a Group B project and this Transportation Environmental Study Report (TESR) has been prepared in accordance with the MTO Class EA document (2000).

This document provides an overview of the project, synopsis of the project rationale and design, summary of existing environmental conditions, and potential impacts and mitigation measures relating to the biophysical and socio-economic environment of the Ottawa Queensway Downtown Bridges Local Study Area. Information found within this report has been compiled through background research of the Local Study Area, as well as recent field-based studies.

E.3 Consultation Process

A key objective of the Class EA process is to provide the public, affected agencies and interested parties with opportunities for meaningful input throughout the EA and Preliminary Design process. In order to ensure this objective was met, a comprehensive public and agency consultation program was undertaken during the project.

The *French Languages Service Act* applies to this project; therefore, selected public communications and presentation materials were provided in both English and French. During the study, the public, community and interest groups and agencies were encouraged to participate in the study through contact letters, notices, a study website, individual meetings, three Public Information Centres (PIC's), a Municipal Technical Advisory Committee (MTAC) and a Federal Advisory Committee (FAC).

Indigenous Peoples communities were contacted at the Study Commencement, PICs and Study Completion with an invitation to meet separately. No responses from Indigenous communities have been received to date.

E.4 Needs Assessment

The project includes two overpass bridge types from the original Queensway construction during the 1959 to 1968 period. The Rideau Canal Bridge consists of two (2) post tensioned T-beam bridges (one westbound bridge and one eastbound bridge) with an integral deck (i.e. the bridge deck is contiguous with the beams as part of the poured concrete deck) and the remaining 5 bridges are rigid frame type bridges which are jointless and continuous from the deck to the footings. Elgin Street and Main Street consist of two (2) rigid frame bridges with separation between the eastbound and westbound bridges; whereas Metcalfe Street is a single rigid frame bridge with both eastbound and westbound lanes on a single continuous bridge.

Based on the engineering assessments completed to date, the Problem/Opportunity Statement for this study is:

- This project's goal is to establish a bridge management plan for 7 bridges on the Ottawa Queensway with consideration of traffic staging options and impacts. All 7 bridges are approximately 50 years old and in need of at least some repair work. Balancing traffic impacts – associated with bridge repairs (scheduled or unscheduled), rehabilitation or replacement – and bridge conditions / structural needs and property impacts, are very important considerations for the bridge management plan. As bridges get older and deteriorate over time the level of upkeep on them tends to increase along with the level of traffic impact associated with this work.
- At the rigid frame bridge locations, both rehabilitation and replacement alternatives are feasible and have trade-offs and the decision at each location was subject to site-specific factors such as costs, traffic impacts and the availability of nearby construction staging areas. Short- and longer-term strategies were considered for these bridges as well as short term "holding strategies" to maintain the condition of the bridges at an acceptable level until more significant works (rehabilitation or replacement) are undertaken.
- The Rideau Canal Bridge is nearing the end of its service life and is also in need of design upgrades. Based on the forecast cost of these repairs, a new replacement bridge is cost effective for this location.

E.5 Environmental Conditions

The planning context and recent planning /background studies were reviewed and the existing natural, cultural and socio-economic environmental conditions of the Local Study Area were documented. The existing traffic and bridge conditions were also studied in support of the development of alternatives and the assessment of the potential impacts of the proposed undertaking.

Figure E3 and **Figure E4** on the following pages provide a Summary of Environmental Conditions.

Figure E3: Summary of Environmental Features within the Immediate Study Area

Figure E4: Immediate Study Area Issues

E.6 Alternatives to the Undertaking (Planning Alternatives)

Three (3) Alternatives to the Undertaking (Planning Alternatives) were initially considered for each of the 7 sites: Do Nothing; Rehabilitation; and Replacement. The recommendations following the evaluation of these alternatives were as follows:

1. Do not carry forward the "Do Nothing" alternative as this alternative would not have defined a future bridge management strategy for any of the 7 bridges.
2. Carry forward both Replacement and Rehabilitation alternatives for the Rideau Canal bridges.
3. Carry forward both Replacement and Rehabilitation alternatives for all rigid frame bridges.

E.7 Alternative Methods of Carrying Out the Undertaking (Preliminary Design Alternatives)

Several Preliminary Design alternatives were identified at each bridge location. These included:

a) Bridge Alternatives – Rigid Frame Locations

- Alternative A: Rehabilitation
- Alternative B: Replacement

Each bridge was evaluated for the existing span only. Shorter and longer spans were not evaluated; however, the span at Elgin Street was investigated at the request of the City of Ottawa. It was determined that any modification of the span would involve very high risk and cost and therefore was not carried forward.

b) Traffic Staging Alternatives on Freeway – Rigid Frame Locations

- Alternative 1: Conventional rehabilitation with 2 lanes per direction
- Alternative A1: Rapid rehabilitation involving a 5-stage rehabilitation sequence
- Alternative A2: Conventional rehabilitation involving a 4-stage rehabilitation sequence
- Alternative 3: Conventional rehabilitation involving "battleship" work areas (construction zones with traffic on both sides) traffic staging
- Alternative 4: Conventional rehabilitation with median crossover
- Alternative B1: Conventional replacement with diversion of freeway traffic
- Alternative C1: Rapid replacement with full eastbound and westbound closure (short term)

c) Bridge Replacements – Rideau Canal Location

- Alternative A: Replacement - constant depth precast on existing pier location
- Alternative B: Replacement - variable depth on existing pier location
- Alternative C: Extrados concrete on new pier location (type of bridge design that is similar to cable stayed with use of concrete deck as structural load carrying members)
- Alternative D: Replacement - variable depth girder on new pier location
- Alternative E: Single span replacement (arch bridge)
- Alternative F: Conventional rehabilitation

d) Traffic Staging Alternatives on Freeway – Rideau Canal Bridge Location

- Alternative 1: Barge transportation of bridge
- Alternative 2A: Conventional construction in strips
- Alternative 2B: Conventional construction in strips allowing wheel tracking on the joint between the bridges
- Alternative 2C: Conventional staging in strips with additional work (to widen the Queensway north side following 2007 TESR recommendations) completed prior to construction
- Alternative 3A: Complete superstructure rapid replacement using Self-Propelled Modular Transporters (SPMTs) (complete bridge replacement)
- Alternative 3B: Complete superstructure rapid replacement using SPMTs (individual bridges for each span with all six bridge staging sites to the north of the Queensway)
- Alternative 3C: Complete superstructure rapid replacement using SPMTs (individual bridges for each span with four bridge staging sites north of the Queensway and two bridge staging sites within Ballantyne Park)
- Alternative 3D: Complete superstructure rapid replacement using SPMTs (individual bridges for each span with two bridge staging sites north of the Queensway and four bridge staging sites within Ballantyne Park)
- Alternative 4: Demolish in place and jack and slide new bridges from each side (two bridges replaced in the same 3-day period)
- Alternative 5: Sequential jack and slide (removing one bridge at a time)
- Alternative 6: SPMT transport to Nicholas (individual bridges for each span)

e) Staging Area Alternatives for Temporary Works

At each of the 4 bridge sites (i.e. Metcalfe Street, Elgin Street, Rideau Canal and Main Street) an initial review of feasible Rapid Bridge Replacement (RBR) staging areas was undertaken and a preferred staging area for each RBR bridge alternative was recommended.

The recommended staging areas require both temporary and permanent land acquisition for the rapid bridge replacements. The recommended staging areas are:

- Metcalfe Street
  - Lands adjacent to the Queensway corridor to the north between Elgin Street and O'Connor Street (temporary MTO land use required) for the bridge staging sites
  - Closure of Catherine Street during the SPMT 3-day move
- Elgin Street
  - Lands adjacent to the Queensway corridor to the north between Queen Elizabeth Driveway and Metcalfe Street (temporary MTO land use required) for the bridge staging sites
  - Closure of one lane of Catherine Street during construction and closure of Catherine Street during the SPMT 3-day move

- Main Street
  - Ballantyne Park for the bridge staging site (temporary City of Ottawa land use required)
  - 58/60 Main Street to accommodate the SPMT movement to avoid crossing the 1220 mm City of Ottawa watermain (permanent property acquisition required)
- Rideau Canal
  - Ballantyne park for the contractor laydown area for the Rideau Canal
  - Demolition of 221 Echo Drive (Royal Oak Pub) to accommodate the cranes for the Rideau Canal bridge construction (permanent property acquisition required for the Technically Preferred Alternative (TPA) shown at PIC No. 2)
  - Demolition of 3/5 Hawthorne Avenue to accommodate the cranes for the Rideau Canal bridge construction (permanent property acquisition required for the TPA shown at PIC No. 2)

Note: See **Section E9** for staging alternative refinements. **The Recommended Plan was updated after PIC No. 2 and no longer includes the acquisition of 221 Echo Drive or 3/5 Hawthorne Avenue..**

E.8 Recommended Plan – Rigid Frame Bridges

The Recommended Plan for the rigid frame bridges will allow the Ministry flexibility in the structural management approach (rehabilitation or replacement). The individual bridge site recommendations can be modified in the future as required by funding availability or other Detail Design considerations. The bridges and their corresponding recommendations are presented in **Table E1**.

Table E1: Rigid Frame Bridges Summary of Recommendations

Bridge Site	Technically Preferred Alternative (TPA)	Flexibility for Alternate TPA
Metcalfe Street	Rapid Replacement (B-C1-e)	Conventional Rehabilitation (A-A2-e)
Elgin Street	Rapid Replacement (B-C1-e)	Conventional Rehabilitation (A-A2-e)
Main Street	Rapid Replacement (B-C1-e)	Conventional Rehabilitation (A-A2-e)

For each of the rigid frame bridges to be replaced, the recommended new bridge is a single-span rigid frame bridge with a span length the same as the existing bridge (see **Figure E5** for representative replacement design). The existing bridge will be removed and the new bridge installed using rapid replacement technology or other accelerated bridge construction techniques that may be used by the contractor during 3-day closures of the Queensway. The footings of the existing bridge will be salvaged for the foundations of the new bridge or alternatively replaced as part of the heavy lift operations. Advance work to facilitate the bridge replacement will be required prior to the rapid replacement operation and will require partial and short-term full closures of the intersecting municipal cross streets. The Preliminary Design recommendation is to close the municipal street for a minimum of 3 weeks in advance of and following the replacement - with the possibility of providing pedestrian movement until the weekend prior to the lift; this will be confirmed at the future Detail Design stage.

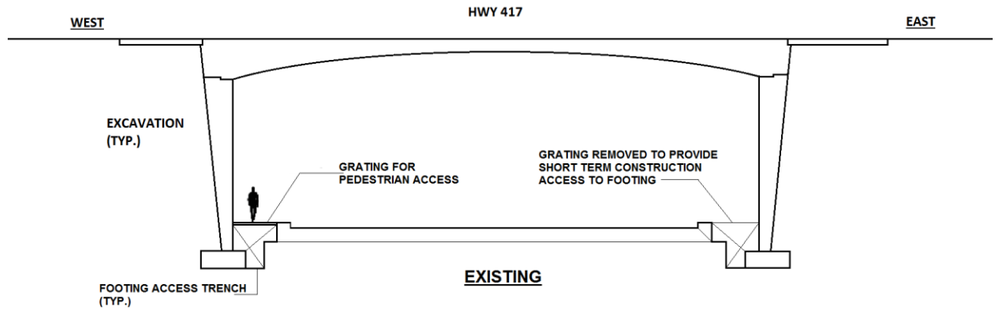

Figure E5: Typical Recommended Replacement Bridge (Temporary Construction Stage)

The construction sequence for the rapid replacement of the bridges is as follows:

1. Construct new bridge in the staging area/ undertake utility relocations in advance.
2. Install temporary supports and prepare the existing bridge for removal.
3. Complete all necessary advance work, including protection system and earth excavation.
4. Remove existing bridge using rapid replacement technology.
5. Install new bridge using rapid replacement technology.
6. Demolish existing bridge at bridge staging site.
7. Complete all remaining work, including barrier wall connection, approach slabs etc.

For the rapid replacement activities in Steps 4 and 5, a 3-day full closure of the Queensway, for example from Thursday evening to Monday morning, will be required. The remaining work in Step 6 can be completed during either the same 3-day period or a following weekend.

The context sensitive design elements of the replacement rigid frame bridges will include the following:

- Context sensitive architectural design features on the facades to provide consistency along the corridor similar to the design features for the bridge replacements for the Queensway Mid-town bridges;
- Landscaping at the four quadrants (where feasible); and
- Improved lighting (by the City of Ottawa) to improve the safety and personal security under the bridges and create a greater sense of openness for the users on the municipal street.

E.9 Rideau Canal Bridge – Refinements to the Technically Preferred Alternative

The Technically Preferred Alternative (TPA) for the Rideau Canal Bridge presented at PIC No. 2 was Alternative D4:

- Alternative D: Replacement - variable depth girder on new pier location

- Alternative 4: Demolish in place and jack and slide new bridges from each side (two bridges replaced in the same 3-day period)

Following PIC No. 2 and the presentation to the City of Ottawa Transportation Committee, the following concerns were raised by the public, agencies and stakeholders:

- The TPA included the acquisition and possible demolition of 221 Echo Drive and 3/5 Hawthorne Avenue. The building at 3/5 Hawthorne Avenue is on the City's Heritage Register but has not been designated. Both are considered community assets by the community and the public, and the City of Ottawa requested alternatives be considered to maintain the buildings.
- Hydro One high voltage transmission buried ducts were identified on both sides of the Rideau Canal. The proposed location of the piers requires the relocation of the west side duct.
- Potential construction impacts to the City's 1220 mm diameter watermain.

The following refinements are recommended for the piers and were shown to the public at PIC No. 3:

- The modified Technically Preferred Rideau Canal Alternative is proposed to shift the piers to avoid conflicts with high voltage buried ducts;
- The technical recommendation is to construct the piers to be integrated with the canal walls; and
- The style and design of the wall/pier integration will be finalized during Detail Design with approvals to be obtained from the NCC and Parks Canada.

The Recommended Rideau Canal Construction Staging includes:

- Build both bridges to the north of the Queensway (single construction area)
- Parkway closures within the zone of the construction and detours (improved safety of construction work area)
- Avoids permanent property impacts (building demolition) to 221 Echo Drive and 3/5 Hawthorne Avenue
- Detour of multi-use path and parkways on east and west side (improved safety of the construction work area)
- Temporary loss of parking: driveway access from Tiffany Apartments to Catherine Street will not be maintained during construction (front door access will be maintained for pedestrians but not for vehicles except Emergency Services when required)
- Avoids risk of construction in close proximity to the City's Regional 1220 mm diameter watermain

E.10 Recommended Plan – Rideau Canal Bridge

The recommended alternative for the Rideau Canal bridge is a 3-span bridge with the piers removed from the Canal, steel girders, and a concrete deck. For each structure, the new deck is to be constructed on temporary work platforms north of the existing bridges, and then slid to its final position using the jack-and-slide method after the existing bridge is removed.

The context sensitive design elements of the Rideau Canal replacement bridge have been developed carefully with a focus on the requirement that the new design should be distinct from and subordinate to the existing historic Rideau Canal elements. This aspect of the project will be investigated further during the future Detail Design stage.

E.11 Recommended Plan – Other Elements

Other elements of the Recommended Plan include:

- Temporary use of Ballantyne Park during the construction of the Main Street Bridges and Rideau Canal Bridges;
- Infill of the Rideau Canal for pile installations (east /west sides); complete infill across the Rideau Canal for demolition and removal of the existing bridge and removal of the fill;
- Purchase 58 and 60 Main Street for the Main Street Bridge rapid replacement (MTO ownership 2019);
- New 5 m high replacement noise barriers on the north and south sides of the Queensway (east of the Rideau Canal); and
- Landmark features and context sensitive design elements to be reviewed during Detail Design.

E.12 Potential Environmental Effects and Proposed Mitigation

Table E2 below provides a summary of the Preliminary Design environmental effects and proposed mitigation measures. The subsequent Detail Design stage will review, update, and revise, where necessary, the effects and mitigation measures at that time. The Design and Construction Report will outline the mitigation measures incorporated in the Detail Design documentation and contract documentation and construction requirements.

Table E2: Summary of Potential Environmental Effects and Proposed Mitigation

I.D. No.	Factor	Agency / Authority	Environmental Issues and Potential Effects	Proposed Mitigation Measures
1.0	**NATURAL ENVIRONMENT**			
1.1	**Species at Risk – Birds**	MECP, Parks Canada	• Potential disruption to migratory birds, nesting and / or species at risk (SAR) including: Chimney Swift (THR) - potential habitat within 200 m if brick chimneys of greater than 30 cm diameter and with rough interiors exist; Barn Swallow (THR) - potential habitat within 200 m if covered ledges and rough concrete exist; Peregrine Falcon (SC) – breeding pairs observed due to suitable nearby habitat (waterbody of the Rideau Canal and River and proximity to ledges on tall buildings). • No Barn Swallow nests were noted during the 2017 bridge inspection.	• Conduct bridge staging site 'sweeps' prior to any tree removals and prior to and during construction, particularly in the northwest quadrant of the Nicholas Street Interchange due to it having the largest undisturbed stands of woody vegetation in the area. A Nesting Survey will be undertaken early in the Detail Design stage. • Completion of an updated Environmental Impact Assessment during Detail Design, including a review of the Natural Heritage Information Centre (NHCI) and field observations and surveys. • Clear any vegetation outside of the breeding bird season which runs from April 1 – August 31, according to the *Migratory Birds Convention Act*. Failure to do so may result in triggering of the *ESA*. • Ensure contractor's staff are trained to recognize potentially affected species and are required to notify authorities if any are encountered on site. • Involvement of Parks Canada if impacts occur on Parks Canada lands/ waters.
1.2	**Species at Risk – Bats**	MECP, Parks Canada	• Potential disruption of SAR bat habitat due to the removal of trees with the potential to contain bat cavities. Species include: Eastern Small-footed Myotis (END); Northern Long-eared Bat (END); Tri-colored Bat (END); Little Brown Myotis (END). • No bats were noted during the 2017 bridge inspection.	• Conduct bridge staging site 'sweeps' prior to any tree removals and prior to and during construction, particularly in the northwest quadrant of the Nicholas Street Interchange due to it having the largest undisturbed stands of woody vegetation in the area. These sweeps should focus on identifying bat cavities at heights greater than 5 m off of the ground. • Completion of an updated Environmental Impact Assessment during Detail Design. • As tree diameter (DBH) is generally less than 50 cm throughout the Study Area, efforts should be made to retain large trees if possible. This will reduce the likelihood of removing trees with adequate bat cavities. • Ensure contractor's staff are trained to recognize potentially affected species and are required to notify authorities if any are encountered on site. • Involvement of Parks Canada if impacts occur on Parks Canada lands/waters, as per the *Species at Risk Act*. • An analysis/survey should be undertaken in advance of the Detailed Design to understand what level of mitigation would be required for Little Brown Myotis and Eastern Small-footed Myotis, the two species more likely to use bridge structures.
1.3	**Species at Risk – Aquatic Species and Amphibians**	MECP DFO, Parks Canada (PC)	• Potential destruction of passive SAR and non-SAR fish habitat due to the proposed infilling of a portion of the Rideau Canal. Specific aquatic SAR species with potential to occur within the Rideau system include: River Redhorse (SC); Pugnose Shiner (THR);	• Conduct site 'sweeps' prior to any vegetation removals or infilling and prior to and during construction. Fish rescues (as many as needed) will be performed prior to any potential infilling by a qualified fisheries professional.

Table E2: Summary of Potential Environmental Effects and Proposed Mitigation

I.D. No.	Factor	Agency / Authority	Environmental Issues and Potential Effects	Proposed Mitigation Measures
			Channel Darter (THR); Bridle Shiner (SC); Lake Sturgeon (THR); Northern Brook Lamprey (SC); American Eel (END); Blanding's Turtle (END); Snapping Turtle (SC) • Potential disruption of turtle habitat and movement patterns.	• Completion of an updated NHIC review and discussion of field observations during detail design. • Infill will be removed, and habitat features reinstated in order to return the area to its previous conditions or better. Note: critical habitat features for reproduction and rearing of young are limited to absent. • Conduct in-water works outside of the restricted window of January 1 – June 30 as per MNRF. • No work should take place following the fill placement immediately after the canal draw down until March 15 at the Rideau Canal Bridge in overwintering turtle habitat, and per MNRF restricted window stated above. • Where turtle brumation habitat is identified during detail design, this in-water work window shall be further reduced to July 1 – October 14. • Install wildlife exclusion fencing prior to April 1 to limit turtle movement into the work area(s). • The Rideau Canal bridge is within a mapped polygon for critical habitat. Although many biophysical attributes will not be present here it will have to have a focused analysis within the federal impact assessment process following the initiation of Detail Design.
1.4	**General – Vegetation**	MNRF, National Capital Commission (NCC), Parks Canada and City of Ottawa.	• Removal of various trees and woody vegetation due to clearing for staging areas. • MNRF has indicated the potential for the SAR Butternut to be in the area, though none are within the immediate construction or staging areas.	• Maintain, if possible, mature tree specimens with a diameter (DBH) greater than 50 cm. • Maintain, if possible, tree line between Hawthorne Avenue properties and the Queensway to provide natural visual shield. • Lilacs in M1 should be maintained if possible. However, it is noted that lilacs are an invasive species, and some consideration will be given to replacing them with native species. • Most sites had no natural environmental features and are not likely to support native features. No trees would qualify for the City of Ottawa's Honour Role Trees list. No environmentally sensitive areas, ANSIs or significant wetlands noted by MNRF or under the City's Official Plan.
1.5	**Stormwater Management**	Parks Canada	• Stormwater ultimately drains into the Rideau Canal.	• Improvements to the storm water quality entering the Rideau Canal will be investigated during Detail Design.
2.0	**CULTURAL ENVIRONMENT**			
2.1	**Archaeology**	MCM, Parks Canada	• Stage 1 Terrestrial and Marine Archaeological Assessments have not identified any areas of archaeological potential for the Recommended Plan.	• The Stage 1 Terrestrial and Marine Archaeological Assessments have not identified any areas of archaeological potential. • If deeply buried archaeological remains are encountered during construction, the contractor must notify the MCM. If they are discovered on Parks Canada lands/waters, Parks Canada must also be notified.

Table E2: Summary of Potential Environmental Effects and Proposed Mitigation

I.D. No.	Factor	Agency / Authority	Environmental Issues and Potential Effects	Proposed Mitigation Measures
2.2	**Heritage**	MCM	• Special attention must be given to the Rideau Canal, as it was designated a National Historic Site of Canada in 1925 and a UNESCO World Heritage Site in 2007, and it is owned by the Government of Canada and administered by Parks Canada. • Short term effects on scenic entry routes and significant views (as described in the City of Ottawa OP Schedule 1 – Multi-Use Pathways and Scenic/Entry Routes – Urban) due to temporary staging areas and alteration of bridge design. • Impacts to buildings with local value at the intersection of Main Street and Hawthorne Avenue: a former gas station landmark (McGovern Construction). Early 19th century buildings in the local Study Area.	• Continue to consult with Federal and Parks Canada agencies during Detail Design to ensure acceptable design considerations for the bridge works, and to facilitate scenic and entry routes to the Rideau Canal and to the City.
2.3	**Heritage**	Parks Canada, MCM, MTO	• The Cultural Heritage Resource Assessment Report (CHRAR)identified three potential Cultural Heritage Landscapes (CHLs) and one potential Built Heritage Resource (BHR) are anticipated to be directly impacted by the TPA and will require further mitigation to avoid any adverse impacts. In addition, there is potential for indirect impacts to identified BHRs and CHLs.	• Construction activities and staging should be suitably planned and undertaken to avoid unintended negative impacts to identified built heritage resources and cultural heritage landscapes. • A Heritage Impact Assessment (HIA) be completed as part of the Detail Design by a qualified heritage professional and in advance of construction for the Rideau Canal Bridges. • A Cultural Heritage Evaluation Report (CHER) to determine Cultural Heritage Value or Interest (CHVI) of the former auto garage (60 Main Street) is required. • Reinstatement of lighting fixtures and vegetation along Queen Elizabeth Drive and Colonel By Drive due to construction activities. • Reinstatement of lighting fixtures, vegetation and the James Ballantyne commemoration monument in Ballantyne Park due to construction activities. In addition, maintain as many trees as possible within Ballantyne Park, especially along the street frontage. • Baseline vibration monitoring during detail design to ensure BHR are not adversely impacted during construction. • A copy of the CHRAR has been submitted to the NCC, MCC, Parks Canada and City of Ottawa Heritage staff for their review.
2.4	**Heritage**	Parks Canada	• Context sensitive design for the Rideau Canal Bridge shall consider the UNESCO World Heritage Site and National Historic Site of Canada designations.	• The Rideau Canal bridge design includes context sensitive design elements including the removal of the piers from the water, a design that is subordinate to, indistinguishable from and compatible with the surrounding landscape and does not impact the existing heritage designations and viewscapes. Commitments are made in this TESR to continue to consult with federal, provincial and municipal stakeholders during Detail Design to receive approvals for the final design.

Table E2: Summary of Potential Environmental Effects and Proposed Mitigation

I.D. No.	Factor	Agency / Authority	Environmental Issues and Potential Effects	Proposed Mitigation Measures
				• The construction methodology for the Rideau Canal Bridge (jack and slide rapid replacement) allows minor modifications including removing the piers from the canal. • The Rideau Canal Bridge replacement and new bridge maintain and protect the canal alignment and the canal walls. • Landscape treatments for 30 m buffer for the World Heritage designation will be reinstated post construction in accordance with Parks Canada standards. • A Context Sensitive Design Report describes future design considerations during subsequent phases.
2.5	**Recreational Resources**	City of Ottawa	• Use of Ballantyne Park for staging area. • Impacts to multi-use paths or cycling lanes under the bridges.	• Preconstruction survey of trees and monuments. • Protection (where possible) of trees along Hawthorne Avenue. • Reinstatement of Park following construction. Consultation with the City of Ottawa for park redevelopment will continue during Detail Design. • Provide alternate detour routes and advance notifications of temporary closures. • Use of protective hoarding and temporary protected walkways to maintain pedestrian passage where practical.
3.0	**SOCIO-ECONOMIC ENVIRONMENT**			
3.1	**Property Impacts – Permanent**	Property Owners, Tenants	• Private property purchased at 58 Main Street and 60 Main Street.	• Early communication / coordination with owners and tenants was undertaken to minimize disruption associated with property purchase prior to purchase by MTO in 2019.
3.2	**Property Impacts – Permanent**	Property Owners, Tenants	• Potential need to acquire / protect other properties for working / staging areas at various bridge sites (either for short or long term).	• Early communication / coordination with owner(s) and tenants to minimize disruption associated with property purchase.
3.3	**Property Impacts – Temporary**	Property Owners, City of Ottawa	• Catherine Street will be used during construction, while maintaining access to the underground parking garage at 475 Elgin Street apartments. • Ballantyne Park will be used as a construction site for the Rideau Canal and Main Street Bridge replacements. Noise barrier replacements may temporarily affect properties along the recommended barrier limits during removal and installation.	• Potential for refinement during Detail Design and documentation of results in Design and Construction Report. • Potential use of City of Ottawa property and Federal lands for construction staging areas. • Early communication / coordination with owner(s) to minimize disruption. • Reinstatement of any disturbed areas to original condition or better. • Protection of all Canal infrastructure and timing of works to minimize effects to navigation and winter skating season. • Construction fencing along rear yards of Hawthorne Avenue properties to reduce intrusion.

Table E2: Summary of Potential Environmental Effects and Proposed Mitigation

I.D. No.	Factor	Agency / Authority	Environmental Issues and Potential Effects	Proposed Mitigation Measures
				• Retention of vegetation along and within fence (where possible) for rear yard properties along Hawthorne Avenue.
3.4	**Parking Impacts – Temporary**	City of Ottawa Property Owners Residents	• Temporary loss of parking on streets and in private parking lots to accommodate contractor laydown areas and construction works. • Temporary loss of parking during localized road closures, detours and during the use of parking lots as construction staging areas.	• Temporary Limited Interest (TLI) will be obtained for the use of the parking lots behind 3/5 Hawthorne Avenue and the Tiffany Apartments (150 Queen Elizabeth Driveway). • Early advance communication with the parking lot owners / operators and regular users of the above parking lots and designated parking areas.
3.5	**Social Environment (During Construction)**	City of Ottawa Property Owners	• Various properties within close proximity to the bridge sites and staging areas may experience some level of temporary impact during construction (e.g. construction noise, dust, visual intrusion etc.) • These temporary works affect: 221 Echo Drive, 3/5 Hawthorne, 7/9 Hawthorne Avenue, 15/17 Hawthorne Avenue, 19/21 Hawthorne Avenue, 25 Hawthorne Avenue, 27 Hawthorne Avenue, 150 Queen Elizabeth Driveway, 475 Elgin Street, Echo Drive and Harvey Street west of Main Street	• Early communication / coordination with owner(s) to minimize disruption. • Reinstatement of any disturbed areas to original condition or better.
3.6	**Tourism / Events**	City of Ottawa, NCC, BIA's, Community Associations	• Potential construction disruption to various festivals / events.	• Schedule construction activities to limit / avoid disruption to major festivals / events (where reasonable).
3.7	**Aesthetics / Landscape Composition**	City of Ottawa, NCC, BIA's, Community Associations	• Bridge rehabilitation or replacement provides opportunity to enhance aesthetics of existing bridge sites.	• If extent of work at any given site supports it, context sensitive design elements will be considered for inclusion.
3.8	**Context Sensitive Design**	City of Ottawa, NCC, BIA's, Community Associations, Property Owners	• Loss of existing vegetation to accommodate recommended design and / or construction access and staging / laydown areas.	• Minimize vegetation removal; provide protection for those trees and shrubs to remain. • Replace vegetation, where feasible, in accordance with final landscape plan. • Removal of slope paving on west abutments of Rideau Canal Bridges to increase openness. • Improving urban design, landscape and active transportation connectivity under the bridge is a critical consideration to the NCC and will be reviewed during Detail Design. The proposed context sensitive design improvements will form part of the Federal Land Use Design and Transaction Approval (FLUDTA) review.
3.9	**Site Contamination**	MECP, PC, NCC, Property Owners	• Potential for soil and/or groundwater contamination given historical land uses. • Six sources of medium or high potential environmental contamination within the local Study Area identified in the Contamination Overview Study (COS). Historic uses of numerous	• Conduct additional site investigations as required prior to construction. • Develop a Soils Management Plan and/or a Phase II ESA in accordance with Part XV.1 of the *Environmental Protection Act* (EPA) and Ontario Regulation 153/04.

Table E2: Summary of Potential Environmental Effects and Proposed Mitigation

I.D. No.	Factor	Agency / Authority	Environmental Issues and Potential Effects	Proposed Mitigation Measures
			sites adjacent to Highway 417 as areas of gasoline storage and manufacturing. • One site listed under the Federal Contaminated Sites Inventory (FCSI) at Nicholas Street and the Queensway: a five-hectare site adjacent to Harvey Street with soil contamination of PAHs (polycyclic aromatic hydrocarbons) and metal, metalloid, and organometallic compounds.	• Use of geotextile along Canal bed to separate engineered fill from Canal soils and allow subsequent removal of debris while not disturbing existing Canal soils. It is noted that any in-water temporary work platforms/areas could interact with contaminated sediment and mitigation will be investigated during Detail Design.
3.10	**Designated Substances**	MECP	• Presence of existing asbestos containing materials.	• Develop plans for management of potentially contaminated bridge material during Detail Design, in advance of construction.
3.11	**Management of Excess Materials**	MECP	• The project will result in the generation of waste asphalt, granulars, concrete and possibly earth materials.	• Waste generation will be minimized through promoting contractor salvage, recycling and re-use in the contract tender documents in accordance with the new regulation titled “On-site and Excess Soil Management” (O.Reg.406/19, under the *Environmental Protection Act*).
3.12	**Noise and Air Quality**	MTO, MECP, City of Ottawa	• Noise and air quality nuisance from construction equipment and vehicles during construction.	• Maintain equipment in good operating condition. • Restrict idling of equipment to the minimum necessary to perform the work. • The contractor will be required to implement dust suppression measures to contain dust from operations such as concrete cutting. Due to the proximity of the work site to water, calcium chloride shall not be used to suppress dust.
3.13	**Federal Permits and Approvals**	NCC, Transport Canada, PC	• The following permits and/or approvals may be required for this project: o Navigation Protection (Transport Canada) o In-water and Shoreline Works Permit (Parks Canada) o Federal Work Permit (NCC) o The project will follow the MTO/DFO/MNRF Protocol in regard to potential fisheries impacts	• The NCC, Parks Canada, Transport Canada and DFO have been consulted during this EA to determine permitting requirements. Additional consultation will be commenced as part of the future Detail Design and contract preparation phase, prior to submission of permit applications.
3.14	**Design and Construction Report**	MTO	• In accordance with the MTO Class EA (2000) process, a Design and Construction Report (DCR) will be completed during Detail Design to outline the mitigation requirements and construction methods and impacts.	• The future preparation and public review of a DCR.
4.0	**TRANSPORTATION ENVIRONMENT**			
4.1	**Pedestrian / Cycling / Recreational Mobility**	City of Ottawa, School Boards	• Potential for temporary restricted and closed pedestrian / cycling / recreational movement under the Queensway or along other localized closures during construction – including along school / commuter / recreational routes. • Longer term sidewalk closures required at bridge replacement sites to provide access to bridge footings.	• Sign alternate detour routes on existing municipal infrastructure and advance notifications of temporary closures. • Use of protective hoarding and temporary protected walkways to maintain pedestrian passage where practical. • Detailed Traffic Management Plans will be required as part of the Federal Approval application to the NCC. The plans must include dedicated detours

Table E2: Summary of Potential Environmental Effects and Proposed Mitigation

I.D. No.	Factor	Agency / Authority	Environmental Issues and Potential Effects	Proposed Mitigation Measures
			• Longer term temporary MUP closures along the Rideau Canal.	and safe intersection crossings for canal pathway users, with facilities for cyclists that are physically separated from other traffic and are winter maintained. • MTO will explore opportunities to minimize the duration of temporary canal pathway closures including the provision of overhead protection during Detail Design.
4.2	**Active Transportation – Multi-use Path**	City of Ottawa, NCC	• The existing width of the MUP in the vicinity of the Rideau Canal Bridge piers is narrow.	• The width and alignment of the paths will be reviewed during Detail Design in an effort to widen the MUP.
4.3	**Traffic Operations – Delays and Closures**	MTO, City of Ottawa, NCC	• Potential for traffic congestion and travel delays associated with construction staging on the Queensway (temporary full closures for bridge replacements) or on ramps or roadways for temporary roadway or sidewalk closures (i.e. at all three affected municipal roadways and two affected NCC parkways). • 2-year closure of Colonel By Drive and Queen Elizabeth Driveway under and north of the Queensway for the replacement of Rideau Canal Bridge.	• Provide advance notice of all closures / lane reductions / detours. • Prepare / implement Traffic Management Plan during construction including changeable message signs and incident detection. • Limit lane closures (Queensway) during peak travel times. • Rideau Canal Bridge on- and off-ramp closures to allow advance demolition of the outside girders to accelerate replacement. • Detailed Traffic Management Plans will be required as part of the Federal Approval application to the NCC. The parkway closures will impact NCC programming and further coordination to minimize impacts will be completed during Detail Design.
4.4	**Bus Transit Operations**	City of Ottawa, OC Transpo	• Disruption of OC Transpo bus service during municipal roadway closures and/or lane reductions (Metcalfe Street, Elgin Street and Main Street).	• Advance coordination with OC Transpo to identity construction impacts to transit service and to develop / communicate alternate service plans.
4.5	**Emergency Services**	City of Ottawa, Local Emergency Service Providers, OPP	• Potential impact to emergency service routes / access due to closures / lane reductions. • Maintain access to 150 Queen Elizabeth Driveway from Argyle Avenue.	• Consider implications of multiple side street closures as part of project phasing. • Prepare / implement Traffic Management Plan during construction. • Ensure ongoing communication with emergency service providers during construction.
4.6	**Erosion and Sediment**	MECP, Parks Canada	• Potential for erosion / sedimentation during construction and potential impacts to the Rideau Canal.	• Standard erosion and sediment control measures to be incorporated into construction contract – including measure to prevent off-site transport of sediment and prompt restoration of disturbed areas. • In-water work zones for the construction of the Rideau Canal bridge will require cofferdam / turbidity control required. PCA will be provided details during Detail Design. Considerations include the potential for DFO/ TC review. Material used to buffer impact from the Rideau Canal bridge demolition in the canal (sand etc.) will have to be contained such that it

Table E2: Summary of Potential Environmental Effects and Proposed Mitigation

I.D. No.	Factor	Agency / Authority	Environmental Issues and Potential Effects	Proposed Mitigation Measures
				doesn't create turbidity and is possible to remove. Parks Canada will be consulted during Detail Design to approve the design.
4.7	**Groundwater**	MECP	• Dewatering at bridge sites for bridge replacement alternatives.	• If any subsurface works will occur during bridge replacement(s), assess impacts to groundwater if dewatering is necessary and obtain MECP Permits – Permit to Take Water, Environmental Activity and Sector Registry and Environmental Compliance Approval.
4.8	**Utilities**	City of Ottawa, Utilities	• Potential for impacts to existing utilities, including the 1220 mm watermain, in the vicinity of the bridges, work sites or along access routes from staging areas. • Hydro One high voltage oil-filled transmission ducts along the Rideau Canal.	• Ensure advance coordination with utility companies and approval for any utility relocations / protections. Rideau Canal bridge construction shifted north of Queensway to avoid risk to Regional 1220 mm watermain supplying east Ottawa. • Protect buried high voltage transmission Hydro line by bridging over during construction and moving footings of piers further away. • Establish soil vibration standards for micro-piling in close proximity to Hydro One and City of Ottawa infrastructure.
4.9	**Lighting**	Parks Canada, NCC, City of Ottawa	• Lighting will be considered at all bridge sites to improve the safety and personal security under the bridges and create a greater sense of openness for the users on the municipal street and canal.	• Approvals from Parks Canada will be required for the proposed lighting associated with the Rideau Canal bridge. In general, PCA aims to restrict lighting to that needed for functional requirements in order to reduce ambient light effects to the surrounding environment. There is a closer look at decorative lighting, however location makes a difference and, in this location, its recognized there is already significant ambient lighting.
4.10	**Approvals**	Parks Canada, NCC, MECP, MCM	• Approvals will be required as part of this project.	• A FLUDTA from NCC will be required during Detail Design. • Temporary Limited Interest (TLI) approvals for temporary land requirements will be prepared during Detail Design.

Legend:

BIA	Business Improvement Area
MECP	Ontario Ministry of the Environment, Conservation and Parks
MCM	Ontario Ministry of Citizenship and Multiculturalism
MTO	Ontario Ministry of Transportation
MNRF	Ontario Ministry of Natural Resources and Forestry
NCC	National Capital Commission
OPP	Ontario Provincial Police
PC	Parks Canada

E.13 Commitments to Future Work – Detail Design

Consultation during the Detail Design stage of the project will focus on issues identified in this report for the various bridge sites and individual construction contracts. PIC's will be held as required to provide opportunities for members of the public and affected stakeholders to review and comment on the Detail Design including details of the proposed mitigation measures.

During the Detail Design stage of the project, contract drawings and specifications will be prepared to allow the components of that contract package to be tendered for construction. Design modifications or refinements may be identified during Detail Design by the designers or the contractors which could result in changes to the project's environmental effects (either positive or negative) that may not have been included in this document. Should this occur, any such modifications are not anticipated to alter either the basic intent of the undertaking or the overall general level of environmental impact. However, any changes to the recommended design will be reviewed for the significance of the environmental effects and the significance of the changes assessed.

DCR's will be prepared during Detail Design to document the development of the recommended plan to the Detail Design level of detail. For this project, DCR's may be prepared for the proposed (or alternate) construction staging areas which have not yet undergone an EA process.

On-site construction administration / inspection by qualified staff (retained by MTO) will ensure that the environmental protection / mitigation measures identified in this TESR and further developed during Detail Design and documented in the Design and Construction Report are implemented. Environmental Specialist staff will be available if needed during construction to provide input.

Subject to the 30-day filing of the TESR and obtaining environmental clearance, MTO may proceed to Detail Design and construction as outlined in the MTO Class Environmental Assessment for Provincial Transportation Facilities (2000). Detail Design and construction activities will include:

- Complete any required additional environmental studies / investigations;
- Utility relocations;
- Complete drawings and tender documents;
- Confirm duration of closures (length of closures may be refined);
- Public Information Centre(s);
- Prepare DCR for construction staging areas and issue 30-day Notice of DCR completion;
- Obtain approvals and Federal permits;
- Tender and award contract(s);
- Undertake construction; and
- Monitor construction for adherence to environmental commitments.

E.14 Statement of Flexibility

The TESR allows for flexibility with regard to several aspects of the project as described in **Section 7.4**. The first area of flexibility is to allow MTO the ability to rehabilitate or replace bridges based on ongoing structural condition assessments or the ability to fund projects. This may accelerate or defer bridge replacements.

The TESR includes this Statement of Flexibility to allow for the review and refinement of the operational utilization of identified staging areas, should constraints or regulatory approvals unknown at the time of this EA require the modification of the temporary works as determined at the future date of Detail Design.

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1. OVERVIEW OF THE UNDERTAKING

1.1 Description of the Undertaking

The Ministry of Transportation of Ontario (MTO) has undertaken a Preliminary Design and Environmental Assessment (EA) Study (GWP 4170-13-00) for the rehabilitation / replacement of seven (7) bridges at four (4) locations along the Ottawa Queensway (Highway 417) between Metcalfe Street and Main Street in Ottawa. The objective is to replace or repair the bridges using traffic staging during construction that minimizes traffic disruption to both highway and City traffic. The Study is being undertaken by MTO in partnership with BT Engineering Inc. (BTE).

This study is subsequent to and addresses a recommendation of G.W.P. 663-93-00, Highway 417 (Ottawa Queensway) from Highway 416 easterly to Anderson Road Preliminary Design Study and Environmental Assessment. This previous study was completed in 2007 for the Queensway between Highway 416 and Anderson Road and examined opportunities to optimize the use of the existing Queensway. The approved 2007 EA study completed the “planning” phase of the Queensway corridor plan.

The current study is a Preliminary Design Study that identifies a bridge management strategy to address the structural needs of the following Queensway Downtown bridges:

- Site No. 3-065 Highway 417 Metcalfe Street Overpass
- Site No. 3-066.1 Highway 417 Eastbound Lanes (EBL) over Elgin Street
- Site No. 3-066.2 Highway 417 Westbound Lanes (WBL) over Elgin Street
- Site No. 3-067.1 Highway 417 EBL over Rideau Canal
- Site No. 3-067.2 Highway 417 WBL over Rideau Canal
- Site No. 3-068.1 Highway 417 EBL over Main Street
- Site No. 3-068.2 Highway 417 WBL over Main Street

1.2 Project Location, Broader Study Area, and Local Study Areas

This project is located in downtown Ottawa, Ontario, south of the core downtown area, and has a length of approximately one kilometre along Provincial Highway 417, also known as the Queensway. The study entails the assessment of seven (7) bridges at four (4) locations, with each bridge location surrounded by a Local Study Area (LSA) with limits of 200 m from the bridge locations. The Broader Study Area (BSA) has limits of 500 m from the bridge locations although selected parts of the review extend beyond this area. The BSA, LSAs, and bridge locations are shown in **Figure 1-1** and **Figure 1-2**.

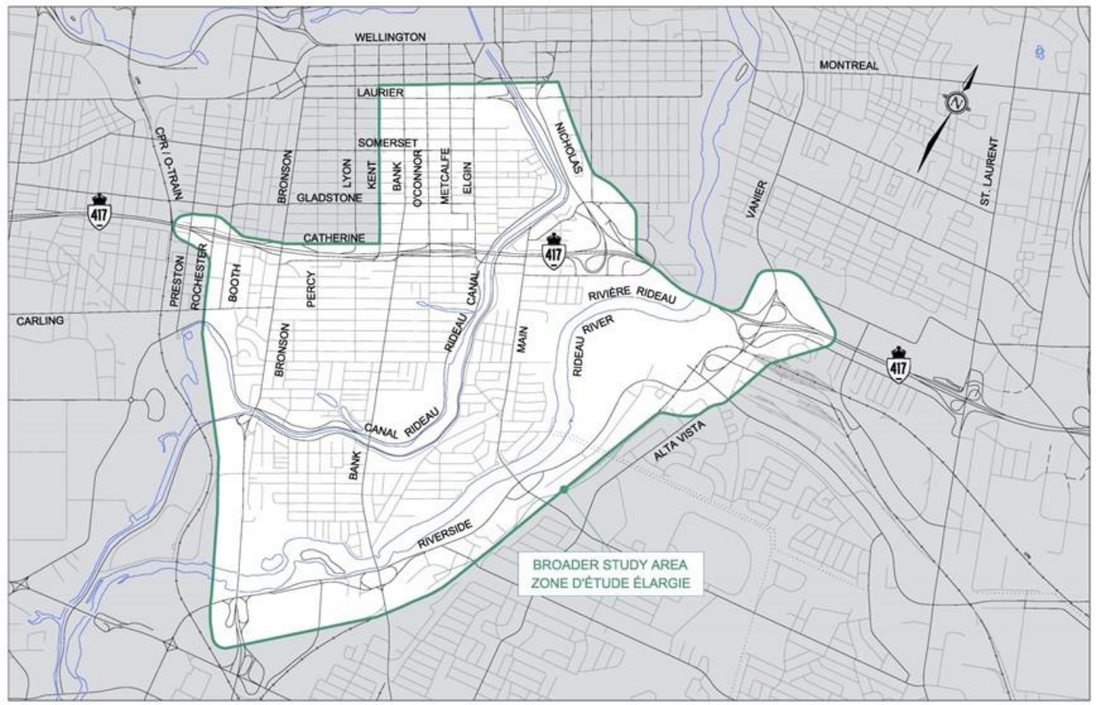


Figure 1-1: Project Broader Study Area

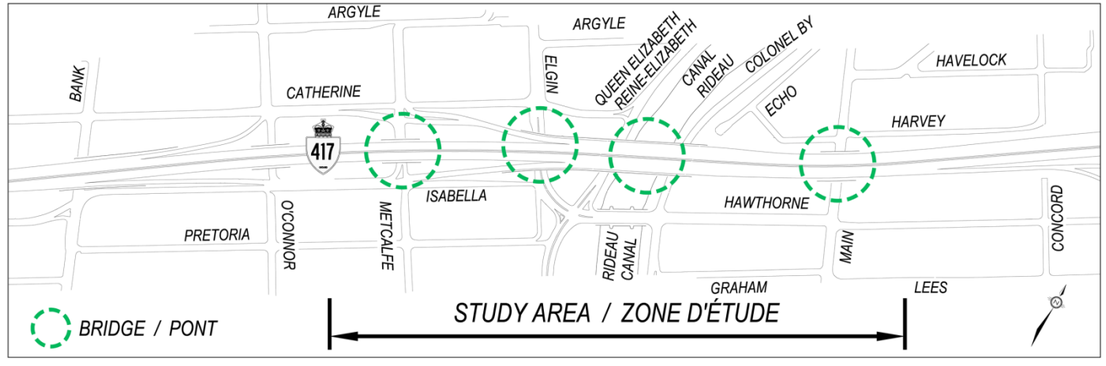


Figure 1-2: Project Local Study Areas

1.3 Purpose of the Transportation Environmental Study Report

1.3.1 Provincial Environmental Assessment Process

The Class Environmental Assessment for Provincial Transportation Facilities (Class EA) (2000) is an approved planning process that the MTO follows to satisfy the requirements of the *Ontario Environmental Assessment Act* 2020 (OEAA). This process ensures that the intent of the OEAA is met by requiring that project alternatives be assessed, environmental concerns be identified, mitigation and protection measures be considered, and that the public, government agencies, and interest groups be given an opportunity to be consulted throughout the project. Subject to the approved process being followed, no further approval is required under the OEAA.

The Class EA process has been developed to apply the requirements of the OEAA to a "group" or "class" of projects which are similar in nature, have common characteristics, are frequently reoccurring, and generally have a predictable range of impacts for which mitigation measures can be applied.

In all situations where the Class EA process is applicable to a project, it is the responsibility of the proponent to ensure that the planning process is undertaken in accordance with the Class EA. A project classification system has been adopted to satisfy the requirements of the OEAA and to concentrate resources where they are most needed.

1.3.2 Group "B" Project Process

Under the MTO Class EA for Provincial Transportation Facilities 2000, MTO projects are classified into four groups and range from Group A to Group D projects. The proposed works for the Preliminary Design and Environmental Assessment study for the rehabilitation / replacement of seven (7) bridges at four (4) locations along the Ottawa Queensway is classified as a "Group B" Project. Group B projects include any highway improvement project which widens the 'footprint' beyond the roadbed of the existing highway through alignment shifts and detours that are constructed to carry traffic outside the existing roadbed over land and water (MTO 2000). Traffic detours and temporary staging areas outside of the existing Queensway roadbed may be required for this undertaking. As part of the Environmental Assessment process for Group B projects, a Transportation Environmental Study Report (TESR) must be completed (this document).

1.3.3 Purpose of Report

This TESR has been prepared in accordance with Table 6.1 of MTO's Class Environmental Assessment for Provincial Transportation Facilities, 2000. This document provides an overview of the project, synopsis of the project rationale and design, and summary of existing environmental conditions, as well as potential impacts and mitigation measures relating to the biophysical and socio-economic environment of the Ottawa Queensway Downtown Bridges Local Study Area. Information found within this report has been compiled through background research of the Study Area, as well as recent field- based studies. All project design alternatives were evaluated with respect to potential impacts to the baseline environmental conditions.

1.3.4 TESR Review and Outstanding Issues After TESR Review

The public is encouraged to review this report. It is being made available from XXX, 2024 until XXX, 2024 at the following locations:

Ottawa Public Library - Main Branch
120 Metcalfe Street, Ottawa
Tel. 613-580-2940
Monday to Thursday: 10 a.m. - 9 p.m.
Friday: 10 a.m. - 6 p.m.
Saturday: 10 a.m. - 5 p.m.
Sunday: 1 p.m. - 5 p.m.

Project Website
https://queenswaydowntownbridges.com/en_CA/

Old Town Hall Community Centre
61 Main St, Ottawa
Tel. (613) 627-0062
Monday to Friday: 9 a.m. - 10 p.m.
Saturday: 9 a.m. - 4:30 p.m.
Sunday: 9:30 a.m. - 4 p.m.

City of Ottawa Service Centre
110 Laurier Avenue West, Ottawa
Monday to Friday: 8:30 a.m. - 5 p.m.

The *Environmental Assessment Act has* been amended through the *Covid-19 Economic Recovery Act* 2020 regarding outstanding concerns remaining after individuals/parties have reviewed the TESR.

The public may request a higher level of assessment on a project if they are concerned about potential adverse impacts to constitutionally protected Aboriginal and treaty rights. In addition, the Minister may issue an order on his or her own initiative within a specified time period. The Director (of the Environmental Assessment Branch) will issue a Notice of Proposed Order to the proponent if the Minister is considering an order for the project within 30 days after the conclusion of the comment period on the Notice of Study Completion. At this time, the Director may request additional information from the proponent. Once the requested information has been received, the Minister will have 30 days within which to make a decision or impose conditions on the project.

The Notice of Study Completion contains directions on how an individual or group can communicate their concerns to the Minister of the Environment. Conservation and Parks. These directions are also outlined below. Therefore, the proponent cannot proceed with the project until at least 30 days after the end of the comment period provided for in the Notice of Study Completion. Further, the proponent may not proceed to Detail Design after this time if:

- A Section 16 Order request has been submitted to the Ministry regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, or
- The Director has issued a Notice of Proposed order regarding the project.

Outstanding concerns are to be directed to the proponent for a response, and that in the event there are outstanding concerns regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, Section 16 Order requests on those matters should be addressed in writing to:

Minister
Ministry of the Environment, Conservation and Parks
777Bay Street, 5th Floor
Toronto ON M7A 2J3
Minister.mecp@ontario.ca

Director, Environmental Assessment Branch
Ministry of the Environment, Conservation and Parks
135 St. Clair Avenue West, 1st Floor
Toronto, ON M4V 1P5
EABDirector@ontario.ca

If there are any other outstanding concern(s), they should be directed to the Project Managers listed below, no later than XXXXX

Steve Taylor, P.Eng.
Project Manager
BT Engineering Inc.
100 Craig Henry Drive, Suite 201
Ottawa, ON K2G 5W3
Tel.: 613-228-4813
Toll free: 1-855-228-4813
Fax: 613-280-1305
E-mail: steven.taylor@bteng.ca

Obinna Obiefule, P.Eng.
Senior Project Engineer
Ministry of Transportation
1355 John Counter Boulevard
Kingston, ON K7L 5A3
Tel: 613-449-8548
Toll free: 1-800-267-0295
E-mail: Obinna.Obiefule@ontario.ca

1.3.5 Additional Information Requests

If you would like to provide comments, or require additional project information, please contact the Consultant or MTO Project Managers listed above or visit the project website at www.queenswaydowntownbridges.com.

2. CONSULTATION PROCESS

2.1 Project Specific Study Process

Consultation is an integral component of the Class EA process and is essential to the successful completion of the study. A project specific Consultation Plan was prepared at the start of the study to highlight the timing and procedures to be used for communication with the public and stakeholders throughout the Preliminary Design and Environmental Assessment process. This document was prepared in accordance with the requirements of the MTO Class EA for Provincial Transportation Facilities, 2000, and the consultation process for a Group B project.

2.2 Consultation Process

A key objective of the Class EA process is to provide the public, affected agencies and interested parties with opportunities for meaningful input throughout the Preliminary Design process. In order to ensure this objective is met, a comprehensive public and agency consultation program was undertaken throughout the duration of the project.

The *French Languages Service Act* applies to this project, therefore selected public communications and presentation materials were provided in both English and French. These included notices and PIC exhibits.

All information received regarding this study will be subject to the provisions and disclosure requirements of the *Freedom of Information and Protection of Privacy Act* R.S.O., 1990, c.F.31. With the exception of personal information, which has been removed throughout this document, all comments have become part of the public record.

2.2.1 Study Website

The Study included a website, located at https://queenswaydowntownbridges.com/en_CA/ in both English and French. The website included information for interested parties on: an introduction to the study; background including previous studies completed; EA Process; public consultation completed; proposed schedule; external links to previous studies; and Frequently Asked Questions. The EA Project Manager and MTO Project Manager contact information was also included on the website.

The website link was included in all notices sent at milestones of the study including the Study Commencement Notice, PIC notices and Study Completion notice. PIC exhibits, the Study Design Report and notices were posted to the website.

2.2.2 Study Design

A Draft Study Design Report was prepared as the initial discretionary public document for the Class EA process and presented a description of the work plan, alternatives, consultation plan and overall study process. The Draft Study Design Report was circulated to agencies, utilities and stakeholders and was posted to the study's website for public review and comments. The Draft Study Design Report was finalized following the first Public Information Centre (PIC) and describes the modified work program. The Final Study Design Report is included in **Appendix A-6**.

2.2.3 External Agency Involvement

Consultation with federal and provincial agencies has been undertaken throughout the project. Notice of Study Commencement letters were mailed to appropriate ministries and agencies on July 12, 2017. The letters provided notice of project commencement, requested comments, and highlighted team contact information. PIC invitation letters were also sent to appropriate agencies by mail / email on November 23, 2017 (PIC No. 1), April 9, 2019 (PIC No. 2) and November 15 to November 30, 2022 (PIC No. 3). A copy of external agency correspondence and a list of agencies contacted are in **Appendix A-5**.

2.2.4 Federal Advisory Committee

As part of the stakeholder consultation process for this study, a Federal Advisory Committee (FAC) was formed to review potential impacts of the undertaking. The FAC included representatives from the National Capital Commission (NCC), Parks Canada and Transport Canada. Federal consultation was undertaken throughout the study to discuss factors such as navigational clearance requirements, Context Sensitive Design, Rideau Canal designations (UNESCO World Heritage Site and National Historic Site of Canada), etc. Copies of select meeting notes are in **Appendix A-5**.

2.2.5 Municipal Advisory Committee

As part of the stakeholder consultation process for this study, a Municipal Technical Advisory Committee (MTAC) was formed to review potential impacts of the undertaking. The MTAC included representatives from the City of Ottawa's planning, parks and recreation, operations, engineering and emergency services staff. Municipal consultation was undertaken throughout the study to discuss factors such as bridge clearance requirements, projected future growth, community group concerns, context sensitive design, etc. Copies of select meeting notes are in **Appendix A-5**.

2.2.6 Indigenous Peoples Consultation

At project commencement, a list of Indigenous Peoples communities that could potentially be affected by or have an interest in the project was prepared. The compiled list was then confirmed through consultation with the Ministry of Indigenous Affairs (MIA) and Indian and Northern Affairs Canada (INAC) to ensure all Indigenous Peoples communities in the vicinity of the Study Area were identified and contacted.

Consultation with Indigenous Peoples communities was maintained throughout the Class EA process for this project. The Notice of Study Commencement letters were mailed to identify groups on July 12, 2017 by the MTO Project Manager. Letters provided notice of project commencement, with an offer to meet in person at their request, requested comments, and highlighted team contact information. PIC invitation letters were also sent on November 23, 2017 (PIC No. 1), April 9, 2019 (PIC No. 2) and November 15 to November 30, 2022 (PIC No. 3). Copies of correspondence with Indigenous Peoples communities are in **Appendix A-5**.

The following Indigenous Peoples communities were contacted as part of the project consultation:

- Indian and Northern Affairs Canada, Gatineau, QC
- Ministry of Indigenous Affairs, Toronto, ON
- Algonquins of Pikwàkanagàn, Golden Lake, ON
- Algonquins of Greater Golden Lake First Nation
- Algonquins of Ontario Consultation Office, Pembroke, ON

- Ottawa Algonquin First Nation, Wendover, ON
- Kinounchepinini Algonquin First Nation, Petawawa, ON
- Kijicho Manito Madaouskarin – Anishinaabe Baptiste, Maynooth, ON
- Bonnechere Algonquins First Nation, Renfrew, ON
- North Bay Algonquin First Nation, Mattawa, ON
- Shabot Obaadjiwan First Nation, Sharbot Lake, ON
- Snimikobi Algonquin First Nation, Eganville, ON
- Whitney and Area Algonquin Community, Whitney, ON
- Chippewas of Georgina Island First Nation, Sutton West, ON
- Mississaugas of the New Credit First Nation, Hagersville, ON
- Mississaugas of Scugog Island First Nation, Port Perry, ON
- Beausoleil First Nation, Christian Island, ON
- Alderville First Nation, Alderville, ON
- Hiawatha First Nation, Hiawatha, ON
- Curve Lake First Nation, Curve Lake, ON
- Moose Deer Point First Nation, Mactier, ON
- Ottawa Métis Council, Ottawa, ON
- Mohawk Council of Akwesasne, Cornwall, ON
- Métis Nation of Ontario, Ottawa, ON
- Williams Treaty First Nation, Barrie, ON

2.2.7 Public Involvement

During the initiation of the project, a one-time “Notice of Study Commencement” was published in local daily newspapers which outlined the project area, the Class EA group, proposed works, and project contacts as well as how members of the public could participate in the study. An English version of the Notice of Study Commencement was published in the Ottawa Citizen on July 12, 2017 and in French in Le Droit in Ottawa on July 13, 2017. Copies of these notices can be found in **Appendix A-1**.

Due to the location and scope of work related to this project, three PIC consultation meetings were held. Notices of the PIC’s were posted in the Ottawa Citizen and Le Droit two weeks prior to the PIC dates and Notice of PIC letters were mailed out to all contacts on the project mailing list and hand delivered to adjacent properties two weeks prior to the PIC date. The first PIC was held on December 5, 2017 and the second was held on April 24, 2019. The two PICs were held at St. Paul’s University on Main Street. The third PIC was held online from November 15 to November 30, 2022. A summary of each PIC can be found in **Sections 2.2.7.1** and **2.2.7.2** below, as well as the individual PIC Summary Reports in **Appendix A-2 A-3** and **A-4**.

A study mailing list was compiled at the start and maintained during the Study. Those persons on the mailing list were notified at key milestones.

As noted in **Section 1.3.4**, at project completion, a one-time “Notice of Submission” has been published in local newspapers and on the study website. The purpose of the notice is to outline the recommended design plan and to notify the public of the start of the formal 30-day public review period of the TESR. The “Notice of Submission” has been published in English in the Ottawa Citizen and in French in Le Droit in Ottawa. Letters notifying the public of the TESR filing have been prepared and distributed to all those originally contacted at project commencement as well as anyone (including residents) subsequently added to the project mailing list during the study. Recipients of the letter have been invited to review the document and provide comments within the 30-day public review period.

2.2.7.1 Public Information Centre No. 1

The first PIC was held on December 5, 2017 at:

St. Paul University
Guigues Building, Ground Floor
223 Main Street, Ottawa
4:00 pm to 8:00 pm

The purpose of the first PIC was to present and obtain comments on:

- Project Overview and Study Area;
- EA Process and Schedule;
- Draft Study Design;
- Existing traffic, bridge and environmental conditions;
- Planning Alternatives (Rehabilitation vs. Replacement) and Preliminary Recommendations;
- Preliminary Design Alternatives; and
- Next Steps.

In addition to publication in local newspapers, approximately 700 copies of the PIC Notice (in English and French) were distributed by hand to residential and commercial properties adjacent to the 4 bridge sites in advance of the PIC.

The PIC used a “drop in” format (4:00 pm to 8:00 pm) with information boards and study team representatives available to address questions and comments. A total of twenty-eight (28) people registered at the PIC.

The comments received at or following PIC No. 1 were generally in support of the proposed preliminary rehabilitation / replacement alternatives for the Ottawa Queensway Downtown Bridges. However, some residents and agency representatives raised concerns regarding construction impacts, noise, safety and general operating characteristics of the proposed works.

A total of seven (7) comment sheets were submitted at the PIC. Another five (5) comments were received by email following the PIC. Responses were prepared and sent to individuals who submitted a comment sheet, letter or email that requested further information, clarification or copies of the PIC exhibits.

A complete copy of the PIC No. 1 Summary Report, which includes display materials (information boards) and comments received, is provided in **Appendix A-2**.

2.2.7.2 Public Information Centre No. 2

The second PIC was held on April 24, 2019 at:

St. Paul University
Guigues Building, Ground Floor
223 Main Street, Ottawa
4:00 pm to 8:00 pm

The purpose of the second PIC was to present and obtain comments on:

- Project Overview and Study Area;
- EA Process and Schedule;
- Final Study Design Report;
- Technically Preferred Alternatives (TPAs);
- Potential Project Effects and Mitigation Plan; and
- Next Steps.

In addition to publication in local newspapers, approximately 700 copies of the PIC Notice (in English and French) were distributed by hand to residential and commercial properties adjacent to the four (4) bridge sites in advance of the PIC.

The PIC used a “drop in” format (4:00 pm to 8:00 pm) with information boards and study team representatives available to address questions and comments. A total of thirty-two (32) individuals attended.

The public was generally in support of the bridge replacement alternatives for all four bridge locations. Comments received expressed concern regarding construction noise, road closures and detour lengths.

A total of ten (10) comment sheets were submitted at the PIC and during the 2-week comment period. Responses were prepared for individuals who submitted a comment sheet, letter or email that requested further information, clarification or copies of the PIC exhibits.

A complete copy of the PIC No. 2 Summary Report, which includes display materials, comments received and correspondence with the public and stakeholders, is provided in **Appendix A-3**.

2.2.7.3 Public Information Centre No. 3

The third PIC was held online from November 15 to November 30, 2022 by posting the exhibits to the website.

The purpose of the third PIC was to present and obtain comments on:

- Revised TPA for the Rideau Canal Bridges;
- Potential Project Effects and Mitigation Plan; and
- Next Steps.

In addition to publication in local newspapers, approximately 200 copies of the PIC Notice (in English and French) were distributed by hand to residential and commercial properties adjacent to the Rideau Canal Bridge sites in advance of the PIC.

A total of twenty-nine (29) comment sheets were submitted during the 2-week comment period. Responses were prepared for individuals who submitted a comment sheet, letter or email that requested further information, clarification or copies of the PIC exhibits.

A complete copy of the PIC No. 3 Summary Report, which includes display materials, comments received and correspondence with the public and stakeholders, is provided in **Appendix A-4**.

3. NEEDS ASSESSMENT

3.1 Problems and Opportunities

3.1.1 Description of Bridges

The Ottawa Queensway was constructed on a former east-west railway line, crossing the Rideau Canal immediately north of the Pretoria Bridge. See **Figure 3-1** for the 1922-23 topographic map.

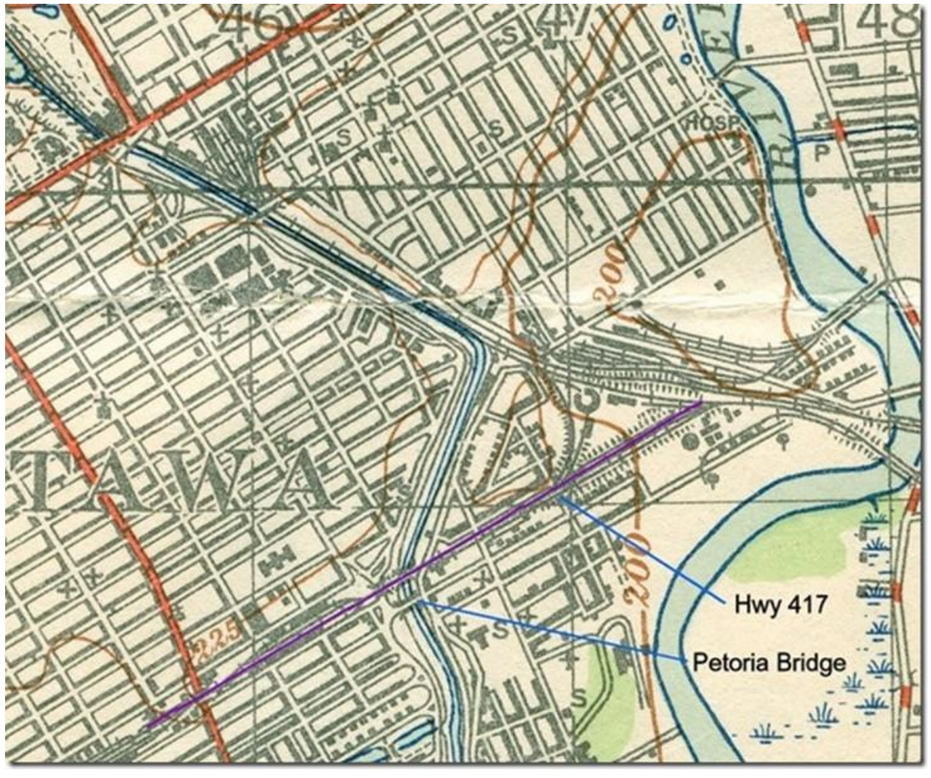


Figure 3-1: Historical Topographic Map (1922-23)

The 7 Ottawa Queensway Downtown bridges consist of two overpass bridge types from the original Queensway construction during the 1959 to 1968 period. See **Photo 3.1** from the Queensway grading construction in 1957. The Rideau Canal Bridge is a T-beam type structure and the remaining 5 bridges are rigid frame type bridges which are jointless and continuous from the deck to the footings.

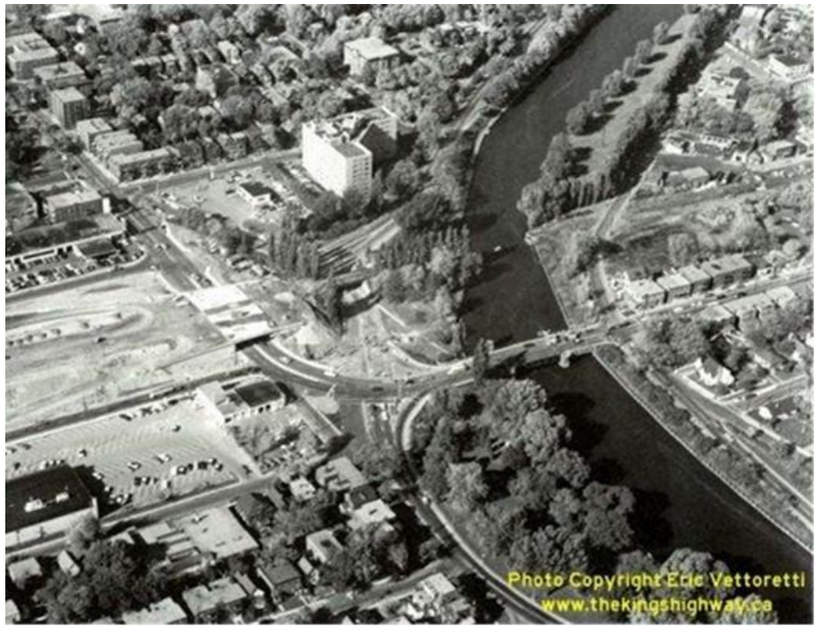


Photo 3.1: Historical Queensway Grading Photo circa 1957

3.1.2 Structural Condition Assessment

The condition of the existing bridges has been assessed during several bridge structural investigations. An Ontario Bridge Management Standards (OBMS) report conducted in 2015 was provided by the Ministry for information. In addition, Gannett Fleming conducted a visual structural inspection in June 2017 and a detailed bridge condition survey was completed by Golder Associates in January 2018. The rigid frame bridges are generally considered to be in fair condition, as summarized in **Table 3.1,** based on the Gannett Fleming/ Brown|CO review of all background documents and as validated by the field review.

Table 3.1: Bridge Condition Index (BCI) Ratings

Structure Name	Year Constructed	BCI / Overall Condition (EBL bridge)	BCI / Overall Condition (WBL bridge)
Metcalfe Street	1965	69.3 / Fair	
Elgin Street	1965/1963	65.8 / Fair	62.4 / Fair
Rideau Canal	1963	68.4 / Fair	68.8 / Fair
Main Street	1963/1959	69.1 / Fair	68.6 / Fair

The typical areas of significant corrosion are elements of the bridges which were exposed over time to salt-laden water, which are primarily the barrier walls and the areas of the soffit in close proximity to the gap between the eastbound and westbound bridges. **Photo 3.2** illustrates the typical extent of corrosion to the soffit in close proximity to the gap between bridges. A summary of the existing conditions is provided in **Table 3.2**.



Photo 3.2: Typical Joint Condition (Rigid Frames)

Table 3.2: Summary of Existing Conditions of Bridge Sites

Name	Description	Photo 1	Photo 2
Metcalfe Street Overpass Site No. 3-065	• Year of Construction: 1962 • Age = 62 years • 18.3 m span, 30.8 m wide • Rigid frame • Fair to good condition		
Elgin Street Overpasses Sites No. 3-066.1 and 3-066.2	• Year of Construction: 1962 • Age = 62 years • 20.7 m span, 23-24 m wide (each) • Rigid frame • Fair condition		
Main Street Overpasses Site Nos. 3-068.1 and 068.2	• Year of Construction: 1962 • Age = 62 years • 18.3 m span, 19.2 m wide (each) • Rigid frame • Fair condition		
Rideau Canal Overpasses Site Nos. 3-067.1 and 3-067.2	• Year of Construction: 1962 • Age = 62 years • 122 m span, 36.9 m outside to outside of coping (each) • Concrete deck on prestressed concrete T girders • Fair to good condition		

The existing Rideau Canal bridge is a 3-span bridge 122 m in length. The original bridge, as shown in **Figure 3-2** below, is nearing the end of its service life with structural deficiencies in the piers.

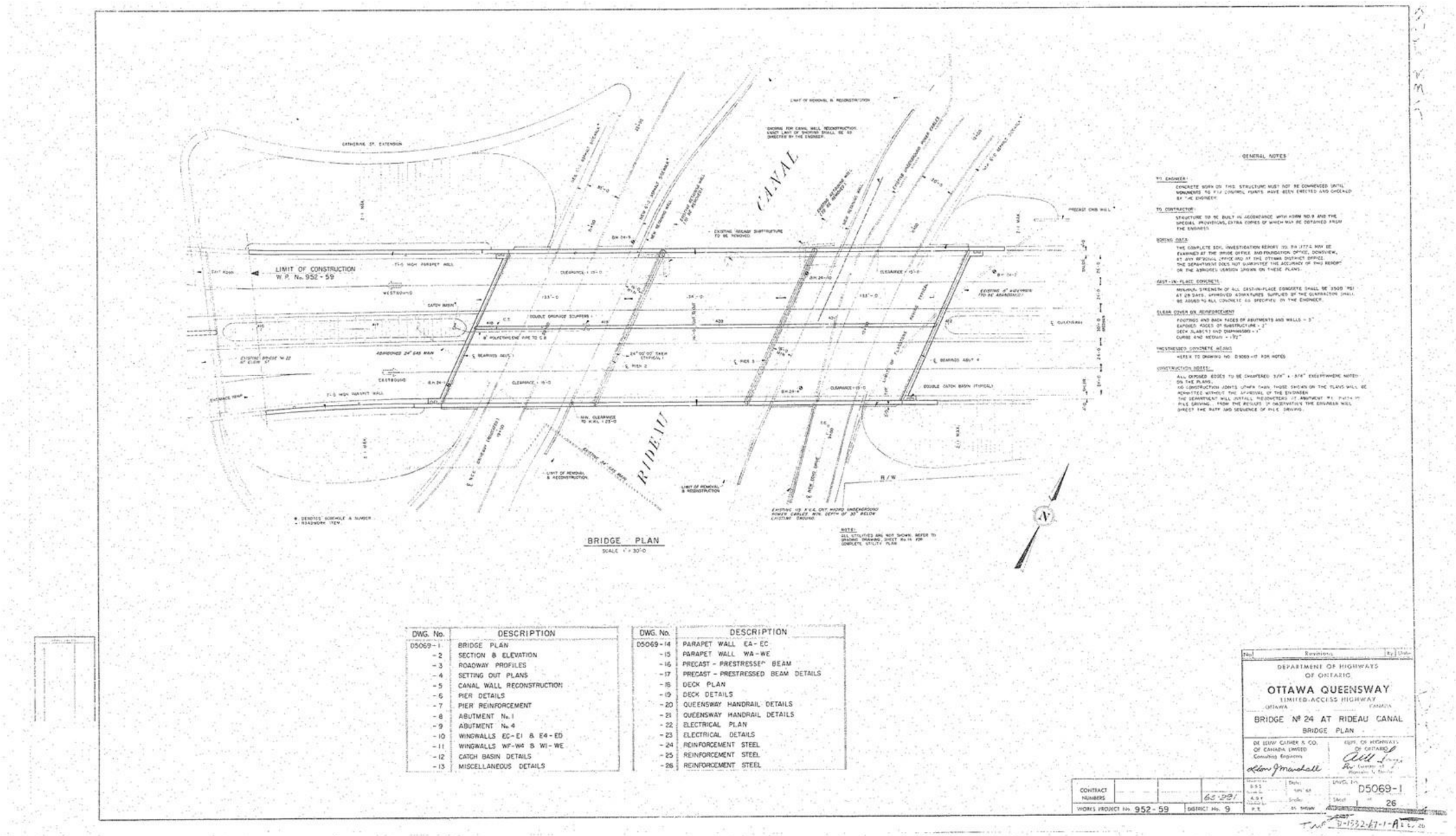


Figure 3-2: Rideau Canal Original Bridge General Arrangement Drawing

3.1.3 Freeway Geometric Design Issues

The freeway within the limits of the Study Area has been identified as having several geometric design issues. The lengths of the speed change lanes are inadequate for the Catherine Street exit ramp and the eastbound on-ramp from the Canal. The median shoulders are also substandard in width; however, they can be tolerated due to the environmental impacts of any widening through the core. These deficiencies were identified in the 2007 Queensway Corridor EA study. Another identified issue is the need for a wider bridge platform on the freeway corridor to facilitate future rehabilitations. While the existing Queensway Downtown bridge dimensions are generally considered adequate to meet projected future Queensway traffic needs, bridge rehabilitations or replacements may provide opportunities for increasing certain bridge dimensions to provide for future traffic staging needs. Any bridges recommended to be replaced should have a sufficient bridge width to facilitate future traffic staging for bridge rehabilitation on the Queensway.

3.1.4 Traffic Considerations

Traffic conditions on the Ottawa Queensway (particularly during peak periods) pose a constraint on construction activities within the freeway corridor. Potential delays (severity and duration) to the travelling public as well as safety (including construction workers) are critical considerations in the project planning, design and implementation.

Given the number of bridges in relatively close proximity to each other that will require work, opportunities were investigated to reduce the overall traffic staging impacts (and corresponding costs) by considering undertaking work on more than one adjacent bridge site at a time. The replacement plan for the centrally located and long span Rideau Canal Bridge will to some extent govern the traffic staging plans for the rehabilitation or replacement of the adjacent rigid frame bridges.

3.1.5 Problem Statement

Based on the preliminary engineering assessments, the Problem/Opportunity Statement for this study was determined to be:

- A bridge management plan is required for 7 bridges on the Ottawa Queensway with consideration of traffic staging alternatives and impacts.
- The Rideau Canal Bridge is nearing the end of its service life and is also in need of design upgrades (seismic).
- Replacement or rehabilitation of the adjacent rigid frame bridges to the east and west of the Rideau Canal Bridge is required and may be staged to coincide with the Rideau Canal bridge improvements, which may dictate the overall traffic staging strategy.
- Rigid frame bridges require seismic assessment and assessment of soil pressure on abutment walls.

4. EXISTING ENVIRONMENTAL AND TRANSPORTATION CONDITIONS

The planning context and background studies; the existing natural, cultural and socio-economic aspects of the environment within the Study Area; and the existing traffic and bridge conditions were all examined to support the development of alternatives and to assess the potential impacts of the proposed undertaking. The following investigations were conducted as part of this Study:

- Terrestrial and aquatic existing conditions including breeding bird surveys;
- Stage 1 archaeological assessment and underwater archaeological assessment;
- Cultural heritage assessment;
- Land use;
- Designated substance survey;
- Contamination overview study;
- Noise assessment;
- Traffic assessment; and
- Existing bridge conditions.

A Summary of Environmental Conditions Report, prepared in accordance with the MTO Environmental Reference for Highway Design (2013), provides information regarding the existing environmental conditions within the broader and localized Study Areas. Environmental information used for the production of this report has been assembled from the review of secondary source information as well as from field investigations conducted specifically for this project. The purpose of the review was to determine the significance of the environmental features found within the Broader and Local Study Areas and to allow for the identification of potential impacts resulting from the bridge rehabilitations and /or replacements. A brief summary of the environmental conditions follows. The Summary of Environmental Conditions Report is provided in **Appendix B**.

4.1 Overview and Planning Context

This project is located in central Ottawa, Ontario, southeast of the core downtown area, and is approximately 800 m in length on Provincial Highway 417, also known as the Ottawa Queensway. Each bridge location is surrounded by a Local Study Area (LSA), which includes the area within a 200 m radius at each individual bridge site location. The Broader Study Area (BSA) includes the geographic area of the City where temporary short term offsite detour routes are being considered for freeway closures.

As part of the consultation program initiated for this project, comments and information have been received from various agencies, City of Ottawa departments, community associations, the public and utility companies. MTO, City of Ottawa, and National Capital Commission (NCC) plans as well as applicable previous studies that have been carried out in the vicinity of the Study Area were reviewed and formed the planning context for the project.

4.1.1 Highway 417 (Ottawa Queensway) – Highway 416 to Anderson Road TESR

MTO completed the Highway 417 (Ottawa Queensway) from Highway 416 Easterly to Anderson Road Preliminary Design Study and Environmental Assessment (G.W.P. 663-93-00) TESR in January 2007.

The approved EA examined the highway mainline (i.e. eastbound and westbound through lanes), as well as all interchanges and crossing streets within the interchange limits and provided a recommended plan to the year 2021. The TESR also stated that during the planning horizon of the study (2021), all of the existing bridges would require some form of rehabilitation to maintain their functionality and that typically these bridge rehabilitations would be included with other adjacent work on the mainline or interchanges in order to minimize the overall impact to the public.

4.1.2 City of Ottawa Cycling and Pedestrian Plans

The City of Ottawa Transportation Master Plan (TMP) identifies on-road cycling routes in the LSA in the north-south direction on Main Street, Metcalfe Street (from Strathcona Avenue to Argyle Avenue), O'Connor Street, and in the east-west direction on Hawthorne Avenue and Isabella Street (from O'Connor Street to Hawthorne Avenue). The TMP also includes the Rideau Canal Pathways along both the east and west sides of the Canal. See **Figure 4-1** for the City of Ottawa's TMP Cycling Network.



Figure 4-1: City of Ottawa TMP Cycling Network – Urban Primary

4.1.3 Adjacent City Projects

The detour routes (described in detail in **Section 7.2.2**) have been determined based on existing conditions and have been discussed with the MTAC (City of Ottawa, MTO and the Consultant team). The detour routes are preliminary and subject to change during Detail Design, upon review of the City of Ottawa's planned construction projects and timing of the Queensway Downtown Bridges bridge management construction (earliest 2024). The City of Ottawa has planned adjacent construction projects including:

- Elgin Street Reconstruction from Catherine Street north to Laurier Avenue (completed 2019/2020)
- Catherine Street Reconstruction from Queen Elizabeth Driveway easterly
- Greenfield/Main/Hawthorne Reconstruction (see **Figure 4-2**) (anticipated start date of 2021/2022 with a 2-3 year construction window)

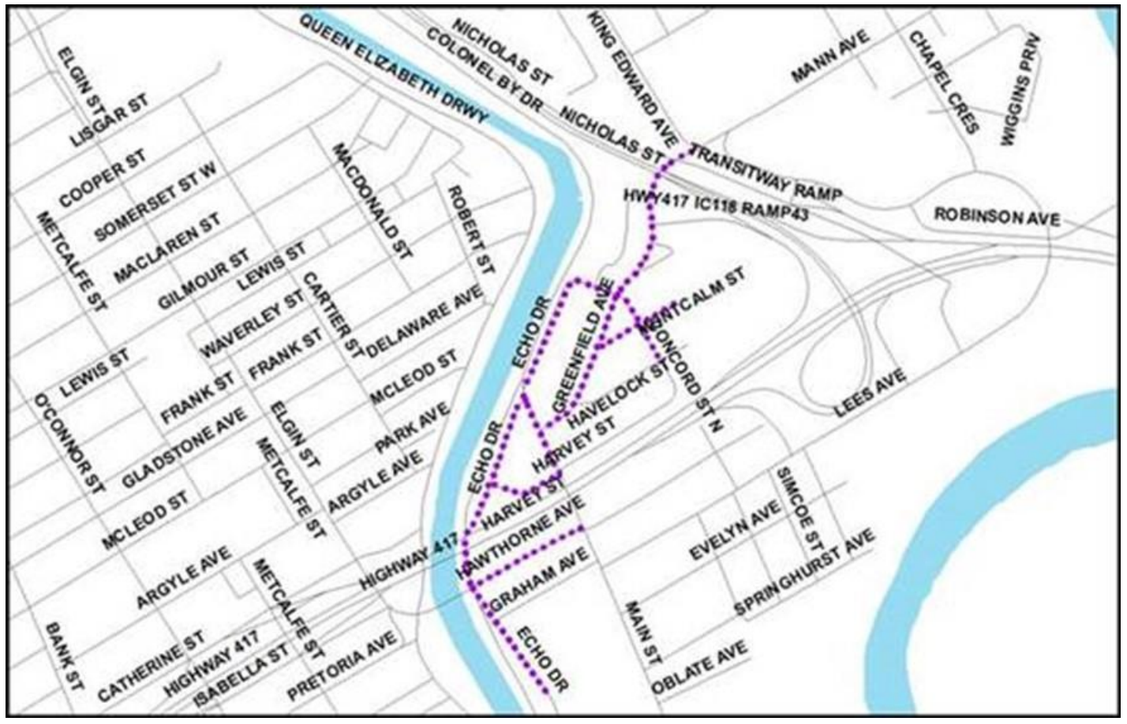


Figure 4-2: Greenfield/Main/Hawthorne Reconstruction Plans from the City of Ottawa

4.2 Natural Environment

The natural environment of the BSA is fairly uniform and contains primarily residential areas within its boundaries. Of interest, at the east end of the BSA, is the Rideau Canal, where the four bridge sites (LSAs) are located. Although the Rideau Canal is not classified as an Environmentally Sensitive Area or Area of Natural or Scientific Interest, it does provide habitat to a number of aquatic species and has significant recreational value. As the bridge sites and potential staging areas are located a maximum distance of 300 m away from the Rideau Canal, there is potential for the watercourse to be affected by the proposed works.

The habitat within the LSAs and their potential staging areas along the Queensway between O'Connor Street and the Nicholas Street interchange were assessed through aerial imagery, desktop reviews[1,2], field visits, and consultation with the MECP to determine if there is potential for SAR to occur. In total, fifteen SAR, ranging in listing rank from Special Concern (SC) to Endangered (END), were identified by the MNRF as having the potential to occur in these areas. This information was cross-referenced with field visits conducted by a qualified environmental professional and other information available regarding the habitat composition in the area[3] to determine the likelihood of their occurrence. The potential for SAR and SAR habitat to be present within the LSA are discussed below.

4.3 Species at Risk

4.3.1 Birds

The following avian SAR have the potential to occur within the LSA:

- Chimney Swift (*Chaetura pelagica*; THR) – Potential habitat exists if brick chimneys of greater than 30 cm diameter and with rough interiors exist. Although less likely to be found in hollow trees or tree cavities, there is also potential for these features to provide habitat.
- Barn Swallow (*Hirundo rustica*; THR) – Potential habitat exists due to the presence of human-made structures such as culverts and bridges. Barn Swallows tend to create cup-shaped mud nests on rough ledges made of unpainted wood or concrete.
- Peregrine Falcon (*Falco peregrinus*; SC) – Potential habitat exists due to tall buildings and ledges available for them roost and rear young. Additionally, Peregrine Falcons prefer to be near water for hunting. Two breeding pairs were observed moving extensively throughout the general urban area.

Although these species have been identified by MNRF (now MECP) as having the potential to occur in the area, no observations have been made by BT Engineering Inc. staff during field visits on May 25, June 17 and October 22, 2017. Nonetheless, mitigation measures will be implemented to ensure that potential SAR habitat remains relatively unaffected. These measures are discussed below in **Section 8**.

4.3.2 Bats

The following bat SAR have the potential to occur within the LSA:

- Eastern Small-footed Myotis (*Myotis leibii*; END) – Potential habitat exists generally due to the presence of older buildings in the area, as well as the presence of bridges under which bats may roost. Additionally, the Rideau Canal acts as a movement corridor for night-time feeding.
- Northern Myotis (*Myotis septentrionalis*; END) – Potential habitat may exist if trees (primarily found in proposed staging areas) of appropriate size and composition (i.e. containing loose bark or tree cavities) are found in the area. Additionally, the Rideau Canal acts as a movement corridor for night-time feeding.
- Tri-colored Bat (*Perimyotis subflavus*; END) – Potential habitat may exist in the area due to the affinity of these bats to roost near water. However, roosts are generally formed in older forests, which are not present in the area.
- Little Brown Myotis (*Myotis lucifugus*; END) – Potential habitat exists generally due to the presence

[1] Natural Heritage Information Centre – Make a Map GIS Application
[2] Department of Fisheries and Oceans – Critical Habitat Mapping
[3] Carleton University, "Inventory of Fish Considered to be at Risk in the Rideau Canal System Including Pugnose Shiner (Notropis anogenus), Bridle Shiner (N. bifrenatus), River Redhorse (Moxostoma carinatum) and American Eel (Anguilla rostrata)", 2009

of older buildings in the area, as well as the presence of bridges under which bats may roost. Additionally, the Rideau Canal acts as a movement corridor for night-time feeding.

Although these species have been identified by MNRF (now MECP) as having the potential to occur in the area, no observations have been made by BT Engineering staff during field visits on May 25, June 17 and October 22, 2017. Nonetheless, mitigation measures will be implemented to ensure that potential SAR habitat remains relatively unaffected. These measures are discussed in **Section 7**.

4.3.3 Aquatic Species and Amphibians

The following aquatic and amphibian SAR have the potential to occur within the LSA, and more generally, within the Rideau system:

- American Eel (*Anguilla rostrate;* END) – Potential habitat exists within the Rideau Canal and greater Rideau system, as the American Eel is considered a generalist and occupies a wide diversity of habitats ranging from saltwater to freshwater.
- Northern Brook Lamprey (*Ichthyomyzon fossor*; SC) – Lamprey may use the Rideau Canal passively as it connects to the greater Rideau system. However, critical habitat features such as coolwater temperatures do not appear directly in the Canal.
- Pugnose Shiner (*Notropis anogenus*; THR) – Potential habitat exists in the Rideau Canal during periods where aquatic vegetation flourishes. However, this period is generally short, and likely does not act as permanent habitat for this shiner.
- Channel Darter (*Percina copelandi*; THR) – Channel Darters may use the Rideau Canal as passive habitat. However, the lack of a gravel substrate in the Rideau Canal within the LSA is a likely deterrent for its use as permanent habitat.
- Lake Sturgeon (*Acipenser fulvescens*; THR) – It is unlikely that Sturgeon use the Rideau Canal as habitat due to their preference of deep water (9 m) rivers and lakes.
- Bridle Shiner (*Notropis bifrenatus*; SC) – Potential habitat exists in the Rideau Canal, as water temperatures and substrate tend to be in line with this species' preferences. A lack of vegetation may, however, be a deterrent.
- River Redhorse (*Moxostoma carinatum*; SC) – Potential habitat exists within the Rideau Canal, as this species has been documented in the area and is a generalist.
- Blanding's Turtle (*Emydoidea blandingii*; THR) – Potential habitat exists at the far east limit of the LSA, as there is a documented wetland near the Rideau River which may supply appropriate habitat for this species.
- Snapping Turtle (*Chelydra serpentine*; SC) – Potential habitat exists at the far east limit of the LSA, as there is a documented wetland near the Rideau River which may supply appropriate habitat for this species.

Although these species have been identified by MNRF as having the potential to occur in the area, only observations as shown in **Table 2** of the **Fish and Fish Habitat Existing Conditions Report (Appendix B, Sub-Appendix F)** have been made by BT Engineering Inc. staff during field visits (May 25, June 17 and October 22, 2017) and via an assessment performed by Carleton University in 2009[4]. Nonetheless, mitigation measures will be implemented to ensure that potential SAR habitat remains relatively unaffected. These measures are discussed below in Section 7. Other, non-SAR aquatic species were identified in the field; these included common cool / warm water forage and sport fish.

[4] Carleton University, "Inventory of Fish Considered to be at Risk in the Rideau Canal System Including Pugnose Shiner (Notropis anogenus), Bridle Shiner (N. bifrenatus), River Redhorse (Moxostoma carinatum) and American Eel (Anguilla rostrata)", 2009

4.4 Cultural Environment

4.4.1 Archaeology

In terms of the cultural environment, there is no evidence of archaeological resources within the existing right-of-way of the Queensway, which has been significantly disturbed, or the Rideau Canal. There are 10 registered sites within one kilometre of Broader Study Area, as per the Ontario Ministry of Citizenship and Multiculturalism (MCM) database (OASD). However, these sites have been previously cleared by the 2007 EA Study.

4.4.2 Built Heritage

Potential impacts to buildings with historical value at the intersection of Main Street and Hawthorne Avenue include Old Town Hall (designated under Part IV of the Ontario Heritage Act). There is a former gas station landmark (not designated). Early 19th century buildings in the Local Study Area, such as 221 Echo Drive, are not designated.

The Rideau Canal is a UNESCO World Heritage Site, a National Historic Site of Canada and a Canadian Heritage River. The canal covers 202 km of the Rideau and Cataraqui rivers from Ottawa south to Kingston harbour on Lake Ontario. It was primarily built for strategic military purposes in the 19th century. It is the best-preserved example of a slackwater canal in North America, demonstrating the use of this European technology on a large scale. It is the only canal dating from the great North American canal-building era of the early 19th century to remain operational along its original line with most of its structures intact.

Repairs and conservation of the locks, dams, canal walls and banks are carried out directly under the control of Parks Canada. A Management Plan exists for the canal, and the Canal Plan is underpinned by the Historic Canals Regulations. A Cultural Heritage Resource Assessment Report (CHRAR) was undertaken to identify potential Built Heritage Resources (BHR) and Cultural Heritage Landscapes (CHL) within the Study Area, undertake a preliminary impact assessment and provide mitigation recommendations and next steps. The CHRAR is in **Appendix D.**

4.5 Socio-Economic Environment

4.5.1 Land Use

Land use within the BSA and LSAs ranges from being mostly residential in most LSAs to mostly commercial in other LSAs with various educational, institutional, recreational, and parkland land uses spread throughout. The LSAs fall within several neighbourhoods including Centre Town, Sandy Hill, Old Ottawa East, and The Glebe. The BSA is highly urbanized and does not contain significant environmental constraints according to the City of Ottawa Official Plan (OP). The BSA contains the following neighbourhood associations:

- Action Sandy Hill/Action Cote-de-Sable
- Lowertown Community Association
- Centretown Community Association
- Dalhousie Community Association
- Dow's Lake Residents' Association
- Glebe Annex Community Association
- Glebe Community Association
- (Old) Ottawa East Community Association
- Old Ottawa South Community Association
- Rideau River Residence Association

There are six Business Improvement Areas (BIA) which overlap with the BSA, including the Downtown

Rideau BIA, Bank Street BIA, Preston Street BIA, Somerset Street Chinatown BIA, Somerset Village BIA, and Glebe BIA. Two of these BIA's (Bank Street and Glebe) are within the limits of the LSAs. The general land use zoning designations and overlays in the vicinity of the LSAs are as follows, and are provided in greater detail in the Land Use Report (**Appendix B)**:

- Residential
- Institutional
- Open Space
- Leisure
- General Mixed
- Local Commercial
- Traditional Mainstreet
- Heritage
- Mature Neighbourhoods

4.5.2 Scenic Entry / Capital Arrival Routes / Tourism

There will be temporary short-term effects on scenic entry routes and significant views (as described in the City of Ottawa OP Schedule 1 – Multi-Use Pathways and Scenic/Entry Routes – Urban) due to temporary staging areas and alteration of bridge design. There will also be a 2-year shut down of the Queen Elizabeth Driveway and Colonel By Drive parkways during the construction of the Rideau Canal Bridge. The Queensway is also considered as a "Capital Arrival Route" by the NCC. From a tourism perspective, a considerable number of festivals and major public events take place within or near the BSA at different times of the year.

4.5.3 Site Contamination and Designated Substances

A Contamination Overview Study (COS) was conducted, and it identified the potential for soil and/or groundwater contamination given historical land uses in the area. More specifically, six (6) Areas of Potential Environmental Concern (APECs) were identified within the LSA, due to historical contaminating activities such as motor vehicle servicing, gasoline sales, industrial and institutional land use, and landfilling.

Only one site was listed under the Federal Contaminated Sites Inventory (FCSI) at Nicholas Street and the Queensway: a 5 hectare site adjacent to Harvey Street with soil contamination of PAHs (polycyclic aromatic hydrocarbons) and metal, metalloid, and organometallic compounds. Sediment contamination including heavy metals such as lead, cadmium, and PAHs has been reported in previous documents, particularly along the Rideau Canal.

4.5.4 Noise and Air Quality

Noise and air quality have been assessed and addressed as part of previous MTO studies. Existing noise attenuation barriers are in place, where warranted, within the project limits. The Noise Assessment has indicated that there is the potential for upgrades or alterations to be carried out on the existing sound barriers along Highway 417 in the LSA, east of the Rideau Canal Bridges. In addition, the extension of the sound barriers near Nicholas Street is recommended.

4.6 Transportation Environment

4.6.1 Transportation Routes

The streets crossed by the Queensway within the LSA include 3 arterials (Metcalfe Street, Elgin Street and Main Street) and 2 parkways (Queen Elizabeth Driveway and Colonel By Drive). The Queensway also crosses the Rideau Canal which is a navigable waterway.

A paved multi-use pathway crosses under the Queensway along both sides of the Rideau Canal. The City of Ottawa has identified the Rideau Canal and Elgin Street as cycling routes within the City. There are existing cycle tracks on Main Street.

4.6.2 Existing Transportation/Traffic Conditions

The section of Highway 417 (Ottawa Queensway) within the LSA accommodates average annual daily traffic (AADT) volumes exceeding 170,000 vehicles/day (veh/d). The Queensway exhibits an "Urban Commuter" traffic pattern which is indicative of low daily and seasonal variations in demand (i.e. repetitive usage profiles).

The LSA also includes an eastbound on-ramp and westbound off-ramp connecting to Metcalfe Street. These 2-lane ramps are among the busiest ramps on the Queensway.

Traffic data from the previous G.W.P. 663-93-00, Highway 417 (Ottawa Queensway) from Highway 416 easterly to Anderson Road Preliminary Design Study and EA was used as a basis and updated using traffic data on the Queensway east of Nicholas Street (MTO, 2012), intersection traffic data at Metcalfe Street and O'Connor Street (City of Ottawa 2014 and 2017) and traffic growth assumptions for this project (1% on mainline and 0% on ramps).

4.6.3 Surface Water and Drainage

The Rideau Canal is a major navigable waterway within the LSA. The Queensway drains to existing municipal storm and combined sewer systems. The sewer systems combine with storm water flows collected by the municipal sewer systems which ultimately discharge to the Rideau River, Rideau Canal or the Ottawa River. Improvements to the quality of storm water entering the Rideau Canal will be reviewed during Detail Design.

4.6.4 Utilities

Various public and privately owned utilities exist in close proximity to the various bridge sites including a large 1220 mm watermain along much of the south side of the corridor (Isabella to Hawthorne) as well as storm and sanitary sewers, gas, hydro, Bell and telecom infrastructure. There are also two 115 kV high voltage transmission ducts along the east and west sides of the Rideau Canal.

4.7 Summary of Environmental Conditions

Figure 4-3 and **Figure 4-4** on the following pages provide a Summary of Environmental Conditions and Issues.

Figure 4-3: Summary of Environmental Features within the Immediate Study Area

Figure 4-4: Immediate Study Area Issues

5. ANALYSIS AND EVALUATION OF ALTERNATIVES

5.1 Assessment and Evaluation

This chapter summarizes the analysis, evaluation and decision-making process used to select a structural alternative, referred to as the TPA, at each of the 7 individual bridge sites along the Ottawa Queensway from Metcalfe Street easterly to Main Street. In accordance with the MTO Class EA process, all reasonable alternatives have been assessed and evaluated using a process that was systematic, traceable and transparent and involved open and meaningful public consultation with affected stakeholders and public. This analysis and evaluation process also included agency input and reflected MTO standards and requirements on the Queensway, City of Ottawa (Ottawa) standards for roads, and OC Transpo requirements for buses that pass under the bridges. The analysis, evaluation and decision-making process is described in the following subsections.

- Section 5.2 Assessment of Alternatives to the Undertaking
  - Assessed alternatives to the undertaking and recommended 2 specific planning alternatives for all 7 bridge sites to be investigated in Subsection 5.3.
- Section 5.3 Assessment of Alternative Methods of Carrying Out the Undertaking
  - Utilized the 2 recommendations from Subsection 5.2 to assess specific Preliminary Design alternatives for each bridge site.
  - Section 5.3.1 Description of Alternatives and Coarse Screening
    - Generated a long list of structural and highway staging alternatives for each roadway section and bridge site.
    - Identified a preliminary long list of assessment factors and sub-factors and utilized a coarse screening methodology to remove from further consideration those factors where there were not meaningful and measurable differences among the alternatives, as well as those factors that do not apply to the Study Area, based on the site-specific bridge site inventories.
    - A coarse screening methodology was used to remove from further consideration alternatives which did not achieve the basic project requirements and/or do not comply with MTO standards/requirements or had a magnitude of environmental effects much greater than other alternatives carried forward.
    - The result of the coarse screening was to create a short-list of reasonable alternatives for subsequent detailed evaluation.
  - Section 5.3 Detailed Evaluation
    - The benefits and potential impacts for the short-listed alternatives were identified for each bridge site.
    - The short-listed alternatives were evaluated using a recognized evaluation technique including weighting the relative importance of global factors and global sub-factor criteria.
  - Section 5.3.3 Results of Evaluation
    - The evaluation resulted in the ranking of the alternatives for each bridge site based on alternative scores.
    - To ensure there were no hidden biases, sensitivity testing was carried out for each set of bridge site alternatives using ranges of criteria weights to assess the 'robustness' (validity) of the evaluation and alternative scores.
- 5.4 Selection of TPA's
  - Based on the evaluation ranking and sensitivity testing verification, a TPA was recommended for each bridge site and carried forward to present to the public and stakeholders.

This analysis, evaluation and decision-making process was undertaken as an independent process for each of the following overpass bridge sites:

- Site No. 3-065 Highway 417 Metcalfe Street Overpass
- Site No. 3-066.1 Highway 417 Eastbound Lanes (EBL) over Elgin Street
- Site No. 3-066.2 Highway 417 Westbound Lanes (WBL) over Elgin Street
- Site No. 3-067.1 Highway 417 EBL over Rideau Canal
- Site No. 3-067.2 Highway 417 WBL over Rideau Canal
- Site No. 3-068.1 Highway 417 EBL over Main Street
- Site No. 3-068.2 Highway 417 WBL over Main Street

The documentation for each of the 7 sites is contained in **Volume II Appendix C - Analysis and Evaluation Report.**

The complete **Analysis and Evaluation Report** divides the process into the following five sub-appendices:

- Sub-Appendix A: Assessment of the Alternatives to the Undertaking Report
- Sub-Appendix B: Evaluation Methodology Report
- Sub-Appendix C: Rapid Bridge Replacement (RBR) Staging Areas Construction Sites Screening Analysis Report
- Sub-Appendix D: Rideau Canal Construction Staging Methodology Memo
- Sub-Appendix E: Preliminary Long List of Preliminary Evaluation Criteria and Screening Report
- Sub-Appendix F: Utility Function Definitions and Measurements for Short Listed Evaluation Criteria

This TESR summarizes the more detailed documentation contained in **Volume II Appendix C** in a manner to provide an understanding of the process as it has been applied to each bridge site. This understanding is best illustrated by selecting two bridge sites, Main Street – eastbound and westbound sites and the Rideau Canal bridge site and following the evaluations at these sites through the process. These two sites demonstrate the complete analysis, evaluation, and decision–making process that resulted in the selection of a TPA recommendation at each of the bridge sites in the study.

5.1.1 Brief Overview of the Evaluation Methodologies Utilized in this Study (Undertaking)

The analysis, evaluation and decision-making process utilized in this undertaking employs both qualitative and quantitative assessment methodologies that are recognized and recommended by the Ministry of the Environment, Conservation and Parks (MECP) in the MECP's publication *Evaluation Methods in Environmental Assessment*.

5.1.1.1 Qualitative Assessment Methodology

The first and least complicated evaluation methodology is a Qualitative Assessment. It is the preferred methodology where there are few alternatives, criteria and trade-offs and there is substantial agreement with regard to the recommendations. The qualitative assessment method was applied to the analysis and evaluations of Alternatives to the Undertaking in **Subsection 5.2 Assessment of Alternatives to the Undertaking**, and **Subsection 5.3.1 Description of Alternatives and Coarse Screening** as part of the coarse screening phase of the evaluation of Alternative Methods / Preliminary Design Alternatives.

5.1.1.2 Quantitative Assessment Methodology

The second and more complicated evaluation methodology, Quantitative Assessment, utilizes the Multi Attribute Trade-off System (MATS), based on the "Weighted Additive Method". Using the MATS method, overall scores are assigned to each alternative and the option with the highest score is selected as the preferred alternative. MATS focuses on the differences between the alternatives, addressing the complexity of the base data collected and providing a traceable decision-making process – as summarized in **Subsection 5.3.3 Detailed Evaluation Methodology**. In addition, the method allows sensitivity tests to be performed because of the matrix configuration of the assessment and the use of numerical scores to measure the impact or performance of the alternatives – as shown in **Subsection 5.3.3 Results of Evaluation**. This approach is consistent with the MTO and MECP practices for the complex evaluation of alternatives.

5.2 Assessment of Alternatives to the Undertaking

The generalized planning process is presented in **Figure 5-1.** The Assessment of Alternatives to the Undertaking is the 5th box illustrated in the 21 steps. The detailed documentation of this step of the assessment is presented in **Volume II Appendix C**, **Analysis and Evaluation Report – Sub-Appendix A – Assessment of Alternatives to the Undertaking.** The description of the alternatives to the undertaking is presented in **Table 5.1**.

Three (3) Alternatives to the Undertaking were considered for each of the 7 bridge sites: Do Nothing; Rehabilitation; and Replacement. The assessment and evaluation of the three alternatives for each site resulted in two recommendations to be carried into the next stage: Generation and Assessment of Preliminary Design Alternatives (Alternative Methods of Carrying Out the Undertaking). The recommendations included:

1. Do not carry forward the Do Nothing alternative as this alternative would not have defined a future bridge management strategy for any of the 7 bridges.
2. Carry forward both Replacement and Rehabilitation alternatives for all rigid frame bridges and the Rideau Canal Bridge.

The Summary of the Assessment of Alternatives to the Undertaking is presented in **Table 5.2**.

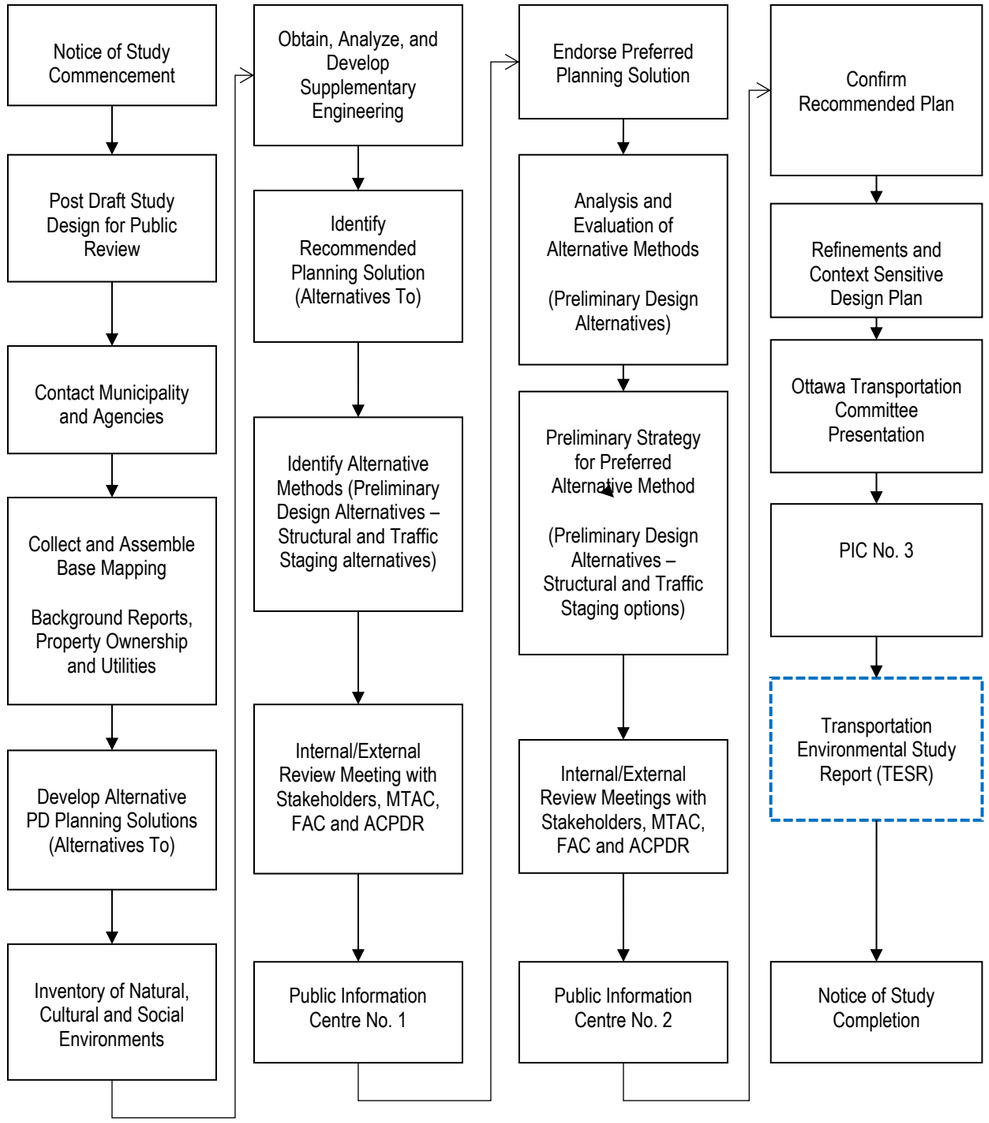


Figure 5-1: Generalized Preliminary Design (PD) Planning Process

Table 5.1: Description and Assessment of Alternatives to the Undertaking		
Alternative 1 - The "Do Nothing" Alternative	**Alternative 2 – Management of Bridge Infrastructure**	
	Alternative 2a - Rehabilitate Overpass Bridges	**Alternative 2b - Replace Overpass Bridges**
• Alternative 1: The "Do Nothing" Alternative maintains the status quo of existing bridge infrastructure with no significant actions taken to manage aging infrastructure. This approach would accept further deterioration within the 20 year planning horizon	• Alternative 2a: Rehabilitate the existing bridges to extend their service lives including structural upgrades to meet existing seismic code requirements	• Alternative 2b: Replace the existing bridges
STRUCTURAL		
• Existing design does not meet current code requirements and would accept risk of structural failure and reduced life safety protection	• Rideau Canal bridge to include seismic retrofit, pier replacement, extensive girder bearing zone repair and general repair to deteriorated areas • Rigid frames to include replacement of barrier walls, approach slabs, removal of pavement and waterproofing and concrete overlay, deck repairs to deteriorated areas of deck (assumed to be minimum 10 %), soffit repairs and frame leg repairs	• Replacement bridges will meet current code requirements
DURABILITY		
• Does not address the deterioration of existing structures and will accelerate deterioration of structure	• Will extend the service lives of bridges to a next planned rehabilitation cycle (objective for 20 + years). The Rideau Canal bridge requires extensive repairs to extend its service life	• Will result in a new 75-year service life for each bridge
CONSTRUCTIBILITY		
• Construction risk / uncertainty associated with emergency repairs. MTO have had to conduct emergency lane closures to address structural issues on bridges on the Queensway of the same age and condition	• Moderate constructability requirements to stage construction	• Moderate constructability requirements to stage construction • Rapid replacement possible (minimum closure time)
TRANSPORTATION		
• The Do Nothing approach will not maintain the existing road network without continued ongoing repairs to the existing bridges. As the bridges reach the end of their service lives, the risk of failure and lane closures will increase	• This approach will manage the infrastructure asset • Limited potential for enhancement of pedestrian / cycling safety and facilities at rigid frames bridges – with higher potential at the Rideau Canal bridge • This approach does not eliminate the need to replace structures but postpones the replacement to a future rehabilitation/replacement cycle.	• This approach will manage the infrastructure asset • Higher potential for enhancement of pedestrian / cycling safety and facilities under the Rideau Canal Bridge
ENVIRONMENTAL		
• No significant negative or positive effects • Context sensitive design elements could be undertaken	• Minimal environmental effects within existing Highway 417 right-of-way • Temporary disruption to local roads and Highway 417 traffic • Potential for positive environmental effects to community	• Minimal environmental effects within existing Highway 417 right-of-way • Temporary disruption to local roads and Highway 417 traffic

Table 5.1: Description and Assessment of Alternatives to the Undertaking		
Alternative 1 - The "Do Nothing" Alternative	**Alternative 2 – Management of Bridge Infrastructure**	
	Alternative 2a - Rehabilitate Overpass Bridges	**Alternative 2b - Replace Overpass Bridges**
	through context sensitive design	• Potential for positive environmental effects to community through context sensitive design
COST (2020 dollars) (Note: All costs are based on a single EB or WB bridge and Rideau Canal rehabilitation includes north side widening to provide 2007 TESR recommended cross-section):		
Magnitude of Capital Cost • No cost	**Magnitude of Capital Cost** • $3 M (for rigid frames, per bridge) • $7 - 10 M (for Rideau Canal, per bridge)	**Magnitude of Capital Cost** • $5.5 M (rigid frames, per bridge) conventional replacement excluding high societal delay costs for freeway lane closures • $7.7 - 11.5 M (rigid frames, per bridge) for Rapid Replacement • $13 M (for Rideau Canal, per bridge) conventional replacement excluding high societal delay costs for freeway lane closures • $13 M (for Rideau Canal, per bridge) rapid jack and slide technology
Magnitude of Net Present Value Cost (including future rehabilitations and replacements) • No cost	**Magnitude of Net Present Value Cost** • $4.5 M (rigid frames, per bridge) • $15 M (for Rideau Canal, per bridge)	**Magnitude of Net Present Value Cost** • $6 M (rigid frames, per bridge) conventional replacement • $8 - 12 M (rigid frames, per bridge) for Rapid Replacement • $20 M (for Rideau Canal, per bridge) conventional replacement • $20 M (for Rideau Canal, per bridge) rapid jack and slide technology
RECOMMENDATIONS WHETHER TO CARRY FORWARD		
Based on the significance of maintaining the provincial road network it is recommended that the "Do Nothing" approach **NOT be carried forward**.	**Rigid Frame Bridges:** Based on the condition assessments of the existing rigid frame bridges there may be additional service life available in these bridges, and this may be a cost-effective approach for one or more of the bridges. Therefore, rehabilitation of the rigid frame bridges is **recommended to be carried forward**. **Rideau Canal Bridge:** Based on the poor condition of the existing bridge and the significant cost of seismic upgrades required for this bridge type, rehabilitation is **recommended to be carried forward** as a fall-back strategy should any delays result that postpone a replacement strategy.	**Rigid Frame Bridges:** It is recommended that the new bridge replacement options **be carried forward for comparison with the rehabilitation alternatives**. **Rideau Canal Bridge:** Based on the poor condition of the existing bridge and the significant cost of seismic upgrades required for this bridge type, replacement alternatives **are recommended to be carried forward.**

Table 5.2: Summary of the Assessment of Alternatives to the Undertaking		
Alternative 1 - The "Do Nothing" Alternative	**Alternative 2 – Management of Bridge Infrastructure**	
	Alternative 2a	**Alternative 2b**
The "Do Nothing" Alternative maintains the status quo of existing bridge infrastructure with no significant actions taken to manage aging infrastructure. This approach would accept further deterioration within the 20-year planning horizon.	Alternative 2a - Rehabilitate Overpass Bridges	Alternative 2b - Replace Overpass Bridges
X	✓	✓
DO NOT CARRY FORWARD	CARRY FORWARD (Rigid Frame Bridges and Rideau Canal Bridge)	CARRY FORWARD (Rigid Frame Bridges and Rideau Canal Bridge)

5.3 Assessment of Alternative Methods of Carrying Out the Undertaking (Preliminary Design Alternatives)

5.3.1 Description of Alternatives and Coarse Screening

Several alternatives were generated for consideration. The long list of alternatives, a description of each alternative, and a coarse screening of the alternatives are found in the Analysis and Evaluation Report – **Appendix C**.

Several Preliminary Design alternatives were identified at each bridge location. These included:

a) Bridge Alternatives – Rigid Frame Locations

- Alternative A: Rehabilitation
- Alternative B: Replacement

Each bridge was evaluated for the existing span only. Shorter and longer spans were not evaluated; however, they were investigated for feasibility at the request of the City of Ottawa.

b) Bridge Replacements – Rideau Canal Location

- Alternative A: Replacement constant depth precast on existing pier locations
- Alternative B: Replacement variable depth on existing pier locations
- Alternative C: Extrados concrete on new pier locations outside the Canal
- Alternative D: Replacement variable depth girder on new pier locations outside the Canal
- Alternative E: Single span replacement (arch bridge) (no piers)
- Alternative F: Conventional Rehabilitation

c) Traffic Staging Alternatives on Freeway – Rigid Frame Locations

- Alternative 1 – Conventional rehabilitation with 2 lanes per direction
- Alternative A1: Rapid rehabilitation involving a 5-stage rehabilitation sequence
- Alternative A2: Conventional rehabilitation involving a 4-stage rehabilitation sequence
- Alternative 3: Conventional rehabilitation involving battleship traffic staging
- Alternative 4: Conventional rehabilitation with median crossover
- Alternative B1: Conventional replacement diversion of freeway traffic
- Alternative C1: Rapid replacement with full eastbound and westbound closure (short term)

d) Traffic Staging Alternatives on Freeway – Rideau Canal Bridge Location

- Alternative 1: Barge transportation of bridge
- Alternative 2A: Conventional construction in strips
- Alternative 2B: Conventional construction in strips allowing wheel tracking on the joint between the bridges
- Alternative 2C: Conventional staging in strips with additional work (to widen the Queensway north side following 2007 TESR recommendations) completed prior to construction
- Alternative 3A: Complete superstructure rapid replacement using SPMTs (complete bridge replacement)
- Alternative 3B: Complete superstructure rapid replacement using SPMTs (individual bridges for each span with all six bridge staging sites north of the Queensway)
- Alternative 3C: Complete superstructure rapid replacement using SPMTs (individual bridges for each span with four bridge staging sites north of the Queensway and two bridge staging sites within Ballantyne Park)
- Alternative 3D: Complete superstructure rapid replacement using SPMTs (individual bridges for each span with two bridge staging sites north of the Queensway and four bridge staging sites within

Ballantyne Park)

- Alternative 4: Demolish in place and jack and slide new bridges from slides (2 bridges replaced in the same 3-day period)
- Alternative 5: Sequential jack and slide (removing one bridge at a time)
- Alternative 6: SPMT transport to Nicholas (individual bridges for each span)

e) Staging Area Alternatives for Temporary Works

- At each of the 7 bridge sites an initial review of feasible Rapid Bridge Replacement (RBR) staging areas was undertaken and a staging area that would be preferred with the RBR bridge alternative was recommended. This assessment is presented in the **Analysis and Evaluation Report – Appendix C**. This initial screening was presented at PIC No. 1 for public review and comments.

Coarse Screening of Alternatives

A long list of alternatives was generated in an attempt to consider a wide range of alternatives for addressing the structural needs identified (i.e. all reasonable alternatives) and is listed in the **Analysis and Evaluation Report – Appendix C**.

The alternatives were subjected to a coarse screening before proceeding with a detailed evaluation. This screening eliminated those alternatives with significant negative impacts in comparison to the other alternatives carried forward.

Those alternatives that had significantly poorer performance, a magnitude higher cost, unacceptable environmental or safety effects, and/or did not comply with MTO/City of Ottawa standards/requirements were not carried forward for further analysis.

Following the coarse screening, the following alternatives were carried forward:

- All structural alternatives (replacement and rehabilitation) for rigid frames
- All structural alternatives (replacement and rehabilitation) for the Rideau Canal Bridge
- Existing structural span alternatives carried forward for rigid frames i.e. longer and shorter spans were coarse screened and could be reviewed following the selection of the TPA
- Traffic staging alternatives only carried forward for alternatives which minimized traffic delays and avoided use of unconventional traffic staging when possible

Rigid Frame Bridge Sites

The combined short-list of alternatives involves a combination of a structural alternative for the bridge + traffic staging alternative + a bridge span alternative for each of the rigid frame sites. The combinations of alternatives are illustrated in **Figure 5-2**. The short-listed bridge alternatives are shown in **Figure 5-3** to **Figure 5-4**. The short-listed traffic staging schemes for the rigid frame bridge sites are shown in **Figure 5-5** to **Figure 5-7**.

For those rigid frame sites requiring a full closure of the Queensway, there will be one eastbound detour route and a single westbound detour following the same route as the current MTO's Emergency Detour Route (EDR). Westbound vehicular traffic will likely exit the Queensway at Nicholas Street/Mann Avenue and follow a western diversion on arterial roads including: Nicholas Street, Albert Street, O'Connor Street and then re-enter the Queensway at the O'Connor Street on-ramp. In the eastbound direction, vehicles will exit the freeway at Bronson Avenue and travel southerly to Riverside Drive. They will then travel northeast on Riverside Drive to enter the freeway on the on-ramp at Riverside Drive. These routes are illustrated on **Figure 5-8**. These detour routes were discussed with City of Ottawa staff during the MTAC meetings. The eastbound detour route was successfully used for the Kent Street bridge superstructure replacement in 2015. All detour routes developed during this Preliminary Design stage will be further reviewed with the City of Ottawa during Detail Design

The general traffic detour routes for the Metcalfe Street, Elgin Street and Main Street rapid replacement alternatives are illustrated in **Figure 5-9** to **Figure 5-12** respectively.

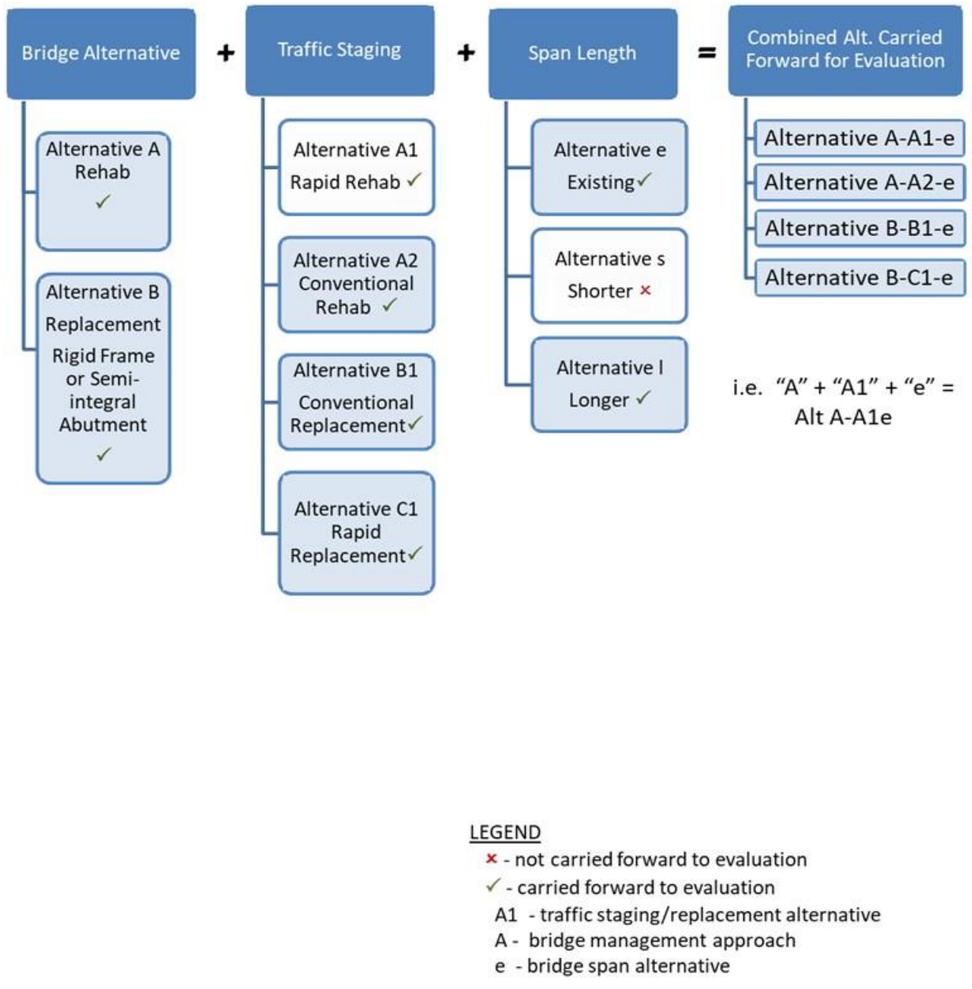


Figure 5-2: Rigid Frame Bridge Alternatives Coarse Screening Decision Flow Chart

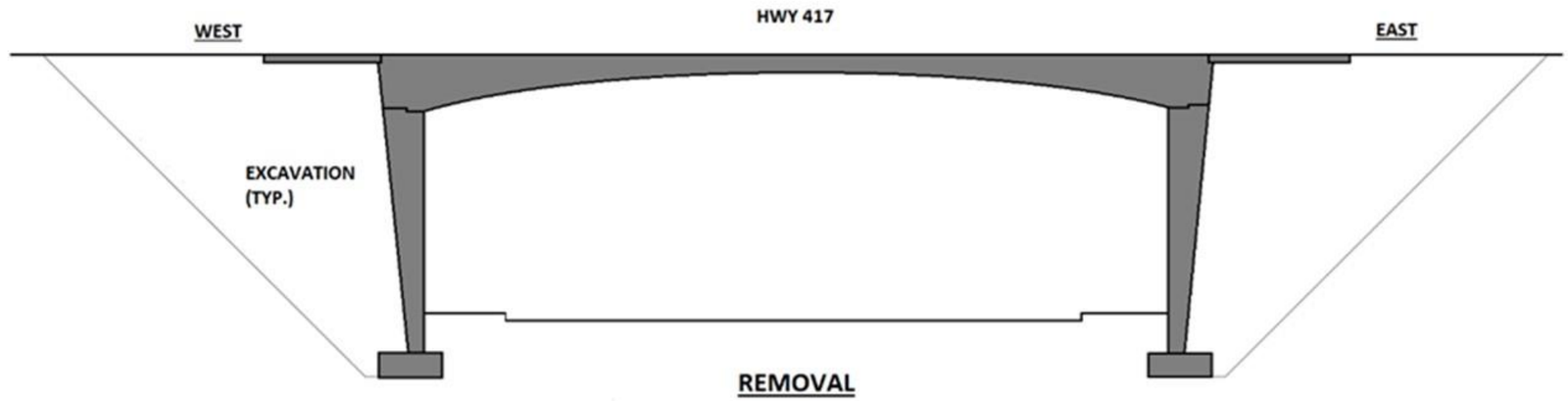


Figure 5-3: Alternative B1 - Conventional Replacement for Same Span

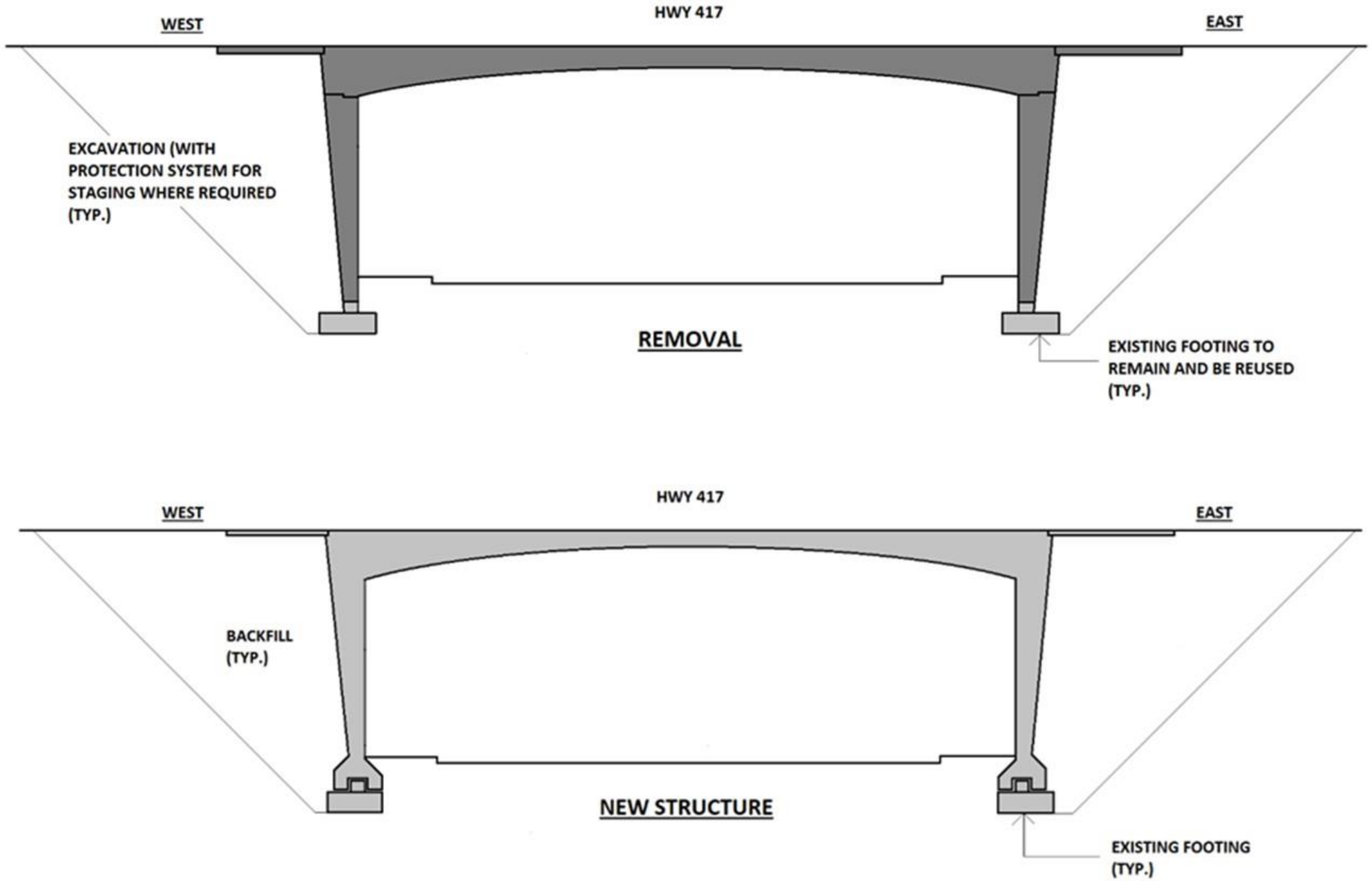


Figure 5-4: Alternative C1 - Rapid Bridge Replacement for Same Span

Figure 5-5: Traffic Staging Short Listed Alternative A1 (Rigid Frame Rapid Rehabilitation)

Figure 5-6: Traffic Staging Short Listed Alternative A2 (Rigid Frame Conventional Rehabilitation)

Figure 5-7: Traffic Staging Short Listed Alternative B1 (Rigid Frame Conventional Replacement)

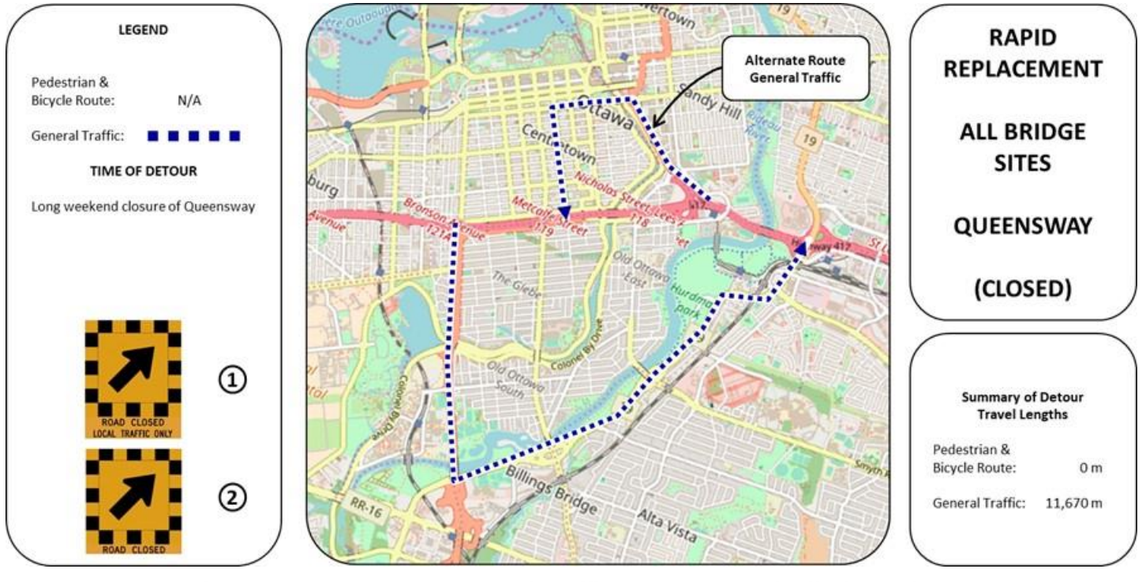
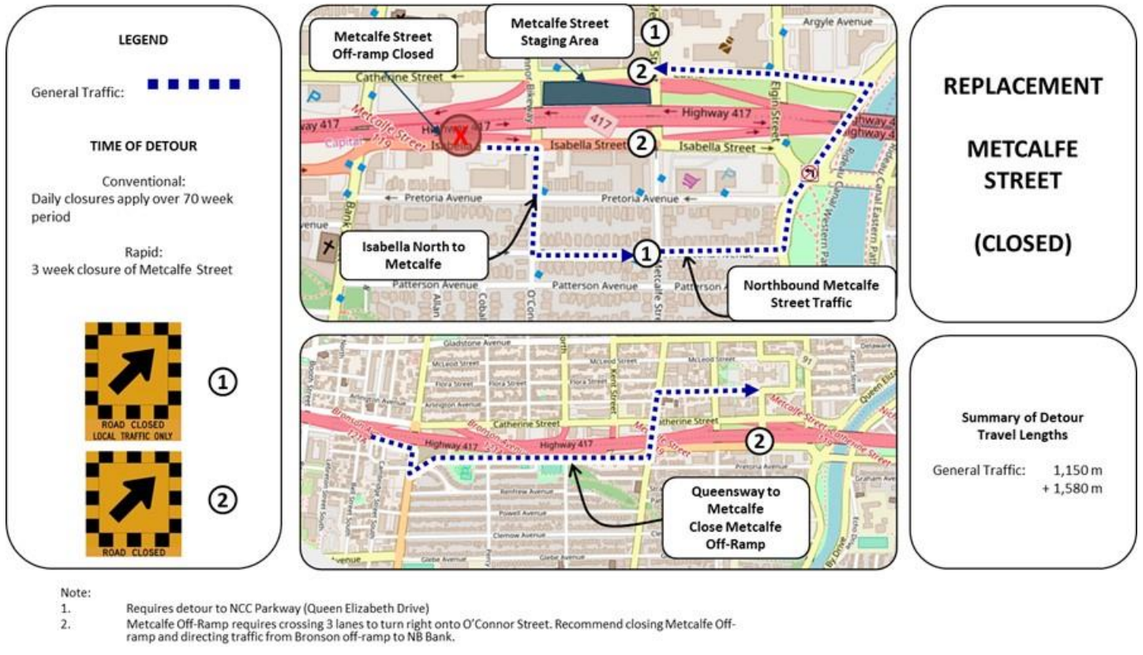
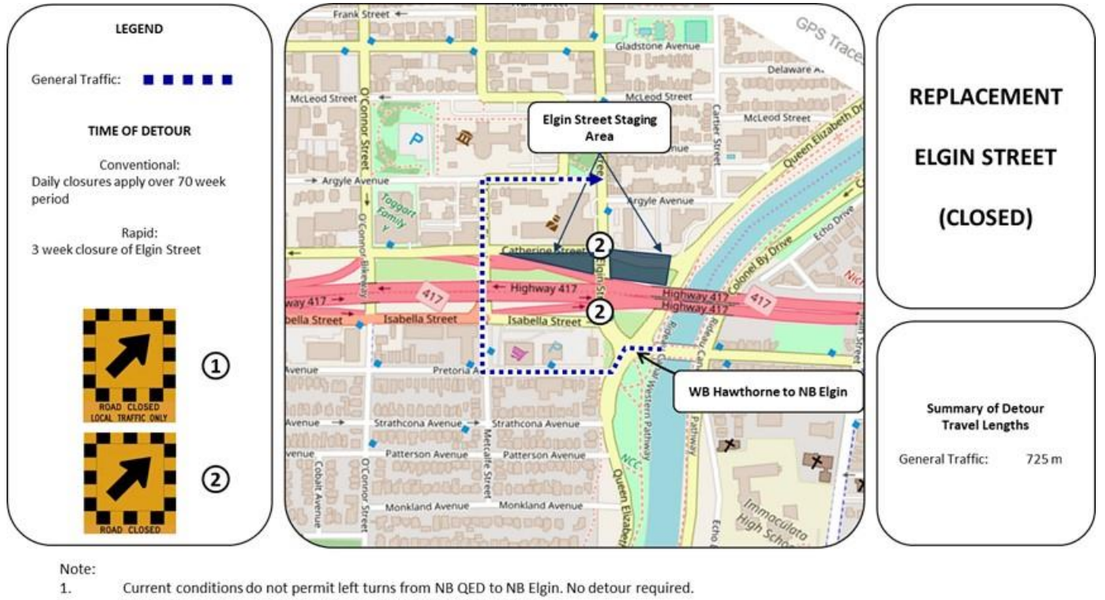


Figure 5-8: Queensway General Traffic Detour Route (Full Closure)



Note:
1. Requires detour to NCC Parkway (Queen Elizabeth Drive)
2. Metcalfe Off-Ramp requires crossing 3 lanes to turn right onto O'Connor Street. Recommend closing Metcalfe Off-ramp and directing traffic from Bronson off-ramp to NB Bank.

Figure 5-9: Metcalfe Street General Traffic Detour Route (Northbound only)



Note:
1. Current conditions do not permit left turns from NB QED to NB Elgin. No detour required.
2. Where possible, detours from city streets to city streets is preferred.

Figure 5-10: Elgin Street General Traffic Detour Route (Northbound)



Note:
1. Rapid Replacement requires closure of Catherine Street from Metcalfe Street to Elgin Street
2. Where possible, detours from city streets to city streets is preferred.

Figure 5-11: Elgin Street General Traffic Detour Route (Southbound)

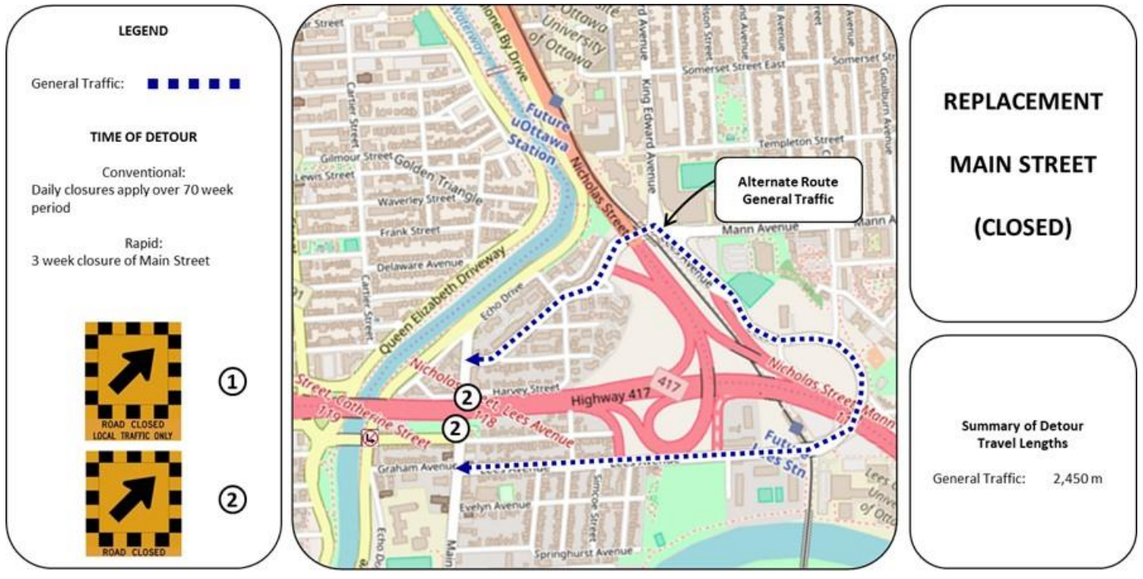


Figure 5-12: Main Street General Traffic Detour Route (Northbound and Southbound)

Rideau Canal Bridge

The combined short-list of alternatives for the Rideau Canal Bridge involves a combination of a structural alternative + construction staging. The combinations of all available alternatives are shown in **Figure 5-13**. The structural alternatives are shown in **Figure 5-14** to **Figure 5-18**, and the short-listed traffic staging alternatives for the Rideau Canal Bridge are shown in **Figure 5-19** to **Figure 5-23.**

The structural alternatives include 1- and 3-span bridges. The bridge alternatives have included a girder bridge, extrados bridge and arch bridge (single span) and jack and slide technology which is constructed beside the freeway using a staging area. The environmental effects of the staging area have been measured and included in the evaluation of the alternatives.

For the Rideau Canal alternatives requiring a full closure of the Queensway, off-site detour routes will be provided. Westbound vehicular traffic will exit the Queensway at the Nicholas Street/Mann Avenue and follow a western diversion on arterial roads including: Nicholas Street, Albert Street, O'Connor Street and then re-enter the Queensway at the O'Connor Street on-ramp. In the eastbound direction, vehicles will exit the freeway at Bronson Avenue and travel southerly to Riverside Drive. They will then travel northeast on Riverside Drive to enter the freeway on the on-ramp at Riverside Drive. These routes are illustrated on **Figure 5-24**.

The general traffic detour routes for traffic staging Alternatives 4 and 5 for the Colonel By Drive and Queen Elizabeth Driveway parkways are illustrated in **Figure 5-25** and **Figure 5-26**. Traffic staging Alternative 6 requires the Main Street Bridge to be closed to drive the SPMT's from the Nicholas Street ramp lot. The general traffic detour route for Alternative 6 is illustrated in **Figure 5-27** and the Main Street general traffic detour route is illustrated in **Figure 5-12**.

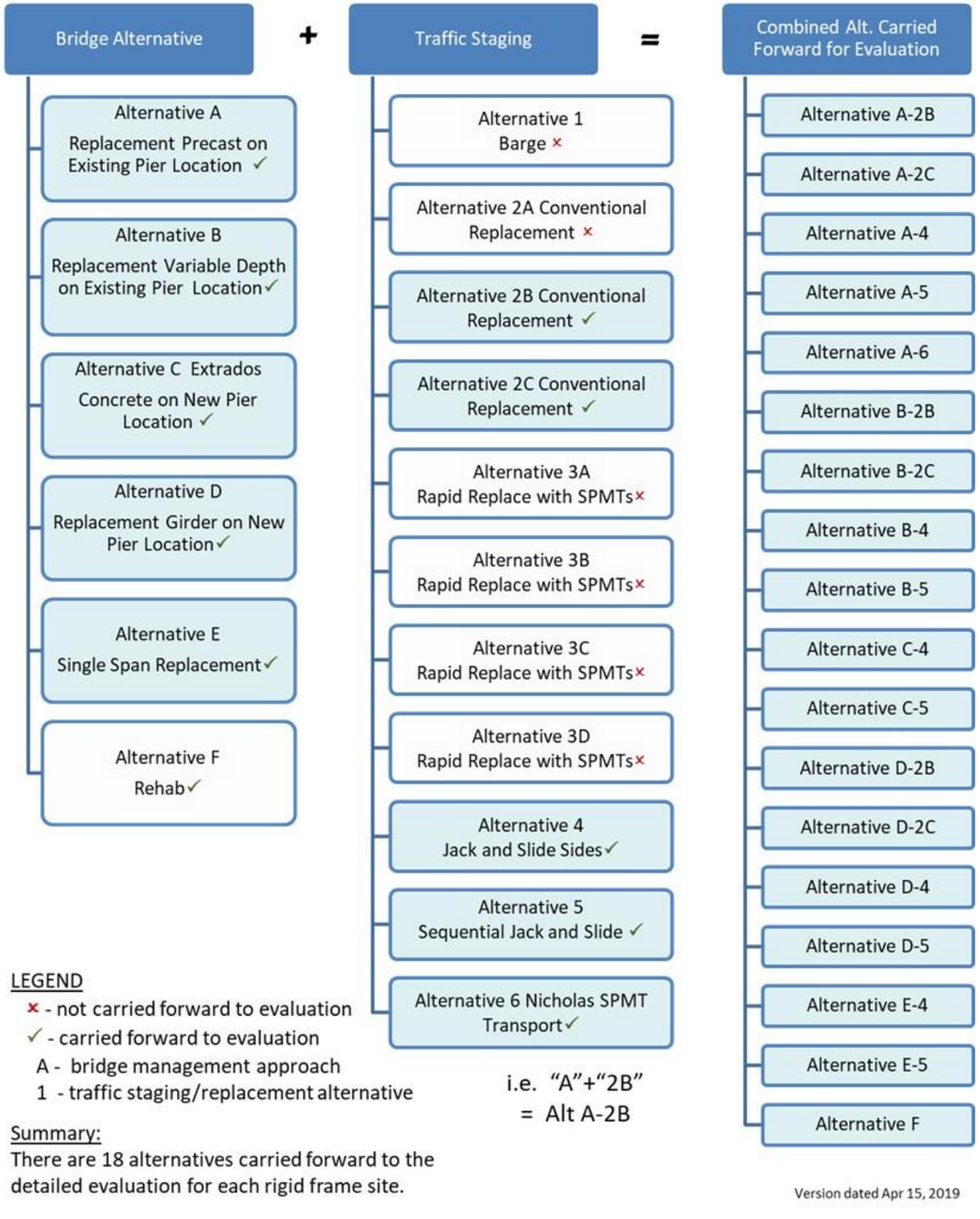


Figure 5-13: Rideau Canal Bridge Alternatives Coarse Screening Decision Flow Chart

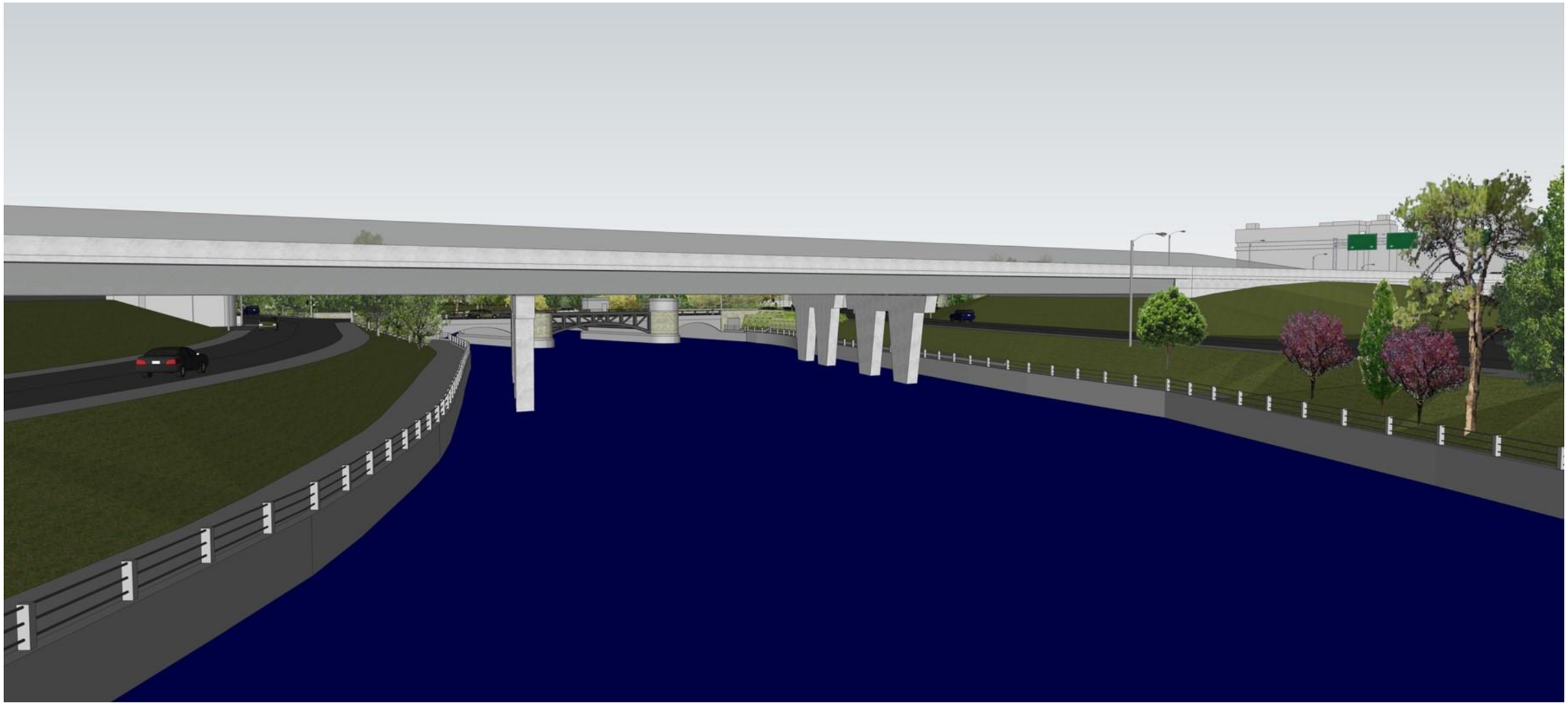


Figure 5-14: Alternative A – Replacement Concrete or Steel Box Girder on Existing Footing Location

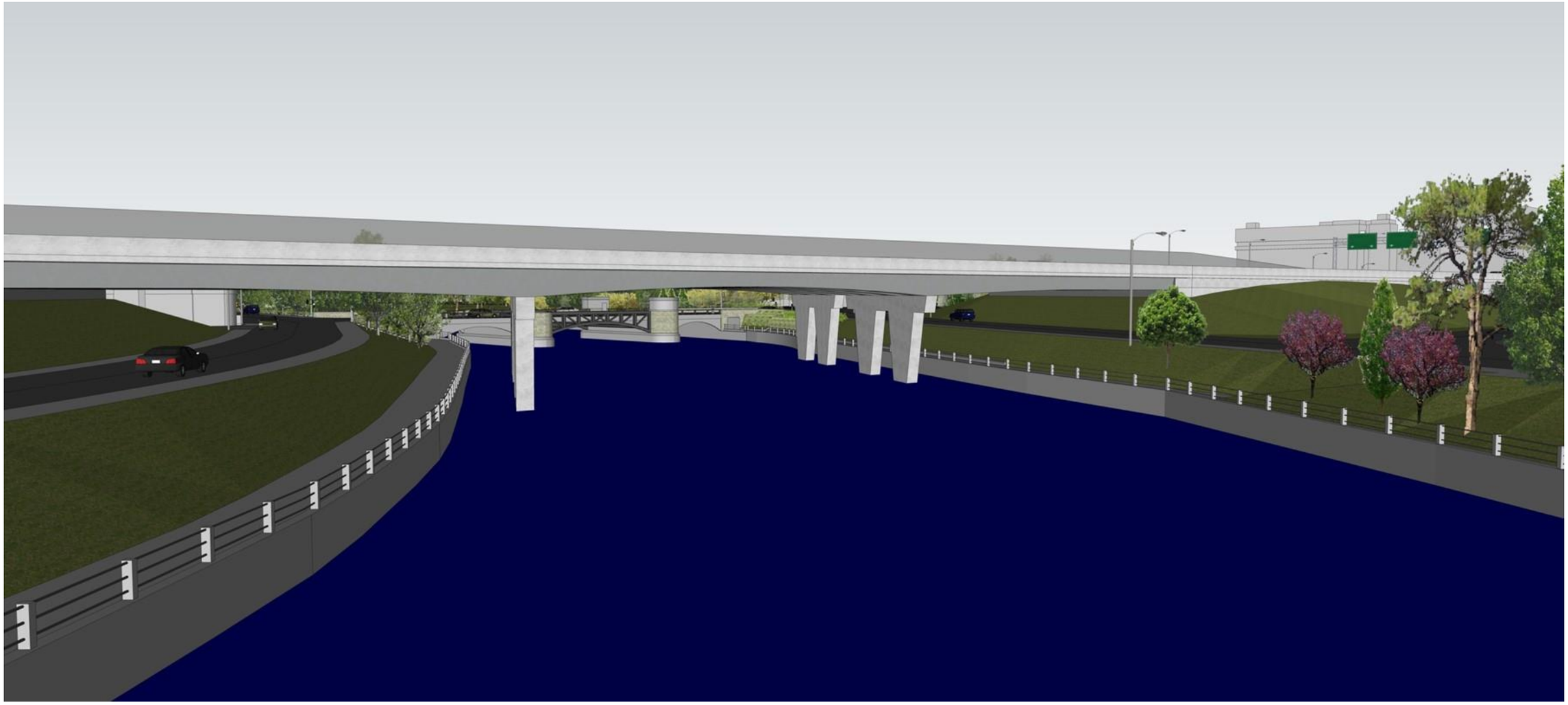


Figure 5-15: Alternative B - Replacement Variable Depth Steel Box Girder on Existing Footing Location

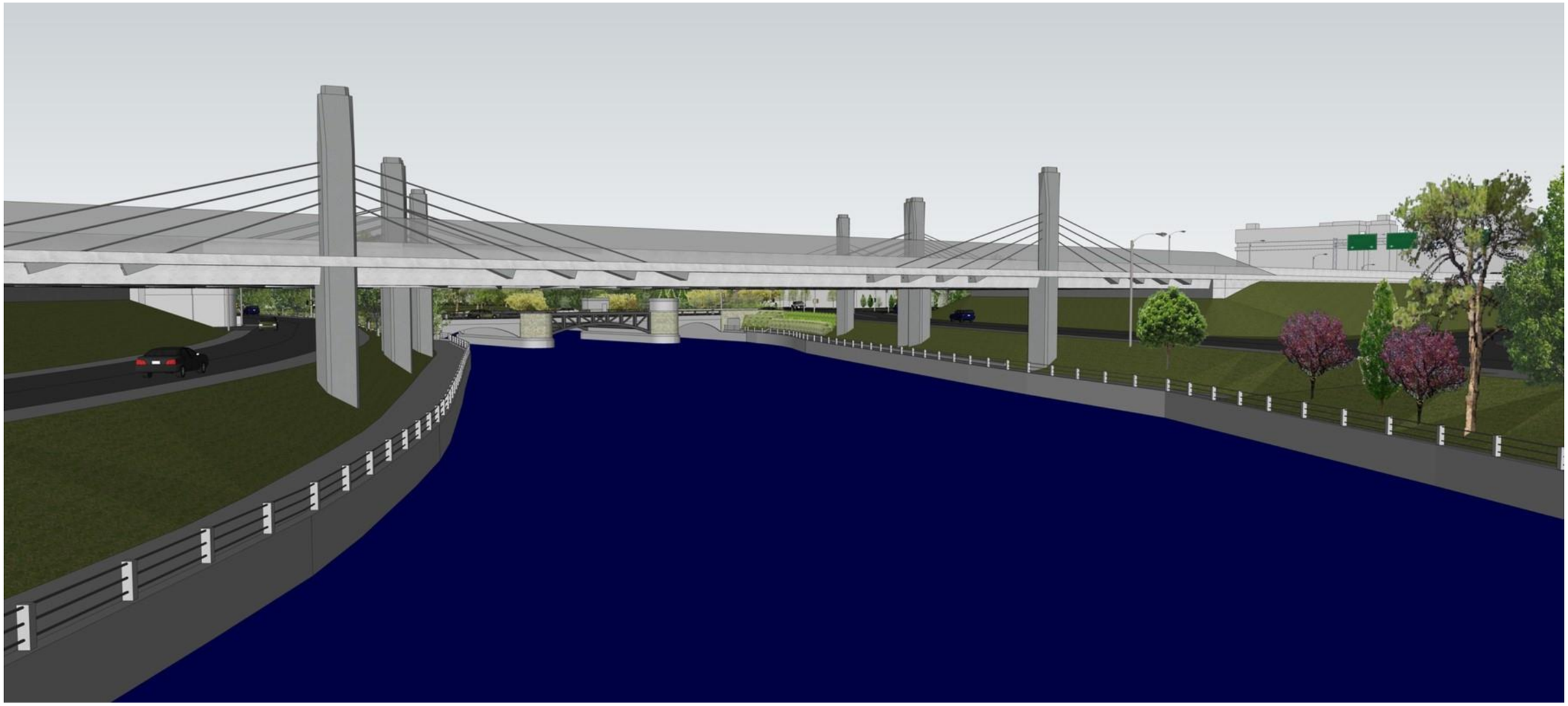


Figure 5-16: Alternative C – Extrados Bridge on New Pier Location



Figure 5-17: Alternative D – Replacement Girder Bridge on New Pier Location

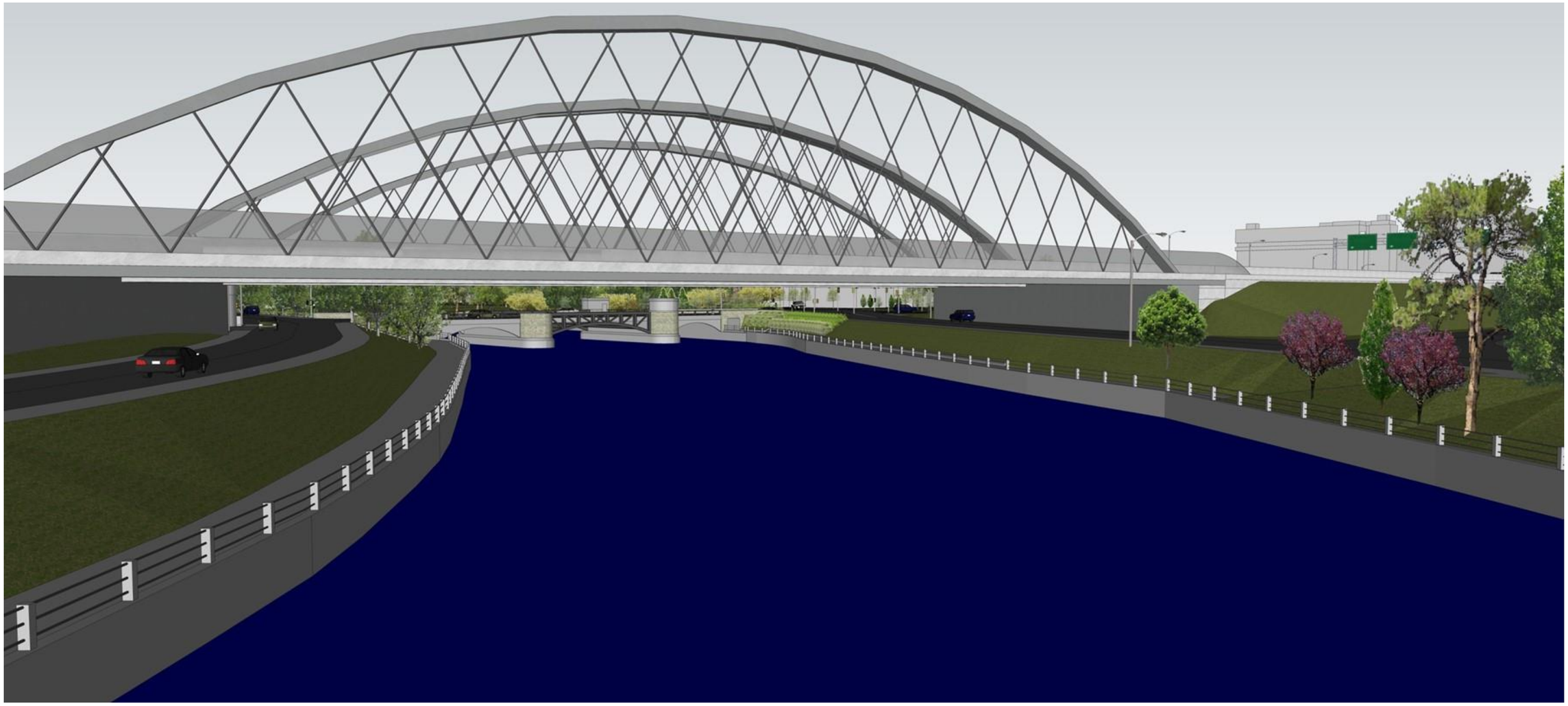


Figure 5-18: Alternative E – Single Span Replacement Bridge

Figure 5-19: Traffic Staging Short-Listed Alternative 2B (Rideau Canal Conventional Replacement)

Figure 5-20: Traffic Staging Short-Listed Alternative 2C (Rideau Canal Conventional Replacement)

Figure 5-21: Traffic Staging Short-Listed Alternative 4 (Rideau Canal Jack and Slide Sides)

Figure 5-22: Traffic Staging Short-Listed Alternative 5 (Rideau Canal Sequential Jack and Slide)

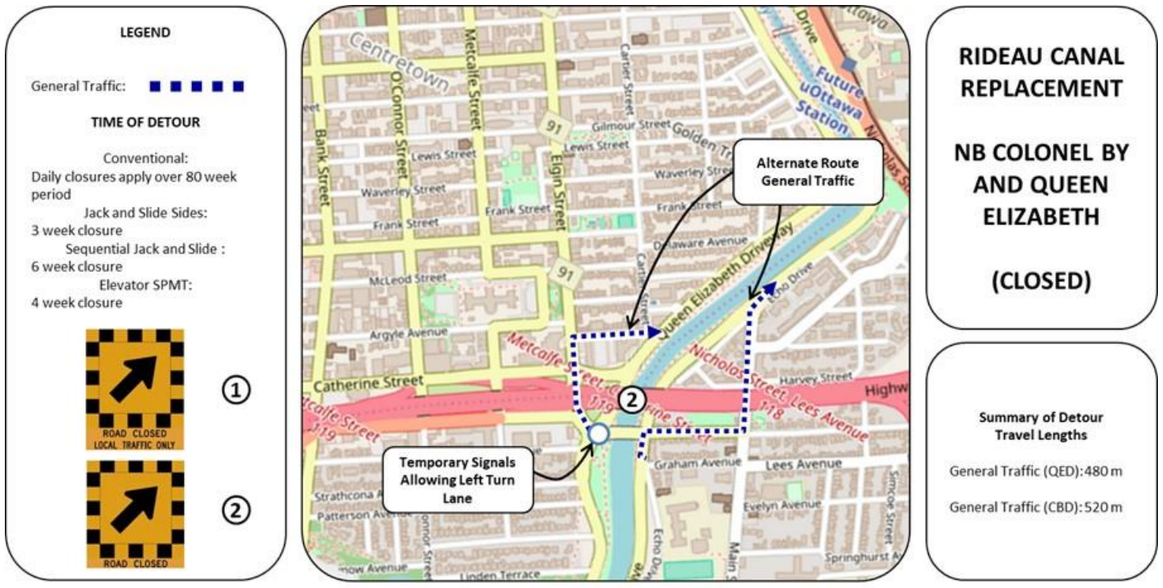
Figure 5-23: Traffic Staging Short-Listed Alternative 6 (Rideau Canal SPMT Transport)



Figure 5-24: Queensway General Traffic Detour Route (Full Closure)



Figure 5-25: Colonel By Drive and Queen Elizabeth Driveway General Traffic Detour (Southbound)



Note:

1. No southbound QED traffic allowed so temporary signals allowing left turns from QED to NB Elgin would be required

Figure 5-26: Colonel By Drive and Queen Elizabeth Driveway General Traffic Detour (Northbound)



Figure 5-27: Colonel By Drive and Queen Elizabeth Driveway General Traffic Detour (Alternative 6)

5.3.2 Detailed Evaluation Methodology

For the evaluation of Preliminary Design alternatives, the study has utilized a formal quantitative evaluation methodology described as the Multi Attribute Trade-off System (MATS). There are several decision-making methodologies available such as qualitative assessments, monetary based techniques, or multi-criteria analysis.

The evaluation approach used for this study is based on the MATS methodology which focuses on the differences between the alternatives, addresses the complexity of the base data collected and provides a traceable decision-making process. In addition, the method allows sensitivity tests to be performed because of the matrix configuration of the assessment and the use of numerical scores to measure the impact or performance of the alternatives. The sensitivity tests are also documented in the **Appendix C - Analysis and Evaluation Report**. This approach is consistent with the MTO and MECP practices for the complex evaluation of alternatives. Using the MATS methodology, overall scores are assigned to each alternative and the alternative with the highest score is selected as the TPA. This approach allows a rigorous comparison of the trade-offs of alternatives and traceability in the decision-making process.

A Technical Advisory Committee (TAC) was created to make technical decisions for the study and to include a wide range of expertise and opinions. The TAC members included:

- MTO staff (planning, environmental, structural, traffic, property)
- Heritage consultants (cultural heritage landscapes, built heritage, urban design, context sensitive design)
- Environmental consultants (aquatic and terrestrial environment)
- Structural engineers
- Transportation and traffic engineers

The steps shown below and in detail in the Analysis and Evaluation Report were undertaken by the TAC to arrive at an overall score for each alternative.

- Development of Evaluation Criteria (coarse screening a long list of criteria to develop a short-list of criteria to carry forward for evaluation). These factors and sub-factors are used to measure the differences between the alternatives;
- Public review (PIC No. 1);
- Development of definitions and utility functions for each sub-factor carried forward. (Data must be collected for each alternative under each sub-factor. Measurements for each alternative, under each sub-factor, are conducted using topographic plans, field surveys, numerical modelling etc.);
- Weighting of Criteria (assigning weights to each factor and sub-factor based on their importance to each team member's discipline or area of expertise);
- Rating Alternatives (based on Average TAC Weights);
- Selection of TPA – Highest Ranked Alternative;
- Sensitivity testing;
- Public review (PIC No. 2); and
- Recommendations and presentation of a Recommended Plan for each bridge site.

This systematic approach is consistent with MECP practices for the evaluation of numerous and complex alternatives. It avoids many of the pitfalls associated with qualitative assessments by using an analytical approach that measures scores based on a mathematical relationship, i.e. the degree of subjectivity by the TAC is minimized. This traceable process allows the TAC and the public an opportunity to assess trade-offs involved in the evaluation. These steps are briefly described in the following sections.

Evaluation Criteria

The initial task in the evaluation is to develop evaluation criteria from which alternatives will be assessed. This process involves the identification of "global" groups of factors followed by the selection of a number of "local" sub-factors under the global groups.

Global Evaluation Factors

As an initial step, the evaluation criteria were grouped into broad categories, or factors, established to describe the study specific engineering and environmental concerns. Nine (9) global factors were selected which were used for each evaluation:

- Transportation
- Natural Environment
- Social Environment
- Context Sensitive Design
- Heritage Resource
- Economic Environment
- Land Use and Property
- Structural
- Cost

Local Evaluation Sub-Factors

Under each of the nine general global factors listed above, there were a number of local sub-factors selected for which measurements could be made. These sub-factors, under one of the applicable global factors, were the individual descriptors for the evaluation. The words criterion, attribute and sub-factor are often used synonymously in the literature. In this report, the word sub-factor will be used rather than attribute or criterion. The selection of the sub-factors is very important to the decision-making process because they must adequately describe the issue or aspect of the environment to be evaluated and the unique features of each alternative. Any information regarding an alternative, where there are differences among alternatives, is incorporated into the decision-making process by including it as a sub-factor. Then, for each group of alternatives being evaluated, the sub-factors are reviewed and screened by eliminating those that were considered equal or not applicable among the alternatives. Generally, the process begins by establishing a long list of potential sub-factors through discussions with the TAC, Stakeholders and the Public, followed by:

- Defining the sub-factor by a subject-area specialist;
- Weighting of Criteria (assigning weights to each Factor and Sub-factor based on their importance to each team member's discipline or area of expertise);
- Rating Alternatives (based on Average TAC Weights);
- Selection of TPA – Highest Ranked Alternative;
- Sensitivity testing;
- Public review (PIC No. 2); and
- Recommendations and presentation of a Recommended Plan.

The long- and short-list screenings of sub-factors are documented in the **Volume II Appendix C (Analysis and Evaluation Report Sub-Appendix C**). This was presented at the initial PIC for public review and comment.

Social Utility Function

The evaluation method (Weighted Additive Method) used to evaluate alternatives related the performance or attractiveness of alternatives using a mathematical relationship. This included two variables. The first was the raw, measured or modelled data, and the second was the utility score. The utility score is the measure of the attractiveness of the alternative under the particular sub-factor. For this study, the relationship between these two variables was described by either a linear, stepped or a dichotomous social utility function. These utility functions assigned a dimensionless score between 0 and 1 to an alternative for each sub-factor. Examples of dichotomous, stepped and linear functions used in this study are explained in the following sections.

Dichotomous Utility Function

The dichotomous utility function, shown in **Figure 5-28**, permits the decision-makers to establish criteria that present an "either-or" situation (desirable or undesirable, negative or positive, present or absent, etc.). If a "yes" answer is desirable then a utility score of 'one' would be assigned to this criterion, otherwise a value of 'zero' would be assigned; no other utility score being available.

Stepped Utility Function

The stepped utility function, shown in **Figure 5-28**, permits the decision-makers to assess criteria when the sub-factor presents more than one level of impact. An example of this situation is where the sub-factor can be categorized into "high, medium or low" degrees of impact. If a "high" answer is undesirable then a utility score or zero is assigned to this criterion, a "medium" answer would be 0.5 and "low" would have a value of 1.0 assigned to it. The stepped function may have more than three categories, with each category assigned a value between one and zero.

The value for each step is determined by the subject area specialist (expert). The maximum value found within the group is either the highest or lowest step. If the maximum value is undesirable it is given a value of zero and conversely the lowest value is desirable and is assigned a value of one.

Linear Utility Function

The linear function, shown in **Figure 5-28**, was used to convert scores for sub-factors that had varying measurements. Given a measurement, a unique score between zero and one could be assigned to a sub-factor.

The slope of the linear utility function is either negative or positive depending on the desirability of the impact. In the example below, the slope of the function is negative.

The short-listed criteria, including definitions and their respective social utility functions are included in **Analysis and Evaluation Report – Appendix C**.

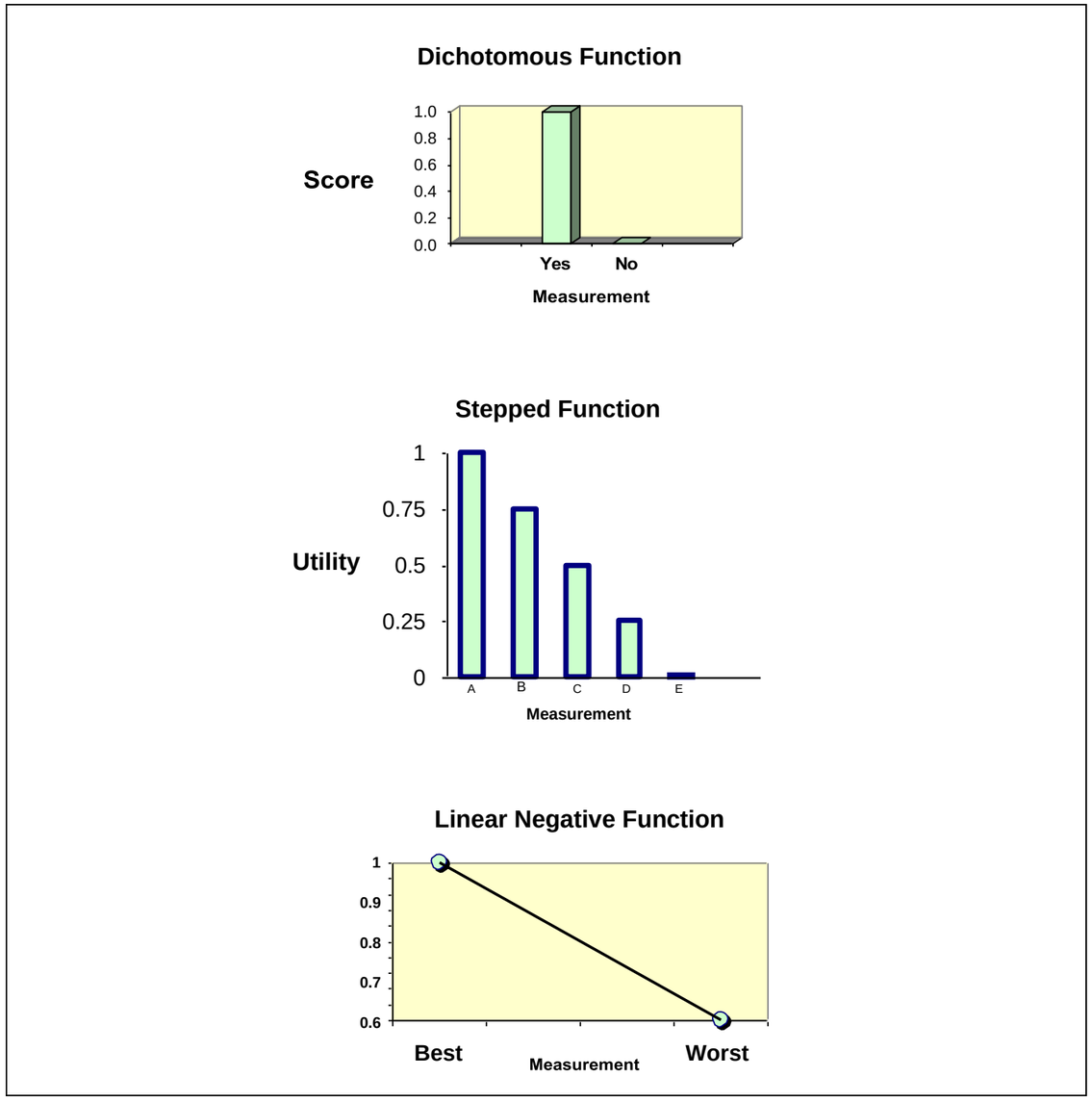


Figure 5-28: Sample Utility Functions

Weighted Factors and Sub-Factors

Factors were eliminated where they were not applicable (because there was no measurable difference between alternatives or they were considered equal). The selection of weights for the factors and sub-factors was based on assessments by the TAC. Within a group of factors, inevitably there was an ordering with some sub-factors having more importance than others. This is accounted for by each individual assigning weights to each factor and sub-factor, which is reflected in the "Factor Weight" and "Sub-factor Weight" columns in **Table 5.3**.

Table 5.3: Sample Factor / Sub-Factor Weights (Sample)

Factors/Sub-factors	TAC	
	Factor Weight	Sub-factor Weight
Transportation	41.7%	
• LOS of cross road		75%
• Ease of construction		10.5%
• Number of entrances		7.8%
• Potential school bus conflicts		6.7%
TOTAL		100%

The percentage weight for all global factors totalled, considered as global weights, is 100%. As well, the percentage weight for the sub-factors under each factor, described as local weights, must total 100%. There is a degree of subjectivity in deciding which global factor is the most important and which is the least important. Every person assigning weights has a personal bias and understanding of the scope of the project and life experience. Hence, there is an advantage to having a diversified team of professionals with varied backgrounds performing the evaluation. The members of the TAC consisted of a diverse group of transportation planners, environmental planners, structural and transportation engineers and technicians.

Each member assigns percentage weights to each global factor and sub-factor based on their opinion of the relative importance of each after a presentation by each specialist to TAC members. Their individual weights were then averaged to determine the TAC weight for each global factor and sub-factor.

As a sample, the results of the weighting exercise generated by the evaluation team for the Main Street and Rideau Canal bridge sites are illustrated in **Figure 5-29** and **Figure 5-31** respectively. The weightings for the remaining sites are provided in **Appendix C – Analysis and Evaluation Report**.

5.3.3 Results of Evaluation

The weighting exercises were carried out by the TAC, reflecting the personal assessment of each evaluator using a value judgment that was based on the opinion of importance based on the range of effects, public comments and subject area expert advice. The results of the weighting exercises and the sensitivity tests for Main Street and the Rideau Canal bridges have been included below as samples of the outcome of the evaluation. The evaluation results for each bridge site can be found in **Analysis and Evaluation Report – Appendix C**. The sensitivity tests provided the Project Team with an indication of possible trade-offs.

Main Street

The results of the weights and rankings for Main Street are illustrated on **Figure 5-29**, with the results of the weights for each sub-factor shown in **Figure 5-30** and **Table 5.4**. **Appendix C** describes the weights and scores in detail.

The MATS ranked Alternative B-C1-e, Rapid Bridge Replacement, as the TPA for Main Street. Taking into consideration the implementation of each alternative, the TPA for both eastbound and westbound Main Street bridges is Alternative B-C1-e.

The Evaluation Committee recommended that the project be refined to allow flexibility in the project to be delivered. Although the project to be implemented is a rapid replacement, the MTO wishes to retain the flexibility for the rapid rehabilitation of the bridges, (Alternative A-A1-e), should funding or availability of staging areas be unavailable or there are changes to Provincial priorities. This is noted in the Statement of Flexibility, described in **Section 7.4**.

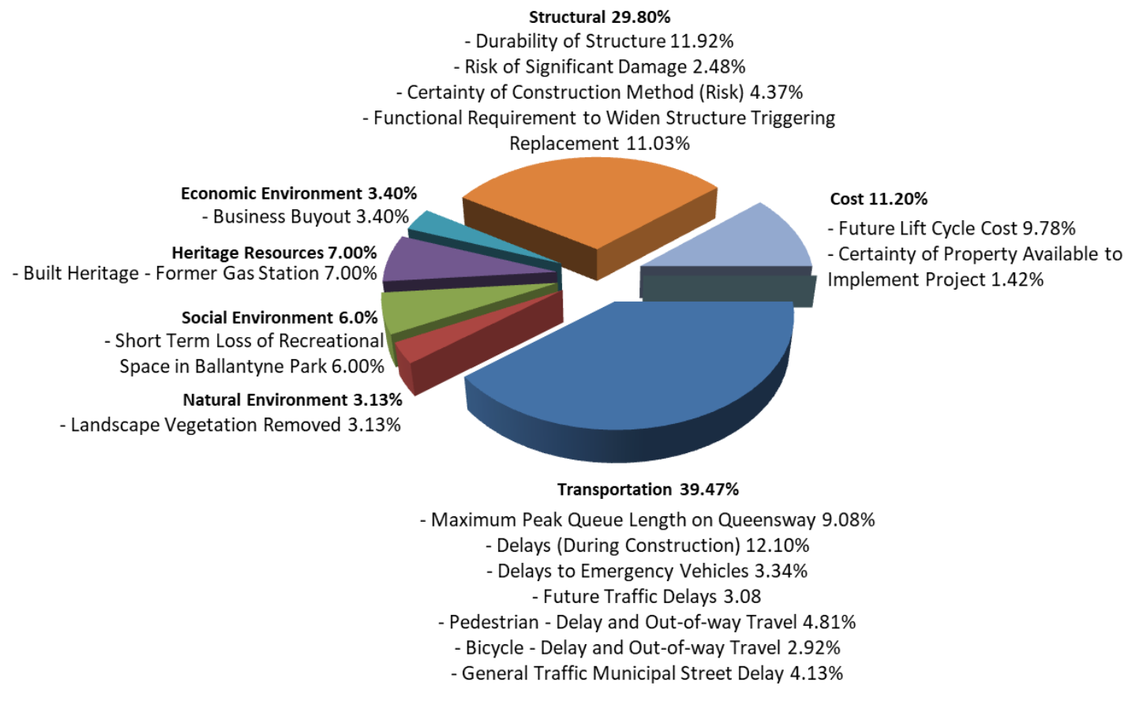


Figure 5-29: Main Street MATS Weights

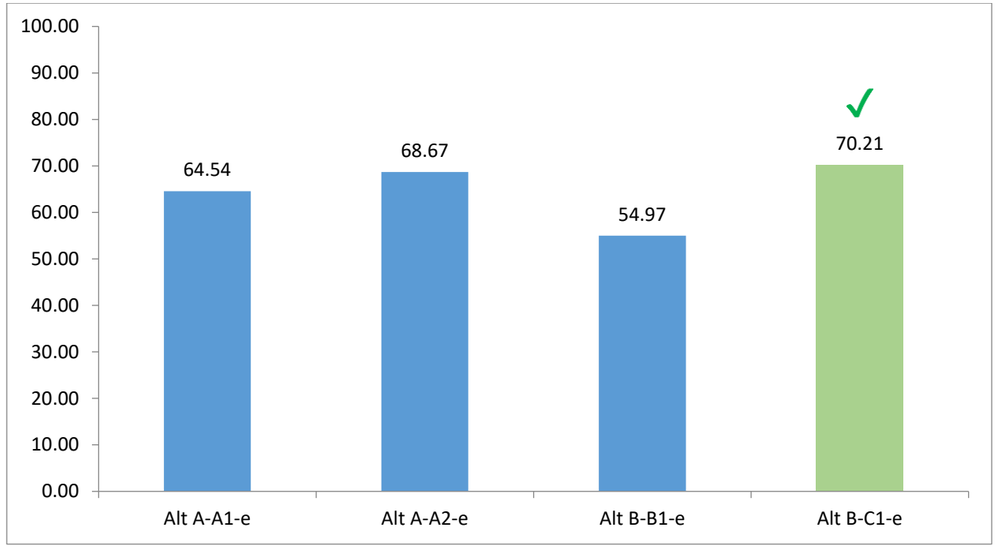


Figure 5-30: Main Street MATS Ranking

Table 5.4: Summary of Main Street MATS Weighted Scores				
	Alt A-A1-e	**Alt A-A2-e**	**Alt B-B1-e**	**Alt B-C1-e**
Transportation				
Maximum Peak Queue Length on Queensway	8.62	7.08	0.00	9.08
Delays (During Construction)	11.50	9.56	0.00	12.10
Delays to Emergency Vehicles	3.24	2.71	0.00	3.34
Future Traffic Delays	0.00	0.00	3.08	3.08
Pedestrian - Delay and Out-of-way Travel	4.81	4.81	0.00	4.62
Bicycle - Delay and Out-of-way Travel	2.92	2.92	0.00	2.80
General Traffic Municipal Street Delay	4.13	4.13	0.00	3.97
Natural Environment				
Landscape Vegetation Removed	3.13	3.13	3.13	0.00
Social Environment				
Short Term Loss of Recreational Space in Ballantyne Park	6.00	6.00	6.00	0.00
Heritage Resources				
Built Heritage – Former Gas Station	7.00	7.00	7.00	0.00
Economic Environment				
Business Buyout	3.40	3.40	3.40	0.00
Structural				
Durability of Structure	0.00	5.96	11.92	11.92
Risk of Significant Damage	0.00	0.00	2.48	2.48
Certainty of Construction Method (Risk)	0.00	2.19	2.19	4.37
Functional Requirement to Widen Structure Triggering Replacement	0.00	0.00	11.03	11.03
Cost				
Future Life Cycle Cost	9.78	9.78	3.33	0.00
Certainty of Property Available to Implement Project	0.00	0.00	1.42	1.42
Final Score	**64.54**	**68.67**	**54.97**	**70.21**

Rideau Canal

The results of the weights and rankings for the Rideau Canal Bridge are illustrated on **Figure 5-31** and **Figure 5-32**, respectively, with the results of the weights for each sub-factor shown in **Table 5.5**. **Appendix C** describes the weights and scores in detail.

For the eastbound and westbound alternative bridge sites, the MATS evaluation ranked Alternative D-4, variable depth Jack and Slide Replacement with piers in a new location, as the TPA. Taking into consideration the implementation of each alternative, the TPA remains Alternative D-4.

The top three preferred alternatives were a traffic staging variation of Alternative D: Replacement variable depth girder on new pier location. The next highest group of alternatives was Alternative B: Replacement variable depth on existing pier location. The TPA (Alternative D-4) rated 7% higher than the next highest bridge type alternative (Alternative B). The value of the score is considered significant, and the range of variation of scores between alternatives reflects the perspective of the evaluation team which prioritized the environment and user experience as high. The trade-off among these closely ranked alternatives is that the TPA (single span jack and slide) requires the acquisition of a community asset (the Royal Oak Pub). The Evaluation Team acknowledged this trade-off and endorsed the preferred alternative.

Note: Following PIC No. 2, refinements were developed to address public and stakeholder comments. The development and evaluation of these refinements is described in **Section 0**.

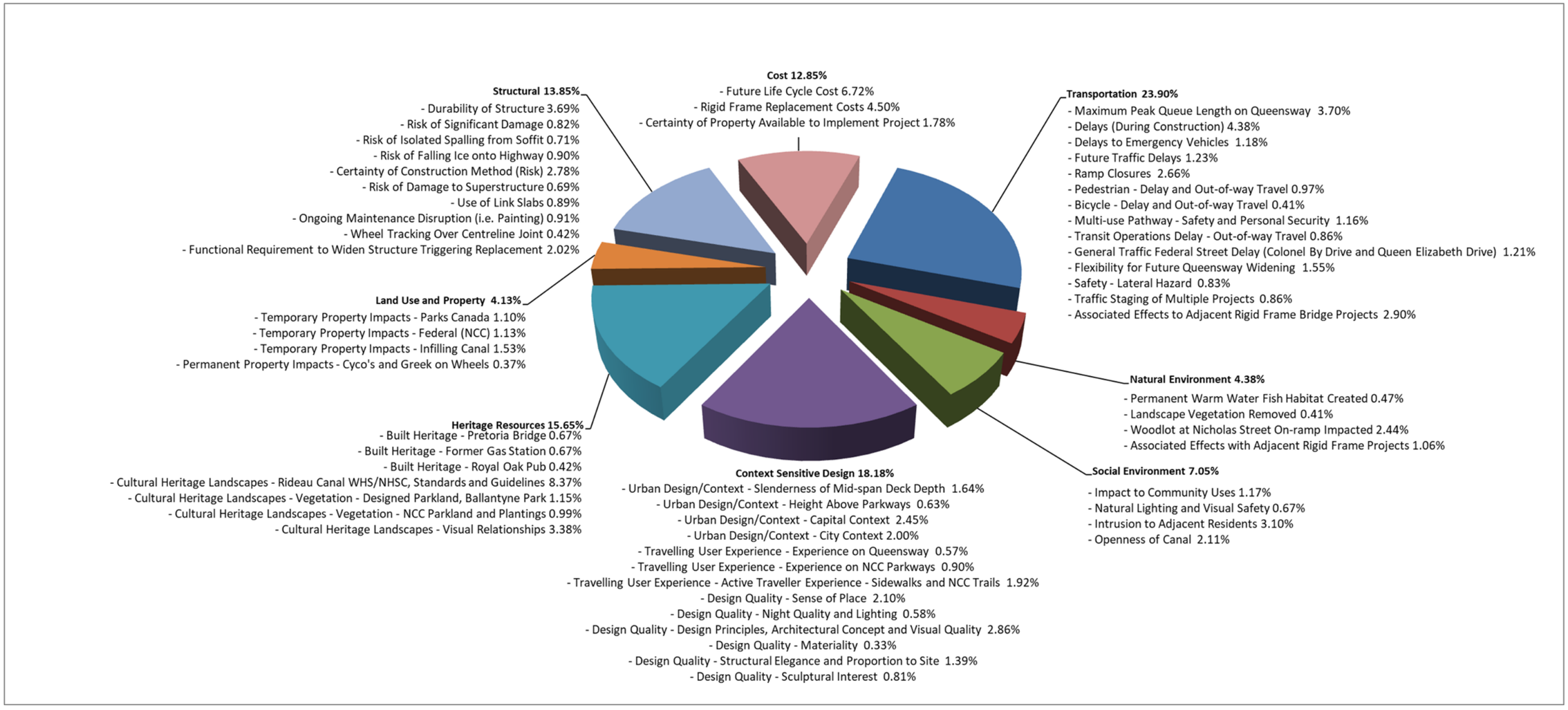


Figure 5-31: Rideau Canal Bridge MATS Weights

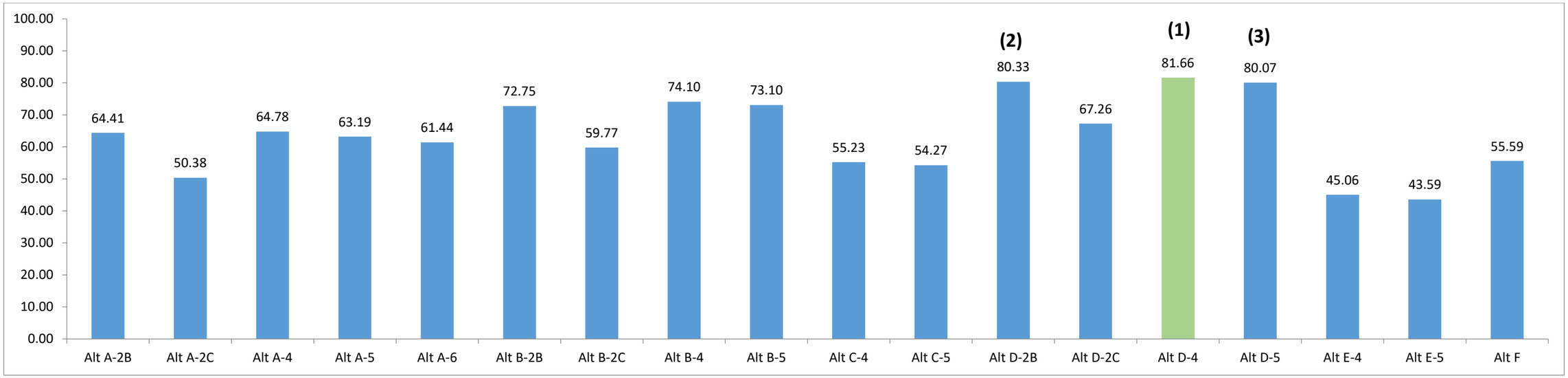


Figure 5-32: Rideau Canal Bridge MATS Ranking

Table 5.5: Summary of Rideau Canal Bridge MATS Weighted Scores

	Alt A-2B	Alt A-2C	Alt A-4	Alt A-5	Alt A-6	Alt B-2B	Alt B-2C	Alt B-4	Alt B-5	Alt C-4	Alt C-5	Alt D-2B	Alt D-2C	Alt D-4	Alt D-5	Alt E-4	Alt E-5	Alt F
Transportation																		
Maximum Peak Queue Length on Queensway	1.85	0.48	3.70	3.70	3.70	1.85	0.48	3.70	3.70	3.70	3.70	1.85	0.48	3.70	3.70	3.70	3.70	0.00
Delays (During Construction)	2.10	0.48	4.38	4.34	4.38	2.10	0.48	4.38	4.34	3.15	3.15	2.10	0.48	4.38	4.34	3.15	3.15	0.00
Delays to Emergency Vehicles	0.61	0.18	1.18	1.12	1.18	0.61	0.18	1.18	1.12	0.74	0.68	0.61	0.18	1.18	1.12	0.74	0.68	0.00
Future Traffic Delays	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	0.00
Ramp Closures	1.81	0.32	2.66	2.66	2.66	1.70	0.32	2.66	2.66	0.00	0.59	1.70	0.32	2.66	2.66	1.09	1.17	1.49
Pedestrian - Delay and Out-of-way Travel	0.00	0.00	0.62	0.28	0.62	0.00	0.00	0.62	0.28	0.62	0.28	0.00	0.00	0.62	0.28	0.62	0.28	0.97
Bicycle - Delay and Out-of-way Travel	0.00	0.00	0.27	0.12	0.27	0.00	0.00	0.27	0.12	0.27	0.12	0.00	0.00	0.27	0.12	0.27	0.12	0.41
Multi-use Pathway - Safety and Personal Security	1.16	1.16	0.00	0.58	1.16	1.16	1.16	0.00	0.58	0.00	0.58	1.16	1.16	0.00	0.58	0.00	0.58	1.16
Transit Operations Delay - Out-of-way Travel	0.86	0.86	0.43	0.00	0.43	0.86	0.86	0.43	0.00	0.43	0.00	0.86	0.86	0.43	0.00	0.43	0.00	0.86
General Traffic Federal Street Delay (Colonel By Drive and Queen Elizabeth Driveway)	1.21	1.21	1.02	0.63	0.00	1.21	1.21	1.02	0.63	1.02	0.63	1.21	1.21	1.02	0.63	1.02	0.63	1.02
Flexibility for Future Queensway Widening	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	0.00	0.00	1.55	1.55	1.55	1.55	0.00	0.00	1.55
Safety - Lateral Hazard	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.55	0.55	0.83	0.83	0.83	0.83	0.00	0.00	0.83
Traffic Staging of Multiple Projects	0.00	0.00	0.86	0.86	0.00	0.00	0.00	0.86	0.86	0.86	0.86	0.00	0.00	0.86	0.86	0.86	0.86	0.86

Table 5.5: Summary of Rideau Canal Bridge MATS Weighted Scores

	Alt A-2B	Alt A-2C	Alt A-4	Alt A-5	Alt A-6	Alt B-2B	Alt B-2C	Alt B-4	Alt B-5	Alt C-4	Alt C-5	Alt D-2B	Alt D-2C	Alt D-4	Alt D-5	Alt E-4	Alt E-5	Alt F
Associated Effects to Adjacent Rigid Frame Bridge Projects	2.90	0.00	2.90	2.90	2.90	2.90	0.00	2.90	2.90	0.00	0.00	2.90	0.00	2.90	2.90	0.00	0.00	2.90
Natural Environment																		
Permanent Warm Water Fish Habitat Created	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.00
Landscape Vegetation Removed	0.41	0.41	0.00	0.00	0.41	0.41	0.41	0.00	0.00	0.00	0.00	0.41	0.41	0.00	0.00	0.00	0.00	0.41
Woodlot at Nicholas Street On-ramp Impacted	2.44	2.44	2.44	2.44	0.00	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44
Associated Effects with Adjacent Rigid Frame Projects	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	0.00	0.00	1.07	1.07	1.07	1.07	0.00	0.00	1.07
Social Environment																		
Impact to Community Uses	1.17	1.17	0.58	0.58	1.17	1.17	1.17	0.58	1.17	0.00	0.00	1.17	1.17	0.58	0.58	0.00	0.00	1.17
Natural Lighting and Visual Safety	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.00	0.00	0.42	0.42	0.42	0.42	0.00	0.00	0.67
Intrusion to Adjacent Residents	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	0.00	0.00	3.10
Openness of Canal	0.00	0.00	0.00	0.00	0.00	0.13	0.13	0.13	0.13	1.99	1.99	2.12	2.12	2.12	2.12	1.99	1.99	0.00
Context Sensitive Design																		
Urban Design/Context - Slenderness of Mid-span Deck Depth	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.43	0.43	0.36	0.36	0.36	0.36	1.64	1.64	0.02
Urban Design/Context - Height Above Parkways	0.06	0.06	0.06	0.06	0.06	0.37	0.37	0.37	0.37	0.61	0.61	0.37	0.37	0.37	0.37	0.63	0.63	0.00
Urban Design/Context - Capital Context	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	2.45	2.45	1.62	1.62	1.62	1.62	2.45	2.45	0.00
Urban Design/Context - City Context	0.66	0.66	0.66	0.66	0.66	2.00	2.00	2.00	2.00	1.32	1.32	2.00	2.00	2.00	2.00	0.00	0.00	0.66
Travelling User Experience - Experience on Queensway	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.57	0.00	0.00	0.00	0.00	0.57	0.57	0.00
Travelling User Experience - Experience on NCC Parkways	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.90	0.90	0.00	0.00	0.00	0.00	0.90	0.90	0.00
Travelling User Experience - Active Traveller Experience - Sidewalks and NCC Trails	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.92	1.92	0.96	0.96	0.96	0.96	1.92	1.92	0.00
Design Quality - Sense of Place	0.21	0.21	0.21	0.21	0.21	0.63	0.63	0.63	0.63	2.10	2.10	1.68	1.68	1.68	1.68	1.26	1.26	0.00
Design Quality - Night Quality and Lighting	0.06	0.06	0.06	0.06	0.06	0.17	0.17	0.17	0.17	0.58	0.58	0.29	0.29	0.29	0.29	0.52	0.52	0.00
Design Quality - Design Principles, Architectural Concept and Visual Quality	0.29	0.29	0.29	0.29	0.29	0.86	0.86	0.86	0.86	2.86	2.86	2.00	2.00	2.00	2.00	0.57	0.57	0.00
Design Quality - Materiality	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.33	0.33	0.33	0.33	0.33	0.33	0.22	0.22	0.00
Design Quality - Structural Elegance and Proportion to Site	0.00	0.00	0.00	0.00	0.00	0.56	0.56	0.56	0.56	1.39	1.39	0.98	0.98	0.98	0.98	0.70	0.70	0.00
Design Quality - Sculptural Interest	0.08	0.08	0.08	0.08	0.08	0.25	0.25	0.25	0.25	0.82	0.82	0.66	0.66	0.66	0.66	0.49	0.49	0.00
Heritage Resources																		
Built Heritage - Pretoria Bridge	0.00	0.00	0.00	0.00	0.00	0.13	0.13	0.13	0.13	0.67	0.67	0.53	0.53	0.53	0.53	0.33	0.33	0.00
Built Heritage - Former Gas Station	0.67	0.00	0.67	0.67	0.67	0.67	0.00	0.67	0.67	0.00	0.00	0.67	0.00	0.67	0.67	0.00	0.00	0.67
Built Heritage - Royal Oak Pub	0.42	0.42	0.00	0.00	0.42	0.42	0.42	0.00	0.00	0.00	0.00	0.42	0.42	0.00	0.00	0.00	0.00	0.42

Table 5.5: Summary of Rideau Canal Bridge MATS Weighted Scores

	Alt A-2B	Alt A-2C	Alt A-4	Alt A-5	Alt A-6	Alt B-2B	Alt B-2C	Alt B-4	Alt B-5	Alt C-4	Alt C-5	Alt D-2B	Alt D-2C	Alt D-4	Alt D-5	Alt E-4	Alt E-5	Alt F
Cultural Heritage Landscapes - Rideau Canal WHS/NHSC, Standards and Guidelines	4.18	4.18	4.18	4.18	4.18	8.37	8.37	8.37	8.37	0.00	0.00	8.37	8.37	8.37	8.37	0.00	0.00	8.37
Cultural Heritage Landscapes - Vegetation - Designed Parkland, Ballantyne Park	0.57	0.00	0.57	0.57	0.57	0.57	0.00	0.57	0.57	0.00	0.00	0.57	0.00	0.57	0.57	0.00	0.00	1.15
Cultural Heritage Landscapes - Vegetation - NCC Parkland and Plantings	0.99	0.99	0.00	0.00	0.99	0.99	0.99	0.00	0.00	0.99	0.99	0.99	0.99	0.00	0.00	0.99	0.99	0.99
Cultural Heritage Landscapes - Visual Relationships	2.54	1.70	1.70	1.70	1.70	3.39	3.39	3.39	3.39	0.85	0.85	3.39	3.39	3.39	3.39	0.00	0.00	3.39
Land Use and Property																		
Temporary Property Impacts - Parks Canada	1.03	1.03	0.16	0.16	1.10	1.03	1.03	0.16	0.16	0.00	0.00	1.03	1.03	0.16	0.16	0.00	0.00	1.10
Temporary Property Impacts - Federal (NCC)	1.07	1.07	0.16	0.16	1.13	1.07	1.07	0.16	0.16	0.00	0.00	1.07	1.07	0.16	0.16	0.00	0.00	1.13
Temporary Property Impacts - Infilling Canal	0.77	0.77	0.77	0.00	0.77	0.77	0.77	0.77	0.00	0.77	0.00	0.77	0.77	0.77	0.00	0.77	0.00	1.53
Permanent Property Impacts - Cyco's and Greek on Wheels	0.37	0.37	0.00	0.00	0.37	0.37	0.37	0.00	0.00	0.00	0.00	0.37	0.37	0.00	0.00	0.00	0.00	0.37
Structural																		
Durability of Structure	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	0.00
Risk of Significant Damage	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.00
Risk of Isolated Spalling from Soffit	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.00
Risk of Falling Ice onto Highway	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.00	0.00	0.90	0.90	0.90	0.90	0.00	0.00	0.90
Certainty of Construction Method (Risk)	2.78	2.78	2.78	2.78	0.00	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	1.39
Risk of Damage to Superstructure	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.14	0.14	0.69	0.69	0.69	0.69	0.00	0.00	0.69
Use of Link Slabs	0.89	0.89	0.89	0.89	0.00	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Ongoing Maintenance Disruption (i.e. Painting)	0.55	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.91	0.91	0.64	0.55	0.55	0.55	0.00	0.00	0.91
Wheel Tracking Over Centreline Joint	0.00	0.42	0.42	0.42	0.42	0.00	0.42	0.42	0.42	0.42	0.42	0.00	0.42	0.42	0.42	0.42	0.42	0.42
Functional Requirement to Widen Structure Triggering Replacement	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	0.00
Cost																		
Future Life Cycle Cost	6.64	6.64	6.57	6.57	5.38	6.31	6.31	6.17	6.17	2.52	2.52	5.91	5.91	5.84	5.84	0.00	0.00	5.24
Rigid Frame Replacement Costs	4.45	0.00	4.45	4.45	4.45	4.45	0.00	4.45	4.45	0.00	0.00	4.45	0.00	4.45	4.45	0.00	0.00	4.45
Certainty of Property Available to Implement Project	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	0.00
Final Score	64.41	50.38	64.78	63.19	61.44	72.75	59.77	74.10	73.10	55.23	54.27	80.33	67.26	81.66	80.07	45.06	43.59	55.59

Sensitivity Testing

It should be recognized that the scope of the evaluation and determination of weights for the evaluation criteria are a matter of professional judgment. Accordingly, it is considered essential to conduct sensitivity testing to determine if the nature of the evaluation is sensitive to the weights assigned to each criterion.

There is a spread of values among the groups of evaluators for the selection of weights. The range is dependent on the value judgment of individuals and specialists. Using the average of the group does not necessarily capture what the standard deviation was among the individual scores. Therefore, sensitivity testing is conducted to test a range of weights either higher or lower than the group's average.

For this study an independent test was undertaken which placed greater or less emphasis on a global factor and redistributing the weight to the other factors using the average values of the TAC. A separate test was completed for each factor using the highest weight given by anyone in the TAC as well as the lowest weight.

Following this methodology a series of tests will be completed varying the weight for each global factor. The three tests include:

- Average TAC Weight
- Highest Weight in a factor group by any TAC member
- Lowest Weight in a factor group by any TAC member

Following this series of tests, the results are reviewed to assess whether the preferred alternative changed when the weights were varied.

Using this information alone is not the only justification for selecting a particular alternative, but it provides a level of confidence in the selection and the ability to assess trade-offs. This information is considered and used in the decision-making process before a TPA is recommended to be carried forward. The sensitivity testing was presented at PIC No. 2.

Main Street and the Rideau Canal sensitivity test results are described in the following section, and the other 5 bridge site sensitivity test results are in **Appendix C – Analysis and Evaluation Report**.

Main Street Sensitivity Testing Results

The sensitivity test results for the Main Street eastbound and westbound bridges showed that the preferred alternative, Alternative B-C1-e, was affected by a high weight for Natural Environment, Social Environment, Heritage Resources and Economic Environment and Cost, as well as a low weight for Transportation and Structural. Alternative A-A2-e (conventional rehabilitation) rated first when a high weight was given for Natural Environment, Social Environment, Heritage Resources, Economic Environment and Cost. Alternative A-A2-e (conventional rehabilitation) does not require removal and reinstatement of the Former Gas Station/Salon and requires a smaller area of Ballantyne Park as a laydown area for construction (rather than a bridge staging site for the rapid replacement), which is why it rated highest for these global factors. The effects can be mitigated for the overall preferred alternative (Alternative B-C1 rapid replacement). Alternative B-B1-e (conventional replacement) rated highest for a low weight on transportation and Alternative A-A1-e (rapid rehabilitation) rates highest for a low weight on structural. The team acknowledges these trade-offs and endorses carrying forward Alternative B-C1-e as the best-balanced alternative. **Table 5.6** tabulates the results of the sensitivity test for the Main Street bridges.

Table 5.6: Summary of Main Street Sensitivity Testing Results

ALTERNATIVE		Alt A-A1-e	Alt A-A2-e	Alt B-B1-e	Alt B-C1-e
SCORE		64.54	68.67	54.97	70.21
TAC Weights		3	2	4	1
Transportation	High	3	2	4	1
	Low	4	2	1	3
Natural Environment	High	2	1	4	3
	Low	3	2	4	1
Social Environment	High	2	1	4	3
	Low	3	2	4	1
Heritage Resources	High	2	1	4	3
	Low	3	2	4	1
Economic Environment	High	2	1	4	3
	Low	3	2	4	1
Structural	High	4	3	2	1
	Low	1	2	4	3
Cost	High	2	1	4	3
	Low	3	2	4	1

Rideau Canal Sensitivity Testing Results

The sensitivity test results for the Rideau Canal eastbound and westbound bridges showed that the preferred alternative, Alternative D-4, was affected by a high weight on Social Environment and Heritage Resources. The preferred alternative, Alternative D-4, has short term impacts on Ballantyne Park (construction laydown area - impacts will be mitigated by providing a small area for dog walkers and reinstatement of landscaping). 221 Echo Street is also impacted by the preferred alternative (acquisition and removal of building from property) and therefore rated second when a high weight is given to Social Environment and Heritage Resources. The team acknowledges these trade-offs and endorses carrying forward Alternative D-4 as the best-balanced alternative. **Table 5.7** tabulates the results of the sensitivity test for the Rideau Canal eastbound and westbound bridges.

Table 5.7: Summary of Rideau Canal Sensitivity Testing Results

		Alt A-2B	Alt A-2C	Alt A-4	Alt A-5	Alt A-6	Alt B-2B	Alt B-2C	Alt B-4	Alt B-5	Alt C-4	Alt C-5	Alt D-2B	Alt D-2C	Alt D-4	Alt D-5	Alt E-4	Alt E-5	Alt F
FACTORS	WEIGHT	64.41	50.38	64.78	63.19	61.44	72.75	59.77	74.10	73.10	55.23	54.27	80.33	67.26	81.66	80.07	45.06	43.59	55.59
TAC Weights		9	16	8	10	11	6	12	4	5	14	15	2	7	1	3	17	18	13
Transportation	High	10	17	6	8	9	7	15	3	4	12	14	5	11	1	2	16	18	13
	Low	8	16	9	10	12	5	11	4	6	14	15	2	7	1	3	17	18	13
Natural Environment	High	8	16	9	10	12	5	11	4	6	14	15	2	7	1	3	17	18	13
	Low	9	16	8	11	10	6	12	4	5	13	15	3	7	1	2	17	18	14
Social Environment	High	8	16	9	10	11	6	12	5	4	14	15	1	7	2	3	17	18	13
	Low	9	16	7	10	11	6	12	4	5	13	14	3	8	1	2	17	18	15
Context Sensitive Design	High	11	18	10	12	14	6	13	4	5	8	9	2	7	1	3	16	17	15
	Low	8	14	7	9	10	6	13	4	5	15	16	2	11	1	3	17	18	12
Heritage Resources	High	9	14	11	13	12	4	8	5	6	15	16	1	7	2	3	17	18	10
	Low	9	15	7	8	11	6	14	4	5	12	13	3	10	1	2	17	18	16
Land Use and Property	High	8	16	9	10	11	5	12	4	6	14	15	2	7	1	3	17	18	13
	Low	10	16	8	9	11	6	12	4	5	13	14	3	7	1	2	17	18	15
Structural	High	9	15	8	10	12	6	11	4	5	13	14	3	7	1	2	17	18	16
	Low	9	16	8	11	10	6	13	4	5	14	15	2	7	1	3	17	18	12
Cost	High	8	14	7	9	10	6	12	4	5	15	16	2	11	1	3	17	18	13
	Low	10	17	8	12	14	6	9	4	5	11	13	2	7	1	3	16	18	15

5.4 Selection of Technically Preferred Alternatives

The TPA's identify the preferred rehabilitation or replacement approach at all the bridge sites, taking into account the technical analysis, environmental considerations and comments of all study participants.

The TPA's were presented to the public and external stakeholders at the second PIC. Refinements, described in **Section 0**, were presented at the third PIC.

The analysis and evaluation of alternatives for the future bridge management plan for the rigid frame bridges was undertaken considering the performance of alternatives using the Multi-Attribute Trade-off System (MATS) evaluation process. This process characterizes the performance and effects of alternatives considering environmental effects (natural, social and cultural environments), societal transportation performance (safety and delays) and costs (capital and life cycle costs). The MATS process provides a traceable tool for quantifying differences among alternatives and ranking the relative preferences between alternatives. This evaluation also examined whether the bridge management approach would include a second major rehabilitation (the first rehabilitations occurred in 1984/85) of the existing rigid frame bridges in approximately 2028 followed by replacement (possibly in the 2055 planning horizon), or replacement (in approximately 2028) as the next cycle of bridge management.

Rigid Frame Bridge Recommendations

Based on the MATS evaluation, the technical evaluation initially rated the rapid replacement project followed by future rehabilitation as the preferred approach for the bridge management plan for the rigid frame bridges. A second recommendation of the evaluation team was to allow the flexibility for both rehabilitation and replacement approaches. The decision for either rehabilitation or replacement will be based on continued monitoring of the structural condition, funding availability or provincial priorities, and the potential to replace select bridges based on the current availability of staging areas to build replacement bridges. The MATS ranking and evaluation approach was only one tool used when making the decision to replace the bridges. See **Section 7.4** for the **Statement of Flexibility.**

The summary of the evaluation and statement of flexibility is provided in **Table 5.8.**

Table 5.8: Ottawa Queensway Downtown Bridges Summary of Evaluation Results – Rigid Frames

Bridge Site	MATS Evaluation Rankings/Scores			TPA (based on MATS rankings and Implementation Considerations)	Statement of Flexibility within TESR for Alternate TPA
	1st	2nd	3rd		
Metcalfe Street	Alt B-C1-e / 82.25	Alt A-A2-e / 60.80	Alt A-A1-e / 59.22	Rapid Replacement (Alt B-C1-e)	Conventional Rehabilitation (Alt A-A2-e)
Elgin Street	Alt B-C1-e / 85.00	Alt A-A2-e / 58.34	Alt B-B1-e / 52.96	Rapid Replacement (Alt B-C1-e)	Conventional Rehabilitation (Alt A-A2-e)
Main Street	Alt B-C1-e / 70.21	Alt A-A2-e / 68.67	Alt A-A1-e / 64.54	Rapid Replacement (Alt B-C1-e)	Conventional Rehabilitation (Alt A-A2-e)

City of Ottawa Span Length Review Request

Upon presentation of the TPAs, the City of Ottawa requested an investigation of the span length for Elgin Street and if it would be feasible to increase the span to accommodate additional active transportation facilities.

It was determined that the requested widening would increase the capital cost of the bridge replacement by approximately $7 M as well as having additional risk that would require significant investigation including:

1. Significant settlement issues of the existing bridge.
2. Significantly increased risks and complexity in terms of the bridge replacement and footing replacement.
3. Increased scheduling risks to complete the rapid bridge replacement in 3 consecutive days.

A longer span bridge at Elgin Street was not recommended.

Rideau Canal Bridge Recommendations

Both rapid replacement and conventional rehabilitation alternatives were considered at the Rideau Canal Bridge site. A wide range of potential bridge alternatives was considered, including two "high level" bridges (an extrados and an arch type). Construction methodology alternatives considered rapid replacement technology including a jack and slide method, and an "SPMT elevator" method (see **Section 5.3**). The alternatives considered effects to Federal lands, such as the Rideau Canal (owned by Parks Canada) and the two parkways (owned by NCC) as well as impacts to year-round users of the Canal. The technical evaluation ranked the single Jack and Slide alternative installed from the side as the preferred alternative. The preferred bridge replacement alternative removes piers from the Canal (which provides a greater navigational clearance) as well as providing a more slender deck to improve the visual experience along the Canal at this location. Furthermore, the preferred bridge replacement alternative complies with the *Standard and Guidelines for Conservation of Historic Places in Canada* Standard 11 in that it is compatible with, subordinate to and distinguishable from the existing surroundings (including the Pretoria Bridge), providing the best-balanced solution for the location. The selection criteria included input from the FAC (Parks Canada and NCC).

Additionally, Alternative D provides a canvas to add architectural detailing such as end treatments or surface treatments (such as a decorative façade) to enhance the bridge within the surroundings, without detracting from the World Heritage Site/National Historic Site of Canada that is the Rideau Canal.

The ranking and ratings of the alternatives are summarized in **Table 5.9**.

Table 5.9: Ottawa Queensway Downtown Bridges Summary of Evaluation Results – Rideau Canal

Bridge Site	MATS Evaluation Rankings/Scores			TPA (based on MATS rankings and Implementation Considerations)	Statement of Flexibility within TESR for Alternate TPA
	1st	2nd	3rd		
Rideau Canal	Alt D-4/ 81.66	Alt D-2B/ 80.33	Alt D-5/ 80.07	Jack and Slide Sides Replacement (Alt D-4)	Conventional Rehabilitation (Alt F)

6. RIDEAU CANAL BRIDGE REFINEMENTS

The TPA's were presented to the public, stakeholders and agencies at PIC No. 2 (August 2019) and the City of Ottawa Transportation Committee (October 2019). The following concerns were raised during the consultation period:

1. High voltage transmission hydro ducts are buried on the east and west sides of the Rideau Canal and are impacted by the placement of the piers.
2. Acquisition and possible demolition of 221 Echo Drive and 3/5 Hawthorne Avenue. 221 Echo Drive is a community asset and 3/5 Hawthorne Avenue is on the City of Ottawa's Heritage Register for potential heritage value.

This chapter describes the refinements that were developed, analyzed and evaluated following the second PIC to reduce the residual impacts of the project. These refinements were reviewed by technical staff of the NCC, Parks Canada and City of Ottawa as well as the public at a third PIC in the fall of 2022. The following sections describe the two refinements to the TPA:

- Pier location modifications to avoid the Hydro One high voltage transmission cables; and
- Construction staging modification for the Rideau Canal Bridges.

No refinements were considered at the rigid frame bridges recommendations post PIC No. 2.

6.1 Pier Location Refinements

Further technical investigations were completed to define the alignment of the existing 115 kV Hydro One high voltage buried cables along the Colonel By Drive and Queen Elizabeth Driveway parkways. The Hydro cables follow a variable alignment on each side of the canal (behind the existing canal walls), which is in direct conflict with the columns/footings of the new piers illustrated at PIC No. 2. Cost estimates from Hydro One estimated the relocation of the cables to be in the order of $12 million per cable. Therefore, the locations of the piers were re-evaluated, without changing the overall structural design philosophy.

The following pier refinement alternatives were developed and evaluated:

- Alternative 1a: Shift the piers immediately behind the canal walls.
- Alternative 1b: Shift the piers in front of canal walls in-water.
- Alternative 1c: Shift the piers to allow minimum offsets to hydro ducts and relocate canal walls (approx. 1 m shift on a smooth alignment of walls in a new location).
- Alternative 1d: Shift the piers to be integrated with the canal walls either centred on the wall or immediately inside the canal walls.
- Alternative 1e: Piers to remain in existing location in the canal (no conflict with hydro lines or retaining walls).

The rationale for not carrying forward alternatives is described as follows:

- Alternative 1a conflicts with the hydro ducts due to insufficient clearances as required by Hydro One and therefore **not recommended to be carried forward**.
- Alternative 1b conflicts with the pile locations of the existing piers which must remain in place until the new bridge is installed and therefore **not recommended to be carried forward**.
- Parks Canada is not in support of Alternative 1c to shift the canal walls because the wall locations are part of the UNESCO World Heritage Site application and approved designation. Major justification and documentation would be required to demonstrate the need to move the canal walls and would set a precedent for national cultural heritage assets. Alternative 1c is therefore **not recommended to be carried forward**.
- Alternative 1e is **not recommended to be carried froward** as Parks Canada's main goal as a participant in the study was to have the piers relocated from the water.

Alternative 1d received support from Parks Canada and NCC as a compromise approach to maintain the canal walls in their current position with either the pier alignment being centred on the wall, or expanding for the width of the pier inside the canal walls (in-water). Benefits of Alternative 1d include:

- Integrated walls/piers design;
- Maintains the existing location of the walls reflected in the UNESCO World Heritage Site designation of the canal;
- Avoids the impact to the Hydro One high voltage 115 kV lines;
- Offsets the new piles from the piles of the existing piers (that are in the water);
- Piers can be designed as part of the landscape; and
- The preliminary design reflects a concept that will be further refined in detail design but as part of the EA Parks Canada and the NCC accepted approval in principle of this approach.

Additional design and rendering drawings of this alternative are illustrated in **Figure 6-1** and **Figure 6-2**.



Figure 6-1: Alternative D New Pier Location Rendering



Figure 6-2: Alternative D New Pier Location Rendering

6.2 Construction Staging Refinement Alternatives

Based on the comments received during the consultation period for PIC No. 2, the Project Team then reviewed the possible staging alternatives for the Rideau Canal Bridge to minimize impacts to the existing buildings along Echo Drive and Hawthorne Avenue. The refinement alternatives include:

1. Alternative 1: Original TPA shown to the public at PIC No. 2, see **Figure 6-3**.
2. Alternative 2: Minor revisions to Alternative 1 to reduce impacts to property owners, see **Figure 6-4**.
3. Alternative 3: Stage both bridges to the north of the existing Queensway to avoid impacts to properties on Echo Drive and Hawthorne Avenue, see **Figure 6-5**.

The evaluation of the construction staging refinement alternatives is illustrated in **Table 6.1**. Alternative 3 (stage both bridges to the north of the existing Queensway) is recommended to be carried forward as the recommended Construction Staging alternative. Alternative 3 mitigates permanent impacts to community buildings and avoids spanning the 1220 mm diameter regional watermain. Mitigation for the temporary loss of parking for the Tiffany Apartments (from outdoor parking on Catherine Street) and short term (2-year) closure of the parkways will be investigated during Detail Design.

Table 6.1: Evaluation of Construction Staging Refinement Alternatives

Issue	Alternative 1	Alternative 2	Alternative 3
Permanent Impacts to Community Buildings	Poor (2 properties)	Fair (1 property)	Good (0 properties)
Risk of Impact to Regional Watermain	Yes	Yes	No
Duration of Queensway Closure	4 days	4 days	4 days
Closures of Parkways (Roads and Pathways)	Required	Required	Required
Impact to Marine Navigation	Minimized/mitigated (25 m navigation channel to be maintained)		
Technical Recommendation	**Not carried forward**	**Carried forward (Statement of Flexibility)**	**Preferred Alternative**

Alternative 3 is the Preferred Alternative for the construction staging of the Rideau Canal Bridge works. Alternative 2 was recognized as feasible and has greater impacts to the community. The EA has incorporated this as a Statement of Flexibility should conditions during the Detail Design require a change in the construction methodology due to a constraint unforeseen during the EA.

Figure 6-3: Construction Stage Alternative Refinement 1 (Original TPA Shown at PIC No. 1)

Figure 6-4: Construction Stage Alternative Refinement 2

Figure 6-5: Construction Stage Alternative Refinement 3

7. DESCRIPTION OF RECOMMENDED PLAN

7.1 Recommended Plan

The Recommended Plan is presented in this section for two separate groups of bridges with similar structural designs. It describes the group of three medium span rigid frame bridge sites (five structures) and the Rideau Canal Bridge site (two longer 3-span structures).

7.2 Rigid Frame Bridges (Metcalfe Street, Elgin Street and Main Street)

The group of rigid frame bridges includes:

- One single rigid frame structure at Metcalfe Street (carrying both eastbound and westbound lanes of the Queensway);
- Two rigid frame structures at Elgin Street (each carrying either eastbound or westbound lanes); and
- Two rigid frame structures at Main Street (each carrying either eastbound or westbound lanes).

7.2.1 Bridge Management Plan

The 5 rigid frame bridges are located at Metcalfe Street, Elgin Street and Main Street. The EA study has recommended the replacement of all of the rigid frame bridges using complete closures of the Queensway for the traffic management in 3 consecutive days in combination with accelerated bridge construction techniques. The construction techniques will include the use of rapid replacement technology accessing the sites from nearby construction staging areas. This rapid replacement technology has been used successfully on the adjacent Mid-town bridge projects.

7.2.2 Traffic Management Plan

This section of the Queensway has an 8-lane urban freeway cross section (4 lanes per direction) with narrow shoulders. The section of Highway 417 (Ottawa Queensway) within the downtown accommodates AADT volumes exceeding 170,000 vehicles/day (veh/d). The Queensway experiences an “Urban Commuter” traffic pattern which is indicative of low daily and seasonal variations in demand (i.e. repetitive usage profiles).

Note: All durations of work provided in this report for traffic staging are initial estimates only (at a Preliminary Design level of detail) and may be subject to change during the Detail Design stage.

7.2.2.1 Municipal Street Closures

For the rapid replacement of the Metcalfe Street, Elgin Street and Main Street bridges there will be a full Queensway closure for 3 days using the detour routes as described in the following sections. The municipal traffic detour plans have been reviewed by the City of Ottawa staff during the EA phase of the project. The temporary traffic detour routes for pedestrians, cyclists, transit and vehicles are described in the following sections. This will include short term closure of each City of Ottawa street (Metcalfe Street, Elgin Street and Main Street) for a minimum of 3 weeks in advance of the 3-day closure. Additional detour routes have been defined for the 3-day closure. The municipal streets will be re-opened after the rapid bridge replacement and roadway reinstatement - expected to be after the 3-day replacement. These durations and detour routes will be finalized during the Detail Design stage of the project and may be subject to change. Detour routes have been prepared for both the 3-week municipal street closure as well as a separate detour route for the 3-day bridge replacement move.

The vehicular detour routes for the re-routed Queensway traffic for the rapid replacement of the bridges are described in the following sections. The City of Ottawa has provided input on these short-term detour routes during the MTAC meetings.

7.2.2.2 Metcalfe Street Bridge Replacement Detour

Metcalfe Street is a one-way northbound arterial with no OC Transpo route along the corridor. During the 3-week Metcalfe Street closure, traffic will be detoured to either O’Connor Street or Bank Street as shown in **Figure 7-1**. The pedestrian, cyclist and truck detour routes are shown in **Figure 7-2** and **Figure 7-3**. During the 3-day closure for the Metcalfe Street bridge replacements, traffic will be detoured to Kent Street or O’Connor Street, depending on the origin of the traffic (i.e. from the Queensway or from Metcalfe Street travelling northbound), see **Figure 7-4**. The pedestrian, cyclist and truck detour routes are shown in **Figure 7-5** and **Figure 7-6**. It should be noted that Catherine Street will be closed during the 3-day removal and replacement and pedestrians and cyclists require a longer detour for that time. The Metcalfe Street off-ramp will remain open during the 3-week advance closure and will be closed during the 3-day bridge replacement (with advance signage).

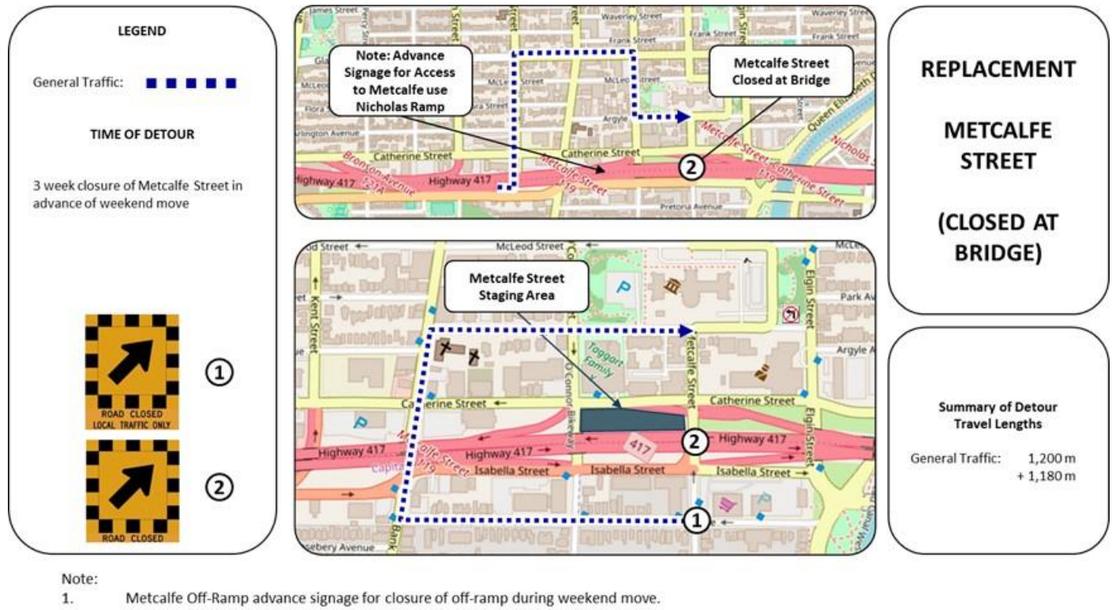
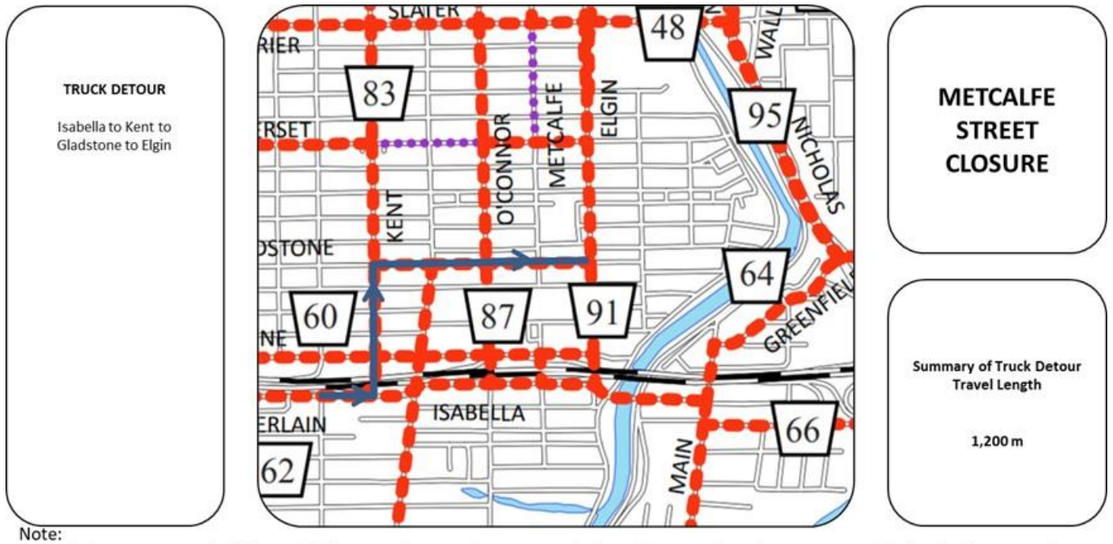


Figure 7-1: Metcalfe Street General Traffic Detour – 3 Week Advance Closure

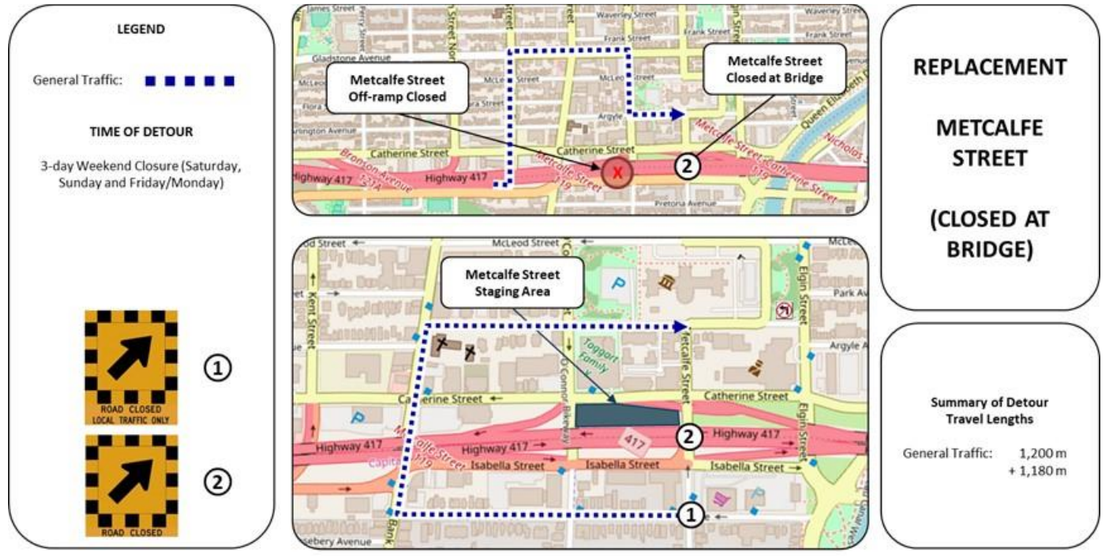


Figure 7-2: Metcalfe Street Pedestrian and Cyclist Detour – 3 Week Advance Closure



Note:
1. Vehicles cannot turn left from Isabella to NB Elgin. Trucks must travel along designated truck routes, except for local deliveries and are not permitted on NCC parkways (QED or CBD)
2. Metcalfe is a one-way northbound road. Trucks are only permitted to travel on Metcalfe from Isabella to Catherine Street.

Figure 7-3: Metcalfe Street Truck Detour – 3 Week Advance Closure



Note:
1. Metcalfe Off-Ramp requires crossing 3 lanes to turn right onto O'Connor Street. Recommend closing Metcalfe Off-ramp and directing traffic from Kent off-ramp.

Figure 7-4: Metcalfe Street General Traffic Detour – Weekend Lift (2 or 3-day)

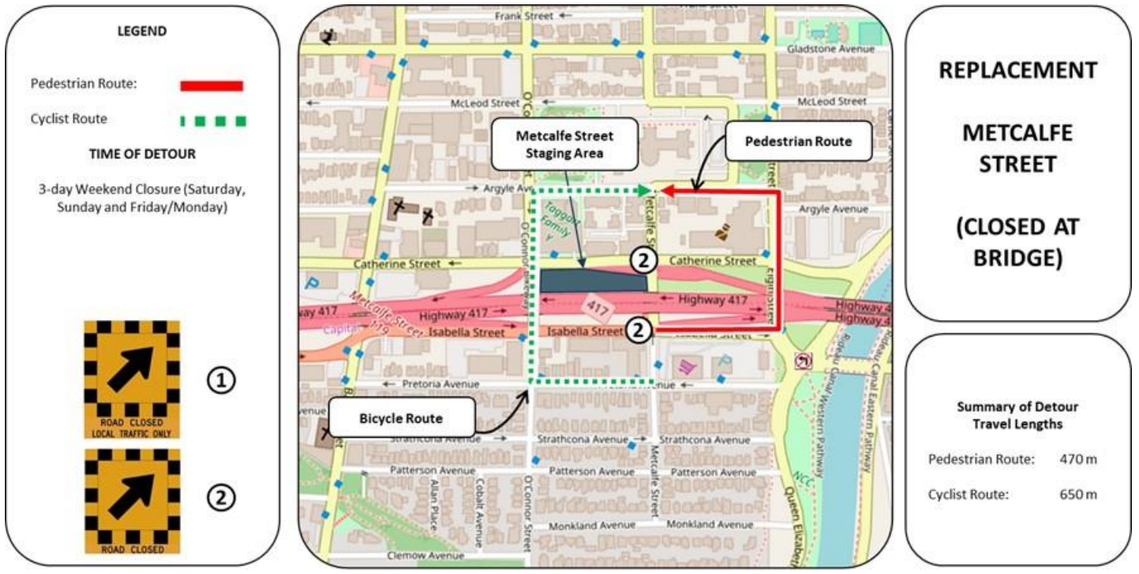
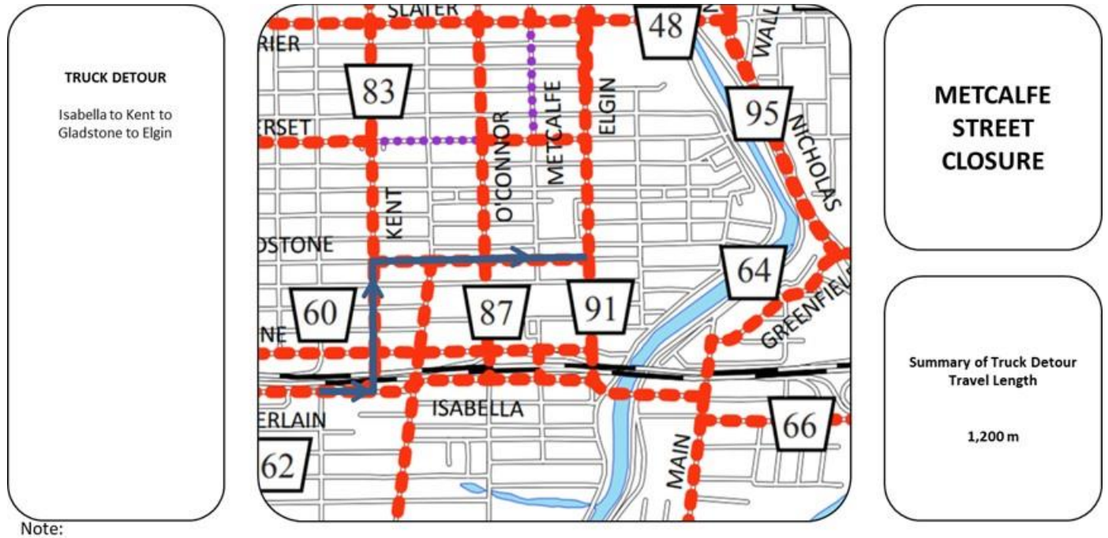
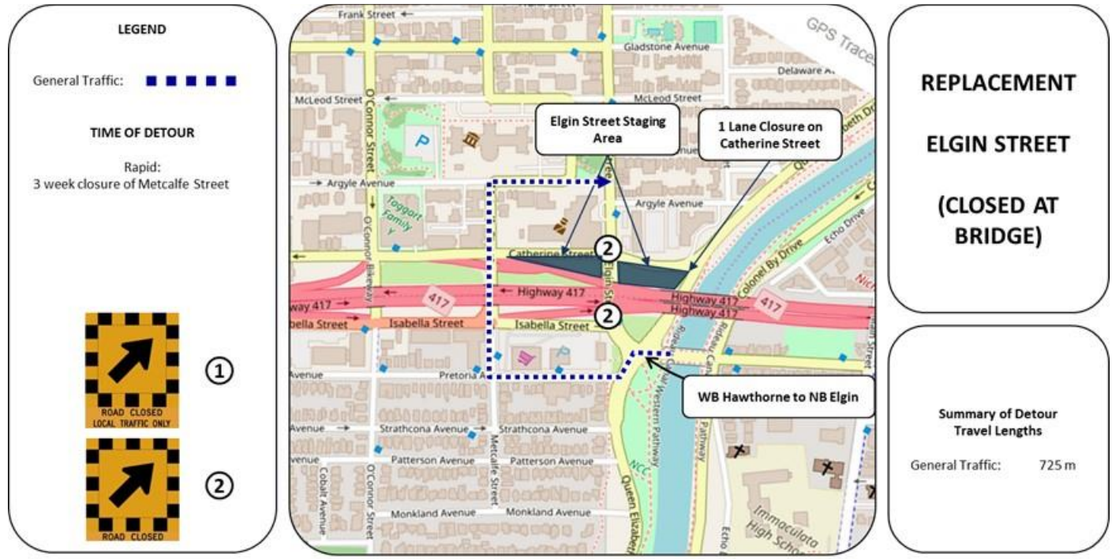


Figure 7-5: Metcalfe Street Pedestrian and Cyclist Detour – Weekend Lift (2 or 3-day)



Note:
1. Vehicles cannot turn left from Isabella to NB Elgin. Trucks must travel along designated truck routes, except for local deliveries and are not permitted on NCC parkways (QED or CBD)
2. Metcalfe is a one-way northbound road. Trucks are only permitted to travel on Metcalfe from Isabella to Catherine Street.

Figure 7-6: Metcalfe Street Truck Detour – Weekend Lift (2 or 3-day)



Note:
1. Current conditions do not permit left turns from NB QED to NB Elgin. No detour required.
2. Where possible, detours from city streets to city streets is preferred.

Figure 7-7: Elgin Street Northbound General Traffic Detour – 3 Week Advance Closure

7.2.2.3 Elgin Street Bridge Replacement Detour

Elgin Street carries vehicular traffic travelling northbound and southbound, OC Transpo route 5 as well as pedestrian and cyclist movement to the Rideau Canal. During the 3 week Elgin Street closure, traffic will be detoured as shown on **Figure 7-7** and **Figure 7-8.** The pedestrian and detour routes are shown in **Figure 7-9**. The Elgin Street transit detours for Routes 5, 101/103 eastbound and 16/101/103 westbound are illustrated in **Figure 7-10**, **Figure 7-11** and **Figure 7-12**, respectively. The northbound and southbound truck detours are illustrated in **Figure 7-13** and **Figure 7-14**, respectively. Additionally, Catherine Street will be reduced to one lane during the 3-week municipal street closure as an extension of the construction staging area. Catherine Street will be closed during the 3-day bridge replacement to allow the SPMT's to travel along Catherine Street to Elgin Street. During the 3-day move, northbound and southbound traffic will be detoured, as shown on **Figure 7-15** and **Figure 7-16,** respectively. The pedestrian and cyclist detours are illustrated in **Figure 7-17**, and the northbound and southbound truck traffic detours are illustrated in **Figure 7-18** and **Figure 7-19**, respectively.



Note:
1. Rapid Replacement requires closure of Catherine Street from Metcalfe Street to Elgin Street
2. Where possible, detours from city streets to city streets is preferred.

Figure 7-8: Elgin Street Southbound General Traffic Detour – 3 Week Advance Closure

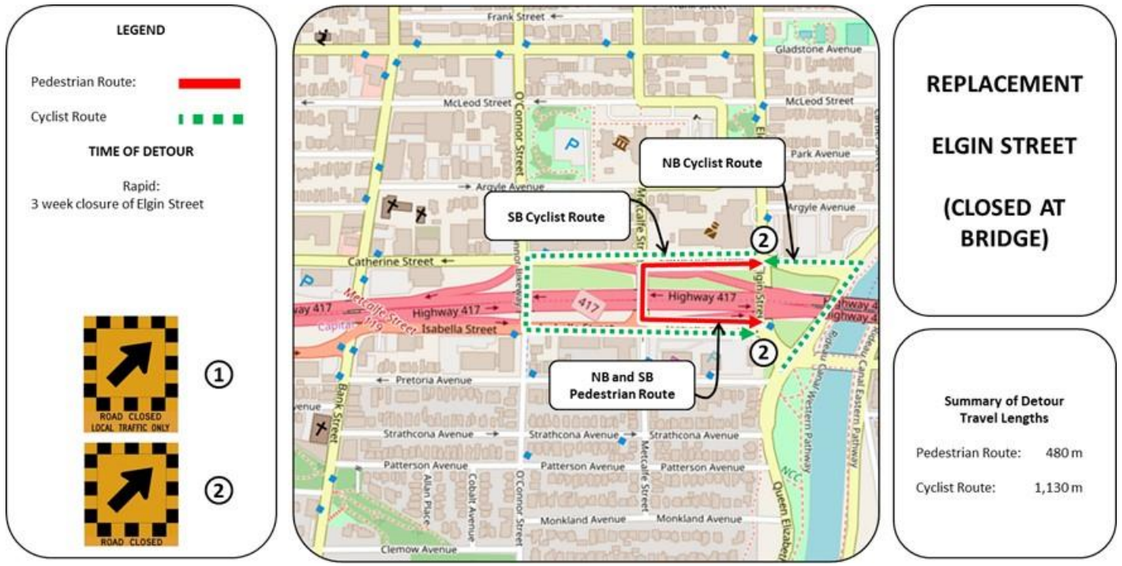


Figure 7-9: Elgin Street Pedestrian and Cyclist Detour – 3 Week Advance Closure

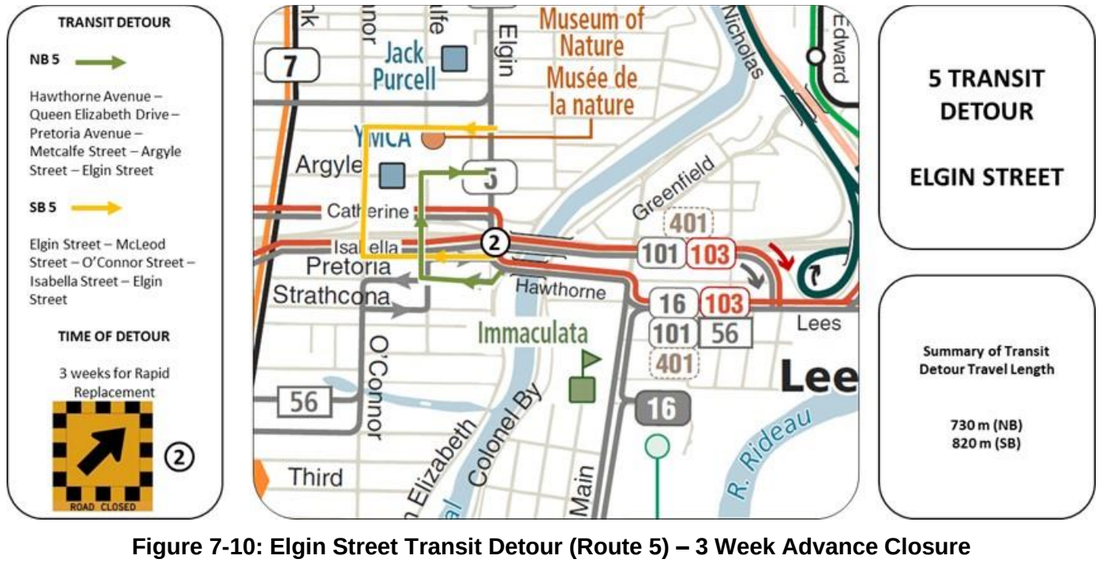


Figure 7-10: Elgin Street Transit Detour (Route 5) – 3 Week Advance Closure

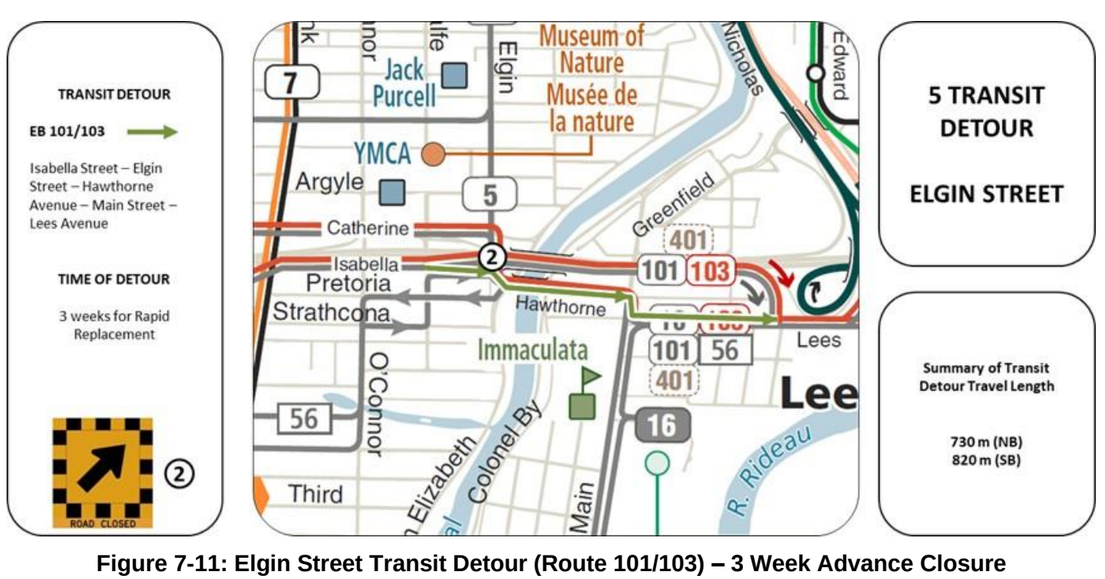


Figure 7-11: Elgin Street Transit Detour (Route 101/103) – 3 Week Advance Closure

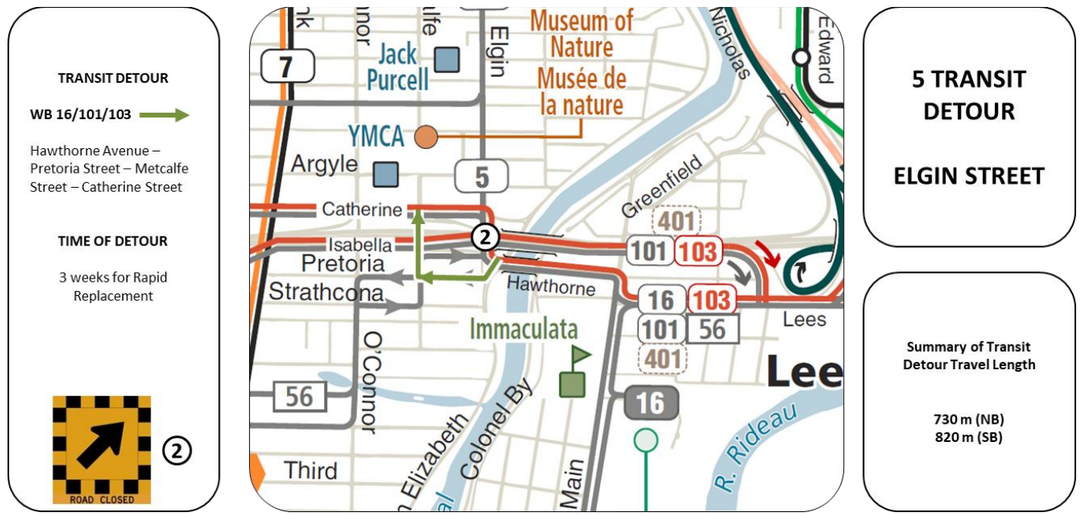
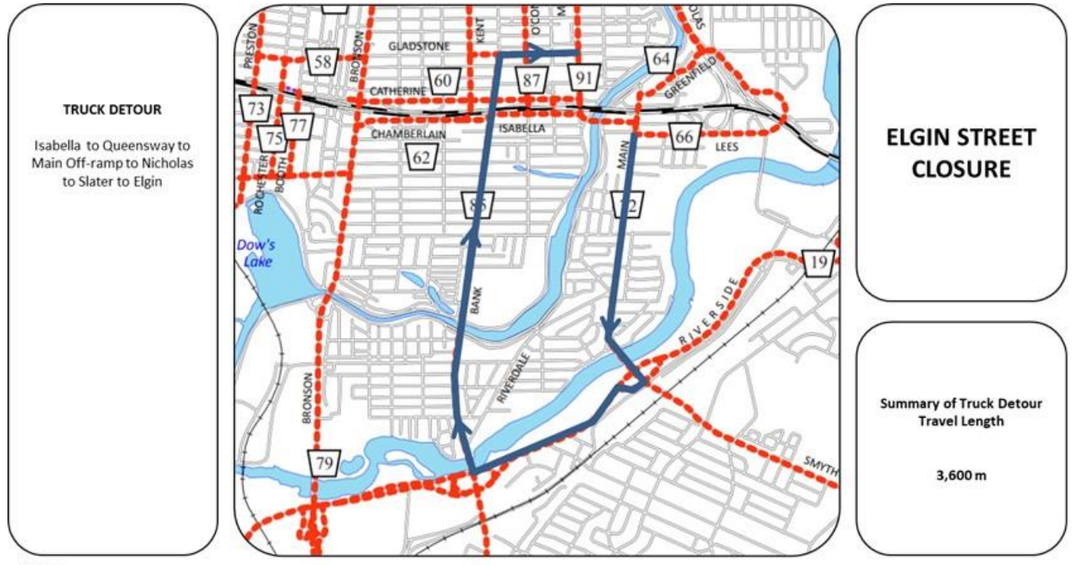
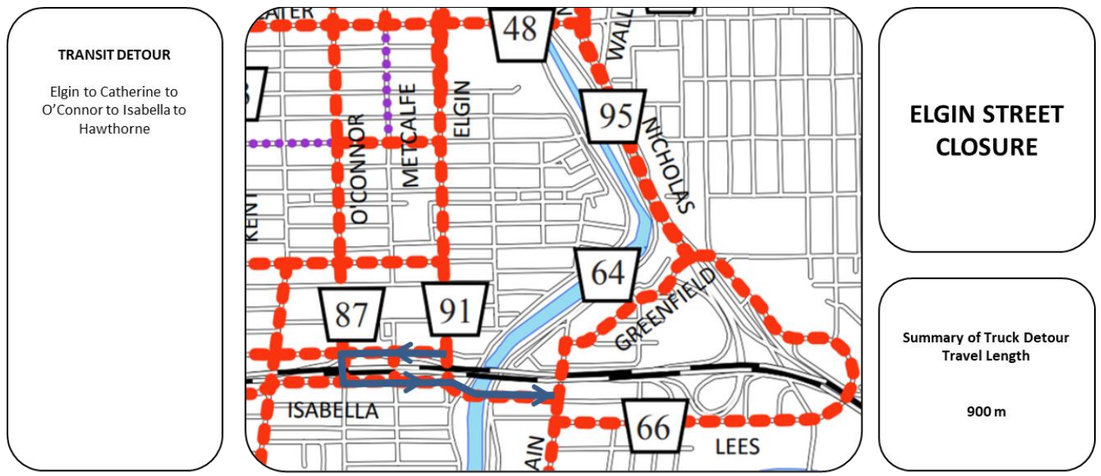


Figure 7-12: Elgin Street Transit Detour (Route 16/101/103) – 3 Week Advance Closure



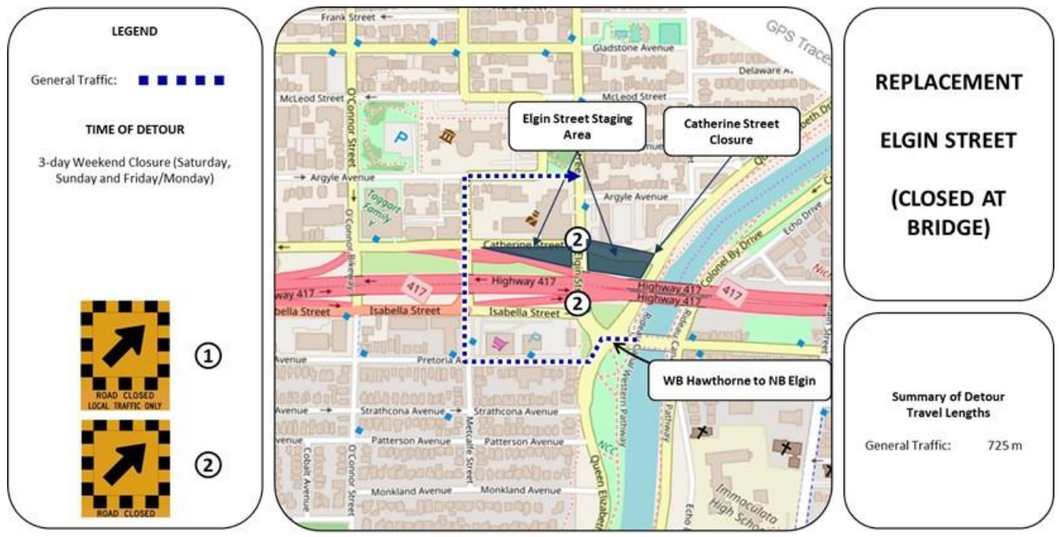
Note:
1. Vehicles cannot turn left from Isabella to NB Elgin.
2. Trucks impacted by Elgin Street closure must be travelling from WB Hawthorne Street to NB Elgin Street or SB Elgin to EB Hawthorne. Trucks must travel along designated truck routes, except for local deliveries and are not permitted on NCC parkways (QED or CBD)
3. Metcalfe is a one-way northbound road. Trucks are only permitted to travel on Metcalfe from Isabella to Catherine Street.

Figure 7-13: Elgin Street Northbound Truck Detour – 3 Week Advance Closure



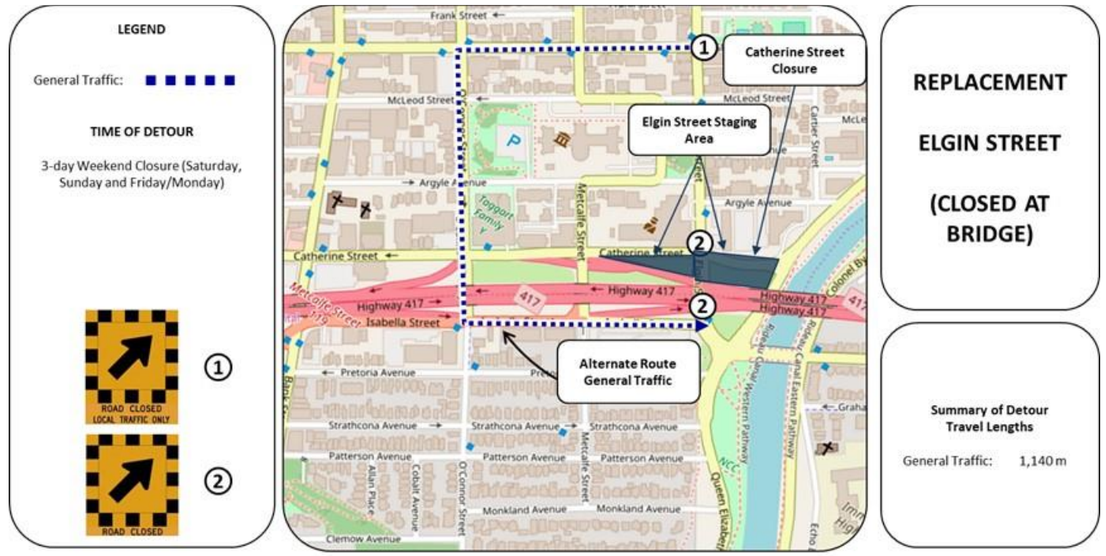
Note:
1. Vehicles cannot turn left from Isabella to NB Elgin. Trucks impacted by Elgin Street closure must be travelling from WB Hawthorne Street to NB Elgin Street or SB Elgin to EB Hawthorne. Trucks must travel along designated truck routes, except for local deliveries and are not permitted on NCC parkways (QED or CBD)
2. Metcalfe is a one-way northbound road. Trucks are only permitted to travel on Metcalfe from Isabella to Catherine Street.

Figure 7-14: Elgin Street Southbound Truck Detour – 3 Week Advance Closure



Note:
1. Current conditions do not permit left turns from NB QED to NB Elgin. No detour required.
2. Where possible, detours from city streets to city streets is preferred.

Figure 7-15: Elgin Street Northbound General Traffic Detour – 3-day Closure



Note:
1. Rapid Replacement requires closure of Catherine Street from Metcalfe Street to Queen Elizabeth Drive (including Catherine/Elgin intersection) for SPMT movement on the weekend.
2. Where possible, detours from city streets to city streets is preferred.

Figure 7-16: Elgin Street Southbound General Traffic Detour – 3-day Closure

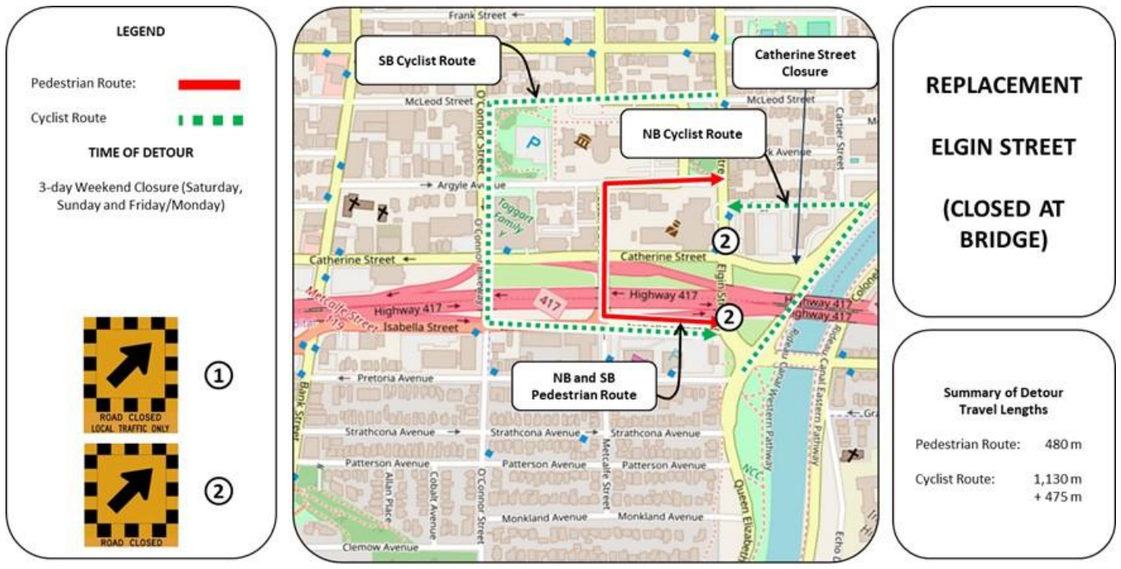
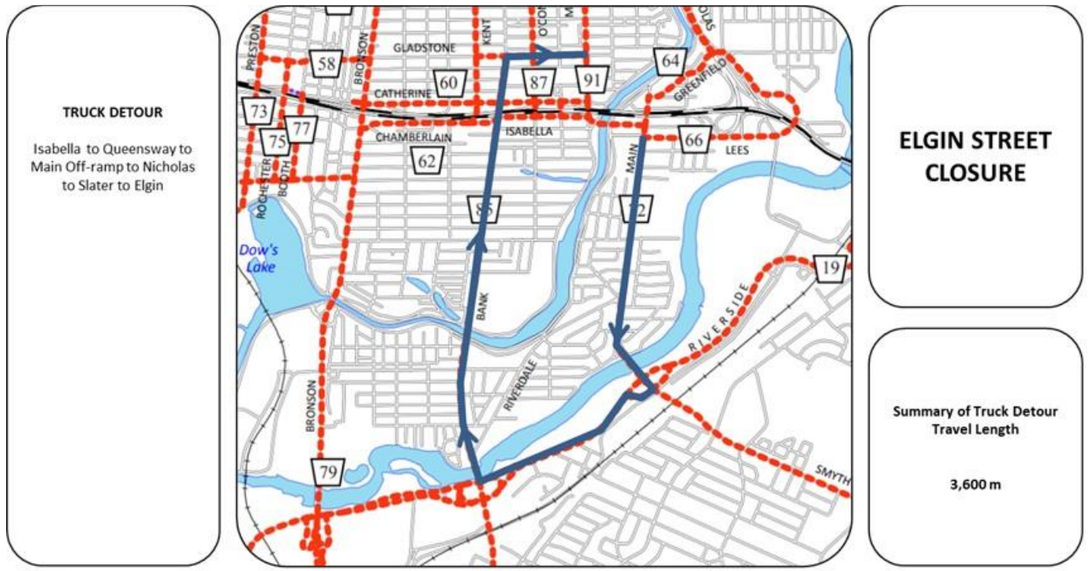
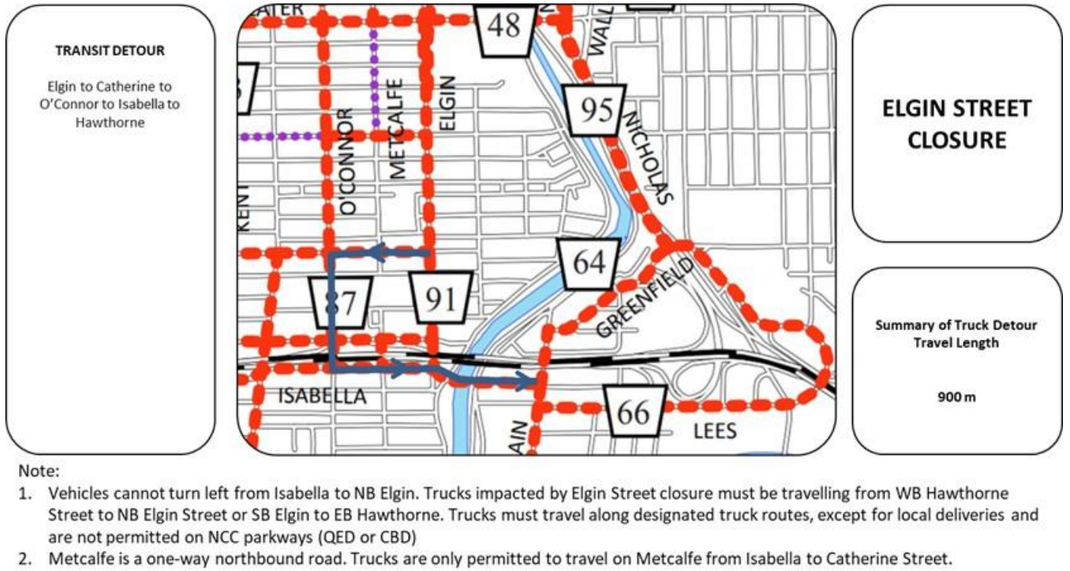


Figure 7-17: Elgin Street Pedestrian and Cyclist Detour – 3-day Closure



Note:
1. Vehicles cannot turn left from Isabella to NB Elgin.
2. Trucks impacted by Elgin Street closure must be travelling from WB Hawthorne Street to NB Elgin Street or SB Elgin to EB Hawthorne. Trucks must travel along designated truck routes, except for local deliveries and are not permitted on NCC parkways (QED or CBD)
3. Metcalfe is a one-way northbound road. Trucks are only permitted to travel on Metcalfe from Isabella to Catherine Street.

Figure 7-18: Elgin Street Northbound Truck Detour – 3-day Closure



Note:
1. Vehicles cannot turn left from Isabella to NB Elgin. Trucks impacted by Elgin Street closure must be travelling from WB Hawthorne Street to NB Elgin Street or SB Elgin to EB Hawthorne. Trucks must travel along designated truck routes, except for local deliveries and are not permitted on NCC parkways (QED or CBD)
2. Metcalfe is a one-way northbound road. Trucks are only permitted to travel on Metcalfe from Isabella to Catherine Street.

Figure 7-19: Elgin Street Southbound Truck Detour – 3-day Closure

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7.2.2.4 Main Street Bridge Replacement Detour

Main Street carries vehicular traffic travelling northbound and southbound with no OC Transpo route along the corridor as well as pedestrian and cyclist movements. During the 3-week Main Street closure, traffic will be detoured as shown in **Figure 7-20**. The pedestrian and cyclist detours are illustrated in **Figure 7-21** and the truck detour is illustrated in **Figure 7-22**. During the 3-day move, the general traffic, pedestrian and cyclist, and truck detour routes are illustrated in **Figure 7-23, Figure 7-24** and **Figure 7-25** respectively.

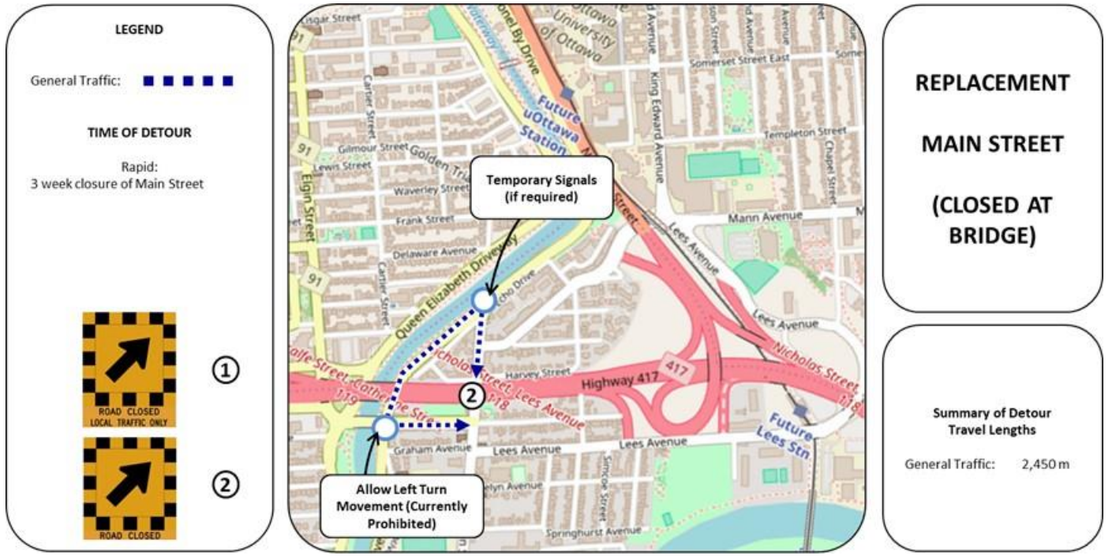

Figure 7-20: Main Street General Traffic Detour – 3 Week Advance Closure

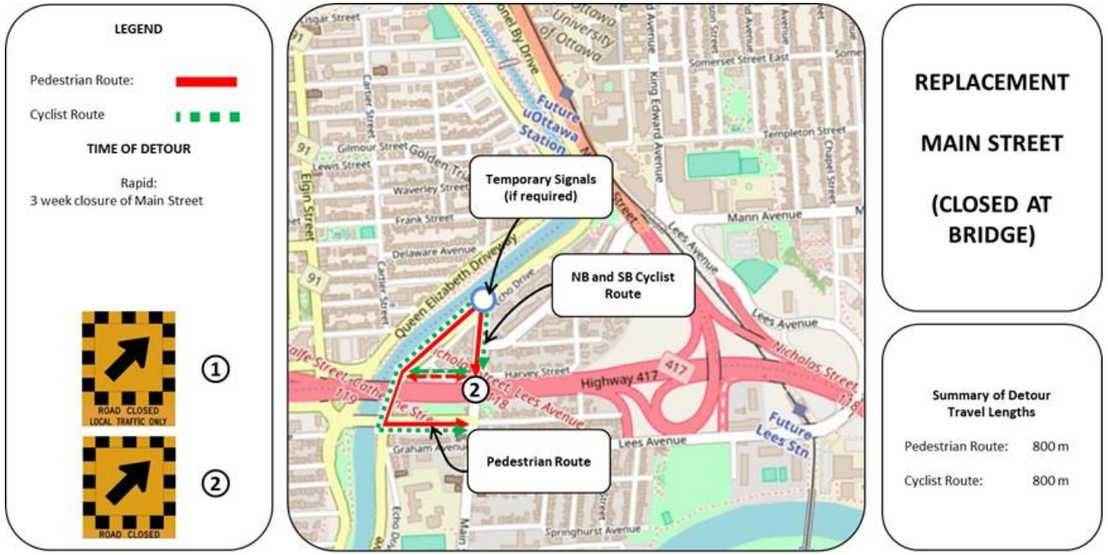

Figure 7-21: Main Street Pedestrian and Cyclist Detour – 3 Week Advance Closure

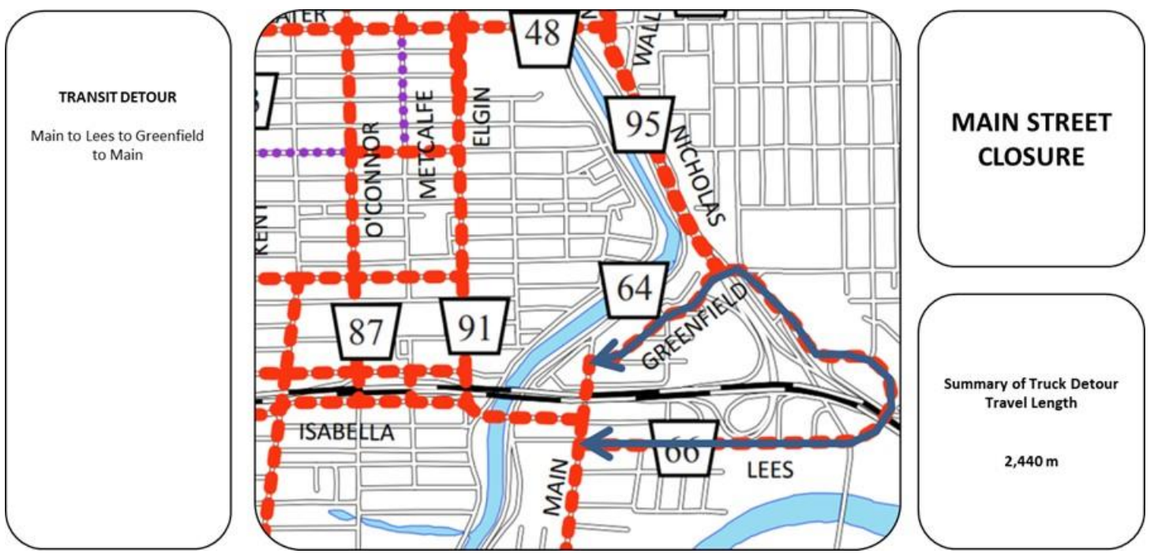

Figure 7-22: Main Street Truck Detour – 3 Week Advance Closure

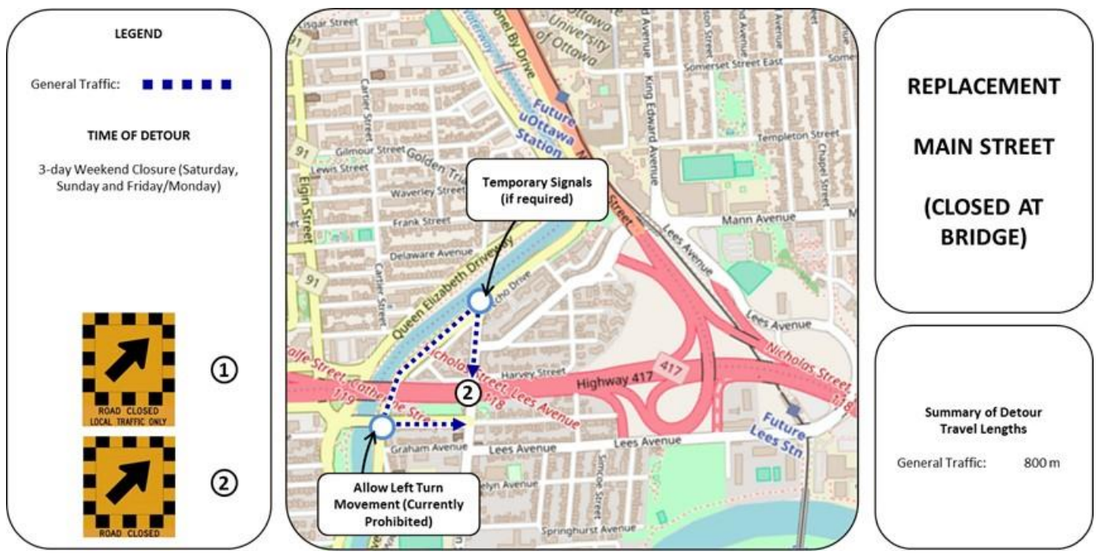

Figure 7-23: Main Street General Traffic Detour – 3-day Closure

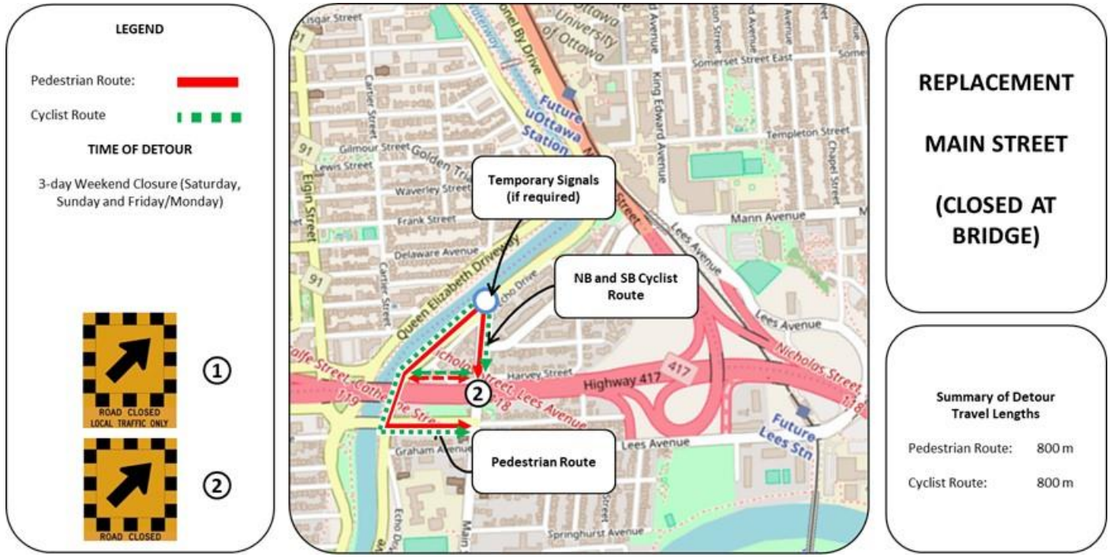

Figure 7-24: Main Street Pedestrian and Cyclist Detour – 3-day Closure

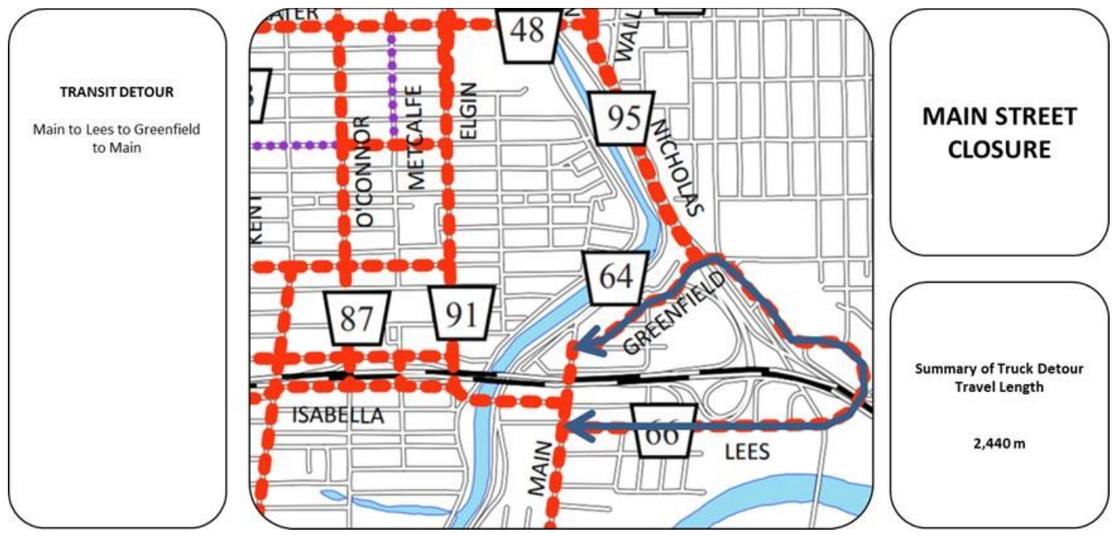

Figure 7-25: Main Street Truck Detour – 3-day Closure

7.2.2.5 Queensway Detour

The traffic management during the bridge replacements will include diversion of the Queensway to City of Ottawa municipal streets. A detour as shown in **Figure 7-26** will be set up utilizing Bronson Avenue and Riverside Drive. During this time, Bronson Avenue in the vicinity of the ramp terminals needs to be available for the travel route from the staging area to the bridge sites. The locations of the staging area and construction sites for the new bridges and laydown area for the removed bridges are described in **Section 5.3.1** for the eastbound and westbound bridges. The OC Transpo detours are described for each bridge replacement detour route in the previous sections, and truck routes are illustrated in **Figure 7-27.**



Figure 7-26: Queensway Detour Route – 3 Week Advance Closure

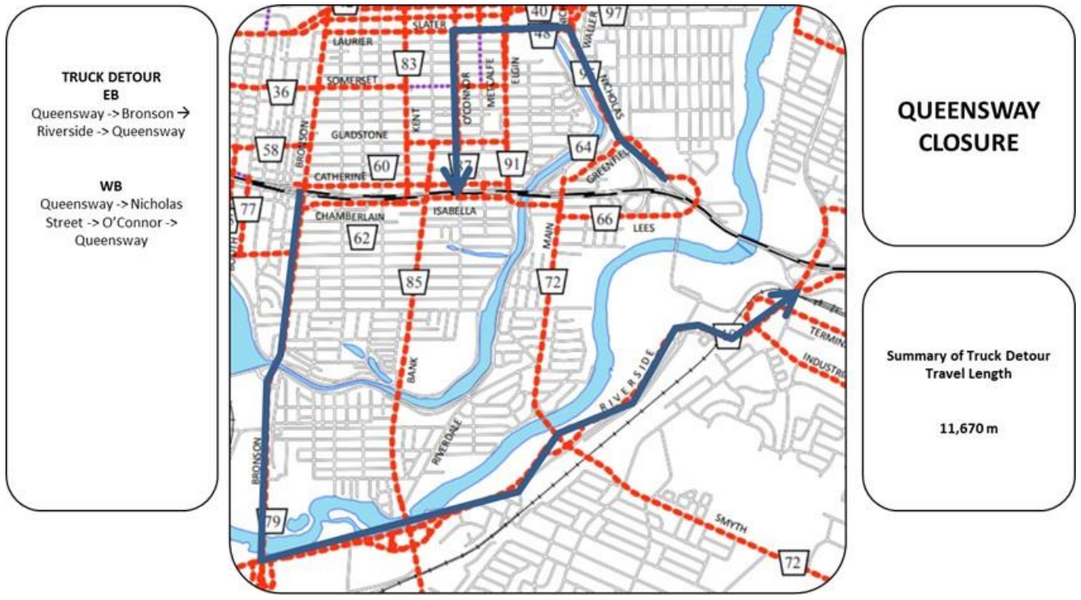

Figure 7-27: Queensway Truck Detour Route

7.2.2.6 Staging Areas for Bridge Construction

The rapid bridge replacements for the rigid frame bridges will utilize staging areas close to but not immediately adjacent to the existing bridges to construct the replacement bridges. The preferred bridge replacement staging areas for the Metcalfe Street, Elgin Street and Main Street bridges and corresponding property requirements for both are illustrated on **Figure 7-28**. These sites will potentially be in use for several construction seasons.

Photo 7.1 illustrates a sample rigid frame construction area to construct the new bridge off-site from the Queensway. The staging area may also have to accommodate the existing bridge when it is removed and transported to the staging area.



RECOMMENDED STAGING SITES FOR THE METCALFE STREET AND ELGIN STREET BRIDGES



RECOMMENDED STAGING SITES FOR MAIN STREET BRIDGE

Figure 7-28: Recommended Staging Sites for Rigid Frame Bridges



Photo 7.1: Typical Staging Area for Construction of New Rigid Frame Bridge

7.2.2.7 Temporary Ramp Closures

The following temporary ramp closures have been recommended on a short term basis (during a 3-day closure). Advance variable message signage will be in place to alert drivers of the closure in advance of the 3-day replacement operations. The recommended ramp closures will be reviewed at the Detail Design stage.

- N/S-E Ramp (Metcalfe Street Interchange)
- W-N/S Ramp (Elgin Street Interchange)

7.2.3 Description of Structural Improvements

7.2.3.1 Metcalfe Street (Rapid Replacement)

Metcalfe Street Overpass consists of one bridge, Site No. 3-065. It was built in 1965 and carries both the eastbound lanes (EBL) and the westbound lanes (WBL) of Highway 417 over Metcalfe Street. The bridge is a single-span concrete rigid frame, with a clear span of 18.3 m measured perpendicular to the abutments. The overall deck width is 30.8 m, measured perpendicular to the centreline of Highway 417. Each abutment has two retaining walls located along the north and south sides of the highway embankment.

Metcalfe Street crosses below the bridge. Two 4.1 m through-traffic lanes shift progressively towards the east to allow for a 4.1m left-turn lane. The existing cross section is completed with 2.4 m sidewalks and 0.6 m shoulders. A sidewalk is provided on both sides of the road.

The existing bridges are overall in fair-to-good condition. The decks have a few localized patches and shallow spalls on the interior of the deck soffit. The abutment walls have narrow-to-medium vertical cracks and

numerous localized delaminated areas on the lower portion of the walls. The retaining walls immediately adjoining the abutments are in fair-to-good condition, with numerous localized cracks, spalls, and concrete patches.

The recommended new bridge is a single-span rigid frame bridge with a span length the same as the existing bridge. The existing bridge will be removed, and the new bridge installed using rapid replacement technology during a single 2 or 3-day closure of the Queensway. Advance work to facilitate the bridge replacement will be required prior to the Rapid Replacement operation and will require partial and short-term full closures of Metcalfe Street. The Preliminary Design recommendation is to close the roadway for 3 weeks in advance of the replacement (with possible protected pedestrian passage until the 3-days of the lift to be investigated at the Detail Design stage).

The detour routes for pedestrians, cyclists and transit and vehicular traffic for the closure of Metcalfe Street at the Queensway are illustrated in **Section 7.2.2**.

The construction sequence for the Rapid Replacement of the bridge is as follows:

1. Construct new bridge in the staging area.
2. Install temporary supports and prepare the existing bridge for removal or prepare for rapid demolition of the bridge in place.
3. Complete all necessary advance work, including protection system, utility relocations and earth excavation.
4. Remove existing bridge using rapid replacement technology or demolish bridge in place.
5. Install new bridge using rapid replacement technology.
6. Complete all remaining work, including barrier wall connection, approach slabs etc.
7. Demolish the old bridge in the staging area if the contractor chooses to lift the bridge out as the removal methodology.

For the Rapid Replacement activities in Steps 4 and 5 above, a single 3-day full closure of the Queensway will be in place. The remaining work in Step 6 can be completed during either the same 3 consecutive days, or on a subsequent weekend with partial closures.

Context Sensitive Design

The context sensitive design elements of the replacement bridge will include the following:

- Context sensitive architectural design features on the facades to provide consistency along the corridor (to be determined during detail design);
- Landscaping at the four quadrants (where feasible); and
- Improved lighting (by the City of Ottawa) to improve the safety and personal security under the bridges and create greater sense of openness for the users on the municipal street.

See **Section 7.4** for the discussion of the Statement of Flexibility of this EA. Should the Provincial priorities change and funding not be available, the bridge may be rapid rehabilitated with a future rapid replacement.

This flexibility will be maintained by MTO. However, it is anticipated that the bridges will be replaced and then rehabilitated in the next rehabilitation cycle in 20-30 years.

7.2.3.2 Elgin Street (Rapid Replacement)

Elgin Street Overpasses consist of two bridges, Site No. 3-066.1, to the south, and Site No. 3-066.2, to the north. They were built in 1965 and carry the eastbound lanes (EBL) and the westbound lanes (WBL) of Highway 417, respectively, over Elgin Street. The bridges are single-span concrete rigid frames, separated by a longitudinal joint, with clear spans of 20.7 m measured perpendicular to the abutments. The overall deck width of the south bridge varies from approximately 23.1 m to 24.6 m to accommodate the EBL on-ramp, and the width of the north bridge varies from approximately 23.4 m to 26.0 m to accommodate the Catherine Street/Metcalfe Street off-ramp. The north and south abutments each have a retaining wall located along the south and north sides of the highway embankment, respectively.

Elgin Street crosses below the bridge. Two 3.7 m northbound lanes and two 3.7 m southbound lanes are separated by a 1.2 m median. The existing cross section includes 2.4 m sidewalks, provided on both sides of the road.

The existing bridges are overall in fair-to-good condition. The decks have a few localized patches and shallow spalls on the interior of the deck soffit with more extensive deterioration along the median joint. The abutment walls have narrow-to-medium vertical cracks and numerous localized delaminated areas on the lower portion of the walls. The retaining walls immediately adjoining the abutments are in fair-to-good condition, with numerous localized cracks, spalls, and concrete patches.

Each recommended new bridge (i.e. 2 rigid frames for Elgin Street) is a single-span rigid frame bridge with a span length the same as the existing bridge. The existing bridges will be removed and the new bridges installed using rapid replacement technology during a single 3-day closure of the Queensway. Advance work to facilitate the bridge replacement will be required prior to the Rapid Replacement operation and will require partial and short-term full closures of Elgin Street. The Preliminary Design recommendation is to close the roadway for a minimum of 3 weeks in advance of the replacement (with possible protected pedestrian passage until the 3 days of the lift to be investigated at the Detail Design stage).

The detour routes for pedestrians, cyclists and transit and vehicular traffic for the closure of Elgin Street at the Queensway are illustrated in **Section 7.2.2**.

The construction sequence for the Rapid Replacement of the bridge is as follows:

1. Construct new bridge in the staging area.
2. Install temporary supports and prepare the existing bridge for removal or prepare for rapid demolition of the bridge in place.
3. Complete all necessary advance work, including protection system, utility relocations and earth excavation.
4. Remove existing bridge using rapid replacement technology or demolish bridge in place.
5. Install new bridge using rapid replacement technology.
6. Complete all remaining work, including barrier wall connection, approach slabs etc.

7. Demolish the old bridge in the staging area if the contractor chooses to lift the bridge out as the removal methodology.

For the Rapid Replacement activities in Steps 4 and 5 above, a single 3-day full closure of the Queensway will be in place. The remaining work in Step 6 can be completed during either the same 3 consecutive days, or on a subsequent weekend or nighttime with partial closures.

Context Sensitive Design

The context sensitive design elements of the replacement bridge will include the following:

- Context sensitive architectural design features on the facades to provide consistency along the corridor (to be determined at detail design);
- Landscaping at the four quadrants (where feasible); and
- Improved lighting (by the City of Ottawa) to improve the safety and personal security under the bridges and create greater sense of openness for the users on the municipal street.

See **Section 7.4** for the discussion of the Statement of Flexibility of this EA. Should the Provincial priorities change and funding not be available, the bridge may be rapid rehabilitated with a future rapid replacement. This flexibility will be maintained by MTO. However, it is anticipated that the bridges will be replaced and then rehabilitated in the next rehabilitation cycle in 20-30 years.

7.2.3.3 Main Street (Rapid Replacement)

The Main Street Overpasses consist of two bridges, Site No. 3-068.1, to the south, and Site No. 3-068.2, to the north. They were built in 1965 and carry the eastbound lanes (EBL) and the westbound lanes (WBL) of Highway 417, respectively, over Main Street. The bridges are single-span concrete rigid frames, separated by a longitudinal joint, with clear spans of 18.3 m measured perpendicular to the abutments. The overall deck widths of south and north bridges are both 19.2 m. The north and south abutments each have a retaining wall located along the south and north sides of the highway embankment, respectively.

Two 3.5 m northbound lanes and one 3.5 m southbound lane are provided along with 1.6 m bike lanes. The existing cross section includes 2.3 m sidewalks.

The existing bridges are overall in fair-to-good condition. The decks have a few localized patches and shallow spalls on the interior of the deck soffit with more extensive deterioration along the median joint. The abutment walls have narrow-to-medium vertical cracks and numerous localized delaminated areas on the lower portion of the walls. The retaining walls immediately adjoining the abutments are in fair-to-good condition, with numerous localized cracks, spalls, and concrete patches.

The recommended new bridge is a single-span rigid frame bridge with a span length the same as the existing bridge. The existing bridge will be removed and the new bridge installed using rapid replacement technology during a single 3-day closure of the Queensway. The footings of the existing bridge will be salvaged for the foundation for the new bridge. Advance work to facilitate the bridge replacement will be required prior to the Rapid Replacement operation and will require partial and short-term full closures of Main Street. The Preliminary Design recommendation is to close the roadway for a minimum of 3 weeks in advance of the replacement (with possible protected pedestrian passage until the 3 days of the lift to be investigated and determined during the Detail Design stage).

The detour routes for pedestrians, cyclists and transit and vehicular traffic for the closure of Main Street at the Queensway are illustrated in **Section 7.2.2**.

The construction sequence for the Rapid Replacement of the bridge is as follows:

1. Construct new bridge in the staging area.
2. Install temporary supports and prepare the existing bridge for removal or prepare for rapid demolition of the bridge in place.
3. Complete all necessary advance work, including protection system, utility relocations and earth excavation.
4. Remove existing bridge using rapid replacement technology or demolish bridge in place.
5. Install new bridge using rapid replacement technology.
6. Complete all remaining work, including barrier wall connection, approach slabs etc.
7. Demolish the old bridge in the staging area if the contractor chooses to lift the bridge out as the removal methodology.

For the Rapid Replacement activities in Steps 4 and 5 above, a single 3-day full closure of the Queensway will be in place. The remaining work in Step 6 can be completed during either the same 3 days, or on a subsequent weekend or nighttime with partial closures.

Context Sensitive Design

The context sensitive design elements of the replacement bridge will include the following:

- Context sensitive architectural design features on the facades to provide consistency along the corridor (to be determined at detail design);
- Landscaping at the four quadrants (where feasible); and
- Improved lighting (by the City of Ottawa) to improve the safety and personal security under the bridges and create greater sense of openness for the users on the municipal street.

See **Section 7.4** for the discussion of the Statement of Flexibility of this EA. Should the Provincial priorities change and funding not be available, the bridge may be rapid rehabilitated with a future rapid replacement. This flexibility will be maintained by MTO. However, it is anticipated that the bridges will be replaced and then rehabilitated in the next rehabilitation cycle in 20-30 years.

7.2.4 Property Requirements – 58 and 60 Main Street

The existing 1220 mm City of Ottawa watermain runs along Hawthorne Avenue, see **Figure 7-29**. The Main Street Bridge rapid replacement will use Ballantyne Park as a bridge staging area for the construction of the Main Street Bridges. In order to avoid travelling perpendicularly over the watermain, the SPMT movement from Ballantyne Park to the Main Street Bridge for replacement requires the permanent property acquisition of 58 Main Street and 60 Main Street, as shown in **Figure 7-30**. The trade-off of the purchase of the property as well as mitigation to avoid crossing the 1220 mm watermain was assessed during the evaluation of alternatives and included mitigation for the acquisition.

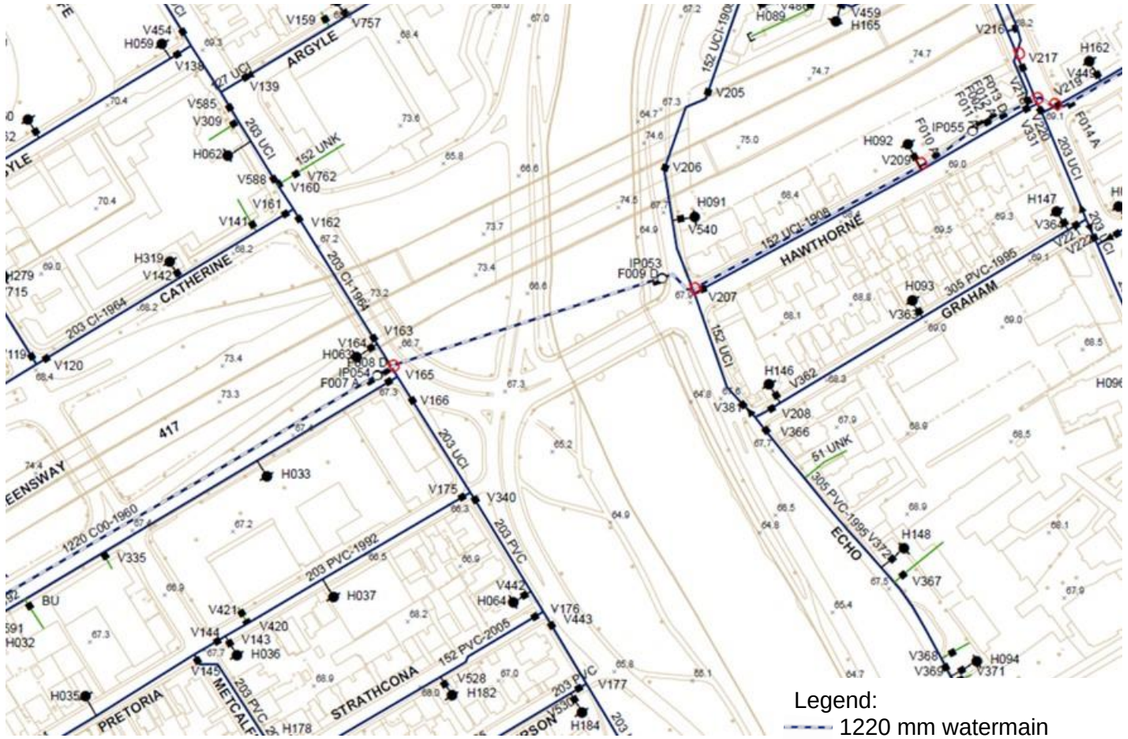

Figure 7-29: City of Ottawa 1220 mm Watermain

7.2.5 Temporary Property Requirements

To accommodate the rapid replacement staging areas required for the Metcalfe Street, Elgin Street and Main Street bridges, there will be a requirement for temporary staging areas that will act as bridge staging sites over several construction seasons. The TPA identified as part of the EA is the MTO owned property on the north side of the Queensway between Metcalfe Street and Elgin Street as well as the City of Ottawa owned property of Ballantyne Park. The City of Ottawa, which has participated in the EA on the MTAC is making the park available to MTO. In addition, one lane on Catherine Street (parking lane) is recommended to be temporarily closed.

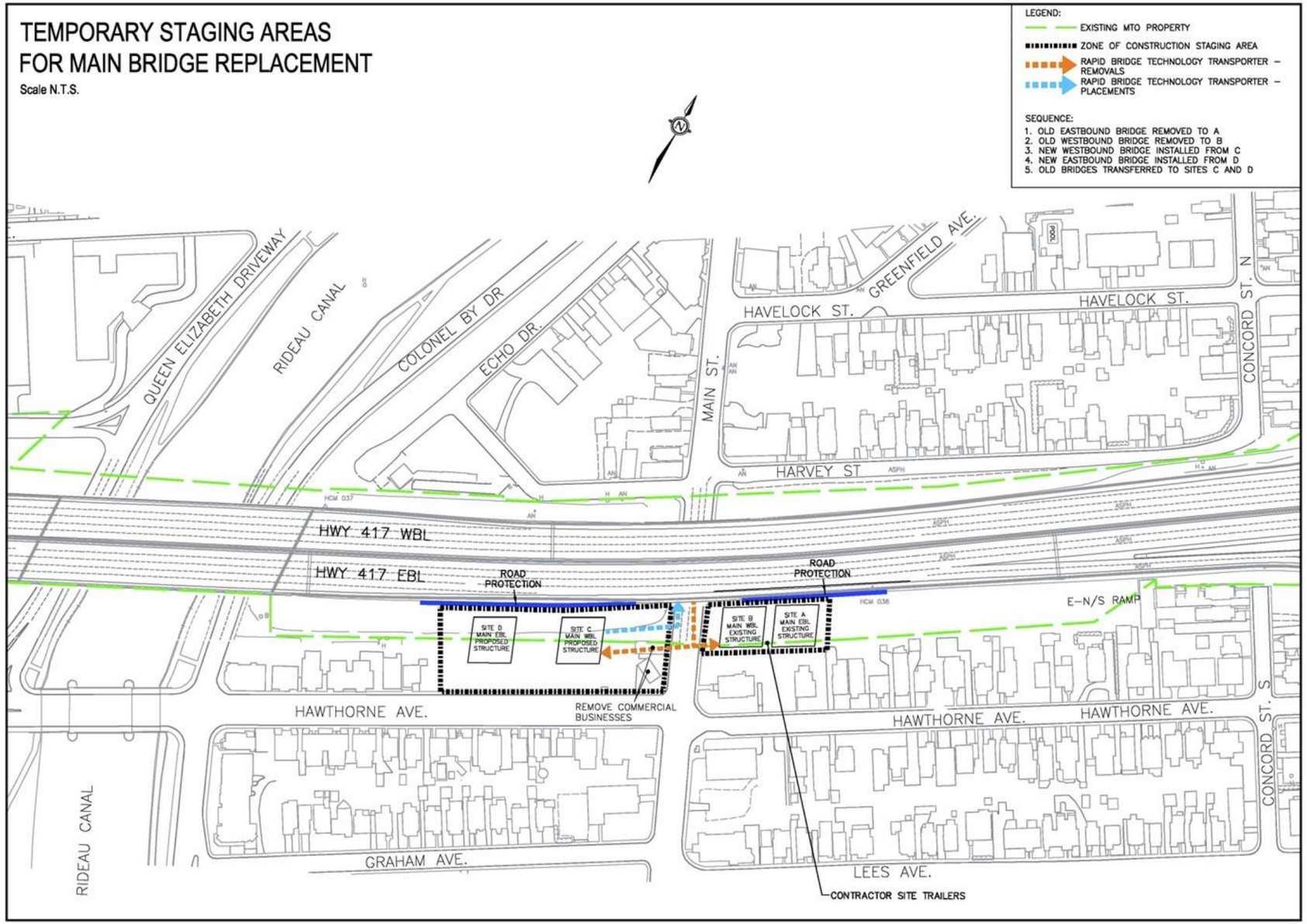

Figure 7-30: Technically Preferred Alternative for Main Street illustrating Property Acquisitions

7.3 Rideau Canal Bridge

7.3.1 Bridge Management Plan

The Rideau Canal bridges are recommended for replacement using a combination of complete closures of the Queensway for the traffic management on an extended weekend in combination with accelerated bridge construction techniques. The construction techniques will include a jack and slide of the new bridge superstructures.

7.3.2 Traffic Management Plan

Note: All durations of work provided in this report for traffic staging are initial estimates only (at a Preliminary Design level of detail) and may be subject to change during the Detail Design stage. The detour routes have been prepared and reviewed based on existing conditions in 2023 and are subject to change during the Detail Design stage based on new projects/restrictions on federal parkways and municipal streets at that time. The detour routes will be refined during the subsequent Detail Design stage.

For the rapid replacement of the Rideau Canal Bridges, there will be a full Queensway closure for an extended weekend using the detour routes as described in the succeeding sections. A weekday closure will include significant advance notice to the public. The description of all the temporary traffic detour routes for pedestrians, bicyclists, transit and vehicles is documented in the Highway Engineering Traffic Staging Alternatives Report. This will include long-term closure of Queen Elizabeth Driveway and Colonel By Drive for approximately 90 weeks. These durations and detour routes will be finalized during the Detail Design stage of the project and may be subject to change.

7.3.2.1 Rideau Canal Bridge Queensway Detours

The traffic management during the bridge replacements will include diversion of the Queensway to municipal streets. A detour as shown in **Figure 7-31** will be set up utilizing Bronson Avenue and Riverside Drive. This detour route has been successfully utilized on several previous heavy lift projects to date. The locations of the staging area and construction sites for the new bridges and laydown area for the removed bridges are described in **Section 5.3.1** for the eastbound and westbound bridges. The OC Transpo detours are described for each bridge replacement detour route in the previous sections and truck routes are illustrated in **Figure 7-32**.

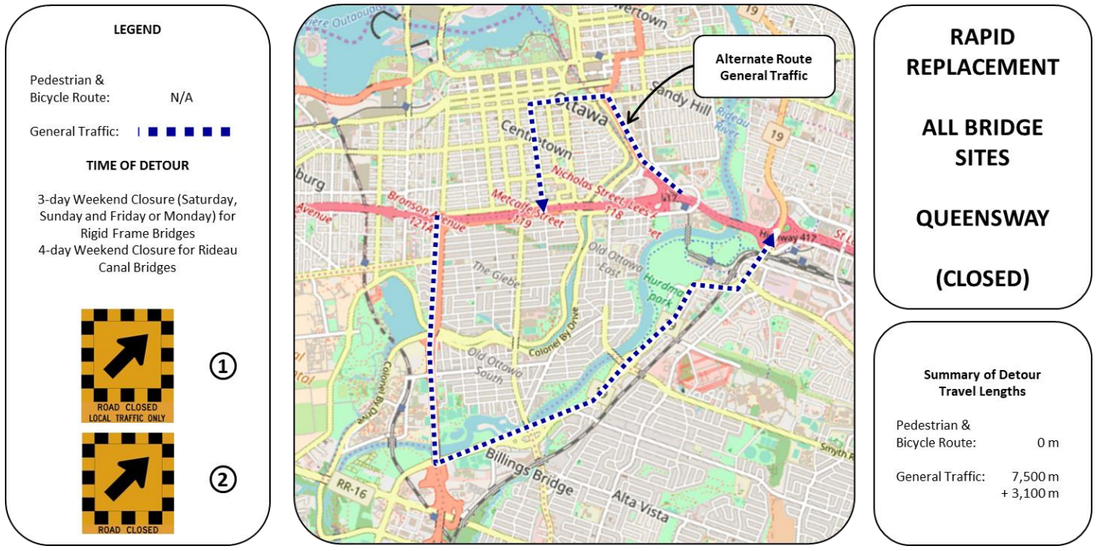

Figure 7-31: Queensway Detour Route – 3 Week Advance Closure and 3-day Move

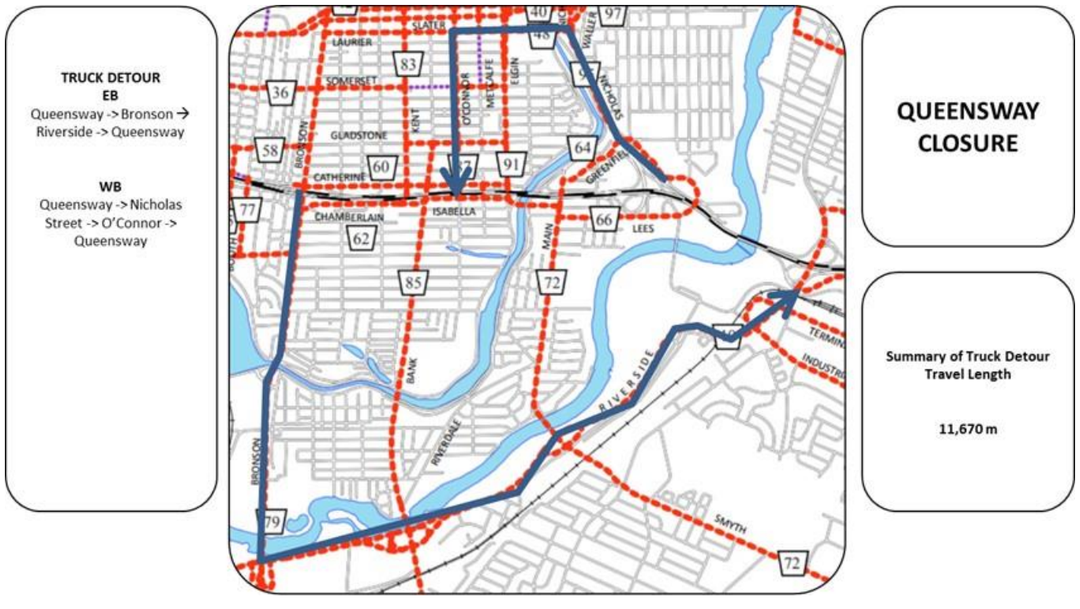

Figure 7-32: Queensway Truck Detour Route

7.3.2.2 Queen Elizabeth Driveway and Colonel By Drive Closures

The traffic management plan for the closure of Queen Elizabeth Driveway and Colonel By Drive will use the detours as shown on **Figure 7-33** and **Figure 7-34.** The pedestrian and cyclist detour routes are shown in **Figure 7-35.** NCC will require additional consultation during Detail Design to define the pedestrian and cycling detour routes and the ability to provide separate protected spaces for cyclists. There are no OC Transpo routes or truck routes on Queen Elizabeth Driveway or Colonel By Drive and therefore no detours are required.

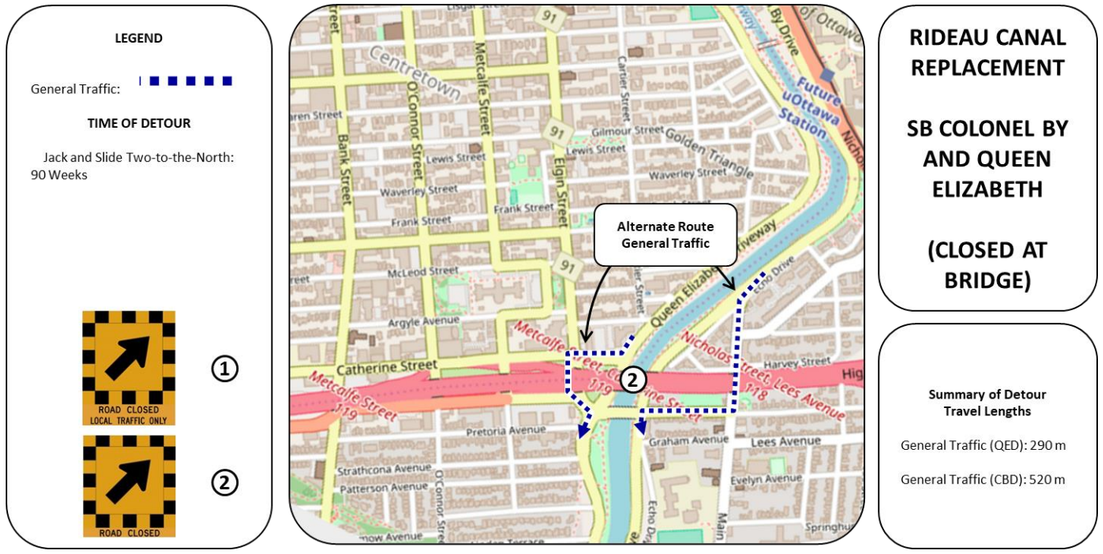

Figure 7-33: Southbound Queen Elizabeth Driveway and Colonel By Drive General Traffic Detour - 90 weeks

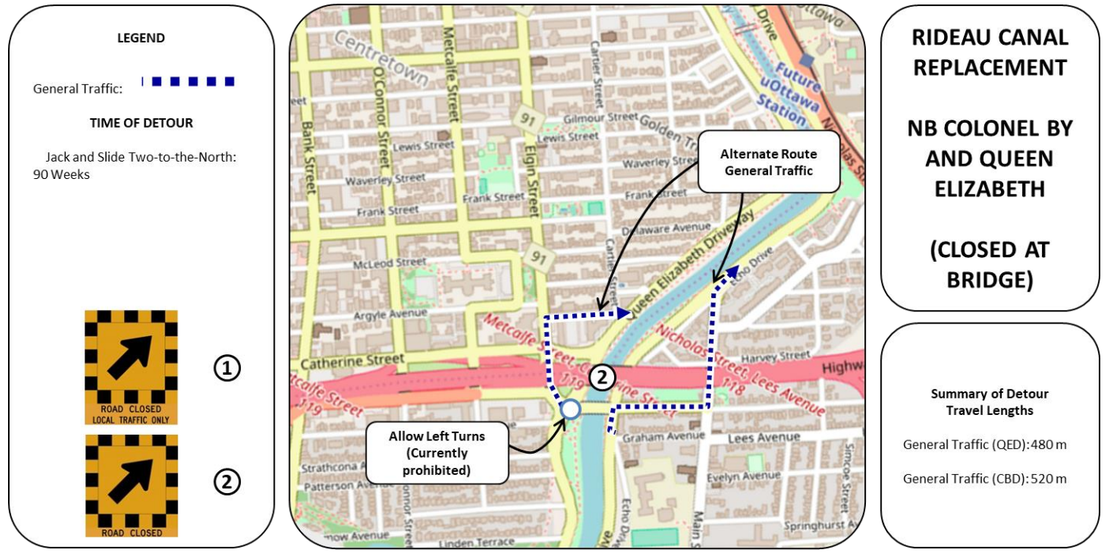

Figure 7-34: Northbound Queen Elizabeth Driveway and Colonel By Drive General Traffic Detour – 90 weeks

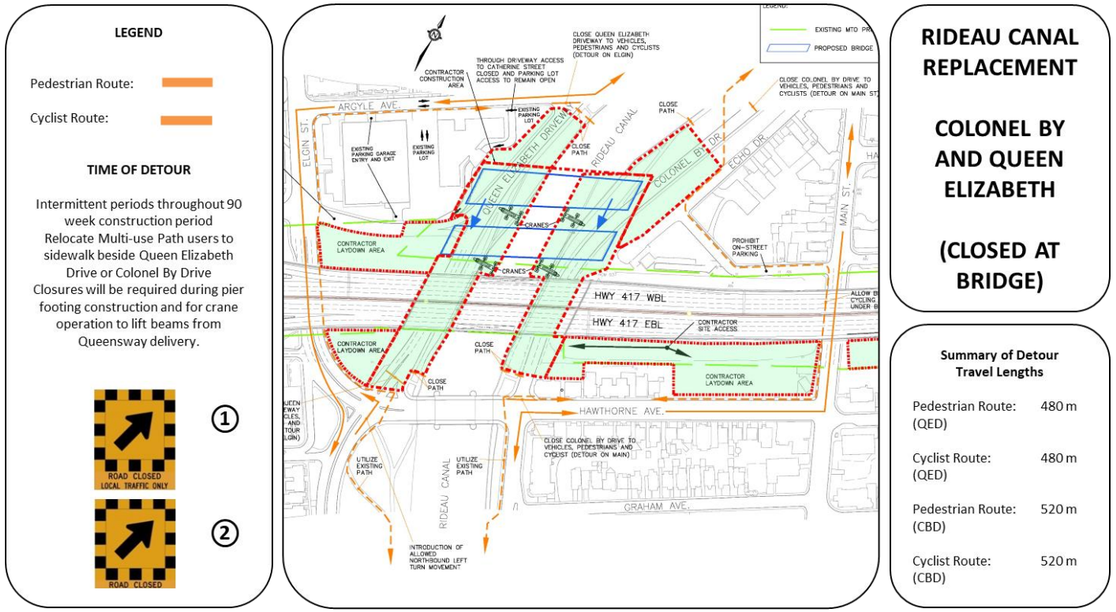

Figure 7-35: Rideau Canal Multi-use Path Detour – 90 weeks

7.3.2.3 Short-term Nighttime Queensway Closures

During construction of the Rideau Canal Bridge, there will be short-term nighttime closures of the Queensway to place material. The closures will follow the MTOs Ottawa Queensway Lane Closures Restrictions Policy for lane and ramp closures.

7.3.3 Staging Areas for Rideau Canal Bridge Construction and Demolition

The rapid bridge replacement will utilize staging areas to build the replacement bridges. The Jack and Slide staging areas are immediately adjacent to the existing structures while the SPMT staging areas can be farther from the existing bridge. The replacement staging areas for the Rideau Canal Bridges are illustrated on **Figure 7-36**. A staging site is located on both sides of the Queensway for the new bridges with contractor laydown areas in Ballantyne Park and in the Vanier Parkway northwest interchange quadrant.

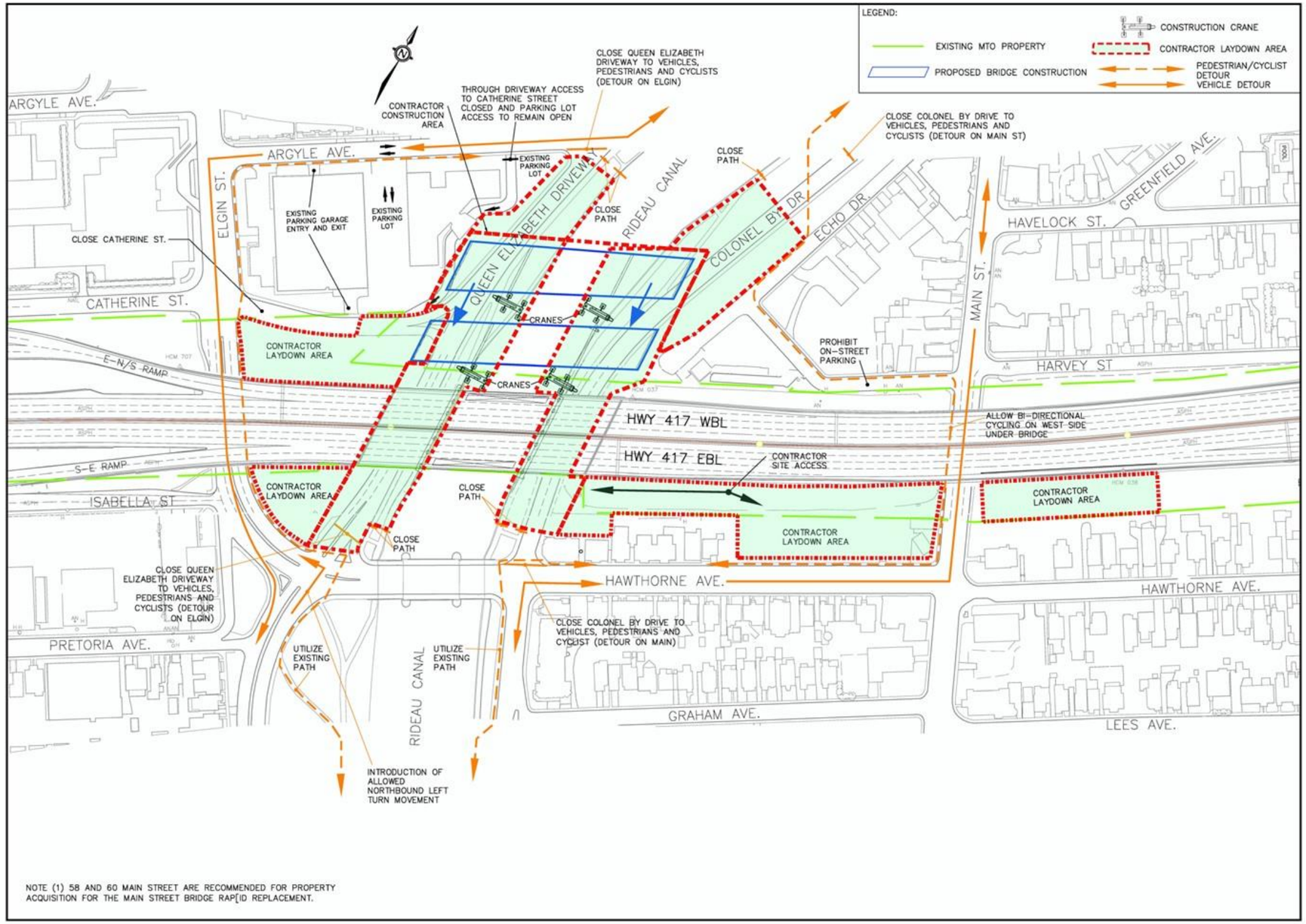

Figure 7-36: Rideau Canal Jack and Slide Replacement Staging Sites and Contractor Laydown Areas

7.3.4 Description of Structural Improvements for Rideau Canal (Jack and Slide Replacement)

The Rideau Canal Overpass consist of two bridges, the eastbound lane bridge, Site No. 03-67.1, and the westbound lane bridge, Site No. 03-67.2. Both bridges were built in 1963. The EB bridge carries 4 lanes of traffic including a speed-change lane and the WB bridge carries 5 lanes of traffic including two speed-change lanes of Highway 417. The bridges span over the Rideau Canal, Queen Elizabeth Driveway and Colonel By Drive. The twin bridges are separated from each other by a 50 mm gap in the superstructure.

Geometric information for the existing bridges is based on the original construction drawings. Each bridge consists of three unequal spans of lengths 40.538 m, 40.843 m, and 40.538 m, measured along the centerline of Highway 417. Both the EBL and WBL bridges have an overall width of 21.49 m. Each bridge is a simply supported precast prestressed concrete girder bridge. Each girder is supported by a single bearing at the pier and/or abutment. The abutments are supported on steel piles founded on bedrock. Each pier consists of three hexagonal shaped columns monolithic with the pier cap beams. The columns are supported on a pile cap which is supported on piles founded on bedrock. The pier cap beams are connected between the two bridges. Two 3.5 m northbound lanes and one 3.5 m southbound lane are provided along with 1.6 m bike lanes. The existing cross section includes 2.3 m sidewalks.

The Rideau Canal Bridge spans over Queen Elizabeth Driveway, the Rideau Canal and Colonel By Drive. Queen Elizabeth Driveway and Colonel By Drive are under the jurisdiction of the NCC and serve as parkways along the Canal. There is significant pedestrian and cyclist travel along this corridor, with the parkways providing an important link in the City of Ottawa's Multi-Use Path network. Pretoria Bridge to the south limits the size of the available staging areas.

The Rideau Canal is a UNESCO World Heritage site and is under the jurisdiction of Parks Canada. In the summer it provides boat access from Kingston to the Ottawa River and in the winter it is the world's longest ice skating path.

The existing bridges are overall in fair-to-good condition. The decks have a few localized patches and shallow spalls on the interior of the deck soffit along with deterioration at the girder ends and along the centre median. The abutment walls have narrow-to-medium vertical cracks and numerous localized delaminated areas on the lower portion of the walls. The piers have been extensively rehabilitated and have localized delaminated areas. The retaining walls immediately adjoining the abutments are in fair-to-good condition, with numerous localized cracks, spalls, and concrete patches.

The recommended new bridge is a three-span girder bridge. The existing bridge will be removed and the new bridge installed using rapid replacement technology during an extended weekend closure of the Queensway following the full closure of the Canal to boats (closure of the canal occurs after the Thanksgiving weekend). Advance work to facilitate the bridge replacement will be required prior to the rapid replacement operation and will require partial and short-term full closures of the two parkways and advance infilling of the Canal following the Labour Day weekend (ensuring a 25 m travel way for boats remains open). The Preliminary Design recommendation is to close the two NCC parkways for the 90-week construction period. See **Figure 7-37** for the general arrangement drawing of the preferred alternative.

The detour routes for pedestrians, cyclists and transit and vehicular traffic for the closure of Queen Elizabeth Driveway and Colonel By Drive at the Queensway are illustrated in **Section 7.3.2**.

The construction sequence for the Rapid Replacement of the bridge is as follows:

1. Install temporary foundations/ supports for the new bridges
2. Protect or relocate utilities and heritage elements such as canal walls within the construction zone
3. Construct new bridges adjacent to the existing bridges.
4. Complete all necessary advance work, including protection system and infill into the Rideau Canal / earth excavation.
5. Demolish the existing bridge
6. Remove all structural debris from on top of the canal infill
7. Install new bridges using rapid replacement bridge deck slide technology
8. Complete all remaining work, including barrier wall connection, approach slabs etc.

For the Rapid Replacement activities in Steps 5 to 7 above, a 4-day full closure of the Queensway will be in place. The remaining work in Step 8 can be completed during either the same 3 days, or on a subsequent weekend with partial closures.

Context Sensitive Design

The context sensitive design elements of the replacement bridge will include the following:

- Context sensitive architectural design features on the facades to provide consistency along the corridor (subject to NCC review) consistent with the project requirements in the UNESCO World Heritage Site (distinct from, compatible with and subordinate to the Canal itself);
- Landscaping (subject to Parks Canada and NCC review); and
- Improved lighting to improve the safety and personal security under the bridges and create greater sense of openness for the users on the municipal street and Canal.

The context sensitive design elements of the replacement bridge will be investigated during Detail Design and a commitment has been given to the NCC that this will be reviewed and presented to the NCC's Advisory Committee on Planning, Design, and Realty (ACPDR) Committee at that time. Replacement snow guards will be transparent, as an improvement to existing solid wall conditions. Markers of some type are anticipated at the highway level to identify the location of the Canal.

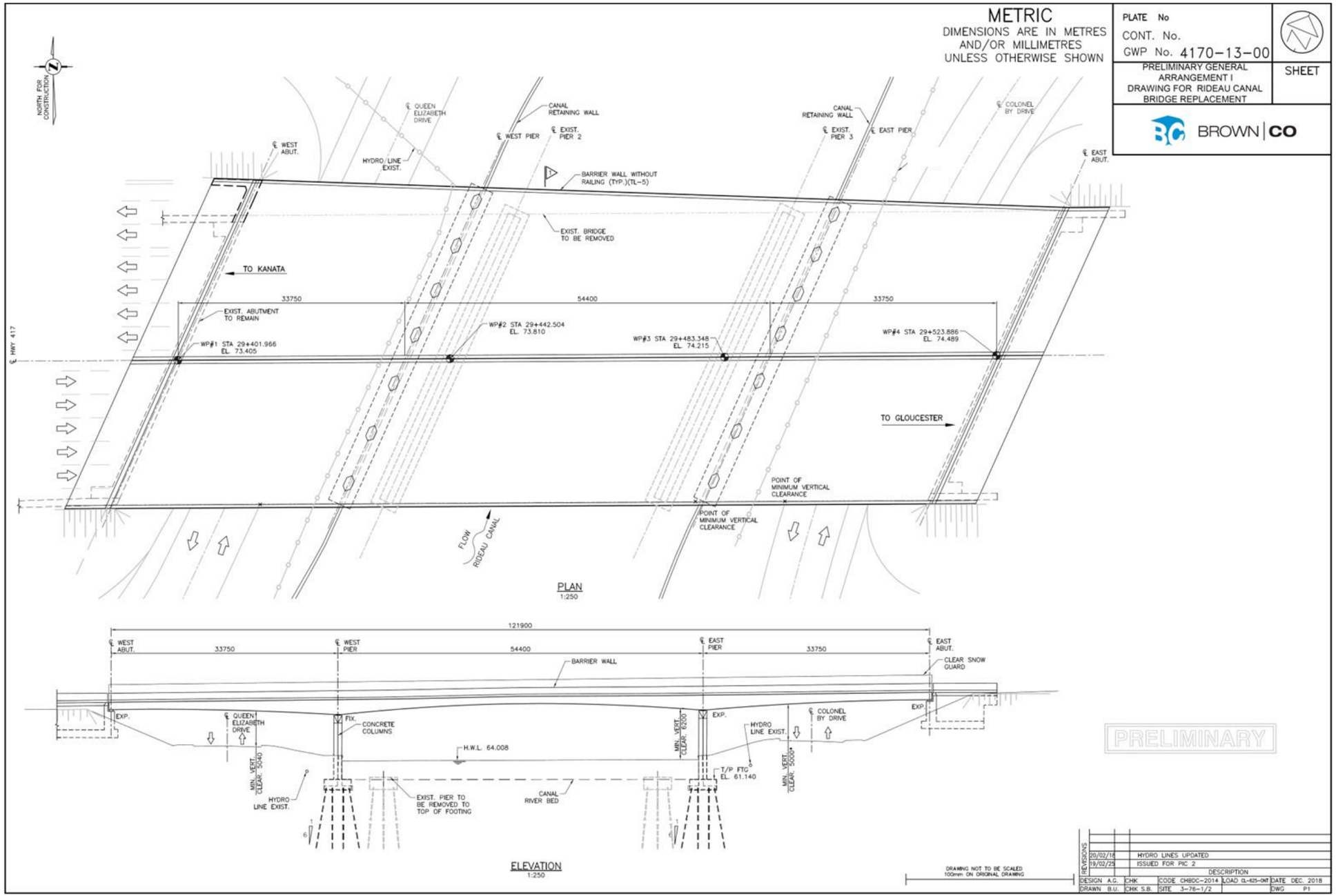

Figure 7-37: General Arrangement Drawing of Rideau Canal Bridge Replacement

7.4 Recommended Plan Statement of Flexibility

The TAC, along with the MTAC and FAC, has supported an approach within the TESR that will allow the Ministry flexibility in the structural management plan. Acknowledging that the Province may have other competing priorities which could affect this large capital investment plan, the TESR has included a statement of flexibility for the bridges. This is to allow the MTO to modify individual bridge site recommendations in future as required by funding availability or other considerations. The statement of flexibility was presented to the public at PIC No. 2 and PIC No. 3. The bridges and their corresponding recommendations are presented in **Table 7.1**.

Table 7.1: Rigid Frame Bridges Summary of Recommendations

Bridge Site	TPA (based on MATS rankings and Implementation Considerations)	Flexibility for Alternate TPA
Metcalfe Street	Rapid Replacement (Alt B-C1-e)	Rapid Rehabilitation (A-A2-e)
Elgin Street	Rapid Replacement (Alt B-C1-e)	Rapid Rehabilitation (A-A2-e)
Main Street	Rapid Replacement (Alt B-C1-e)	Rapid Rehabilitation (A-A2-e)
Rideau Canal	Jack and Slide Replacement (D-4)	Conventional Rehabilitation (F)
Rideau Canal Staging	Staging sites on the north side of the Queensway	Staging sites on both the north and south sides of the Queensway

8. POTENTIAL ENVIRONMENTAL EFFECTS AND PROPOSED MITIGATION

The following sections identify potential environmental effects associated with the recommended design and, where necessary, proposed mitigation measures to reduce the residual effects of the project(s). The following sections apply to the recommendations described in **Chapter 6**.

Many of the potential effects related to construction (i.e. closures, delays, nuisance, construction noise, etc.) have been avoided or minimized through the selection of design alternatives that minimize construction durations and roadway (or other) closures. These traffic plans have been reviewed with the City of Ottawa staff and NCC.

It should be noted that the rapid bridge replacement staging area locations presented in **Sections 7.2.3** and **7.3.2.3** are preliminary only and could be subject to change in Detail Design. The locations have been screened for suitability and make use of publicly owned lands.

8.1 Natural Environment

8.1.1 Terrestrial Ecosystems

There is potential for disruption to migratory birds, nesting and / or SAR including: Chimney Swift (THR) - potential habitat within 200 m if brick chimneys of greater than 30 cm diameter and with rough interiors exist; Barn Swallow (THR) - potential habitat within 200 m if covered ledges and rough concrete exist; Peregrine Falcon (SC) – likely habitat due to waterbody of the Rideau Canal and River and proximity to ledges on tall buildings. Mitigation measures to address potential concerns related to the above include:

- Conduct staging site ‘sweeps’ prior to any tree or bridge removals and prior to and during construction, particularly in the northwest quadrant of the Nicholas Street Interchange due to it having the largest undisturbed stands of woody vegetation in the area, and underneath bridges due to their use by Barn Swallows (THR).
- Clear any vegetation outside of the breeding bird season which runs from March 20 – August 16, according to *The Migratory Birds Convention Act*. Failure to do so may result in triggering of the *ESA*.
- Ensure contractor’s staff are trained to recognize potential wildlife and other wildlife, and that they are aware of requirements to notify authorities if they are encountered on site.

Additionally, there is potential for disruption of SAR bat habitat due to the removal of trees that may contain bat cavities. Species include: Eastern Small-footed Myotis (END); Northern Long-eared Bat (END); Tri-colored Bat (END); Little Brown Myotis (END). Mitigation measures to address potential concerns related to the above include:

- Conduct staging site ‘sweeps’ prior to any tree removals and prior to and during construction, particularly in the northwest quadrant of the Nicholas Street Interchange due to it having the largest undisturbed stands of woody vegetation in the area. These sweeps should focus on identifying bat cavities at heights greater than 5 m off of the ground.
- As tree diameters (DBH) are generally less than 50 cm throughout the Study Area, efforts should be made to retain large trees if possible. This will reduce the likelihood of removing trees with adequate bat cavities.
- Ensure contractor’s workers are trained to recognize potentially affected species and are required to notify authorities if any are encountered on site.

8.1.2 Aquatic Ecosystems

There is the potential for the destruction of passive SAR and non-SAR fish and turtle habitat due to the proposed infilling of a portion of the Rideau Canal immediately upstream and downstream of the Rideau Canal Bridge. Specific aquatic SAR species with potential to occur within the Rideau system include: River Redhorse (SC); Pugnose Shiner (THR); Channel Darter (THR); Bridle Shiner (SC); Lake Sturgeon (THR); Northern Brook Lamprey (SC); American Eel (END); Blanding’s Turtle (THR); and Snapping Turtle (SC). Mitigation measures to address potential concerns related to the above include:

- Conduct site ‘sweeps’ prior to any aquatic vegetation removals or infilling and prior to and during construction. Fish rescues (as many as needed) will be performed prior to any potential infilling by a qualified fisheries professional.
- Infill will be placed on a geotextile base to ensure the complete removal of fill from the watercourse once work is completed.
- Infill will be removed, and habitat features reinstated in order to return the area to its previous conditions or better. Note: critical habitat features for reproduction and rearing of young are limited to absent.
- Conduct in-water works outside of the restricted window of January 1 – June 30 as per MNRF.
- No work should take place from October 16 – March 15 in overwintering turtle habitat. Fencing should also be in place prior to the season in which turtles travel on land (April 1 – October 30) which will be the case for the Rideau Canal bridges.

8.1.3 Vegetation

Proposed works will generally require the removal of various trees and woody vegetation. General mitigation measures include:

- Conduct site ‘sweeps’ prior to any vegetation removals to ensure no rare or SAR species are present.
- Maintain, as possible, mature tree specimens with a diameter (DBH) greater than 50 cm.
- Lilacs in M1 should be maintained if possible.

8.2 Cultural Environment

8.2.1 Archaeology

Although there is no evidence of archaeological resources within the existing right-of-way of the Queensway which has been significantly disturbed, if deeply buried archaeological remains are encountered during construction at any of the temporary or permanent locations, the MCM must be notified immediately. Additionally, should the proposed staging areas M2, M3 and M6 (see **Figure 8-1**) be subjected to ground disturbing activities during this project, a Stage 2 Property Survey will be required. A marine archaeology survey was completed for the recommended plan at the Rideau Canal and cleared the site for archaeological potential.

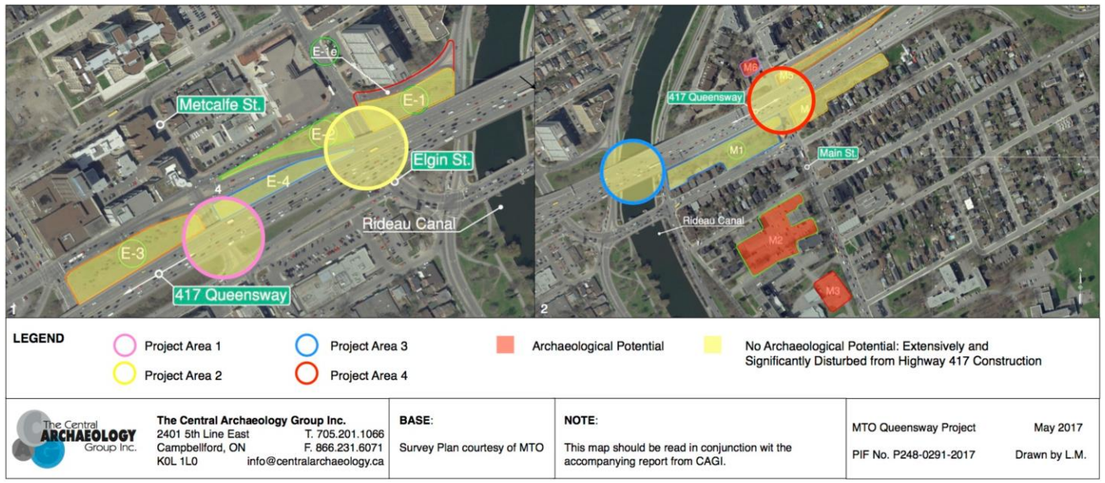

Figure 8-1: Archaeological Potential

8.2.2 Built Heritage

Local buildings will be lost (**Section 8.3.1**) due to the proposed staging area near the intersection of Main Street and Hawthorne Avenue. As well, special attention must be given to the Rideau Canal, as it is a National Historic Site of Canada and a UNESCO World Heritage Site, and is owned by the Government of Canada and administered by Parks Canada. Heritage Documentation of the above buildings will be undertaken during Detail Design prior to their removal.

The Cultural Heritage Resource Assessment Report describes the potential effects of the new Queensway bridges on neighbouring cultural heritage resources and assisted in the development of preliminary mitigation measures. The Rideau Canal is a UNESCO World Heritage Site, a National Historic Site of Canada, and a Canadian Heritage River. Special attention has been given to the Rideau Canal, including:

- No changes to the alignment of the canal walls.
- The removal of the Rideau Canal Bridge piers from the water. The removal of the piers was requested by Parks Canada and is accommodated by the proposed design. Due to the alignment of two buried high voltage oil-filled hydro ducts, the piers will be integrated with the canal walls, similar to the Pretoria Bridge design.
- A bridge design that is subordinate to, distinguishable from and compatible with the existing cultural heritage landscape and respects the heritage landscapes and designations of the Rideau Canal.
- Improves the existing navigation channel by removing the piers from the water.
- No changes to the 30 m buffer zone of the canal. All landscape features disturbed during construction will be reinstated post construction, in consultation with Parks Canada.
- Additional mitigation measures and design features will be defined during the subsequent Detail Design stage. Elements will include, but not be limited to, light design treatments, landscaping, etc.

8.2.3 Recreational Resources

The use of Ballantyne Park as a staging area will remove some features in the park. The trees along the street frontage shall be protected where possible and a landscape plan shall be established with City of Ottawa approval for the park reinstatement. The James Ballantyne commemoration monument will be salvaged and reinstated in the park following construction.

8.3 Socio- Economic Environment

8.3.1 Property Impacts - Permanent

Private property acquisitions at 58 Main Street (Gordon and McGovern Construction) and 60 Main Street (The Organic Salon) were completed in 2019. During the development of the emerging plan for the post construction use of the former gas station site and Ballantyne Park with the City of Ottawa, a proposed approach was suggested to temporarily remove the former gas station building and sign, and then return them to be incorporated in the open space. The building structure could be reinstated as an open-air pavilion/ storyboard/ bench area.

The above impacts will be mitigated through consultation with the City of Ottawa. The lands will be retained by MTO but available for passive park space in joint use with the City.

8.3.2 Property Impacts - Temporary

Various properties within close proximity to the bridge sites may experience some level of temporary impact during construction (e.g. loss of access, encroachment, nuisance, etc.). These may include impacts from potential access routes and construction staging areas for rapid bridge replacements.

Mitigation measures to address the above impacts include:

- Construction fencing to reduce visual intrusion to backyards for properties on Hawthorne Avenue and to reduce visual intrusion for the first storey of the Tiffany Apartments, as appropriate.
- Protection, to the greatest extent possible, of existing vegetation along the fence line of the backyards of the Hawthorne Avenue properties although clearing within MTO's right-of-way will occur to accommodate construction vehicle access on the south side of the Queensway from the canal to Main Street.
- Early communication / coordination with owner(s) and tenants to minimize disruption.
- Reinstatement of any disturbed areas to original condition or better.

8.3.3 Loss of Parking – Temporary

There will be temporary loss of parking during roadway closures where there is on-street parking in the vicinity of existing bridges (on Catherine Street and in private parking lots including the Tiffany Apartments, 221 Echo Drive and 3/5 Hawthorne Avenue).

These impacts will be mitigated through early advance communication with the site's owners / operators and regular users of the above parking lots and designated parking areas.

8.3.4 Tourism / Events

The project has the potential to result in construction related disruption to local festivals / events including the NCC's parkway closures for active transportation and the winter skateway (reduced width through the construction area). Construction activities will be scheduled to limit / avoid disruption to major festivals / events and if not, signage will be provided.

8.3.5 Aesthetics / Landscape Composition

There is potential for loss of existing vegetation to accommodate the recommended design and / or construction access and staging / layout areas.

To mitigate against these potential effects the Ministry will:

- Minimize vegetation removal and provide protection for those trees and shrubs to remain where they can be maintained.
- Maintain, to the extent possible, native, mature trees with a DBH of 50 cm or greater.
- Replace vegetation, where feasible.
- Reinstate Ballantyne Park.
- Protection of mature trees along the south side of Ballantyne Park (where possible) and protection and temporary relocation and reinstatement of the James Ballantyne Monument within the park.

Opportunities to provide landscaping treatments at each bridge site, where feasible, will be considered during the Detail Design, including:

- Setting back large plantings to increase useable, comfortable pedestrian space.
- Utilizing pedestrian scale planting, fencing, and/or retaining walls at sidewalks.
- Naturalized, large scale planting set back on slopes.
- Creating impact through plant massing, arrangement and colour.
- Landscaping properties purchased for staging areas.

Landscaping that exceeds the Ministry's standard proposed as part of this study will be considered in partnership with communities, with permitting conditions established by MTO during Detail Design.

8.3.6 Context Sensitive Design

The general Context Sensitive Design (CSD) approach is to make each bridge site safer, brighter, and more open and green for persons using the side streets under the Queensway; the approach will build on previously developed Queensway CSD guidelines. For this project, CSD is anticipated to include common architectural design features on the facades of each rigid frame bridge to provide design consistency along the corridor (see **Figure 8-2**). The Rideau Canal Bridges will be designed to be compatible with but distinct and subordinate to the existing features of the Rideau Canal UNESCO site, which imposes somewhat different requirements on this site from those imposed on the rigid frames. The design incorporates features to address the special requirements, most notably the removal of the piers from the Canal and improvements to the shape and clearance of the new girders above the roadway. Gateway markers to make highway users aware of the Canal are also anticipated to be incorporated with a commitment to the NCC that these design features will be reviewed at the detail design stage of the project.

Design elements and landscaping that exceed the MTO standards proposed as part of this study will be considered in partnership with the NCC, City of Ottawa, Parks Canada, and communities, with permitting conditions established by MTO. Public art and / or furnishings such as street furniture would only be considered in partnership with others at the time of Detail Design.



Figure 8-2: Typical Rigid Frame Bridge Façade Context Sensitive Design Concept (with Potential Transparent Noise Barrier Option where Noise Barriers are Required)

8.3.7 Site Contamination and Designated Substances

Several of the bridge sites have potential for soil and/or groundwater contamination given historical land uses along Highway 417. Specifically, six (6) sources of medium or high potential environmental contamination within the Local Study Area were identified by the COS. One site was listed under the Federal Contaminated Sites Inventory (FCSI) at Nicholas Street and the Queensway: a 5 hectare site adjacent to Harvey Street with soil contamination of PAHs (polycyclic aromatic hydrocarbons) and metal, metalloid, and organometallic compounds. The presence of existing asbestos containing materials at all bridge sites (as per drawings from the 1960s) requires the development of plans during Detail Design for management of any potentially contaminated bridge material in advance of construction.

Depending on the level of potential site disturbance at these sites, it is recommended that additional site assessments / investigations (e.g. Phase II Environmental Site Assessments) be conducted as required prior to construction to confirm the presence and potential limits of contamination and the need for development and implementation of contamination management plans during Detail Design.

The temporary fill within the Rideau Canal, placed to collect debris from the in-place demolition of the bridges, is proposed to include a geotextile to isolate waste material from the contaminated soils of the Canal bed.

8.3.8 Management of Excess Materials

The project will result in the generation of waste asphalt, granulars, concrete and possibly earth materials.

Waste generation will be minimized through contractor salvage, recycling and re-use which will be specified in the contract tender documents as part of the Management Plan for Excess Materials in accordance with the On-Site and Excess Soil Management (O. Reg 406/19).

8.3.9 Noise and Air Quality

A key consideration in the selection of the recommended designs has been the minimization of construction durations – which will serve to minimize the potential nuisance effects of construction noise and air quality. In addition, potential noise and air quality from construction equipment and vehicles during construction will be mitigated through the following:

- Maintain equipment in good operating condition.
- Restrict idling of equipment to the minimum necessary to perform the work.
- The contractor will be required to implement dust suppression measures to contain dust from operations such as concrete cutting.
- Restricting night work to key operations.

In an effort to reduce noise along this section of the Queensway, the existing noise barriers along the perimeter of the LSAs will be replaced with new 5 m high barriers as part of this project. In addition, new barriers are recommended in select locations, as described in **Appendix B, Sub-Appendix J**.

8.4 Transportation Environment

8.4.1 Pedestrian / Cycling / Recreational Mobility

There will be restricted pedestrian / cycling / recreational movement under the Queensway during construction. Longer term sidewalk closures will be required at bridge replacement sites to provide access to bridge footings. To mitigate these effects, durations of full closures will be minimized and alternate detour routes will be signed on existing municipal infrastructure with advance notifications of any temporary closures. Where there is a reasonable opportunity to provide safe and secure passage for pedestrians and cyclists, hoarding may be provided along sidewalks and pathways at the Ministry's discretion.

The detour routes for pedestrians and bicyclists for full closure bridge replacements are shown in **Section 7.2.2** for the Rigid Frames and **Section 7.3.2** for the Rideau Canal.

8.4.2 Traffic Operations

There is potential for traffic congestion and travel delays associated with construction staging on the Queensway (full closures for bridge replacements) or on ramps or municipal streets for extended temporary roadway or sidewalk closures (i.e. at potentially affected interchanges at Metcalfe and Elgin).

Mitigation measures to address the potential effects on traffic operations will include:

- Providing advance notice of all closures / lane reductions / detours.
- Preparing / implementing Traffic Management Plans during construction including variable message signs and incident detection.
- Limiting lane closures (Queensway) during peak travel times.

8.4.3 Bus Transit Operations

Disruption of OC Transpo bus service will occur during municipal roadway closures and/or lane reductions along Elgin Street, Catherine Street, Isabella Street, Hawthorne Street and Main Street.

Advance consultation will be undertaken with OC Transpo to identity construction impacts to transit service and to develop / communicate alternate service plans.

8.4.4 Emergency Services

There is potential for impacts to emergency service routes and access due to closures and lane reductions.

Mitigation measures to minimize potential impacts include:

- Consider implications of multiple side street closures as part of project / construction phasing.
- Prepare / implement a Traffic Management Plan during construction.
- Ensure ongoing communication with emergency service providers during construction.

8.4.5 Erosion and Sediment Control

There is potential for erosion and / or sedimentation during construction which could negatively affect existing municipal storm and combined sewer systems along existing municipal and federal roadways (and their eventual outfalls) and the Rideau Canal. Standard erosion and sediment control measures will be incorporated into the construction contract including measures to prevent off-site transport of sediment (e.g. silt fencing, turbidity curtains, straw bales, and siltation basins) and prompt restoration of disturbed areas. All in- or near-water works will be overseen by a qualified environmental professional, and any control measures assessed for their successful implementation.

8.4.6 Groundwater

There is some potential for temporary dewatering at bridge sites for bridge replacement alternatives which could result in temporary drawdown of groundwater levels. If any subsurface works are required during bridge replacement(s), impacts to groundwater will be assessed during Detail Design if dewatering is anticipated to be necessary. If required, registration of the project under the Environmental Activity and Sector Registry (EASR) or registration for a Permit to Take Water (PTTW) will be completed.

8.4.7 Utilities

There is potential for impacts to existing utilities in the vicinity of the bridges, work sites or along access routes. Advance coordination will be undertaken with utility companies and approval obtained for any utility relocations / protections during Detail Design.

Two key utilities include:

1. **City of Ottawa 1220 mm Watermain**: This watermain has been avoided by the proposed design.
2. **Ontario Hydro One High Voltage Line**: There are high voltage lines using oil filled conduits to cool the cables on both the Queen Elizabeth Driveway and Colonel By Drive Parkways. These were constructed in 1956 and 1965. The recommended plan for these cables includes:
    - **Colonel By Drive**: Avoid the cable by spanning over the cable for the temporary westbound

lane substructure. Micropiles will not be allowed within 1 m of the cable.

- **Queen Elizabeth Driveway**: Avoid the cable by spanning over the cable for the temporary westbound lane substructure. Micropiles will not be allowed within 1 m of the cable.

8.5 Summary of Environmental Effects and Mitigation Measures

Table 8.1 below provides a summary of the Preliminary Design environmental effects and proposed mitigation measures. The subsequent Detail Design stage will review, update and revise where necessary the effects and mitigation measures at that time. The Design and Construction Report will outline the mitigation measures incorporated in the Detail Design, contract documentation and construction requirements.

Table 8.1: Summary of Potential Environmental Effects and Proposed Mitigation

I.D. No.	Factor	Agency / Authority	Environmental Issues and Potential Effects	Proposed Mitigation Measures
1.0	**NATURAL ENVIRONMENT**			
1.1	**Species at Risk – Birds**	MECP, Parks Canada	• Potential disruption to migratory birds, nesting and / or species at risk (SAR) including: Chimney Swift (THR) - potential habitat within 200 m if brick chimneys of greater than 30 cm diameter and with rough interiors exist; Barn Swallow (THR) - potential habitat within 200 m if covered ledges and rough concrete exist; Peregrine Falcon (SC) – breeding pairs observed due to suitable nearby habitat (waterbody of the Rideau Canal and River and proximity to ledges on tall buildings). • No possible presence of Barn Swallow Nests was noted during the 2017 bridge inspection.	• Conduct bridge staging site 'sweeps' prior to any tree removals and prior to and during construction, particularly in the northwest quadrant of the Nicholas Street Interchange due to it having the largest undisturbed stands of woody vegetation in the area. A Nesting Survey will be undertaken early in the subsequent Detail Design stage. • Completion of an updated Environmental Impact Assessment during Detail Design, including a review of the NHCI and field observations and surveys. • Clear any vegetation outside of the breeding bird season which runs from April 1 – August 31, according to the *Migratory Birds Convention Act*. Failure to do so may result in triggering of the *ESA*. • Ensure contractor's staff are trained to recognize potentially affected species and are required to notify authorities if any are encountered on site. • Involvement of Parks Canada if impacts occur on Parks Canada lands/waters.
1.2	**Species at Risk – Bats**	MECP, Parks Canada	• Potential disruption of SAR bat habitat due to the removal of trees with the potential to contain bat cavities. Species include: Eastern Small-footed Myotis (END); Northern Long-eared Bat (END); Tri-colored Bat (END); Little Brown Myotis (END). • No bats were noted during the 2017 bridge inspection.	• Conduct bridge staging site 'sweeps' prior to any tree removals and prior to and during construction, particularly in the northwest quadrant of the Nicholas Street Interchange due to it having the largest undisturbed stands of woody vegetation in the area. These sweeps should focus on identifying bat cavities at heights greater than 5 m off of the ground. • Completion of an updated Environmental Impact Assessment during Detail Design. • As tree diameter (DBH) is generally less than 50 cm throughout the Study Area, efforts should be made to retain large trees if possible. This will reduce the likelihood of removing trees with adequate bat cavities. • Ensure contractor's staff are trained to recognize potentially affected species and are required to notify authorities if any are encountered on site. • Involvement of Parks Canada if impacts occur on Parks Canada lands/waters, as per the *Species at Risk Act*. • An analysis/survey should be undertaken in advance of the Detailed Design to understand what level of mitigation would be required for Little Brown Myotis and Eastern Small-footed Myotis, the two species more likely to use bridge structures.
1.3	**Species at Risk – Aquatic Species and Amphibians**	MECP DFO, Parks Canada (PC)	• Potential destruction of passive SAR and non-SAR fish habitat due to the proposed infilling of a portion of the Rideau Canal. Specific aquatic SAR species with potential to occur within the Rideau system include: River Redhorse (SC); Pugnose Shiner (THR); Channel Darter (THR); Bridle Shiner (SC); Lake Sturgeon	• Conduct site 'sweeps' prior to any vegetation removals or infilling and prior to and during construction. Fish rescues (as many as needed) will be performed prior to any potential infilling by a qualified fisheries professional. • Completion of an updated NHCI review and discussion of field observations during Detail Design.

Table 8.1: Summary of Potential Environmental Effects and Proposed Mitigation

I.D. No.	Factor	Agency / Authority	Environmental Issues and Potential Effects	Proposed Mitigation Measures
			(THR); Northern Brook Lamprey (SC); American Eel (END); Blanding's Turtle (END); Snapping Turtle (SC) • Potential disruption of turtle habitat and movement patterns.	• Infill will be removed, and habitat features reinstated in order to return the area to its previous conditions or better. Note: critical habitat features for reproduction and rearing of young are limited to absent. • Conduct in-water works outside of the restricted window of January 1 – June 30 as per MNRF. • No work should take place following the fill placement immediately after the canal draw down until March 15 at the Rideau Canal Bridge in overwintering turtle habitat, and per MNRF restricted window stated above. • Where turtle brumation habitat is identified during detail design, this in-water work window shall be further reduced to July 1 – October 14. • Install wildlife exclusion fencing prior to April 1 to limit turtle movement into the work area(s). • The Rideau Canal bridge is within a mapped polygon for critical habitat. Although many biophysical attributes will not be present here it will have to have a focused analysis within the federal impact assessment process following the initiation of Detailed Design.
1.4	**General – Vegetation**	MNRF, National Capital Commission (NCC), Parks Canada and City of Ottawa.	• Removal of various trees and woody vegetation due to clearing for staging areas. • MNRF has indicated the potential for the SAR Butternut to be in the area, though none are within the immediate construction or staging areas.	• Maintain, if possible, mature tree specimens with a diameter (DBH) greater than 50 cm. • Maintain, if possible, tree line between Hawthorne Avenue properties and the Queensway to provide natural visual shield. • Lilacs in M1 should be maintained if possible. However, it is noted that lilacs are an invasive species, and some consideration will be given to replacing them with native species. • Most sites had no natural environmental features and are not likely to support native features. No trees would qualify for the City of Ottawa's Honour Role Trees list. No environmentally sensitive areas, ANSIs or significant wetlands noted by MNRF or under the City's Official Plan.
1.5	**Stormwater Management**	Parks Canada	• Stormwater ultimately drains into the Rideau Canal.	• Improvements to the storm water quality entering the Rideau Canal will be investigated during Detail Design.
2.0	**CULTURAL ENVIRONMENT**			
2.1	**Archaeology**	MCM, Parks Canada	• Stage 1 Terrestrial and Marine Archaeological Assessments have not identified any areas of archaeological potential for the Recommended Plan.	• The Stage 1 Terrestrial and Marine Archaeological Assessments have not identified any areas of archaeological potential. • If deeply buried archaeological remains are encountered during construction, the contractor must notify the MCM. If they are discovered on Parks Canada lands/waters, Parks Canada must also be notified.

Table 8.1: Summary of Potential Environmental Effects and Proposed Mitigation

I.D. No.	Factor	Agency / Authority	Environmental Issues and Potential Effects	Proposed Mitigation Measures
2.2	**Heritage**	MCM	• Special attention must be given to the Rideau Canal, as it was designated a National Historic Site of Canada in 1925 and a UNESCO World Heritage Site in 2007 and is owned by the Government of Canada and administered by Parks Canada. • Short term effects on scenic entry routes and significant views (as described in the City of Ottawa OP Schedule 1 – Multi-Use Pathways and Scenic/Entry Routes – Urban) due to temporary staging areas and alteration of bridge design. • Impacts to buildings with local value at the intersection of Main Street and Hawthorne Avenue: a former gas station landmark (McGovern Construction). Early 19th century buildings in the local Study Area.	• Continue to consult with Federal and Parks Canada agencies during Detail Design to ensure acceptable design considerations for the bridge works, and to facilitate scenic and entry routes to the Rideau Canal and to the City. • Undertake a Cultural Heritage Evaluation Report for 60 Main Street, a former gas station landmark, to assist in the future management of the property. The ability to address potential historical features at 60 Main Street post construction is under investigation.
2.3	**Heritage**	Parks Canada	• The Cultural Heritage Resource Assessment Report (HRAR) identified three potential Cultural Heritage Landscape ()and one potential Built Heritage Resources (BHR) are anticipated to be directly impacted by the TPA and will require further mitigation to avoid any adverse impacts. In addition, there is potential for indirect impacts to identified BHRs and CHLs.	• Construction activities and staging should be suitably planned and undertaken to avoid unintended negative impacts to identified built heritage resources and cultural heritage landscapes. • A Heritage Impact Assessment (HIA) be completed as part of the Detailed Design by a qualified heritage professional and in advance of construction for the Rideau Canal Bridges. • A Cultural Heritage Evaluation Report (CHER) to determine cultural Heritage Value or Interest (CHVI) of the former auto garage (60 Main Street) is required. • Reinstatement of lighting fixtures and vegetation along Queen Elizabeth Drive and Colonel By Drive due to construction activities. • Reinstatement of lighting fixtures, vegetation and the James Ballantyne commemoration monument in Ballantyne Park due to construction activities. In addition, maintain as many trees within Ballantyne Park, especially along the street frontage. • Baseline vibration monitoring during detail design to ensure BHR are not adversely impacted during construction. • A copy of the CHRAR should be sent to NCC, MCM, Parks Canada and the City of Ottawa Heritage staff for their review..
2.4	**Heritage**	Parks Canada	• Context sensitive design for the Rideau Canal Bridge shall consider the UNESCO World Heritage Site and National Historic Site of Canada designations.	• The Rideau Canal bridge design includes context sensitive design elements including: the removal of the piers from the water, a design that is subordinate to, indistinguishable from and compatible with the surrounding landscape and does not impact the existing heritage designations and viewscapes. Commitments in this TESR to continue to consult with federal, provincial and municipal stakeholders during Detail Design to receive approvals for the final design.

Table 8.1: Summary of Potential Environmental Effects and Proposed Mitigation

I.D. No.	Factor	Agency / Authority	Environmental Issues and Potential Effects	Proposed Mitigation Measures
				• The construction methodology for the Rideau Canal Bridge (jack and slide rapid replacement) allows minor modifications including removing the piers from the canal. • The Rideau Canal Bridge replacement and new bridge maintains and protects the canal alignment and the canal walls. • Landscape treatments for 30 m buffer for the World Heritage designation will be reinstated post construction in accordance with Parks Canada standards. • A Context Sensitive Design Report describes future design considerations during subsequent phases.
2.5	**Recreational Resources**	City of Ottawa	• Use of Ballantyne Park for staging area. • Impacts to multi-use paths or cycling lanes under the bridges.	• Preconstruction survey of trees and monuments. • Protection (where possible) of trees along Hawthorne Avenue. • Reinstatement of Park following construction. Consultation with the City of Ottawa for park redevelopment will be continued during Detail Design. • Provide alternate detour routes and advance notifications of temporary closures. • Use of protective hoarding and temporary protected walkways to maintain pedestrian passage where practical.
3.0	**SOCIO-ECONOMIC ENVIRONMENT**			
3.1	**Property Impacts – Permanent**	Property Owners, Tenants	• Private property purchased at 58 Main Street and 60 Main Street.	• Early communication / coordination with owner(s) and tenants was undertaken to minimize disruption associated with property purchase prior to purchase by MTO in 2019.
3.2	**Property Impacts – Permanent**	Property Owners, Tenants	• Potential need to acquire / protect other properties for working / staging areas at various bridge sites (either for short or long term).	• Early communication / coordination with owner(s) and tenants to minimize disruption associated with property purchase.
3.3	**Property Impacts – Temporary**	Property Owners, City of Ottawa	• Catherine Street will be used during construction, while maintaining access to the underground parking garage at 475 Elgin Street apartments. • Ballantyne Park will be used as a construction site for the Rideau Canal and Main Street Bridge replacements. Noise barrier replacements may temporarily affect properties along the recommended barrier limits during removal and installation.	• Potential for refinement during Detail Design and documentation of results in Design and Construction Report. • Potential use of City of Ottawa property and Federal lands for construction staging areas. • Early communication / coordination with owner(s) to minimize disruption. • Reinstatement of any disturbed areas to original condition or better. • Protection of all Canal infrastructure and timing of works to minimize effects to navigation and winter skating season. • Construction fencing along rear yards of Hawthorne Avenue properties to reduce intrusion. • Retention of vegetation along and within fence (where possible) for rear yard properties along Hawthorne Avenue.

Table 8.1: Summary of Potential Environmental Effects and Proposed Mitigation

I.D. No.	Factor	Agency / Authority	Environmental Issues and Potential Effects	Proposed Mitigation Measures
3.4	**Parking Impacts – Temporary**	City of Ottawa Property Owners Residents	• Temporary loss of parking on streets and in private parking lots to accommodate contractor laydown areas and construction works. • Temporary loss of parking during localized road closures, detours and during the use of parking lots as construction staging areas.	• Temporary Limited Interest (TLI) will be obtained for the use of the parking lots behind 3/5 Hawthorne Avenue and the Tiffany Apartments (150 Queen Elizabeth Driveway). • Early advance communication with the parking lot owners / operators and regular users of the above parking lots and designated parking areas.
3.5	**Social Environment (During Construction)**	City of Ottawa Property Owners	• Various properties within close proximity to the bridge sites and staging areas may experience some level of temporary impact during construction (e.g., construction noise, dust, visual intrusion etc.) • These temporary works affect: 221 Echo Drive, 3/5 Hawthorne, 7/9 Hawthorne Avenue, 15/17 Hawthorne Avenue, 19/21 Hawthorne Avenue, 25 Hawthorne Avenue, 27 Hawthorne Avenue, 150 Queen Elizabeth Driveway, 475 Elgin Street, Echo Drive and Harvey Street west of Main Street	• Early communication / coordination with owner(s) to minimize disruption. • Reinstatement of any disturbed areas to original condition or better.
3.6	**Tourism / Events**	City of Ottawa, NCC, BIA's, Community Associations	• Potential construction disruption to various festivals / events.	• Schedule construction activities to limit / avoid disruption to major festivals / events (where reasonable).
3.7	**Aesthetics / Landscape Composition**	City of Ottawa, NCC, BIA's, Community Associations	• Bridge rehabilitation or replacement provides opportunity to enhance aesthetics of existing bridge sites.	• If extent of work at any given site supports it, context sensitive design elements will be considered for inclusion.
3.8	**Context Sensitive Design**	City of Ottawa, NCC, BIA's, Community Associations, Property Owners	• Loss of existing vegetation to accommodate recommended design and / or construction access and staging / laydown areas.	• Minimize vegetation removal; provide protection for those trees and shrubs to remain. • Replace vegetation, where feasible, in accordance with final landscape plan. • Removal of slope paving on west abutments of Rideau Canal Bridges to increase openness. • Improving urban design, landscape and active transportation connectivity under the bridge is a critical consideration to the NCC and will be reviewed during detail design. The proposed context sensitive design improvements will form part of the Federal Land Use Design and Transaction Approval (FLUDTA) review.
3.9	**Site Contamination**	MECP, PC, NCC, Property Owners	• Potential for soil and/or groundwater contamination given historical land uses. • Six sources of medium or high potential environmental contamination within the local Study Area identified in the Contamination Overview Study (COS). Historic uses of numerous sites adjacent to Highway 417 as areas of gasoline storage and manufacturing.	• Conduct additional site investigations as required prior to construction. • Develop a Soils Management Plan and/or a Phase II ESA in accordance with Part XV.1 of the *Environmental Protection Act* (EPA) and Ontario Regulation 153/04. • Use of geotextile along Canal bed to separate engineered fill from Canal soils and allow subsequent removal of debris while not disturbing existing Canal soils.

Table 8.1: Summary of Potential Environmental Effects and Proposed Mitigation

I.D. No.	Factor	Agency / Authority	Environmental Issues and Potential Effects	Proposed Mitigation Measures
			• One site listed under the Federal Contaminated Sites Inventory (FCSI) at Nicholas Street and the Queensway: a five-hectare site adjacent to Harvey Street with soil contamination of PAHs (polycyclic aromatic hydrocarbons) and metal, metalloid, and organometallic compounds.	It is noted that any in-water temporary work platforms/areas will also interact with contaminated sediment and will be investigated during Detail Design.
3.10	**Designated Substances**	MECP	• Presence of existing asbestos containing materials.	• Develop plans for management of potentially contaminated bridge material during Detail Design, in advance of construction.
3.11	**Management of Excess Materials**	MECP	• The project will result in the generation of waste asphalt, granulars, concrete and possibly earth materials.	• Waste generation will be minimized through promoting contractor salvage, recycling and re-use in the contract tender documents in accordance with the new regulation titled “On-site and Excess Soil Management” (O.Reg.406/19, under the *Environmental Protection Act*.
3.12	**Noise and Air Quality**	MTO, MECP, City of Ottawa	• Noise and air quality nuisance from construction equipment and vehicles during construction.	• Maintain equipment in good operating condition. • Restrict idling of equipment to the minimum necessary to perform the work. • The contractor will be required to implement dust suppression measures to contain dust from operations such as concrete cutting. Due to the proximity of the work site to water, calcium chloride shall not be used to suppress dust.

3.13	**Federal Permits and Approvals**	NCC, Transport Canada, PC	• The following permits and/or approvals may be required for this project:
			  ○ Navigation Protection (Transport Canada)
			  ○ In-water and Shoreline Works Permit (Parks Canada)
			  ○ Federal Work Permit (NCC)
			  ○ The project will follow the MTO/DFO/MNRF Protocol in regard to potential fisheries impacts
				• The NCC, Parks Canada, Transport Canada and DFO have been consulted during this EA to determine permitting requirements. Additional consultation will be commenced as part of the future Detail Design and contract preparation phase, prior to submission of permit applications.

3.14	**Design and Construction Report**	MTO	• In accordance with the MTO Class EA (2000) process, a Design and Construction Report (DCR) will be completed during Detail Design to outline the mitigation requirements and construction methods and impacts.	• The future preparation and public review of a DCR.
4.0	**TRANSPORTATION ENVIRONMENT**			
4.1	**Pedestrian / Cycling / Recreational Mobility**	City of Ottawa, School Boards	• Potential for temporary restricted and closed pedestrian / cycling / recreational movement under the Queensway or along other localized closures during construction – including along school / commuter / recreational routes. • Longer term sidewalk closures required at bridge replacement sites to provide access to bridge footings. • Longer term temporary MUP closures along the Rideau Canal.	• Sign alternate detour routes on existing municipal infrastructure and advance notifications of temporary closures. • Use of protective hoarding and temporary protected walkways to maintain pedestrian passage where practical. • Detailed Traffic Management Plans will be required as part of the Federal Approval application to the NCC. The plans must include dedicated detours and safe intersection crossings for canal pathway users with facilities for cyclists that are physically separated from other traffic and are winter maintained.

Table 8.1: Summary of Potential Environmental Effects and Proposed Mitigation

I.D. No.	Factor	Agency / Authority	Environmental Issues and Potential Effects	Proposed Mitigation Measures
				• The MTO will explore opportunities to minimize the duration of temporary canal pathway closures including the provision of overhead protection during the staging areas or other detour options during detail design.
4.2	**Active Transportation – Multi-use Path**	City of Ottawa, NCC	• The existing width of the MUP in the vicinity of the Rideau Canal Bridge piers is narrow.	• The width and alignment of the paths will be reviewed during Detail Design in an effort to widen the MUP.
4.3	**Traffic Operations – Delays and Closures**	MTO, City of Ottawa, NCC	• Potential for traffic congestion and travel delays associated with construction staging on the Queensway (temporary full closures for bridge replacements) or on ramps or roadways for temporary roadway or sidewalk closures (i.e., at all three affected municipal roadways and two affected NCC parkways). • 2-year closure of Colonel By Drive and Queen Elizabeth Driveway under and north of the Queensway for the replacement of Rideau Canal Bridge.	• Provide advance notice of all closures / lane reductions / detours. • Prepare / implement Traffic Management Plan during construction including changeable message signs and incident detection. • Limit lane closures (Queensway) during peak travel times. • Rideau Canal Bridge on- and off-ramp closures to allow advance demolition of the outside girders to accelerate replacement. • Detailed Traffic Management Plans will be required as part of the Federal Approval application to the NCC. The parkway closures will impact NCC programming and further coordination to minimize impacts will be completed during Detail Design.
4.4	**Bus Transit Operations**	City of Ottawa, OC Transpo	• Disruption of OC Transpo bus service during municipal roadway closures and/or lane reductions (Metcalfe Street, Elgin Street and Main Street).	• Advance coordination with OC Transpo to identity construction impacts to transit service and to develop / communicate alternate service plans.
4.5	**Emergency Services**	City of Ottawa, Local Emergency Service Providers, OPP	• Potential impact to emergency service routes / access due to closures / lane reductions. • Maintain access to 150 Queen Elizabeth Driveway from Argyle Avenue.	• Consider implications of multiple side street closures as part of project phasing. • Prepare / implement Traffic Management Plan during construction. • Ensure ongoing communication with emergency service providers during construction.
4.6	**Erosion and Sediment**	MECP, Parks Canada	• Potential for erosion / sedimentation during construction and potential impacts to the Rideau Canal.	• Standard erosion and sediment control measures to be incorporated into construction contract – including measure to prevent off-site transport of sediment and prompt restoration of disturbed areas. • Should there be in-water work zones for the construction of the Rideau Canal bridge it can be assumed there would be a cofferdam / turbidity control required. PCA will need to see details on the proposal during the Detailed Design period. Considerations would be potential for DFO/TC review and interactions with contaminated sediment. • Material used to buffer impact from the Rideau Canal bridge demolition in the canal (sand etc.) will have to be contained such that it doesn't create turbidity and is possible to remove. Parks Canada will be consulted during Detail Design to approve the design.

Table 8.1: Summary of Potential Environmental Effects and Proposed Mitigation

I.D. No.	Factor	Agency / Authority	Environmental Issues and Potential Effects	Proposed Mitigation Measures
4.7	**Groundwater**	MECP	• Dewatering at bridge sites for bridge replacement alternatives.	• If any subsurface works will occur during bridge replacement(s), assess impacts to groundwater if dewatering is necessary and obtain MECP Permits – Permit to Take Water, Environmental Activity and Sector Registry and Environmental Compliance Approval.
4.8	**Utilities**	City of Ottawa, Utilities	• Potential for impacts to existing utilities, including the 1220 mm watermain, in the vicinity of the bridges, work sites or along access routes from staging areas. • Hydro One high voltage oil-filled transmission ducts along the Rideau Canal.	• Ensure advance coordination with utility companies and approval for any utility relocations / protections. Rideau Canal bridge construction shifted north of Queensway to avoid risk to Regional 1220 mm watermain supplying east Ottawa. • Protect buried high voltage transmission Hydro line by bridging over during construction and moving footings of piers further away. • Establish soil vibration standards for micro-piling in close proximity to Hydro One and City of Ottawa infrastructure.
4.9	**Lighting**	Parks Canada, NCC, City of Ottawa	• Lighting at all bridge sites will consider improved lighting to improve the safety and personal security under the bridges and create a greater sense of openness for the users on the municipal street and canal.	• Approvals from Parks Canada will be required for the proposed lighting associated with the Rideau Canal bridge. In general, PCA aims to restrict lighting to that needed for functional requirements in order to reduce ambient light effects to the surrounding environment. There is a closer look at decorative lighting, however location makes a difference and, in this location, its recognized there is already significant ambient lighting.
4.10	**Approvals**	Parks Canada, NCC, MECP, MCM	• Approvals will be required as part of this project.	• A FLUDTA from NCC will be required during Detail Design. • Temporary Limited Interest (TLI) approvals for temporary land requirements will be prepared during Detail Design.

Legend:

BIA	Business Improvement Area
MECP	Ontario Ministry of the Environment, Conservation and Parks
MCM	Ontario Ministry of Citizenship and Multiculturalism
MTO	Ontario Ministry of Transportation
MNRF	Ontario Ministry of Natural Resources and Forestry
NCC	National Capital Commission
OPP	Ontario Provincial Police
PC	Parks Canada

8.6 Adherence to Class EA Principles

8.6.1 Transportation Engineering Principles

The recommended design for the rehabilitation and/or replacement of the Ottawa Downtown Bridges, Metcalfe Street to Main Street, addresses the transportation engineering principles of the Class EA. The improvements will provide a constructible and cost-effective design that minimizes impacts on the local community and natural environment.

8.6.2 Environmental Protection Principles

The Preliminary Design Study addressed the Class EA principles for environmental protection through the following steps undertaken during the study:

- Scientific and technical studies were undertaken to identify existing conditions for the natural environment, cultural environment and socio-economic factors (land use, transportation, local community, emergency services);
- The development of design alternatives gave due consideration to the environmental impacts of the alternatives during the evaluation process;
- The development of design alternatives was carried out with the approach of avoiding or minimizing potential environmental impacts;
- Environmental studies were carried out in sufficient detail to determine the need for environmental approvals;
- Development of Preliminary Designs of the new bridges and Construction Staging Plans through technical review with the NCC, Parks Canada, City of Ottawa and Hydro One; and
- The study team made a concerted effort to consult with all identified stakeholders.

8.6.3 External Consultation Principles

In carrying out the study, the consultation principles of the Class EA were addressed by:

- Providing all stakeholders including external agencies and the public with notification of the intent to commence the Preliminary Design Study and conducting PICs (3) through Ontario Government Notices and direct letter mailing to known stakeholders. Additional consultative efforts were made with new stakeholders as they became known to the study team.
- Consultation with Indigenous Peoples communities.
- Consultation with the public and external agencies was used to obtain information regarding the Study Area, potential effects on external agency mandates as they pertain to the project, and to identify issues and concerns.
- A Study Design outlining how the study was to be carried out, similar to a road map, was prepared and finalized following the first PIC.
- A project website was created and updated on a regular basis to advise the public of the status and upcoming activities associated with the Study.
- Changes to the Rideau Canal pier locations and the temporary staging areas were incorporated into the final Recommended Plan following input from the public and City of Ottawa following PIC No. 2.

8.6.4 Documentation Principles

The documentation principles set forth in the Class EA were addressed through the preparation of this TESR, which fulfills the content requirements outlined in the Class EA. This document provides a summary of the need and justification for the proposed undertaking, describes existing environmental conditions, identifies significant features of the preferred alternative, identifies potential environmental impacts and appropriate mitigation measures, and summarizes the consultation process employed throughout this Study.

9. COMMITMENTS TO FUTURE WORK

9.1 Future Consultation

Consultation during the Detail Design stage of the project will focus on issues identified in this TESR report for the various bridge sites and individual construction contracts. Commitments have been made to the City of Ottawa for the design of Ballantyne Park and to the NCC and Parks Canada for the urban design features associated with the gateway markers, pier integration with the canal walls and façade of the Rideau Canal structures. A commitment has been made to return to the NCC's ACPDR committee at the Detail Design phase of the project.

Public Information Centres will be held as required to provide opportunities for members of the public and affected stakeholders to review and comment on the Detail Design, including details of the proposed mitigation measures.

9.2 Federal Agency Concerns

Parks Canada, the NCC and Transport Canada are approval agencies for the final design and construction and will continue to be consulted with during the Detail Design stage. Concerns and commitments for future work/mitigation that have been identified during the Preliminary Design and EA stage have been recorded in **Table 8.1**.

9.3 Addressing Changes during Detail Design

This TESR has been prepared based on the recommended design described in **Chapter 7**. During the Detail Design stage of the project, contract drawings and specifications will be prepared to allow the components of that contract package to be tendered for construction. Design modifications or refinements may be identified during Detail Design by the designers or the contractors which could result in changes to the project's environmental effects (either positive or negative) that may not have been included in this TESR document. Should this occur, any such modifications are not anticipated to alter either the basic intent of the undertaking or the overall general level of environmental impact. However, any changes to the recommended design will be reviewed for potential environmental effects and the significance of the changes assessed to determine the need for any further Environmental Assessment process.

9.4 Design and Construction Reports

Design and Construction Reports (DCR's) will be prepared during Detail Design to document the development of the recommended plan to the Detail Design level of detail. For this project, DCR's may be prepared for the proposed (or alternate) construction staging areas which have not yet undergone an Environmental Assessment process.

9.5 Monitoring during Construction

On-site construction administration / inspection by qualified staff (retained by MTO) will ensure that the environmental protection / mitigation measures identified in this TESR, and further developed during Detail Design and documented in the Design and Construction Report, are implemented. Environmental specialist staff will be available if needed during construction to provide input. The Ministry's Environmental Planner will be contacted as needed to provide additional input to the project during construction.

9.6 Next Steps

Subject to the 30-day filing of the TESR and obtaining environmental clearance, MTO may proceed to Detail Design and construction as outlined in the Class Environmental Assessment for Provincial Transportation Facilities (2000).

There is a requirement for advance utility relocation of Hydro One high voltage cables on Queen Elizabeth Driveway including test pits, planning, study and agreements for the relocations.

Detail Design and construction activities will include:

- Complete any required additional environmental studies / investigations;
- Confirm duration of closures (length of closures may be refined);
- Public Information Centre;
- Utility relocations;
- Complete drawings and tender documents;
- Prepare Design and Construction Report (DCR) for construction staging areas and issue 30-day Notice of DCR completion;
- Obtain approvals and Federal permits;
- Tender and award contract(s);
- Undertake construction; and
- Monitor construction for adherence to environmental commitments.