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<b>TO:</b>	<b>CHAIR AND MEMBERS CIVIC WORKS COMMITTEE MEETING ON SEPTEMBER 9, 2013</b>
<b>FROM:</b>	<b>JOHN BRAAM, P. ENG. MANAGING DIRECTOR, ENVIRONMENTAL AND ENGINEERING SERVICES &amp; CITY ENGINEER</b>
<b>SUBJECT:</b>	<b>BLACKFRIARS BRIDGE – STRUCTURAL REPAIRS AND TEMPORARY CLOSURE</b>

<b>RECOMMENDATION</b>
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That, on the recommendation of the Managing Director, Environmental and Engineering Services & City Engineer, the following actions **BE TAKEN** in respect to the Blackfriars Bridge:

- a) Emergency repairs undertaken by McLean Taylor Construction Limited, 25 Water Street, St. Marys, ON N4X 1B1, in the amount of \$49,450 (excluding HST) **BE APPROVED** in accordance with Section 14.2 of the Procurement of Goods and Services Policy, it being noted that this was a non-competitive emergency procurement to maintain an essential City service and to address a public and worker safety concern;
- b) Emergency repair design and construction administration fees incurred by Dillon Consulting Limited 130 Dufferin Avenue, Suite 1400, London, ON N6A 5R2, in the amount of \$25,550 (excluding HST) **BE APPROVED** it being noted that this was a non-competitive emergency procurement to maintain an essential City service and to address a public and worker safety concern;
- c) the financing for this project **BE APPROVED** as set out in the Source of Financing Report attached hereto as Appendix 'A';
- d) the Civic Administration **BE AUTHORIZED** to undertake all the administrative acts that are necessary in connection with this project; and,
- e) Civic Administration **BE AUTHORIZED** to proceed with the Environmental Assessment for the rehabilitation for the Blackfriars Bridge, it being noted that a future report will be required for the authorization to appoint a consulting engineer for the project.

<b>PREVIOUS REPORTS PERTINENT TO THIS MATTER</b>
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- 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
- March 18, 2013 – CWC – Blackfriars Bridge Detailed Structural Inspection

<b>BACKGROUND</b>
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**Purpose:**

The purpose of this report is to advise Civic Works Committee and Council of the initial results of the Detailed Structural Inspection of the Blackfriars Bridge. The up close inspection has allowed the City and consulting engineer to evaluate the condition of the bridge connections and main structural elements not typically visible. As a result of the inspection, a number of deficiencies have been identified that require emergency repairs to the bridge. Due to the ongoing inspection work and as a matter of public safety, the bridge was closed to all vehicles

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and pedestrian traffic on August 20, 2013 until a course of action could be developed and the various options presented to Council for approval.

<b>DISCUSSION</b>
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**Heritage:**

The Blackfriars Bridge is the third distinct structure built in 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 (WIBC) on two stone abutments constructed by Isaac Crouse. 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 nineteen (19) WIBC bowstring truss bridges still in existence in the United States and Canada, of which only five (5) are open to pedestrian traffic and three (3) carry one lane of vehicle traffic. With the exception of the Blackfriars Bridge, the remaining ten (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 WIBC structure remaining in Canada.

The bridge was designated as a Heritage Structure under the Ontario Heritage Act (Part IV) on April 21, 1992. Blackfriars Bridge is a significant heritage landmark for the City of London and, at 138 years old, it requires ongoing maintenance and review.

**Background:**

In March, the Blackfriars Bridge Risk Assessment Summary Report was presented to Council. The Risk Assessment was part of development of a long-term strategy to protect the bridge and its significant heritage and aesthetic value, balanced with its function in the transportation system.

In order to provide the additional information required to develop long term treatment strategies, a Detailed Structural Inspection of the Blackfriars Bridge was approved. The inspection, the first in more than twenty-five (25) years, would provide the information required to undertake a full structural analysis of all bridge components. This missing information is needed to evaluate risk treatment options conceptualized in the Risk Assessment.

The inspection to date has involved the installation of temporary scaffolding along the underside of the bridge, which provided access for the inspectors to normally inaccessible locations. A review of the superstructure was also completed by the use of mobile scaffolding. Further tests are underway to complete the condition inspection of the existing structure.

*Preliminary Inspection Findings*

The inspection to date has identified a number of structural deficiencies. These deficiencies raised concerns related to the overall integrity of the structure and as a matter of public safety, prompted the closure of the bridge to all vehicle and pedestrian traffic.

The inspection has identified the following deficiencies:

- significant deterioration in the top chord. The top arch is showing deformation, delamination, weld cracks, broken rivets and rust jacking along various welded joints such that it is not performing as originally designed;
- ten (10) out of twenty-eight (28) primary support member locations below the deck are exhibiting significant corrosion-related loss of section and evidence of concerning deformation; and,
- diagonal braces below the deck are broken.

These deficiencies are more severe than anticipated and raise into question the overall structural capacity of the bridge. Prior to the reopening of the bridge, these items must be repaired.

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In addition, the existing deck type on the bridge is an ongoing issue. Deterioration of the deck since the last emergency repairs in the winter has progressed such that the deck needs to be repaired prior to the reopening to vehicles.

In addition to the structural deficiencies, the current inspection is reviewing in greater detail the condition of the top chord of the bridge using video techniques (internal to the structure).

While not included as part of the current assignment, the stability of the abutments and the east slopes and the condition of the abutment bearing areas need to be assessed. These inspections, planned for the future design phase, may yield additional deficiencies and remedial actions/costs.

### *Repair Options*

The findings of the Detailed Structural Inspection were to be incorporated into the development of a long term strategy to manage the Blackfriars Bridge. The structural deficiencies that have been identified introduced short term implications in terms of maintaining access across the bridge. The overall long term viability of the structure will be confirmed with analysis following the inspection.

The structural deficiencies have implications on the bridge use for both vehicle and pedestrian/cyclist traffic. The structural elements in question would need to be repaired prior to the reopening of the bridge for either use.

### Short Term Options

1. Proceed to Long Term Option Review, Bridge Remains Closed

2. Temporary Repairs to Allow for the Reopening of the Bridge to Vehicle Traffic

- To address the structural deficiencies and provide a lifespan of 2-3 years, the top chord would be strengthened using external bracing (~200 locations), a temporary wire hanger system would be installed at the 10 locations, broken diagonals would be repaired.
- Wooden deck would be replaced.
- 18 week closure (until December 2013)
- Additional Cost: \$430,000 including engineering and contractor costs.



3. Temporary Repairs to Allow for the Reopening of the Bridge Sidewalk to Pedestrian Traffic

- To address the structural deficiencies and provide a lifespan of 2-3 years, the top chord would be strengthened using external bracing (~200 locations), a temporary wire hanger system would be installed at the 10 locations, broken diagonals would be repaired.
- Wooden deck would NOT be replaced and fencing would restrict access to sidewalk only.
- 12 week closure (until November 2013)
- Additional Cost: \$260,000 including engineering and contractor costs.

### Long Term Option

The Blackfriars Bridge is a Heritage structure that is 138 years old. The Municipal Engineers Association Class Environmental Assessment (EA) – October 2000 (amended 2007 and 2011) process applies to the reconstruction or alteration of a structure over 40 years old when the basic structural system, overall configuration or appearance of the structure is altered.

In order to undertake a long term rehabilitation of the structure, change its function/use (vehicle to pedestrian only), remove the bridge or to replace with a replica bridge, the City must undertake an EA.

Maintaining any form of traffic in the long term (vehicle or pedestrian/cyclist access) will require

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a major planned rehabilitation. The anticipated major rehabilitation would be similar to work completed on London's other century old steel bridges such as the King Street Bridge in 2009 for \$1.75 million and the rehabilitation currently underway on the Meadowlily Footbridge for \$2.0 million. If abutment stability concerns are identified, the cost of the bridge rehabilitation could escalate significantly higher.

The EA would confirm the problem/opportunity; generate and assess alternative planning solutions; document the natural, historical, technical, socio- economic and cultural environments in the area; complete an impact assessment of all alternatives and identify the preliminary preferred alternative.

The EA and detailed design for the rehabilitation could be completed by the end of 2014 with the rehabilitation proceeding in 2015. The cost of the EA and detailed design would be approximately \$200,000 to \$250,000.

There are risks associated with the long term option, the bridge will continue to deteriorate from a structural perspective and additional costs may be required to complete the rehabilitation without the short term measures. The bridge would remain closed until the rehabilitation is undertaken. To potentially mitigate additional costs on a complete rehabilitation, the temporary wire hanger system could be installed at the 10 distressed primary support members and the broken diagonals beneath the deck repaired while the current scaffolding access is in place. Conducting these repairs at this time would be cost-effective because the scaffolding installation cost has already been absorbed. The emergency repairs to the top chord could be deferred until the full rehabilitation. Completing these limited repairs would be approximately \$120,000. These repairs would not be sufficient to re-open the bridge to traffic, but would ensure more structural integrity for the longer term. They would be utilized to allow the disassembly of the joint for construction of the ultimate repair during the full rehabilitation.

Some accommodation to London's winters must be anticipated with a long term closure. The design ground snow load for London, if not removed after each storm would more than double the vehicle live load the bridge has been supporting. It is proposed to maintain access gate(s) to allow snow removal by the City after each storm event. Alternatively the existing bridge deck could be removed at an estimated cost of \$35,000 to reduce the loading on the bridge from accumulated snow falls.

<b>SUMMARY</b>
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The detailed inspection of the Blackfriars Bridge has identified the need for repairs prior to the bridge being reopened to any traffic. The bridge is currently closed to all traffic including pedestrians as a precautionary public safety measure.

**Recommendation:**

Staff recommends the completion of an Environmental Assessment for the rehabilitation of the existing structure. The Environmental Assessment will determine the long-term strategy for this iconic heritage structure through an informed and consultative process.

The City's current Capital Budget for Bridge Maintenance/Rehabilitation TS1763-12 has the funds available to complete the study. A Request for Proposal could be issued for the EA/detail design in Fall 2013 and an accelerated schedule may enable the project to be completed in time for the 2015 Capital Budget process.

*Alternative Course of Action*

In the case that Civic Works Committee and Council determines that a closure of the bridge to vehicle and pedestrian/cycling traffic until the completion of the EA and subsequent rehabilitation is not viable, the following additional recommendations related to the implementation of short term repairs would be required:

- f) McLean Taylor Construction Limited 25 Water Street, St. Marys, ON N4X 1B1, **BE AUTHORIZED** to proceed with the emergency repairs to the Blackfriars Bridge estimated to not exceed \$407,810 (excluding HST), in accordance with Section 14.2 of

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the Procurement of Goods and Services Policy, it being noted that this is a non-competitive emergency procurement to maintain an essential City service;

- g) Dillon Consulting Limited, 130 Dufferin Avenue, Suite 1400, London, ON N6A 5R2, **BE APPOINTED** Consulting Engineers to complete the design and inspection of the short term emergency repairs to the Blackfriars Bridge, in accordance with the estimate, at an upset amount of \$21,300 (excluding H.S.T.), in accordance with Section 15.2 'g' of the Procurement of Goods and Services Policy;

The continued use of Dillon Consulting Limited and McLean Taylor Construction Limited on this project is of financial advantage to the City due to the fact that the firm/contractor has specific knowledge of the project, has already mobilized on site and will utilize the temporary scaffolding already in place for the structural inspection.

**Acknowledgements**

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

<b>PREPARED BY:</b>	<b>REVIEWED AND CONCURRED BY:</b>
<b>DOUG MACRAE, P. ENG. DIVISION MANAGER TRANSPORTATION PLANNING &amp; DESIGN</b>	<b>EDWARD SOLDI, P. ENG. DIRECTOR, ROADS AND TRANSPORTATION</b>
<b>RECOMMENDED BY:</b>	
<b>JOHN BRAAM, P. ENG. MANAGING DIRECTOR, ENVIRONMENTAL &amp; ENGINEERING SERVICES &amp; CITY ENGINEER</b>	

Attach:            Appendix 'A' – Sources of Financing

- cc.     J. Freeman, Manager, Purchasing & Supply
- C. Haines, Dillon Consulting Limited
- M. Doupe, McLean Taylor Construction Limited