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Date March 7, 2023 **Report No.** 2023-181

To Chair and Members
Committee of the Whole - Operations

From Inderjit Hans, P.Eng., PMP
General Manager, Public Works Commission

1.0 Type of Report

Consent Item	[ ]
Item For Consideration	[X]

2.0 Topic Ava Road Bridge Rehabilitation Update [Financial Impact – $3.2 million]

3.0 Recommendation

A. THAT Report 2022-191, titled “Ava Road Bridge Rehabilitation Update” BE RECEIVED; and
B. THAT the full road closure of the Paris Road between Terrace Hill St. and Brant Ave to complete the Ava Road Bridge Rehabilitation work (2023/2024 construction) BE ENDORSED; and
C. THAT an increase in the amount of $3.2 million to the capital budget for Ava Bridge (CNR) – OSIM 102 Bridge Rehabilitation Program and Intersection Improvements project (BR1805) BE FUNDED as follows:

    i. $1,000,000 from the OCIF Reserve Fund (RF0448); and
    ii. $1,980,000 from the Roads and Related Reserve (RF0537)
    iii. $220,00 from the Water and Related Reserve Funds (RF0542)

4.0 Executive Summary

The purpose of the report is to update Council on the progress of the Ava Road Bridge Rehabilitation project. This report is also to present Council with two traffic control methods that are being considered for the Ava Road Bridge Rehabilitations (2023 construction) and their impact on the construction cost, construction duration, safety, constructability, bridge durability and local traffic. The two options that have been explored by the City's Consultant and reviewed by the City Staff are full road closure, and partial closure based on staged construction.

It is recommended that staff proceed with the full road closure of Paris Road between Terrace Hill St. and Brant Ave for the 27 week duration of construction due to construction cost savings of approximately $1.7 million, shortened construction duration by 14 working weeks, safe construction, higher durability and easier constructability relative to the staged construction alternative.

It is further recommended that the capital budget (BR1805) for the Ava Road Bridge rehabilitation and associated road work be increased by $3.2 million. The current budget was approved for the bridge rehabilitation based on the 2021 preliminary estimate and the City has recently received an updated cost estimate including additional infrastructure, construction methods and 2023 construction dollars.

5.0 Purpose and Overview

The purpose of the report is to update Council on the Ava Road Bridge Rehabilitation project, recommend full closure of Paris Road between Terrace Hill St. and Brant Ave to through traffic while maintaining access to affected educational institutions and businesses during the construction of the Ava Road Bridge, and to increase the capital budget for the Rehabilitation of the Ava Road Bridge and associated road work.

6.0 Background

The Ava Road Bridge is located between Paris Road and Brant Avenue and crosses over Ava Road and two Canadian National Railway (CNR) tracks. The existing bridge is a four span reinforced concrete deck on steel girders structure supporting two lanes of traffic in each direction and one sidewalk on the east side. Since its original construction in 1959, the bridge has undergone two rehabilitations in 1985 and 1998.

A Schedule 'B' Municipal Class Environmental Assessment (EA) study was initiated in 2008 through the competitive procurement process (completed by

Planmac Inc, in November 2009) to evaluate alternatives for the required rehabilitation of the Ava Road Bridge as well as upgrades to pedestrian links between neighbourhoods and improvements to the adjacent intersections. The study's recommendations were approached in two phases:

- Phase 1 - Re-alignment of the Paris Road and Terrace Hill intersection (successfully completed in 2019 - RFT 2019-59, Network Sewer and Watermain Ltd.);

- Phase 2 - Rehabilitation of the Ava Road Bridge, relocation of the sidewalk from the east side to the west side of the bridge, road realignment at the intersections of Ava Road and Brant Avenue, and addition of an intersection pedestrian signal at the intersection of Paris Road and Terrace Hill Street.

In July 2020, the City retained engineering services of McIntosh Perry Engineers Ltd. (MP) through the public procurement process (RFP 2020-66) for the design of Phase 2 of the EA. During the preliminary design MP completed an Enhanced OSIM inspection (detailed up-close visual inspection) of the bridge which revealed newly discovered deficiencies in the superstructure that have not been previously identified during regular OSIM inspections (visual inspections from the ground). Due to the severity of the deficiencies, on June 23, 2021, as per the MP recommendation, the traffic lanes over the bridge were reduced from four to two lanes to eliminate vehicle load over the deficient structural components of the bridge and as such protect the traveling public. A semi-permanent lane configuration constructed using concrete barriers was put in place to provide a safe alternative for pedestrians and the traveling public. Subsequent to the lane closures, the rehabilitation work for the bridge was reassessed to identify the best rehabilitation option based on the life cycle cost (Present Value) for the structure.

Report No. 2021-746[1] was received by Council on December 7, 2021 detailing the emergency work and funding required for the Ava Road Bridge lane reductions and related work.

The recommended Option 2 was approved by Council and design work proceeded as such. As part of the preliminary design for Option 2, the replacement of the superstructure was proposed to be completed in stages over

[1] Hyperlink to Council Report 2021-746 - Non-competitive Procurement for the Structural Engineering of the Ava Road Bridge, https://pub-brantford.escribemeetings.com/filestream.ashx?DocumentId=9465

a period of two construction seasons with a winter work shutdown in between. The overall construction duration was estimated to take approximately 55 working weeks with winter shutdown lasting approximately 24 working weeks.

7.0 Corporate Policy Context

City of Brantford Council Priority #3, meets with the desired outcome of “A safe, efficient transportation system connects the community across neighbourhoods, with neighbouring communities and provincial transportation networks”.

8.0 Input From Other Sources

Input for this report has been provided by Finance, Purchasing, Engineering Services, Operational Services departments, and McIntosh Perry Engineers Ltd.

9.0 Analysis

9.1 General

Following approval to advance into full superstructure replacement design, the City requested that MP explore and propose design and traffic control options to reduce the overall construction duration for the Ava Road Bridge rehabilitation and associated road work. The Analysis below discusses the proposed traffic control methods and financial implications associated with both alternatives.

With either traffic control option, there are risks to both the timeline and the cost of the construction. CN Rail has insisted that the City add the construction of crash walls around the piers adjacent to the tracks. Staff are currently working with CN to either remove this requirement or, if unsuccessful, to allow the City to defer that construction of the crash wall as independent project to a later stage and possibility of cost sharing. Staff have allowed for cost and time in the project at this stage, however the crash walls will require a foundation investigation and may result in foundation strengthening that may require more time. Also, there are a number of unknowns that will not be revealed until the excavation is undertaken. This item also requires additional flagging from CN which could be difficult to secure on short notice.

City staff are making all efforts to begin the construction as soon as possible this year and to minimize construction duration. However, the actual construction start and duration also depends on the CN work permit approval and the availability of CN flagging during construction. For safety reasons, no bridge

rehabilitation work within 30ft of the centerline of the nearest CN track can proceed without CN flagging.

9.2 Traffic Control During Construction

9.2.1 Alternative No. 1 – Two Stage Construction

Replacement under two stages of construction would be comprised of completing removals, repairs, and new construction of each half of the structure independently. This approach would maintain traffic over the bridge during the construction, particularly pedestrian traffic as the bridge provides key access from the north side of the CN tracks to Brantford Collegiate Institute to the south and from the south side of the tracks to St. John's College to the north.

Under this option, minimum one lane of traffic in both directions would be maintained over the bridge during stage 1. During stage 2, only southbound traffic would be open over the bridge with northbound traffic detoured via St. Paul Ave. and Terrace Hill Street. The various phases of the staging are illustrated in Appendix 2, Staging Phases.

The impacts of staged traffic construction on the project can be presented using the following categories:

Construction Duration – The construction duration will be longer relative to full road closure and would extend beyond one construction season. It is anticipated that approximately 202 working days (41 working weeks) will be required to complete the construction, which is 68 working days or 14 working weeks longer than the full road closure alternative.

Traffic Management – the vehicle traffic impact caused by the rehabilitation work will be prolonged and risker due to longer construction time and more safety precautions and procedures need to be in place for longer period of time, hence possibility of accident will increase. Also changing construction zone traffic patterns can lead to confusion and increased traffic delays. However, pedestrian traffic will not be impacted as a result of the construction.

Construction Cost – The total estimated cost of construction to complete the rehabilitation of the bridge and all associated road work is $8.46 million, which is an additional $1.26 million compared to the full road closure alternative. When contingency, contract administration, construction inspection and staff time, estimated at $2.14, million are included, the overall capital cost of the

project is estimated to be $10.6 million. This is $1.7 million more than the full closure option.

Constructability – The staged construction would require a temporary traffic lane protection system (jersey barriers, traffic signage), and temporary road protection on bridge approaches (soil retaining system) to rehabilitate the substructure of the bridge while keeping one traffic lane open. The longer construction time associated with staged construction would also increase the need for CN coordination and flagging time during construction. Furthermore, a temporary crane platform on the approaches or underneath the structure would need to be provided due to the limited working zone. Longer construction time will lead to longer winter construction which will require additional labour and material efforts.

Durability – The majority of concrete will be cast in two pours resulting in construction joints which impact the quality of the roadbed causing future operational issues and maintenance costs. Longer construction time will result in the construction extending into the winter. Winter construction is more costly and can have detrimental effects on asphalt paving, deck waterproofing and cast concrete, reducing their durability.

9.2.2 Alternative No. 2 - Full Road Closure

The full road closure of the bridge would allow all removals and reconstruction work to be completed in one mobilization for each element consecutively, or simultaneously where practical.

Figure 1: Limits of the Full Closure

A more detailed detour and signing plan will consider moving the northbound closure close to the intersection of St Paul and Brant and allow for “local traffic” only. Based on the traffic study completed by MP (Appendix 1), overall, the adjacent road network is capable and has sufficient capacity to accommodate the full road closure. The passenger vehicle detour is expected to run through St. Paul Avenue and Terrace Hill Street. While more significant impacts are observed at the intersection of St. Paul Avenue and Terrace Hill Street, only minor increases in delays and queueing would be expected at all other

intersections affected by the road closure. Furthermore, the impacts at the St. Paul Avenue and Terrace Hill Street intersection are not expected to result in any significant operational issues such as excessive queueing and can be accommodated by the existing road geometry. Signal timing changes can also be investigated to optimize the splits to accommodate the increased volumes on the northbound, eastbound, and westbound approaches and mitigate impacts associated with increased delays and queueing.

Trucks will be detoured via St. Paul Avenue and King George Road for northbound truck traffic and Tollgate Road and King George Road for southbound truck traffic.

The impacts of the road closure on the project can be presented using the following categories:

Construction Duration – The construction would be expedited and potentially completed in one construction season. It is anticipated that approximately 134 working days (27 working weeks) will be required to complete construction.

Traffic Management – All vehicle traffic volume can be adequately and safely accommodated by the adjacent road network with minor optimization. However, full closure would prohibit pedestrians from crossing the bridge and construction area. The closure option provides for a predictable and consistent detour for the duration of the closure. The out-of-way travel for pedestrians could result in as much as a 1.4 km (15 -20 min) detour to foot traffic.

Construction Cost – The total estimated cost of construction to complete the rehabilitation of the bridge and all associated road work is $7.2 million. This cost is comprised of $5.0 million from the original estimate in the 2021 Technically Preferred Alternative memorandum plus the following additional costs:

- $870,000 for road works and watermain replacement;
- $330,000 for changes to materials to expedite construction and increase longevity of the structure; and
- $1.0 million for crash walls requested by CN.

Additionally, further funds in the amount of $1.7 million are required to provide contingency and cover contract administration, construction inspection and staff time. The total estimated capital cost of this project is $8.9 million.

Constructability – The full road closure is a safer alternative as this will eliminate the need for a temporary traffic lane protection system (jersey barriers, traffic signage), and for temporary road protection on bridge approaches (soil retaining system) that would be required to rehabilitate the substructure of the bridge. The shorter construction time associated with full road closure would also reduce the need for CN coordination and flagging time during construction. Furthermore, a temporary crane platform on the approaches or underneath the structure would not be required as the full road closure would result in more working zone.

Durability – With the road fully closed, the majority if not all construction joints can be eliminated as concrete casting will be monolithic (all in one pour). Additionally, the shorter construction time associated with full road closure would avoid or minimize winter construction.

9.2.3 Evaluation of Alternatives

MP has evaluated both alternatives and provided their recommendation based on Table 1 below which can also be found in the Staged Assessment Memo in Appendix A.

Table 1: Comparison of Alignment Alternatives

Criteria	Alternative 1 Two Stage Construction	Rating	Alternative 2 Full Closure	Rating
Constructability	• Roadway protection system required • Greater complexity • Longer duration flagging by CN • Tempoary crane platform required outside of approach road platform • Winter construction slow construction	0.3	• No roadway protection system need • Single mobilization • Shorter duration flagging by CN • No additional crane platform outside of existing roadway platform	1.0
Durability	• Construction joints at piers, ballast walls, and deck • Winter construction	0.6	• No construction joints • Completed before winter conditions	1.0
Working Days	• 202 Working days	0.2	• 134 Working days	1.0
Traffic Management	• Both directions of traffic maintained in stage 1 and southbound traffic only open in stage 2	0.8	• Traffic fully detoured. Traffic detour is manageable	0.8
Pedestrian Access	• Maintains pedestrian access	1.0	• No pedestrian access	0.2
Cost	• Greater cost ($7.19 M)	0.8	• Lower cost ($6.79 M)	1.0
Total Score		**64.5**	**Technically Preferred**	**81.0**

The scores for each criterion assigned in Table 1 were based on the favorability of the alternative between 0 and 1. A rating of 0 was deemed not acceptable, with 1 most preferred. The total score was derived by multiplying the rating by the weighting assigned to each category. An equal weighting of 15% was assigned to constructability, durability, working days, and traffic management, and a higher weighting of 20% was assigned to pedestrian access and cost criteria.

Staff recommend Council approve Alternative 2 – Full Road Closure. Approval is required at this time, to allow the Tender and Specification to be completed and processed as soon as possible so that the contract can be awarded as early in the year as possible.

10.0 Financial Implications

The current approved funding for the Ava Road Bridge Rehabilitation project is $6,720,000, which has accrued over several years.

Between 2018 and 2020, a total of $1,220,000 was approved for the design and construction of the improvements to the Paris Rd./Terrace Hill St. intersection,

and the design of the Ava Road Bridge rehabilitation. An additional $5,500,000 was approved during the 2022 Capital Budget Process based on the 2021 Consultant provided estimate.

Amounts have been utilized on the Phase 1 intersection project, and encumbered to account for the studies and detailed design, and $5,716,056.27 remains. At the time of the 2021 estimate, costs included the superstructure replacement and a ten percent contingency.

The latest class A estimate provided by MP on February 8, 2023 estimates construction costs for Alternative 2 at $7.2 million. This value includes:

- $5.0 million for the superstructure replacement;
- $220,000 for the watermain work;
- $650,000 for the road work;
- $330,000 for changes to materials to expedite construction and extend the lifespan of the piers; and
- $1 million for the crash walls.

The estimate does not include contingency, Contract Administration and Construction Inspection or Staff time for tendering and construction which will amount to $1.7 million. Based on the 100% design estimates, the required capital budget increase is estimated to be the following:

Alternative No. 1 – Staged Construction: $4.9 million.

Alternative No. 2 – Full Road Closure: $3.2 million

A budget increase of $3.2 million is required to support full road closure as recommended for this project, to be funded as follows:

- $1,000,000 from RF0448 – Ontario Community Infrastructure Fund (OCIF) Reserve,
- $1,980,000 from RF0537 - Roads and Related Reserve, and
- $220,000 from RF542 – Water and Related

11.0 Climate and Environmental Implications

This Report does not have any direct climate and environmental implications. However, the alternatives addressed within this report will have some impact on construction and vehicle greenhouse gas (GHG) emissions for the duration of

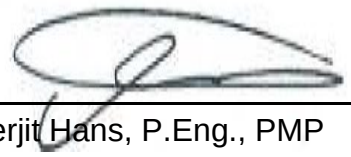
construction. It is assumed, Alternative 1 would result in more GHG emissions since construction is expected to last for 202 working days as opposed to Alternative 2 which is expected to last for 134 days. At this time, GHG emissions from construction cannot be quantified since construction variables such as equipment type, number, hours of operation, fuel type, etc. are not yet known.

12.0 Conclusion

Ava Road Bridge is an essential part of the city's transportation network that currently has reduced lanes of traffic due to structural deficiencies found in the bridge superstructure. It is advantageous to complete the construction of the bridge in a timely manner and with minimal impact to the city's transportation network.

In order to secure a sufficient construction budget and to minimize the risk of delayed construction start, it is essential that additional funding in the amount of $3.2 million be assigned to this capital project (BR1805).

By authorizing the full road closure over the Ava Road Bridge both construction duration and the length of traffic disturbance can be reduced. Furthermore, full road closure during construction is expected to reduce construction costs by approximately $1.7 million, improve bridge constructability, durability, and minimize risks associated with CN coordination, flagging, and winter construction.



Inderjit Hans, P.Eng., PMP
General Manager, Public Works Commission

Prepared By:

Jennifer Elliott, LET, C.E.T., Director of Engineering Services
Hyder Rajab, P. Eng., Manager of Design and Construction
Adam Galezowski, P. Eng., Senior Project Manager
Mike Campbell, P. Eng., Engineer

Attachments (if applicable)

Appendix 1 – Staging Assessment Memo prepared by McIntosh Perry Consulting Engineering Ltd.

Appendix 2 – Staging Phases

Copy to:

In adopting this report, is a by-law or agreement required? If so, it should be referenced in the recommendation section.

By-law required	[ ] yes	[X] no
Agreement(s) or other documents to be signed by Mayor and/or City Clerk	[ ] yes	[X] no
Is the necessary by-law or agreement being sent concurrently to Council?	[ ] yes	[X] no