Agenda Item # Page #

TO:	**CHAIR AND MEMBERS CIVIC WORKS COMMITTEE MEETING ON MARCH 18, 2013**
FROM:	**EDWARD SOLDO, P. ENG. DIRECTOR, ROADS AND TRANSPORTATION**
SUBJECT:	**BLACKFRIARS BRIDGE DETAILED STRUCTURAL INSPECTION**

RECOMMENDATION

That, on the recommendation of the Director, Roads and Transportation, the following actions **BE TAKEN** in respect to the Blackfriars Bridge:

a) The Blackfriars Bridge Risk Assessment Report, November 2012 **BE ACCEPTED**;

b) Dillon Consulting Ltd. **BE APPOINTED** Consulting Engineers to complete a Detailed Structural Inspection, including the underside of the structure, in accordance with the estimate, on file, at an upset amount of $306,843.00 (excluding H.S.T.), in accordance with Section 15.2 'g' of the Procurement of Goods and Services Policy; it being noted that future approval to proceed with subsequent phases of engineering services for the project will be subject to satisfying all financial, reporting and other conditions contained within this Policy; and, it being further noted that approximately half of this cost is to design and build custom access to all parts of the bridge;

c) the financing for this project **BE APPROVED** as set out in the Source of Financing Report attached hereto as Appendix 'A';

d) the consulting fee for the project identified in (b), above, which is in accordance with the estimate on file, and which is based upon the Fee Guideline for Professional Engineering Services recommended by the Ontario Society of Professional Engineers **BE APPROVED**; and

e) the approvals given herein **BE CONDITIONAL** upon the Corporation entering into a formal contract with the consultant for the work.

PREVIOUS REPORTS PERTINENT TO THIS MATTER

- July 9, 2007 – ETC – Blackfriars Street Community Concerns
- February 8, 2010 – ETC - Appointment of Consulting Engineers - Bridge Rehabilitation Program and Traffic Studies, Meadowlily Bridge Evaluation and Blackfriars Bridge Risk Assessment;
- April 26, 2010 – ETC - Appointment of Consulting Engineers - Traffic Study - Blackfriars Bridge Risk Assessment

BACKGROUND

Purpose:

The purpose of this report is to advise Committee and Council on the outcome of the Risk Assessment Assignment undertaken for the structure, and receive approval to proceed with a Detailed Structural Inspection of the Blackfriars Bridge. With this information, the City can develop a "long term management plan" for this heritage designated structure.

DISCUSSION

Risk Assessment

On May 2nd, 2010, the Municipal Council awarded a Risk Assessment Study of the Blackfriars Bridge to Dillon Consulting. The Risk Assessment was the first logical step in developing a long-term strategy to protect the bridge and its significant heritage and aesthetic value, balanced with its function in the transportation system. The Risk Assessment provides an evaluation of the current situation.

Over the course of the Risk Assessment, a number of workshops were held to define a generalized municipal framework that can be used as a model for any City project. This was then used as the basis for completion of a specific Risk Assessment for the Blackfriars Bridge. It required the assembly of subject matter experts across a broad spectrum of interests, including input from City staff (Transportation, Heritage, Risk Management, Operations, Business Planning), UTRCA, London Police, UWO and Dillon Consulting Staff (Structural, Transportation, Hydraulic, and Planning).

The results are documented in the Blackfriars Bridge Risk Assessment Summary Report (Executive Summary attached as Appendix 'B'). The Risk Assessment process has identified some knowledge gaps and recommends the City address these gaps in order to make an informed long-term management strategy plan for the Blackfriars Bridge. While development of treatment strategies was not a part of the scope, some conceptual strategies were documented during the assessment process.

Heritage

At 138 years old, Blackfriars Bridge is a significant heritage landmark for the City of London that requires ongoing maintenance and review. Concurrent with the Risk Assessment, the heritage value of the structure was fully documented in a Cultural Heritage Evaluation Report. This was done for two reasons: it provides a compendium of all documentation on this important heritage structure; and, provides a basis upon which to make informed decisions on a future bridge management plan.

The Blackfriars Bridge is the third distinct structure built at this location. The first and second structures, built in 1831 and 1851, were destroyed by flooding in 1851 and 1875, respectively. The current structure was constructed in 1875 with the superstructure supplied and erected by the Wrought Iron Bridge Company (WICB) of Canton, Ohio. Two supporting stone abutments were constructed by Isaac Crouse, a well known local bridge builder. The bow string arch trusses were common in the 1870's but by 1885 were largely replaced by parallel chord trusses which were easier to fabricate. The use of wrought iron as a building material for bridges was replaced by steel in the 1890's.

There are only 19 WIBC bowstring truss bridges still in existence in the United States and Canada, of which only five are open to pedestrian traffic and three carry one lane of vehicle traffic. With the exception of the Blackfriars Bridge, the remaining 10 are stored, closed or abandoned. *Blackfriars Bridge is the only one in North America that still carries two lanes of vehicular traffic and the only WICB structure remaining in Canada.*

Recommended Next Steps

At the conclusion of the Risk Assessment, it became apparent that the last detailed inspection of the bridge was over 25 years ago (prior to 1986). Having a current condition and assessment of the bridge is critical to the feasibility of many of the conceptual risk treatment strategies considered by the team of experts, and therefore to the management strategy itself. Therefore, completion of a detailed, up-close inspection to evaluate the condition of the bridge connections and details is an important step in preparing to develop a new bridge management plan.

Dillon Consulting was asked to prepare a plan, and cost estimate for the completion of an up close, hands-on inspection. Access to the underside of the structure is necessary to complete this thorough inspection, and it will be a challenge. Due to the unique style of the bridge and the load restrictions, the current conventional method of accessing the underside of bridges using a truck mounted 'swing stage' is not an option. Scaffolding along the entire length of the bridge is required with specialized expertise and custom construction in order to ensure the safety of all inspection staff, to not introduce any blockage for the flow in the river, and to not add any additional loading to the Blackfriars Bridge that may cause damage.

The results of the detailed inspection and material testing results will then be used to undertake a full structural analyse of all bridge components. This is the missing information needed to evaluate Risk Treatment options conceptualized in the Risk Assessment.

Once the inspection, condition assessment and risk treatment analysis is completed, the City will have a clearer understanding of the management options that may or may not be possible as part of a long term strategy for this structure. These strategies could include development of a custom maintenance program, structural reinforcement of the bridge, alterations to the deck, changes in traffic / loading / use of the bridge or maintaining the status quo.

Inspection Timing

The proposed inspection will require the closure of the Blackfriars Bridge. Pedestrian and cyclist access across the bridge can be maintained.

This closure will be coordinated with other City (watermain replacement, sewer lining, manhole replacement) and Utility (Union Gas main replacement) maintenance needs on Ridout Street that will also require the Blackfriars Bridge to be closed, and timed for the summer months when there is typically less traffic.

The closure of the bridge for the inspection will require approximately four to five weeks. This will be undertaken during other capital and maintenance work on Ridout Street which will require a closure of the bridge/Ridout Street corridor across the Thames River from mid May to mid September.

SUMMARY

To start the development a long term strategy to manage the Blackfriars Bridge, a Risk Assessment has been completed. A Cultural Heritage Evaluation Report and a compendium of all information on the bridge have also been prepared to assist with the future preparation of a management plan. A detailed structural inspection was recommended within the Risk Assessment, along with a follow-up risk treatment analysis.

Over the last number of years, ongoing annual maintenance costs related to the repair of the wooden deck, in the order of $35,000 have become the norm.

The findings of these activities will serve to allow the City to develop optional management strategies to mitigate risks and maintenance issues now facing the Blackfriars Bridge.

This report recommends the appointing of a consultant to complete a Detailed Structural Inspection of the entire structure, including access to the underside, at an upset fee of $306,843.00 (excluding H.S.T.), approximately half of which is the cost of custom scaffolding for access.

Acknowledgements

This report was prepared with assistance from Jane Fullick, C.E.T., Technologist II, Karl Grabowski, P.Eng., Transportation Design Engineer of the Transportation Planning and Design Division and John Lucas, P.Eng., Director of Water and Wastewater & Treatment.

PREPARED BY:	RECOMMENDED BY:
DOUG MACRAE, P. ENG. DIVISION MANAGER TRANSPORTATION PLANNING & DESIGN	EDWARD SOLDO, P. ENG. DIRECTOR, ROADS AND TRANSPORTATION

REVIEWED & CONCURRED BY:
JOHN BRAAM, P. ENG. MANAGING DIRECTOR, ENVIRONMENTAL & ENGINEERING SERVICES & CITY ENGINEER

Attach:

Appendix 'A' – Sources of Financing
Appendix 'B' – Blackfriars Bridge Risk Assessment Executive Summary (6 pages)

cc. C. Haines, Dillon Consulting

APPENDIX 'A'

#13020

Chair and Members
Civic Works Committee

March 1, 2013
(Appoint Consulting Engineer)

RE: Blackfriars Bridge Detailed Structural Inspection
Capital Project TS1763 - 2010 Bridges Major Upgrades
Dillon Consulting Ltd - $306,843.00 (excluding H.S.T.)

FINANCE DEPARTMENT REPORT ON THE SOURCES OF FINANCING:

Finance Department confirms that the cost of this project can be accommodated within the financing available for it in the Capital Works Budgets and that, subject to the adoption of the recommendation of the Director, Roads and Transportation, the detailed source of financing for this project is:

ESTIMATED EXPENDITURES	Approved Budget	Committed To Date	This Submission		Balance For Future Work
Engineering	552,246	552,246			0
Construction	1,982,313	1,668,200	312,244		1,869
City Related Expenses	478	478			0
NET ESTIMATED EXPENDITURES	**$2,535,037**	**$2,220,924**	**$312,244**	1)	**$1,869**
SUMMARY OF FINANCING:					
Debenture By-Law No. W.-5245-137	535,037	220,924	312,244		1,869
Federal Gas Tax	2,000,000	2,000,000			0
TOTAL FINANCING	**$2,535,037**	**$2,220,924**	**$312,244**		**$1,869**

1) **Financial Note:**

	Total
Contract Price	$306,843
Add: HST @13%	39,890
Total Contract Price Including Taxes	346,733
Less: HST Rebate	34,489
Net Contract Price	$312,244

EH

Alan Dunbar
Manager of Financial Planning & Policy

Agenda Item # Page #

Appendix 'B'

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BLACKFRIARS BRIDGE RISK ASSESSMENT

EXECUTIVE SUMMARY

1 Introduction

Dillon Consulting Limited (Dillon) was retained by the City to conduct a risk assessment for the Blackfriars Bridge, considering the current status ("status quo") scenario. The risk assessment was intended as the first phase in the development of a long-term strategy to protect the bridge and its significant heritage and aesthetic value, balanced with its function as a Thames River crossing.

The goal was to clearly understand the risks inherent in the current configuration, to aid in decision making during subsequent phases.

2 Study Participants

A two-day risk assessment workshop was held on April 12 and 13, 2012 with 15 participants from the City of London, Dillon Consulting, Upper Thames River Conservation Authority and heritage representatives. The group included individuals experienced in cultural heritage, bridge design, river hydraulics, environmental protection, transportation safety, traffic systems, municipal planning, parks and recreation, risk management and policing services.

3 Situational Overview

History and Background

Opened in September 1875, Blackfriars Bridge is a single span structure, over the north branch of the Thames River, that connects Ridout Street North to Blackfriars Street near the northwest corner of the Central Business District of the City of London, Ontario.

The present bridge carries two lanes of vehicular traffic and has a single sidewalk extending along its south elevation. It also serves to accommodate pedestrians and cyclists providing a connection between segments of the Thames Valley Parkway.

The structure is currently posted for a maximum load limit of 3 tonnes; however, heavy trucks continue to periodically cross the Thames River over the Blackfriars Bridge. This load limit prohibits use by fire and emergency vehicles and standard-size roadway snow clearing equipment. (At the time of its construction, horse drawn wagons were the heaviest loads placed upon the structure.)

There are only three predominantly wrought iron bridge structures remaining in Ontario:

- Blackfriars Bridge
- Ball's Bridge in Huron County
- Hudson Bridge in Leeds and Grenville County.

Of the 19 Wrought Iron Bridge Company (WIBC) bowstring trusses still in existence in the United States and Canada:

- Three are stored
- Three are closed
- Four are abandoned
- Five are pedestrian only
- Three are open to one lane of traffic.

Blackfriars is the only WIBC bowstring arch truss in Canada, the only one open to two lanes of traffic and one of only four that still carry vehicular loads.

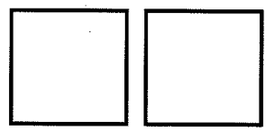
There are a number of properties in the general vicinity of Blackfriars Bridge that are identified in the City of London's Inventory of Heritage Resources.

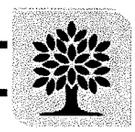
Heritage Evaluation

Blackfriars Bridge is included on the Ontario Heritage Bridge List and designated under Part IV of the Ontario Heritage Act. A Cultural Heritage Evaluation Report was prepared by Archaeological Services Inc. (ASI) in December, 2010.

Current Status

Blackfriars Street is classified as a secondary collector in London's Official Plan. It currently carries an average of 4,000 vehicles per day. These traffic demands along Blackfriars Street are typical for a secondary collector within the city.





Hydraulics

The bridge is located adjacent to the West London Dyke, and an extensive floodplain along the west side of the North Branch of the Thames River. Future raising of the dyke is being considered as part of a current Master Plan study being carried out by The City of London, and the Upper Thames River Conservation Authority (UTRCA). If the dyke is raised, the clearance at the bridge would be reduced and impacts on the bridge from debris or ice flows in extreme conditions should be evaluated.

4 Risk Management Framework

4.1 Principles of Risk Management

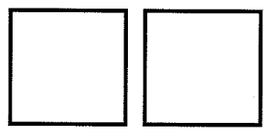
The following principles of risk management were used for this assignment:

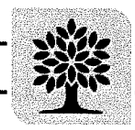
- Risk management creates and protects value;
- Risk management is an integral part of all organizational processes;
- Risk management is part of decision making;
- Risk management explicitly addresses uncertainty;
- Risk management is systematic, structured and timely;
- Risk management is based on the best available information;
- Risk management is tailored;
- Risk management takes human and cultural factors into account;
- Risk management is transparent and inclusive;
- Risk management is dynamic, iterative and responsive to change; and
- Risk management facilitates continual improvement of the organization.

4.2 Risk Receptors

The following risk receptors (possible areas of impact on the City) were included in the City of London's risk management framework, developed in 2011:

- Public Safety
- Employee Safety
- Environmental
- Financial
- Reputation
- Legal & Regulatory
- Service and Productivity
- Technological Issues





4.3 Risk Assessment Methodology

Risk Assessment is the first step in a risk management process, to understand the risks inherent in the current situation at the bridge. Once the risks are understood, risk treatment strategies can be developed and evaluated.

The risk assessment framework is based on the following principle:

Risk = Frequency x Severity

where:

Frequency = qualitative score representing the how often a loss with occur; and

Severity = qualitative score representing the magnitude of the loss, should it occur.

Once the severity and frequency scores are determined for each risk event, they are combined and categorized to determine the overall risk ranking. This exercise was completed by individuals experienced in each relevant subject matter.

5 Risk Assessment

5.1 Summary of Risk Ranking by Event

The table below summarizes the consensus of the workshop participants. It is not intended to apply a strict hierarchy of risks, but rather to provide approximate relative rankings for interpretation by the reader. It should be noted that many Risk Events may be interrelated and trigger one another.

Having large areas of the bridge not inspected (Event 'N') essentially represents the risk of the unknown, with a wide range of possible impacts. This risk could be mitigated by an up-close inspection of the bridge.

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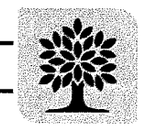
Table 4: Scores by Event and Receptor (sorted)

	Risk Event	Public Safety	Employee Safety	Environmental	Financial	Reputation	Legal & Regulatory	Service & Productivity	Technological Issues	Aggregate Risk Score
V	Collapse of the bridge	H	L	M	H	H	H	L	H	H
A	Collision with bridge compression chord (west bound)	M		M	H	H	M	L	H	H
N	Large areas not accessible, defects not observed	H	VL		H	H	M	M	L	H
W	Erosion & undermining of the banks, degradation of abuts	M		M	H	H	M	M	M	H
I	Collision with bridge compression chord (east bound)	L		L	M	M	L	L	M	H
Z	Loss/reduction of heritage status					H	H		H	H
Q	Increased frequency and duration of repairs				H	M		M	M	H
S	Acceleration of deck and/or steel deterioration				H	M		M		M
R	Different operational requirements for winter maintenance			M	M			M		M
U	Significant bridge damage	L			L	M	L	L		M
O	Closure of bridge to vehicle traffic	VL				M		M	L	M
B	Collision with pedestrian/cyclist crossing road	H				L	VL	M		M
J	Dynamic loading due to speed and other effects				L	L		M	L	M
G	Coming from east, cannot turn around and crossing bridge				L	L	L	M		L
T	Sidewalk railing fails	L			L	L	L	VL		L
BB	Earthquake that damages superstructure and/or abutment	VL		VL	L	VL	VL	VL	VL	L
E	Collision with bridge secondary member	VL			L	L		L	L	L
L	Inspection staff hit by passing vehicle		VL		VL	VL	VL	VL		L
F	Collision and entry to river	VL	VL	VL		VL		VL		VL
Y	Fire (wood decking)				VL	VL		VL	VL	VL
D	High volume of traffic at night					L				VL
C	Collision with vehicle	VL				VL				VL
K	Pedestrian and cyclist collisions	VL								VL
H	Traffic jam on bridge							VL		VL

Legend: Very High (VH), High (H), Medium (M), Low (L), Very Low (VL).



6 Risk Treatment Strategies

The scope of this study was to evaluate the current situation and did not include development and assessment of specific risk treatment strategies. This is a logical next step in developing of a long-term strategy to protect the bridge and its significant heritage and aesthetic value, balanced with its function in the transportation system.

While development of treatment strategies was not a part of the scope, some conceptual strategies were discussed during the workshop.

Of these, completion of a detailed up-close inspection to evaluate the condition of the bridge connections and details is an important next step in preparing to develop a new bridge management plan. The information is critical to the feasibility of many of the conceptual risk treatment strategies considered by the team, and therefore to the management strategy itself.

7 Recommendations & Conclusion

The Risk Assessment of Blackfriars Bridge was intended to provide an understanding of the key risks that exist in the current configuration for this special heritage structure. Based on the findings of this assessment, the City is better equipped to evaluate and develop a management plan to address those risks which exceed acceptable limits in an economical and effective manner.

It was observed during the session that there was a gap in knowledge about the condition of the bridge, since the last up-close detailed inspection of the bridge was conducted over 25 years ago (1986). In addition, there are many risk treatment strategies that could be implemented but not all of these are compatible with one another.

It is recommended that:

1. a detailed up-close structural inspection and condition assessment and evaluation of the bridge be completed.

2. an evaluation of various risk treatment strategies be completed, based on the results of this risk assessment, to provide a better understanding of the practical options available to the City and key impacts associated with the actions.