E) Traffic Bridge Needs Assessment and Functional Planning Study Final Report (File: CK 6050 – 8; IS 6332 – 24; and IS 6050 – 2)

RECOMMENDATION:

1) that the existing Traffic Bridge be replaced with a modern steel truss bridge as outlined in this report;

2) that the replacement structure be completed through a design-build process;

3) that the trusses be engineered to accommodate a safe minimum vertical clearance for emergency vehicles and transit;

4) that the Administration report further regarding a source of funding; and

5) that as part of the design-build process, efforts be made to incorporate elements of the heritage and architecture of the existing bridge.

EXECUTIVE SUMMARY

The Administration is recommending that a modern steel truss bridge be constructed to replace the existing Traffic Bridge, on refurbished existing piers. A modern, weathering steel Parker through-truss bridge will provide a unique design aesthetic which meets modern bridge engineering standards while maintaining some elements of the original heritage and character.

Increasing the width of driving lanes from the current 2.9 metres to 3.7 metres will permit use of firefighting equipment and reduce the frequency of side-swipe and fixed-object collisions. A modern bridge will also change the pedestrian and cycling facility from a single 1.8 metre wide walkway to twinned 3.0 metre walkways expanding accessibility to pedestrians and cyclists. In addition, the use of a modern steel truss will retain the existing vertical profile of the bridge and maintain the overhead clearances of this heavily-used section of the South Saskatchewan River.

Throughout the public consultation process, improving the non-vehicular facilities and the width of the driving lanes were identified as important elements of any new bridge. Each of the three options identified in this project were shaped by the public through the consultation process and tempered by the engineering and financial analysis. Each option has a significant amount of community support, and all three are technically feasible. During the third round of public consultation, approximately 59% of the feedback supported the construction of a new bridge.

The Administration is recommending the modern steel truss replacement option because it balances the needs of the community while reducing the engineering and financial risks.

BACKGROUND

City Council, at its meeting held on May 25, 2010, approved the contract award for the Needs Assessment and Functional Planning Study of the Traffic Bridge to Stantec Consulting Ltd.

The Study includes an extensive public consultation component; assesses current traffic and pedestrian and cycling usage; recommends the number of lanes, if it is to remain a Traffic Bridge; and identifies what changes would be necessary in order to increase its utility as a Traffic Bridge. Each transportation option has a corresponding structural evaluation to determine detailed cost estimates and a feasibility analysis.

On August 24, 2010, the Traffic Bridge closed in the interest of public safety, based on a preliminary inspection.

REPORT

The City of Saskatoon commissioned Stantec to undertake a needs assessment of the Traffic Bridge to examine options for the future and its potential to accommodate a variety of pedestrian/bicycle, transit, vehicle and community functions. The study included:

- Detailed traffic analysis and structural assessments;
- Development of various concepts to maintain or modify the current bridge usage, including cost estimates and a comparison of the advantages/disadvantages of each concept; and
- Public consultation to ensure the public has an opportunity to express their views and help guide the development of potential alternatives (three open houses).

First Round of Public Consultation

The first public consultation/open house regarding the future of the Traffic Bridge was held at Nutana Collegiate Library on June 22, 2010, from 6:00 to 9:00 p.m. The come-and-go open house was an information-only event, designed to facilitate an inclusive, balanced and open community engagement. An estimated 250 to 300 people attended, with approximately 125 survey and comment sheets being completed. Approximately 25 boards containing information about the Traffic Bridge were available for viewing, and seven boards, with sticky notes, were set up for people to write their comments. In addition, an online forum was available on the City's website from June 23 to the end of July in order to solicit a broad range of opinions and to engage as many people as possible. Approximately 420 surveys were completed online.

Attachment 2 illustrates the overall responses from both the online and open-house surveys. (A total of 548 responses were received.)

Second Round of Public Consultation

City Council, at its meeting held on September 13, 2010, considered a report of the General Manager, Infrastructure Services Department, which provided a status report on the Study to date.

Council resolved that as the Administration moves forward with the Open Houses, only Options 1, 4, 5 and 6 be considered. These options, detailed below, had been developed based on the public input already received, traffic analysis, the inspection and the structural analysis.

Option	Description
1.	Complete rehabilitation for vehicle, pedestrian and cyclist use
4.	Replace with a conventionally designed structure (girder and deck) for vehicle, pedestrian and cyclist use
5.	Replace with a modern steel truss or similar form to the existing bridge for vehicle, pedestrian and cyclist use
6.	Replace with an architecturally significant structure for vehicle, pedestrian and cyclist use, a modern "signature bridge"

The second public open house was held on Wednesday, September 15, 2010, from 6:00 p.m. to 9:00 p.m., at Victoria School. A come-and-go format, similar to the first open house, was used to gather responses to the four options. An estimated 350 to 450 people attended, with approximately 360 survey and comment sheets being completed. Twenty-four boards containing information about the Traffic Bridge were available for viewing, and four boards with sticky notes were set up for people to write their comments. In addition, an online forum was available on the City's website from September 16 to September 30. Approximately 575 surveys were completed online and nearly 900 surveys were completed in total.

Attachment 3 summarizes the overall responses received from both the open house and online surveys.

Common concerns identified in the consultation included operating costs, what would likely be saved in complete rehabilitation, and the implications of non-standard width driving lanes.

Third Round of Public Consultation

Following the second open house, a short list of recommendations was developed and a third round of public consultation was held to discuss the short-list and provide additional information to address the common concerns which had been identified. This final event was held on October 20, 2010, from 6:00 p.m. to 9:00 p.m., at the Royal Canadian Legion, Branch 63.

The short list, outlined below, had been developed based on the public input already received, traffic analysis, the inspection and the structural analysis:

Option	Description
1.	**Complete rehabilitation for vehicle, pedestrian and cyclist use: Maintain the bridge in its existing form and function.**
	2 non-standard 2.9 metre driving lanes (remains the same as existing lanes)
	2 new separate 3.0 metre clear zone multi-use walkways
	Concept probable cost $24M – $34M
	Estimated construction time: 24 – 36 months
	Estimated annualized operating cost $150,000/year
4.	**Replace with a conventionally designed structure (girder and deck) for vehicle, pedestrian and cyclist use. Likely a concrete bridge.**
	2 standard 3.7 metre driving lanes
	2 standard 1.5 metre shoulders that provide an offset from the guardrail/barrier curb, and an opportunity for bike lanes
	2 separate 3.0 metre clear zone multi-use walkways
	Concept probable cost $26M - $35M
	Estimated construction time: 18 – 24 months
	Estimated annualized operating cost $16,000/year
5A.	**Replace with a modern steel truss for vehicle, pedestrian and cyclist use.**
	2 non-standard 3.3 metre driving lanes
	2 separate 3.0 metre clear zone multi-use walkways
	Concept probable cost $25M - $33M
	Estimated construction time: 18 – 24 months
	Estimated annualized operating cost $15,000/year
5B.	**Replace with a modern steel truss for vehicle, pedestrian and cyclist use.**
	2 standard 3.7 metre driving lanes
	2 separate 3.0 metre clear zone multi-use walkways
	Concept probable cost $27M - $34M
	Estimated construction time: 18 – 24 months
	Estimated annualized operating cost $18,000/year
5C.	**Replace with a modern steel truss for vehicle, pedestrian and cyclist use.**
	2 standard 3.7 metre driving lanes
	2 standard 1.5 mere shoulders that provide an offset from the guardrail/barrier curb, and an opportunity for bike lanes
	2 separate 3.0 metre clear zone multi-use walkways
	Concept probable cost $29M - $37M
	Estimated construction time: 18 – 24 months
	Estimated annualized operating cost $20,000/year

Option 6, the "signature bridge", was not highly regarded during the public consultation process, although a number of letters to Infrastructure Services and Council were received supporting the concept. In general, it is seen as an opportunity to establish a new vision or architectural presence for the site. This option would require an Expression of Interest process involving design, detailed engineering and construction. An initial estimate for a signature bridge is approximately $60,000,000; and would take years to complete.

The come-and-go format, similar to the first and second open houses, was used to gather responses to the options above, with all the panels, the survey and opportunity for comments. An estimated 134 people attended, with approximately 121 survey and comment sheets being completed. Twenty-three boards containing information about the Traffic Bridge were available for viewing, and four boards with sticky notes were set up for people to write their comments. In addition, the online forum was available on the City's website from October 20 to November 1. Approximately 180 surveys were completed online, 301 surveys in total.

Attachment 4 summarizes the overall responses received from both the open house and online surveys combined.

Recommendations

Based on public response and comments from the last public consultation, as well as detailed engineering analysis, the following short-list of options was considered:

Option	Description
1.	**Complete rehabilitation for vehicle, pedestrian and cyclist use: Maintain the bridge in its existing form and function.**
	80 year design life
	2 non-standard 2.9 metre driving lanes (remains the same as existing lanes)
	2 new separate 3.0 metre clear zone multi-use walkways
	Concept probable cost $24M – $34M
	Estimated construction time: 24 – 36 months
	Estimated annualized operating cost $150,000/year (i.e. primarily painting every 15 years), total operating costs over 80 years estimated at $12M
	Benefits:
	▪ Much of the existing heritage and character would be maintained ▪ The original shop drawings would be used to replicate each element of the built-up members, the restored bridge would be a replica of the original bridge (except for the modern steel bolts instead of rivets) ▪ Narrow 2.9 metre driving lanes promote appropriate driving behaviour on connecting streets ▪ The unique and distinctive architectural form makes it an object for study, as the last surviving Parker through truss, and as an historic linkage of our founding communities ▪ Contributes towards our cultural heritage and tourism ▪ Potential access to senior government funding related to national historic recognition for the rehabilitation project
	Drawbacks:
	▪ Narrow 2.9 metre driving lanes may increase collision frequencies ▪ Current 2.6 metre height restriction remains (precludes transit and emergency vehicle use) ▪ Extensive annual and scheduled maintenance required ▪ The special treatment of joints between original and replacement metals is required to prevent corrosion; monitoring will be required ▪ Complex and expensive future inspections will be required ▪ Original steel prone to brittle (sudden) failure at low temperatures

	▪ Trusses do not have redundancy in the event of main element failure ▪ All the modern elements will be noticeably different from the existing elements ▪ Highest risks financially, greatest project complexity
4.	**Replace with a conventionally designed structure (girder and deck) for vehicle, pedestrian and cyclist use. Likely a concrete bridge.**
	80 year design life
	2 standard 3.7 metre driving lanes
	2 standard 1.5 metre shoulders that provide an offset from the guardrail/barrier curb, and an opportunity for dedicated bike lanes
	2 separate 3.0 metre clear zone multi-use walkways
	Concept probable cost $26M - $35M
	Estimated construction time: 18 – 24 months
	Estimated annualized operating cost $16,000/year, total operating costs over 80 years estimated at $1.28M
	Benefits:
	▪ Standard 3.7 metre driving lanes and 1.5 metre shoulders adequate for cyclists ▪ Remove current weight restriction ▪ Remove current height restriction ▪ Straight-forward future inspections ▪ Opportunity to illustrate current and contemporary bridge design and engineering
	Drawbacks:
	▪ None of the existing heritage or character would be preserved ▪ Major arterial (highway) design may promote undesirable driver behaviour ▪ Aesthetics have not been considered within this cost estimate ▪ No potential access to senior government funding related to national historic recognition for the rehabilitation project ▪ Potentially, a reduction to the vertical clearance of the navigable waterway below
5B	**Replace with a modern steel truss for vehicle, pedestrian and cyclist use.**
	80 year design life
	2 standard 3.7 metre driving lanes, marked with sharrows
	2 separate 3.0 metre clear zone multi-use walkways
	Concept probable cost $27M - $34M
	Estimated construction time: 18 – 24 months
	Estimated annualized operating cost $18,000/year, total operating costs over 80 years estimated at $1.44M
	Benefits:
	▪ Standard 3.7 metre driving lanes, marked with sharrows (the wider lane width will significantly alter the appearance of the bridge) ▪ Retaining the truss design provides a reference to the original character ▪ Remove current weight restriction ▪ Use of weathering steel (reduces maintenance) ▪ Modern engineering and materials ▪ A modern Parker through truss will have a unique design aesthetic
	Drawbacks:
	▪ Aesthetic impact of use of weathering steel (rusted appearance)

	▪ Major arterial design may promote undesirable driver behaviour ▪ Truss design requires complex and expensive future inspections ▪ Trusses do not have redundancy in the event of main element failure ▪ No potential access to senior government funding related to national historic recognition for the rehabilitation project ▪ The wide structure will require a significant alteration of the piers and pier caps

Included in the concept estimates is approximately $4,000,000, which is required to refurbish the piers to ensure their service life matches the chosen option's service life. Without refurbishment, the piers have been assessed as having up to 20 years of serviceable life under similar loading conditions as today. All three options have the same design life of 80 years, assuming the piers are refurbished at the same time.

Based on the engineering and financial analysis, the Administration is recommending Option 5B, replace with a modern steel truss for vehicle, pedestrian and cyclist use; and that the replacement structure is completed through a design-build process.

In addition, the Administration is recommending that the trusses be engineered to accommodate a safe minimum vertical clearance for emergency vehicles and transit (3.8 metre minimum vertical clearance is required for current fire trucks).

Throughout the public consultation process, the public stressed the importance of pedestrian access and the desire to improve the facilities (primarily for comfort and safety) of this crossing. Currently, pedestrians share a narrow walkway with cyclists on one side of the bridge. As on all bridges in the City, cyclists are allowed to use the walkways. On the University, Broadway and Traffic Bridge, cyclists may share the bridge deck with motor vehicle traffic.

The Traffic Bridge has provided a unique, heavily used access across the river for cyclists and pedestrians; however, with the mix of recreational, commuter and sight-seeing pedestrians, wider walkways are required to reduce conflicts. The recommended option will provide greater accessibility and increased comfort for pedestrians, as well as reduce conflicts. In addition, it will eliminate the need for pedestrians to cross Victoria Avenue to use the river crossing.

There is a mix of cyclist demand at this crossing; from recreational family groups exploring the river valley, to fast-paced commuters. Cyclists will continue to be allowed to use the walkways or the bridge deck. It is anticipated that slower-paced recreational cyclists will choose the walkways. The bridge deck will be marked with sharrows in the driving lanes to encourage commuter cyclists to remain on the road, as well as to indicate to motorists that cyclists are allowed on the road.

The public expressed little interest in a four-lane bridge early in the public consultation process. The Administration is recommending a two-lane bridge, which will maintain the existing character, function and traffic volumes from Third Avenue and Victoria Avenue, which is an important consideration in determining how this bridge function in the road network.

OPTIONS

Option 1 (complete rehabilitation) is not being recommended for the following reasons:

- Inherent safety risks of the rehabilitation process itself.
- Risk that original material will remain.
- Any original remaining metal will not meet modern bridge design codes and will be prone to brittle failures at low temperatures. As much as 60% to 70% of the original steel is expected to be removed during the rehabilitation process; however, there is no certainty in the amount of original material that may remain.
- From a bridge design/inspection perspective, a truss bridge is considered a fracture-critical bridge. That is, if a main structural element of the truss were to fail, there are no alternative paths for the load to be distributed to. This is referred to as structural redundancy. Trusses by their nature are non-redundant and, if a main element of the truss fails, it can cause complete collapse of the bridge span.
- From an inspection standpoint, a truss bridge is inherently more complex than a simple deck-on-girder bridge. More critical members (i.e. bottom chord, floor beams, stringers, etc.) mean increased inspection requirements and the risk of more problems arising, especially if members are not properly maintained. A truss bridge is also more difficult to inspect, often requiring need of special access to the underside.
- Actual rehabilitation costs may vary greatly from initial estimates because of the high risk that contractors may place on restoring an older structure with difficult accessibility, and potential environmental concerns due to the lead-based paint that was used.
- Higher annual maintenance and inspection costs (including painting every 15 years at approximately $5,000,000, in 2010 dollars).

Option 4 (conventional design) is not being recommended for the following reasons:

- None of the existing heritage or character would be preserved, and no reference to the original river crossing would remain.
- The major arterial design may promote undesirable driver behaviour, such as excessive speed, which could potentially alter the function of the adjoining roads.
- Aesthetics have not been considered within the cost estimate.
- There could be a potential reduction to the vertical clearance of the navigable waterway, depending on the engineering of the girders.

During the review process, the Administration identified an opportunity for a reduction of legacy (operating) costs by eliminating Span 1 (the span entirely over the riverbank on the south side). The elimination of this span could potentially permit the relocation of Saskatchewan Crescent West to an at-grade intersection with Victoria Avenue, improving access to the bridge. It is recommended that a functional planning study and construction of this intersection be included in the bridge replacement project. The costs of reconstruction of a new intersection are not included in the estimates provided.

Collision statistics from the Traffic Bridge from 1990 to 2009 show, on average, 15 collisions per year. Of the collisions, 54% involved a fixed and/or movable object; 8 % were reported as sideswipes; and 11% were reported as loss of control. It is the Administration's opinion that standard width driving lanes will reduce the frequency of these types of collisions.

ENVIRONMENTAL IMPLICATIONS

There are significant regulatory environmental protections approvals/permits required for the demolition of the existing bridge, as well as the construction of a future bridge. An outline of the permitting process and implications for refurbishment/replacement of the bridge are as follows:

Assuming the Traffic Bridge is either rehabilitated or replaced, the issues will be similar, and permits and approvals will be required from:

- Department of Fisheries and Oceans (DFO): Concern will focus on materials being deposited in the river (this assumes no new pier development or shoreland development). Details regarding how the river environment will be protected during the operations will be required.
- Transport Canada - Navigable Waters Protection Program (TC): Concern will be maintaining a navigable channel, and if any new design is closer to the high water level.
- Ministry of Environment (MOE): Concern will be with riparian and shoreland protection.

The City will need to submit a project description to each of these agencies for their review, and perhaps to the MOE Environmental Assessment Branch. This should not be a concern, as it is not classified as a development. The project description will need to address potential impacts and proposed mitigation measures (e.g. enclosing the bridge during certain activities; methods to keep debris out of the river; how navigable channels will be maintained during construction; etc.).

The Meewasin Valley Authority (MVA) will review the plans, as well as the specific measures proposed to mitigate or avoid potential environmental effects. Typically, adherence to the federal regulatory framework has been sufficient. MVA approval will be required for any work in the river channel and within the conservation zone.

The MVA's Development Review Policy sets guidelines related to:

- Natural resources;
- Slope stability and drainage;
- Landscape construction and maintenance;
- River channel improvement;
- Public access;
- Design;
- Traffic and parking;
- Service facilities and service maintenance; and
- Heritage resources.

The approvals process is expected to require a minimum of 12 months. Refurbishing the piers is expected to require a minimum of one summer construction season, during which the fabrication of the structural steel is expected to occur. Construction of the replacement structure is expected to require a minimum of 18 months. Budget approval, tender and award of tender are expected to require a minimum of 8 months.

FINANCIAL IMPLICATIONS

It is estimated that the cost to replace the Traffic Bridge with a modern steel truss bridge will be between $27,000,000 and $34,000,000.

The following two additional costs are not included in these estimates:

- Moving the Saskatoon Light & Power 15kV circuit from the bridge; and
- Assisting AT&T Canada (AllStream) in relocating the fibre optic cable from the bridge. AT&T was issued a Notice to Relocate on September 30, 2010.

These costs are unknown at this time.

It is recommended that the Administration report further regarding a source of funding.

PUBLIC NOTICE

Public Notice pursuant to Section 3 of Policy No. C01-021, Public Notice Policy is not required.

ATTACHMENTS

1. Needs Assessment and Functional Planning Study of the Traffic Bridge – Executive Summary;
2. Results from Public Consultation 1 (June 22-July 31, 2010);
3. Results from Public Consultation 2 (September 15-30, 2010);
4. Results from Public Consultation 3 (October 20-November 1, 2010);
5. Drawing – Option 5 – New Modern Truss Bridge; and
6. Artist's Rendering of Options.

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